

# GUIDANCE PACK

## Use of the Rainfall Deficiency Analyser for the Farm Management Deposits (FMD) Scheme

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*This document provides background information on the Bureau of Meteorology's rainfall deficiency dataset used to support primary producers' self-assessment under the drought early access provision for the Farm Management Deposits (FMD) Scheme.*

### Rainfall deficiencies

Rainfall deficiency is used to describe the situation where there has been lower than average rainfall over a given period when compared with similar periods over the whole historical record (since 1900).

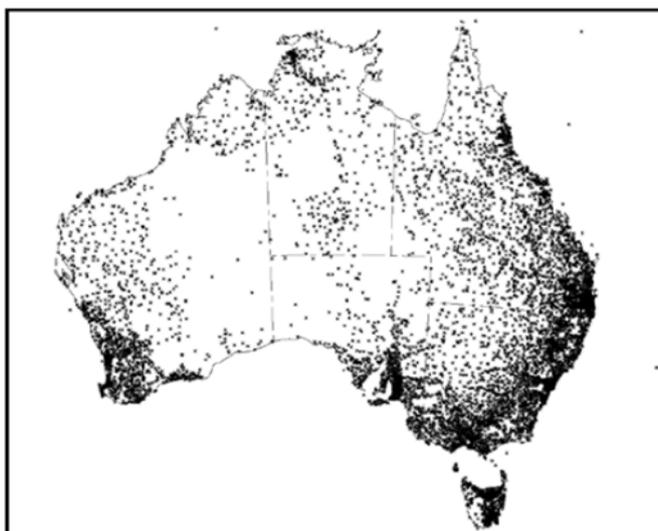
The Australian Government's FMD Scheme allows primary producers, under certain circumstances, to make withdrawals of their FMDs within 12 months without losing the tax concession they claimed for an FMD made in the previous financial year; one of these circumstances (applicable from 1 July 2016) requires a primary producer to demonstrate that an area of their farming property has been affected by a rainfall deficiency for six consecutive months.

To be eligible, the rainfall must be within the lowest five per cent of recorded rainfall for their property for that six-month period; this is equivalent to the fifth percentile of six-monthly rainfall. Since this rainfall level occurs on average once every twenty years, this level is also often called a 1-in-20-year rainfall deficiency.

The Bureau of Meteorology's (the Bureau's) FMD Rainfall Analyser is a tool on the Bureau's website which displays an [interactive map](#) and can generate a Rainfall Deficiency Report for a chosen location. A Rainfall Deficiency Report is required for primary producers to demonstrate their eligibility for early withdrawal.

### The Bureau's long-term rainfall dataset

The Bureau's rainfall deficiency dataset, used to support the early access provision under the Australian Government's FMD Scheme, is derived from the Bureau's long-term national [Australian Water Availability Project \(AWAP\) gridded rainfall dataset](#). The AWAP dataset provides a nationally consistent, long-term record of observed rainfall from around 6,000 individual stations from 1900 to present (see **Figure 1**).

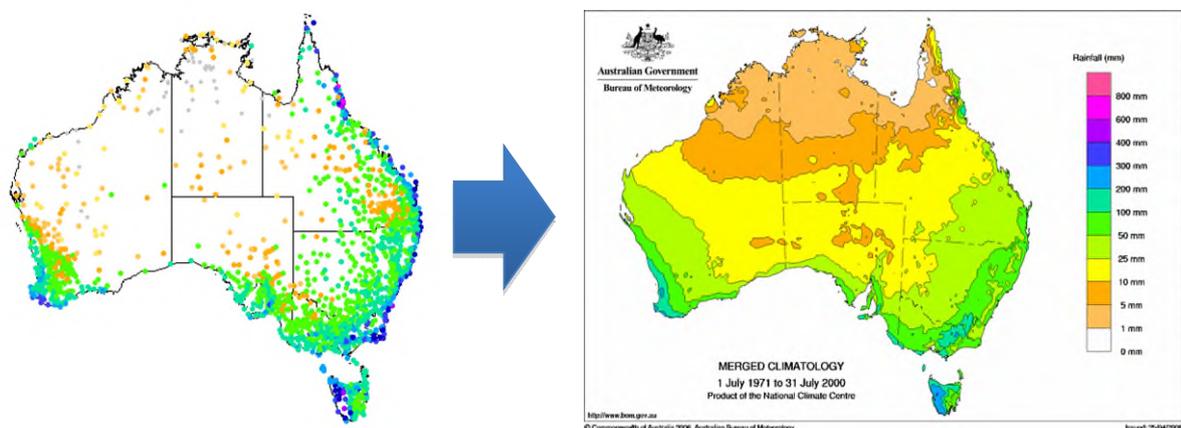


**Figure 1:** Location of rainfall stations which contributed data to AWAP from 1980-2007.

All stations which contribute data to AWAP conform to the World Meteorological Organization (WMO) guidelines for climate observational standards and practices, and all data is contained in the Bureau's climate database, the Australian Data Archive for Meteorology (ADAM).

## National rainfall grids

To enable assessment of rainfall over all parts of the country, the Bureau generates monthly national rainfall grids from the individual station data using a statistical technique called optimised Barnes interpolation (see **Figure 2**). This technique applies an averaging process to the data from all available stations [see [Jones et al. \(2009\)](#)] to generate grids at approximately five kilometre horizontal resolution. The effects of topography are taken into consideration by assessing the actual rainfall against monthly average rainfall in the analysis process. The analysis methodologies are similar to those applied internationally, but were modified and adapted to suit Australia's unique climate and the seasonality of rainfall.



**Figure 2:** Development of national grids from individual weather stations

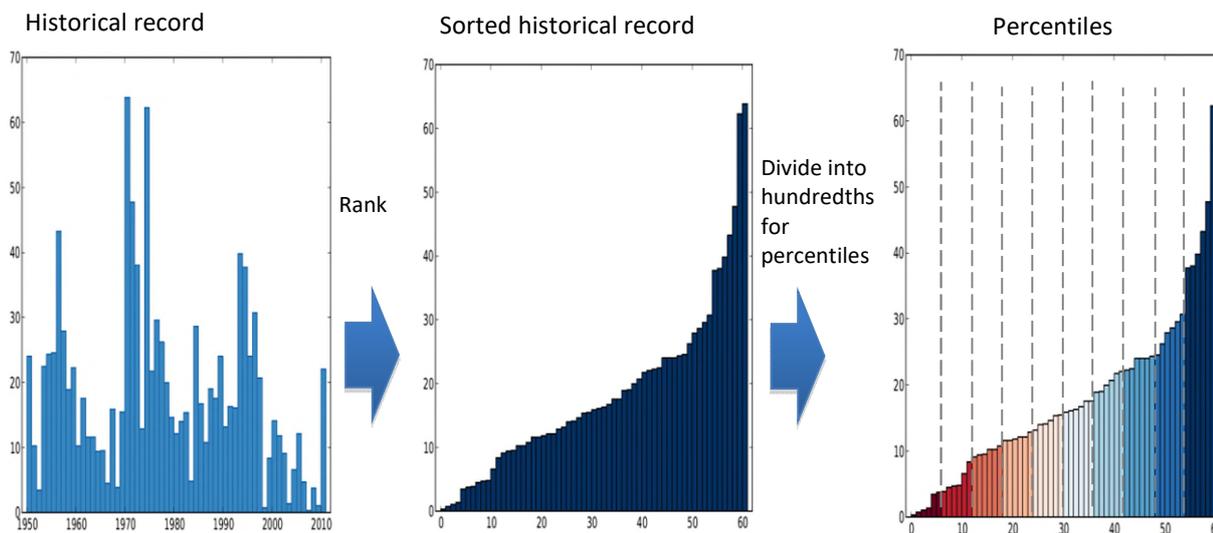
## Benefits and limitations of a gridded analysis

The technique of generating national rainfall grids from observed point station data provides an objective average for each grid square and enables useful rainfall estimates in data-sparse areas such as central Australia. However, in data-rich areas such as southeast Australia or in regions with strong gradients, 'data smoothing' may occur resulting in grid values that may differ slightly from the exact rainfall amount measured at the contributing stations. It is important to note that the rainfall is effectively an average across the 5 square km grid box, and as such it deliberately smooths out small scale features such as individual showers of rain which cannot be confidently assessed.

The analysis technique provides a robust, consistent method of analysing Australia's climate and the AWAP rainfall dataset has been subsequently used in a large number of scientific studies and as input for various applications.

## Calculating rainfall deficiencies

The FMD Scheme considers periods of rainfall deficiency of six months; the calculation methodology is as follows (see **Figure 3**).



**Figure 3.** Ranking of 60 years of rainfall records into percentiles.

Rainfall over all six-month periods is calculated using monthly rainfall data from 1900 to present. The resulting six-monthly values are arranged in ascending order (from lowest to highest). The ranked data set is divided into parts of equal size to generate what are known as *percentile values*. For the purposes of the FMD Scheme, the fifth percentile level is considered. The fifth percentile is the level of rainfall which is exceeded by 95 per cent of the six-monthly periods in the historical record, meaning that 5 per cent of six-monthly periods received less rain than the fifth percentile.

**Note:**

Reference is sometimes made to rainfall *deciles*. Deciles are a division of the ranked historical monthly rainfall data into 10 equal parts (rather than 100, for percentiles). Decile 1 corresponds to the lowest 10 per cent of values, which is equivalent to the tenth percentile. Rainfall in decile 10 would be in the top 10 per cent of recorded values.

**Rainfall deficiency determination under the scheme**

For the purposes of the FMD Scheme, the previous six month period (that is, the six months prior to the month of the FMD withdrawal) is analysed to determine if the location has experienced a fifth-percentile rainfall deficiency.

**Timing of data updates**

Due to differences in how data is recorded at individual rainfall stations (real time or manual), not all rainfall data is immediately available for inclusion into the Bureau’s monthly rainfall analysis. After the end of each month, an analysis is performed using available data retrieved from approximately 3000 stations. As more rainfall station data becomes available, a further analysis is conducted on the 21<sup>st</sup> of each month and the data is uploaded to the FMD Rainfall Analyser on the next business day (22<sup>nd</sup> or 23<sup>rd</sup>). At this point, data from approximately 4500 stations contributes to the analysis.

## How reliable is the Bureau's rainfall data?

The Bureau's data is based on long-term records collected from an extensive network of standardised rainfall gauges using consistent observation practices. The data has undergone world-leading quality control and thorough review to ensure it conforms to international best practice standards set by the World Meteorological Organization.

Rainfall data which is not part of the Bureau's national dataset was not considered reliable for the purposes of the FMD Scheme, as it has not been collected using standardised instruments and observation practices or undergone sufficient quality control or review.

The usefulness of climate data is highly dependent on its continuity and accuracy. Meteorological observations pass through rigorous Bureau quality control processes before being used. These include: checking for values which are outside realistic bounds; inconsistent observations (e.g. high rainfall recorded together with clear skies); and discontinuous or abrupt changes in values over a short period of time. Erroneous observations are examined to determine whether they are true errors or just unusual. Data can be subjected to physical and statistical checks, compared against those for nearby stations with similar observations, or staff may refer to the original observations or observers for verification.

The Bureau rainfall data is the only national, long-term record of a suitable quality for this purpose. It should be noted that other available hydrological network rainfall data has not been utilised in the AWAP analysis, as it does not conform to WMO guidelines in the provision of metadata to support data confidence. The Bureau strives to make use of all data which is of a suitable quality, including being objective, repeatable (i.e. values can be confirmed), and consistent.

This long record means that we are able to confidently determine the frequency of low-rainfall periods, enabling the determination of regions affected by significant rainfall deficiencies.

## Verification of the Rainfall Deficiency Reports

Audit tables are compiled as Rainfall Deficiency Reports are generated (see **Figure 3**). These tables enable the Australian Taxation Office (ATO) to verify that the information held by applicants matches that provided by the Bureau.

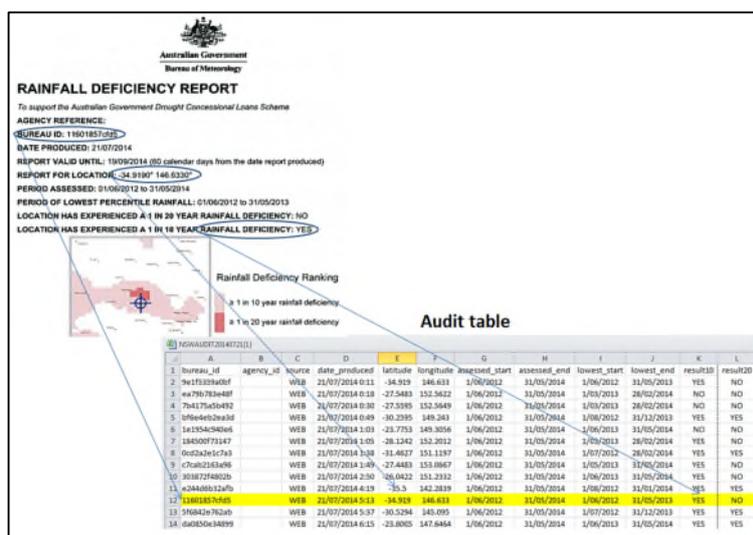


Figure 3. Verification of Rainfall Deficiency Report.

## Further Information

The Australian Taxation Office (ATO) administers (and interprets) the FMD tax provisions. The ATO maintains a website with important information relating to the FMD Scheme at the following address: [www.ato.gov.au/business/primary-producers/in-detail/farm-management-deposits-scheme](http://www.ato.gov.au/business/primary-producers/in-detail/farm-management-deposits-scheme).

For more information call the ATO's business enquiry line on 13 28 66 or visit the ATO Website.

The Australian Government Department of Agriculture and Water Resources also maintains a website relating to the FMD Scheme at [www.agriculture.gov.au/ag-farm-food/drought/assistance/fmd](http://www.agriculture.gov.au/ag-farm-food/drought/assistance/fmd).

Further information on the Bureau of Meteorology's rainfall dataset can be found at [www.bom.gov.au/climate/austmaps/about-rain-maps.shtml](http://www.bom.gov.au/climate/austmaps/about-rain-maps.shtml)

Further technical information on the analysis technique used to calculate rainfall deficiency information can be found at: Jones, D., W. Wang and R. Fawcett (2009) *High-quality spatial climate data-sets for Australia*. Australian Meteorological and Oceanographic Journal 58 (2009) 233-248