A New Quantitative Smoke and Air Quality Forecasting System for Victoria

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Photo by Jenny Howell FFMVic
Outline

Defining the problem

Creating a solution

Key Elements and Products

Verification

Extension beyond Victoria

Future Work
Defining the problem

Minimise public exposure to unsafe levels of fine particles in smoke.
Smoke from outside the jurisdiction can also have an impact.
Creating a solution

Tier 1

**Coming week**
- Dangerous conditions?
- Can I schedule fuel reduction burns?
- 6-day 52-member ECMWF ensemble
- Weather variables
  - Fire danger indices

Tier 2

**Next few days**
- What about existing air pollution?
- ACCESS-R + Chemical Transport Model
  - Emissions (Sentinel, local)
- smoke, PM10, PM2.5, O\textsubscript{3}, NO\textsubscript{2}, NO\textsubscript{x}, CO

Tier 3

**Tomorrow**
- Planned or going fire - where will the smoke go?
- ACCESS-C
  - Phoenix FireFlux
  - CTM tracer dispersion
  - Fire data
- Total air pollution load
Creating a solution

Linked state-of-the-art models combining weather and fire information

- ECMWF, ACCESS-R, ACCESS-C
- Weather forecast model output
- Trajectories and dispersion
- Emission factors for Victorian fuels
- Emissions
- Consumption
- Fuel loading
- Fire information reporting systems
- Sentinel hotspots, Agency fire data
- Phoenix FireFlux
- BIOS2
- Smoke trajectory and concentration forecasts
- Code for Phoenix FireFlux provided by Sean Walsh
Key Elements & Products

Web User Interface

Click on a shaded part of the forecast to see the predicted concentration at that point.

Click on one of the circles to see detailed, ensemble weather forecasts out to 10 days at that point.

Click through the times to see the air quality forecast.

Click to view forecasts of smoke from prescribed burns.

Click to view forecasts of smoke concentrations.

Click to view Tier 3 forecasts.

Click to view Fire weather layer.

Click to view forecasted boundary layer information.

Legend is aligned with the community smoke, air quality and health standards.

Click to refresh.

Turn bushfire data on/off.

Turn planned burn data on/off.

Click to select which ground-level air quality forecast you would like to view.
Tier 1: Coming Week
Point Location Forecasts

Wind speed, temperature, relative humidity, FFDI and GFDI
3-hourly to 6 days
Tier 2: Next Few Days
Air Quality Forecasts

Hourly to 72 hours, 27km and 9km grid
Hourly to 24 hours, 3 km grid
Tier 3: Tomorrow
Prescribed Burn pollution load

Hourly to 24 hours, 3 km grid
Fuel reduction burn near Wodonga, 1 April 2017

Photo by Lisa Beach
Verification Results

Major burns in NSW
2-10 May 2016

Verification of PM$_{2.5}$ concentration

Station: St. Mary's

Station: Prospect

Station: Chullora

Station: Earlwood

Station: Campbelltown

Station: Richmond
Extension beyond Victoria

ACCESS Model Domains

Strong inversion over Sydney is trapping smoke. This is forecast to break mid morning clearing quickly to a fine & warm day.

@NSWRFS

8:50 AM - Aug 14, 2017 - Sydney, New South Wales

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Future Work

- Use of ensemble forecasts
- Improve plume rise forecasting
- Develop module for forecasting health impact
- Experiments to better understand emissions from smouldering
- Understand smoke plume perception
- Improve prescribed burn simulator
Thank you.

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