

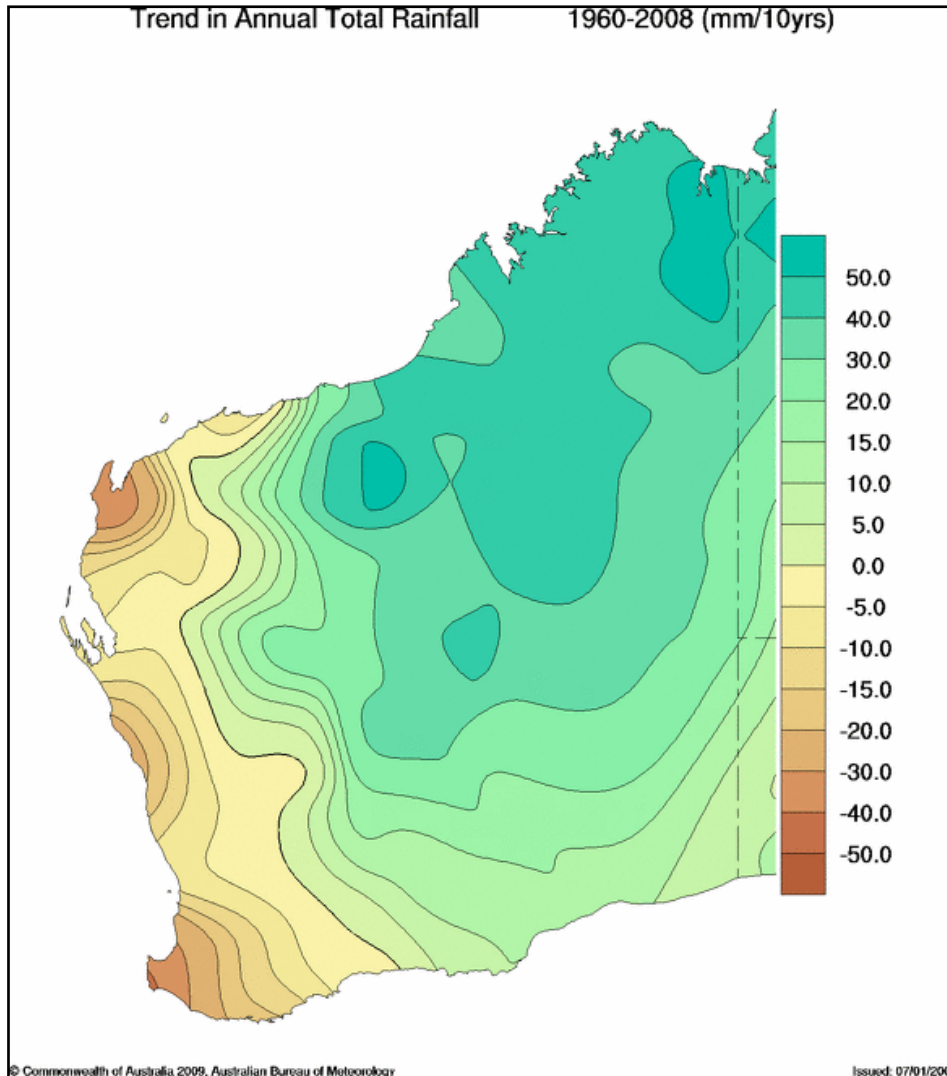


Improved Climate Data and Monitoring for Western Australia to Support the Understanding of Past, Present and Future Climate

Karl Braganza, Dean Collins, David Jones, Marco Marinelli, Catherine Ganter, Pandora Hope, Glen Cook.

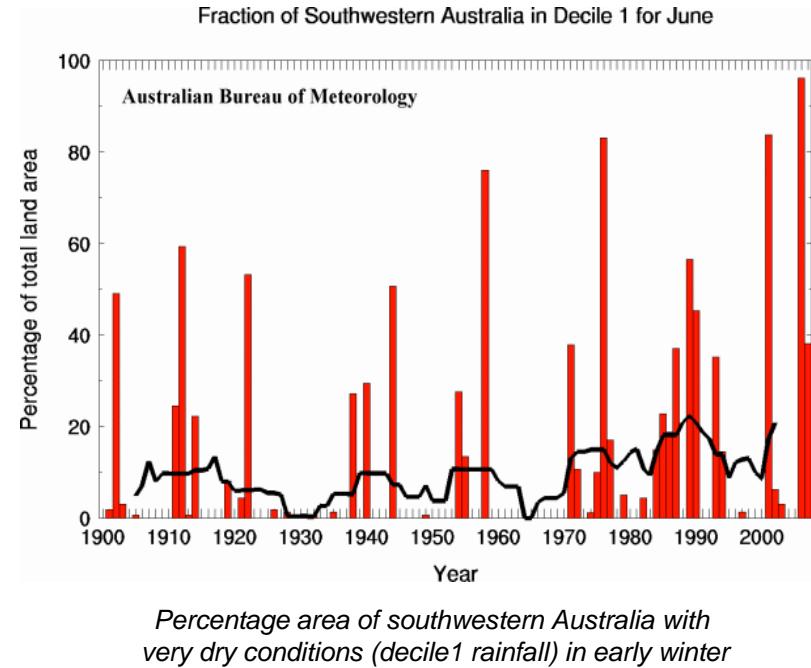
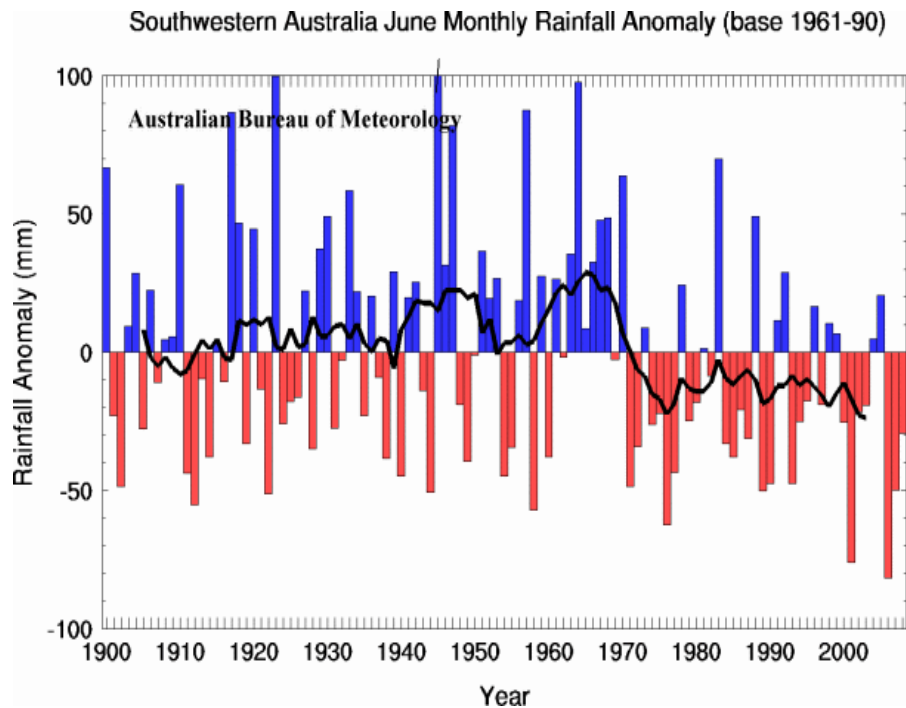
National Climate Centre, Bureau of Meteorology.

Rainfall in WA



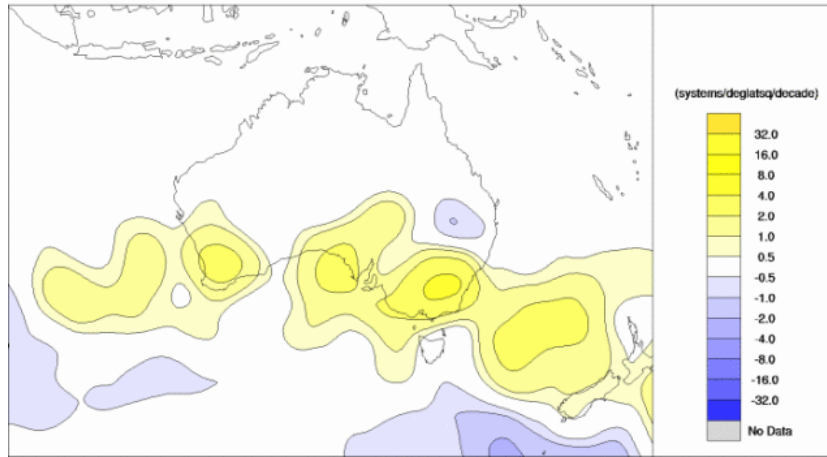
- General increase in rainfall through much of inland WA and the north-west
- Strong decline in southwest agricultural regions

- Abrupt downward shift in southwest WA rainfall in the mid-1970s



- Most very dry years have occurred since 1975
- Very few wet years since 1975 so little opportunity to replenish water storages

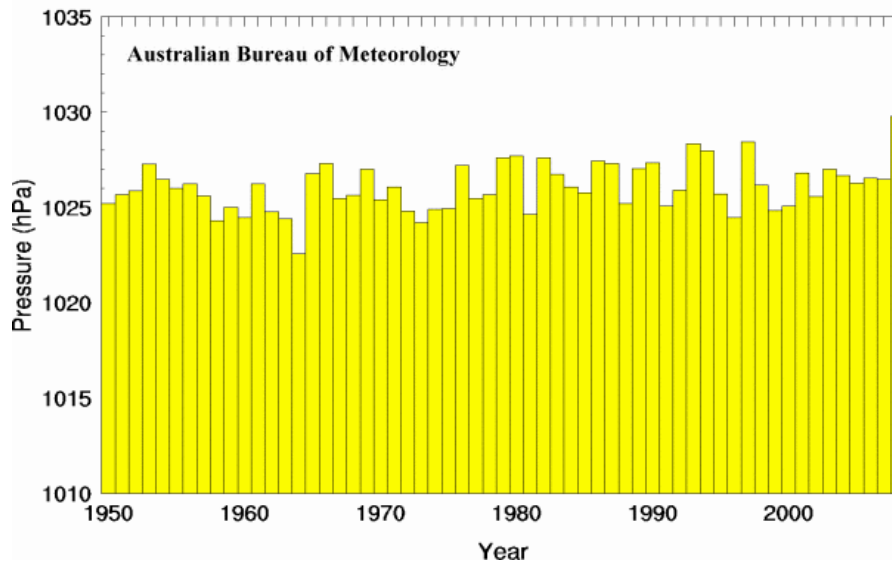
Trend in Winter Anti-Cyclone Density 1970-2006



Change in the number of highs

- Large scale changes in atmospheric circulation patterns have been observed since the 1970s

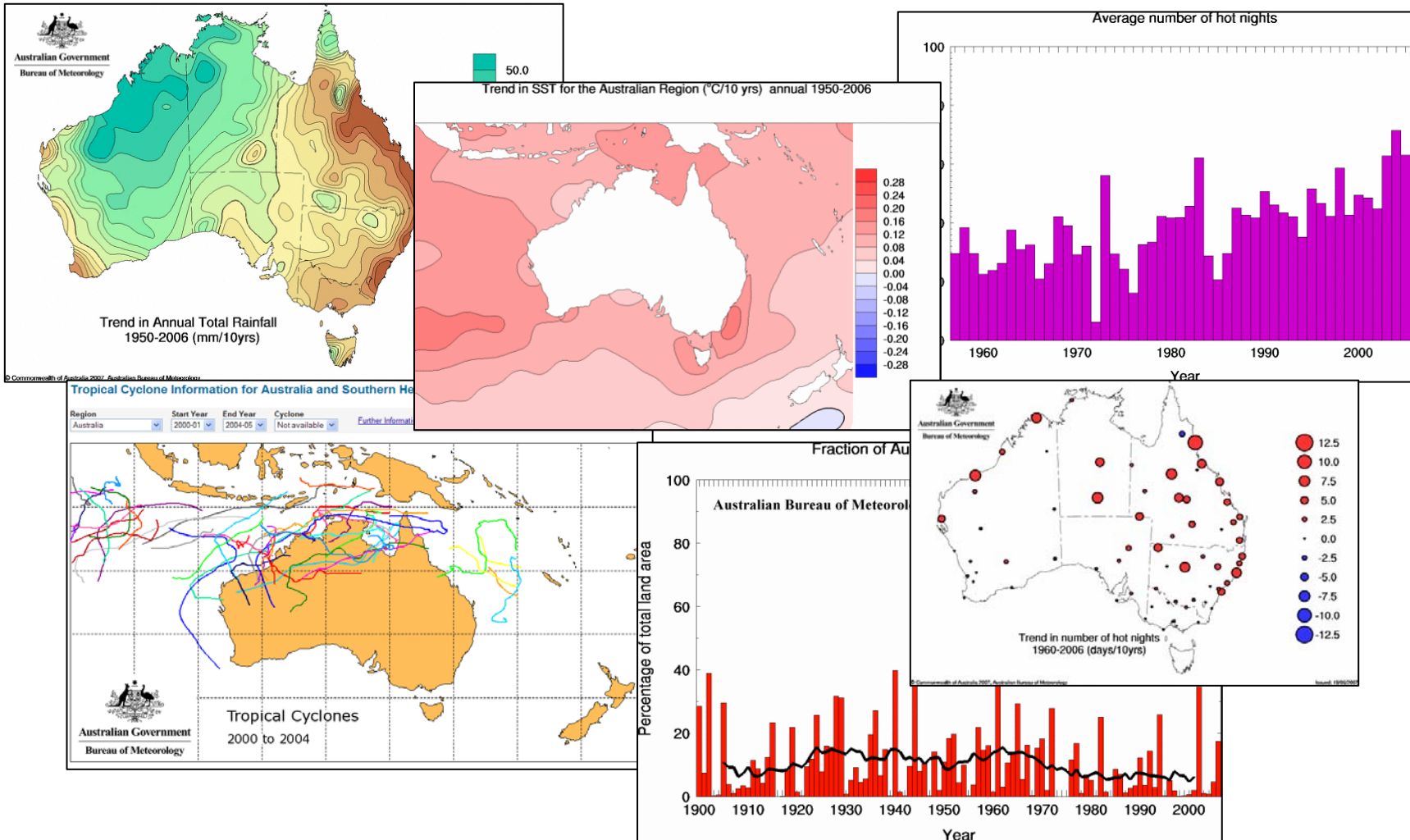
Winter Mean Central Pressure of Anti-cyclones in the Southwest



In southwest WA:

- Average surface pressure has increased
- Favoured region for winter storm development has shifted away

Climate Monitoring @ BOM

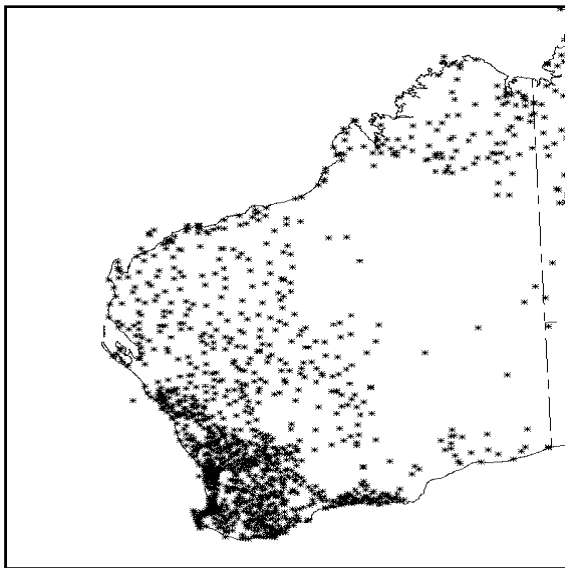


Updating and Improving Climate Observations for Western Australia

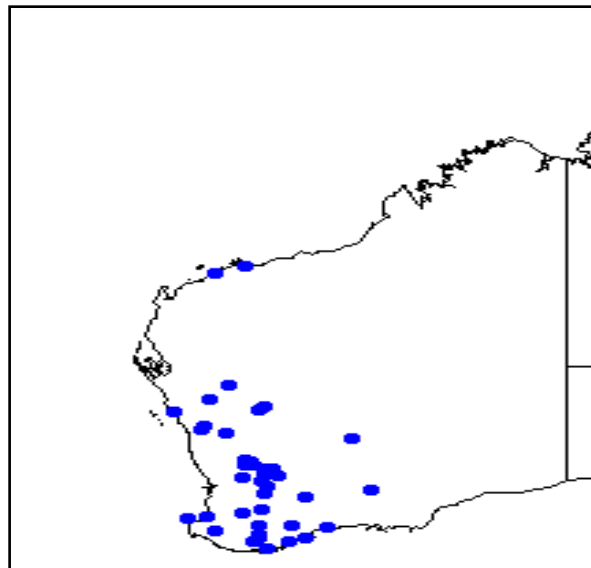
- The National Climate Centre (NCC), at the Bureau of Meteorology, plans to prepare a range of improved climate datasets for WA.
- These include high-quality daily rainfall data, extended high-quality temperature data, surface solar-radiation and cloud data and tropical cyclone data.
- These datasets will be developed with the specific aim of supporting IOCI 3 research, and will include sector relevant climatologies.
- In particular, new data sets should be suitable for analyses of observations (e.g., trend and change point detection), model validation, adaptation studies and downscaling.

Indian Ocean Climate Initiative (IOCI) 3 Project 1.4

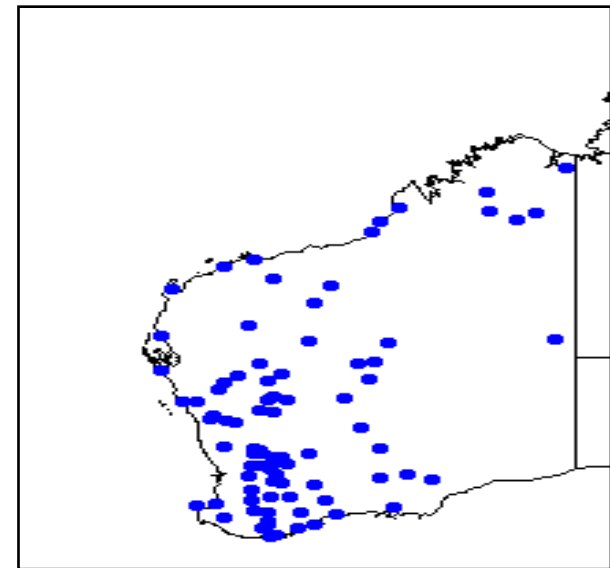
- WA has diverse climates and often sparse observation networks
- Large changes in networks over the past century not well accounted for
- Significant effort required to develop datasets suitable for monitoring climate change, model validation and downscaling
- There are major ongoing deficiencies and gaps in the available high-quality datasets in the northwest



Current Daily Network



Long Term Daily Stations



Long Term Monthly Stations

Rainfall Accumulations:

- Accumulated rainfall totals occur when rainfall in the gauge remains unchecked for more than a single day.
- Multi-day rainfall accumulations exist in many of the WA station records.
- Having unidentified accumulations will cause errors in analysis of wet/dry spells and daily maxima. They will also affect the analysis of changes in rainfall intensity and changes in the frequency distribution of daily rainfall.

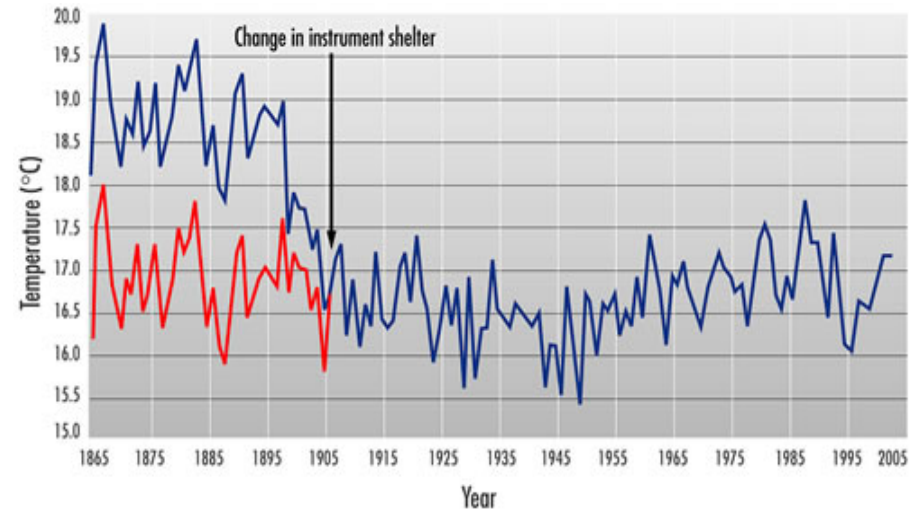
- **Trace Rainfall recording practices.**
- It has been noted by the NCC and elsewhere that observational practices for trace rainfall amounts (< 1 mm/day) vary from site to site, and marked changes are noticeable when metrification took place in 1974.
- This is quite important for analyses on the frequency characteristics of wet and dry days when the threshold for a wet day is set below 1 mm/day.
- Preliminary analysis by the NCC has identified that approximately 70% of all falls < 1 mm and 50% of 1-2 mm falls were not reported. Reference checking individual station rainfall records against near neighbours is one method for identifying systematic errors in trace rainfall recording.

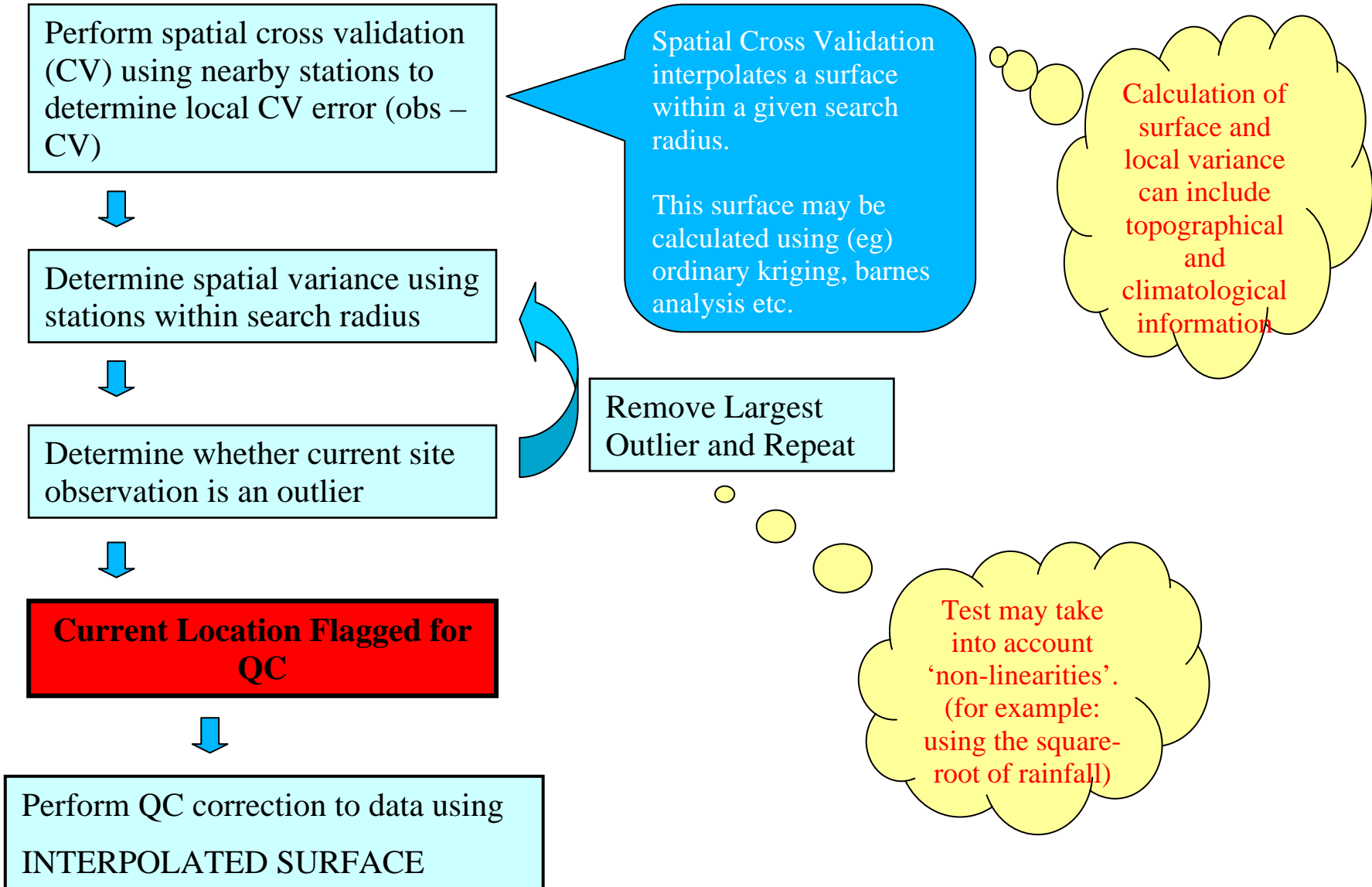
Station Closures

- There is a significant current and pending problem associated with station closures in WA. Specifically, volunteer stations which once contributed to the national high-quality networks have recently closed.
- This trend in closures is expected to continue due to changing population demographics in the region.
- The NCC aims to assess the affect of station closures on the climate record, and identify which discontinued stations can be merged with nearby records

Homogeneity

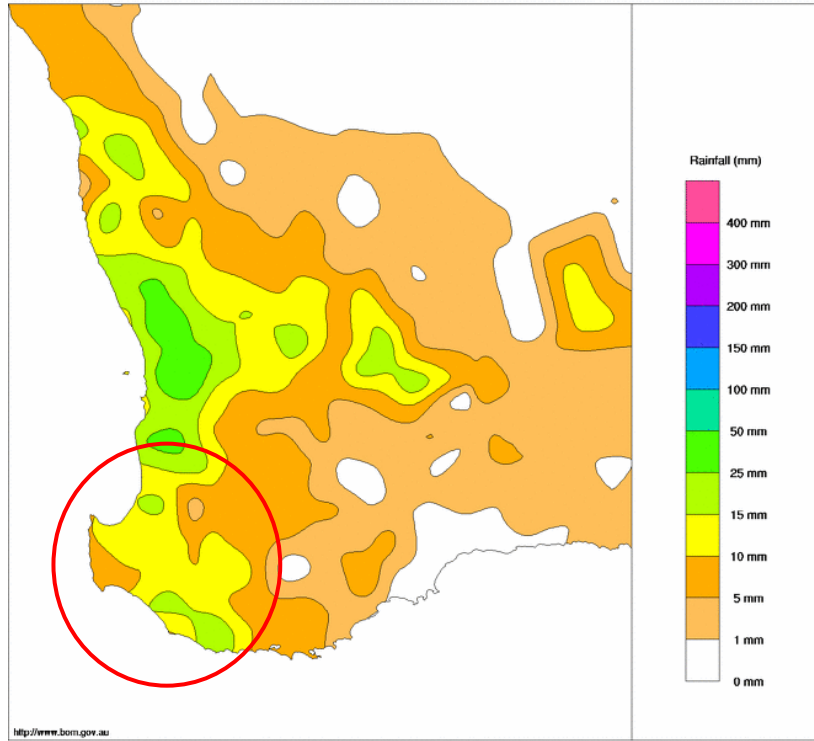
- All of the above issues (plus many others) create discontinuities in the station climate records.
- Identifying and (where possible) adjusting for discontinuities in the climate records is an important component of correctly identifying trends and break-points in rainfall.
- For rainfall, it is unclear whether objective tests- such as used for temperature, will provide accurate identification of discontinuities.





Rainfall Disaggregation

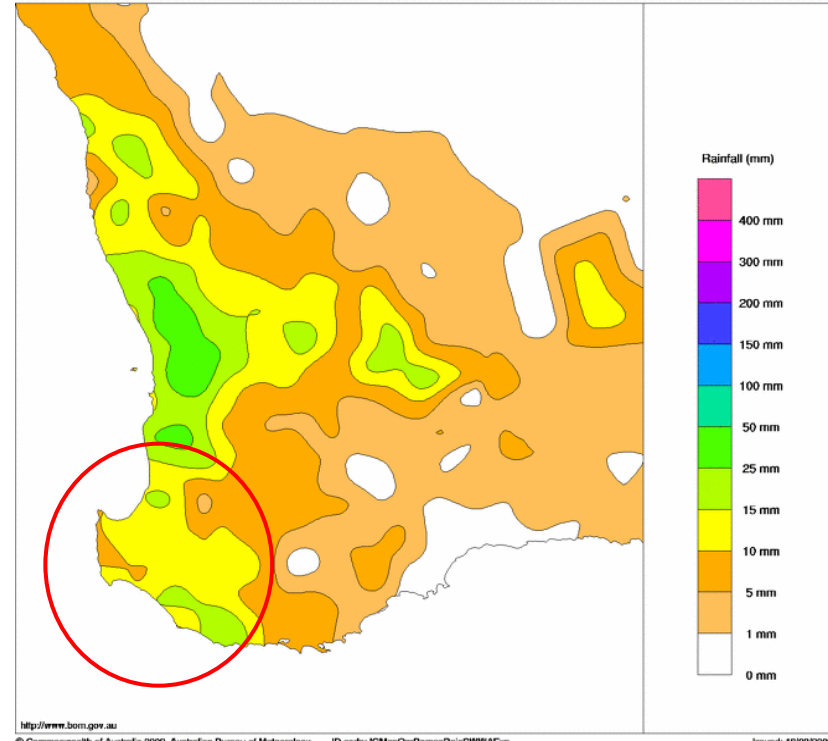
SW WA Rainfall Analysis (mm) 25th October 2008
Product of the National Climate Centre



25th October 2008- Flagged accumulations removed.

650 Stations

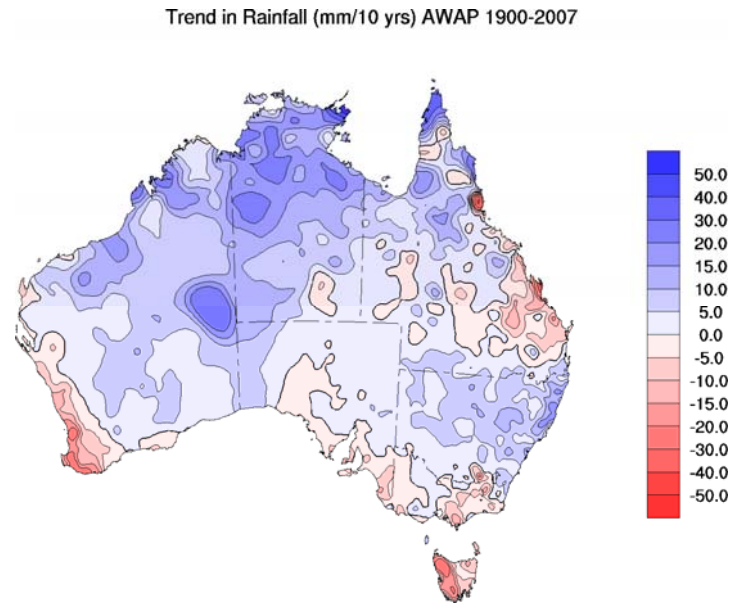
SW WA Rainfall Analysis (mm) 25th October 2008
Product of the National Climate Centre



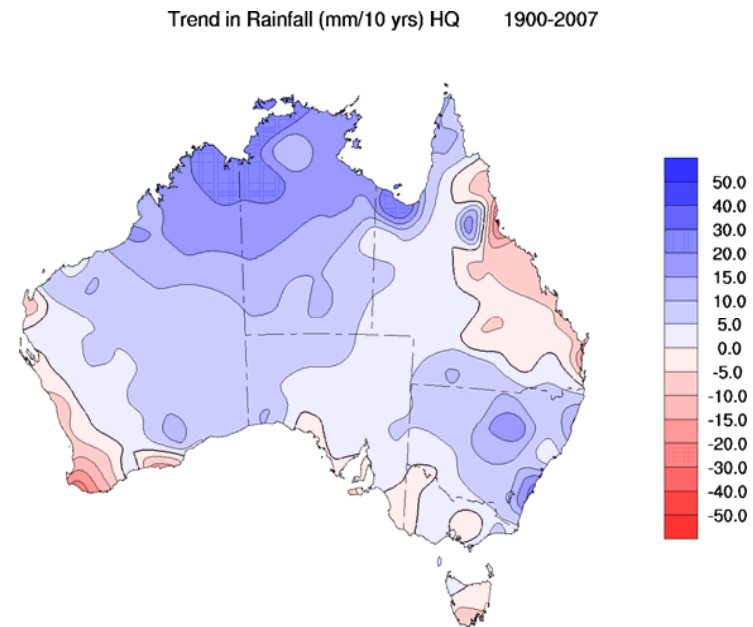
25th October 2008- Disaggregated accumulations replaced.

679 Stations

New robust topography-resolving analysis methods have been developed and applied to observations of rainfall, temperature and vapour pressure to produce analyses at a resolution of $0.05^\circ \times 0.05^\circ$ (approximately $5 \text{ km} \times 5 \text{ km}$).



AWAP 0.05 degree gridded data



Existing Operational 0.25 degree gridded rainfall data