Australian Government
Bureau of Meteorology

Basic User Guide for the Australian Digital Forecast Database precipitation grids

Date of issue 30 April 2014

Contents

Basic User Guide for the Australian Digital Forecast Database precipitation grids

This document outlines the basic principles and details of each precipitation dataset within the Australian Digital Forecast Database (ADFD) providing examples where possible. Scenarios are presented for possible uses of each grid type.

Grid types

There are six grid types within the Bureau's precipitation suite produced for either daily or three-hourly periods. These are summarised in Table 1 and explained in the following sections.

Table 1 - ADFD precipitation grids.

	Grid	Definition	Notes
Daily	DailyPoP	Chance of receiving any precipitation above 0.2 mm (%)	
	DailyPrecip	The mean precipitation amount (mm)	
	DailyPrecip*y*Pct	Amount of precipitation where there is *y*% chance of exceeding that amount (mm)	*y* is one of 25% or 50%
3-hourly	PoP	Chance of receiving any precipitation above 0.2 mm (%)	
	Precip	The mean precipitation amount (mm)	
	Precip*y*	Amount of precipitation where there is *y*% chance of exceeding that amount (mm)	*y* is one of 25% or 50%

Daily grids

Daily grids represent the forecast values over a 24 hour period from 15Z to 1459Z for the Australian domain (for clarification of times, see the "Time intervals" section). The available daily grids are explained below.

DailyPoP (Daily Chance of Precipitation)

DailyPoP values represent the chance of receiving any precipitation above 0.2 mm for that cell. For example, a cell value of "45%" means there is a 45% chance of *at least* 0.2 mm occurring within that cell over 24 hours. Conversely, this represents a 55% chance of receiving no precipitation.

DailyPrecip (Daily Amount of Precipitation)

DailyPrecip returns the average precipitation amount for anywhere in that cell for that day. The forecast is calculated from the average of all precipitation model outcomes including zero. For example, given five outcomes for a particular day (3, 0, 8, 4, and 0) the DailyPrecip grid value would be 3 mm.

DailyPrecip*y*Pct for *y* in {25, 50} (Daily Precipitation for a Specific Chance of Occurrence)

DailyPrecip*y*Pct returns the minimum *amount* of precipitation forecast for that 24 hour period for the defined likelihood of occurrence anywhere within the cell. The chance of at least "some amount" of precipitation occurring can be set to 25% or 50%. This allows minimum precipitation amounts ("at least" values) to be compared relative to the likelihood of those amounts occurring. For example, in Figure 1 if the user set *y* to 50%, the forecast would be for 8 mm (aka an even chance of receiving greater than 8 mm). If *y* was set to 25%, the forecast would be for 22 mm (aka a 25% chance of receiving at least 22 mm). Conversely, this relates to a 50% chance of receiving less than 8 mm and a 75% chance of receiving less than 22 mm. Put simply, the lower the chance of occurrence, the higher the predicted rainfall.

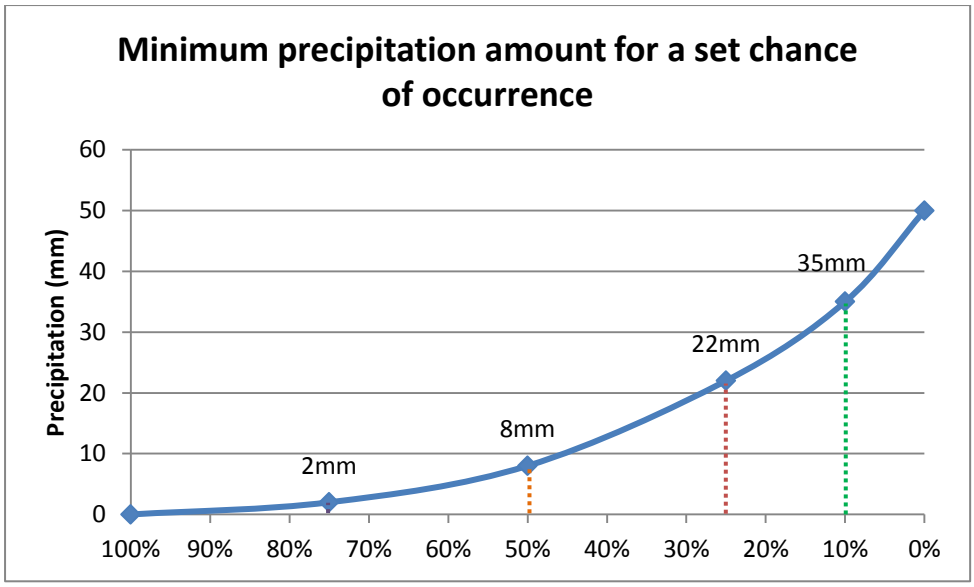

Figure 1 - An example of DailyPrecip*y*Pct showing the variation in minimum precipitation for variations in *y*.

For examples of DailyPrecip*y*Pct currently in use, see 'likely rainfall amount' and 'possible higher rainfall amount' in the Bureau's MetEye (http://www.bom.gov.au/australia/meteye/). These variables use DailyPrecip50% and DailyPrecip25% respectively.

Three-hourly grids

Three-hourly grids represent the forecast values over a three-hour period for the Australian domain. The available three-hourly grids are explained below.

PoP (Chance of Precipitation)

PoP values provide the chance of receiving any precipitation above 0.2 mm anywhere within the target cell. For example, a cell value of "80%" means there is an 80% chance of *at least* 0.2 mm occurring over the three-hour period. Conversely, this relates to a 20% chance of receiving less than 0.2 mm over the three-hour period.

Precip (Amount of Precipitation)

Precip values provide the mean precipitation amount for anywhere in that cell over a three-hour period. This is calculated in the same way as DailyPrecip but for three-hourly intervals. Precip may be used to calculate DailyPrecip by summing Precip over the course of a 24-hour period (1500Z to 1459Z).

Precip*y*Pct for y in {25, 50} (Precipitation for a Specific Chance of Occurrence)

Precip*y*Pct provides the minimum *amount* of precipitation forecast for a three-hour period for the defined likelihood of occurrence for that cell. It is calculated in the same way as DailyPrecip*y*Pct except for three-hourly intervals only. The chance of precipitation occurring can be set to 25% or 50%. This allows a range of minimum precipitation amounts to be compared relative to the likelihood of it occurring. See Figure 1 for an example.

Unlike the relationship with Precip and DailyPrecip, Precip*y*Pct cannot be used to reproduce DailyPrecip*y*Pct. Neither can it be used to calculate Precip*y*Pct over an area larger than one cell (e.g. the values of four neighbouring cells cannot be averaged to produce a Precip*y*Pct value for the larger area).

"*How can I use the Bureau's precipitation data?*" Applications and possible uses of the precipitation grids

The following paragraphs provide examples and situations where ADFD precipitation grids could be used. These are provided to explore the potential uses of the grids and are in no way a specific recommendation for use.

Replicating Bureau rainfall forecasts

The Bureau website provides rainfall range forecasts in the format "*A* mm to *B* mm" alongside the chance of any rain. The chance of any rain is simply DailyPoP or PoP extracted from the ADFD grid for the target location. Therefore, a forecast of "Chance of any rain: 55%" actually reflects a 55% chance of receiving *at least* 0.2 mm. When viewed spatially, this can quickly reveal weather patterns across the continent allowing broader conditions to be assessed easily.

Rainfall ranges are created by extracting DailyPrecip50Pct and DailyPrecip25Pct from the ADFD grids for the target location (or Precip50Pct to Precip25Pct for three-hourly) representing the first and second values within the range respectively. Hence, a forecast of "2 mm to 5 mm" actually reflects a 50% chance of receiving at least 2 mm and a 25% chance of receiving at least 5 mm. When viewed spatially, these variables provide a clear picture of regions that may receive rainfall and the subregions that may receive heavier rainfall.

For example, Figure 2 shows three extracts from the Bureau's MetEye service (http://www.bom.gov.au/australia/meteye/): Chance of any rain (PoP); Likely rainfall (Precip*y*Pct set at 50%); and Possible higher rainfall (Precip*y*Pct set at 25%).

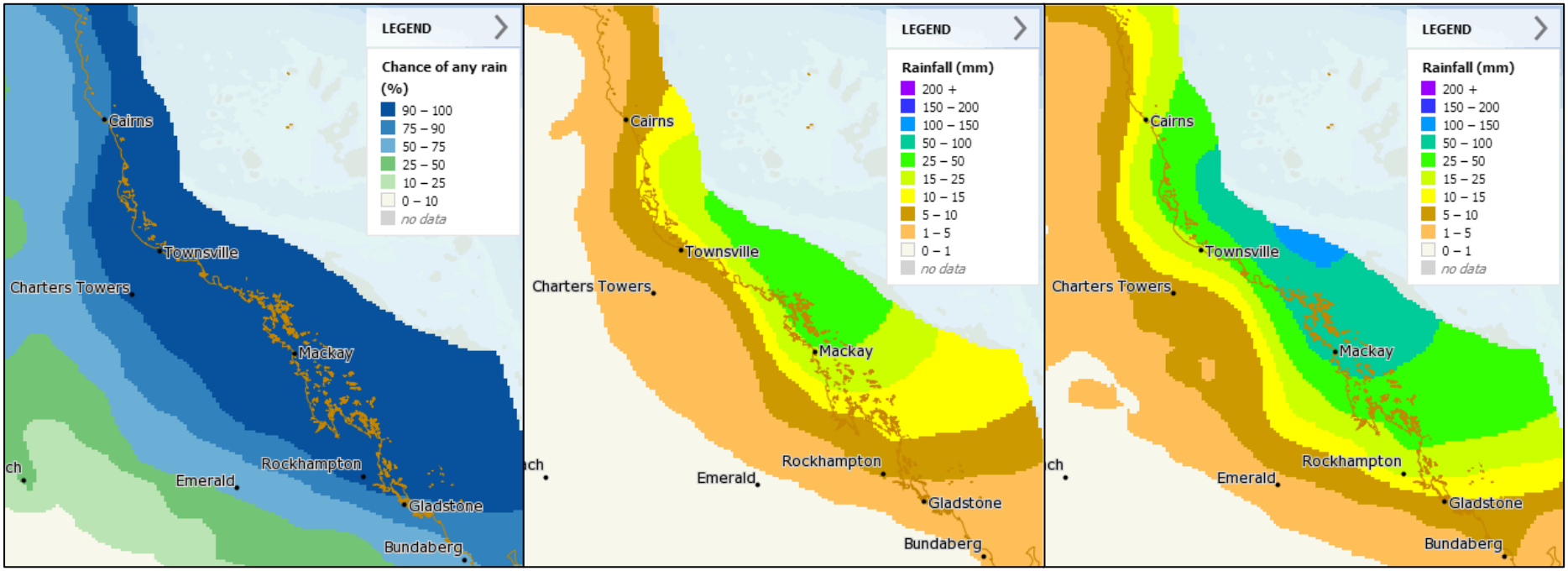

Figure 2 - Example of a gridded output of the 3 hourly Bureau rainfall forecasts as seen in MetEye (http://www.bom.gov.au/australia/meteye/). Left: Chance of any rain [PoP]; Centre: Likely rainfall [Precip50Pct]; Right: Possible higher rainfall [Precip25Pct].

Producing text forecasts

Automated text forecasts are a useful product for a range of different uses including website displays and radio broadcasts. The Bureau produces text forecasts using PoP to automatically produce precipitation forecast terms such as “isolated” or “patchy”. Each term is triggered by a specific PoP range; however, they are also dependent upon the broader weather environment as defined by a forecaster (e.g. a PoP range of more than 10% and less than 25% will trigger either “isolated” or “patchy” for a convective or stratiform weather environment respectively; Table 2).

Table 2 – Example of PoP ranges used to produce text forecasts dependent on broader weather conditions.

PoP Range	Convective Weather	Stratiform Weather
PoP < 10	Nil	Nil
10 ≤ PoP < 25	Isolated or Chance	Patchy or Chance
25 ≤ PoP < 55	Scattered	Areas
PoP ≥ 55	Widespread	Widespread

These terms are also dependent upon the scale of the forecast region. At a district level “isolated showers” retains the term “isolated”, whereas at a town level the text is modified to a “shower or two”. The creation of threshold triggers within any of the precipitation grids may be applied to industries or activities where specific ranges of rainfall are critical for planning.

Fire weather forecasts

An important aspect for planning during a fire event is the knowledge of when rainfall is expected. By using the three-hourly grids PoP, Precip and Precip*y*Pct grids concurrently, the evolution of fire fronts can be quickly assessed spatially. Firstly, the PoP grid can provide the likelihood of any rainfall for each three-hour period while the Precip grid provides the most likely amount of rainfall. Viewed spatially this would allow teams to be rotated out of areas that are likely to receive a heavy downfall and allow reinforcement to areas that look likely to miss out. This can then be refined with the Precip*y*Pct grid by comparing the chances of receiving enough rainfall to douse the fire. For example, if it was calculated that a 36km^2 spot fire (i.e. encompassed by one grid cell) would require at least 20 mm over a period of six hours, Precip50Pct would provide the 50% chance of receiving X mm for each three-hour interval. Therefore, if the first three-hour interval had a Precip50Pct output of receiving at least 15 mm and the second interval had a Precip50Pct output of receiving at least 20 mm, this spot fire would likely receive more than the required 20 mm over the next six hours. When paired with a Precip output of 20 mm and 25 mm over the first and second interval respectively (summing to 45 mm over the next six hours) it would appear highly likely that the spot fire would be doused by rainfall alone within six hours.

Considerations for ADFD grids and times

Grid cells and their interpretation

Each grid cell value represents the forecast across an area of approximately 36km^2. The elevation across each cell is averaged and may cause variability where there is considerable variation in height within the grid square (i.e. valleys or mountains). Local orographic effects which may cause variations include the phenomena of rain shadows, leeside wind acceleration, windward stalling/calming and variations in temperature due to diurnal mountain/valley winds. Figure 3

provides a cross-section of a hypothetical grid cell where point observations are likely to vary from the cell forecast. Conditions at point A should be well represented by the average cell forecast as it is farthest away from any large hills and sits at the average cell height. Point B is likely to experience less rain than forecast due to its leeward position. Point C is likely to experience higher rainfall than forecast due to mechanical convection (wind being forced uphill triggering condensation). Finally, if point D was considered a coastal location, rainfall travelling parallel to the coast would likely affect D much more than A due to channelling along the range.

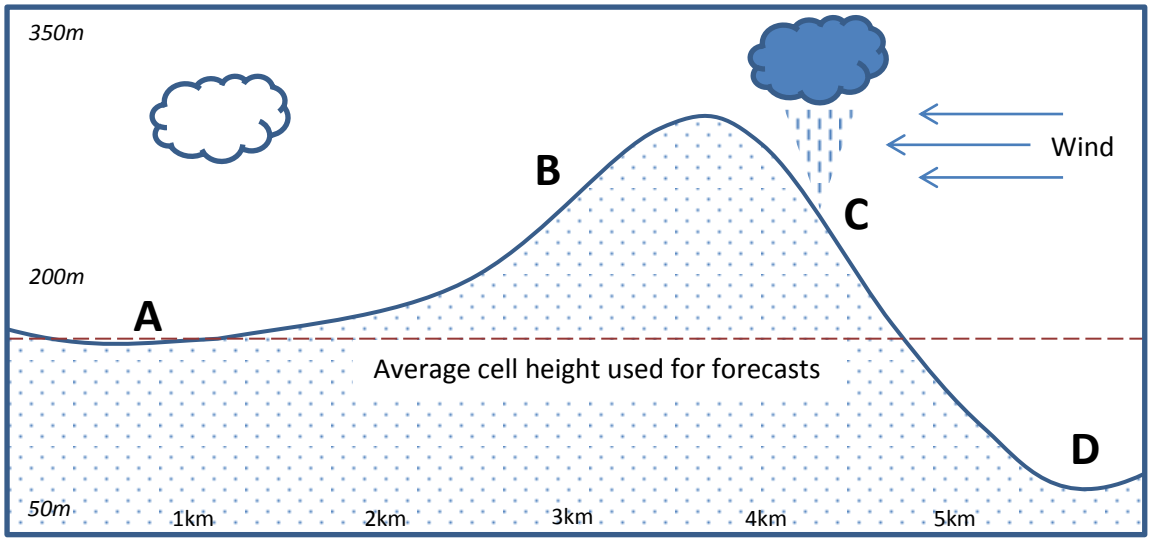

Figure 3 – Cross-section of a ~36km^2 grid cell with varying topography highlighting likely variations from the cell forecast.

Time intervals

Daily forecasts start at time "15Z" and are valid for 24 hours. "Z" is shorthand for Coordinated Universal Time (UTC) and, therefore each daily forecast is valid from 1am-1am Australian Eastern Standard Time (AEST), 2am-2am Australian Eastern Daylight Time (AEDT), 12:30am-12:30am Australian Central Standard Time (ACST), 1:30am-1:30am Australian Central Daylight Time (ACDT), and 11pm-11pm Australian Western Standard Time (AWST).

Three-hourly forecasts begin at the labelled time in Z hours (aka UTC) and are designed to coincide with 15Z so that they align with the start of daily forecasts. For example, a three-hourly forecast for Coober Pedy labelled 03Z relates to the period starting 03Z (1:30pm ACDT) and ending 0559Z (4:29pm ACDT). See Table 4 for all Australian UTC conversions.

Table 3 – Conversions from "Z" (UTC) for Australian time zones.

Z (UTC)	AEST	AEDT	ACST	ACDT	AWST
00	10:00 AM	11:00 AM	09:30 AM	10:30 AM	08:00 AM
03	01:00 PM	02:00 PM	12:30 PM	01:30 PM	11:00 AM
06	04:00 PM	05:00 PM	03:30 PM	04:30 PM	02:00 PM
09	07:00 PM	08:00 PM	06:30 PM	07:30 PM	05:00 PM
12	10:00 PM	11:00 PM	09:30 PM	10:30 PM	08:00 PM
15	01:00 AM	02:00 AM	12:30 AM	01:30 AM	11:00 PM
18	04:00 AM	05:00 AM	03:30 AM	04:30 AM	02:00 AM
21	07:00 AM	08:00 AM	06:30 AM	07:30 AM	05:00 AM