Utilizing hi-resolution gridded fire climate and danger data for risk assessment

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Wildland Fire Canada 2016 Kelowna, BC 27 October 2016

Many thanks to Victoria’s Department of Environment, Land, Water and Planning
Part 1
Downscaling
Model spatial scales

Source: Linda O. Mearns, NCAR
Challenges – Matching climate services to scale

10 March 2004

Source: Kelly Redmond, WRCC
Regional Modeling Approach

Source: Linda O. Mearns, NCAR
Downscaling and aggregation
Part 2

Victoria example
Victoria project objectives

◆ Provide a high-resolution temporally and spatially complete record of temperature, humidity, wind, precipitation, drought and fire danger

◆ Provide decision-support information for fire management (Phoenix, planned burning, fire behaviour, vegetation management, fire danger and fire weather studies)

◆ Provide background information for climate change analyses (trends, variability)

◆ Fill in gaps between observation points

◆ To help determine if assumptions that go into policy and operations are supported by what is known about the climate record

Challenge – provide both realistic meteorology and climatology
Act 1

The WRF
Model choice and configuration

- WRF (V3.5.1)
- Initial state and lateral boundary conditions from reanalyses
- 36, 12, and 4km grids
- Re-initialise every 14 days, integrate to 15 days, discard “spinup” Day1
- Physics options
  - Thompson et al microphysics
  - Kain-Fritsch cumulus parameterisation
  - RRTM longwave radiation
  - Goddard short wave radiation
  - NOAH land surface scheme
  - Yonsei University PBL
  - Combined diffusion options
- U,V grid nudging above level 10
WRF terrain
Act 2

Bias correction
Bias correction

(a) Essendon

(b) Bairnsdale
Bias correction - method

Victoria gridded data creation process

Global reanalysis → WRF → Empirical CDF data at station locations (by hour, by month)

Observations → QC outliers/gross errors → Empirical CDF data (by hour, by month)

Quantile mapping at station locations → Bias correction at station locations

Interpolate station network to regular WRF grid

Corrected WRF grids

AWAP rainfall → Drought factor, KBDI

FFDI
Bias correction - method

The 10 degrees at the WRF 0.2 quantile is mapped to the station 0.2 quantile and becomes 8.9.
Bias correction - method

Stations used in bias correction
Bias correction - analysis

January 2003-2012 hourly (UTC) WRF minus observed for Melbourne airport
Bias correction - analysis

Falls Creek

January hour 0000 UTC for the years 2003-2012
Blue – before; red after correction
Bias correction - analysis

Horsham Aerodrome

January hour 0000 UTC for the years 2003-2012
Blue – before; red after correction
Bias correction - analysis

Mount Hotham

January hour 0000 UTC for the years 2003-2012
Blue – before; red after correction
Bias correction - analysis

JAN 3PM local time

JAN 3AM local time
Bias correction - analysis

Mildura station temperature bias

2003-2012

1980-2002

1972-1979
Evaluation method

- Many hourly fields visual inspected (> 40000 graphics)
- Individual weather events studied for reality check – do we get the big events correctly?
- Pick out interesting features and examine
- Statistical fit against observations – trends, biases, spikes
The dry slot
Act 3

Climatology
Outputs

- 1972-2013
- 4-km spatial resolution covering Victoria
- Format – compatible with Phoenix
- Hourly – Temperature, relative humidity, wind speed, wind direction, FFDI, precipitation
- Daily – Precipitation, KBDI and Drought Factor
- Bias-corrected 2m temperature and humidity fields; 10m wind speed
- Full 3-D volume atmosphere (32 levels)
Climatology examples
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DJF maximum temperature (°C)

DJF minimum relative humidity (%)
Fire spread model input
Part 3

Alberta example
Slave Lake fire  14-16 May 2011
Slave Lake fire  14-16 May 2011
And now,
A short fire safety video
Greetings From Reno!

Fire near Tim’s house