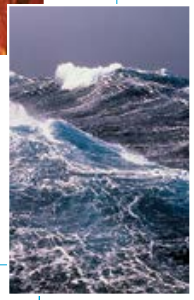
Department of Environment, Land, Water & Planning
State Government Victoria

Smoke Emission and Transport Modelling Project

www.cawcr.gov.au

Principal Investigators
Mick Meyer, Clare Murphy, Kevin Tolhurst, Andrew Sullivan, Nigel Tapper, Alan Wain, Chris Weston



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The Centre for Australian Weather and Climate Research
A partnership between CSIRO and the Bureau of Meteorology

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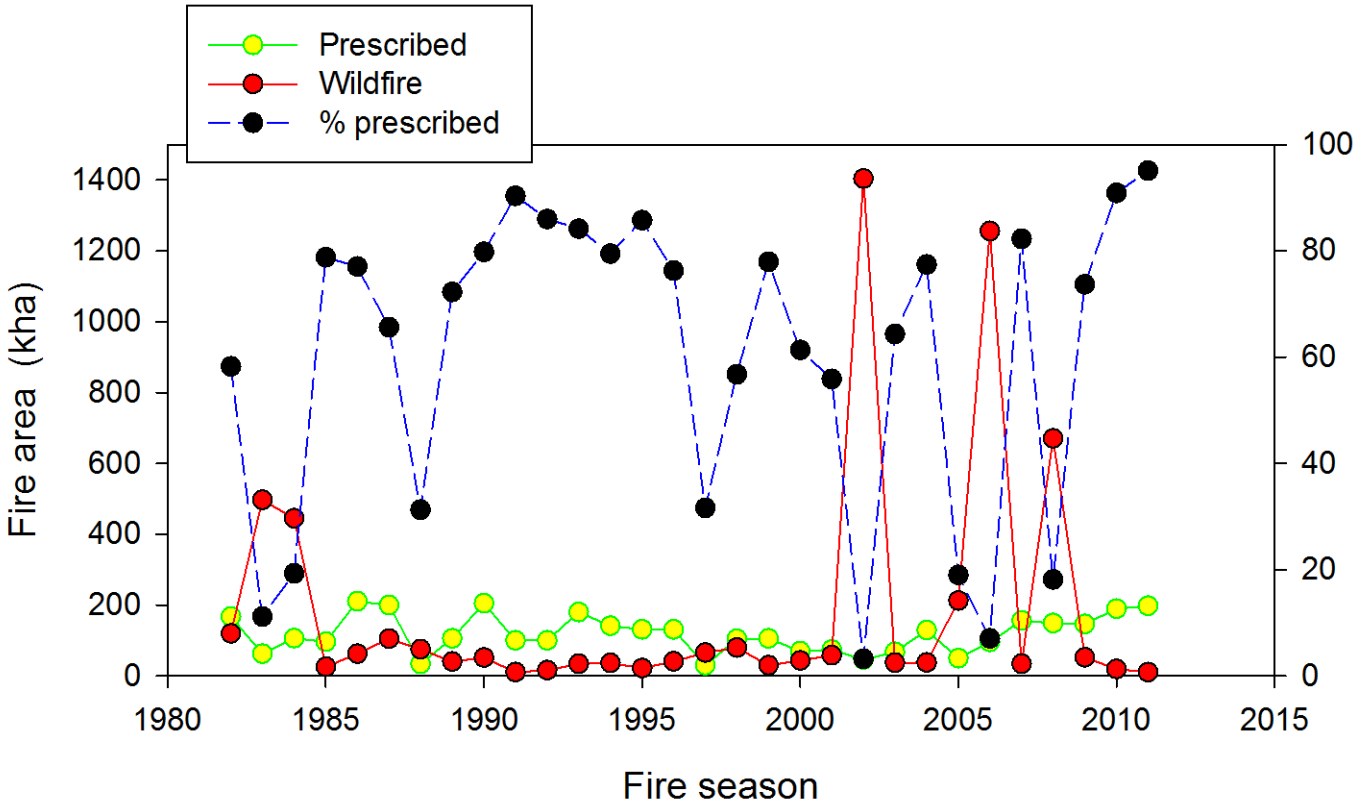
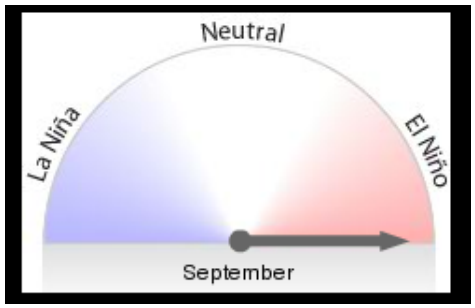
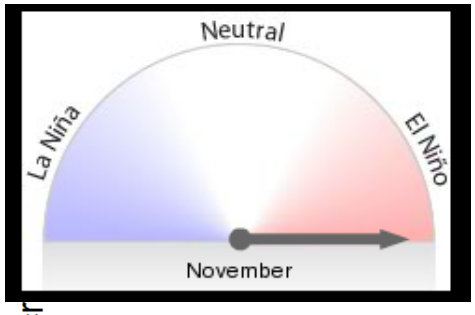
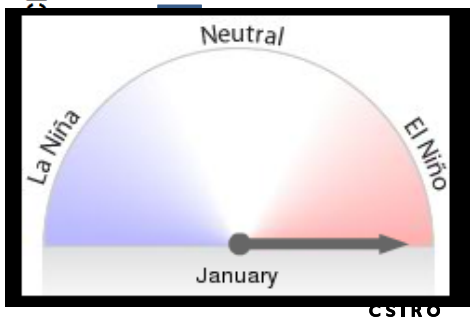
PROJECT AIM

To improve our capability to model and predict the spread and accumulation or dissipation of smoke for planned and unplanned fire events through improved smoke trajectory and accumulation or dissipation modelling.









2014 HAZELWOOD MINE FIRE
- another major project driver

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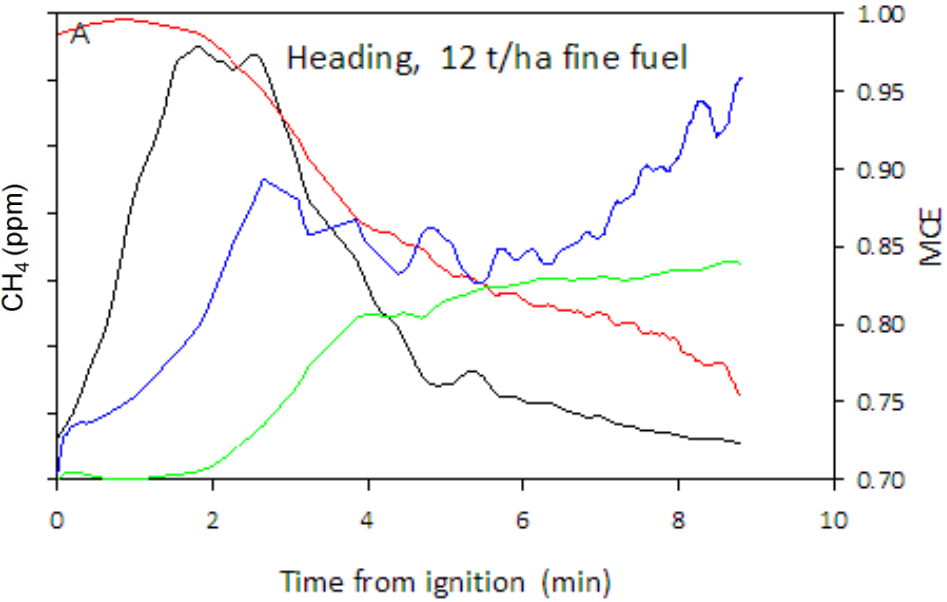
KNOWLEDGE GAPS AND WORK PROGRAM

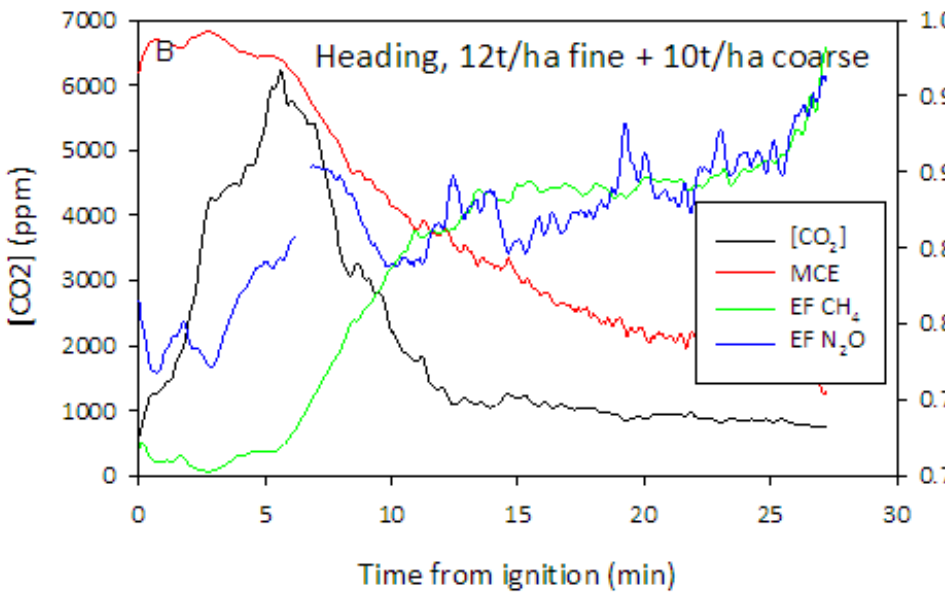
- Development of a quantified smoke emissions and transport modelling framework for Victoria.

  - Knowledge Gaps
    - Coarse fuel types and their combustion characteristics;
    - The relationship between fire behaviour, and chemical constituent emissions and heat emissions;
  - Fuel type, combustion and emission characterisation studies
  - Development of a forecasting framework
    - Fire behavior, emissions, smoke transport, decision support system
    - Build a flexible approach tailored to the specific requirements of DEPI
  - System Verification and Uncertainty analysis;
  - Training + deployment

THE PYROTRON STUDY- February 2014

24 burns in total consisting of 18 heading fires and 6 backing fires



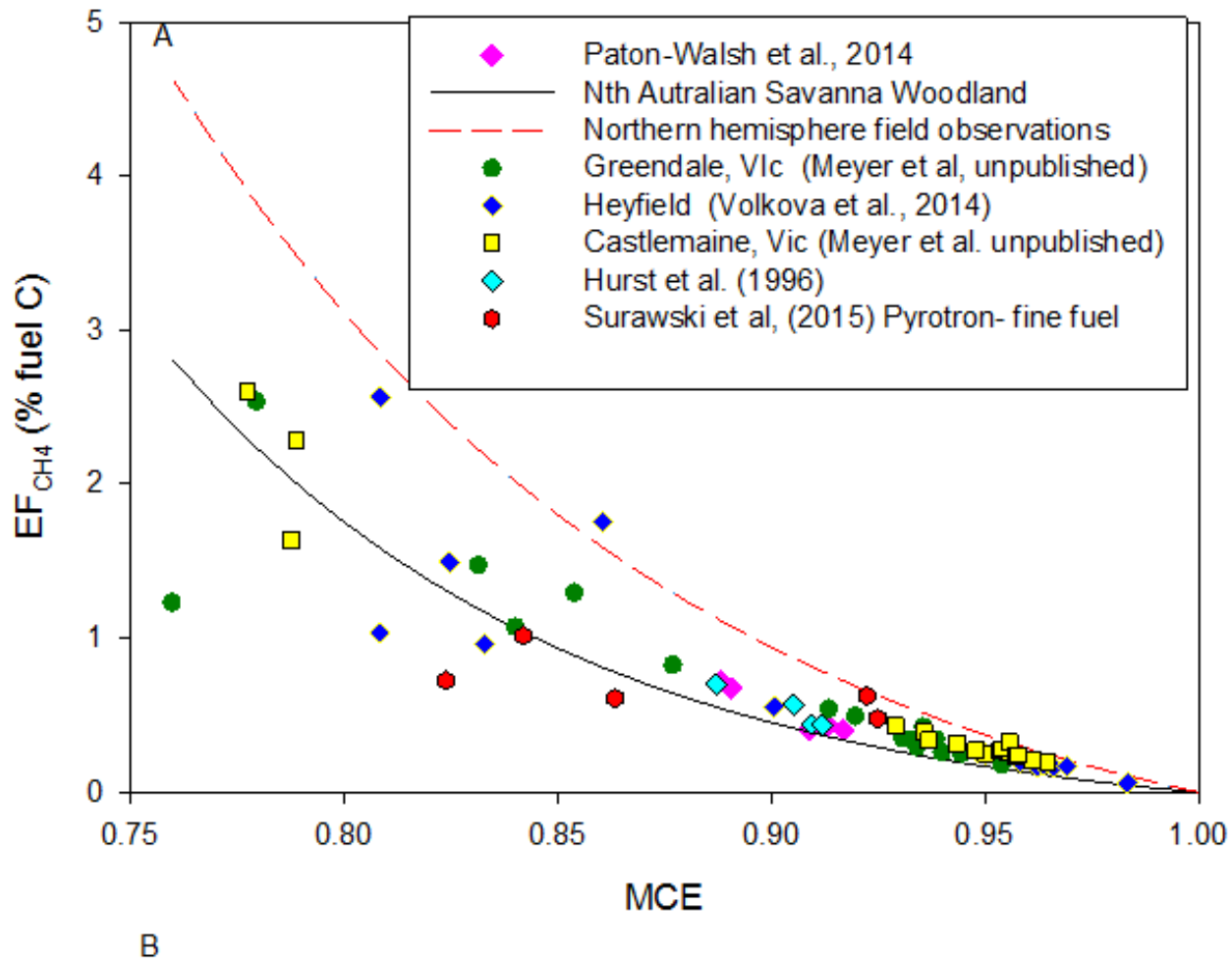


THE FIELD CAMPAIGN (when the weather plays ball)

- Multi-component observation study- fuel types; emissions; heat fluxes

Fuel characterisation

Back packs



THE 3-TIERED SMOKE PREDICTION SYSTEM

Coming week

Dangerous conditions?

Can I schedule fuel reduction burns?

10-day 24-member ACCESS-GE ensemble

Weather variables

Fire danger indices

Next few days

What about existing air pollution?

ACCESS-R
ACCESS-C + Chemical Transport Model
ACCESS-RUC

Emissions (MACC, local)

PM10, PM2.5, O_3, NO_2, NO_x, CO

Today/ tomorrow

Planned or going fire - where will the smoke go?

Phoenix Rapidfire

HYSPLIT dispersion

Fire data

Total air pollution load

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NSW GOVERNMENT Office of Environment & Heritage

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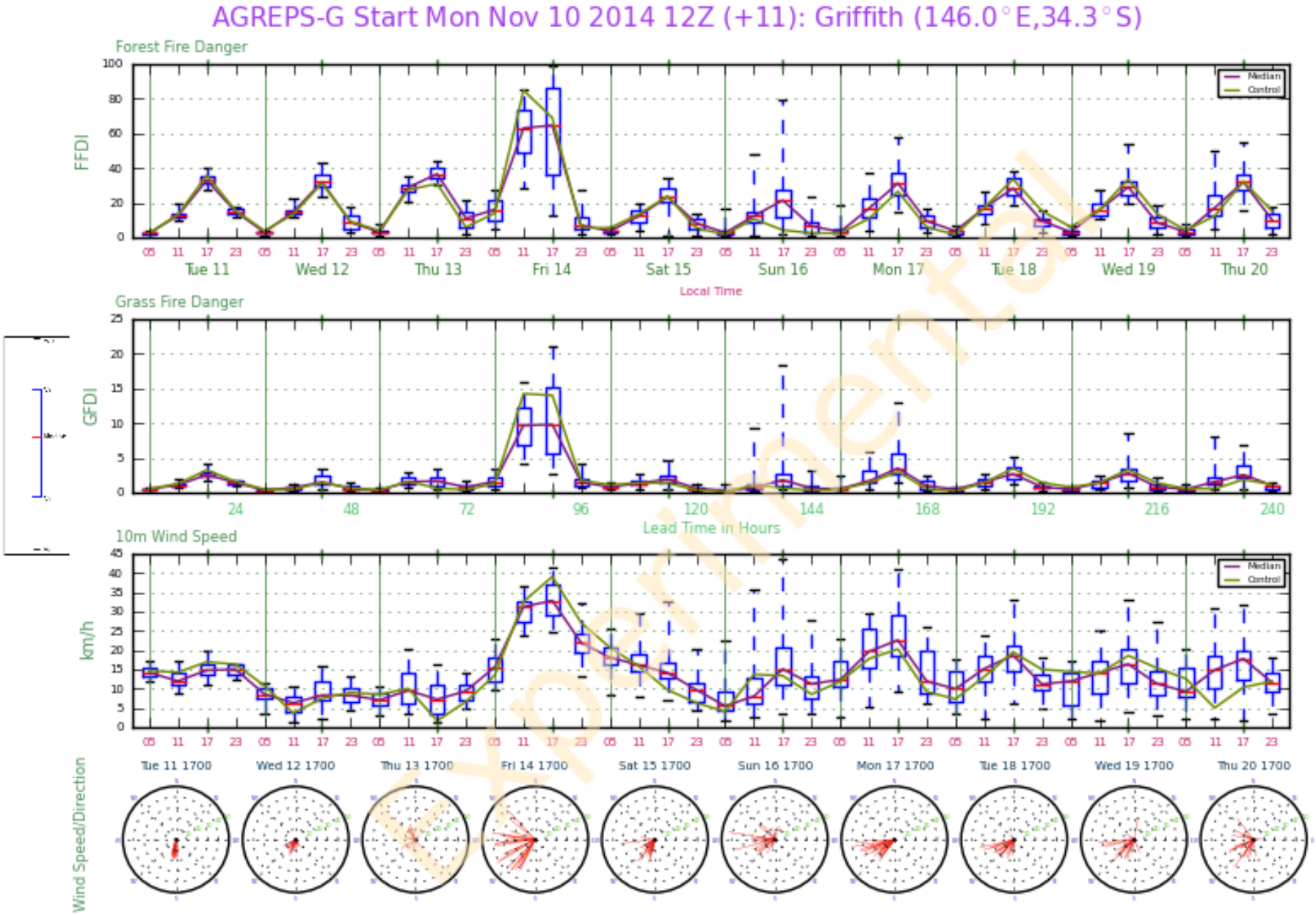
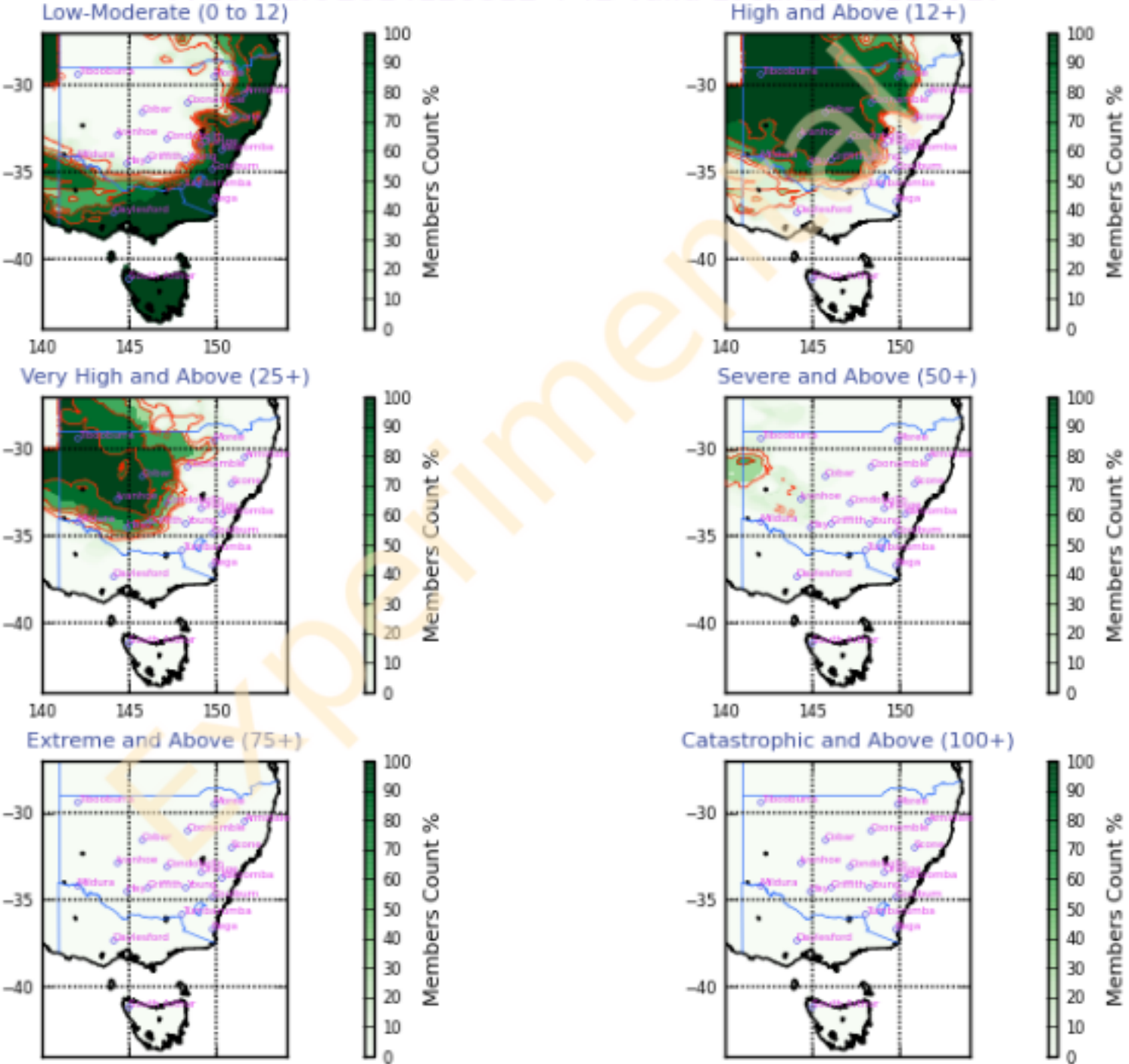
Tier 1- Ensemble forecasts of fire weather



Experimental

FFDI Start 2014120812 +42 Valid Local 2014121017



Experimental

Tier 2- Regional air pollution forecasts

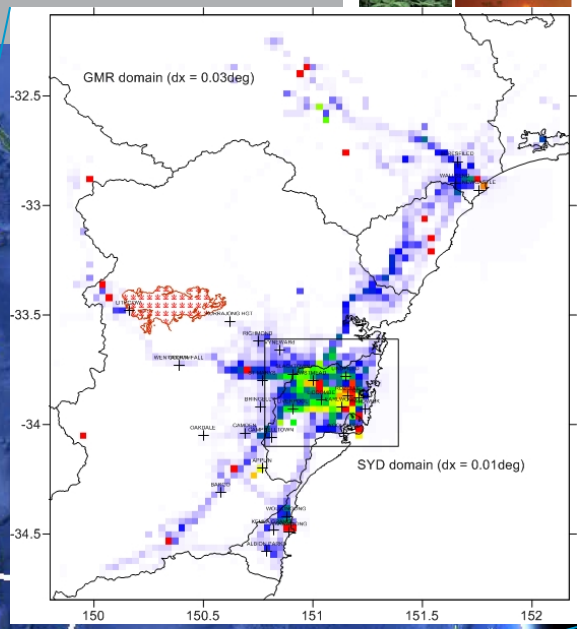
Meteorology- ACCESS-UM

CSIRO Chemical Transport Model

Carbon Bond chemical mechanism

Aerosols- simple bin or GLOMAP
- ISORROPIA- inorganics
- Volatility Basis Set- organics

Emissions- wind blown dust
- sea salt aerosol
- biogenic- SOA
- fires- PHEONIX
- State anthropogenic inventories



Outer domain dx = 0.9°

Image Landsat
US Dept of State Geographer
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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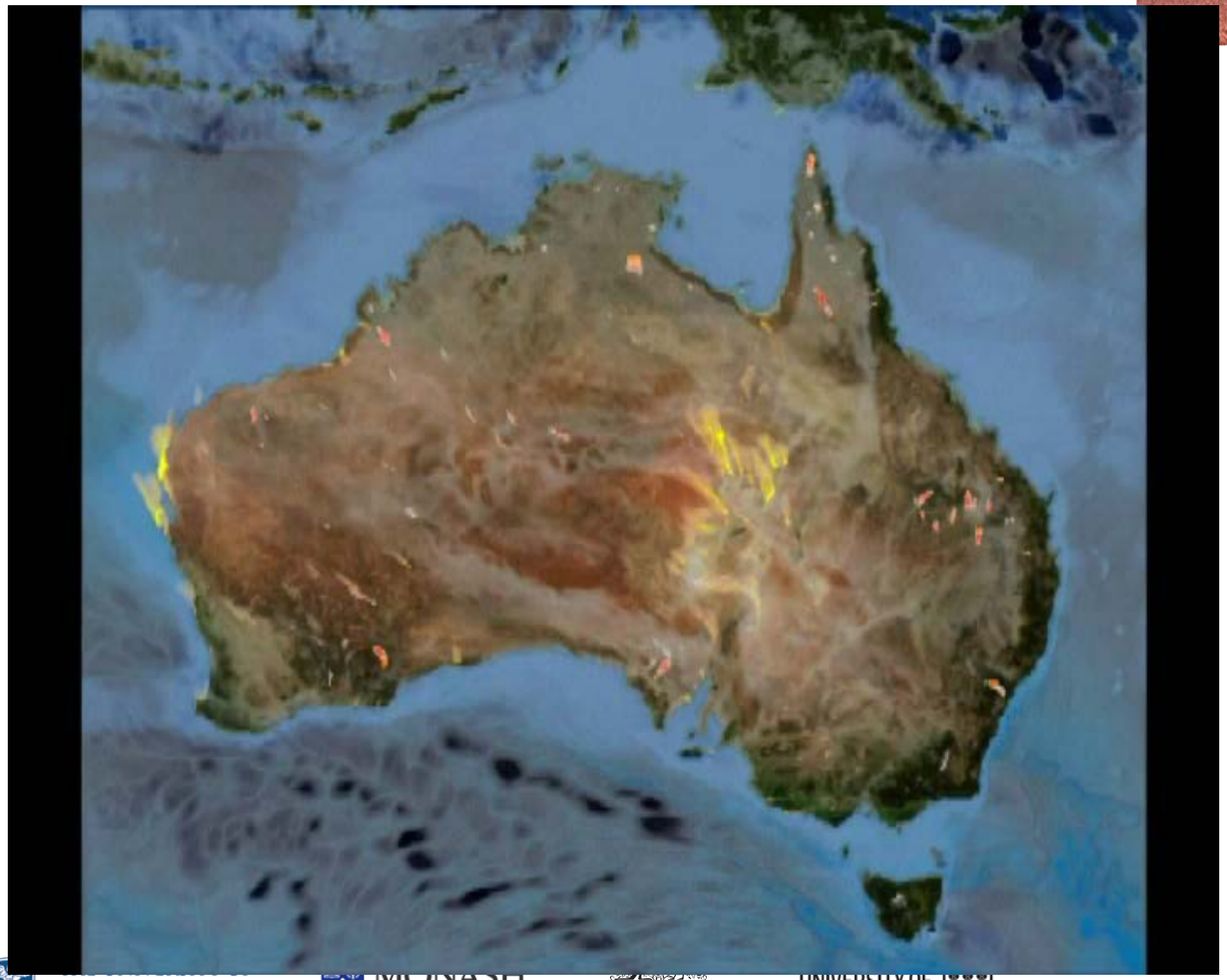
Google earth

Tier 2- PM2.5 for the Australian Domain

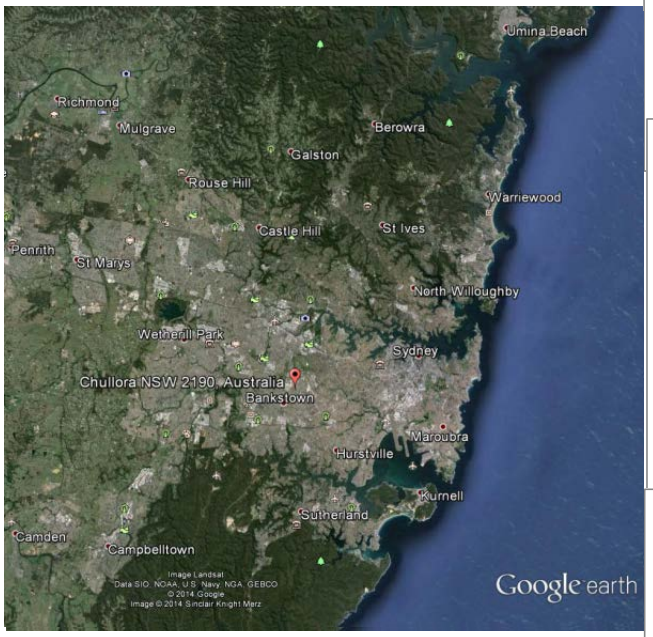


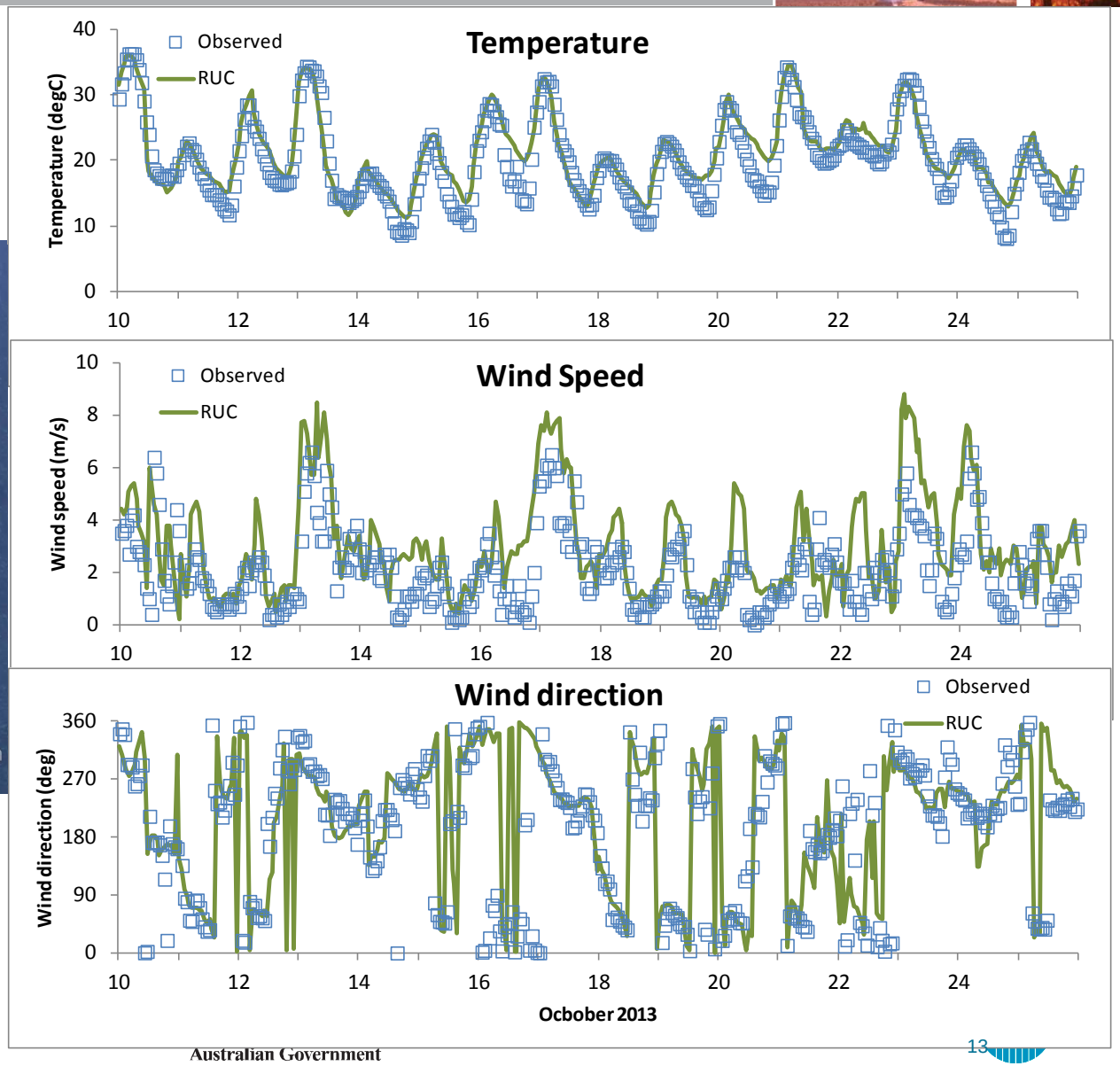
TIER 2 FORECAST OF A SMOKE POLLUTION EPISODE IN SYDNEY

10-25th October 2013

The UM meteorology is good!

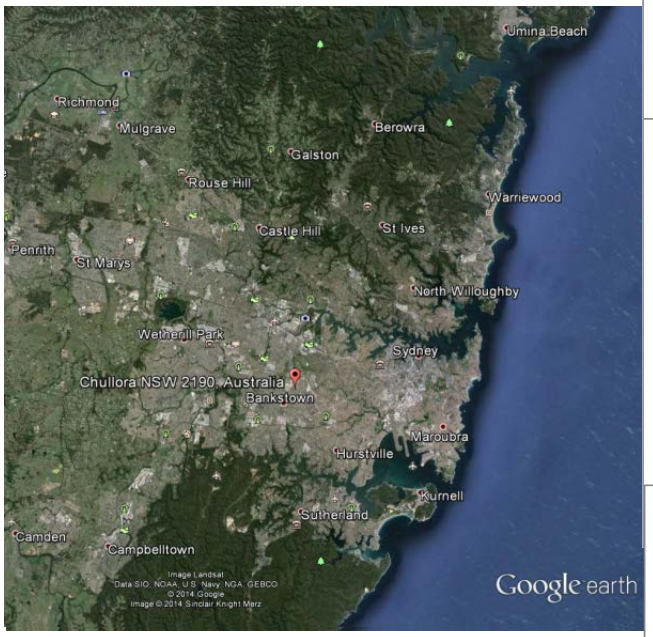
10-25th October 2013
i.e. Chullora AQMS

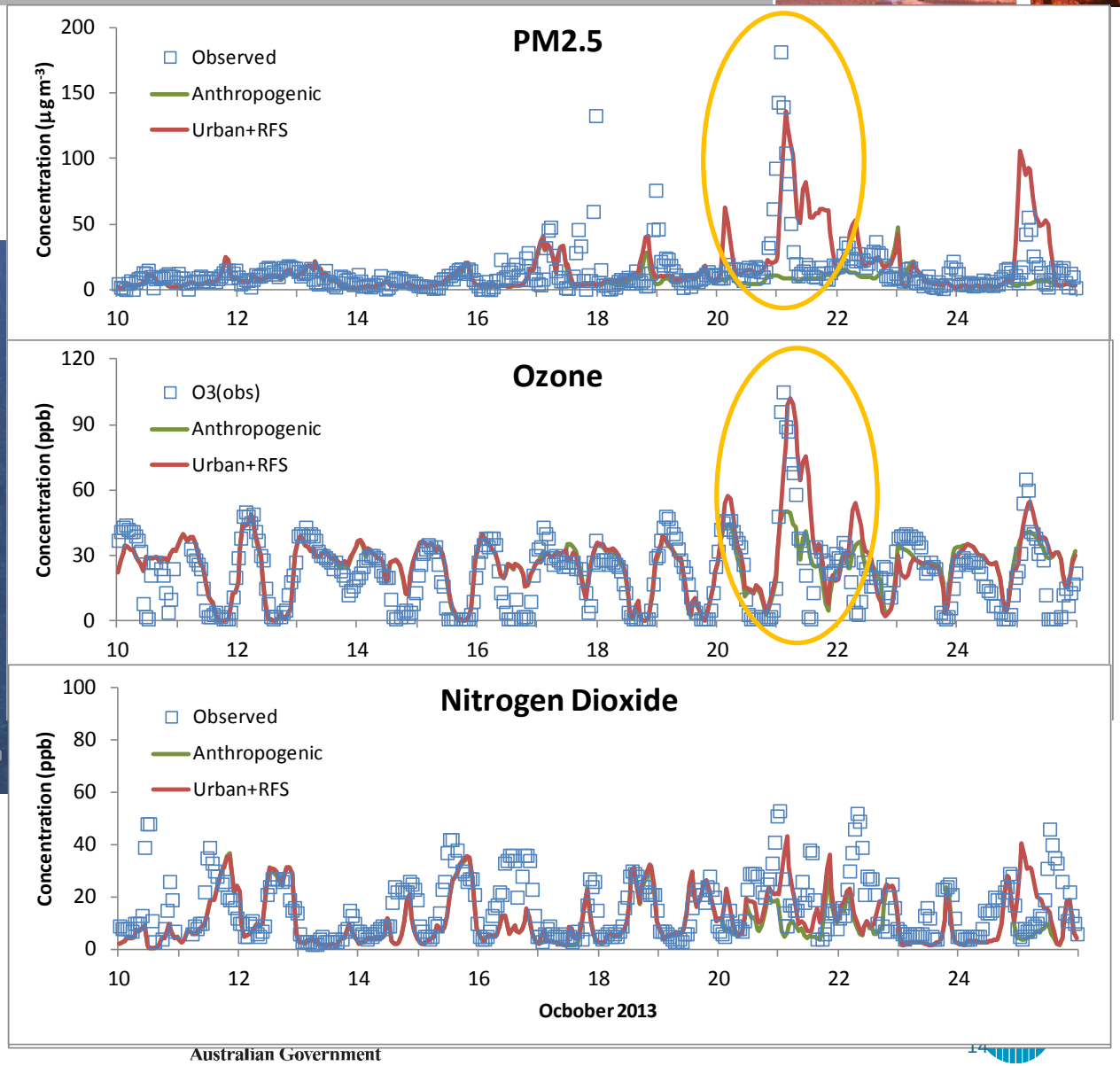




Performance and model sensitivity- a good example

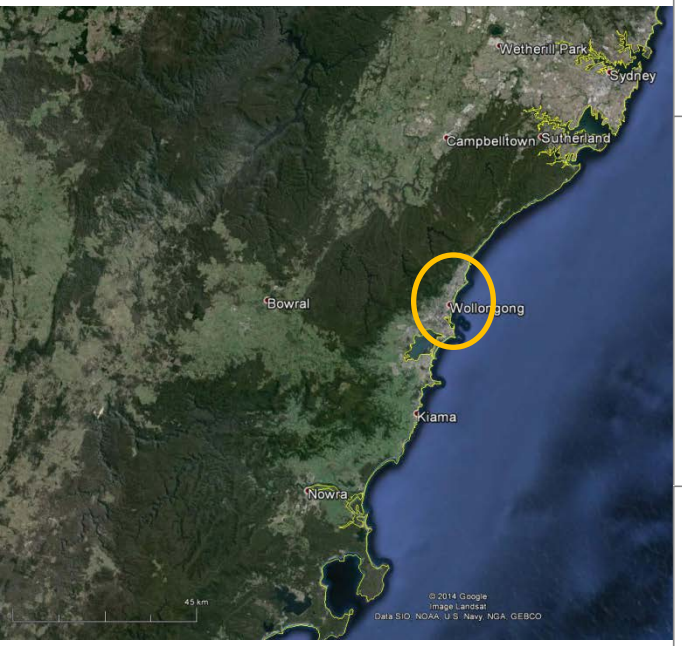
10-25th October 2013 i.e. Chullora AQMS

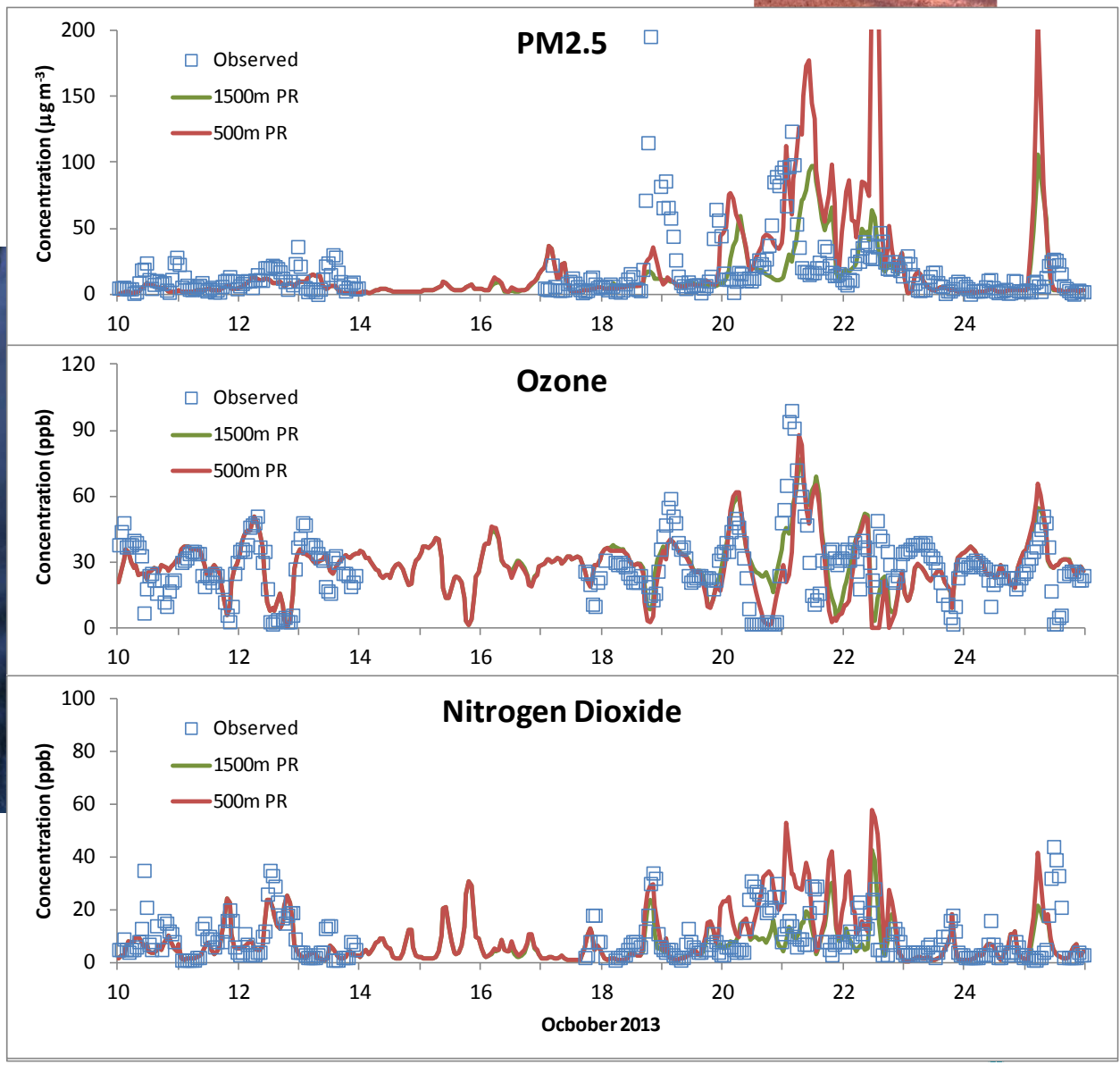




Performance and model sensitivity- here more challenged

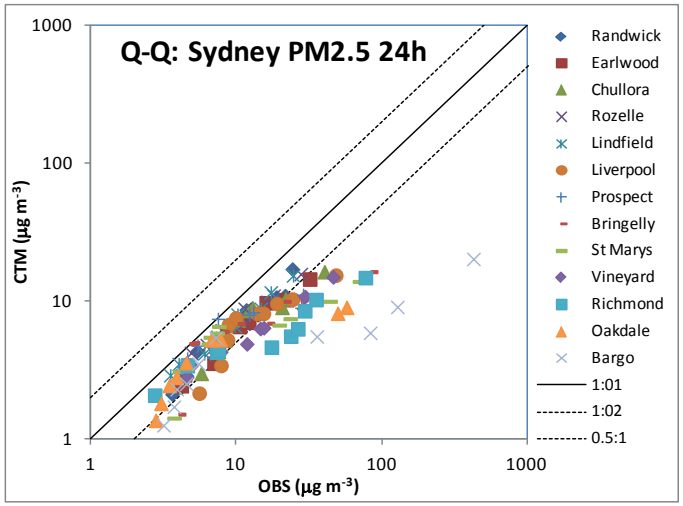
10-25th October 2013
i.e. Wollongong AQMS

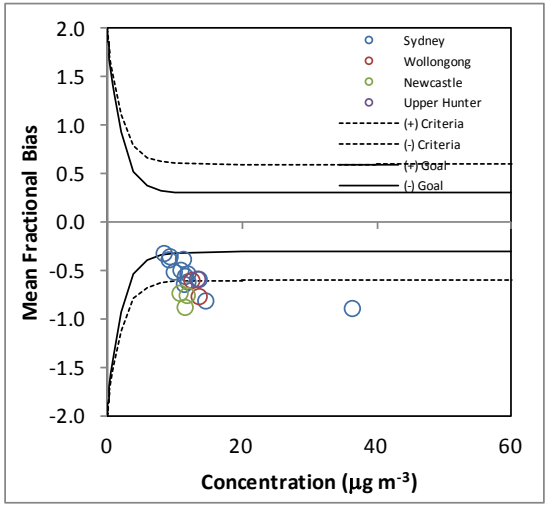


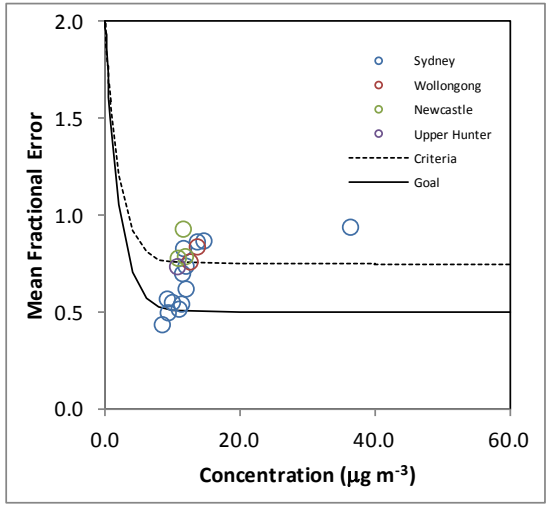


Performance and model sensitivity
Q-Q's, Bias and Error

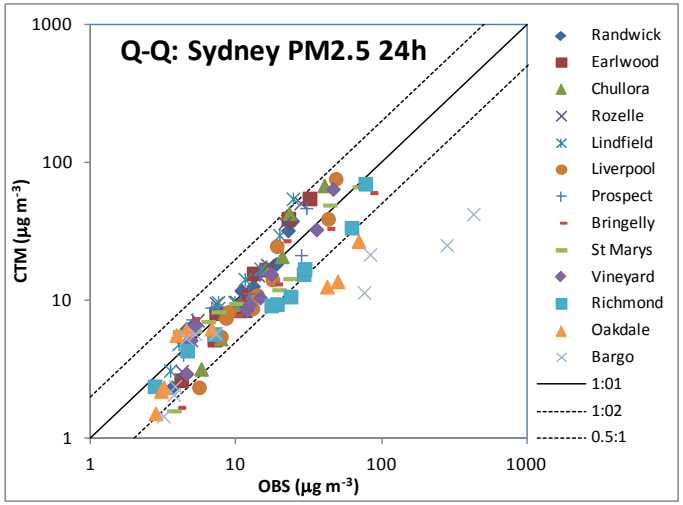
No fires

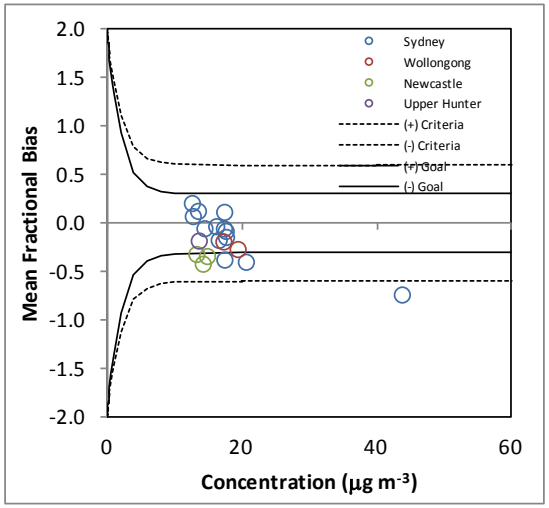


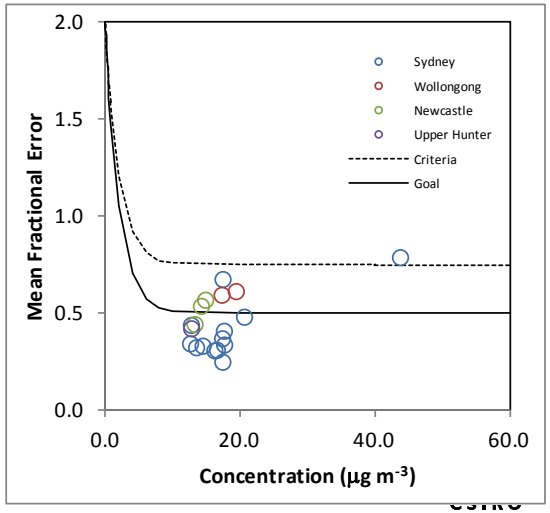




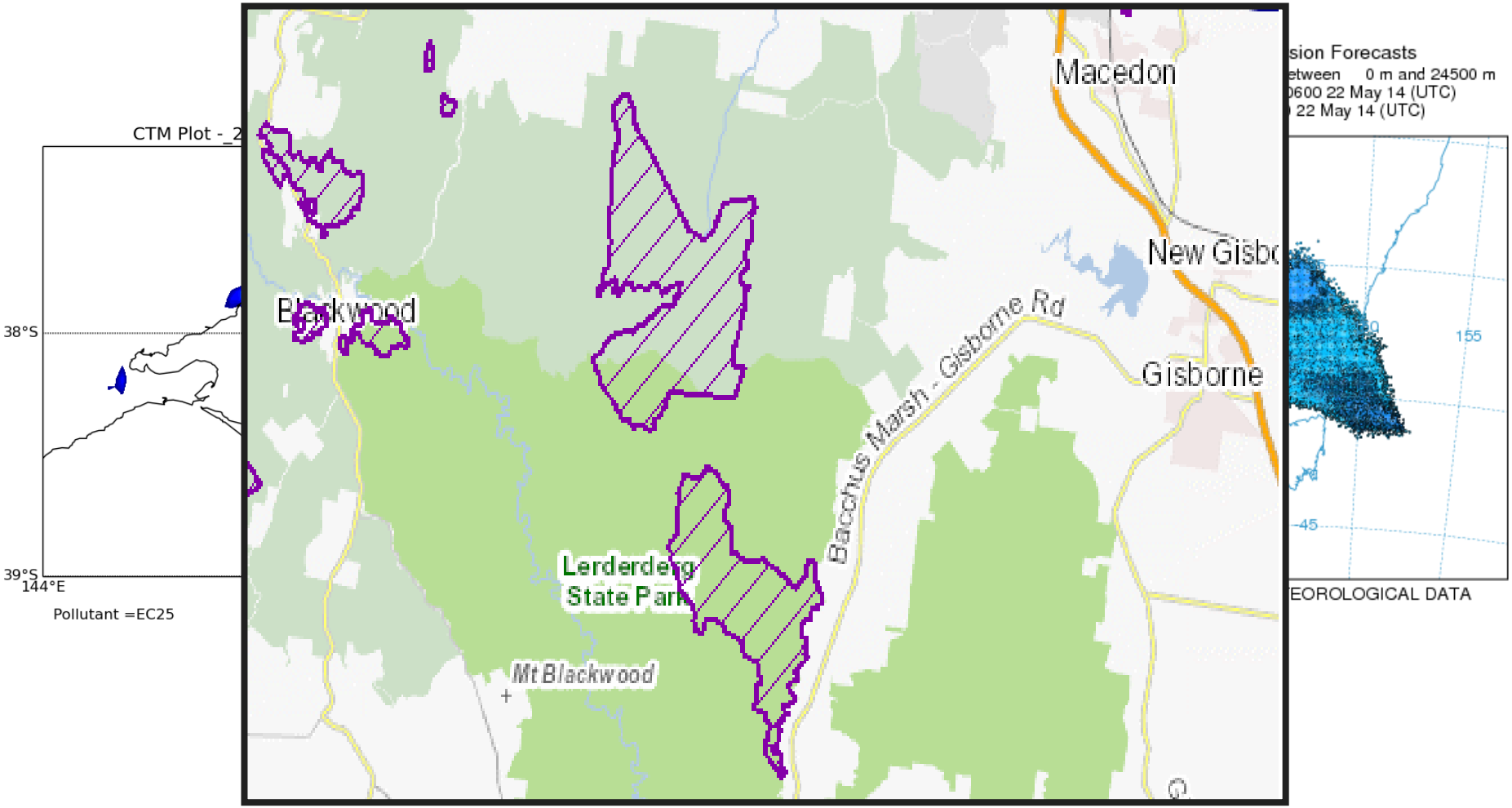
Fires, plume rise =1500m, MCE=0.92







Tier 3 Fuel Reduction Smoke Transport



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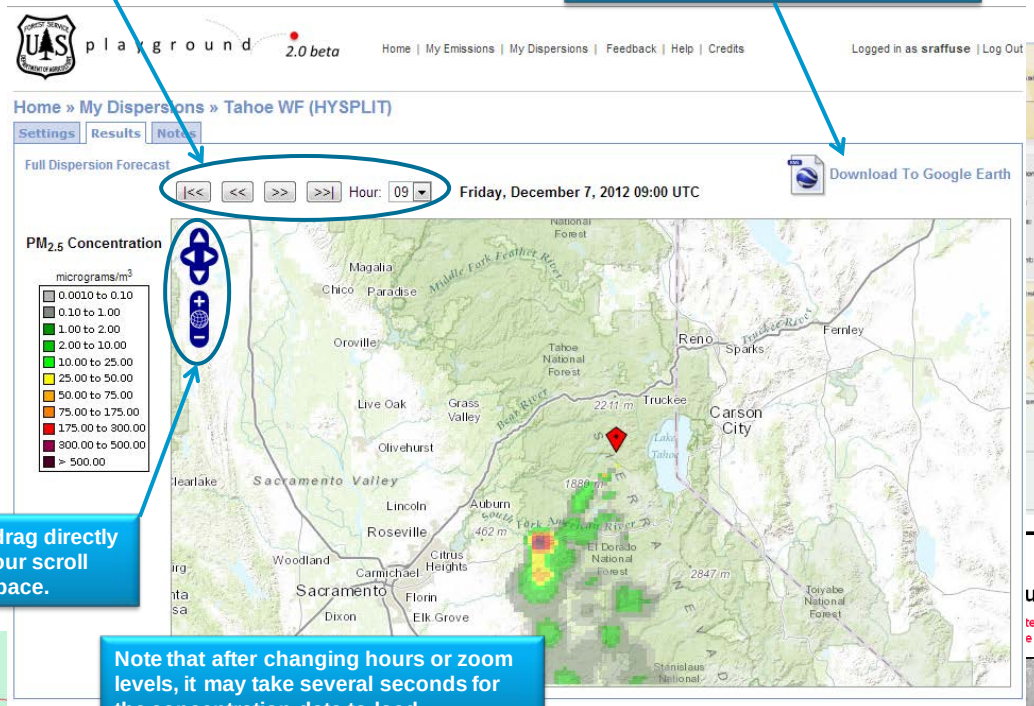
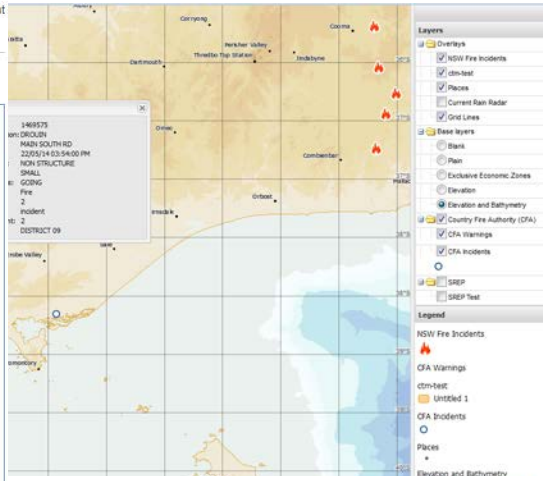
Question- what works best operationally?

Use these buttons to navigate in time.

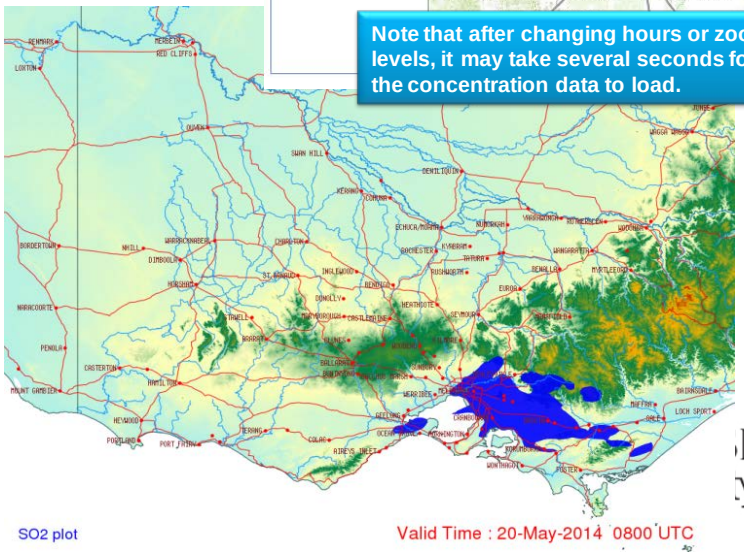
Click here to download the data as a KMZ file for viewing in Google Earth.

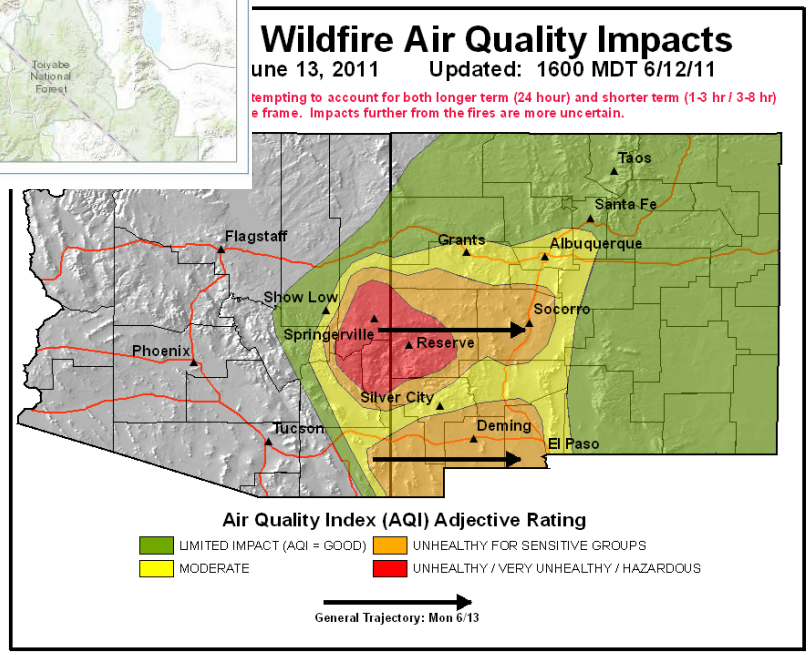




Use these buttons or drag directly on the map and use your scroll wheel to navigate in space.

Note that after changing hours or zoom levels, it may take several seconds for the concentration data to load.





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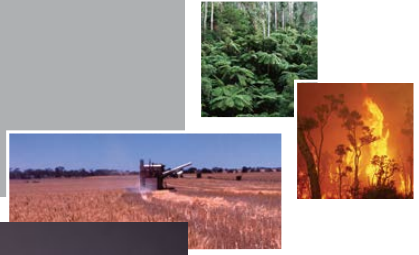
THANKS



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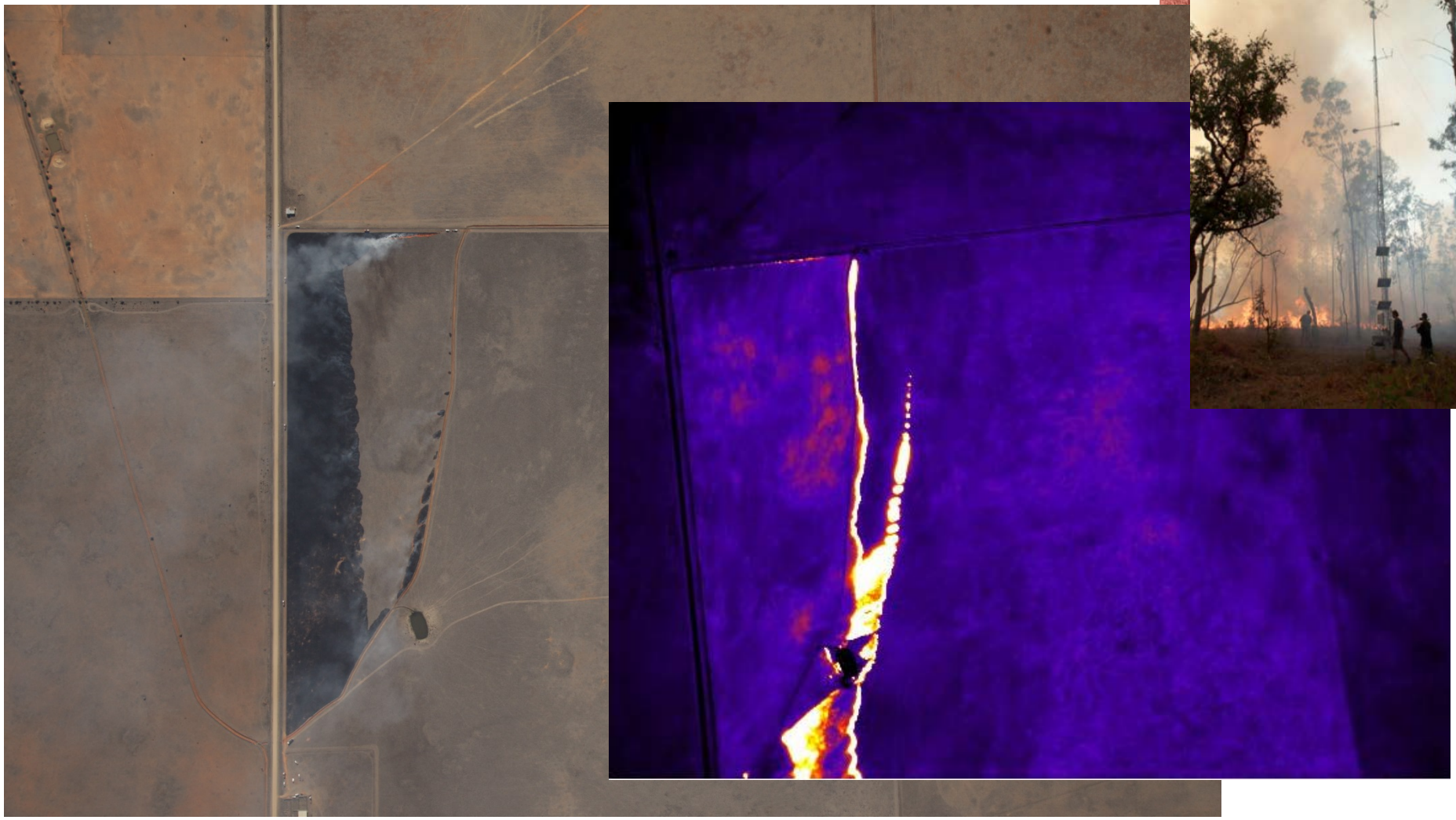
FIRE INTENSITY- VALIDATING SATELLITE FRP



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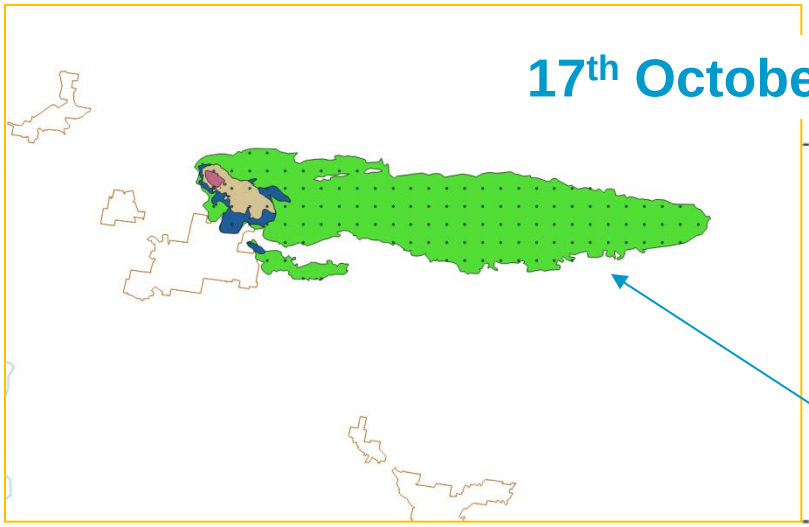
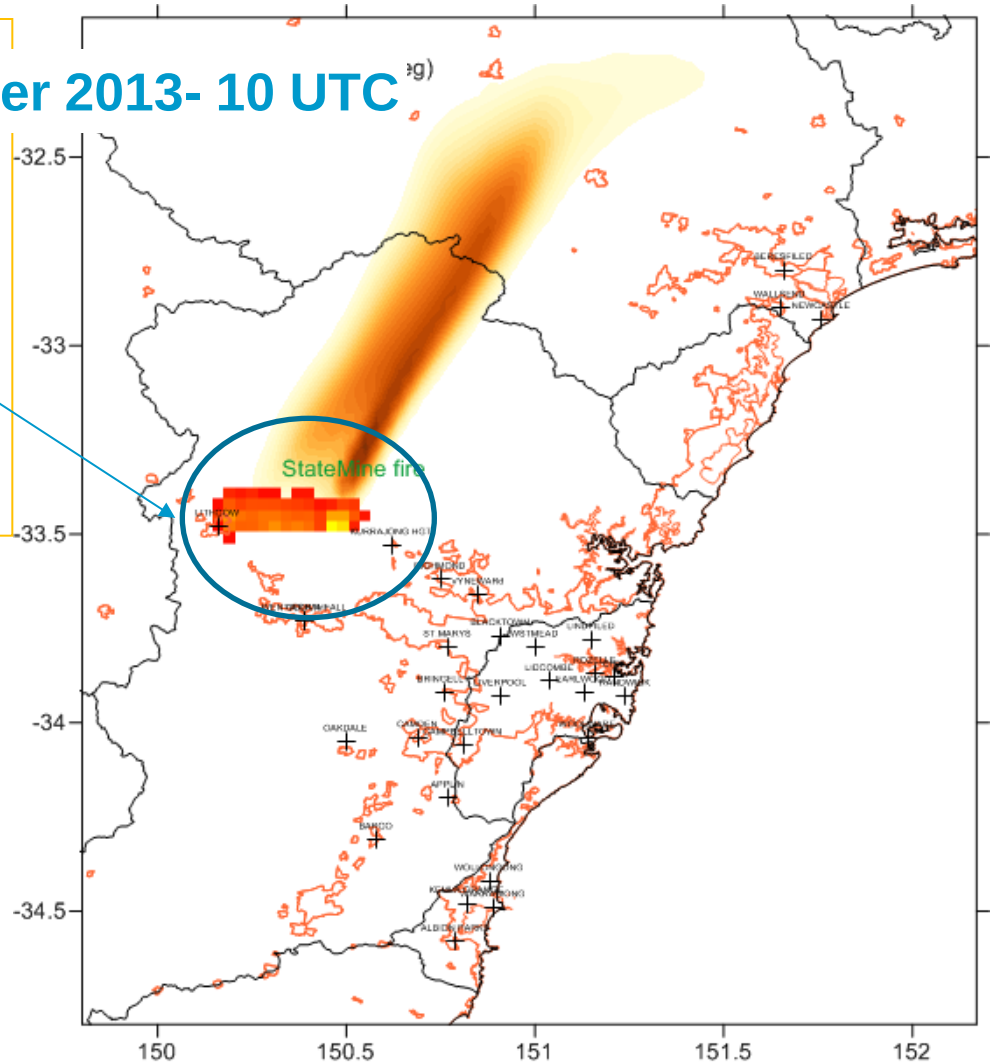
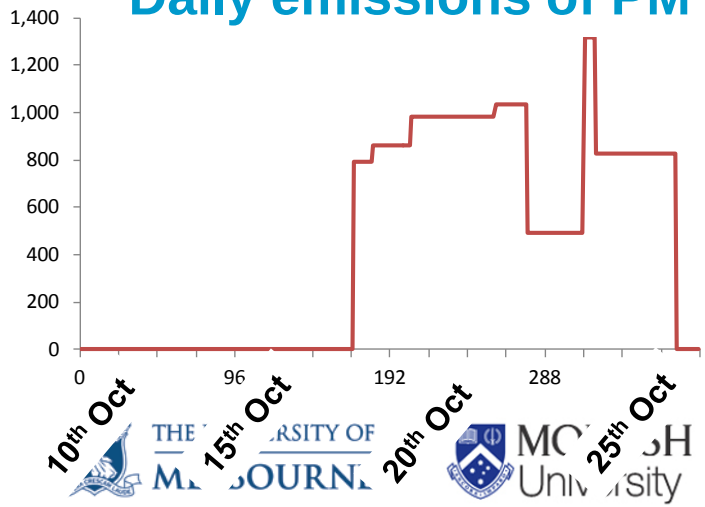
Fire behaviour is modelled with Pheonix



17th October 2013- 10 UTC



Daily emissions of PM



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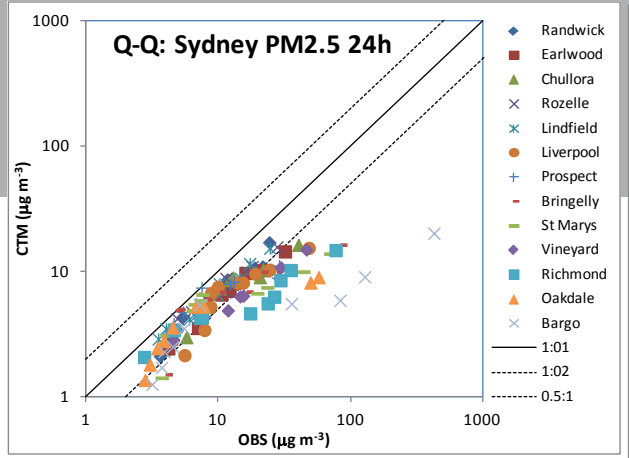
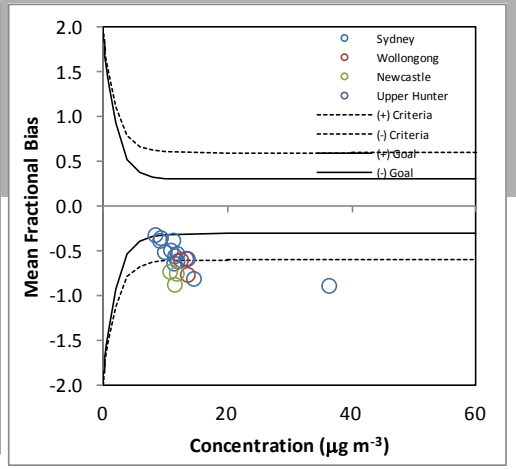
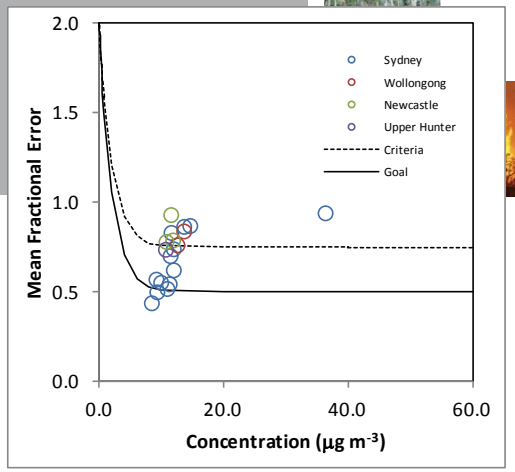
Oct 10-25 2013

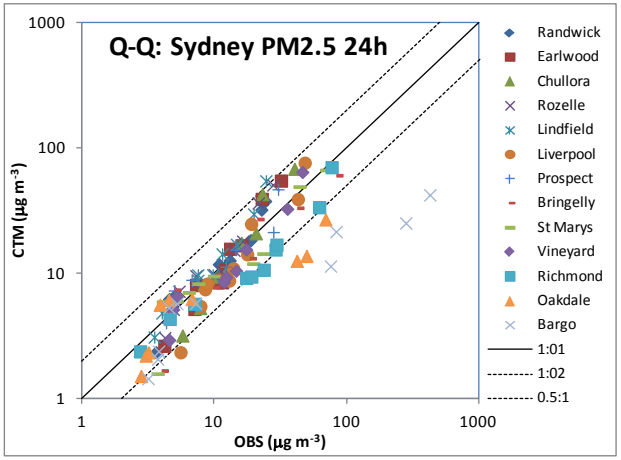
No fires

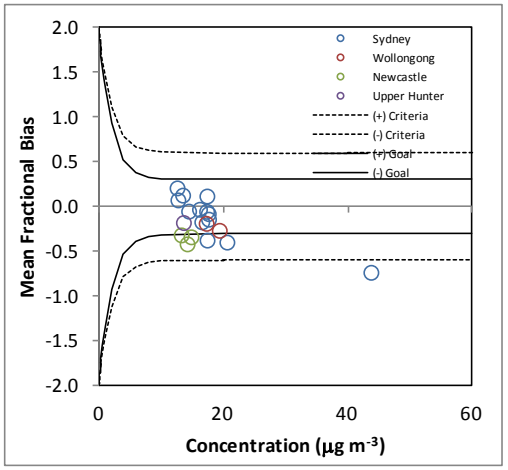


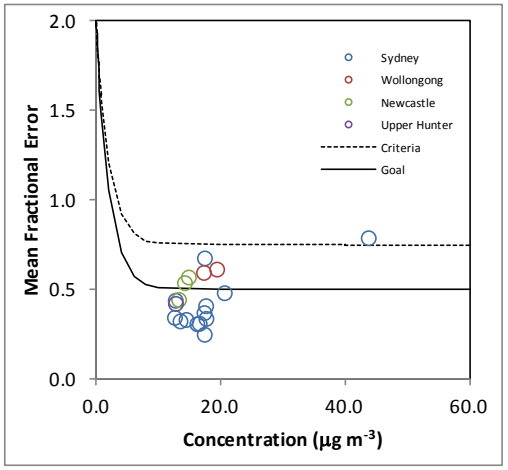
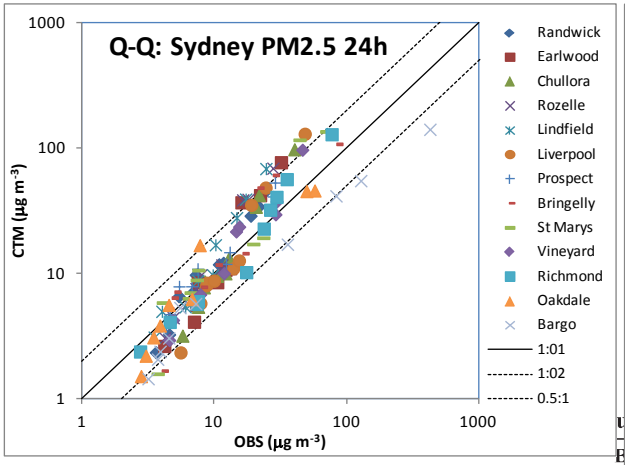
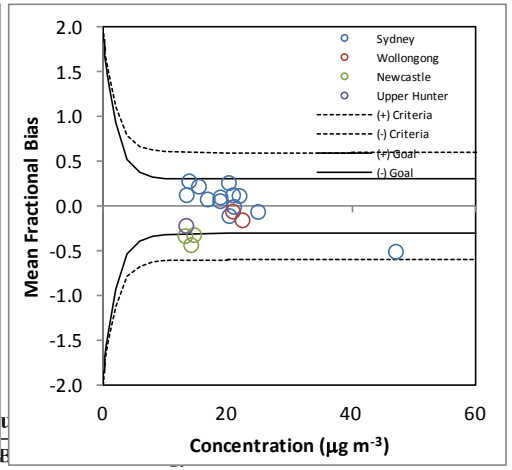
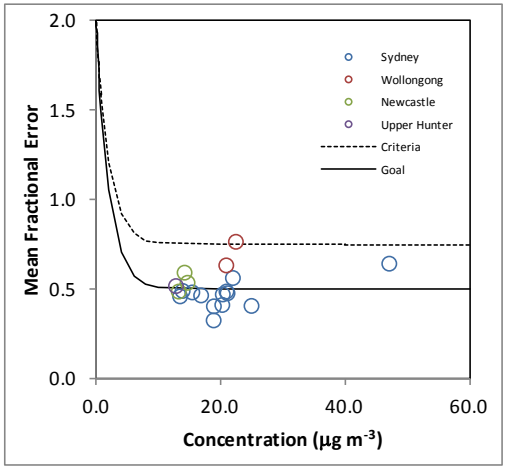




Fires Pr=1500m mce=0.92



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