Bushfire Climatology Project – Phase 2

Research Fact Sheet

Forests, Fire and Regions Group invests in a *Bushfire Risk Management Research* agreement with the Bushfire and Natural Hazards CRC that deliver critical science research to support policy and operational practices. This project '*Bushfire Climatology Project – Phase 2'* is part of this work and commenced in October 2017. It was completed in June 2018.

The Project

This project builds on the previous Bushfire climatology project "Phase 1" that developed a 4 km, hourly, gridded climate dataset for Victoria for the period 1972-2012. This dataset was generated using a combination of modelling, datasets, surface observations and historical rainfall analyses (**Figure 1**). Surface observations of temperature, relative humidity and wind speed were used to apply bias correction to the model surface fields across the full range of each variable.

Outputs included:

- Surface weather variables - hourly temperature, relative humidity, wind speed (bias corrected) and wind direction, forest fire danger index (FFDI) daily drought factor (DF) and Keetch-Byram Drought Index (KBDI).
- Upper air variables (e.g. mixing height and transport wind for smoke, stability indices).

Although considerable effort was given to fine tuning the resulting Weather Research and Forecast (WRF) model parameters and configurations during Phase 1, precipitation estimates still contained some bias. Precipitation is a very difficult element to simulate in a model and to validate on sub-daily time scales.

While it is desirable that these biases be improved, the bias correction method used in Phase 1 was not suitable for rainfall.

As a result, Phase 2 of the project extended the bias corrected dataset from 2012 to 2017, culminating in a 46-year climate dataset for Victoria including drought and fire indices. From the updated dataset, the fire weather trends and variability were examined.

Further, a range of useful outputs was be calculated for direct use by the fire agencies including the most extreme conditions (e.g. **Figure 2**), time-series of seasonal /annual irregularities (e.g. **Figure 3**), average return intervals of each fire danger category and FFDI values at ignition points.

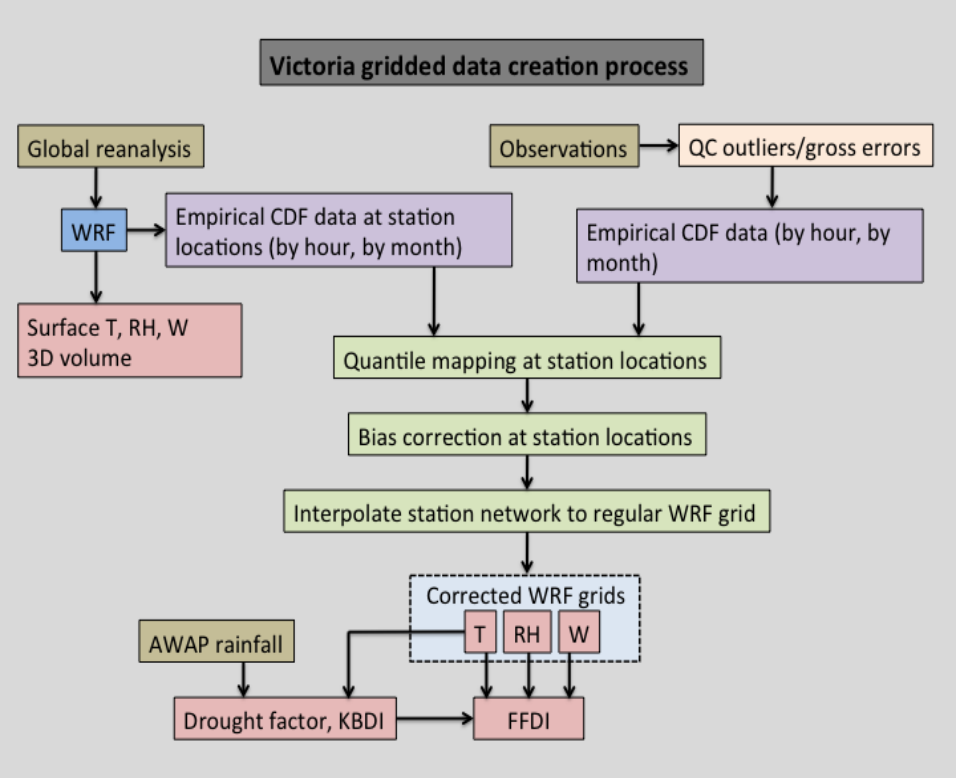

Figure 1: Flow chart of steps followed to create the gridded dataset

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Phase 2 also addressed the precipitation bias identified in Phase 1 by analysing the modelled precipitation. This will:

- Enable the objective verification of the model rainfall simulations.
- Determine the influence of the precipitation variable on the primary fire weather elements of temperature, relative humidity and wind speed.

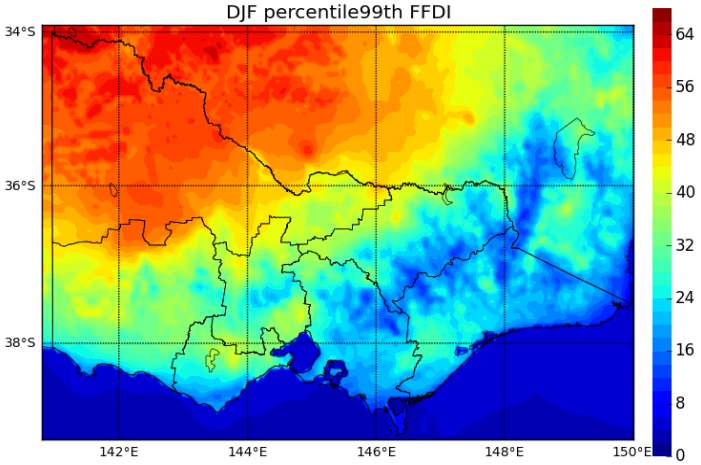

Figure 2: 99th percentile of FFDI created from the dataset (1972-2012)

Using these verifications as a reference, a series of model sensitivity experiments was conducted to determine if improvements to model precipitation can be made and incorporated into the gridded dataset.

Project Outputs

The project provided Victorian fire agencies with:

- Extended bias corrected dataset through to December 2017
- Climatological analysis of the extended dataset.
- Extracted data from the dataset for fire agency use, and
- Recommendations on updating precipitation in the primary gridded dataset.

Policy and Operational Implications

Understanding the bushfire climatology of Victoria is a critical element underpinning the management of fire prone and adapted landscapes. This understanding further reinforces the ability of DELWP and other agencies to determine the impact of predicted climate change on Victorian fire risk, and to characterise human and environmental aspects of bushfire risk now and into the future.

The project will:

- Allow fire managers to base decisions on the most up to-date information on the trends and variability of fire weather (Figure 3 currently only extends to 2012).
- Provide an update dataset that can be used in the Phoenix Bushfire Simulator to better understand recent Victorian fires such as Aberfeldy 2013.
- Provide decision makers with advice on the role the precipitation variable has on the other fire weather variables in the gridded dataset.

The Research Team

The project is being managed by the Bushfire and Natural Hazards CRC and the research team includes national and international experts in climate, fire, meteorology and modelling. The researchers include Dr Sarah Harris and Dr Graham Mills from Monash University and Dr Tim Brown and his team of modelling experts from the Desert Research Institute (USA).

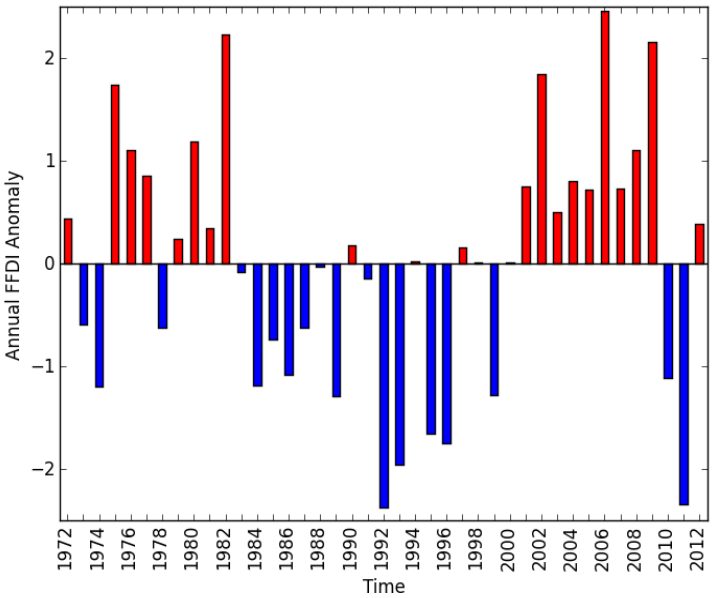

Figure 3: The Victorian mean daily maximum FFDI annual anomaly (1972-2012)

Project Status

The project is now complete.

The WRF model was run through to December 2017 and a new bias correction method was tested and applied. Following this, fire weather data were extracted for fire agency use along with analysis of the trends and variability of fire weather for Victoria.

Analysis of the influence of precipitation variable on the other fire weather variables was tested and recommendations on updating precipitation in the primary gridded dataset were produced.