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FIRE WEATHER

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Thanks to :

Graham Mills

Jeff Kepert

Lachie McCaw

Trent Mattner



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Fire weather and fire behaviour

The Project

Fire weather and fire behaviour

Unexpected fire behaviour – can we explain it through atmospheric processes?

Background

Limitations of the McArthur model (T, RH, wind)

Science required as input to a new rating scheme

... Relevant information in Fire Weather Forecasts.

Research question

How does vertical and spatial atmospheric structure influence fire behaviour?

... Case studies and numerical simulation ...

Methodology

1. Case studies

Kangaroo Island bushfires (December 2007)

Layman fuel reduction burn (October 2010)

2. Numerical simulation

WRF-fire

Timeline

Masters started mid-2010 (2yrs)

Upgrade to PhD late 2011 (3yrs) - completion mid-2013

Results so far

Case studies (2 events, 4 days) when unexpected fire behaviour occurred and linked this to the atmospheric structure (beyond T, RH, wind)

Run the coupled atmospheric-fire behaviour model WRF-fire on an Australian event

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Kangaroo Island bushfires December 2007

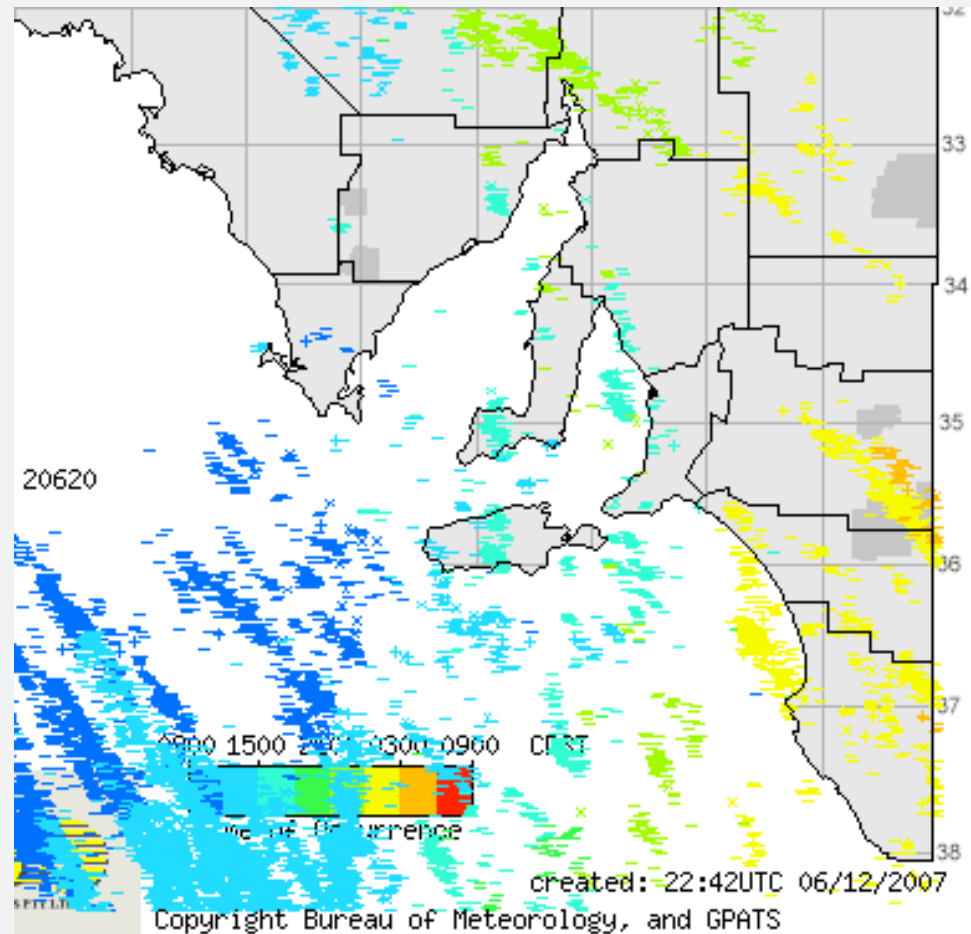
~20 fires ignited by dry lightning

4 fires burnt for ~ 2 weeks

20% of the island burnt

Unusual fire activity

8th and 9th December



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8th December – D'Estrees Bay fire

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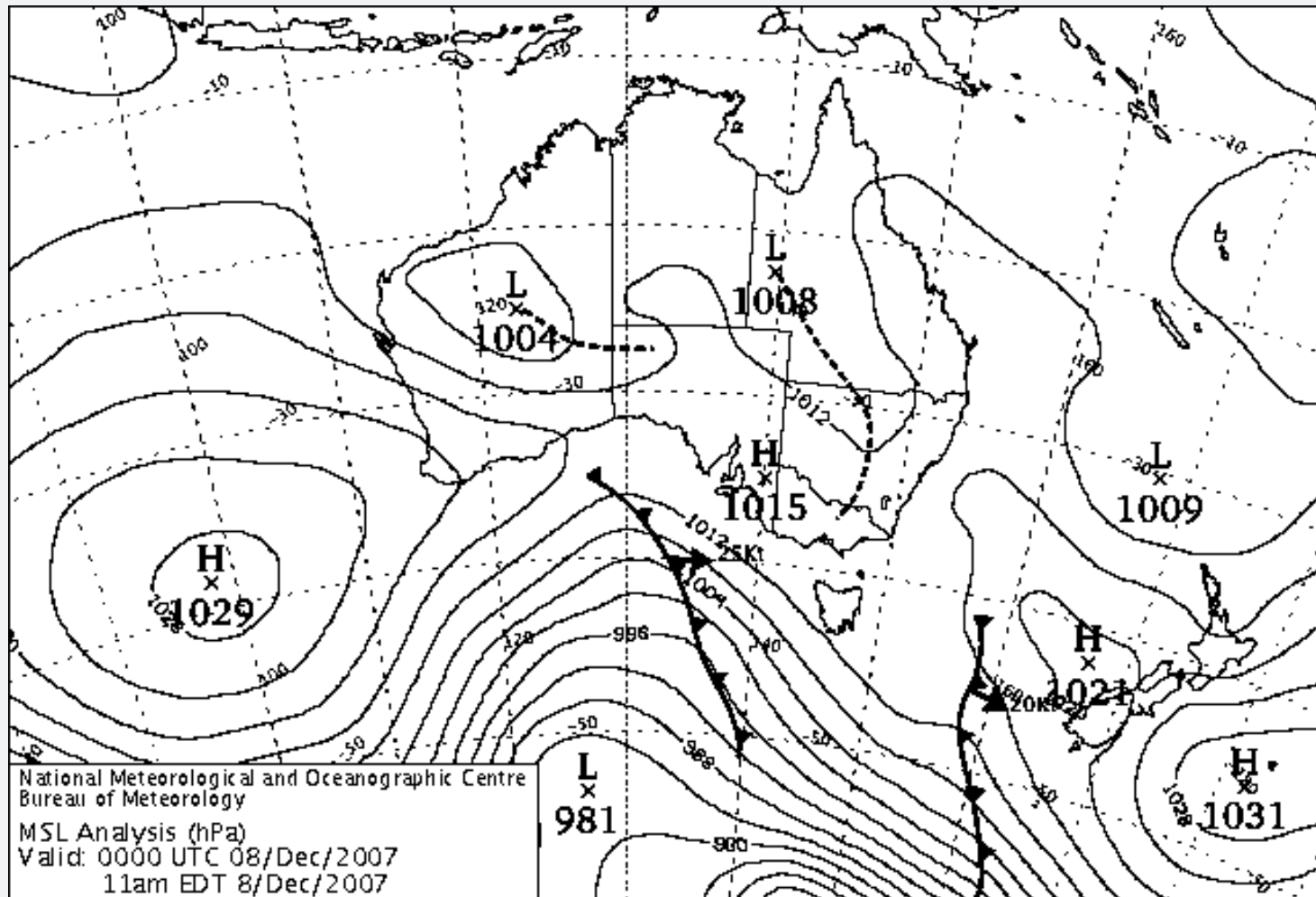
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7th December ~ 3pm

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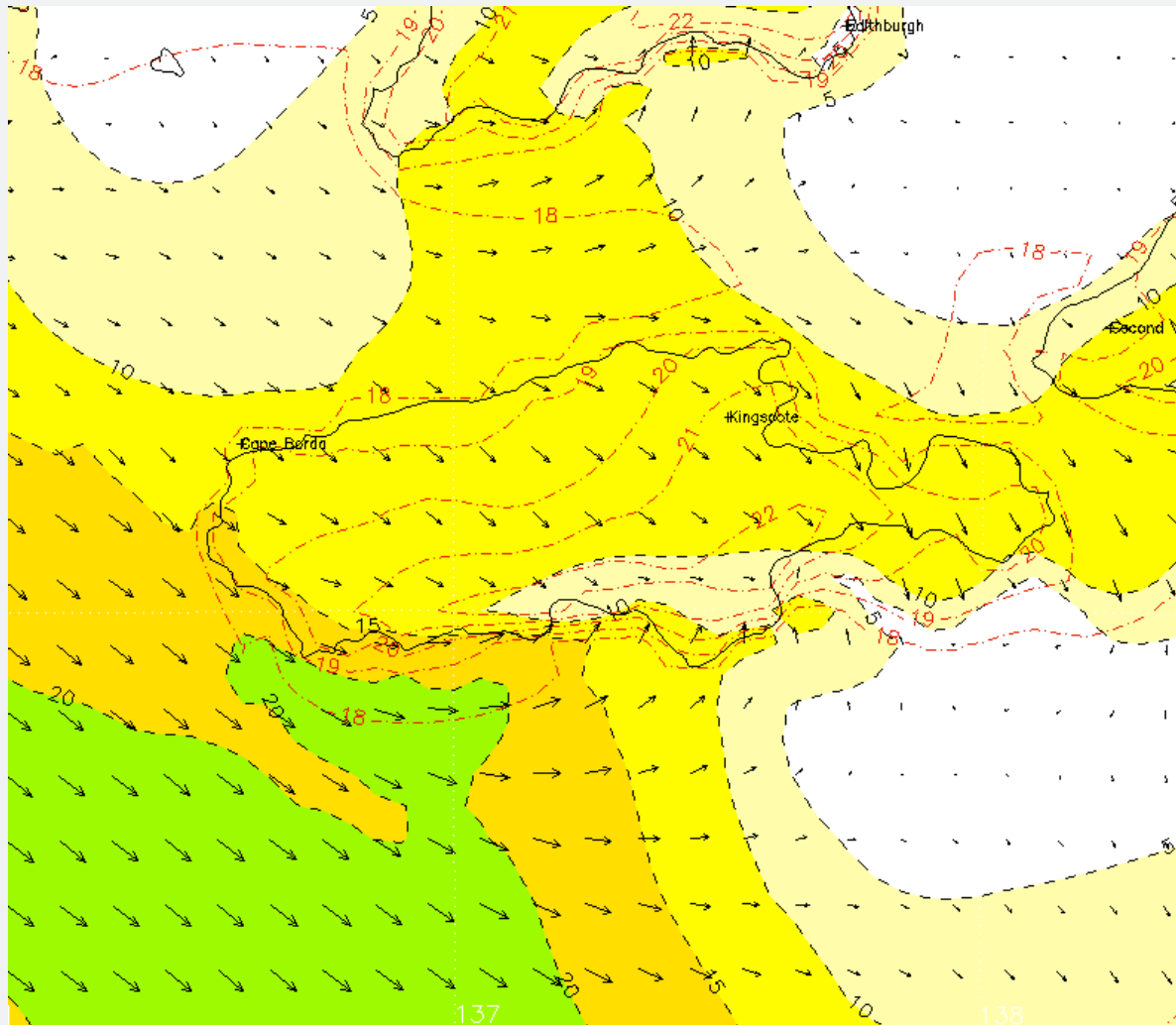
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MSLP chart 00UTC 8th December

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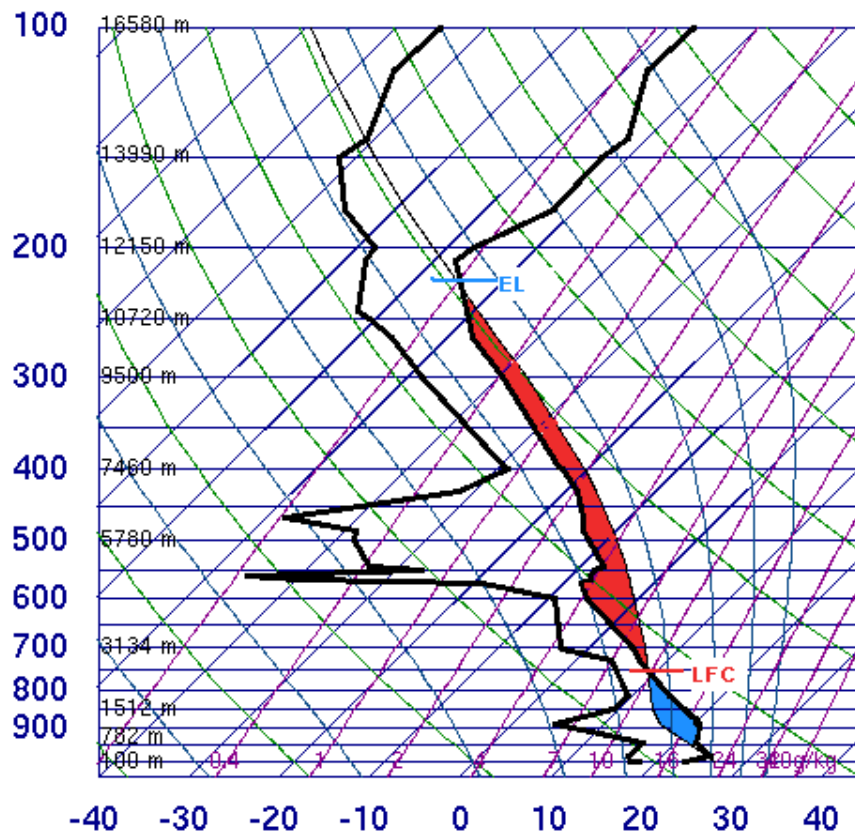


MesoLAPS 05UTC wind (knots) and temperature

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16044 LIPD Udine



SLAT	46.03
SLON	13.18
SELV	94.00
SHOW	-1.02
LIFT	-3.13
LFTV	-3.72
SWET	193.8
KINX	30.70
CTOT	21.30
VTOT	29.30
TOTL	50.60
CAPE	922.5
CAPV	1030.
CINS	-155.
CINV	-123.
EQLV	227.4
EQTV	227.2
LFCT	751.1
LFCV	761.8
BRCH	17.33
BRCV	19.36
LCLT	287.9
LCLP	871.3
MLTH	299.4
MLMR	12.29
THCK	5660.
PWAT	33.10

00Z 03 Aug 2009

University of Wyoming

“FireCAPE”

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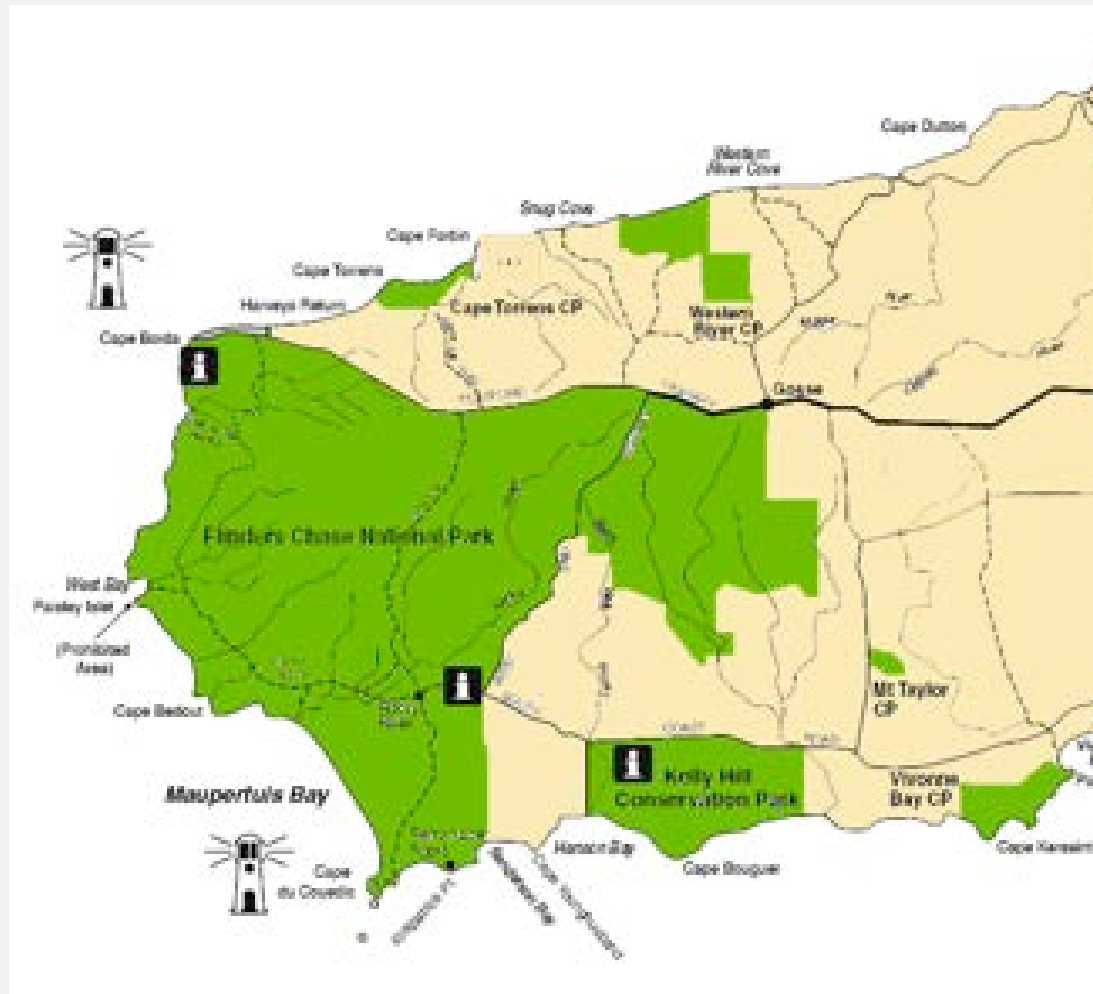
Convergence, conditionally unstable atmosphere

(could also happen at other coastal locations)

Fire intensity cf. fire spread

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Rocky River fire – 9th December 2007

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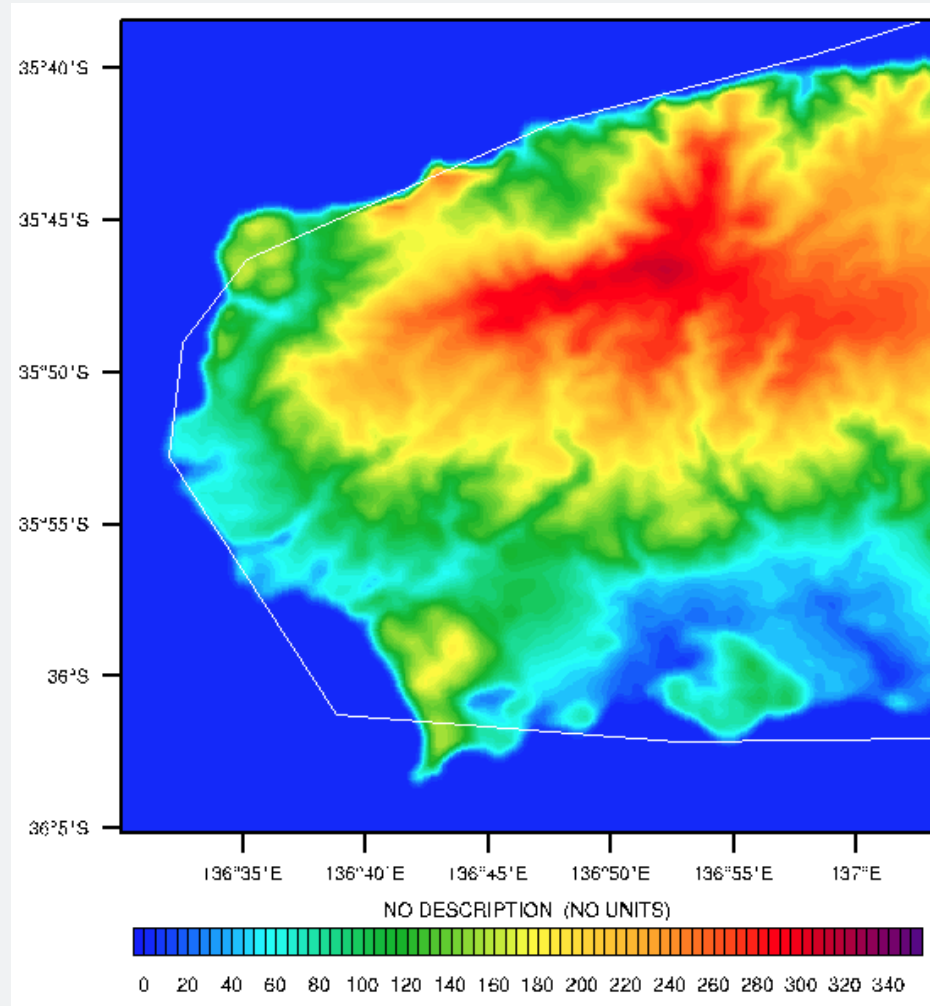
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... Fire crews were evacuated from the area ahead of the intense, rapidly approaching fire. Aircraft water bombing efforts had no impact. As the head fire approached the highway, spotting activity resulted in the ignition of a second fire on the northern side of the highway, 1-2 km ahead of the main fire front. The second fire was drawn back into the main head fire, against the prevailing winds, over a distance of a kilometer or more and flame heights were estimated to reach 45-50m. Experienced fire managers had never seen the like, particularly in mild temperatures not expected to be conducive to extreme fire behaviour.

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Rocky River fire

Topography, very dry heavy fuels, dry air aloft

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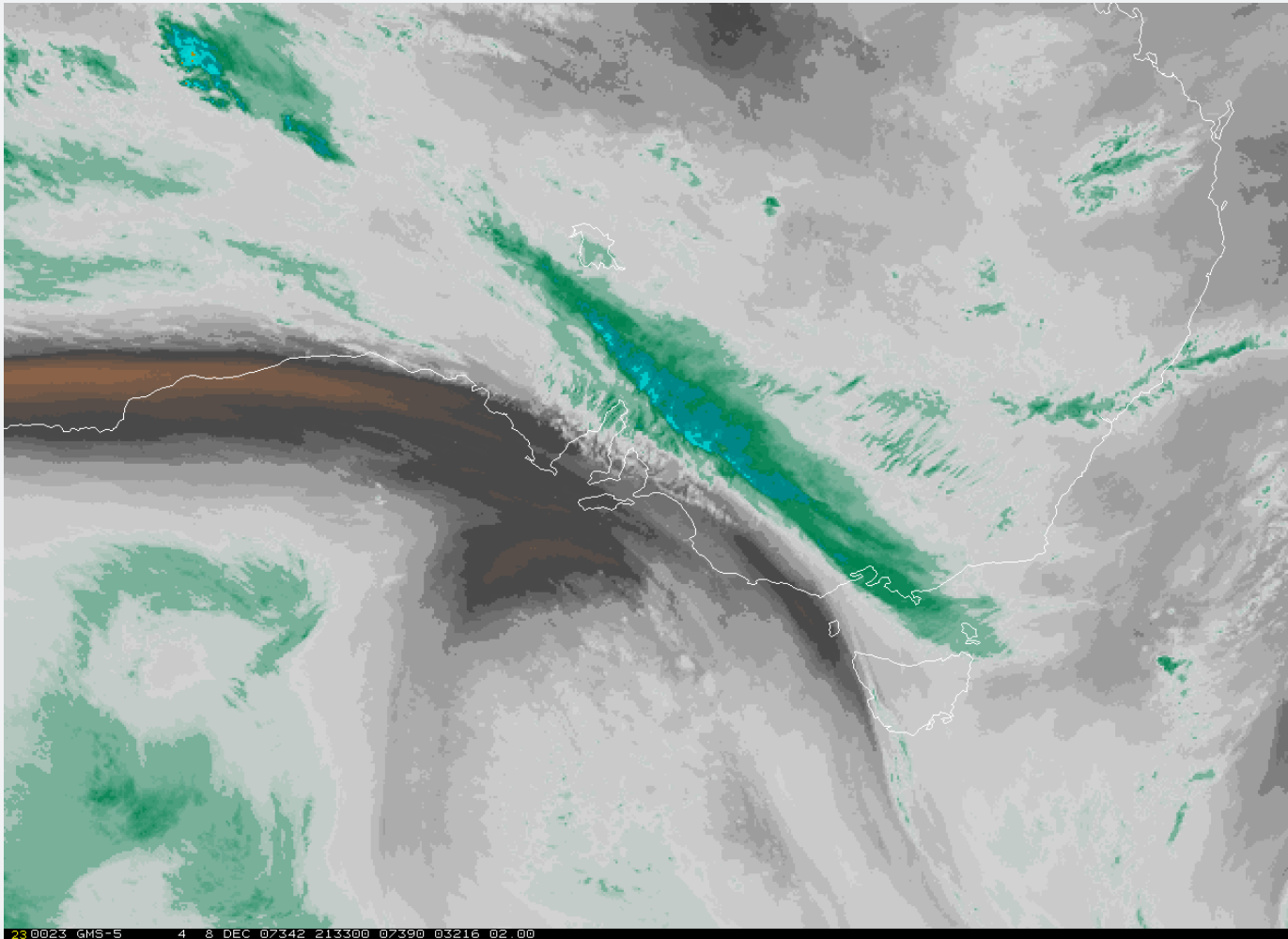


Rocky River fire

Topography, **very dry heavy fuels**, dry air aloft

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Rocky River fire

Topography, very dry heavy fuels, **dry air aloft**

Case study findings ...

In the Kangaroo Island (and Layman) fires

- Convection columns (feedback)
- Low level wind convergence
- Potential instability (FireCAPE)
- Dry air aloft (mixed down by the convection column?)

Where to from here ... Fire behaviour models

WRF-fire simulations

Completed so far... (nearly 18 months)

1. Kangaroo Island case study. Published as a CAWCR Technical Report (~50pp)
2. Layman fuel reduction burn case study (draft completed)
(Submission to AMOJ journal late 2011)
3. Low resolution WRF-fire runs of Kangaroo Island fires
4. MODSIM conference paper accepted

Work presented to ...

1. Fire Weather Workshop
2. American Meteorological Society conference
3. SA CFS

Future plans ... (next 18 months)

- MODSIM conference in Perth December 2011 & invited to DEC WA (Layman burn)
- Presentation to DEH SA (late 2011)
- Presentation to AMOS conference early 2012 (?)

- High-resolution WRF-fire runs of Kangaroo Island fires (late 2011 - early 2012)
- Two further (numerical/simulation) studies planned to follow-up findings from the case studies (2012-2013).

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Thank you