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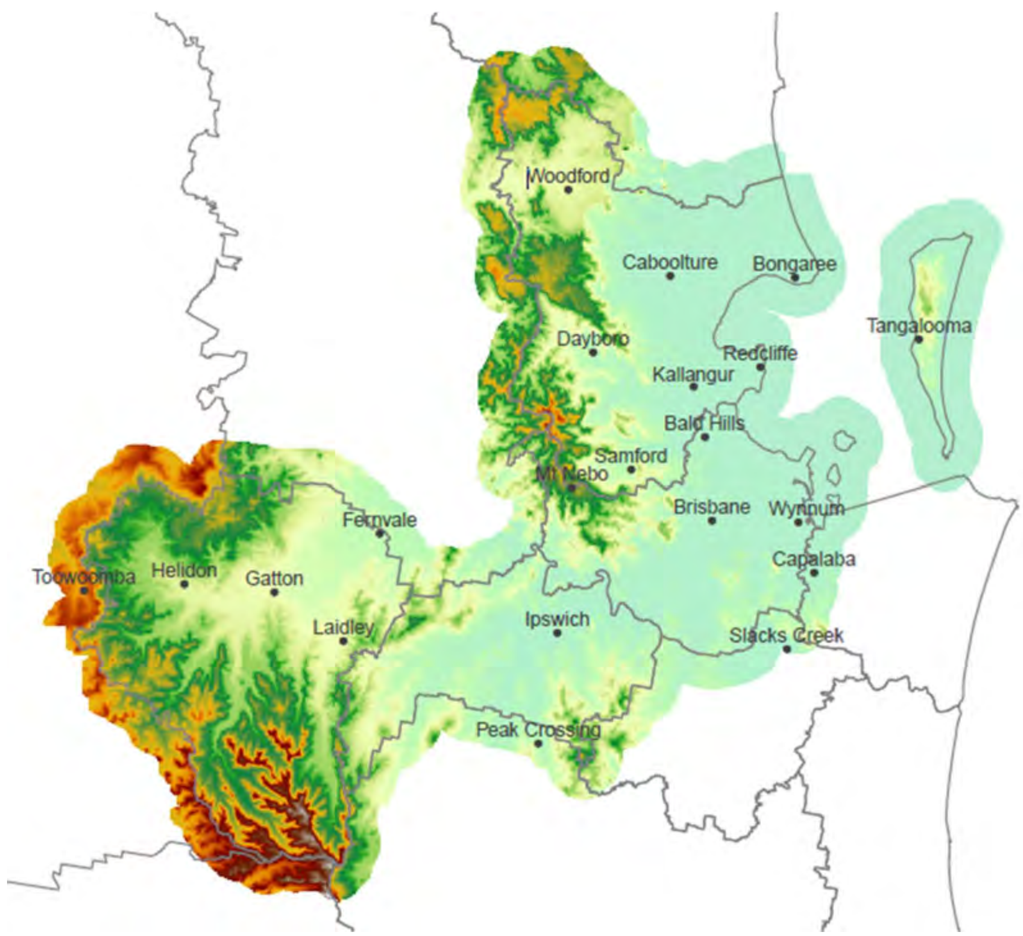
UPDATED LOCAL DESIGN RAINFALLS FOR BRISBANE, IPSWICH, LOCKYER VALLEY AND MORETON BAY

FINAL REPORT



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JUNE 2021

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FINAL REPORT

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Project Updated Local Design Rainfalls for Brisbane, Ipswich, Lockyer Valley and Moreton Bay	**Project Number** **119057**
Client Brisbane City Council Ipswich City Council Lockyer Valley Regional Council Moreton Bay Regional Council	**Client's Representative** Daniel Copelin
Project Manager Mark Babister RPEQ 10962	

Revision History

Revision	Description	Distribution	Authors	Reviewed by	Verified by	Date
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1	Final Report	BCC, ICC, LVRC, MBRC	Sarah Blundy Fiona Ling RPEQ 12421	Mark Babister RPEQ 10962	MB	JULY 2020
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UPDATED LOCAL DESIGN RAINFALLS FOR BRISBANE, IPSWICH, LOCKYER VALLEY AND MORETON BAY

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LIST OF ACRONYMS

AEP	Annual Exceedance Probability
ARI	Average Recurrence Interval
ALERT	Automated Local Evaluation in Real Time
AMS	Annual Maximum Series
ARR	Australian Rainfall and Runoff
AWS	Automatic Weather Station
BGLSR	Bayesian generalised least squares regression
BOM	Bureau of Meteorology
DEM	Digital Elevation Model
EY	Exceedances per Year
GEV	Generalised Extreme Value distribution
GIS	Geographic Information System
GPS	Global Positioning System
IFD	Intensity, Frequency and Duration (Rainfall)
MAE	Mean Absolute Error
m AHD	Metres above Australian Height Datum
OEH	Office of Environment and Heritage
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
QAQC	Quality assurance and quality control
R^2	Coefficient of determination
RMSE	Root Mean Squared Error
SDE	Standard deviation of elevation
SRMT	Shuttle Radar Mission Topography

ADOPTED TERMINOLOGY

Australian Rainfall and Runoff (ARR, ed Ball et al, 2019) recommends terminology that is not misleading to the public and stakeholders. Therefore, the use of terms such as “recurrence interval” and “return period” are no longer recommended as they imply that a given event magnitude is only exceeded at regular intervals such as every 100 years. However, rare events may occur in clusters. For example, there are several instances of an event with a 1% chance of occurring within a short period, for example the 1949 and 1950 events at Kempsey. Historically the term Average Recurrence Interval (ARI) has been used.

ARR 2016 recommends the use of Annual Exceedance Probability (AEP). Annual Exceedance Probability (AEP) is the probability of an event being equalled or exceeded within a year. AEP may be expressed as either a percentage (%) or 1 in X. Floodplain management typically uses the percentage form of terminology. Therefore a 1% AEP event or 1 in 100 AEP has a 1% chance of being equalled or exceeded in any year.

ARI and AEP are often mistaken as being interchangeable for events equal to or more frequent than 10% AEP. The table below describes how they are subtly different.

For events more frequent than 50% AEP, expressing frequency in terms of Annual Exceedance Probability is not meaningful and misleading particularly in areas with strong seasonality. Therefore, the term Exceedances per Year (EY) is recommended. Statistically a 0.5 EY event is not the same as a 50% AEP event, and likewise an event with a 20% AEP is not the same as a 0.2 EY event. For example, an event of 0.5 EY is an event which would, on average, occur every two years. A 2 EY event is equivalent to a design event with a 6 month Average Recurrence Interval where there is no seasonality, or an event that is likely to occur twice in one year.

The Probable Maximum Flood is the largest flood that could possibly occur on a catchment. It is related to the Probable Maximum Precipitation (PMP). The PMP has an approximate probability. Due to the conservativeness applied to other factors influencing flooding a PMP does not translate to a PMF of the same AEP. Therefore, an AEP is not assigned to the PMF.

This report has adopted the approach recommended by ARR and uses % AEP for all events rarer than the 50 % AEP and EY for all events more frequent than this.

Frequency Descriptor	EY	AEP (%)	AEP (1 in x)	ARI
Very Frequent	12			
	6	99.75	1.002	0.17
	4	98.17	1.02	0.25
	3	95.02	1.05	0.33
	2	86.47	1.16	0.5
	1	63.21	1.58	1
Frequent	0.69	50	2	1.44
	0.5	39.35	2.54	2
	0.22	20	5	4.48
	0.2	18.13	5.52	5
	0.11	10	10	9.49
Rare	0.05	5	20	19.5
	0.02	2	50	49.5
	0.01	1	100	99.5
Very Rare	0.005	0.5	200	199.5
	0.002	0.2	500	499.5
	0.001	0.1	1000	999.5
	0.0005	0.05	2000	1999.5
Extreme	0.0002	0.02	5000	4999.5
			↓	
			PMP/ PMP Flood	

EXECUTIVE SUMMARY

As part of the revision of Australian Rainfall and Runoff (ARR, Ball et al, 2019), the Bureau of Meteorology (BOM) updated the Intensity-Frequency-Duration (IFD) (BOM 2019) design rainfalls from those previously derived for Australian Rainfall and Runoff 1987 (ARR1987) (Pilgrim DH, 1987). The BOM used contemporary statistical methods and extended the IFDs to include rare design rainfall estimates. A more extensive database was used as the basis for analysis, incorporating more than 30 years of additional rainfall data and data from additional rainfall stations. In general, the additional data and new methods used in 2016 result in significant improvements to IFDs compared to the 1987 estimates. The changes in IFD values can be quite significant and will have a large impact on design flood estimates in some areas of Australia.

Brisbane City Council, Ipswich City Council, Lockyer Valley Regional Council and Moreton Bay Regional Council initiated a project to derive new local design rainfall estimates for their council areas, to leverage existing data to better inform future designs and studies. This new information will form part of the councils' continual process improvements. A comparison between old and new design rainfall estimates will also help to inform baseline risk assessments undertaken as part of local flood management studies.

Revised IFD grids have been developed for the Brisbane, Ipswich, Lockyer Valley and Moreton Bay areas. The revised IFDs were developed using methods that place higher weighting on the local sub-daily data and use an alternative regionalisation technique to that used to develop the ARR 2016 IFDs. The revised IFDs resulted in a reduction in local biases across all AEPs, durations and areas, compared to the ARR 2016 IFDs. It is therefore recommended that the revised grids be utilised for design flood analysis for these areas. If conservatively high estimates are desired, it would be valid for practitioners to use the envelope of the revised IFD grids and the 2016 IFDs.

1. INTRODUCTION

As part of the revision of Australian Rainfall and Runoff (ARR, Ball et al, 2019), the Bureau of Meteorology (BOM) updated the Intensity-Frequency-Duration (IFD) design rainfalls from those previously derived for Australian Rainfall and Runoff 1987 (ARR 1987). The BOM used contemporary statistical methods and extended the IFDs to include rare design rainfall estimates. A more extensive database was used as the basis for analysis, incorporating more than 30 years of additional rainfall data and data from additional rainfall stations. In general, the additional data and new methods used in 2016 result in significant improvements to IFDs compared to the 1987 estimates. The changes in IFD values can be quite significant and will have a large impact on design flood estimates in some areas of Australia.

Brisbane and Ipswich City Councils discovered inconsistencies between their own rain gauge records and the 2016 IFDs. Some rain gauges in the Bremer catchment include 3 or more recorded events with magnitudes higher than the 1% AEP IFD suggesting the IFDs were too low at these sites. Brisbane City Council found that the frequent short duration IFDs are very different to values derived from their own extensive pluviograph network and that their networks show distinct spatial behaviour that is not present in the BOM IFD The councils in the area have an extensive network of rain gauges that were not included in BOMs 2016 IFD project. Therefore, Brisbane City Council, Ipswich City Council, Lockyer Valley Regional Council and Moreton Bay Regional Council initiated a project to derive new local design rainfall estimates for their council areas, to leverage existing data to better inform future designs and studies. This new information will form part of the councils' continual process improvements. A comparison between old and new design rainfall estimates will also help to inform baseline risk assessments undertaken as part of Local Flood Management Studies. The revised short duration rainfall estimates will also assist Brisbane City correctly size components of a of an extensive water quality improvement program.

This report includes descriptions of methods and data used to derive local IFDs for the study area, the results of the analyses, and comparisons of IFD estimates derived at-site, and for ARR 1987, ARR 2019 (called BOM 2016) and this study.

In response to requests by councils on the completion of the project and independent external review of this project minor updates were undertaken in 2021 to interpolate and extend grids to estimate 1 in 2 year ARI (39.35% AEP), 1 in 5 year ARI (18.13% AEP) and 1 in 200, 500, 1000 and 2000 year AEP events, as well as to provide additional storm durations within the durations range already provided. The report has been amended to detail production of these additional grids. Outputs grids were provided directly to council, rather than adding additional maps to the appendix figures.

2. AVAILABLE DATA

Rainfall data was collected from different data sources. A summary of all the rain gauges is shown in Table 1; the location of all rain gauges used is shown in Figure 1 and in Appendix C.

Table 1 Summary of all rain gauge data considered for use for this study

Council Area	Bom Daily		Bom AWS		Bom Alert		Council Data	
	Used	Excluded	Used	Excluded	Used	Excluded	Used	Excluded
Brisbane	88	30	18	4	9	1	42	15
Gold Coast	5	2	3	2	-	-	-	-
Ipswich	27	11	2	-	-	-	21	16
Lockyer Valley	25	6	2	-	10	31	-	-
Logan	28	13	6	1	11	-	3	-
Moreton Bay	43	7	10	2	33	4	27	2
Redland	15	3	3	-	2	-	-	-
Scenic Rim	39	13	5	3	-	-	3	10
Somerset	50	15	2	-	10	7	-	-
South Burnett	1	2	-	-	-	-	-	-
Southern Downs	4	3	-	-	-	1	-	-
Sunshine Coast	45	13	2	-	6	1	-	-
Toowoomba	20	4	3	-	3	1	-	-
Other	5	1	2	1	-	-	-	-
Total	395	123	58	13	84	46	96	43

2.1. BOM Automatic Weather Station (AWS)

Rainfall data was obtained from 71 Bureau of Meteorology automatic weather stations (AWS). This data was at a one minute time step. AWS data may have been quality controlled by BOM. Of these 71 gauges 13 were excluded either because the record length of complete data was too short (less than 8 years, in accordance with ARR Book 2 Chapter 3 (Ball et. Al. 2019)) or issues were identified in the data. Almost 50% of the remaining gauges were in Brisbane or Moreton Bay council areas with only 2 gauges in each of Ipswich and Lockyer Valley council. The remainder were located in nearby councils.

2.2. BOM ALERT data

Rainfall data was obtained from 130 Bureau of Meteorology data ALERT gauges. BOM ALERT data is sub-daily data, provided as accumulated rainfall over various periods, and variable time steps. ALERT data is not quality controlled by BOM and in some cases may contain errors. 46 of these gauges had to be excluded as they had short record length, significant missing periods or suspicious data. Just over 50% of the remaining gauges were in Moreton Bay or Lockyer Valley council areas, with 9 in Brisbane and none in Ipswich. The remainder were in nearby councils. 23 of the gauges were also included in the gauges that the council's provided data for, although in many cases the period of record covered were different. ALERT gauges are not always installed in accordance with standards and are designed for instantaneous use to processes for archiving data are not as refined as for AWS data, thus the relatively high number of gauges that were discarded.

2.3. Council data

Sub-daily rainfall data from council rainfall gauges was provided by:
- Brisbane City Council
- Ipswich City Council and
- Moreton Bay Region Council

This data was in a variety of different formats. Rainfall was recorded as event rainfall not aggregated to any timestep except for Moreton Bay data which was aggregated to 5 min totals. In total, councils provided data at 139 different gauges. Data at 43 of these gauges was excluded due to short record length or other issues with data quality. Of the remaining gauges 23 overlapped with BOM ALERT gauges. These overlapping gauges meant data was provided by both the council and BOM for the same gauge, in some cases this was the same data and in some cases one source provided a different period of record to the other. If data was overlapping a single AMS event was derived for each year data was available for each gauge.

2.4. BOM daily gauges

Daily data from 518 gauges was downloaded from the BOM website. This data is recorded as daily totals from 9am to 9am. In some cases, where readings have been missed, a total is given over a period of more than one day. 123 gauges were excluded for short records or large amounts of missing data. 64 of these gauges were also available as pluviograph data from one of the above sources, but often the daily record is longer than the pluviography record.

2.5. BOM daily annual maximum data

Annual Maximum Series (AMS) rainfall data from BOM daily read gauges had been obtained from BOM for the whole of Australia for previous projects. The AMS data was used in development of the ARR 2016 IFDs and was available up until 2012. This dataset had been quality control and events where individual gauges had recorded over multiple days had been disaggregated using surrounding gauges (Green et.al 2011). This dataset was therefore a useful resource for daily rainfall prior to 2013, however as data was not available up to present day and water years rather than calendar years were used for WMA 2020, it could not be used instead of deriving AMS events from time series data. However, in cases where the same events were present in the AMS derived for this study so comparisons could be made to take advantage of quality controlling that had gone into the BOM AMS database(see Section 3.3). The data for gauges within the study area was extracted from the national data set.

2.6. 2016 IFD grids

The 2016 IFD rainfall grids were obtained from the Bureau of Meteorology website (BOM, 2019).

These grids were extracted at all durations. These grids are at a resolution of 0.025° and cover the entirety of the country.

2.7. 1987 IFD grids

The design rainfall intensity grids that were used in conjunction with ARR87 were obtained from the Bureau of Meteorology website (BOM, 2017). These grids were available at a resolution of 0.025° covering the entire country. These grids were not naturally aligned with the 2016 IFD grids, so the 1987 IFD grids were re-extracted at the cell centres of the 2016 IFD grids to enable direct comparisons.

2.8. Digital Elevation Model (DEM)

Digital Elevation Model (DEM) data was downloaded from https://elevation.fsdf.org.au/ across the entire study area and surrounds. The final grid used a combination of the 5 m DEM from LiDAR (Geoscience Australia, 2015) and the 1 second SRTM derived hydrological DEM (Wilson et al. 2011).

2.9. SILO gridded rainfall data

SILO is a Queensland Government database containing continuous daily climate data for Australia from 1889 to present (DES, 2017). This database includes daily rainfall grids covering all of Australia, which are spatially interpolated from observations (Jeffrey et. al 2001).

3. METHOD

3.1. Quality controlling and standardising rainfall data

Rainfall data was received in many different formats, therefore it needed to be standardised to a common format and timestep. There was also some highly suspicious data found in some time series. Therefore, some quality controlling was undertaken on the raw times series data (Sections 3.1.1). Further QAQC was undertaken after the calculation of the annual maximum series (AMS) of rainfall events (Section 3.3) and fitting of at site GEV distributions (Section 3.6).

This quality controlling was done as an iterative process, looking at annual maximum rainfall events that were unrealistically high in the context of nearby gauges. The process was not an in-depth review of all the data received and some erroneous events may persist, particularly for events where a gauge falsely under recorded a larger rainfall event. The quality controlling process is outlined in Diagram 1 with further details in Sections 3.1.1.

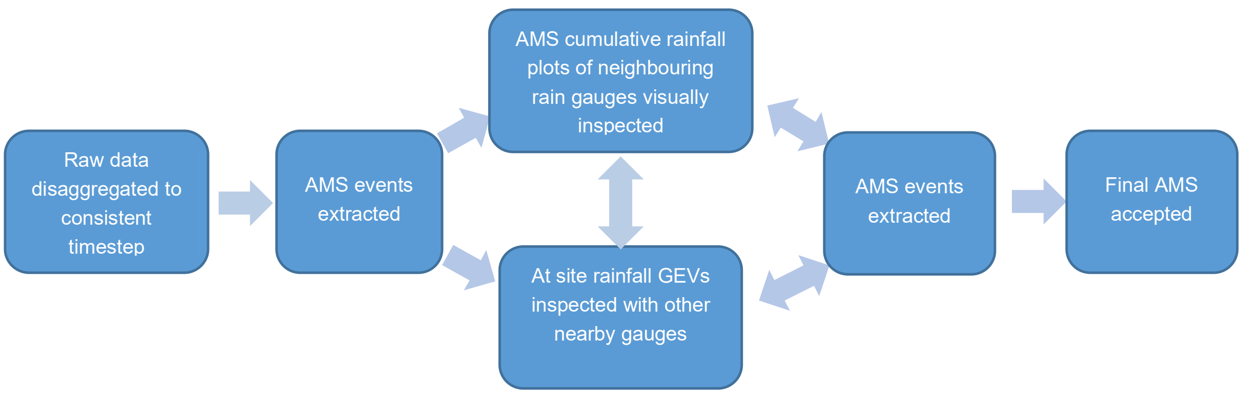

Diagram 1 Process to obtain AMS events from raw timeseries data

3.1.1. Sub-daily data

Additional quality assurance and quality control (QAQC) was conducted on all sub-daily data provided for this project. Rainfall data that was provided as accumulated rainfall, including BOM ALERT data, required significantly more QAQC than the other data received.

Accumulated rainfall was disaggregated by subtracting rainfall in the previous timestep from rainfall in the current timestep, to give rainfall in the preceding period. Resets, where the accumulated rainfall count resets to zero, occur periodically (sometimes every few months, or after several years). At these timesteps a negative rainfall would occur, in the disaggregation process so these are set to zero rainfall. Using accumulated rainfall timeseries means that otherwise small errors in data can lead to large issues when decumulating data. For example, sometimes the accumulated rainfall count can slide backwards by a very small amount (say go from 1010 mm to 1009.8 mm), for unknown reasons. If this were taken as a reset, it could lead to a very large amount of rain occurring in the next time step. Therefore, a process that checked for errors like this over a number of timesteps was run so that there could be reasonable faith in the time series data. This checked if high spikes, low spikes or non zero resets returned to normal behaviour within two timesteps and, if so, assigned erroneous values as NA.

Once decumulated, all data was standardised into the same format to allow further processing to be undertaken on the entire dataset.

Cumulative rainfalls for all AMS events at each site were plotted with cumulative rainfalls at nearby gauges. These were visually inspected to identify events that looked unrealistic, for example the event show in Diagram 2, where more than 400 mm of rain was recorded in less than an hour at site 540063, and there was almost no rainfall recorded at other nearby sites.

Similarly, the at site AMS events and GEV distribution derived for nearby sites, were plotted together to check for events that were much larger than events at surrounding sites or sat a long way off the FFA. These events were then reviewed in the cumulative rainfall event plots to check if the event looked reasonable.

Events that looked unreasonable were excluded from the analysis. In some initial cases the actual event was removed from the timeseries file and the AMS recalculated at this site. However, in the interests of timely processing of the data, when the AMS event was found to be unrealistic, in most cases the entire year was excluded from the AMS at that site for that duration.

Diagram 2: Cumulative rainfall at site 540063 Colleges Crossing ALERT Rn and surrounding gauges for an event in 2006 with a unrealistic rainfall recorded at Colleges Crossing

3.1.2. Daily data

Very limited QAQC was undertaken by WMA on daily data. Where possible daily AMS event totals were taken from the BOM database which had already undergone extensive QAQC (as described in Section 2.5). The process for deriving daily AMS values is explained in Section 3.3.2.

3.2. Deriving water year

The AMS were derived for water years rather than calendar years. To determine the appropriate start and finish dates for the water year, the AMS was calculated at a subset of sites that were available at the beginning of the project, based on calendar years. The month these AMS events occurred was extracted and the water year was determined based on the period where the fewest AMS events occurred. This gives a water year going from 1st September to 31 August. Water years were assigned based on the calendar year at the end of the water year; i.e. 10th August 2019 is in the 2019 water year and 10th September 2019 is in the 2020 water year.

3.3. Annual Maximum Series (AMS) extraction

Annual maximum series were extracted for the durations of interest shown in Table 2.

Table 2 Durations used to extract AMS data and fit IFDs

Sub daily gauges		Sub daily and daily gauges	
Duration (min)	**Duration (hours)**	**Duration (min)**	**Duration (days)**
5	-	1440	1
15	-	2880	2
30	-	4320	3
60	1	5760	4
120	2	7200	5
180	3	8640	6
360	6	10080	7
720	12		

3.3.1. Sub-daily data

Sub-daily rainfall data was aggregated or disaggregated to a one minute timestep. Where the timestep was greater than one minute, the rainfall was spread evenly over the time period since the previous data point. As data was typically recorded as event rainfall with a data point when every millimetre of rain was recorded, averaging one mm over a period of time was judged to be unlikely to have any significant impact on annual maximum events.

The one minutely data was summed using rolling duration windows to calculate totals for all durations of interest. The maximum rainfall for each water year for each duration was then extracted.

Incomplete years of data were difficult to deal with as, depending on the data source, it is not clear whether prolonged periods of no rain are valid or due to outages or missing data. The following approach was adopted:

- If an AMS event was in the highest three AMS events at that site for a duration it was always accepted, even if substantial parts of the year were missing
- The SILO rainfall grids were used to find the highest two days of rainfall at a site in a given year. If more than six hours were missing or NA on these days, then the year was excluded.

Whilst it is understood that this is relatively simple approach to filtering years with missing data, due to the extremely large number of events involved, it was considered to be an acceptable practical alternative to a process that would normally be done manually.

3.3.2. Daily data

As discussed in Section 3.1.2, where possible, the AMS for daily data was taken from the database used by BOM for the 2016 IFDs. This database has been quality controlled, and rainfall recorded as a block across several days had been disaggregated. This data was therefore preferred where it was available. The AMS database was derived based on calendar years and only had data up until 2012. In order to align the daily and sub-daily AMS and extend with the additional years of data since 2012, the following process was undertaken:

- AMS events at each site for all water years and all durations were extracted from daily timeseries data (downloaded from BOM website as described in section 2.4)
- If the events were in the BOM database (section 2.5), they were accepted from the BOM database without modification
- If there was a larger event for that year in the BOM database, this was accepted without modification
- If a multiday accumulated event is observed in the daily rainfall data with a duration longer than the duration of interest, and there is no coincident event in the BOM data base (e.g. if for year > 2012), then the event was excluded
- If a multiday accumulated event is observed in the daily rainfall data with a duration longer than the duration of interest, and the event is in the BOM database and is lower, the value from the BOM database was adopted (it was assumed that BOM's QAQC resulted in a lower event total)

3.4. Restriction factors

Australian Rainfall and Runoff Book 2 (Ball et al. 2019) includes a table of recommended 'restriction factors' that can be used to estimate 'unrestricted' rainfall (e.g. maximum over a rolling 24 hour period) from 'restricted' rainfall (i.e. BOM daily read site totals collected at 9am) (Table 3). To check the validity of these factors in the study region for AMS events, rainfall at sub-daily gauges was aggregated to totals in a 9am to 9am period and 1-7 day totals for the AMS events were compared with the 'unrestricted' rolling window calculated using the original sub-daily data. This showed that applying the factors presented in ARR 2016 resulted in more than 75% of AMS events being overestimated; 2-7 day events and the majority of one day events were overestimated (Diagram 3b). Therefore, for the purpose of this project, new restriction factors were derived using the median ratio of unrestricted to restricted rainfalls for each of 1-7 days (Diagram 3a and Table 3).

These restriction factors were applied to AMS events at daily gauges to give 1-7 day rainfalls equivalent to the 1-7 day AMS events at the sub-daily gauges.

There was a large rainfall event in January 2011, which was the maximum observed event at a number of gauges. This event happened to be almost perfectly divided in half at 9am which caused a very large difference between 24 hour unrestricted and 1 day rainfalls even with the restriction factor applied. As this event was so significant and had good coverage of sub-daily gauges in the area in which it was most intense, a separate restriction factor was developed for this event for the 1 day rainfall only (as the vast majority of the rain fell within 24 hours).

Table 3: Restricted to unrestricted factors for daily read rainfall gauges with both ARR factors (from Book 2 Table 2.3.4) and locally derived factors

Duration (days)	ARR restriction factors	Locally derived restriction factors
1	1.15	1.0994
2	1.11	1.0204
3	1.07	1.0083
4	1.05	1.0036
5	1.04	1.0015
6	1.03	1.0009
7	1.02	1.0000

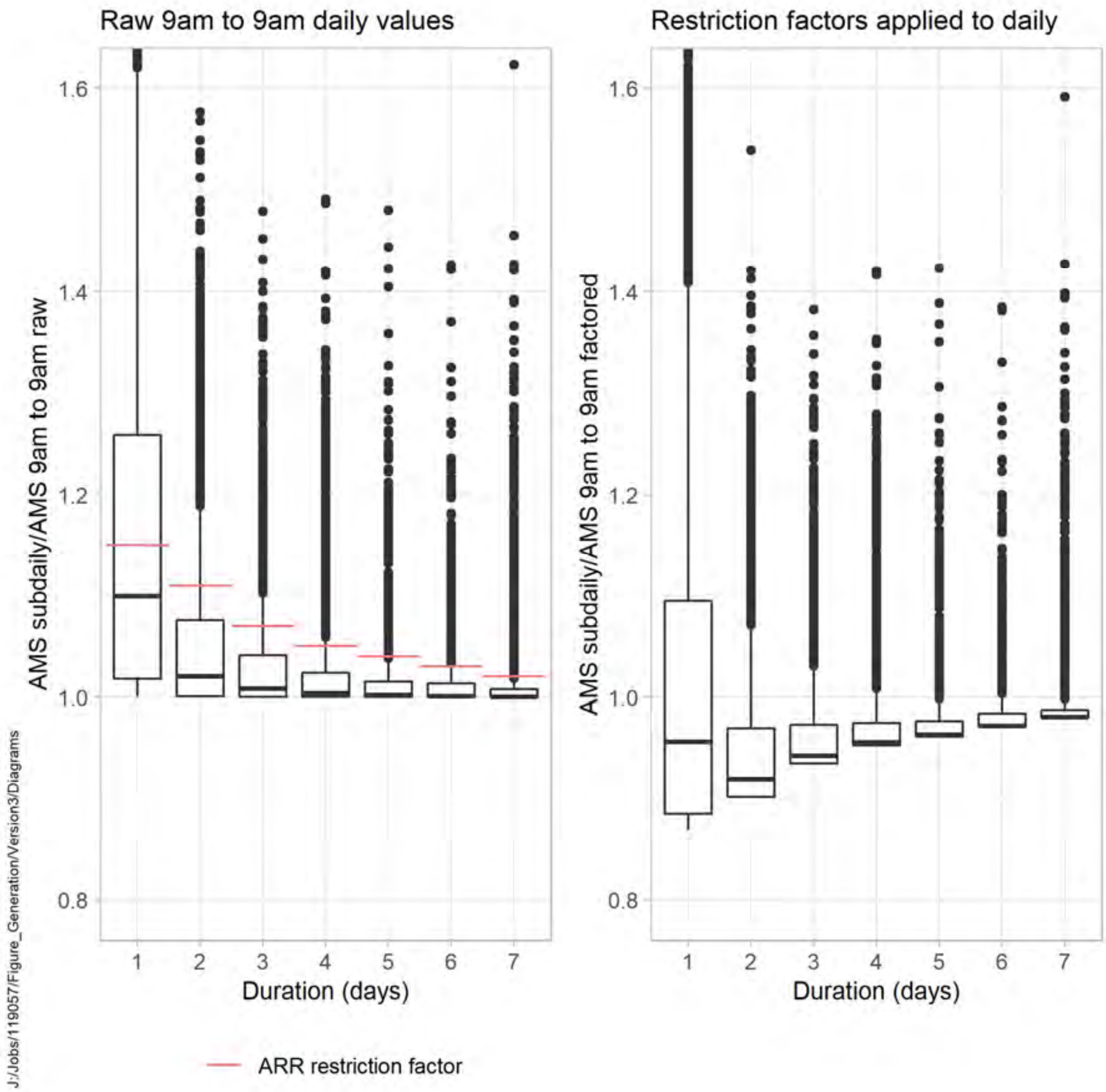

Diagram 3 Ratio of AMS event totals
a (left hand pane): Ratio of AMS event total (derived using rolling calculation window) to 9am to 9am totals.
B (right hand pane): Ratio of AMS event total (derived using rolling calculation window) to 9am to 9am totals factored by ARR restriction factors

3.5. GEV distribution summary

The Generalised Extreme Value (GEV) distribution is one of the distributions recommended for fitting annual maximum series for flood frequency analysis in ARR 2019 (Ball et. Al. Book 3 Chapter 2 ref), and was used by BOM to fit IFDs.

L-moments are statistics calculated from the AMS data that are used to calculate parameters of the GEV distribution. L-moments are linear combinations of order statistics that are analogous to conventional moments. The index rainfall is the mean. L-CV is analogous to standard deviation, which describes the variability of the data. L-Skew is analogous to skewness, which is a measure of the asymmetry of the distribution of the data. Generally speaking, the index is roughly equal to the 50% AEP rainfall, the L-CV is used to calculate the GEV parameter that defines the variation within the GEV or the steepness of the line, and the L-skew is used to calculate the GEV parameter that determines how curved the GEV line is.

Diagram 4 shows how different L-CV and L-skew values (with a fixed index rainfall) alter the final rainfall IFDs for a range of L-CV and L-skew relevant to this study. Low L-CV values give less variability between frequent and rare rainfalls than high L-CV values. Low L-skew values mean there is a flattening off of the distribution, with lower increases at rarer AEPs. High L-skew values mean that at rarer AEPs, rainfalls are getting larger at an increasing rate. While theoretical values for L-CV are > 0 and L-skew are between -1 and 1, typically values for this study are an L-CV between 0.15 and 0.35 and L-skew between 0.05 and 0.5.

L-moments can be calculated from the AMS at a rain gauge to give an estimate of the actual rainfall distribution at that site (Section 3.6). The index rainfall, L-CV and L-skew are then regionalised using surrounding gauges and local topography to give grids for each of these (see Section 3.7 for index grids and Section 3.8 for (L-CV and L-skew). These L-moment grids can then be used to calculate the parameters of the GEV distribution at each individual grid cell which are used to fit the GEV distribution to give the IFD value grids.

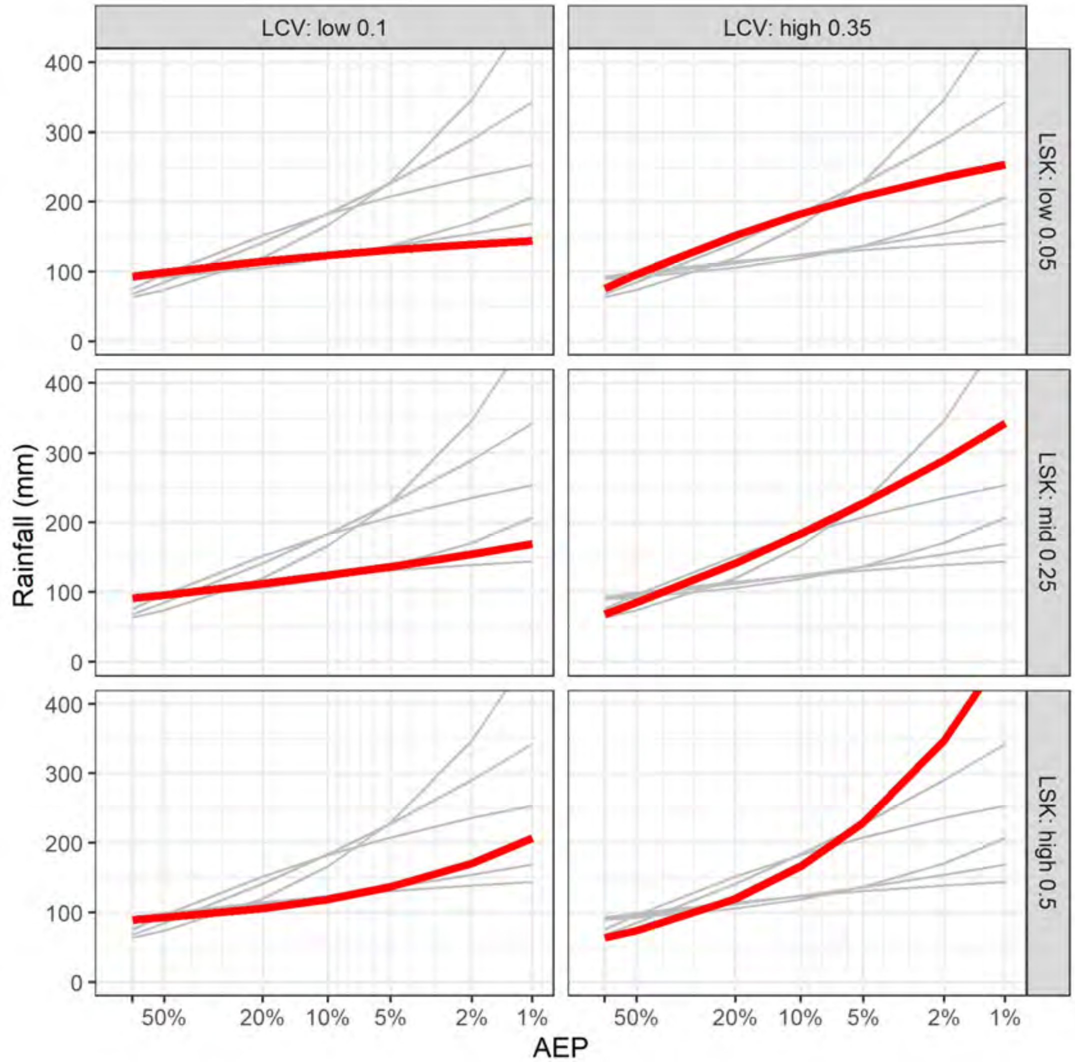

Diagram 4 Theoretical rainfall IFDs derived from a range of L-CV and L-skew values show how each impacts on the curve

3.6. At Site GEV fitting

Generalised Extreme Value (GEV) distributions were fitted to the AMS at all sites. The GEV distributions were fitted using the method of L-moments, using the lmom package (Hosking, 2019) in R software (R Core Team 2019). Diagram 5 shows an example of fitting local GEV distributions to rain gauge AMS data at Site 40004 Amberley Amo for four different durations.

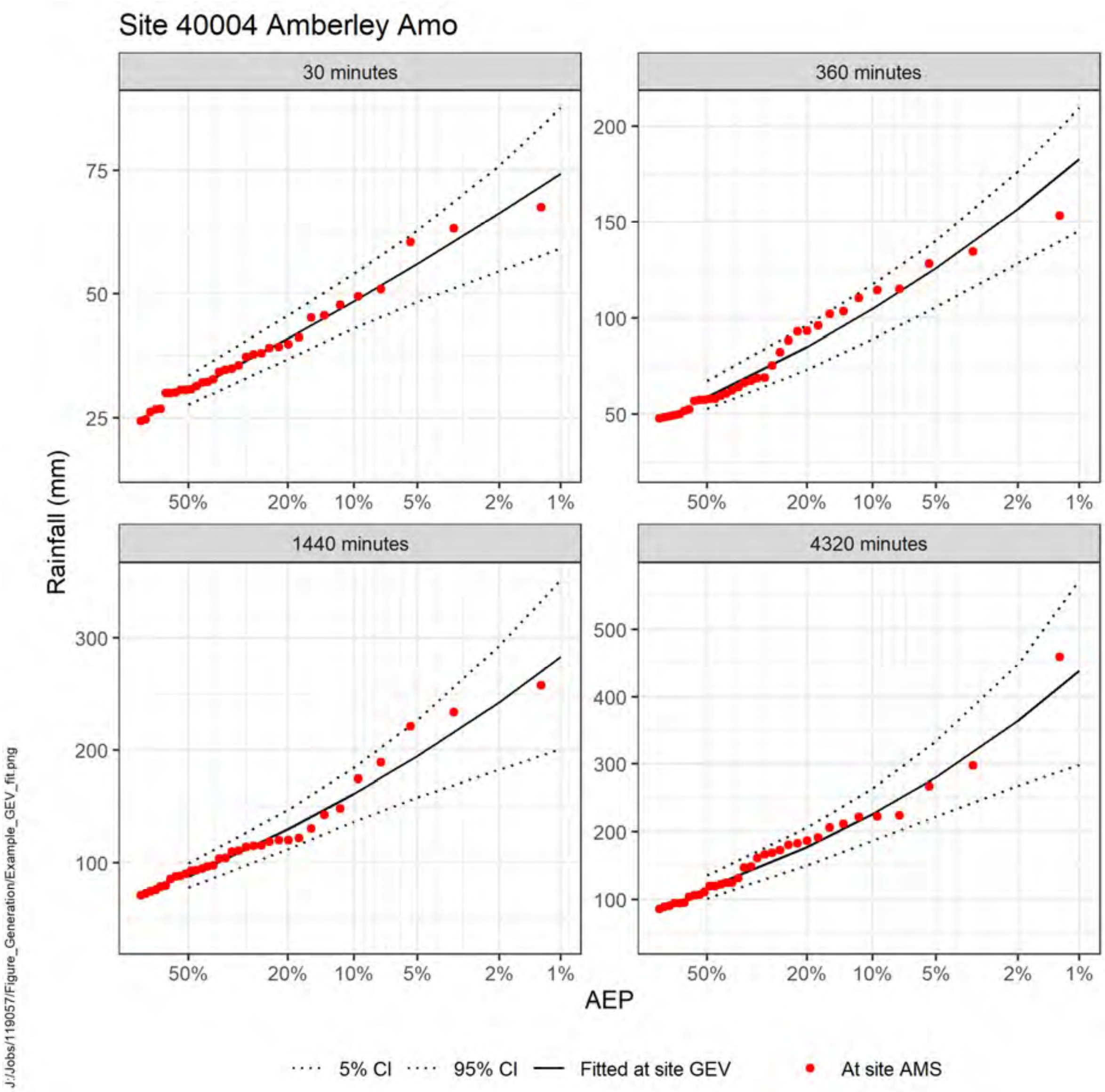

Diagram 5 Example of the at site AMS values and fitted at site GEV for the Amberley Amo gauge

3.7. Kriging of index rainfall

The BOM used a spline surface fitting technique (ANUSPLIN) to grid index rainfalls in development of the 2016 IFDs. Elevation was used as a covariate for this process. For this project, gridding of index rainfall for each duration was undertaken using elevation and the standard deviation of elevation (SDE) as covariates (Figure 2 and Figure 3) using the kriging R package (Olmedo, 2014). Kriging is a method of spatial interpolation widely used in spatial analysis. Kriging can be used to derive a grid from known point values by fitting a statistical relationship, which uses the physical distance as well as the difference in other covariates (in this case elevation and SDE).

The standard deviation of elevation grid was derived by taking the standard deviation of elevation of all cells within 0.05° latitude or longitude of the target cell. SDE was chosen to reflect the relationship between topography and orographic enhancement. Using SDE as a covariate is similar to the use of the rough and smooth adjustment that was used in the BoM 'Generalised Short-Duration Probable Maximum Precipitation Method' (BOM, 2003), where rough weighting is applied to areas within 20 km of a location where elevation changes more than 50 m within a horizontal distance of 400 m.

For this project, kriging was used for the gridding process. A grid resolution of 0.005° was used to capture the topography of the area.

3.8. Regionalisation of L-CV and L-skew

Regionalisation of L-CV and L-skew was used by BOM in development of the 2016 IFDs. BOM used a method where nearby sites were pooled and weighted averages of L-CV and L-skew were calculated based on each site's AMS length (Green et al 2012b). The method generally resulted in higher weighting being given to daily stations, as there is often longer record length at these sites. For durations shorter than 1 day, L-moments at these sites were estimated by regression. As regression estimates bring the pool of values closer to the mean, use of this method has potential to result in over-smoothing of local features.

For this project, an approach for regionalising L-CV and L-skew was developed with the aim of better resolving local features. Regionalisation was carried out using the same 0.005°grid as used for the index rainfall. Elevation and the SDE were used as parameters for regionalisation of L-CV and L-skew values, as for the index rainfall.

The calculation of regional L-CV and L-skew values for each duration, at each grid cell used the following process.
Six sites were selected for input to the regionalisation. The sites were selected as those with the lowest regionalisation distance, calculated using Equation 1.

$$RD = Distance_{g,s} + EW * (E_g - E_s) + SDW * (SDE_g - SDE_s) \quad \text{Equation 1}$$

Where:

RD = Regionalisation Distance
$Distance_{g,s}$ = Distance between grid cell centroid *(g)* and site *(s)*
EW = Elevation Weighting
E = Elevation
SDW = Standard Deviation of Elevation Weighting
SDE = Standard Deviation of Elevation

If the combined AMS length at the six sites was less than 100 years, additional sites were added until the AMS length was greater than 100 years.

Ranges of weightings for elevation and standard deviation of elevation were tested. The above process was run hundreds of times with different factors (weightings) applied to SDE and elevation and then R^2 values were calculated using at-site L-CV and L-skew as observed values, and regionalised L-CV and L-skew as predicted values (Figure 4). The final weightings were selected based on the best average R^2 across both L-CV and L-skew for all the durations between 180 min and 3 days; these are shown in Table 4 and Figure 4. The same weightings were used across all durations.

Table 4 Final weightings for elevation and SDE for regionalisation of L-CV and L-skew

Elevation weighting	SD of elevation weighting
0.06	0.22

Once the sites for regionalisation were chosen for each grid cell, the L-CV and L-skew for each grid cell were calculated based on the weighted average of the sites. Weighting was based on the AMS length at each site.

The L-CV and L-skew grids were then smoothed based on the average of values within 0.01° distance of the target cell.

3.9. Generate IFDs

The gridded index rainfalls and L-moments were used to fit parameters of the GEV distribution for each grid cell. The GEV distribution was then used to calculate IFDs. The IFDs for each grid cell were then checked for three types of inconsistencies:

- Inconsistency in depth across durations e.g. if 24 hour depth < 12 hour depth.
- Inconsistency in intensity across duration e.g. is mm/h for 24 hour depth > mm/h for 12 hour depth
- Inconsistency in depth across AEP e.g. if 1% event < 2% event

Significant inconsistencies were found in depth across durations, particularly between 12 and 24 hours, due to inconsistencies between the data from daily and sub-daily sites. This issue is shown in Figure 5a. To resolve this issue, one duration was chosen as the “point of truth”. The 48 hour duration was chosen for durations from 6 to 48 hours. This was based on the fact that inclusion of the daily rainfall sites significantly increases the average record length, which reduces uncertainty in rare rainfall estimates. This narrowed the selection to a duration of 24 hours or greater. There is some uncertainty introduced into the 24 hour rainfalls due to the conversion of 9am to 9am totals to unrestricted 24 hour totals. This issue is not as significant in the 48 hour rainfalls. Therefore, the 48 hour rainfall was used as the point of truth.

The procedure used for resolving the inconsistency in depths across durations was as follows:

- The index rainfalls across durations from 6 to 48 hours were checked to ensure that they increased with duration. If this was not the case, then the index rainfalls were derived using linear interpolation between 6 hour and 48 hour index rainfalls.
- An iterative process was then run on each grid cell, firstly to adjust L-skew, and then to adjust L-CV if necessary, until there were no inconsistencies in IFDs, up to an AEP of 1 in

1000. L-moments for the 48 hour duration were not changed. An example of the IFDs calculated using the results of this process is shown in Figure 5b.

- Inconsistencies between the 2 and 3 hour duration IFDs and other durations were then addressed by calculating the L-skew and L-CV values using the weighted mean of the 1 and revised 6 hour values. An example of the resulting IFDs is shown in Figure 5c.
- All L-moments were then smoothed based on the average of values within 0.01° distance of the target cell.
- The L-moments in each grid cell were then used to fit GEV distributions to create IFD grids.

An example of the results of resolving the inconsistencies in the L-CV and L-skew are shown in Figure 6 to Figure 9 for the 180 min duration. These clearly show that the areas with the greatest inconsistencies, particularly in western and northern Ipswich have been greatly improved.

This project was initiated due to inconsistencies between the BOM 2016 IFDs and at site frequency analysis. The difficulties that occurred in trying to fit IFDs across all durations with gauges of various record lengths make it apparent that this is a complex problem, and in some locations it was not a question of the council data not being included in the dataset, but that independent analysis on short and long duration data gave conflicting results.

Minor inconsistencies were observed in the multi day events, particularly in the 5-7 day range. These inconsistencies were also present in the 2016 IFDs. In almost all cases this occurred because the largest few events were only 3 to 4 day events, therefore the same rainfall total was used in the AMS for that event for all durations above the event duration. Where there was an inconsistency for durations greater than 48 hours, a single millimetre was added to the IFD for each longer duration. This reflects the fact that there actually is very limited change in depth for durations longer than approximately 4 days, as most events simply do not persist for this long.

3.9.1. January 2011 event

Inconsistencies were particularly bad in the north and west of Ipswich City Council area. This was an area where the highest event on record at many sub-daily gauges was in January 2011. These sub-daily gauges often had fairly short records compared with daily gauges also found in this area. The majority of the rainfall for this event fell fairly evenly between 4am and 2pm so 9am to 9am daily read totals were cut almost in half. This caused two issues:

1. Daily totals were significantly lower than 24 hour totals at pluviograph gauges
2. The larger 24 hour totals were assigned a much more frequent AEP than the lower daily totals, as the record lengths at the pluviometers are overwhelmingly shorter.

To address issue 1, a local factor was derived using pluviograph data to scale the 2 day rainfall down to 1 day rainfall at daily read stations. 24 hour rainfalls were then calculated at each daily read station using Equation 2.

$$24\ hour\ rainfall = \max\left(1\ day\ daily\ read\ rainfall, local\ factor * 2\ day\ daily\ read\ rainfall\right)$$
Equation 2

To address issue 2, the 2011 event total was decreased at sites where it was plotting at a more frequent AEP than evidence from the longer record lengths suggested was likely. This was done by applying a blanket factor of 0.8 to this event for sites in affected areas. Ideally, a more sophisticated method would have been used to artificially assign a rarer AEP to the event based on the longer daily read stations. This could be further investigated using Bayesian prior information fitting techniques but would require an entirely different approach to fitting historic frequency, so this was not possible within the current framework, even for a single site investigation. Therefore, the scaling was used to bring the event more into line with an actual event magnitude of this frequency. Figure 10 shows GEVs subset of sites in the impacted area with and without scaling on the shorter records. This demonstrates that the scaling brings them closer to the shape of sites with long records.

3.10. Validation

A leave one out analysis was undertaken to check the final IFD grids generated. For this analysis, the whole process of regionalisation was rerun with each individual site left out of the data analysis to compare the final gridded value at that location without that rainfall included and with the rainfall included.

3.11. Fit across durations

In order to calculate IFDs at durations that were not calculated from the process described, a 6th order polynomial was fitted in log space across all durations, for each AEP at each grid cell. This is the same process that was used in development of the 2016 IFDs. This process was used for durations between 5 minutes and 60 minutes. IFDs were calculated for 1 minute duration using a fixed ratio of (5 min rainfall)/3.6. This was the mean of the ratios of 1 minute to 5 minute rainfalls in the 2016 IFD grids across the study area. The final grids were developed for the durations shown in Table 5.

Table 5 Final IFD grids durations

Duration (min)	Duration (hours)
5	
10	
15	
20	
25	
30	
45	
60	1
90	1.5
120	2
180	3
270	4.5
360	6

Duration (min)	Duration (hours)	Duration (days)
540	9	
720	12	
1080	18	
1440	24	1
1800	30	1.25
2160	36	1.5
2880	48	2
4320	72	3
5760	96	4
7200	120	5
8640	144	6
10080	168	7

In some cases there appeared to be two conflicting polynomial fits to nearby grid cells. For some AEPs or durations this resulted in a motley appearance to IFD grids in some areas, or single cells where values looked unrealistic when compared to the surrounding cells. In cases where the coefficients of the fitted polynomial varied significantly from nearby cells, the polynomial fitting was rerun using the fit parameters for the cell to the left as a starting point. This helped to reduce occasions where alternating fits were assigned to many neighbouring cells. While this results in a more consistent grid, in most cases the differences are very small (generally less than 2% and almost always less than 5%). Diagram 6 shows an example of the fits of a 3x3 cell section within the overall grid where initially one grid cell used an alternative fit polynomial. Refitting this grid cell with an appropriate starting point gives a more consistent fit. This was only applied to grid cells with evidence of conflicting fits. In a few cases this can result in a more rapid transition than would otherwise occur; causing neighbouring grid cells to change by up to 5% in some cases. It is not expected that this would result in any real differences where catchment average IFDs are used. However, in a few specific cases where only one grid cell is used (such as if a catchment centroid or specific gauge location is used), results may be sensitive to small changes in location.

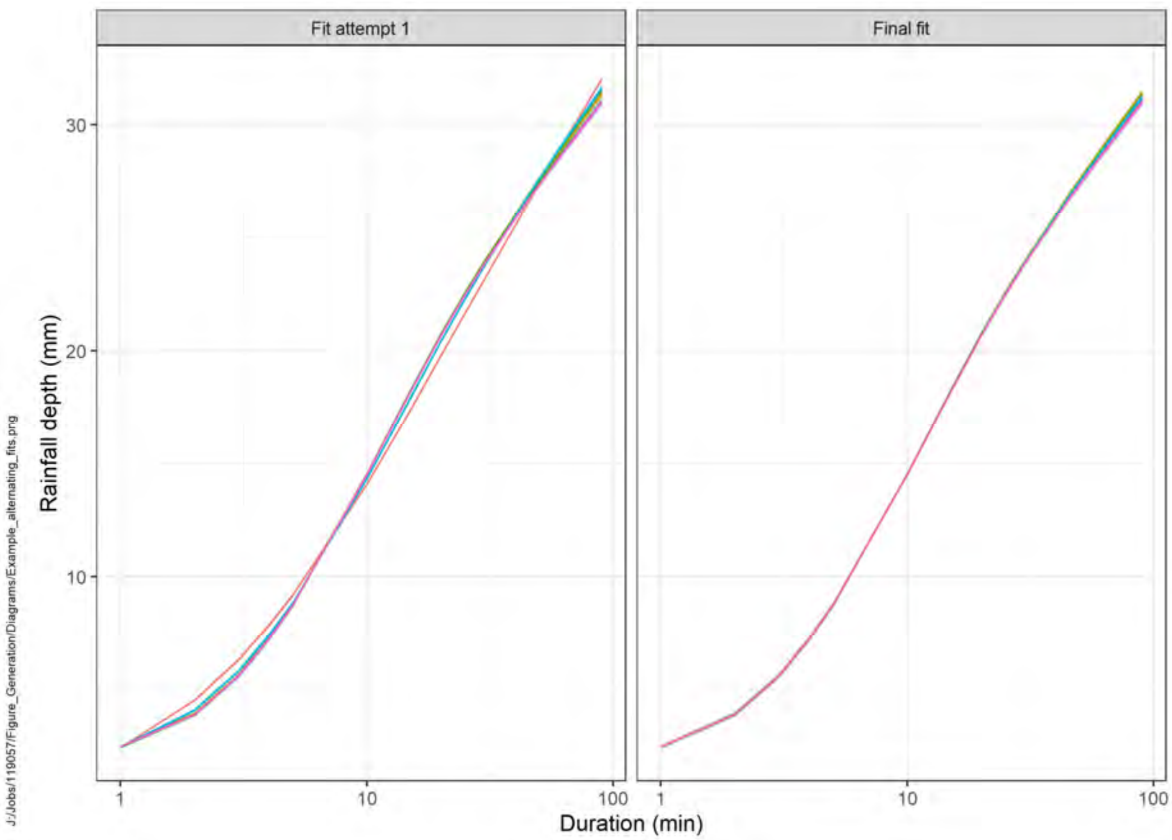

Diagram 6 Initial and final fit across durations for 9 grid cells in a 3x3 grid for the 1EY events.

3.12. Comparison to BOM 2016 methodology

The major steps in deriving IFD grids undertaken by BOM in 2016 and WMA in 2020 are outlined in Table 6. While the overall process was similar, there are a few key differences. WMA 2020 incorporated more gauges by including council run rain gauges, and a longer period of record was available. About 25% of sub-daily AMS values used in the project have occurred since 2012, so would not have been available for the BOM 2016 IFD process.

For the 2016 IFDs, a Bayesian Generalised Least Squares Regression (BGLSR) was used to give estimates of L-moment parameters at daily read rainfall gauges for durations less than 1 day (Green et al 2012a). In many areas of Australia there is very low density of sub-daily gauges and using only sub-daily gauges can yield very poor results. Therefore, BOM filled these gaps with regressed values to provide much better estimates of sub-daily IFDs. These regressed parameters will, in general, be closer to the mean of the training sample than observed values. In areas such as central NSW, this increased uniformity is a trade-off with the lack of sub-daily rainfall data, and the method will yield better estimates than not using regressed parameters (Green et al 2012a).

In areas such as the Brisbane area however, there is a high density of continuous rainfall gauges with relatively significant periods of record, so it is less clear whether the addition of regressed values increases the level of spatial information or if it brings all estimates closer to the mean, diminishing the representation of local features. It is also important to consider that daily gauges in this area are given relatively high weightings in regionalisation, given the large number of daily gauges available (shown in Figure 1). This is possibly obscuring the detail at the sub-daily stations.

The BOM 2016 IFDs were regionalised using a pool of 500 AMS years, while the WMA 2020 IFDs used at least 6 gauges with at least 100 years of record. WMA 2020 also used the SDE of elevation as well as elevation in regionalisation, which results in areas with more similar terrain being treated similarly. This means that the WMA 2020 grids give more highly localised final IFDs than those developed by BOM in 2016. Also, as BOM's 500 years included estimated L-moments at daily sites for sub-daily durations, the number of years of actual sub-daily data used is likely to be similar.

Table 6: Comparison of methods used for 2016 IFD and the Brisbane area revised IFDs

Step	2016 IFD	WMA 2020 IFDs
Extract AMS	Uses data to 2012 at BOM gauges	Uses available data until 2019 including council gauges
Fit Site L-moments	Standard LH0 fit of L-moments (sub-daily estimates and for AEPs more frequent then 2%)	Standard LH0 fit of L-moments
Regress L-moments at daily stations	BGLSR used to get sub-daily L-moment estimates at daily stations	No regression
Regionalisation	Pool of 500 AMS, calculating distance in latitude longitude and elevation to get site estimates of L-moments, then use them to calculate GEV parameters	Pool at least 6 stations with at least 100 AMS years, calculate distance in latitude longitude elevation and the standard deviation of elevation to get estimates of L-moments at all grid cells
Gridding	Grid GEV parameters using ANSUPLIN and elevation as a	Grid index rainfall using kriging and elevation and SDE as

	covariate	covariates. Smooth L-moment grids using spatial averaging
IFD grids	Calculate IFDs using gridded GEV parameters	Calculate IFDs using GEV parameters derived from gridded L-moments
Post processing	Fit polynomials through durations at each quantile and ensure consistency by increasing values of higher durations that are inconsistent	Resolve inconsistencies across durations and fit monotonically increasing polynomials through each quantile across range of durations

3.13. Interpolation of 1in 2 year and 1 in 5 year ARI events

In 2021, at the request of the councils, additional grids were estimated for the 1 in 2 year ARI (39.35% AEP) and 1 in 5 year ARI (18.13% AEP) events. These were interpolated using the 50%, 20% and 10% AEP grids using a gumbel space interpolation.

3.14. Extrapolation to 0.05% AEP using BoM growth factors

Both the independent external reviewer and the councils expressed concern about how to use the 2020 IFD grids for projects that would also require rarer rainfalls from 0.5% (1 in 200 year) AEP up to 0.05% (1 in 2000 year) AEP, which is outside the scope of WMA's original project. In some parts of the study area, using the 2020 IFD grids up to 1% AEP and reverting to BoM's original grids for rarer events could result in a lower total rainfall for the 0.5% AEP event than the 1% AEP rainfall, which is clearly not an acceptable outcome. Therefore, a new set of grids was derived for events from 0.5% AEP to 0.05% AEP using the Bureau growth factors above the 1% AEPs, and the 2020 1% AEP depths; i.e. these grids were derived using equation Equation 3.

Equation 3:

$$New\ Depth_{p\%} = \frac{IFD2016_{p\%}}{IFD2016_{1\%}} \times IFD2020_{1\%} \qquad for\ p = 0.5, 0.2, 0.1, 0.05$$

4. RESULTS

4.1. WMA 2020 IFDs

The WMA 2020 IFDs are shown in Figure 11 to Figure 13 for 3 day rainfalls for 1EY, 10% and 1% AEP. The full set of AEPs and durations are shown in Appendix A.

The percentage difference to the site IFD was calculated using Equation 4.

$$Percentage\ difference = \frac{Revised\ IFD - Site}{Site} \times 100 \qquad \text{Equation 4}$$

Summaries of the comparisons of the WMA 2020 IFDs to site GEVs are shown in Figure 14 and Figure 15. These figures give a very broad overview of the number of sites that show various percentage differences for each AEP and duration. These can be read like a stacked column chart with the total number of sites (~175 gauges for subdaily data and ~500 for daily data) divided by colour based on how many sites are in each category of % difference.

This shows a fairly even distribution of positive and negative differences between the WMA 2020 IFDs and at site data, with an increase in variability at rarer AEPs.

Maps of point differences are shown for the 1%, 10% and 1EY events for 180 mins, 1 day and 3 days in Figure 16 - Figure 24.

Figure 25 to Figure 30 show grids of the WMA 2020 IFDs, the 2016 IFDs and the ARR 1987 IFDs for the 1%, 10% and 1EY AEPs for the 180 min, 1 day and 3 day events. This clearly shows more spatial variability in the WMA 2020 grids. More details on the relative differences between the grids are discussed in sections 4.3 and 4.4.

4.2. Comparison of WMA 2020 and ARR 2016 IFDs to at-site estimates

To investigate whether the WMA 2020 IFD grids lower site residuals, Mean Average Error (MAE), Root Mean Square Error (RMSE) and the coefficient of determination (R^2) were calculated using both the WMA 2020 IFDs and the 2016 IFDs as the predicted dataset, and the site IFD estimates as the observed. This produced the results shown in Figure 34 to Figure 36.

RMSE, MAE and R^2 are all commonly used metrics for measuring accuracy of predicted data to observed data. RMSE and MAE are very similar except that errors are squared in RMSE which puts a higher weighting on larger errors; this means that a low number of points with very large errors will influence RMSE more than MAE. For both MAE and RMSE, the lower the value the better the fit, with a perfect fit having an error of 0. R^2 is a measurement of how much variability in observed data can be explained by predicted data. Higher values of R^2 mean a better fit, with a perfect fit having an R^2 of 1.

The RMSE and MAE were reduced with the WMA 2020 IFDs compared to the 2016 IFDs over all durations and AEPs. R^2 was also improved across all AEPs and durations and areas, noting that negative R^2s were evident for many durations and AEPs in the ARR 2016 IFDs. On average the WMA 2020 method has created grids that better represent site estimates compared to the ARR 2016 IFDs.

These results were validated by using the validation leave-one-out (loo) data grids and the 2016 IFDs as the predicted dataset, and the site IFD estimates as the observed. This validation dataset showed that RMSE and MAE were reduced for almost all durations and AEPs although there was a slight increase in rare AEPs for durations less than 1 hour (Figure 37 and Figure 38). Similarly, R^2 increased for all durations greater than 1 hour (Figure 39).

The differences between the ARR 2016 IFDs, WMA 2020 IFDs, and at-site estimates are shown in Figure 14 and Figure 15 for WMA 2020 IFDs and Figure 40 and Figure 41 for BOM 2016 IFDs. These figures show that the WMA 2020 estimates reduce the number of sites where there are large differences between the IFDs and the at-site estimates, across all AEPs and durations, indicating that the WMA 2020 grids provide a better fit to the at-site estimates.

4.3. Comparison to ARR 2016 IFDs

4.3.1. Sub-daily rainfall grids

The percentage differences between the WMA 2020 and ARR 2016 IFD grids are shown for all durations and AEPs in Figure 42 and the gridded differences 1% AEP 180 min differences are shown in Figure 43. Figure 42 can be read in a similar way to Figure 14 except as we are looking at overall difference between grids instead of differences at individual gauges the y-axis totals are given as a percentage of grid cells instead of count of rain gauge locations. All durations and AEPs are shown in Appendix B. For short durations of 5 to 60 minutes, the WMA 2020 IFDs are generally higher than the ARR 2016 IFDs for the 1EY to 50% AEP event. The increase shown in the WMA 2020 IFDs is greatest in areas of higher elevation in the south west of Lockyer Valley Regional Council area, and in a small area in the south of the Brisbane City Council area. As events become rarer, there are more sites where the WMA 2020 IFDs are lower than the ARR 2016 IFDs, particularly at shorter durations of 5 to 30 minutes.

For durations of 120 to 720 minutes, the WMA 2020 IFDs are generally higher than the ARR 2016 IFDs, particularly for the 2% and 1% AEP events, with some areas showing greater than 45% difference. These areas are in the south of the Lockyer Regional Council area, the west of Ipswich City Council area, and the centre and south in Moreton Bay Regional Council area. For these durations, the WMA 2020 IFDs are lower for the 2% and 1% AEP events on the majority of the coast in the Brisbane City Council area and Moreton Island.

4.3.2. Daily and longer duration rainfall grids

The percentage differences between the WMA 2020 and ARR 2016 IFDs are shown for all durations and AEPs in Figure 44 and the gridded differences 1% AEP 3 day differences are shown in Figure 45. All durations and AEPs are shown in Appendix A. At durations of 2 to 6 days, the revised IFDs are generally lower than the ARR 2016 IFDs across all AEPs, typically by less than 15%. The areas with the greatest reduction in IFDs are in central Lockyer Valley Regional Council area, the east of Ipswich Regional Council area, the south of Brisbane City Council area and the north west of Moreton Bay Regional Council area. The main area where the WMA 2020 IFDs are markedly higher is in the south of the Lockyer Valley Regional Council area. Other areas where the WMA 2020 IFDs are higher, particularly for the 1% AEP event are in the west of the Ipswich and Lockyer Valley Regional Council areas, and an area from the west of Brisbane north to Dayboro.

4.4. Comparison to ARR 1987 IFDs

The percentage differences between the WMA 2020 IFDs and ARR 1987 grids are shown for all durations and AEPs in Figure 46 and Figure 47 and the gridded differences 1% AEP 180 min, 1 day and 3 days differences are shown in Figure 48 to Figure 50. For short durations of 5 to 30 minutes, the WMA 2020 IFDs are higher than the 1987 IFDs for the 1EY event and are generally lower for the 2% and 1% AEP events. For very short duration events, the area with the greatest decrease from the 1987 IFDs for the short duration 2% and 1% AEP events is greatest around Kallangur and Bald Hills, in the centre and north of the Ipswich City Council area, and along the coast in the Brisbane City Council area. For durations 60 to 720 minutes, the largest decreases in IFDs compared to ARR 1987 values are generally in the south west of the Moreton Bay Regional Council area, north of the Lockyer Valley Regional Council area, west of the Brisbane City Council area and the north east of the Ipswich City Council area. For durations of 360 to 720 minutes there are also some areas where the WMA 2020 IFDs increase by more than 35% at AEPs of 2% and 1%. These areas are in the west of the Ipswich City Council area, south of the Lockyer Valley Regional Council area, and centre and south east of the Moreton Bay Regional Council area.

For events from 1 to 3 days, the WMA 2020 IFDs are higher than the ARR 1987 IFDs in some areas, and lower in others, for all AEP events, particularly rarer than 10% AEP. The WMA 2020 IFDs are generally higher in the south of Lockyer Valley Regional Council area, the west and south east of the Ipswich City Council area, and the west of the Moreton Bay Regional Council and Brisbane City Council areas. The WMA 2020 IFDs are generally lower than the ARR 1987 IFDs in the centre and north west of the Lockyer Valley Regional Council area, the centre and east of the Ipswich City Council area and the east and coastal areas of the Moreton Bay Regional Council and Brisbane City Council areas.

4.5. Interpolation of 1 in 2 year and 1 in 5 year ARI events

IFDs were interpolated for the 1 in 2 year ARI and 1 in 5 year ARI as described in Section 3.13. Full grids were supplied to the councils. An example of the 1 day rainfall depths created are shown for some selected grid cells in Diagram 7.

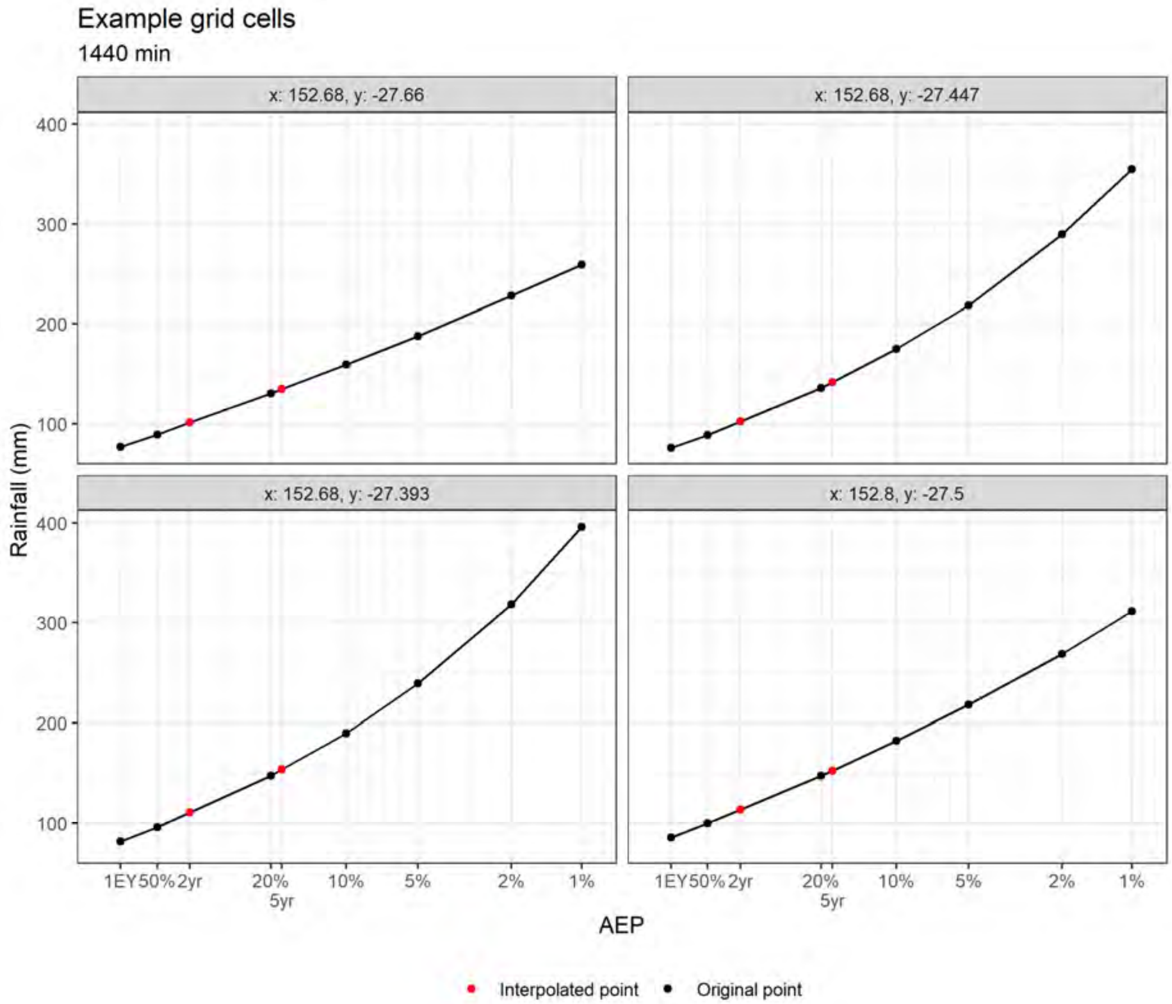

Diagram 7 Example grid cells showing the original 1 day IFD rainfall totals (using full process described in Table 6) and the 1 year and 5 year ARI depths interpolated from these values in Gumbel space.

4.6. Extrapolation to 0.05% AEP using BoM growth factors

IFDs were extrapolated up to the 0.05% AEP (1 in 2000 year) rainfalls using the method described in Section 3.14. Diagram 8 shows some examples of the extended IFD curves for the 1 day rainfall events. In some cases this extension using the Bureau growth factors causes a notable change in slope to the depths at 1% AEP, where the slope of the IFD 2016 curves was significantly different to the IFD 2020 curve. Therefore, some degree of caution should be used when using this dataset. However, use of the extrapolated IFDs will provide much better outcomes than use of the IFD 2016 grids without factoring. This approach provides a feasible alternative to undertaking the same analysis for these rarer rainfalls, which would be a significant project. Diagram 9 shows the extended 2020 IFDs in context with the BoM 2016 IFDs to help show why a difference in slope may occur, and why even with this these should be adopted.

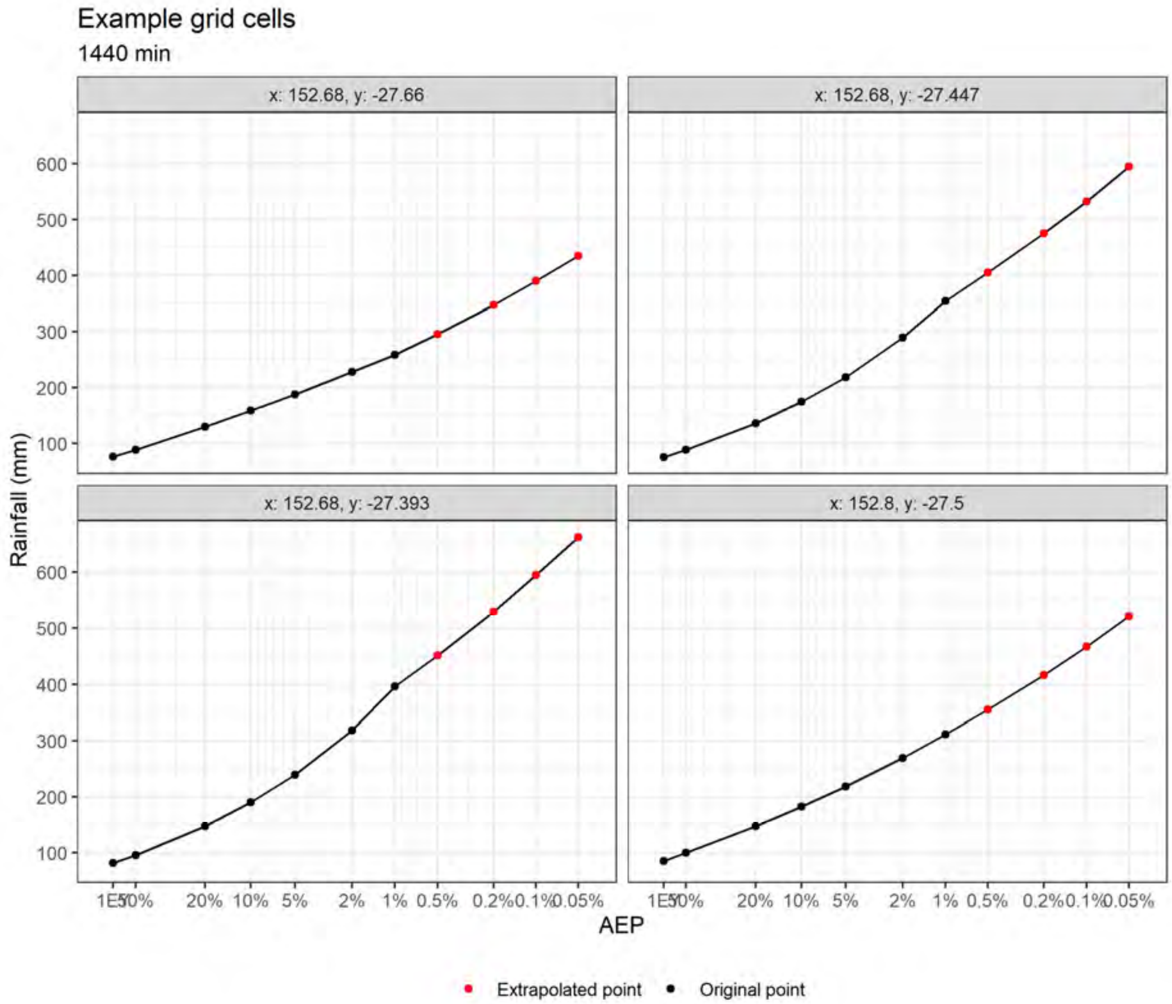

Diagram 8 Example grid cells showing the original 1 day IFD rainfall totals (using full process described in Table 6) and depths extended up to the 0.05% AEP based on the IFD 2016 growth factors.

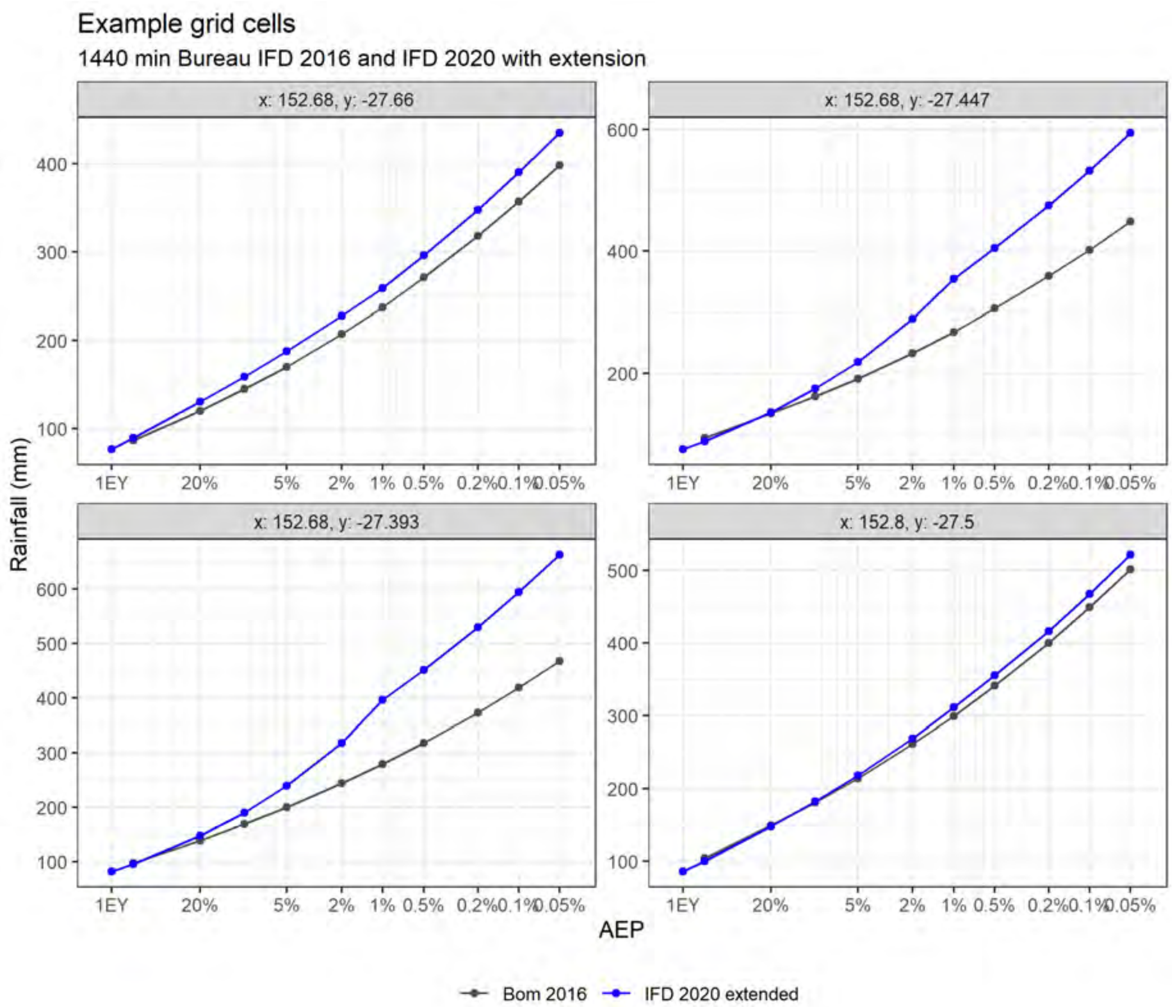

Diagram 9 Example grid cells showing the extending IFD 2020 depths (from Diagram 8) and the BOM 2016 depths, showing that it is necessary to scale the 2016 depth to give a consistently increasing depths at some grid cells.

5. RECOMMENDATIONS

The ARR 2016 IFD grids were a great improvement on the ARR 1987 IFD grids, as they were based on considerably more data and used improved fitting techniques. However, in some areas there may be local biases in the 2016 IFDs. The large region sizes used in the ARR 2016 IFD analysis, and the incorporation of a regression to estimate sub-daily rainfalls at daily gauges yields better large-scale accuracy, may not be optimal for areas with high sub-daily gauge density and localised high rainfall gradients.

Revised IFD grids (referenced as WMA 2020 grids) have been developed for the Brisbane, Ipswich, Lockyer Valley and Moreton Bay areas. The WMA 2020 IFDs were developed using methods that place higher weighting on the local sub-daily data, and use an alternative regionalisation technique. The WMA 2020 IFDs resulted in a reduction in local biases across all AEPs, durations and areas, compared to the ARR 2016 IFDs. It is therefore recommended that the WMA 2020 grids be utilised for design flood analysis for these areas. If conservatively high estimates are desired, it would be valid for practitioners to use the envelope of the WMA 2020 IFD grids and the 2016 IFDs. Changes in IFDs will not necessarily translate to equivalent changes in peak flows. The changes in flood peaks will be catchment and event dependent; i.e. a 10% increase in IFDs does not necessarily mean a 10% increase in flood peak. Therefore, in areas where the WMA 2020 IFDs are significantly different to the 2016 IFDs, flood studies may need to be reviewed.

The intent is to upload the WMA 2020 IFDs to the ARR datahub (Babister et. al 2016) subsequent to review and discussion with BOM. This will require consensus among the councils given many catchments cross council boundaries.

For areas that are likely to have local bias in the 2016 IFDs, the introduction to ARR 2019 provides some relevant guidance (ARR, Ball et al, 2019). Where no other more appropriate estimates are available, the 2016 IFDs are currently the best estimates and should be used. If it is evident that local biases may impact design flood estimates, it is appropriate that alternative methods are used to develop IFDs in these areas. The following statement in ARR 2019 provides guidance.

> "*In development of this guidance, it was recognised that knowledge and information availability is not fixed and that future research and applications will develop new techniques and information. This is particularly relevant in applications where techniques have been extrapolated from the region of their development to other regions and where efforts should be made to reduce large uncertainties in current estimates of design flood characteristics.*
>
> *Therefore, where circumstances warrant, designers have a duty to use other procedures and design information more appropriate for their design flood problem. The authorship team of this edition of Australian Rainfall and Runoff believe that the use of new or improved procedures should be encouraged, especially where these are more appropriate than the methods described in this publication. Assessment of the relative merits of new procedures and design information should be based on the following*

desirable attributes:

- *based on observed data relevant to the specific application;*
- *consistent with current knowledge of flood processes;*
- *able to reproduce observed flood behaviour in the area of interest; and*
- *where possible, endorsed by a peer review process*"

This work has also shown that the current IFD approach of individually fitting durations early in the process and smoothing across durations very late in the process is problematic when there is serious conflict between growth curves fitted to sub daily and daily data. An approach that fitted all durations together with consistent growth curves would be more defendable and would make regionalisation much easier. If this study is updated in the future, testing of this type of approach should be considered as a first step

6. CLIMATE CHANGE CONSIDERATIONS

The work carried out in this report assumes that the climate is stationary and rainfalls observed in the past are representative of what will be observed in the future. Climate change is however accepted as occurring and will likely have impacts on IFD relationships (Bates et al, 2015). Therefore, the IFD estimates provided as part of this report will be likely underestimates once climate change starts having significant impacts on IFD relationships. A high level assessment was undertaken to investigate whether there were any significant trends in the AMS records of the 15 daily gauges with continuous records of at least 50 years, that were still operational since 2000. The analysis showed a significant Mann-Kendall trend test result at only one site, therefore unfortunately, there is not enough data in the areas studied in this report to make confident estimates about the effect of climate change on IFDs.

ARR 2019 (Bates et al, 2019) provides guidance on adjusting IFD estimates to account for climate change. Expected changes in heavy rainfalls relate to between 2% and 15% per °C of warming over Australia, and the recommended adjustment is to increase rainfall by 5% per °C of warming. ARR 2019 also details guidelines on how to incorporate climate change into asset design decisions. It is highly recommended that these guidelines are followed when developing significant infrastructure that will be impacted by flooding.

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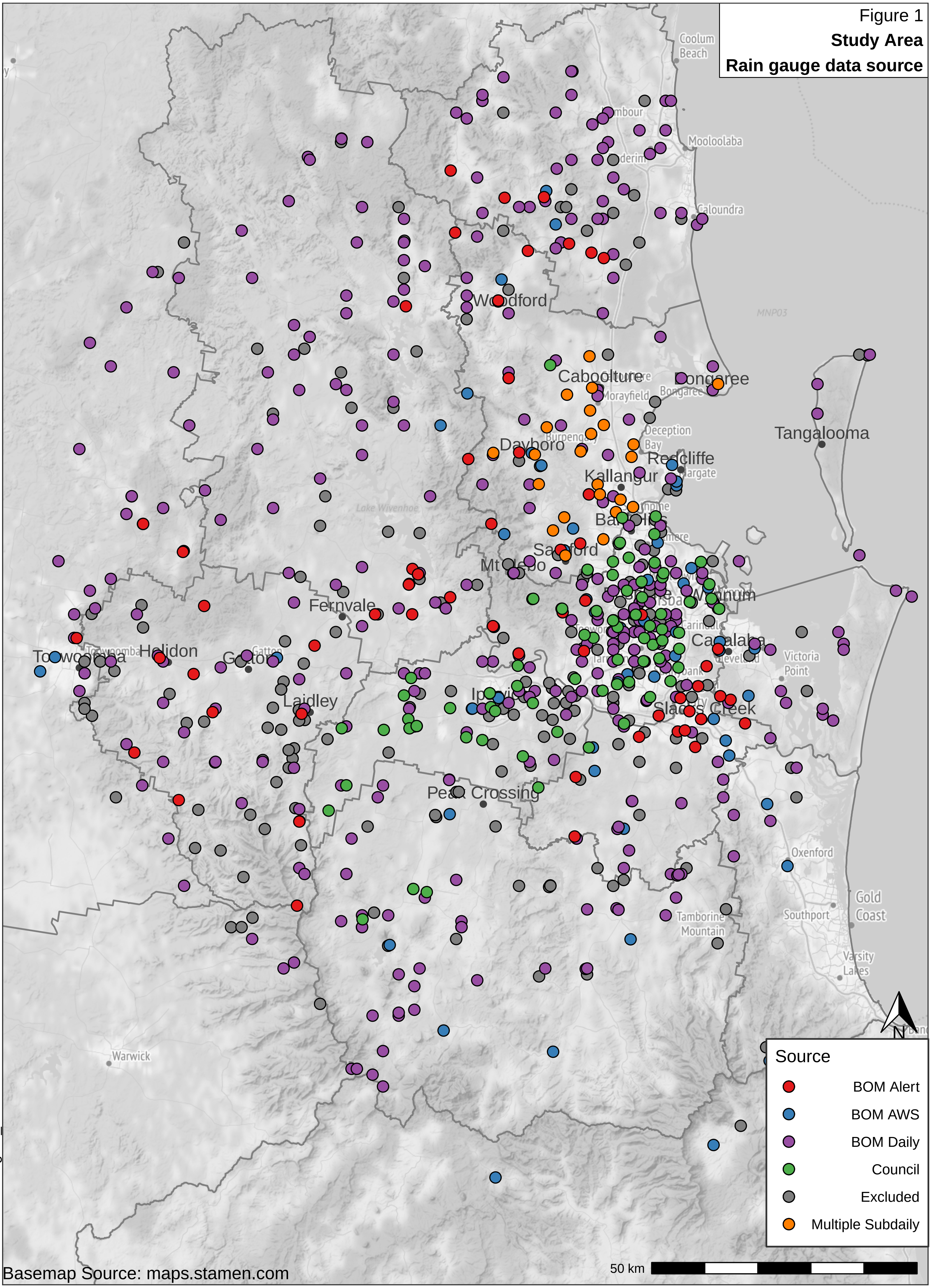
Figures



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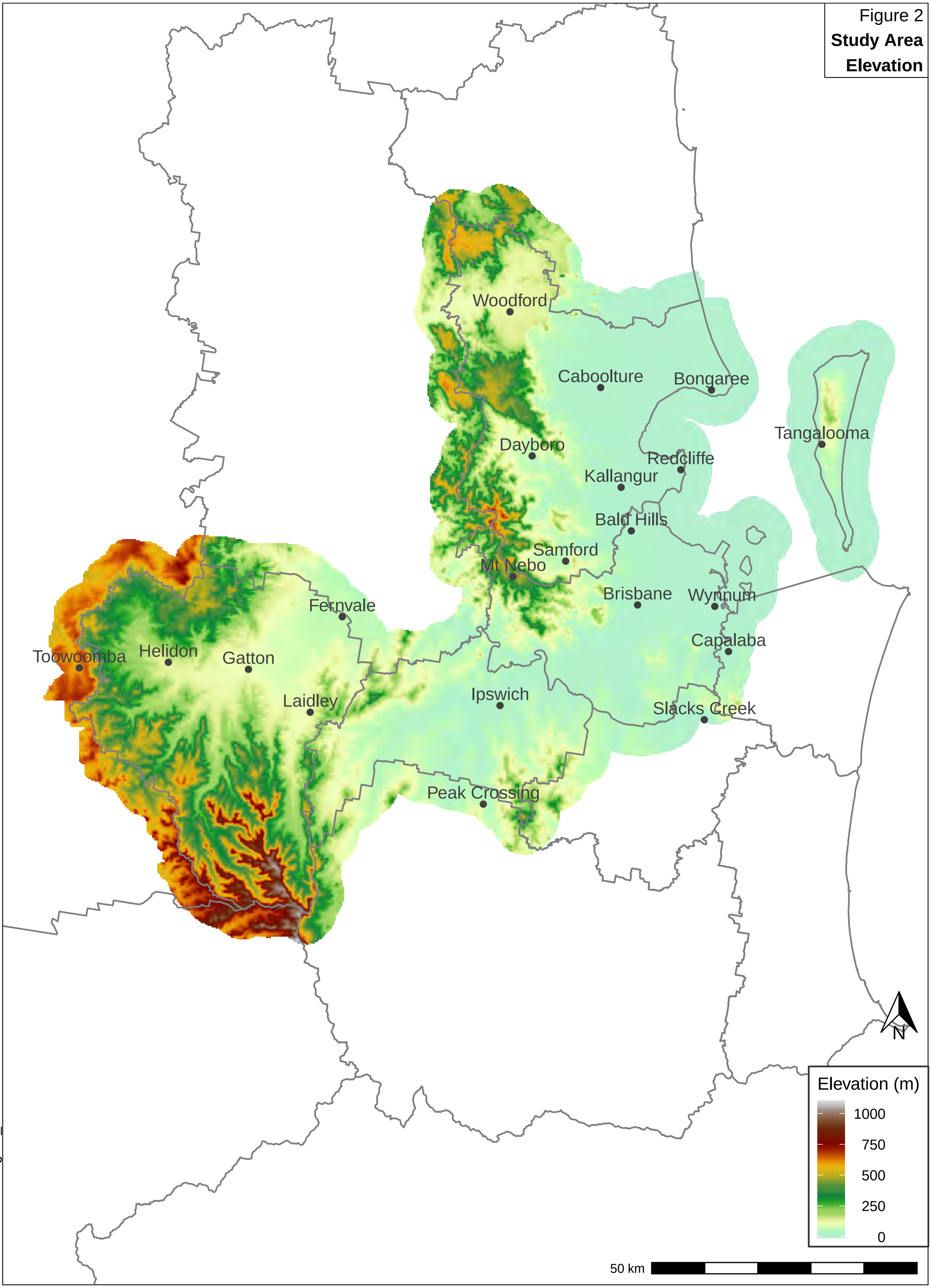

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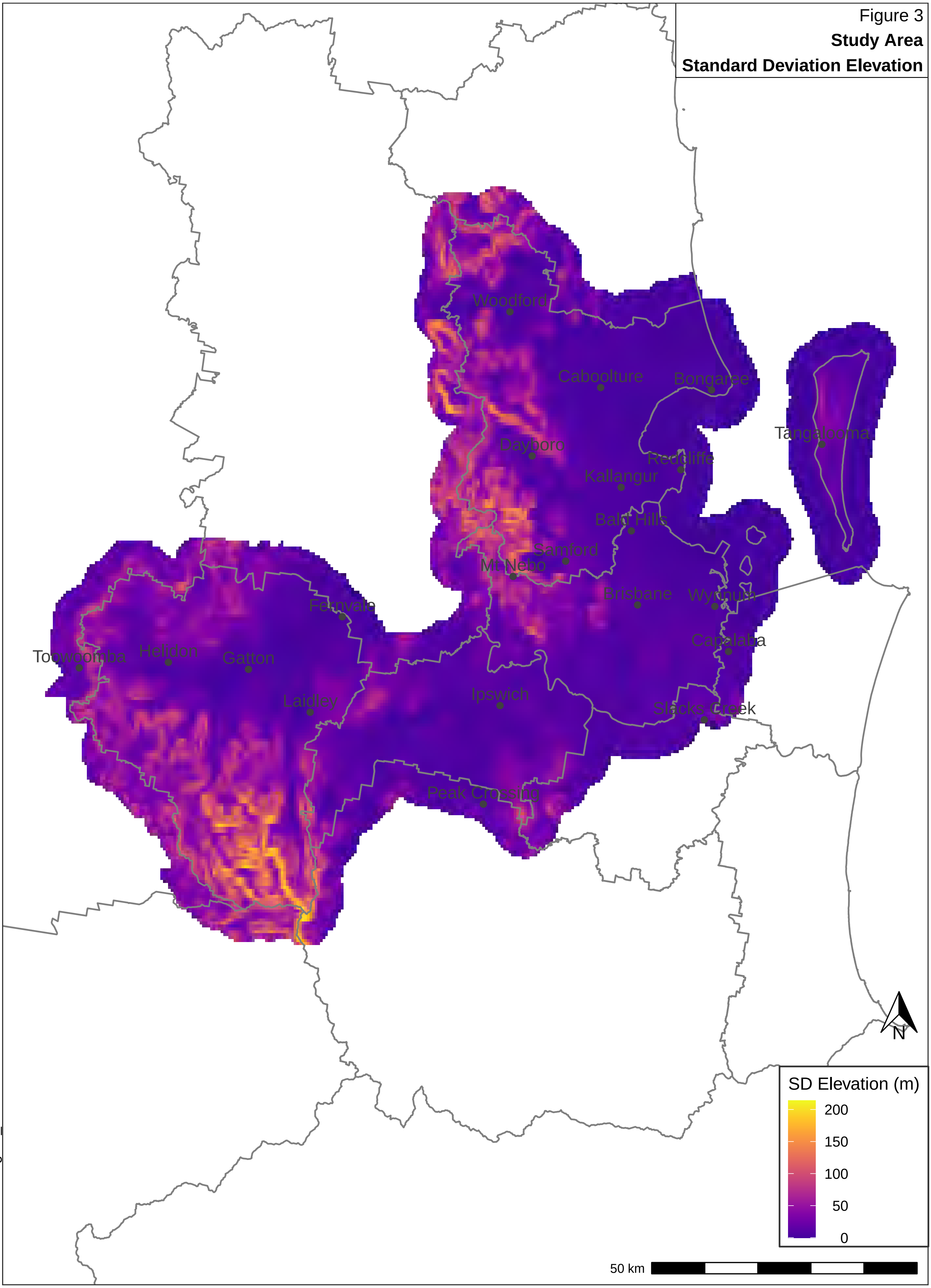
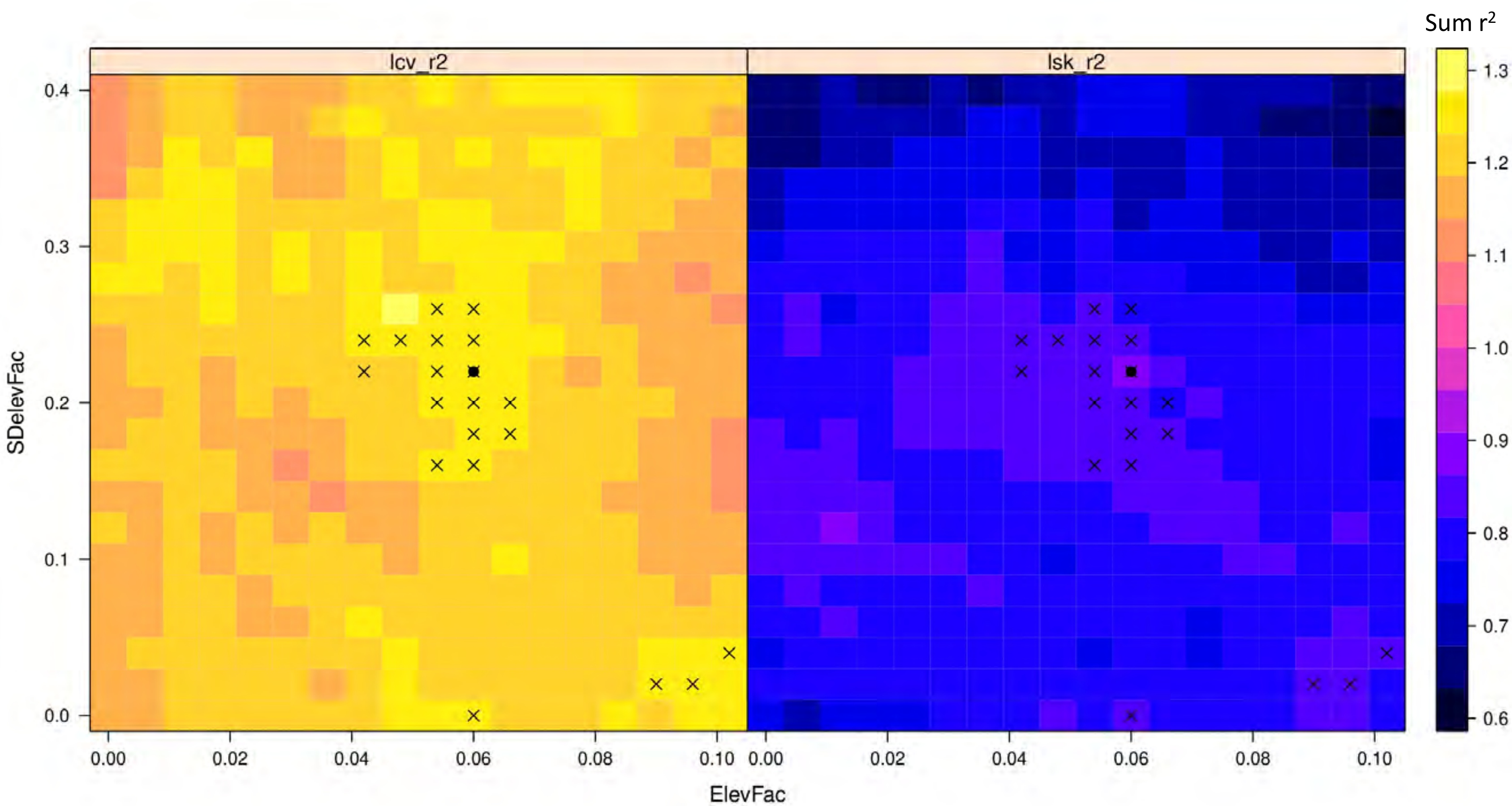


Figure 3
Study Area
Standard Deviation Elevation
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
SD Elevation (m)
200
150
100
50
0
50 km

Figure 4
Sum of Coefficient of Determination 180 min to 4320 min
For different SDE and elevation factor combinations



Legend

■ Adopted factors

× Top 20 factor combinations

J:\Jobs\119057\Analysis\Region_Gridding\100Yrs_Buffer0_01_nYrMin10\Factors\Adopted_Factors.pdf

Figure 5
Example Grid Cell Rainfalls
Prior to and After Resolving Inconsistencies

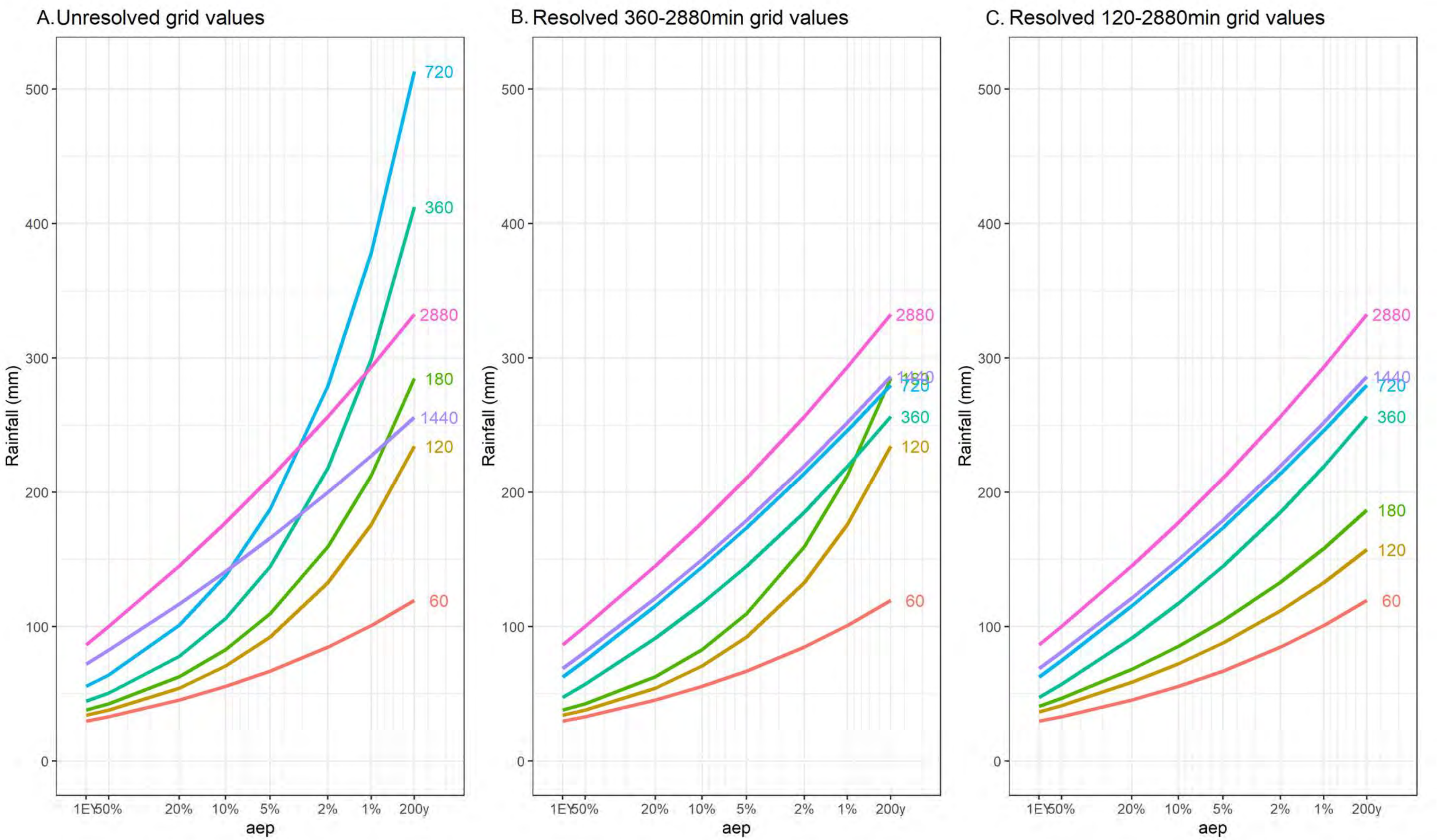


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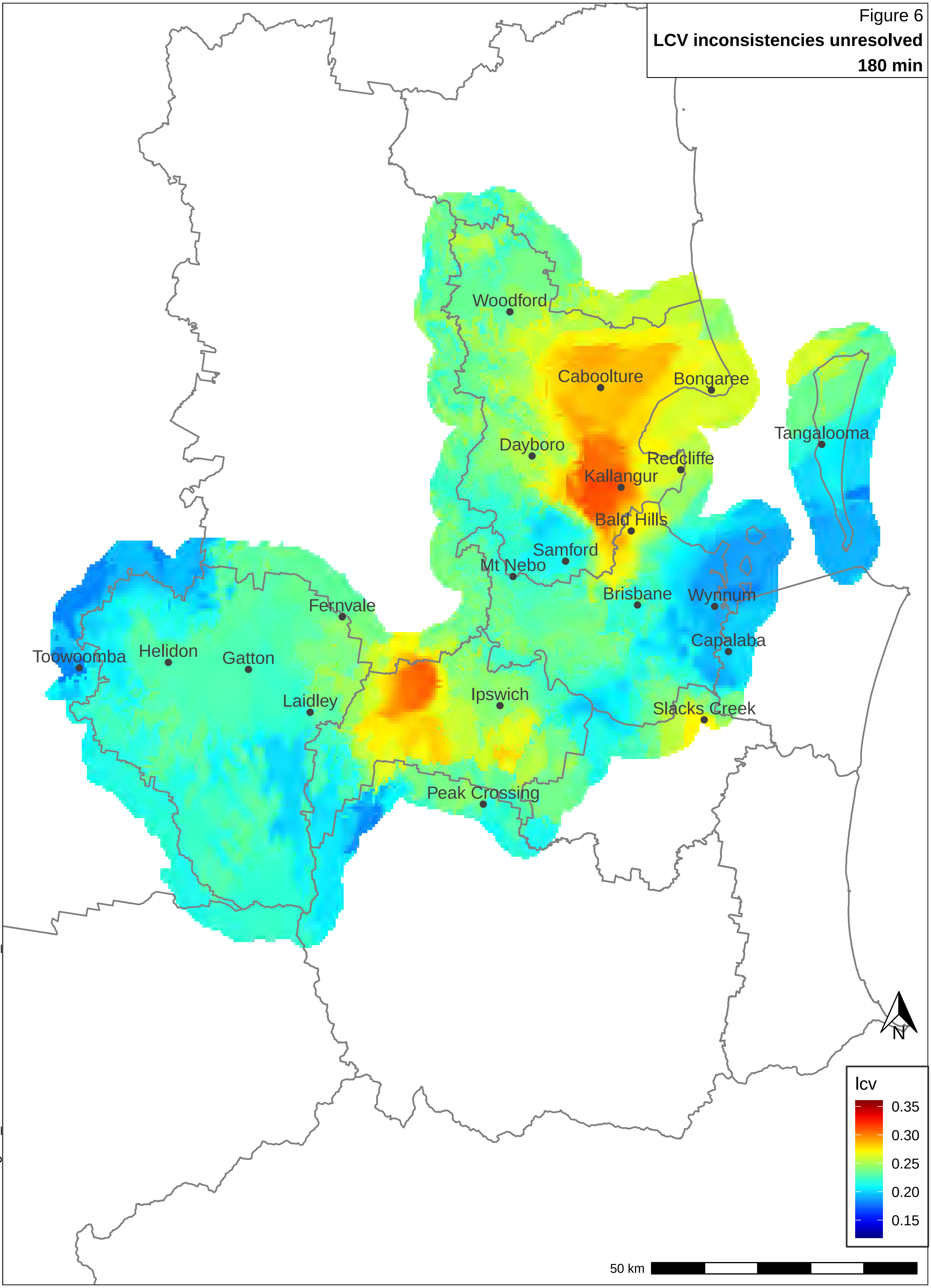
Figure 6
LCV inconsistencies unresolved
180 min



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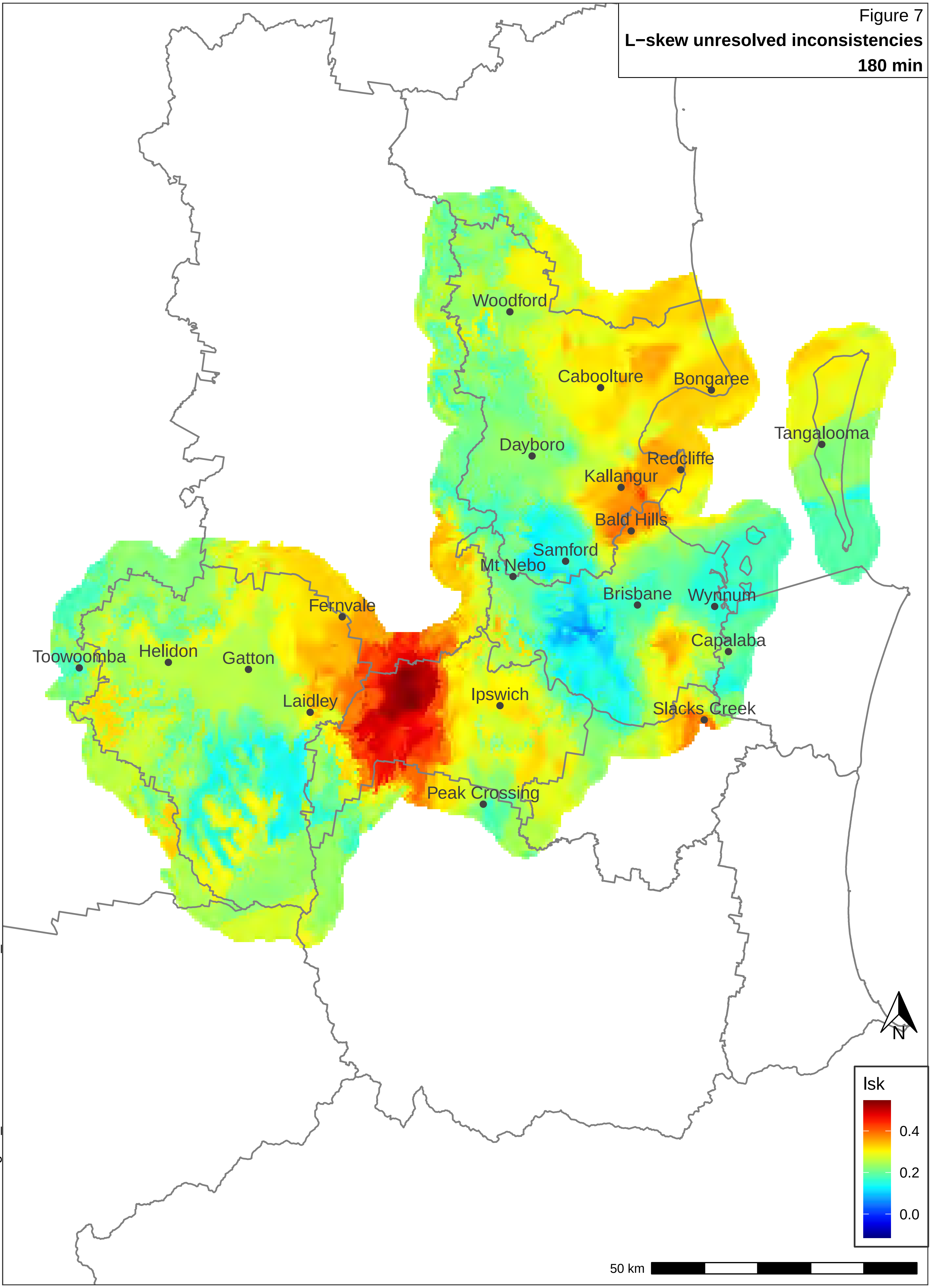

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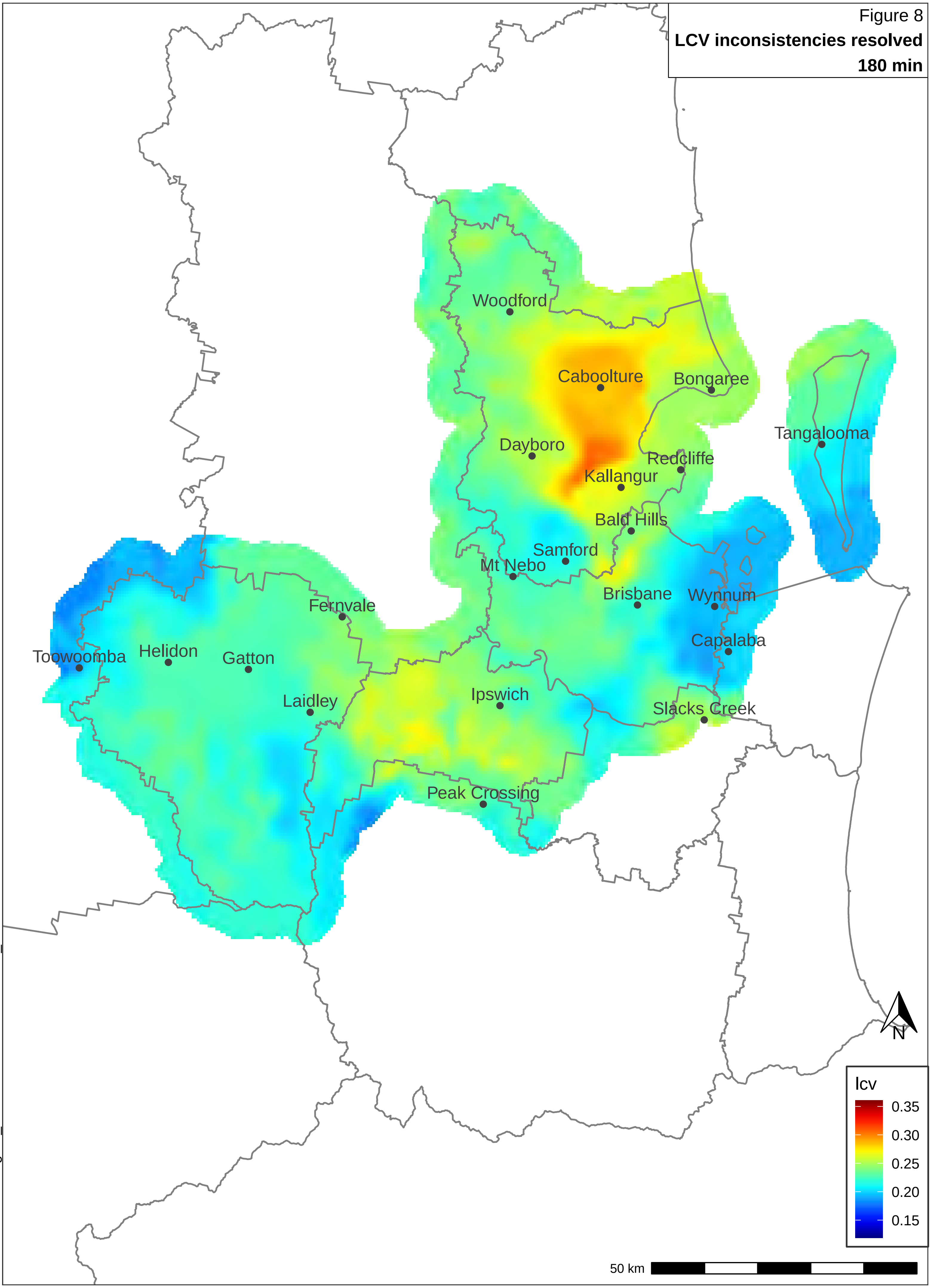

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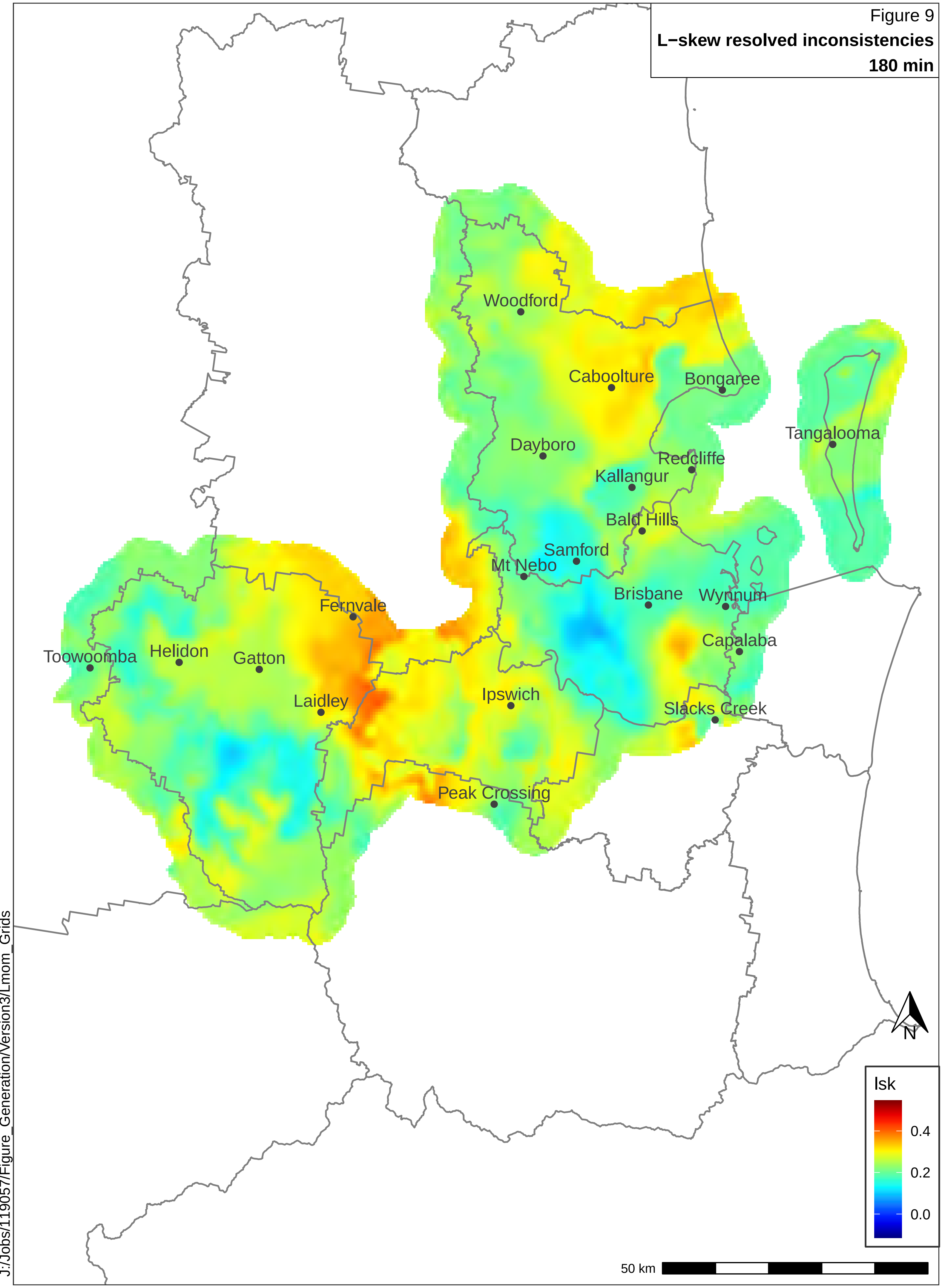
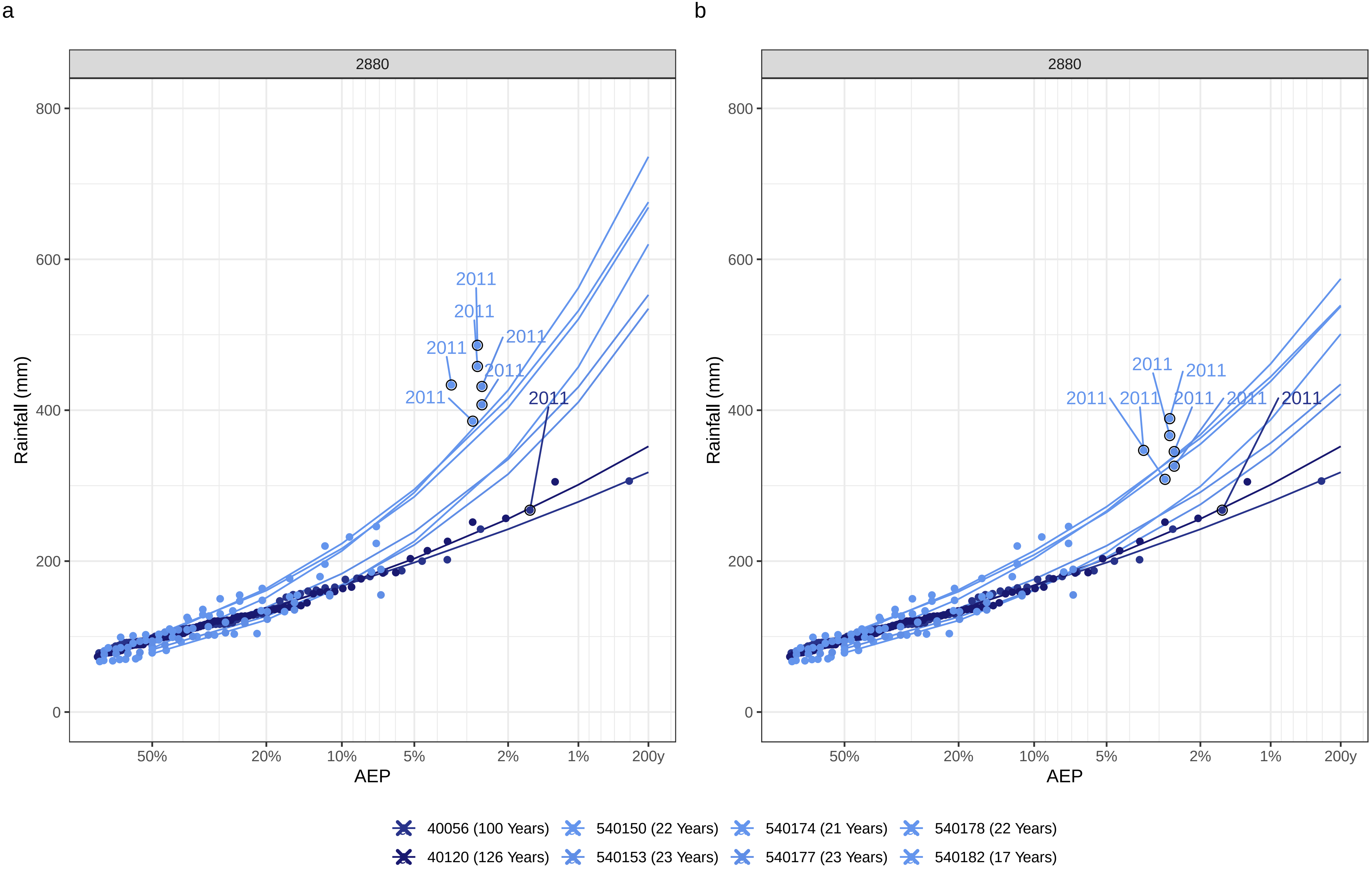


Figure 9
L−skew resolved inconsistencies
180 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
lsk
0.4
0.2
0.0
50 km
J:/Jobs/119057/Figure_Generation/Version3/Lmom_Grids

Figure 10

Selected sites in impacted area of 2011 event
Pre and post scaling



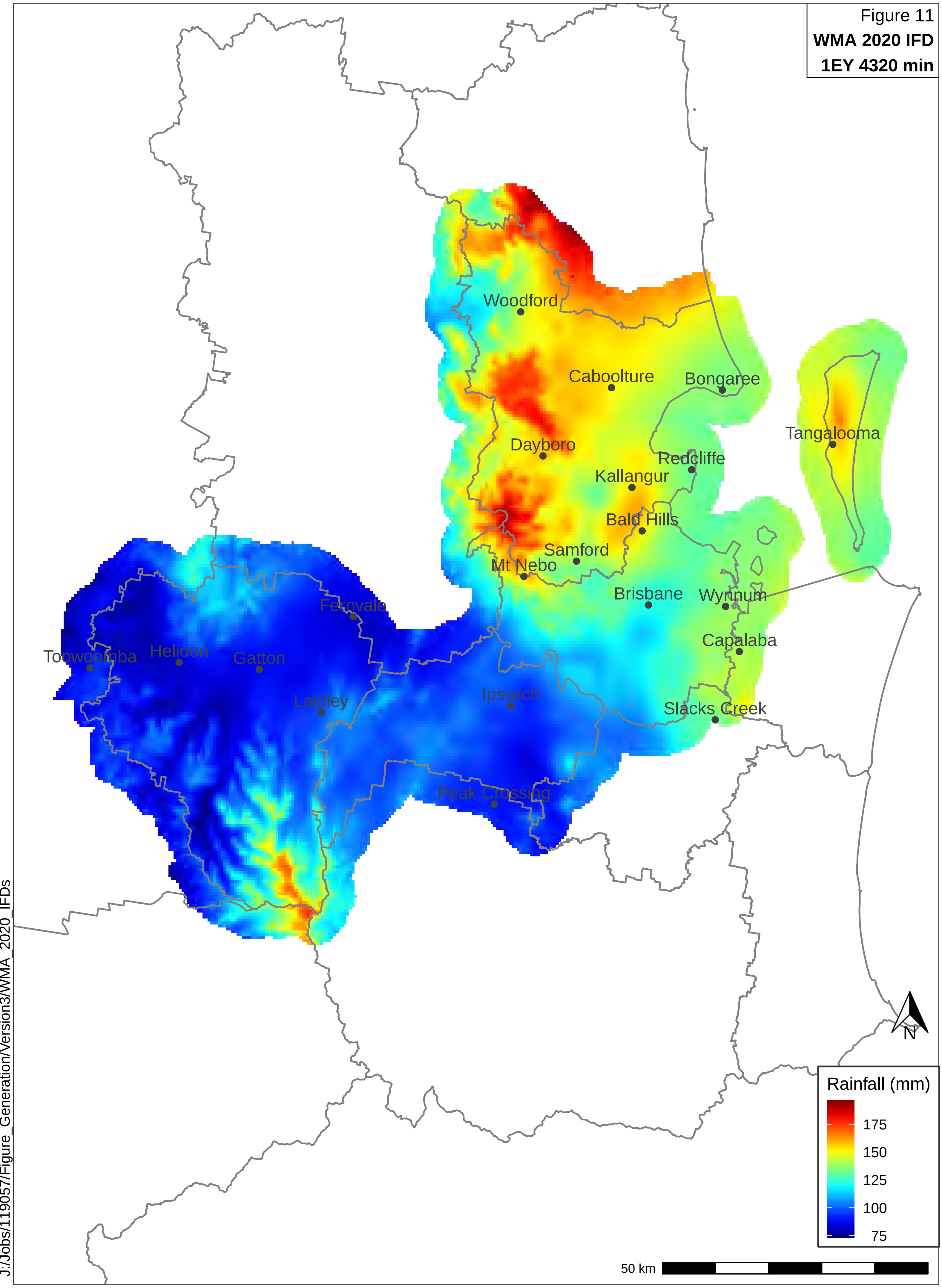
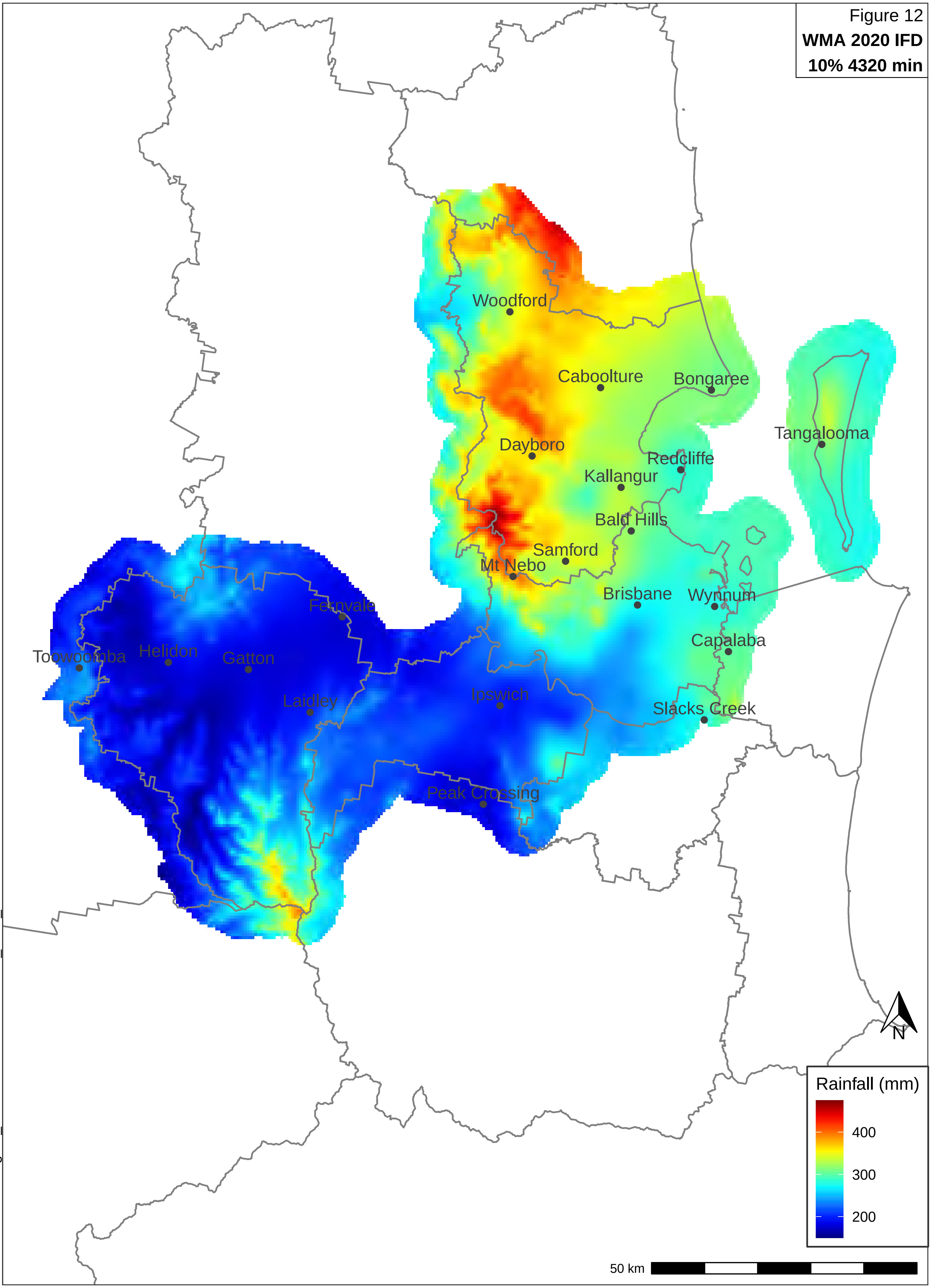
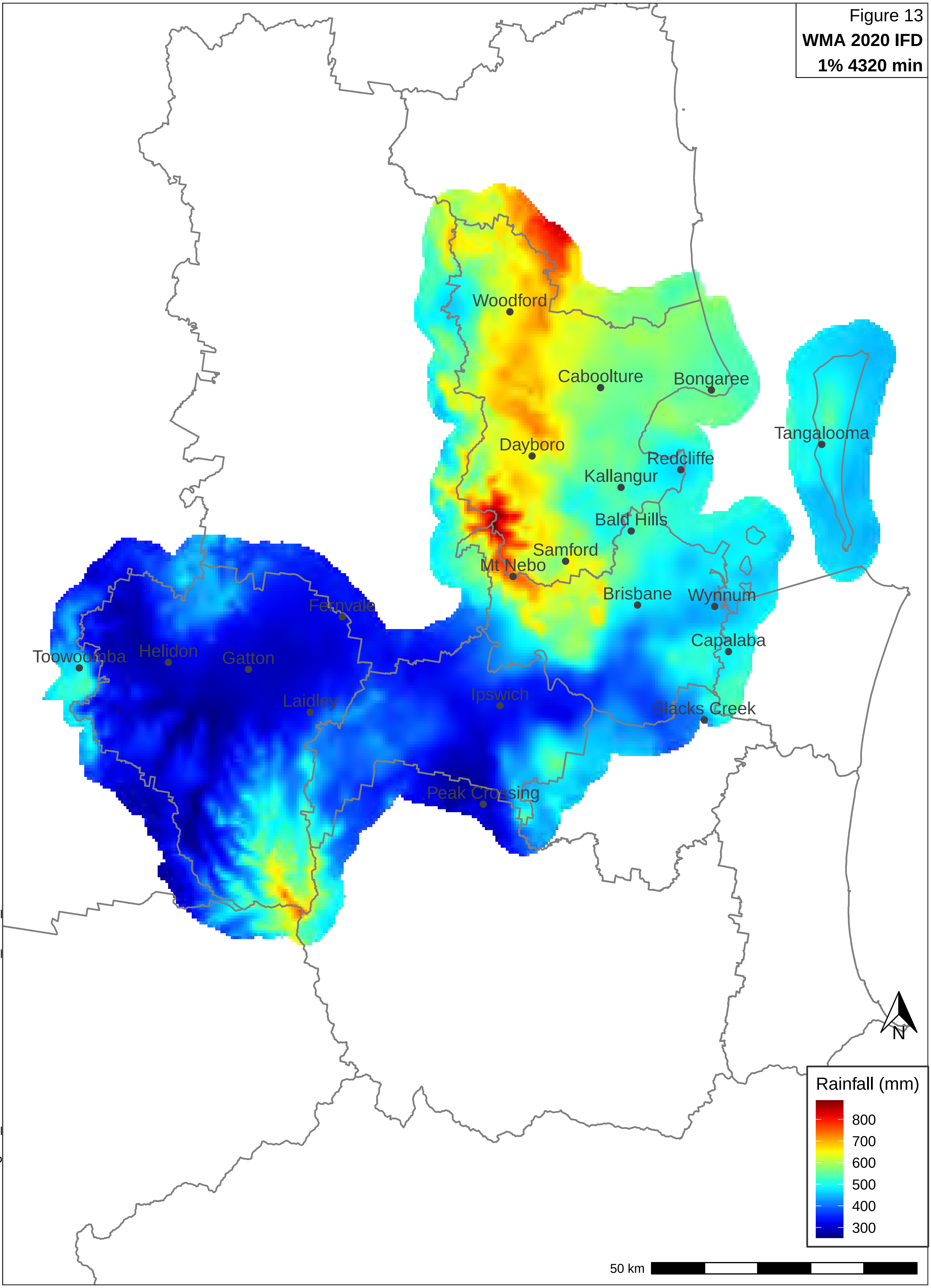


Figure 11
WMA 2020 IFD
1EY 4320 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
Rainfall (mm)
175
150
125
100
75
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

Figure 13
WMA 2020 IFD
1% 4320 min



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

Figure 14

% Difference WMA 2020 IFDs:At Site
< 1 day

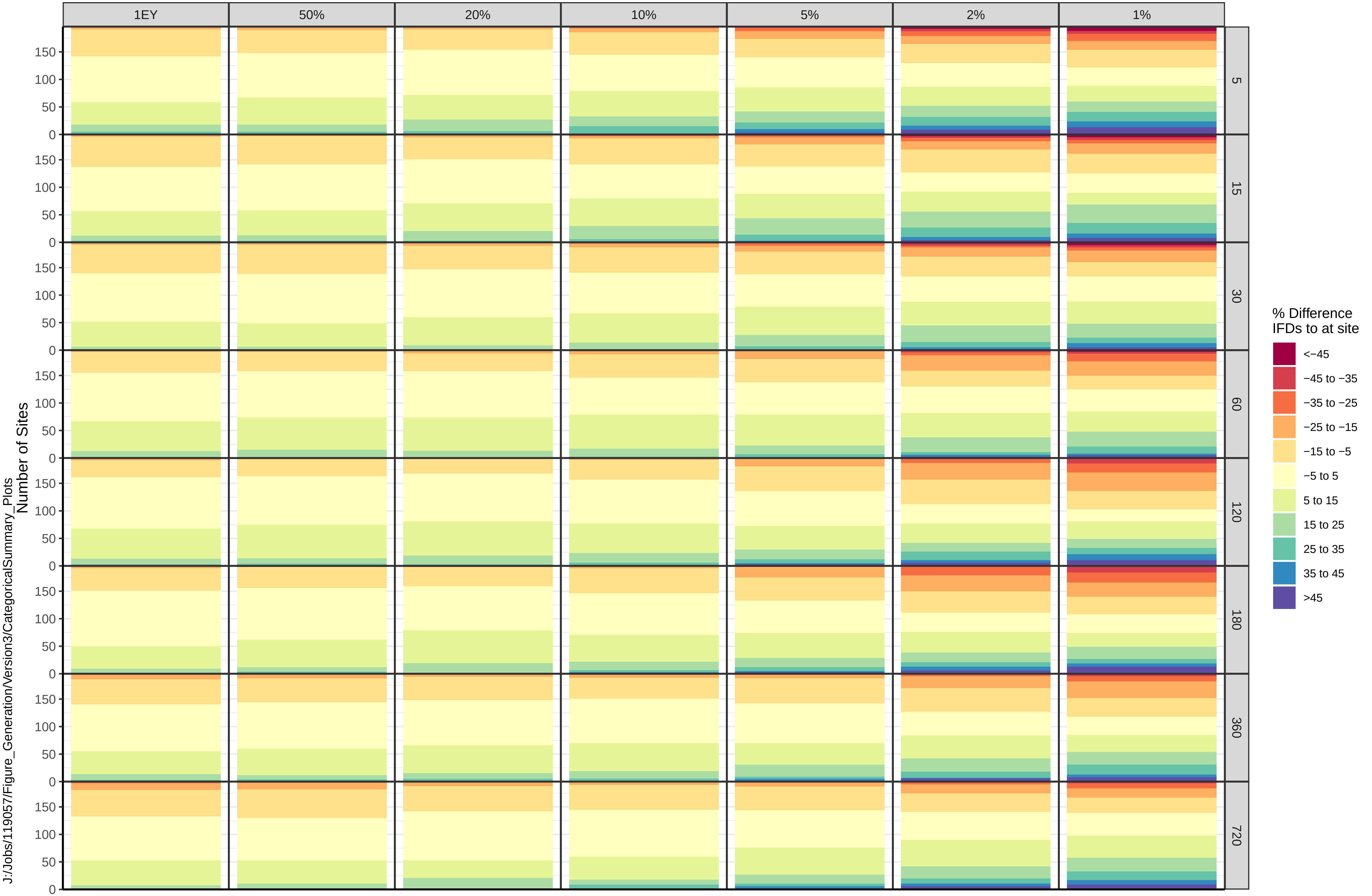
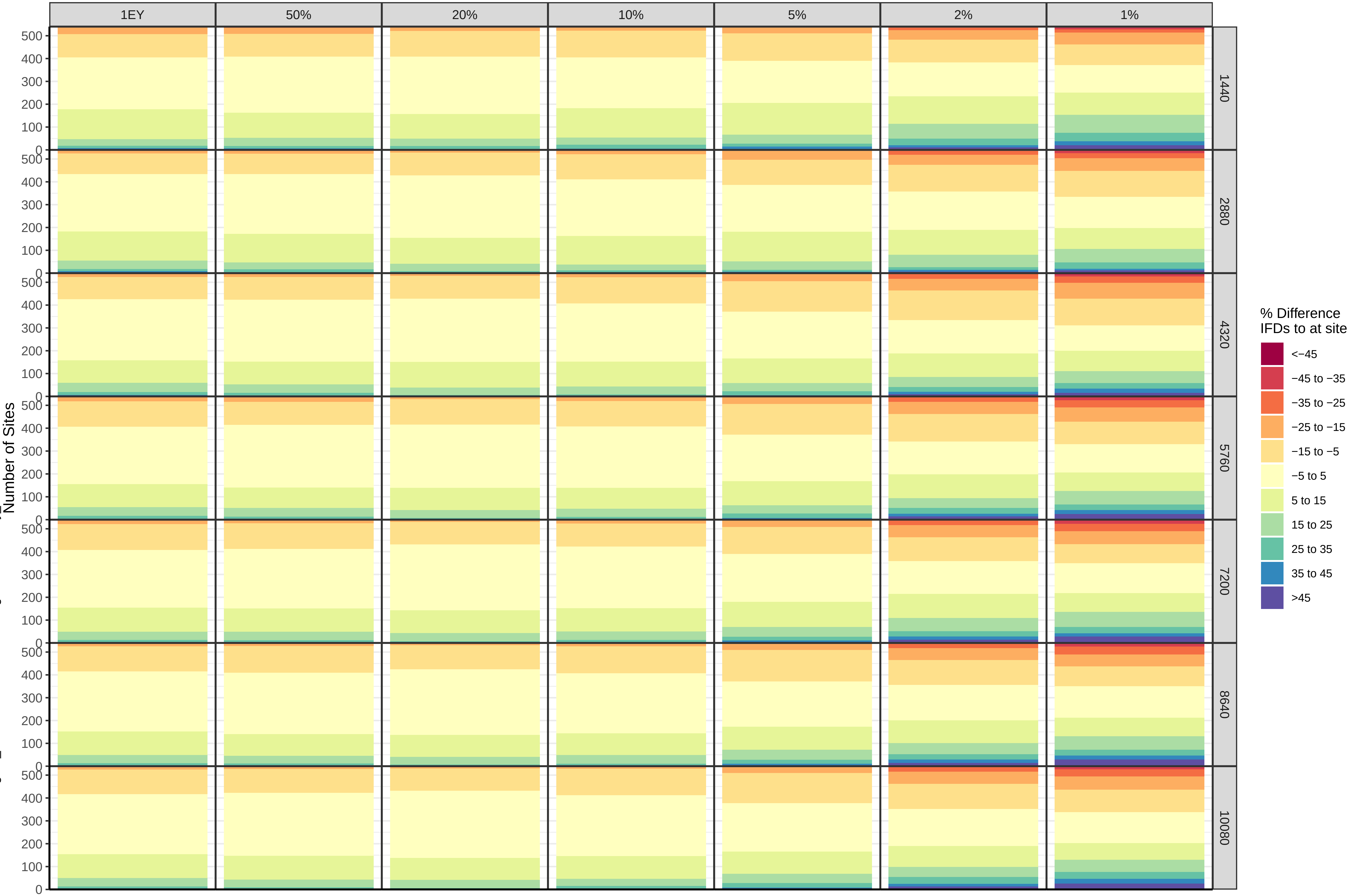


Figure 15

% Difference WMA 2020 IFDs:At Site
>= 1 day



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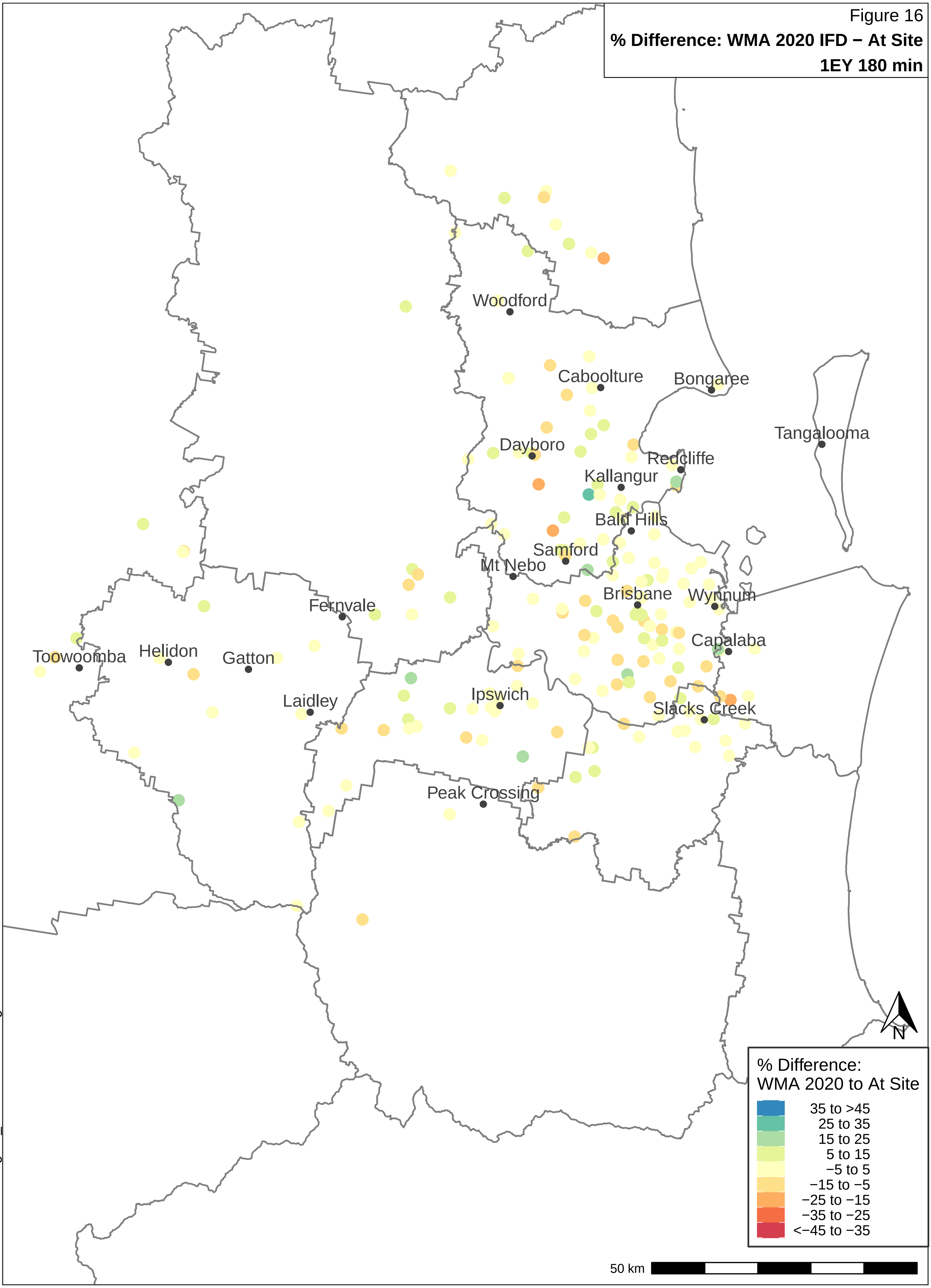

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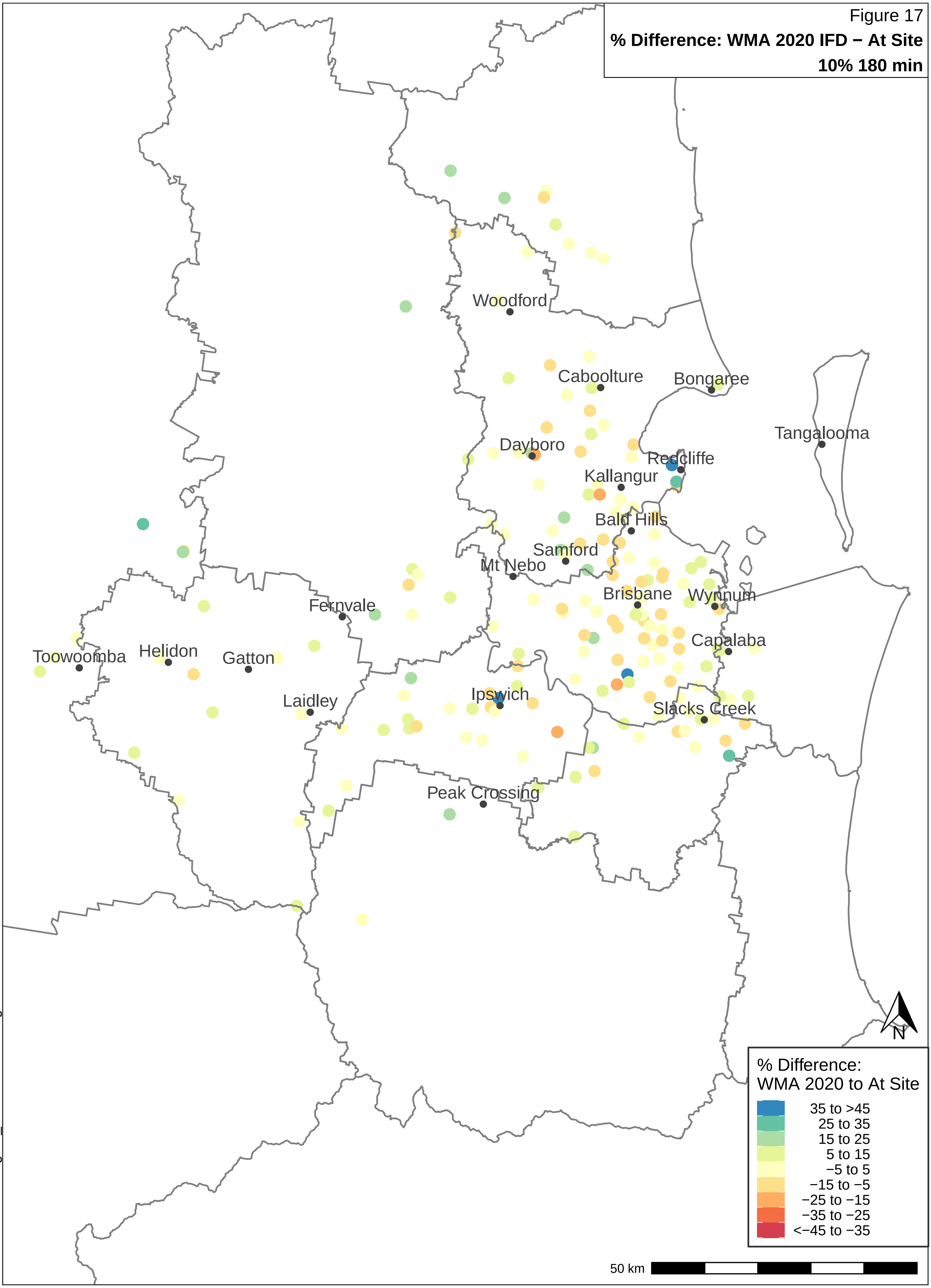

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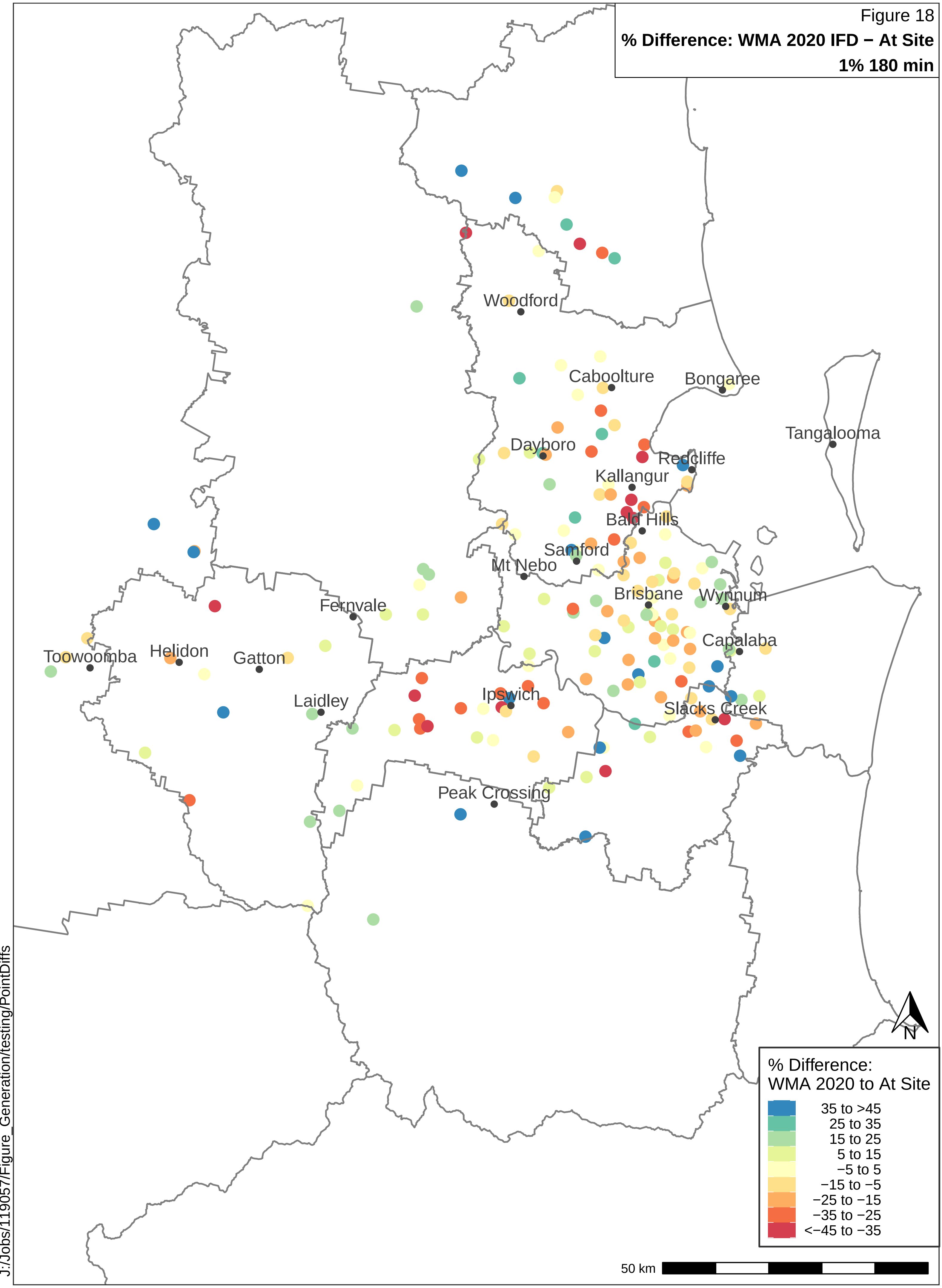
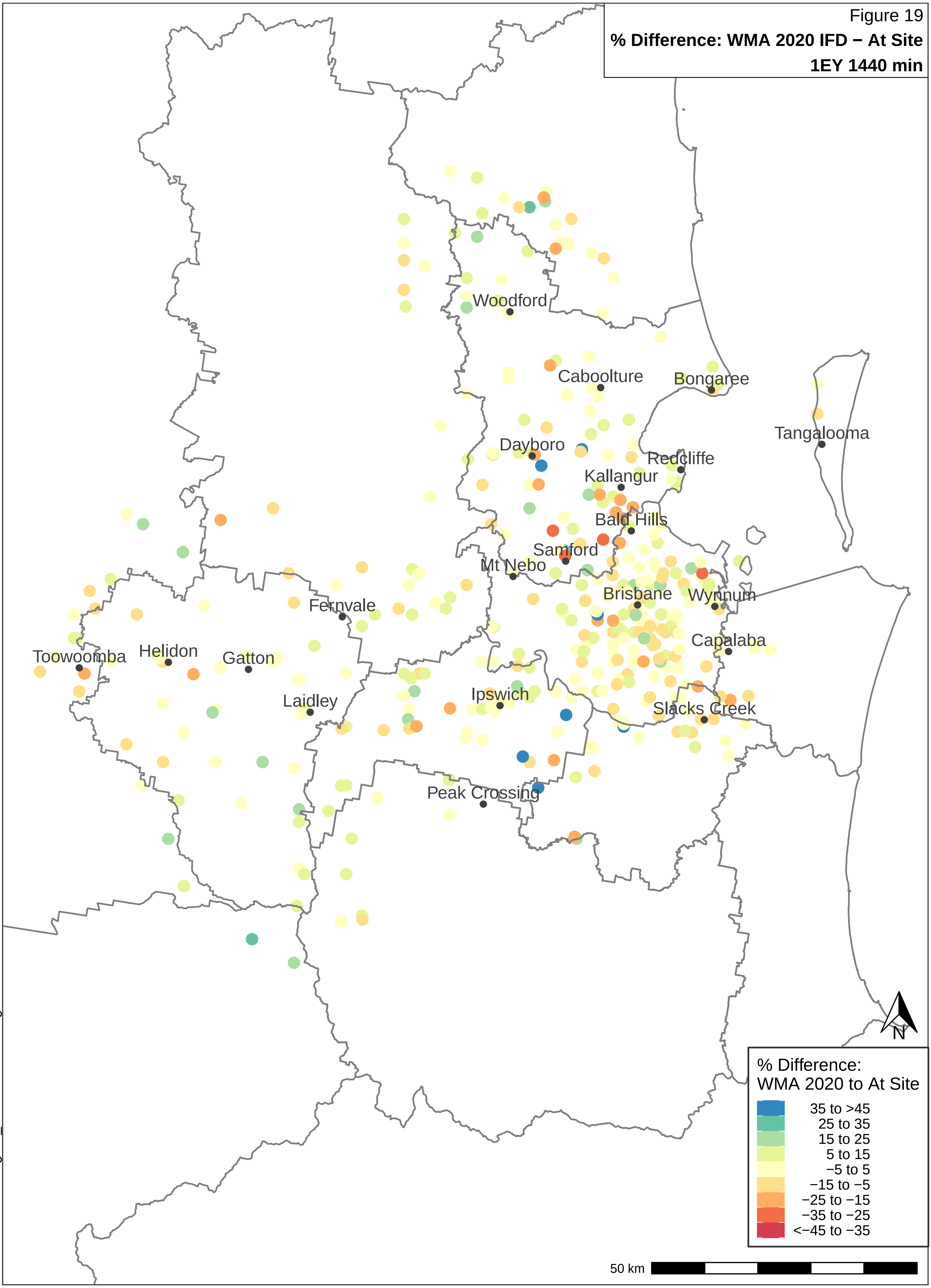


Figure 18
% Difference: WMA 2020 IFD − At Site
1% 180 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to At Site
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/testing/PointDiffs

Figure 19

% Difference: WMA 2020 IFD − At Site

1EY 1440 min



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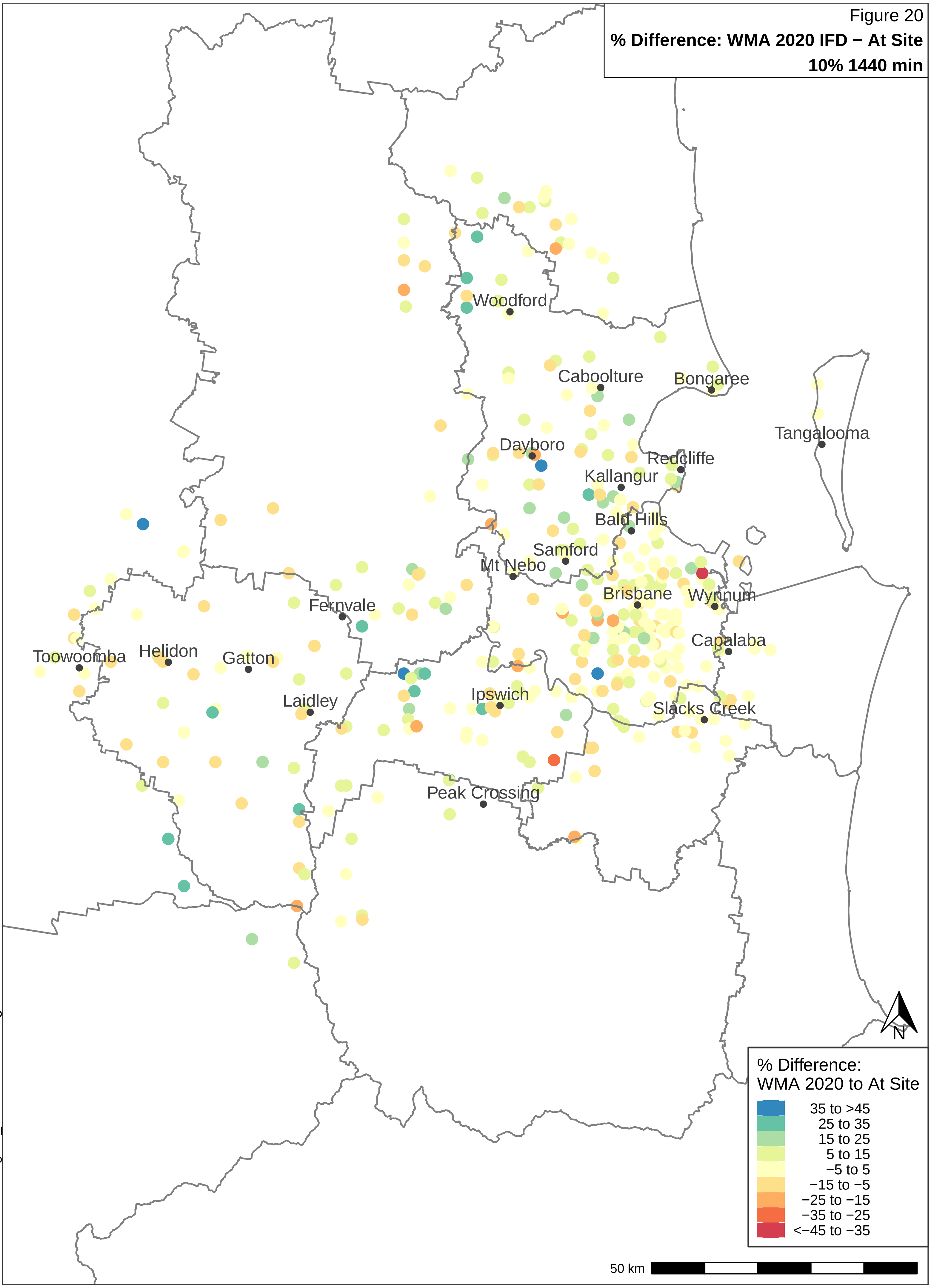

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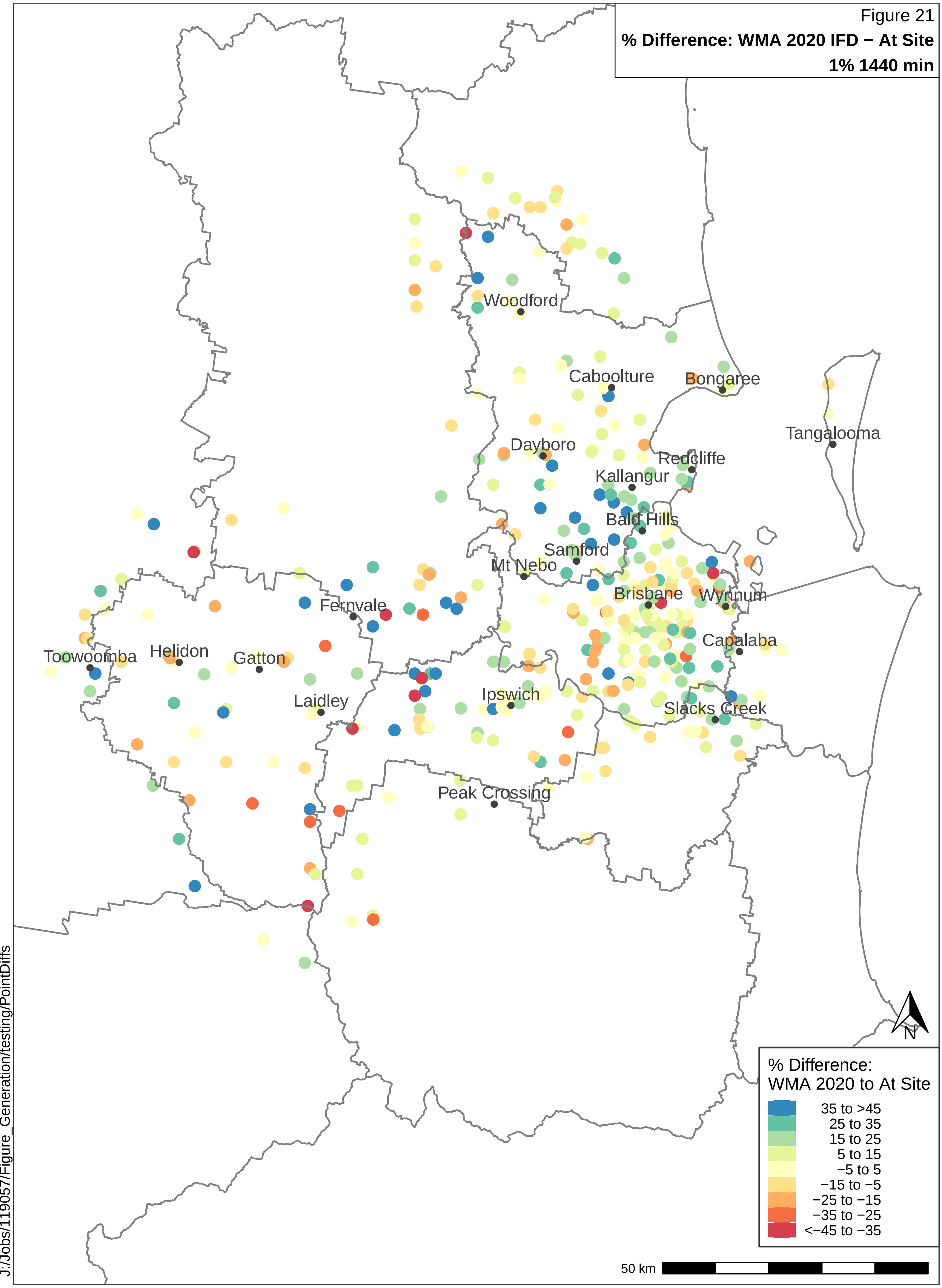
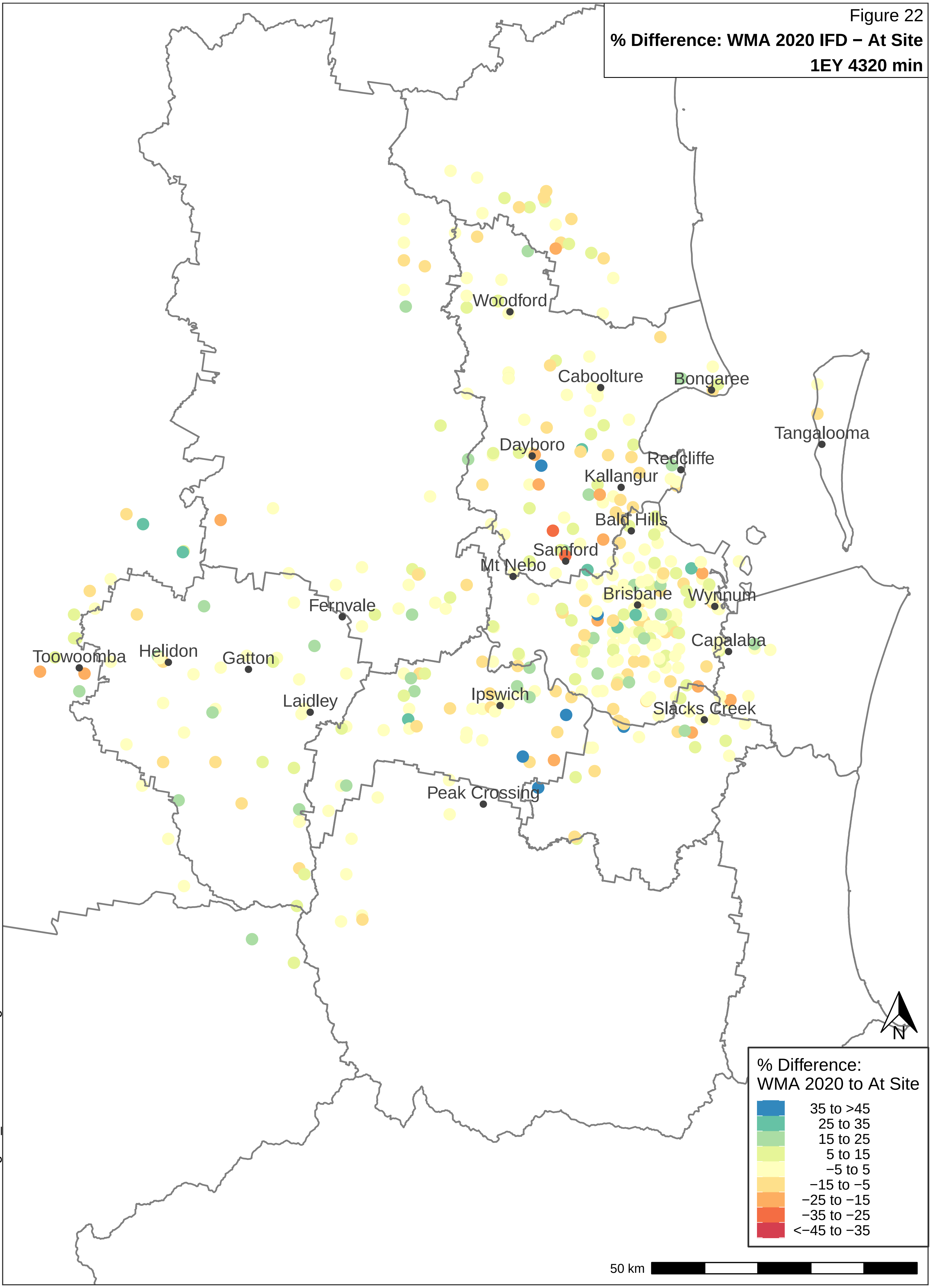


Figure 21
% Difference: WMA 2020 IFD − At Site
1% 1440 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to At Site
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/testing/PointDiffs

Figure 22

% Difference: WMA 2020 IFD − At Site

1EY 4320 min



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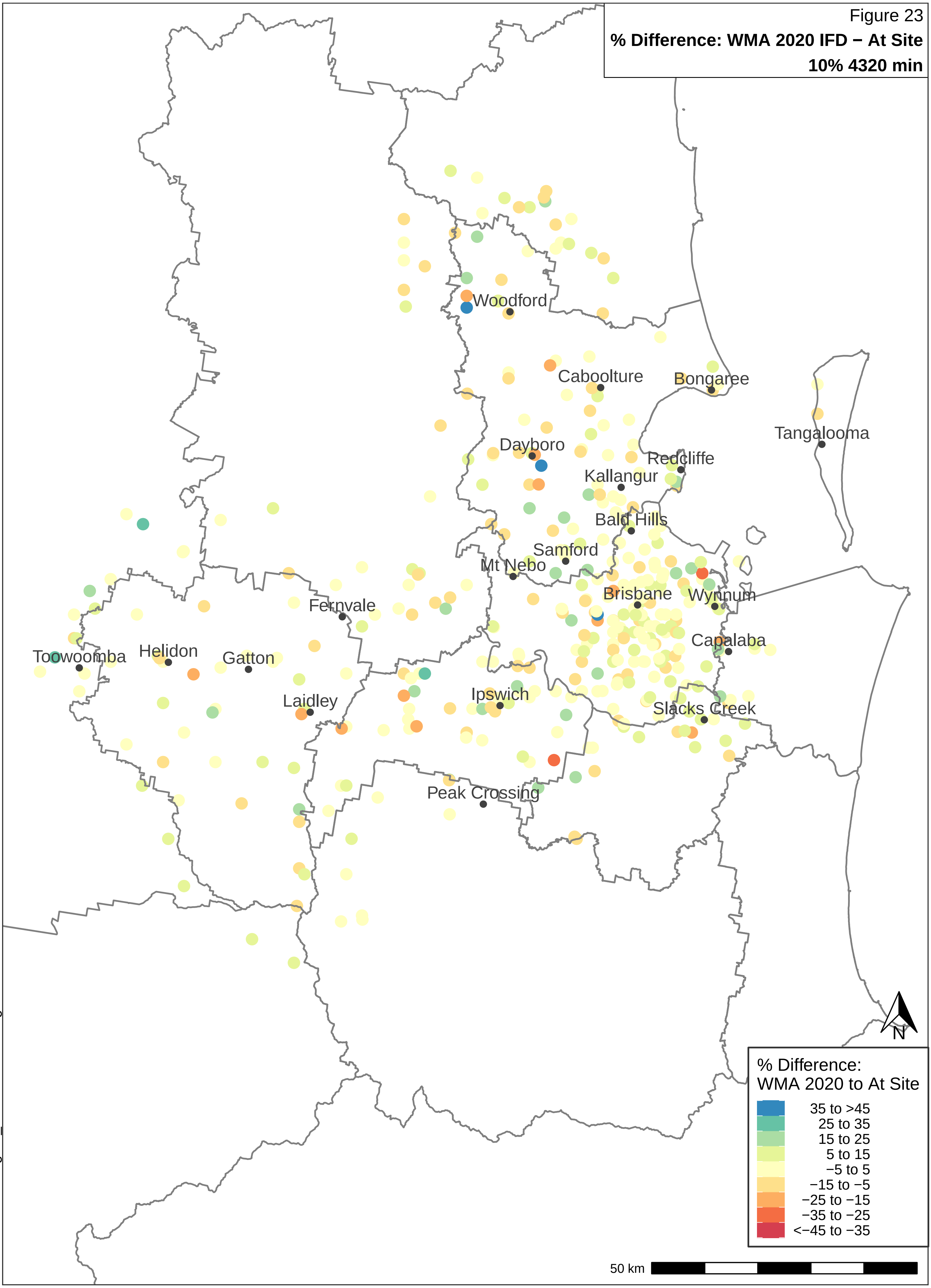

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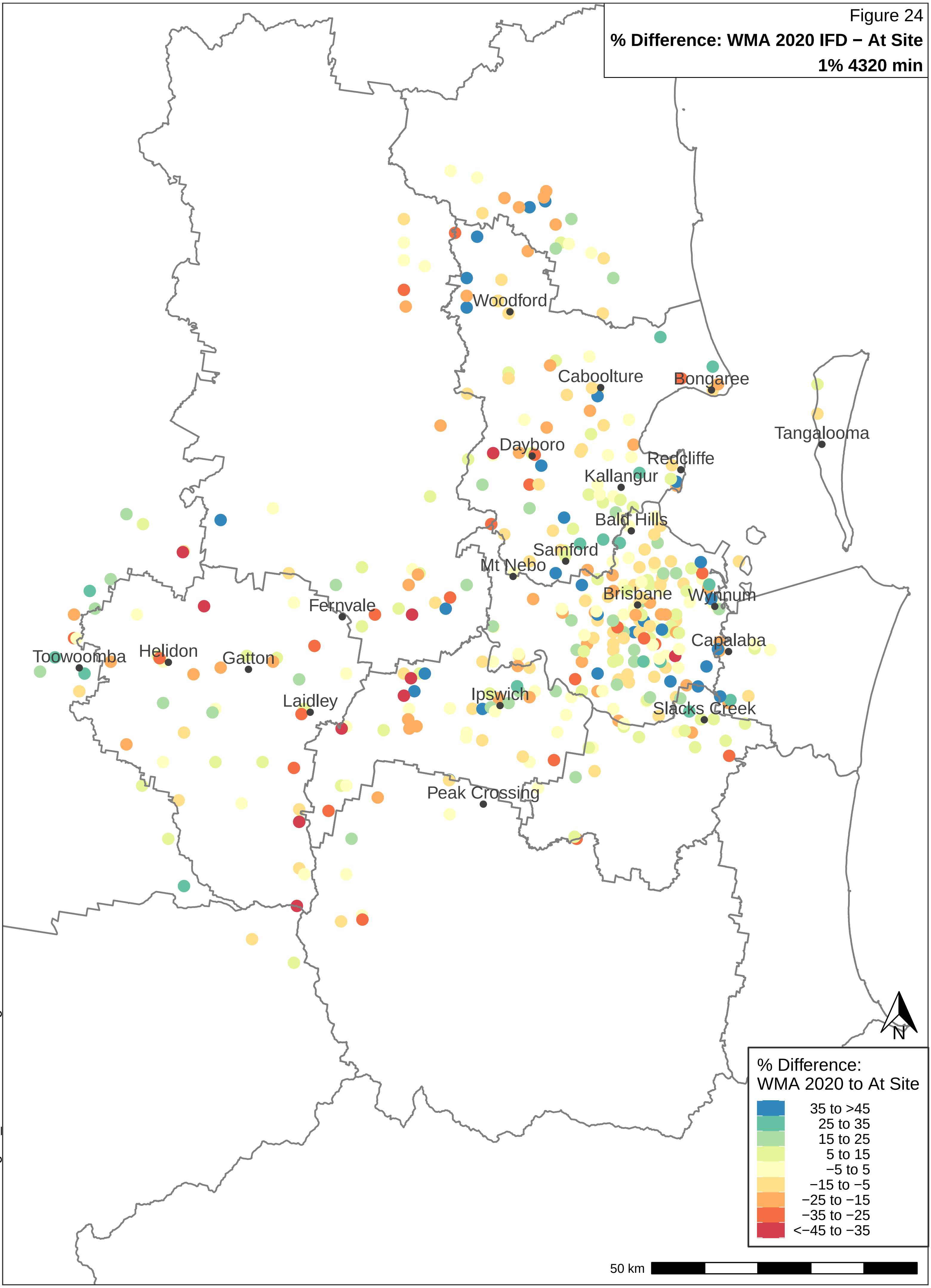
Figure 24

% Difference: WMA 2020 IFD − At Site

1% 4320 min



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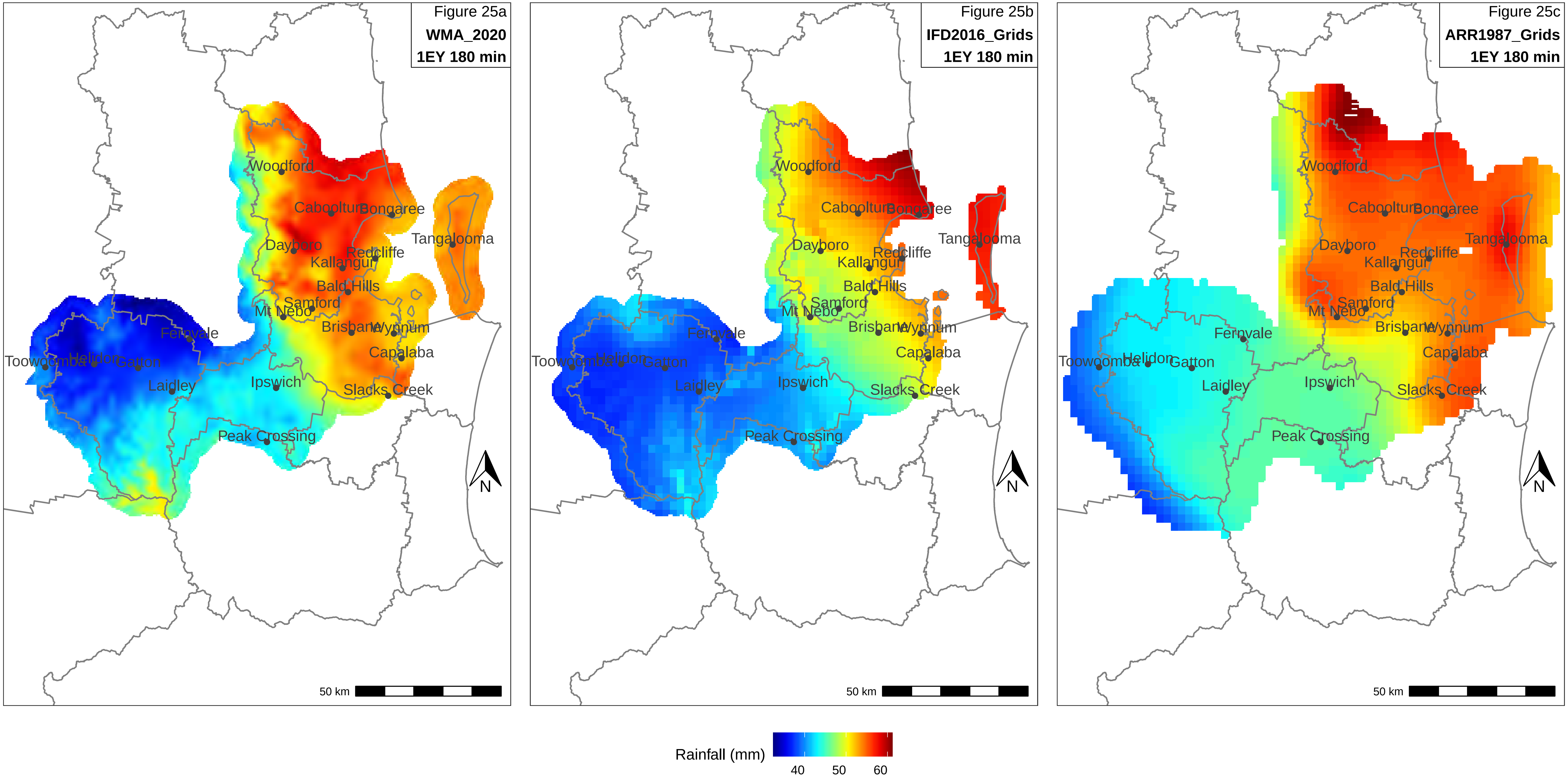


Figure 25a
WMA_2020
1EY 180 min
Figure 25b
IFD2016_Grids
1EY 180 min
Figure 25c
ARR1987_Grids
1EY 180 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Fernvale
Brisbane
Wynnum
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
50 km
Rainfall (mm)
40
50
60

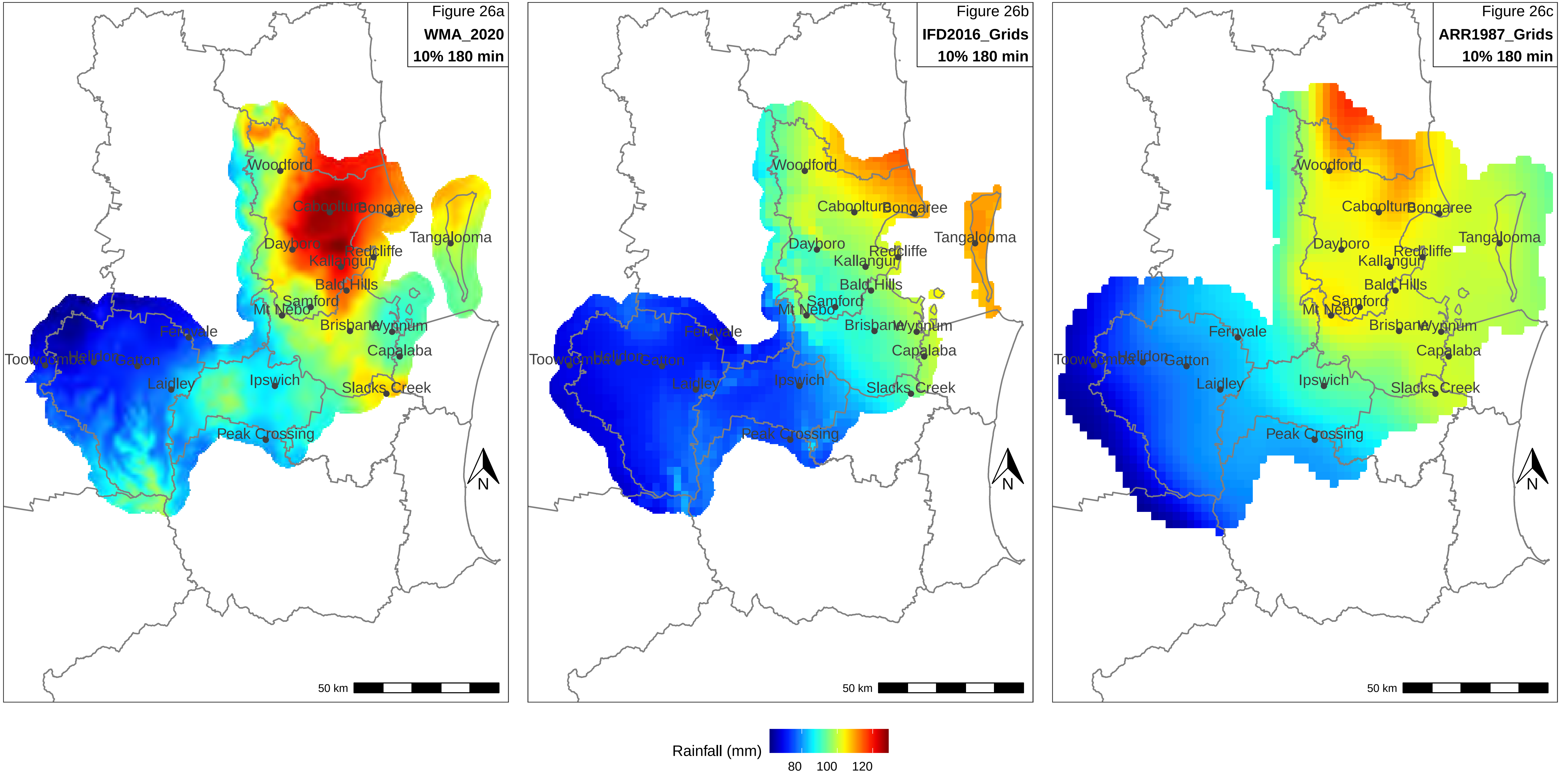


Figure 26a
WMA_2020
10% 180 min
Figure 26b
IFD2016_Grids
10% 180 min
Figure 26c
ARR1987_Grids
10% 180 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
50 km
Rainfall (mm)
80
100
120

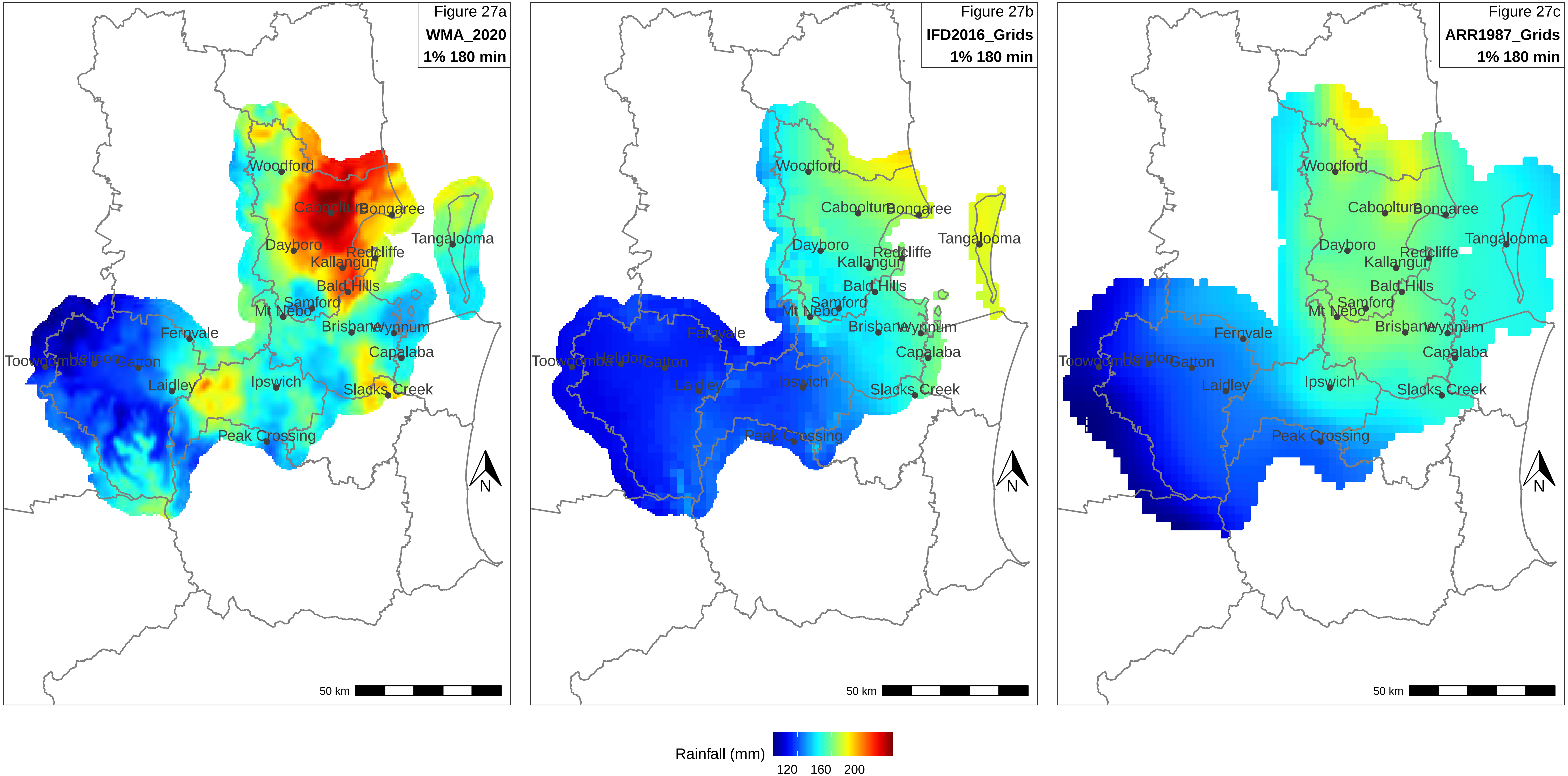


Figure 27a
WMA_2020
1% 180 min
Figure 27b
IFD2016_Grids
1% 180 min
Figure 27c
ARR1987_Grids
1% 180 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
50 km
Rainfall (mm)
120
160
200

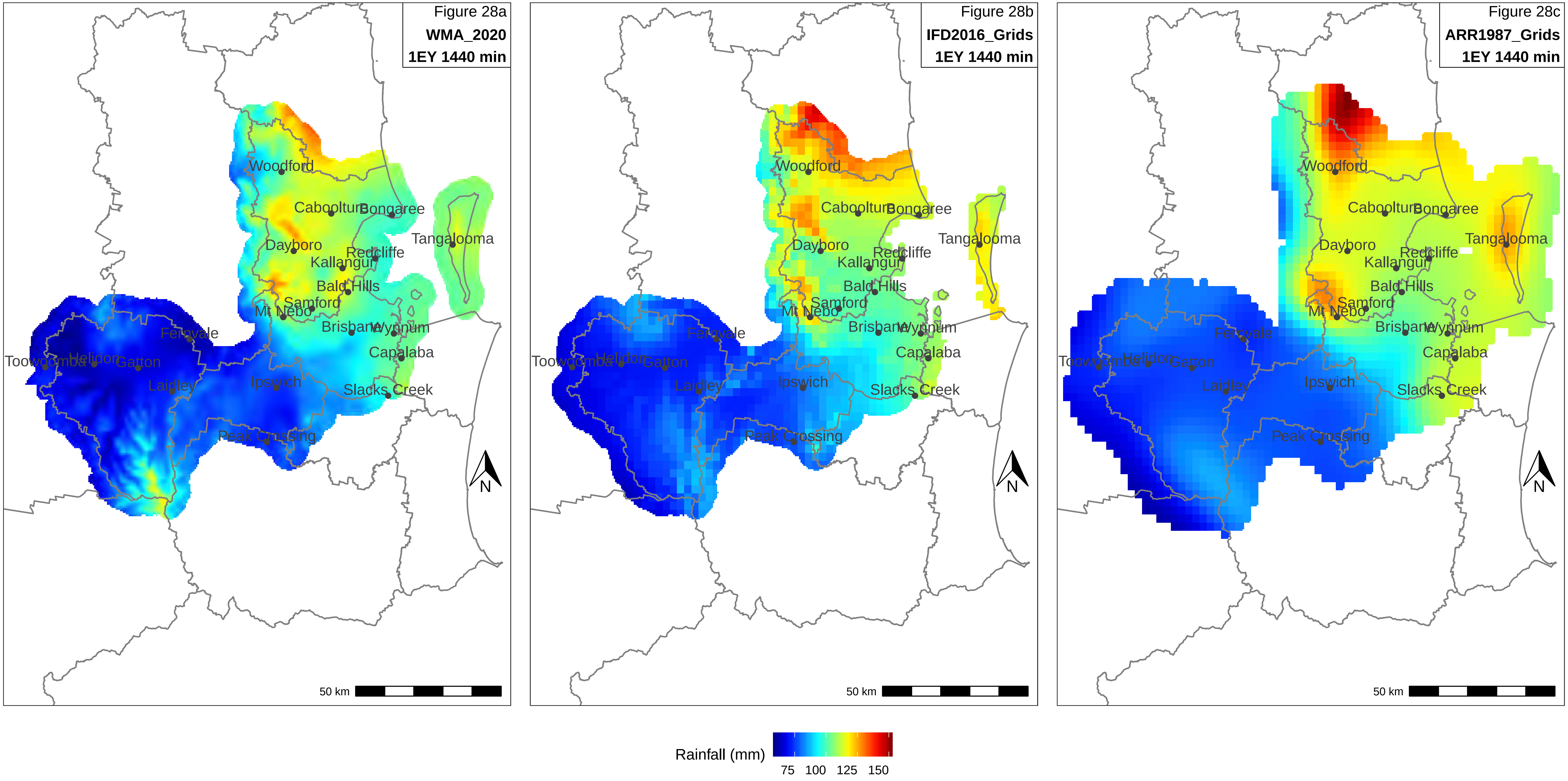


Figure 28a
WMA_2020
1EY 1440 min
Figure 28b
IFD2016_Grids
1EY 1440 min
Figure 28c
ARR1987_Grids
1EY 1440 min
Woodford
Caboolture
Bongaree
Dayboro
Redcliffe
Kallangur
Tangalooma
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
50 km
Rainfall (mm)
75
100
125
150

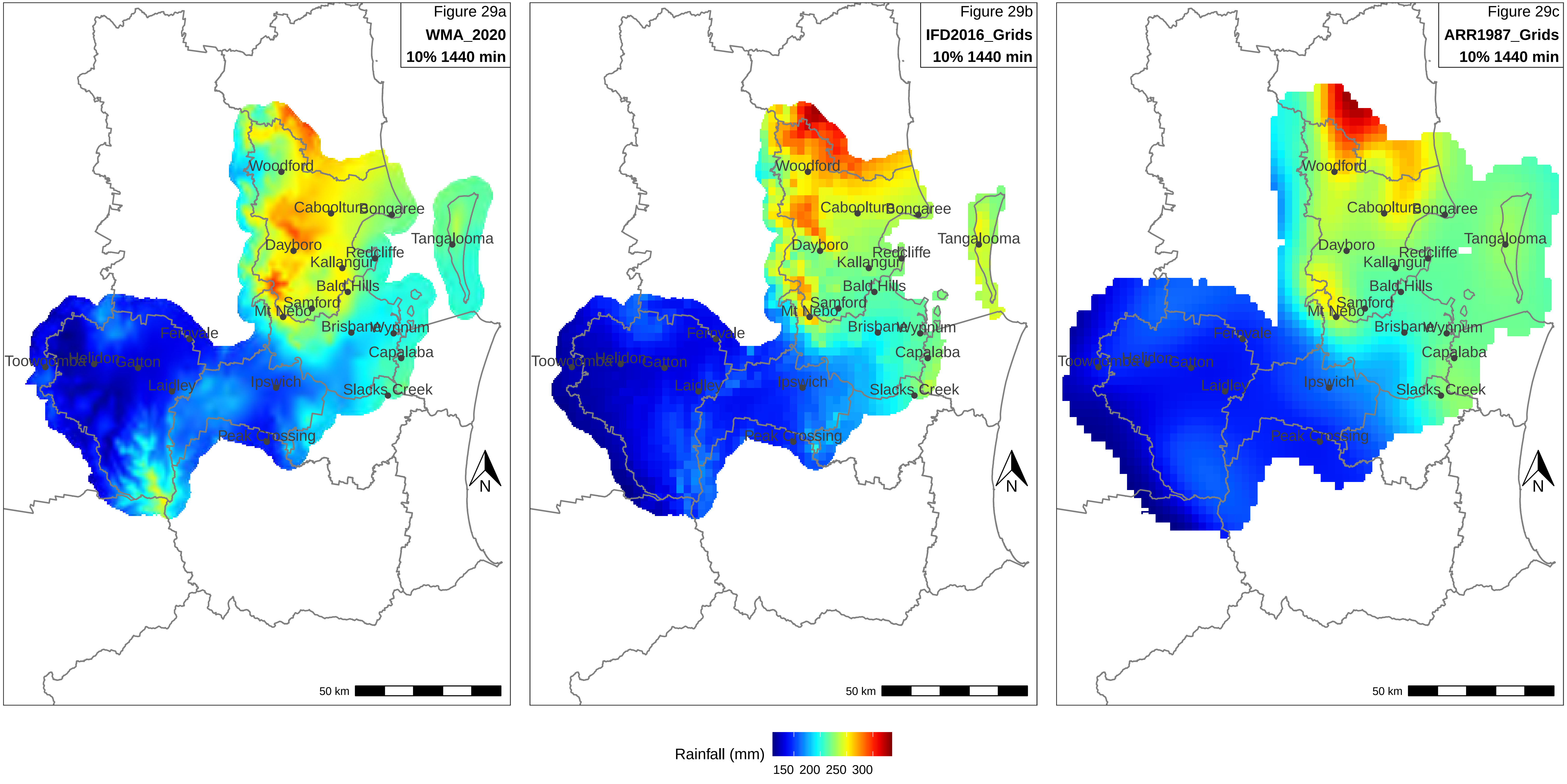


Figure 29a
WMA_2020
10% 1440 min
Figure 29b
IFD2016_Grids
10% 1440 min
Figure 29c
ARR1987_Grids
10% 1440 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
50 km
Rainfall (mm)
150 200 250 300

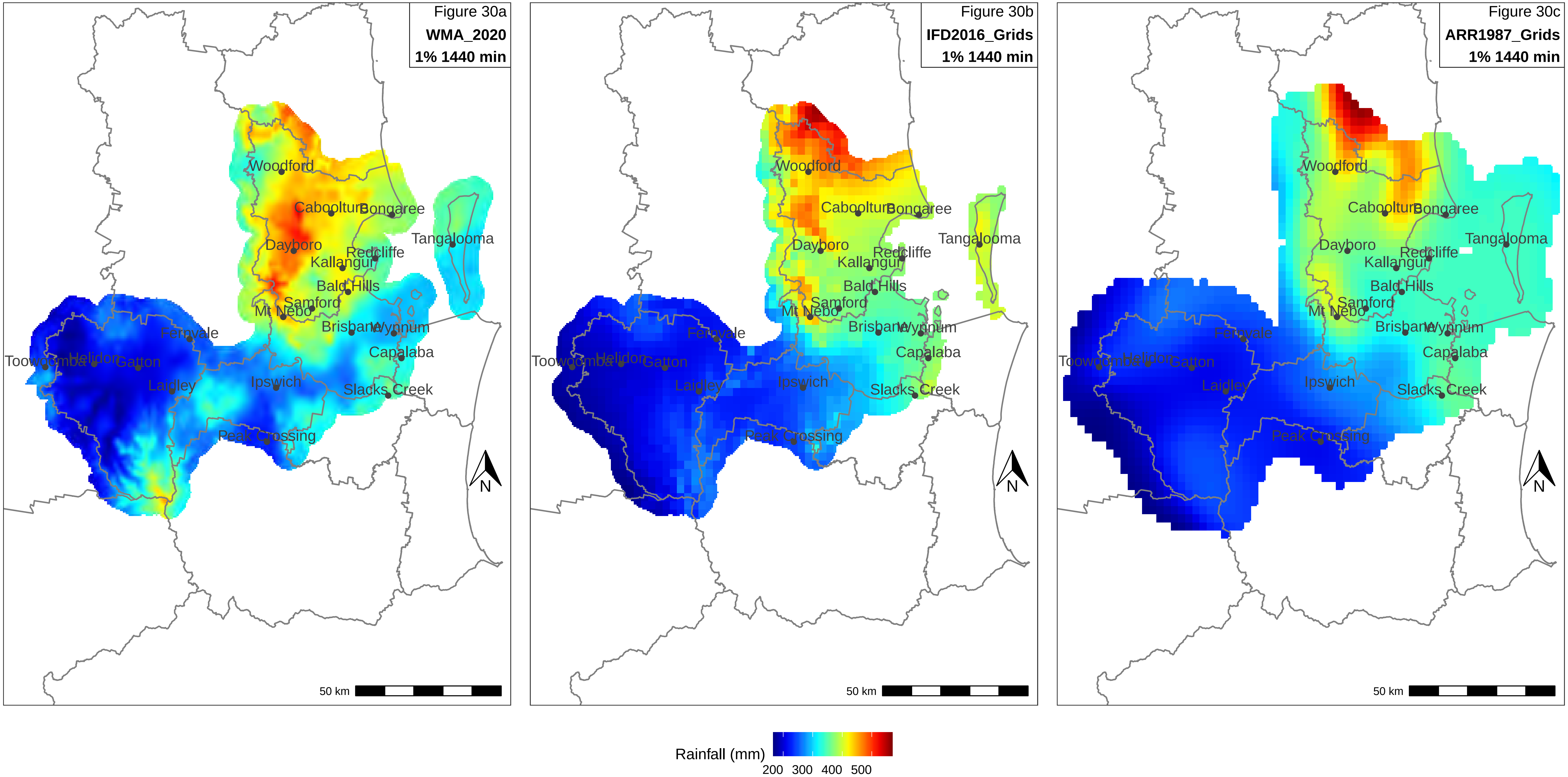


Figure 30a
WMA_2020
1% 1440 min
Figure 30b
IFD2016_Grids
1% 1440 min
Figure 30c
ARR1987_Grids
1% 1440 min
Woodford
Caboolture
Bongaree
Dayboro
Redcliffe
Kallangur
Tangalooma
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
50 km
Rainfall (mm)
200
300
400
500

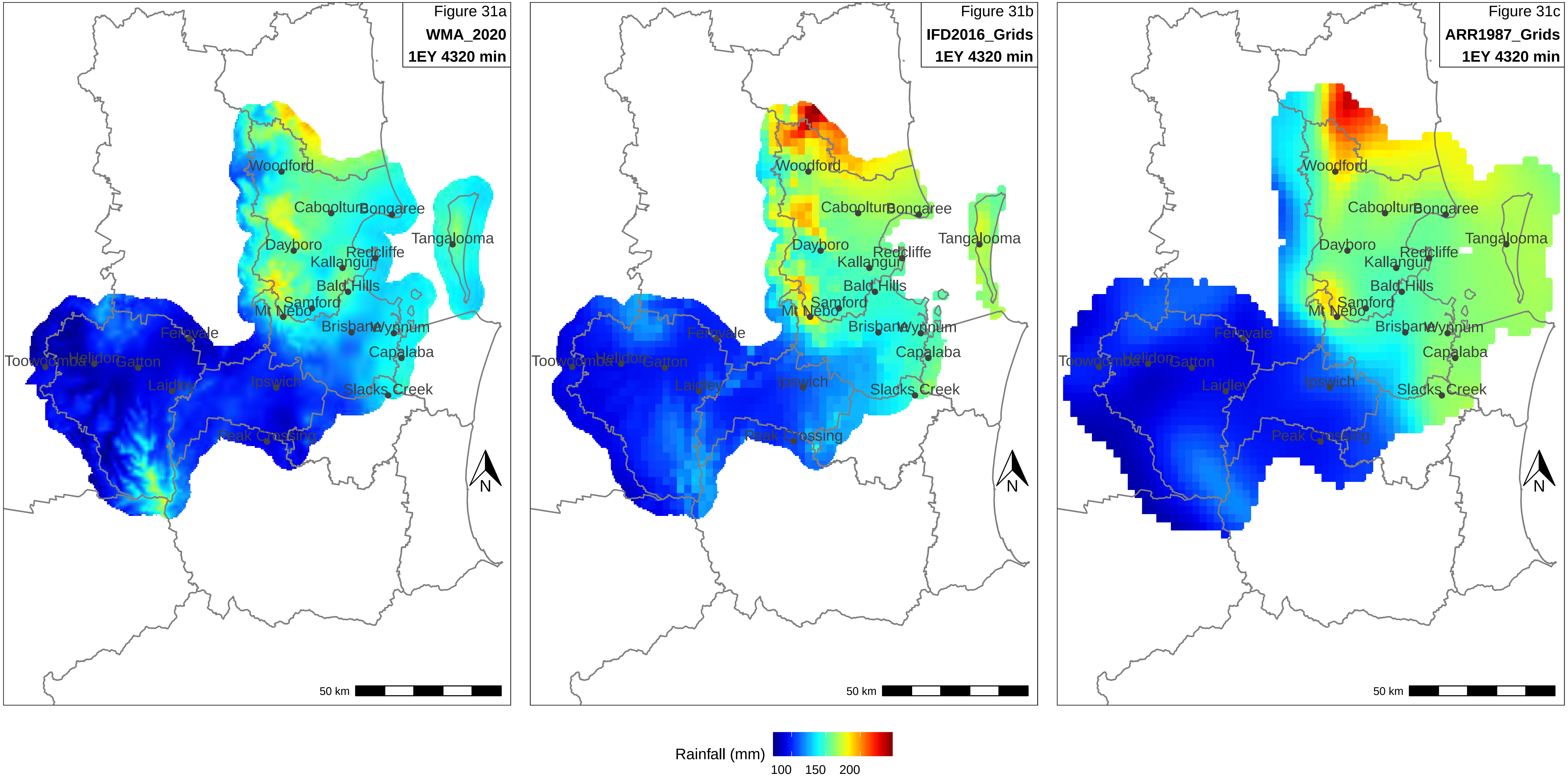


Figure 31a
WMA_2020
1EY 4320 min
Figure 31b
IFD2016_Grids
1EY 4320 min
Figure 31c
ARR1987_Grids
1EY 4320 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Capalaba
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
50 km
Rainfall (mm)
100
150
200

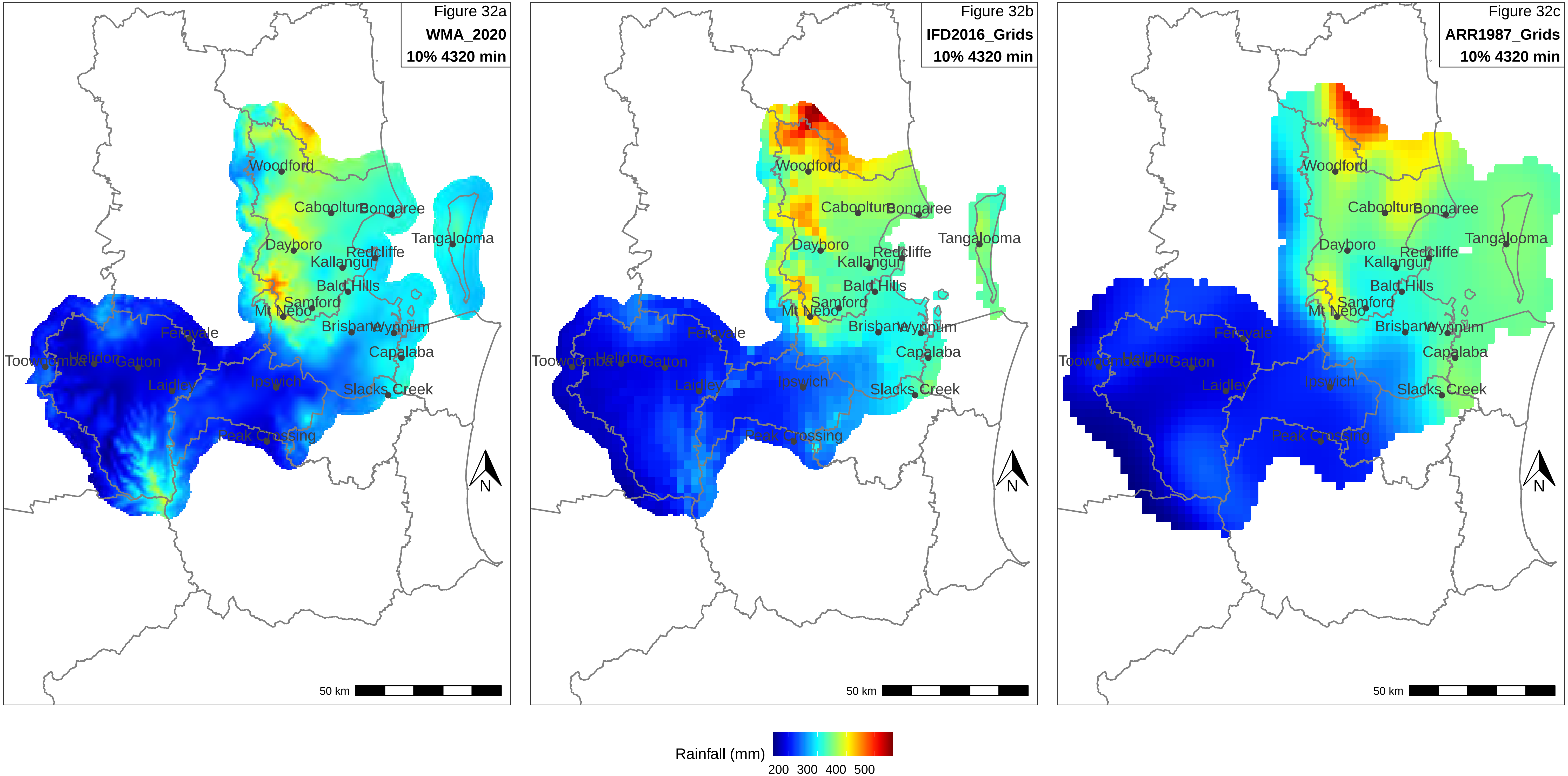


Figure 32a
WMA_2020
10% 4320 min
Figure 32b
IFD2016_Grids
10% 4320 min
Figure 32c
ARR1987_Grids
10% 4320 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
50 km
Rainfall (mm)
200
300
400
500

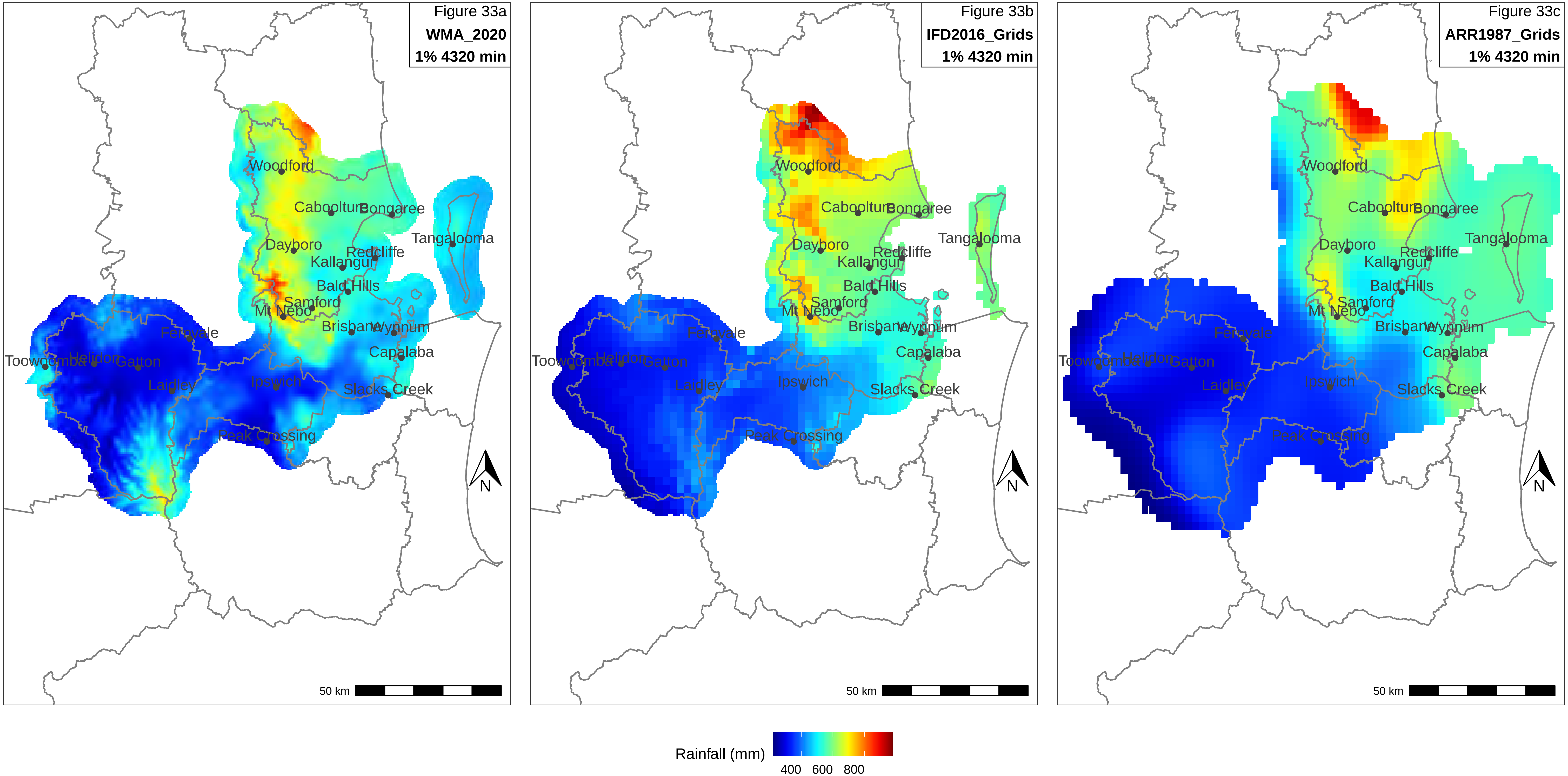
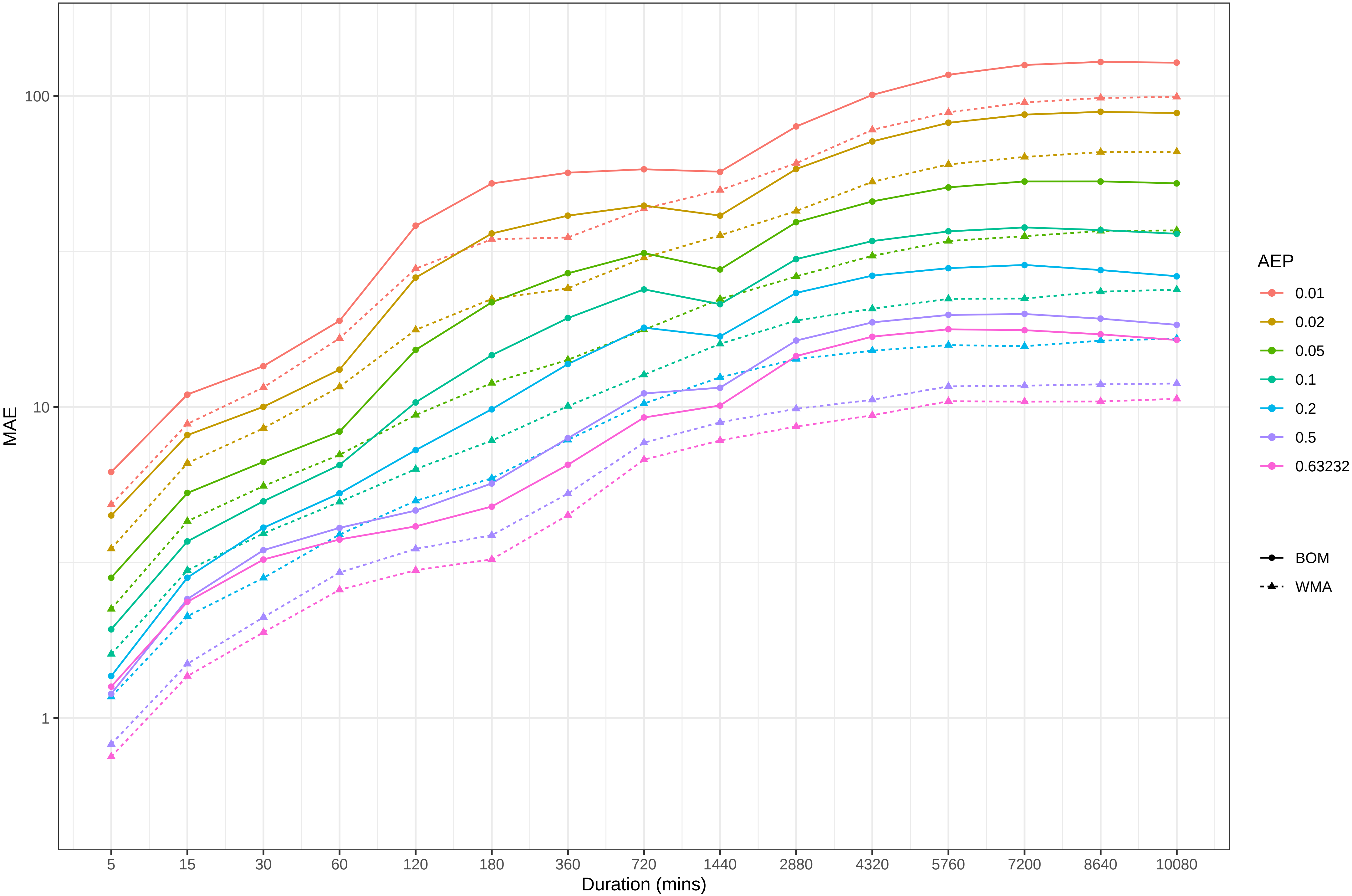


Figure 33a
WMA_2020
1% 4320 min
Figure 33b
IFD2016_Grids
1% 4320 min
Figure 33c
ARR1987_Grids
1% 4320 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
50 km
Rainfall (mm)
400
600
800

Figure 34

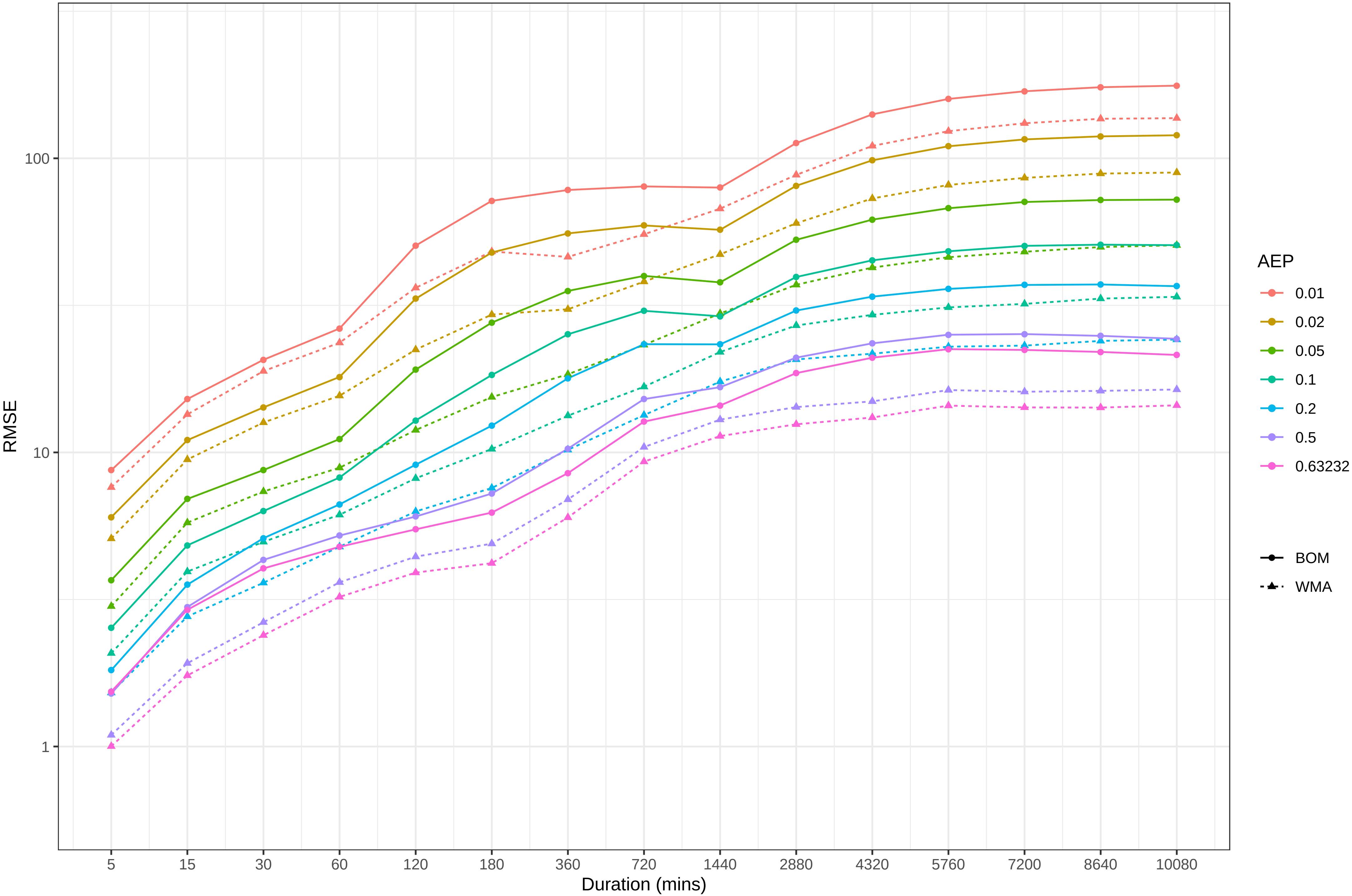
Mean Average Error
Revised IFDs and 2016 IFDs



J:/Jobs/119057/Analysis/IFD_Grid_Differences/ResolvedInconsistency/AlgorithmAttempt4/SummaryStatistics_Plots

Figure 35

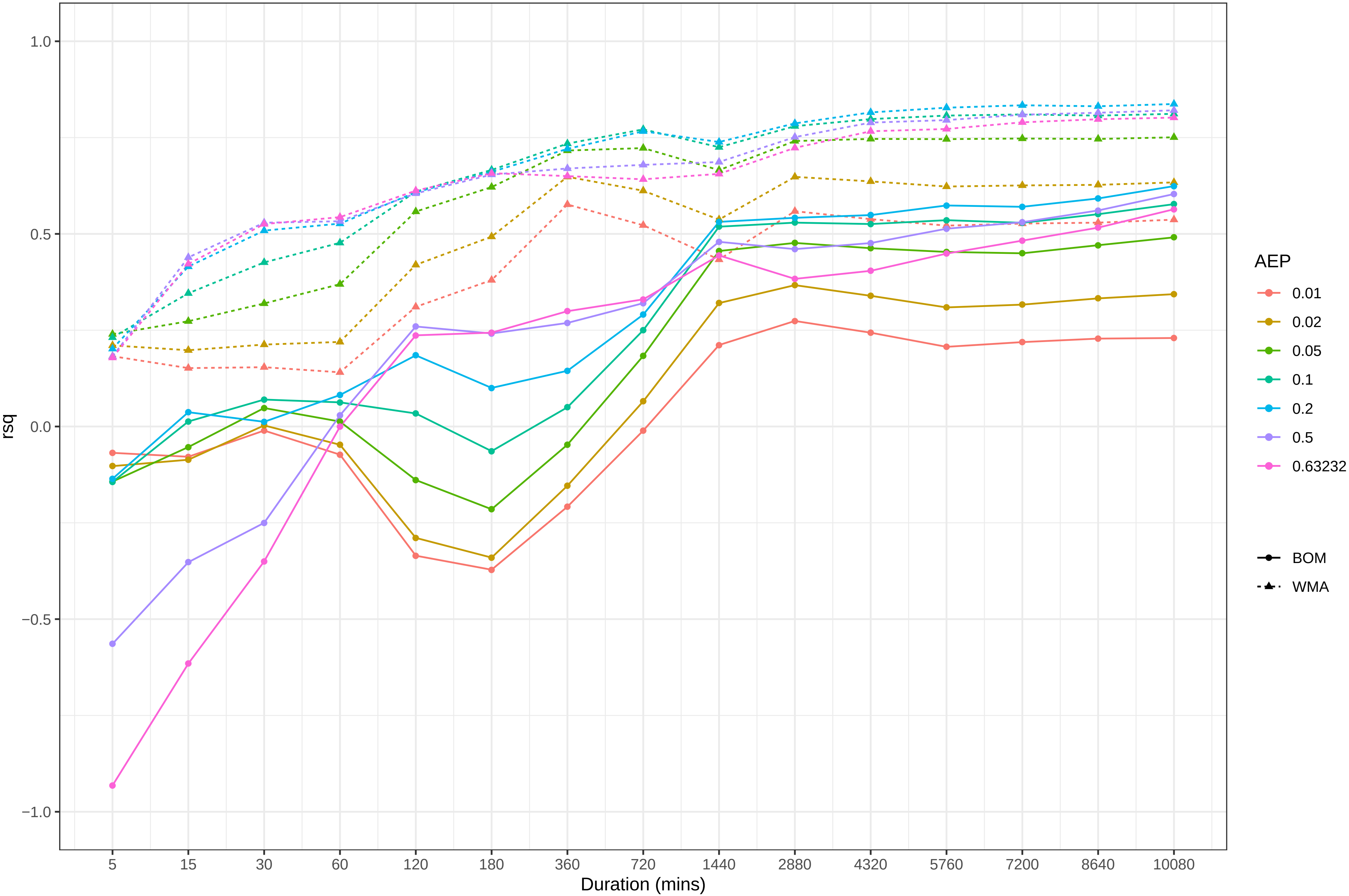
Root mean square error
Revised IFDs and 2016 IFDs



J:/Jobs/119057/Analysis/IFD_Grid_Differences/ResolvedInconsistency/AlgorithmAttempt4/SummaryStatistics_Plots

Figure 36

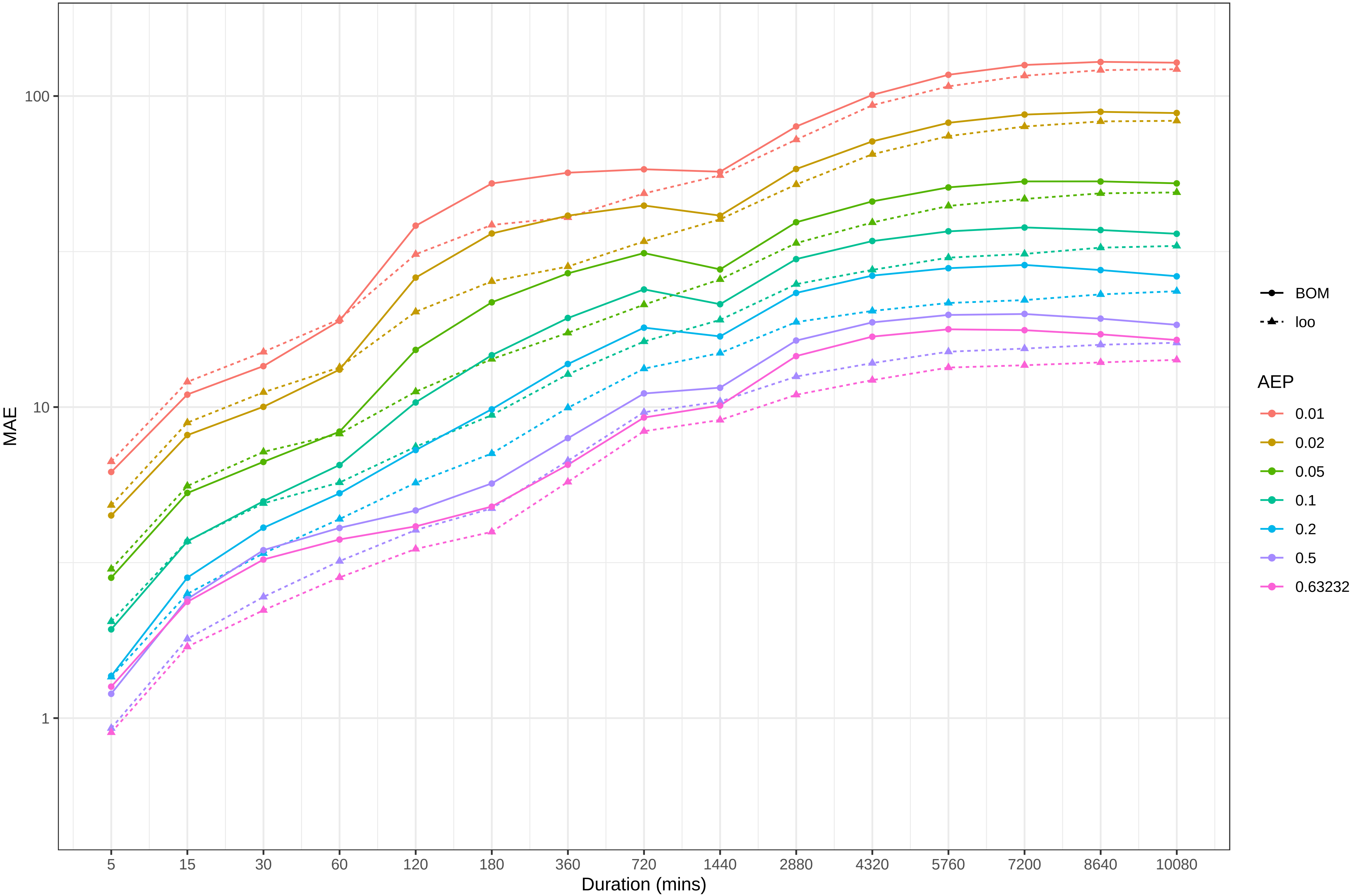
Coefficient of determination
Revised IFDs and 2016 IFDs



J:/Jobs/119057/Analysis/IFD_Grid_Differences/ResolvedInconsistency/AlgorithmAttempt4/SummaryStatistics_Plots

Figure 37

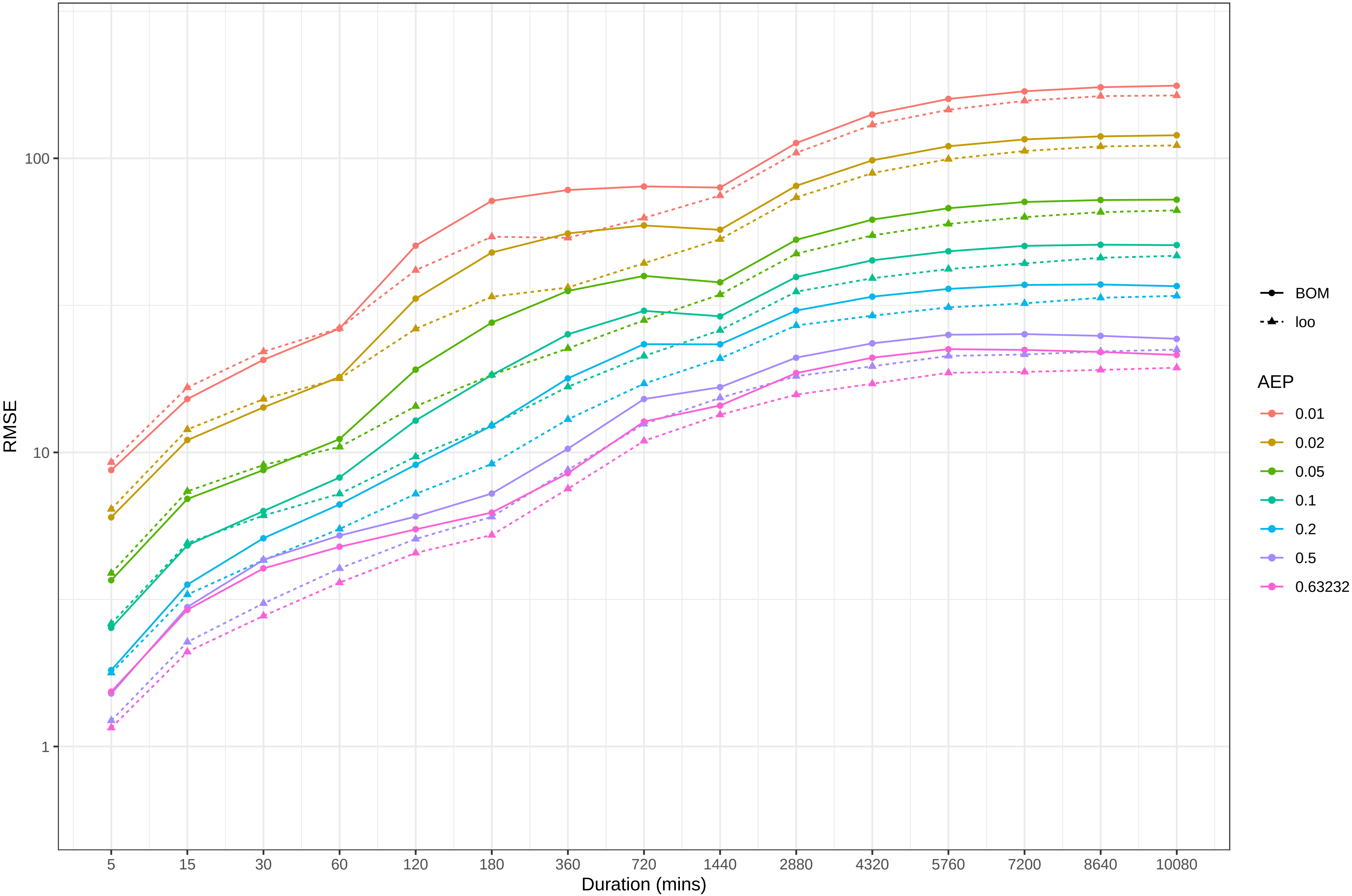
Mean Average Error
Revised leave one out and 2016 IFDs



J:/Jobs/119057/Analysis/IFD_Grid_Differences/ResolvedInconsistency/AlgorithmAttempt4/SummaryStatistics_Plots

Figure 38

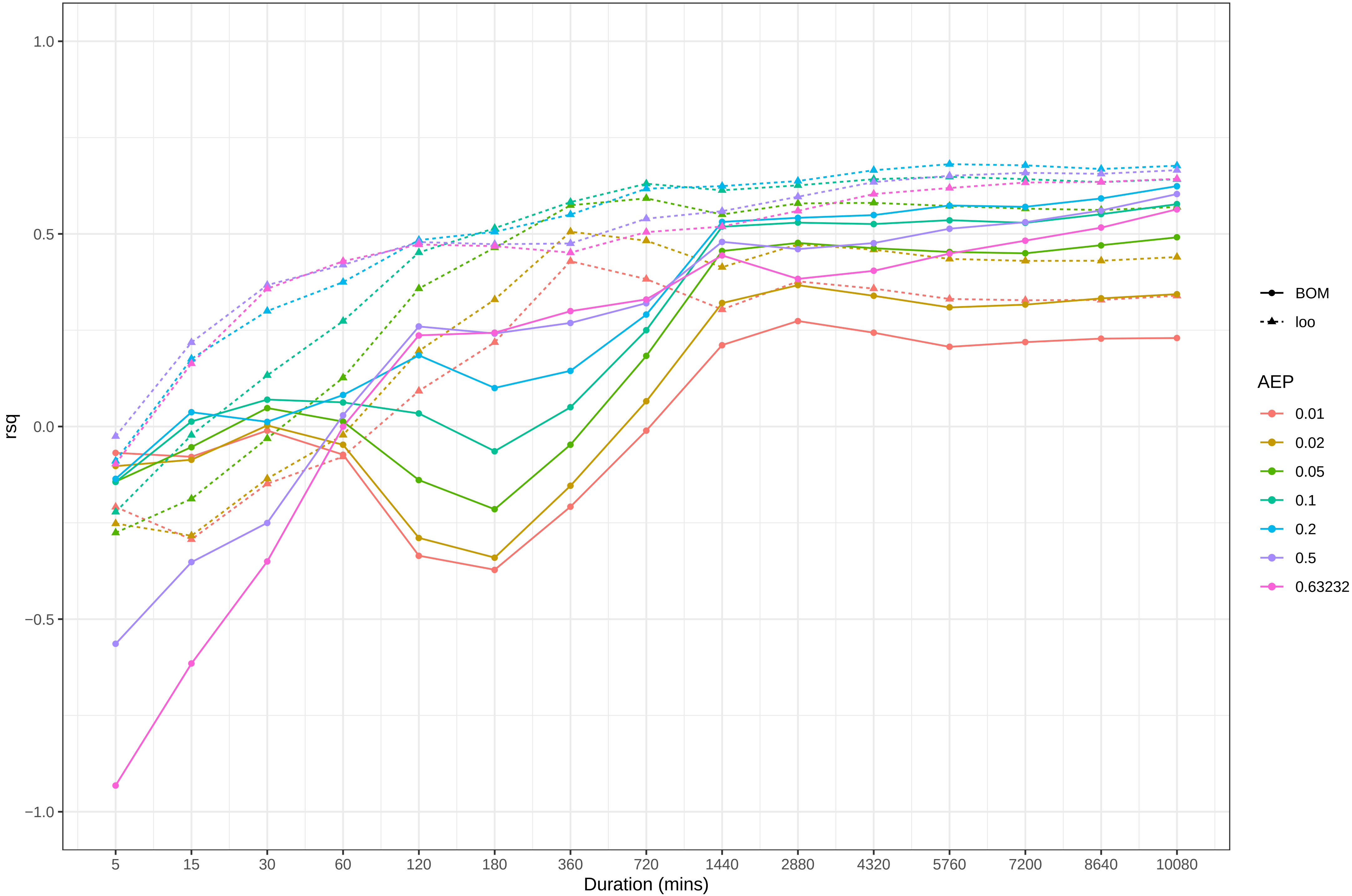
Root mean square error
Revised leave one out and 2016 IFDs



J:/Jobs/119057/Analysis/IFD_Grid_Differences/ResolvedInconsistency/AlgorithmAttempt4/SummaryStatistics_Plots

Figure 39

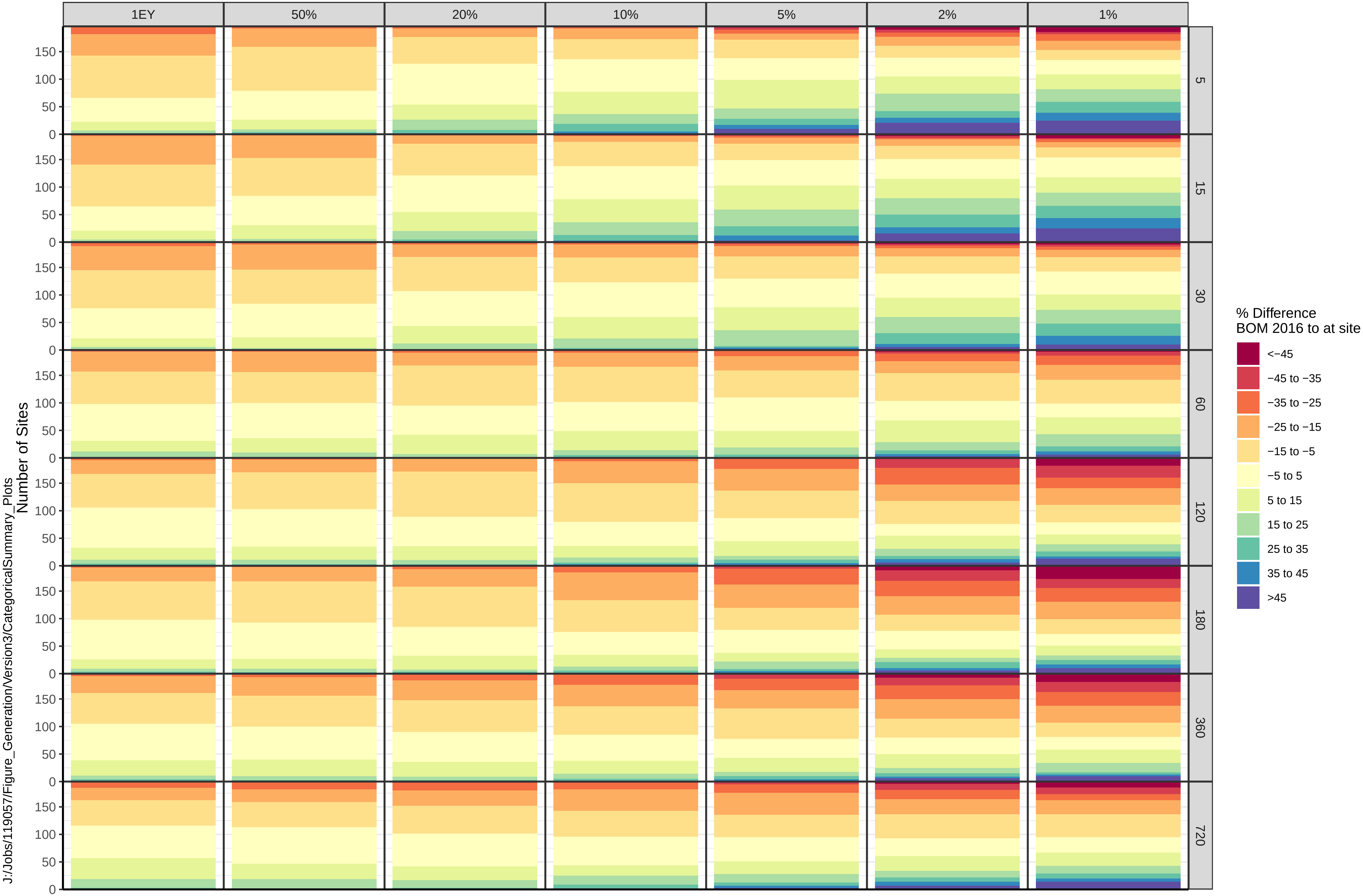
Coefficient of determination
Revised leave one out and 2016 IFDs



J:/Jobs/119057/Analysis/IFD_Grid_Differences/ResolvedInconsistency/AlgorithmAttempt4/SummaryStatistics_Plots

Figure 40

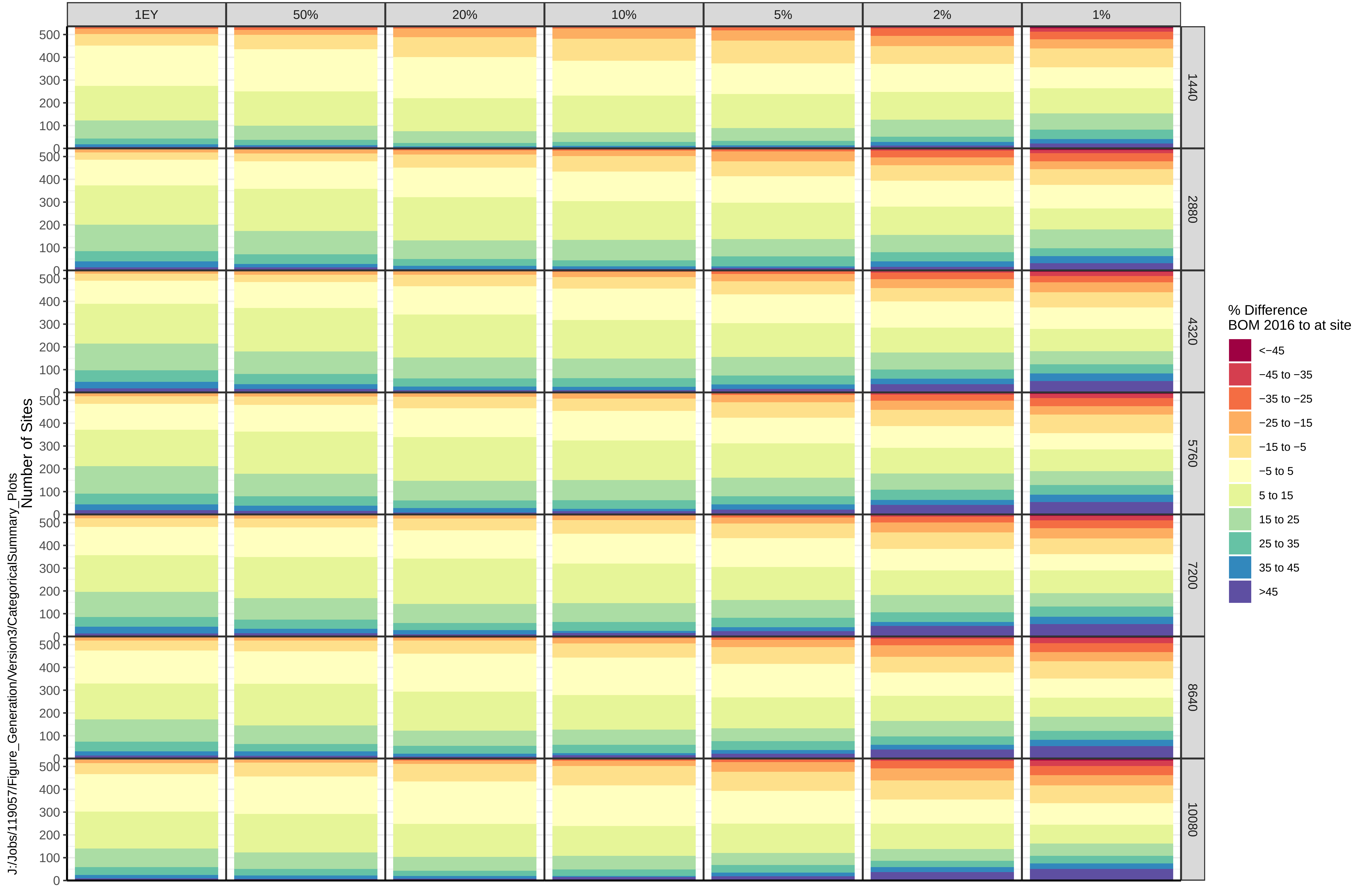
% Difference BOM 2016:At Site
< 1 day



J:/Jobs/119057/Figure_Generation/Version3/CategoricalSummary_Plots

Figure 41

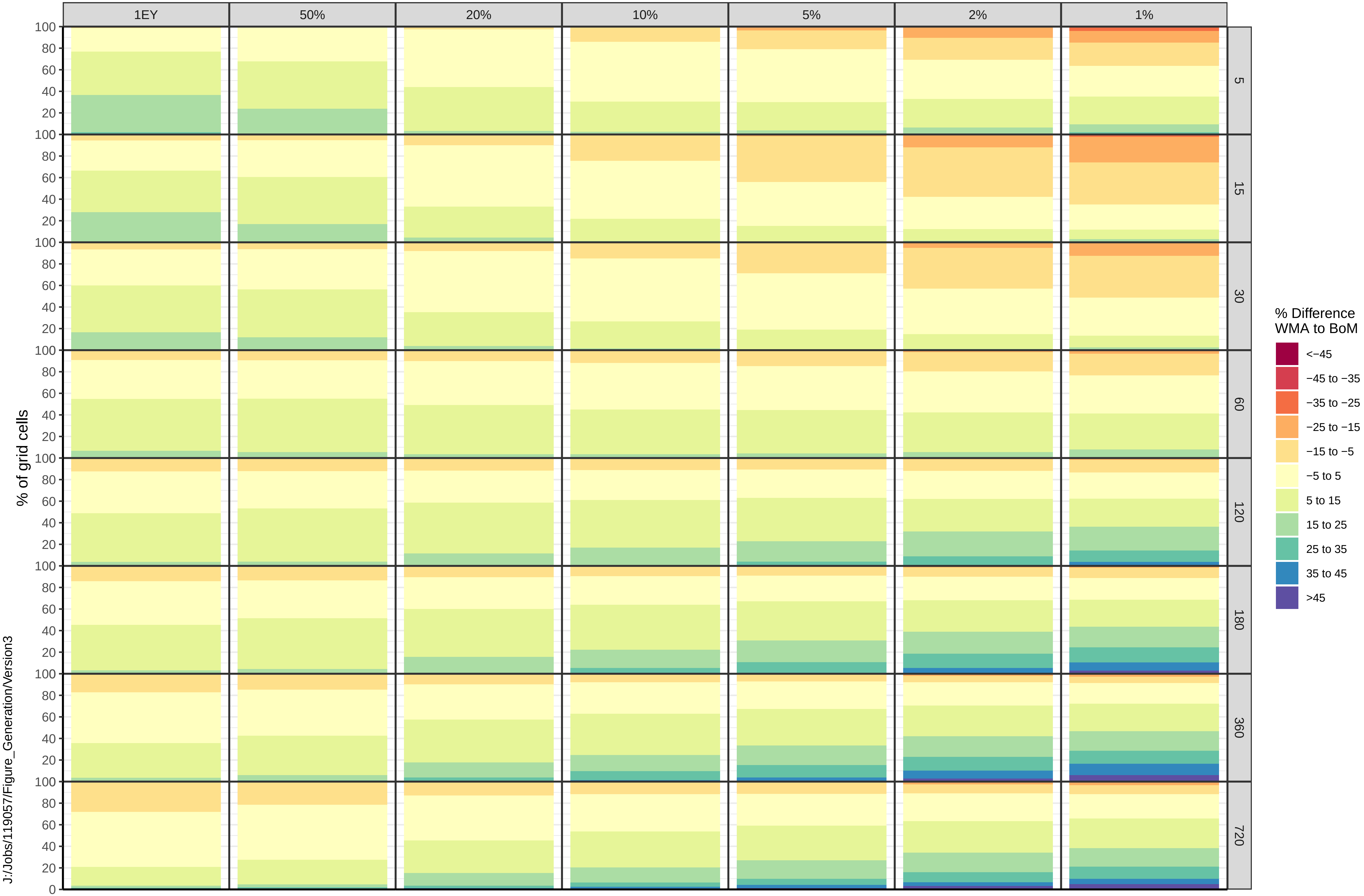
% Difference BOM 2016:At Site
>= 1 day



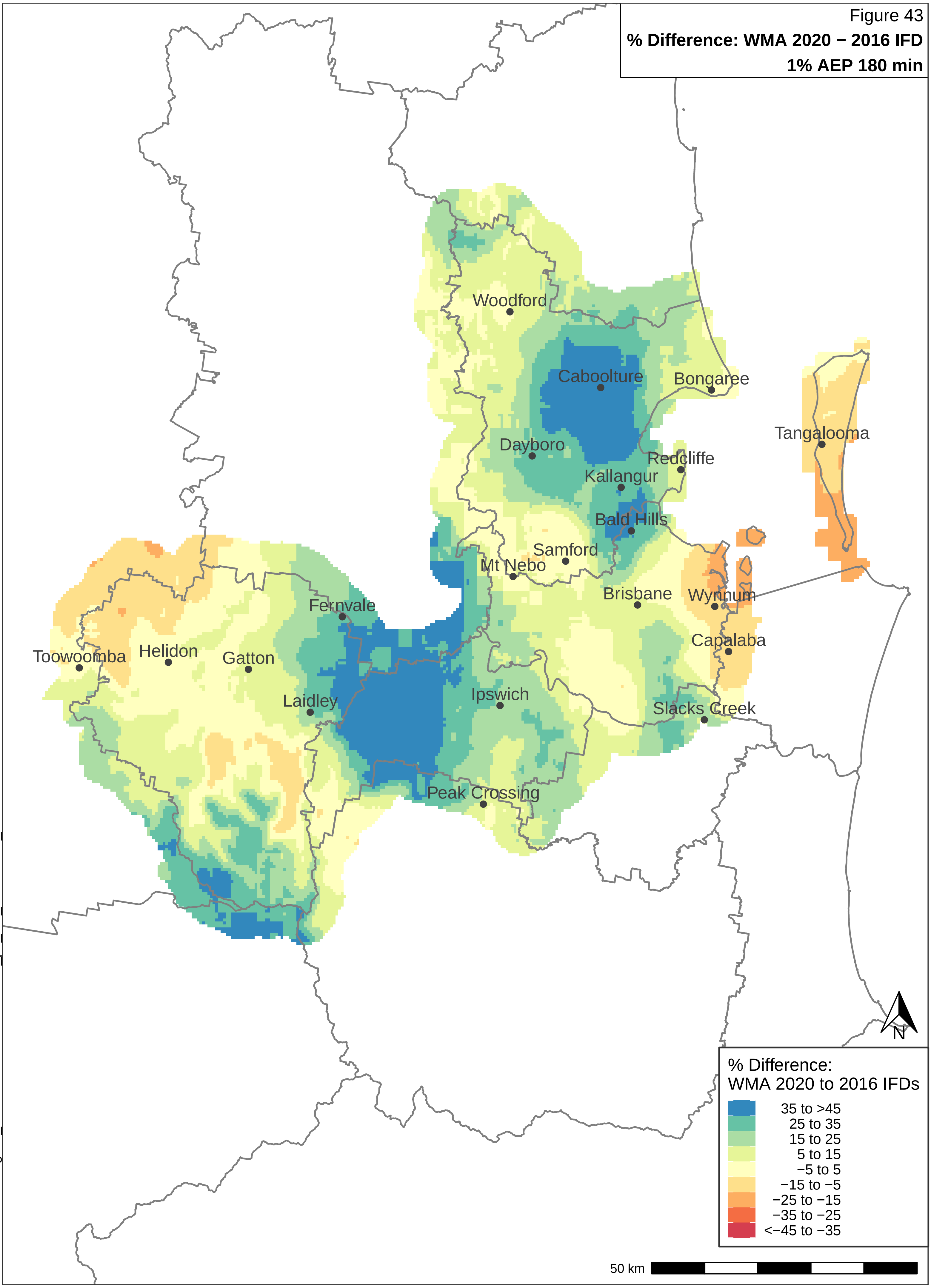
J:/Jobs/119057/Figure_Generation/Version3/CategoricalSummary_Plots

Figure 42

% Difference WMA 2020 IFD:BoM IFDs
< 1 day



J:/Jobs/119057/Figure_Generation/Version3



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure 44

% Difference WMA 2020 IFD:BoM IFDs
>= 1 day

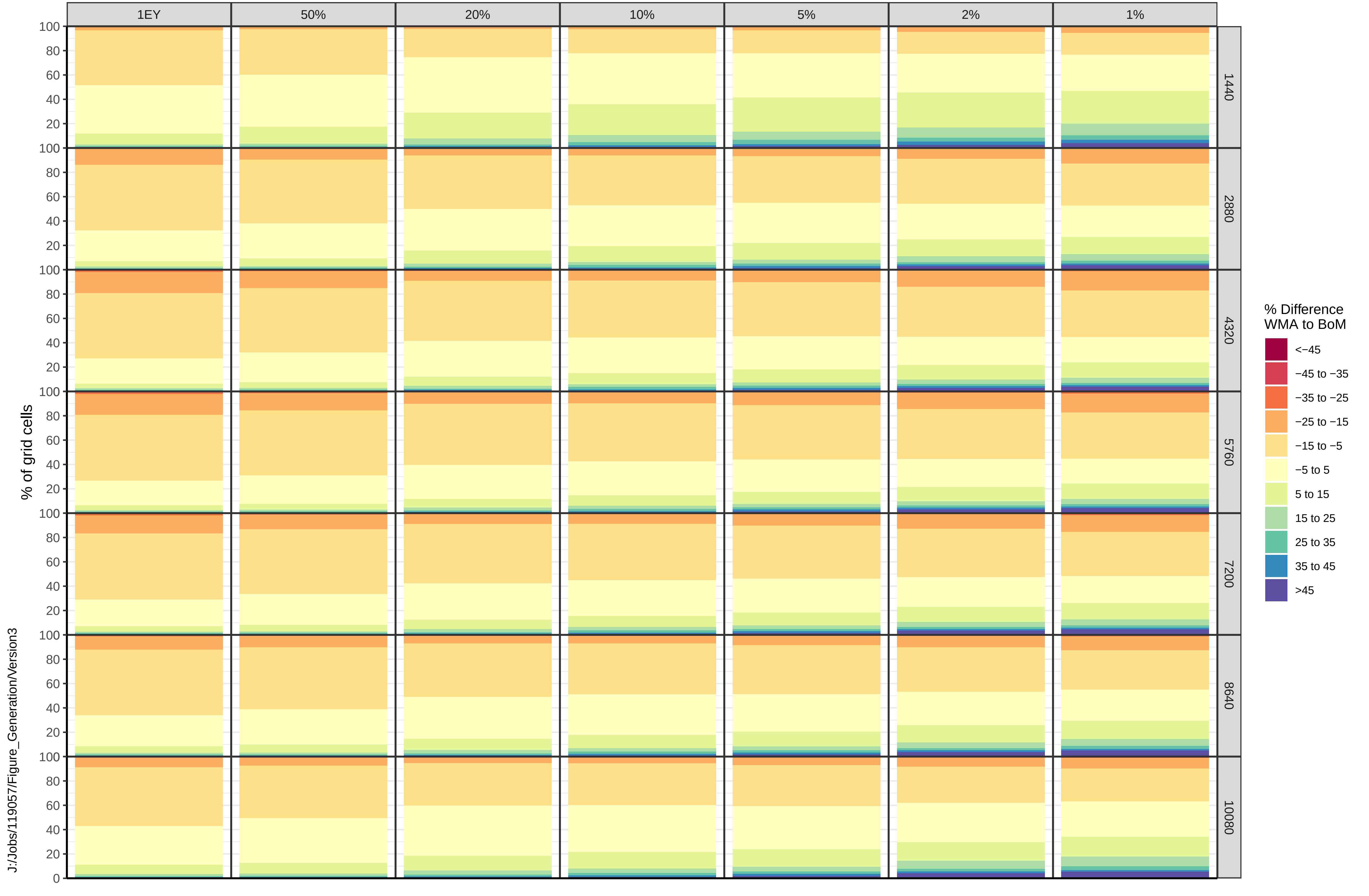
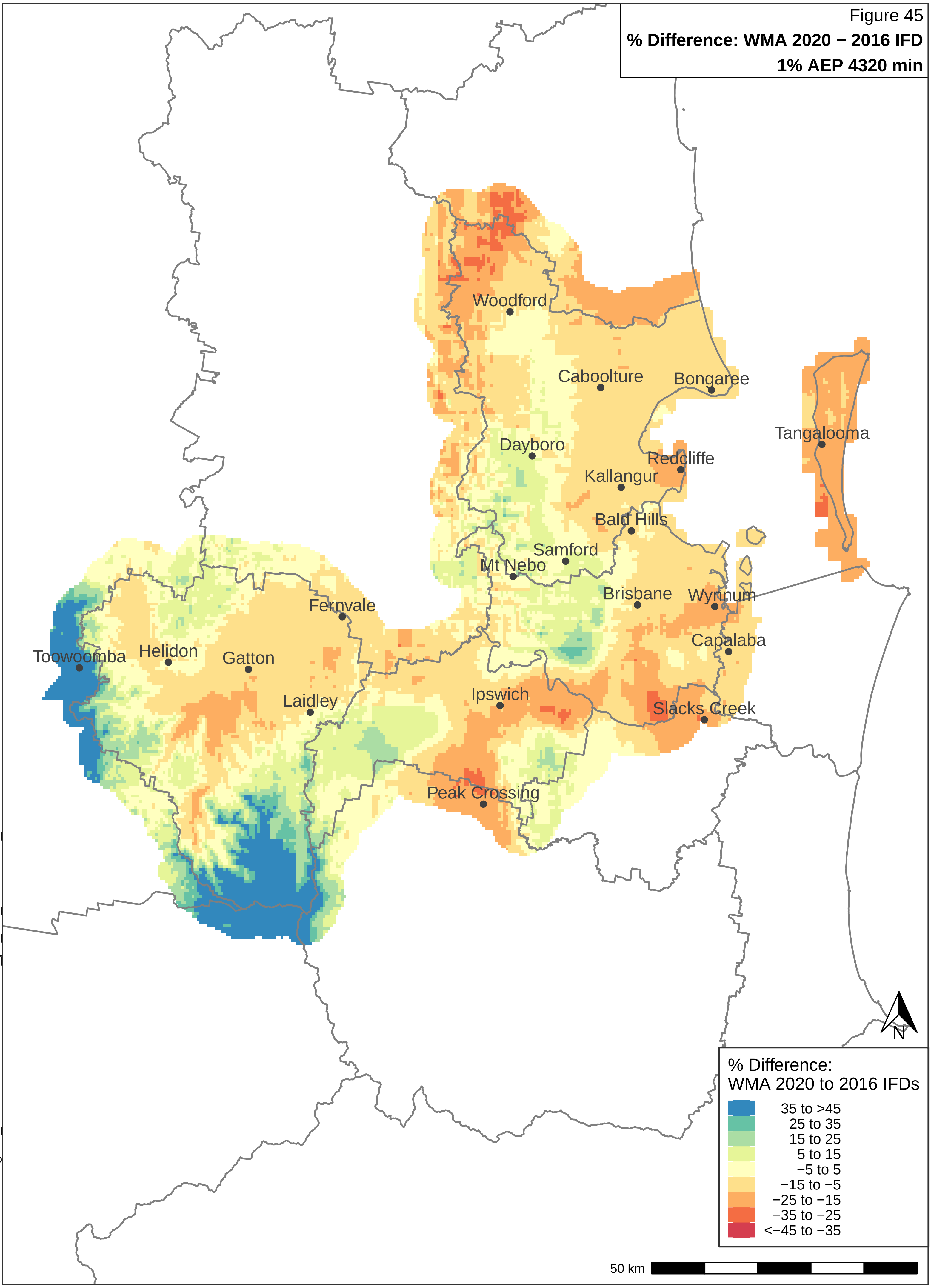


Figure 45
% Difference: WMA 2020 − 2016 IFD
1% AEP 4320 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure 46

% Difference WMA 2020 IFDs:ARR 1987
< 1 day

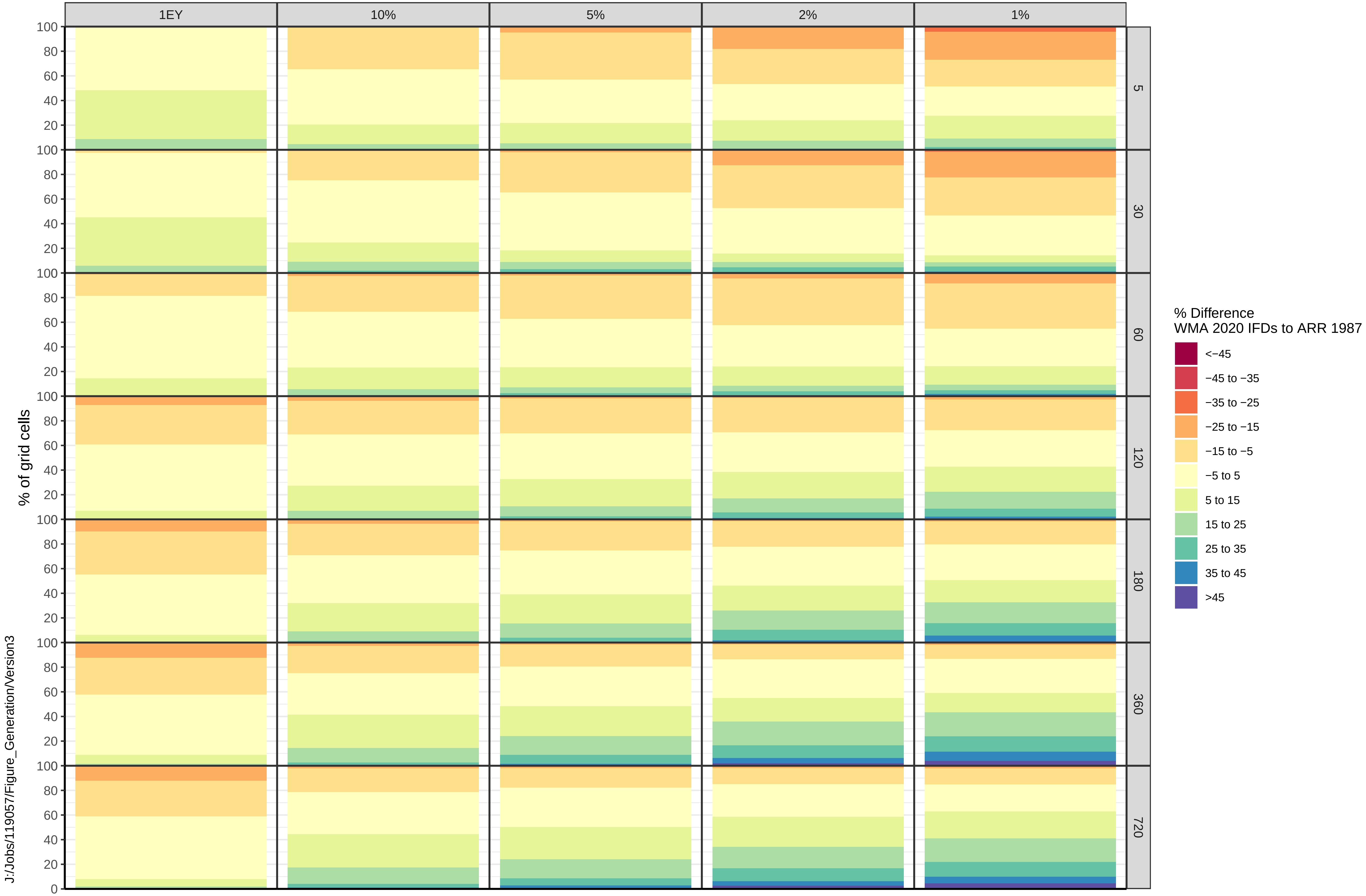
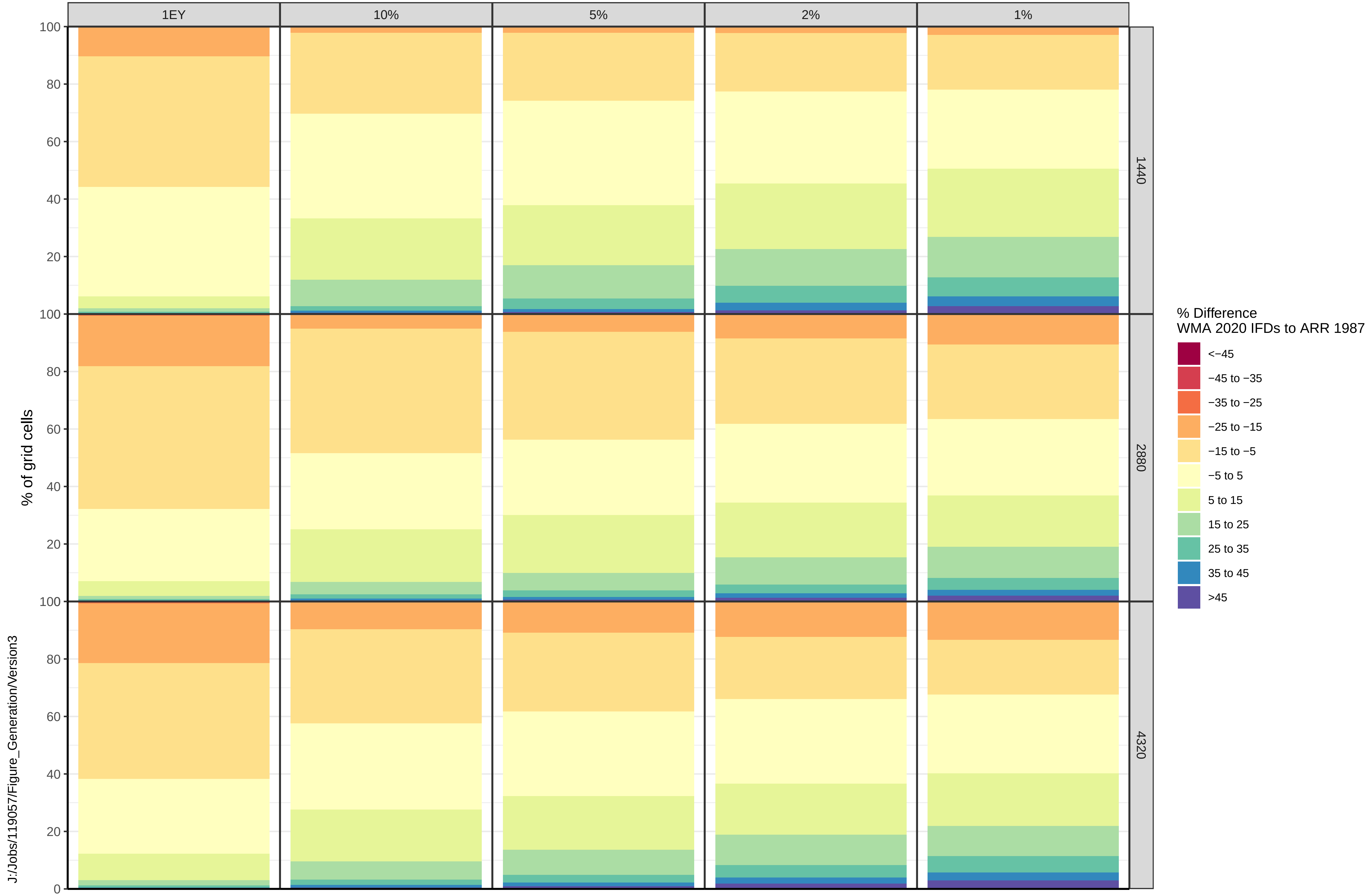


Figure 47

% Difference WMA 2020 IFDs:ARR 1987
>= 1 day



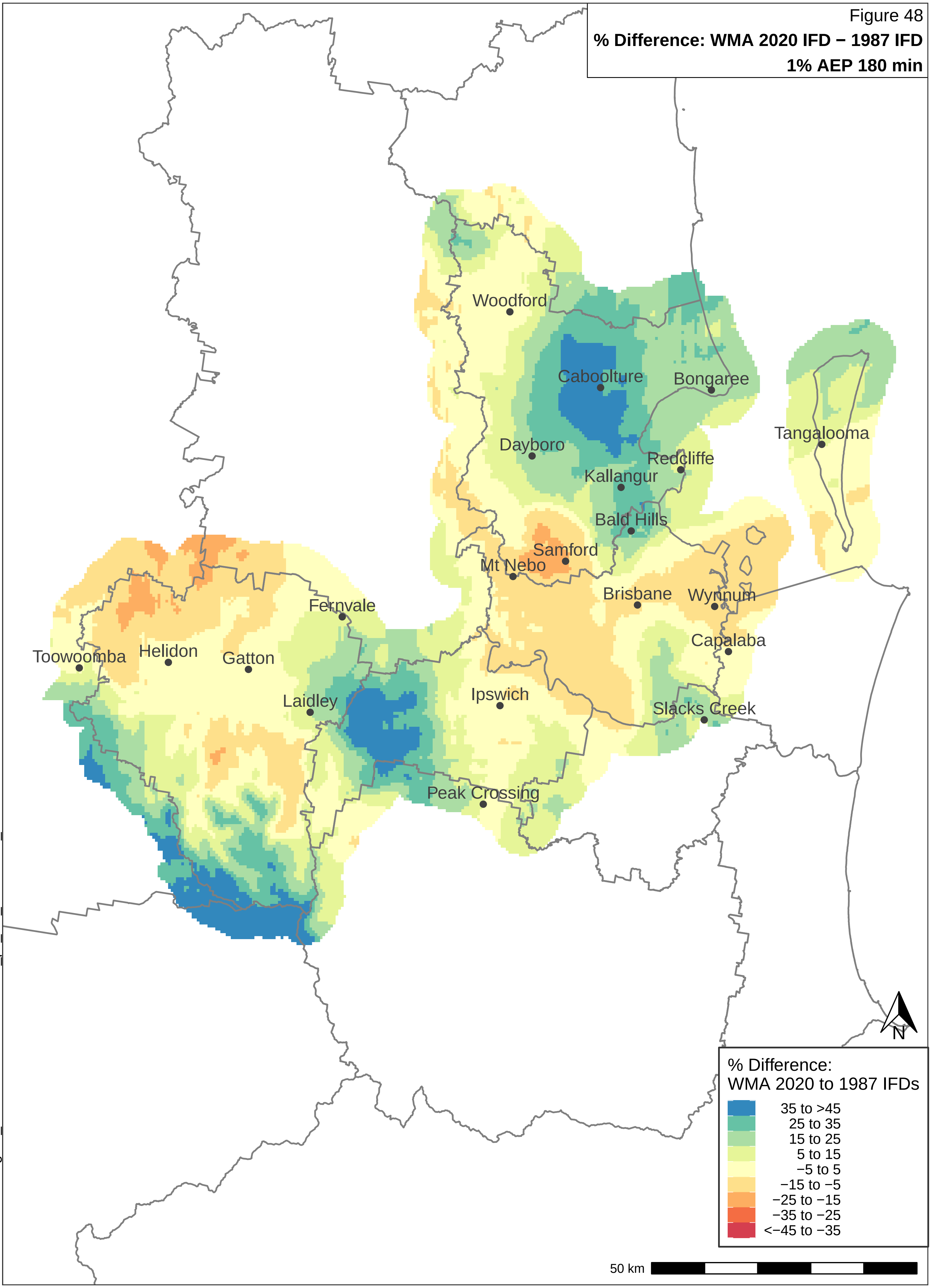


Figure 48

% Difference: WMA 2020 IFD − 1987 IFD

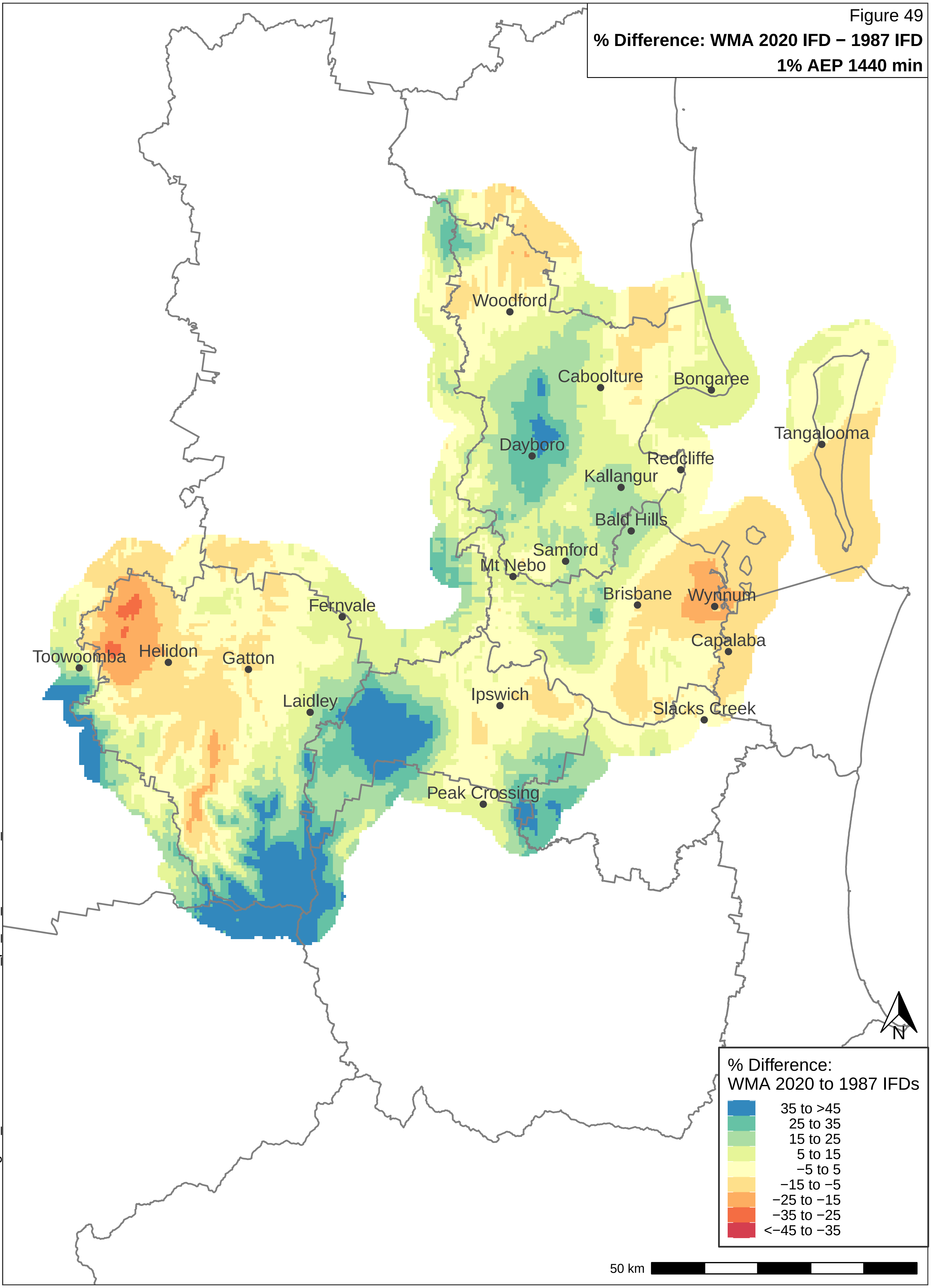
1% AEP 180 min

J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_ARR1987

Figure 49

% Difference: WMA 2020 IFD – 1987 IFD

1% AEP 1440 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_ARR1987

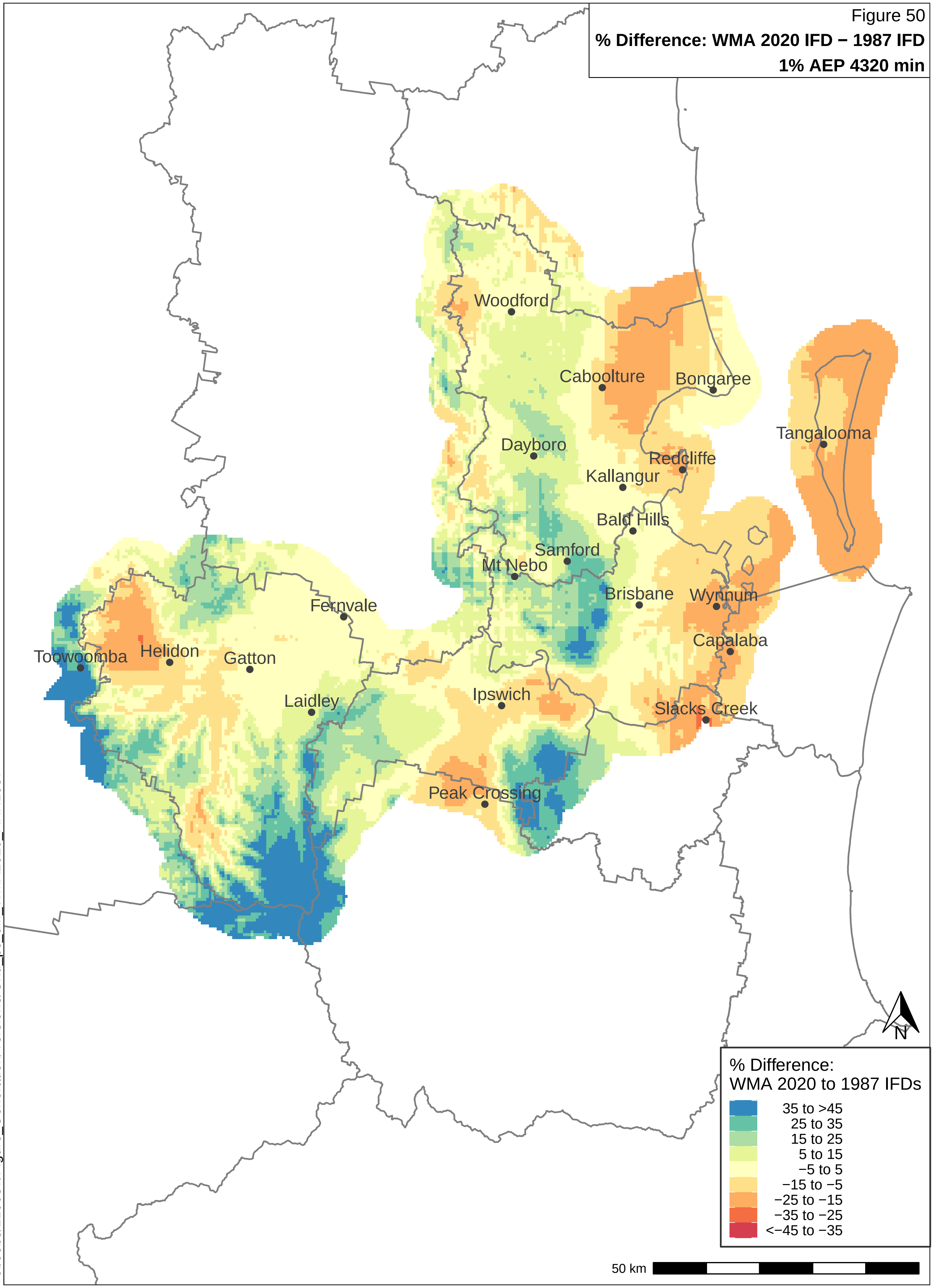


Figure 50
% Difference: WMA 2020 IFD − 1987 IFD
1% AEP 4320 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 1987 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_ARR1987

Appendix A

APPENDIX A. Revised rainfall grid maps

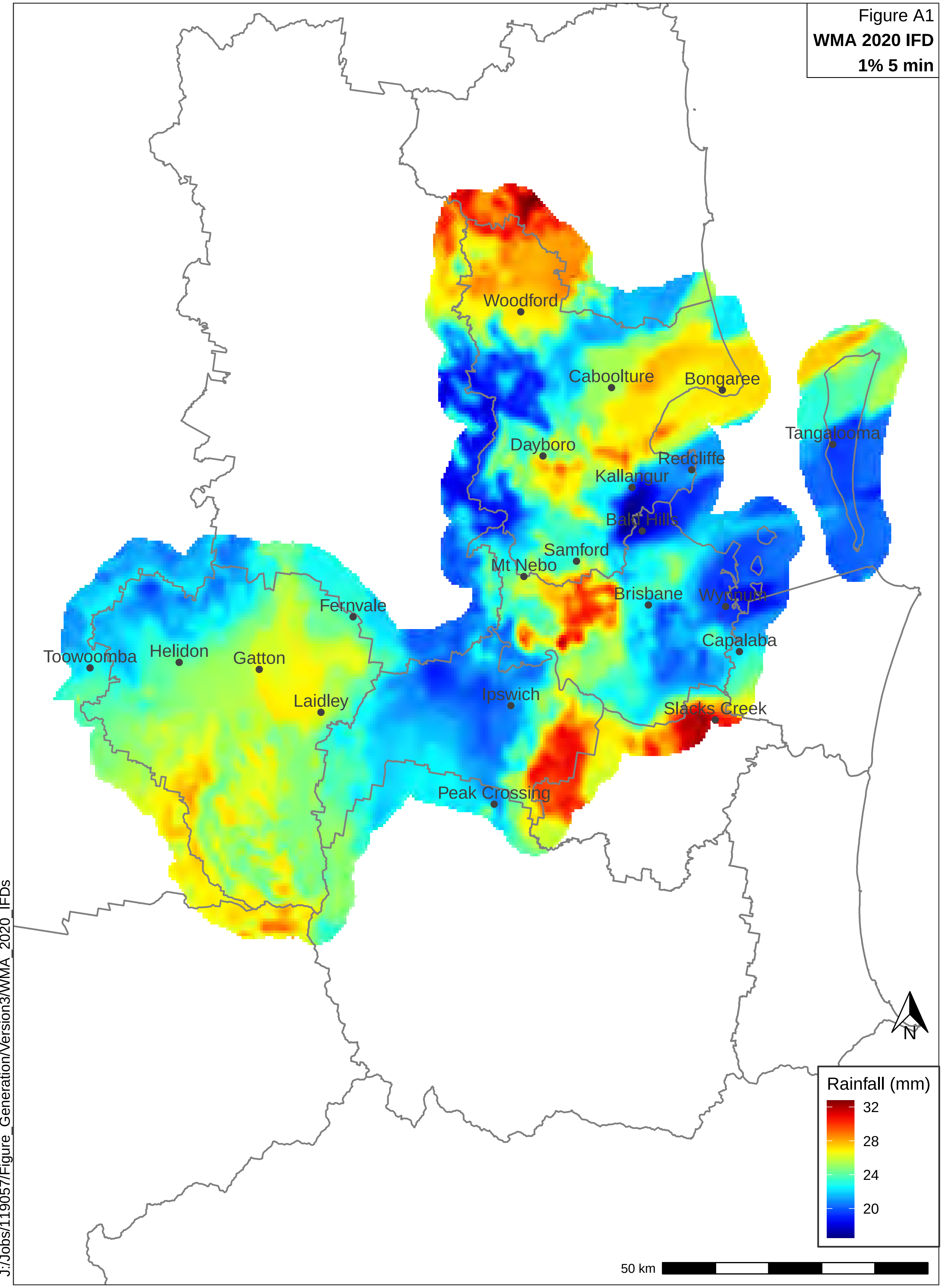
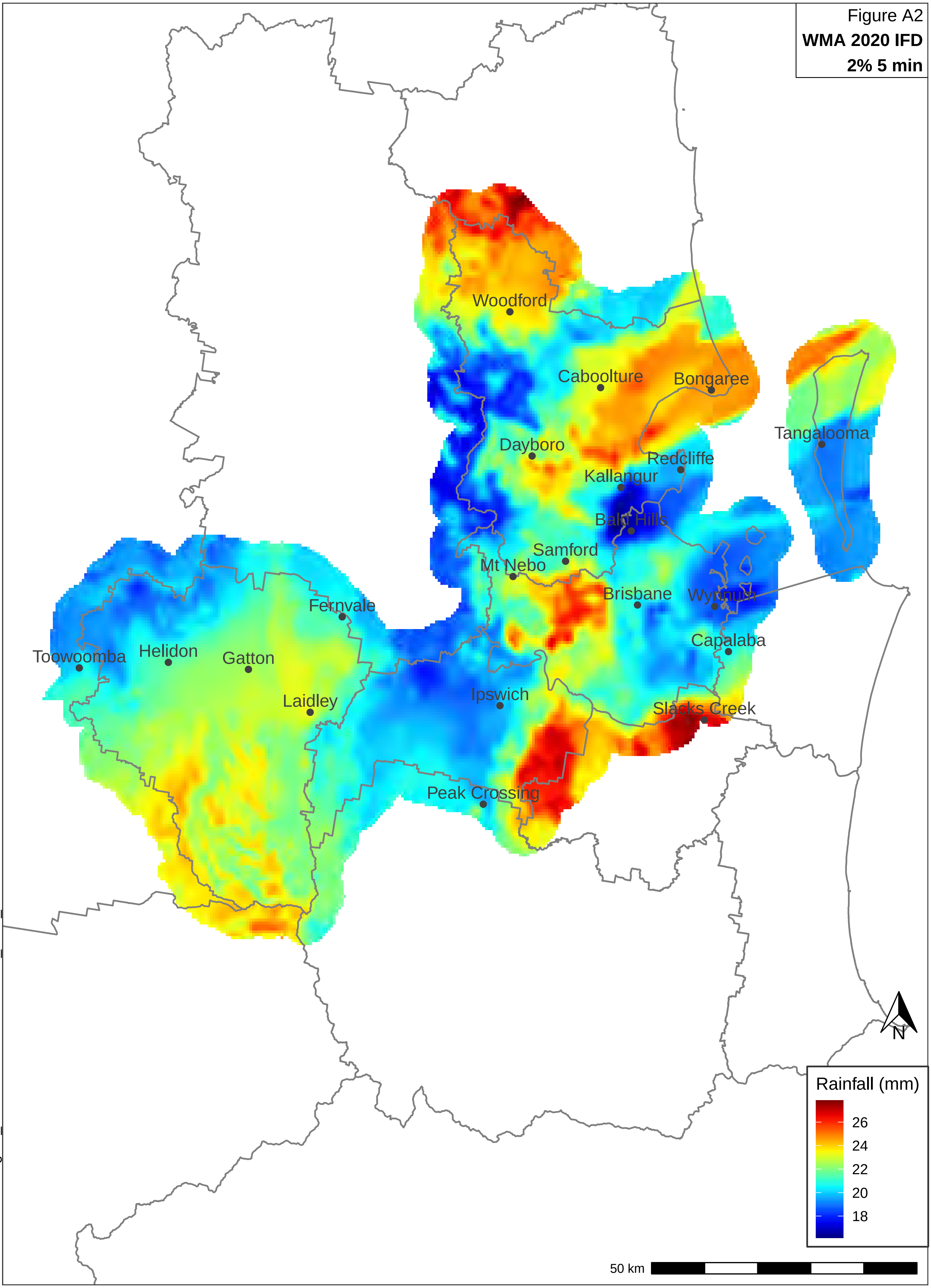
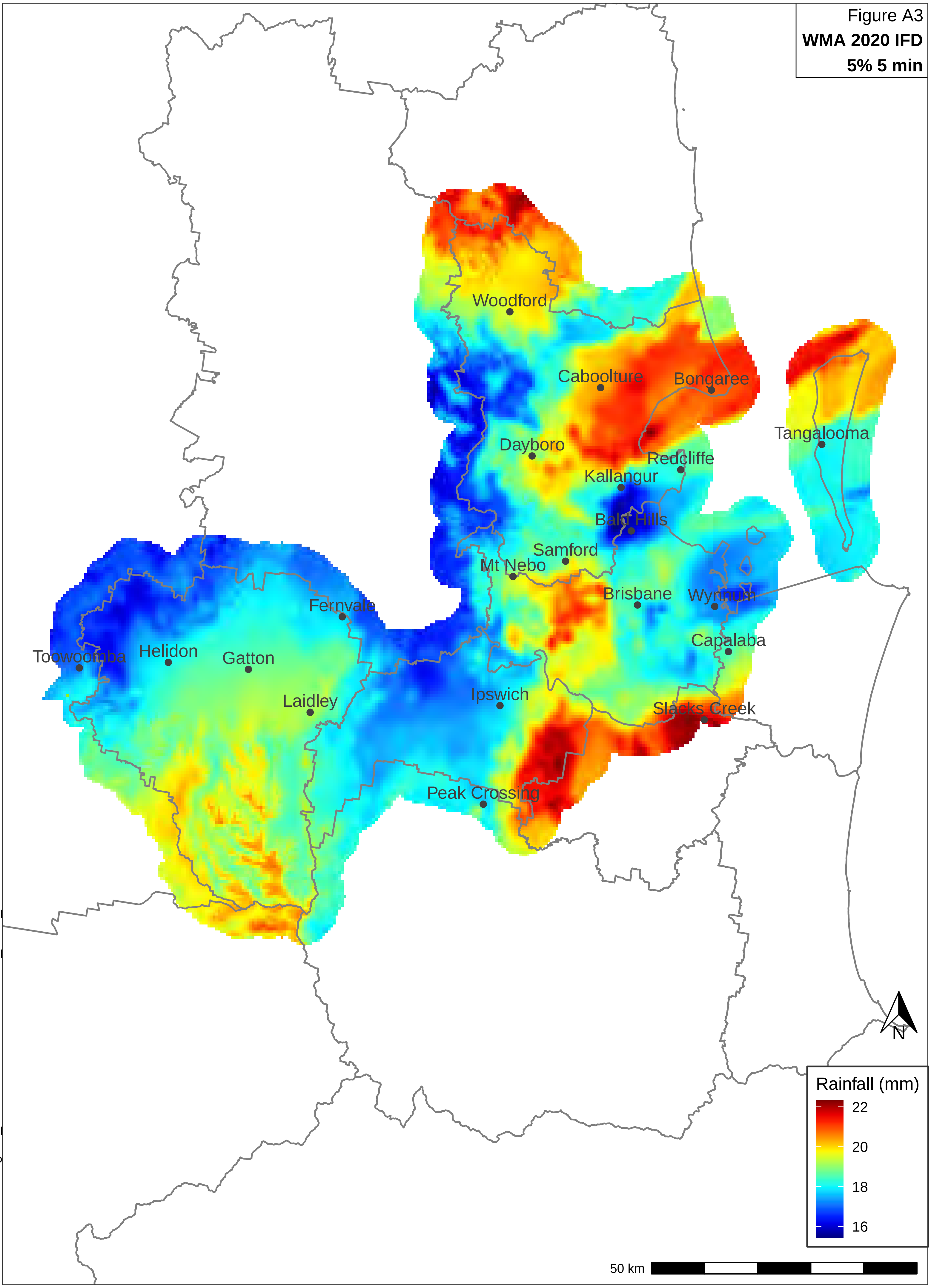


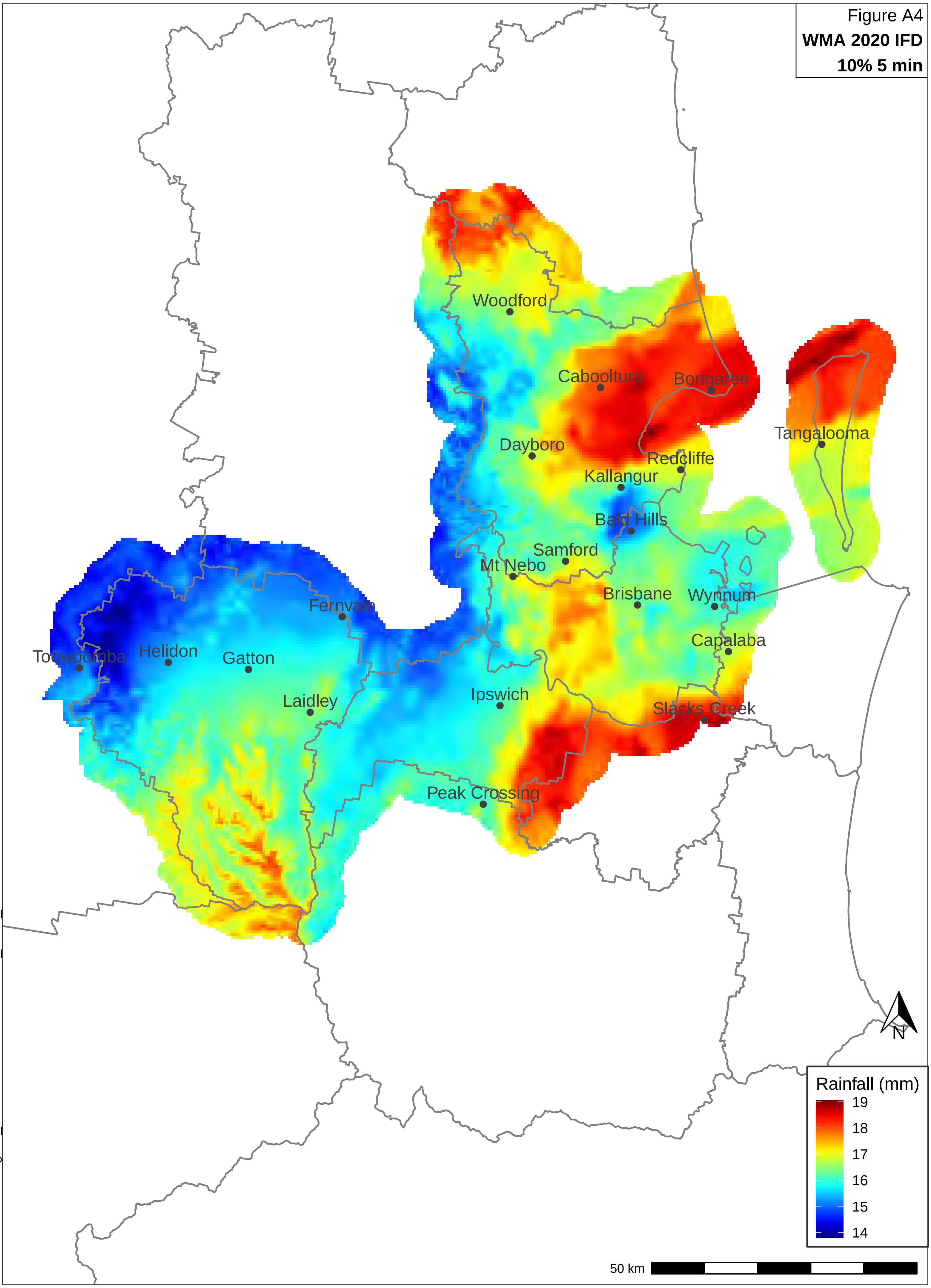
Figure A1
WMA 2020 IFD
1% 5 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Capalaba
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
32
28
24
20
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

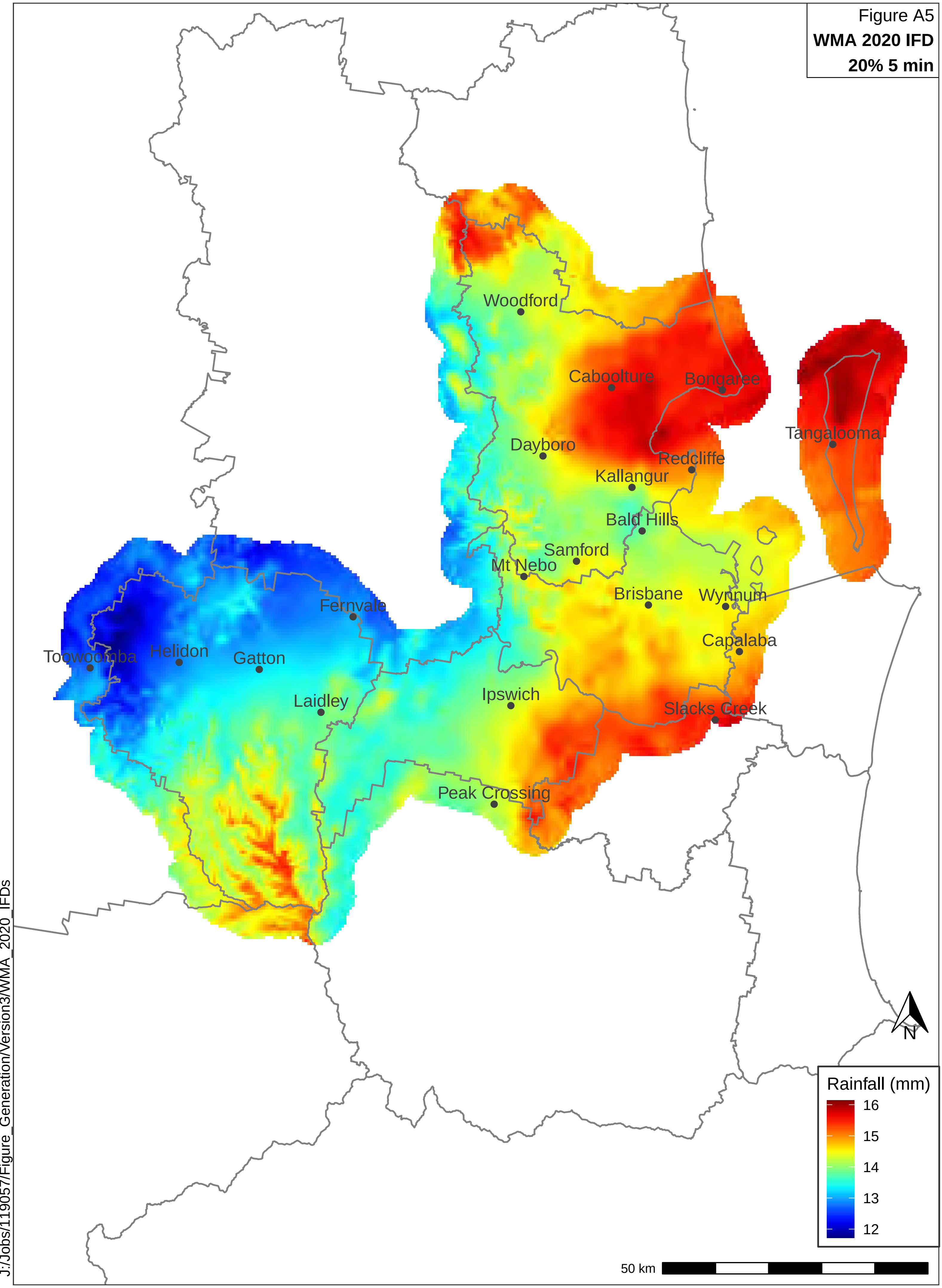


Figure A5
WMA 2020 IFD
20% 5 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
16
15
14
13
12
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

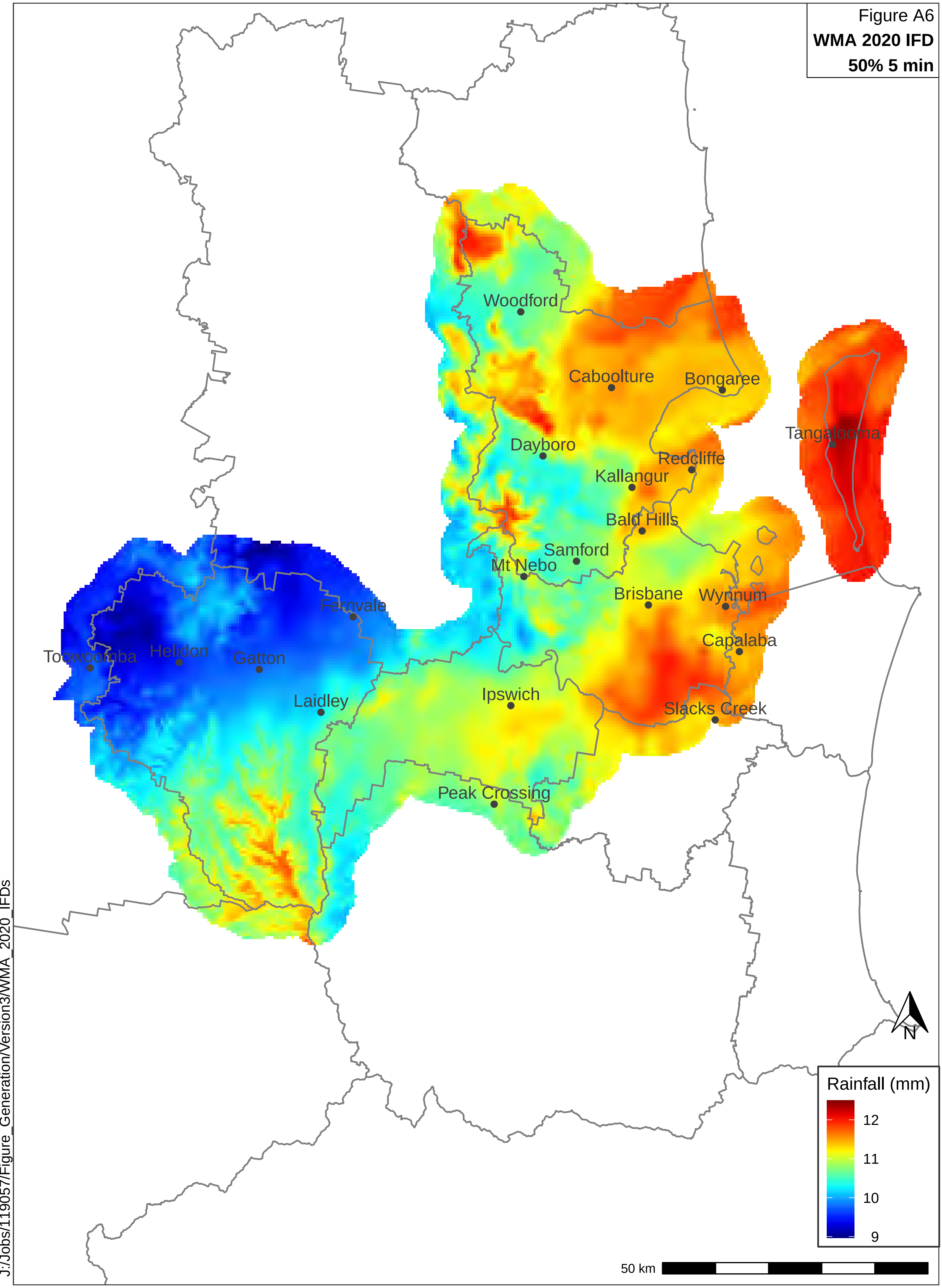


Figure A6
WMA 2020 IFD
50% 5 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
12
11
10
9
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

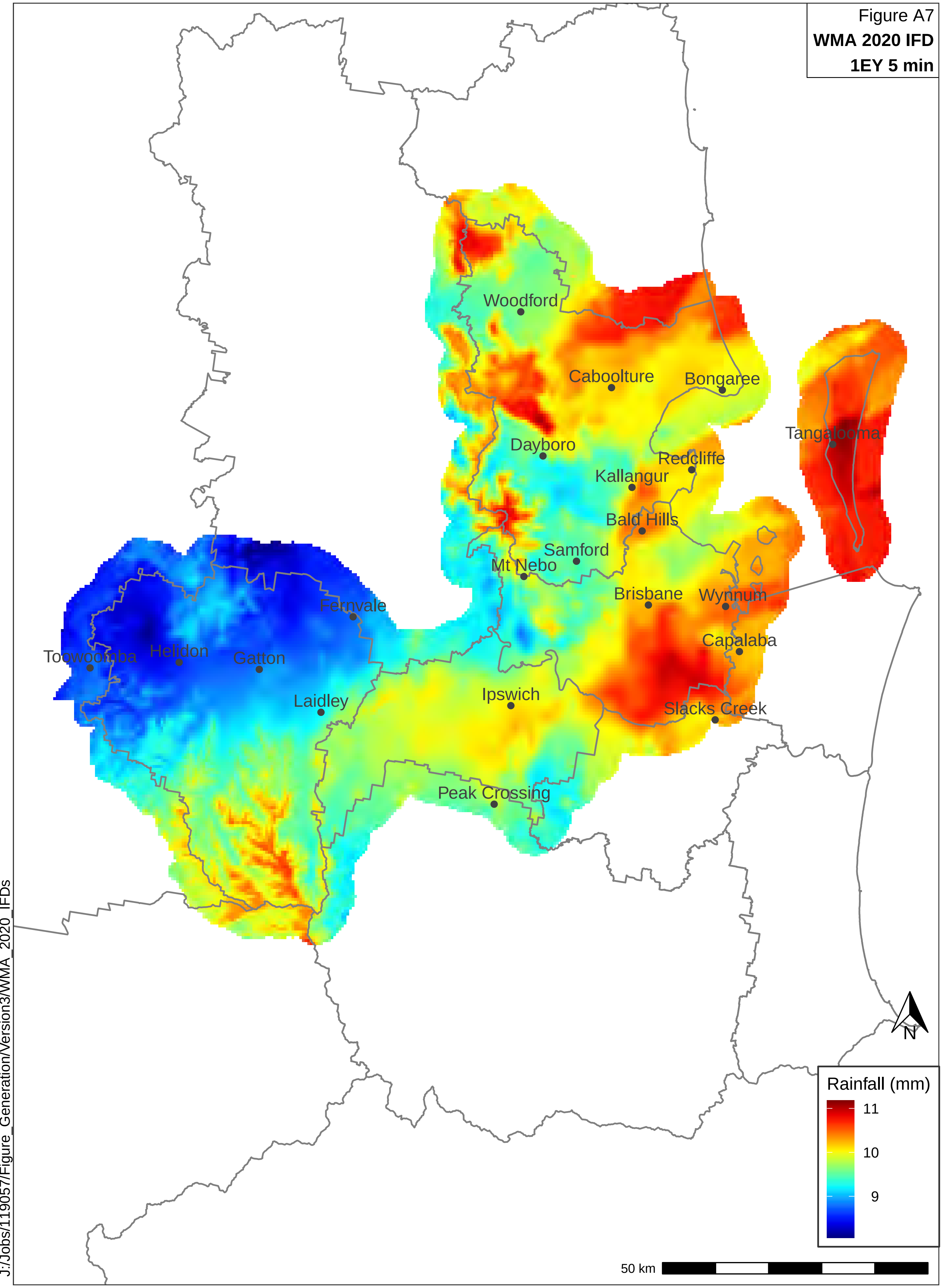
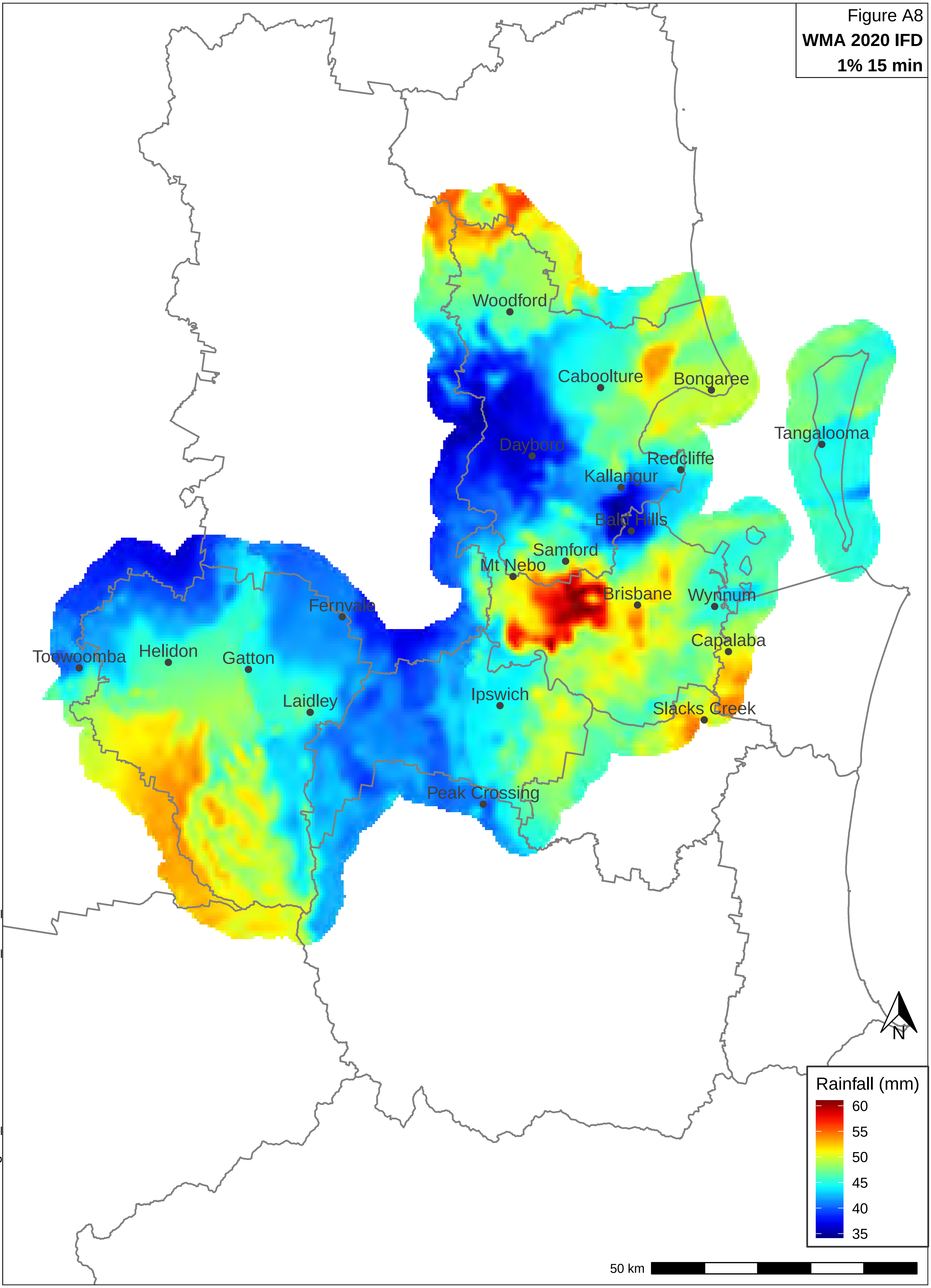
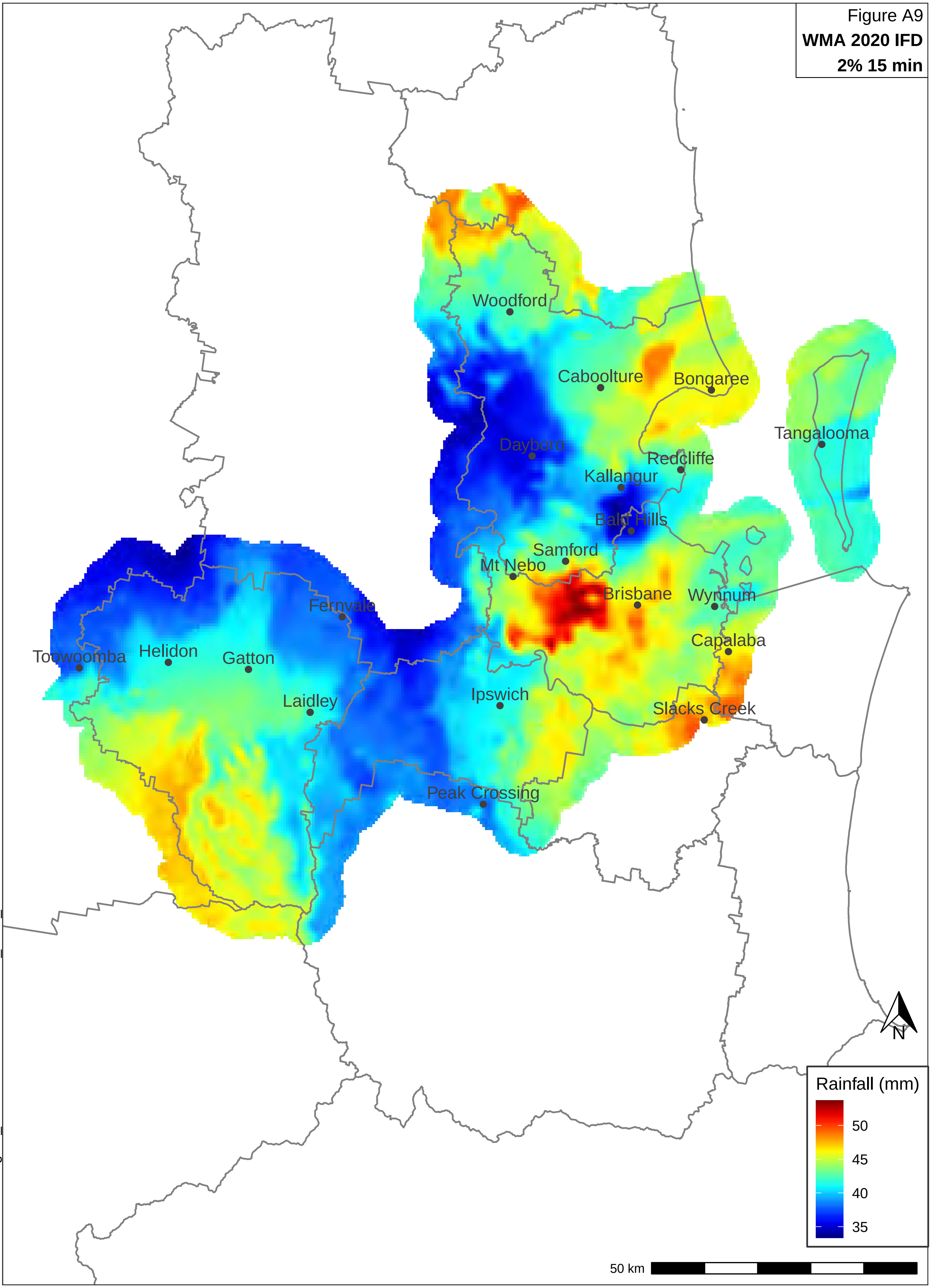


Figure A7
WMA 2020 IFD
1EY 5 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
11
10
9
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

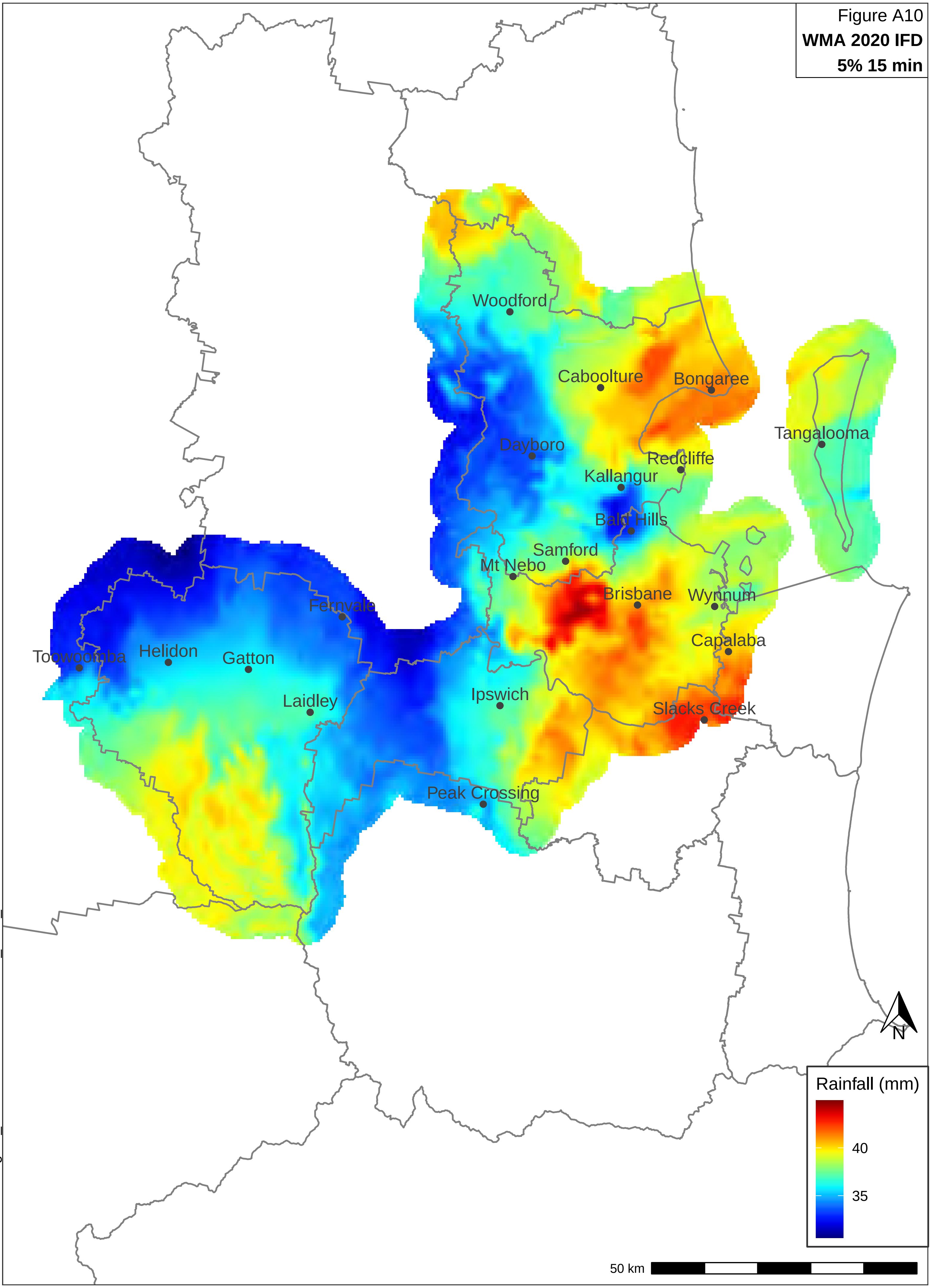
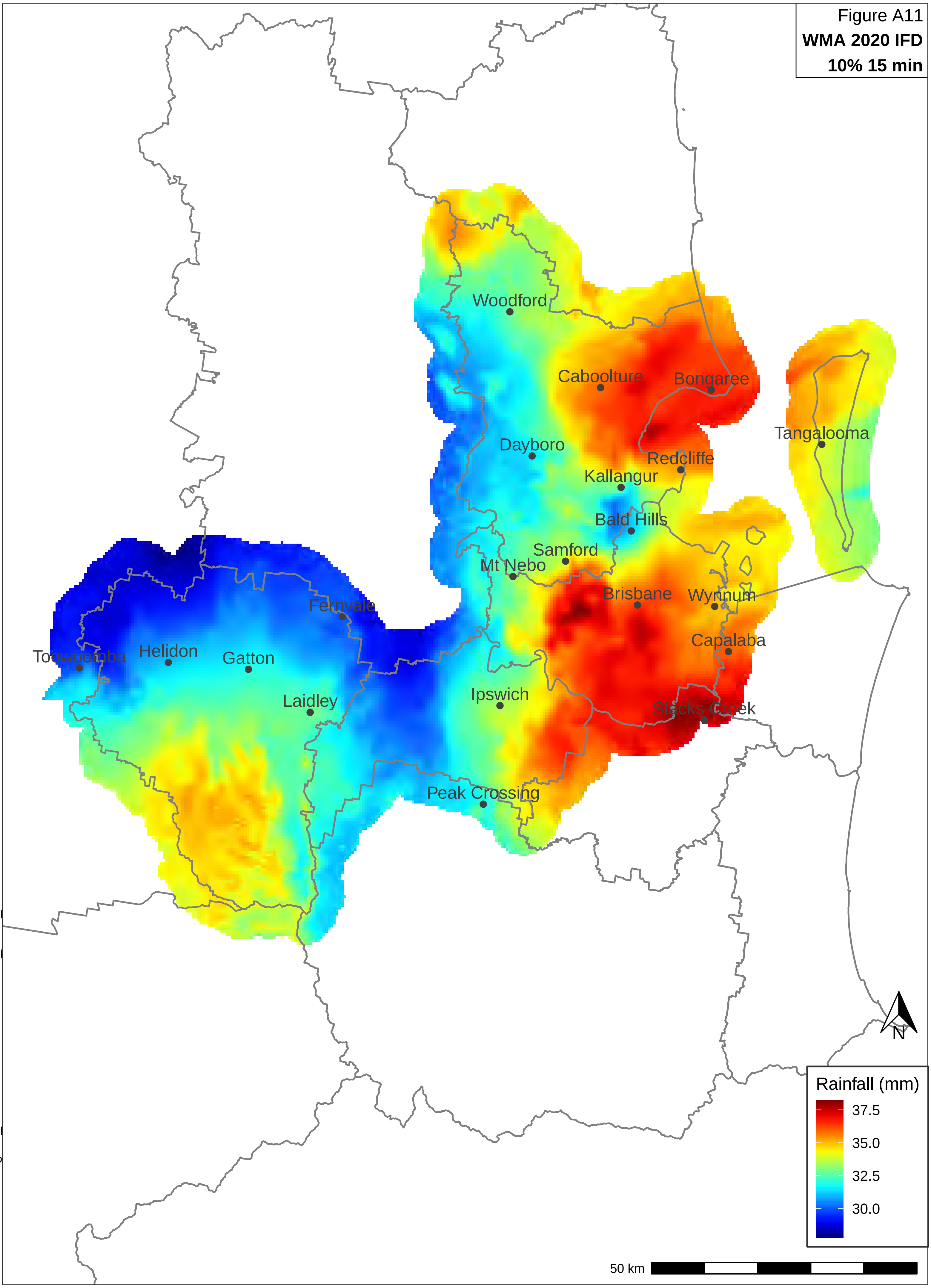
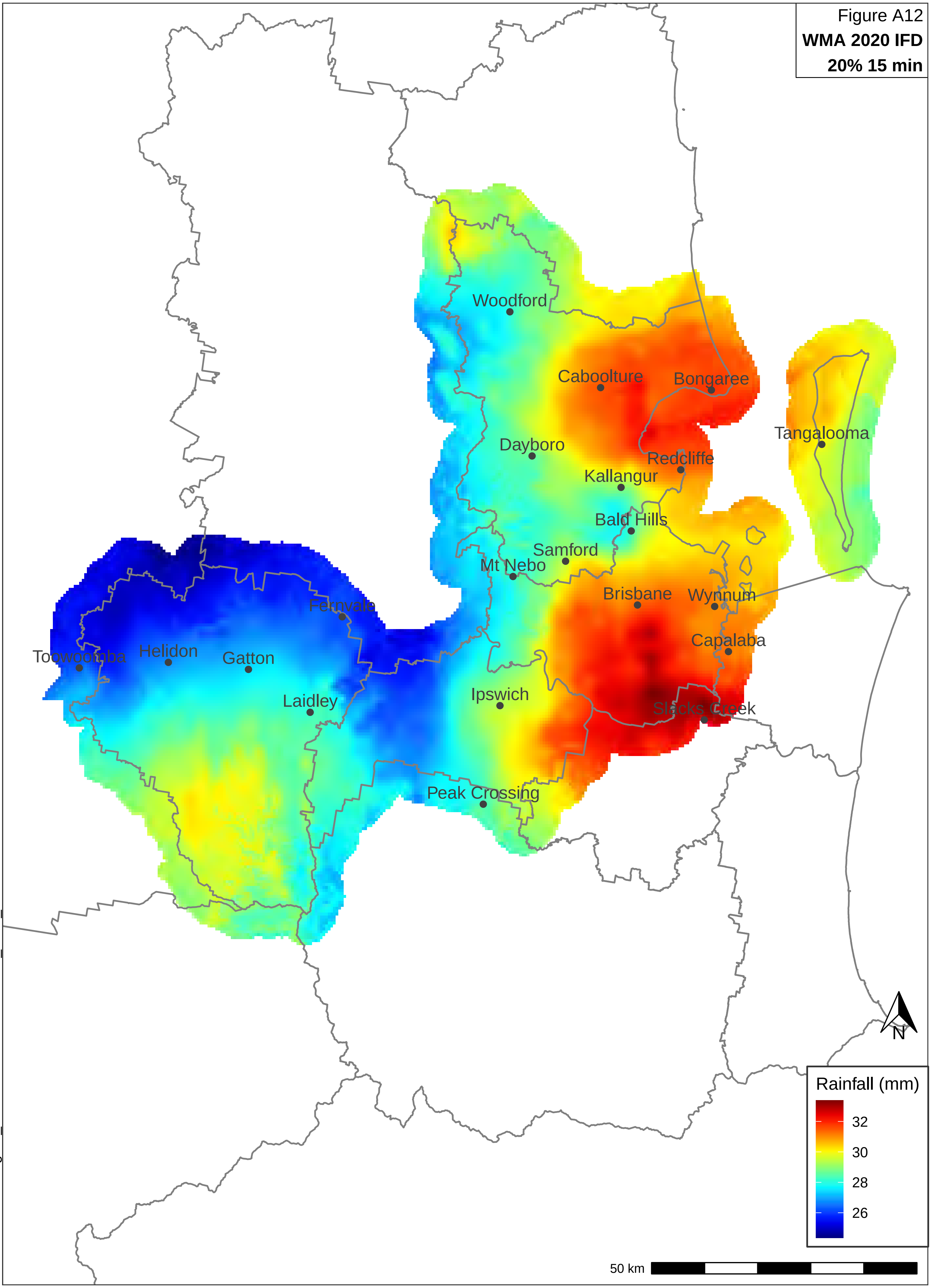


Figure A10
WMA 2020 IFD
5% 15 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
40
35
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

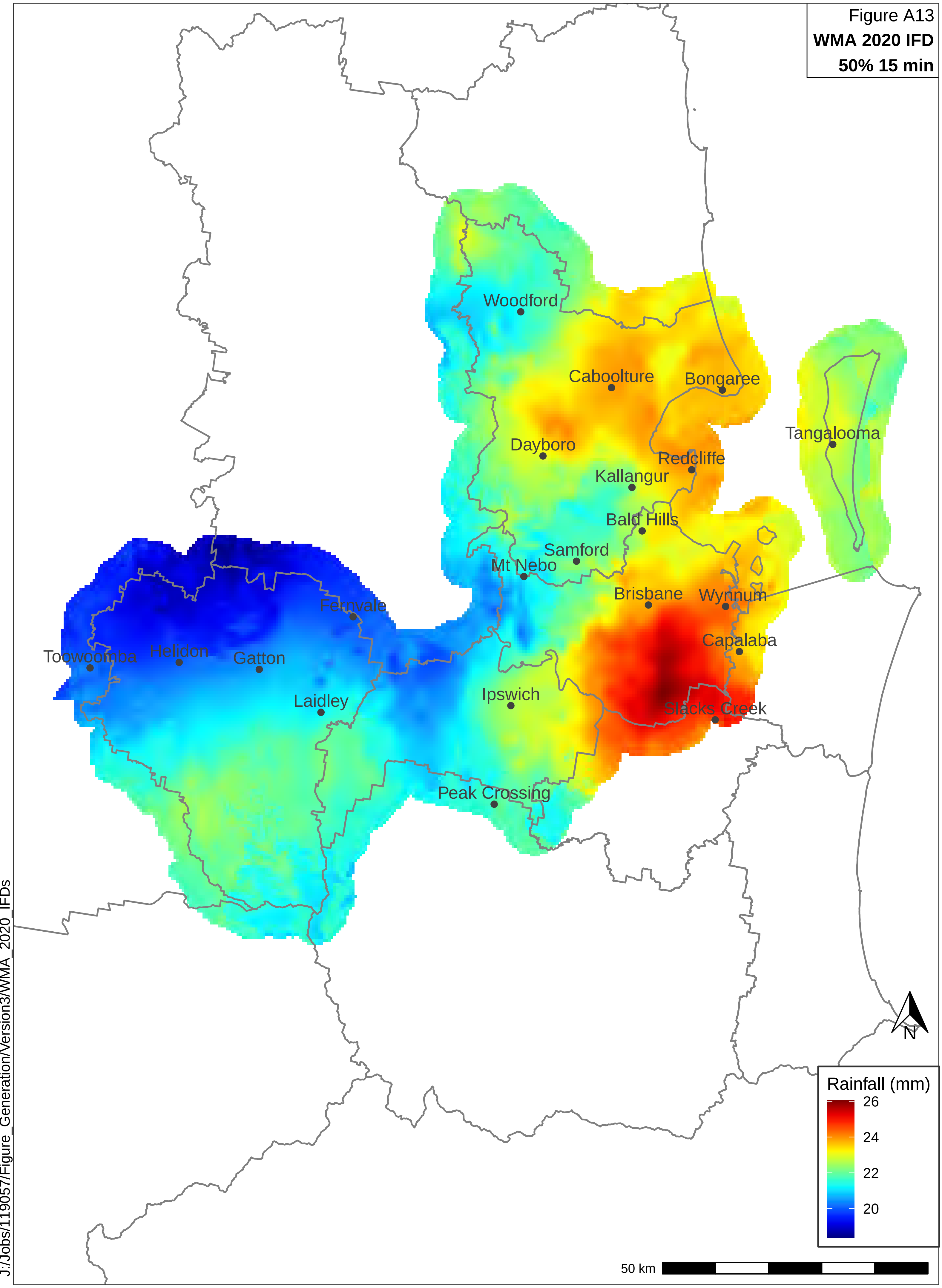
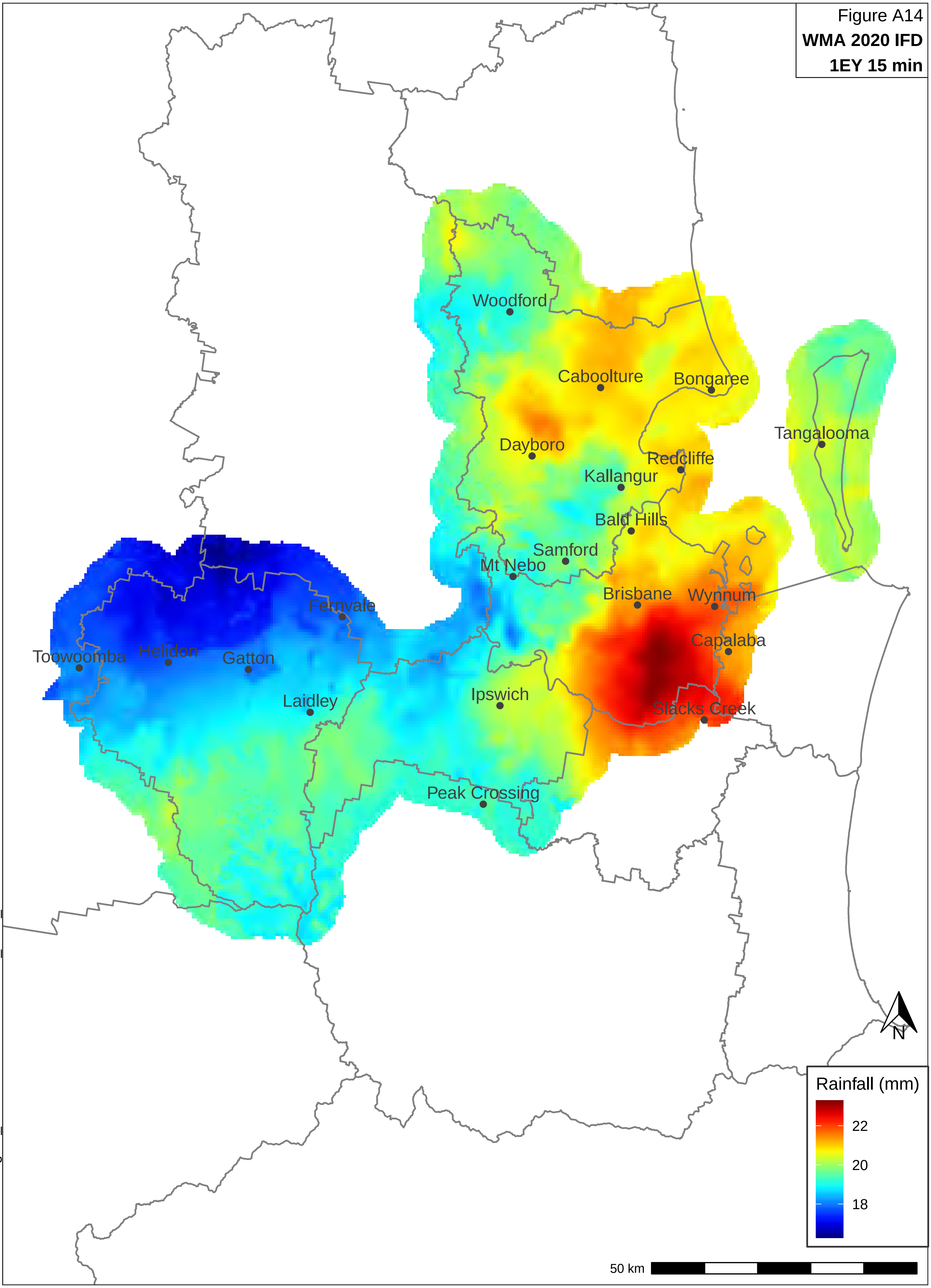
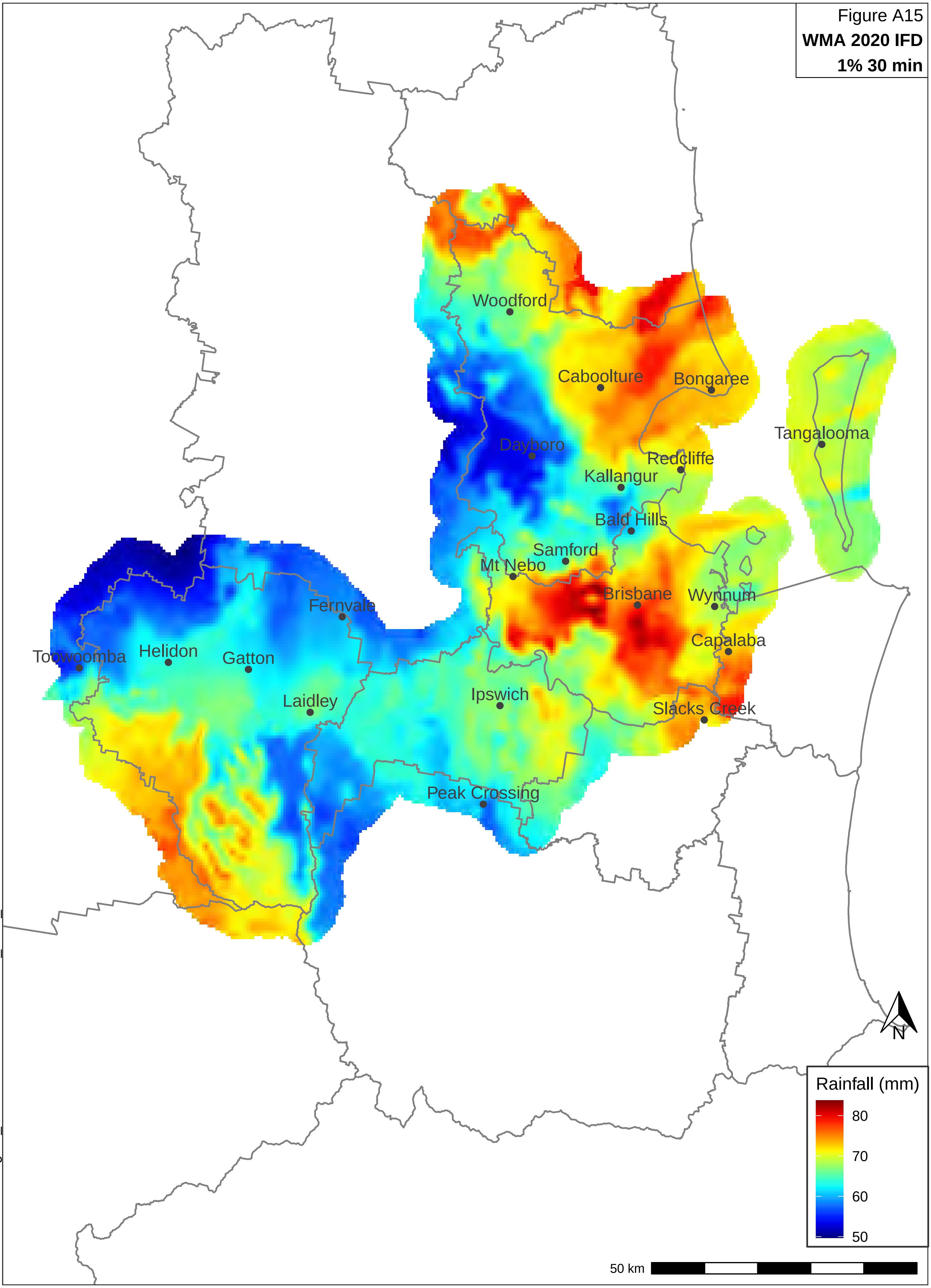


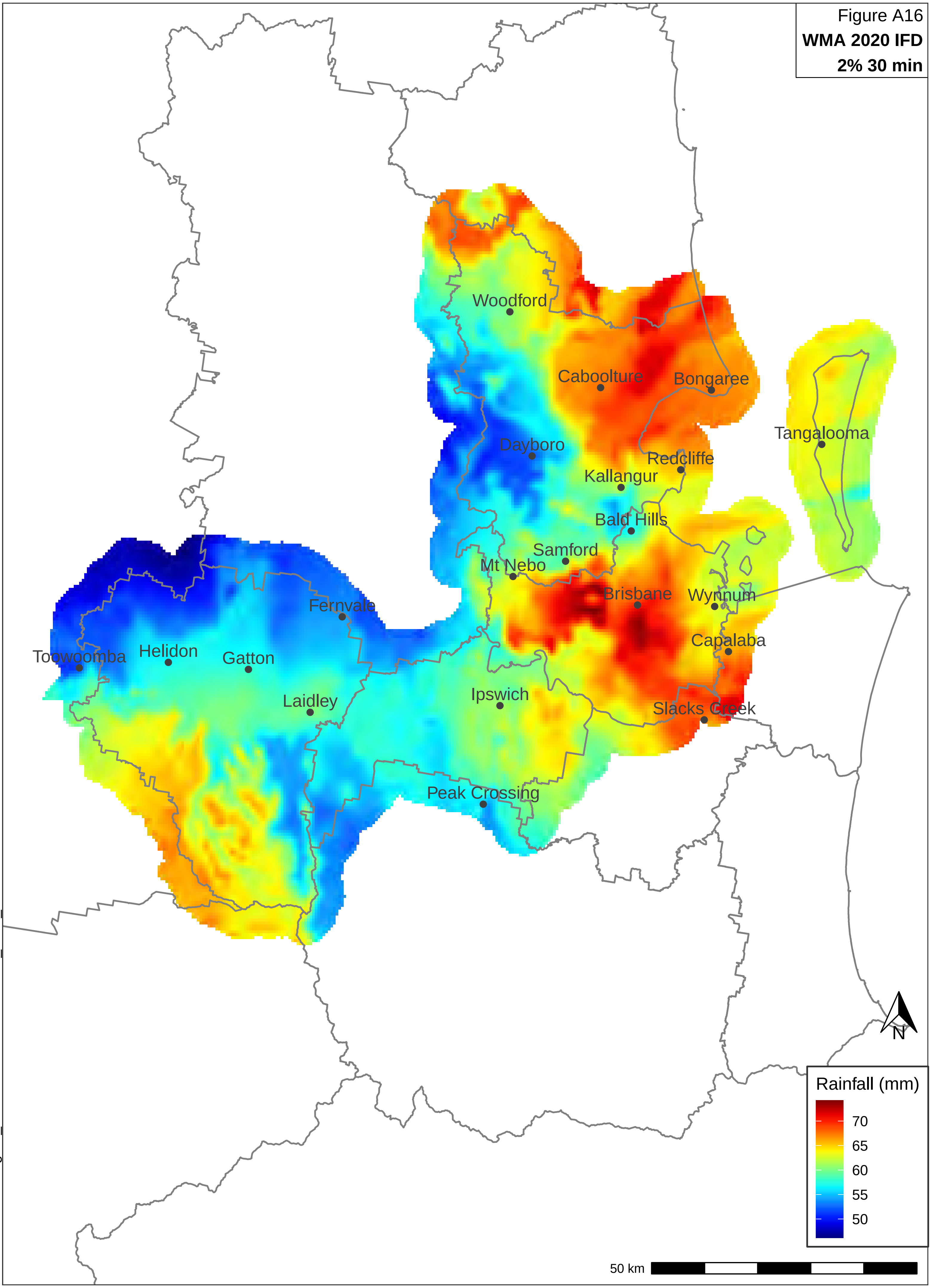
Figure A13
WMA 2020 IFD
50% 15 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
26
24
22
20
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



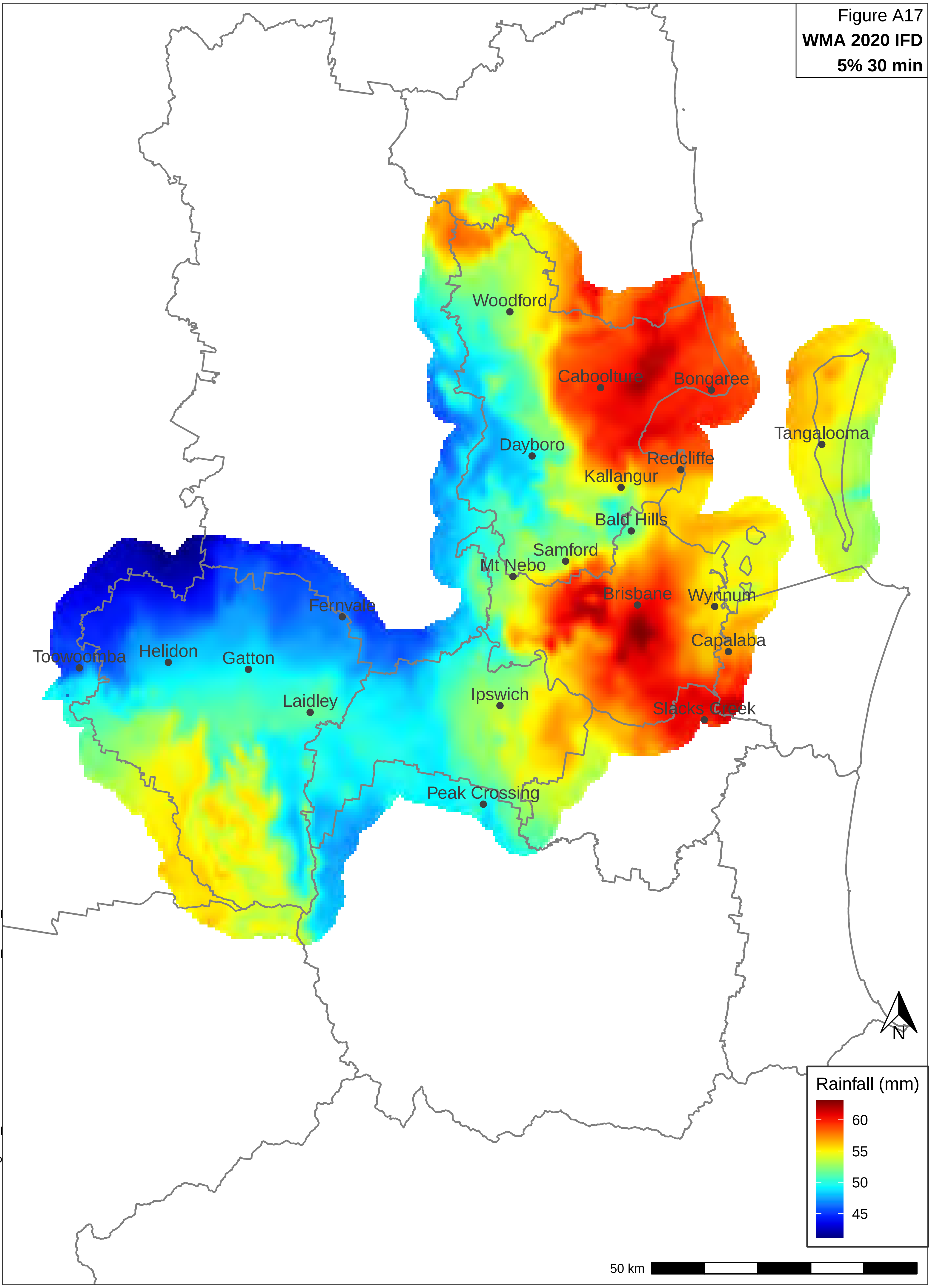
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



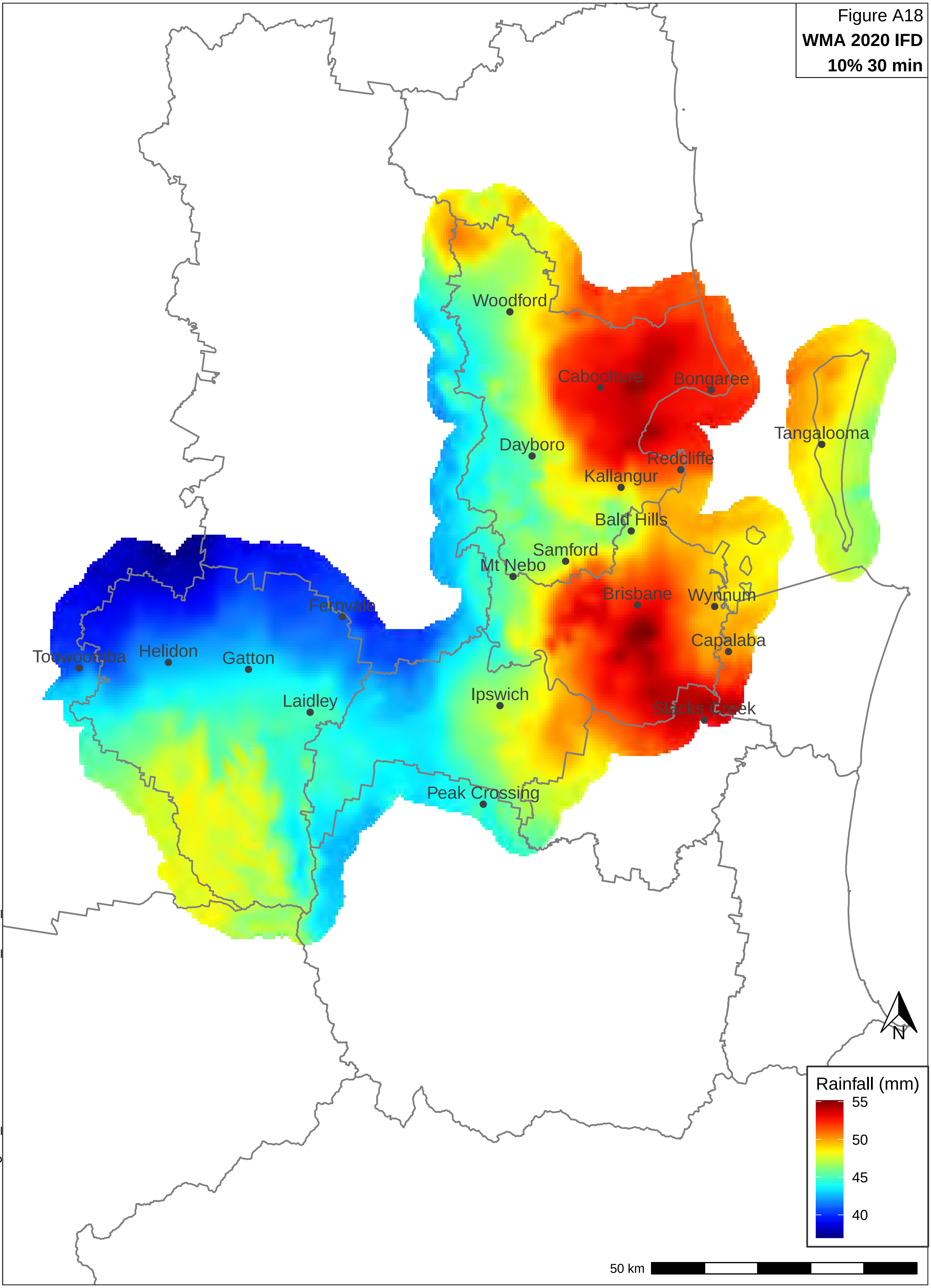
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

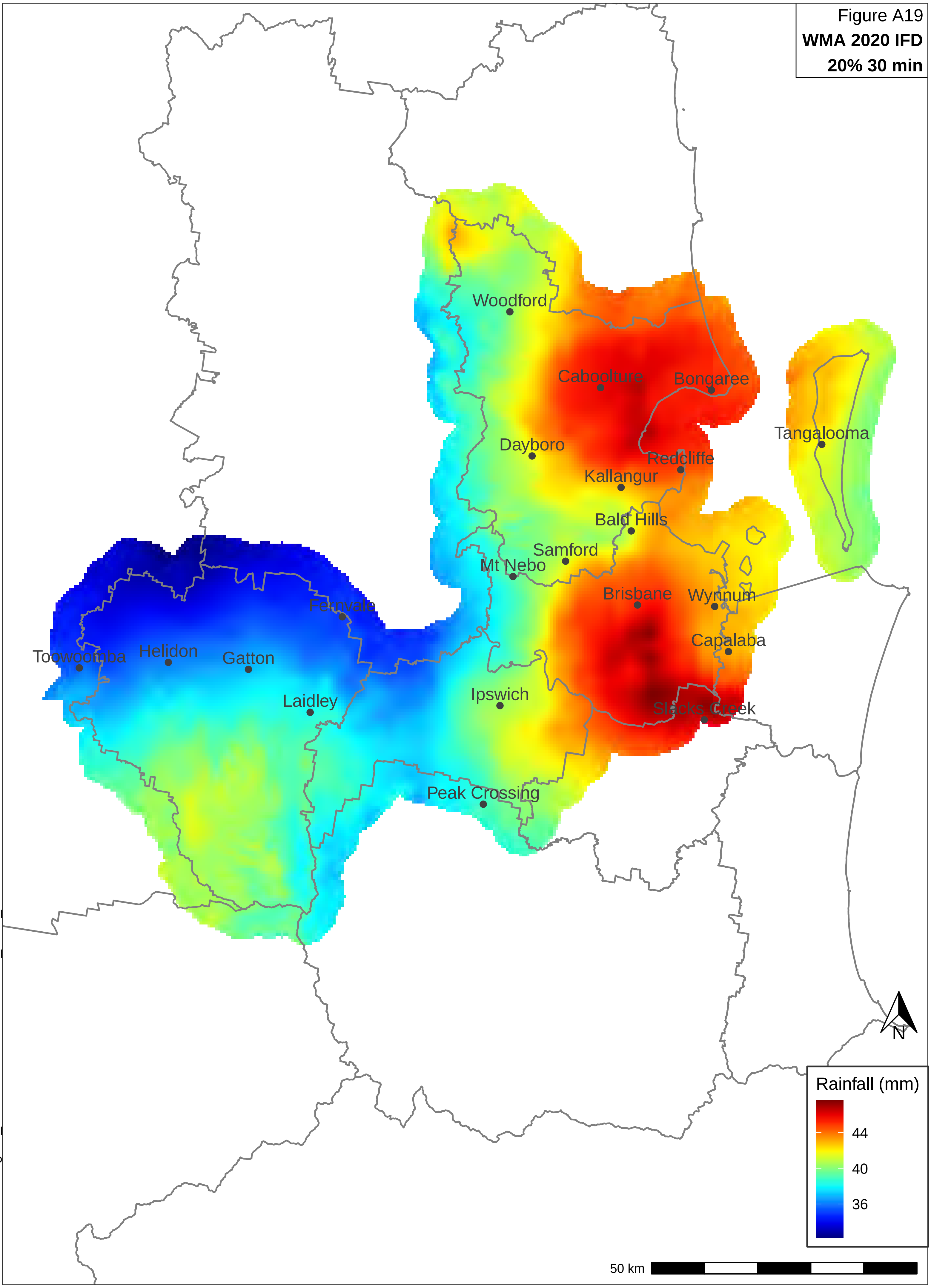
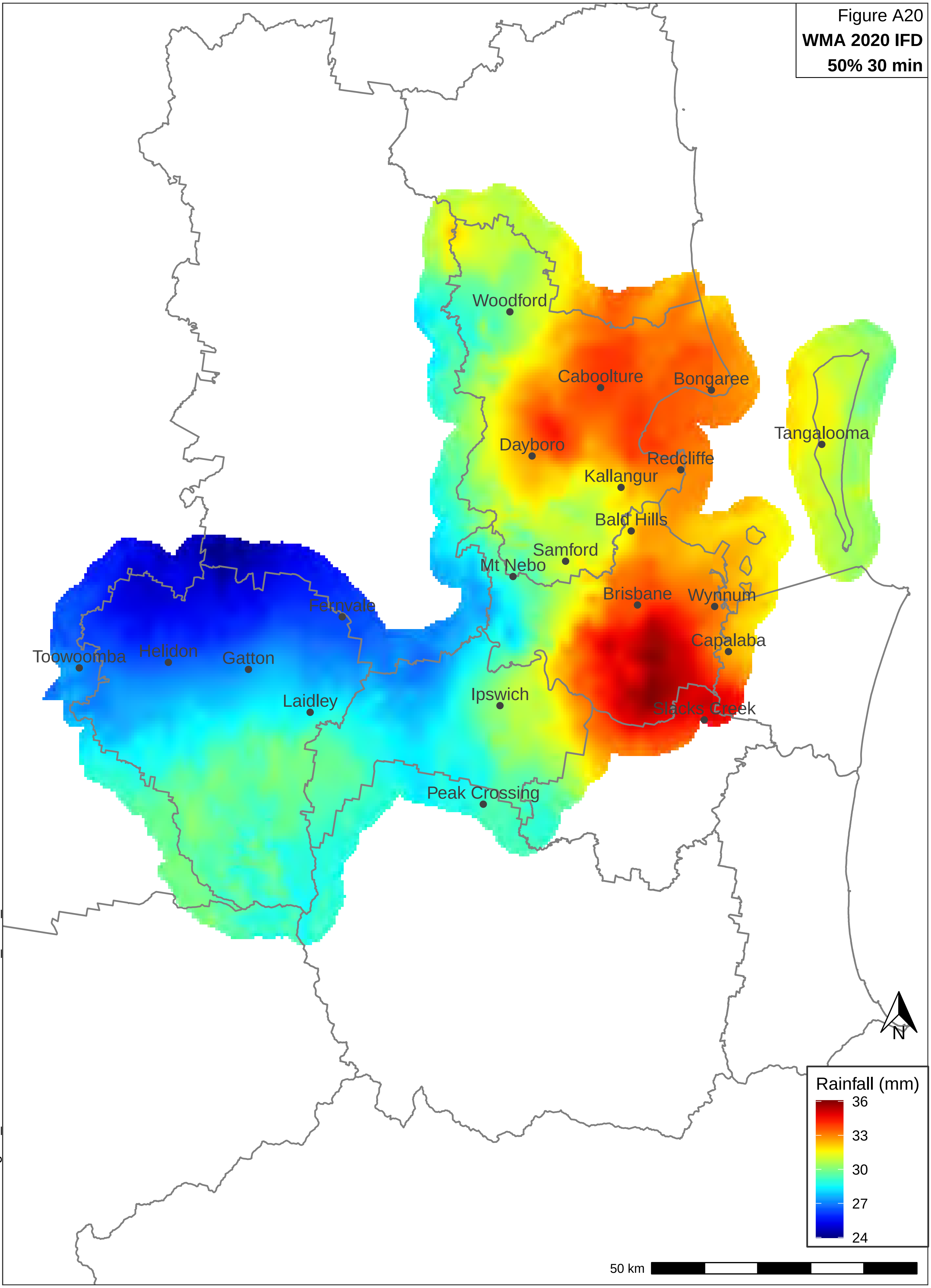


Figure A19
WMA 2020 IFD
20% 30 min

J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

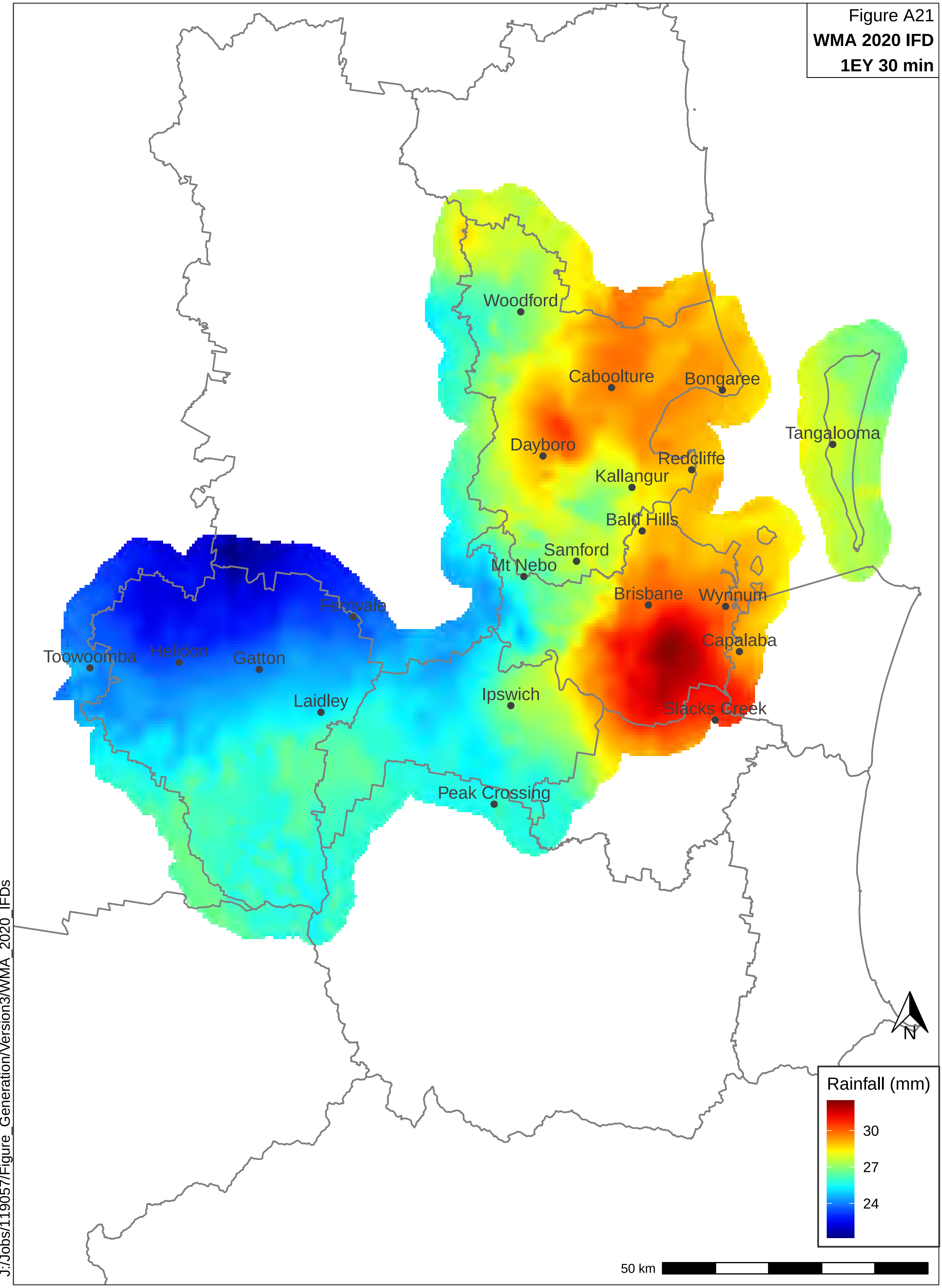


Figure A21
WMA 2020 IFD
1EY 30 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
30
27
24
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

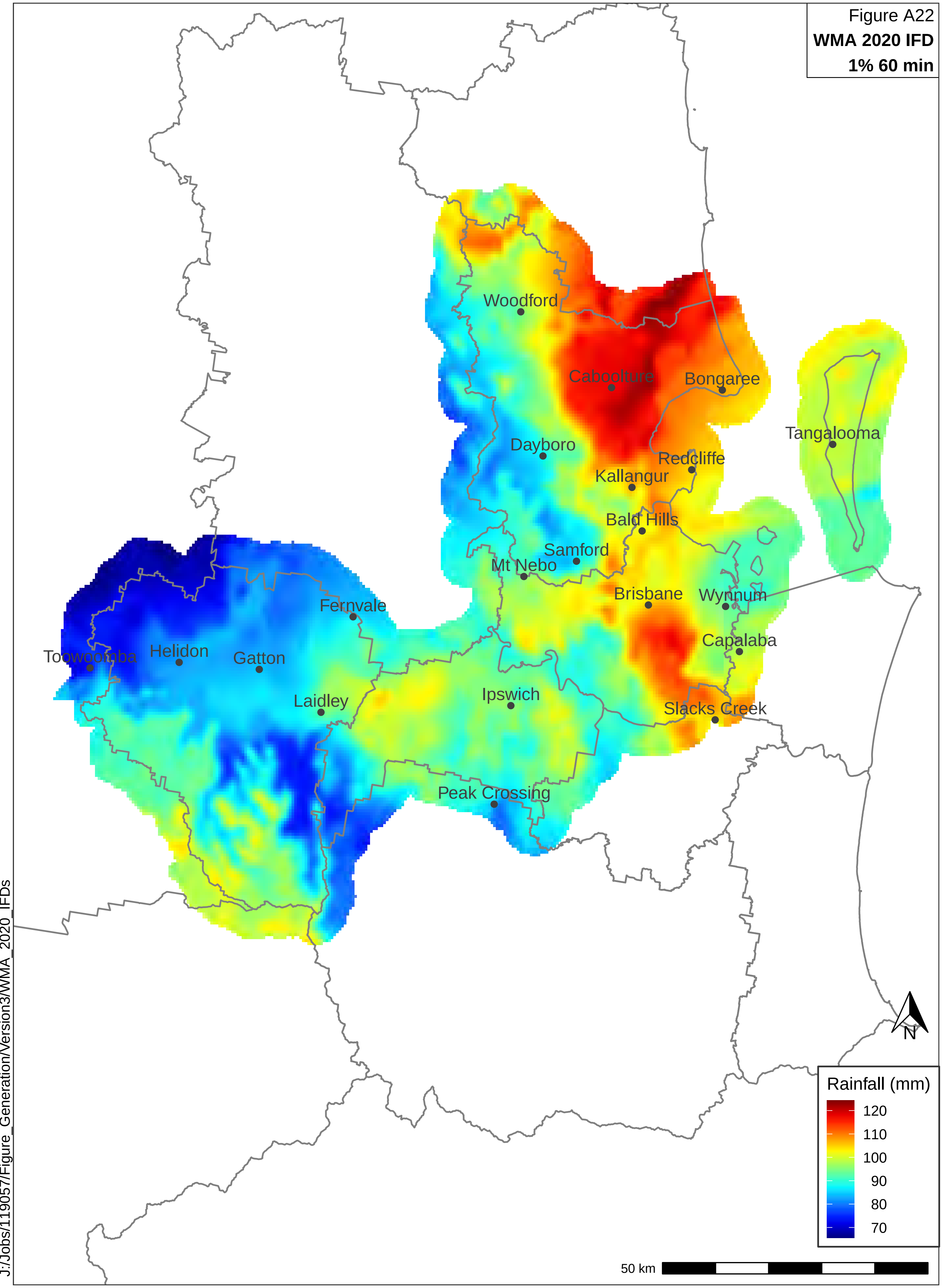
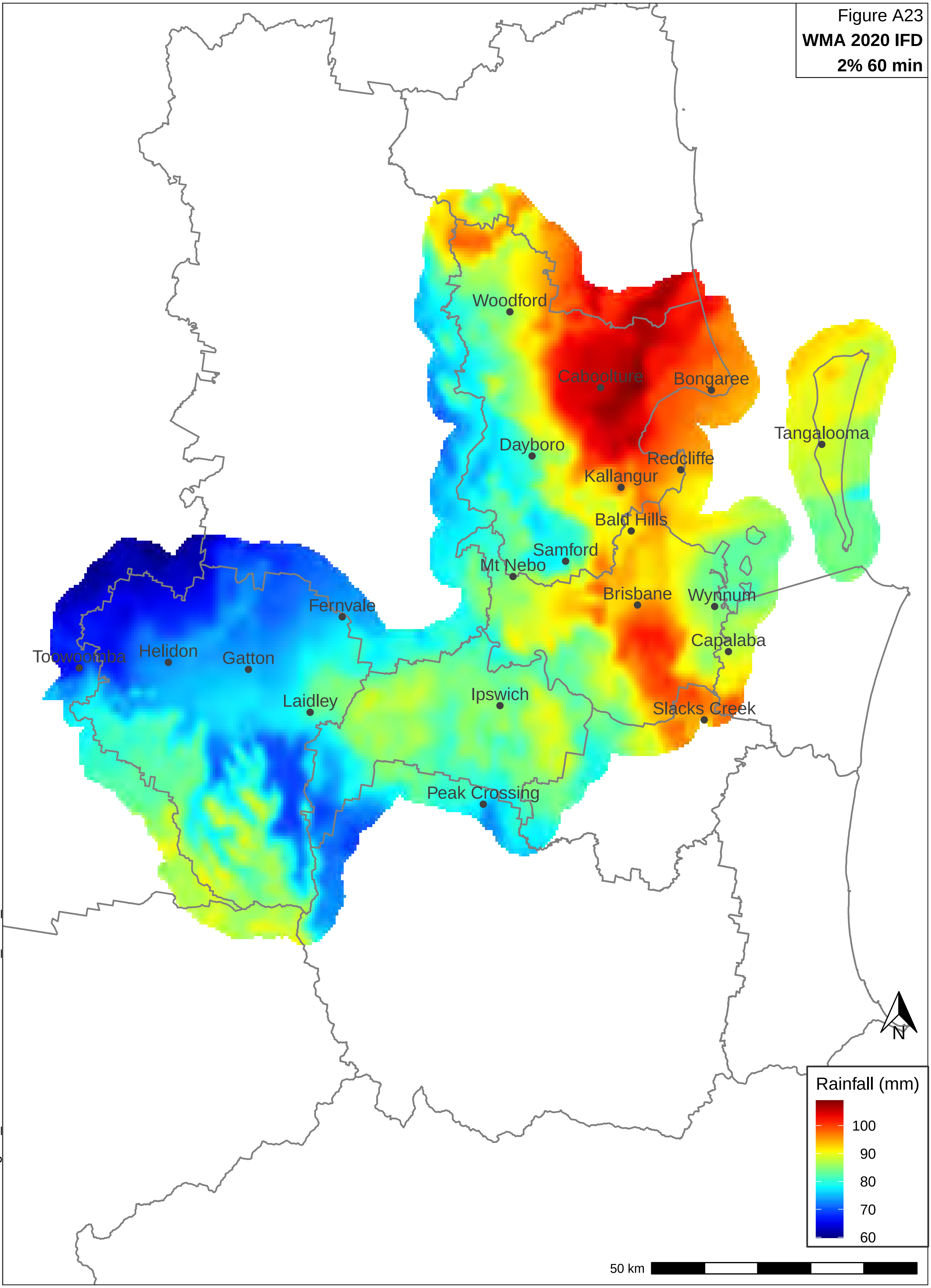
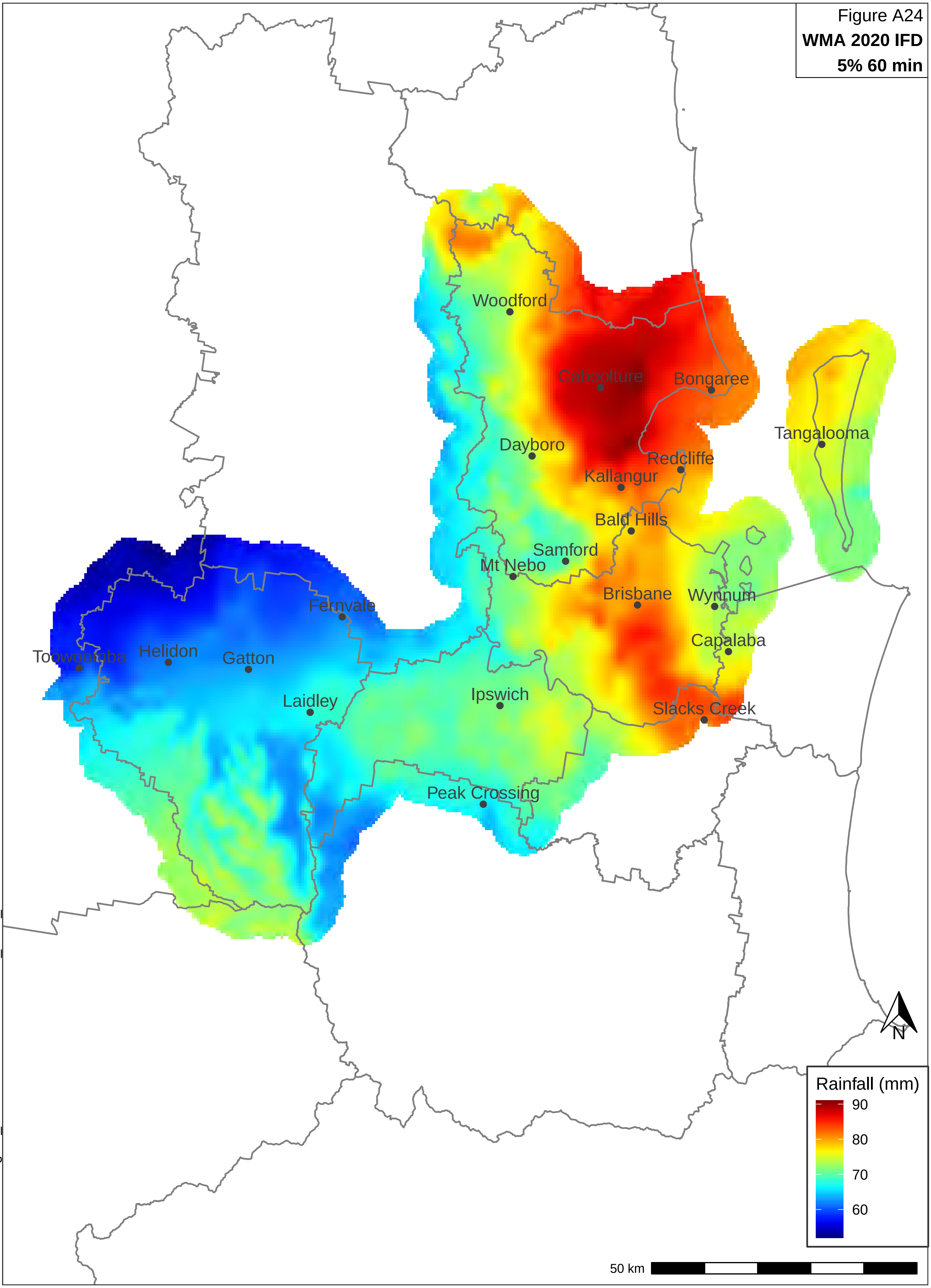


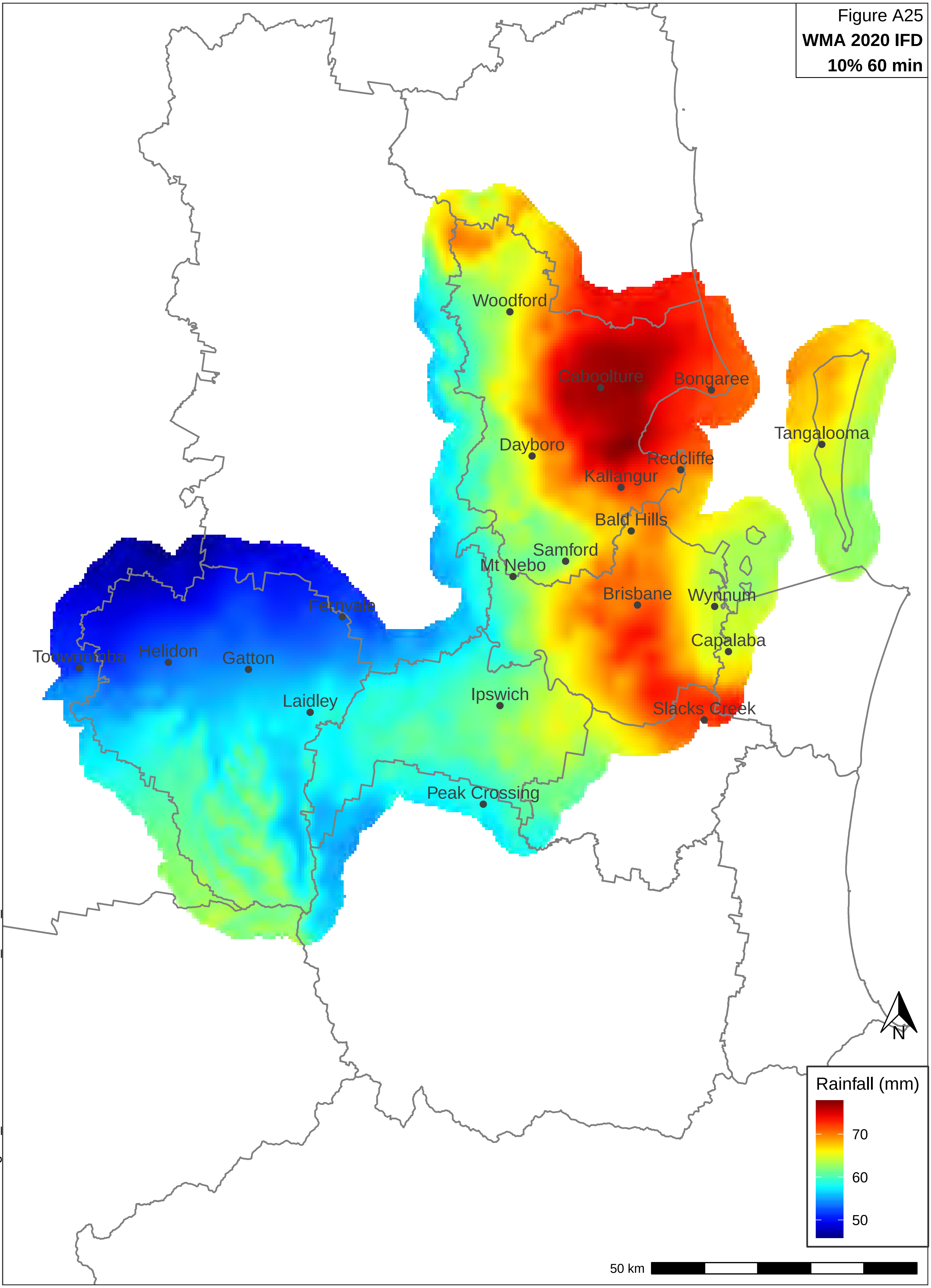
Figure A22
WMA 2020 IFD
1% 60 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Ipswich
Laidley
Slacks Creek
Peak Crossing
N
Rainfall (mm)
120
110
100
90
80
70
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

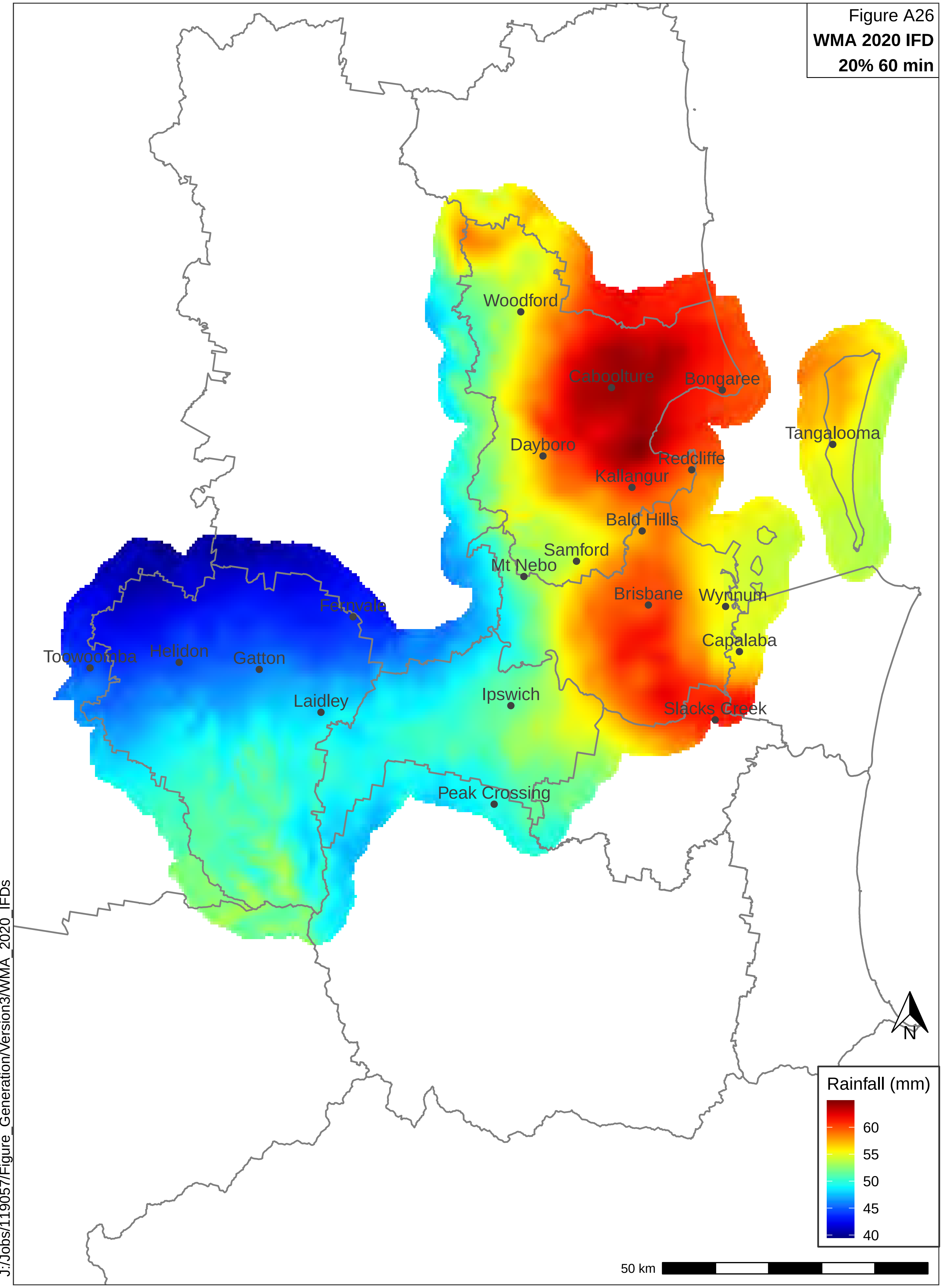
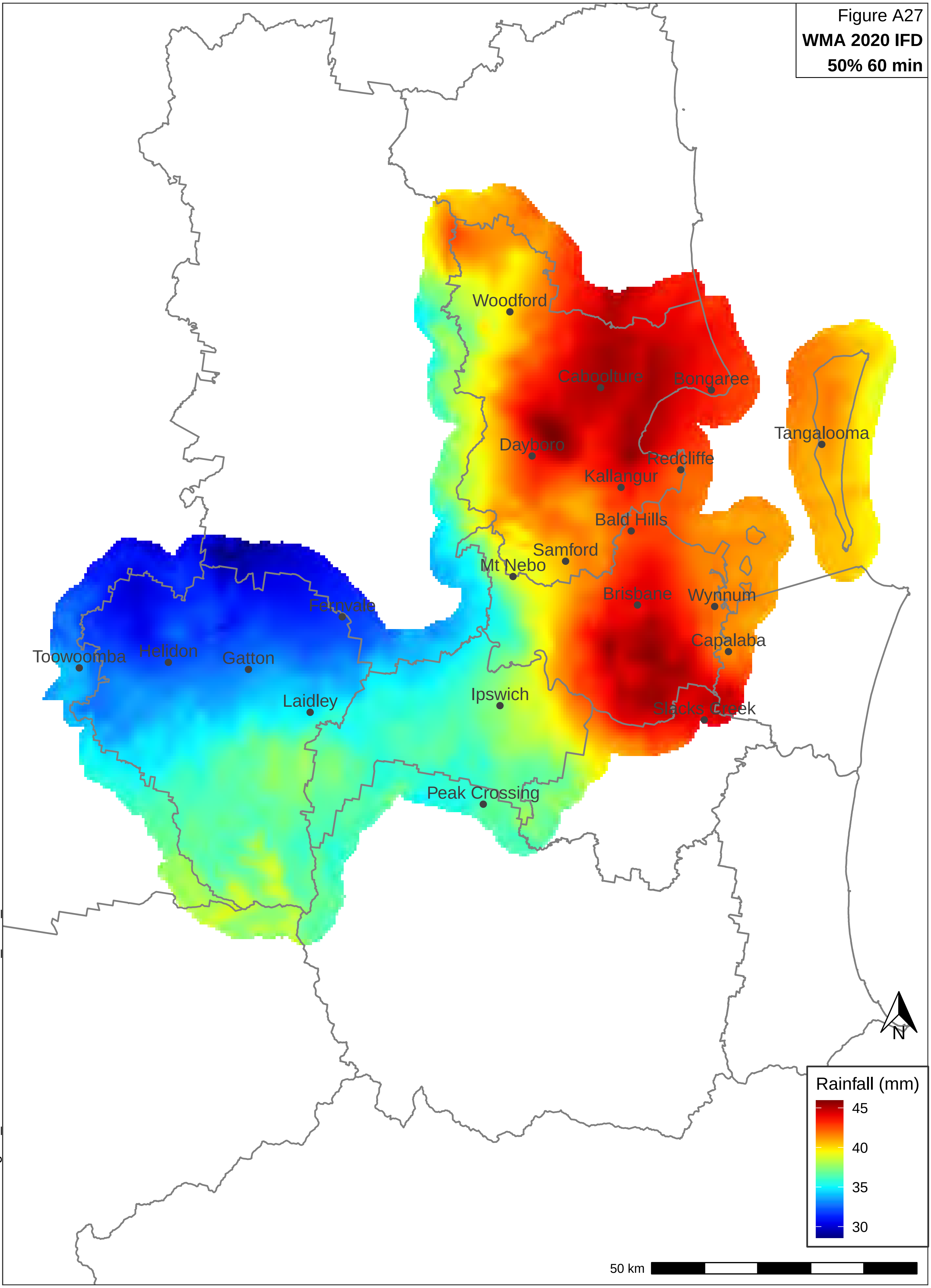


Figure A26
WMA 2020 IFD
20% 60 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Ipswich
Laidley
Slacks Creek
Peak Crossing
N
Rainfall (mm)
60
55
50
45
40
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

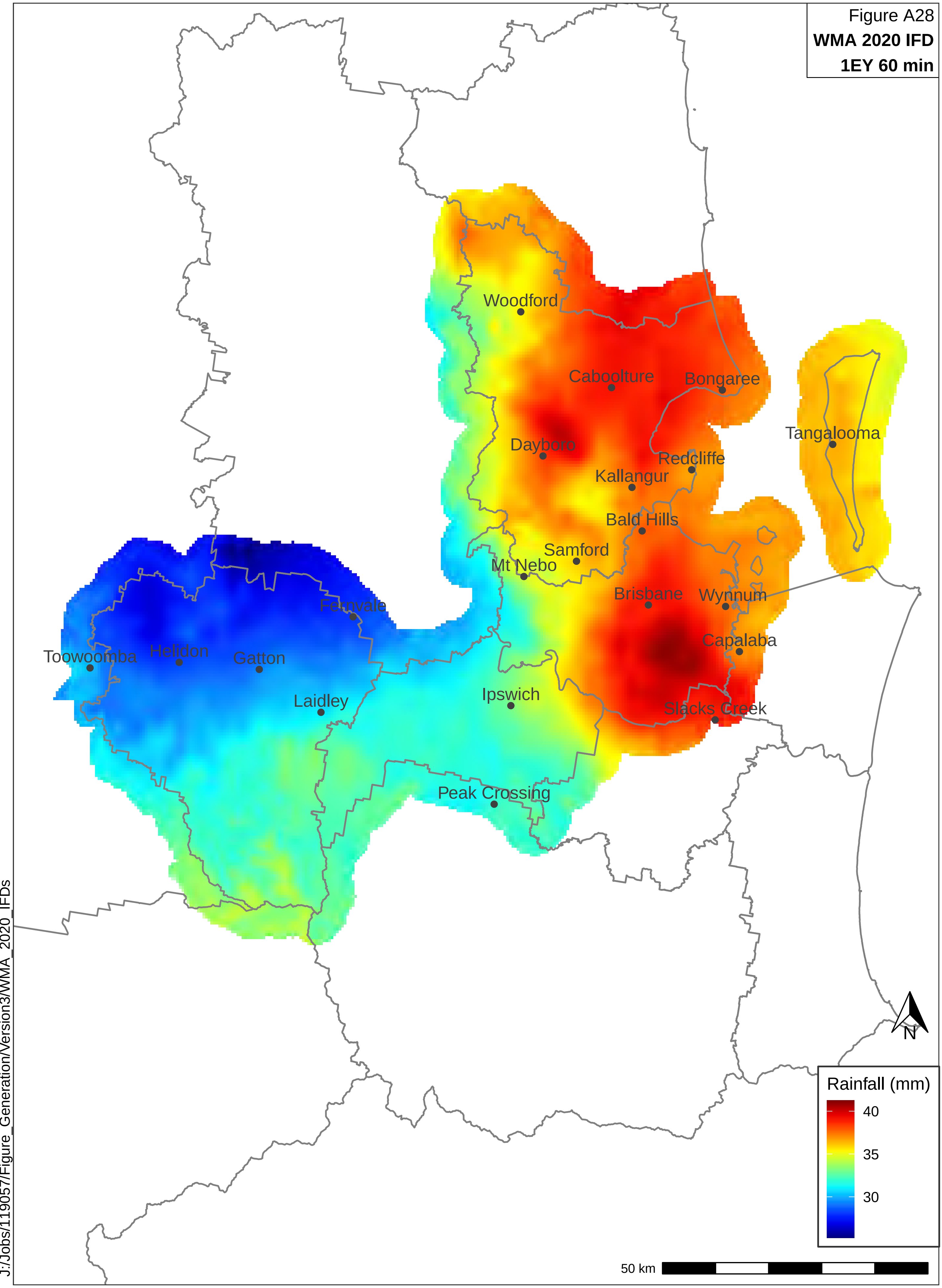
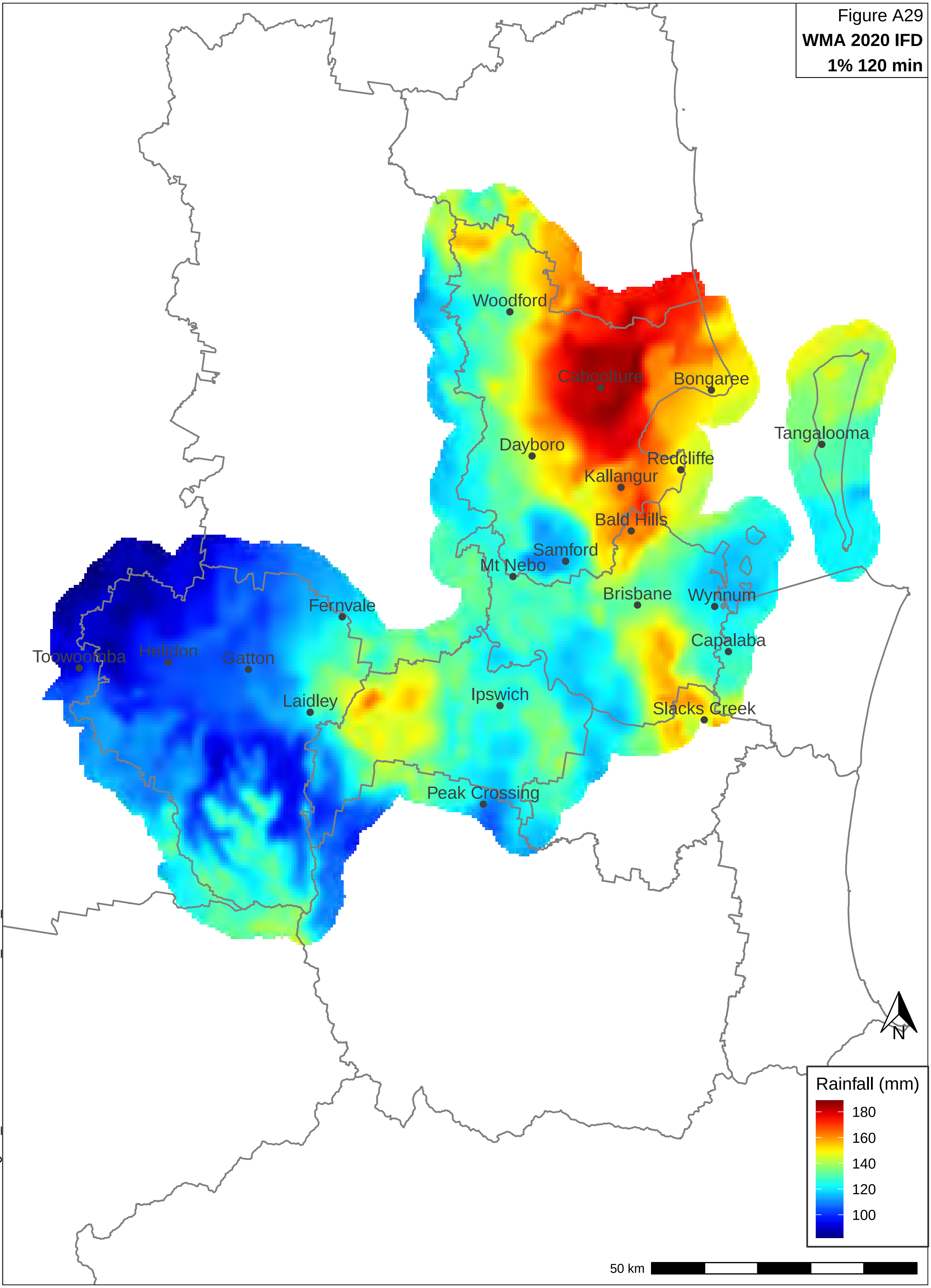
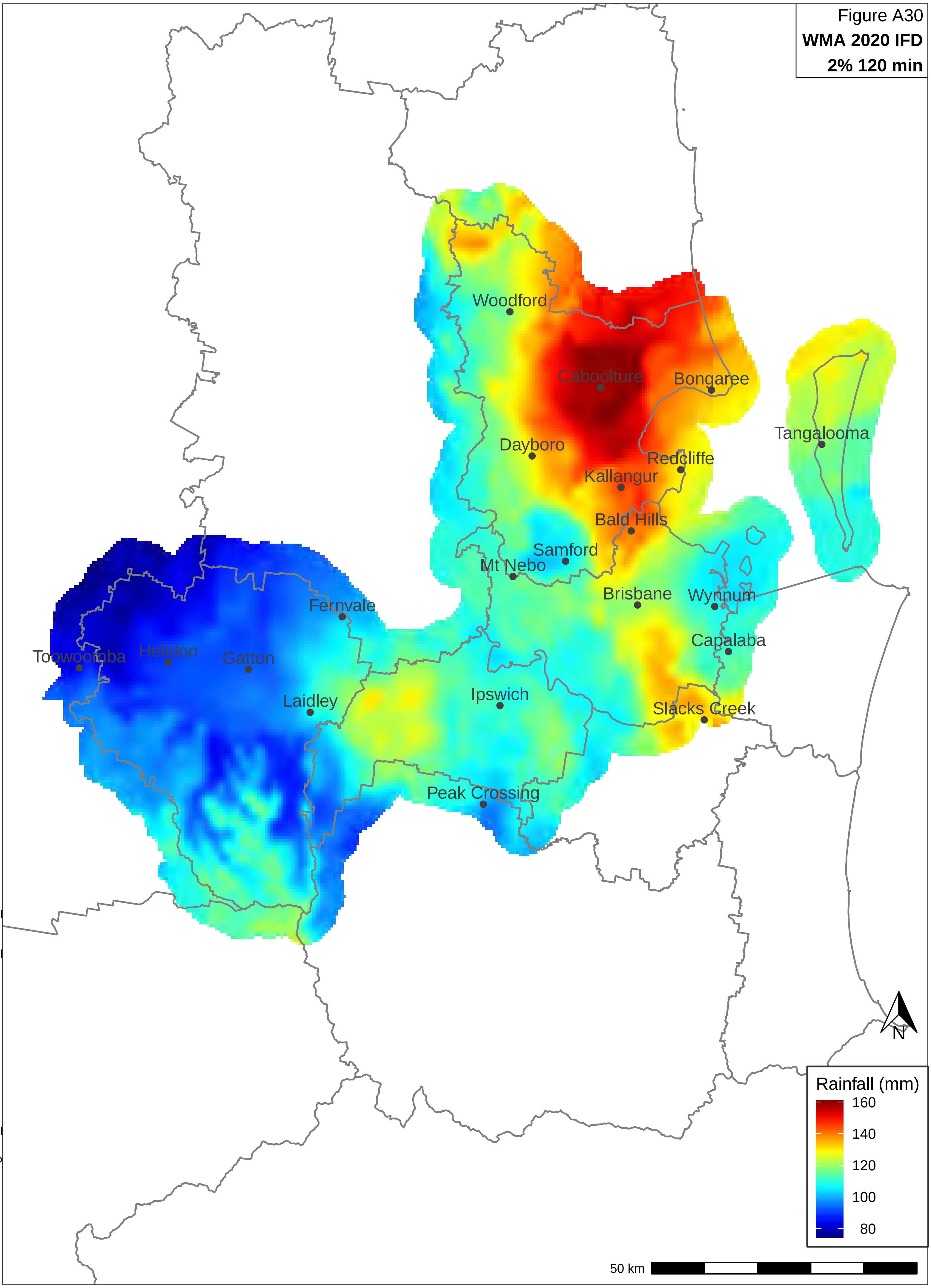


Figure A28
WMA 2020 IFD
1EY 60 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
40
35
30
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

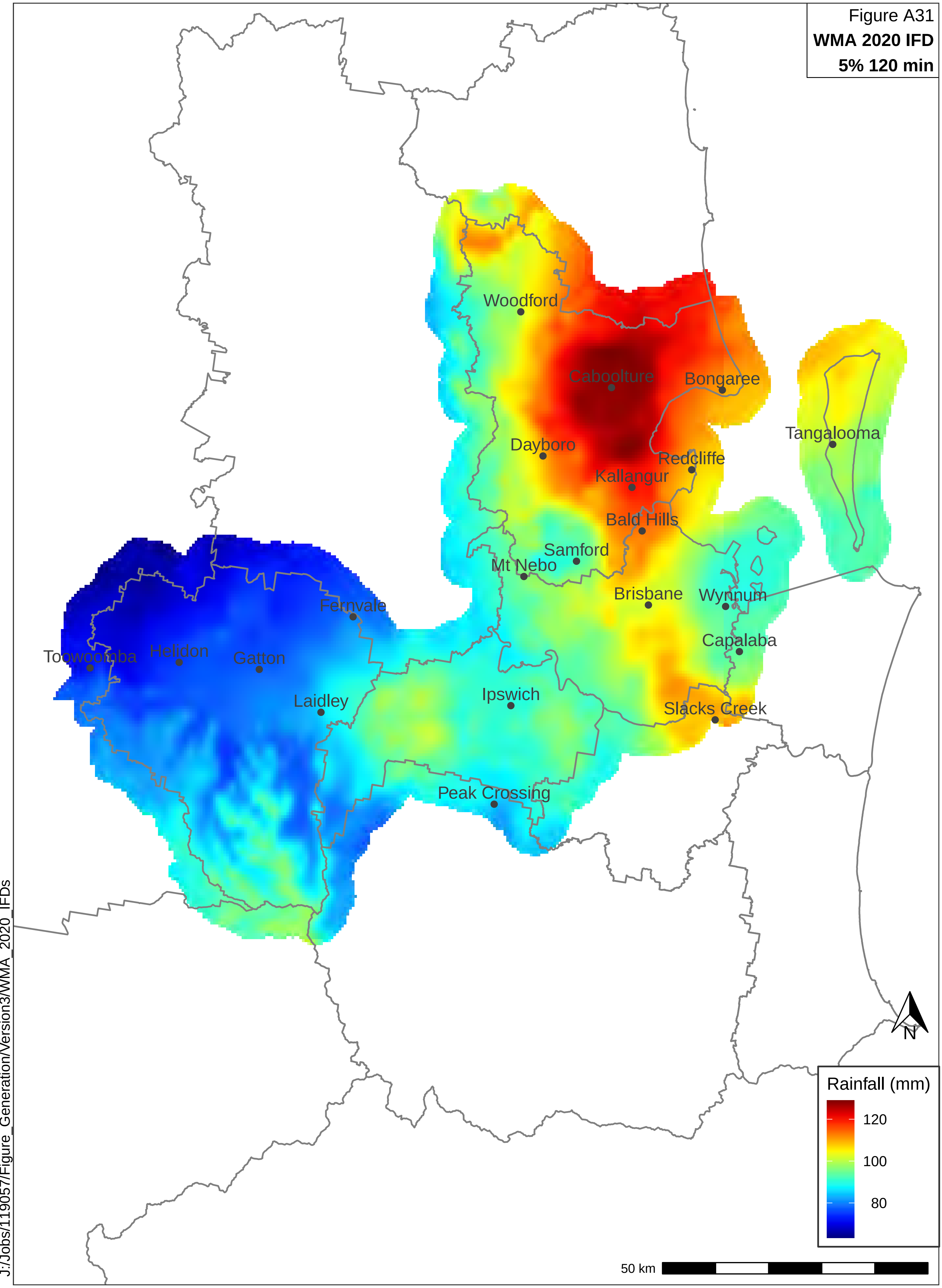
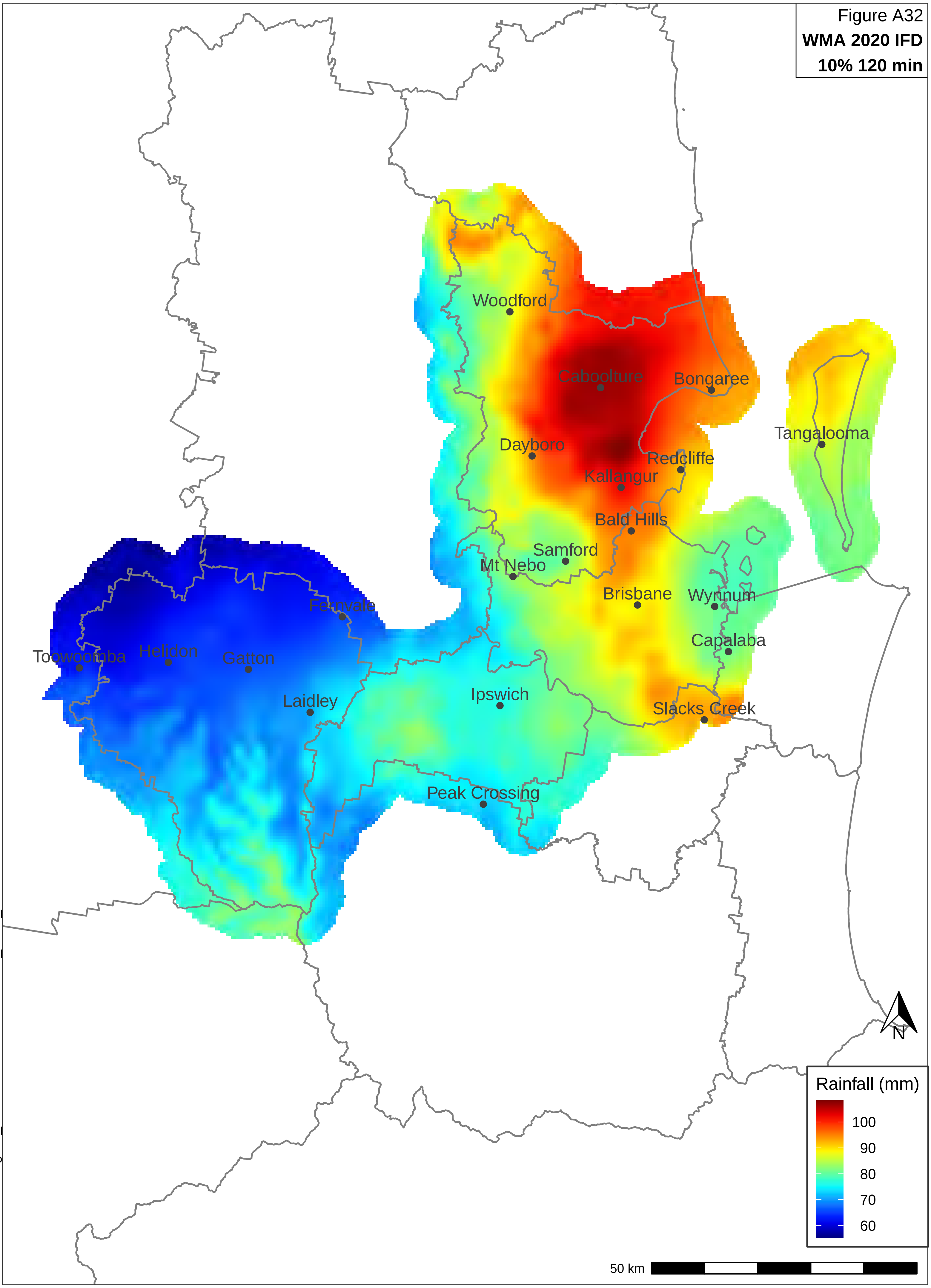
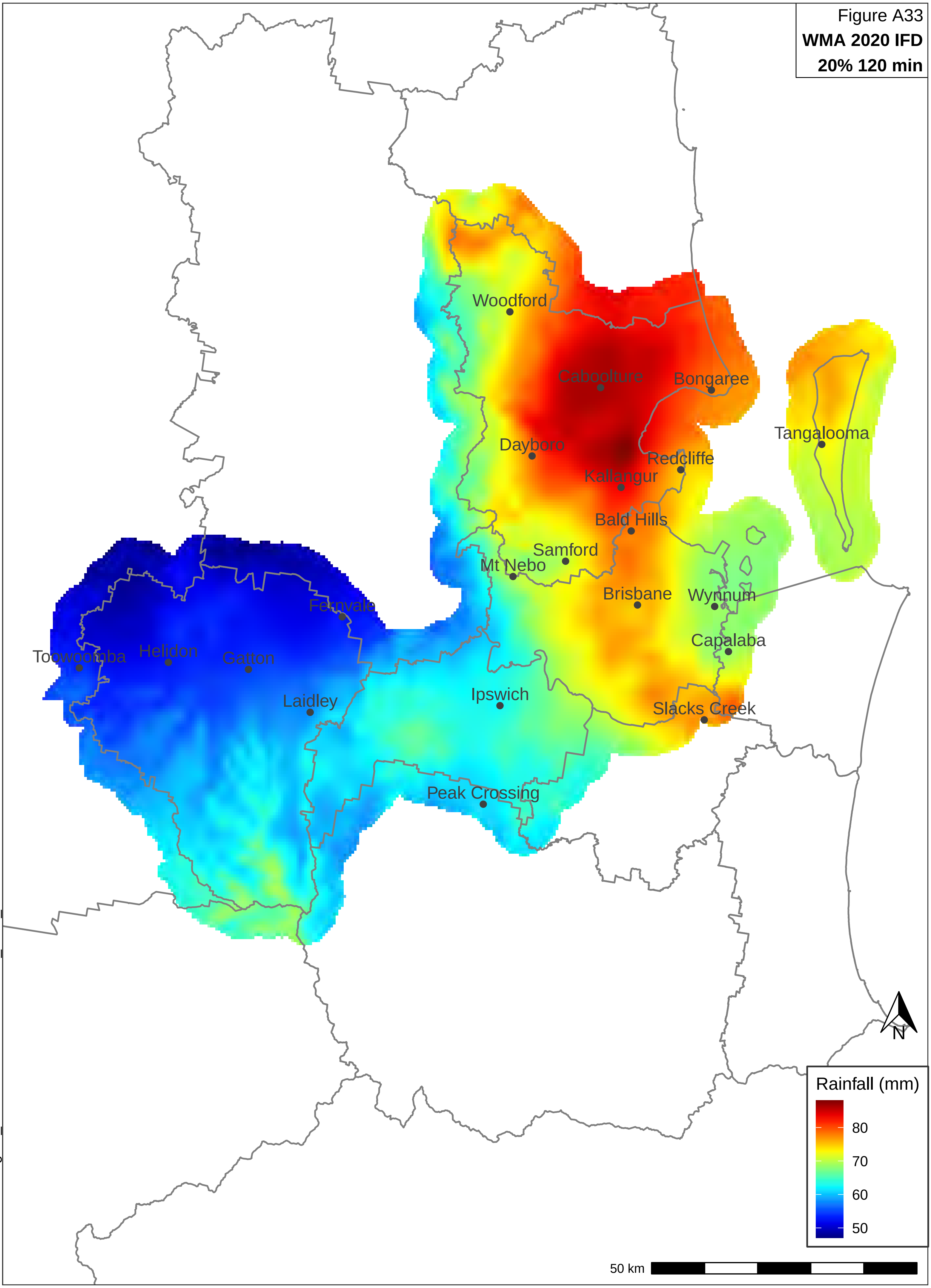


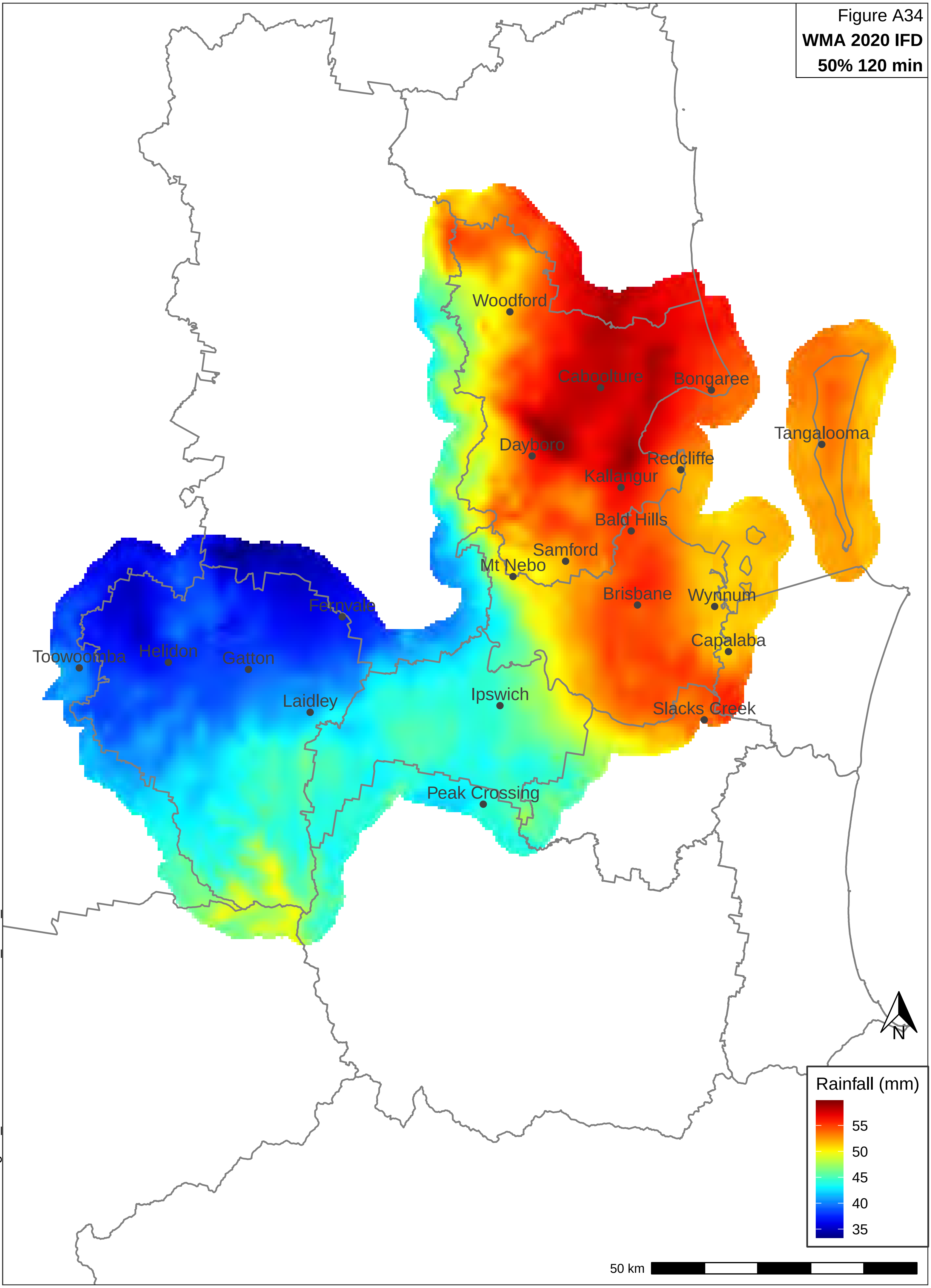
Figure A31
WMA 2020 IFD
5% 120 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Ipswich
Laidley
Slacks Creek
Peak Crossing
N
Rainfall (mm)
120
100
80
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



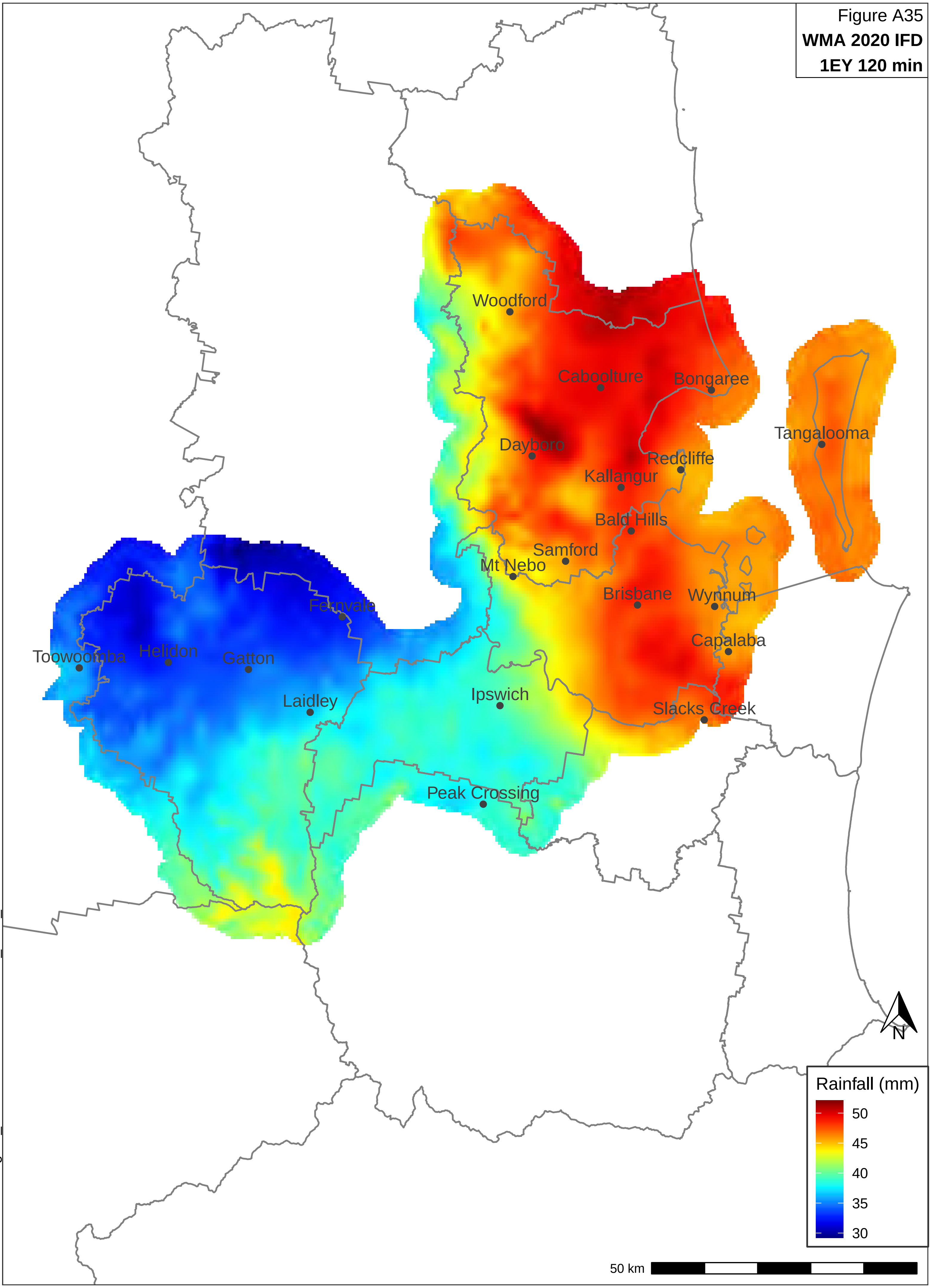
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



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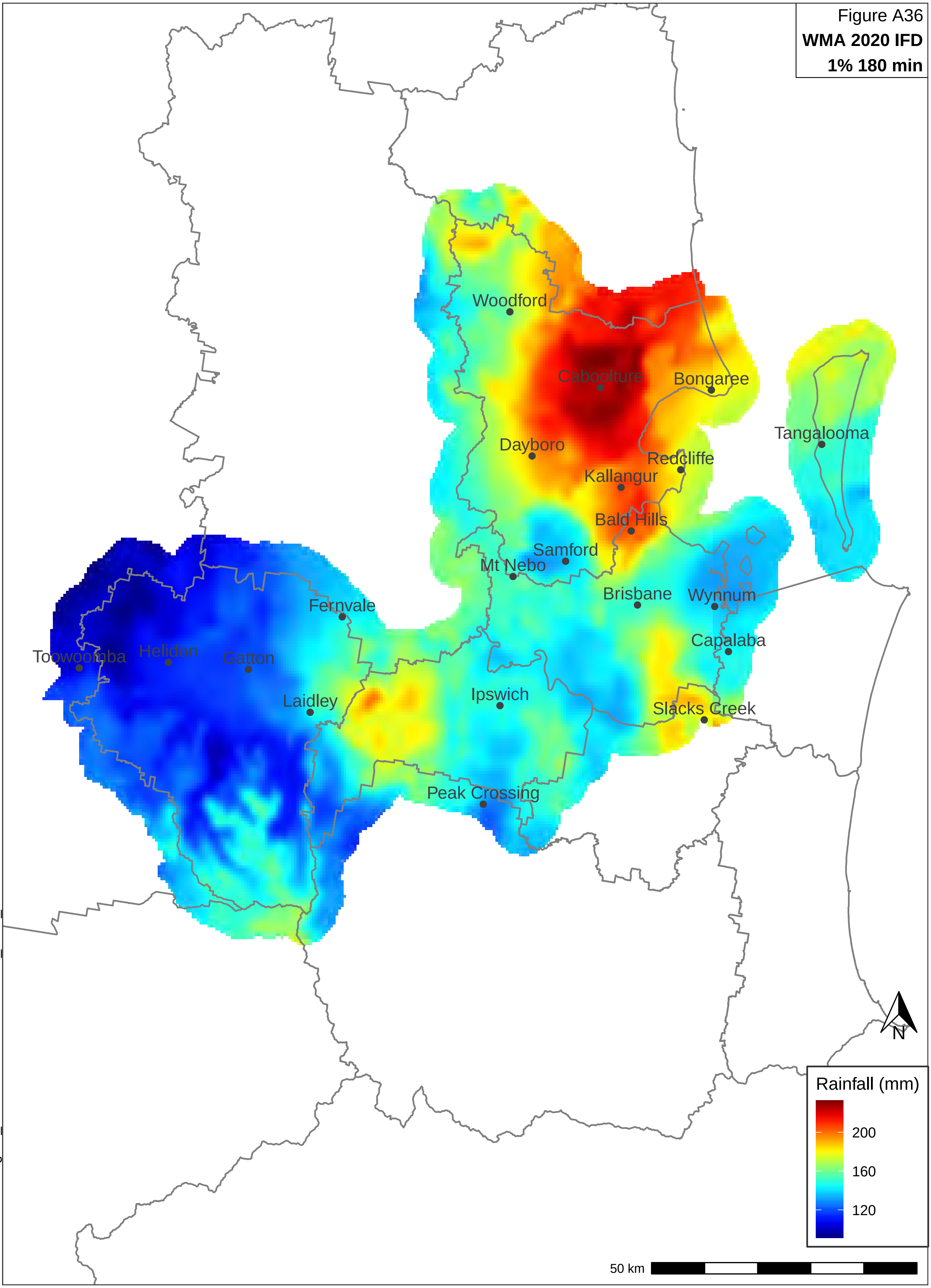

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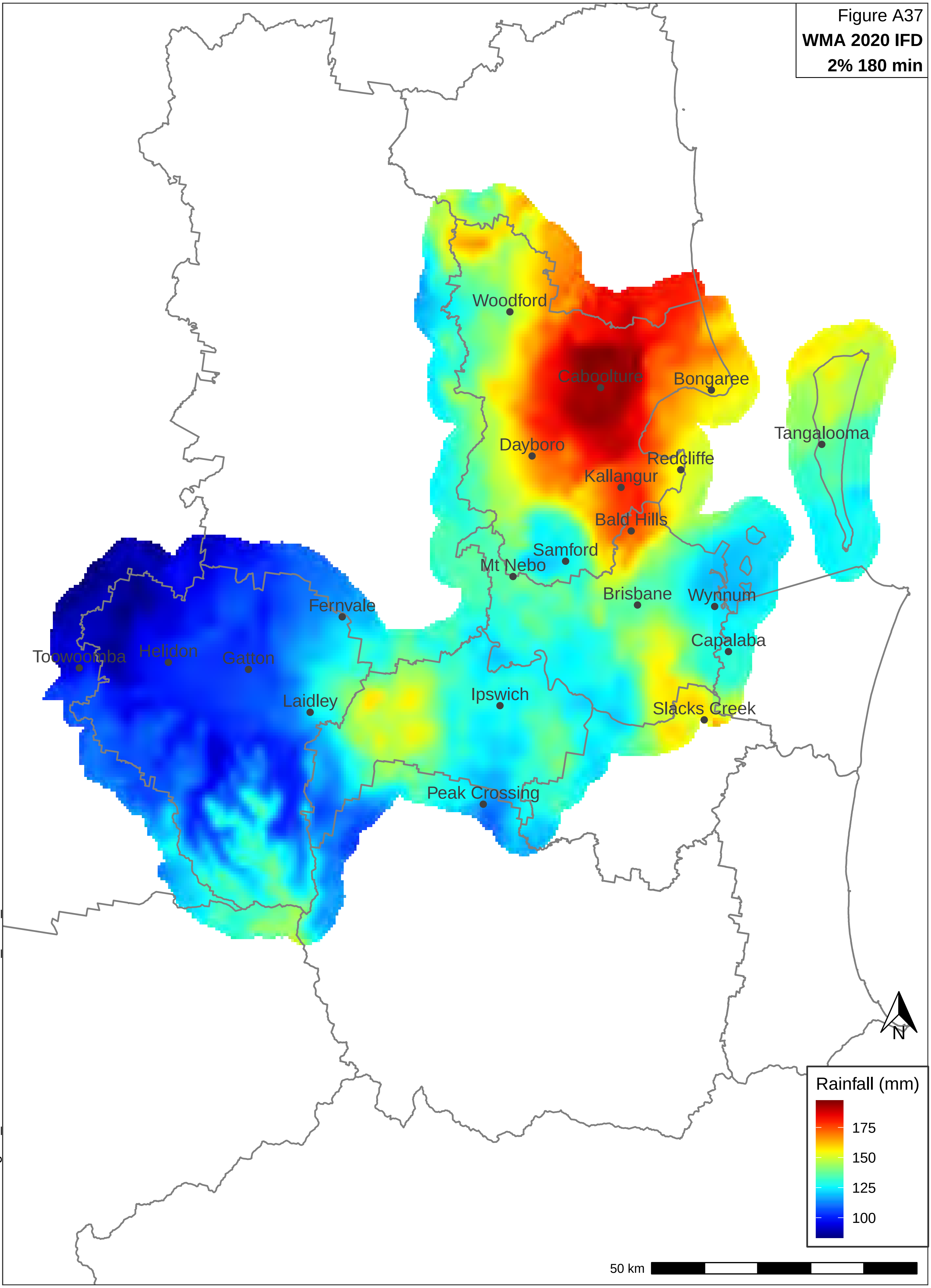


J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

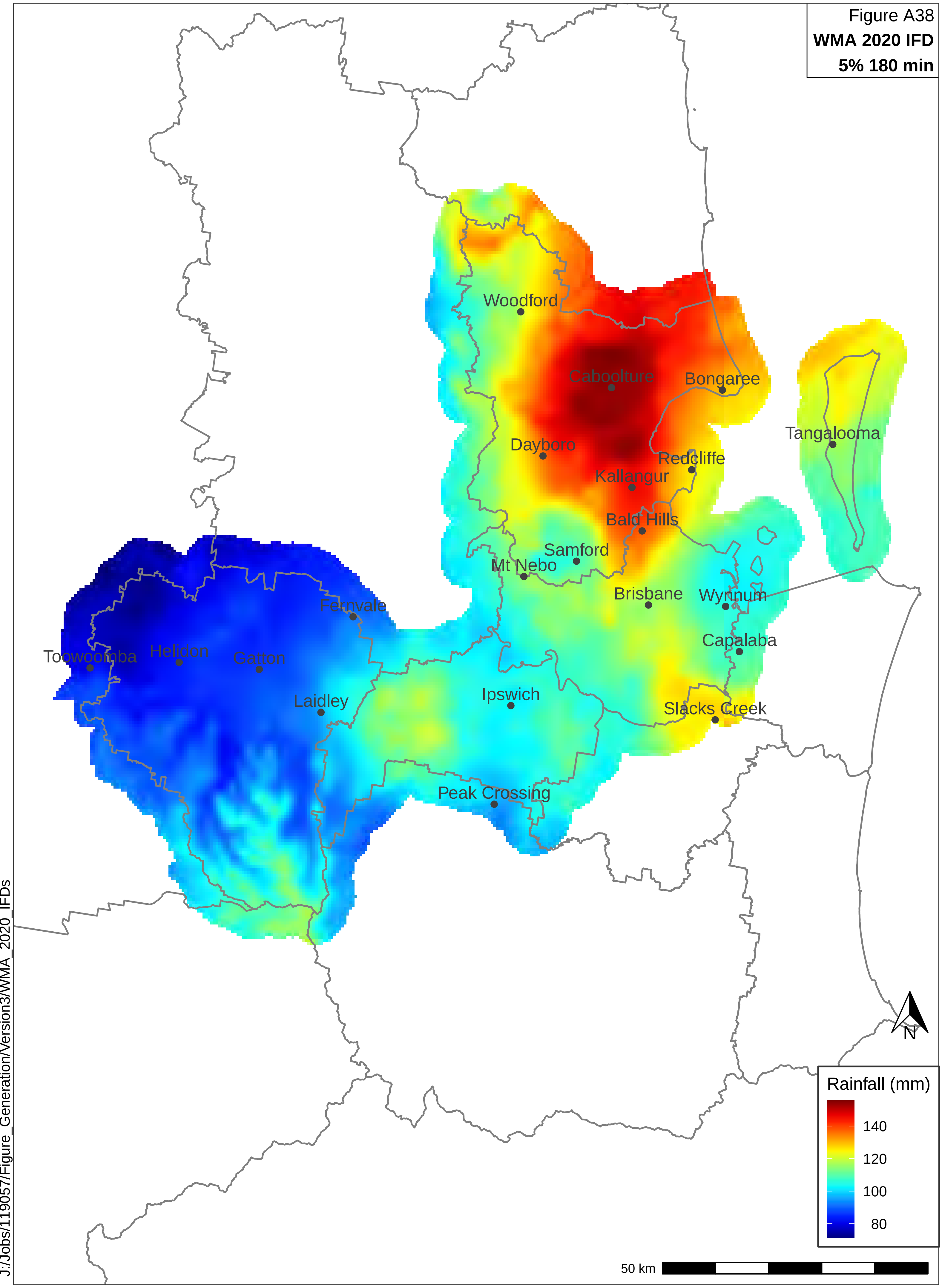
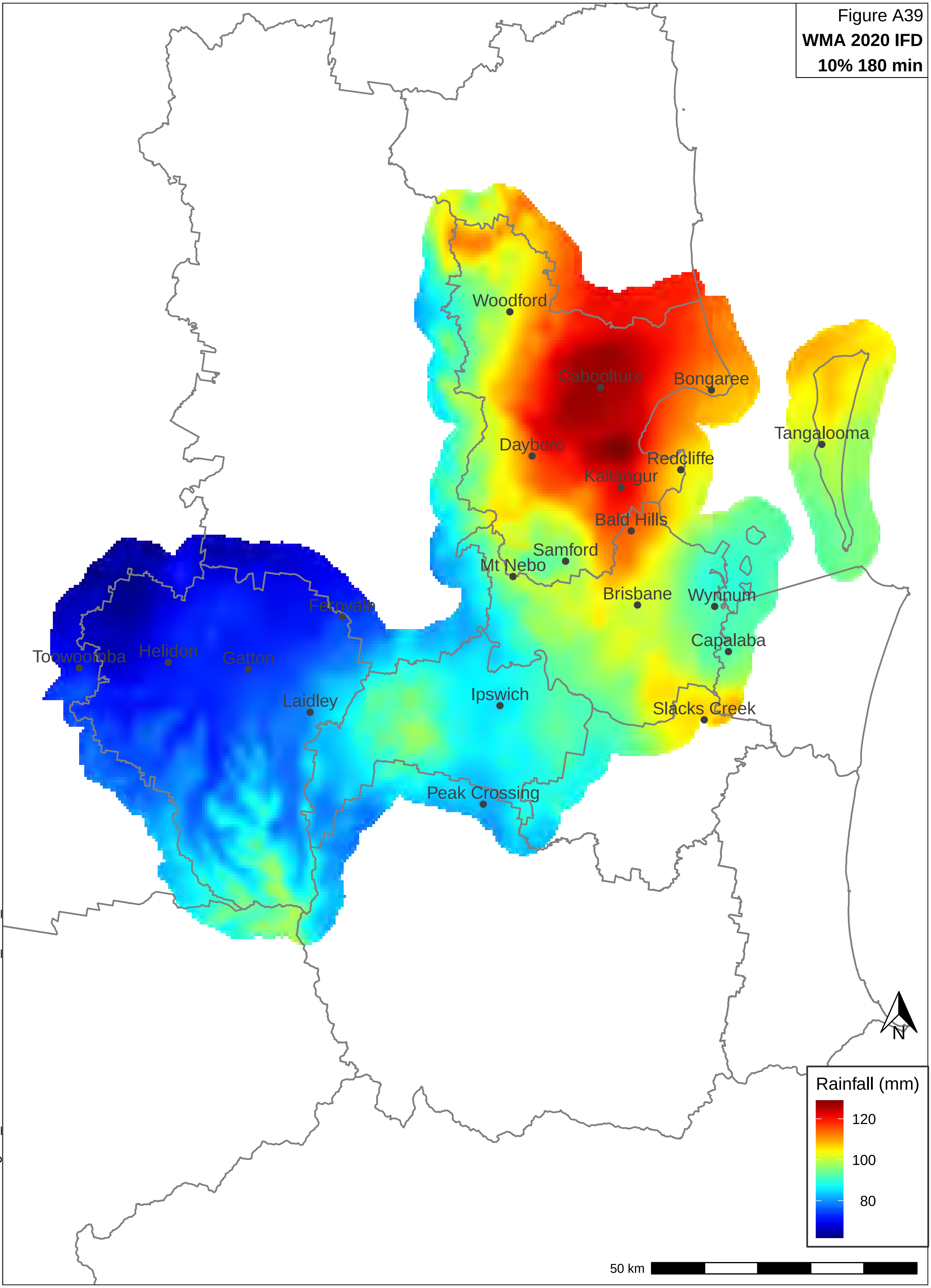
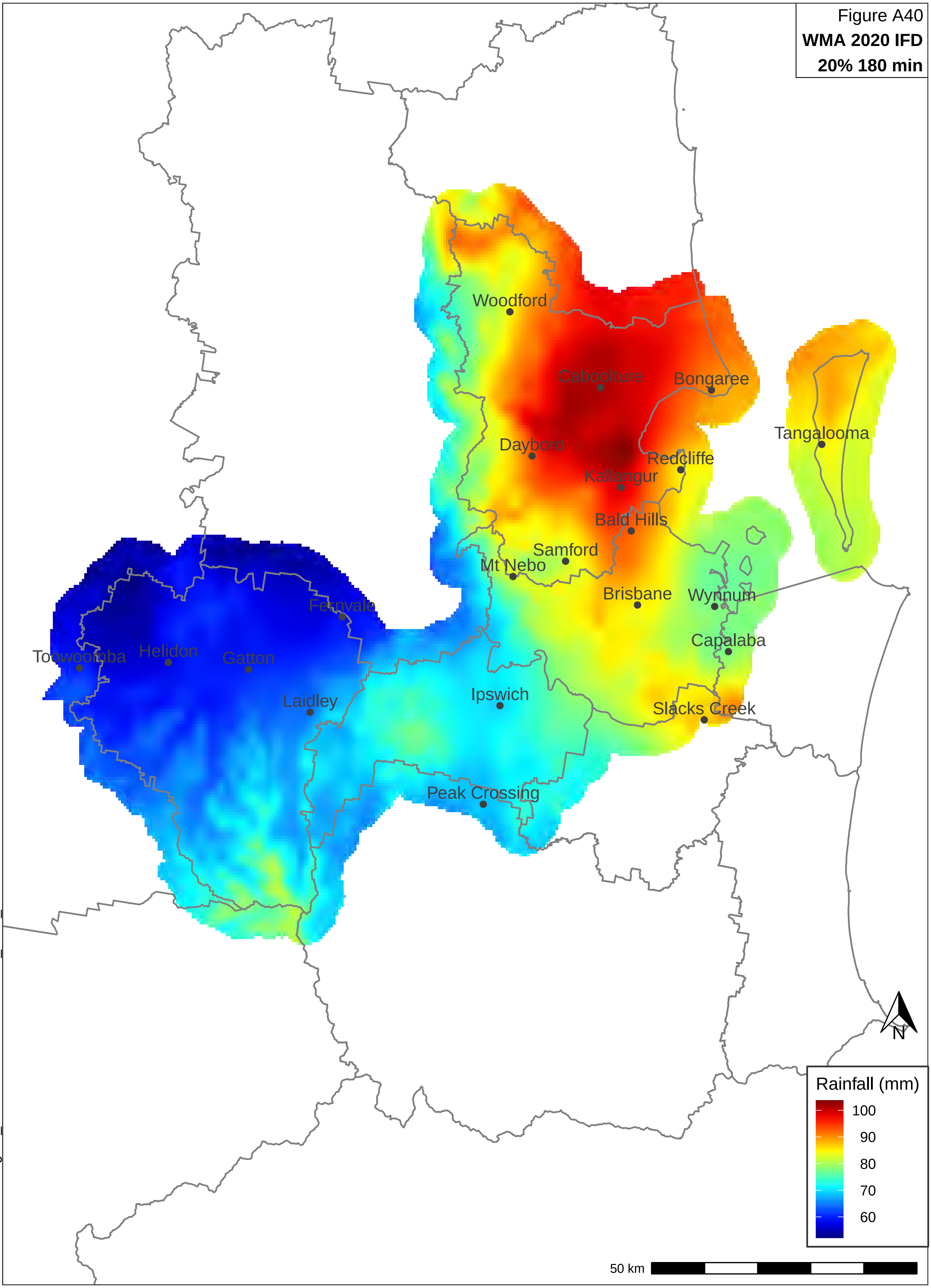


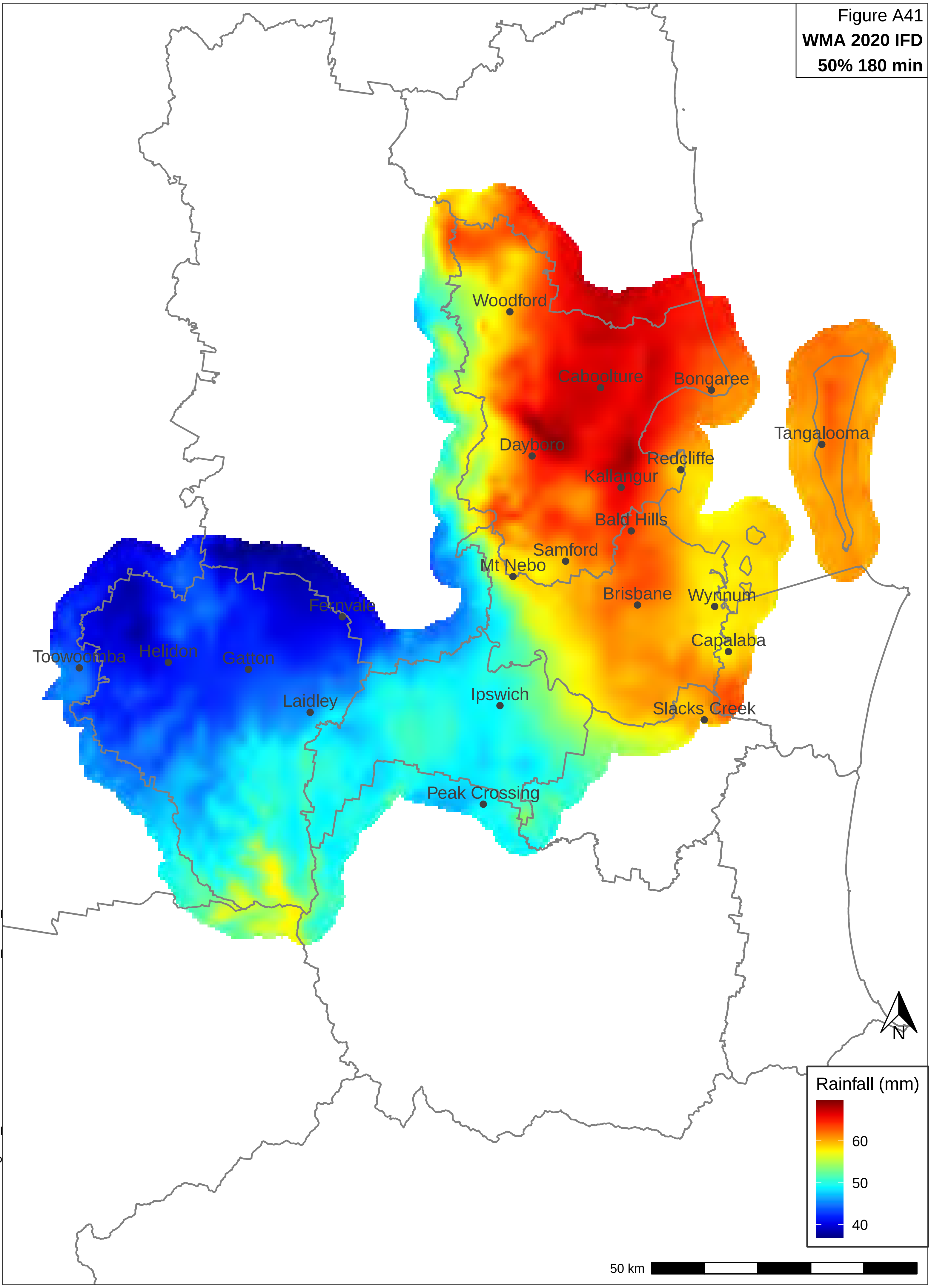
Figure A38
WMA 2020 IFD
5% 180 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
140
120
100
80
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



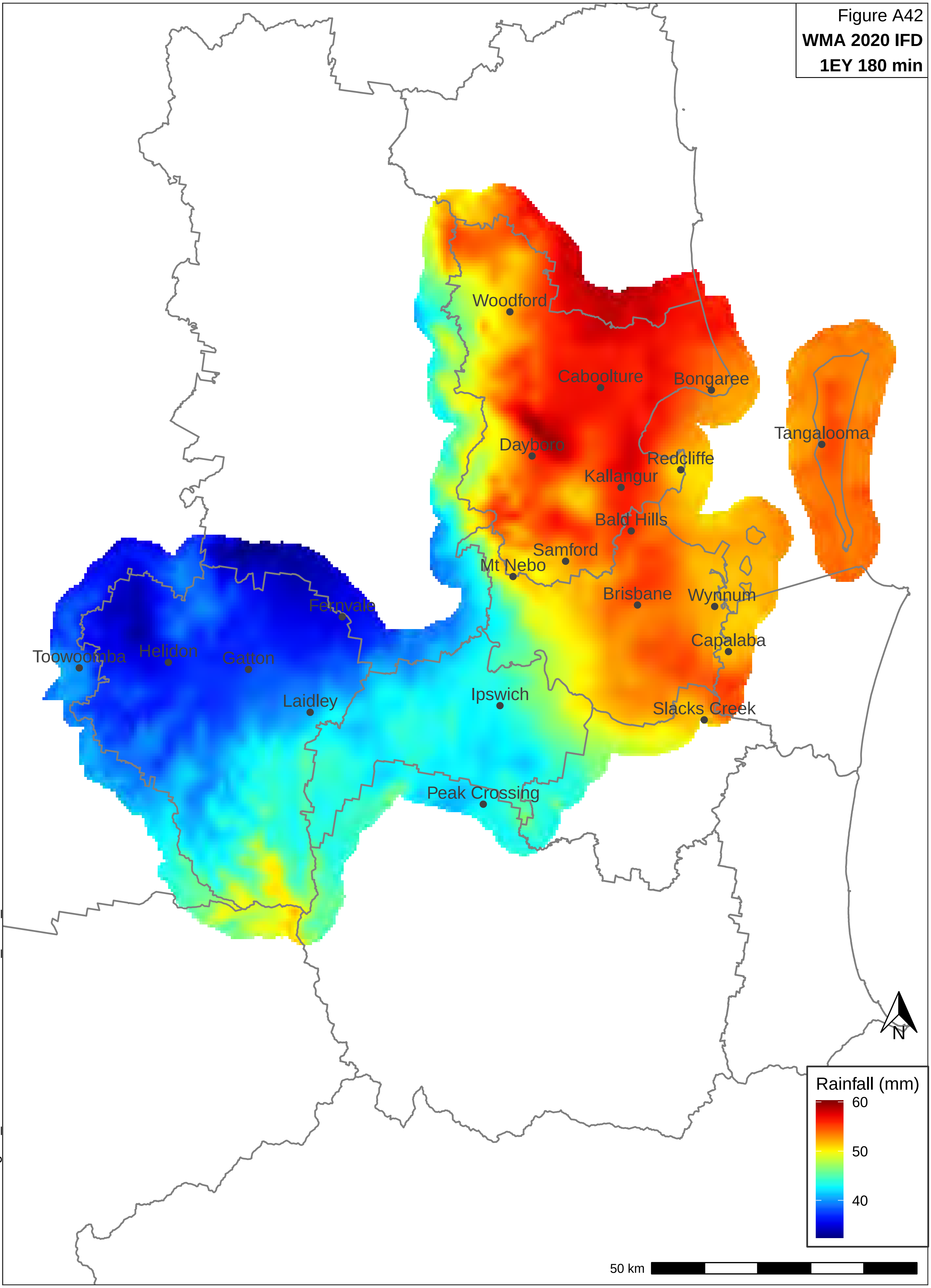
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

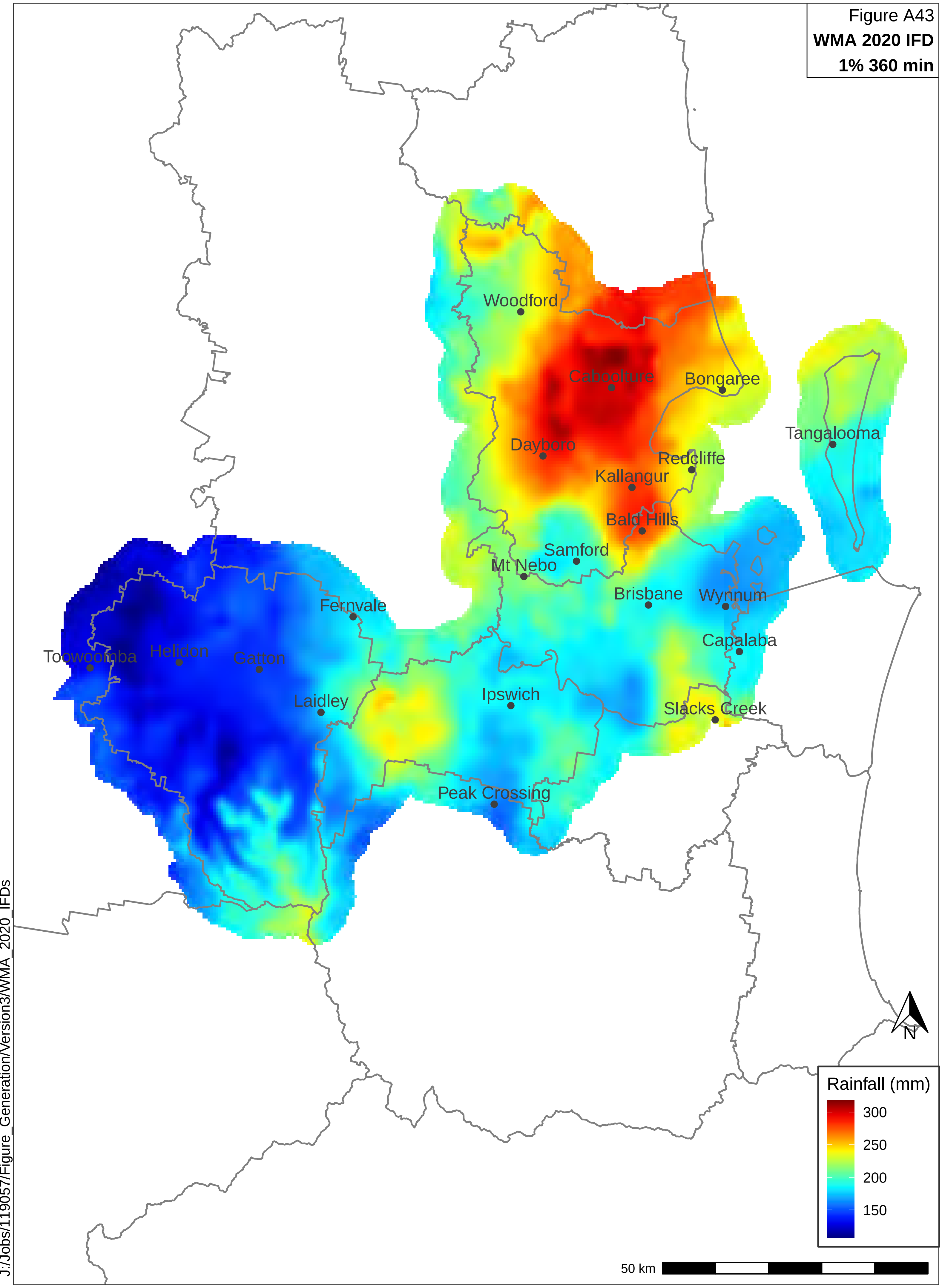
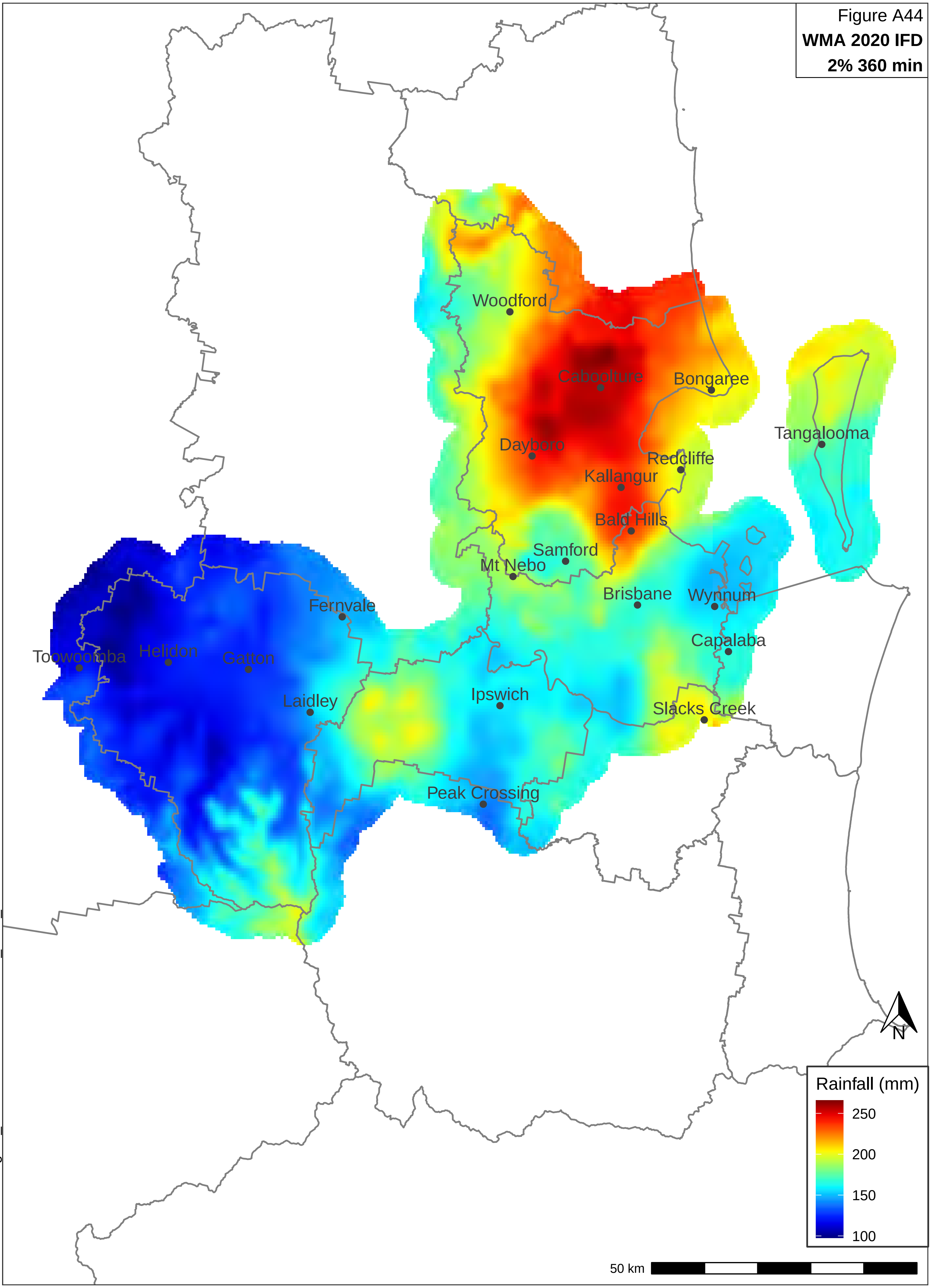
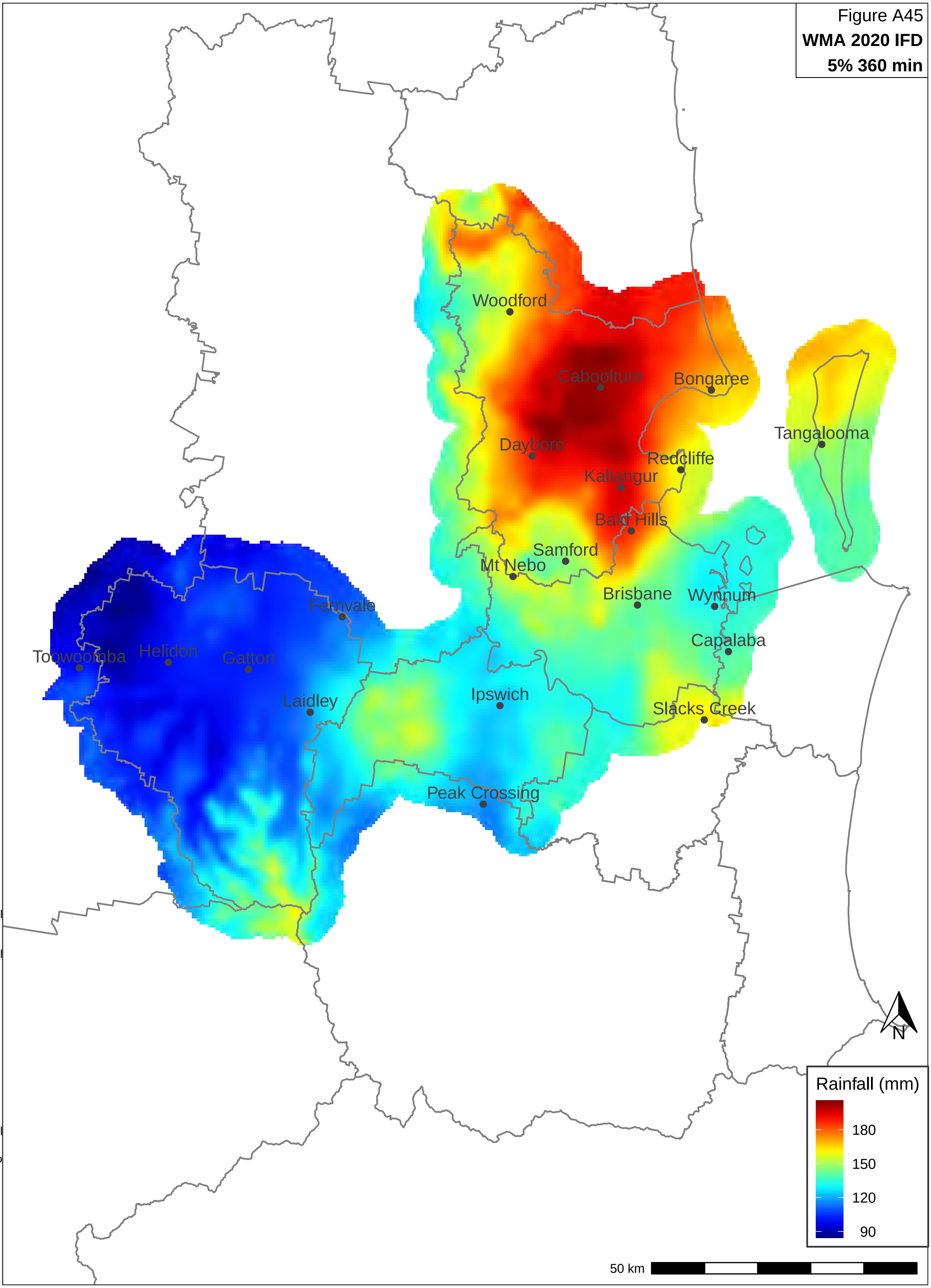


Figure A43
WMA 2020 IFD
1% 360 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
300
250
200
150
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

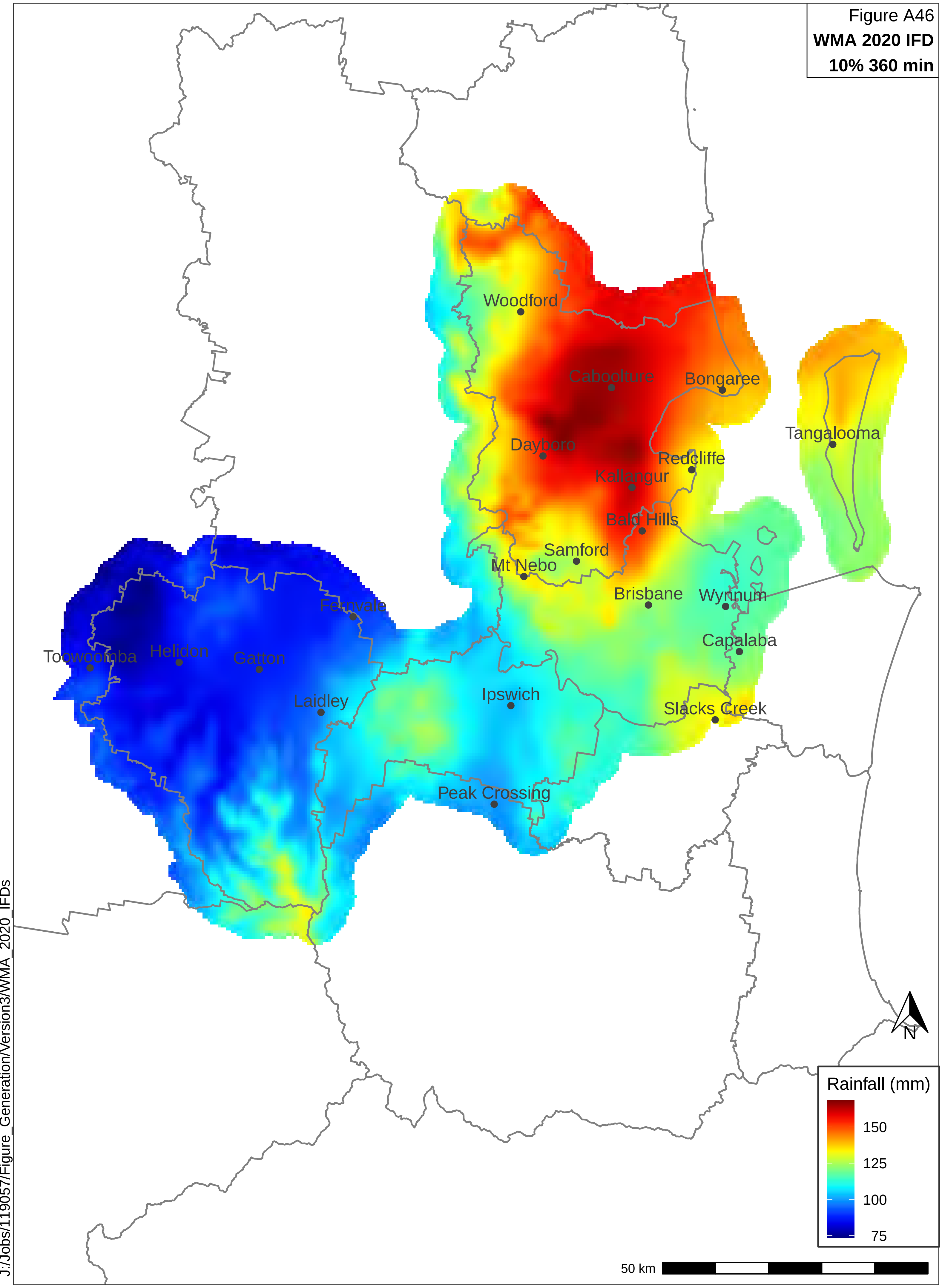
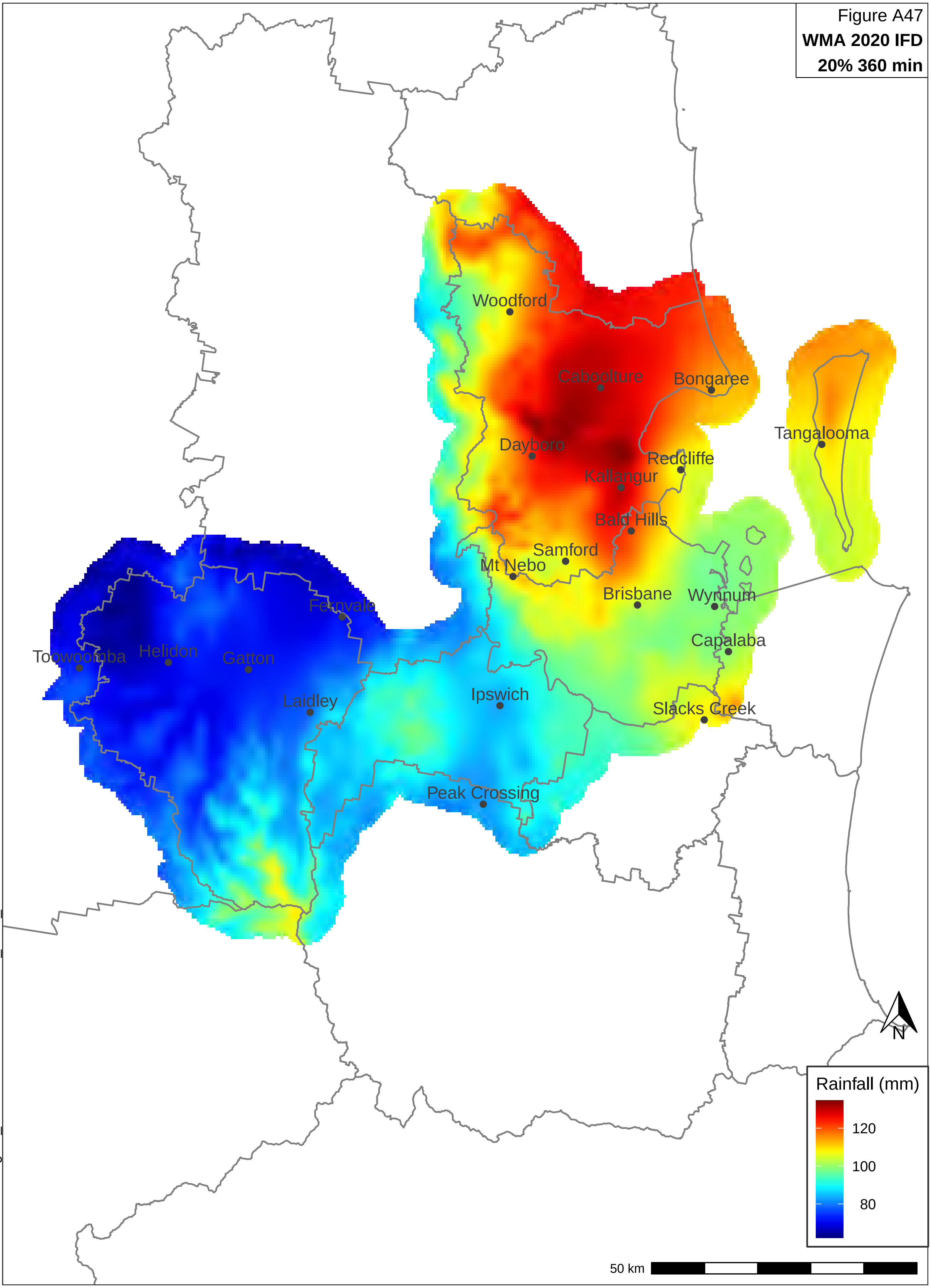
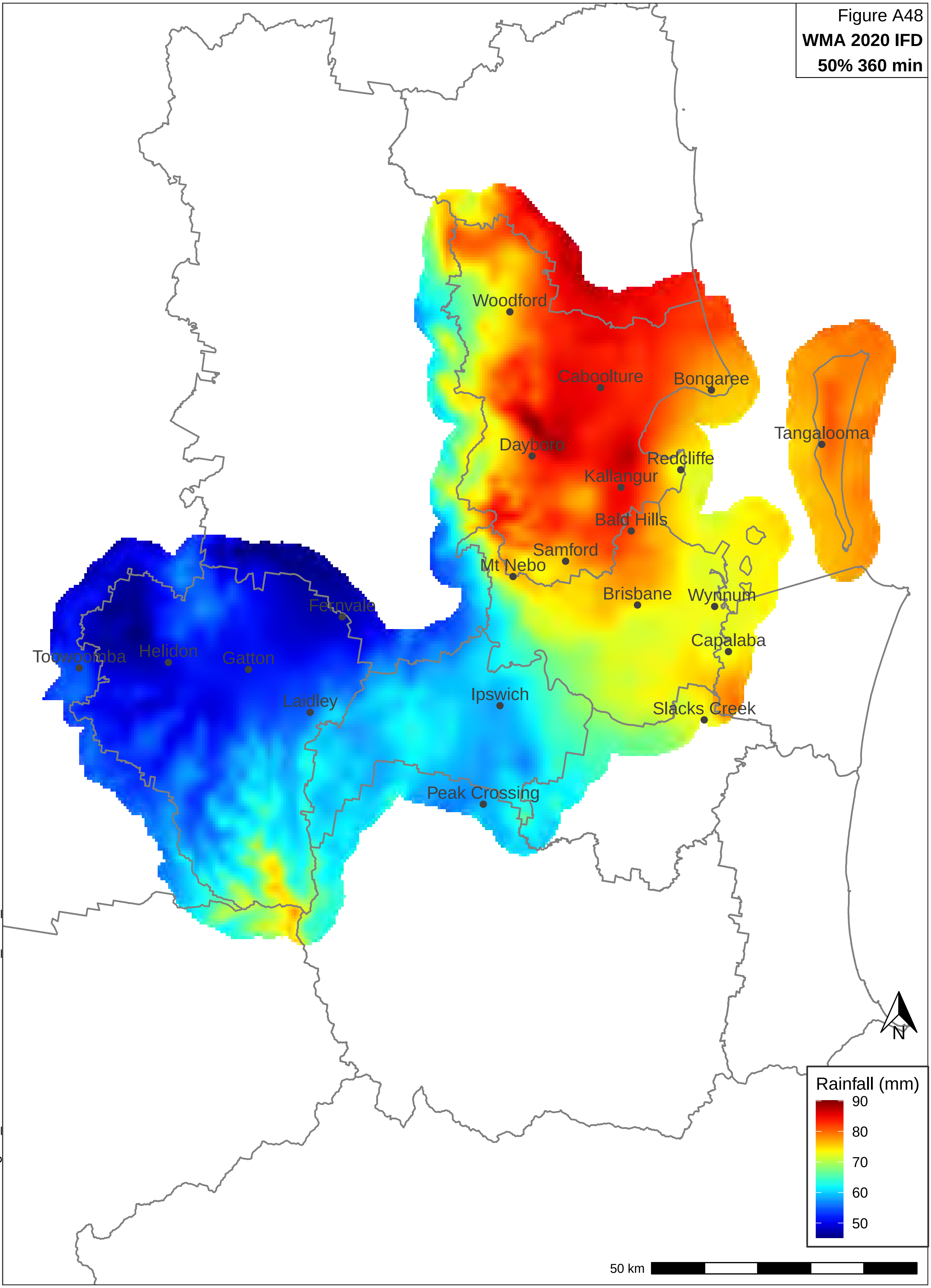


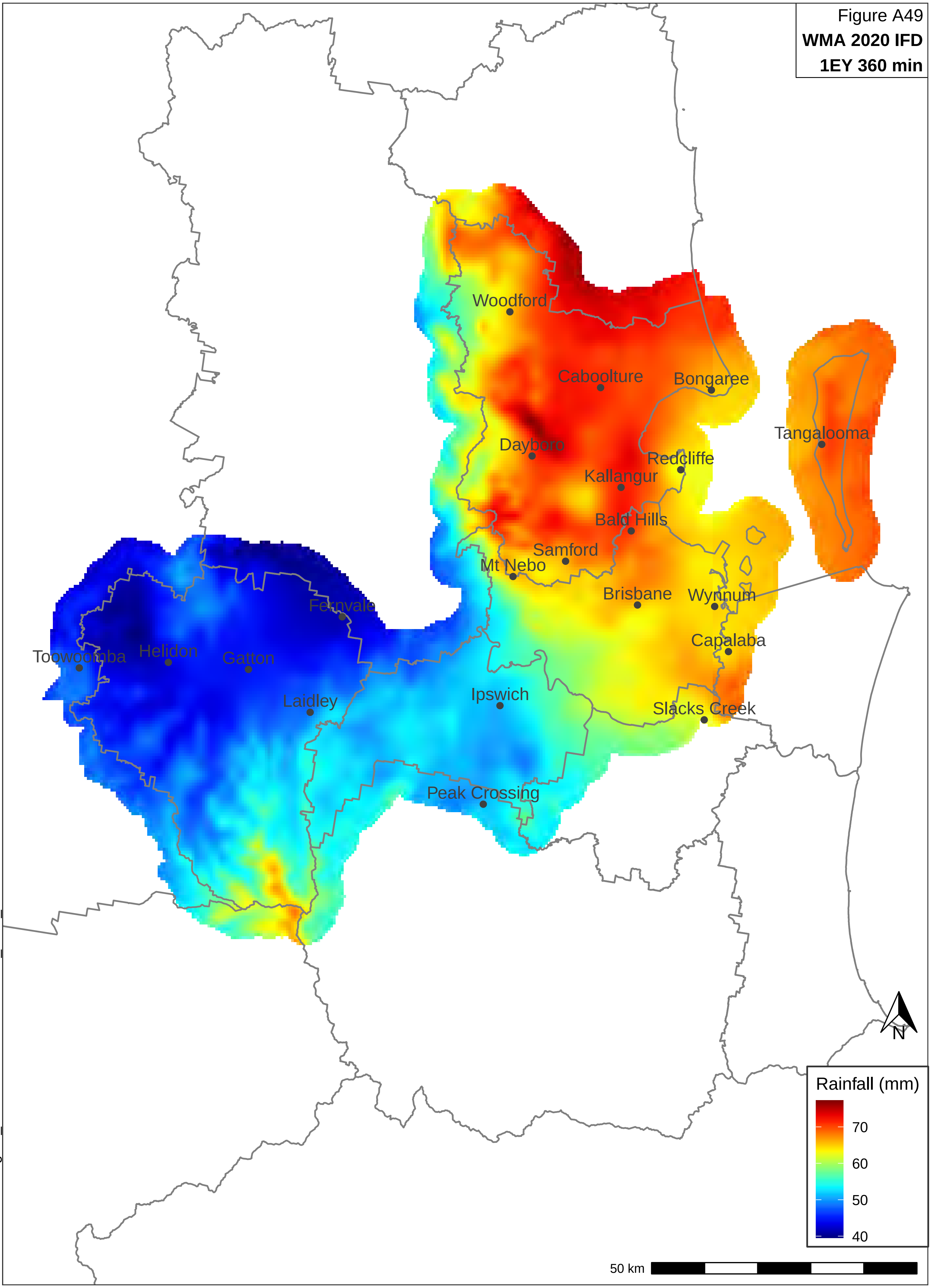
Figure A46
WMA 2020 IFD
10% 360 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Ipswich
Laidley
Slacks Creek
Peak Crossing
N
Rainfall (mm)
150
125
100
75
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



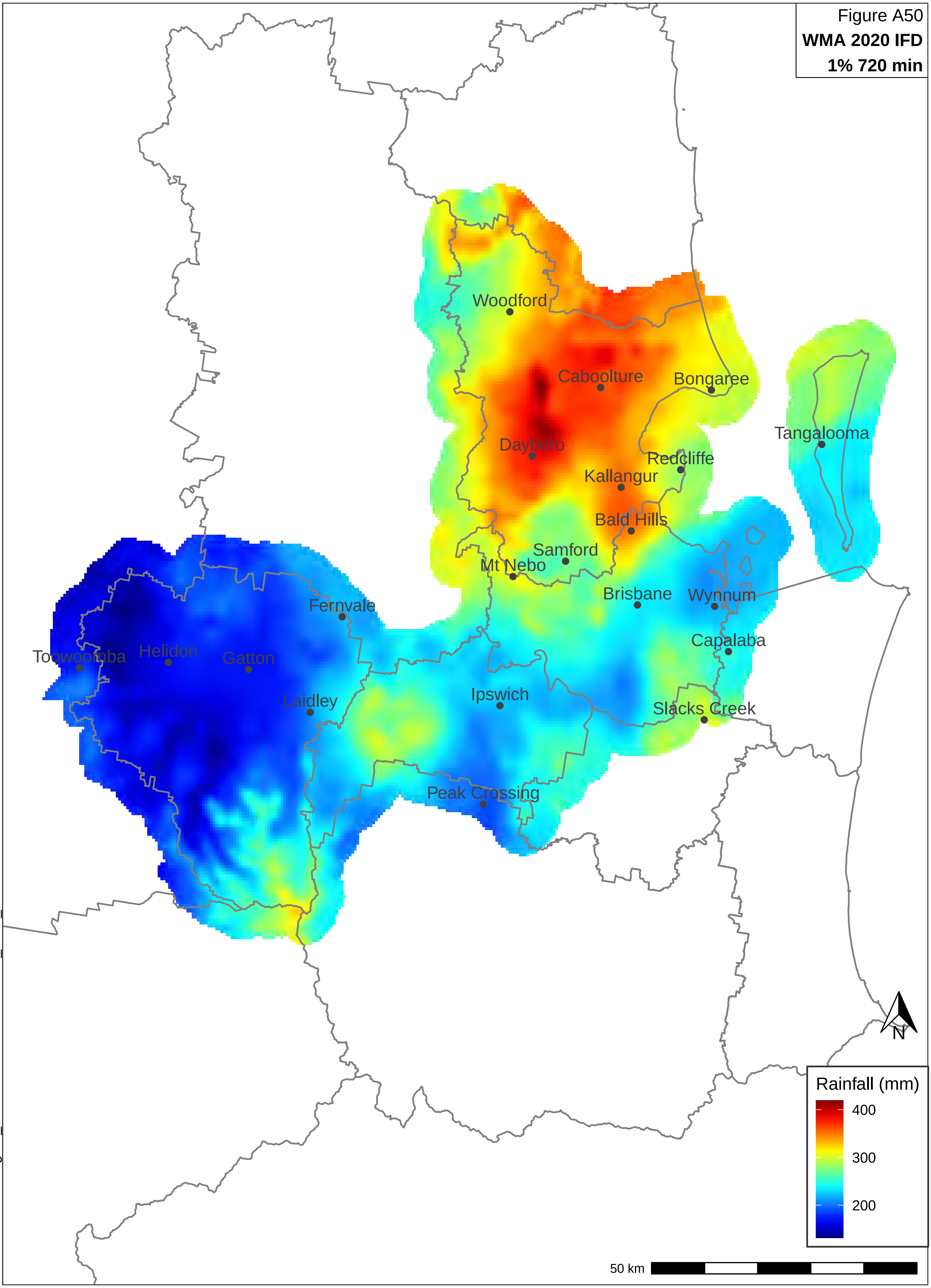
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



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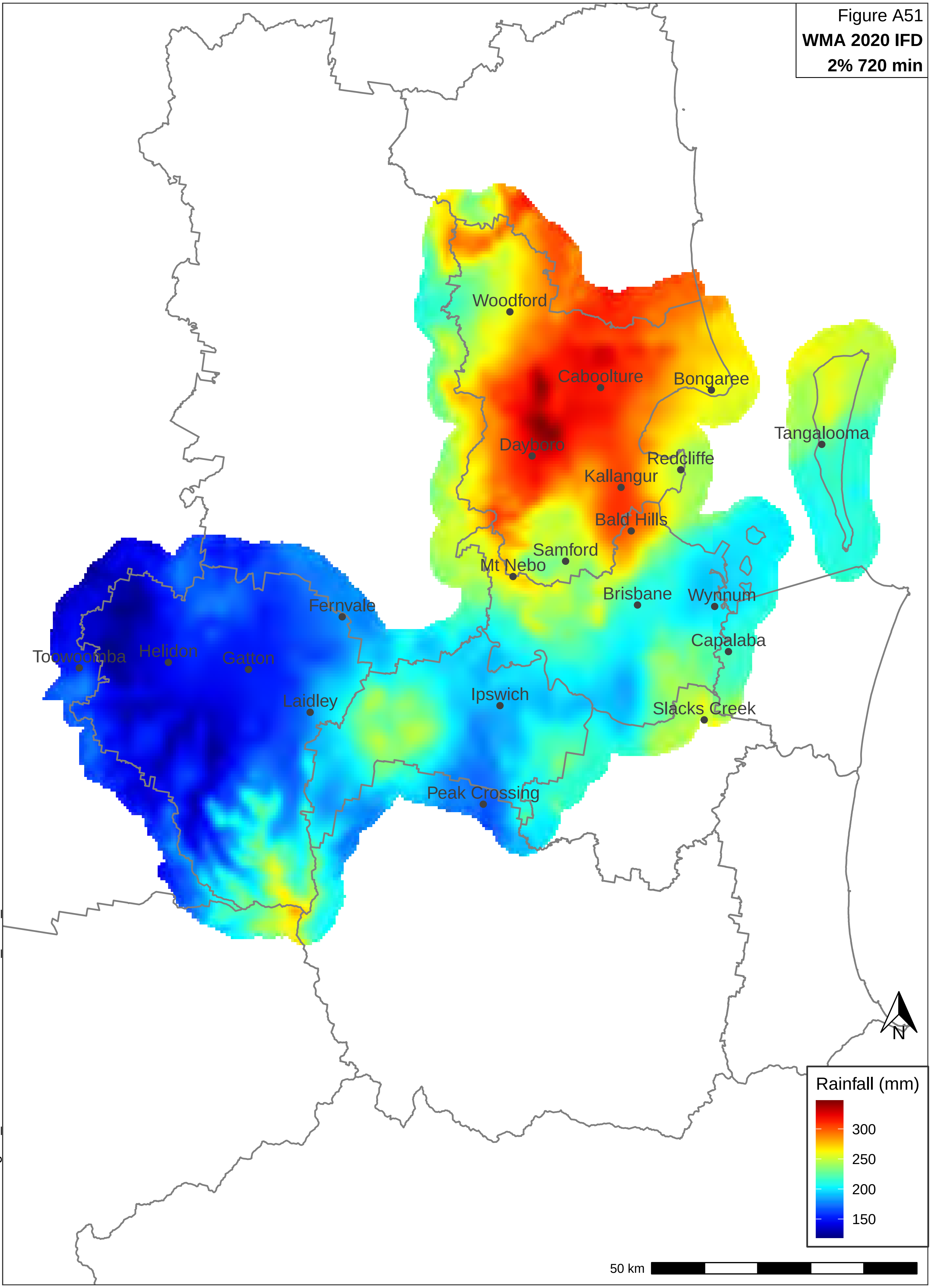
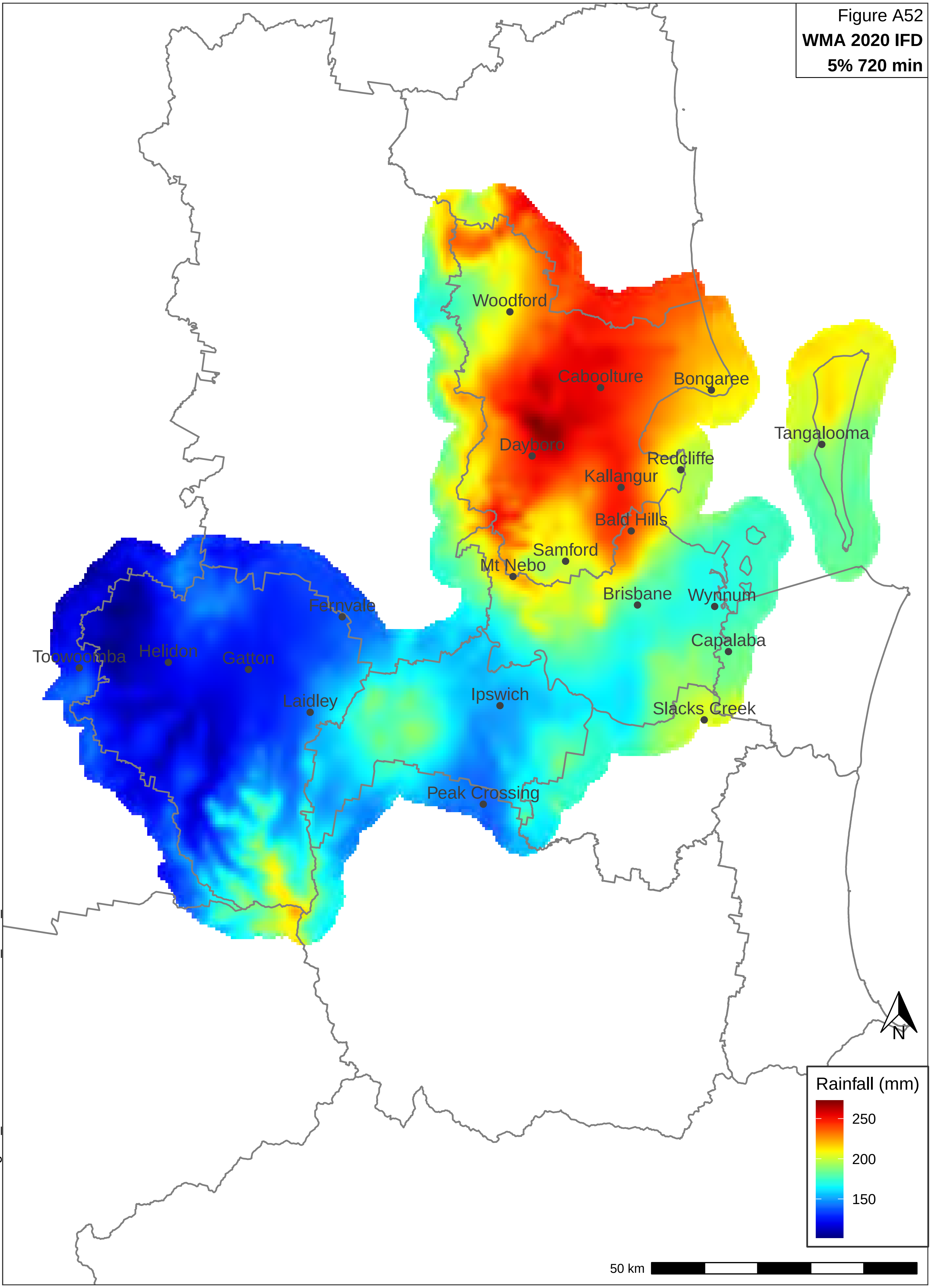


J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



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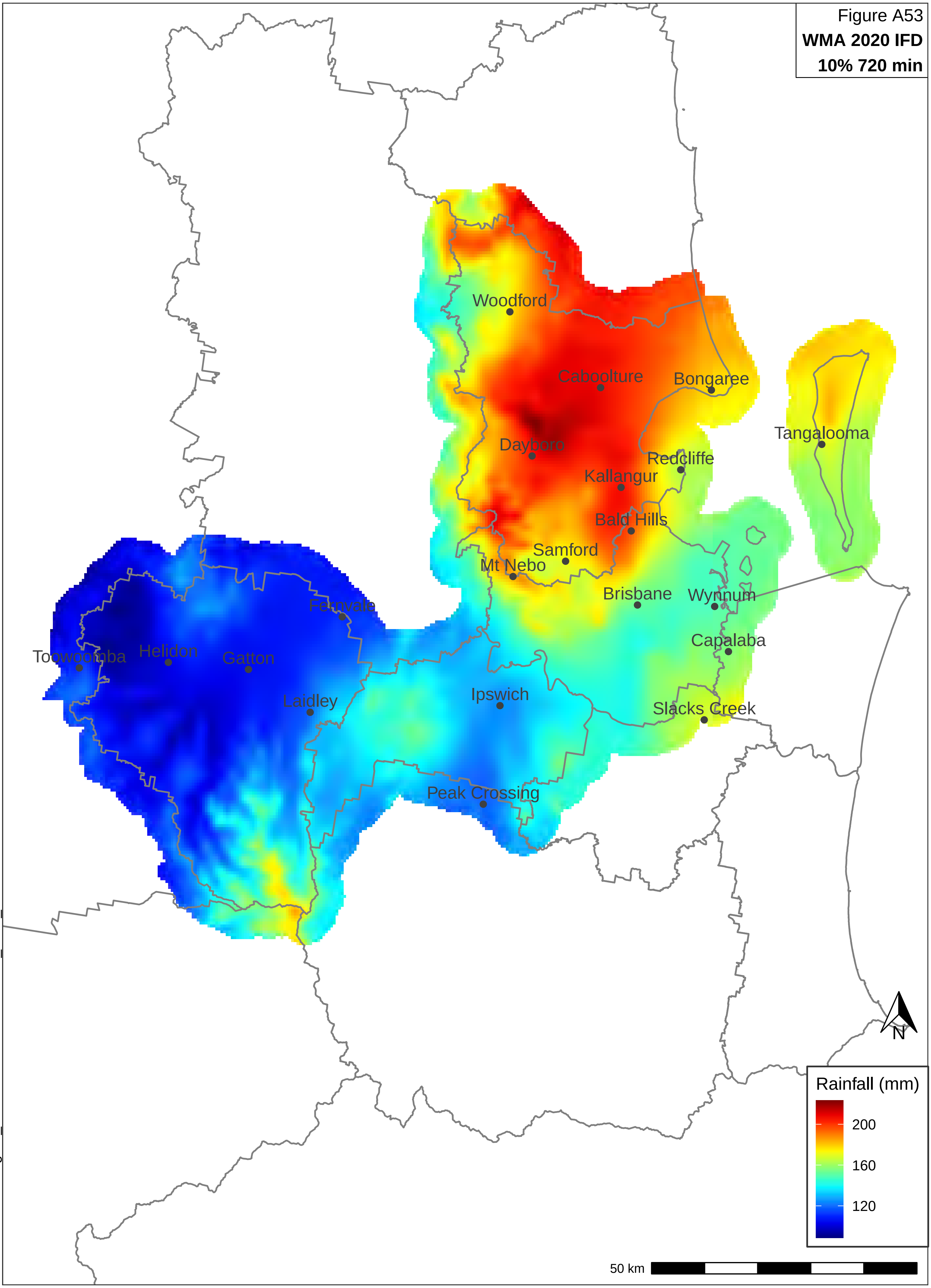
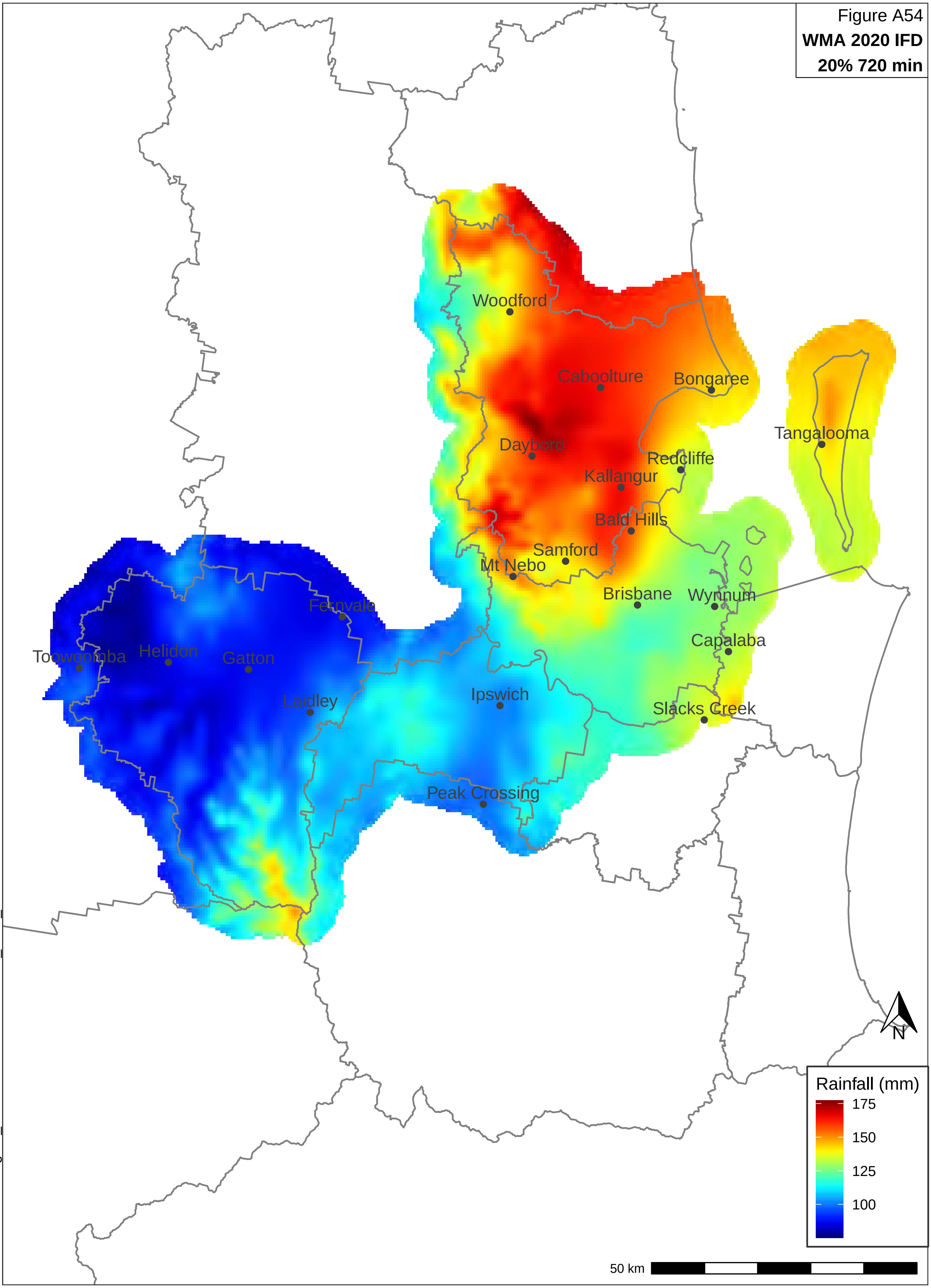
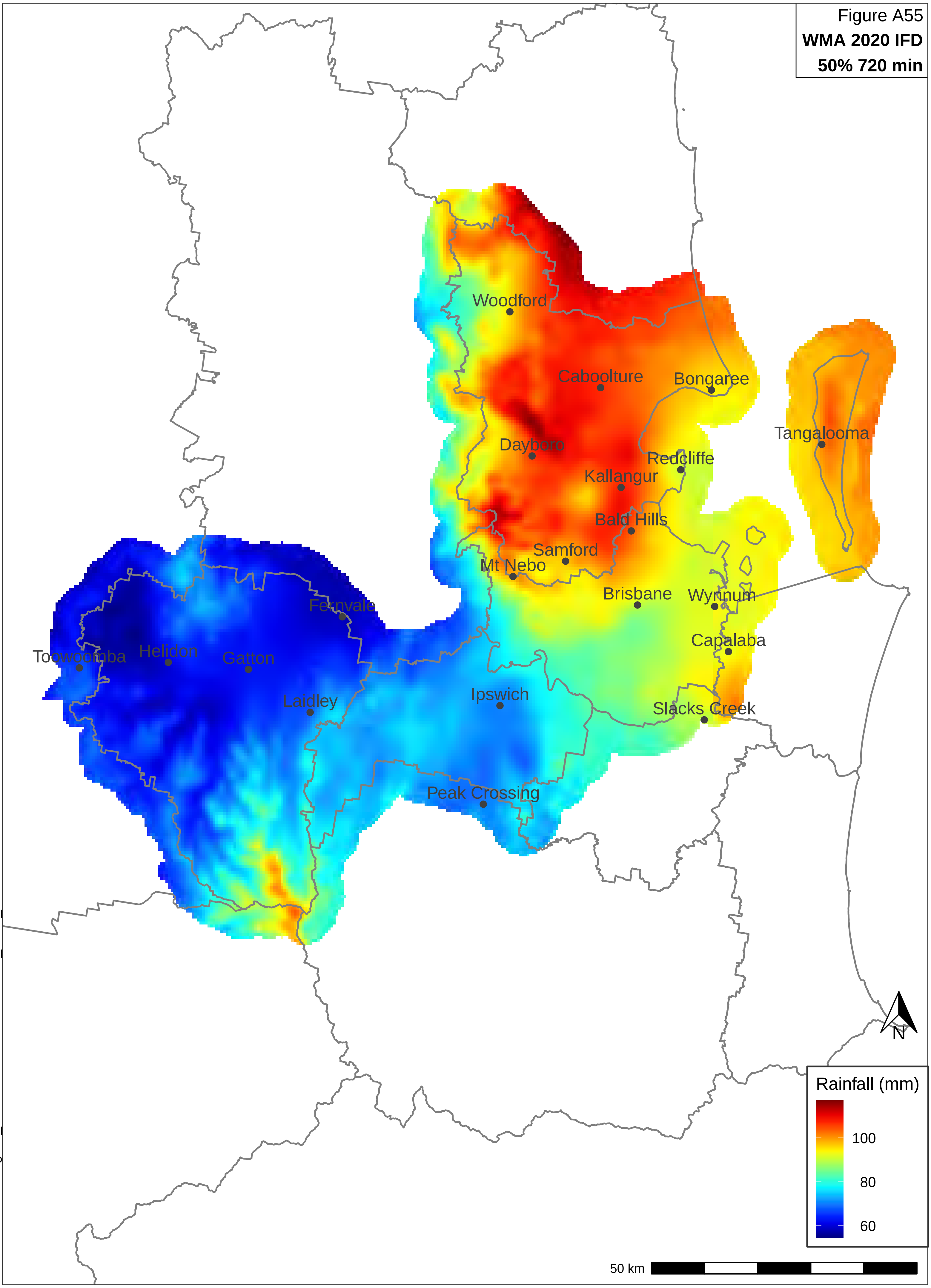


J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

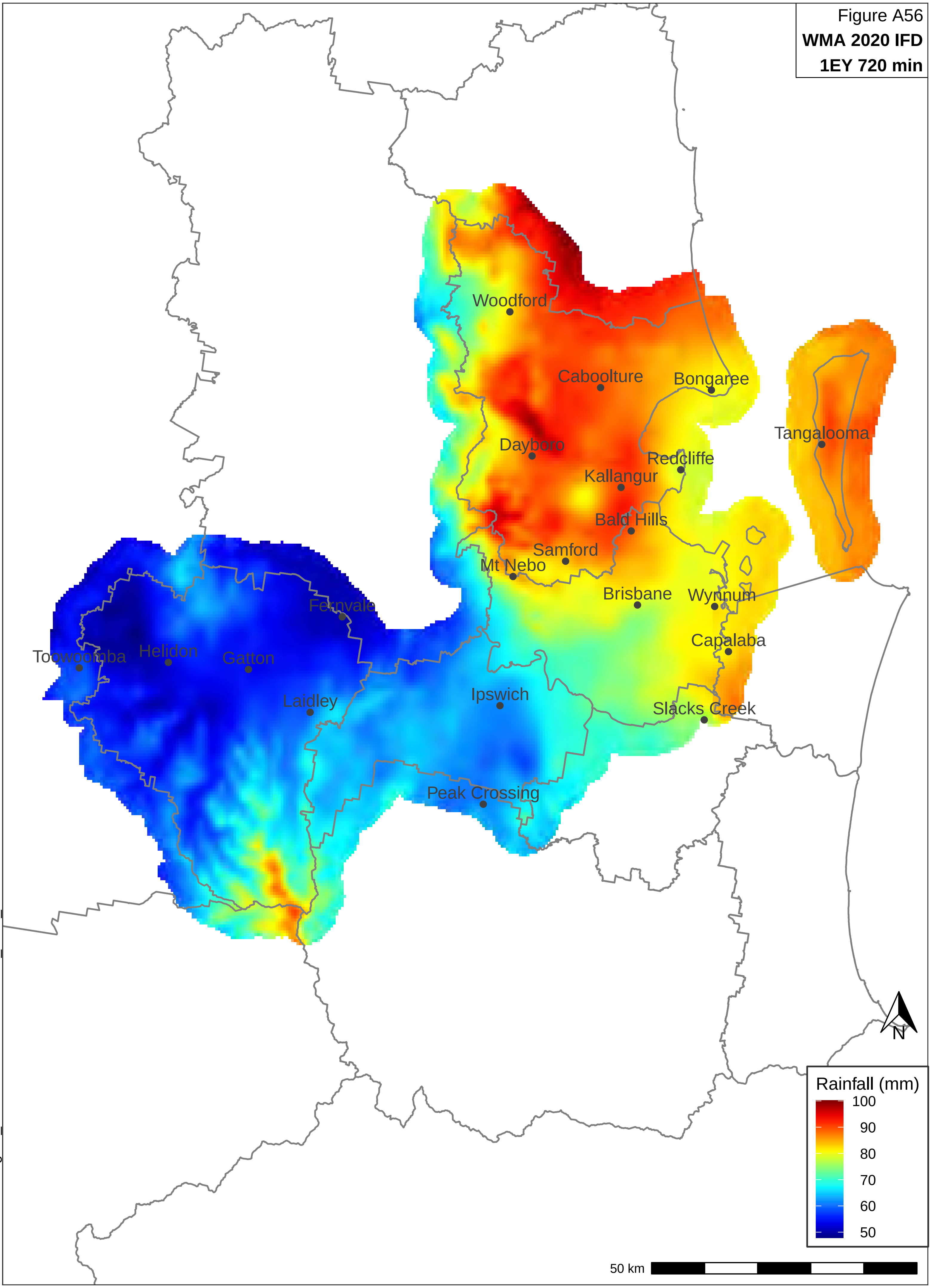


J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

Figure A55
WMA 2020 IFD
50% 720 min



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

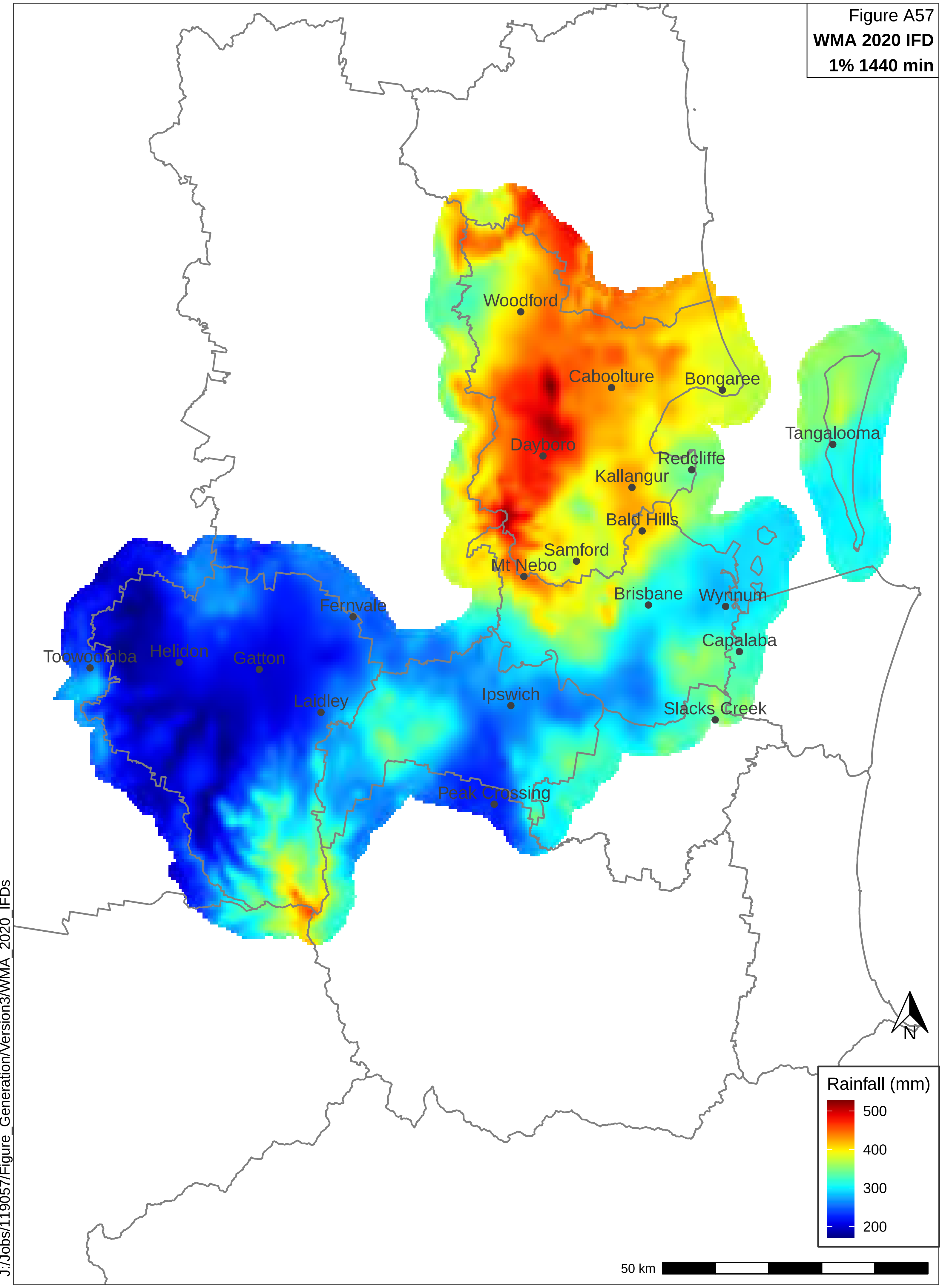
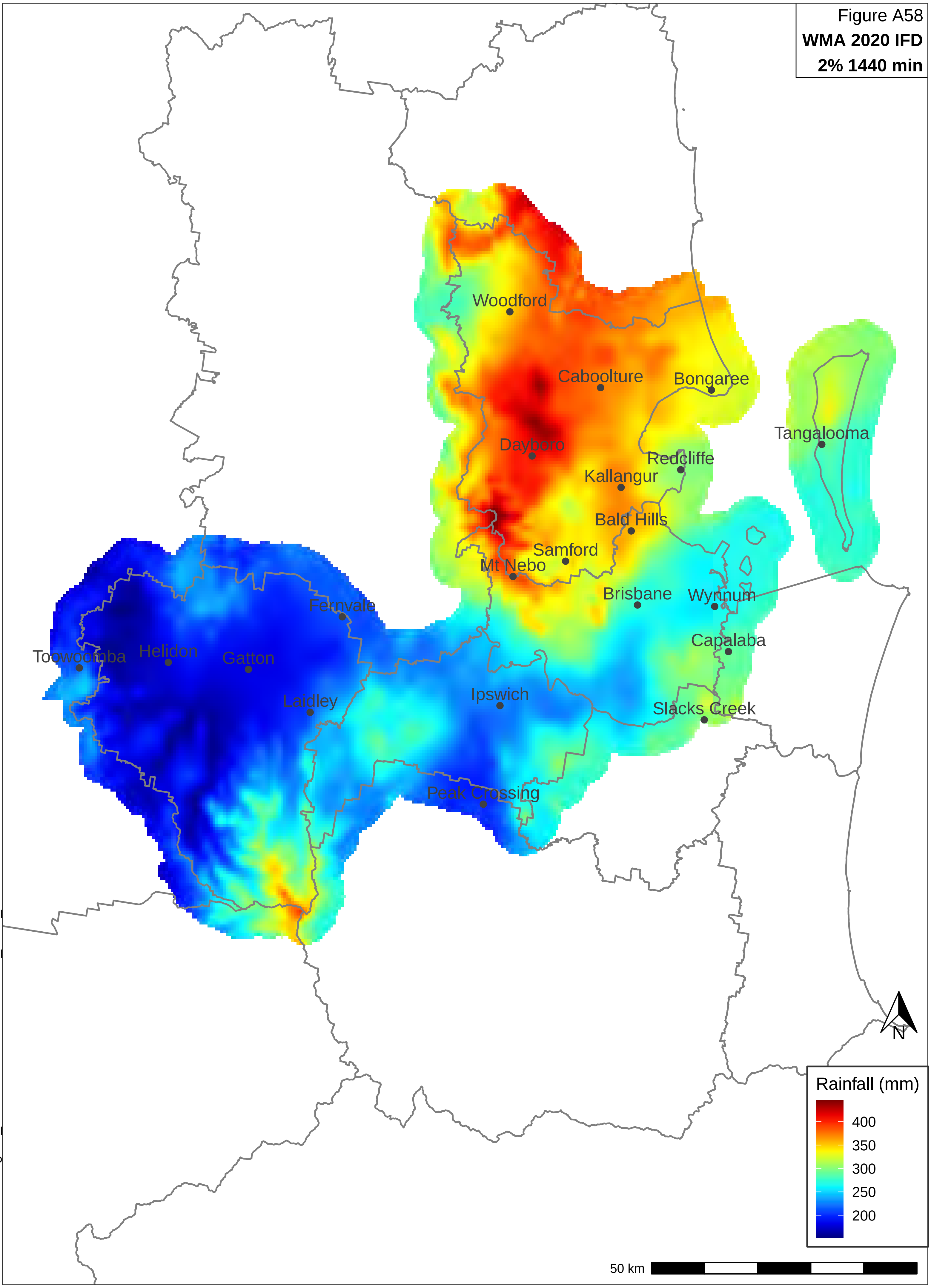


Figure A57
WMA 2020 IFD
1% 1440 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
500
400
300
200
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

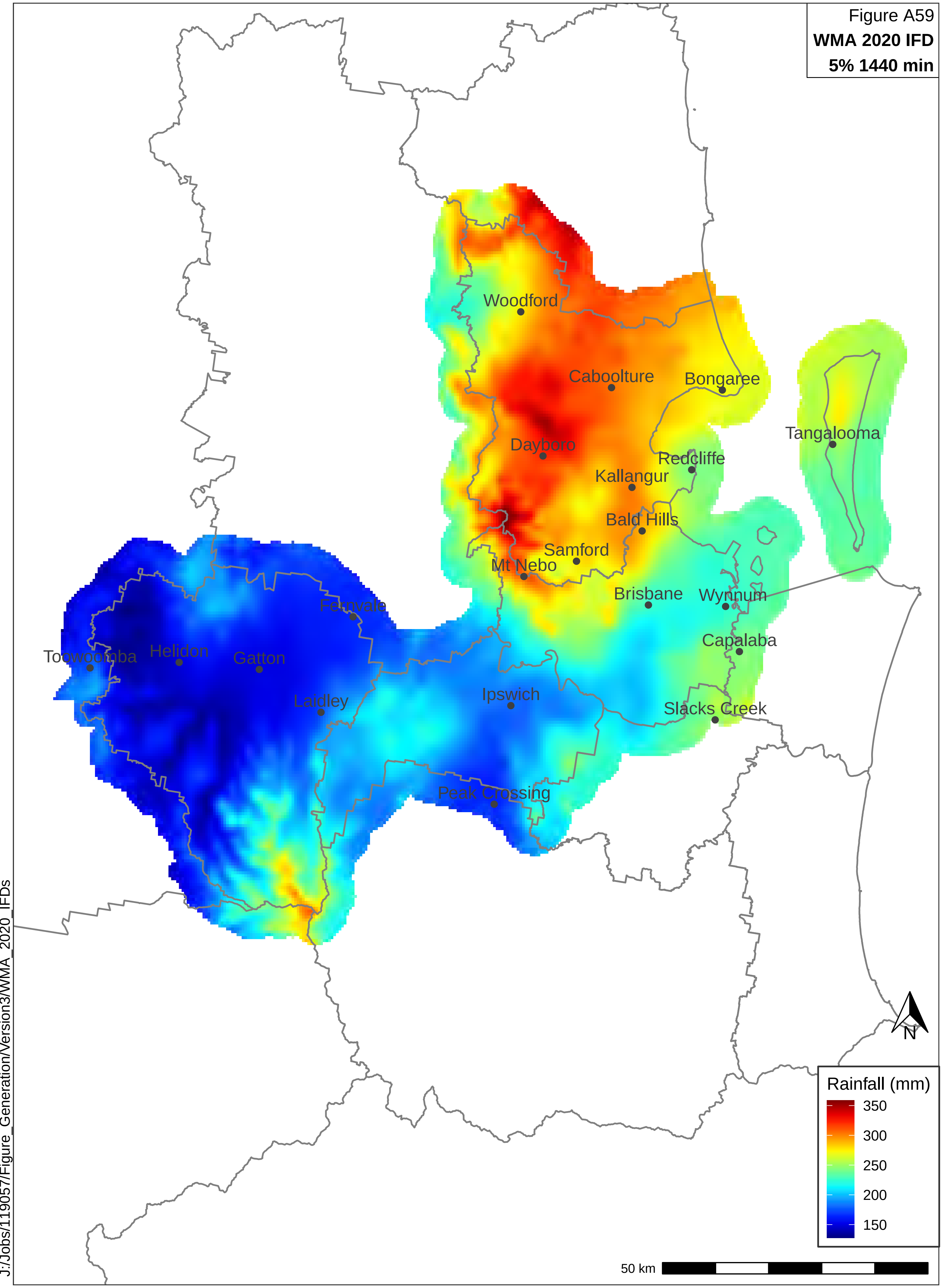


Figure A59
WMA 2020 IFD
5% 1440 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
350
300
250
200
150
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

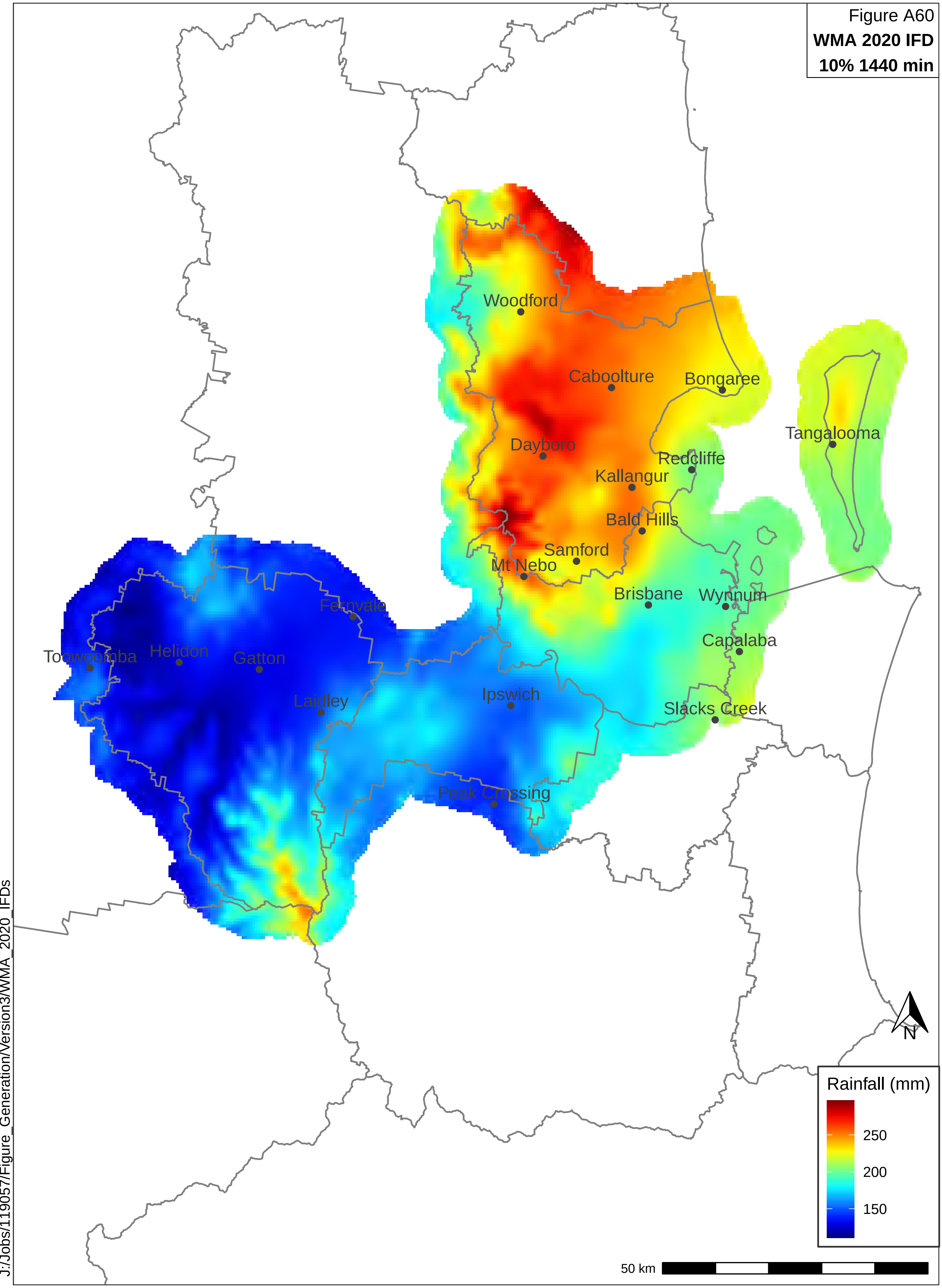
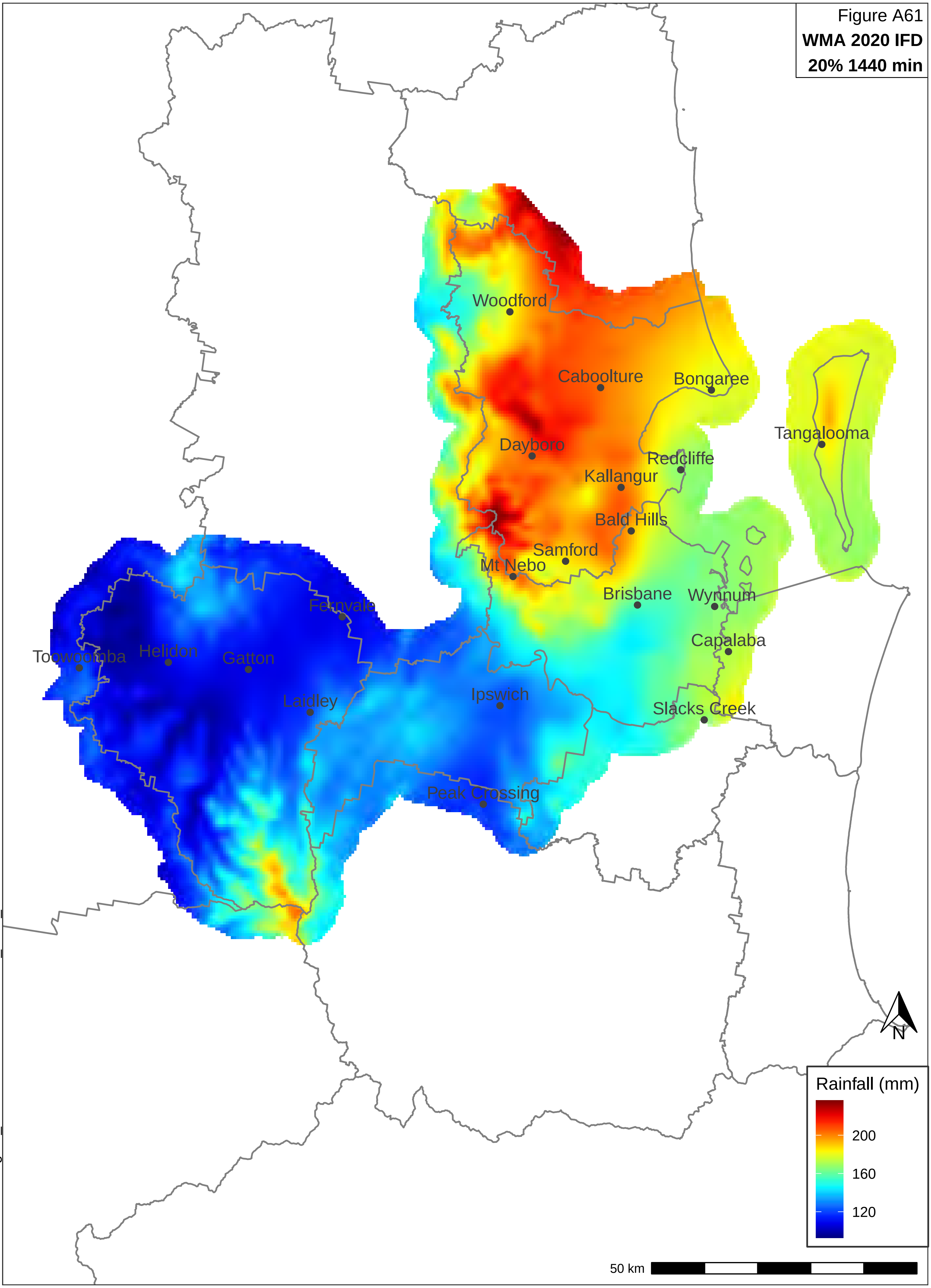
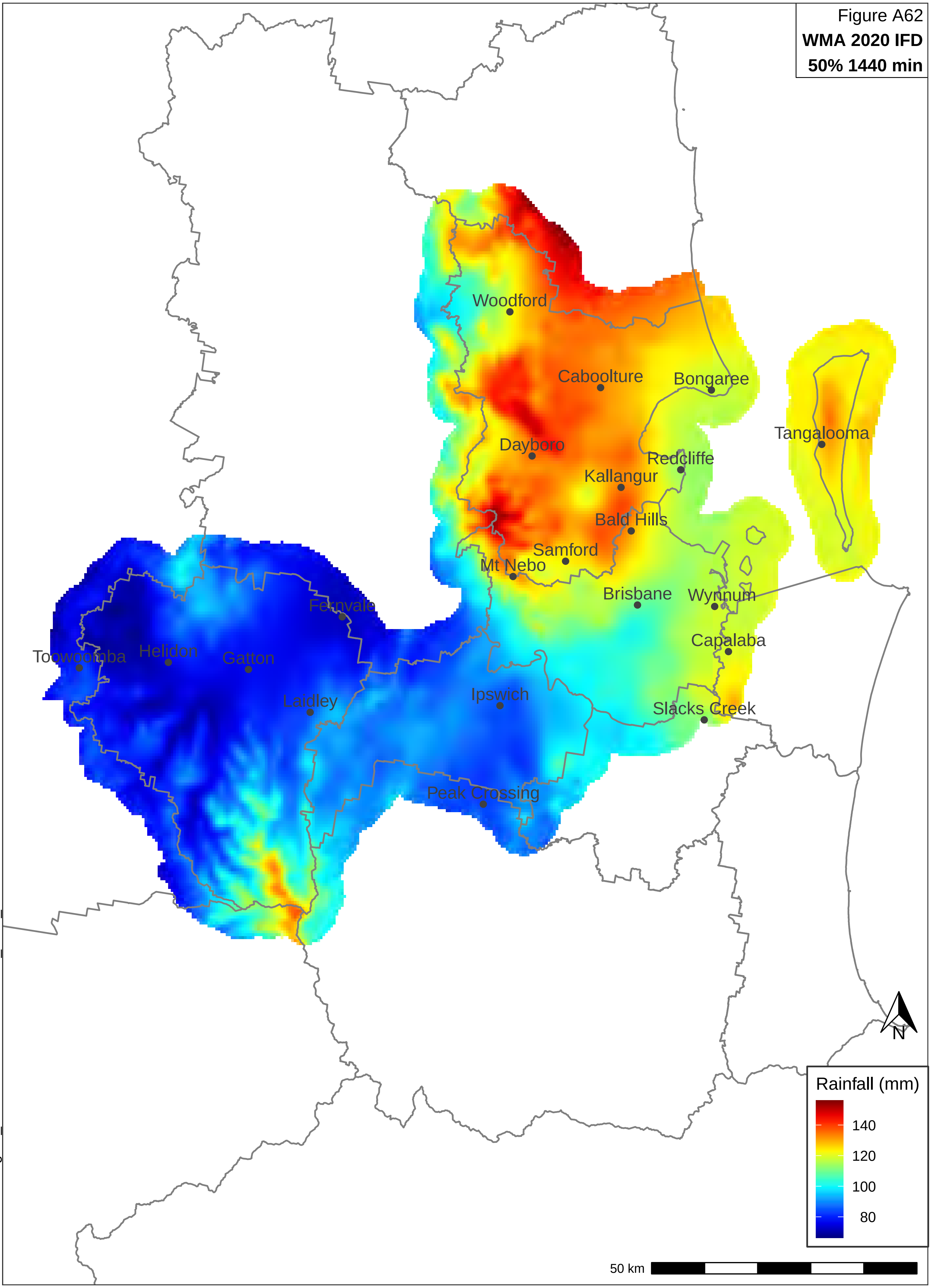


Figure A60
WMA 2020 IFD
10% 1440 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
Rainfall (mm)
250
200
150
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

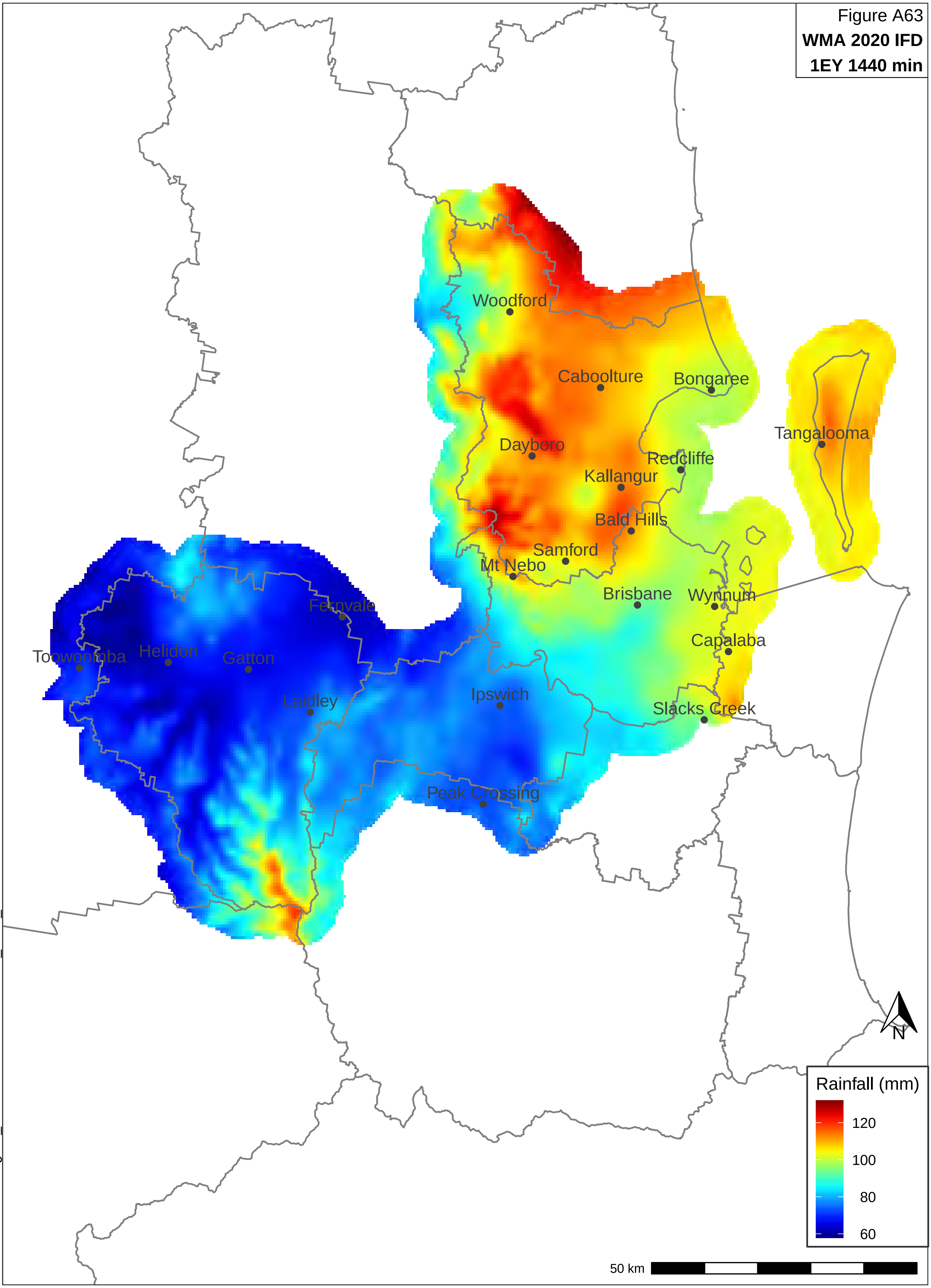


J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

Figure A63
WMA 2020 IFD
1EY 1440 min



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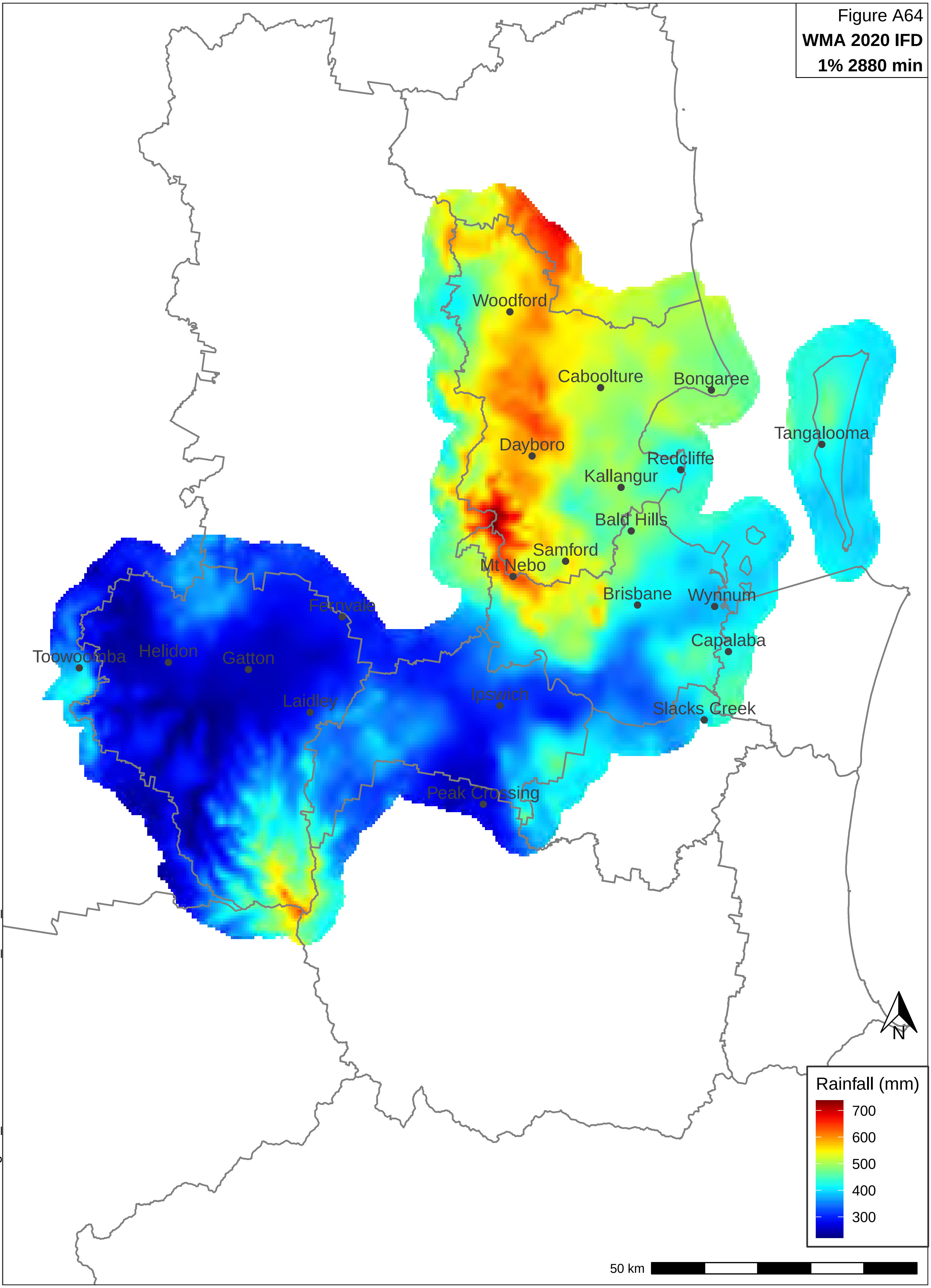

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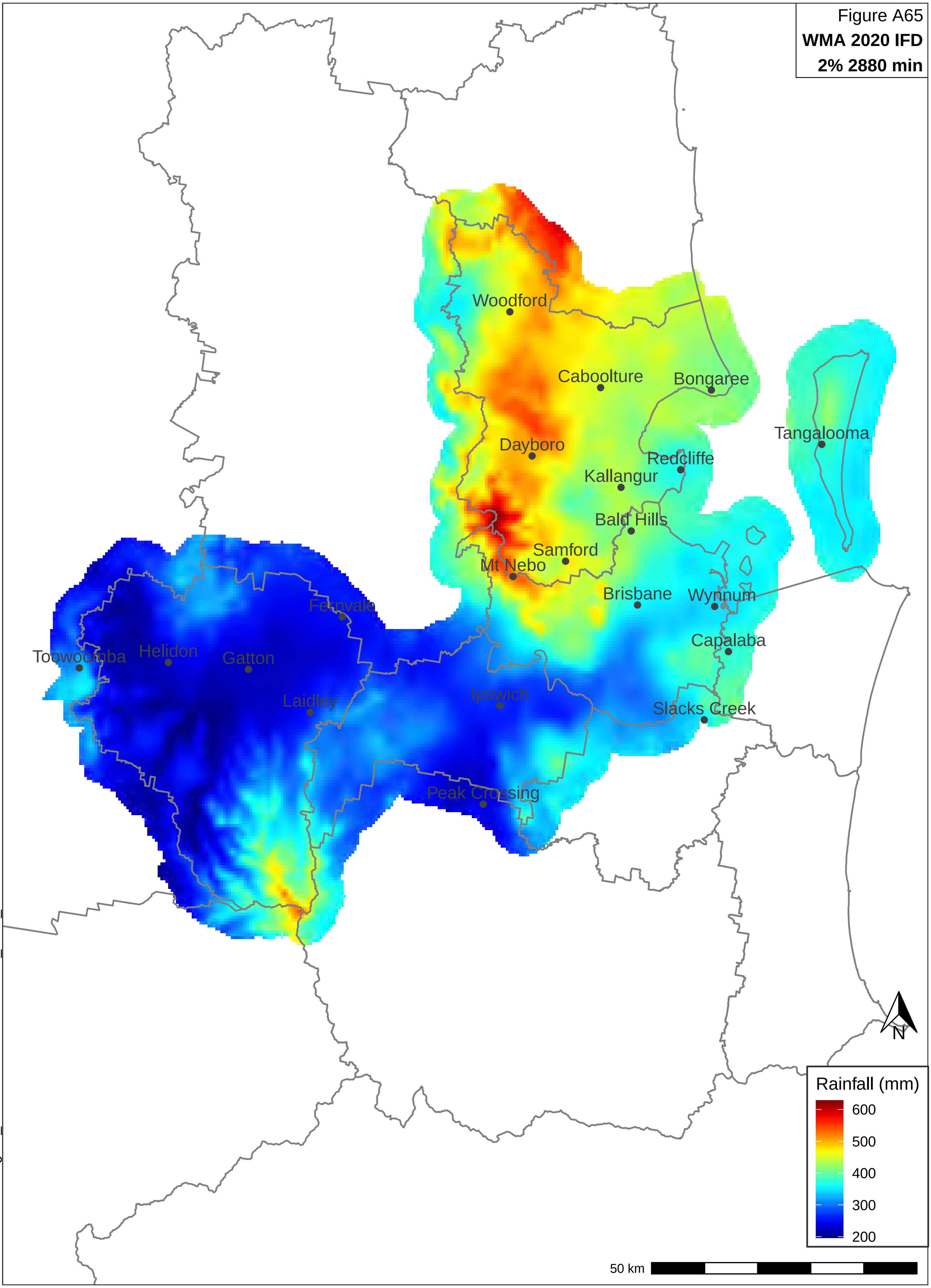

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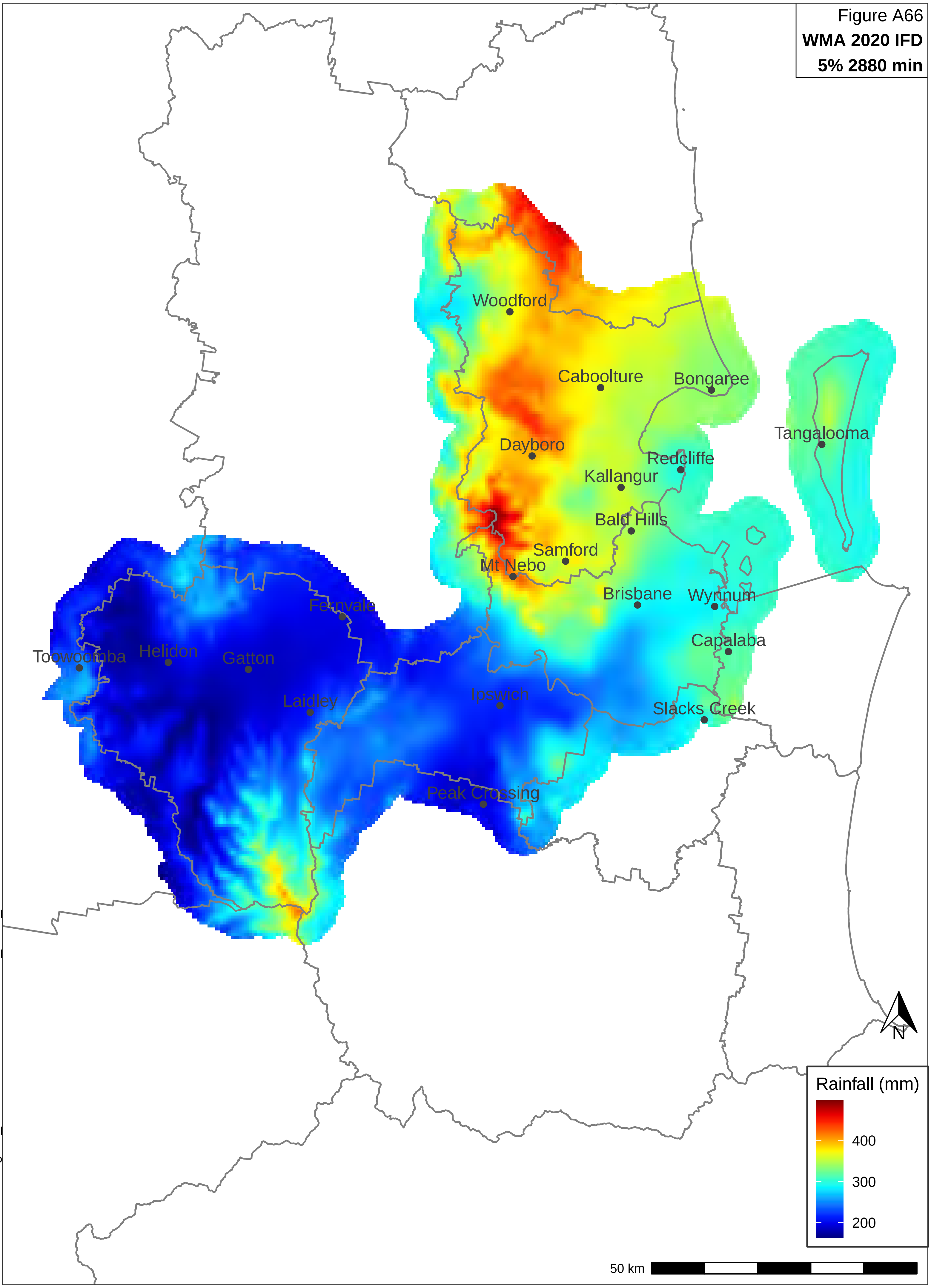
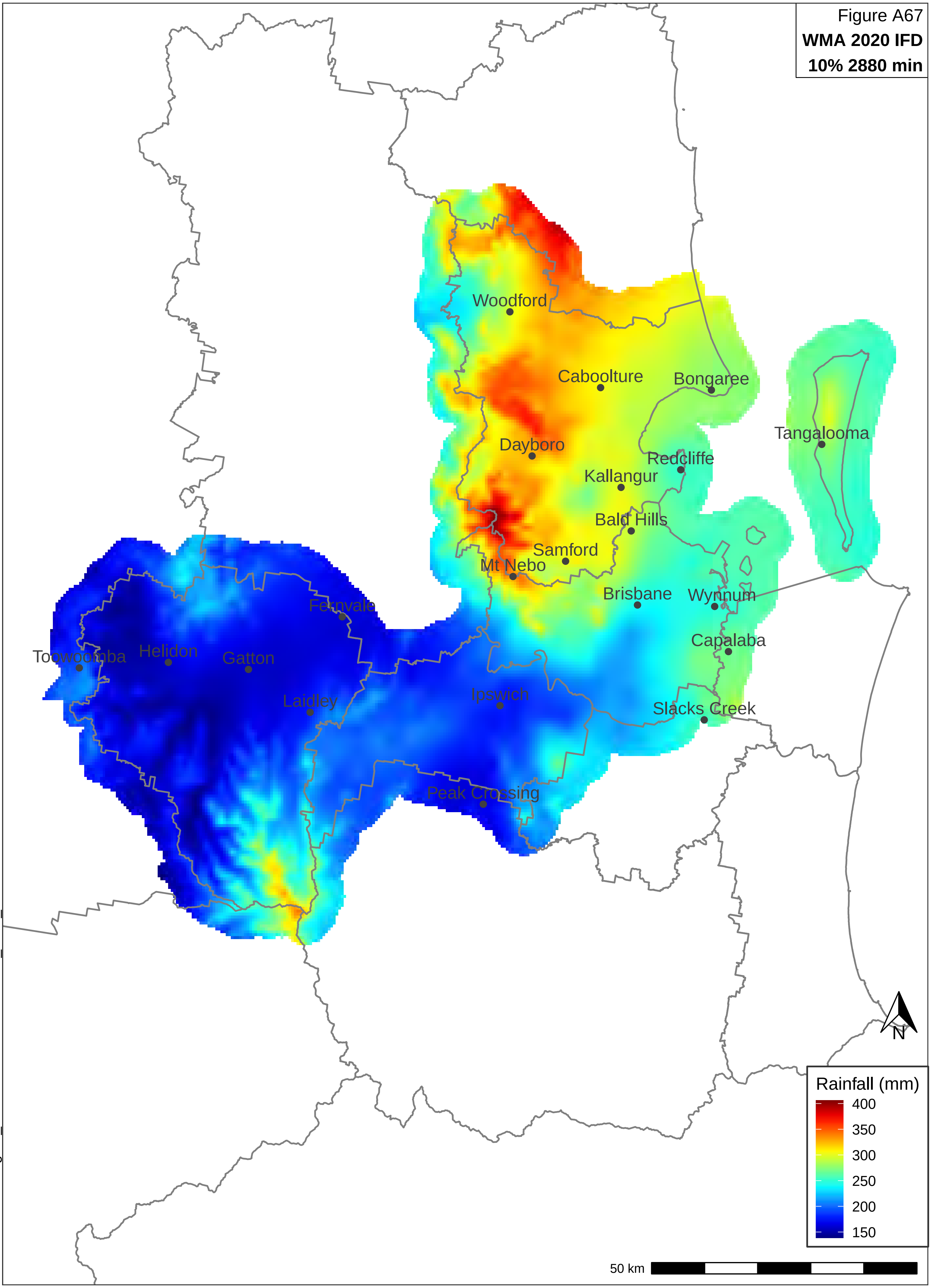
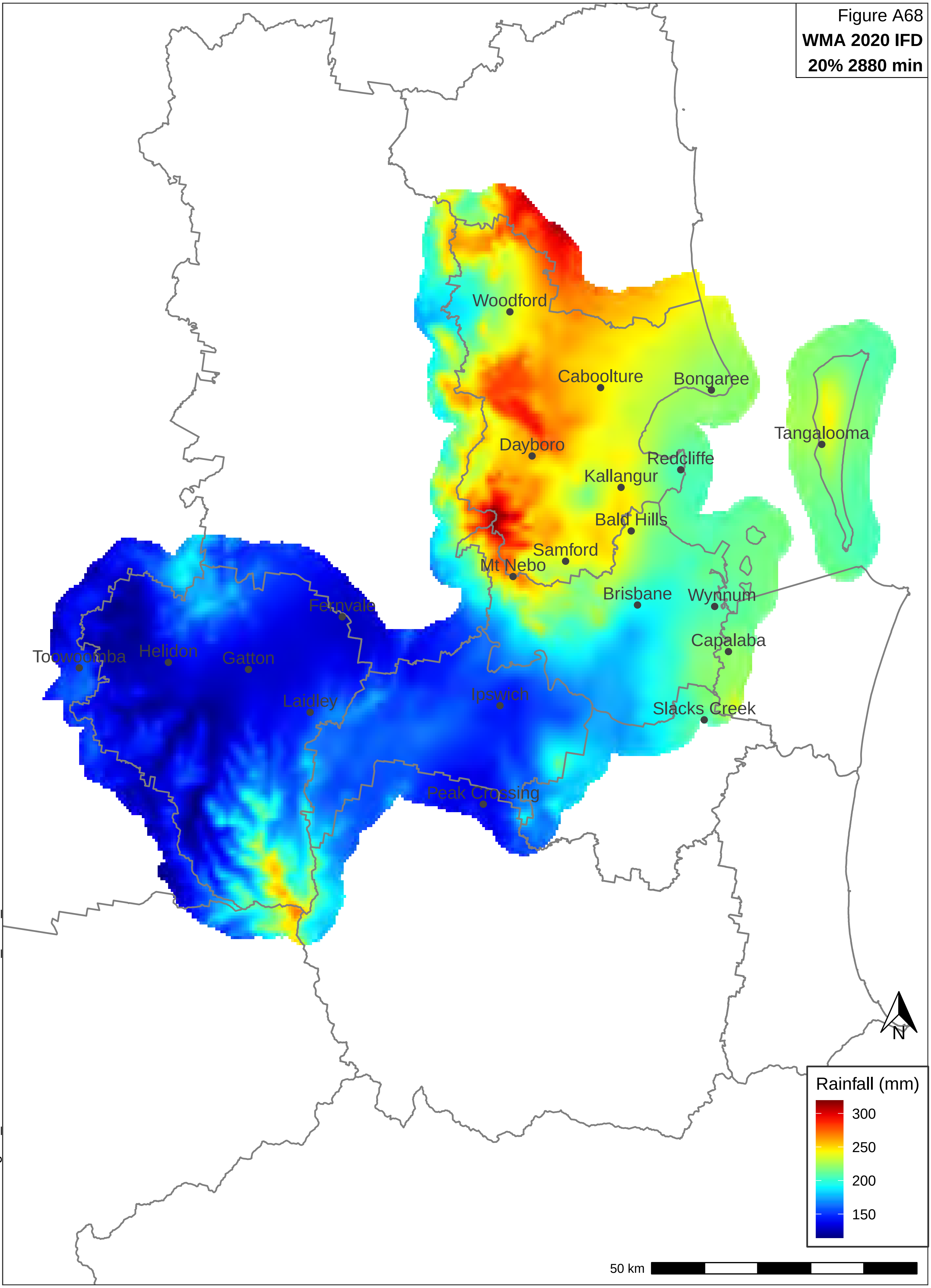


J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

Figure A68
WMA 2020 IFD
20% 2880 min



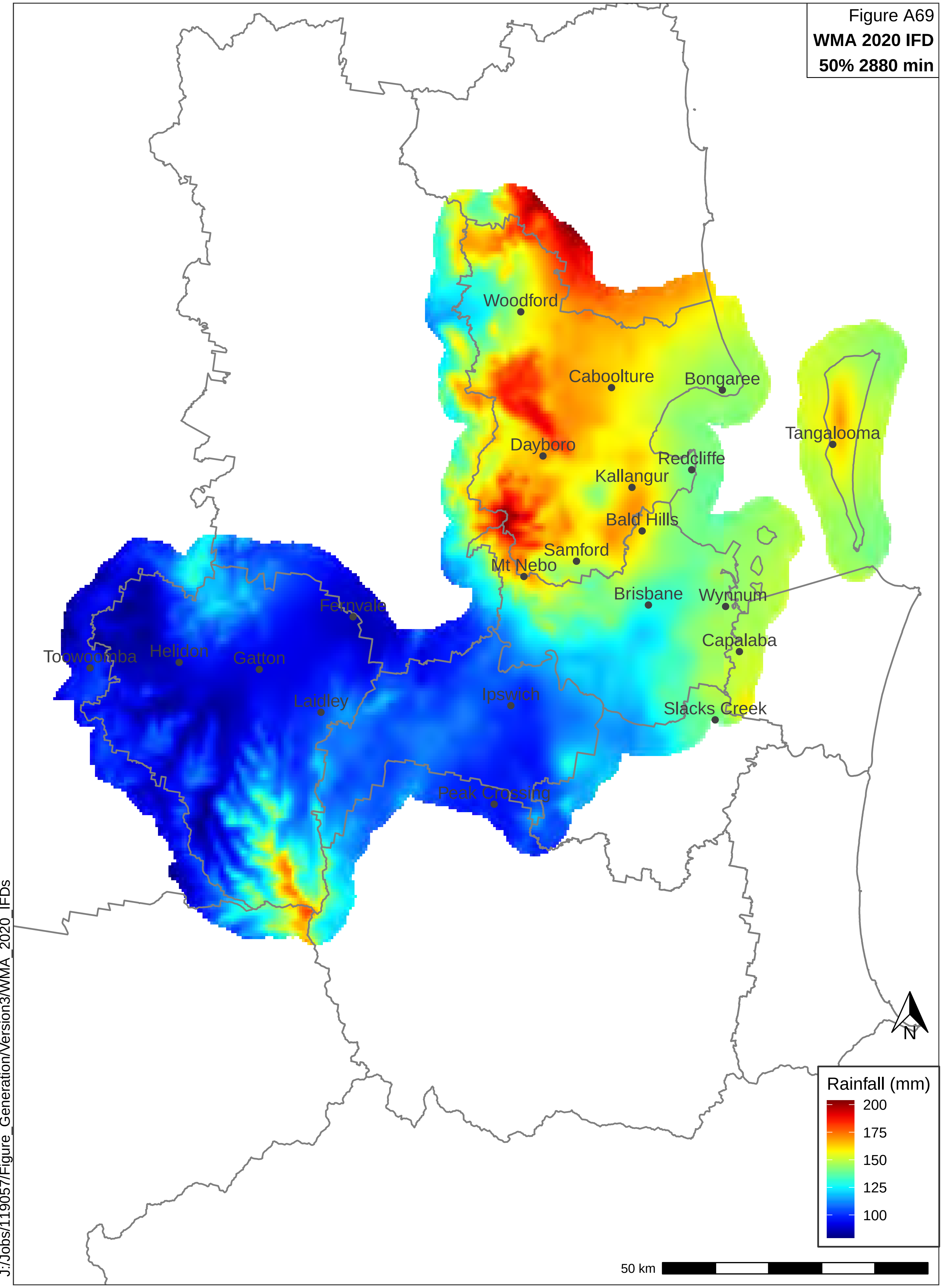
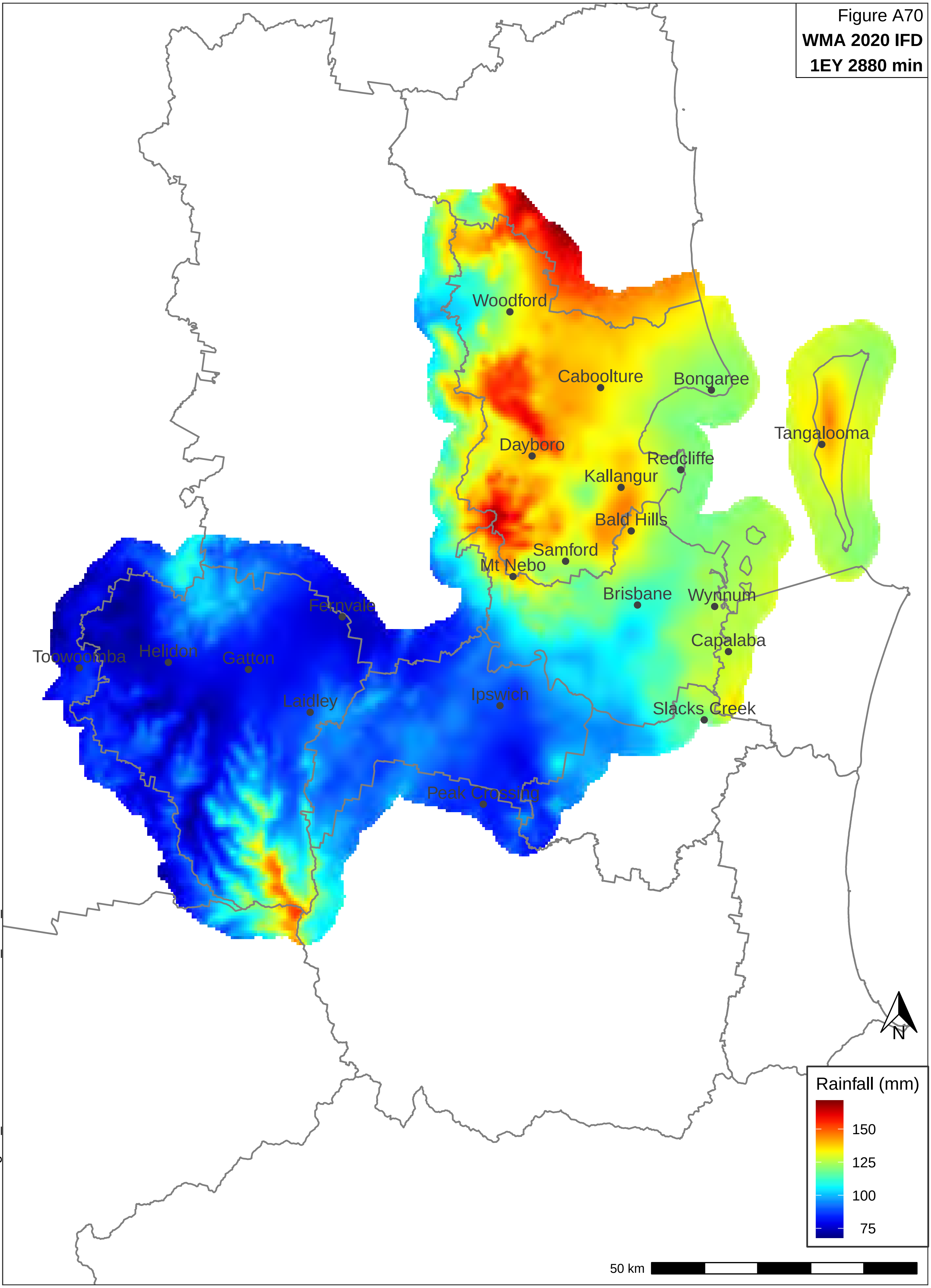


Figure A69
WMA 2020 IFD
50% 2880 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
200
175
150
125
100
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

Figure A70
WMA 2020 IFD
1EY 2880 min



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

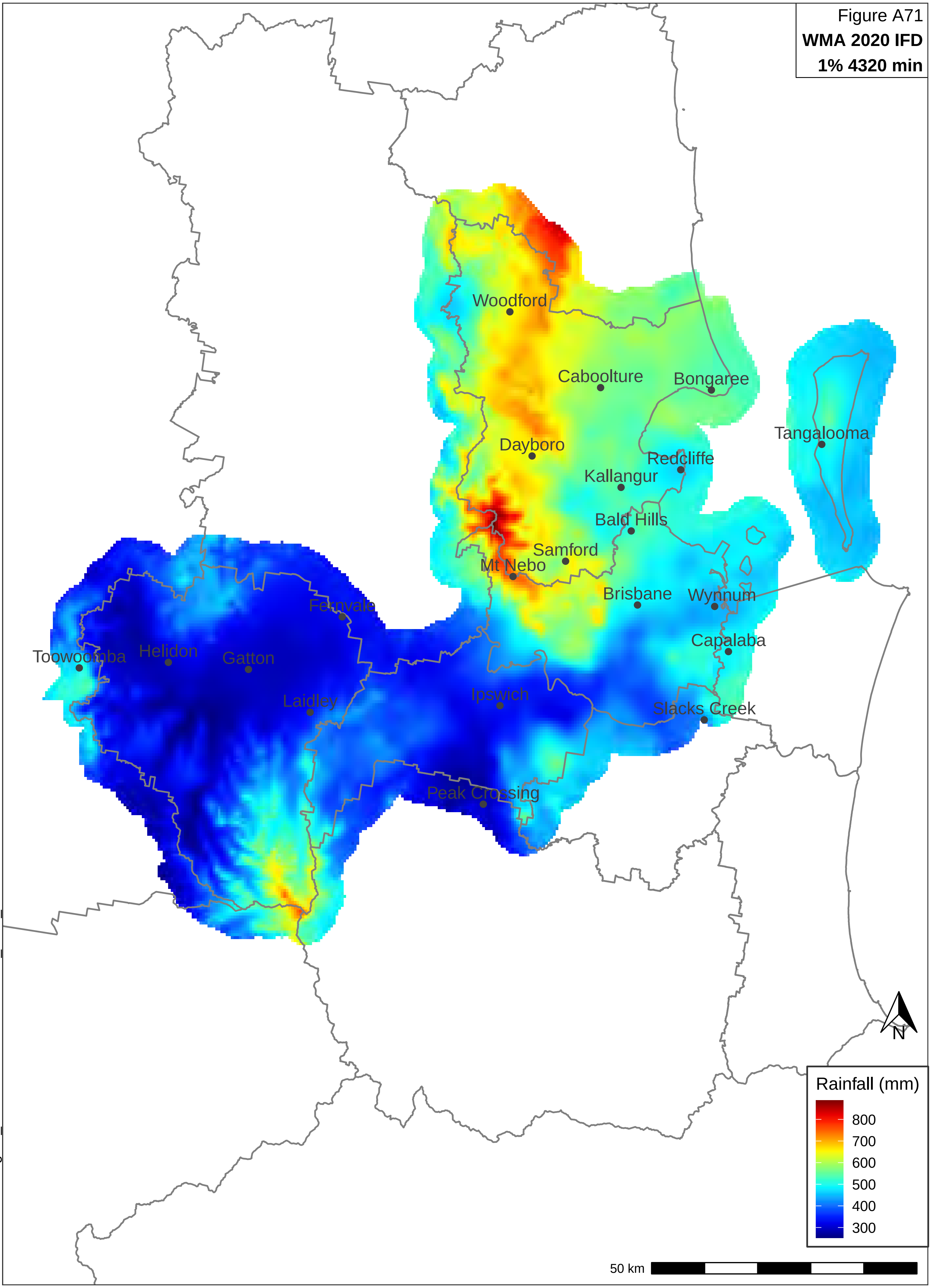
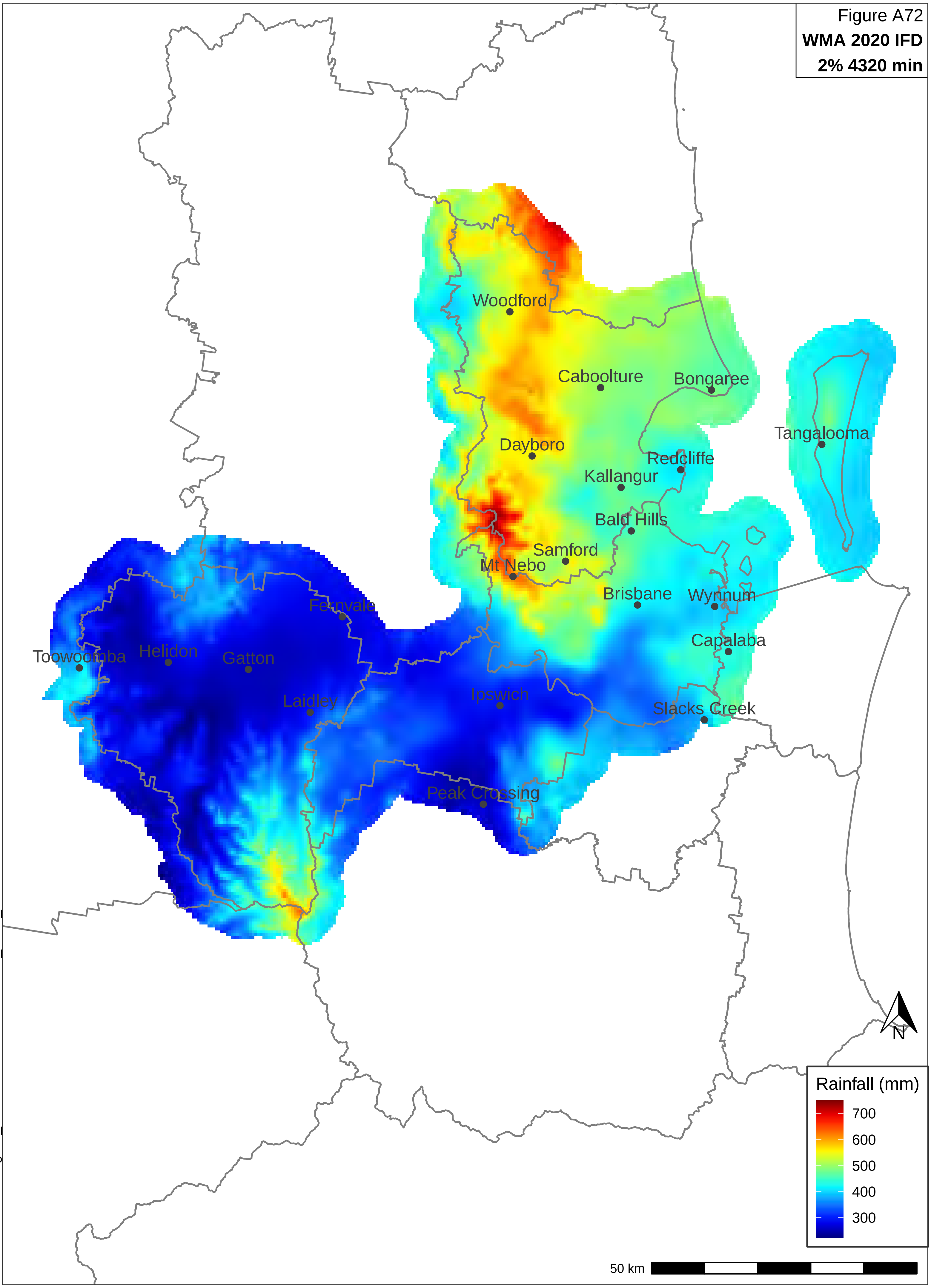
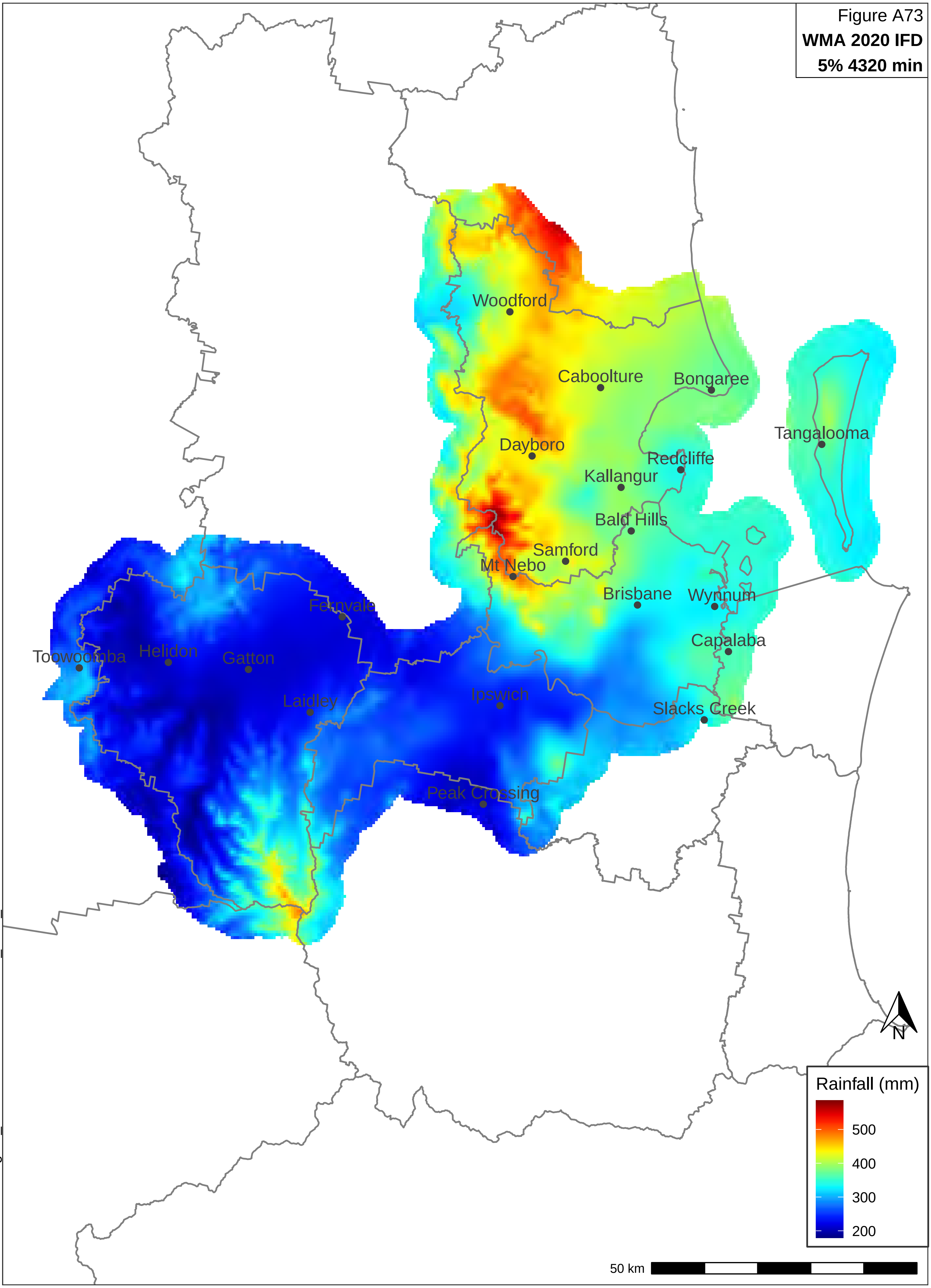


Figure A71
WMA 2020 IFD
1% 4320 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
Rainfall (mm)
800
700
600
500
400
300
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

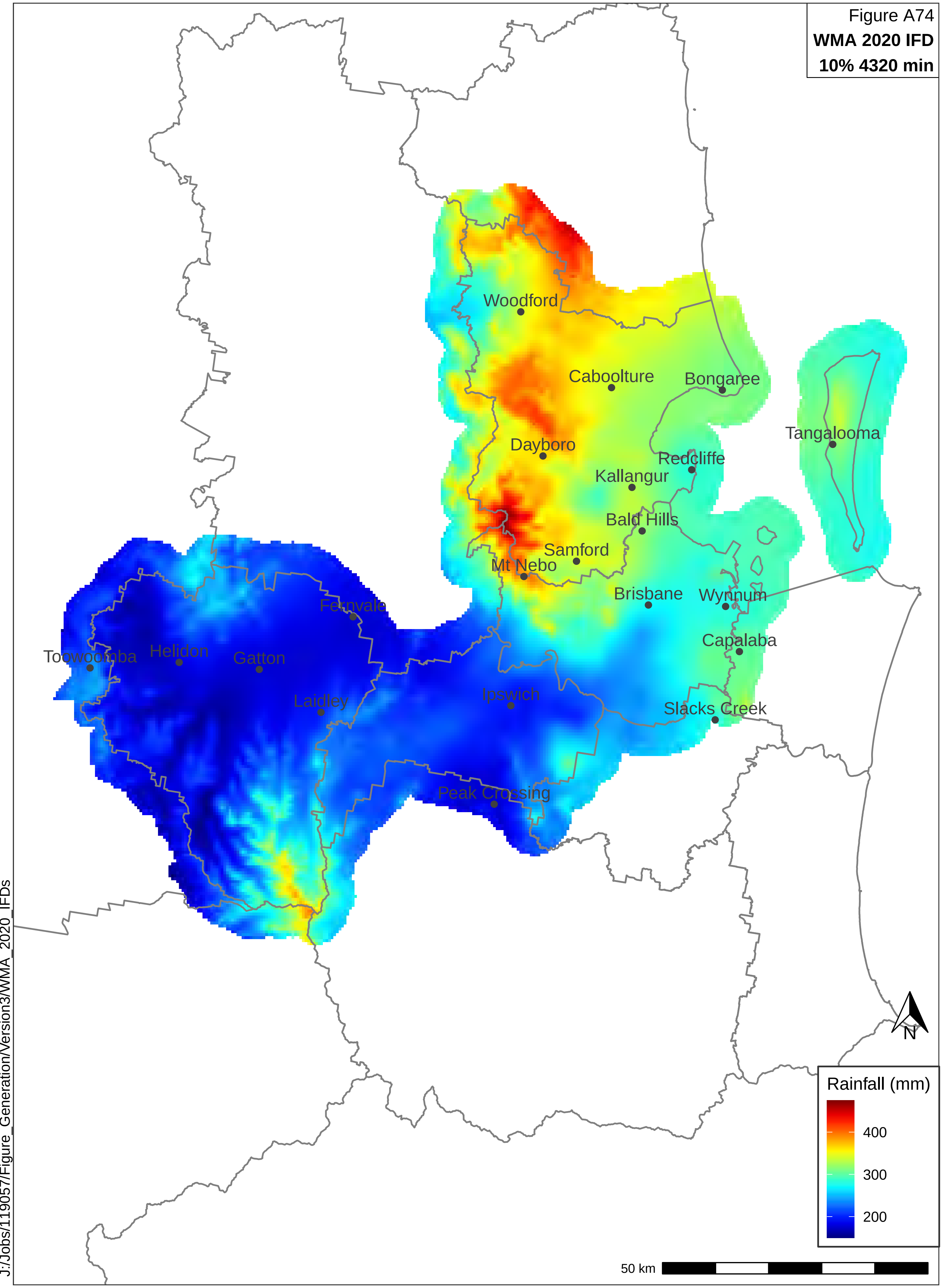


Figure A74
WMA 2020 IFD
10% 4320 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
400
300
200
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

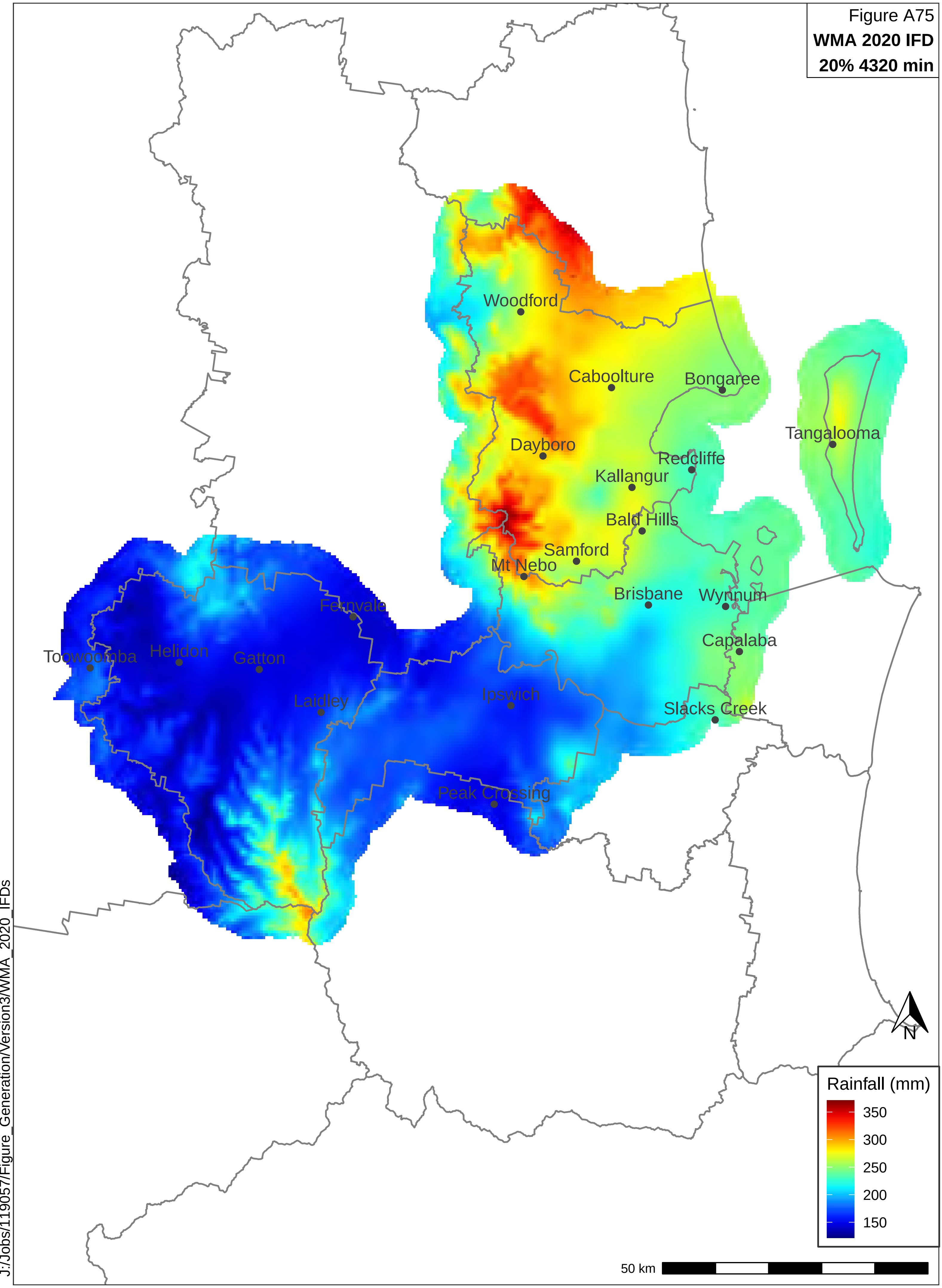


Figure A75
WMA 2020 IFD
20% 4320 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
350
300
250
200
150
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

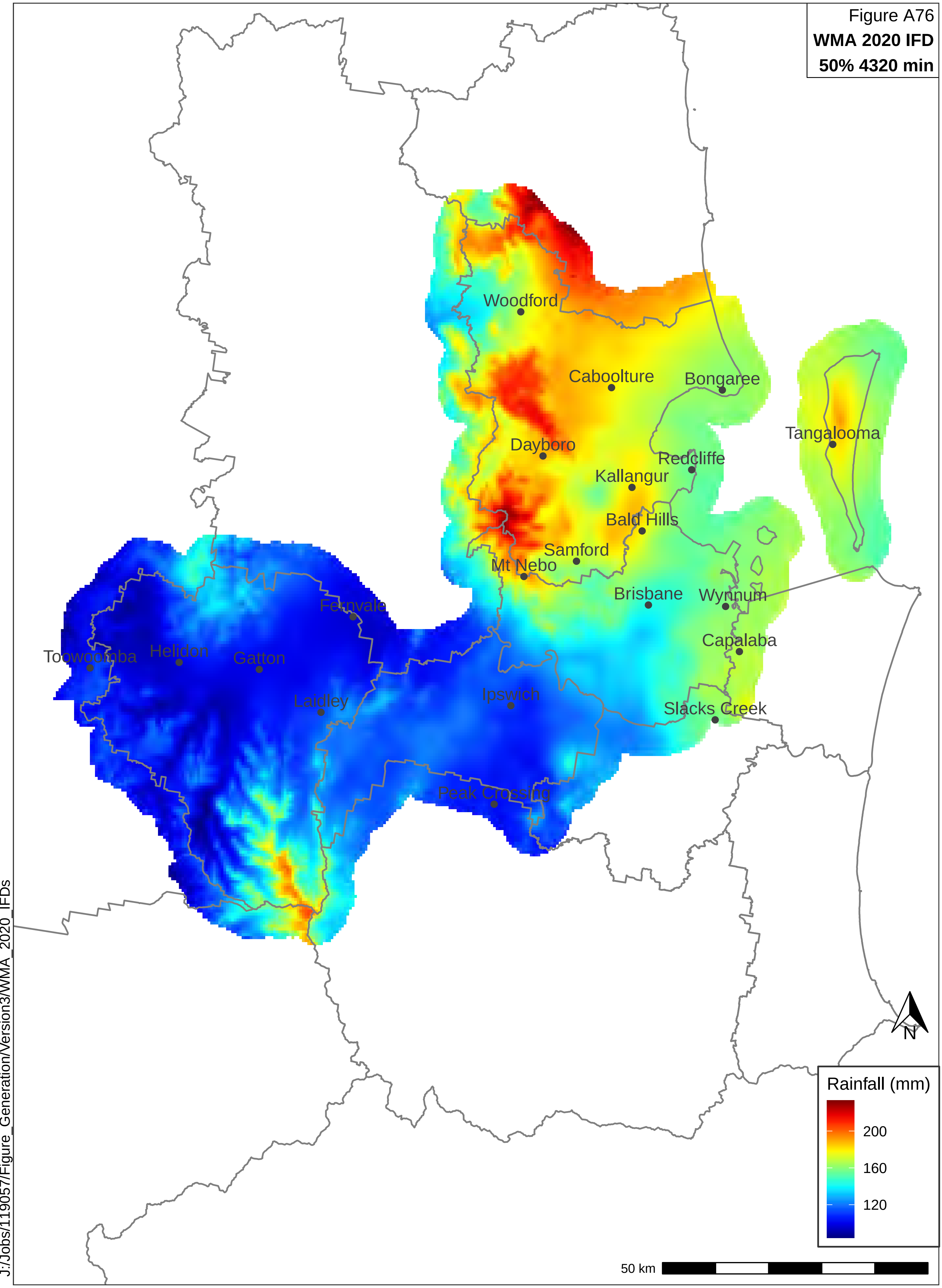


Figure A76
WMA 2020 IFD
50% 4320 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
200
160
120
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

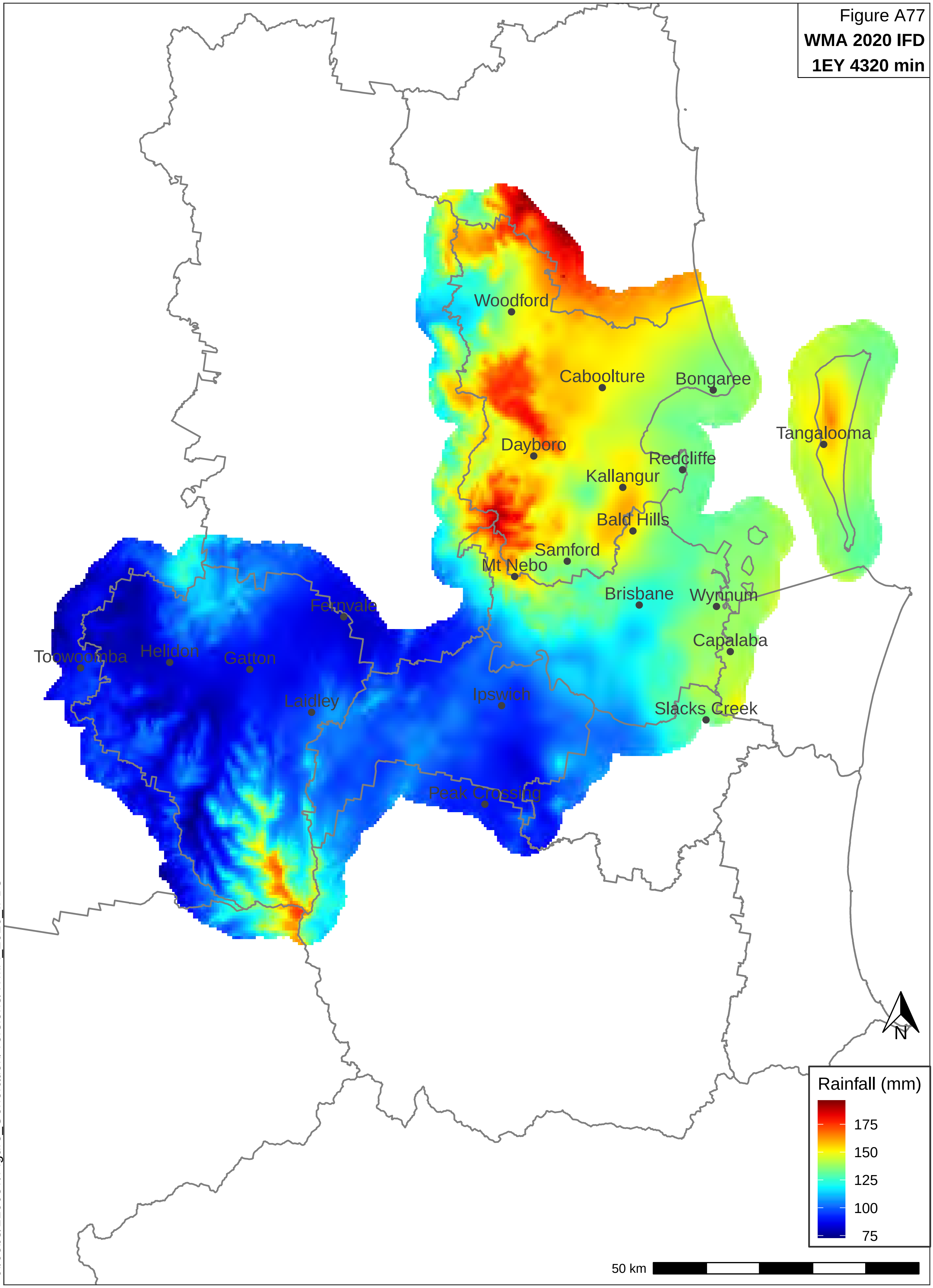


Figure A77
WMA 2020 IFD
1EY 4320 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
Rainfall (mm)
175
150
125
100
75
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

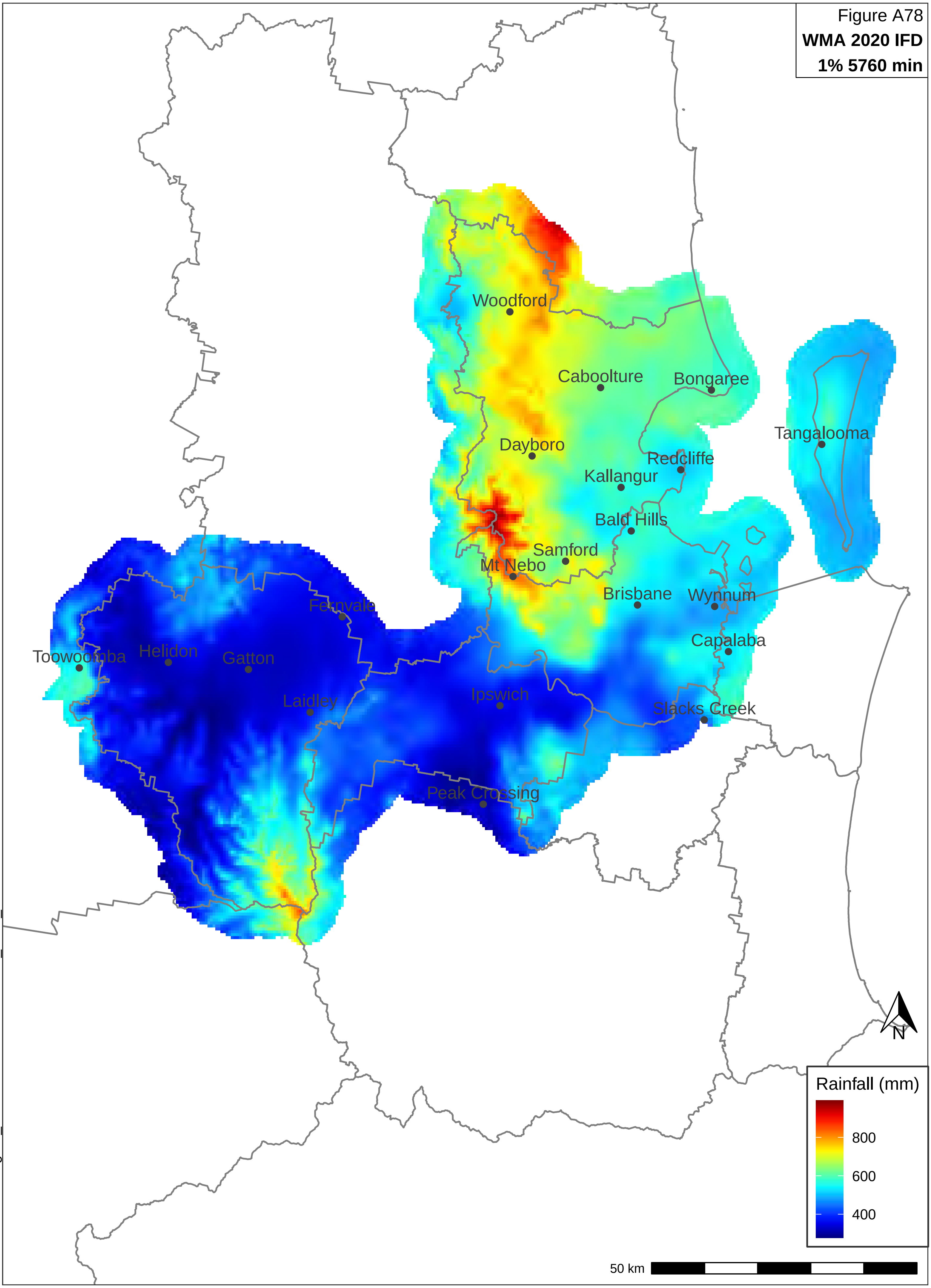


Figure A78
WMA 2020 IFD
1% 5760 min

J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

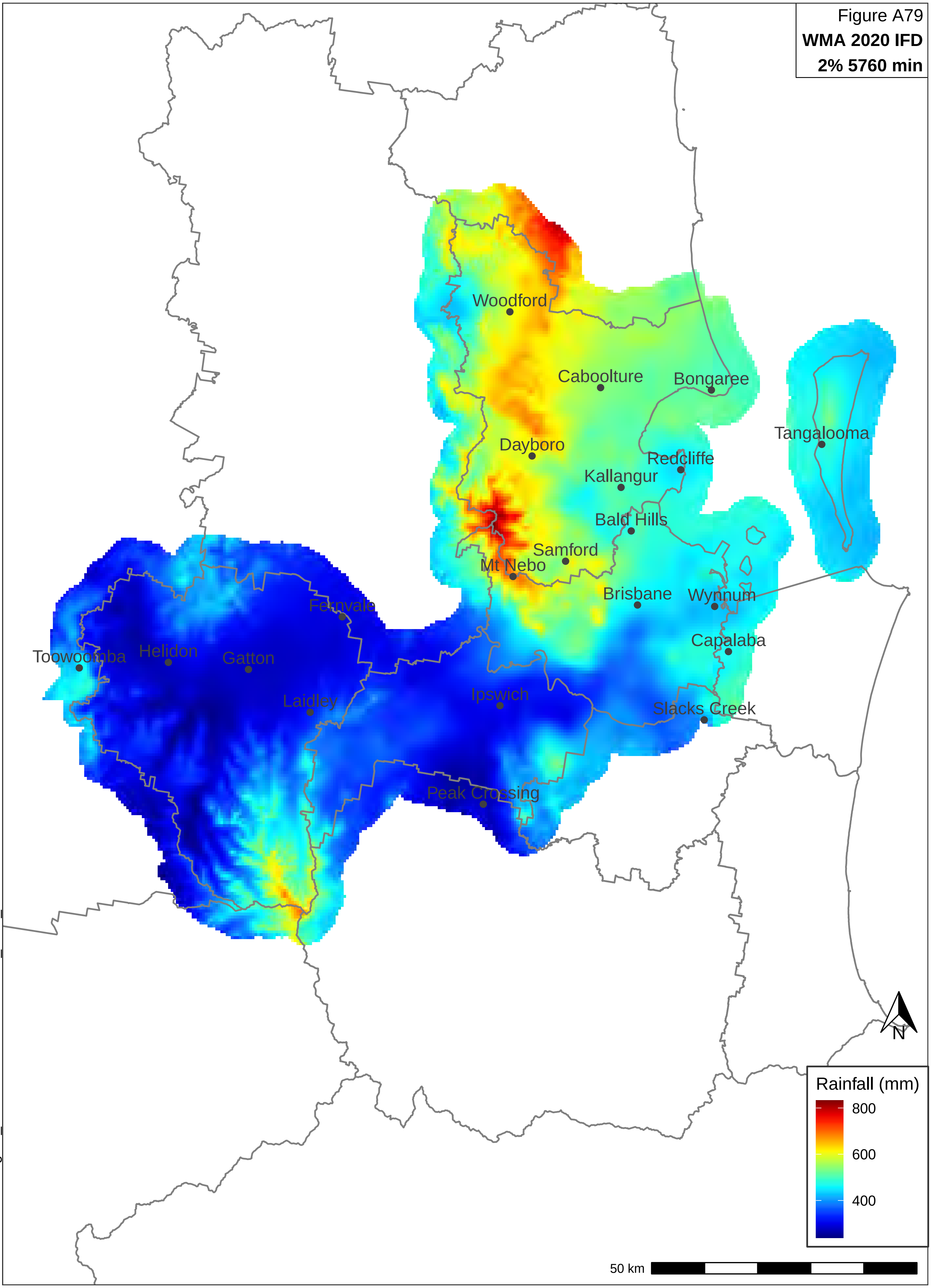


Figure A79
WMA 2020 IFD
2% 5760 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
800
600
400
50 km

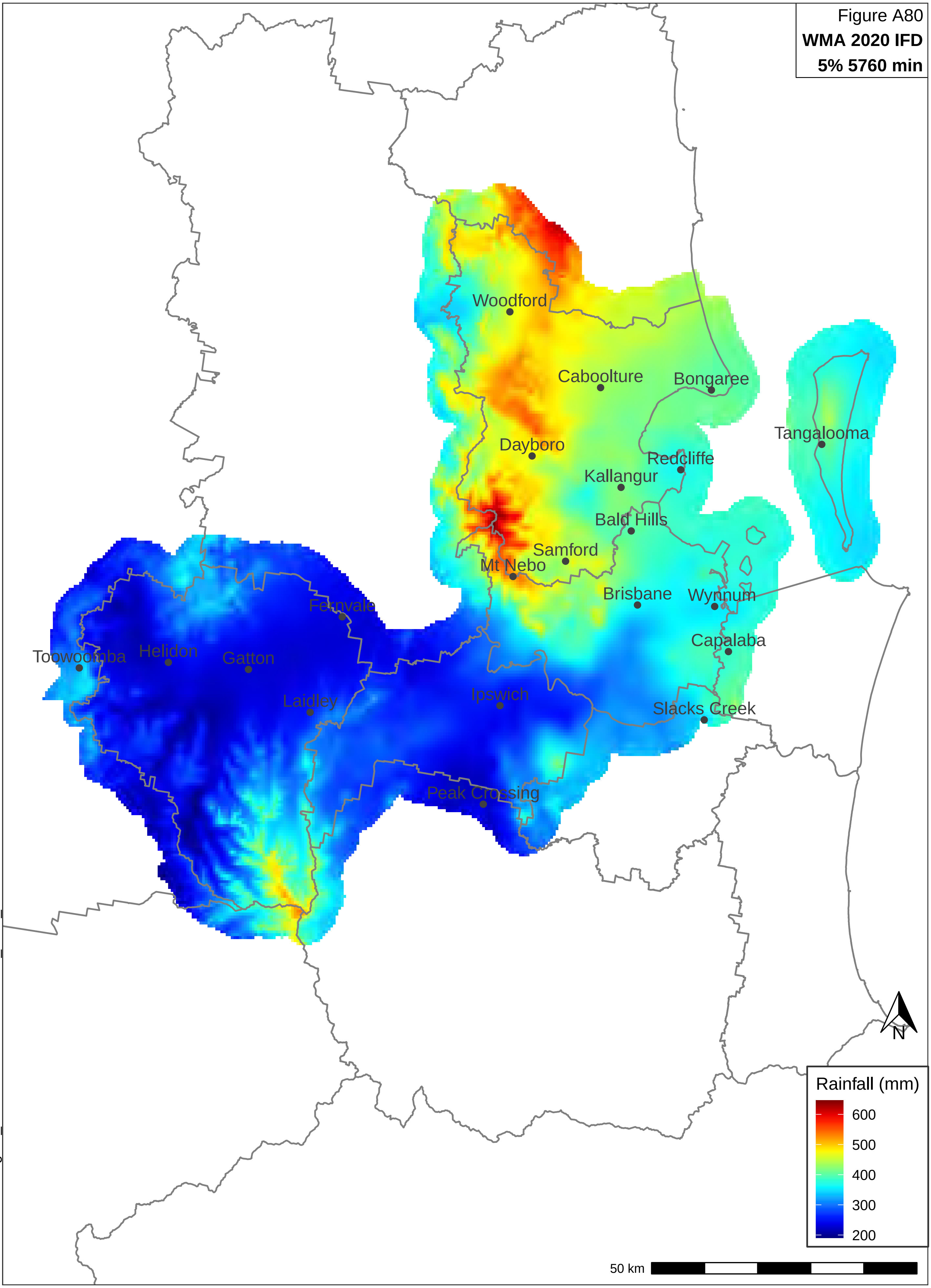


Figure A80
WMA 2020 IFD
5% 5760 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
Rainfall (mm)
600
500
400
300
200
50 km

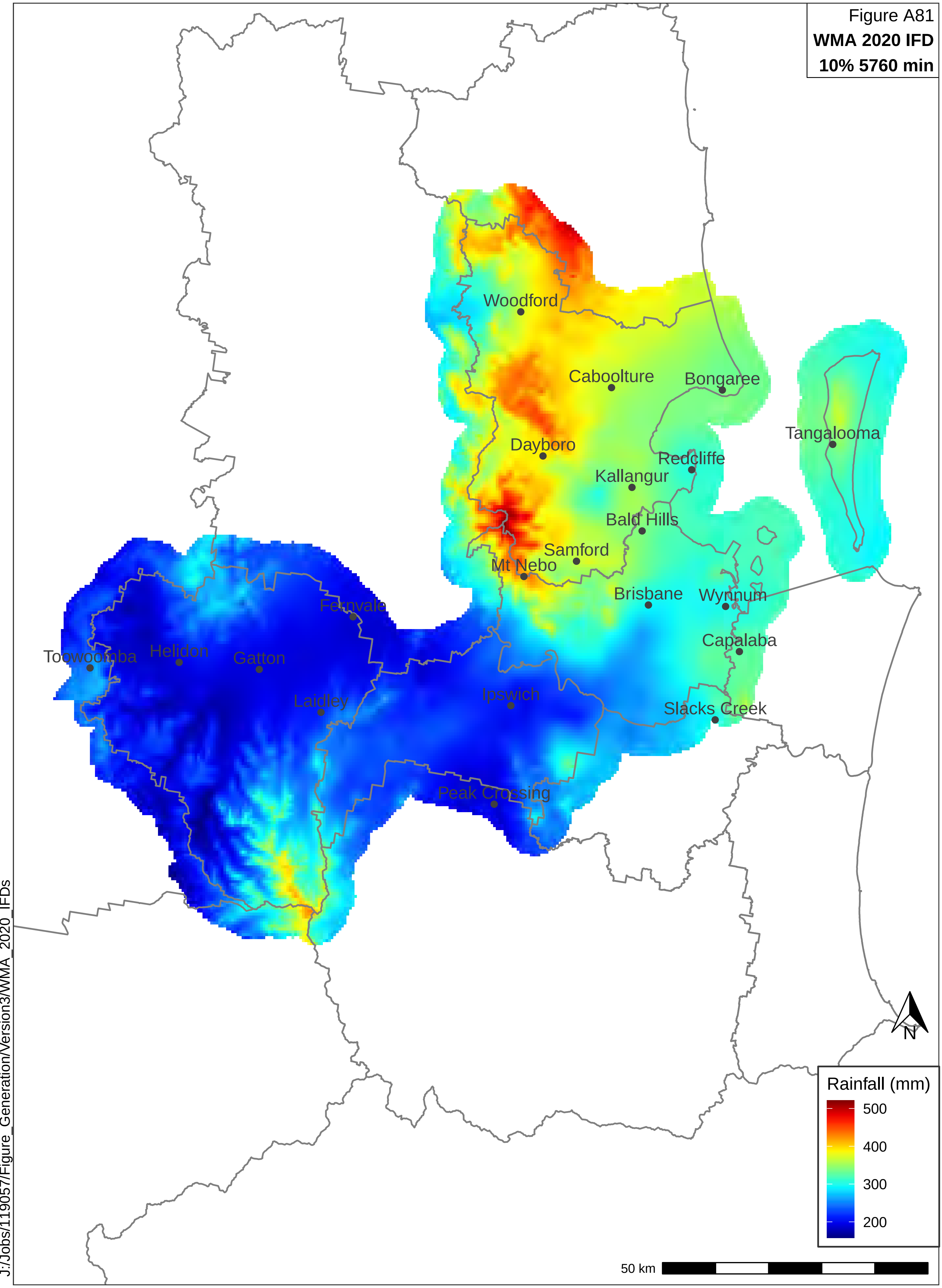
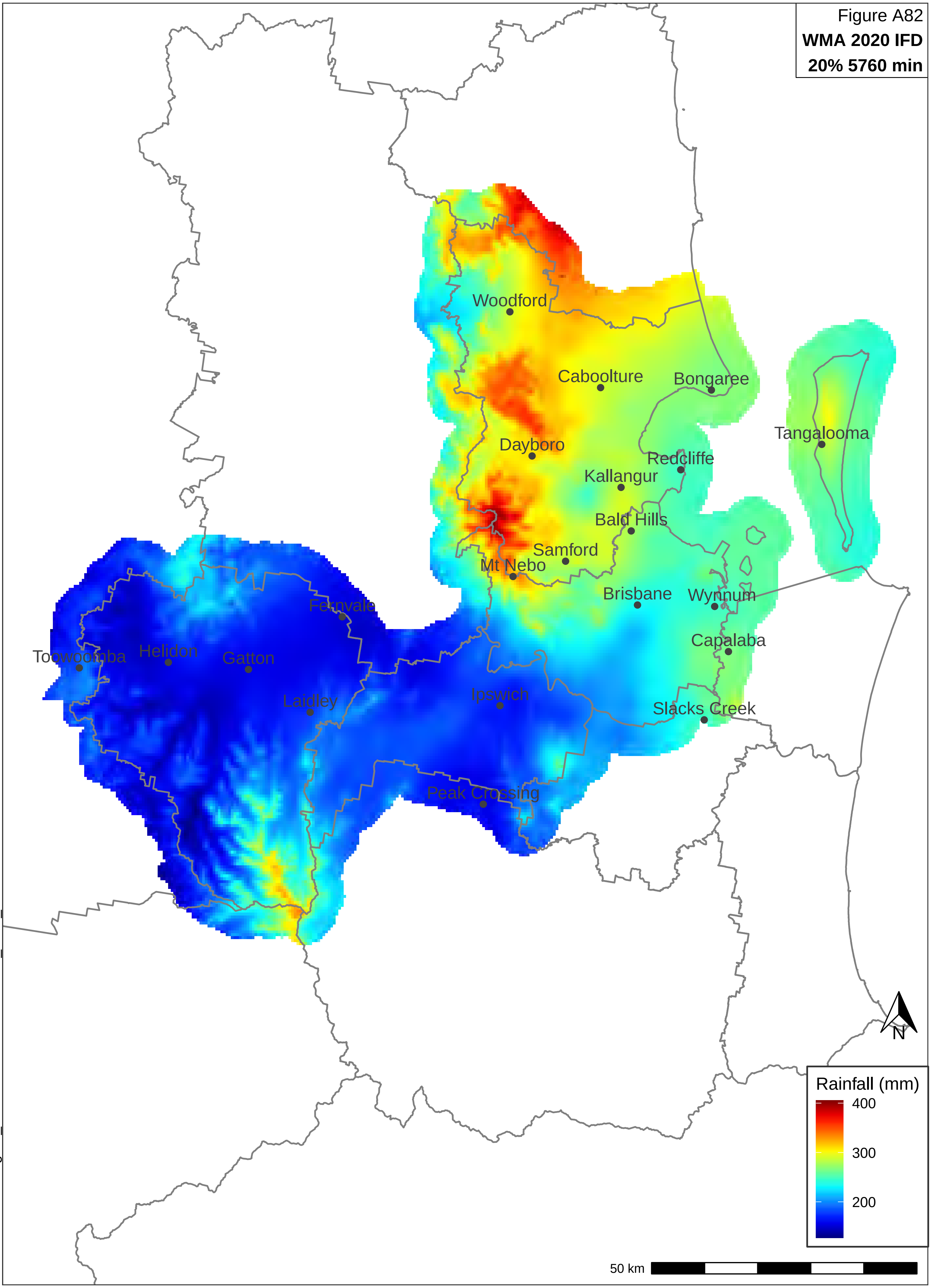
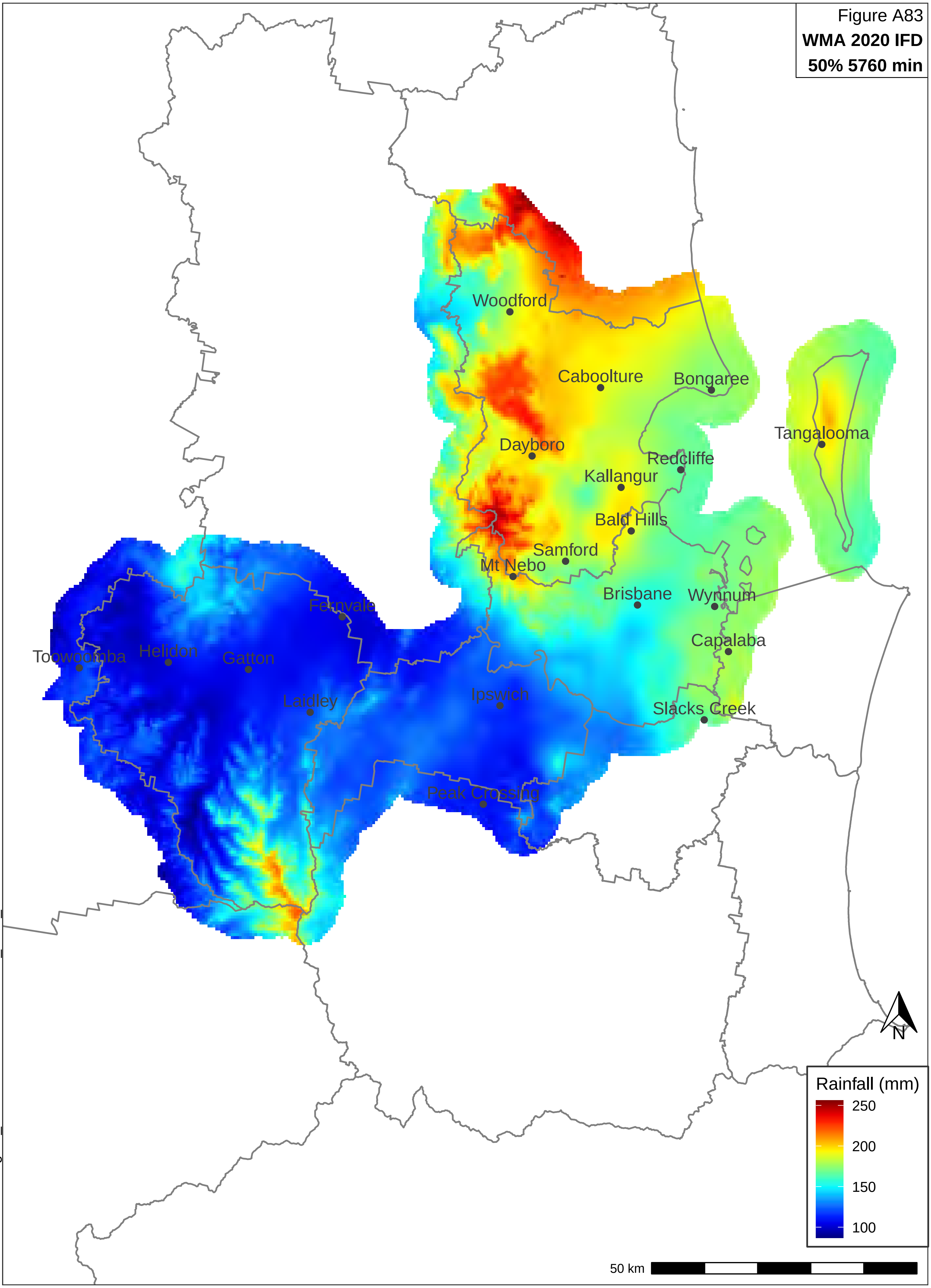


Figure A81
WMA 2020 IFD
10% 5760 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
Rainfall (mm)
500
400
300
200
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

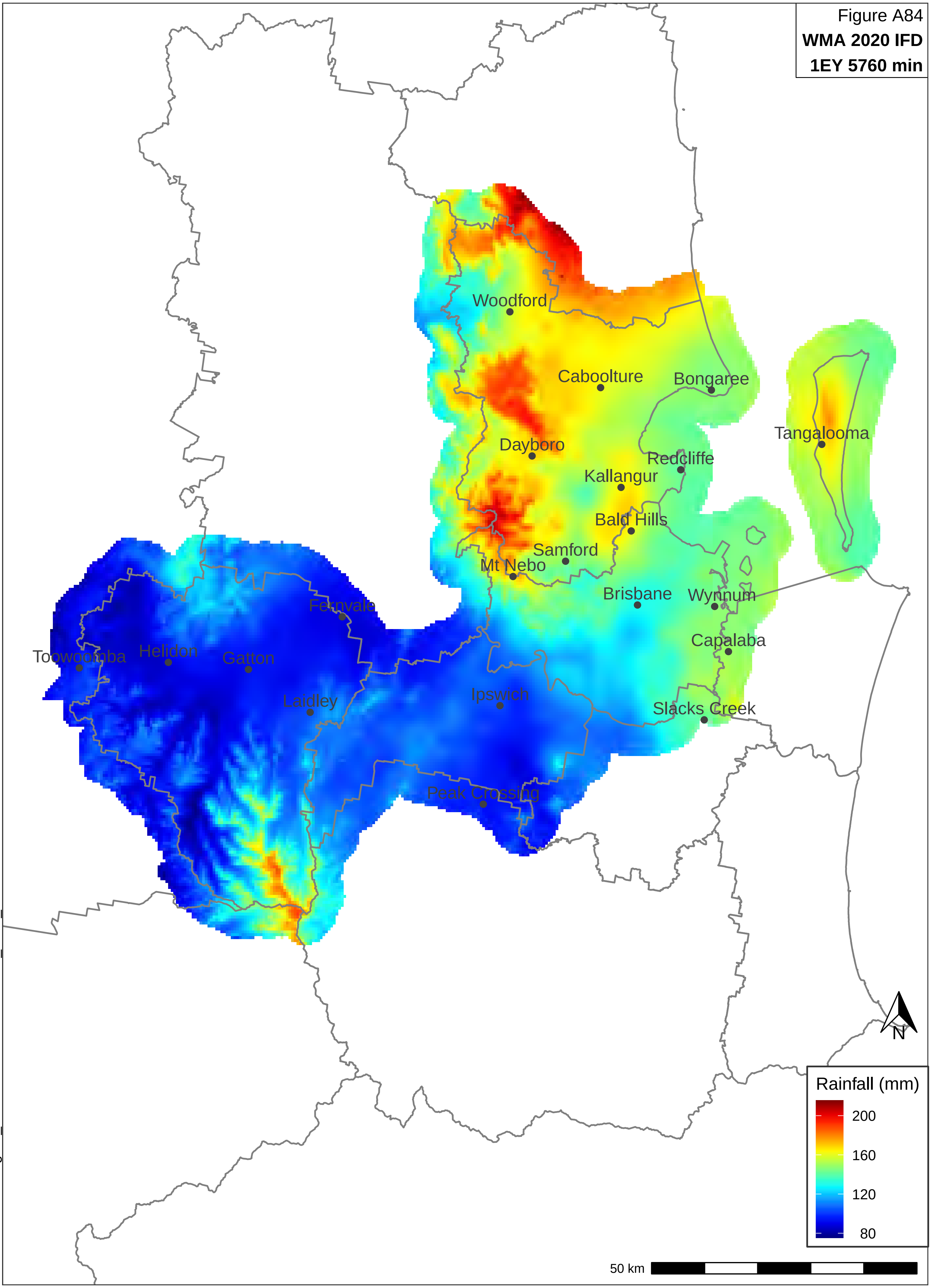
Figure A82
WMA 2020 IFD
20% 5760 min



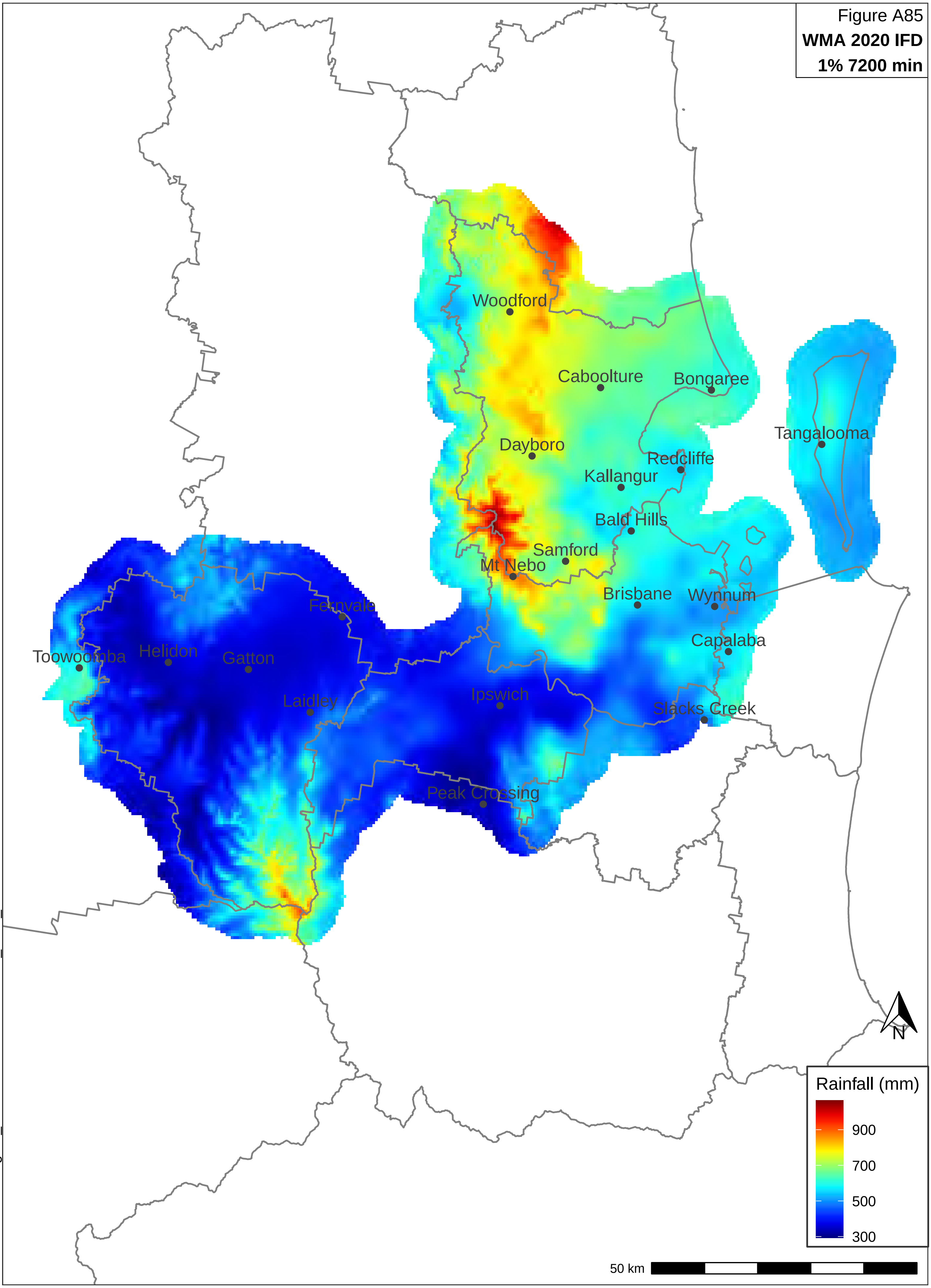
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



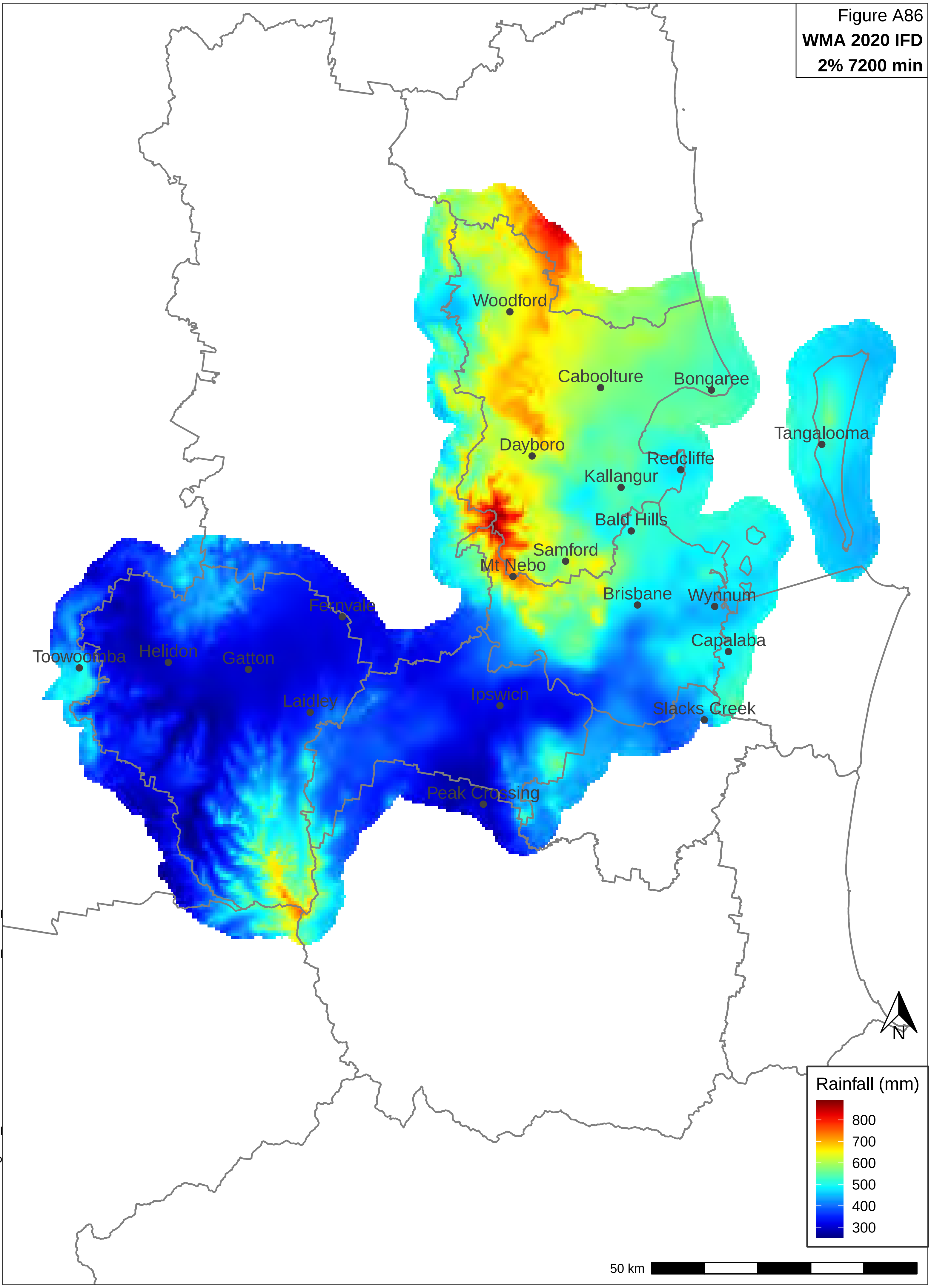
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

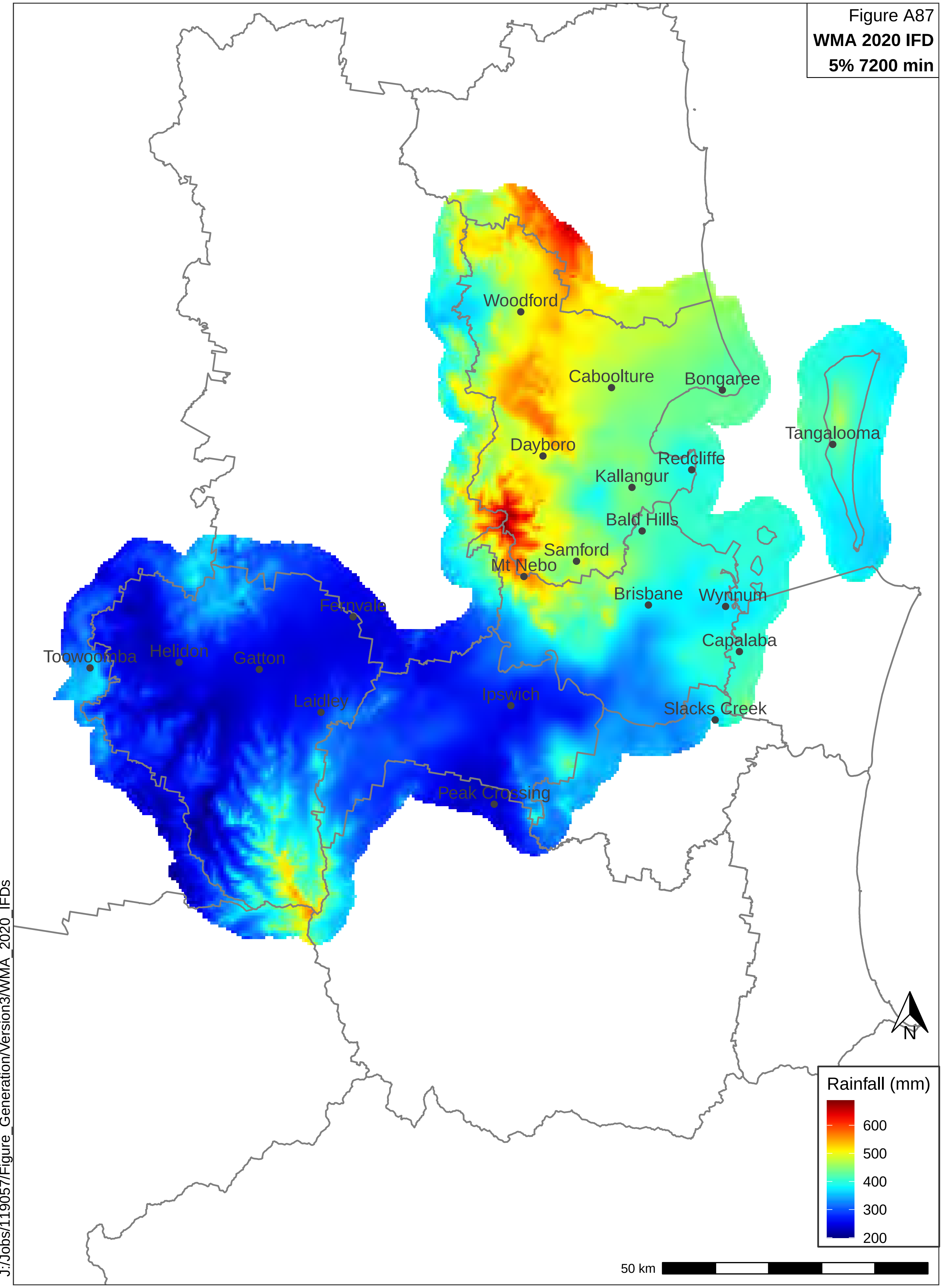


Figure A87
WMA 2020 IFD
5% 7200 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
600
500
400
300
200
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

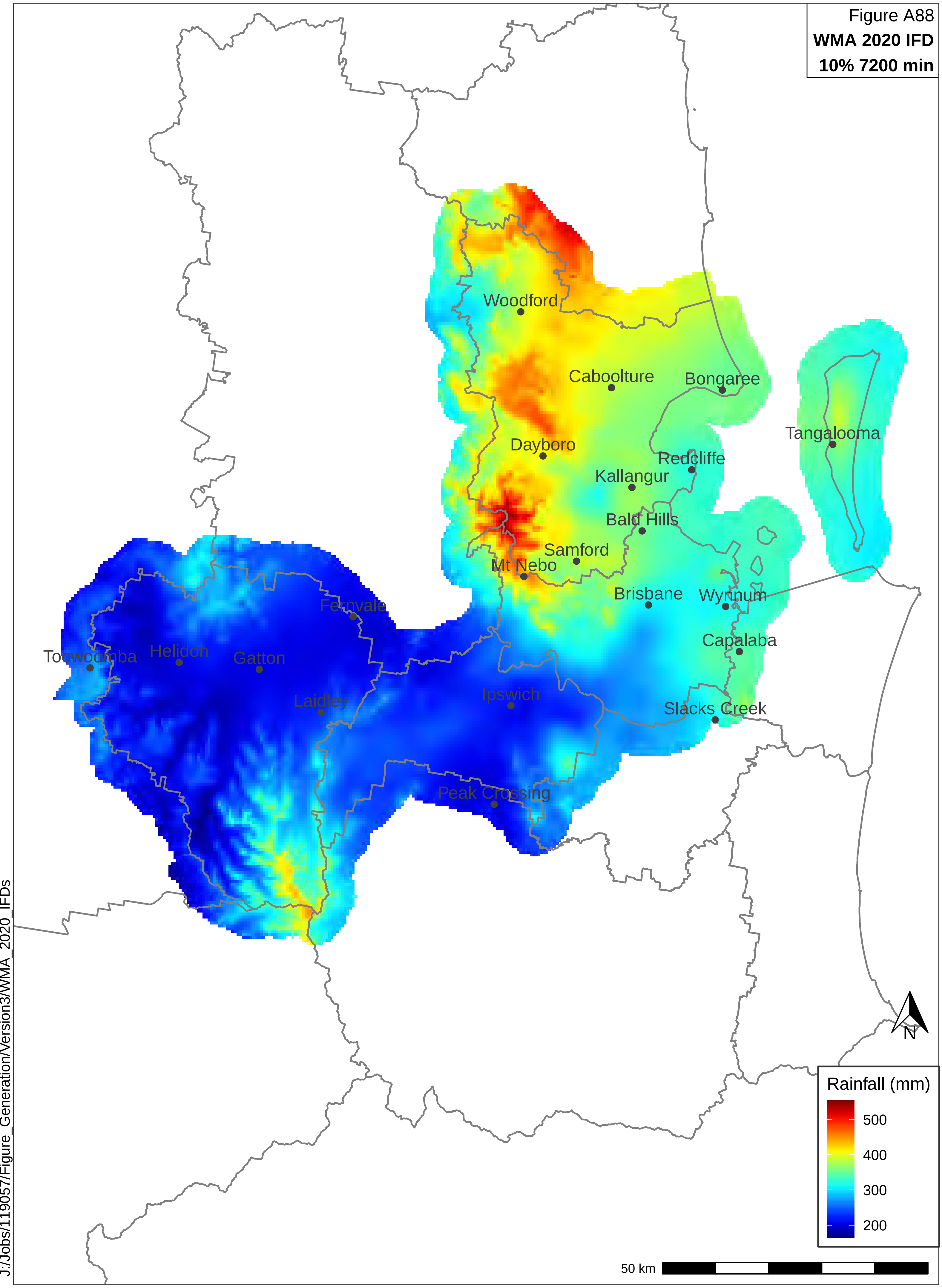


Figure A88
WMA 2020 IFD
10% 7200 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
500
400
300
200
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

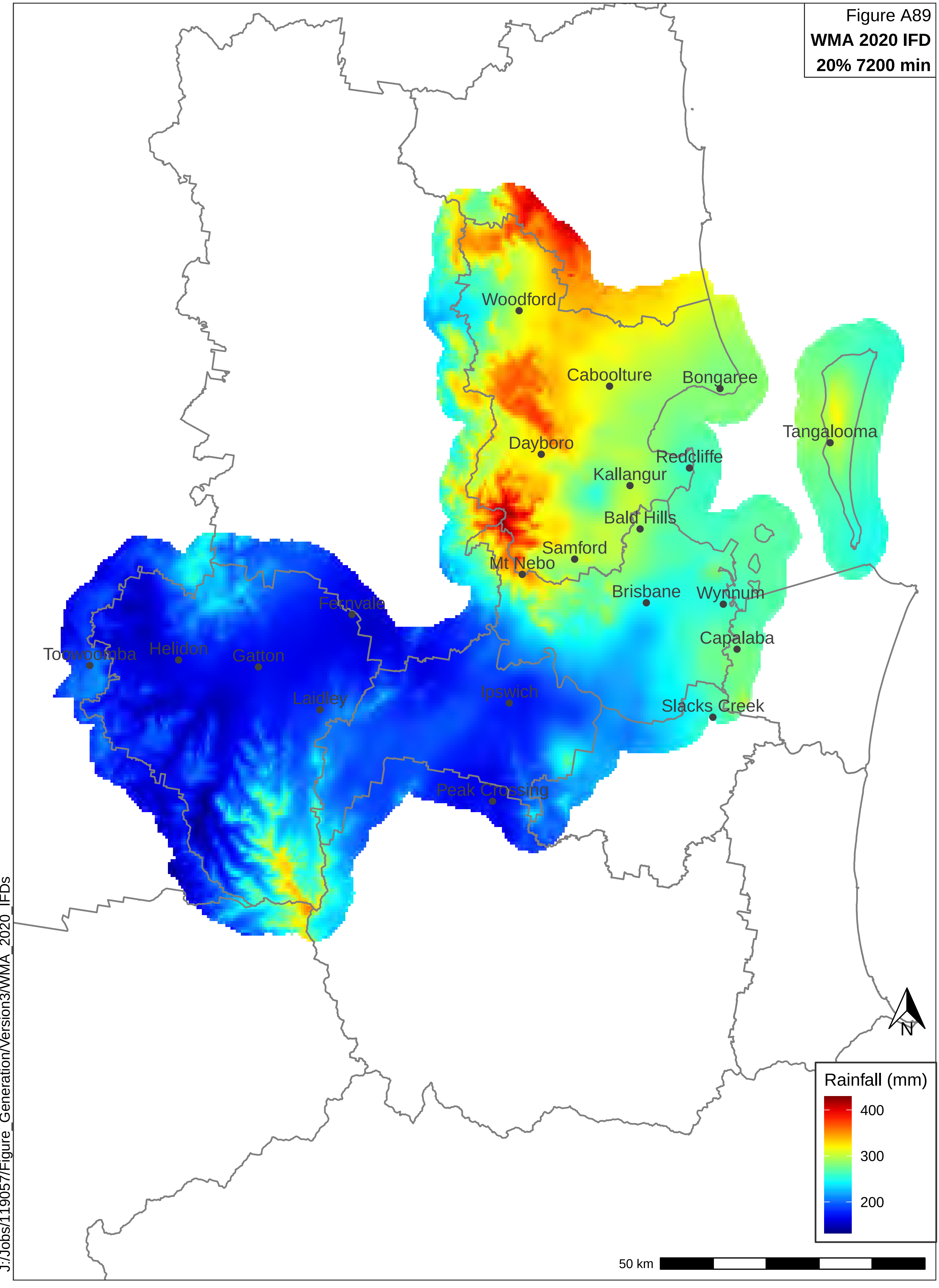
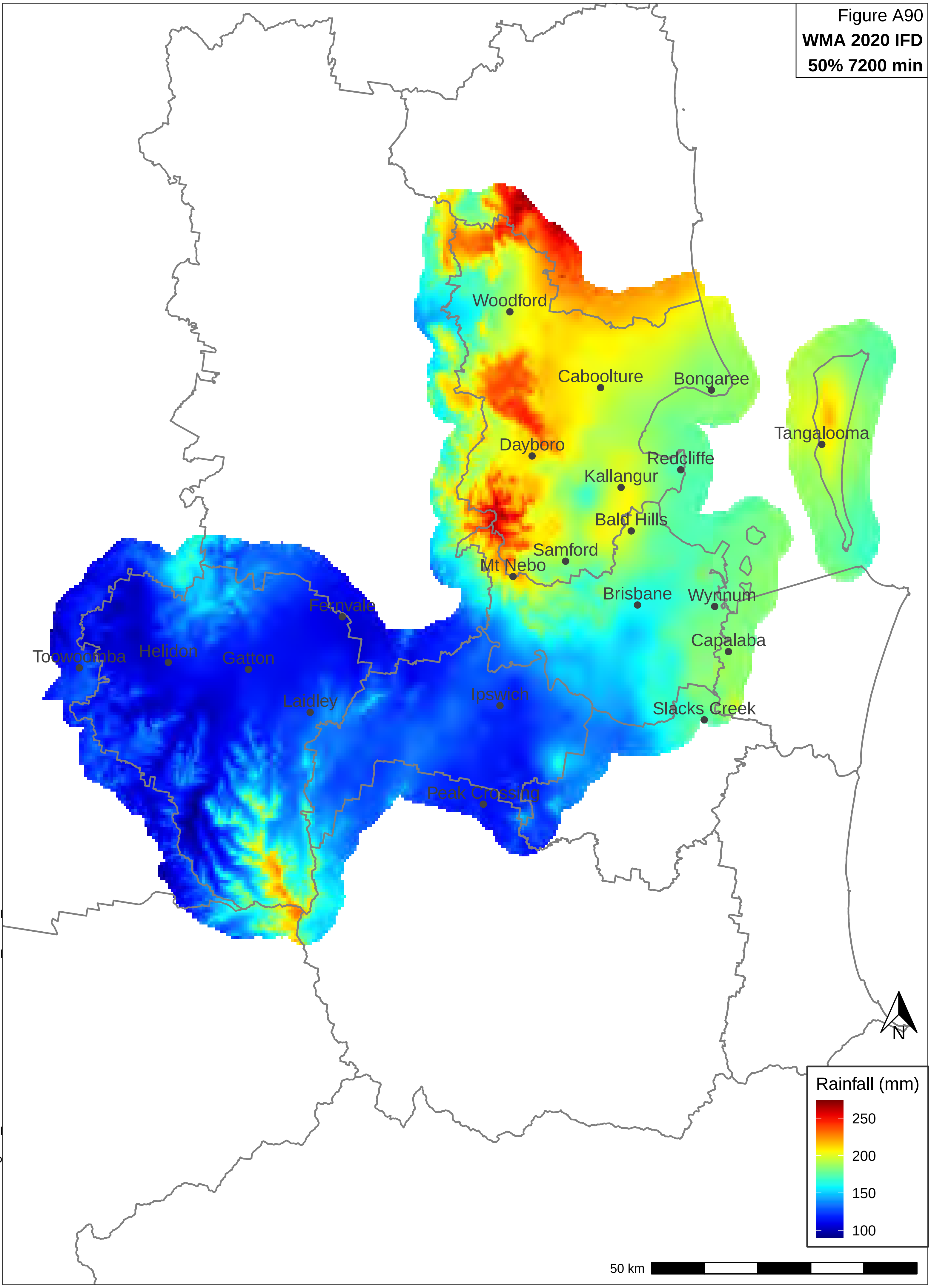
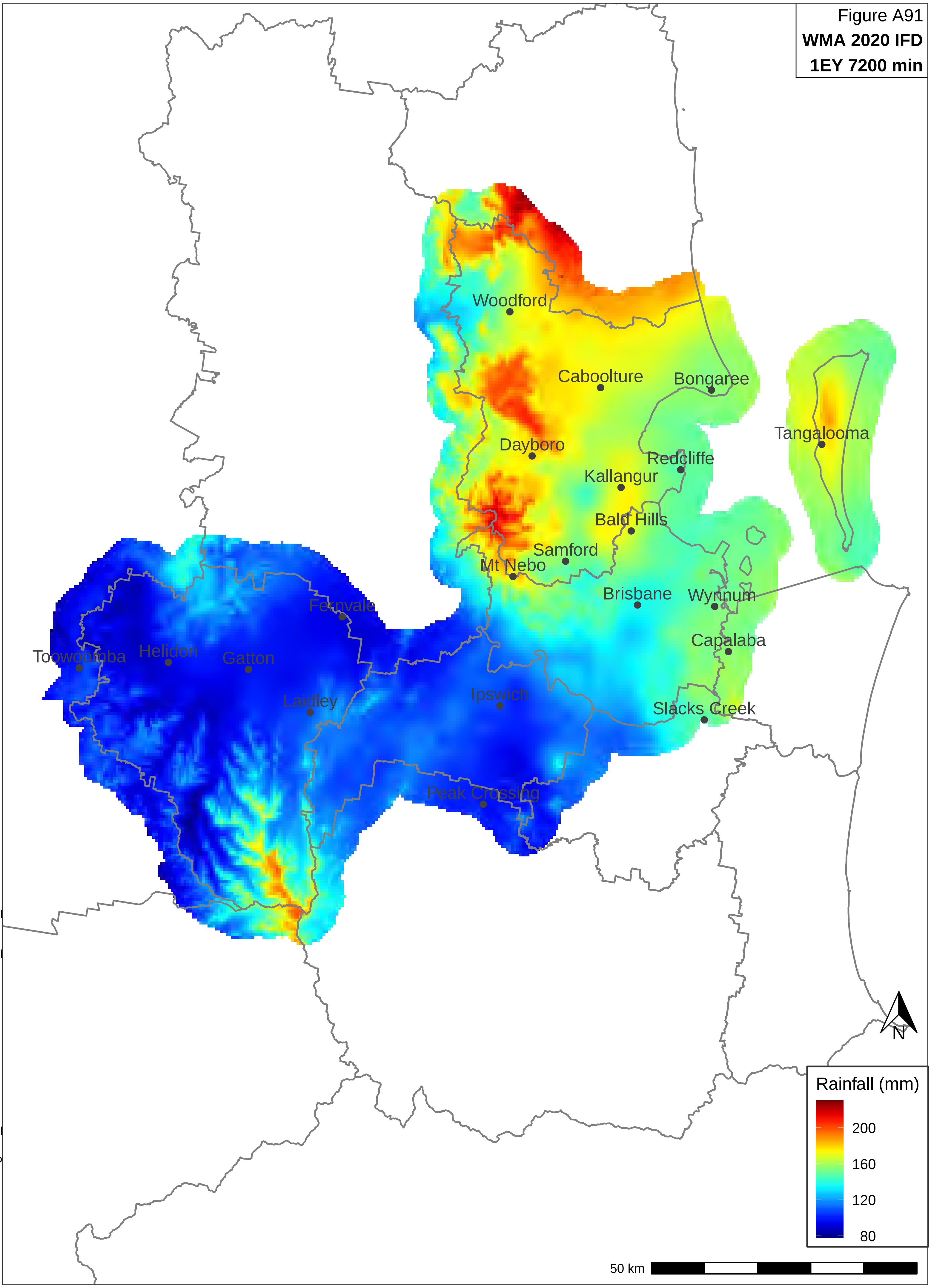


Figure A89
WMA 2020 IFD
20% 7200 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
Rainfall (mm)
400
300
200
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

Figure A91
WMA 2020 IFD
1EY 7200 min



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

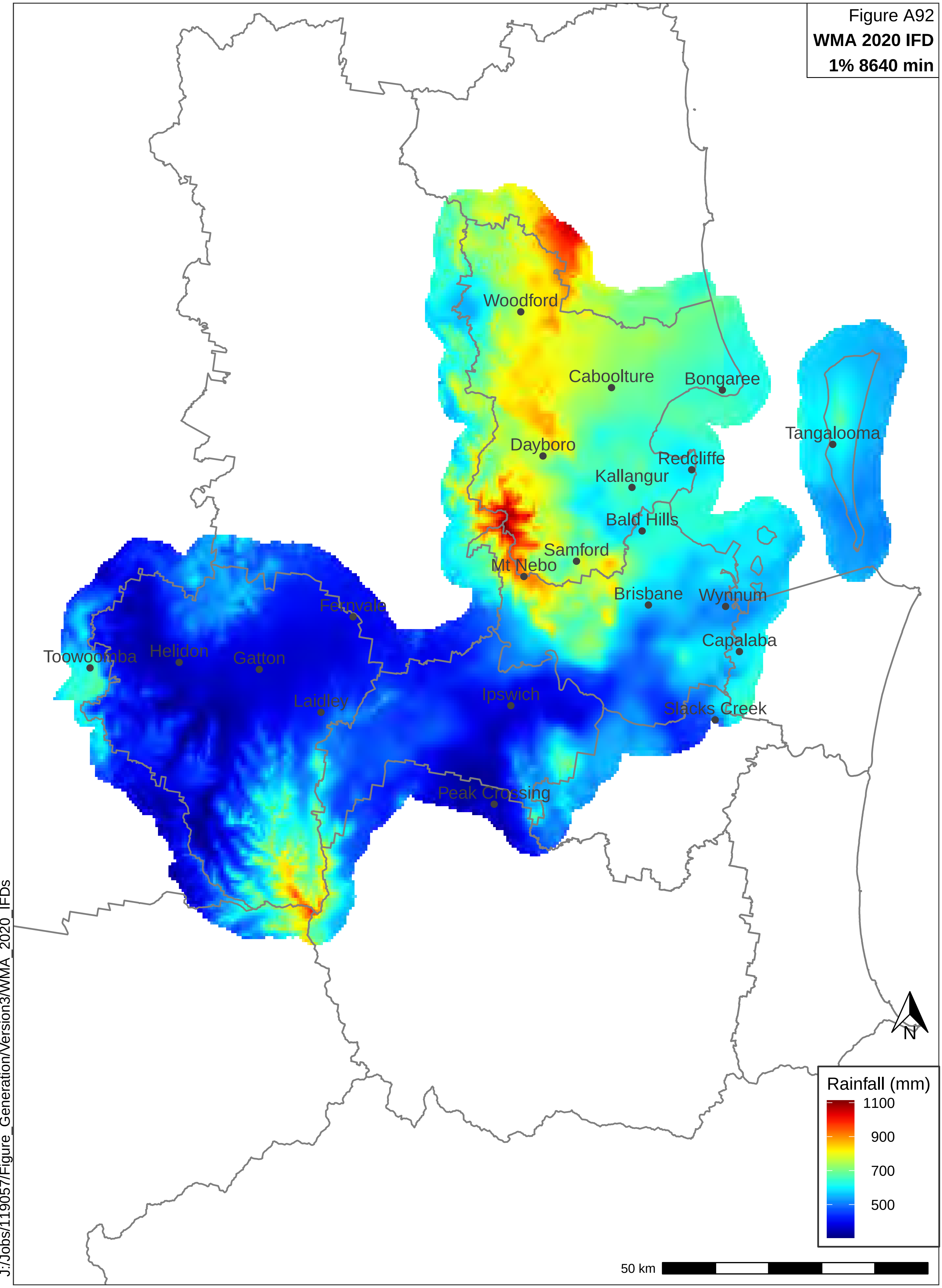


Figure A92
WMA 2020 IFD
1% 8640 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
1100
900
700
500
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

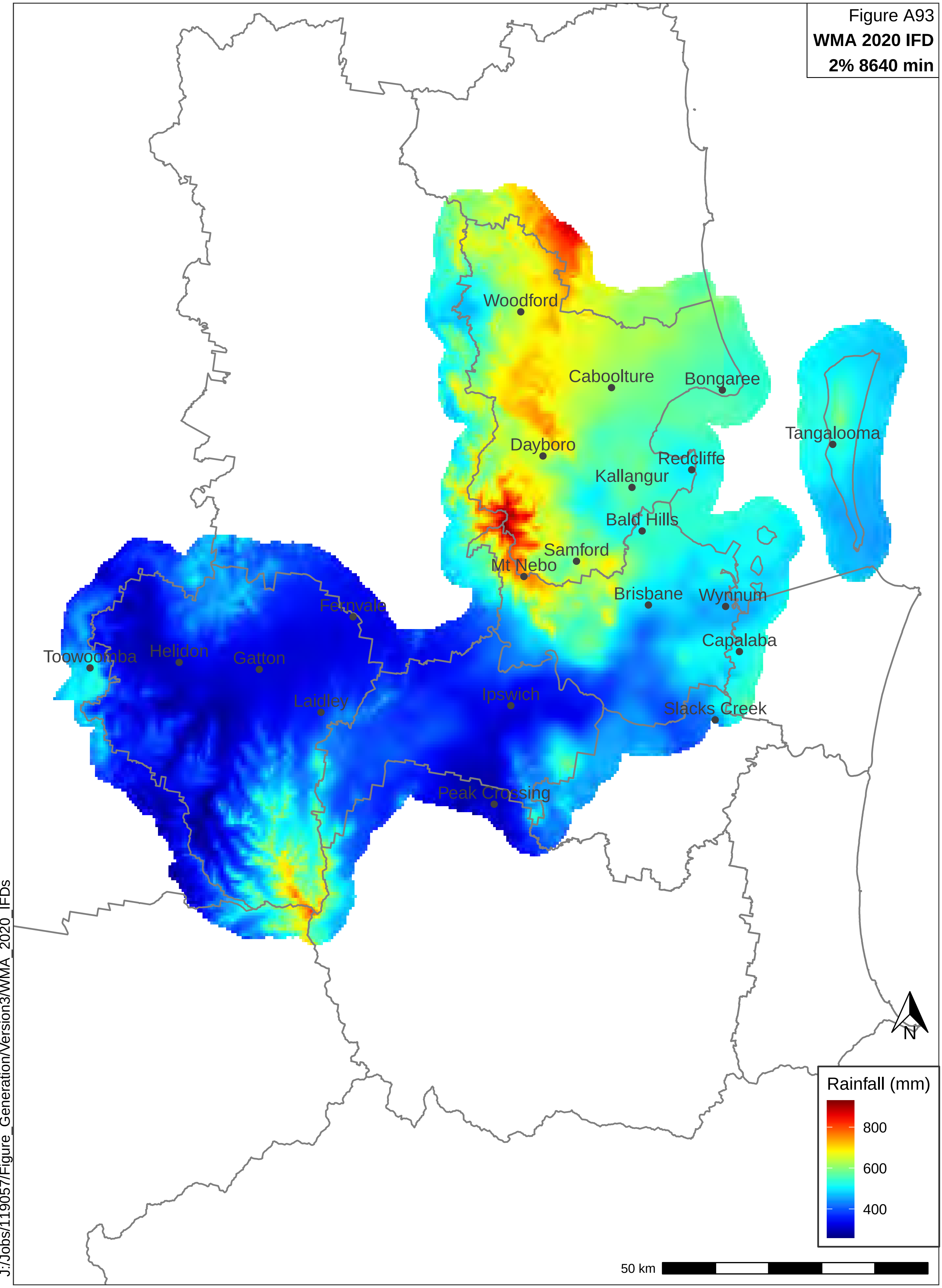
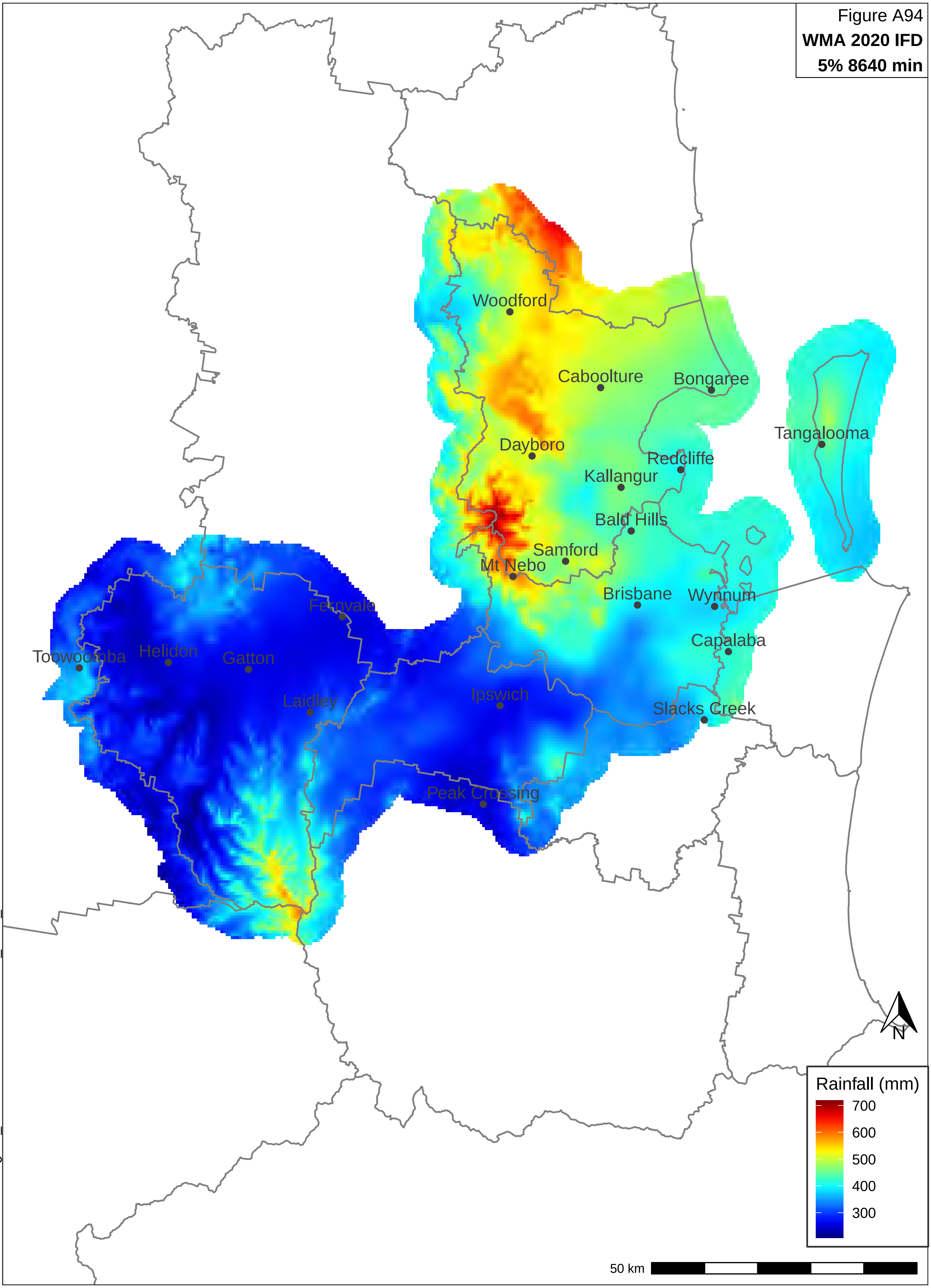


Figure A93
WMA 2020 IFD
2% 8640 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
Rainfall (mm)
800
600
400
N
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

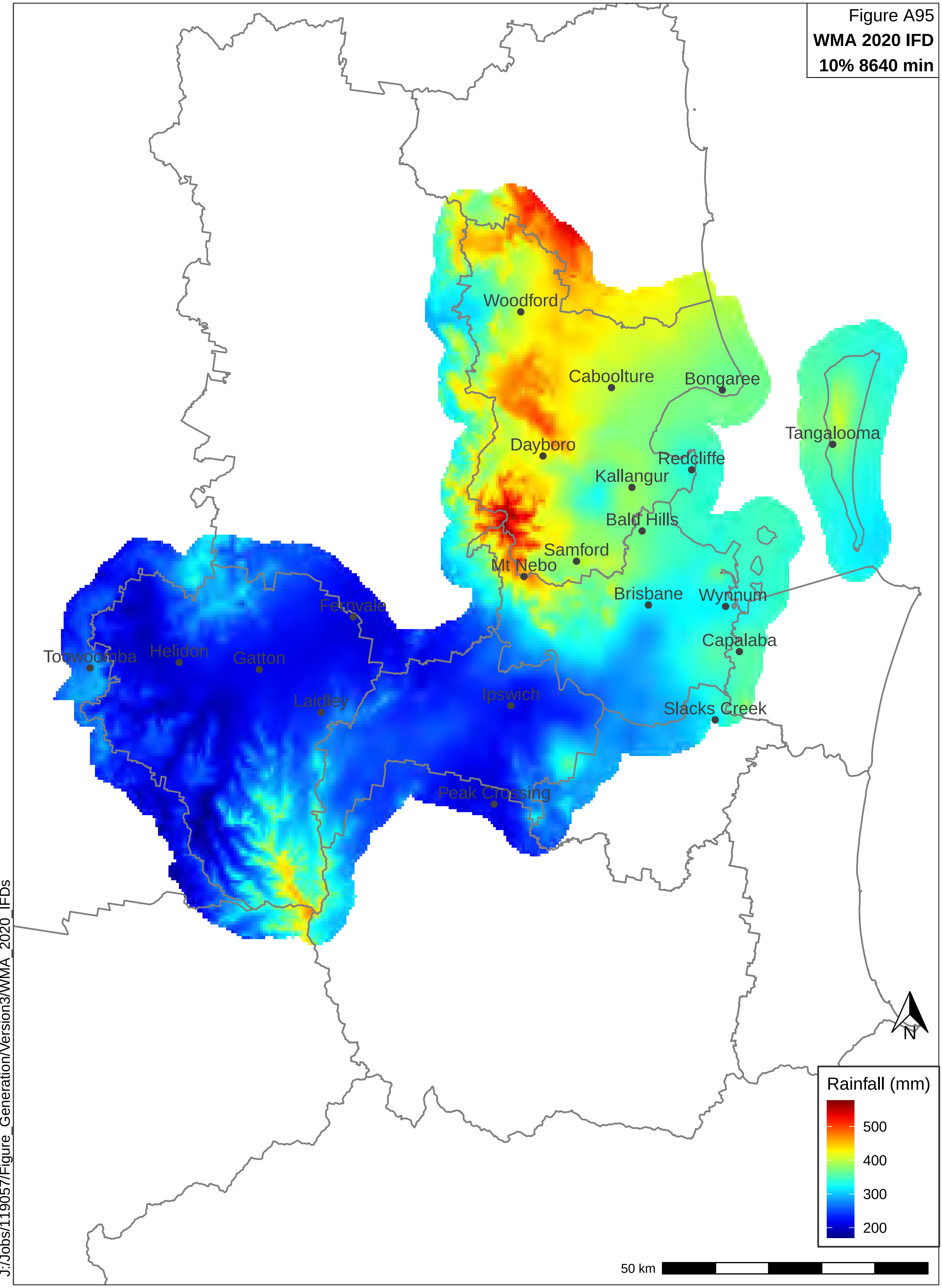
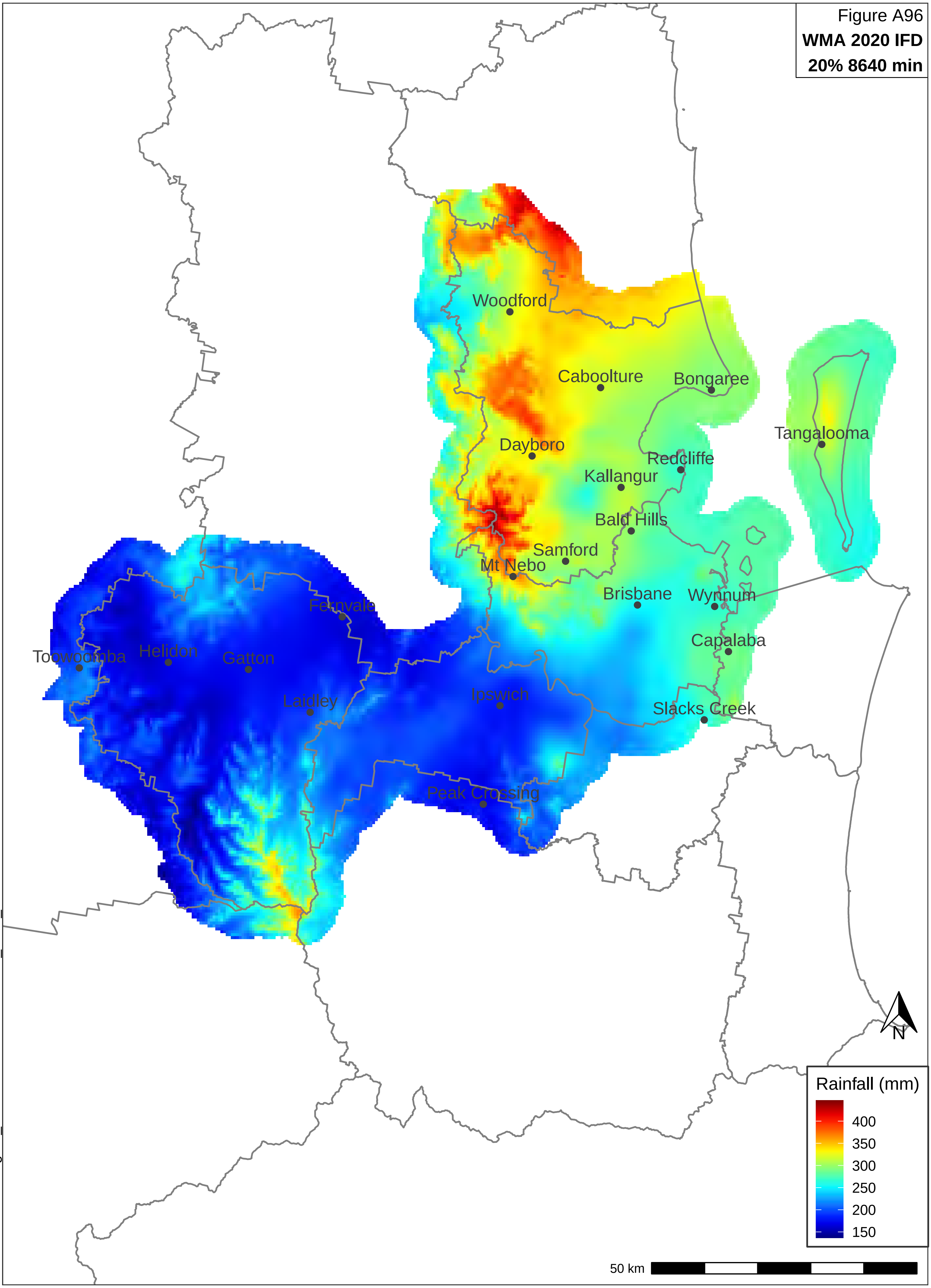


Figure A95
WMA 2020 IFD
10% 8640 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
500
400
300
200
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

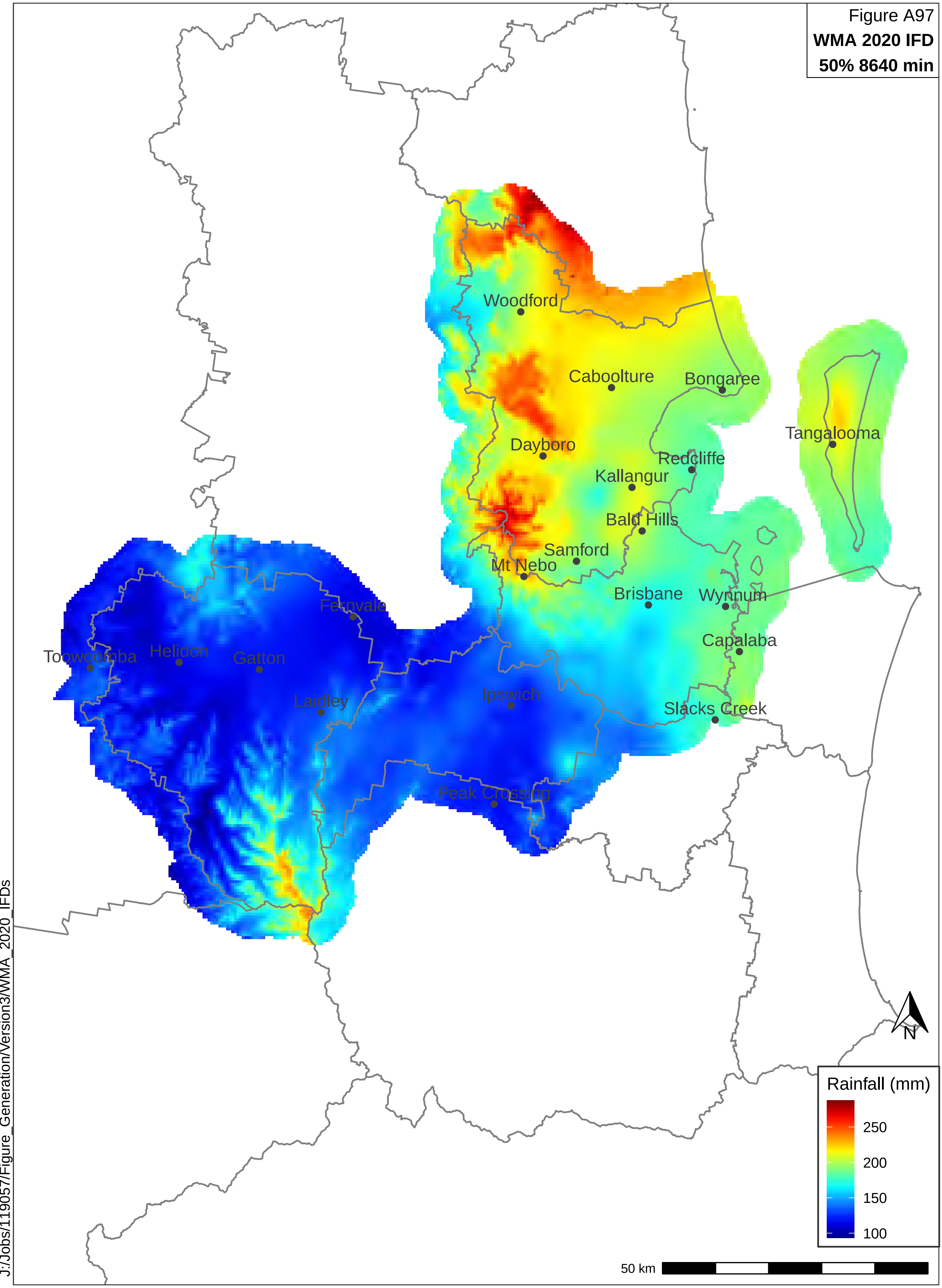


Figure A97
WMA 2020 IFD
50% 8640 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
250
200
150
100
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

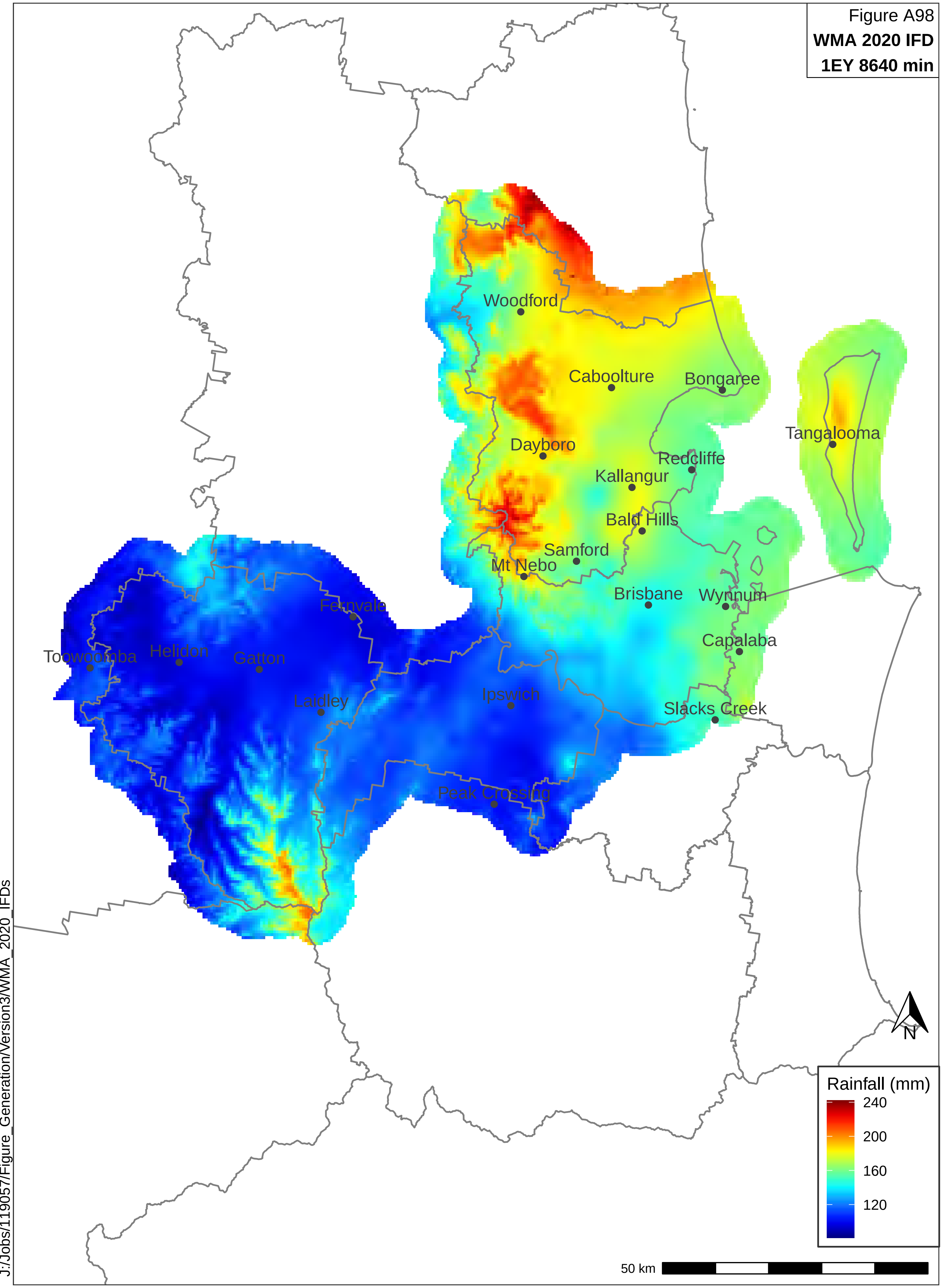


Figure A98
WMA 2020 IFD
1EY 8640 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
240
200
160
120
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

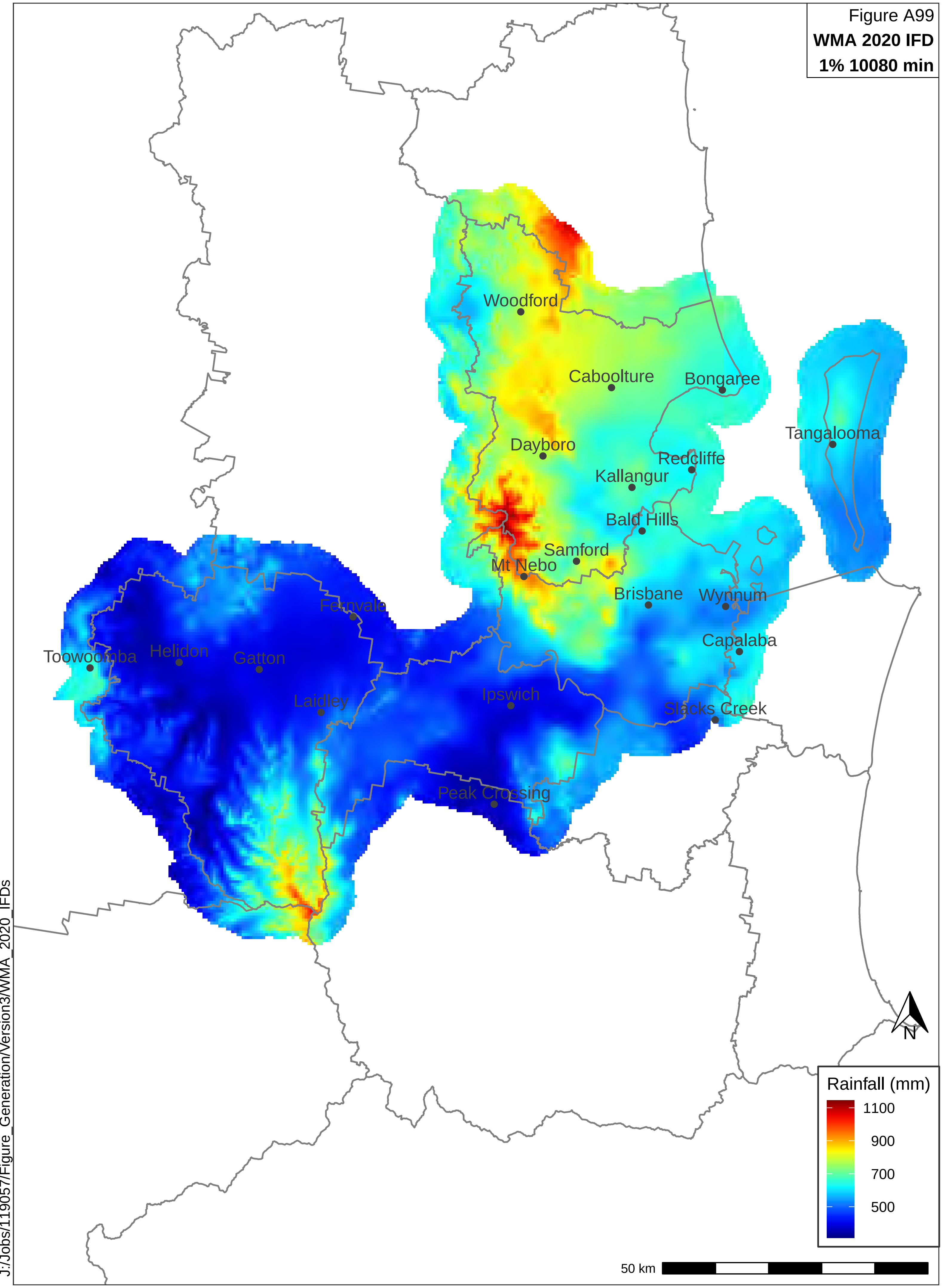
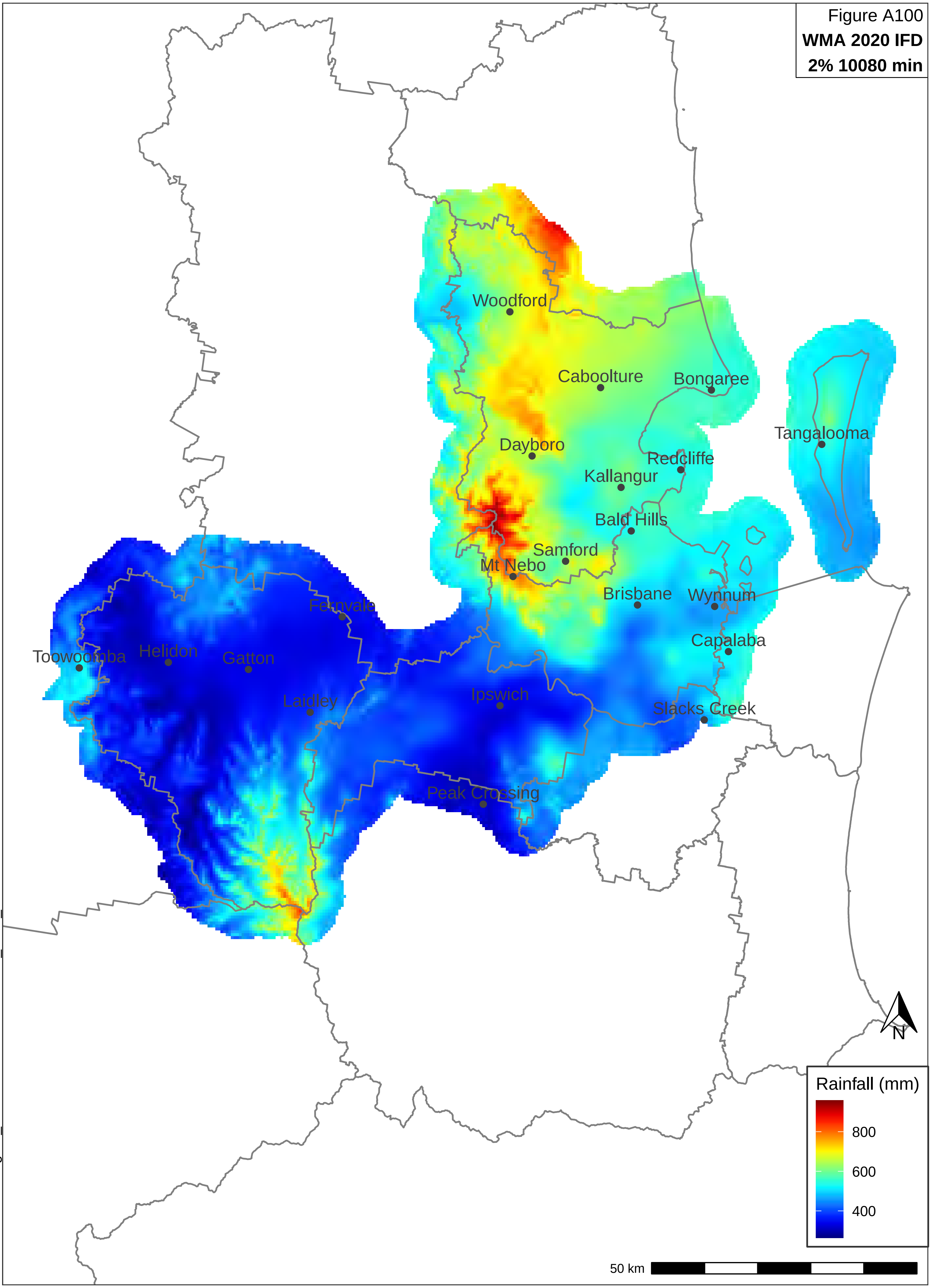


Figure A99
WMA 2020 IFD
1% 10080 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
1100
900
700
500
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

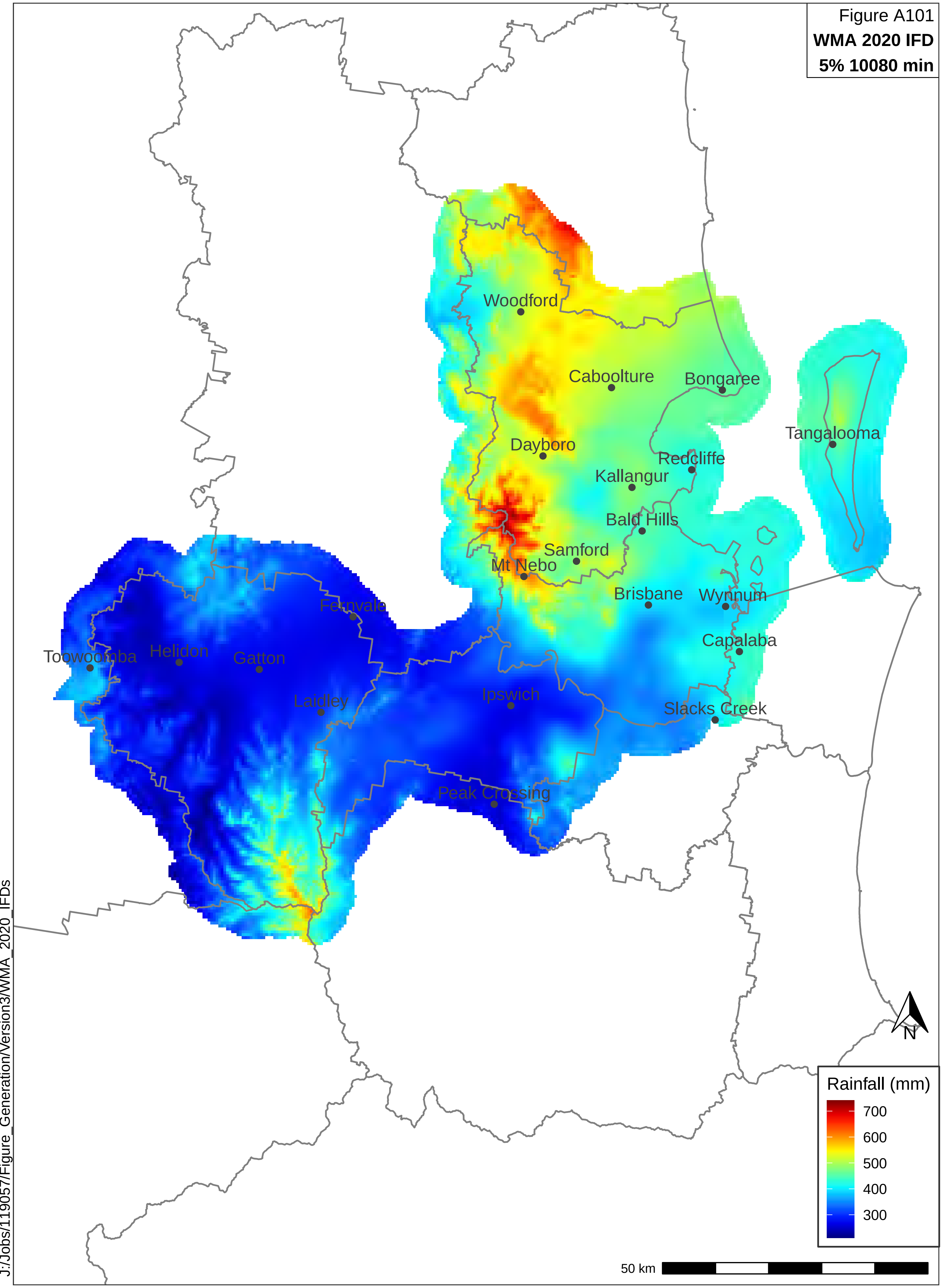


Figure A101
WMA 2020 IFD
5% 10080 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
700
600
500
400
300
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

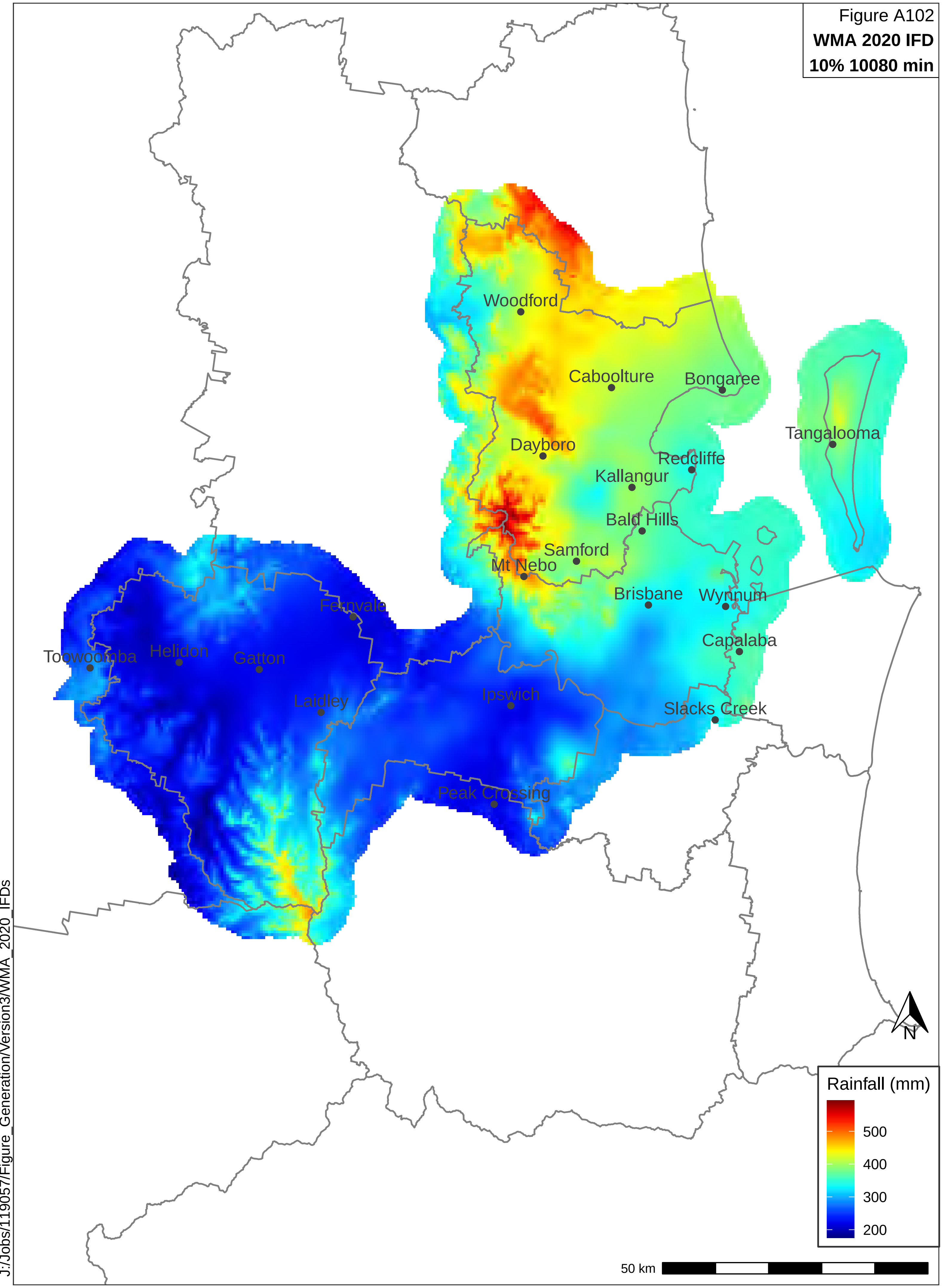


Figure A102
WMA 2020 IFD
10% 10080 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
Rainfall (mm)
500
400
300
200
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

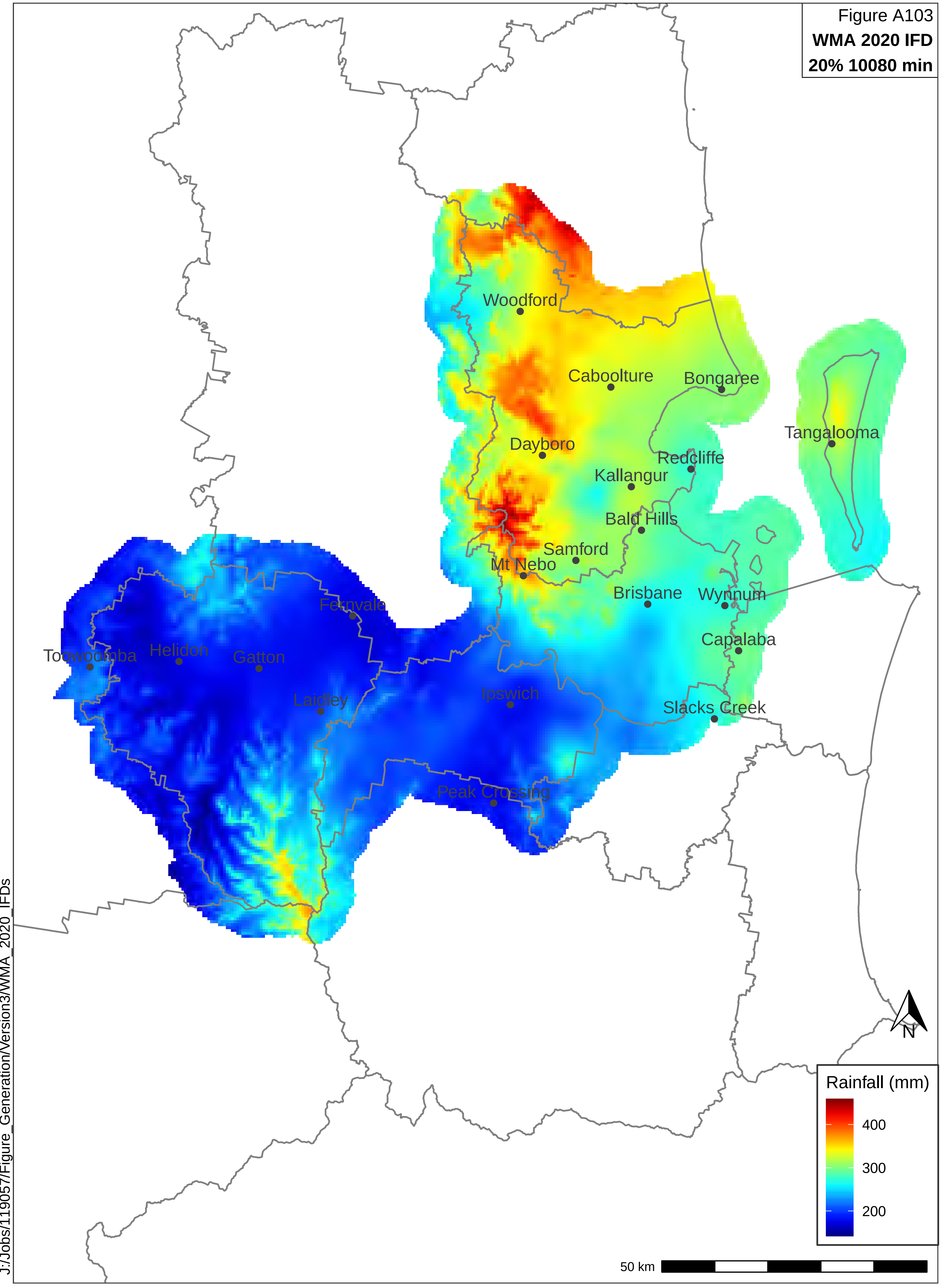
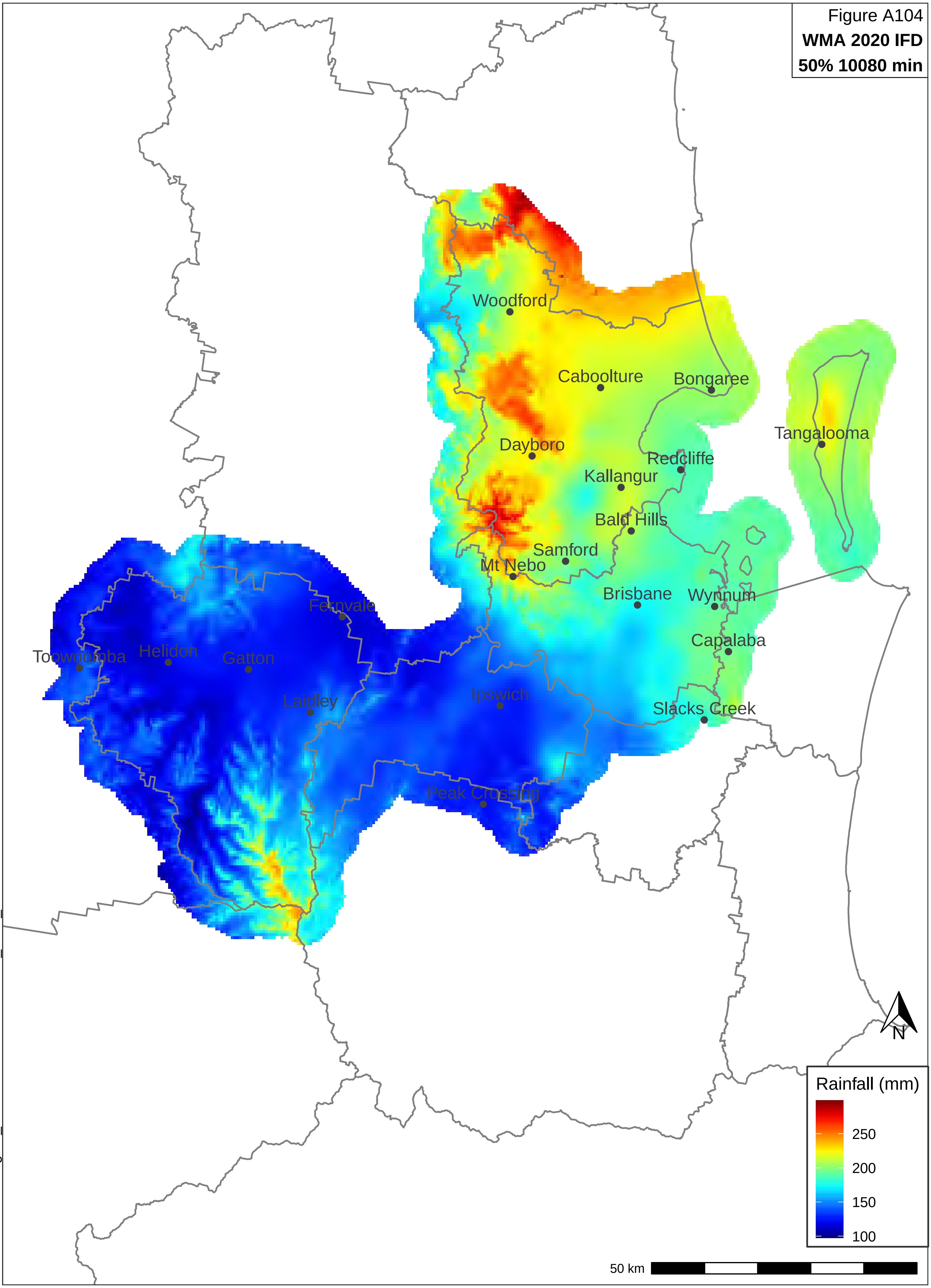


Figure A103
WMA 2020 IFD
20% 10080 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
Rainfall (mm)
400
300
200
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs



J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

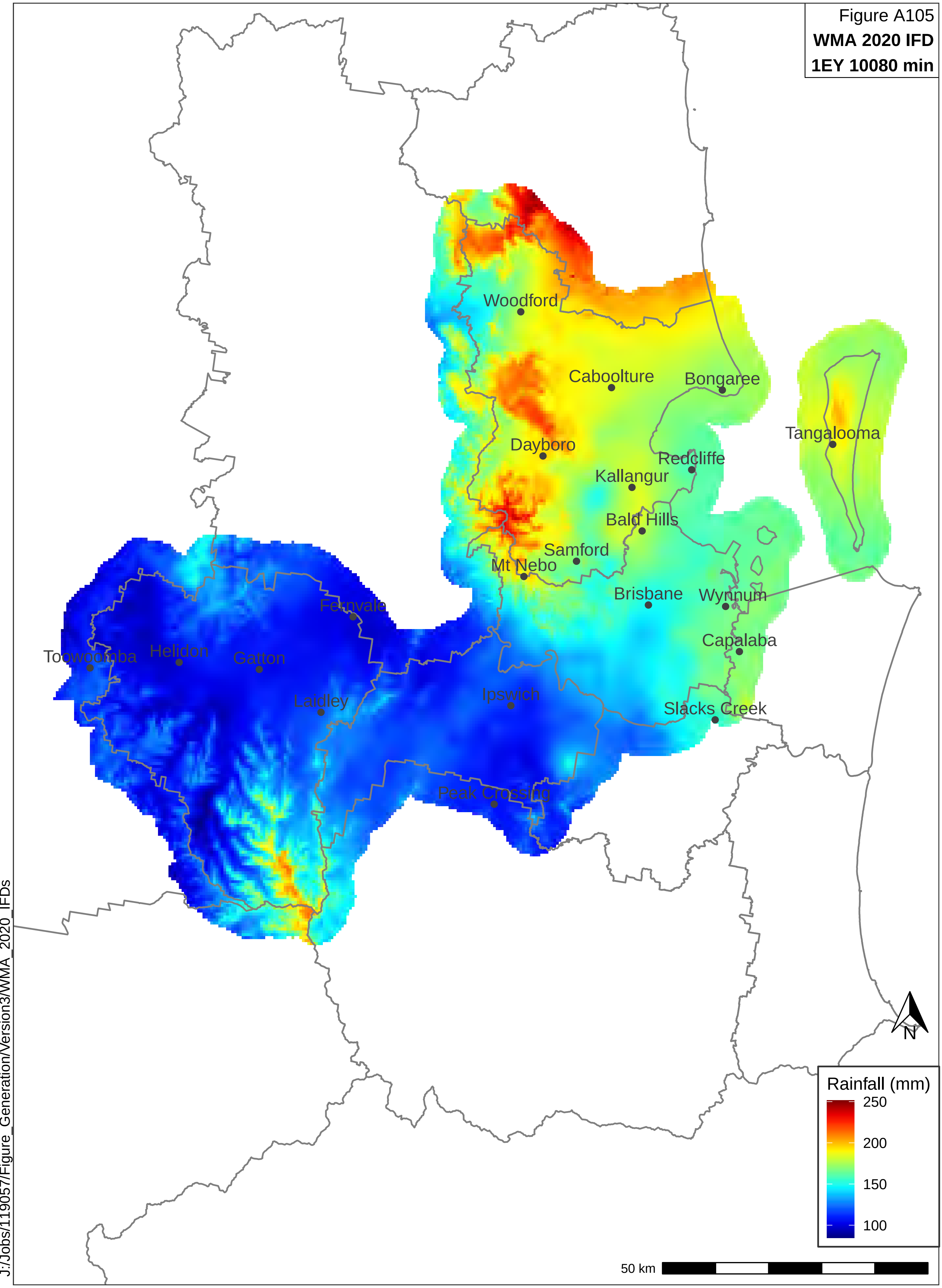


Figure A105
WMA 2020 IFD
1EY 10080 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
Rainfall (mm)
250
200
150
100
50 km
J:/Jobs/119057/Figure_Generation/Version3/WMA_2020_IFDs

Appendix B

APPENDIX B. Gridded percent difference WMA 2020 to BOM 2016 IFDs

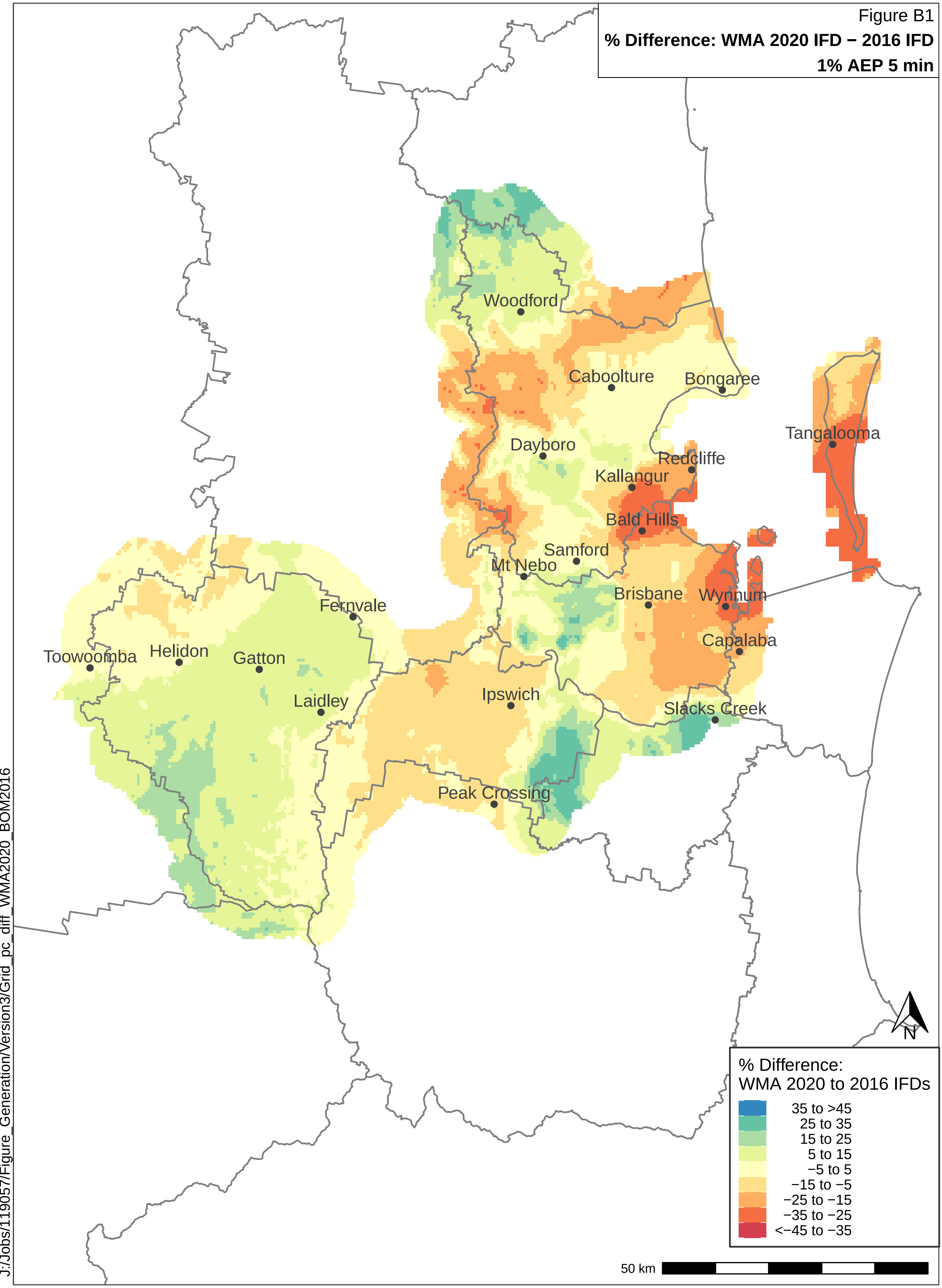
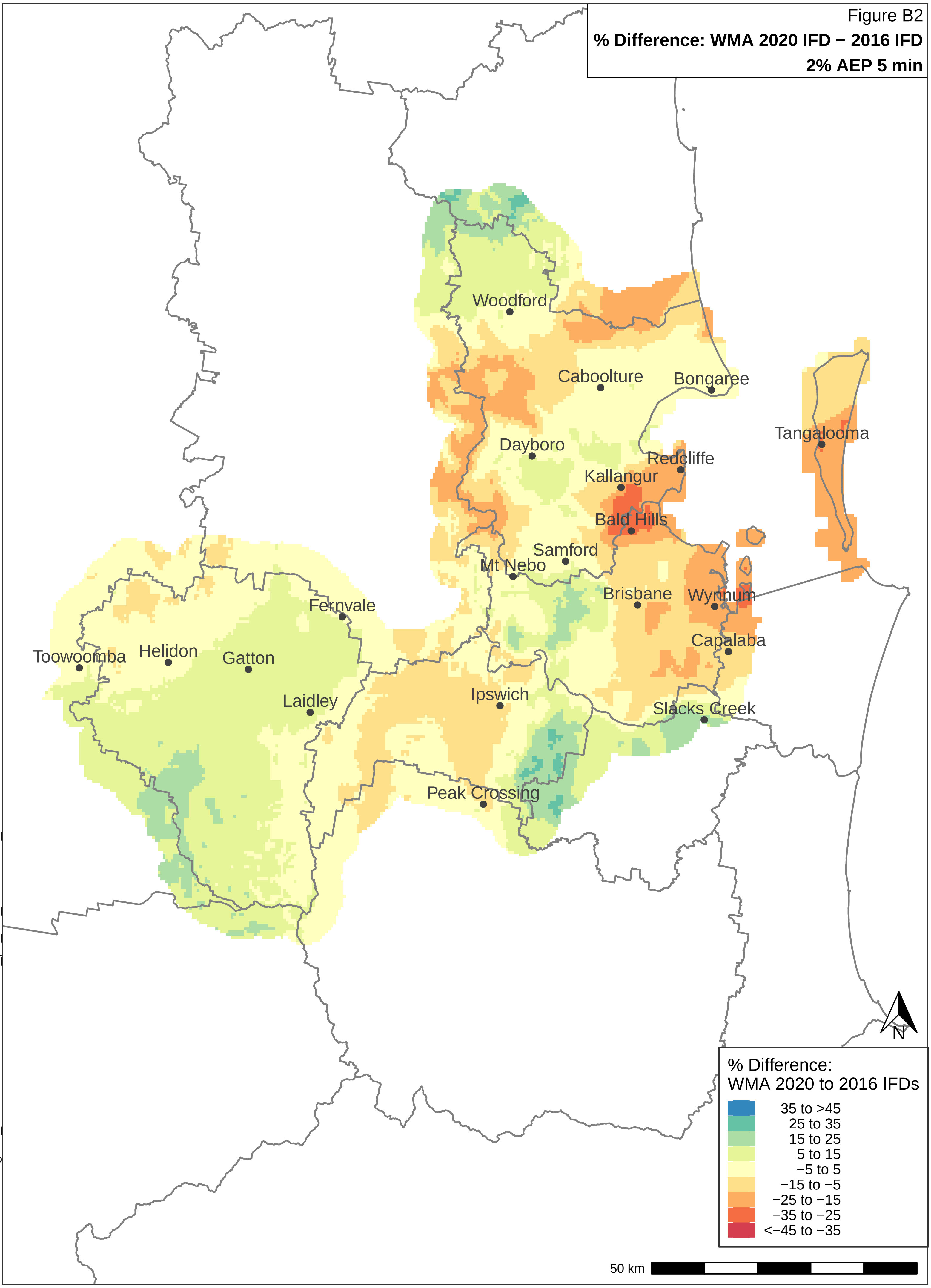


Figure B1
% Difference: WMA 2020 IFD − 2016 IFD
1% AEP 5 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Capalaba
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

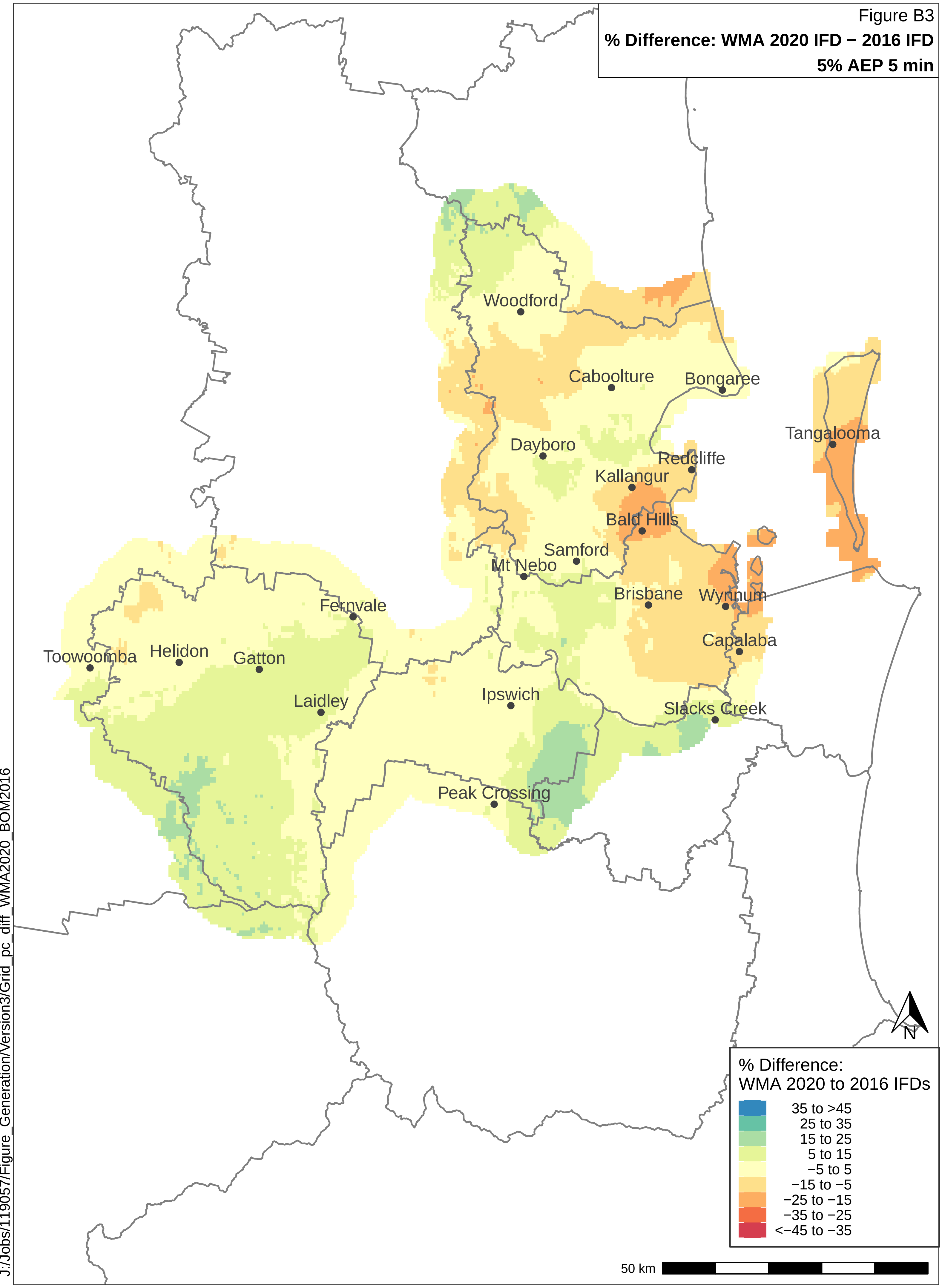
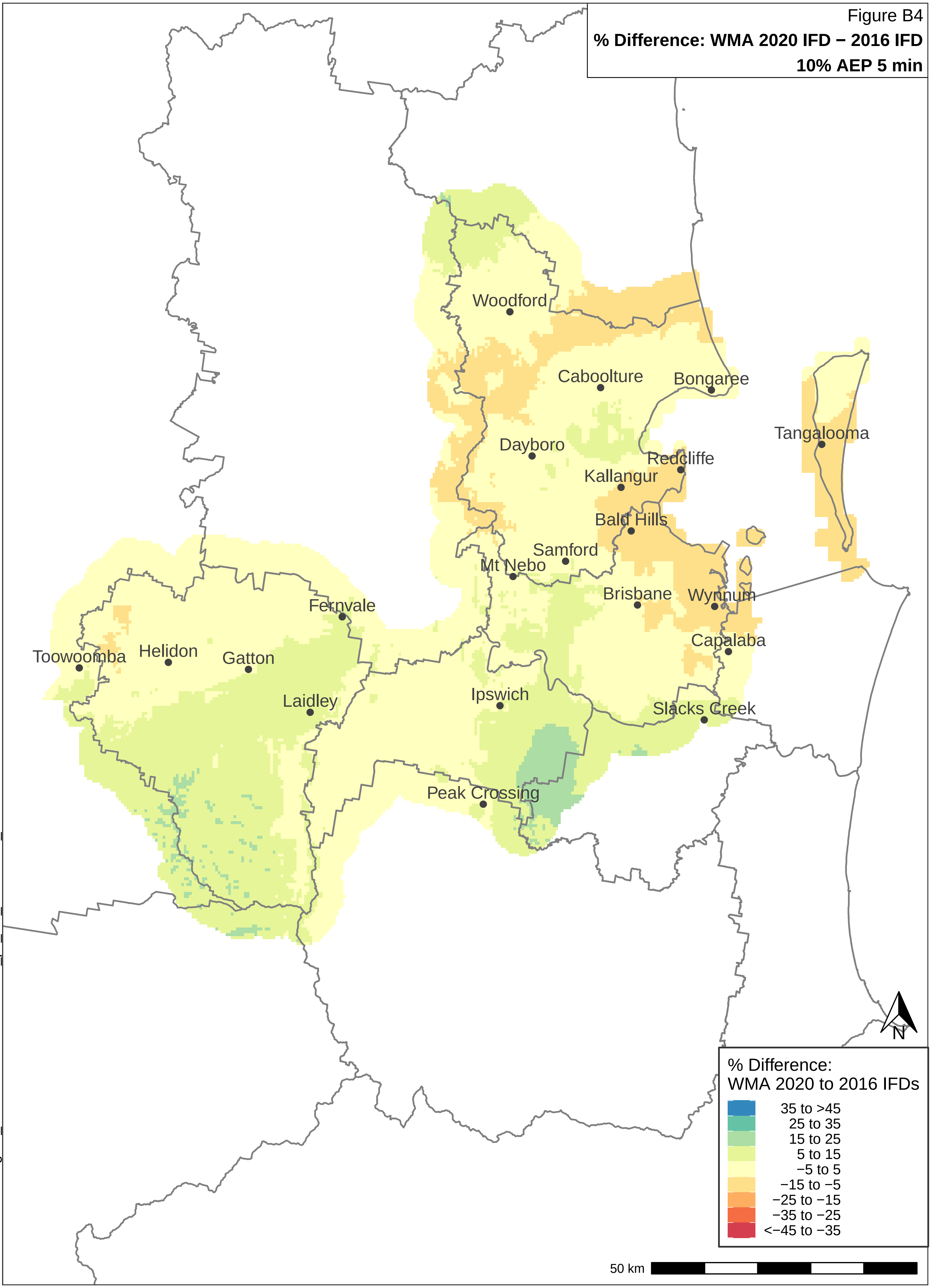


Figure B3
% Difference: WMA 2020 IFD − 2016 IFD
5% AEP 5 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Fernvale
Brisbane
Wynnum
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

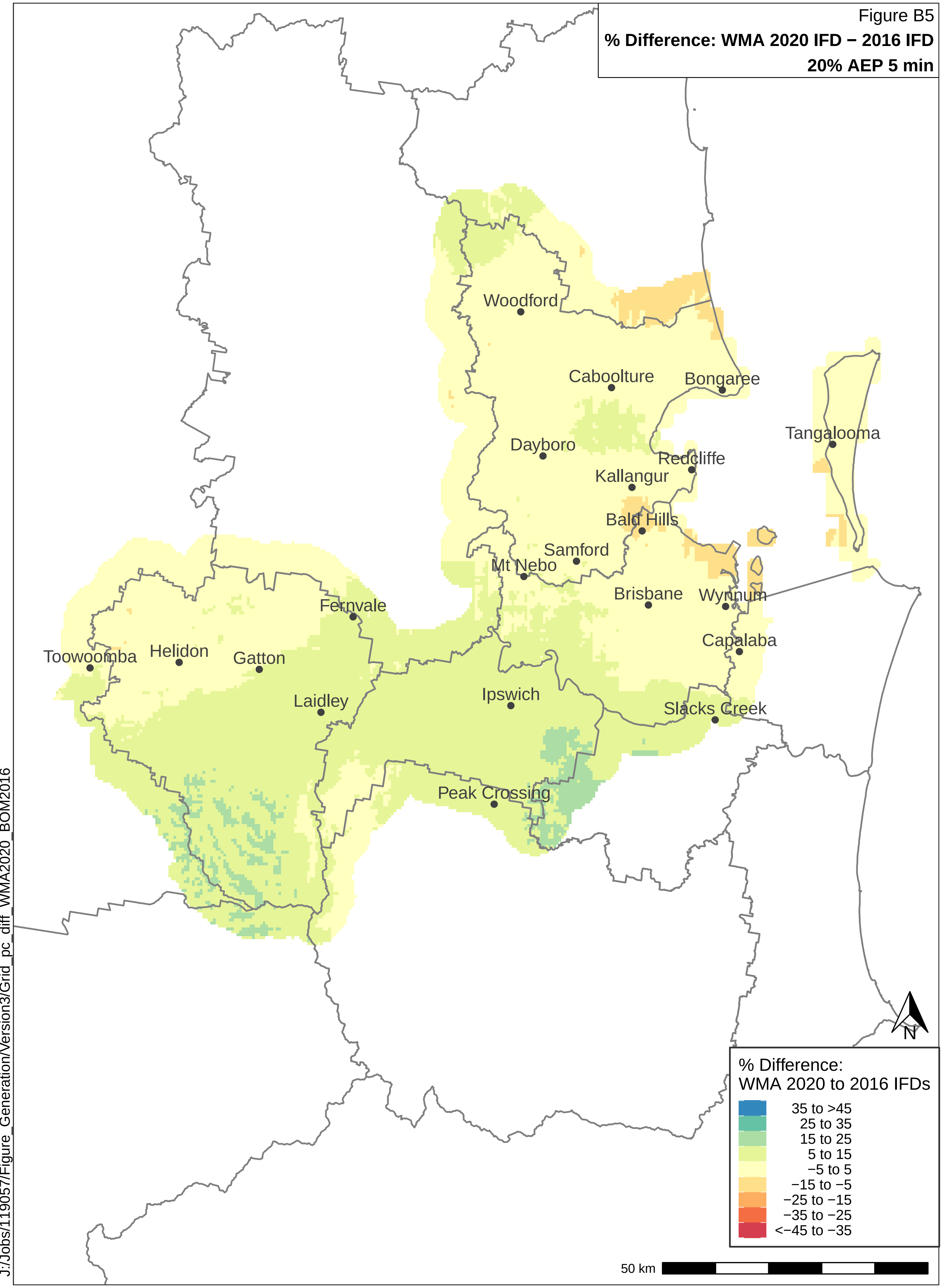
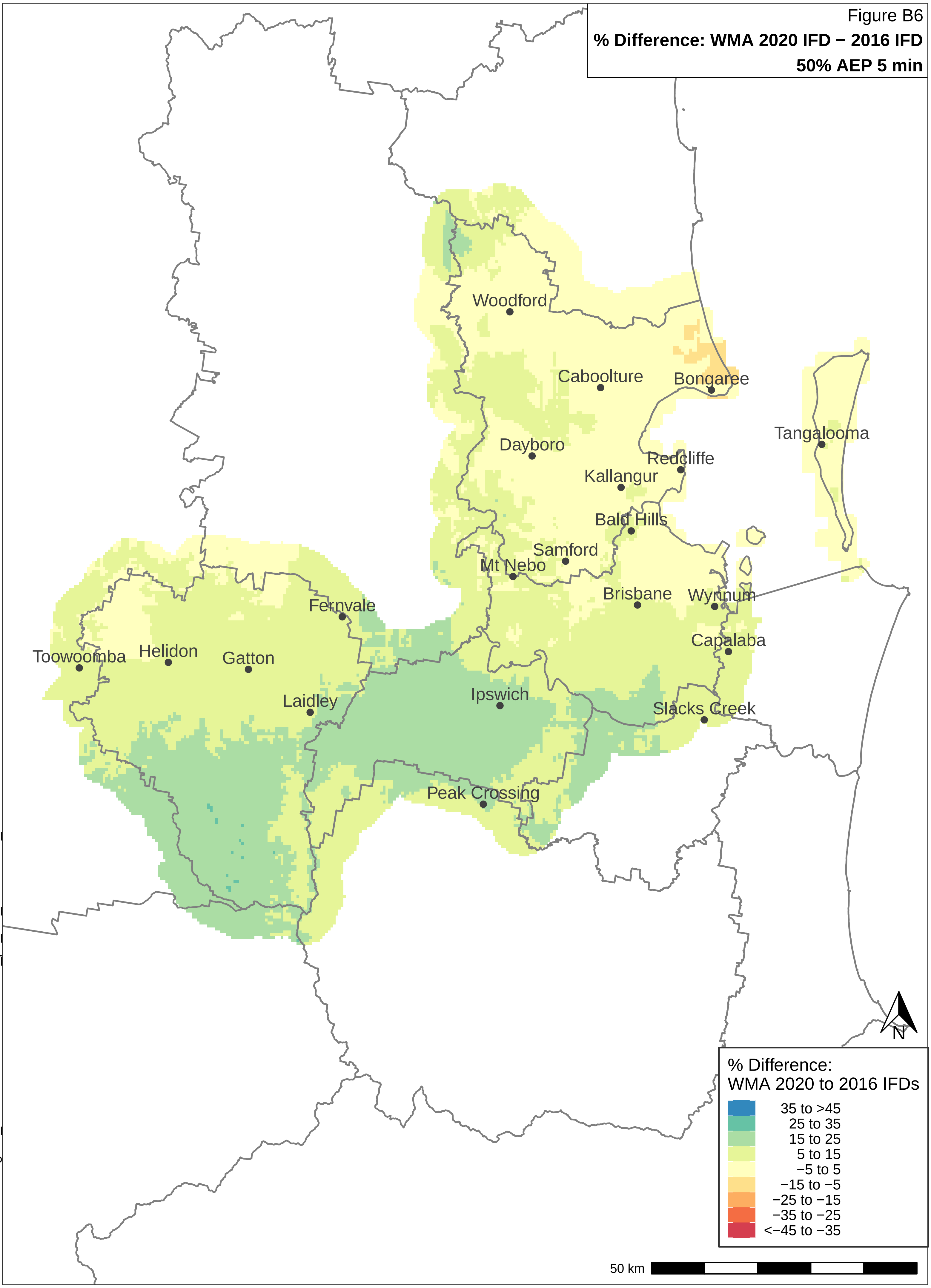


Figure B5
% Difference: WMA 2020 IFD − 2016 IFD
20% AEP 5 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

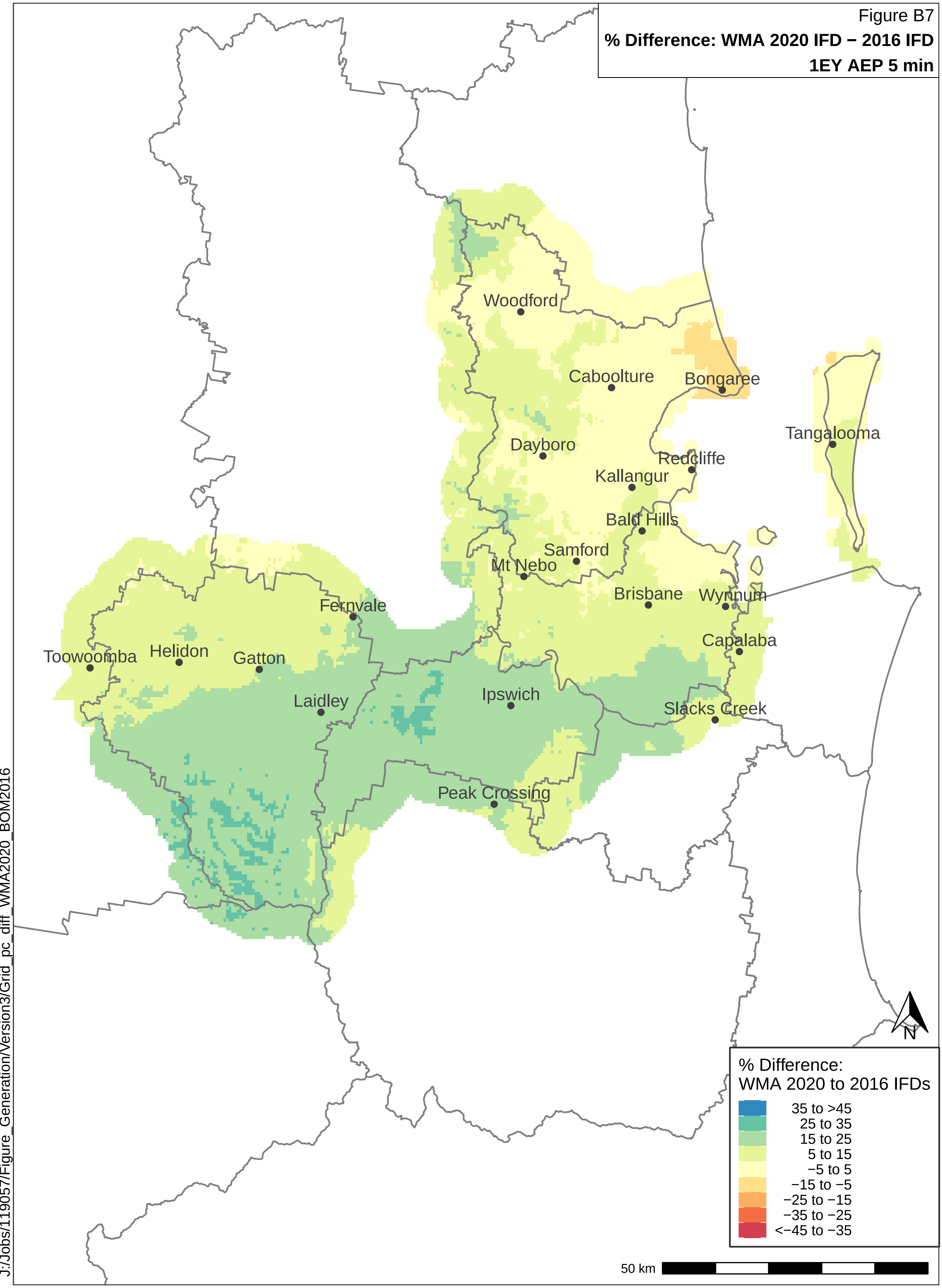
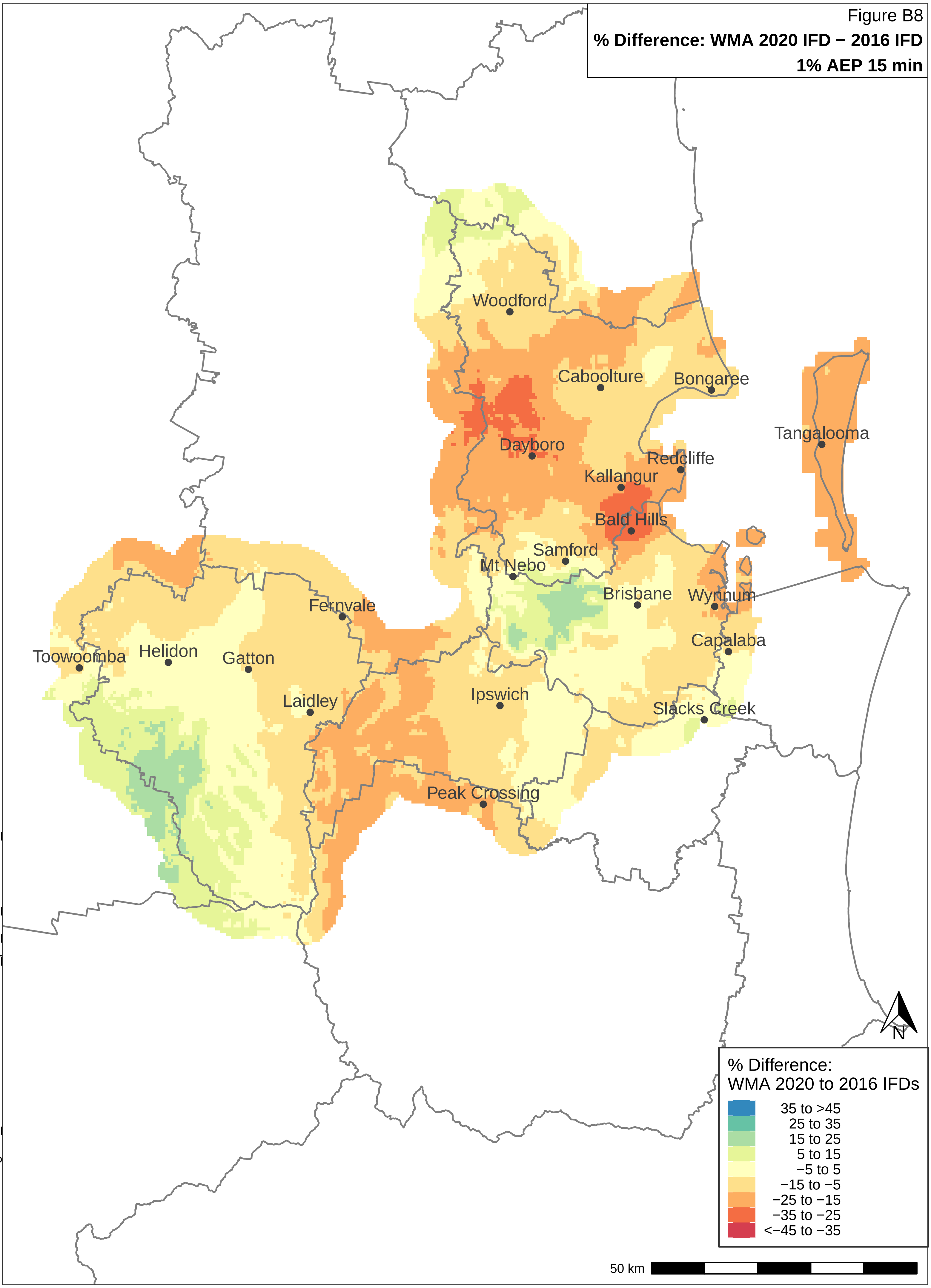


Figure B7
% Difference: WMA 2020 IFD − 2016 IFD
1EY AEP 5 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B8

% Difference: WMA 2020 IFD − 2016 IFD

1% AEP 15 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

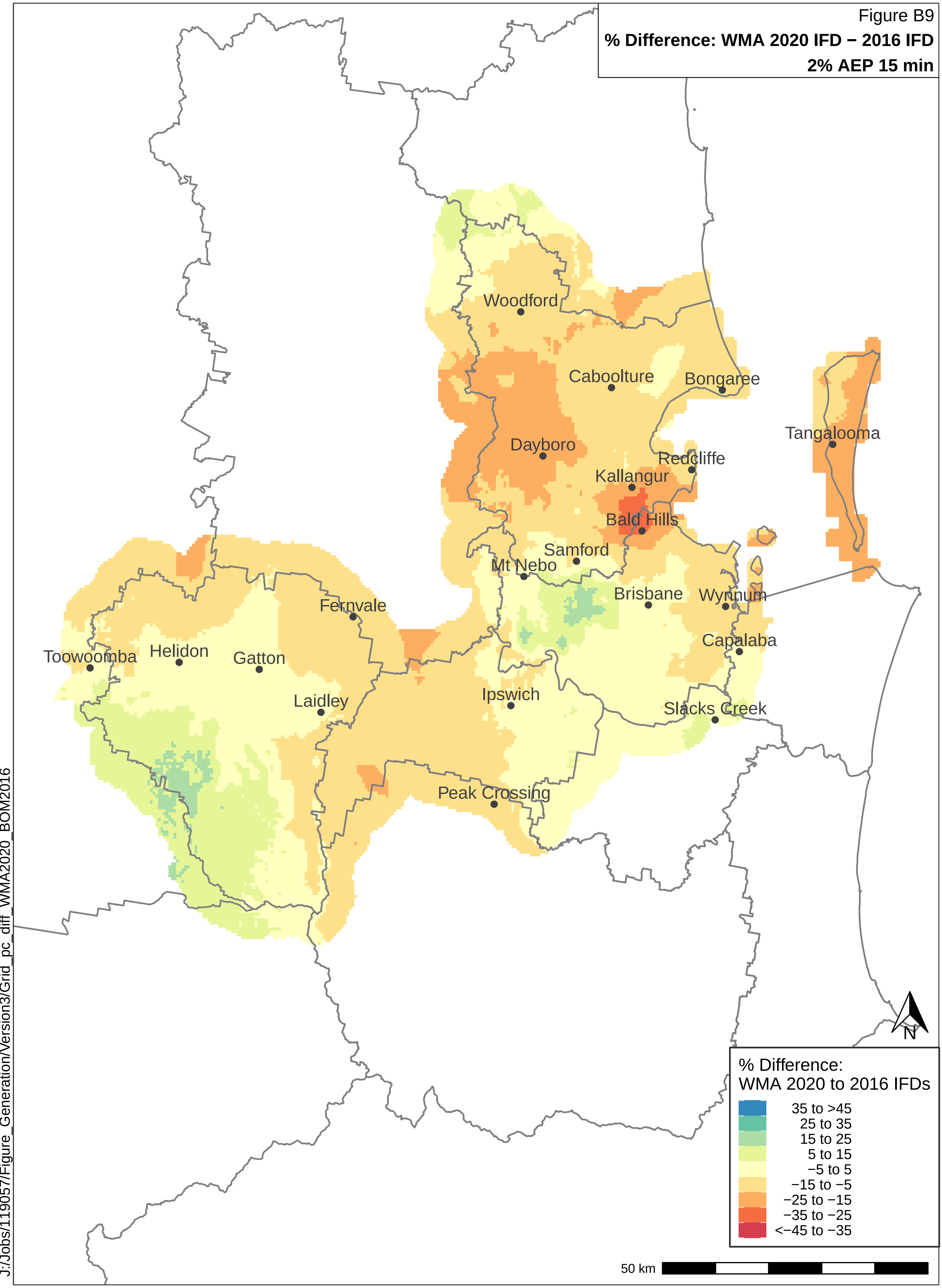
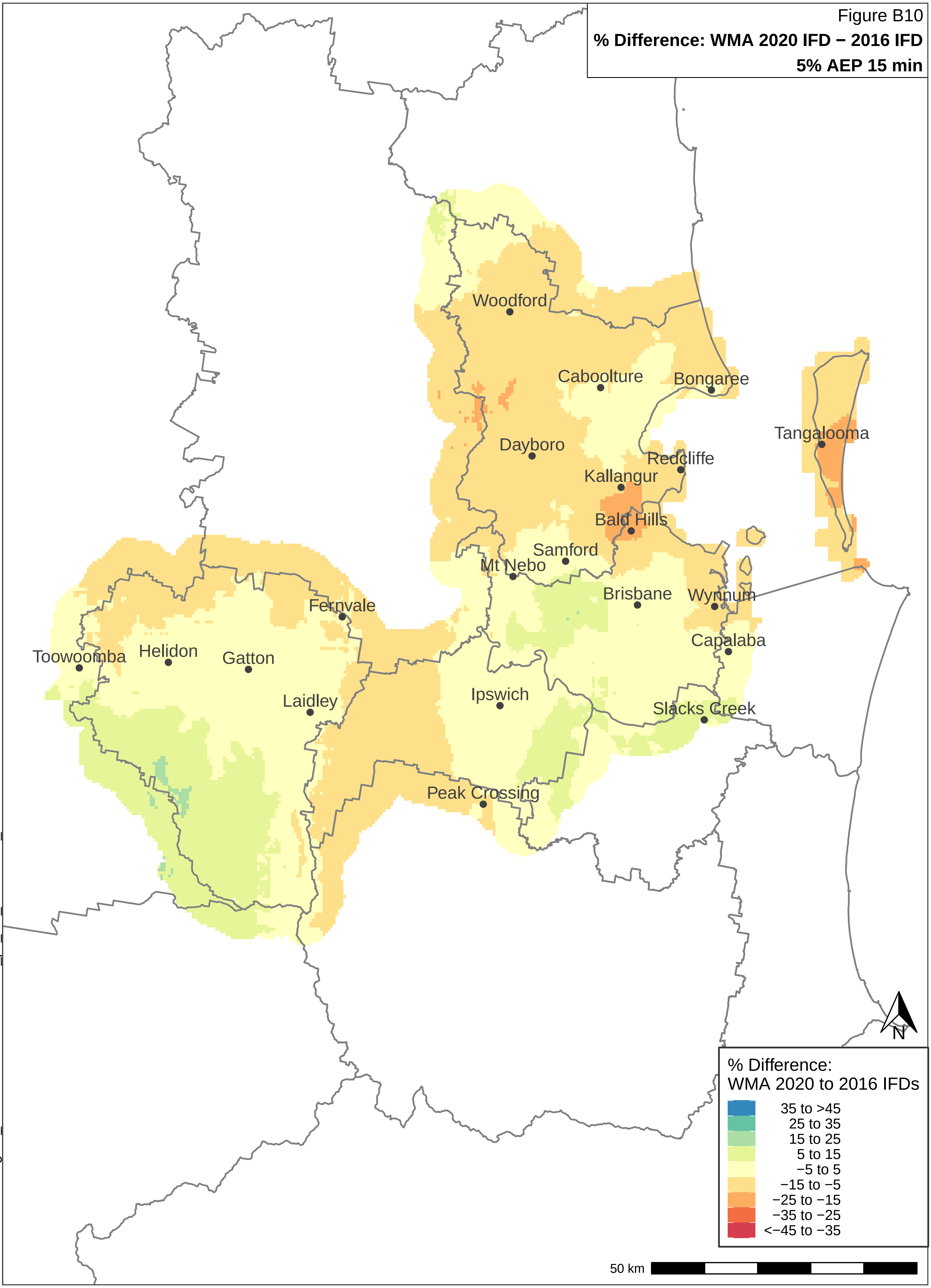


Figure B9
% Difference: WMA 2020 IFD − 2016 IFD
2% AEP 15 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

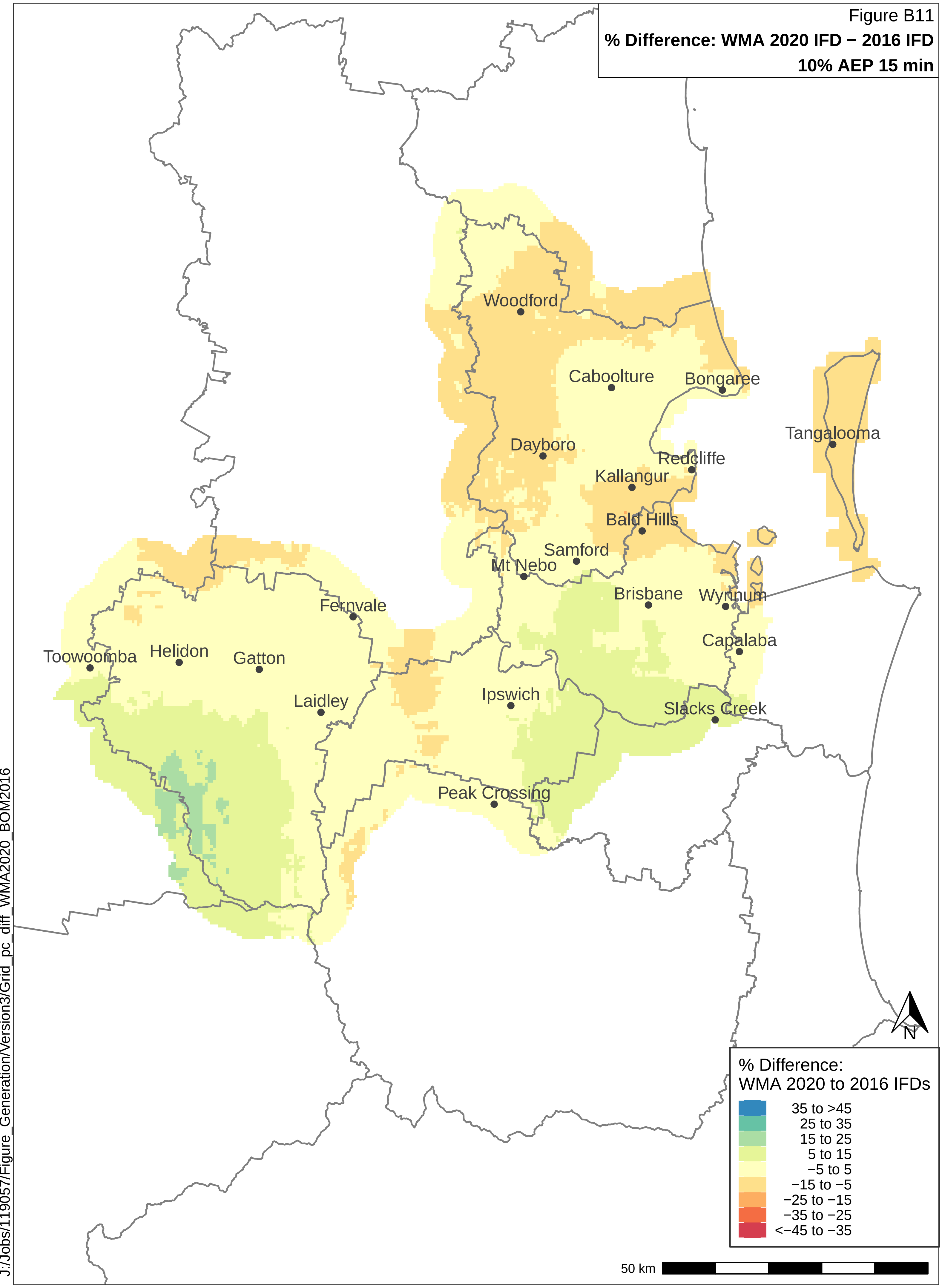


Figure B11
% Difference: WMA 2020 IFD − 2016 IFD
10% AEP 15 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

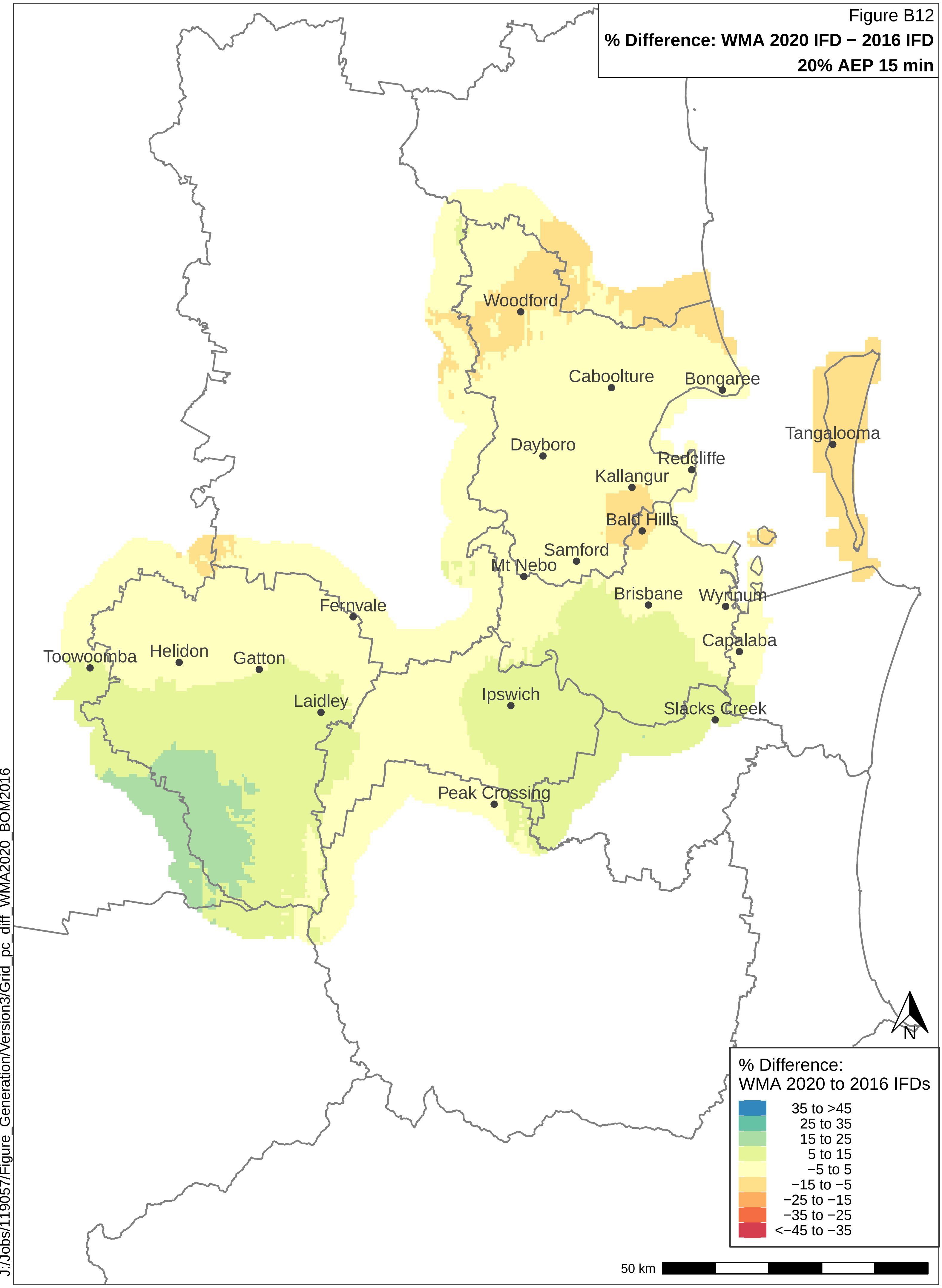


Figure B12
% Difference: WMA 2020 IFD − 2016 IFD
20% AEP 15 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

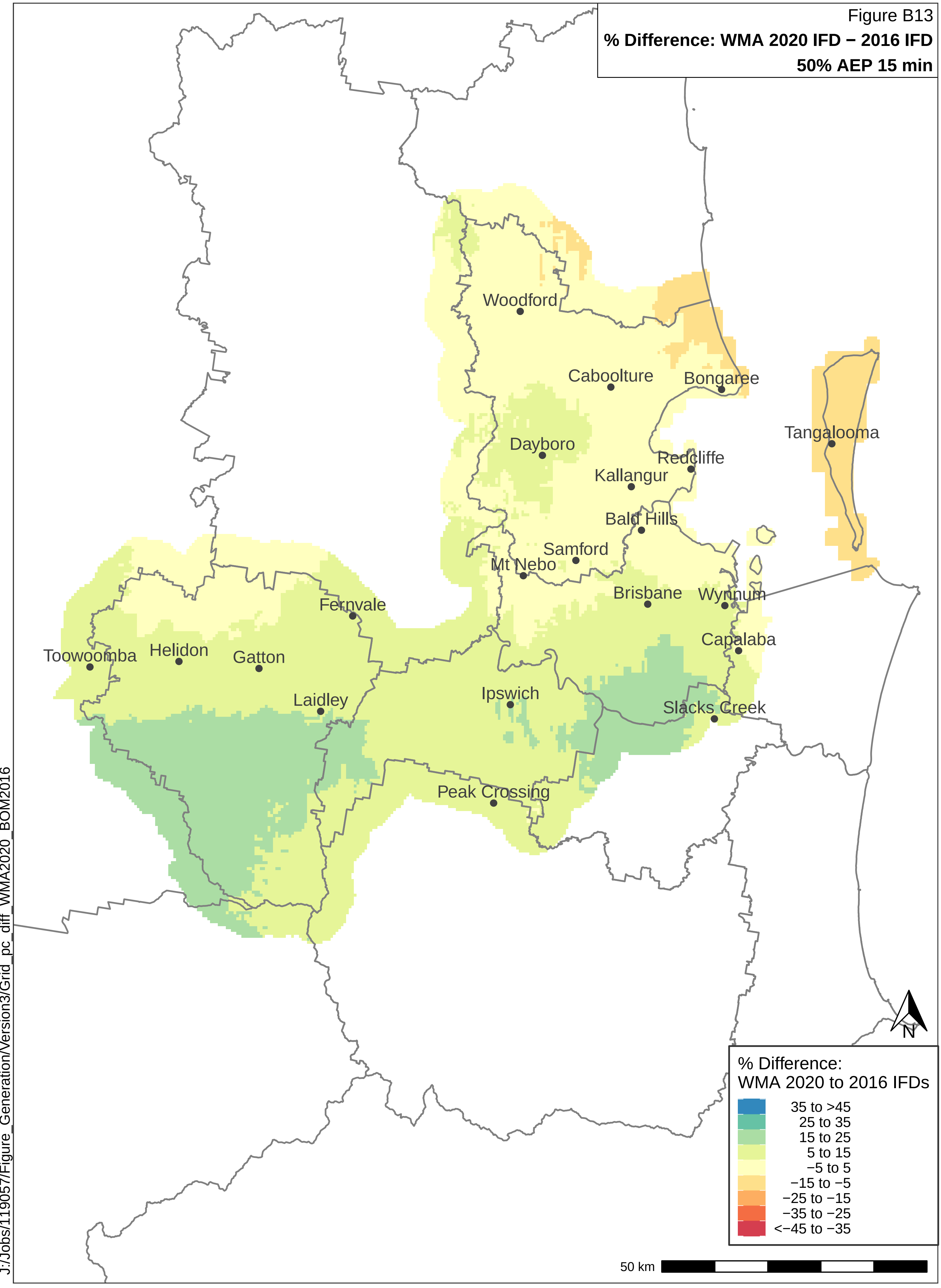


Figure B13
% Difference: WMA 2020 IFD − 2016 IFD
50% AEP 15 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

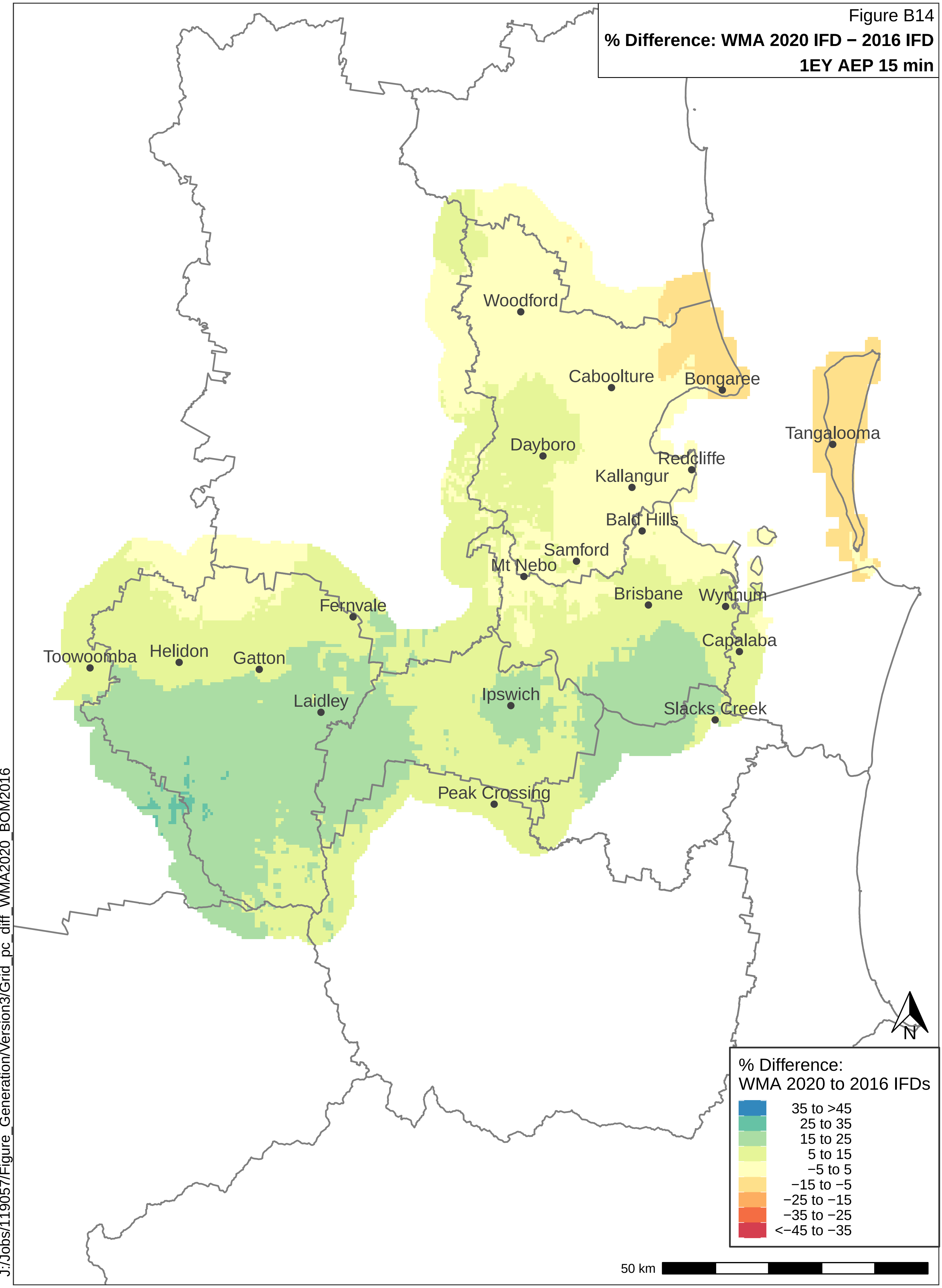


Figure B14
% Difference: WMA 2020 IFD − 2016 IFD
1EY AEP 15 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

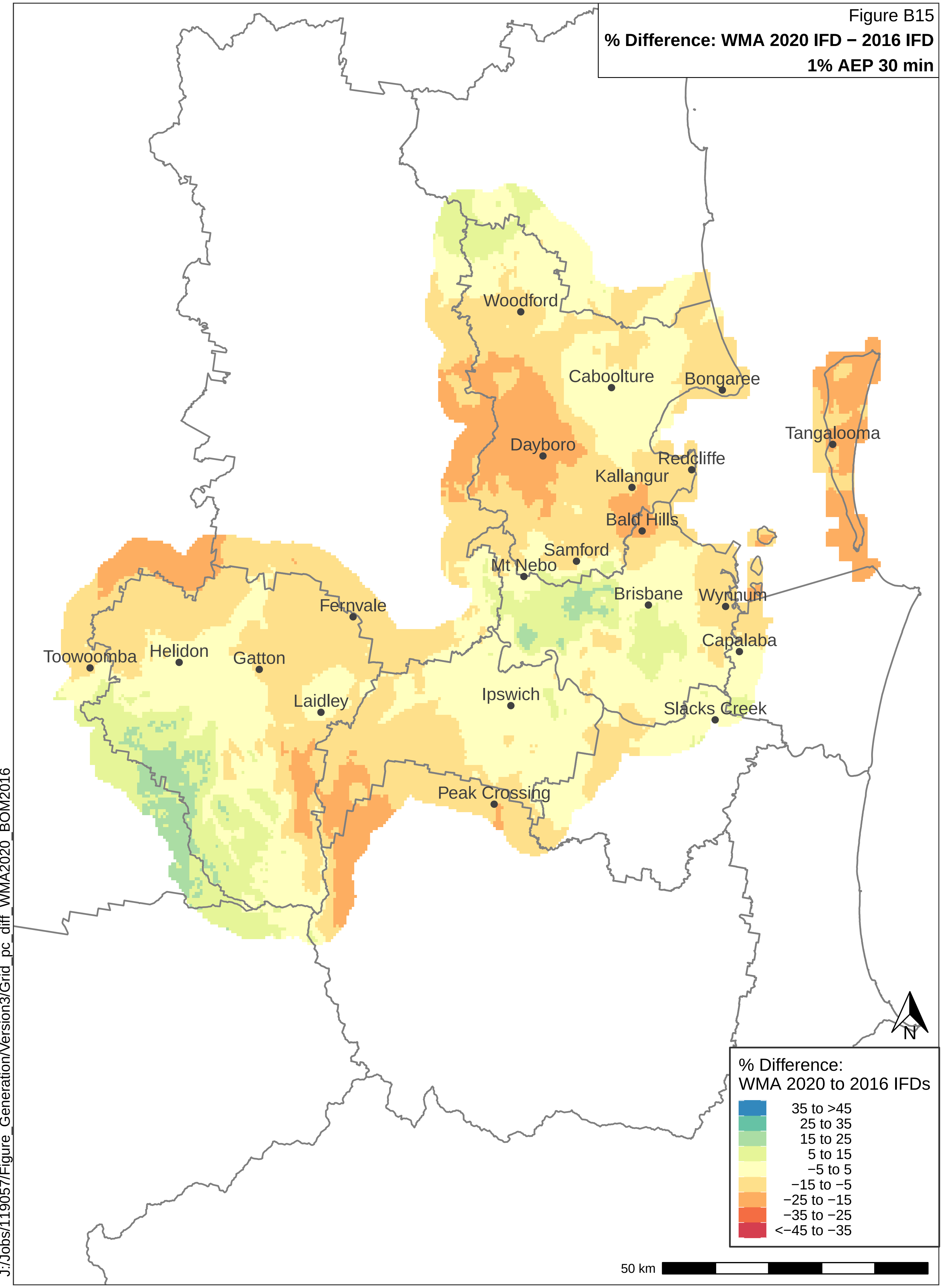


Figure B15
% Difference: WMA 2020 IFD − 2016 IFD
1% AEP 30 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Ipswich
Laidley
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

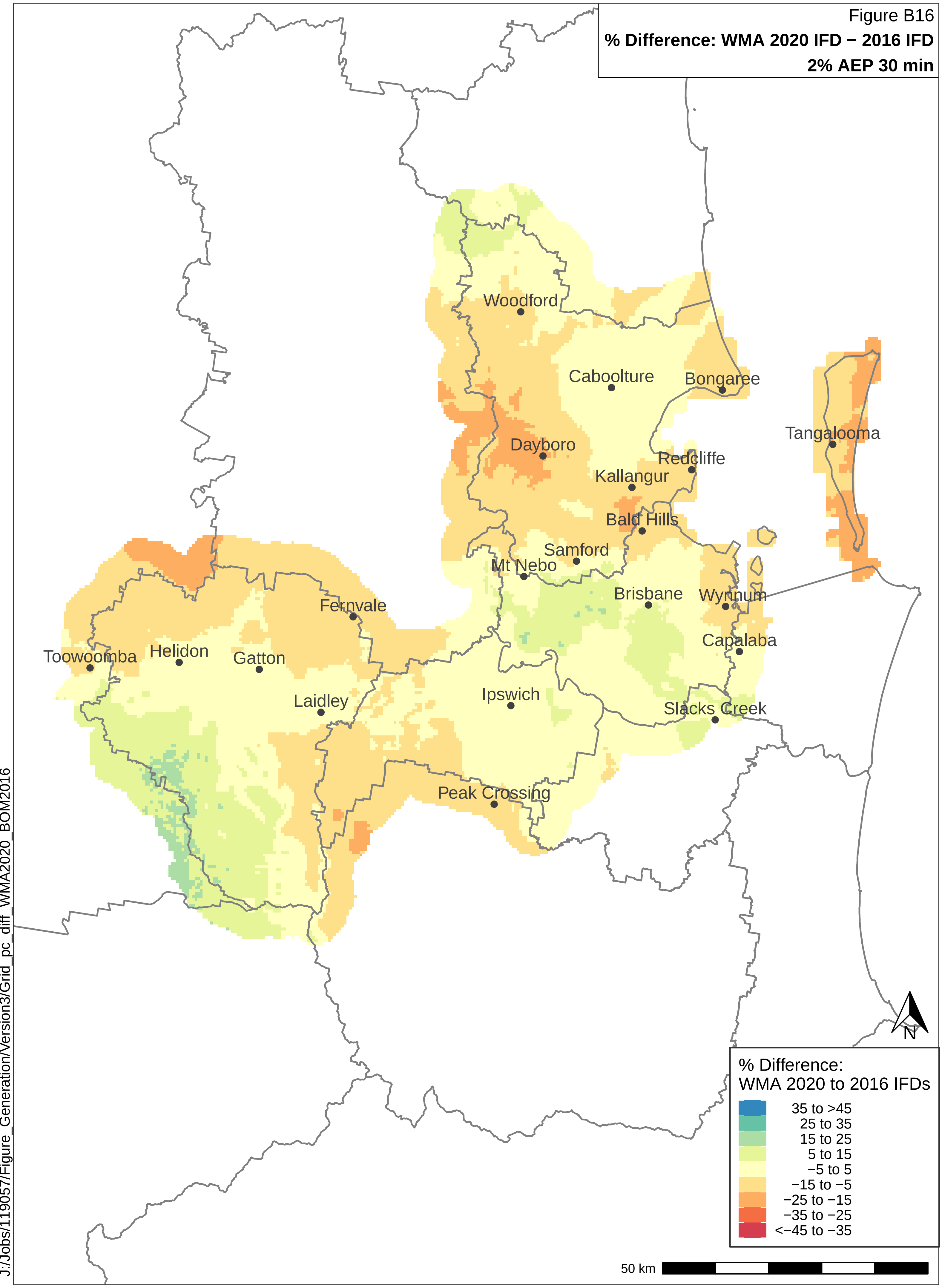


Figure B16
% Difference: WMA 2020 IFD − 2016 IFD
2% AEP 30 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

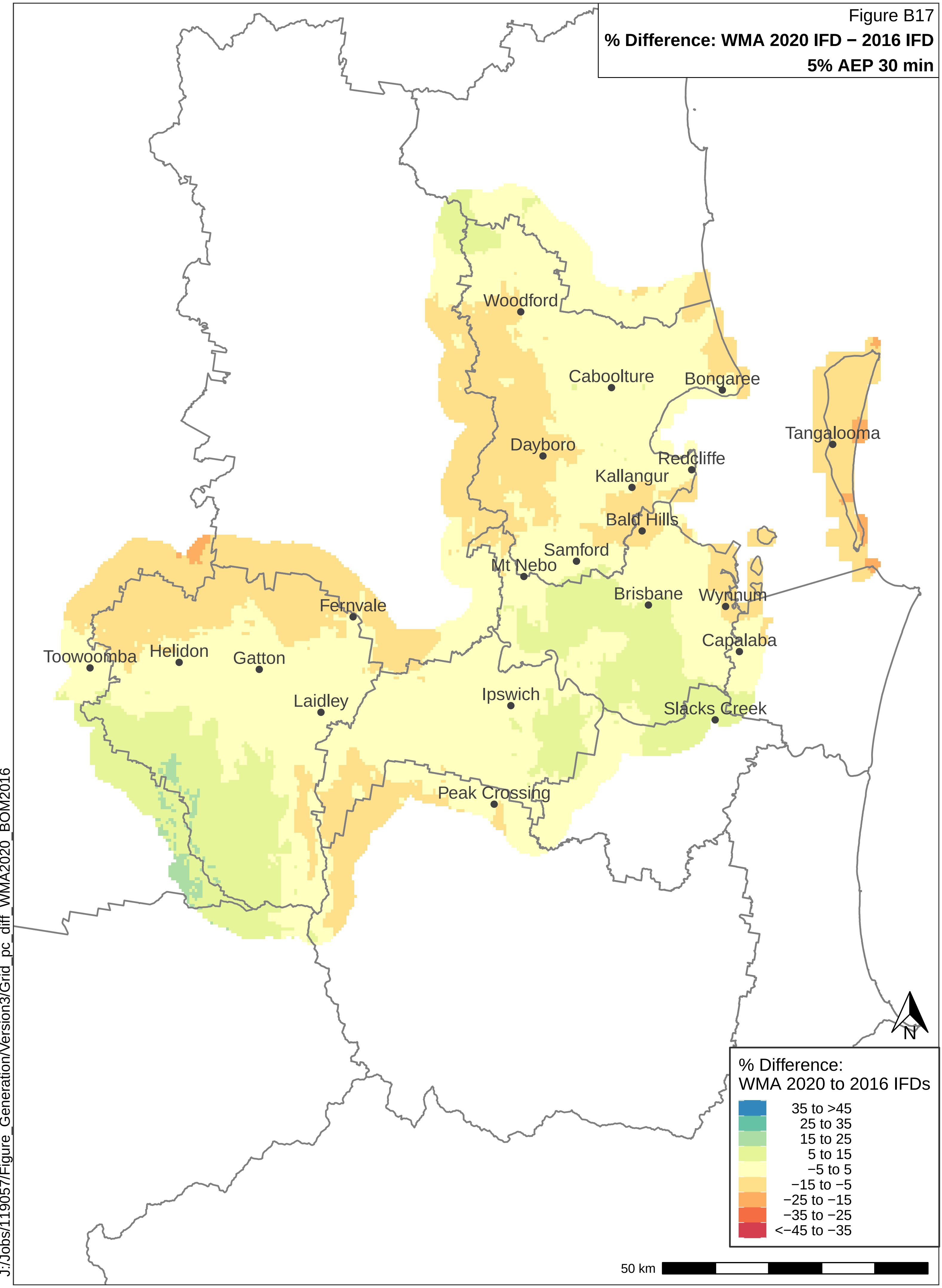


Figure B17
% Difference: WMA 2020 IFD − 2016 IFD
5% AEP 30 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

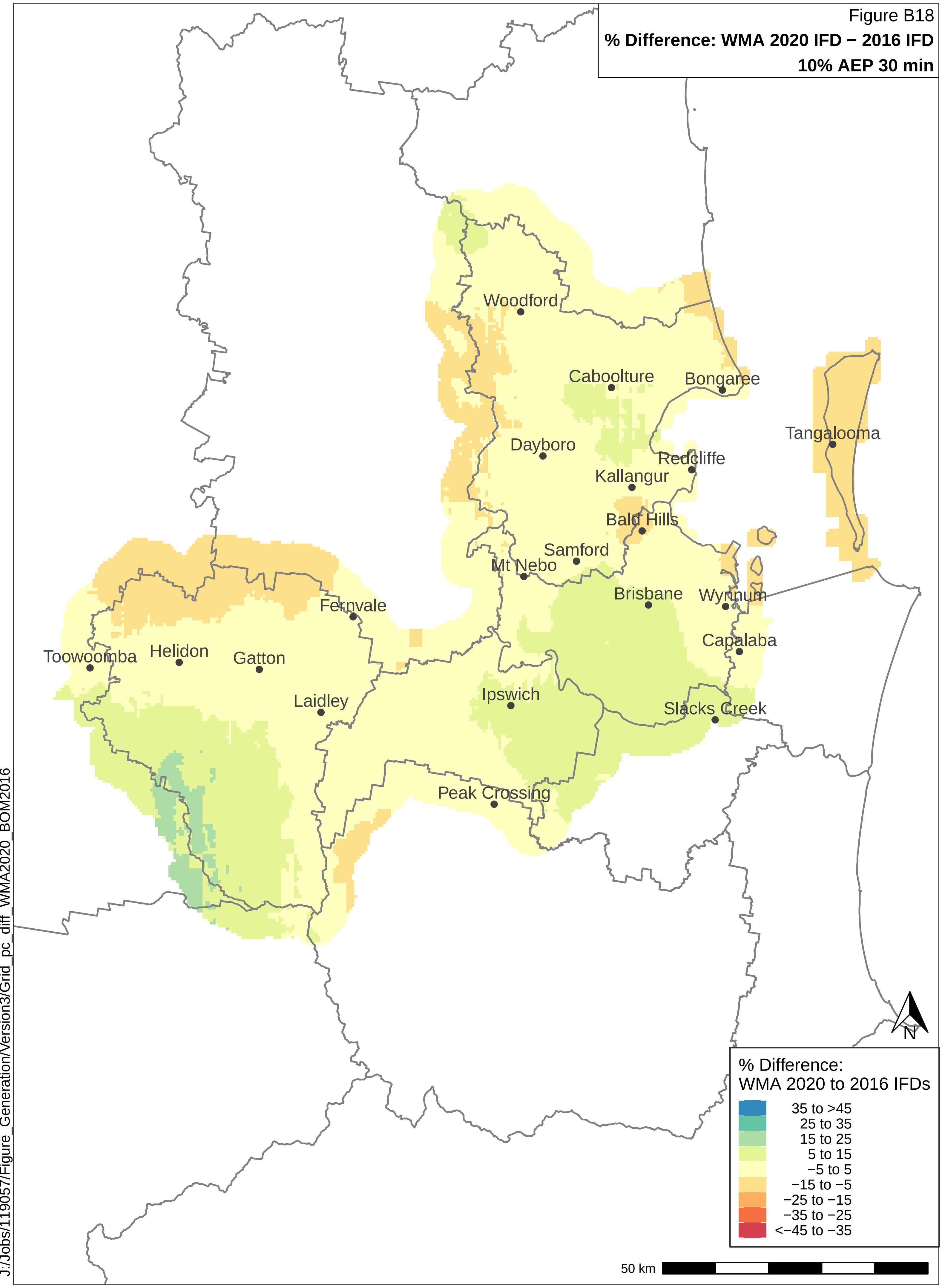


Figure B18
% Difference: WMA 2020 IFD − 2016 IFD
10% AEP 30 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

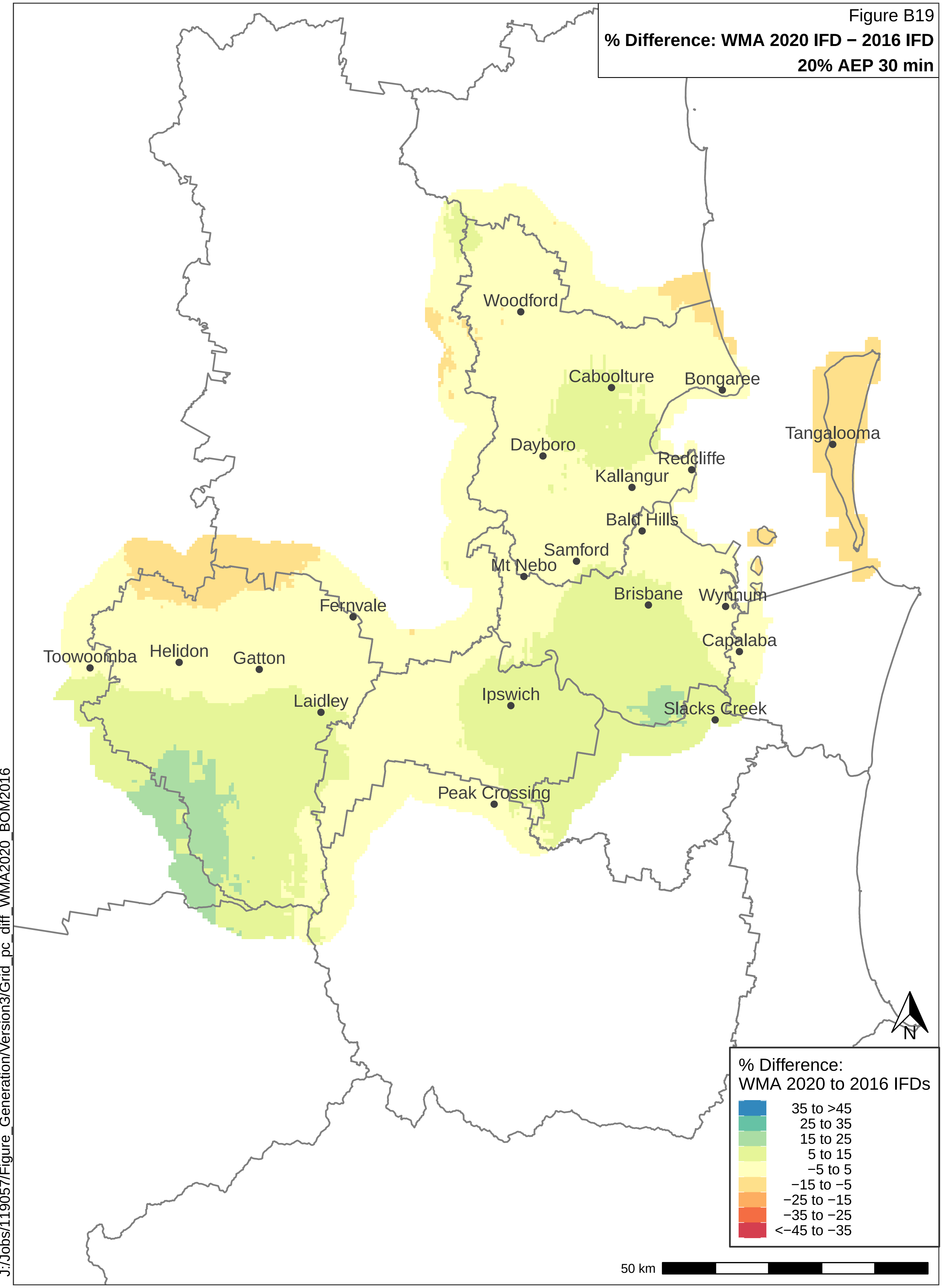


Figure B19
% Difference: WMA 2020 IFD − 2016 IFD
20% AEP 30 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

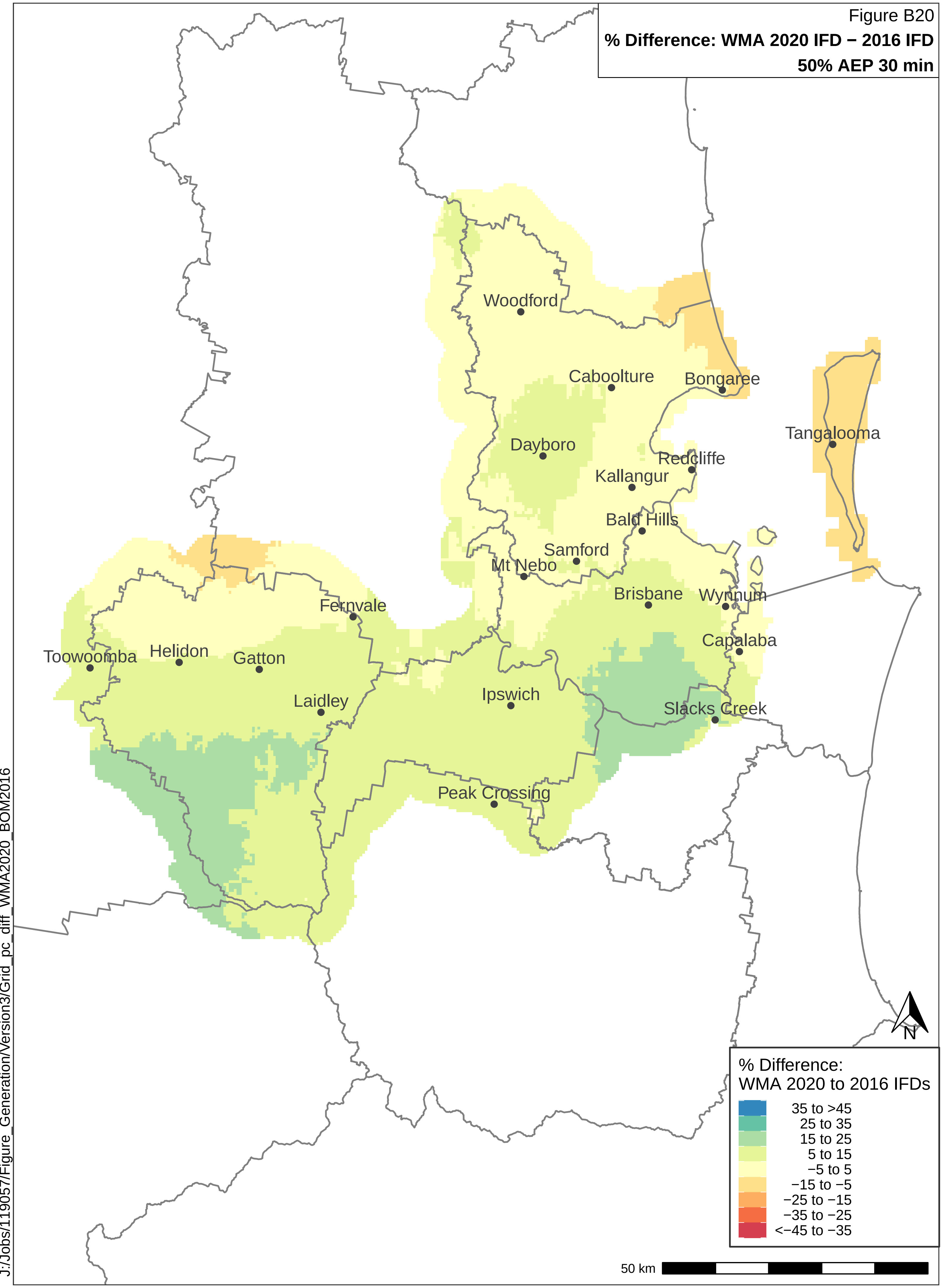


Figure B20
% Difference: WMA 2020 IFD − 2016 IFD
50% AEP 30 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

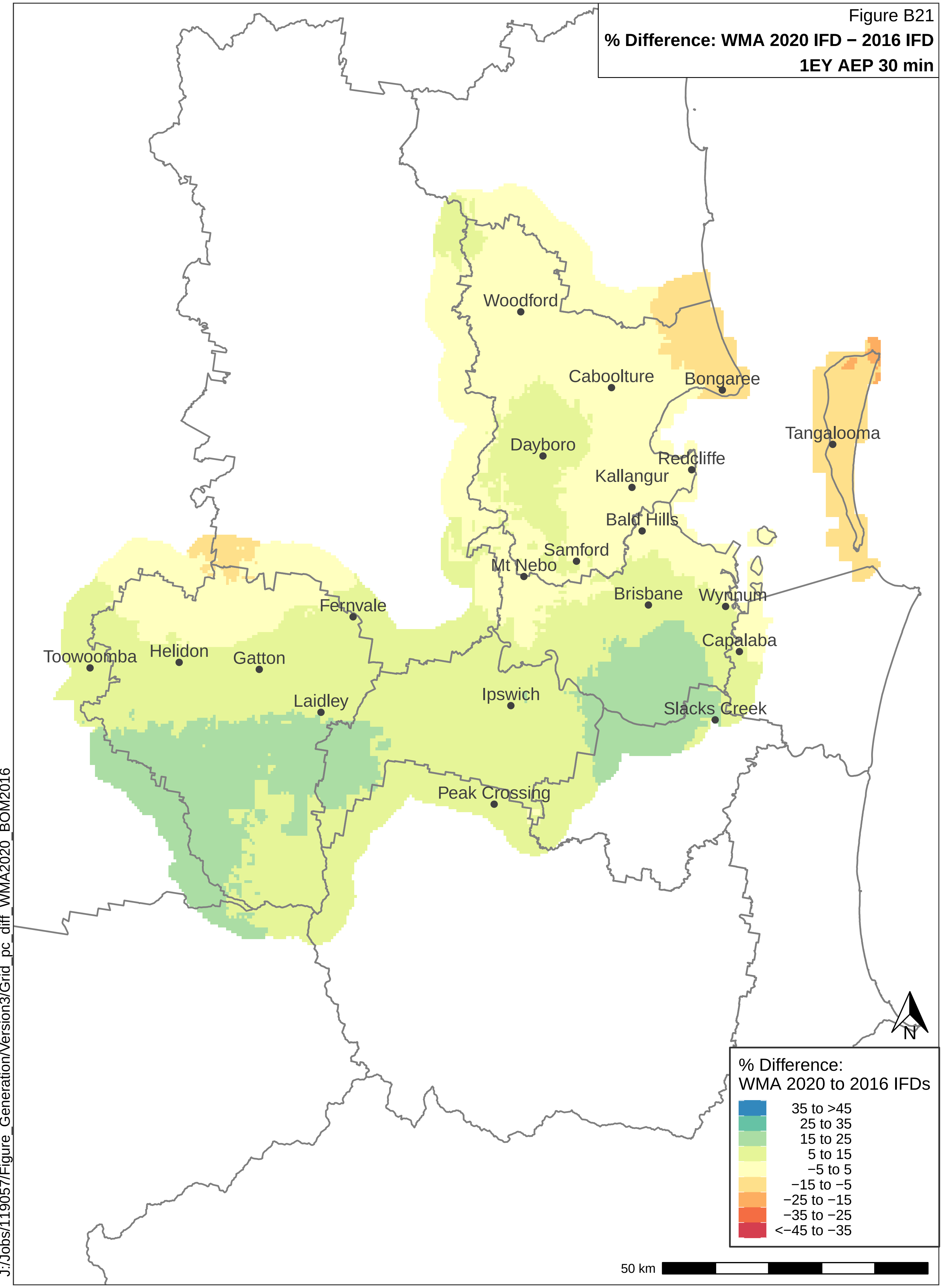
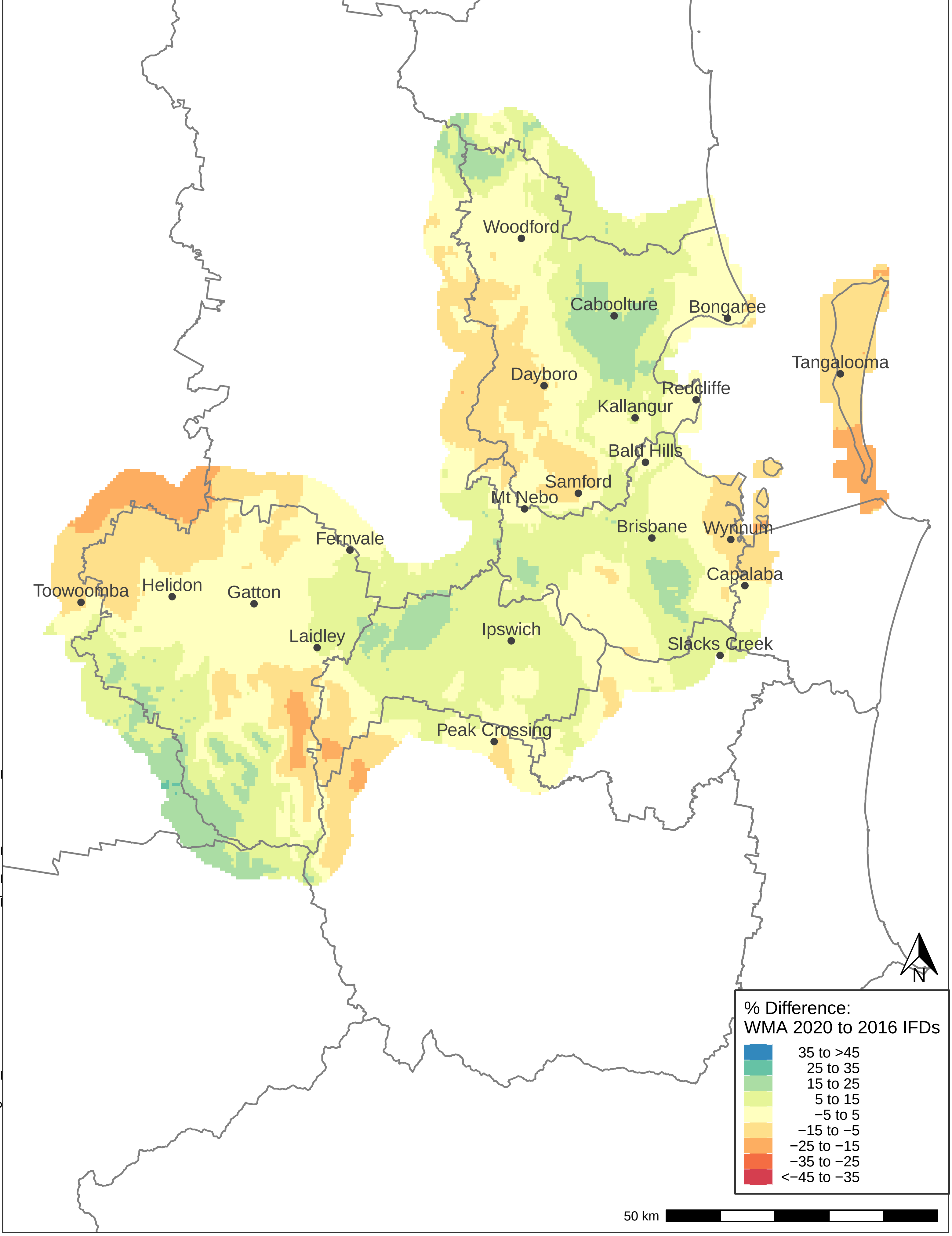


Figure B21
% Difference: WMA 2020 IFD − 2016 IFD
1EY AEP 30 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B22
% Difference: WMA 2020 IFD − 2016 IFD
1% AEP 60 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

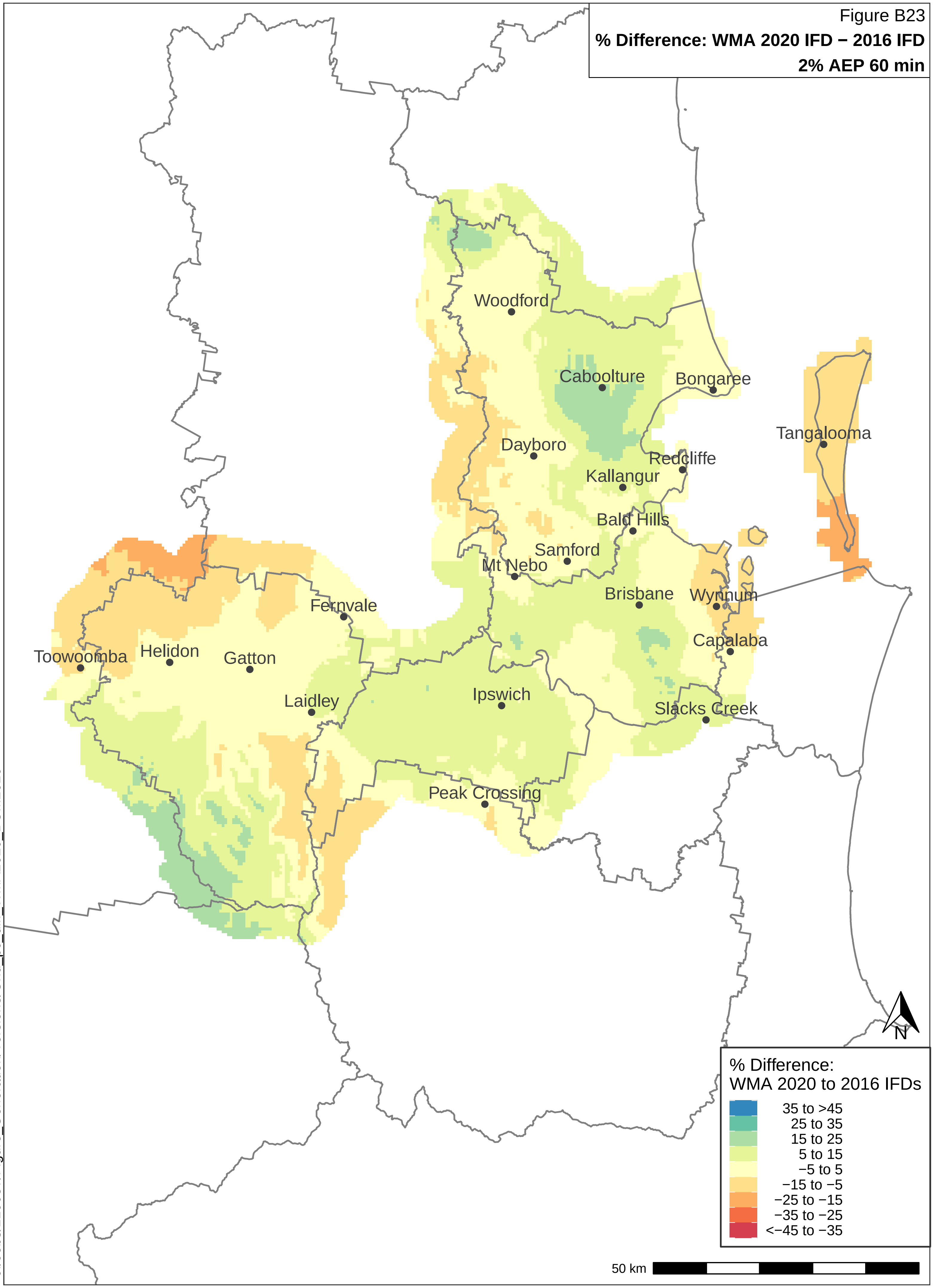
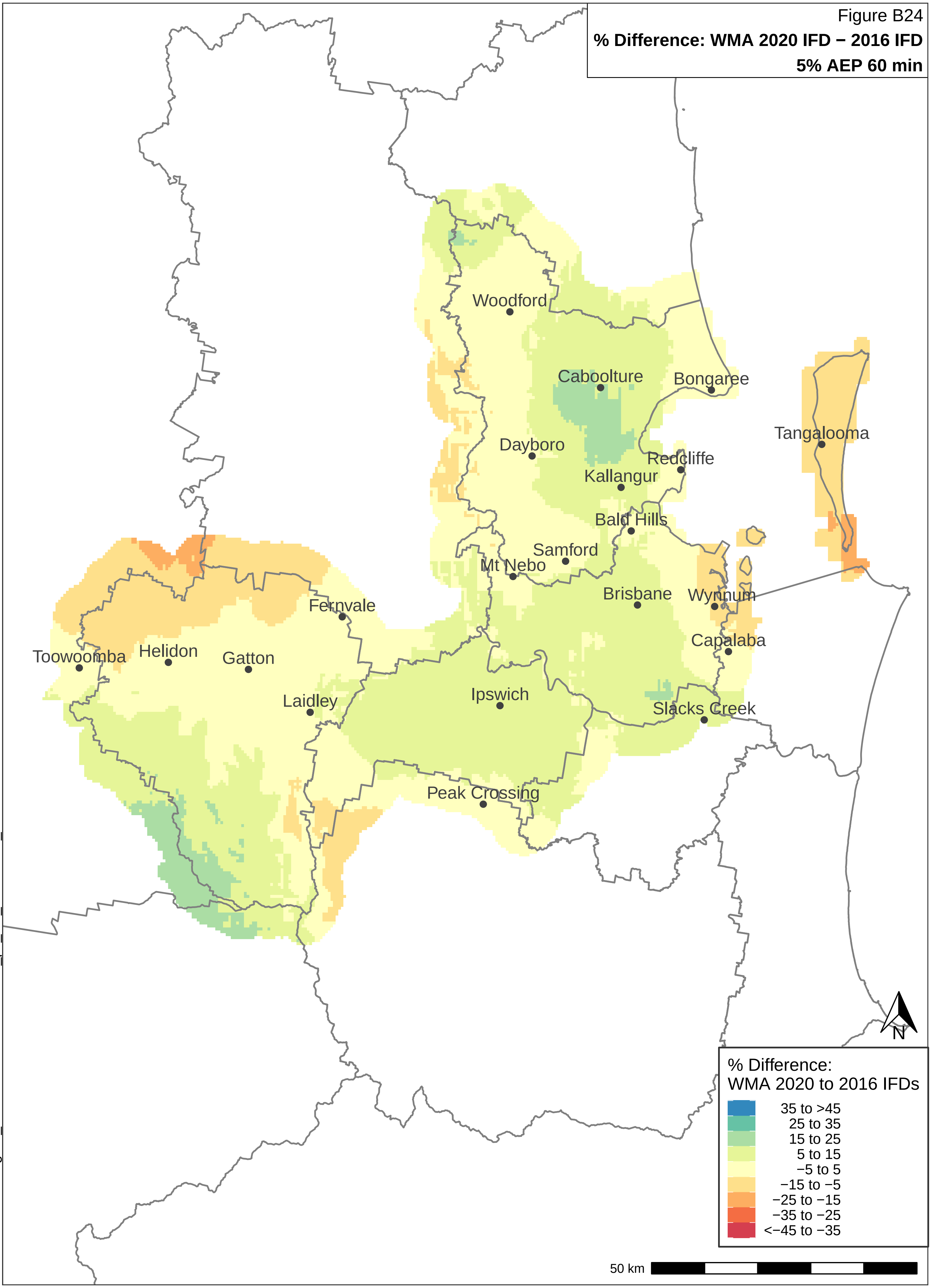


Figure B23
% Difference: WMA 2020 IFD – 2016 IFD
2% AEP 60 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Ipswich
Laidley
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

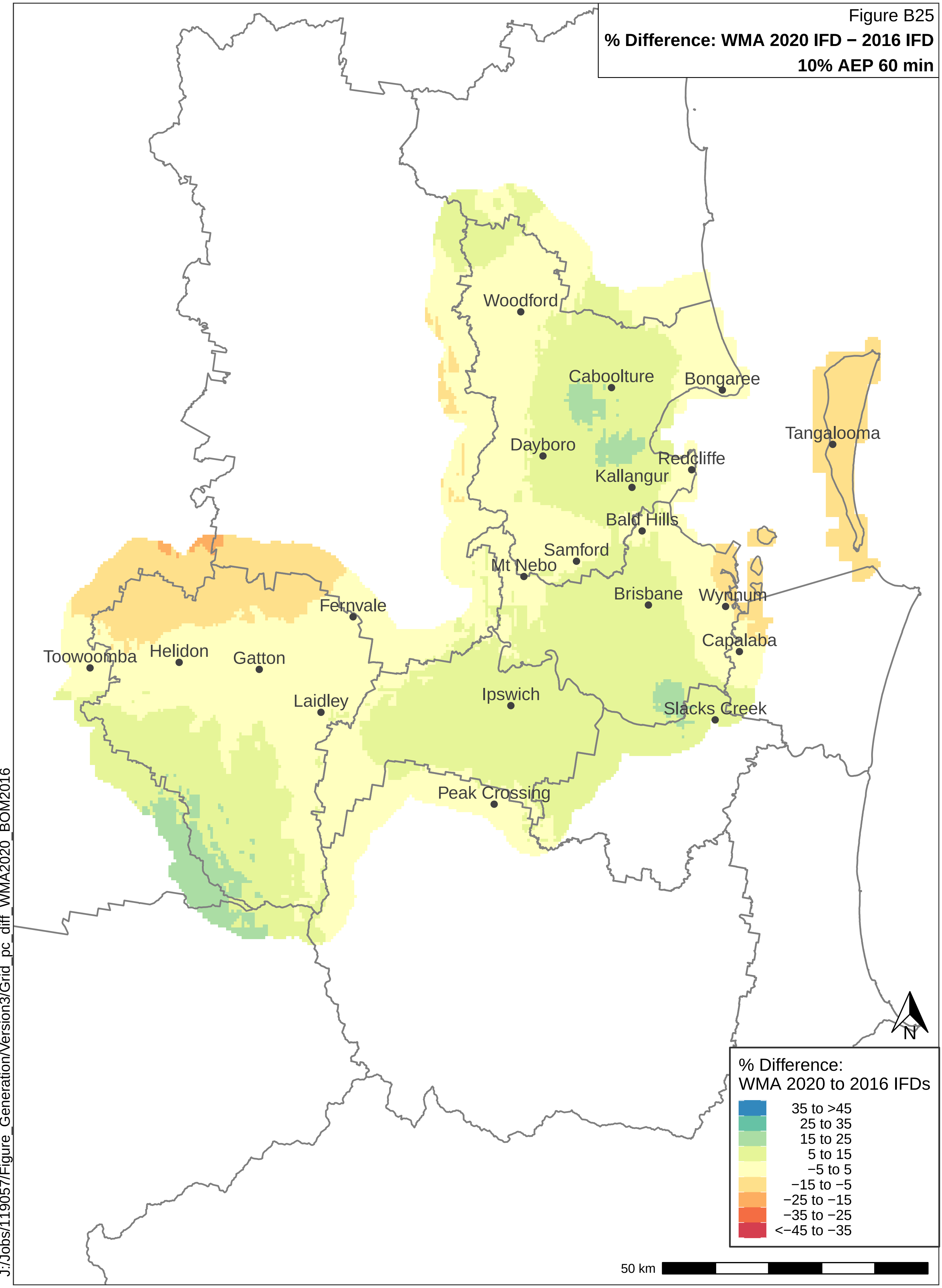


Figure B25
% Difference: WMA 2020 IFD − 2016 IFD
10% AEP 60 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

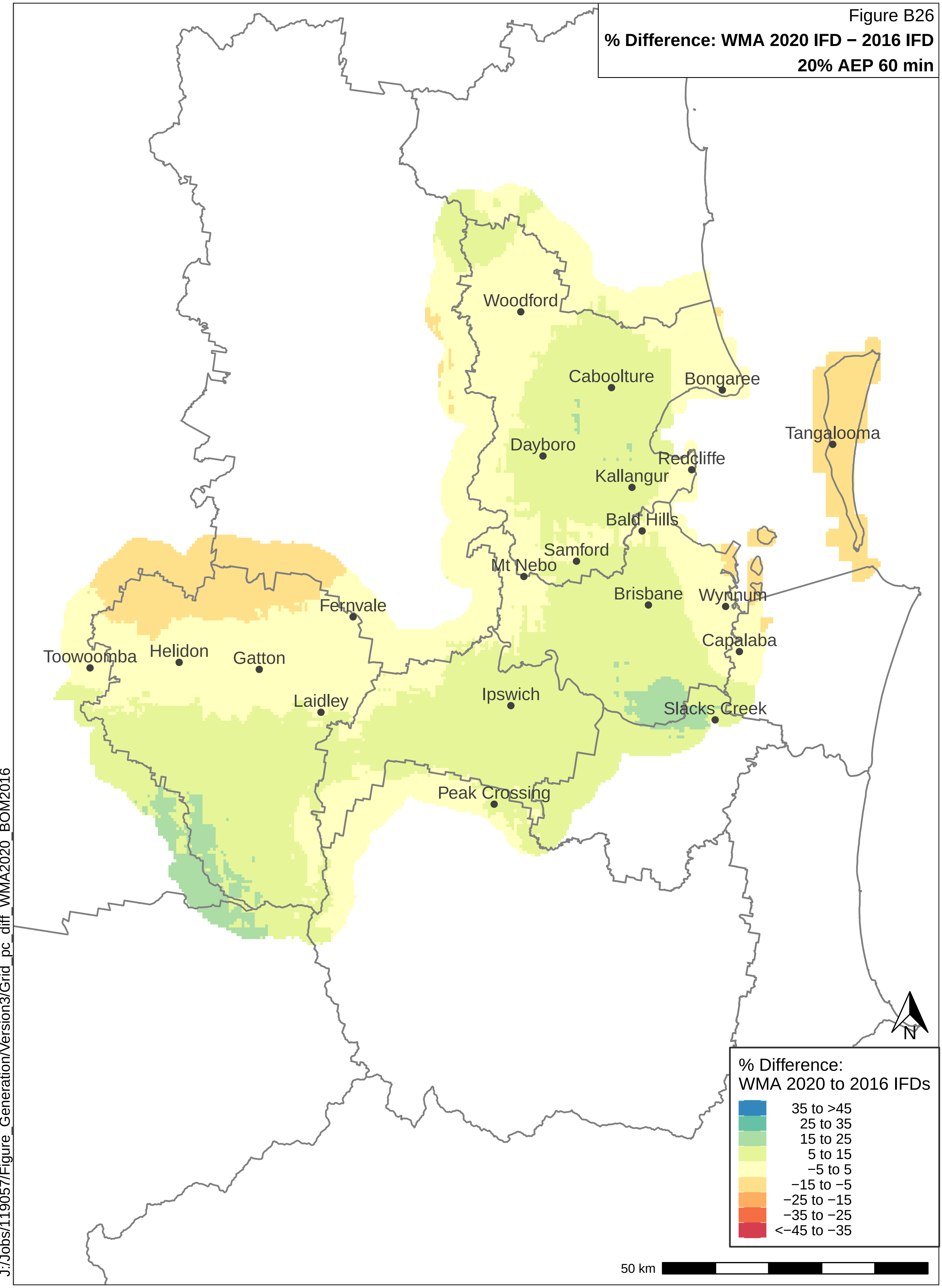
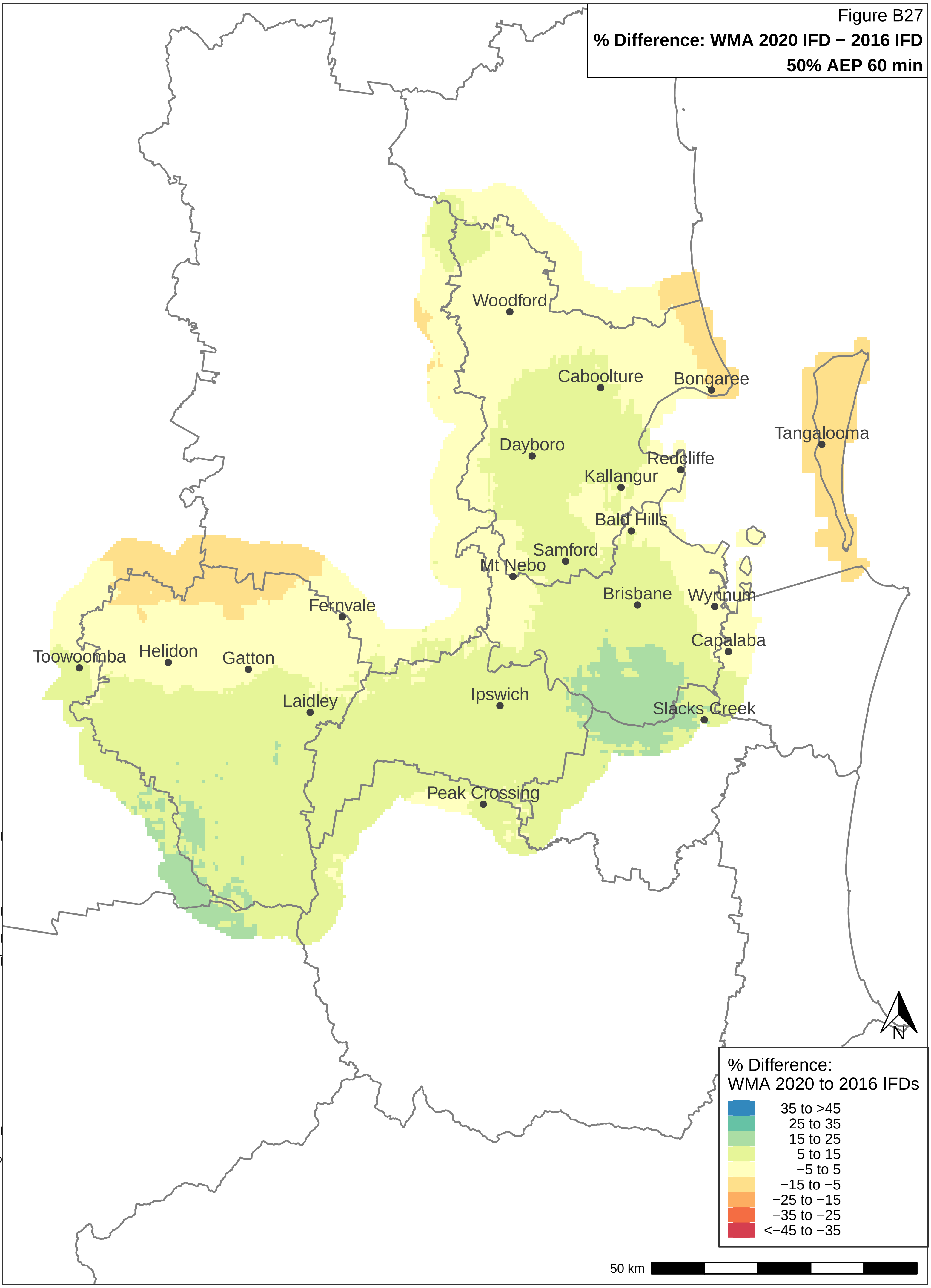


Figure B26
% Difference: WMA 2020 IFD − 2016 IFD
20% AEP 60 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B27

% Difference: WMA 2020 IFD − 2016 IFD

50% AEP 60 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

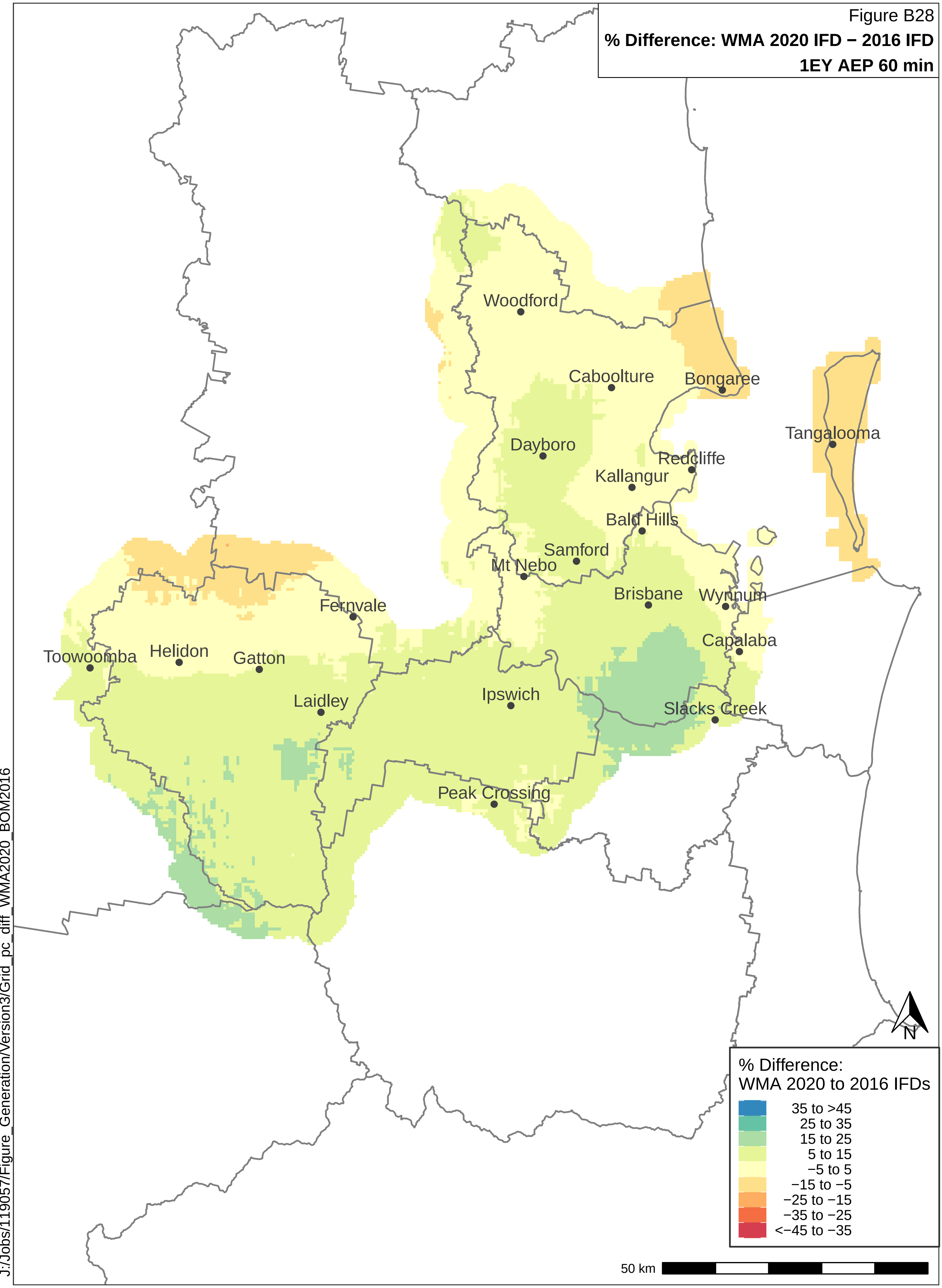
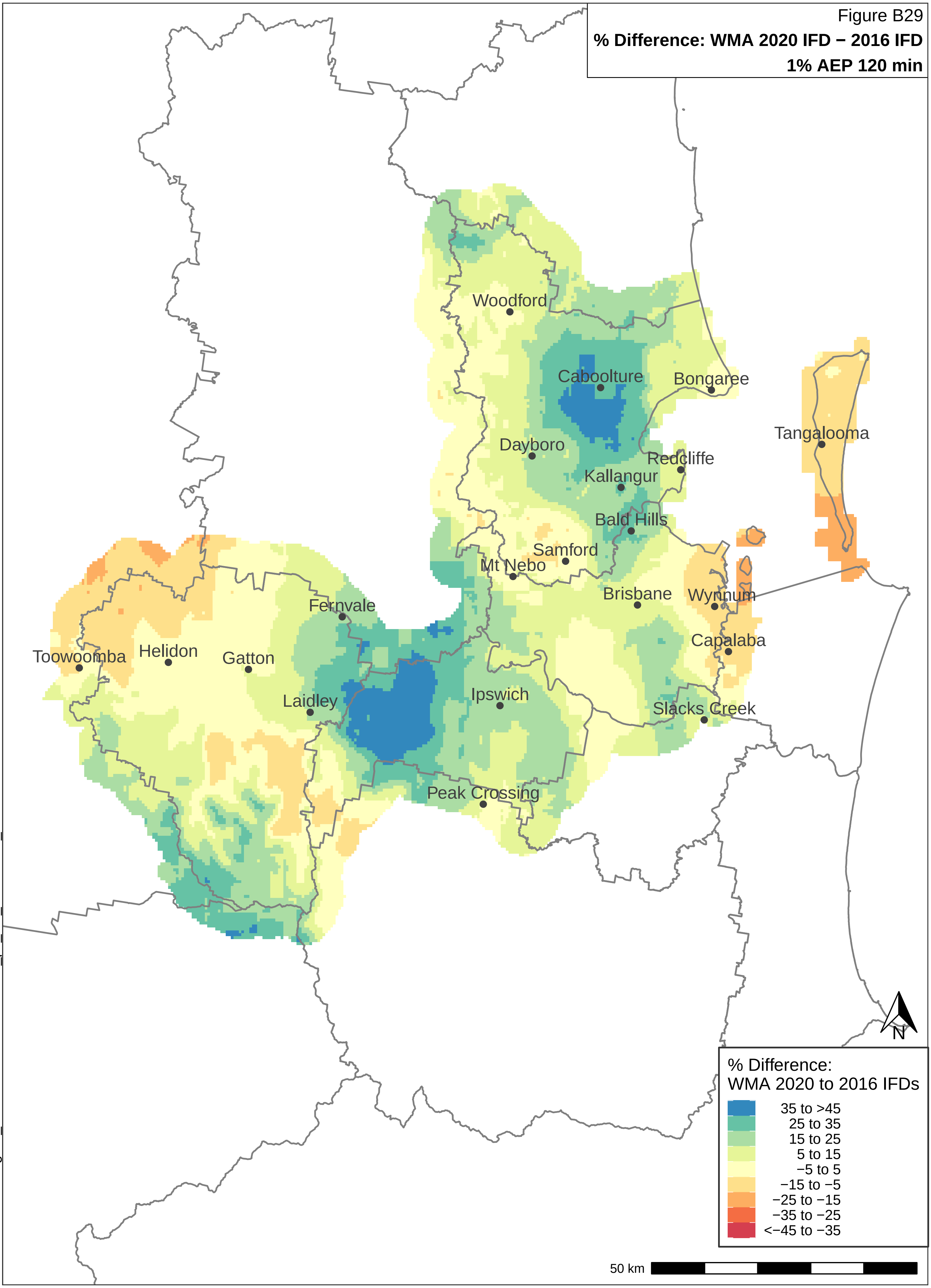


Figure B28
% Difference: WMA 2020 IFD − 2016 IFD
1EY AEP 60 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

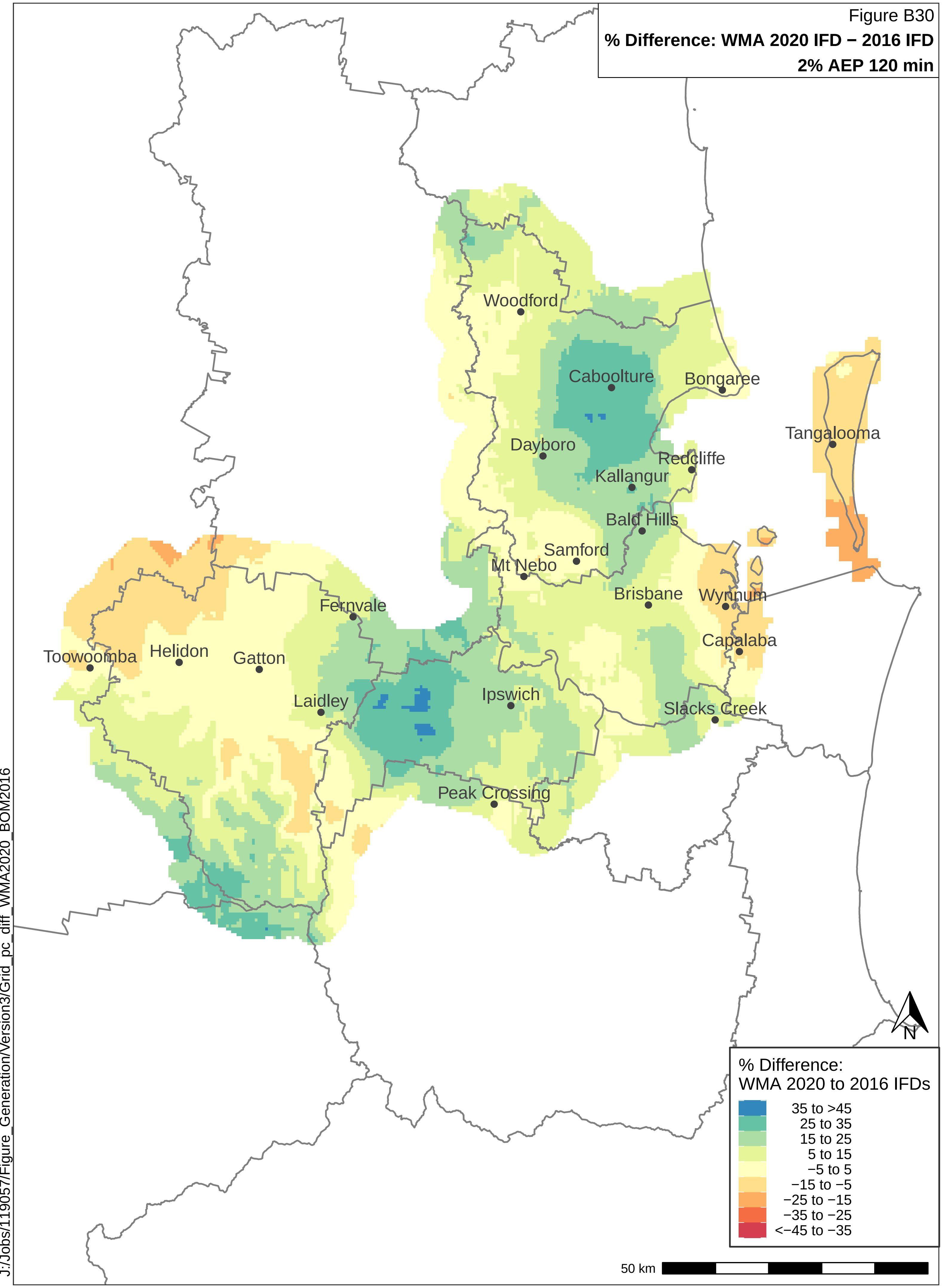


Figure B30
% Difference: WMA 2020 IFD − 2016 IFD
2% AEP 120 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

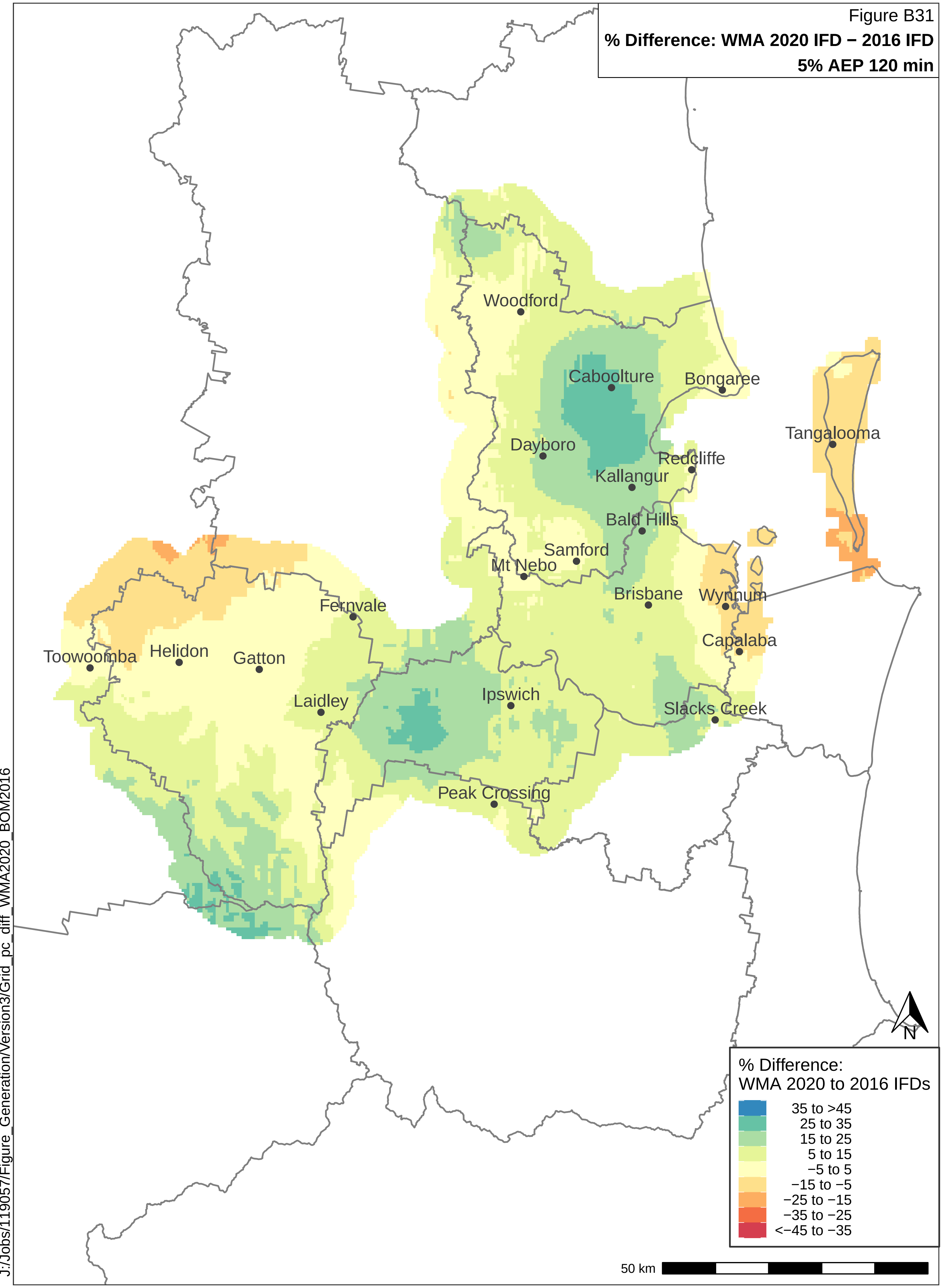


Figure B31
% Difference: WMA 2020 IFD − 2016 IFD
5% AEP 120 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Capalaba
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

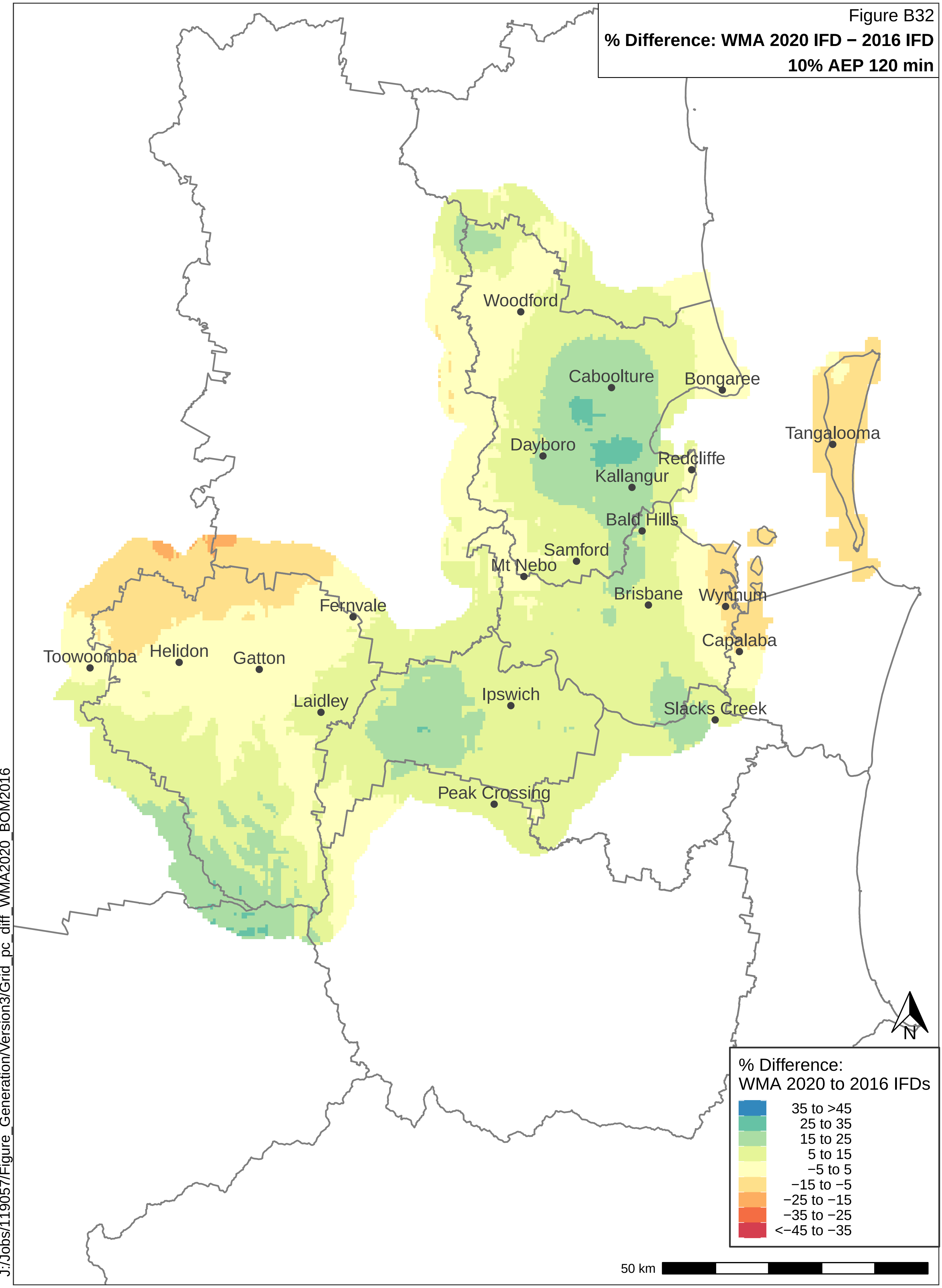


Figure B32
% Difference: WMA 2020 IFD – 2016 IFD
10% AEP 120 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

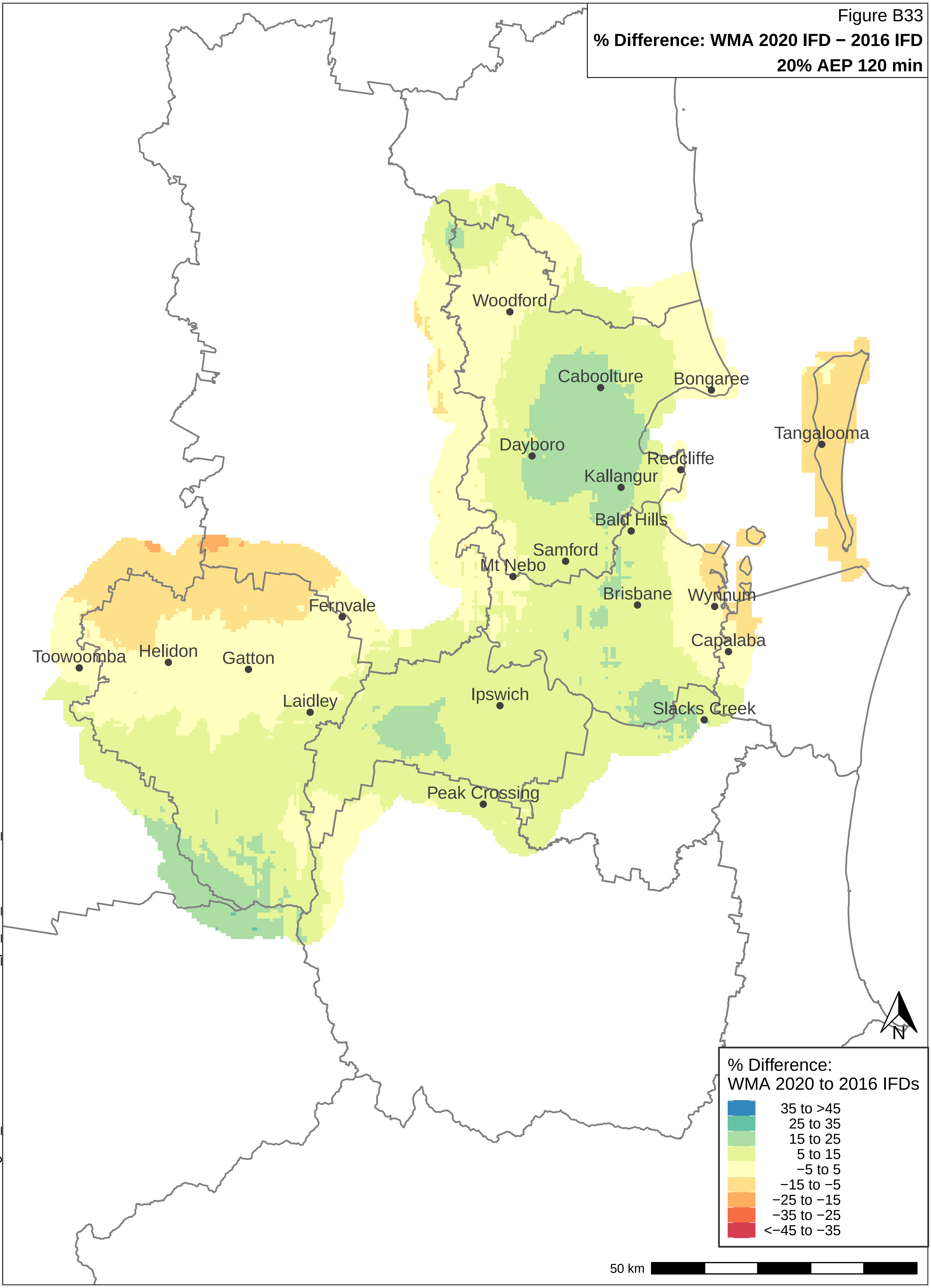


Figure B33
% Difference: WMA 2020 IFD − 2016 IFD
20% AEP 120 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

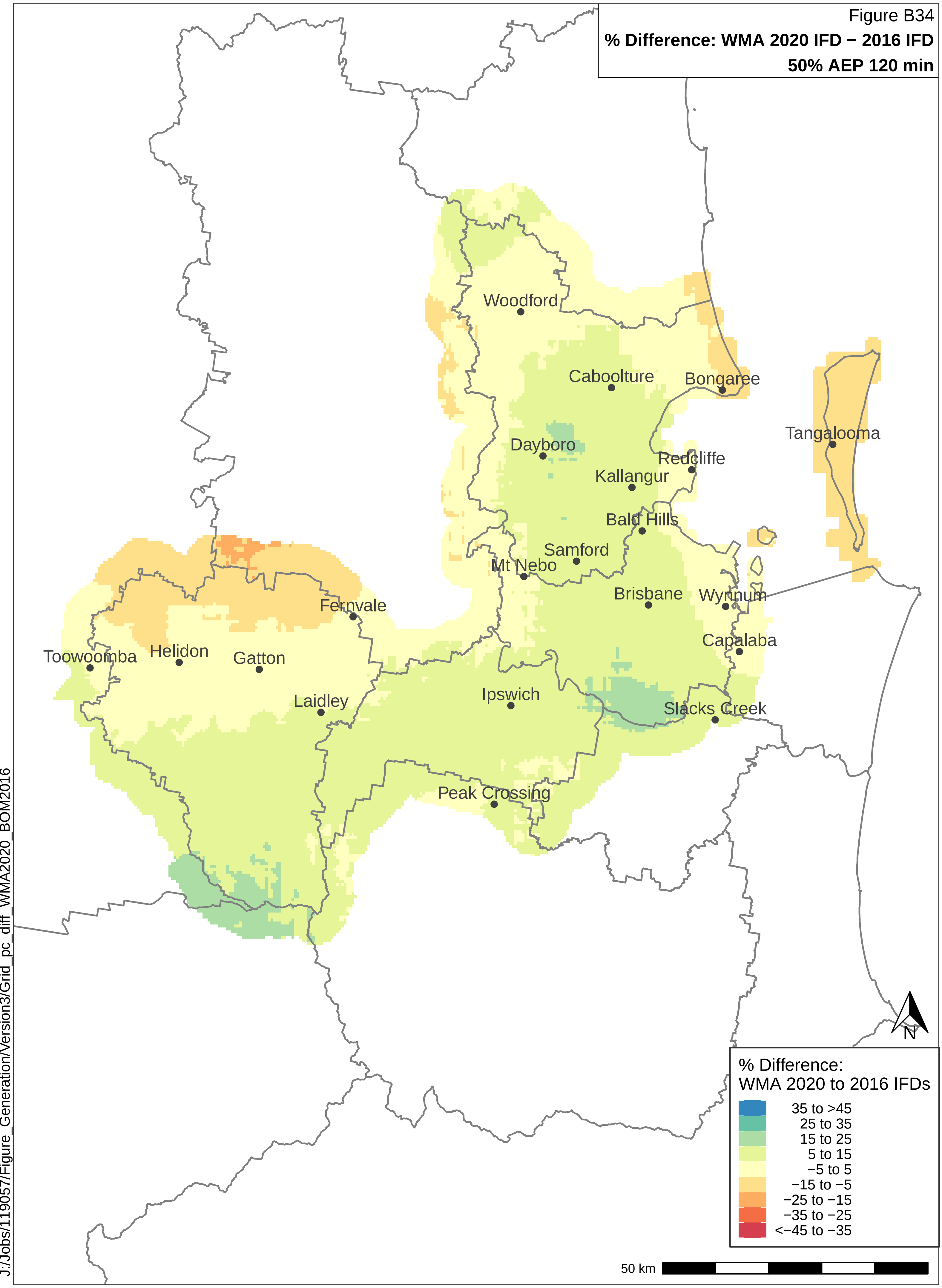


Figure B34
% Difference: WMA 2020 IFD − 2016 IFD
50% AEP 120 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

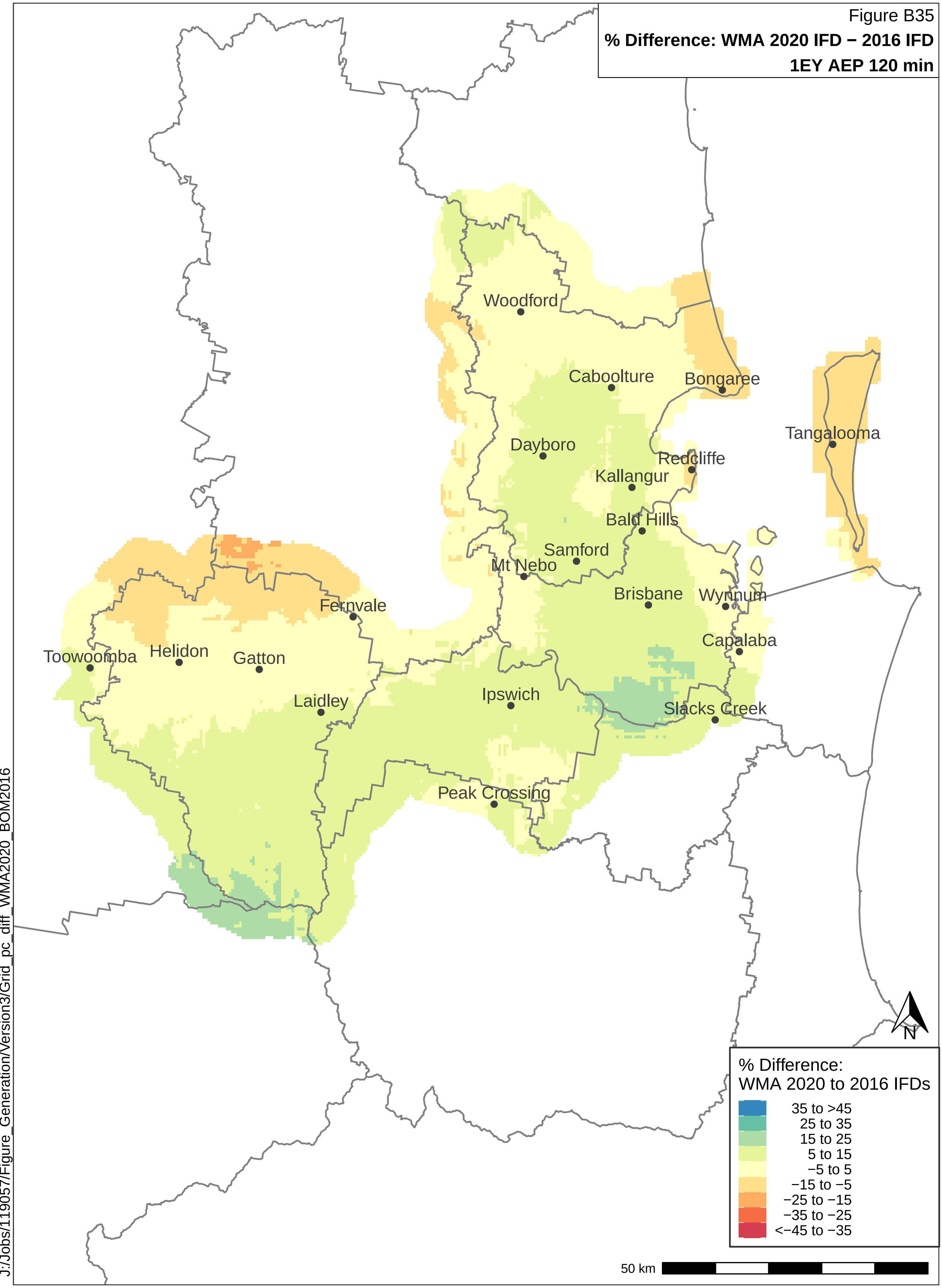


Figure B35
% Difference: WMA 2020 IFD − 2016 IFD
1EY AEP 120 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

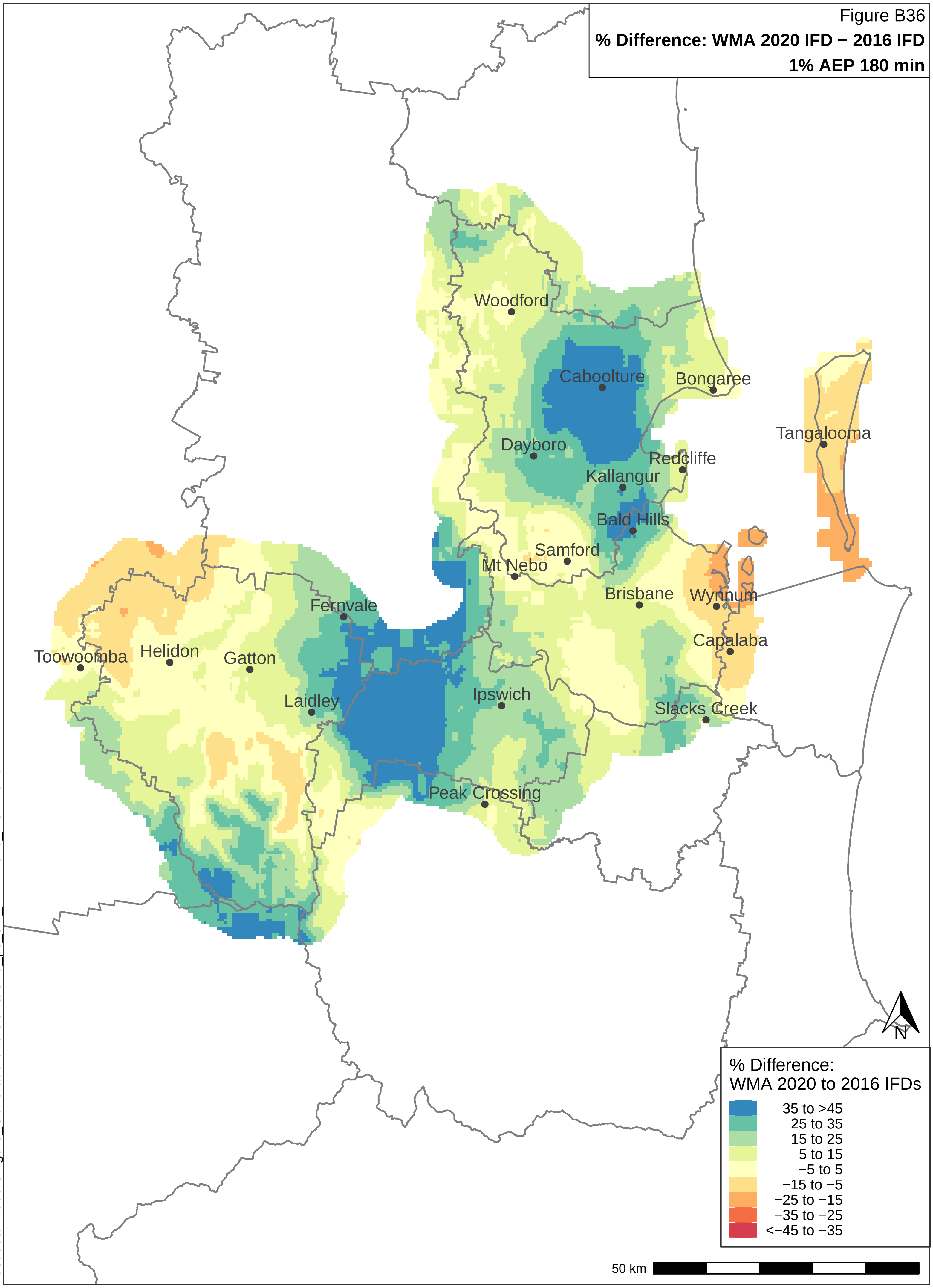


Figure B36
% Difference: WMA 2020 IFD − 2016 IFD
1% AEP 180 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

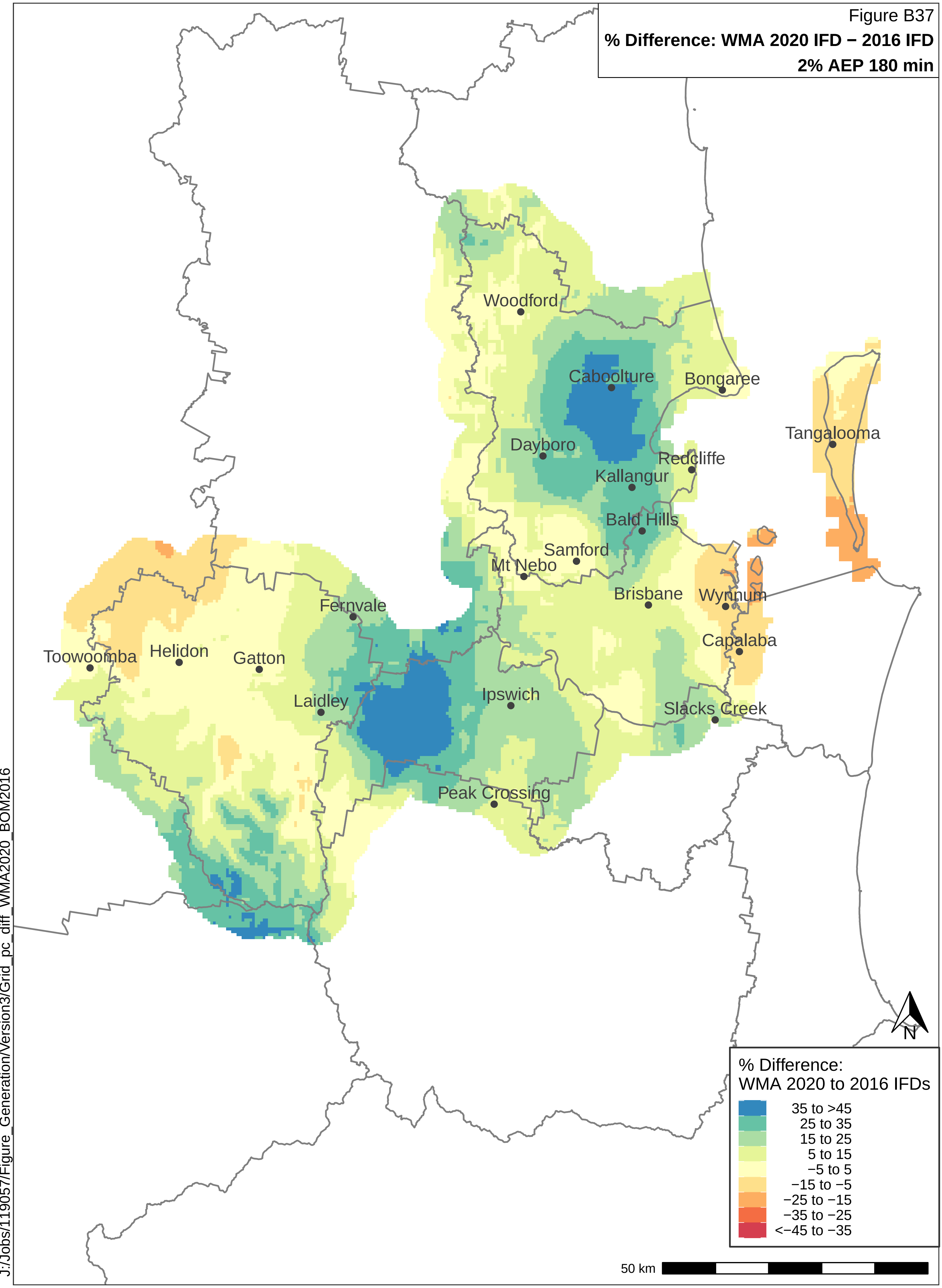


Figure B37
% Difference: WMA 2020 IFD − 2016 IFD
2% AEP 180 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

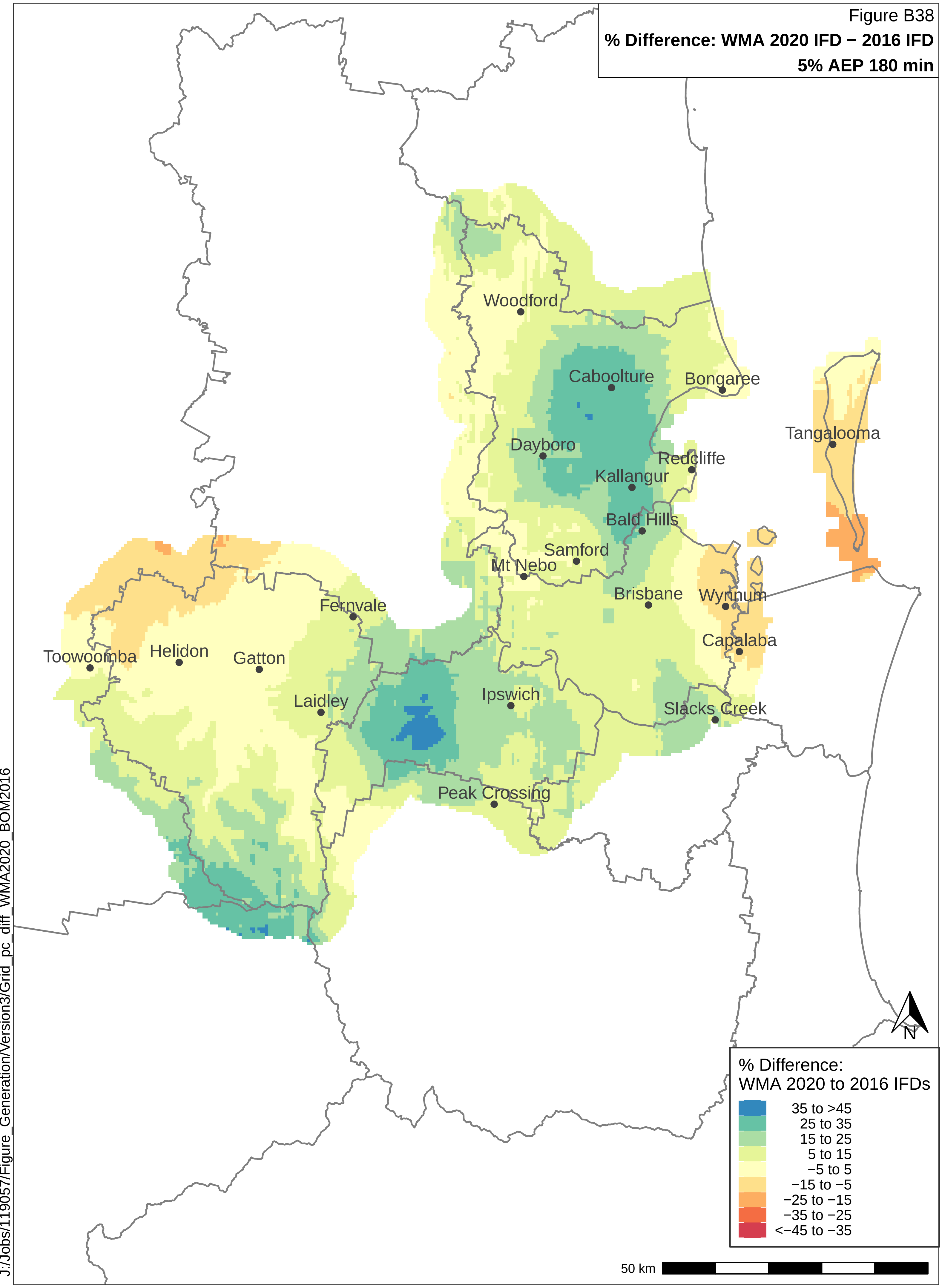


Figure B38
% Difference: WMA 2020 IFD − 2016 IFD
5% AEP 180 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

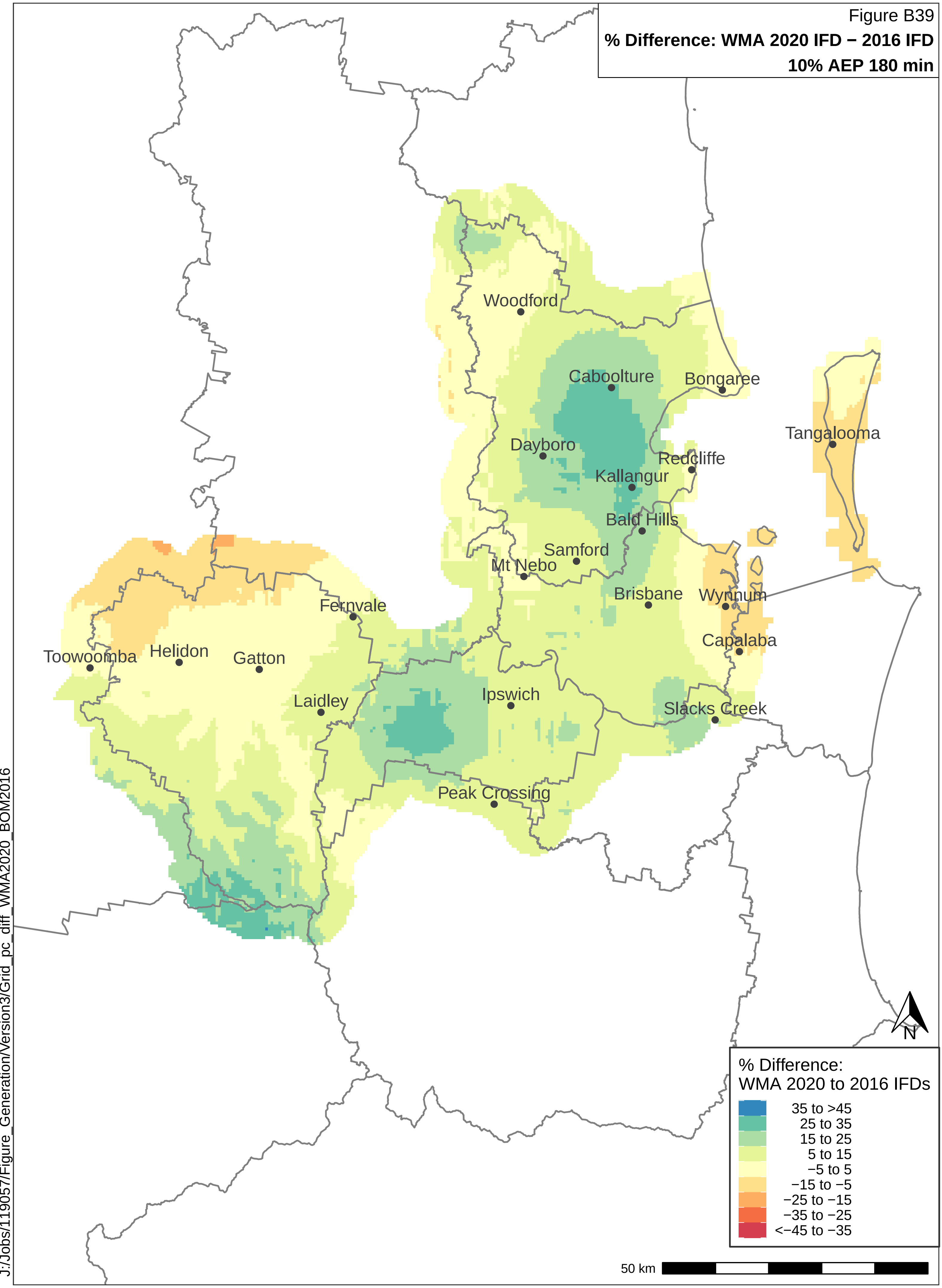
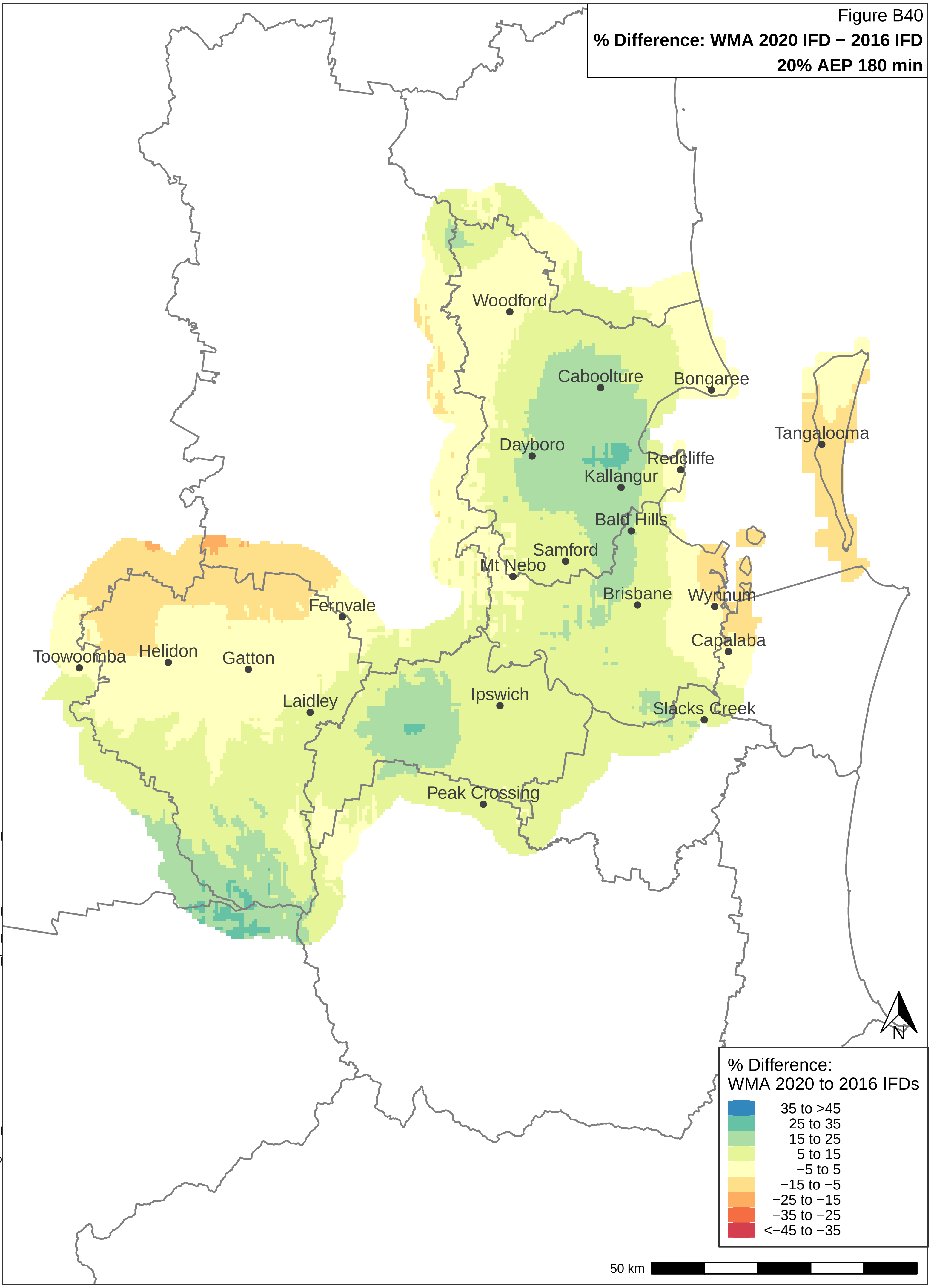


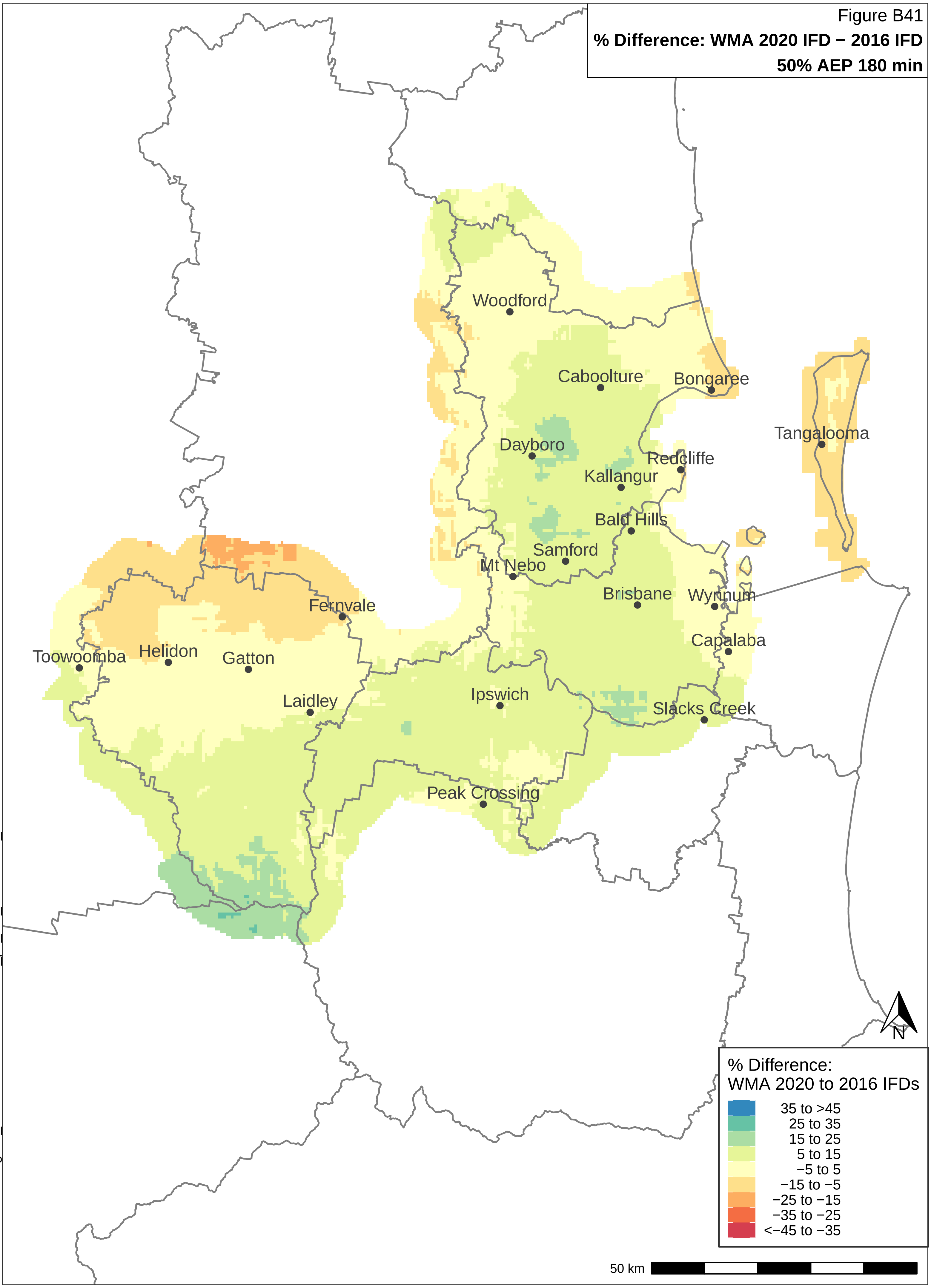
Figure B39
% Difference: WMA 2020 IFD – 2016 IFD
10% AEP 180 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B40
% Difference: WMA 2020 IFD − 2016 IFD
20% AEP 180 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B41
% Difference: WMA 2020 IFD − 2016 IFD
50% AEP 180 min

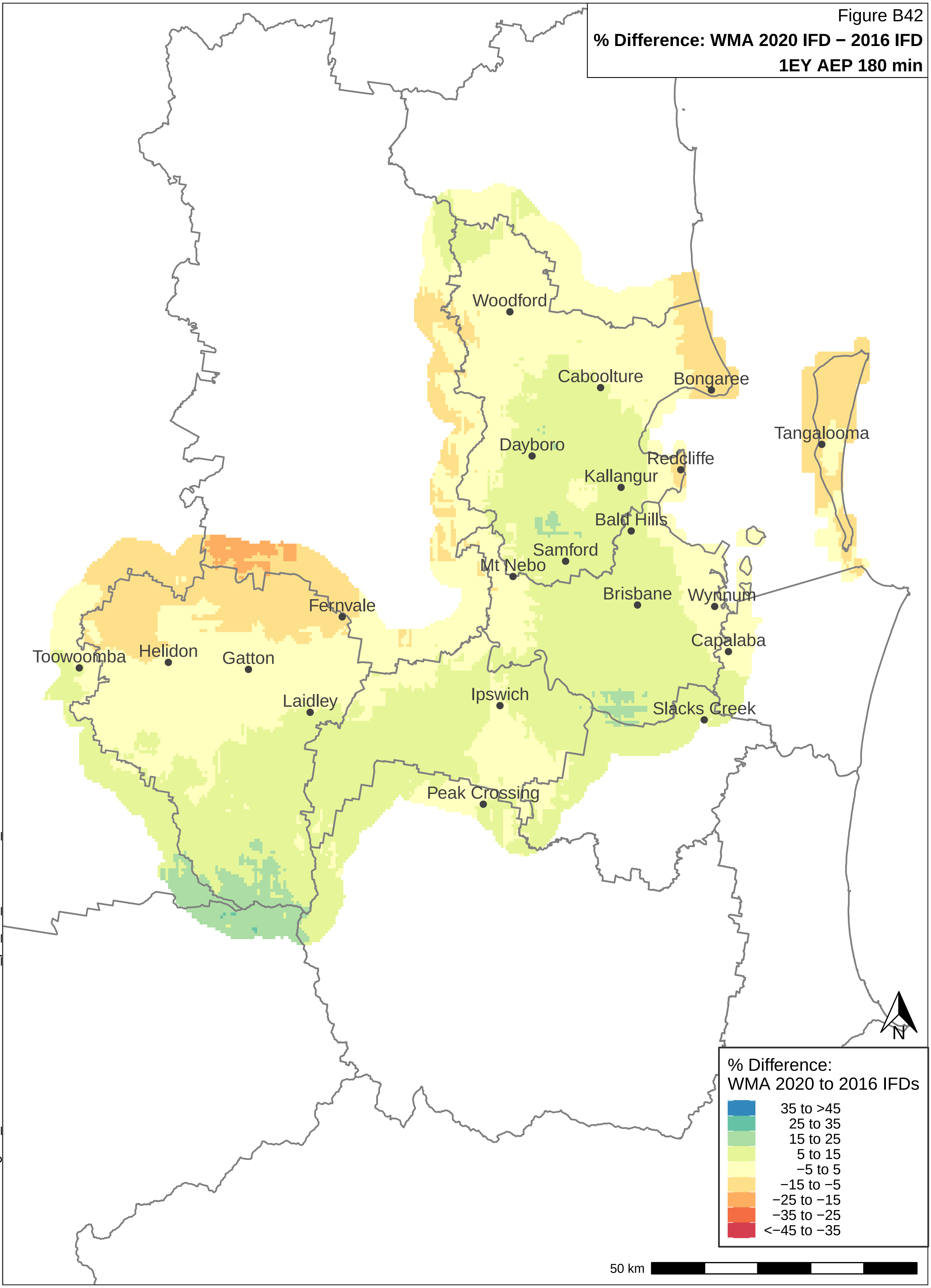


J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B42

% Difference: WMA 2020 IFD − 2016 IFD

1EY AEP 180 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

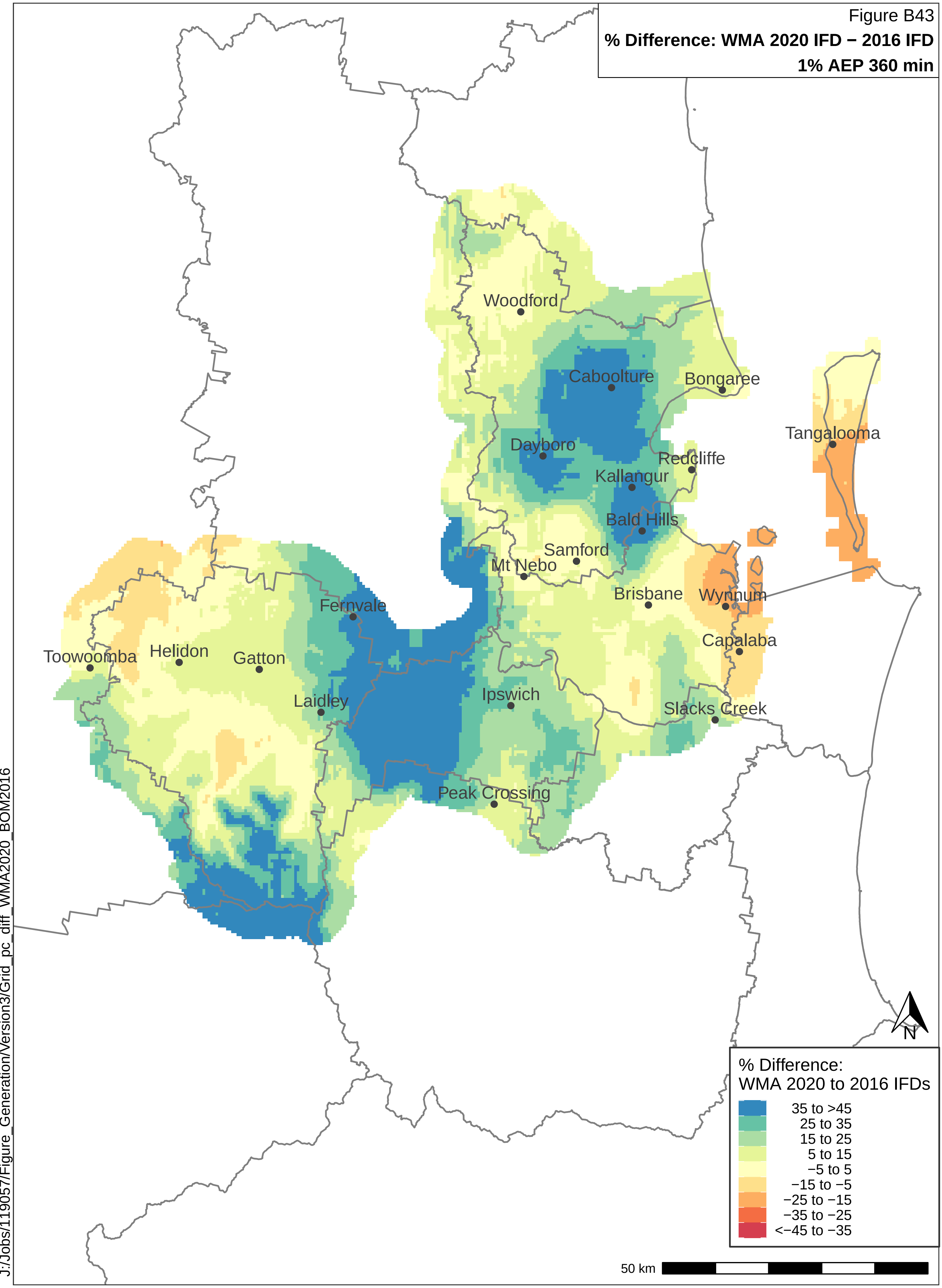
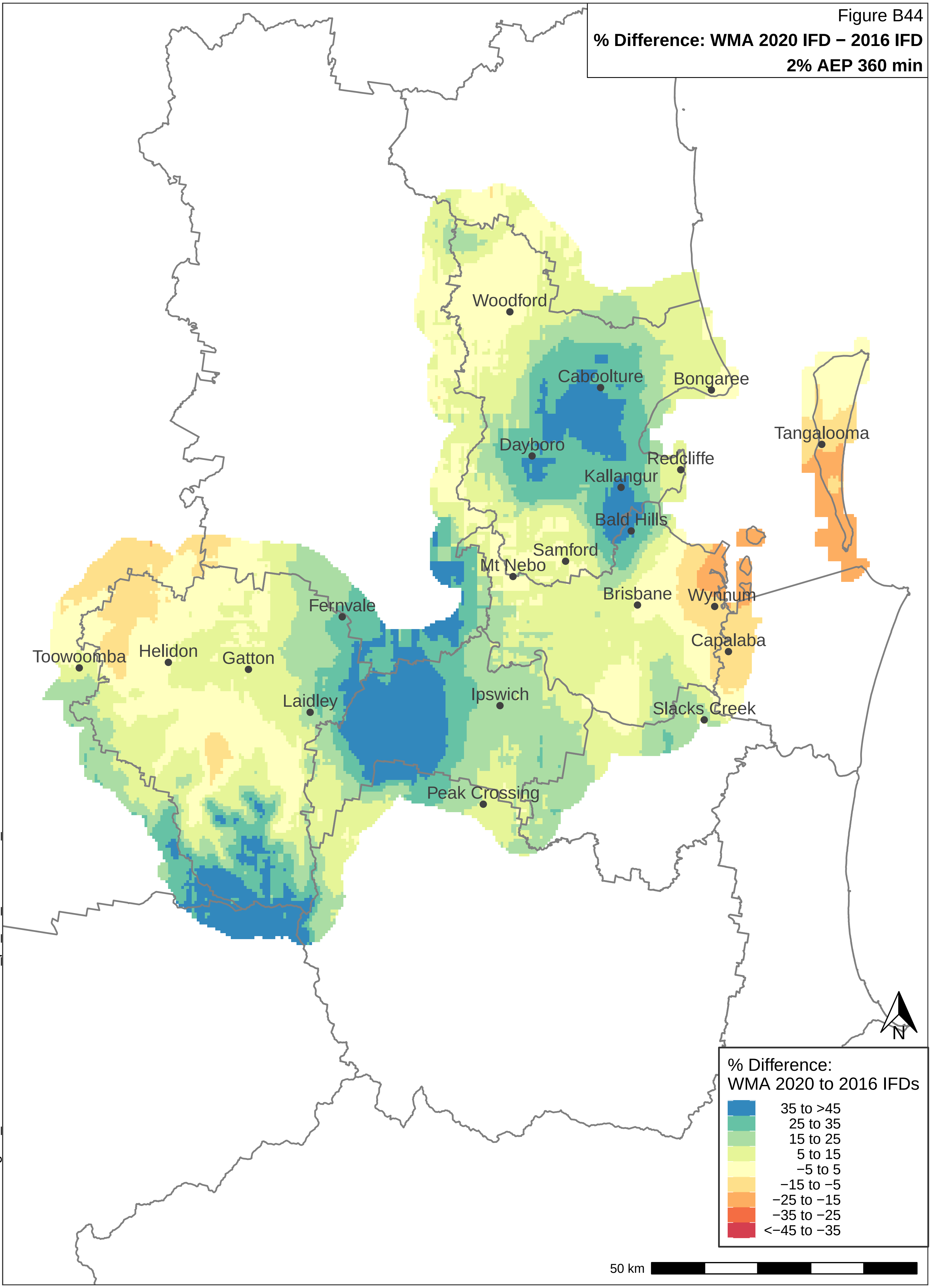


Figure B43
% Difference: WMA 2020 IFD − 2016 IFD
1% AEP 360 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B44

% Difference: WMA 2020 IFD − 2016 IFD

2% AEP 360 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

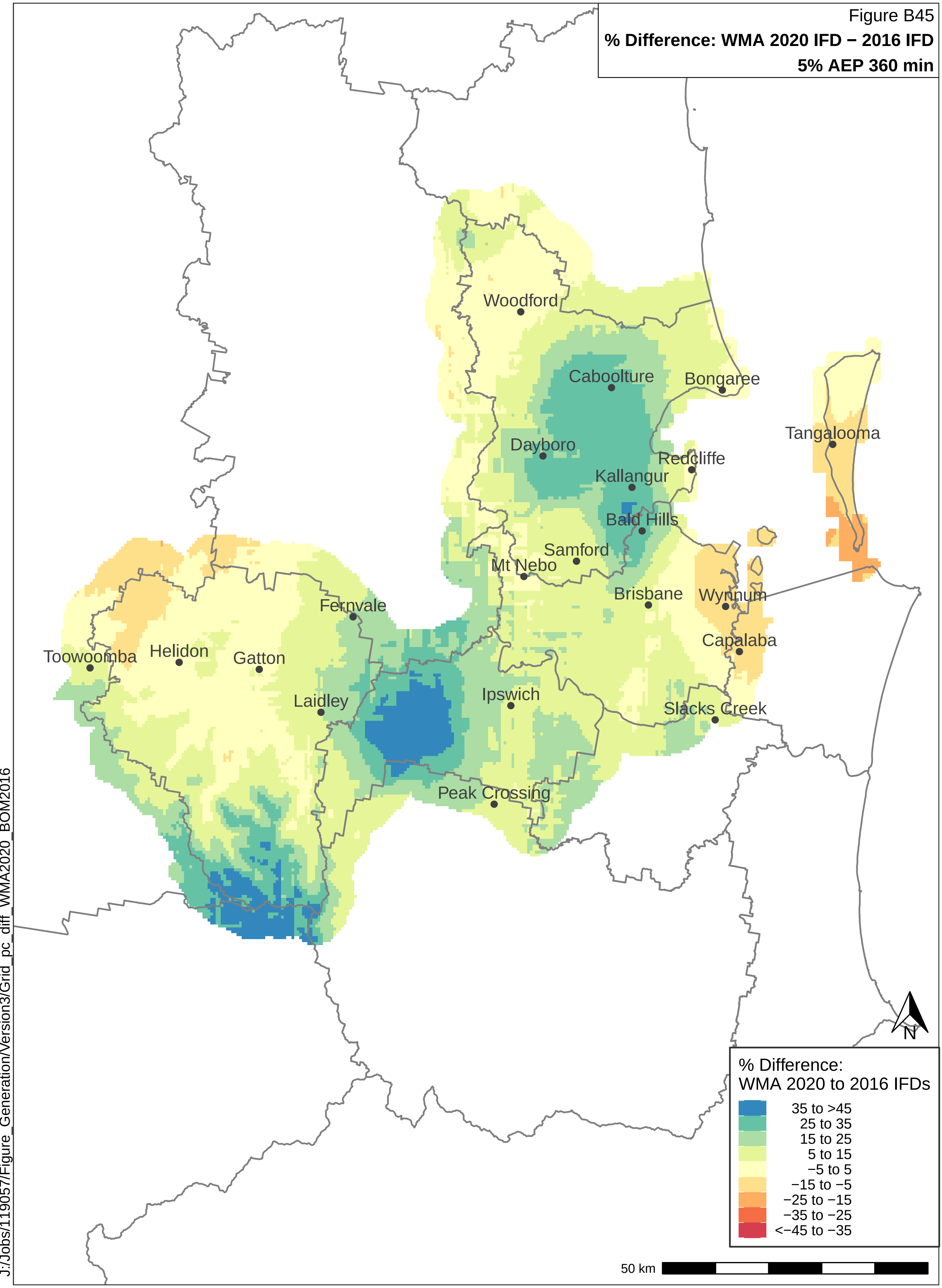


Figure B45
% Difference: WMA 2020 IFD − 2016 IFD
5% AEP 360 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

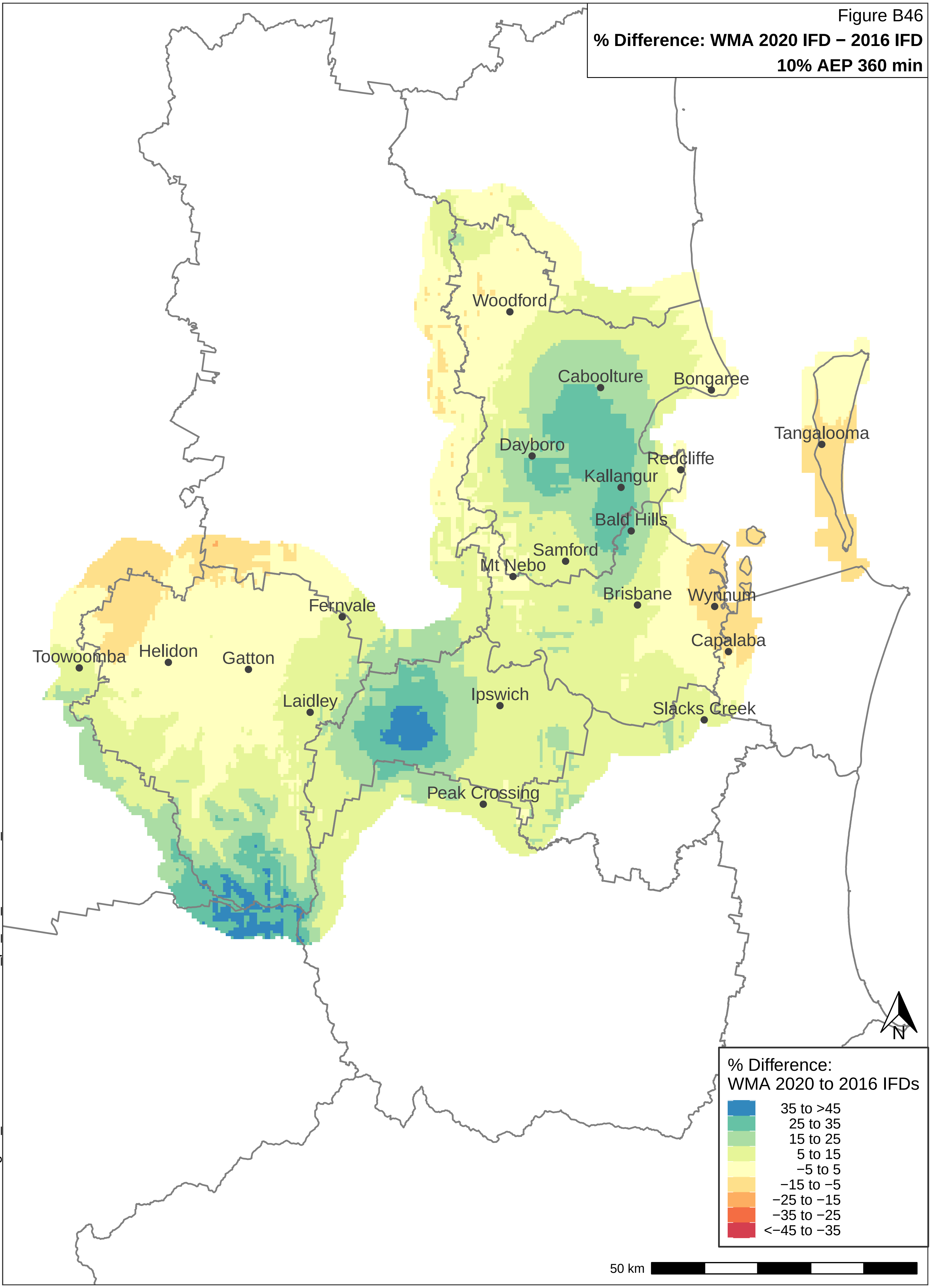


Figure B46

% Difference: WMA 2020 IFD − 2016 IFD

10% AEP 360 min

J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

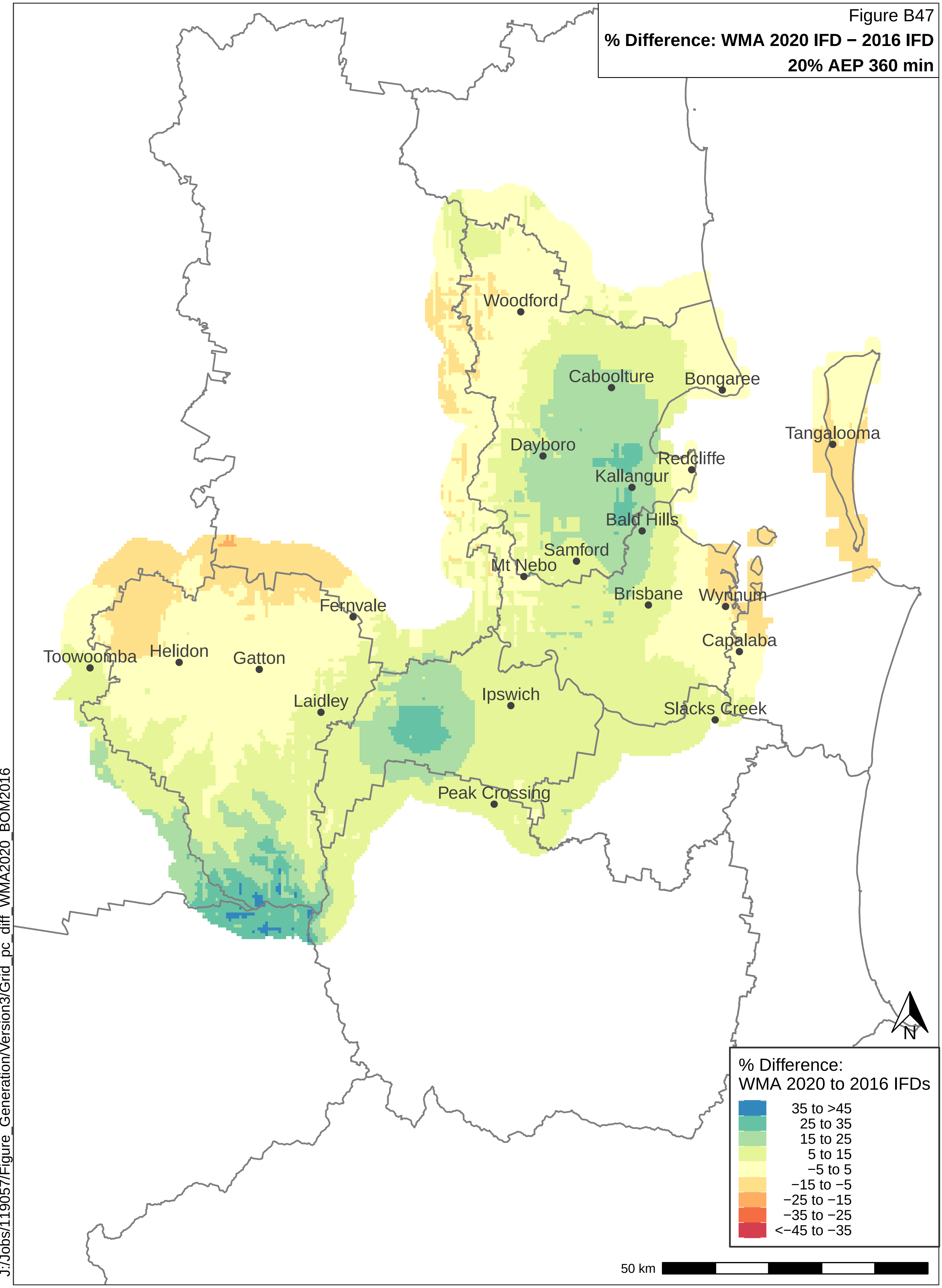
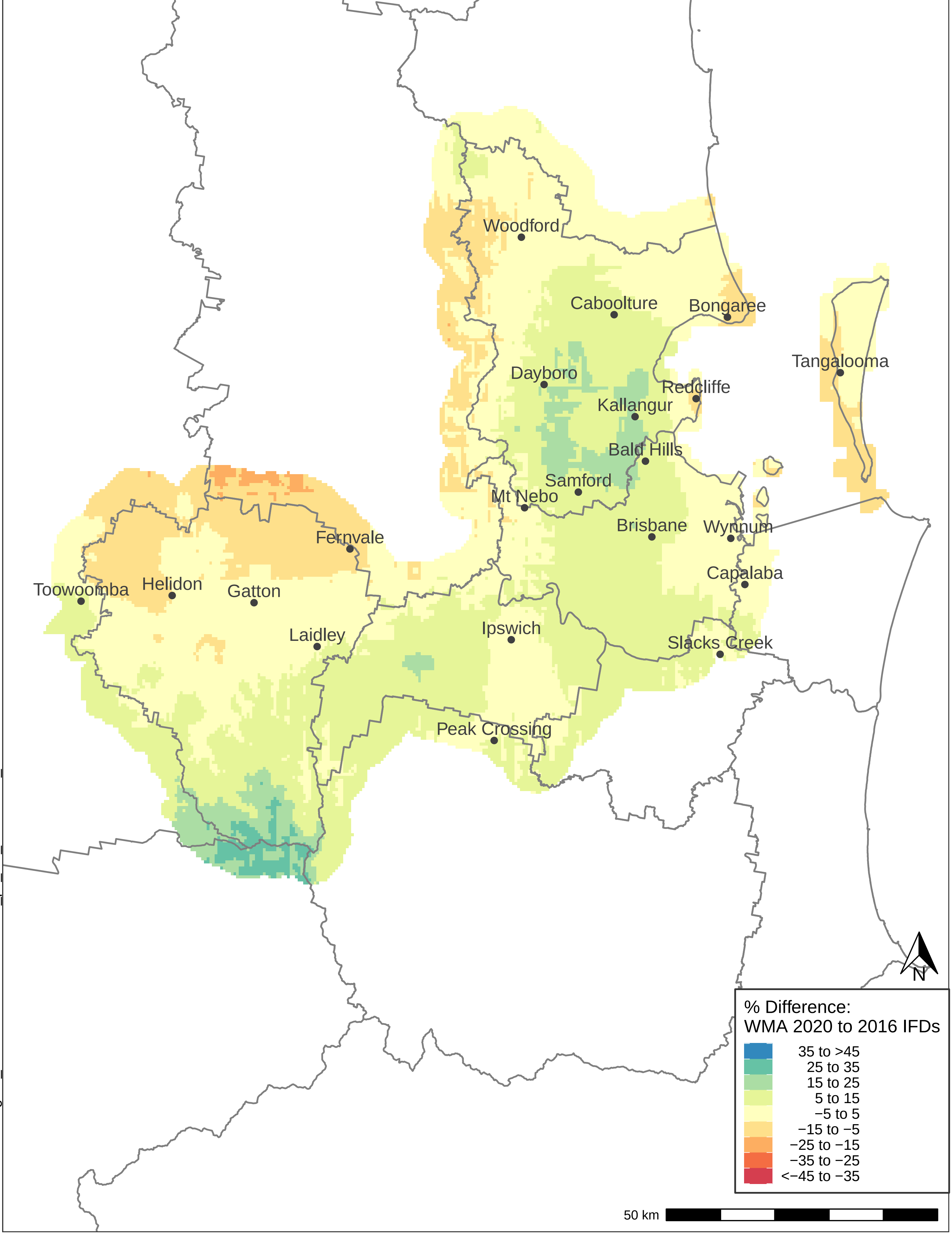


Figure B47
% Difference: WMA 2020 IFD − 2016 IFD
20% AEP 360 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B48

% Difference: WMA 2020 IFD − 2016 IFD

50% AEP 360 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

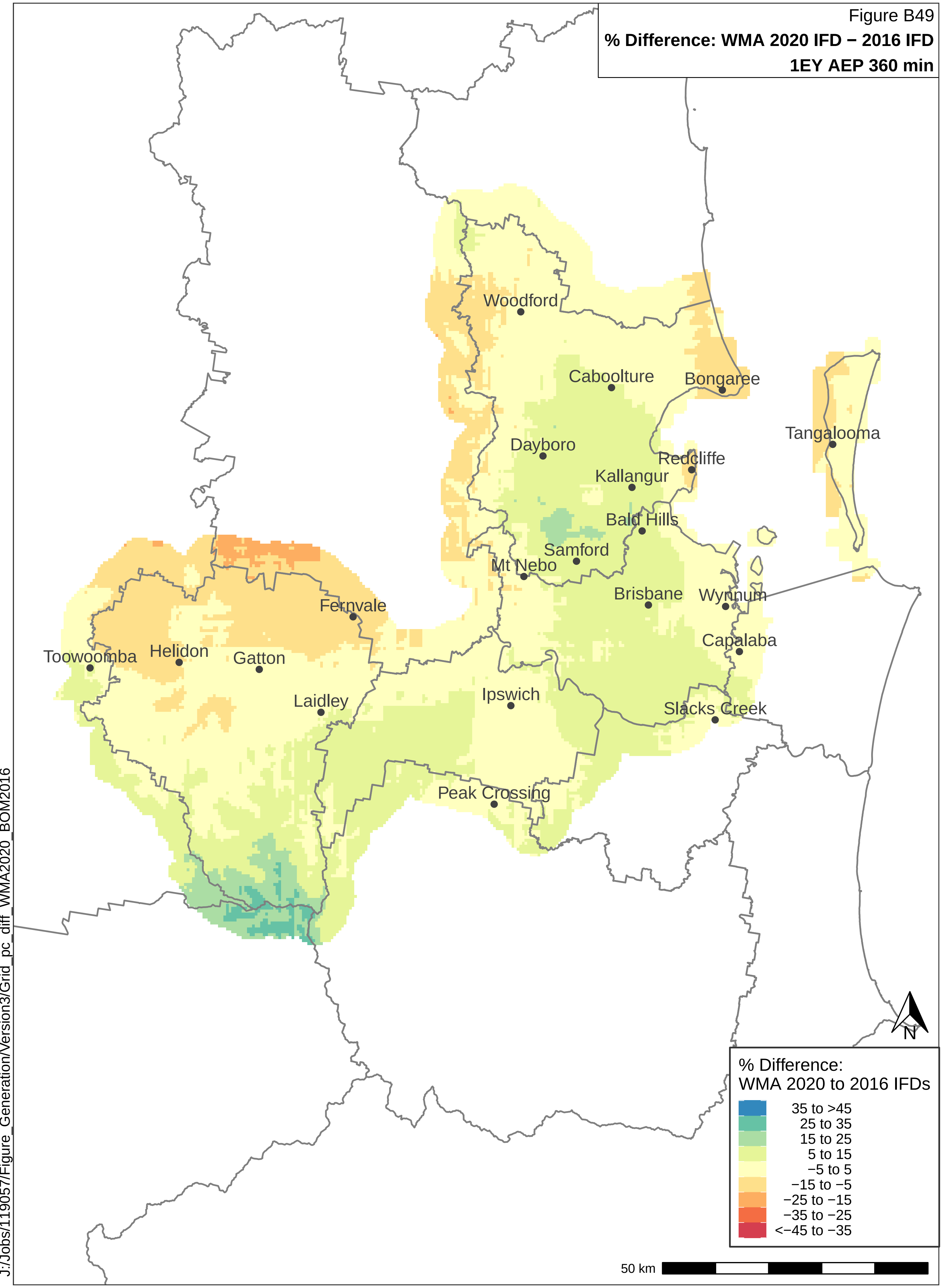
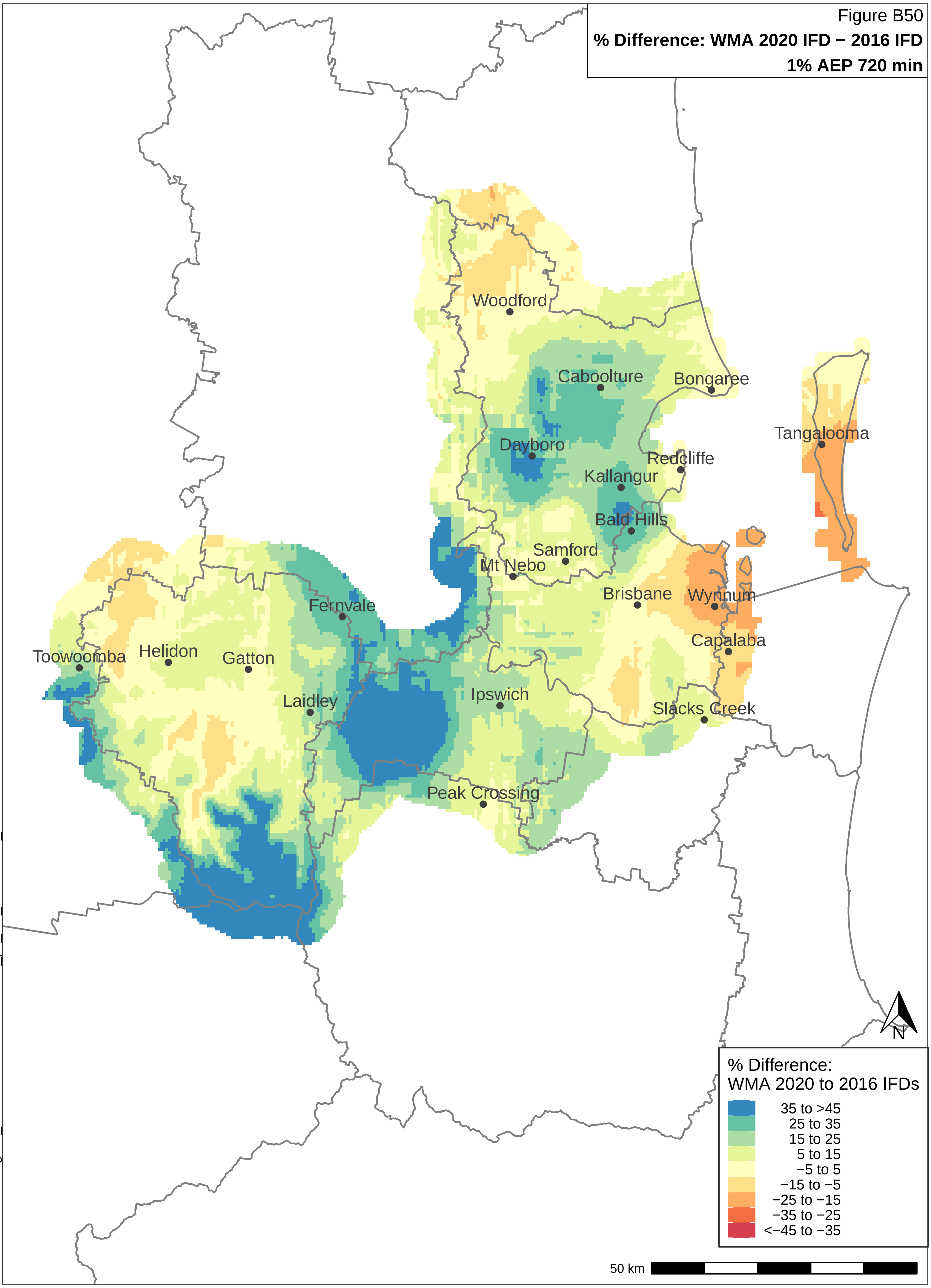


Figure B49
% Difference: WMA 2020 IFD − 2016 IFD
1EY AEP 360 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B50

% Difference: WMA 2020 IFD – 2016 IFD

1% AEP 720 min

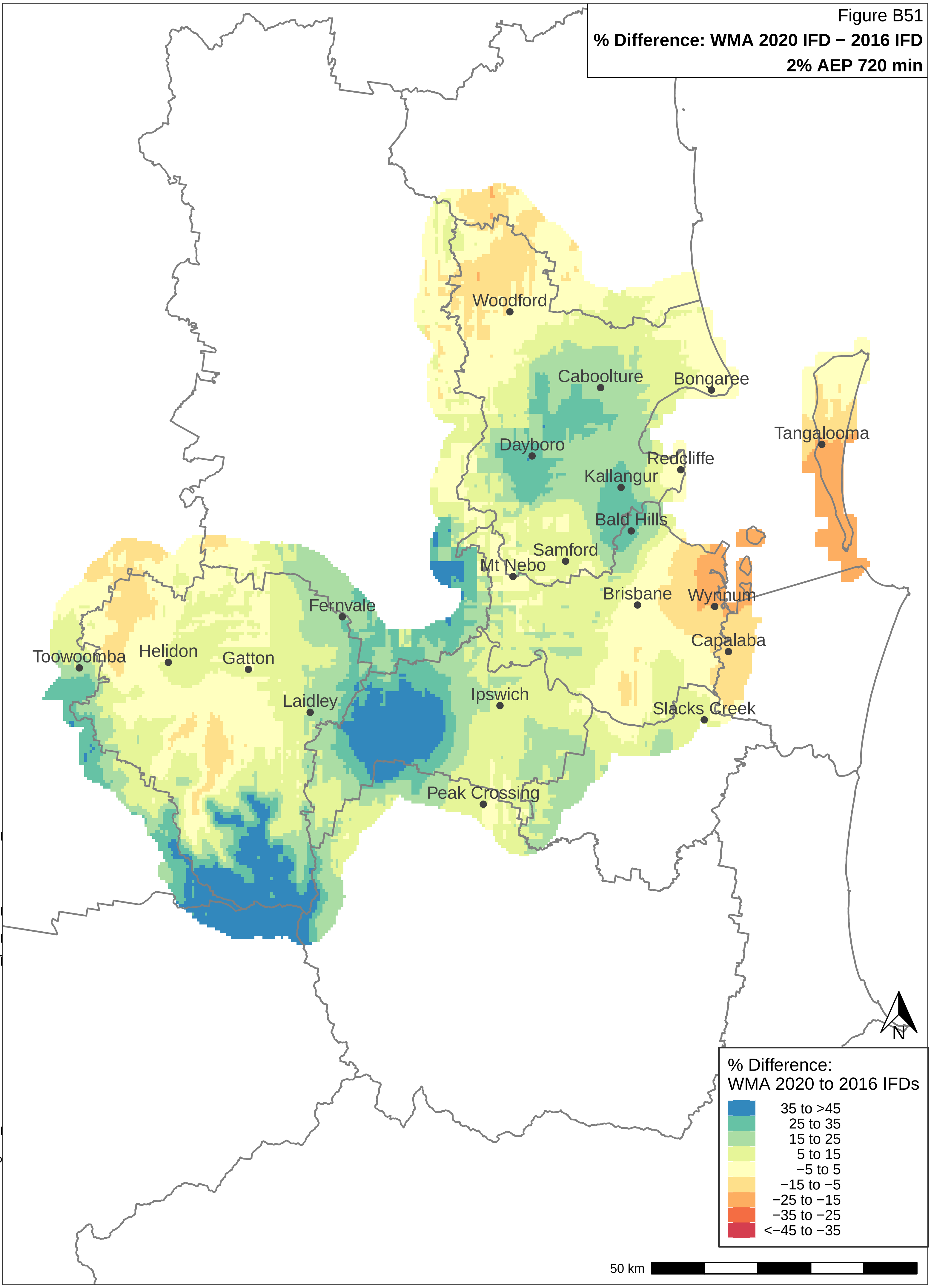


J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B51

% Difference: WMA 2020 IFD − 2016 IFD

2% AEP 720 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

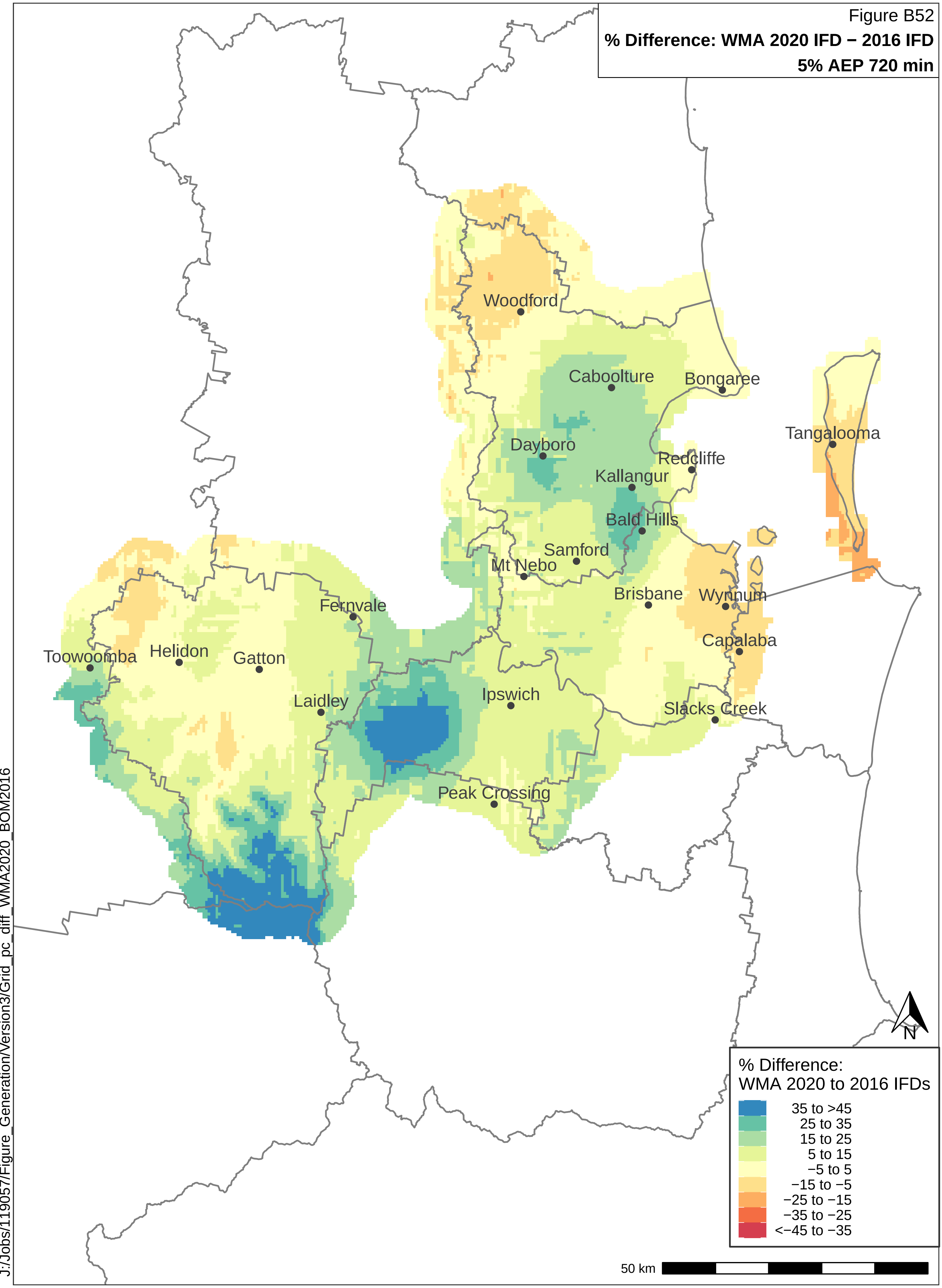


Figure B52
% Difference: WMA 2020 IFD − 2016 IFD
5% AEP 720 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

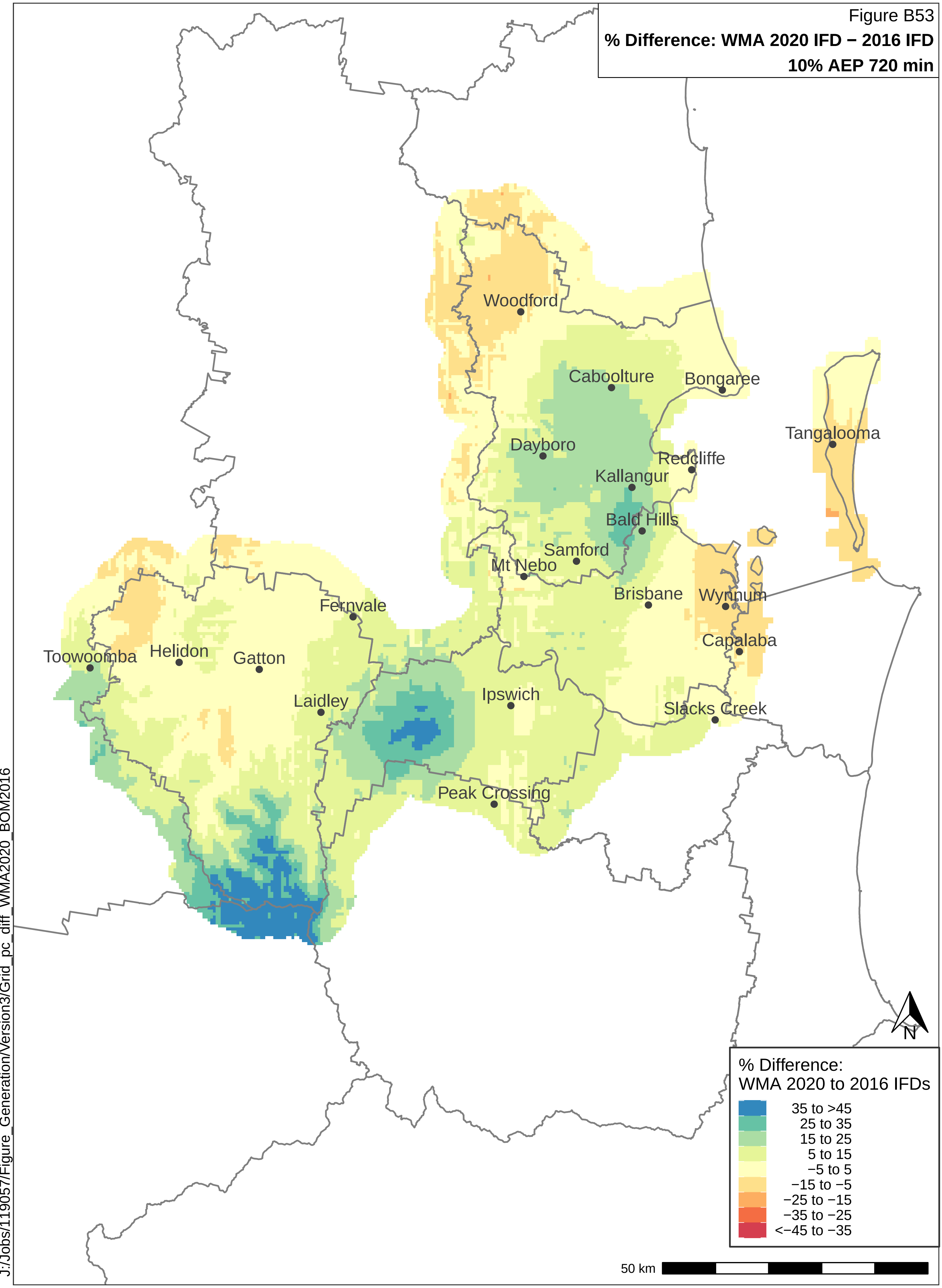
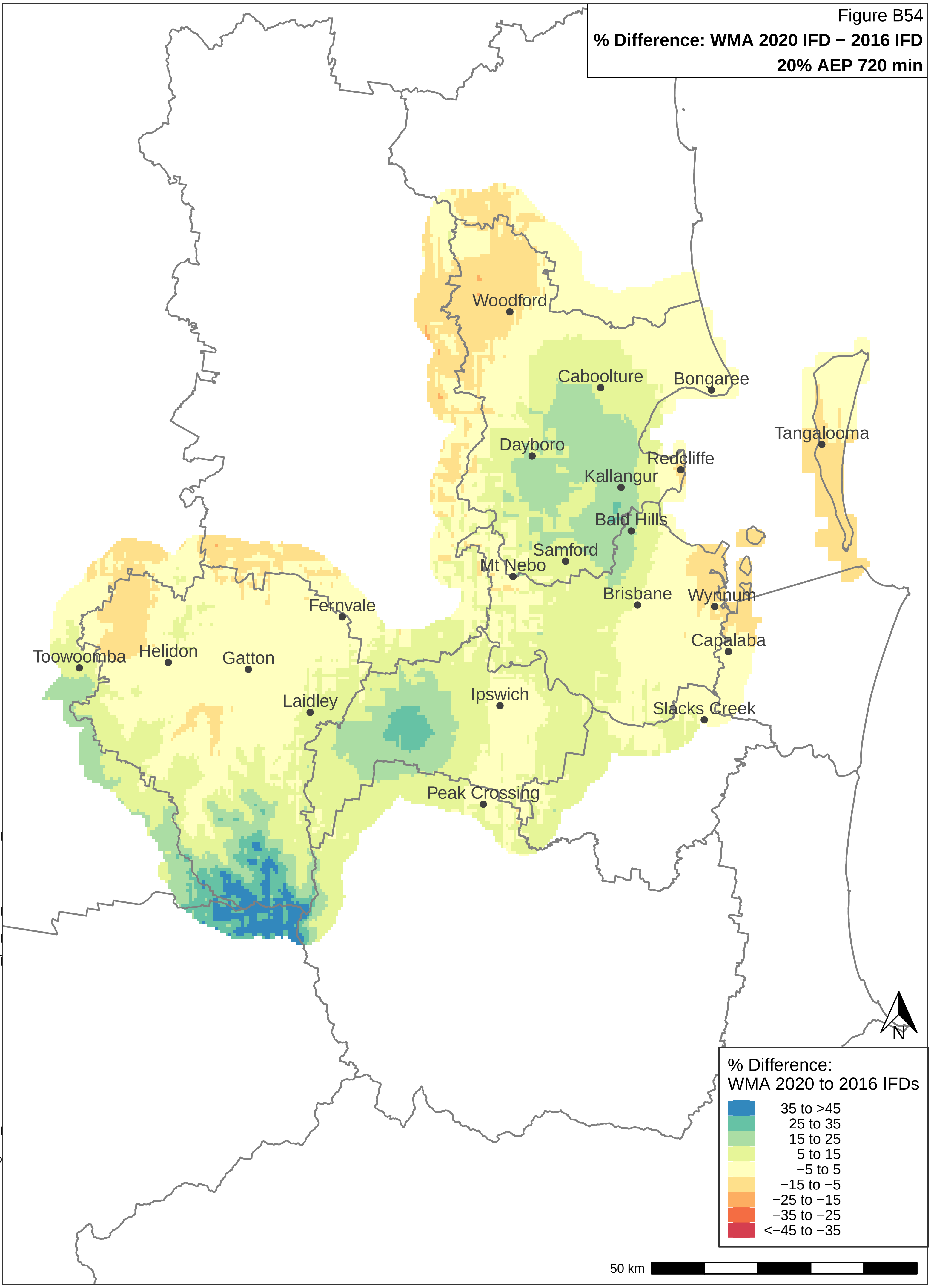


Figure B53
% Difference: WMA 2020 IFD − 2016 IFD
10% AEP 720 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

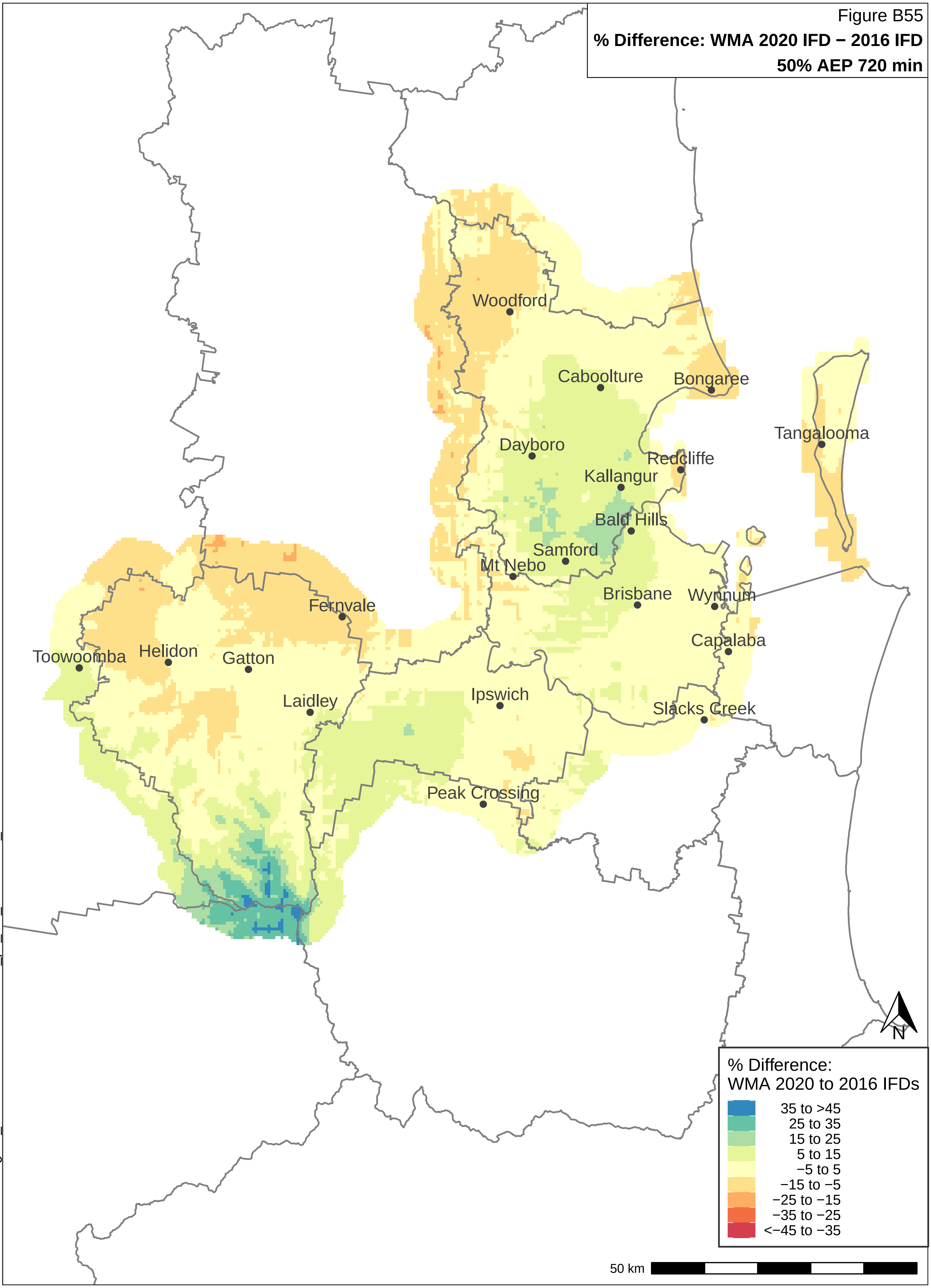
Figure B54

% Difference: WMA 2020 IFD − 2016 IFD

20% AEP 720 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

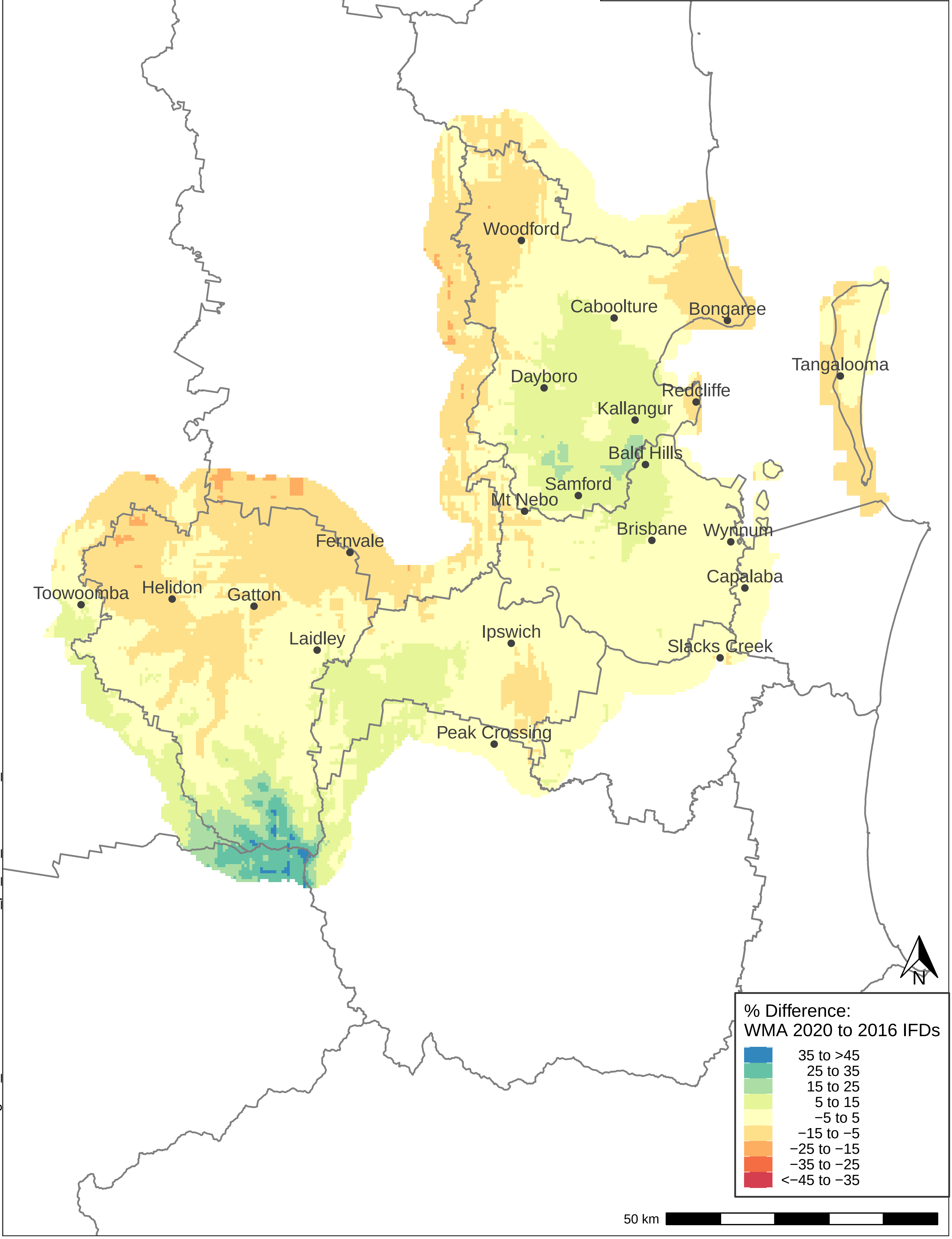


J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B56

% Difference: WMA 2020 IFD − 2016 IFD

1EY AEP 720 min

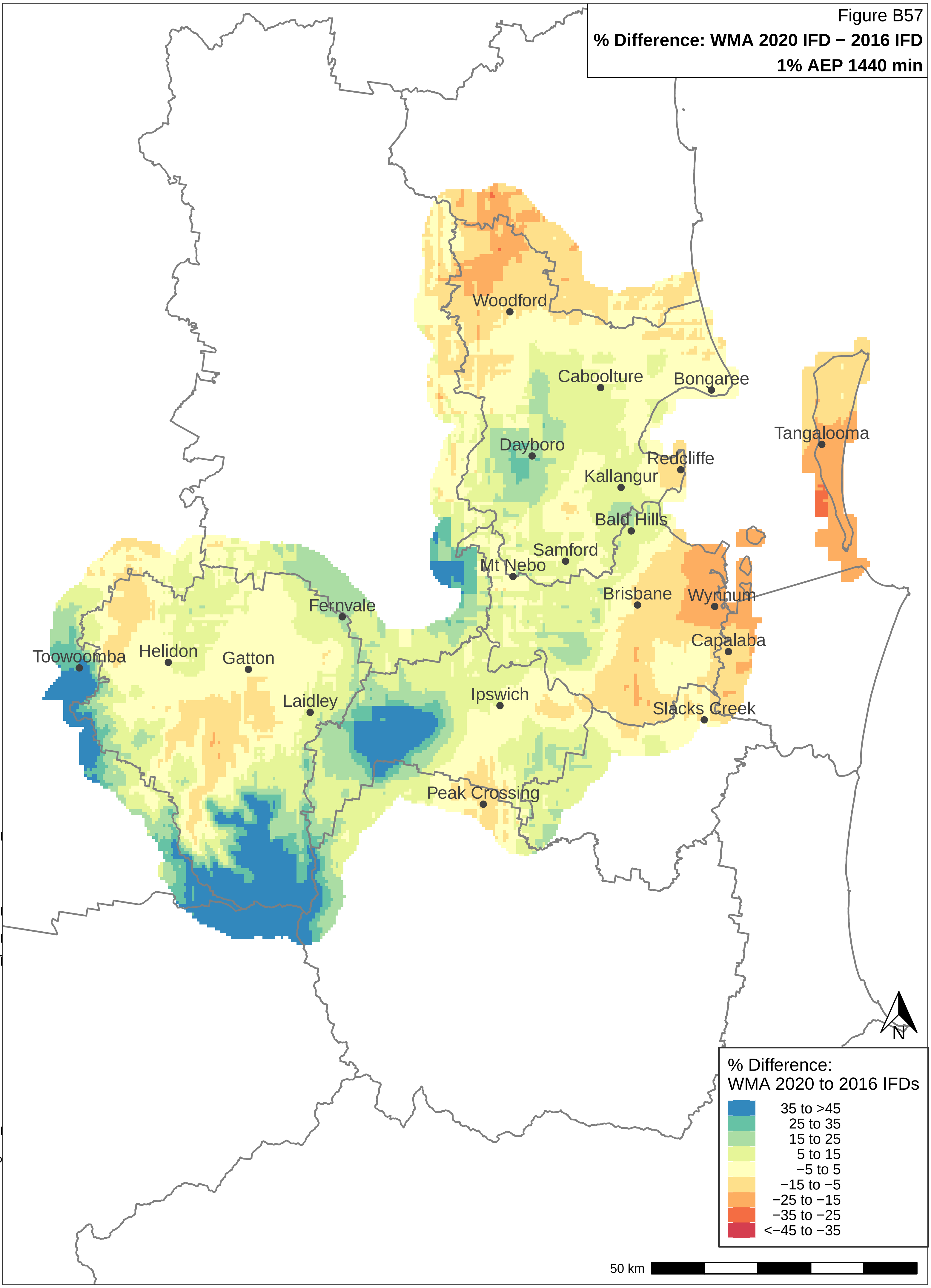


J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B57

% Difference: WMA 2020 IFD − 2016 IFD

1% AEP 1440 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

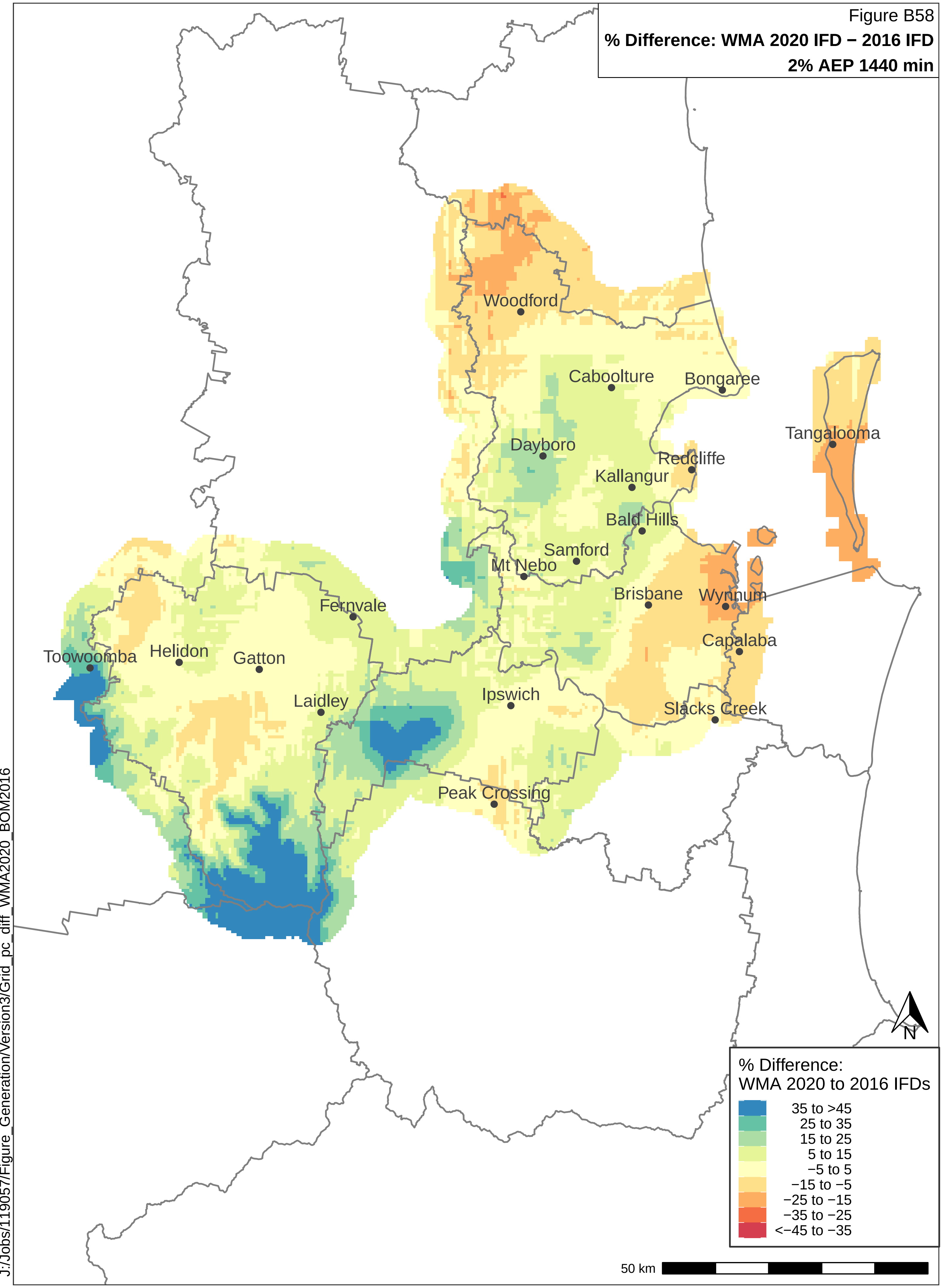


Figure B58
% Difference: WMA 2020 IFD − 2016 IFD
2% AEP 1440 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

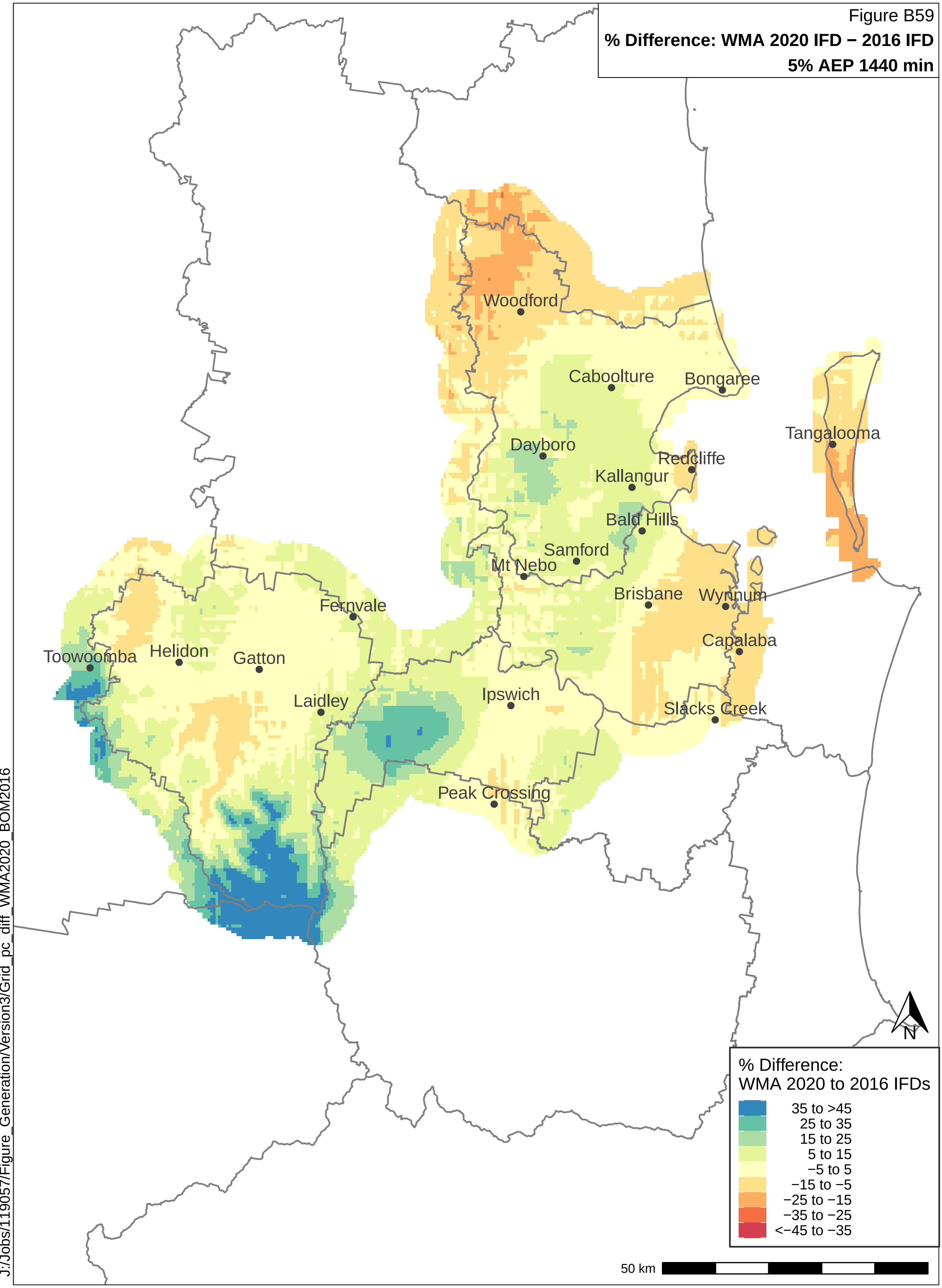


Figure B59
% Difference: WMA 2020 IFD − 2016 IFD
5% AEP 1440 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

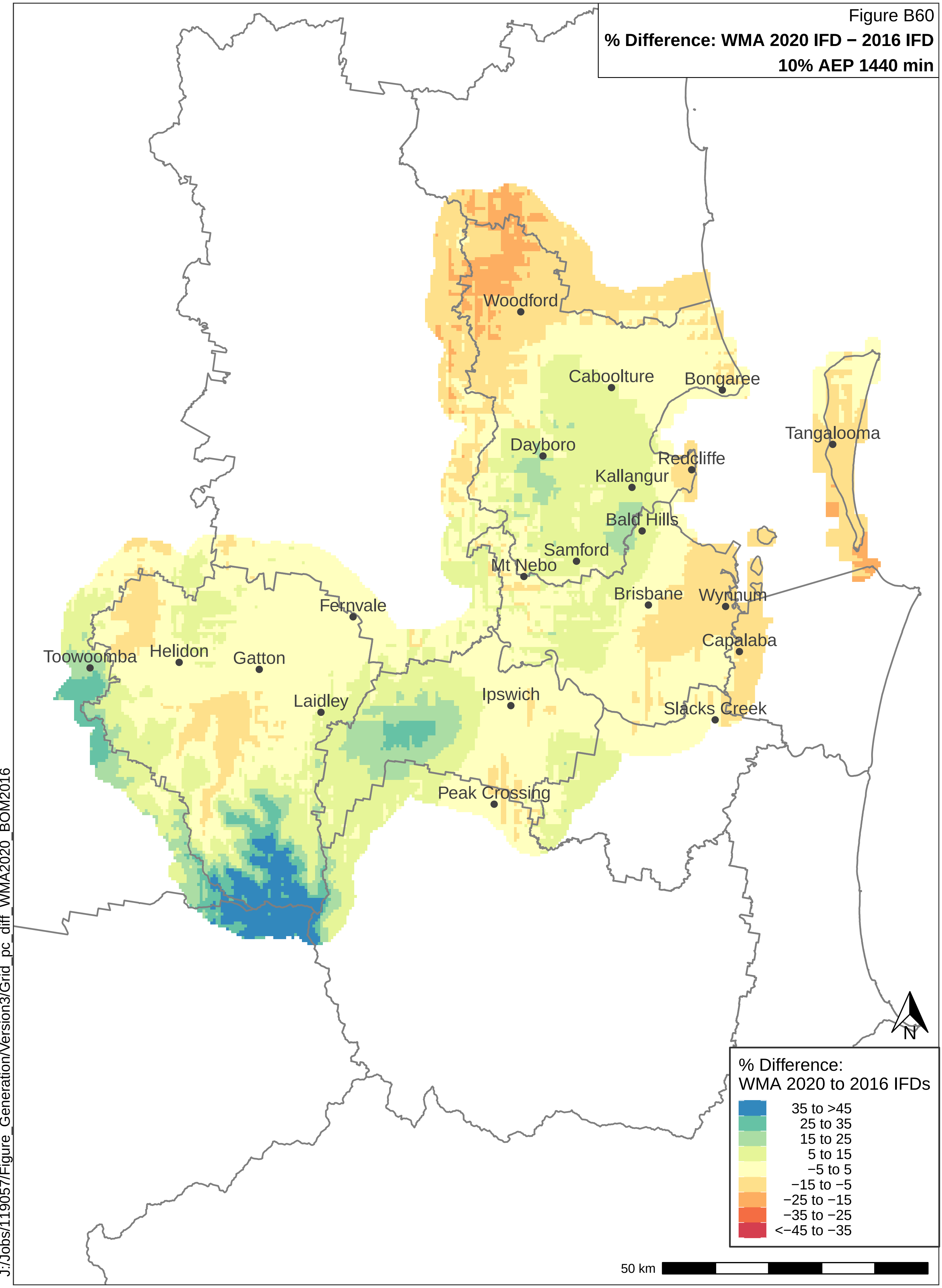


Figure B60
% Difference: WMA 2020 IFD − 2016 IFD
10% AEP 1440 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

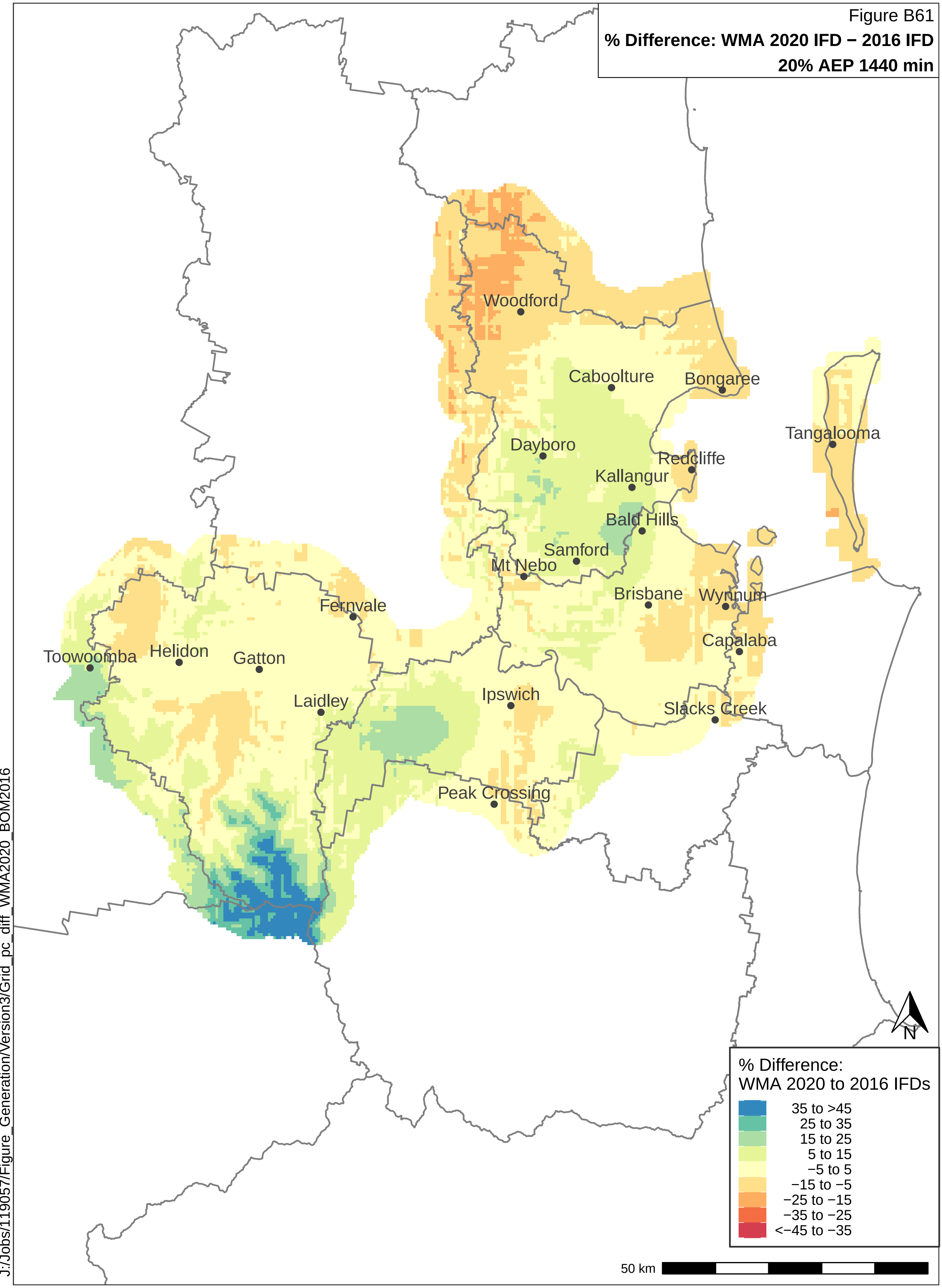
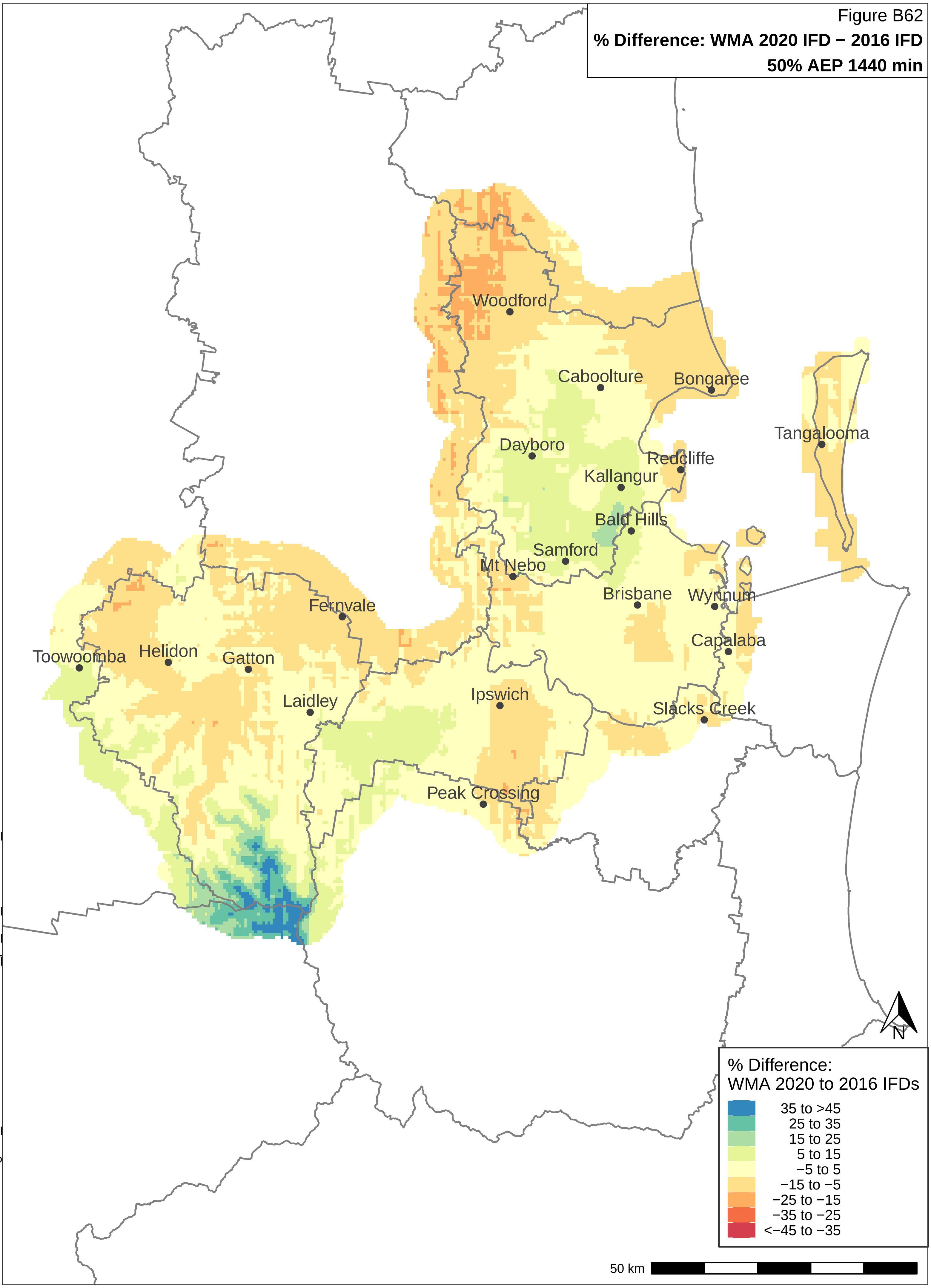


Figure B61
% Difference: WMA 2020 IFD − 2016 IFD
20% AEP 1440 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

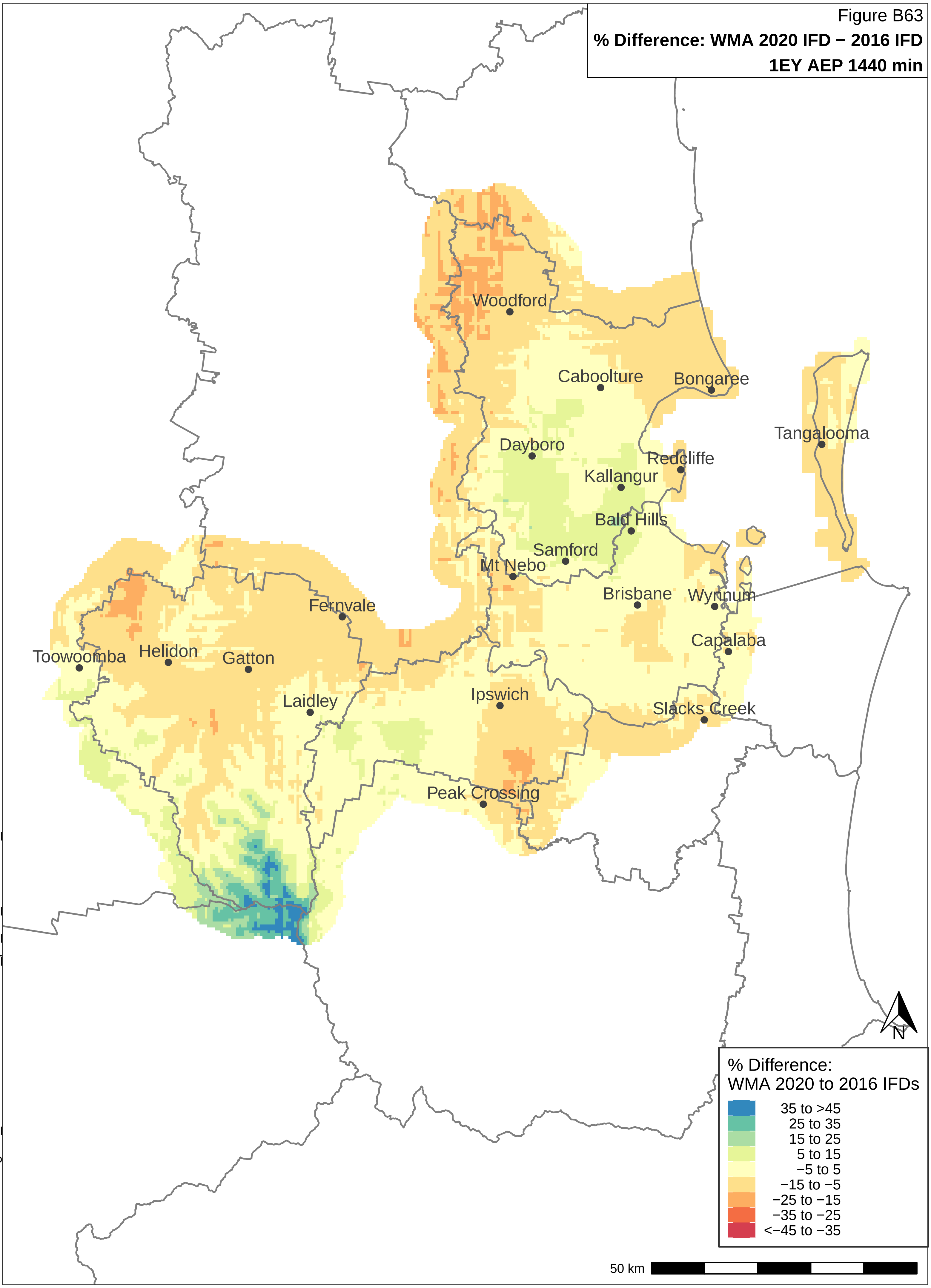


J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

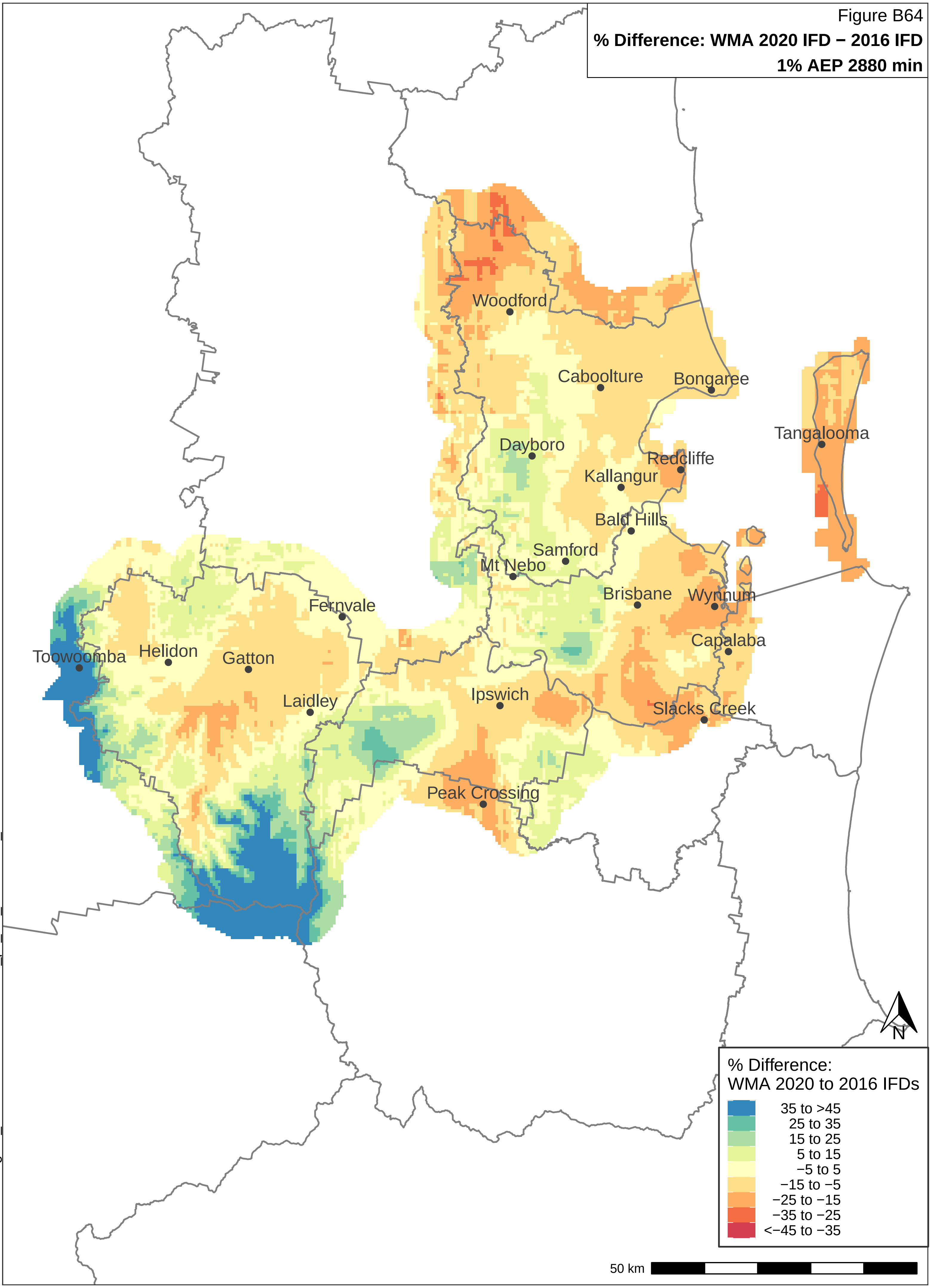
Figure B63

% Difference: WMA 2020 IFD − 2016 IFD

1EY AEP 1440 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

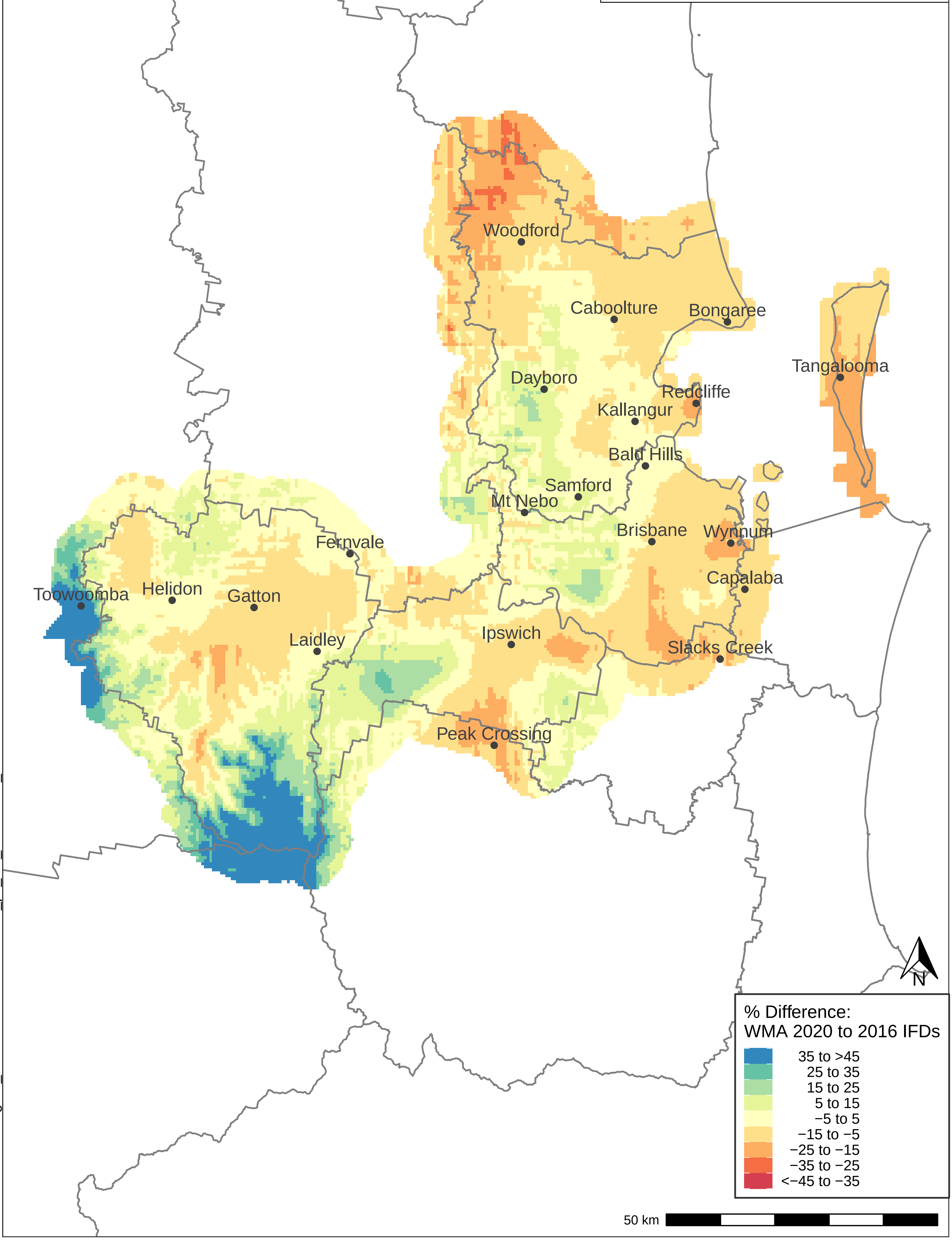


J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B65

% Difference: WMA 2020 IFD − 2016 IFD

2% AEP 2880 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

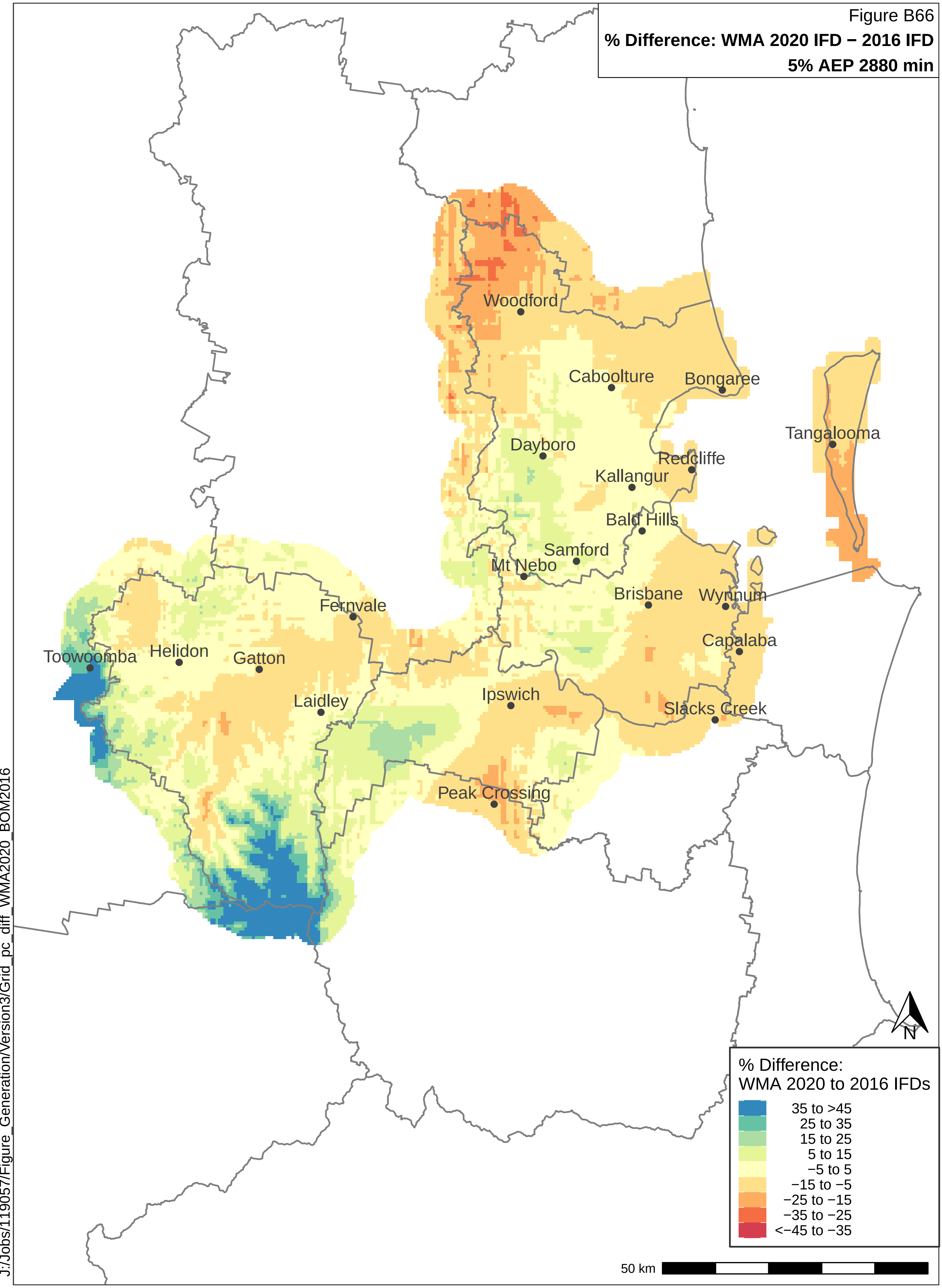


Figure B66
% Difference: WMA 2020 IFD − 2016 IFD
5% AEP 2880 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

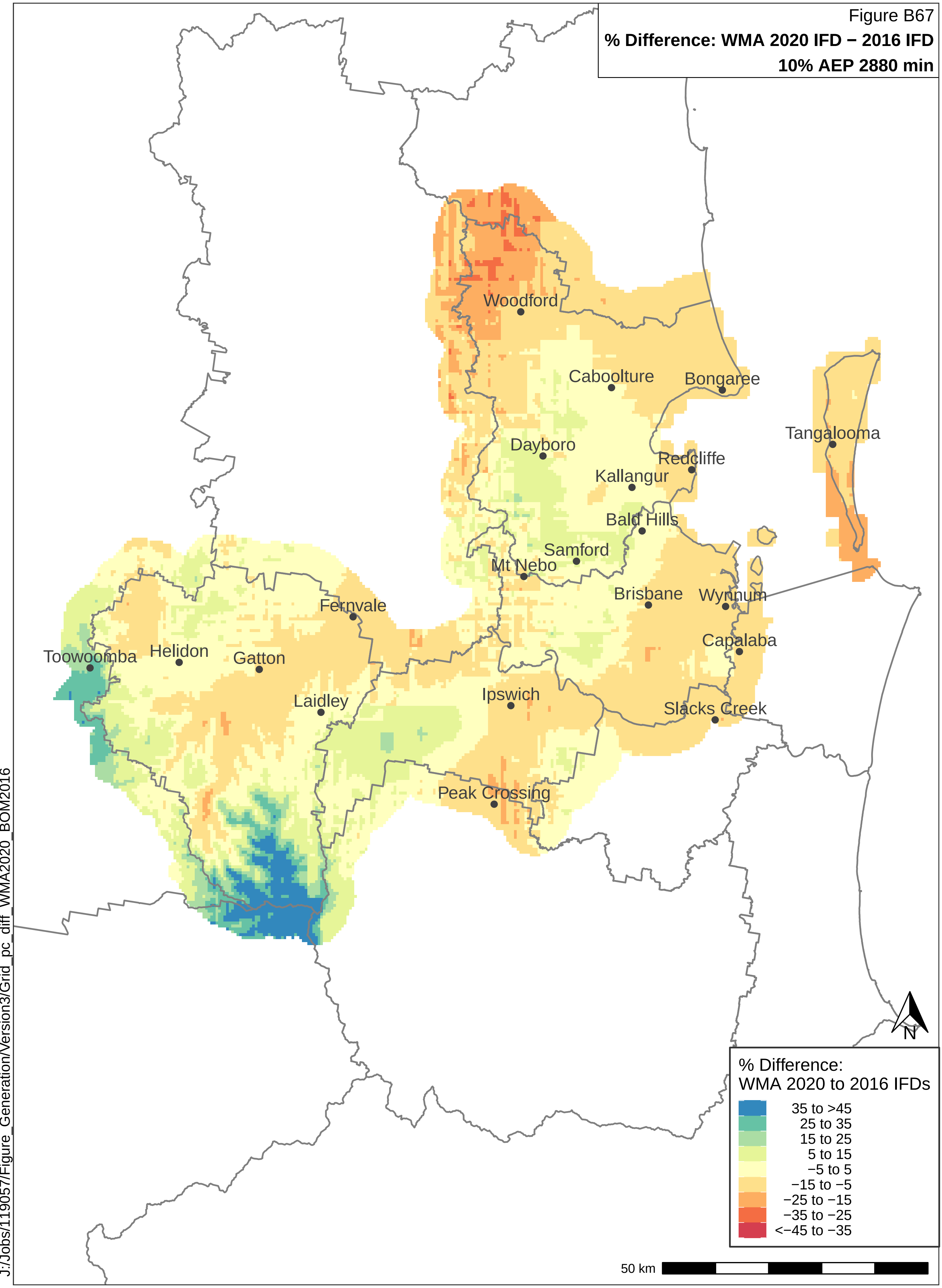
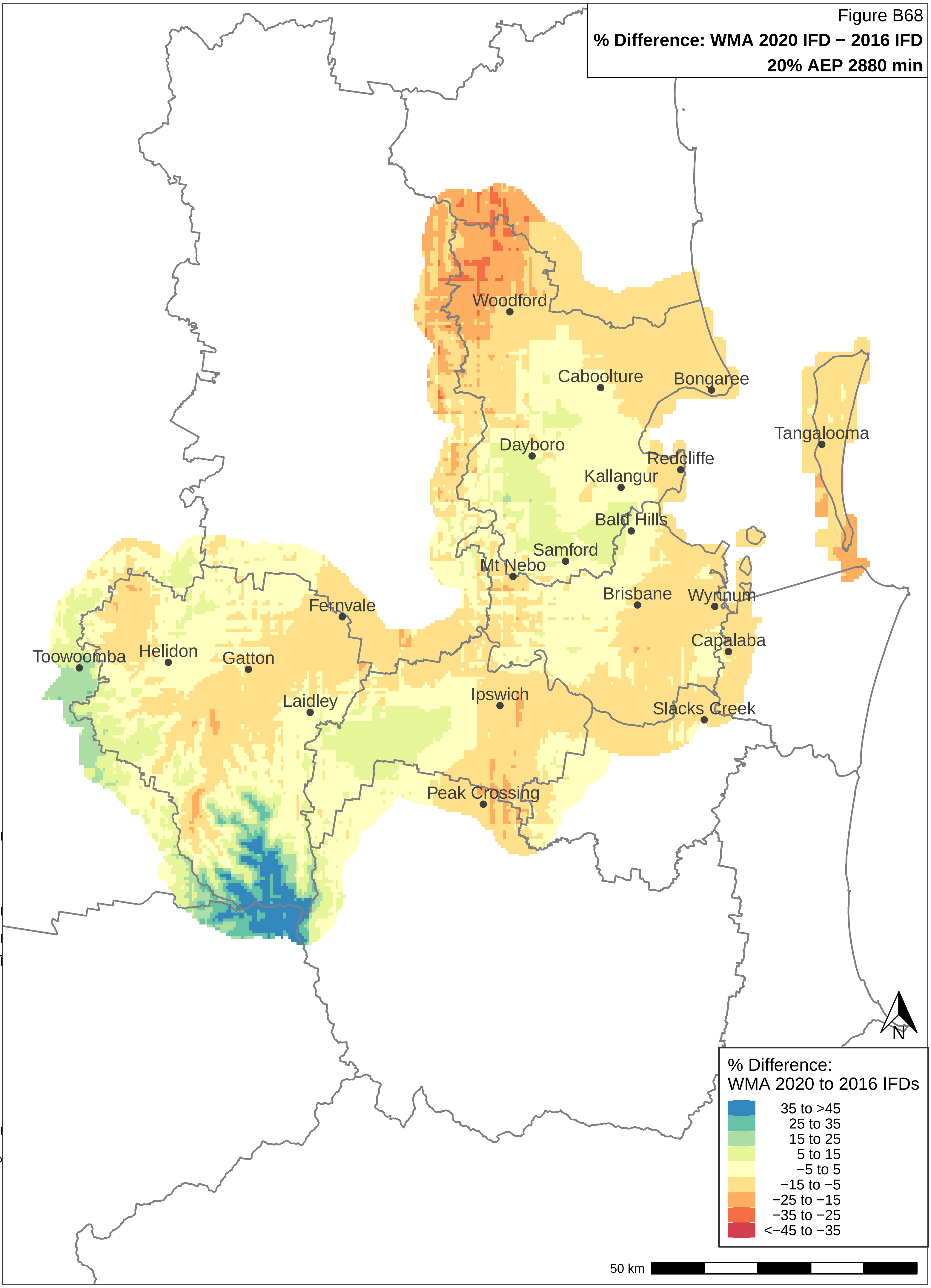


Figure B67
% Difference: WMA 2020 IFD − 2016 IFD
10% AEP 2880 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Capalaba
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B68

% Difference: WMA 2020 IFD − 2016 IFD

20% AEP 2880 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

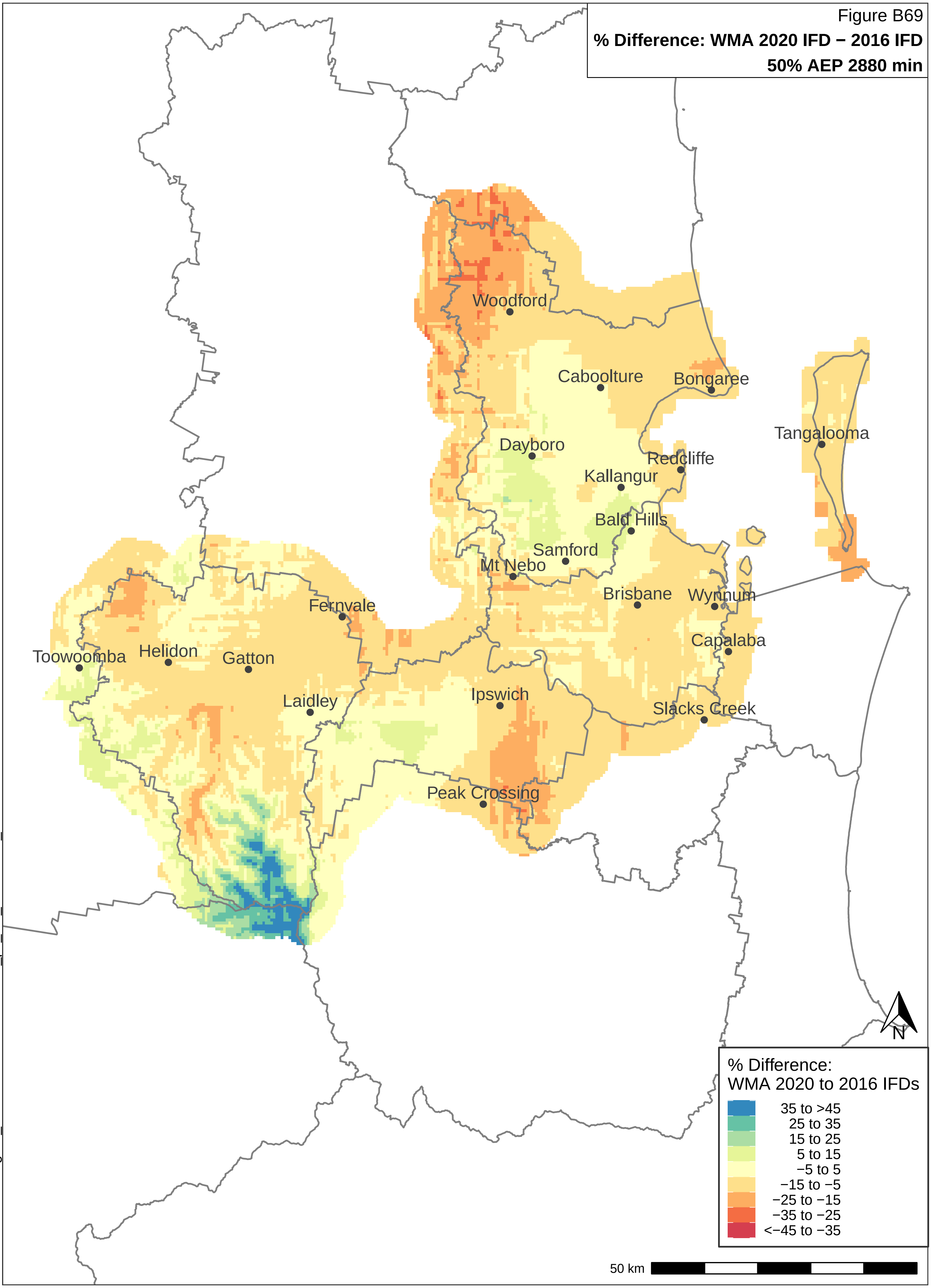
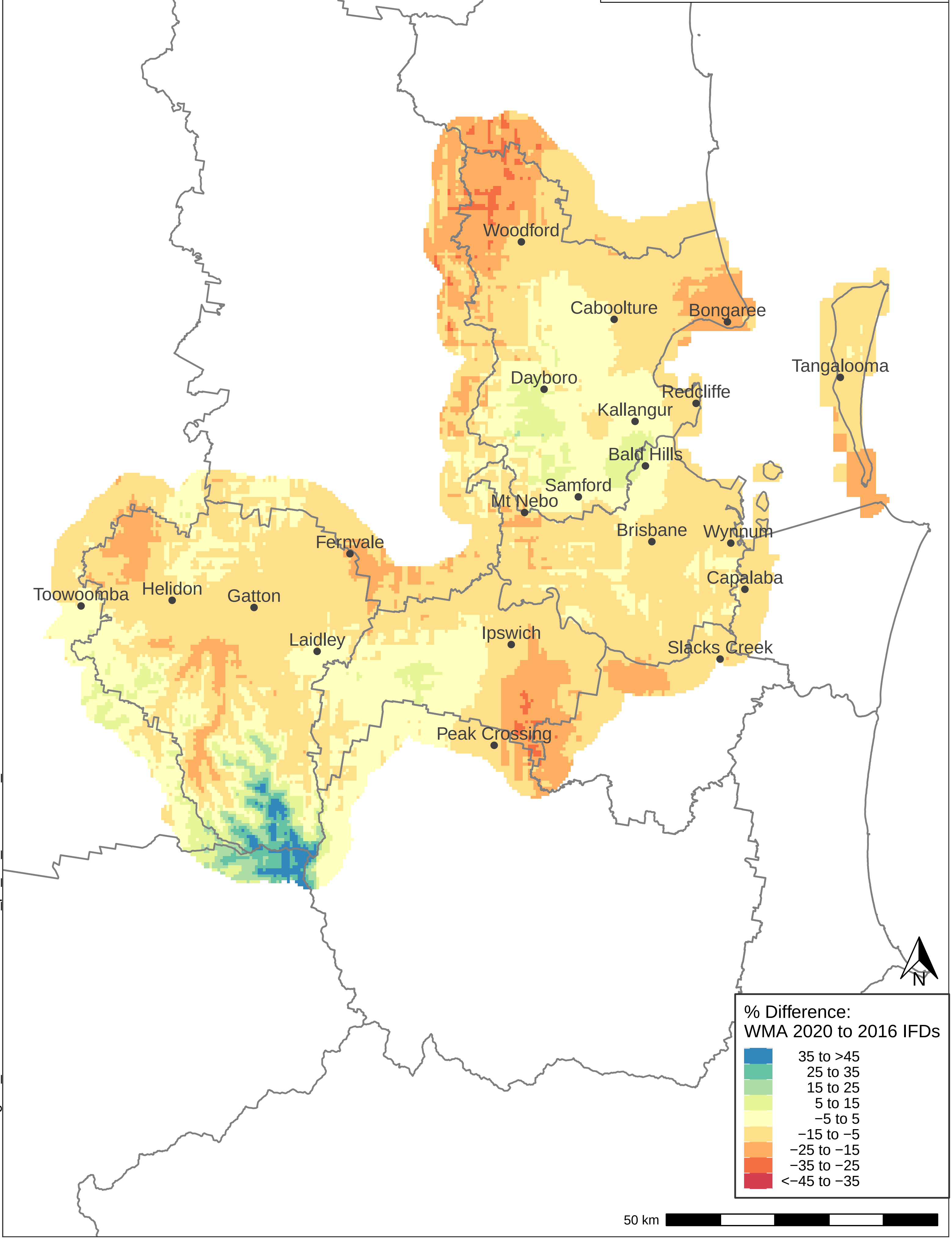


Figure B69
% Difference: WMA 2020 IFD − 2016 IFD
50% AEP 2880 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B70
% Difference: WMA 2020 IFD − 2016 IFD
1EY AEP 2880 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

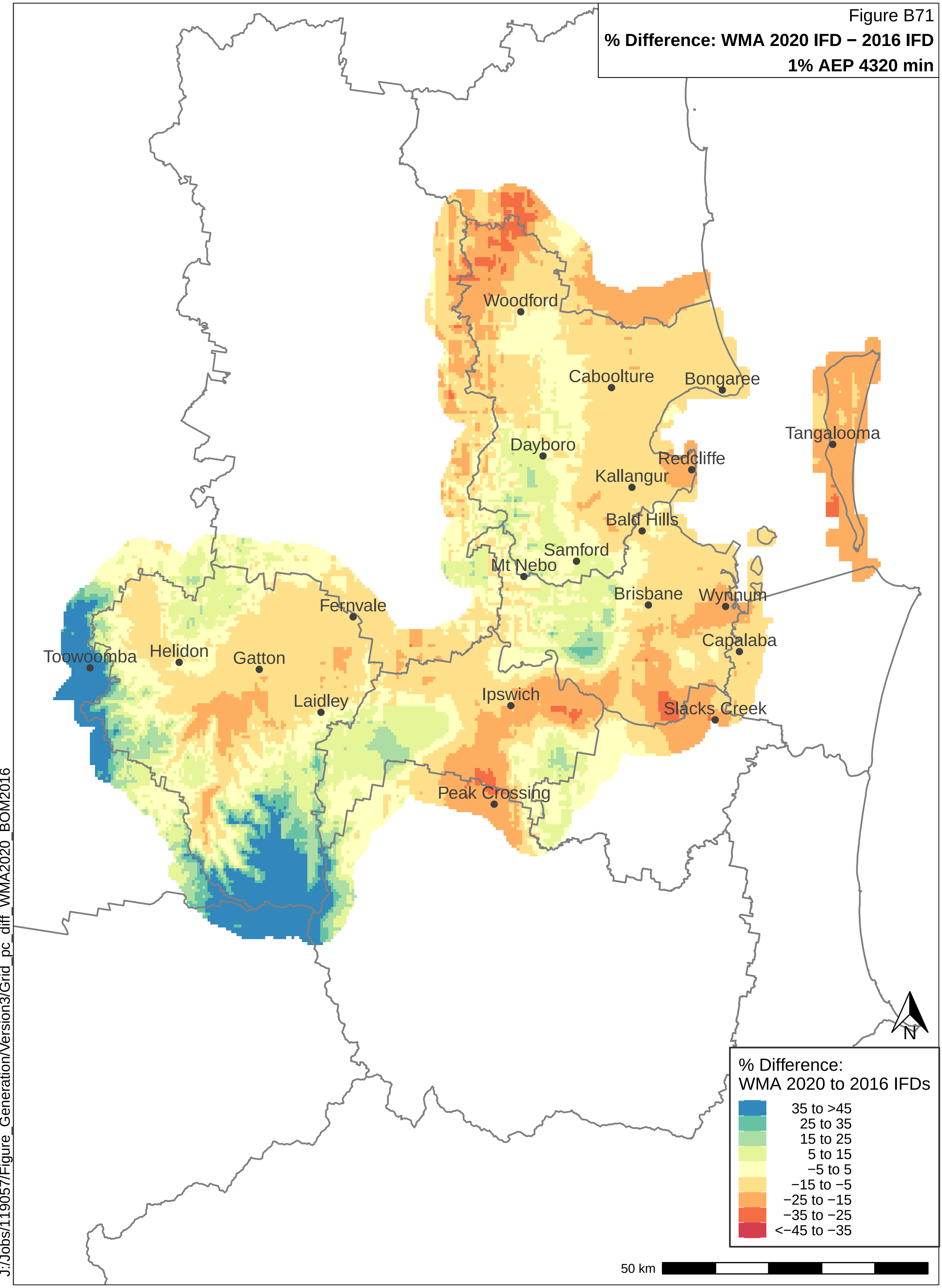
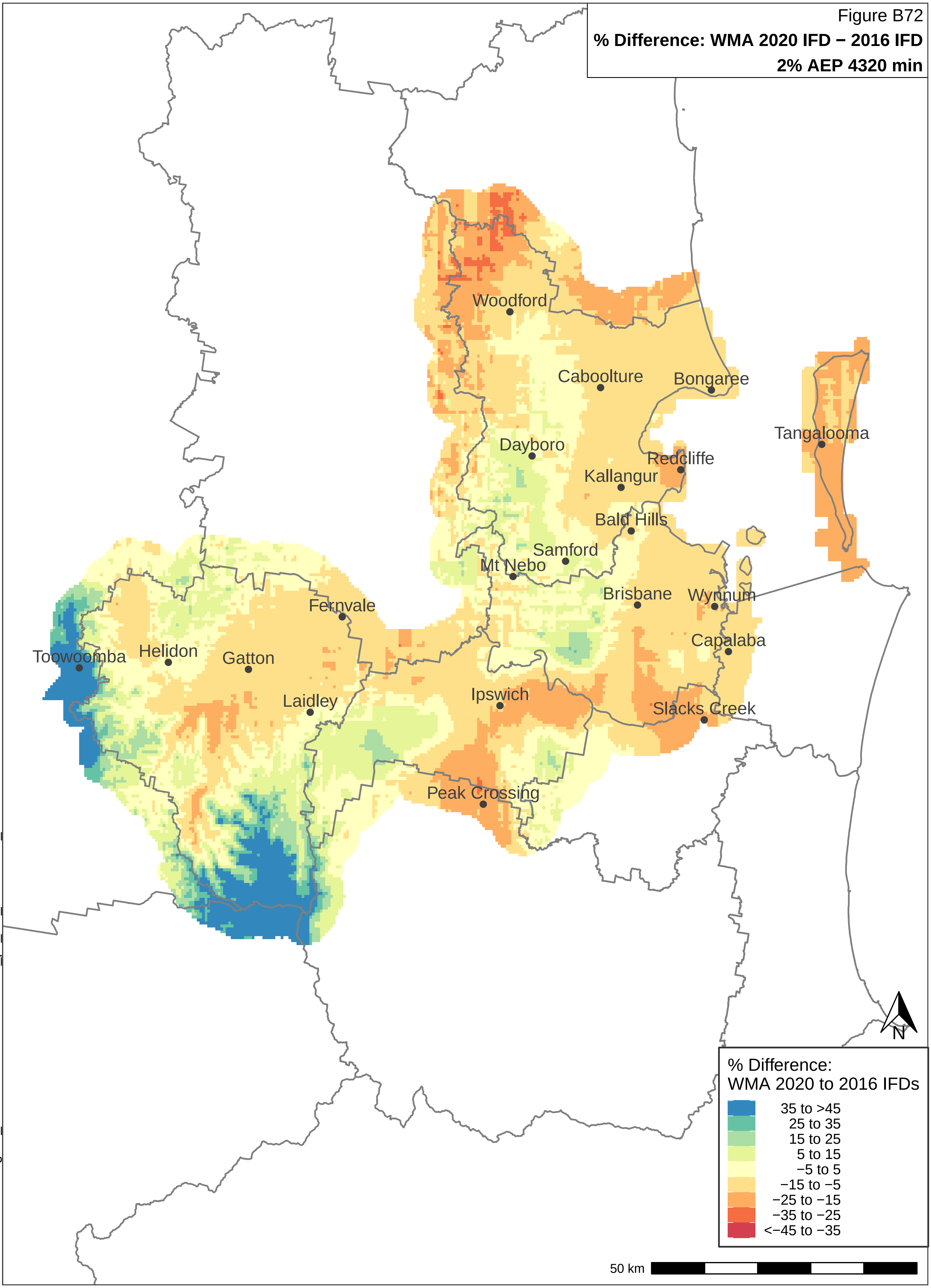


Figure B71
% Difference: WMA 2020 IFD − 2016 IFD
1% AEP 4320 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

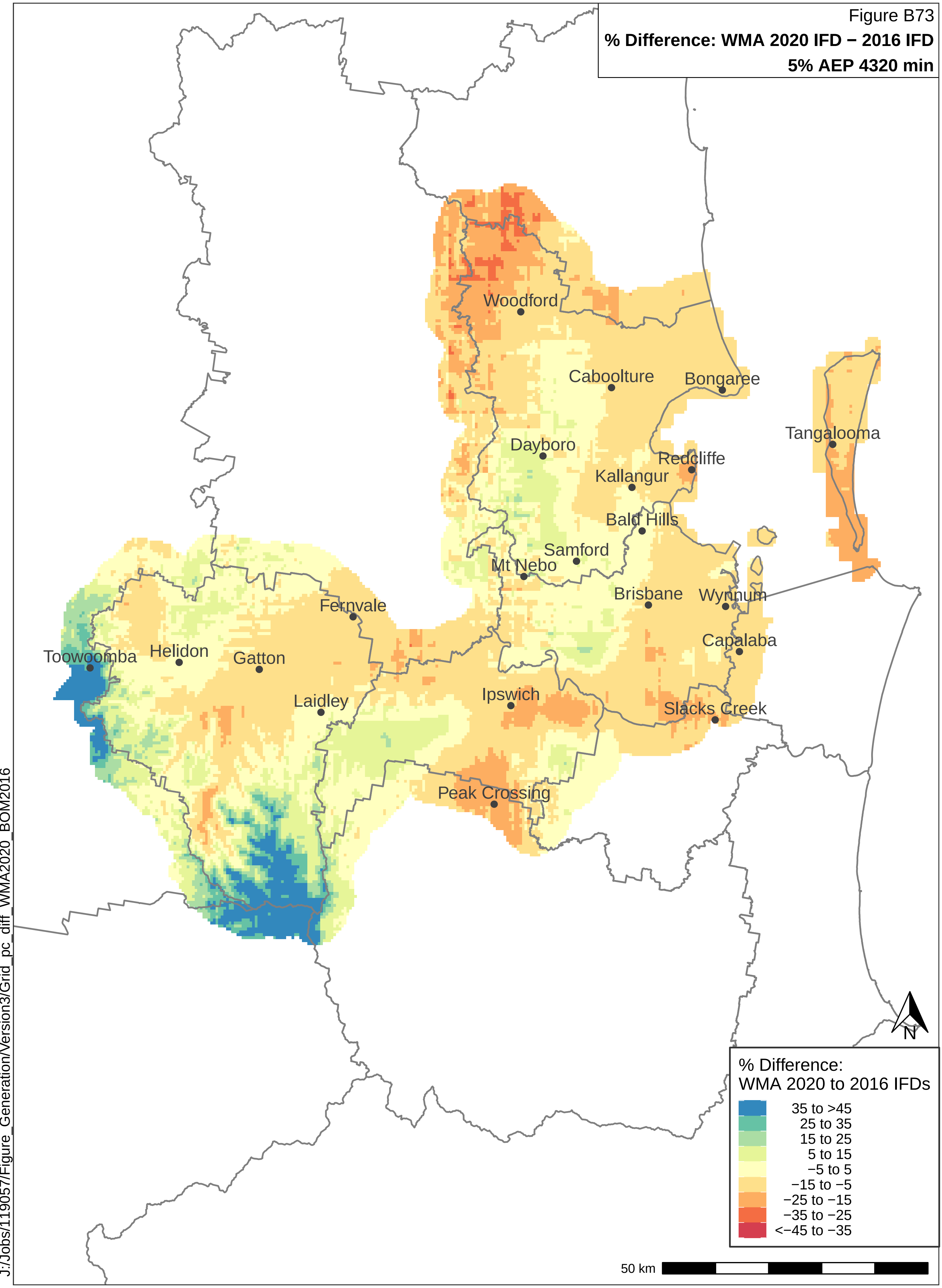
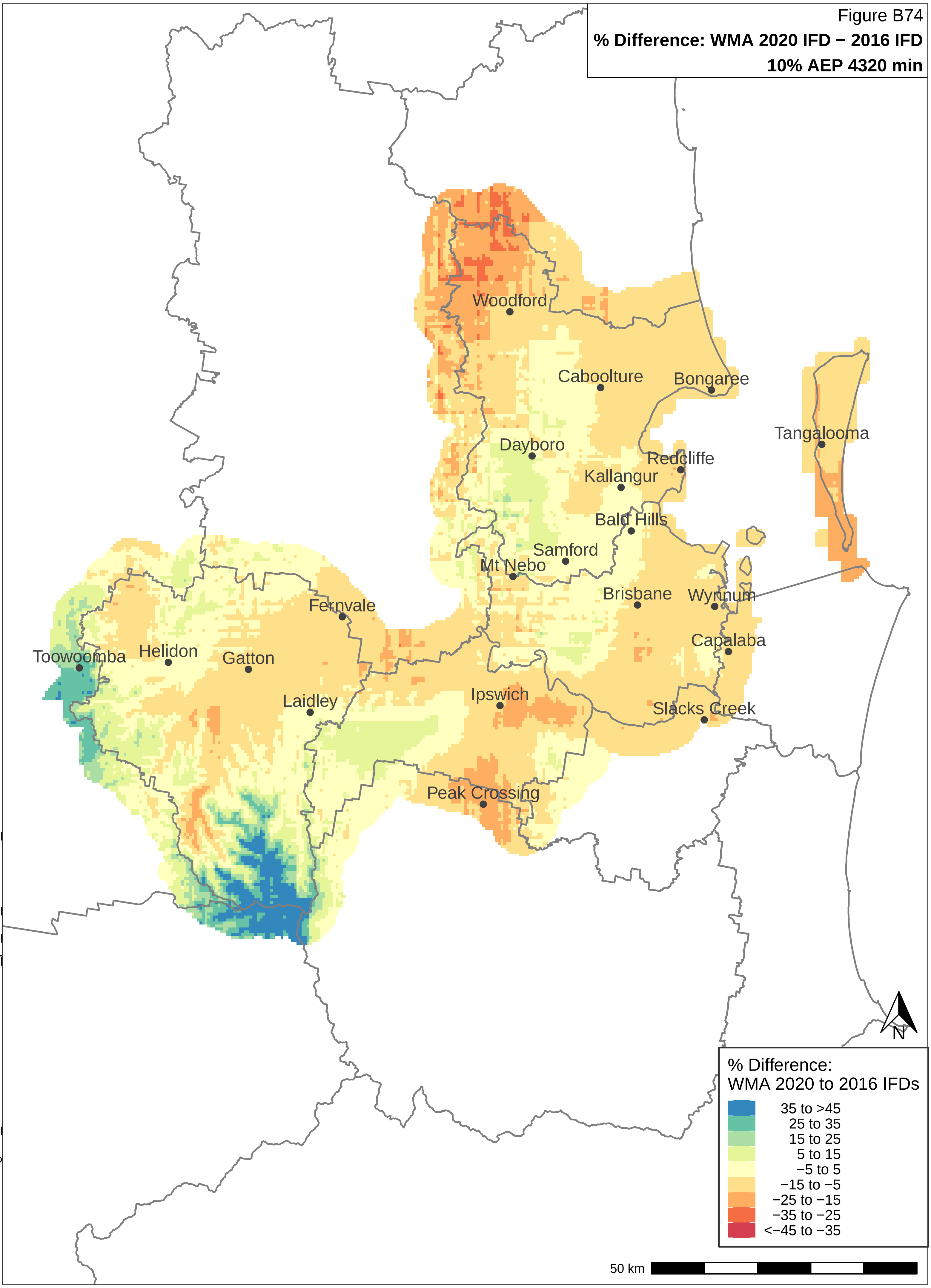


Figure B73
% Difference: WMA 2020 IFD − 2016 IFD
5% AEP 4320 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B74

% Difference: WMA 2020 IFD − 2016 IFD

10% AEP 4320 min

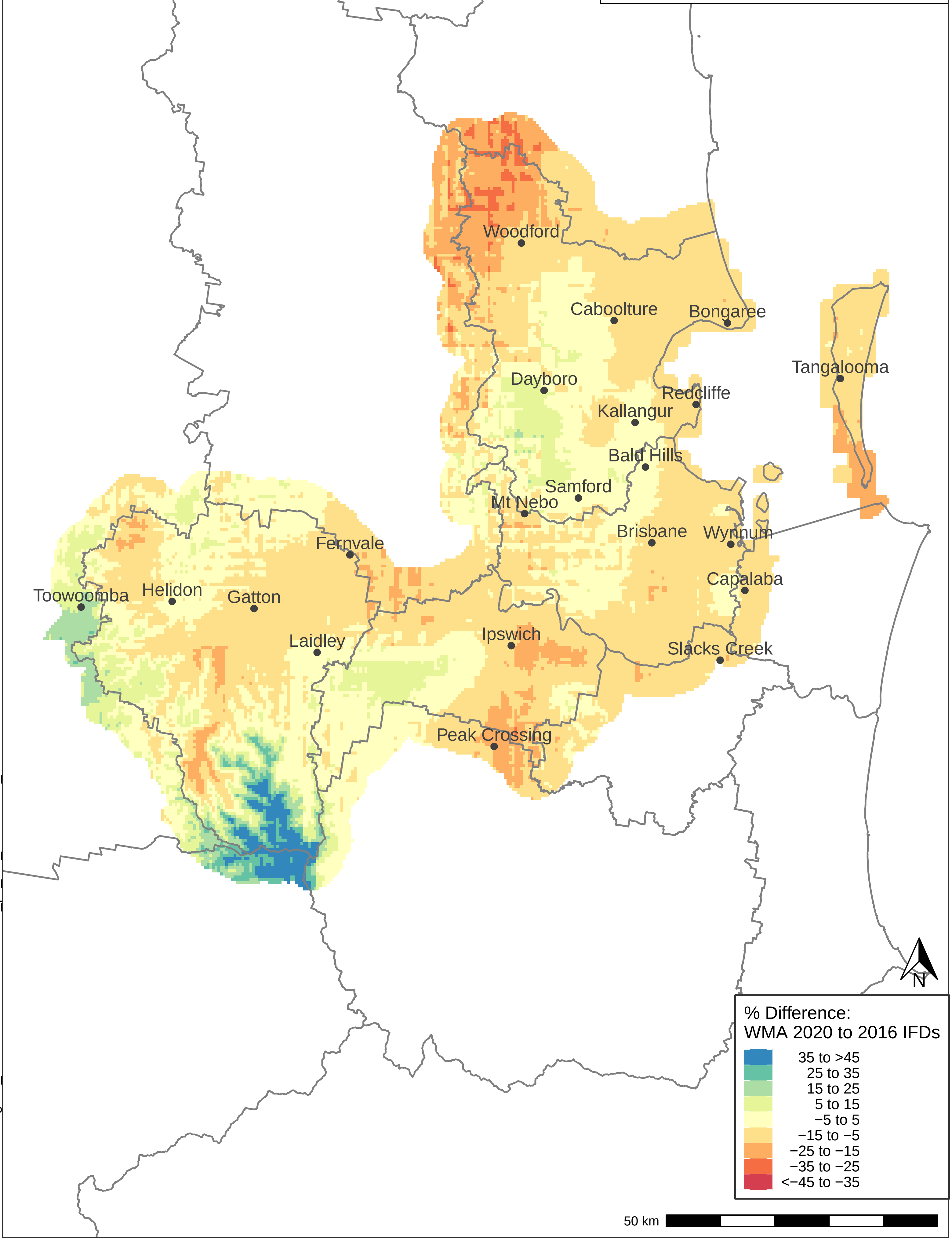


J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B75

% Difference: WMA 2020 IFD − 2016 IFD

20% AEP 4320 min

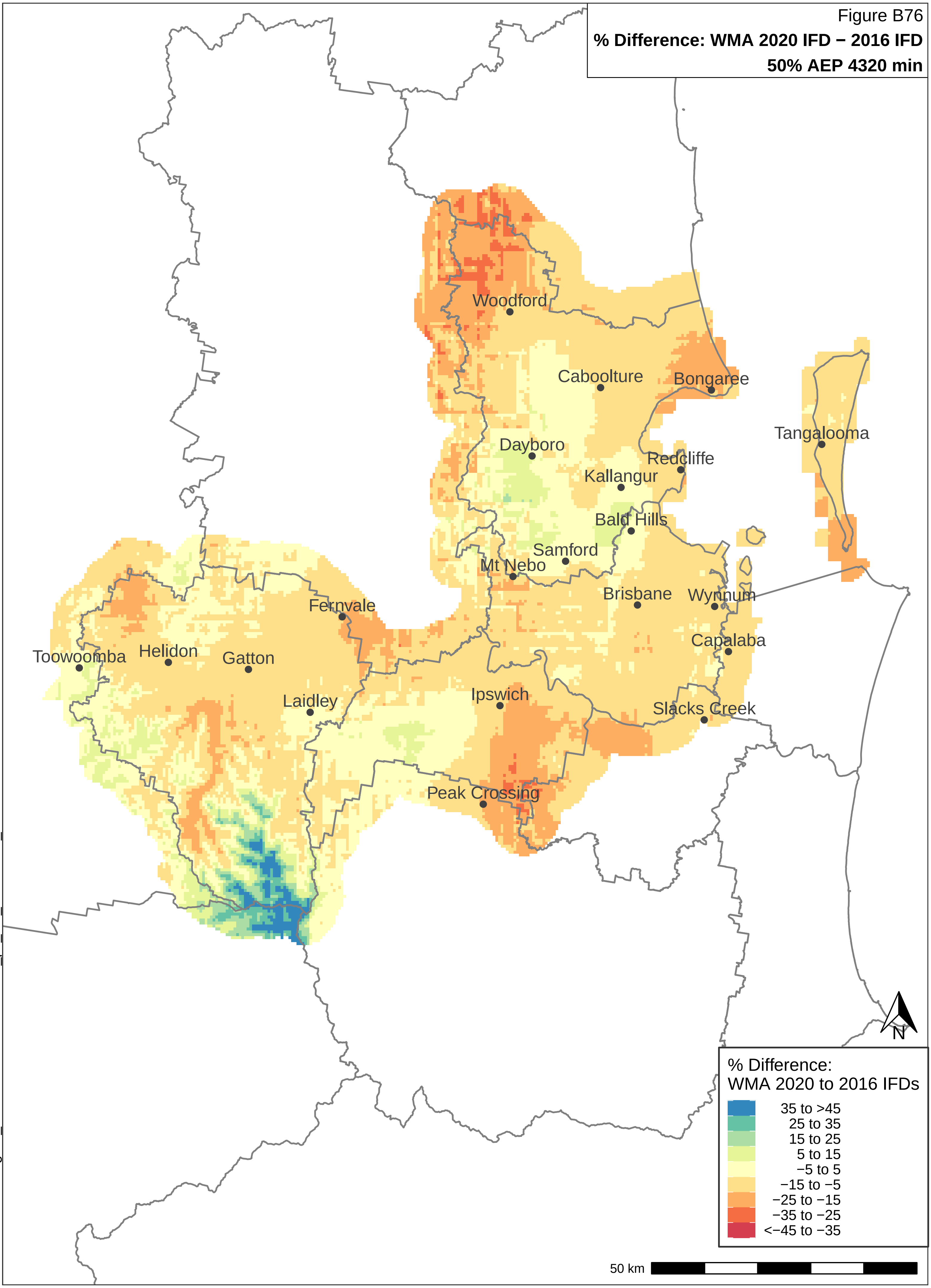


J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B76

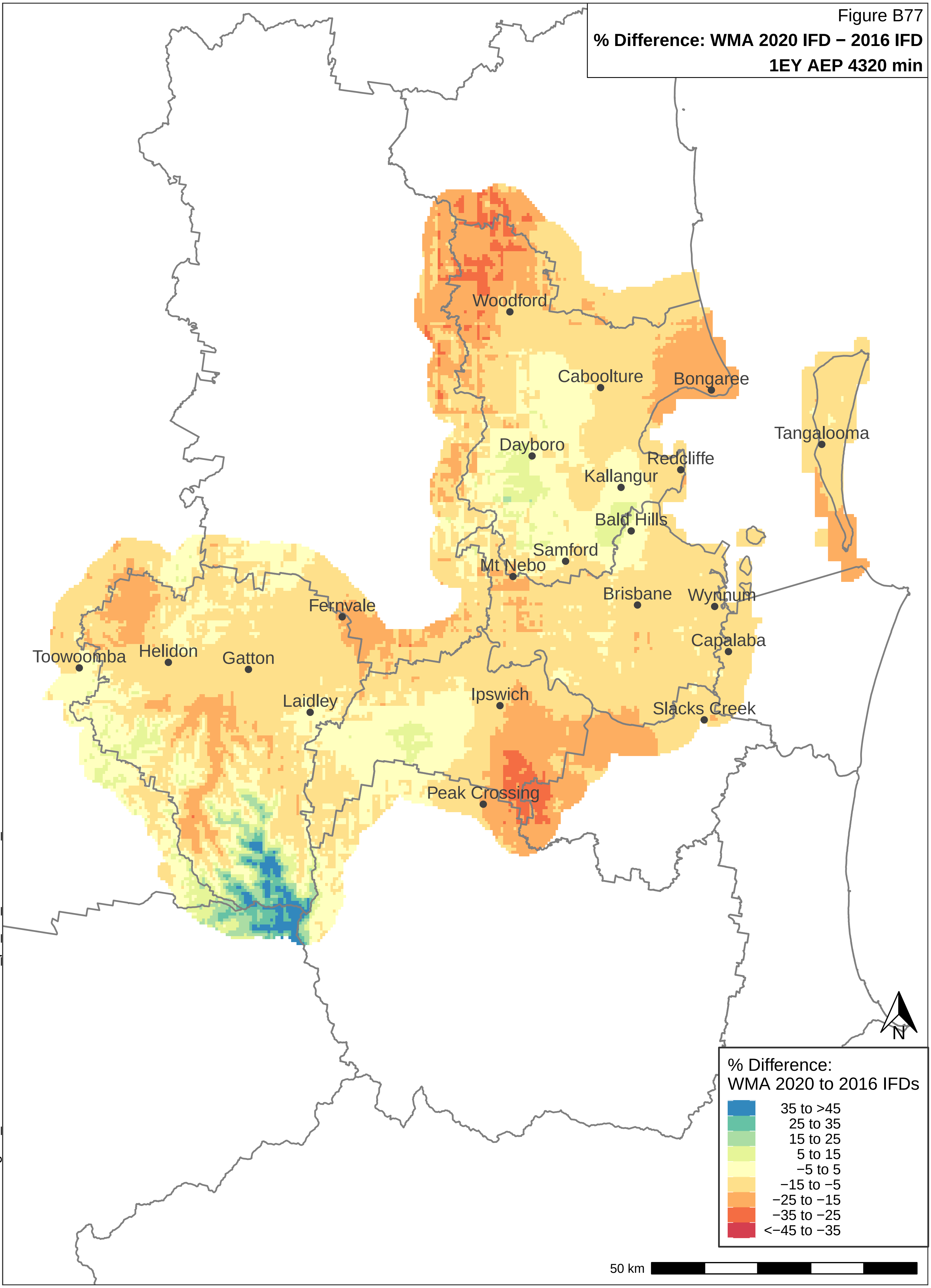
% Difference: WMA 2020 IFD − 2016 IFD

50% AEP 4320 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B77
% Difference: WMA 2020 IFD − 2016 IFD
1EY AEP 4320 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

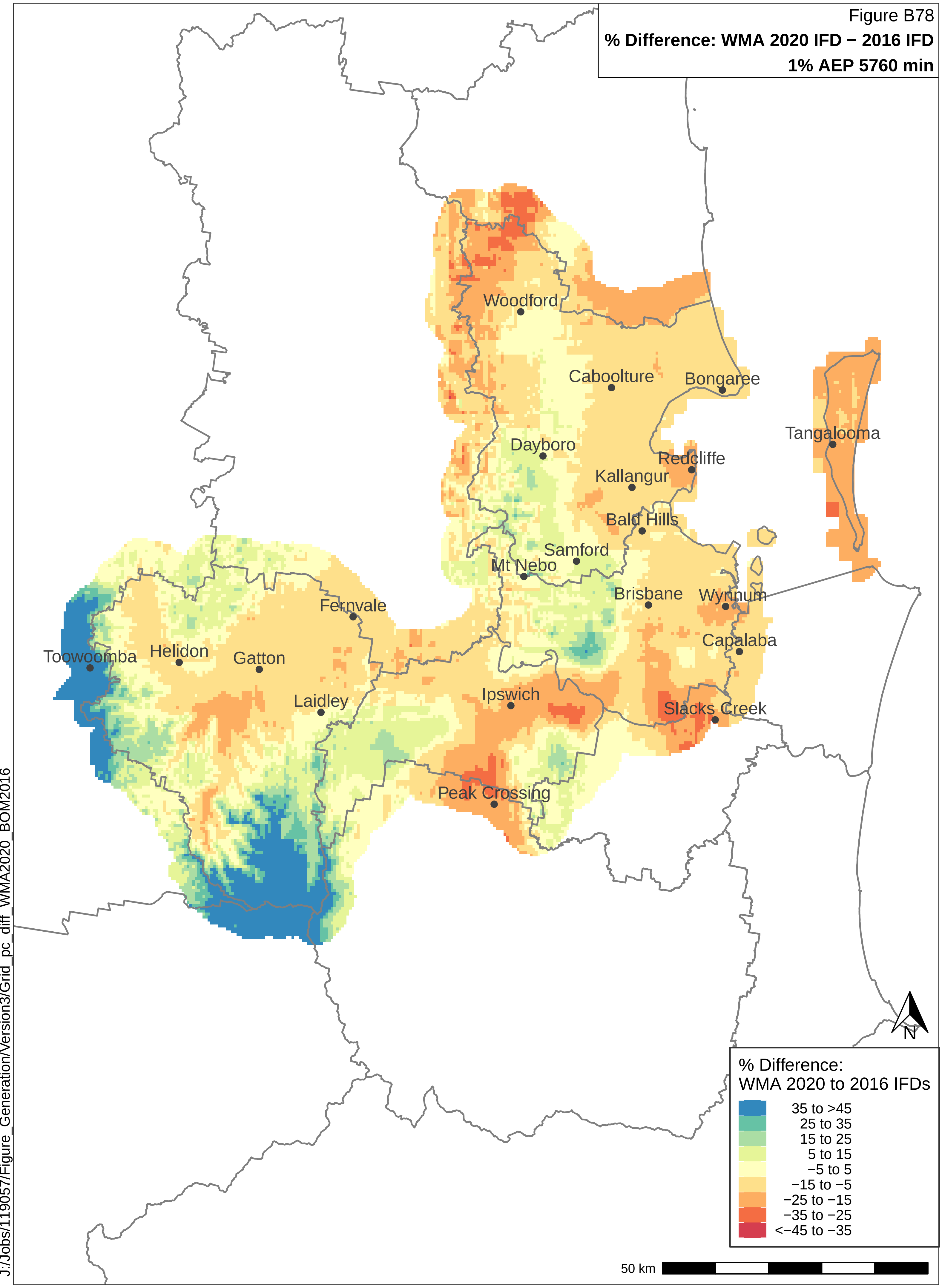
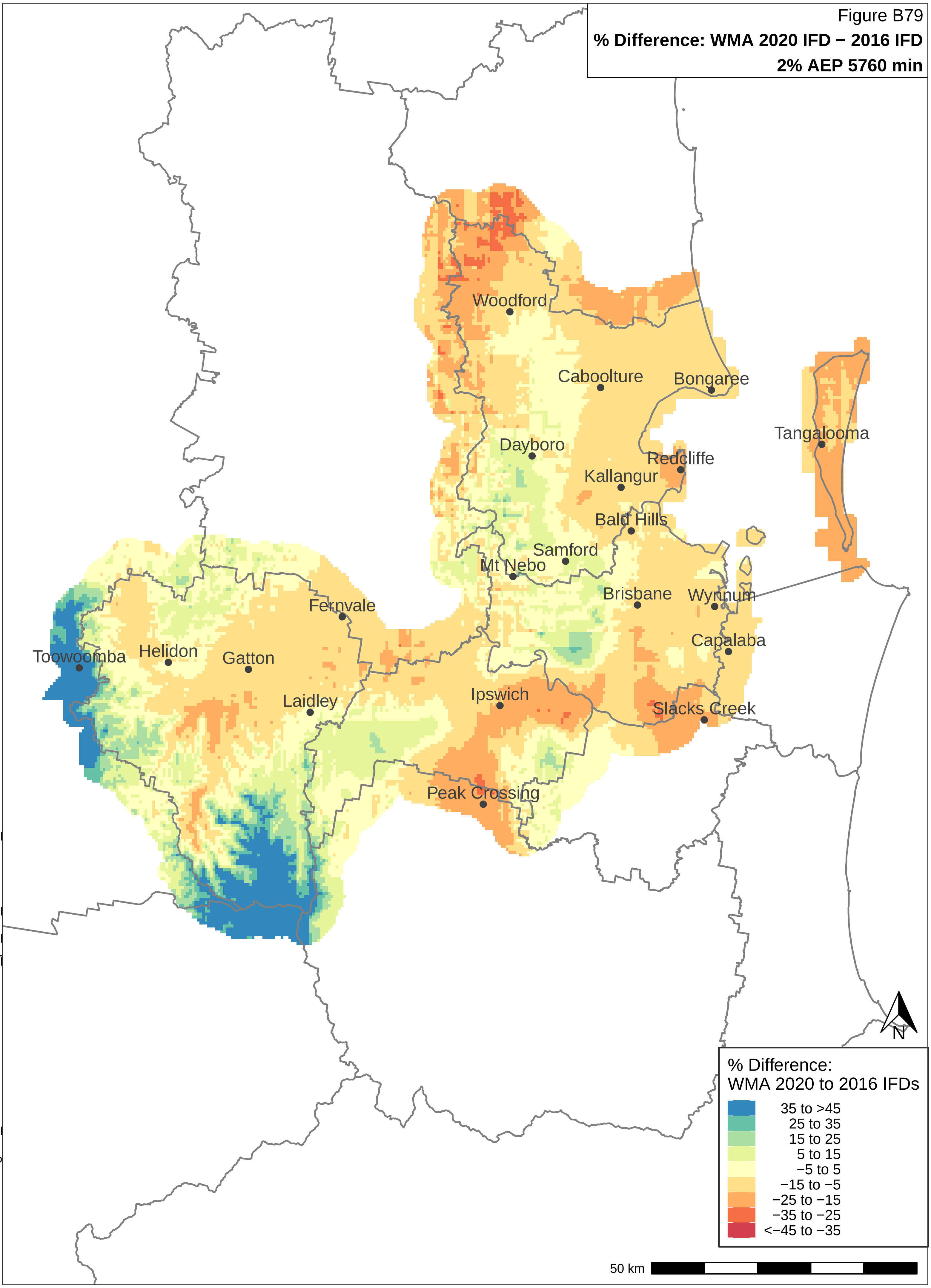


Figure B78
% Difference: WMA 2020 IFD – 2016 IFD
1% AEP 5760 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Ipswich
Laidley
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B79
% Difference: WMA 2020 IFD − 2016 IFD
2% AEP 5760 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

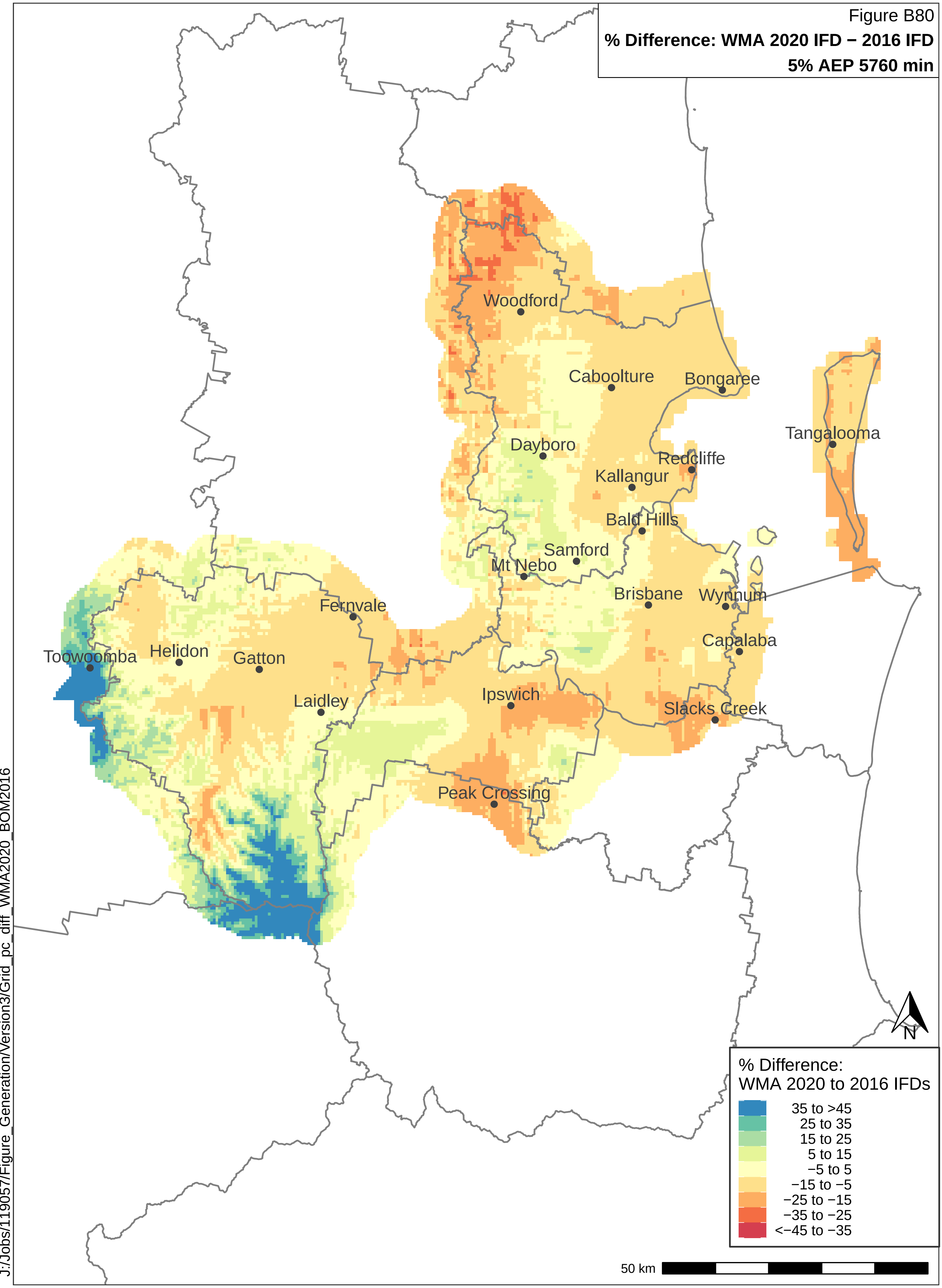
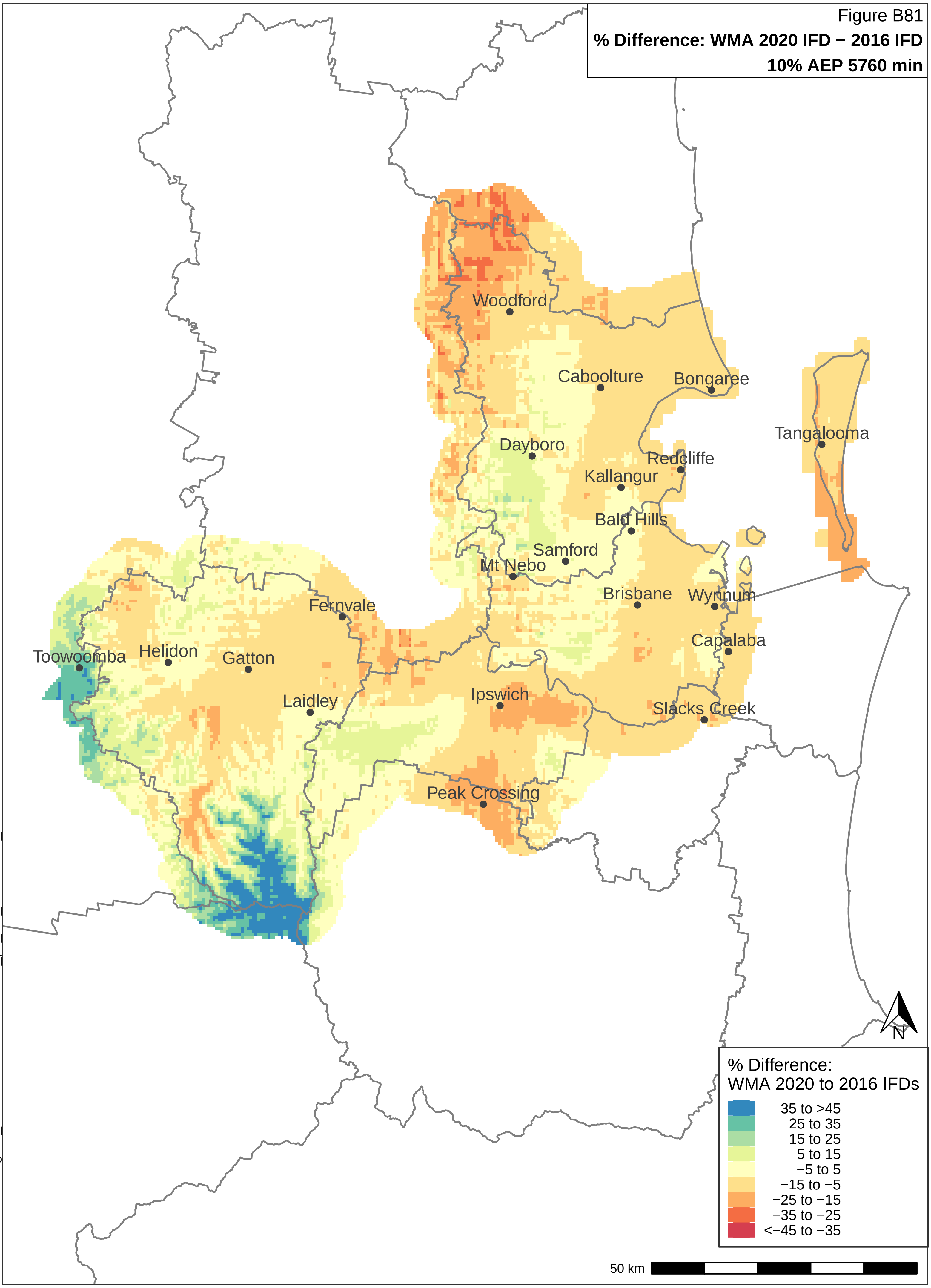


Figure B80
% Difference: WMA 2020 IFD − 2016 IFD
5% AEP 5760 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B81

% Difference: WMA 2020 IFD − 2016 IFD

10% AEP 5760 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

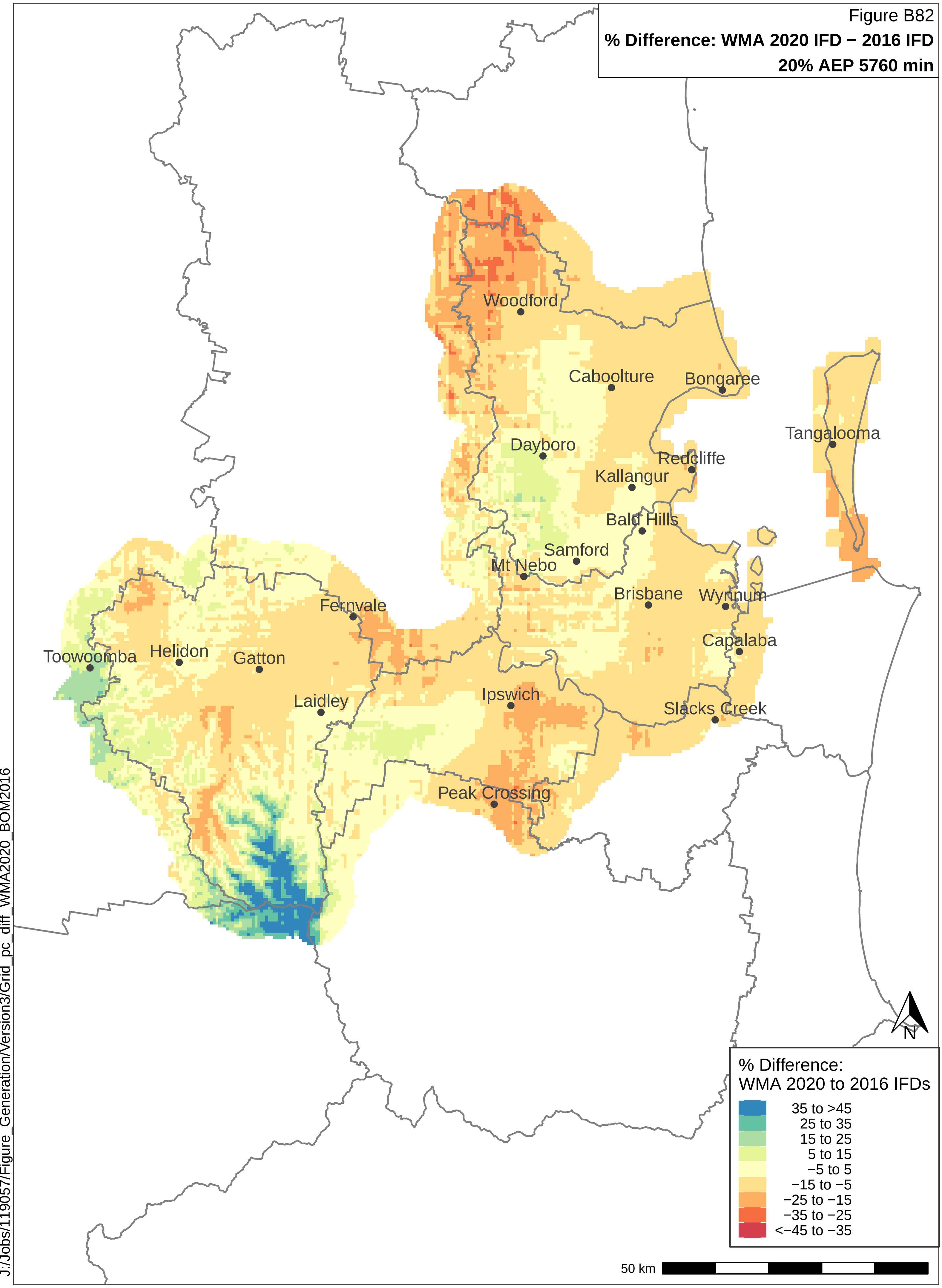


Figure B82
% Difference: WMA 2020 IFD − 2016 IFD
20% AEP 5760 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

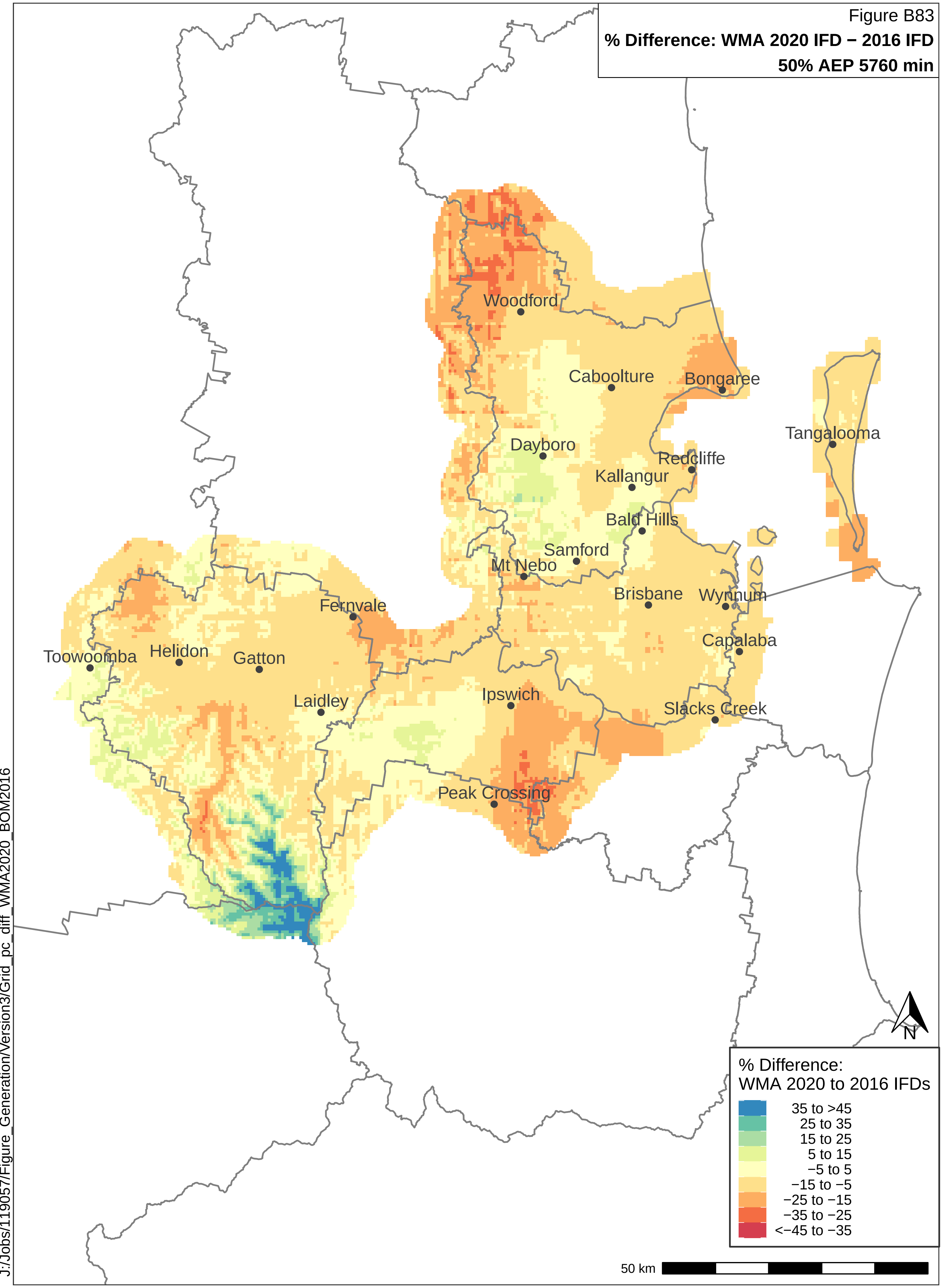
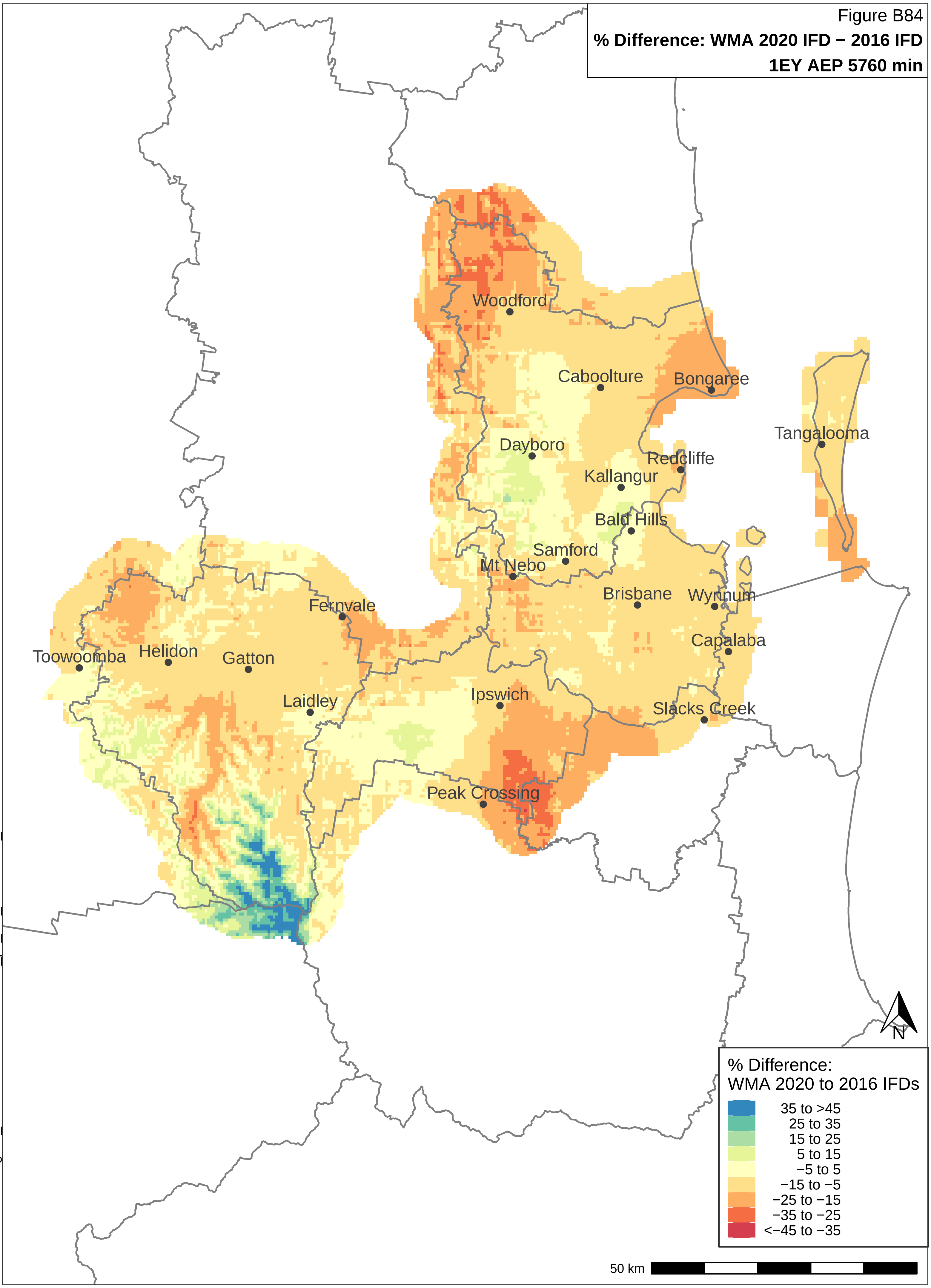


Figure B83
% Difference: WMA 2020 IFD − 2016 IFD
50% AEP 5760 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

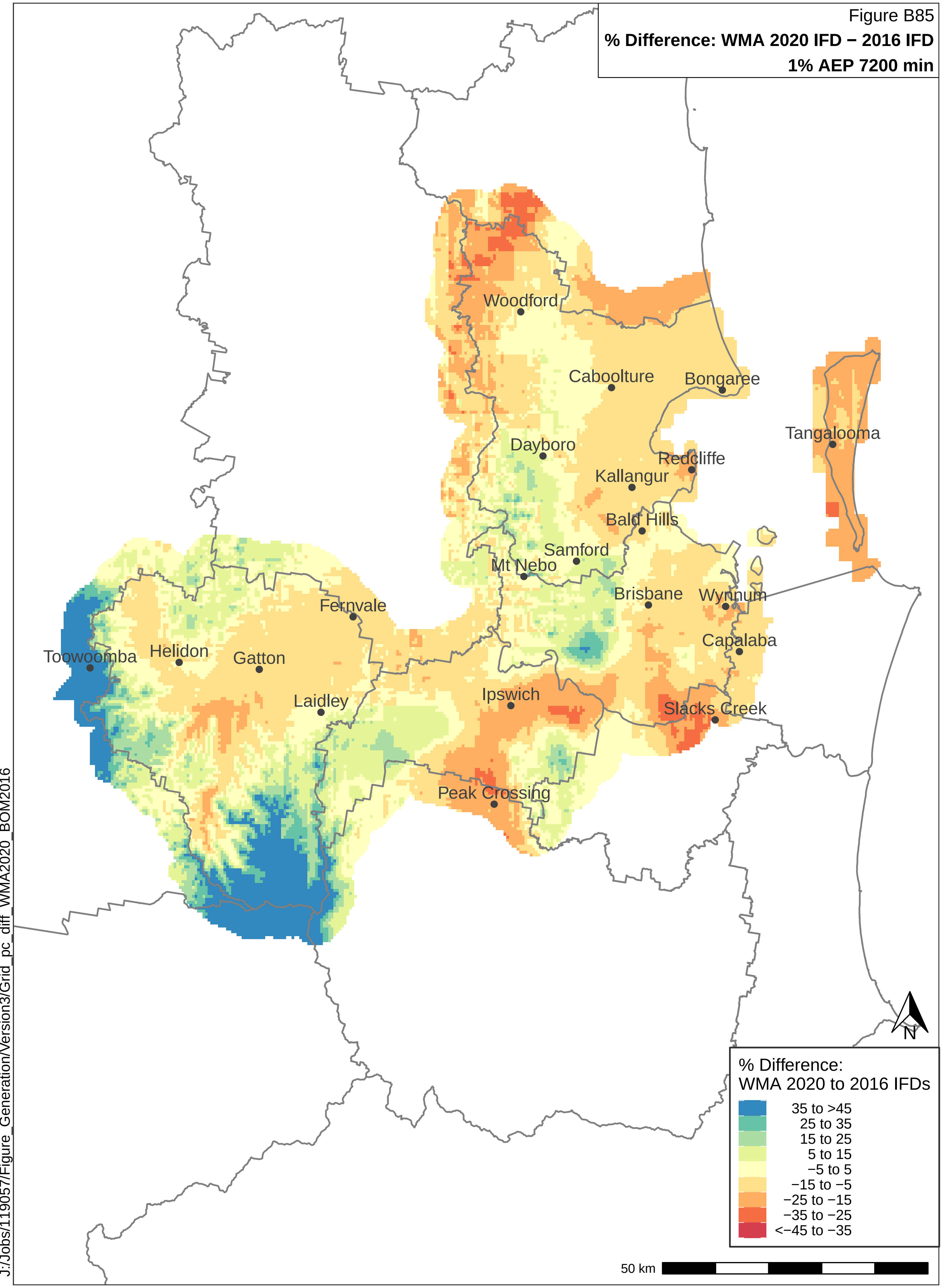
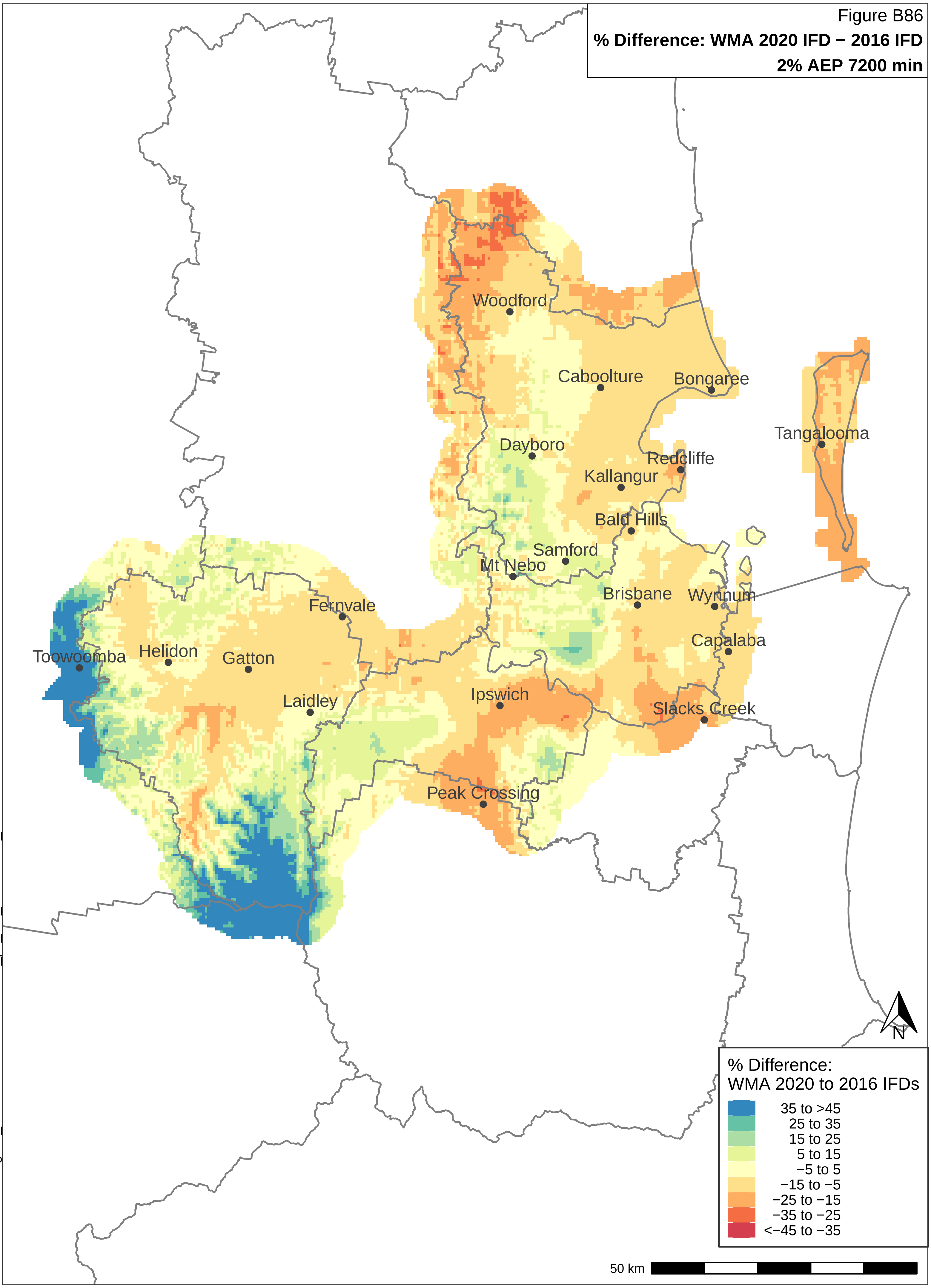


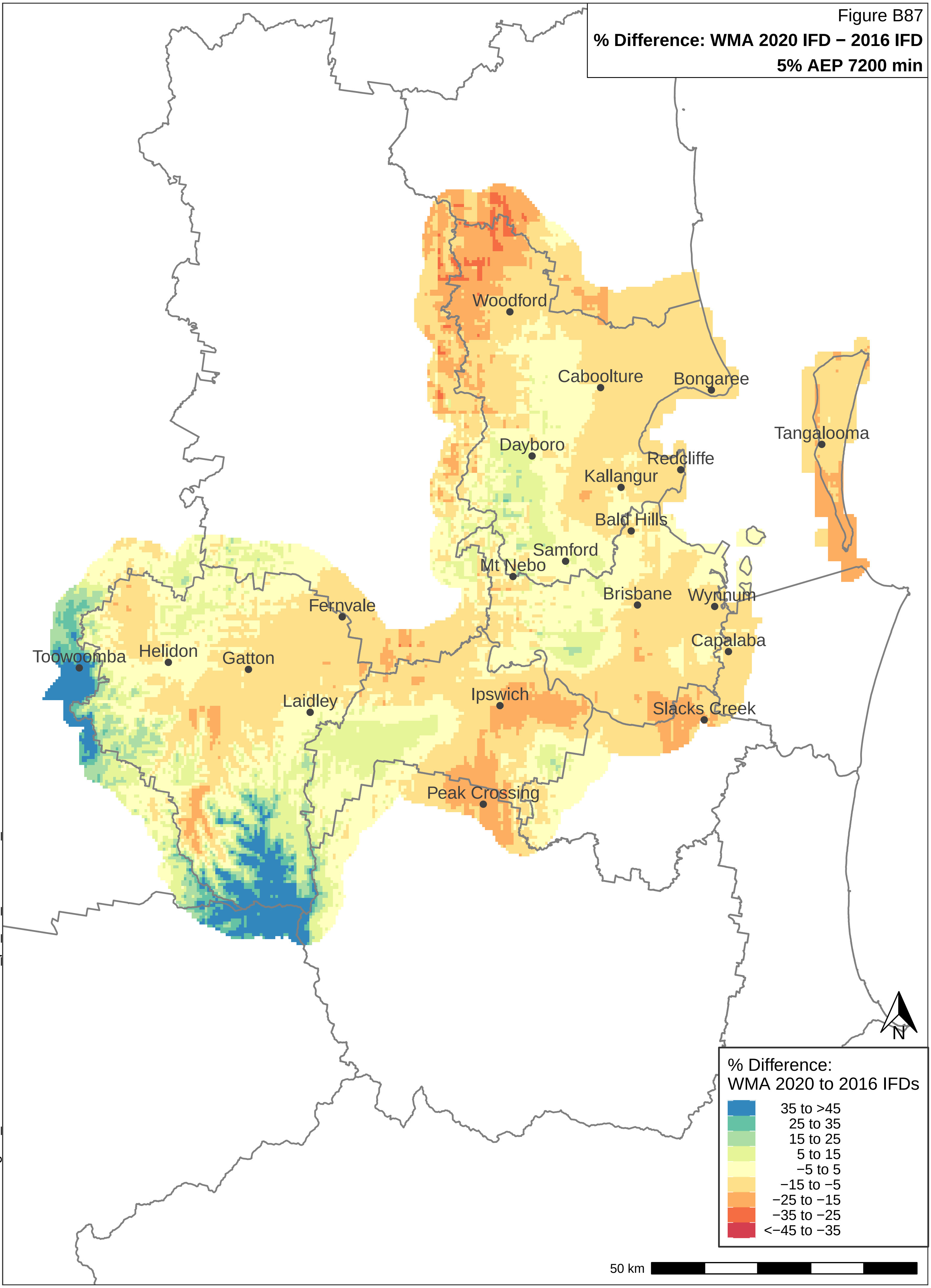
Figure B85
% Difference: WMA 2020 IFD − 2016 IFD
1% AEP 7200 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B86
% Difference: WMA 2020 IFD − 2016 IFD
2% AEP 7200 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B87
% Difference: WMA 2020 IFD − 2016 IFD
5% AEP 7200 min

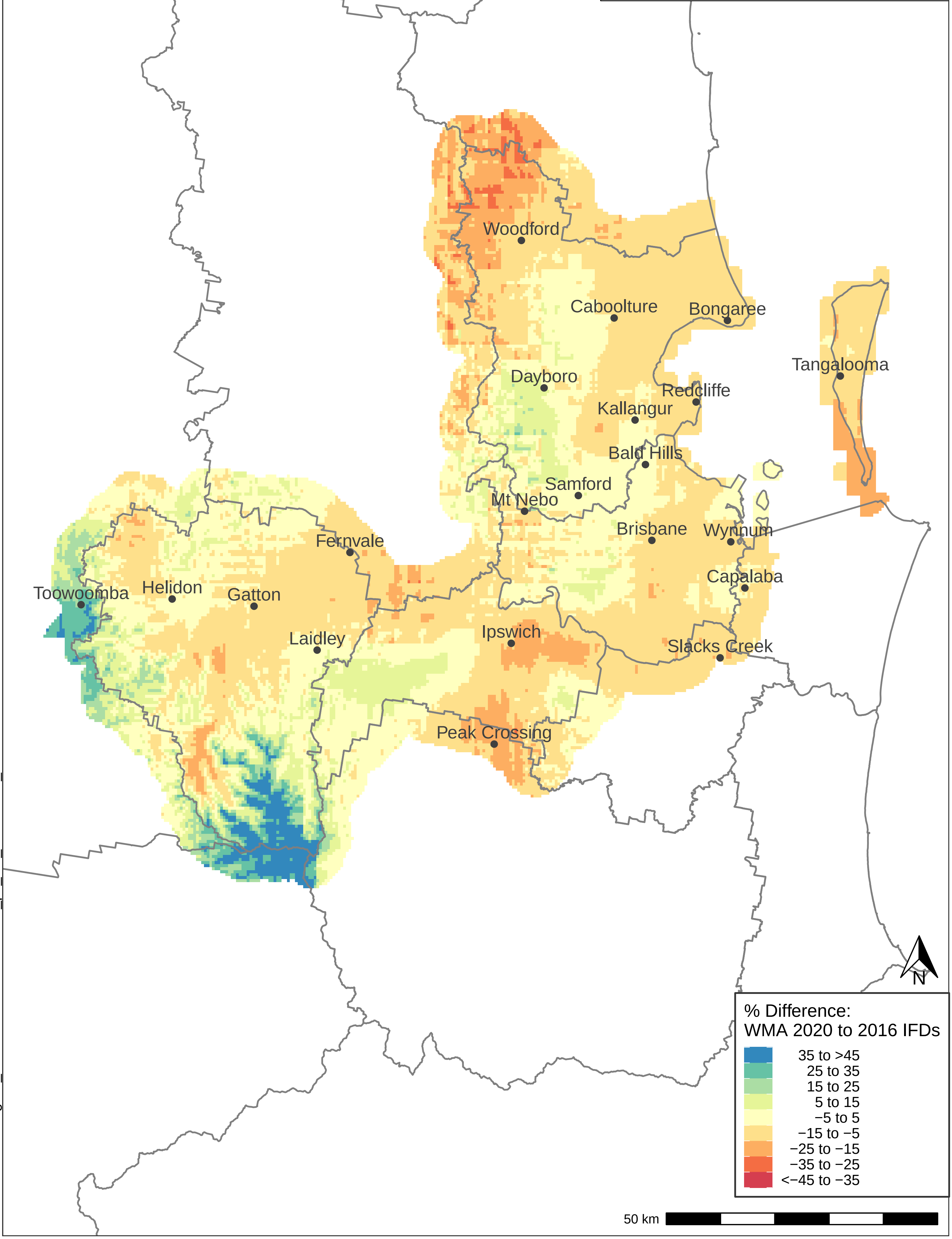


J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B88

% Difference: WMA 2020 IFD − 2016 IFD

10% AEP 7200 min

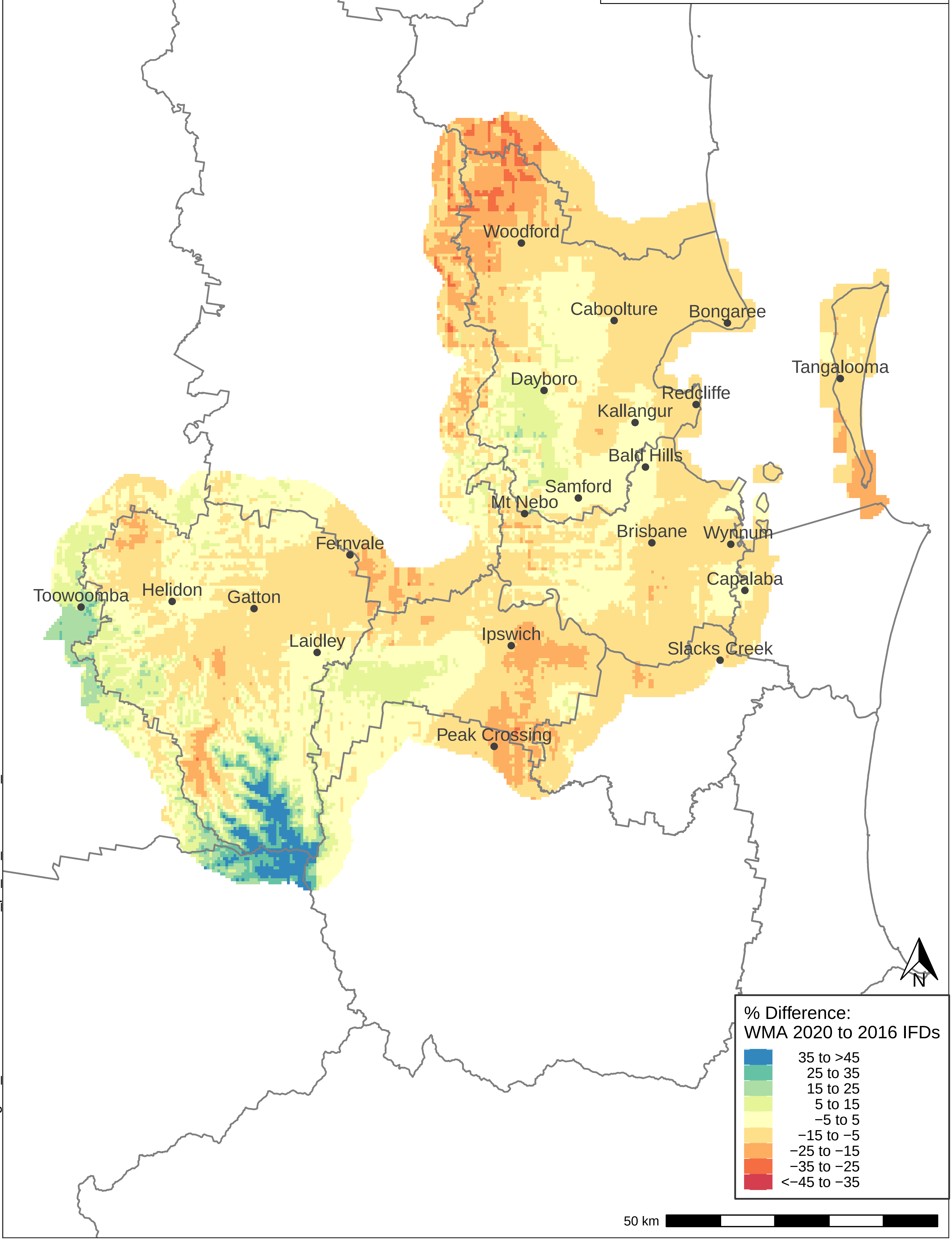


J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B89

% Difference: WMA 2020 IFD − 2016 IFD

20% AEP 7200 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

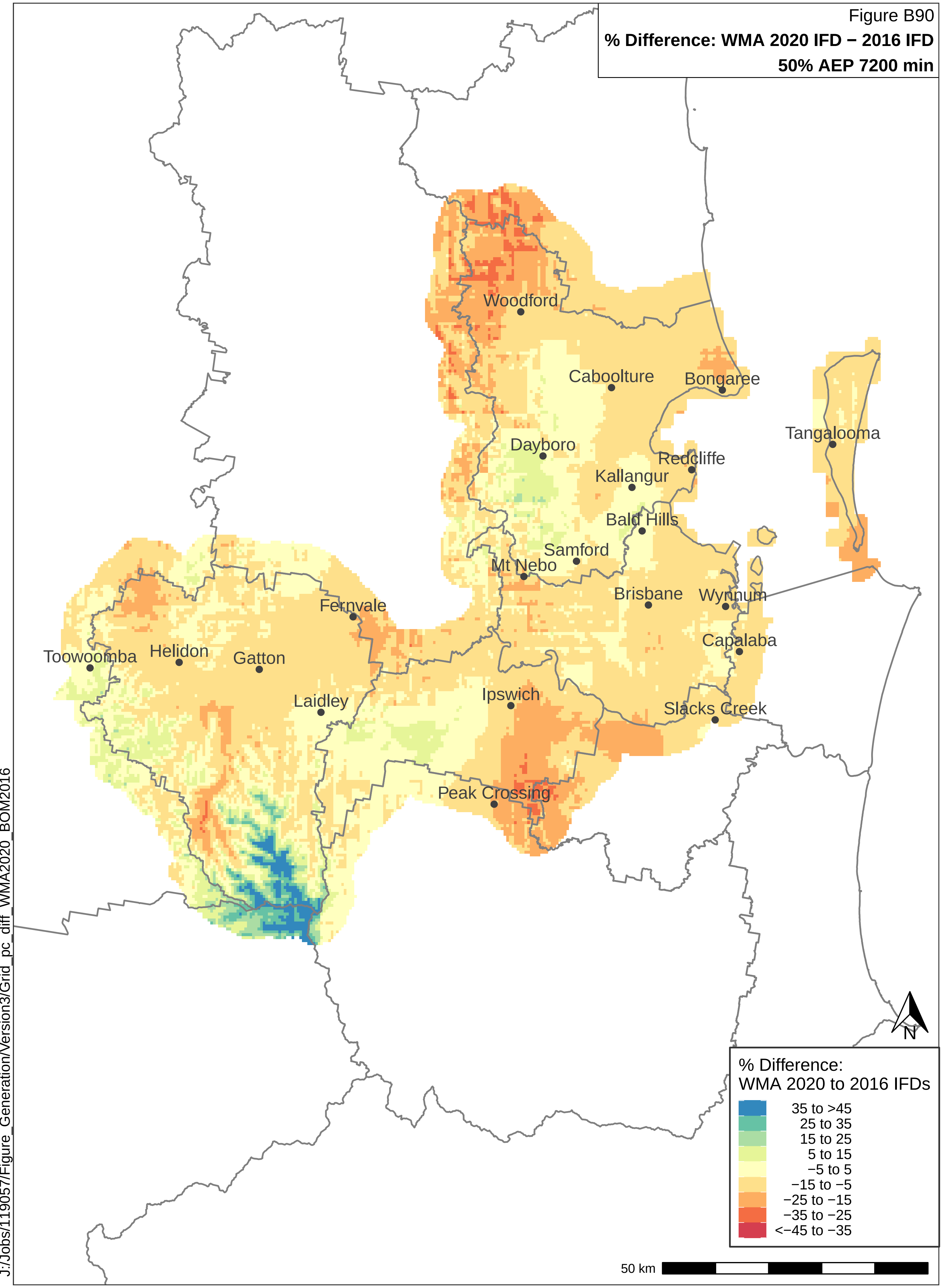
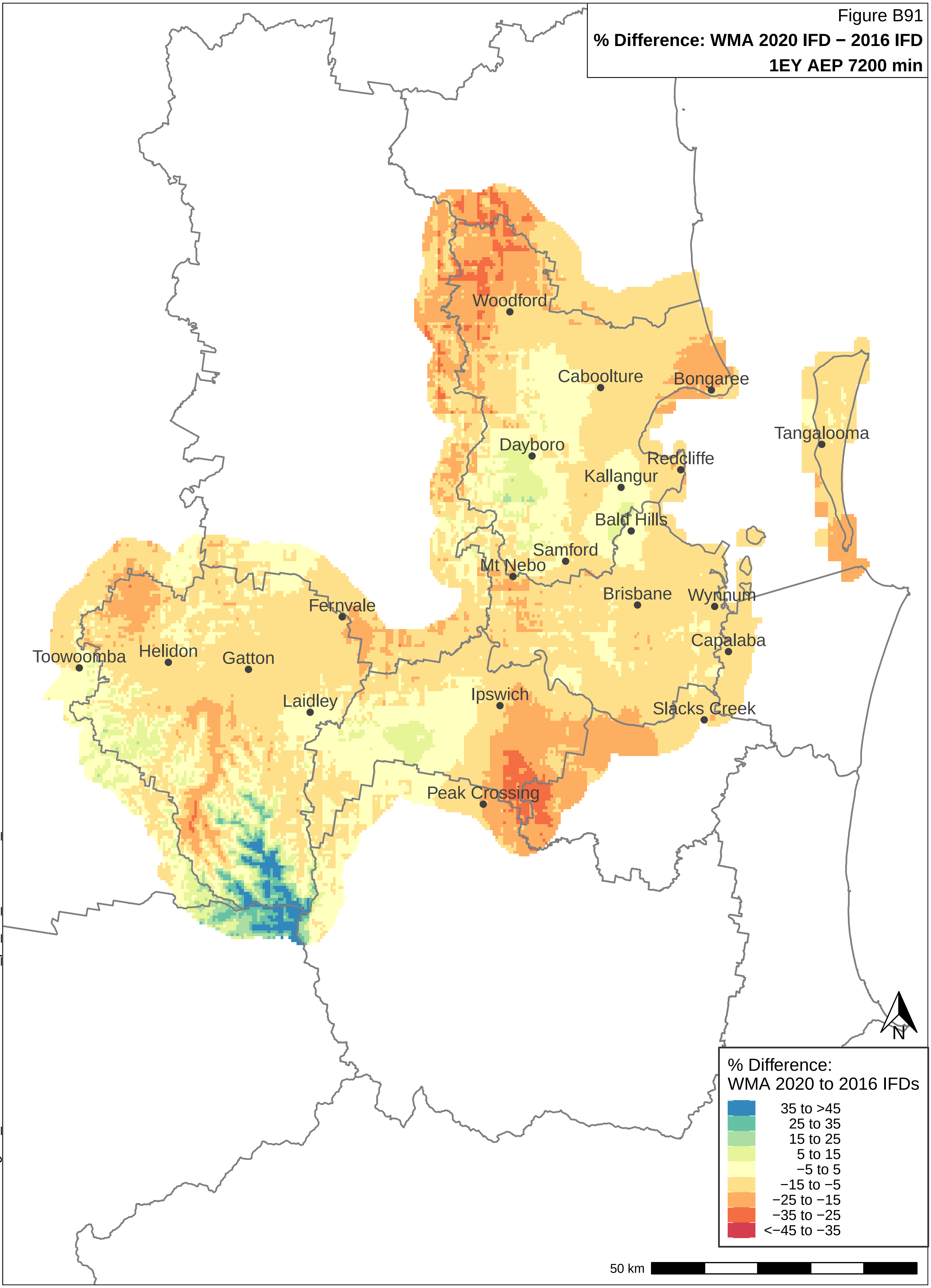


Figure B90
% Difference: WMA 2020 IFD − 2016 IFD
50% AEP 7200 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B91
% Difference: WMA 2020 IFD − 2016 IFD
1EY AEP 7200 min

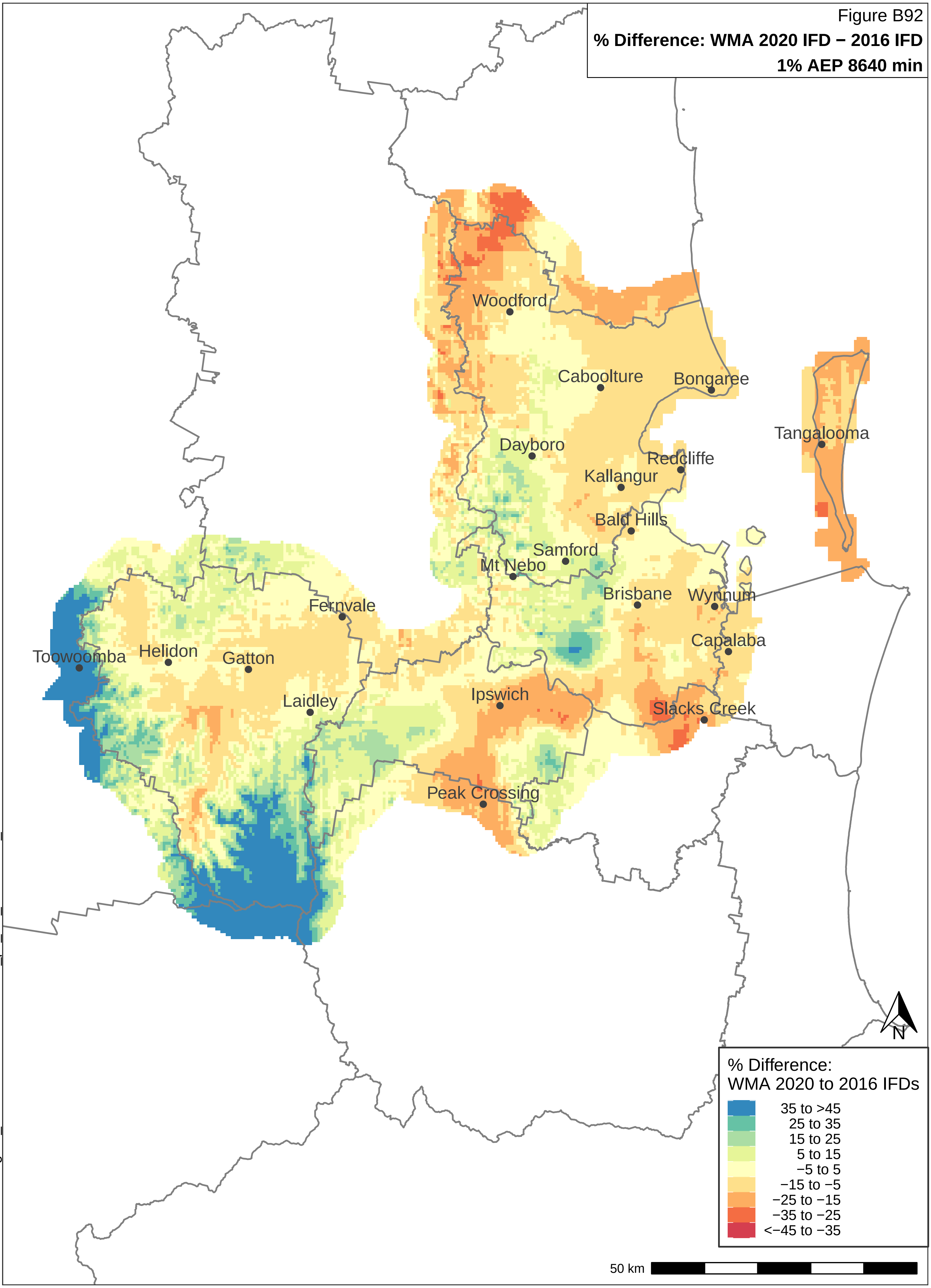


J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B92

% Difference: WMA 2020 IFD − 2016 IFD

1% AEP 8640 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

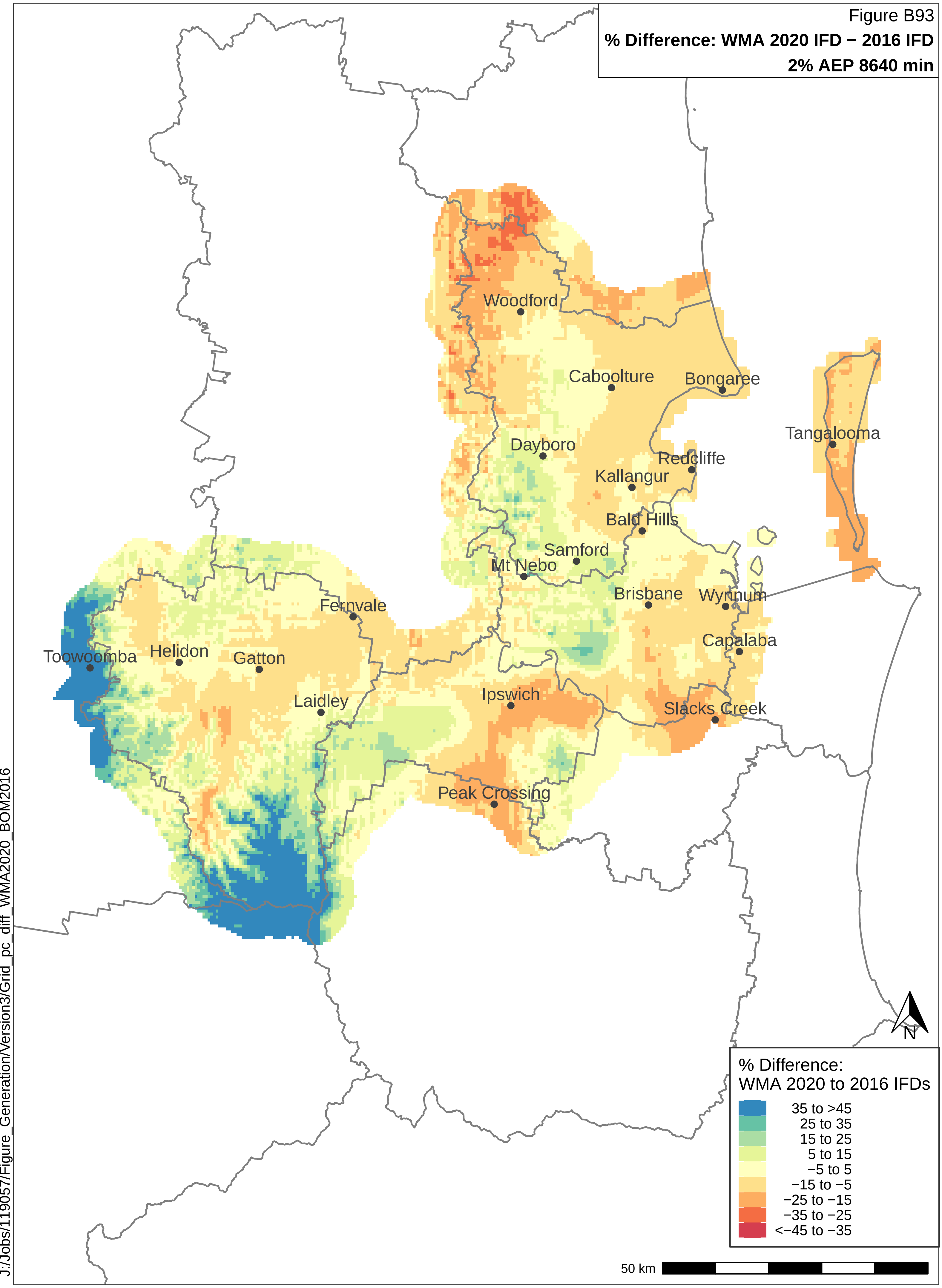
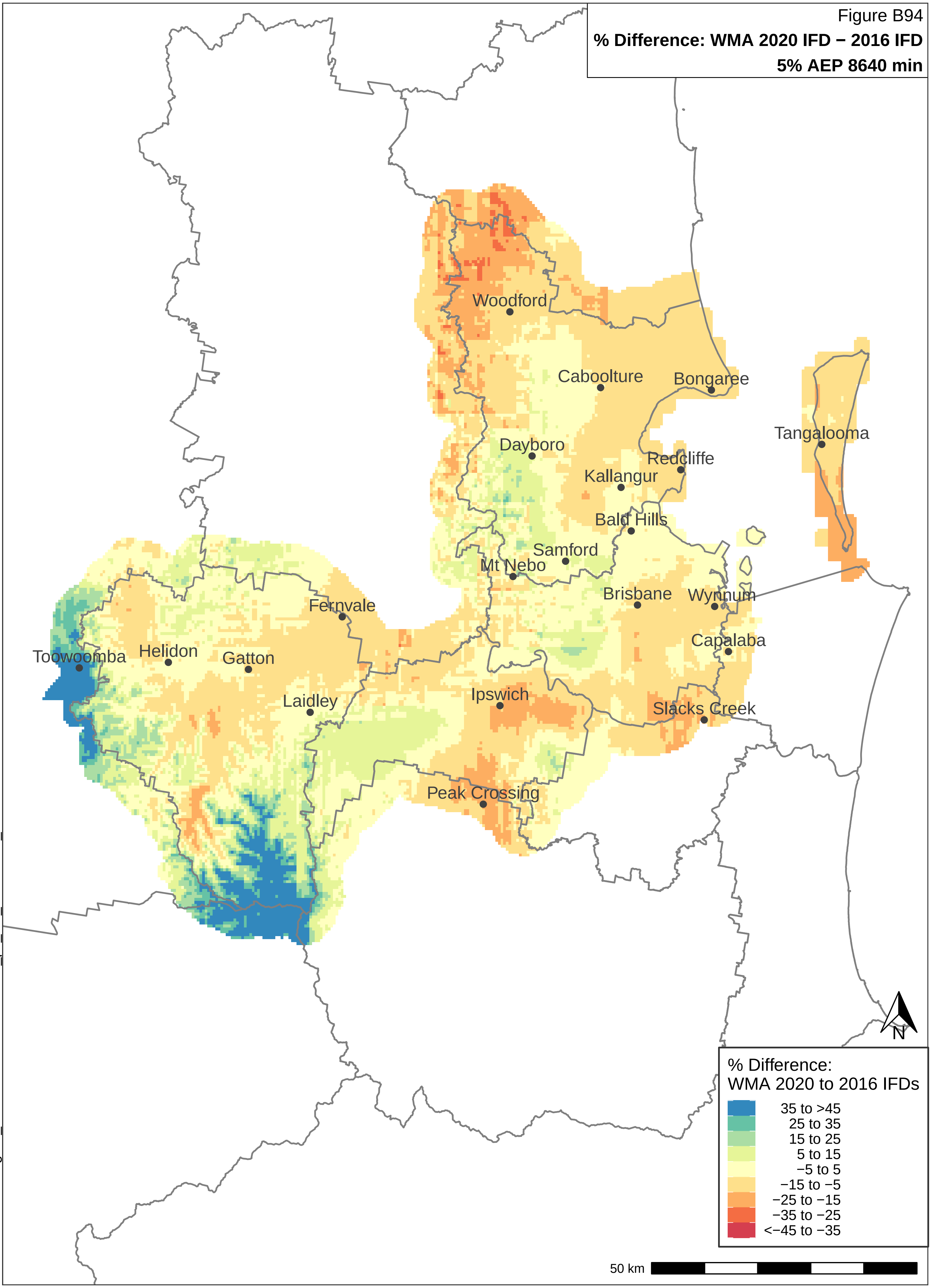


Figure B93
% Difference: WMA 2020 IFD − 2016 IFD
2% AEP 8640 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B94
% Difference: WMA 2020 IFD − 2016 IFD
5% AEP 8640 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

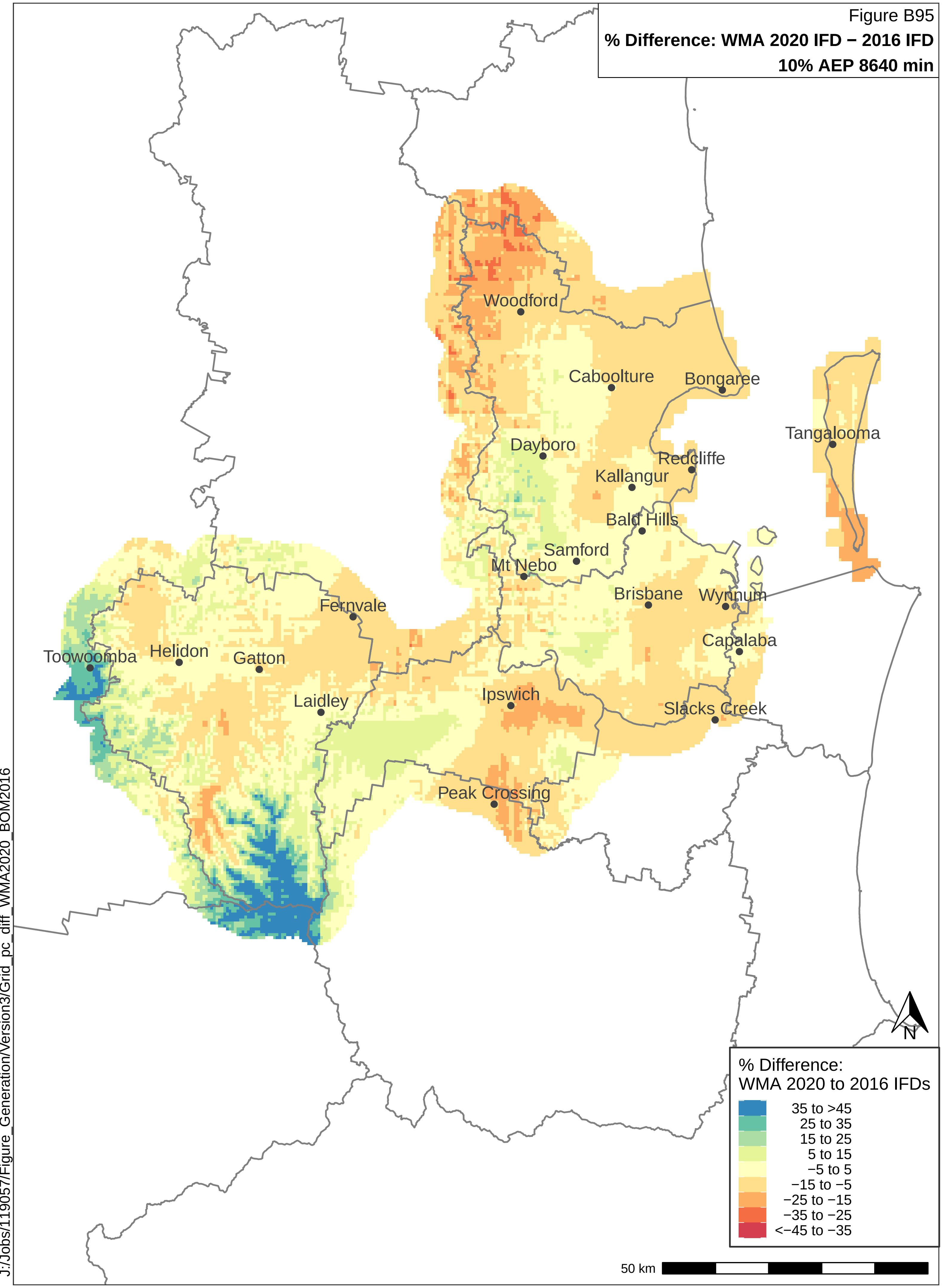
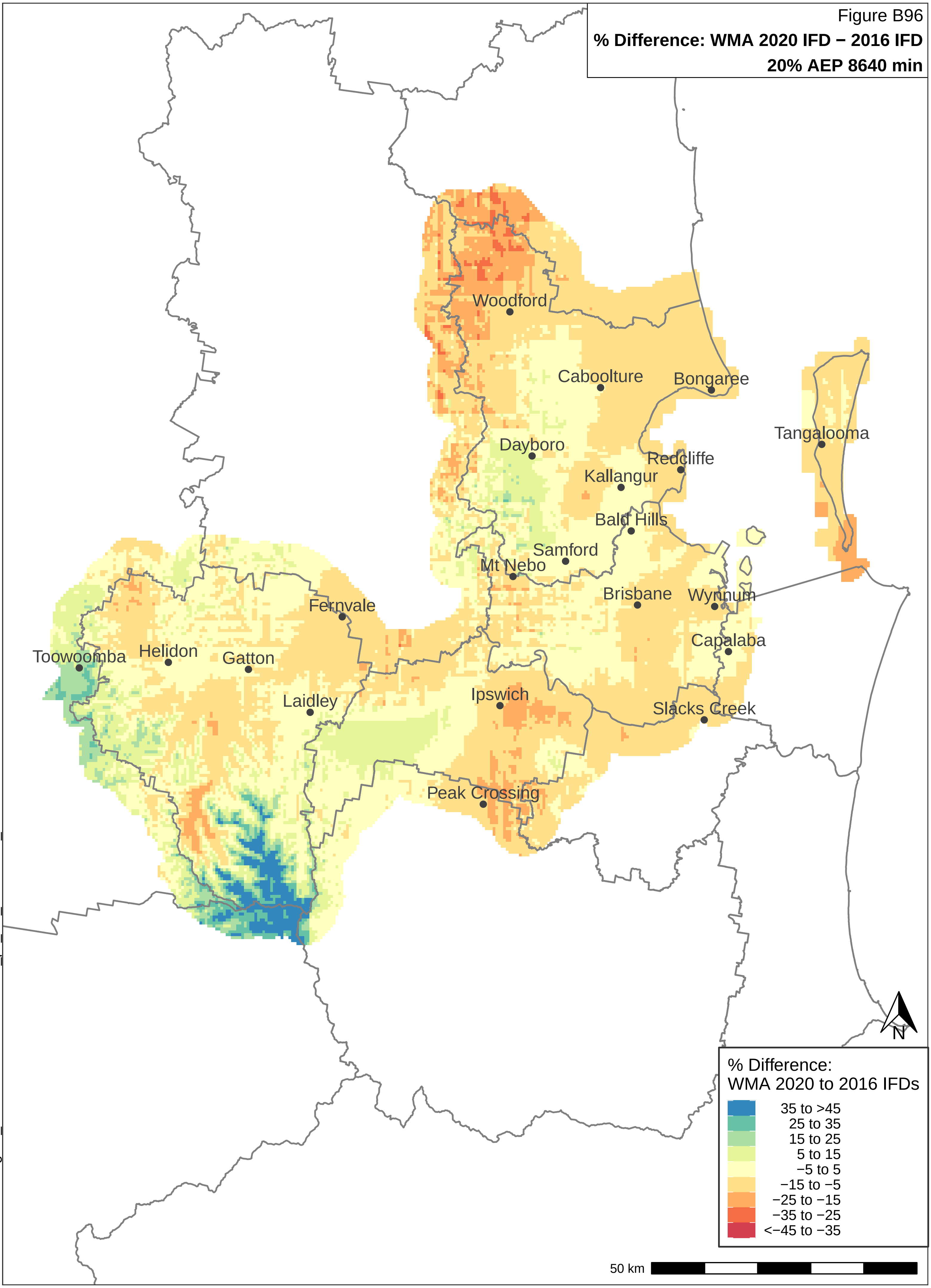


Figure B95
% Difference: WMA 2020 IFD − 2016 IFD
10% AEP 8640 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

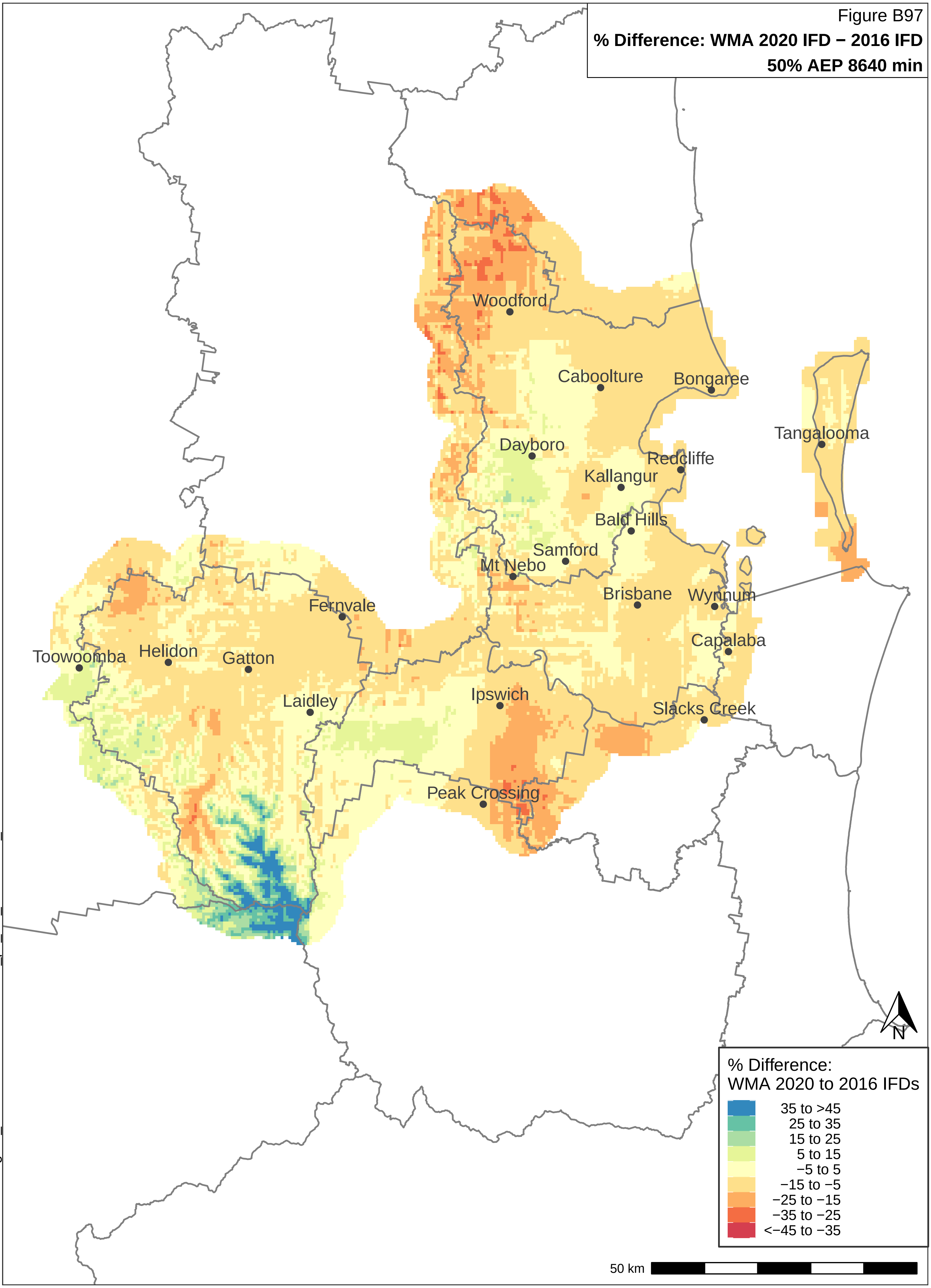


Figure B97
% Difference: WMA 2020 IFD − 2016 IFD
50% AEP 8640 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Laidley
Capalaba
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

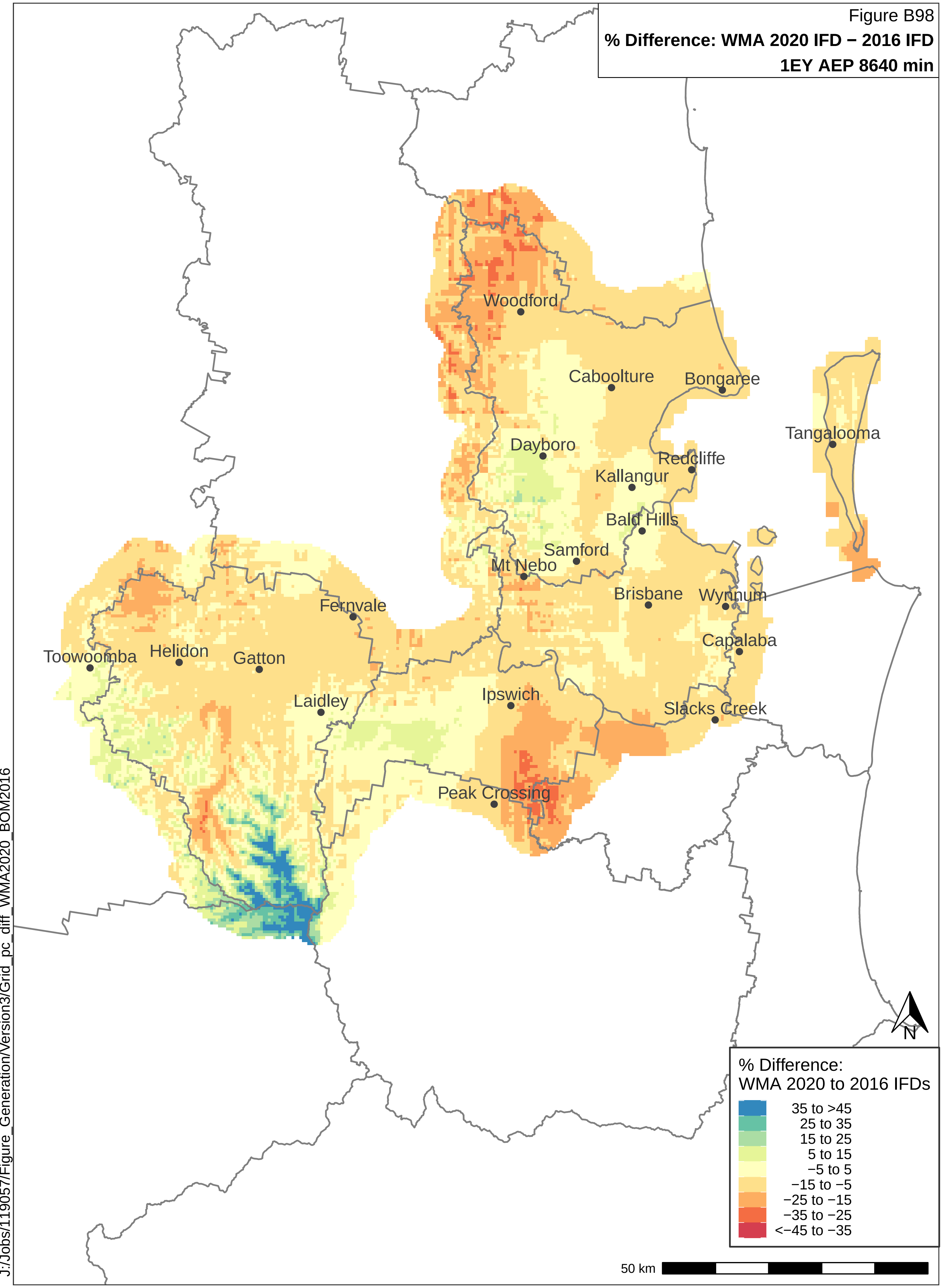
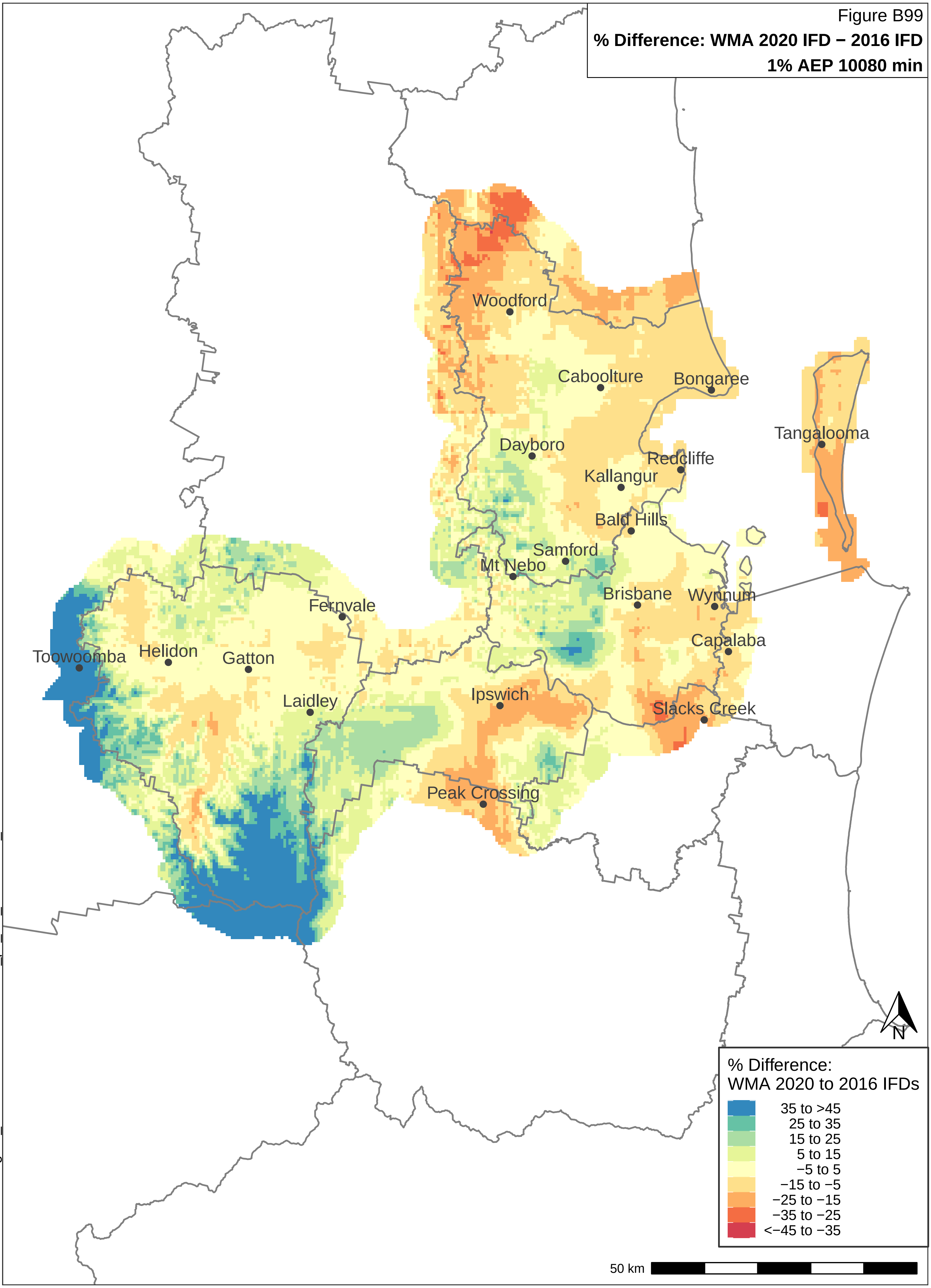


Figure B98
% Difference: WMA 2020 IFD − 2016 IFD
1EY AEP 8640 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

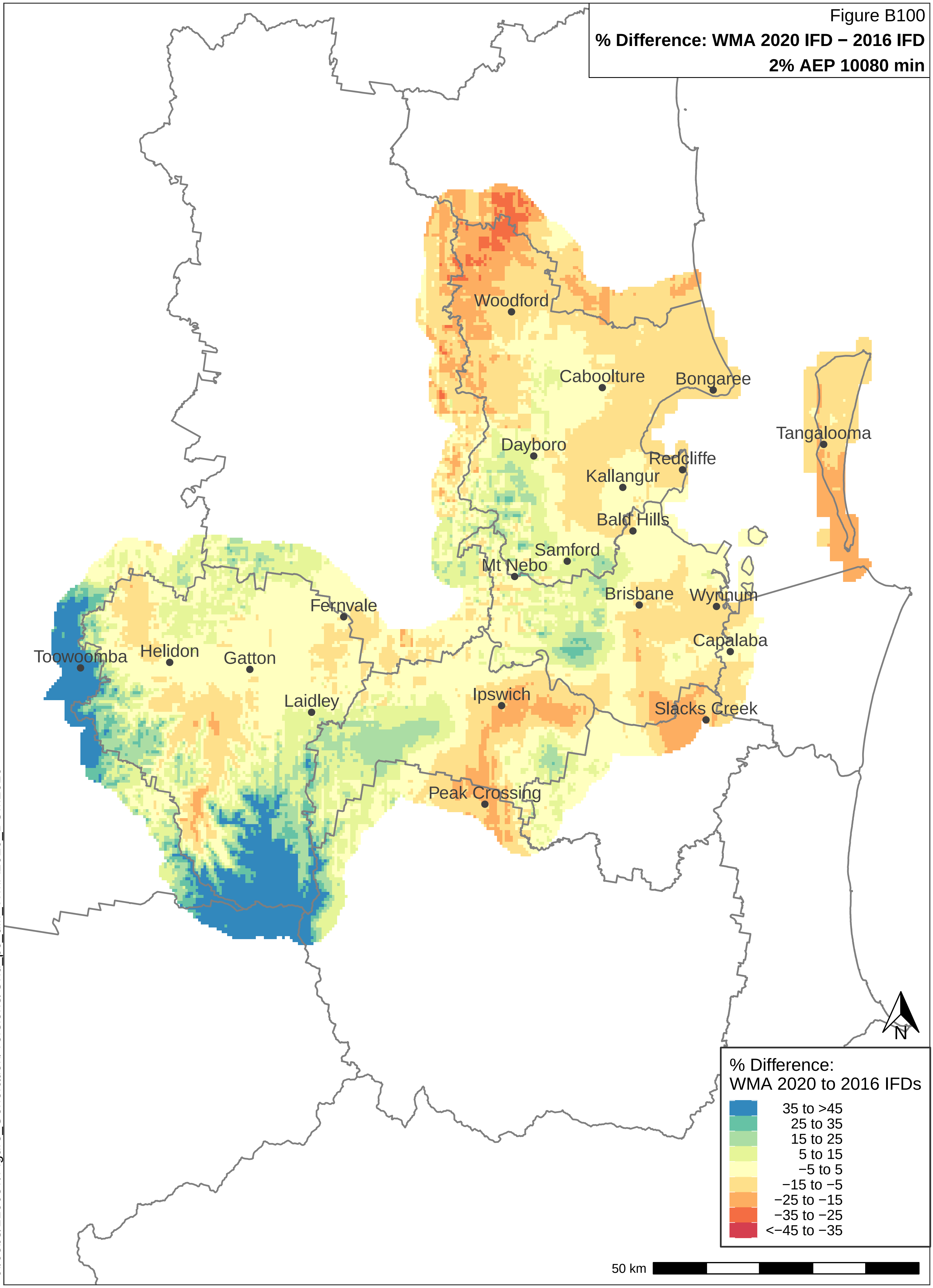


Figure B100
% Difference: WMA 2020 IFD − 2016 IFD
2% AEP 10080 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Toowoomba
Helidon
Gatton
Capalaba
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

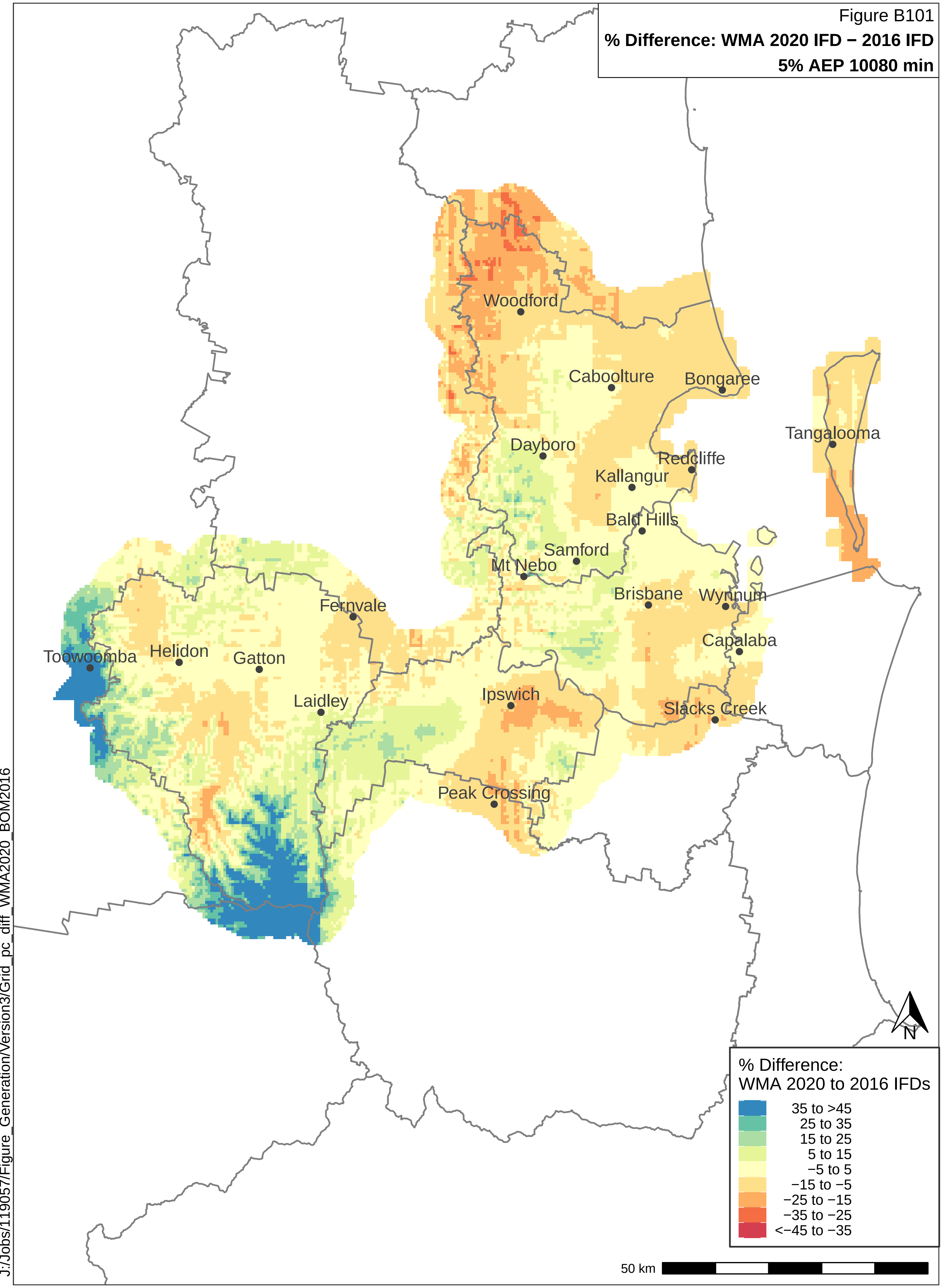
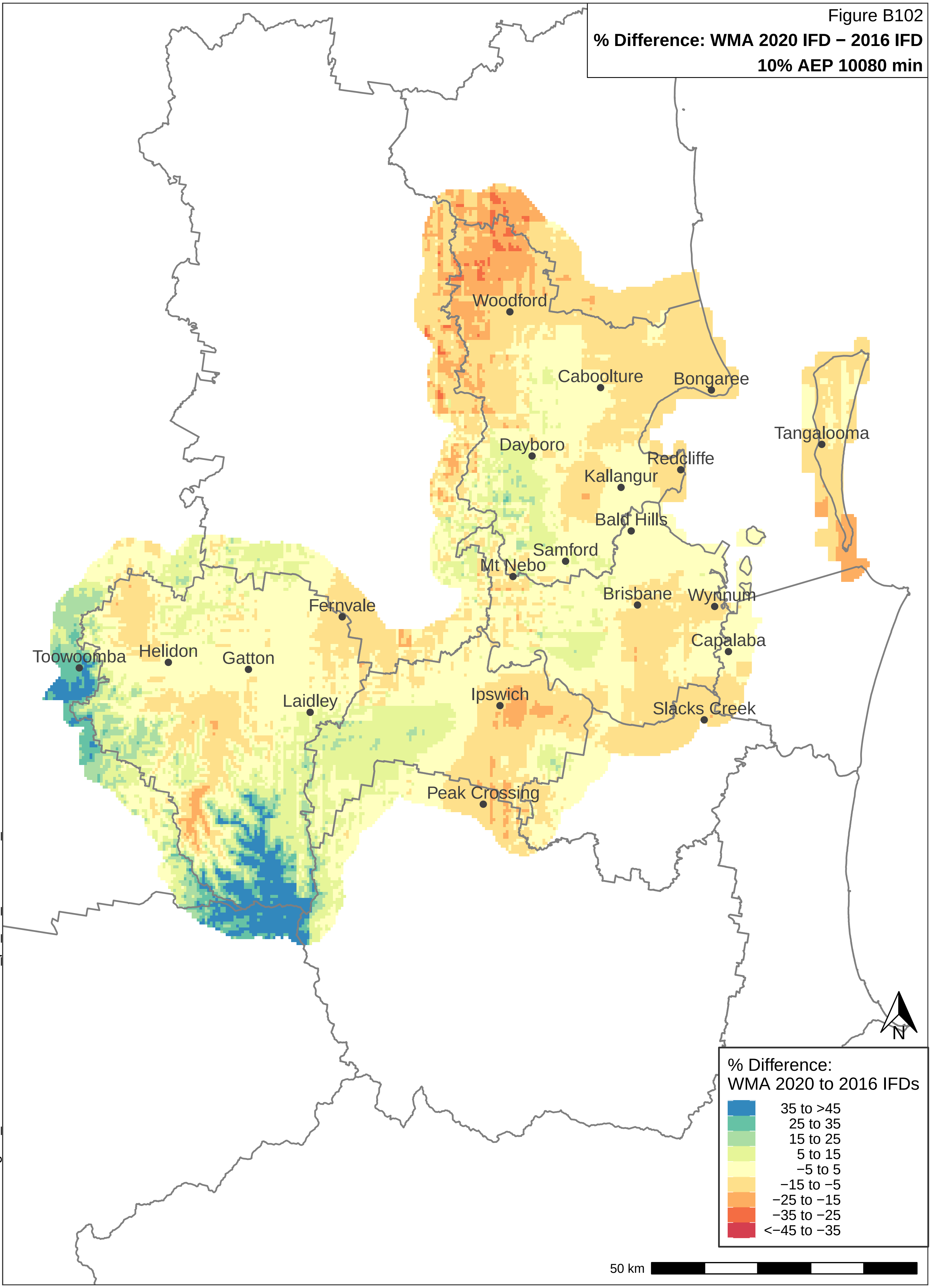


Figure B101
% Difference: WMA 2020 IFD − 2016 IFD
5% AEP 10080 min
Woodford
Caboolture
Bongaree
Tangalooma
Dayboro
Redcliffe
Kallangur
Bald Hills
Samford
Mt Nebo
Brisbane
Wynnum
Fernvale
Capalaba
Toowoomba
Helidon
Gatton
Laidley
Ipswich
Slacks Creek
Peak Crossing
N
% Difference:
WMA 2020 to 2016 IFDs
35 to >45
25 to 35
15 to 25
5 to 15
−5 to 5
−15 to −5
−25 to −15
−35 to −25
<−45 to −35
50 km
J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B102

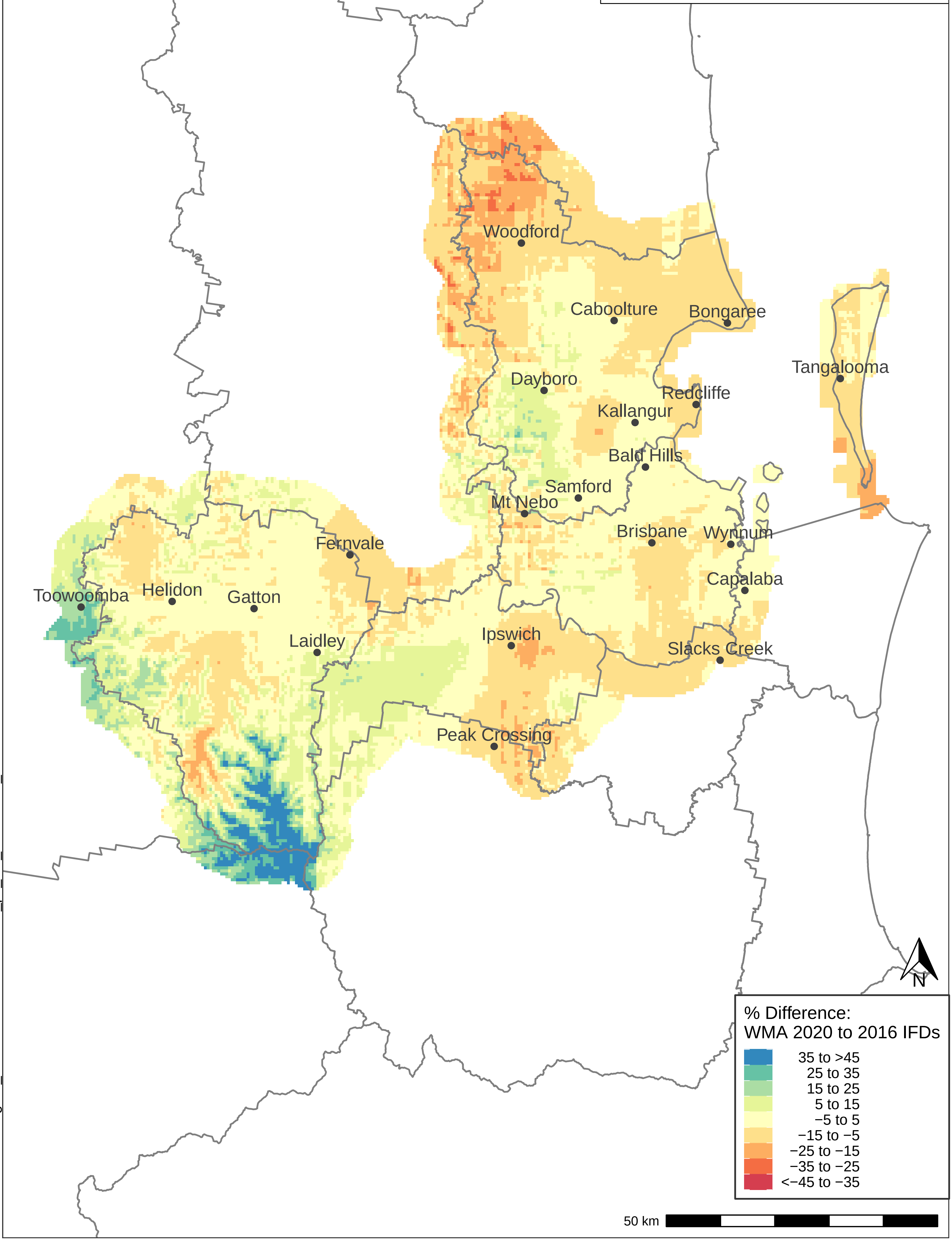
% Difference: WMA 2020 IFD − 2016 IFD

10% AEP 10080 min

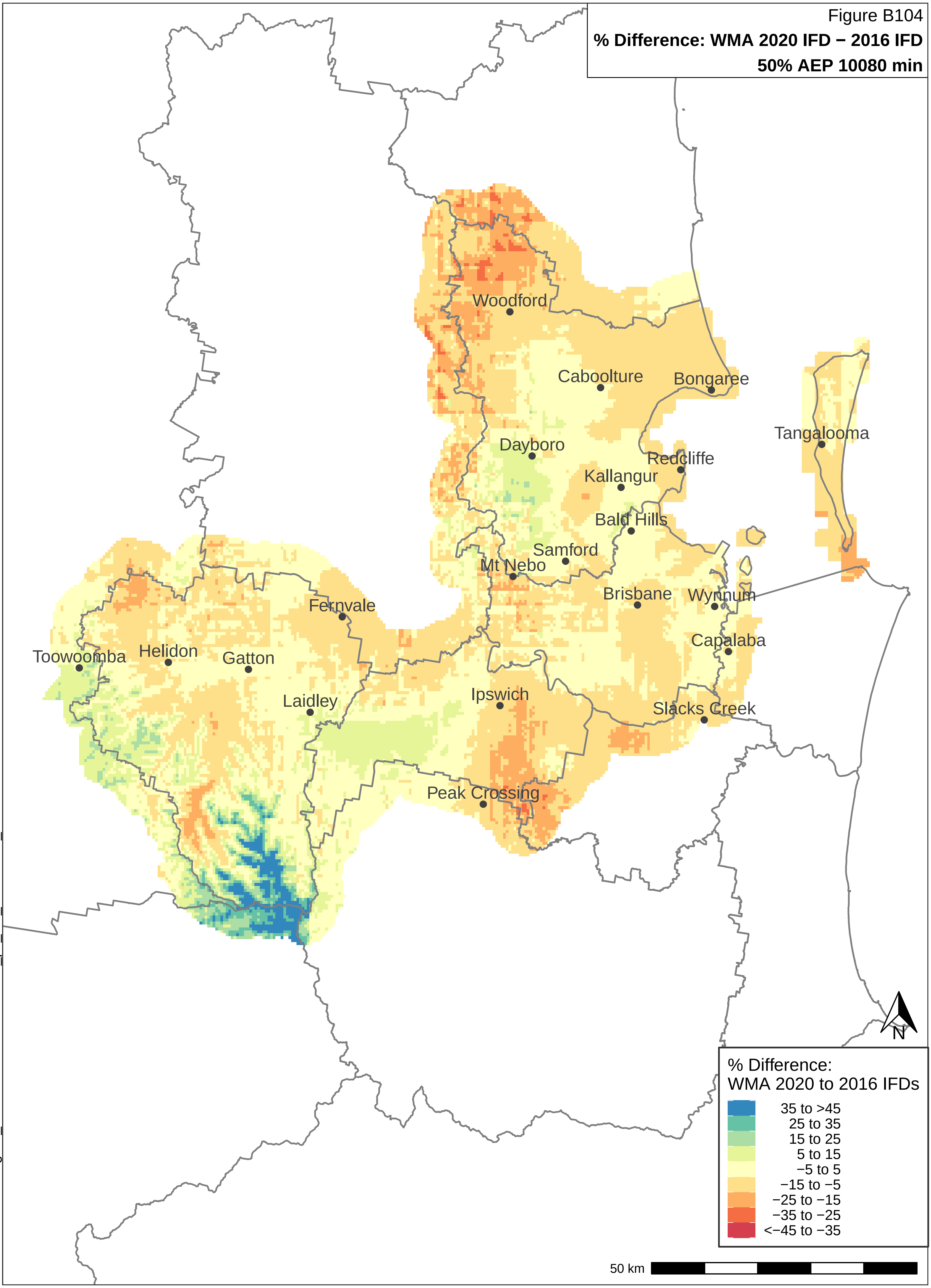


J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B103
% Difference: WMA 2020 IFD − 2016 IFD
20% AEP 10080 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

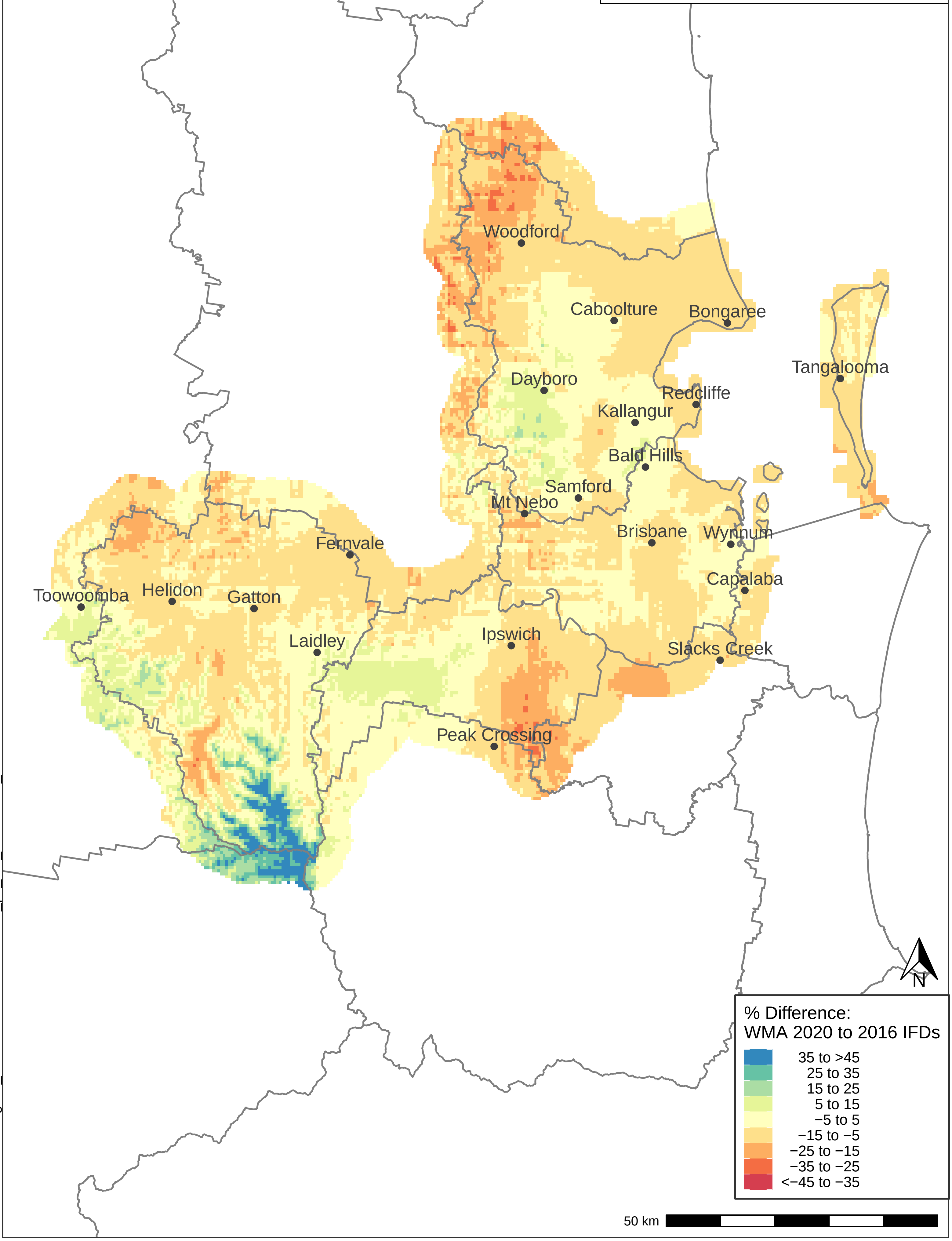


J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Figure B105

% Difference: WMA 2020 IFD − 2016 IFD

1EY AEP 10080 min



J:/Jobs/119057/Figure_Generation/Version3/Grid_pc_diff_WMA2020_BOM2016

Appendix C

APPENDIX C. Rain gauges

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
40004	Amberley Amo	-27.6297	152.7111	Ipswich	1962	2017	48	1942	2020	78
40014	Beaudesert Cryna	-28.0206	153.0131	Scenic Rim	1968	2012	36	1887	2012	117
40062	Crohamhurst	-26.8094	152.87	Sunshine Coast	1962	1995	25	1893	2003	107
40063	Dayboro Post Office	-27.1967	152.8244	Moreton Bay	1969	1996	24	1932	2013	82
40082	University of Queensland Gatton	-27.5436	152.3375	Lockyer Valley	1957	2016	50	1897	2020	124
40094	Harrisville Mary Street	-27.8086	152.6675	Scenic Rim	1972	2015	36	1897	2020	122
40101	Ipswich	-27.6117	152.7608	Ipswich	1976	1991	13	1887	1994	108
40121	Maleny Tamarind St	-26.7528	152.8519	Sunshine Coast	2003	2015	11	1916	2017	93
40135	Moogerah Dam	-28.0302	152.5529	Scenic Rim	1965	2014	43	1918	2020	96
40166	Oxenford (Oberon Way)	-27.8965	153.3128	Gold Coast	1999	2015	15	1999	2015	15
40178	Rathdowney Post Office	-28.2111	152.865	Scenic Rim	1966	2015	33	1966	2015	31
40180	Margate Collins St	-27.2517	153.1008	Moreton Bay	1963	1989	18	1887	1989	102
40192	Springbrook Forestry	-28.2264	153.2786	Gold Coast	1967	2003	30	1967	2003	30
40197	Mt Tamborine Fern St	-27.9695	153.1954	Scenic Rim	1973	2017	44	1973	2017	44
40211	Archerfield Airport	-27.5716	153.0071	Brisbane	1948	1992	9	1929	2020	91
40214	Brisbane Regional Office	-27.466	153.027	Brisbane	1908	1994	84	1849	1994	135
40222	Kalinga Bowls Club	-27.4118	153.0457	Brisbane	1972	2008	26	1956	2008	52
40223	Brisbane Aero	-27.4178	153.1142	Brisbane	1950	2000	49	1949	2000	52
40241	Samford Csiro	-27.3617	152.8861	Moreton Bay	1968	2003	32	1912	2003	83
40265	Redlands Hrs	-27.5278	153.25	Redland	1965	2013	37	1899	2013	65
40270	Ravensbourne	-27.3628	152.1594	Toowoomba	1966	1981	14	1933	2004	57
40308	Mt Glorious Fahey Rd	-27.3342	152.7717	Moreton Bay	1968	2014	35	1934	2014	81
40312	New Beith	-27.7354	152.9443	Logan	1974	2015	26	1961	2020	53
40406	Beenleigh Bowls Club	-27.7094	153.2014	Logan	1968	2003	28	1967	2010	43
40454	Glenlogan Field Station	-27.8333	153	Logan	1972	1982	9	1971	1986	16

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
40457	Wacol DI	-27.5767	152.9042	Brisbane	1972	1979	8	-	-	-
40458	Capalaba Water Treat	-27.5314	153.1825	Redland	1972	2017	39	1972	2020	49
40459	Carina Bcc Donaldson Rd	-27.5	153.1	Brisbane	1972	1988	13	1972	1989	18
40460	Mount Cotton Farm	-27.6081	153.2381	Redland	1972	2016	33	1966	2020	51
40461	Ferny Hills Aust Woolshed	-27.3947	152.9308	Moreton Bay	1972	2005	22	1972	2005	32
40503	Tallegalla Alert Rn	-27.6075	152.58	Ipswich	2001	2018	17	2001	2020	20
40659	Greenbank Thompson Road	-27.6956	152.9408	Logan	1976	2017	33	1976	2020	44
40677	Maroon Dam	-28.1752	152.6557	Scenic Rim	1978	2017	38	1978	2017	38
40697	Redcliffe Council	-27.245	153.1006	Moreton Bay	1991	2004	11	1981	2005	25
40715	Shailer Park Oregon Drive	-27.6473	153.1718	Logan	1990	2016	20	1980	2020	40
40786	Jingle Downs Alert	-27.7456	152.9081	Logan	1990	2019	25	1990	2020	27
40792	Ripley Alert Rn	-27.7106	152.8072	Ipswich	1994	2007	10	1994	2015	20
40793	Lyons Alert	-27.7633	152.8367	Logan	2007	2015	8	1994	2020	22
40794	Greenbank (Thompson Rd) Al	-27.6956	152.9333	Logan	2007	2018	10	2001	2020	20
40836	One Mile Bridge Alert Rn	-27.6272	152.7461	Ipswich	1999	2018	19	1999	2020	21
40842	Brisbane Aero	-27.3917	153.1292	Brisbane	2001	2017	16	1994	2020	26
40854	Logan City Water Treatment Plant	-27.6839	153.1947	Logan	1994	2018	22	1993	2020	28
40878	Waterford Alert	-27.6947	153.1364	Logan	1994	2019	23	1994	2020	25
40912	Franklyn Vale Alert Rn	-27.7597	152.47	Ipswich	2001	2018	16	2001	2020	20
40913	Brisbane	-27.4808	153.0389	Brisbane	2001	2017	15	2000	2020	20
40934	Romani Alert	-27.8464	152.9061	Logan	2003	2019	17	2002	2020	19
40958	Redcliffe	-27.2169	153.0922	Moreton Bay	2007	2018	11	2004	2020	17
40978	Bribie Island Alert	-27.0797	153.1803	Moreton Bay	2006	2019	13	2006	2020	14
40979	Morayfield (Petersen Rd) Alert	-27.1247	152.9356	Moreton Bay	2006	2018	13	2006	2020	15
40980	Deception Bay Alert	-27.1822	153.0186	Moreton Bay	2006	2019	13	2006	2020	15
40985	Bellbird Park (Purser Rd) Al	-27.6692	152.8731	Ipswich	2008	2018	10	2007	2020	14
41467	Tawoomba City Council	-27.5667	151.885	Toowoomba	1959	1983	21	1959	1983	21

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
41529	Toowoomba Airport	-27.5425	151.9134	Toowoomba	2004	2018	12	2004	2016	12
540028	Lake Manchester Alert	-27.49	152.75	Brisbane	1999	2019	20	1999	2019	20
540060	Samford Alert	-27.3608	152.8794	Moreton Bay	1996	2019	22	1996	2019	22
540062	Loamside Alert Rn	-27.6831	152.7297	Ipswich	1998	2014	16	1998	2014	16
540063	Colleges Crossing Alert Rn	-27.5572	152.7975	Ipswich	2000	2018	17	2000	2018	17
540064	Grandchester Alert Rn	-27.6631	152.4611	Ipswich	2000	2018	14	2000	2018	14
540078	Marsden (First Ave) Al	-27.6686	153.1031	Logan	1995	2019	19	1995	2019	19
540079	Slacks Ck Reserve Pk Al	-27.6342	153.1253	Logan	1994	2019	23	1994	2019	23
540091	Slacks Ck (Loganlea Rd) Al	-27.6475	153.1475	Logan	1994	2019	24	1994	2019	24
540107	Gold Ck Reservoir Alert	-27.4667	152.8831	Brisbane	1995	2019	22	1995	2019	22
540119	Enoggera Dam Alert	-27.4469	152.9264	Brisbane	1996	2019	24	1996	2019	24
540138	Mt Glorious Alert	-27.3167	152.7469	Somerset	1995	2019	25	1995	2019	25
540143	Helidon Alert	-27.5439	152.1133	Lockyer Valley	1998	2019	19	1998	2019	19
540147	Walloon Alert-P Rn	-27.6289	152.6681	Ipswich	1996	2018	17	1996	2018	17
540149	Glenore Grove Alert	-27.5231	152.4092	Lockyer Valley	1996	2019	23	1996	2019	23
540150	Savages Crossing Alert	-27.4411	152.6683	Somerset	1995	2019	22	1995	2019	22
540151	Kalbar Weir	-27.9353	152.5978	Scenic Rim	2007	2018	12	2007	2018	12
540152	Tenthill Alert	-27.6358	152.2144	Lockyer Valley	1995	2019	23	1995	2019	23
540153	O'Reilly's Weir Alert	-27.4197	152.5892	Somerset	1995	2019	23	1995	2019	23
540154	Harrisville	-27.8133	152.6417	Scenic Rim	2008	2018	11	2008	2018	11
540157	Adams Bridge	-27.8294	152.5108	Scenic Rim	2010	2018	9	-	-	-
540158	Showground Weir Alert	-27.6386	152.3844	Lockyer Valley	1995	2019	19	1995	2019	19
540162	Toowoomba Alert	-27.5103	151.9547	Toowoomba	1995	2019	24	1995	2019	23
540163	Kilcoy Alert	-26.9481	152.5836	Somerset	1997	2019	20	1997	2019	20
540166	West Woodbine Alert	-27.7847	152.1497	Lockyer Valley	1995	2019	18	1995	2019	18
540168	Kluvers Lookout Alert	-27.2069	152.7028	Somerset	1995	2019	22	1995	2019	22
540169	Thornton Alert	-27.8211	152.38	Lockyer Valley	1995	2019	22	1995	2019	22

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
540170	Little Egypt Alert	-27.7042	152.065	Lockyer Valley	2009	2019	10	-	-	-
540171	Mt Castle Alert	-27.9636	152.3756	Lockyer Valley	1997	2019	18	1997	2019	18
540173	Tarome	-27.9867	152.5008	Scenic Rim	2008	2018	11	2008	2018	11
540174	Lyons Bridge Alert-P	-27.47	152.5247	Somerset	1995	2019	22	1995	2019	21
540177	Wivenhoe Dam Hw Alert-P	-27.3931	152.5961	Somerset	1995	2019	24	1995	2019	23
540178	Wivenhoe Dam Tw Alert	-27.4022	152.6069	Somerset	1995	2019	23	1995	2019	22
540180	Amberley Alert-P Rn	-27.6783	152.6989	Ipswich	1995	2018	21	1995	2018	21
540182	Lowood Alert-P	-27.47	152.5956	Somerset	1995	2019	17	1995	2019	17
540185	Mt Mee Alert-P	-27.0697	152.78	Moreton Bay	1997	2019	22	1997	2019	22
540189	Baxters Creek Alert	-27.1958	152.8	Moreton Bay	1999	2019	19	1999	2019	19
540190	Ferris Knob Alert	-26.8542	152.8167	Moreton Bay	1997	2019	19	1997	2019	19
540191	West Bellthorpe Alert	-26.8233	152.6778	Somerset	1997	2019	20	1997	2019	20
540192	Jindalee Alert	-27.5322	152.9239	Brisbane	1997	2019	20	1997	2019	20
540193	Rosewood Alert Rn	-27.6594	152.6044	Ipswich	1997	2018	18	1997	2018	19
540194	Kuss Road Alert Rn	-27.6658	152.5414	Ipswich	1997	2018	13	1997	2018	13
540195	Washpool	-27.8292	152.7553	Scenic Rim	2008	2018	11	2008	2018	11
540198	Brisbane City Alert	-27.4707	153.0341	Brisbane	1997	2019	22	1996	2019	23
540199	Mt Crosby Alert	-27.5364	152.7992	Brisbane	1997	2019	21	1997	2019	21
540200	Moggill	-27.5861	152.8578	Brisbane	2007	2018	12	2007	2018	12
540202	North Pine Dam Alert	-27.2667	152.9333	Moreton Bay	1997	2019	20	1997	2019	20
540204	Lake Kurwongbah Alert	-27.25	152.95	Moreton Bay	1995	2019	24	1995	2019	25
540205	Drapers Crossing Alert	-27.35	152.9167	Moreton Bay	1997	2019	21	1997	2019	21
540233	Underwood (Millers Rd) Al	-27.6119	153.1081	Logan	1994	2019	22	1994	2019	22
540234	Stretton (Gowan Rd) Alert	-27.6417	153.0667	Brisbane	1994	2019	26	1994	2019	26
540235	Hillcrest (Wine Glass) Al	-27.6775	153.0292	Logan	1994	2019	25	1994	2019	25
540237	Bega Road Quarry Alert	-27.6667	153.1167	Logan	1998	2019	19	1998	2019	19
540241	Round Mt Reservoir Alert	-27.0328	152.9344	Moreton Bay	1999	2019	20	1999	2019	20

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
540242	Burpengary (Dale St) Al	-27.1492	152.9617	Moreton Bay	1998	2019	22	1998	2019	22
540243	Caboolture WTP Alert	-27.0861	152.9394	Moreton Bay	1999	2019	21	1999	2019	21
540244	Wamuran Al	-27.0478	152.8594	Moreton Bay	2007	2018	12	2007	2018	12
540245	Burpengary (Rowley Rd) Al	-27.1642	152.9375	Moreton Bay	1995	2018	23	1995	2019	24
540246	Mt Mee Alert-B	-27.0698	152.78	Moreton Bay	1997	2017	19	1997	2017	19
540247	Bundamba (Barclay St) Al Rn	-27.6203	152.8261	Ipswich	1999	2016	11	-	-	-
540248	Churchill Alert Rn	-27.6339	152.7542	Ipswich	1997	2018	18	1997	2018	18
540249	Bundamba (Hanlon St) Al Rn	-27.5914	152.7964	Ipswich	1997	2016	16	1997	2016	16
540250	Brassall (Hancocks Br) Al Rn	-27.6036	152.7439	Ipswich	1997	2018	20	1997	2018	20
540255	Carbrook Alert	-27.6547	153.2317	Logan	2000	2019	20	2000	2019	20
540277	North Pine Dam Alert-B	-27.2668	152.9333	Moreton Bay	2001	2019	18	2001	2019	18
540299	Ravensbourne Alert	-27.3642	152.1578	Toowoomba	1998	2018	18	1998	2018	18
540312	Marburg Alert Rn	-27.5778	152.5936	Ipswich	2002	2018	15	2002	2018	15
540313	Rosewood WWTP Alert Rn	-27.6475	152.5883	Ipswich	2002	2018	17	2002	2018	17
540314	Spressers Bridge Alert Rn	-27.6631	152.5906	Ipswich	2002	2018	16	2002	2018	16
540316	Churchbank Weir	-27.7706	152.685	Scenic Rim	2007	2018	9	-	-	-
540317	Grey's Plains Road Alert Rn	-27.8025	152.4361	Ipswich	2002	2018	15	2002	2018	15
540334	Grigor Road Alert	-26.7181	152.6692	Sunshine Coast	2003	2019	16	2003	2019	16
540335	Harper Creek Alert	-26.7642	152.7722	Sunshine Coast	2003	2019	17	2003	2019	17
540336	Maleny Alert	-26.7631	152.8475	Sunshine Coast	2003	2019	17	2003	2019	17
540337	Woodford Alert-P	-26.9383	152.76	Moreton Bay	1997	2019	19	1997	2019	19
540338	Woodford Alert-B	-26.9384	152.76	Moreton Bay	1997	2019	21	1997	2019	21
540341	Hume Lane Alert	-26.8419	152.8953	Sunshine Coast	2007	2019	11	2007	2019	11
540342	Old Gympie Rd Al	-26.8572	152.9381	Sunshine Coast	2005	2019	14	2005	2019	14
540343	Beerwah Al	-26.8664	152.9617	Sunshine Coast	2005	2019	14	2005	2019	14
540357	Upper Caboolture Alert	-27.0978	152.8914	Moreton Bay	2004	2019	16	2004	2019	16
540358	Moorina Alert	-27.1531	152.8528	Moreton Bay	2004	2019	16	2004	2019	16

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
540379	Burbank Alert	-27.5578	153.1581	Brisbane	2008	2019	12	2008	2019	12
540380	Mt Cotton West Alert	-27.6147	153.2039	Redland	2008	2019	11	2008	2019	11
540381	Priestdale Alert	-27.6086	153.1842	Redland	2008	2019	12	2008	2019	12
540382	Rochedale South Alert	-27.5917	153.1419	Logan	2008	2019	12	2008	2019	12
540384	Leslie Harrison Dam Alert	-27.5286	153.18	Brisbane	2007	2019	13	2007	2019	13
540385	Upper Sandy Creek Alert	-27.4558	152.1983	Lockyer Valley	2008	2019	11	2008	2019	11
540386	Sandy Creek Road Alert	-27.5711	152.1781	Lockyer Valley	2008	2019	12	2008	2019	12
540387	Harrisville	-27.8133	152.6417	Scenic Rim	2007	2018	9	-	-	-
540388	Rosewood Alert-B Rn	-27.6592	152.6042	Ipswich	2007	2018	12	2007	2018	12
540409	Laceys Creek Alert	-27.1964	152.7506	Moreton Bay	2007	2019	12	2007	2019	13
540410	Dayboro Alert	-27.1992	152.83	Moreton Bay	2007	2018	12	2007	2019	13
540411	Browns Creek Road Alert	-27.1939	152.9175	Moreton Bay	2007	2019	12	2007	2019	13
540412	Youngs Crossing Alert	-27.2667	152.9542	Moreton Bay	2007	2019	13	2007	2019	13
540413	John Bray Park Alert	-27.2967	152.985	Moreton Bay	2007	2019	13	2007	2019	13
540414	Normanby Way Al	-27.3064	152.9969	Moreton Bay	2008	2019	11	2008	2019	11
540415	Cash's Crossing Alert	-27.3428	152.9608	Moreton Bay	2007	2019	12	2007	2019	12
540416	Samford Village Alert	-27.3703	152.8883	Moreton Bay	2008	2019	12	2008	2019	12
540417	Murrumba Downs Alert	-27.2881	153.0175	Moreton Bay	2007	2019	13	2007	2019	13
540418	Clear Mountain Alert	-27.3056	152.8861	Moreton Bay	2007	2019	13	2007	2019	13
540439	Lawnton Alert	-27.2756	152.9936	Moreton Bay	2008	2019	12	2008	2019	12
540444	Cedar Ck Rd Alert	-27.3278	152.8647	Moreton Bay	2009	2019	10	2009	2019	11
540445	Lipscombe Rd Alert	-27.2031	153.0147	Moreton Bay	2010	2019	10	2009	2019	11
540447	Mt Samson Rd Alert	-27.2494	152.8375	Moreton Bay	2009	2019	10	2009	2019	11
540457	Buaraba Alert	-27.4064	152.3825	Somerset	2010	2019	9	-	-	-
540458	Hays Landing Alert	-27.3322	152.6103	Somerset	2010	2019	9	-	-	-
540467	Albany Creek Al	-27.3508	152.9908	Brisbane	2011	2019	9	-	-	-
540472	Bill Gunn Dam Alert	-27.6317	152.3794	Lockyer Valley	2010	2019	10	-	-	-

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
540473	Lake Clarendon Alert	-27.5156	152.3531	Lockyer Valley	2010	2019	10	-	-	-
540474	Moogerah Dam Hw	-28.0314	152.55	Scenic Rim	2011	2018	8	-	-	-
540479	Atkinson Dam Alert	-27.4319	152.4642	Somerset	2010	2019	9	-	-	-
540484	Dayboro WWTP Alert	-27.2186	152.8403	Moreton Bay	2011	2019	9	-	-	-
540491	Lindfield Alert	-26.8369	152.5811	Somerset	2012	2019	8	-	-	-
540496	Beachmere Alert	-27.1369	153.0497	Moreton Bay	2011	2019	8	-	-	-
540498	Woody Point Alert	-27.258	153.085	Moreton Bay	2011	2019	9	-	-	-
540533	Mawsons Road Al	-26.8775	153.0041	Sunshine Coast	2012	2019	8	-	-	-
541057	Mt Pechey Alert	-27.3167	152.0817	Toowoomba	1996	2019	22	1996	2019	21
541068	Mt Pechey Alert-B	-27.3168	152.0817	Toowoomba	1997	2006	9	-	-	-
58016	Unumgar (Summerland Way)	-28.424	152.7548	-	2001	2017	13	2001	2017	13
58109	Tyalgum (Kerrs Lane)	-28.369	153.1713	-	1967	1995	23	1967	1995	23
AVR842	Albany Creek at Pinnarroo Cemetery Graham St, Bridgema	-27.3486	152.9925	Brisbane	2006	2018	13	2006	2018	13
BCR015	Roof Bac To 18/01/07 Then Roof Bris Sq. From 15	-27.4705	153.0228	Brisbane	1991	2009	18	1991	2009	18
BDR712	Bald Hills Ck at Bracken Ridge Rd Bracken Ridge	-27.3099	153.0232	Brisbane	1995	2003	9	-	-	-
BLR116	Blunder Creek at Richlands Reservoir	-27.5993	152.9593	Brisbane	1990	2018	29	1990	2018	29
BLR736	Blunder Ck @ Inala STP/Durack, Inala Bowls Bowhill Rd.	-27.5884	152.9871	Brisbane	1998	2018	21	1998	2018	21
BMR138	Bulimba Creek at Griffith Uni, Mt Gravatt Campus	-27.5445	153.0678	Brisbane	1990	2018	29	1990	2018	29
BMR527	Bulimba Ck, at Doughboy Parade, Hemmant	-27.4488	153.126	Brisbane	1994	2018	25	1994	2018	25
BMR706	Bulimba Ck, at Old Cleveland Rd Carindale	-27.501	153.1054	Brisbane	1994	2018	25	1994	2018	25
BMR803	Bulimba Creek, at Greenwood Road, Wishart	-27.56	153.1042	Brisbane	1995	2018	23	1995	2018	23

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
BMR830	Bulimba Ck. Merion Pl, Carindale	-27.5283	153.1058	Brisbane	1995	2018	23	1995	2018	23
BMR836	Gagarra St, Eight Miles Plains	-27.5831	153.0892	Brisbane	2001	2018	18	2001	2018	18
BNR739	Brisbane River at Wynnum STP Fisherman Island	-27.419	153.1634	Brisbane	1997	2018	22	1997	2018	22
BNR838	Luggage Point STP	-27.3811	153.1473	Brisbane	2005	2018	14	2005	2018	14
BVR524	Breakfast Ck Opposite Mann Pk, Bowen Hills	-27.4411	153.0348	Brisbane	1995	2018	24	1995	2018	24
BVR578	Brekfast Creek at Sedgley Park Newmarket	-27.4299	153.006	Brisbane	1998	2018	21	1998	2018	21
CDR761	Cedar Ck @ Upper Kedron Rec. Res.	-27.4104	152.9225	Brisbane	2010	2018	9	-	-	-
CVR560	Cabbage Tree Creek U/S from Braun Street, Deagon	-27.3342	153.0584	Brisbane	1995	2018	24	1995	2018	24
CVR572	Cabbage Tree Creek U/S Old Northern Rd, Everton H	-27.3806	152.9792	Moreton Bay	1995	2018	24	1995	2018	24
CVR715	Cabbage Tree Creek at Pineapple St, Carseldine	-27.3534	153.0322	Brisbane	1995	2002	8	-	-	-
DVR509	Downfall Ck. Chermside Pool, Hamilton Rd	-27.3857	153.0357	Brisbane	1994	2002	8	-	-	-
DVR563	Downfall Creek End of Brickyard Road, Geebung	-27.3824	153.0588	Brisbane	1995	2018	24	1995	2018	24
EVR507	Enoggera Ck at Three Ways, Brisbane Forest Park	-27.4436	152.827	Brisbane	1995	2018	24	1995	2018	24
GBR017	Gubberley Ck-Anglican Church Moggill Rd, Kenmore	-27.5097	152.942	Brisbane	1991	2001	11	1991	2001	11
GVR718	Gold Creek Reservoir (Brisbane Water)	-27.4604	152.8821	Brisbane	1995	2012	15	1995	2012	15
IVR512	Ithaca Creek at Abq2 Mt. Coot-tha	-27.4643	152.9478	Brisbane	1995	2018	24	1995	2018	24
IVR536	Ithaca Creek at Jason Street, Ithaca	-27.4488	152.9934	Brisbane	1995	2002	8	-	-	-
KVR539	Kedron Brook at Osborne Road, Everton Park	-27.4033	152.9787	Brisbane	1995	2018	24	1995	2018	24

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		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
KVR542	Kedron Brook at Hayward Street, Stafford	-27.4152	153.0118	Brisbane	1995	2004	10	-	-	-
KVR545	Kedron Brook at Australian Woolshed, Ferny Hills	-27.3944	152.9307	Moreton Bay	1995	2008	13	1995	2008	13
KVR557	Schulz Canal at Nudgee Road, Toombul	-27.4071	153.0736	Brisbane	1994	2018	22	1994	2018	22
KVR598	Kedron Brook at Suez St, Gordon Park (Brisbane Water)	-27.4146	153.0338	Brisbane	2001	2012	12	2001	2012	12
LCR566	Little Cabbage Tree Ck @ Aspley Reservoir, Aspley	-27.3739	153.0095	Brisbane	1995	2018	24	1995	2018	24
LTR755	Lota Creek Harman Rec. Res. Manly (Brisbane Water)	-27.4606	153.1821	Brisbane	2001	2018	18	2001	2018	18
MBR752	Moreton Bay at Brighton Bowls Club (Brisbane Water)	-27.304	153.0609	Brisbane	2000	2018	18	2000	2018	18
MVR515	Moggill Ck at Chadston Close	-27.5047	152.9249	Brisbane	1993	2018	26	1993	2018	26
NMR548	Norman Ck at Joachim St, Holland Park West	-27.5215	153.0554	Brisbane	1995	2018	24	1995	2018	24
NMR551	Norman Creek at South East Freeway, Greenslopes	-27.5102	153.0389	Brisbane	1995	2005	11	1995	2005	11
NMR554	Norman Creek at Caswell Street, East Brisbane	-27.4896	153.0498	Brisbane	1994	2018	25	1994	2018	25
NMR596	Tarana Street Park, Camp Hill (Brisbane Water)	-27.4954	153.073	Brisbane	1999	2018	20	1999	2018	20
NMR833	Norman Ck Cnr Cavendish & Boundary Rds, Coorparo	-27.5142	153.0736	Brisbane	1995	2005	11	-	-	-
OXR020	Oxley Ck at Corinda High School	-27.5468	152.9884	Brisbane	1992	2018	27	1992	2018	27
OXR108	Oxley Creek at Johnson Rd, Forestdale.	-27.6552	153.0004	Logan	1991	2013	22	1991	2013	22
OXR114	Oxley Ck T'com Exchange, Beaudesert Rd Calamval	-27.6101	153.0501	Brisbane	1990	2018	29	1990	2018	29

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		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
OXR126	Oxley Creek D/S Beatty Rd, Acacia Ridge	-27.5846	153.01	Brisbane	1990	2001	12	1990	2001	12
PDR844	Pound Ck, at Hendra Pony Club, D/S Nudgee Rd	-27.4002	153.0756	Brisbane	2007	2018	12	2007	2018	12
PVR029	Perrin Ck-Balmoral Works Depot, Morningside	-27.4695	153.0712	Brisbane	1992	2005	14	1992	2005	14
RVR747	Rn: Dulcie St, Salisbury	-27.5494	153.0376	Brisbane	2001	2018	18	2001	2018	18
SSR130	S.S. Ck Musgrave Rd Coopers Plains	-27.5619	153.027	Brisbane	1995	2003	9	-	-	-
TWR027	Toowong Ck-Taringa Works Depot, Alpha St Taringa	-27.4914	152.9881	Brisbane	1992	2003	12	1992	2003	12
TWR749	Toowong Ck at Anzac Park Toowong (Brisbane Water)	-27.4802	152.9794	Brisbane	2001	2018	18	2001	2018	18
WSR518	Wolston Ck. @ STP Grindle Rd	-27.5794	152.9072	Brisbane	1994	2018	25	1994	2018	25
WVR837	Wynnum Bowls Club	-27.4434	153.1673	Brisbane	2003	2018	16	2003	2018	16
ZVR850	Zillman Waterholes Ck @ Frank Sleeman Pk	-27.3617	153.0576	Brisbane	2009	2018	10	-	-	-
40000	Abbotsford	-27.95	153.1	Scenic Rim	-	-	-	1910	1974	65
40007	Bald Knob	-26.8	152.9	Sunshine Coast	-	-	-	1927	1983	55
40008	Banks Creek	-27.42	152.7	Somerset	-	-	-	1920	1955	35
40011	Laidley Creek	-27.73	152.37	Lockyer Valley	-	-	-	1965	1988	18
40016	Beenleigh Post Office	-27.72	153.18	Logan	-	-	-	1887	1967	81
40017	Beerwah Forest	-26.86	152.98	Sunshine Coast	-	-	-	1930	2003	67
40018	Bellthorpe	-26.83	152.72	Moreton Bay	-	-	-	1932	1949	15
40019	Benarkin Forest Station	-26.9	152.15	Somerset	-	-	-	1935	1988	52
40020	Blackbutt Post Office	-26.89	152.1	South Burnett	-	-	-	1900	2019	105
40022	Bli Bli	-26.6	153.08	Sunshine Coast	-	-	-	1928	1953	26
40024	Boonah Stark Ave	-27.99	152.69	Scenic Rim	-	-	-	1899	2011	106
40027	Bongaree Bowls Club	-27.09	153.17	Moreton Bay	-	-	-	1932	1989	57

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		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
40030	Bryn Euryn	-28.24	152.48	Southern Downs	-	-	-	1917	1974	47
40031	Buderim Post Office	-26.69	153.05	Sunshine Coast	-	-	-	1893	1995	86
40032	Mons Mari	-26.68	153.07	Sunshine Coast	-	-	-	1945	1981	37
40033	Bunjurgen	-28.1	152.6	Scenic Rim	-	-	-	1925	1955	31
40035	Burpengary Ulmann Rd	-27.14	153.01	Moreton Bay	-	-	-	1900	2000	86
40037	Caboonbah	-27.15	152.5	Somerset	-	-	-	1898	1966	51
40038	Caboolture Post Office	-27.09	152.95	Moreton Bay	-	-	-	1887	2000	102
40039	Caloundra Post Office	-26.81	153.14	-	-	-	-	1938	1975	36
40040	Caloundra Signal Station	-26.8	153.15	Sunshine Coast	-	-	-	1899	1993	67
40041	Camp Mountain (Davison Road)	-27.4	152.87	Moreton Bay	-	-	-	1926	2006	39
40043	Cape Moreton Lighthouse	-27.03	153.47	-	-	-	-	1887	2020	134
40047	Cleveland Bowls Club	-27.53	153.28	Redland	-	-	-	1887	2003	116
40051	Conondale Township	-26.73	152.72	Sunshine Coast	-	-	-	1934	2020	73
40053	Cooloolabin Forestry	-26.55	152.902	Sunshine Coast	-	-	-	1928	1975	47
40054	Rocky Vale	-26.55	152.9	Sunshine Coast	-	-	-	1915	1972	58
40056	Coominya Post Office	-27.39	152.5	Somerset	-	-	-	1916	2019	100
40061	Cowan Cowan Signal Stn	-27.13	153.37	Brisbane	-	-	-	1913	1965	53
40064	Deongwar State Forest	-27.31	152.23	Somerset	-	-	-	1937	1969	33
40065	Diddillibah	-26.65	153.03	Sunshine Coast	-	-	-	1914	1966	50
40066	Dinmore Post Office	-27.6	152.83	Ipswich	-	-	-	1894	1979	82
40070	Dunwich Post Office	-27.52	153.42	Redland	-	-	-	1893	1956	58
40075	Esk Post Office	-27.24	152.42	Somerset	-	-	-	1887	2020	128
40076	Esk Dale West	-27.15	152.17	Somerset	-	-	-	1933	1988	54
40077	Eudlo	-26.73	152.98	Sunshine Coast	-	-	-	1898	1961	27
40079	Forest Hill	-27.58	152.38	Lockyer Valley	-	-	-	1894	2020	117
40083	Gatton Allan Street	-27.54	152.28	Lockyer Valley	-	-	-	1894	2020	118
40084	Glass House Mountains	-26.9	152.98	Sunshine Coast	-	-	-	1908	1944	33

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		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
40087	Googa Googa Crk Forest	-26.95	152.05	Toowoomba	-	-	-	1927	1987	56
40091	Grandchester Symes St	-27.66	152.47	Ipswich	-	-	-	1894	2014	112
40095	Hattonvale Oshea Rd	-27.57	152.47	Lockyer Valley	-	-	-	1908	2014	101
40096	Helidon Post Office	-27.55	152.12	Lockyer Valley	-	-	-	1887	2020	131
40102	Jimna Composite	-26.6639	152.4608	Somerset	-	-	-	1927	2008	80
40104	Englesberg Village	-27.95	152.62	Scenic Rim	-	-	-	1887	2020	127
40106	Kenilworth Township	-26.6	152.73	Sunshine Coast	-	-	-	1903	2020	114
40108	Kholo	-27.55	152.75	Brisbane	-	-	-	1940	2005	62
40110	Kilcoy Post Office	-26.94	152.56	Somerset	-	-	-	1890	2017	112
40114	Laidley Post Office	-27.63	152.39	Lockyer Valley	-	-	-	1890	1994	102
40115	Lake Manchester	-27.4914	152.7519	Brisbane	-	-	-	1917	2011	92
40117	Landsborough Post Office	-26.8	152.96	Sunshine Coast	-	-	-	1892	2009	106
40118	Little Yabba SFR 274	-26.62	152.68	Sunshine Coast	-	-	-	1940	2017	60
40120	Lowood Don St	-27.46	152.57	Somerset	-	-	-	1887	2020	125
40123	Mapleton Post Office	-26.62	152.87	Sunshine Coast	-	-	-	1903	2020	112
40124	Marburg - Warrego Highway	-27.57	152.61	Ipswich	-	-	-	1894	2003	108
40125	Maroochydore Swan Bowls Club	-26.65	153.08	Sunshine Coast	-	-	-	1929	1988	58
40133	Monsildale	-26.695	152.3967	Somerset	-	-	-	1913	1978	66
40134	Montville "Clovelly"	-26.7	152.9	Sunshine Coast	-	-	-	1910	2018	109
40136	Mooloolah Post Office	-26.77	152.96	Sunshine Coast	-	-	-	1888	2000	82
40137	Moore Post Office	-26.9	152.29	Somerset	-	-	-	1912	1983	66
40139	Mt Alford	-28.07	152.61	Scenic Rim	-	-	-	1911	2020	83
40140	Mt Brisbane	-27.15	152.58	Somerset	-	-	-	1893	2020	115
40141	Mount Cotton West	-27.62	153.2	Redland	-	-	-	1915	2020	106
40142	Mt Crosby	-27.54	152.8	Brisbane	-	-	-	1894	1996	102
40143	Mount Gravatt	-27.54	153.08	Brisbane	-	-	-	1904	1953	50
40145	Mt Mee	-27.06	152.78	Moreton Bay	-	-	-	1909	2019	105

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		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
40147	Mt Nebo Post Office	-27.4	152.79	Moreton Bay	-	-	-	1947	2016	68
40149	Mountain View	-28.14	152.6	Scenic Rim	-	-	-	1924	1991	37
40150	Mundoolin	-27.91	153.09	Logan	-	-	-	1887	1997	109
40153	Murphys Creek Post Office	-27.47	152.07	Lockyer Valley	-	-	-	1895	1985	86
40154	Fairview	-27.2	152.5	Somerset	-	-	-	1926	1974	49
40155	Derrylin	-27.75	152.6667	Scenic Rim	-	-	-	1918	1957	40
40157	Nambour Bowling Club	-26.62	152.97	Sunshine Coast	-	-	-	1894	2015	115
40159	Narangba Railway Stn	-27.2	152.97	Moreton Bay	-	-	-	1921	1986	63
40168	Palmwoods Post Office	-26.7	152.95	Sunshine Coast	-	-	-	1893	1979	80
40169	Peachester	-26.84	152.88	Sunshine Coast	-	-	-	1916	2020	102
40170	Pechey Forestry	-27.3	152.05	Toowoomba	-	-	-	1927	2020	89
40171	Amcor - Petrie Mill	-27.27	152.98	Moreton Bay	-	-	-	1887	2011	123
40174	Plain View	-26.87	152.58	Somerset	-	-	-	1925	1971	47
40175	Point Lookout Bowls Club	-27.43	153.52	Redland	-	-	-	1947	2014	53
40179	Redbank Post Office	-27.6	152.87	Ipswich	-	-	-	1888	1978	82
40181	Roadvale Post Office	-27.92	152.68	Scenic Rim	-	-	-	1907	1983	76
40183	Rosevale	-27.85	152.48	Scenic Rim	-	-	-	1909	2019	105
40184	Rosewood Walloon Rd	-27.63	152.59	Ipswich	-	-	-	1894	2020	117
40185	Russell Island	-27.65	153.4	Redland	-	-	-	1914	2009	72
40186	Samsonvale	-27.29	152.82	Moreton Bay	-	-	-	1919	2019	97
40187	Freewood	-26.88	152.62	Somerset	-	-	-	1928	1987	57
40188	Sim Jue Creek	-27.27	152.63	Somerset	-	-	-	1938	2019	81
40189	Somerset Dam	-27.11	152.56	Somerset	-	-	-	1937	2020	84
40198	Tarome	-27.98	152.5	Scenic Rim	-	-	-	1912	2017	105
40202	Thornton Bvrt	-27.8206	152.3806	Lockyer Valley	-	-	-	1915	1983	64
40204	Banyo Seminary	-27.38	153.09	Brisbane	-	-	-	1956	2001	45
40205	Toogoolawah Post Office	-27.09	152.38	Somerset	-	-	-	1909	2020	101

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40208	Viewmount	-27.55	152.73	Ipswich	-	-	-	1925	2000	68
40209	Point Lookout	-27.44	153.55	-	-	-	-	1997	2020	18
40212	Eagle Farm Racecourse	-27.43	153.07	Brisbane	-	-	-	1920	2014	95
40213	Bald Hills Post Office	-27.32	153.01	Brisbane	-	-	-	1895	1992	92
40215	Brisbane Botanical Gardens	-27.48	153.03	Brisbane	-	-	-	1890	1983	81
40216	Brisbane Show Grounds	-27.4506	153.03	Brisbane	-	-	-	1890	2005	74
40217	Cannon Hill	-27.48	153.1	Brisbane	-	-	-	1930	1947	18
40218	Carina Hill Crescent	-27.5	153.08	Brisbane	-	-	-	1921	1975	54
40219	Toombul	-27.42	153.05	Brisbane	-	-	-	1894	1933	36
40220	Coorparoo Bowls Club	-27.49	153.06	Brisbane	-	-	-	1898	2001	93
40221	Dutton Park	-27.5	153.02	Brisbane	-	-	-	1899	1956	57
40224	Alderley	-27.42	153	Brisbane	-	-	-	1899	2020	117
40225	Enoggera Reservoir	-27.4447	152.9286	Brisbane	-	-	-	1887	1997	111
40226	Goodna Ampol	-27.61	152.9	Ipswich	-	-	-	1887	1997	96
40227	Wolston Park Hospital	-27.6	152.92	Brisbane	-	-	-	1894	1973	80
40229	Indooroopilly Bowls Club	-27.5	152.98	Brisbane	-	-	-	1888	2001	108
40230	Gold Creek Reservoir	-27.4606	152.8811	Brisbane	-	-	-	1887	1994	107
40231	Manly Railway Station	-27.46	153.18	Brisbane	-	-	-	1899	2020	115
40232	Mayne Junction	-27.447	153.0358	Brisbane	-	-	-	1898	1965	67
40233	Milton	-27.47	153	Brisbane	-	-	-	1899	1953	49
40234	Morningside	-27.49	153.09	Brisbane	-	-	-	1899	1955	53
40235	Murarrie Road Csiro	-27.47	153.1	Brisbane	-	-	-	1899	1995	91
40236	Nudgee	-27.42	153.07	Brisbane	-	-	-	1911	1949	38
40237	Toombul Bowls Club	-27.39	153.06	Brisbane	-	-	-	1895	2020	118
40238	Oxley Post Office	-27.55	152.98	Brisbane	-	-	-	1898	1972	72
40239	Pinkenba	-27.43	153.12	Brisbane	-	-	-	1898	1950	53
40240	Salisbury Bowls Club	-27.55	153.04	Brisbane	-	-	-	1899	1999	96

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40242	Sandgate Post Office	-27.32	153.07	Brisbane	-	-	-	1887	1999	97
40243	Graceville Bowls Club	-27.52	152.98	Brisbane	-	-	-	1898	1986	86
40244	Sunnybank Bowls Club	-27.5756	153.0583	Brisbane	-	-	-	1889	2019	119
40245	Toowong Bowls Club	-27.4928	152.9933	Brisbane	-	-	-	1898	2015	109
40247	Lindfield	-26.84	152.58	Somerset	-	-	-	1928	2020	93
40252	Woodford Post Office	-26.96	152.78	Moreton Bay	-	-	-	1887	1987	98
40256	Wynnum Railway Station	-27.45	153.17	Brisbane	-	-	-	1899	1979	81
40260	Yednia	-26.78	152.5	Somerset	-	-	-	1916	1949	34
40261	Yeerongpilly	-27.55	153.02	Brisbane	-	-	-	1951	1969	19
40263	Zillmere Post Office	-27.36	153.04	Brisbane	-	-	-	1899	1994	86
40266	Aratula Elizabeth St	-27.98	152.55	Scenic Rim	-	-	-	1950	2000	50
40268	Chermside Bowls Club	-27.39	153.03	Brisbane	-	-	-	1957	1994	32
40269	Karragarra Island	-27.64	153.38	Redland	-	-	-	1955	2018	64
40274	Mount Gravatt Bowls Club	-27.56	153.08	Brisbane	-	-	-	1956	2004	48
40275	Kenmore St David St	-27.52	152.93	Brisbane	-	-	-	1956	1978	21
40276	Capalaba Post Office	-27.5167	153.1833	Brisbane	-	-	-	1956	1978	22
40282	Nambour DPI	-26.64	152.94	Sunshine Coast	-	-	-	1953	2008	48
40283	Kuraby Beenleigh Road	-27.61	153.1	Brisbane	-	-	-	1920	2000	36
40284	Beerburrum Forest Station	-26.96	152.96	Sunshine Coast	-	-	-	1899	2020	77
40286	Pumicestone Post Office	-27	153.07	Moreton Bay	-	-	-	1958	1974	17
40291	Redland Bay Qld Uni Farm	-27.62	153.31	Redland	-	-	-	1961	2004	43
40292	The Grange	-26.82	152.93	Sunshine Coast	-	-	-	1916	1926	11
40293	Neurum Retreat	-26.95	152.7	Moreton Bay	-	-	-	1932	1947	15
40294	Riverview	-27.6	152.8	Ipswich	-	-	-	1899	1939	32
40295	Kenmore War Vets Home	-27.53	152.91	Brisbane	-	-	-	1962	2003	41
40296	Kobblestone	-27.25	152.82	Moreton Bay	-	-	-	1962	1975	14
40300	Balaam Hill	-27.45	152.37	Lockyer Valley	-	-	-	1961	1999	37

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40301	Glenaven	-27.19	151.96	Toowoomba	-	-	-	1961	2020	60
40302	Flagstone Creek	-27.62	152.12	Lockyer Valley	-	-	-	1961	2004	34
40303	Gregor Creek	-27	152.4	Somerset	-	-	-	1962	1977	16
40305	Louisavale	-26.77	152.36	Somerset	-	-	-	1936	1984	25
40306	Loganlea Elleslie Rd	-27.67	153.13	Logan	-	-	-	1962	1987	26
40309	Mt Byron	-27.15	152.65	Somerset	-	-	-	1961	1980	20
40310	Mt Berryman	-27.72	152.31	Lockyer Valley	-	-	-	1961	2020	57
40311	Nukinenda	-27.06	152.14	Toowoomba	-	-	-	1901	1993	58
40313	Neara Creek Station	-26.93	152.47	Somerset	-	-	-	1961	1978	17
40314	Ripley Valley	-27.72	152.82	Ipswich	-	-	-	1961	2008	47
40317	Range View	-27.7508	152.6664	Scenic Rim	-	-	-	1961	2020	59
40318	Kirkleagh	-27.03	152.56	Somerset	-	-	-	1956	1987	26
40319	Rocky Point Sugar Mill	-27.73	153.33	Gold Coast	-	-	-	1956	2015	44
40320	Fort Lytton	-27.41	153.15	Brisbane	-	-	-	1964	2014	49
40324	Mount Coot-tha	-27.48	152.95	Brisbane	-	-	-	1964	1975	12
40326	Ashgrove Bowls Club	-27.44	152.97	Brisbane	-	-	-	1964	2006	40
40327	Mary Smokes	-26.9	152.7	Moreton Bay	-	-	-	1928	1945	18
40329	Atkinsons Dam	-27.42	152.45	Somerset	-	-	-	1997	2019	23
40330	Hillcrest	-26.75	153	Sunshine Coast	-	-	-	1909	1923	15
40331	Ipswich Pump	-27.63	152.73	Ipswich	-	-	-	1909	1923	15
40332	Taringa	-27.5	153	Brisbane	-	-	-	1900	1942	41
40333	Booval	-27.62	152.78	Ipswich	-	-	-	1899	1929	31
40336	Veresdale	-27.9	153	Logan	-	-	-	1911	1933	23
40337	St Helena Island	-27.38	153.22	-	-	-	-	1887	1939	53
40339	Ascot	-27.4	153.1	Brisbane	-	-	-	1899	1930	32
40340	Ashwell	-27.6	152.6	Ipswich	-	-	-	1890	1929	40
40341	Wongawallan Alert	-27.88	153.21	Gold Coast	-	-	-	2001	2020	20

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
40343	Wamuran	-27.04	152.87	Moreton Bay	-	-	-	1915	2020	68
40344	Bulimba	-27.45	153.05	Brisbane	-	-	-	1883	1901	19
40345	Luscombe Alert	-27.81	153.21	Gold Coast	-	-	-	2001	2020	20
40346	Bromelton	-27.97	152.93	Scenic Rim	-	-	-	1897	1930	22
40347	Brookfield	-27.48	152.9	Brisbane	-	-	-	1895	1925	31
40350	Wooloowin	-27.43	153.05	Brisbane	-	-	-	1888	1922	16
40352	Wonga	-28	152.25	Southern Downs	-	-	-	1930	1943	14
40353	South Passage	-27.37	153.45	-	-	-	-	1899	1922	23
40356	Mount Woot-Tha	-26.78	152.82	Sunshine Coast	-	-	-	1895	1918	19
40357	Kannangur	-27.03	152.37	Somerset	-	-	-	1905	1920	16
40358	Lytton	-27.4	153.15	Brisbane	-	-	-	1887	1903	17
40360	Fernyhurst	-26.98	152.37	Somerset	-	-	-	1916	1930	15
40364	Anglesea	-26.8	152.95	Sunshine Coast	-	-	-	1909	1931	23
40368	Lynndon Park Bowls Club	-27.52	153.06	Brisbane	-	-	-	1966	2004	38
40369	Darra	-27.57	152.95	Brisbane	-	-	-	1894	1904	11
40370	Dugandan	-28.02	152.68	Scenic Rim	-	-	-	1896	1909	14
40371	Emscote Farm	-26.85	152.87	Sunshine Coast	-	-	-	1907	1921	15
40372	Maleny	-26.77	152.85	Sunshine Coast	-	-	-	1906	1927	22
40374	Franklyn Vale	-27.76	152.46	Ipswich	-	-	-	1886	2020	134
40378	Tinton	-27.19	152.3	Somerset	-	-	-	1959	1987	29
40382	Crows Nest	-27.27	152.06	Toowoomba	-	-	-	1893	2011	119
40383	Greenslopes Private Hospital	-27.51	153.05	Brisbane	-	-	-	1965	2011	28
40384	Mount Sylvia	-27.72	152.22	Lockyer Valley	-	-	-	1953	2002	49
40386	Kenilworth Bridge	-26.59	152.73	Sunshine Coast	-	-	-	1959	1978	20
40387	Linville	-26.82	152.27	Somerset	-	-	-	1967	2012	39
40388	Upper Tenthill	-27.63	152.22	Lockyer Valley	-	-	-	1959	2020	62
40391	Watts Bridge	-27.09	152.47	Somerset	-	-	-	1959	1981	23

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
40392	Townson East	-27.9	152.38	Lockyer Valley	-	-	-	1958	1978	21
40393	Baroon Pocket	-27.7167	152.8667	Ipswich	-	-	-	1959	1973	11
40395	Fordsdale	-27.72	152.12	Lockyer Valley	-	-	-	1953	2020	64
40396	Maleny Denning Rd	-26.78	152.8	Sunshine Coast	-	-	-	1928	2020	93
40397	Mt Whitestone	-27.67	152.16	Lockyer Valley	-	-	-	1953	2015	63
40398	Mt Kilcoy	-26.92	152.58	Somerset	-	-	-	1959	1974	13
40400	Moorang	-27.91	152.47	Scenic Rim	-	-	-	1919	2020	96
40403	Buaraba	-27.4	152.36	Somerset	-	-	-	1953	2018	64
40408	Carbrook Longland Road	-27.68	153.28	Logan	-	-	-	1967	2019	21
40411	Romani	-27.85	152.91	Logan	-	-	-	1967	2001	35
40421	Spring Bluff Railway Stn	-27.46	151.99	Toowoomba	-	-	-	1895	2018	102
40422	Emu Creek	-27.05	152.02	Toowoomba	-	-	-	1961	1977	17
40424	West Haldon	-27.76	152.08	Toowoomba	-	-	-	1916	2019	96
40425	Dayboro Strong Road	-27.2178	152.8425	Moreton Bay	-	-	-	1998	2008	11
40429	Rochedale South	-27.59	153.12	Brisbane	-	-	-	1969	2012	44
40431	Esk State Forest R531	-27.29	152.33	Somerset	-	-	-	1969	1992	18
40432	Monsildale School	-26.7	152.4	Somerset	-	-	-	1945	1961	17
40436	Gatton Daff Research Stn	-27.55	152.33	Lockyer Valley	-	-	-	1968	2014	46
40437	Rivermead	-27.45	152.64	Somerset	-	-	-	1971	2001	30
40447	Rhonda	-27.99	152.46	Scenic Rim	-	-	-	1953	2017	63
40449	Placid Hills	-27.56	152.23	Lockyer Valley	-	-	-	1970	2020	49
40450	Long Pocket CSIRO Lab	-27.51	153	Brisbane	-	-	-	1969	2011	43
40452	Mt Ommaney Golf Club	-27.55	152.92	Brisbane	-	-	-	1971	1991	19
40463	Oxley	-27.58	152.99	Brisbane	-	-	-	1972	2020	49
40468	Cannon Hill Bowls Club	-27.47	153.08	Brisbane	-	-	-	1972	2010	36
40476	Keperra Country Golf Club	-27.41	152.95	Brisbane	-	-	-	1973	2010	32
40479	Enoggera Army	-27.43	152.98	Brisbane	-	-	-	1972	1984	13

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
40480	Perseverance Dam	-27.29	152.12	Toowoomba	-	-	-	1971	2020	50
40485	Wilsons Peak	-28.25	152.52	Scenic Rim	-	-	-	1958	2020	63
40488	Grange Bowling Club	-27.42	153.02	Brisbane	-	-	-	1972	2007	32
40490	Carneys Creek the Ranch	-28.21	152.54	Scenic Rim	-	-	-	1973	2020	48
40492	Yielo	-26.67	152.51	Somerset	-	-	-	1973	2011	35
40493	Homeleigh	-27.78	152.53	Scenic Rim	-	-	-	1959	2020	59
40496	Caloundra WTP	-26.79	153.11	Sunshine Coast	-	-	-	1973	2009	35
40497	The Overflow	-27.9319	152.8575	Scenic Rim	-	-	-	1965	2006	22
40512	Forestdale Stapylton Rd	-27.65	152.99	Brisbane	-	-	-	1973	2006	34
40517	Mckenzie Creek	-27.2	152.75	Moreton Bay	-	-	-	1953	2020	68
40523	Boonah Border Gate	-28.27	152.54	Scenic Rim	-	-	-	1959	2008	50
40525	Kiamba	-26.59	152.9	Sunshine Coast	-	-	-	1953	2014	59
40527	Acacia Ridge	-27.6167	153.0433	Brisbane	-	-	-	1975	1992	18
40529	Mount Gravatt East	-27.5403	153.0983	Brisbane	-	-	-	1974	1989	16
40530	Inala	-27.5853	152.9883	Brisbane	-	-	-	1975	2003	29
40531	Boondall	-27.3486	153.0647	Brisbane	-	-	-	1975	2016	39
40532	Wynnum Bcc	-27.4247	153.1614	Brisbane	-	-	-	1974	1997	24
40533	Mt Coot-tha Abq 2	-27.4664	152.945	Brisbane	-	-	-	1972	1994	23
40536	Ocean View	-27.14	152.81	Moreton Bay	-	-	-	1956	2005	44
40537	Dunwich	-27.5	153.41	Redland	-	-	-	1961	2019	31
40538	Tabragalba	-27.98	153.08	Scenic Rim	-	-	-	1960	1993	33
40542	Maclean Bridge	-27.7866	153.0153	Logan	-	-	-	1983	2019	37
40544	Bromfleet	-27.9125	153.1022	Logan	-	-	-	1995	2012	15
40547	Moreton Sugar Mill	-26.63	152.96	Sunshine Coast	-	-	-	1938	2002	58
40562	Bulwer Signal Station	-27.08	153.37	Brisbane	-	-	-	1899	1913	15
40568	Woodlands	-27.57	152.62	Ipswich	-	-	-	1900	1928	18
40571	Pimpama State School	-27.82	153.28	Gold Coast	-	-	-	1909	1926	18

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
40574	Chiefswood	-27.47	152.95	Brisbane	-	-	-	1897	1916	15
40576	Rangeview Farm	-28	152.5	Scenic Rim	-	-	-	1947	1970	23
40578	Dayboro	-27.21	152.8	Moreton Bay	-	-	-	1920	2012	16
40589	Cedar View	-26.8	152.58	Somerset	-	-	-	1924	1941	15
40594	Woombye	-26.67	152.97	Sunshine Coast	-	-	-	1898	1924	27
40595	Cressbrook	-27.08	152.45	Somerset	-	-	-	1890	1905	16
40598	Clumber	-28.08	152.57	Scenic Rim	-	-	-	1919	1942	24
40605	Rock View	-27.79	152.27	Lockyer Valley	-	-	-	1919	1970	35
40617	Raynbird Creek	-27.25	152.73	Moreton Bay	-	-	-	1953	1971	19
40622	Rockville	-28.15	152.52	Scenic Rim	-	-	-	1934	1963	27
40623	Greenbank Army Camp	-27.69	152.99	Logan	-	-	-	1975	1993	19
40628	Woodford Bcc	-26.94	152.76	Moreton Bay	-	-	-	1978	1996	19
40629	Corinda	-27.53	152.98	Brisbane	-	-	-	1889	1906	18
40633	Lawnton Colonial Drive	-27.28	152.96	Moreton Bay	-	-	-	1976	2012	37
40635	Danewood Vale	-26.84	152.49	Somerset	-	-	-	1963	2020	56
40637	Mount Mee Forest Station	-27.0958	152.7011	Somerset	-	-	-	1970	2001	28
40651	Jimna Forestry	-26.6644	152.4606	Somerset	-	-	-	2000	2017	18
40657	Sirios	-27.57	152.58	Ipswich	-	-	-	1926	1943	18
40664	Yeerongpilly Post Office	-27.53	153.02	Brisbane	-	-	-	1894	1922	28
40672	Withcott	-27.55	152.02	Lockyer Valley	-	-	-	1975	2020	45
40675	Townson	-27.91	152.39	Lockyer Valley	-	-	-	1978	2017	40
40685	Bribie Island Qld Uni	-27.05	153.17	Moreton Bay	-	-	-	1978	1994	16
40693	Highvale	-27.38	152.82	Moreton Bay	-	-	-	1955	2020	54
40695	Palmwoods	-26.68	152.96	Sunshine Coast	-	-	-	1951	2020	69
40698	Connemarra	-26.79	152.73	Sunshine Coast	-	-	-	1981	1998	18
40703	Ferny Grove Cedar Ck Rd	-27.42	152.92	Brisbane	-	-	-	1982	1995	14
40714	Round Mountain Tm	-28.0708	152.9272	Scenic Rim	-	-	-	2001	2020	20

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
40732	Wallen Wallen	-27.53	153.42	Redland	-	-	-	1985	2017	20
40738	Bromfleet Tm	-27.91	153.11	Scenic Rim	-	-	-	2001	2020	20
40739	The Overflow Tm	-27.9292	152.8597	Scenic Rim	-	-	-	2001	2011	11
40751	Thornton	-27.8	152.38	Lockyer Valley	-	-	-	1994	2008	14
40755	Cooran	-26.56	152.77	Sunshine Coast	-	-	-	1992	2004	13
40759	Corbould Pk Racecourse	-26.79	153.07	Sunshine Coast	-	-	-	1986	2020	27
40761	Wolffdene Alert	-27.78	153.19	Logan	-	-	-	2001	2020	20
40762	Yarrahappini Tm	-27.8336	152.9878	Logan	-	-	-	2001	2020	20
40763	Wivenhoe Dam	-27.4	152.61	Somerset	-	-	-	1995	2020	25
40766	Logan Village Tamborine Rd	-27.79	153.11	Logan	-	-	-	1988	2007	20
40767	Brisbane RPA Hospital	-27.5	153.03	Brisbane	-	-	-	1991	2014	11
40768	Jimboomba Millstream Road	-27.87	153.01	Logan	-	-	-	1988	2017	29
40770	Ormiston College	-27.52	153.25	Redland	-	-	-	1990	2013	20
40774	Morayfield Mark St	-27.1	152.95	Moreton Bay	-	-	-	1988	2020	25
40784	Calamvale Alert	-27.615	153.0444	Brisbane	-	-	-	2001	2020	20
40785	Carole Park Alert	-27.6	152.95	Brisbane	-	-	-	2001	2020	20
40788	Forestdale (Johnson Rd) Al	-27.66	153	Logan	-	-	-	2001	2020	19
40790	Mt Gravatt Alert	-27.55	153.07	Brisbane	-	-	-	2001	2020	18
40795	Opossum Alert	-27.64	152.89	Ipswich	-	-	-	2003	2015	13
40808	Cressbrook Dam	-27.26	152.2	Somerset	-	-	-	1990	2020	30
40816	Amberley (Dnrm) Tm	-27.67	152.7	Ipswich	-	-	-	2001	2020	20
40823	Rosentreters Bridge Tm	-27.14	152.33	Somerset	-	-	-	2001	2020	20
40829	Helidon Tm	-27.54	152.11	Lockyer Valley	-	-	-	2001	2020	20
40830	Bellbird Creek Tm	-26.63	152.7	Sunshine Coast	-	-	-	2001	2020	20
40841	Croftby Tm	-28.15	152.57	Scenic Rim	-	-	-	2001	2020	20
40850	Baroon Pocket Dam	-26.715	152.8719	Sunshine Coast	-	-	-	1992	2017	19
40851	Lamb Island Pine Ave	-27.63	153.38	Redland	-	-	-	1992	2012	21

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
40853	Redland Bay Golf Club	-27.6	153.3	Redland	-	-	-	1992	2020	21
40861	Sunshine Coast Airport	-26.6	153.09	Sunshine Coast	-	-	-	1994	2020	27
40863	Ormeau (Stewarts Rd)	-27.7914	153.2739	Gold Coast	-	-	-	1993	2005	12
40865	Cannon Cove Tm	-28.09	152.72	Scenic Rim	-	-	-	2001	2020	20
40867	Kalbar Tm	-27.9406	152.6236	Scenic Rim	-	-	-	2001	2020	20
40876	Wilsons Peak Alert	-28.24	152.49	Southern Downs	-	-	-	2001	2020	20
40883	Deverton Sawpit Gully Rd	-27.69	152.05	Lockyer Valley	-	-	-	1990	2017	28
40886	Mt Binga	-27.01	151.98	Toowoomba	-	-	-	1994	2014	21
40887	Woodford Eaton Lane	-26.93	152.7	Moreton Bay	-	-	-	1990	2018	20
40911	Hilltop Gardens	-27.46	153.02	Brisbane	-	-	-	2000	2016	17
40914	Mt Tarampa	-27.49	152.5	Somerset	-	-	-	2000	2020	20
40915	Sugarloaf Mountain	-27.06	152.32	Somerset	-	-	-	2000	2015	14
40924	Woodford Stanmore	-26.9028	152.7664	Moreton Bay	-	-	-	2001	2020	19
40928	Karalee	-27.56	152.82	Ipswich	-	-	-	2002	2020	19
40929	Narangba - Browns Crk Road	-27.19	152.92	Moreton Bay	-	-	-	2001	2014	14
40935	Maclean Bridge Alert	-27.7864	153.0161	Logan	-	-	-	2002	2020	19
40938	Bromfleet Alert	-27.9108	153.1047	Logan	-	-	-	2002	2020	19
40939	Beaudesert Alert	-27.9681	152.9861	Scenic Rim	-	-	-	2002	2020	19
40940	Yarrahappini Alert	-27.83	152.99	Logan	-	-	-	2002	2020	19
40941	Kooralbyn Alert	-28.07	152.85	Scenic Rim	-	-	-	2002	2020	19
40945	Round Mountain Alert	-28.07	152.93	Scenic Rim	-	-	-	2002	2020	19
40947	Croftby Alert	-28.145	152.57	Scenic Rim	-	-	-	2002	2020	19
40949	Boonah Alert	-28	152.69	Scenic Rim	-	-	-	2002	2020	19
40951	Heathwood (Wadeville St)	-27.63	152.98	Brisbane	-	-	-	1974	2014	39
40960	Clear Mountain Buranda Rd	-27.3247	152.9031	Moreton Bay	-	-	-	2004	2020	17
40962	Ebbw Vale	-27.61	152.82	Ipswich	-	-	-	2005	2020	14
40963	Fernvale - Burns St	-27.46	152.66	Somerset	-	-	-	2005	2020	16

Site ID	Site Name	Co-ordinates		Council Area	Sub-daily			Daily		
		Lat	Lon		Start Year	End Year	Number Years AMS	Start Year	End Year	Number Years AMS
40964	Regents Park	-27.67	153.04	Logan	-	-	-	2005	2020	16
40965	Clontarf	-27.24	153.09	Moreton Bay	-	-	-	1987	2020	33
40969	Godwin Beach	-27.07	153.11	Moreton Bay	-	-	-	2005	2020	16
40973	Windaroo	-27.75	153.19	Logan	-	-	-	2006	2020	15
40976	Brisbane Botanic Gardens Mt Coot-tha	-27.48	152.98	Brisbane	-	-	-	2005	2020	15
40983	Beaudesert Drumley Street	-27.9707	152.9898	Scenic Rim	-	-	-	2007	2020	14
40986	Mango Hill	-27.23	153.03	Moreton Bay	-	-	-	1980	2015	34
40989	Gregors Creek	-26.96	152.47	Somerset	-	-	-	2008	2020	13
40990	Kholo The Plateau	-27.51	152.77	Brisbane	-	-	-	2008	2020	12
41031	Geham State School	-27.41	152.02	Toowoomba	-	-	-	1912	1975	56
41096	Mt Kynoch	-27.51	151.95	Toowoomba	-	-	-	1999	2020	22
41267	Hillview	-27.85	152.13	Toowoomba	-	-	-	1959	1974	16
41276	Glenrive	-27.93	152.16	Toowoomba	-	-	-	1959	2020	60
41323	Mandala	-28.02	152.29	Southern Downs	-	-	-	1959	2020	51
41332	Akuna	-28.07	152.35	Scenic Rim	-	-	-	1923	1973	46
41380	Swanfels Upper	-28.13	152.42	Southern Downs	-	-	-	1919	1964	46
41421	Cabarlah Railway Station	-27.43	151.98	Toowoomba	-	-	-	1894	1912	19
41455	The Laurels	-27.57	151.97	Toowoomba	-	-	-	1889	1899	11
41456	Cunninghams Gap National Park	-28.06	152.37	Southern Downs	-	-	-	1977	2017	34
41510	Tamba	-27.47	151.95	Toowoomba	-	-	-	1989	2020	32
41512	Cooby Creek Dam	-27.38	151.92	Toowoomba	-	-	-	1991	2020	30
41553	Middle Ridge	-27.6	151.96	Toowoomba	-	-	-	2003	2017	13