Watch out!
Latest Findings…

Recent research results from
ESA Risk Management Section
in collaboration with:
BushfireCRC HighFire Risk
project and
Bureau of Meteorology.

1) CLIMATE CHANGE

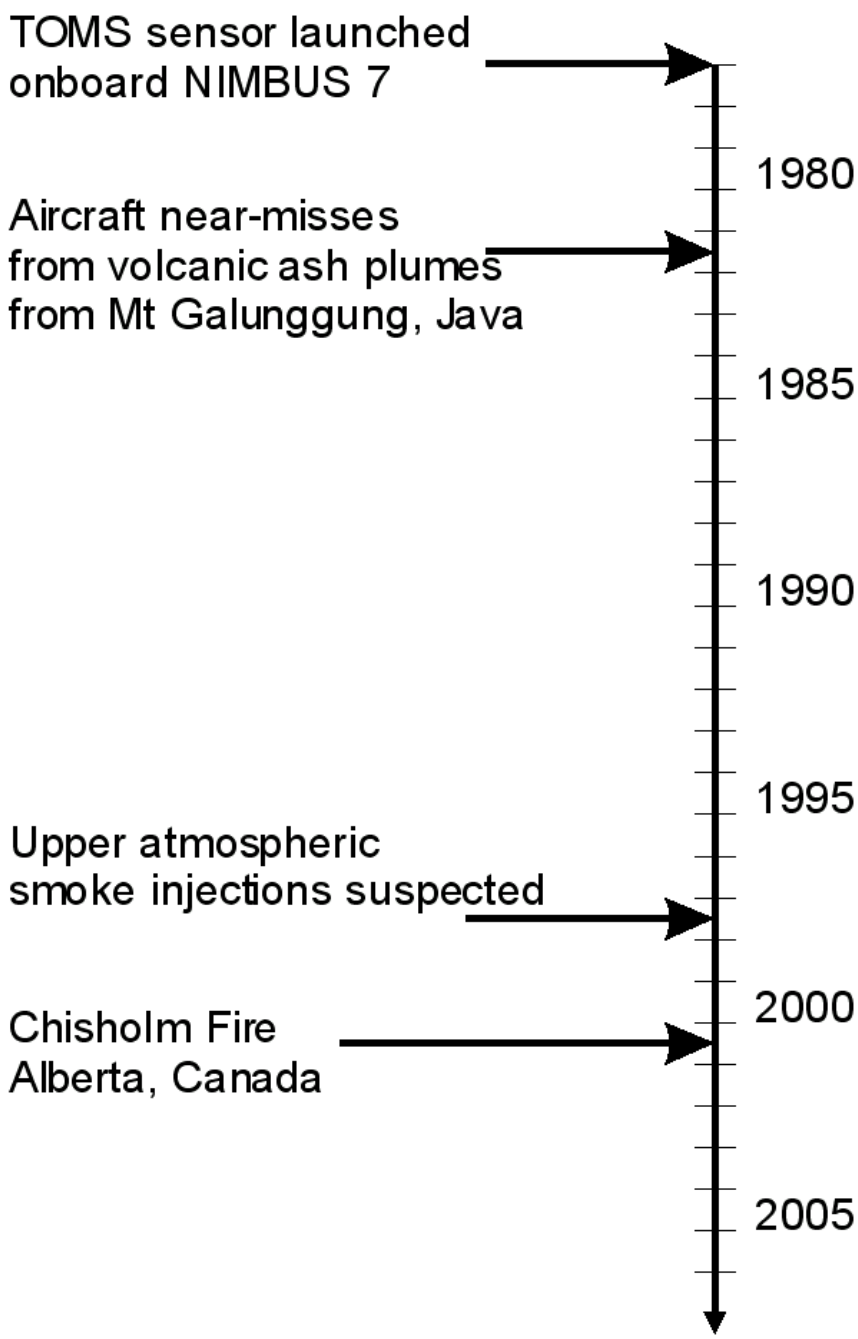
- It is possible that we are experiencing severe fire behaviour in way that is different to what we experienced in the past. The things that we need to watch out for are changing.

CLIMATE CHANGE

- PODER THE QUESTION:
  How would climate change manifest itself in the Australian wildfire arena?
- Examine data from 30 years of global satellite monitoring for major upper atmospheric particulates injection events (includes volcanoes, dust storms and nuclear detonations).

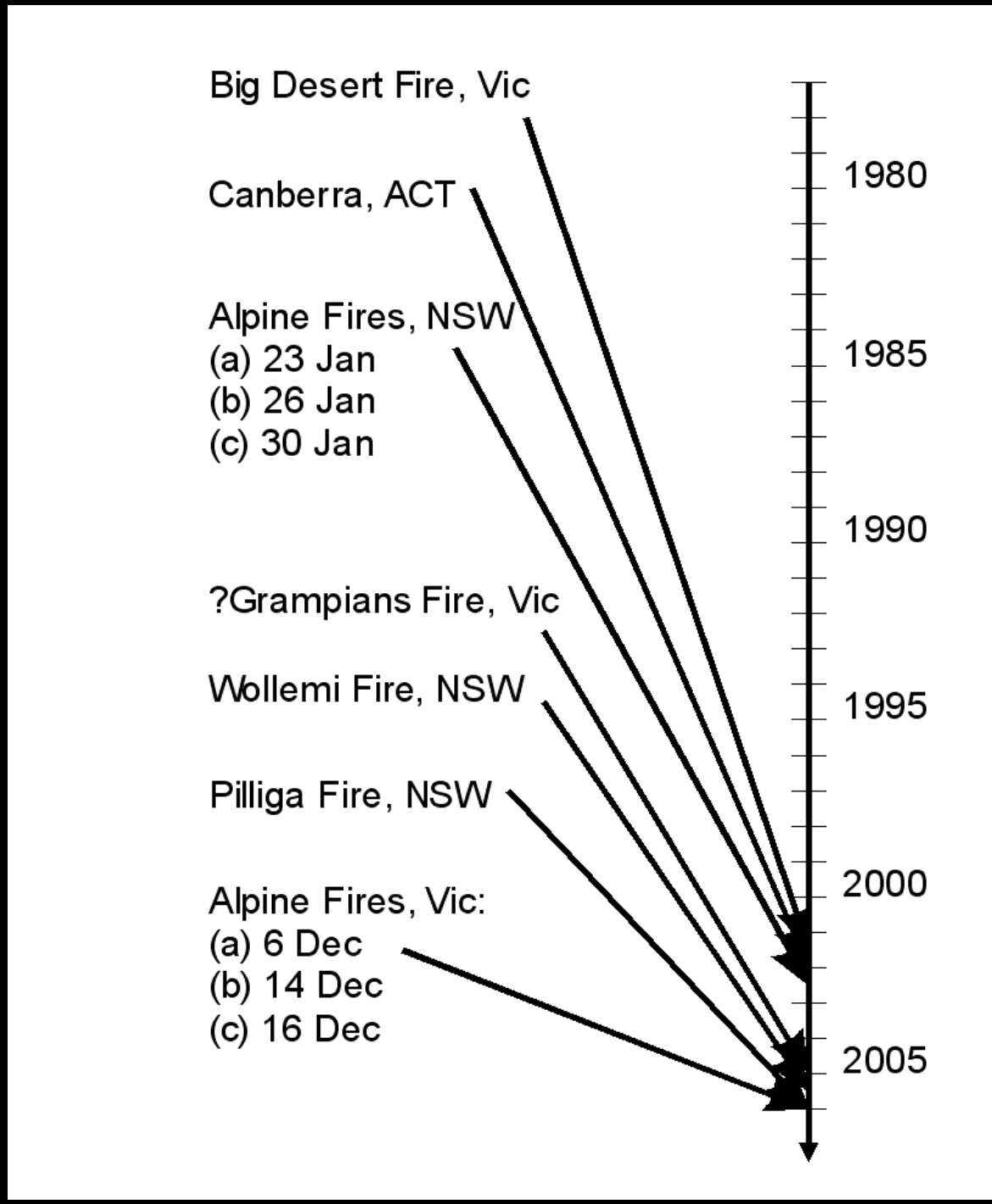
Global pyroCb hunt

- Chisholm = first confirmed pyroCb and UTLS injection



Aust pyroCb data

- Canberra = first well observed case study & first validation of “nuclear winter” hypothesis.
- 1983 Ash Wednesday did not earn a place on this list.

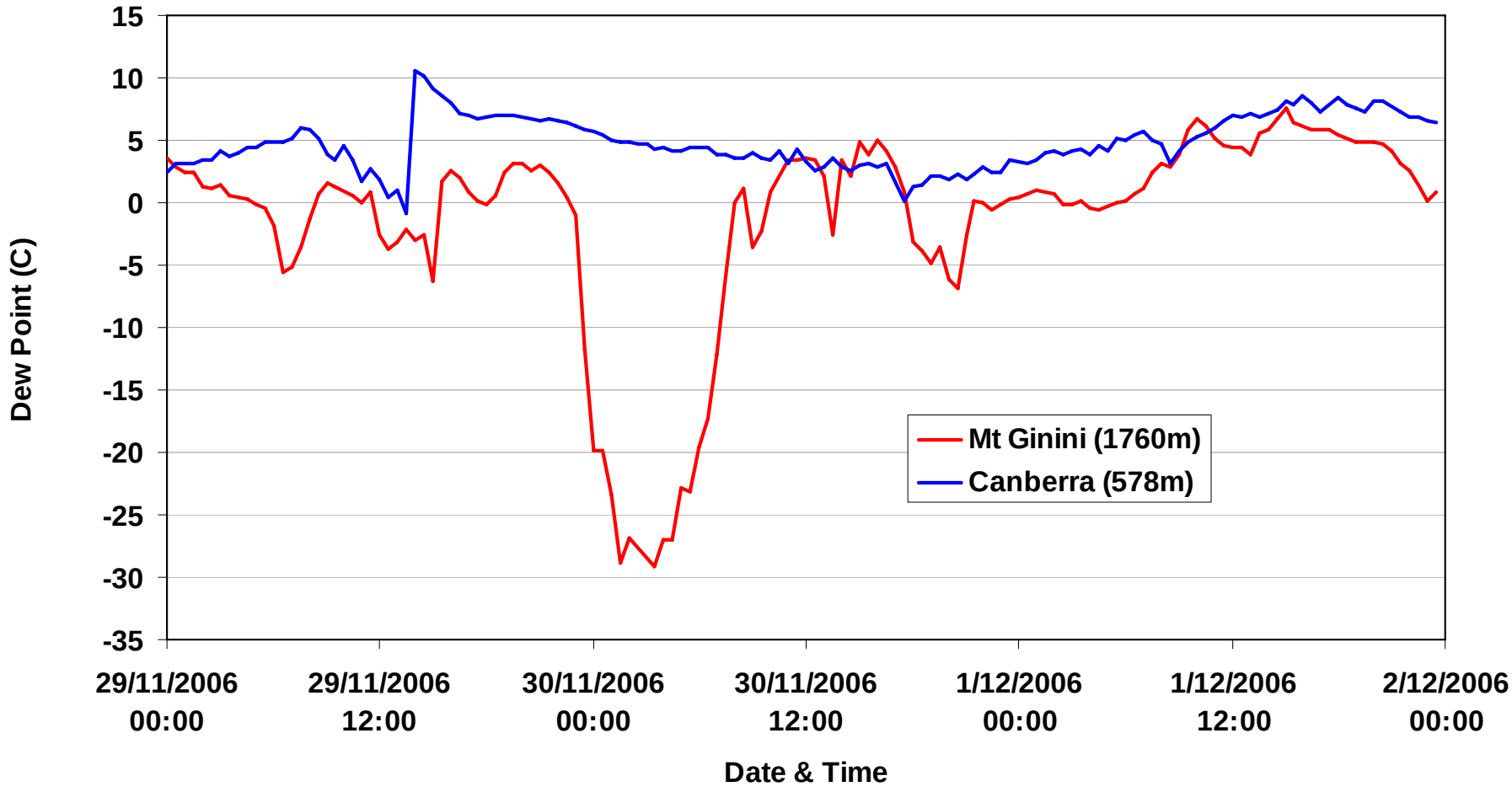


- Fromm, M., Tupper, A., Rosenfeld, D., Severanckx, R. and McRae, R. (2006). Violent pyro-cumulonimbus storm devastates Australia's capital and pollutes the stratosphere. *Geophysical Research Letters* Vol **33** L05815

2) DEW POINT DEPRESSION

- In alpine and sub-alpine areas there can be a spike in FDI between midnight and sunrise.
- This is often the time when crews are tasked to light back-burns.
- RESULT: crowning at 3 am!

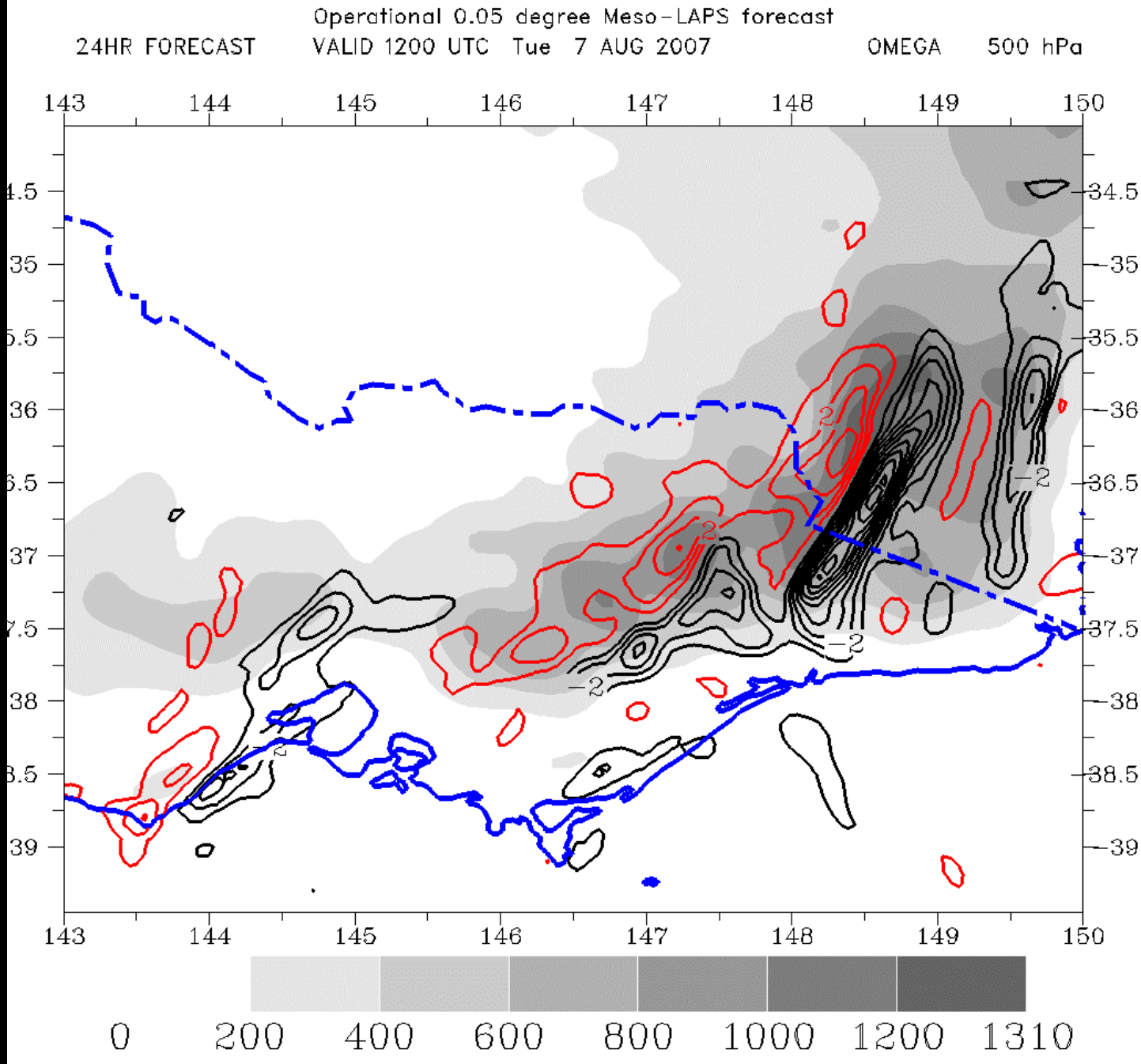
Weather Anomalies



- Title: An analysis of anomalous dewpoint temperatures in the south-eastern Australian high country.
- Author(s): J.J. Sharples, R.H.D. McRae, R.O. Weber, G.A. Mills
- Status: In preparation – case study selection still underway

3) DOWNSLOPE WINDS

- A number of processes can accelerate winds downslope on the lee side of the ranges:
  - Foehn Winds
  - Low level jets
  - Mountain wind waves
- Some also bring drier air with them.


Operational 0.05 degree Meso-LAPS forecast
24HR FORECAST
VALID 1200 UTC Tue 7 AUG 2007
OMEGA 500 hPa
143
144
145
146
147
148
149
150
34.5
35
35.5
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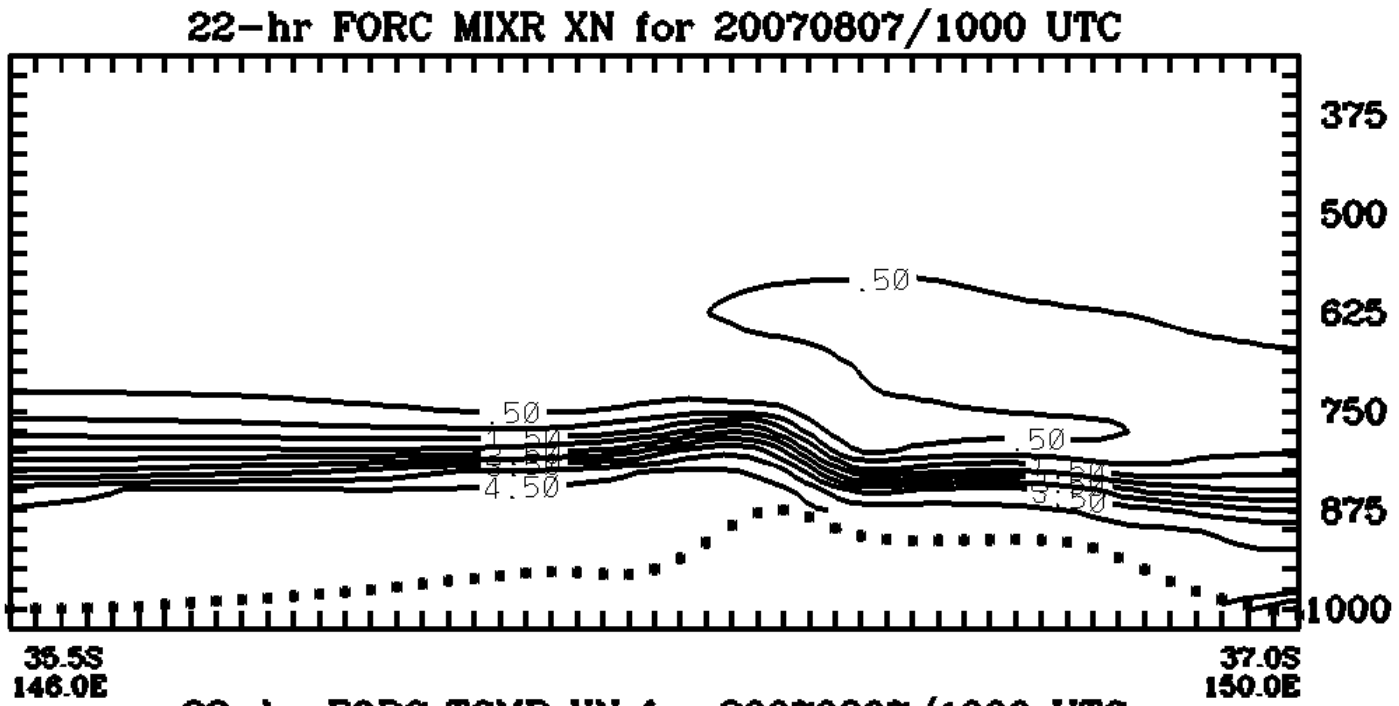
22-hr FORC MIXR XN for 20070807/1000 UTC
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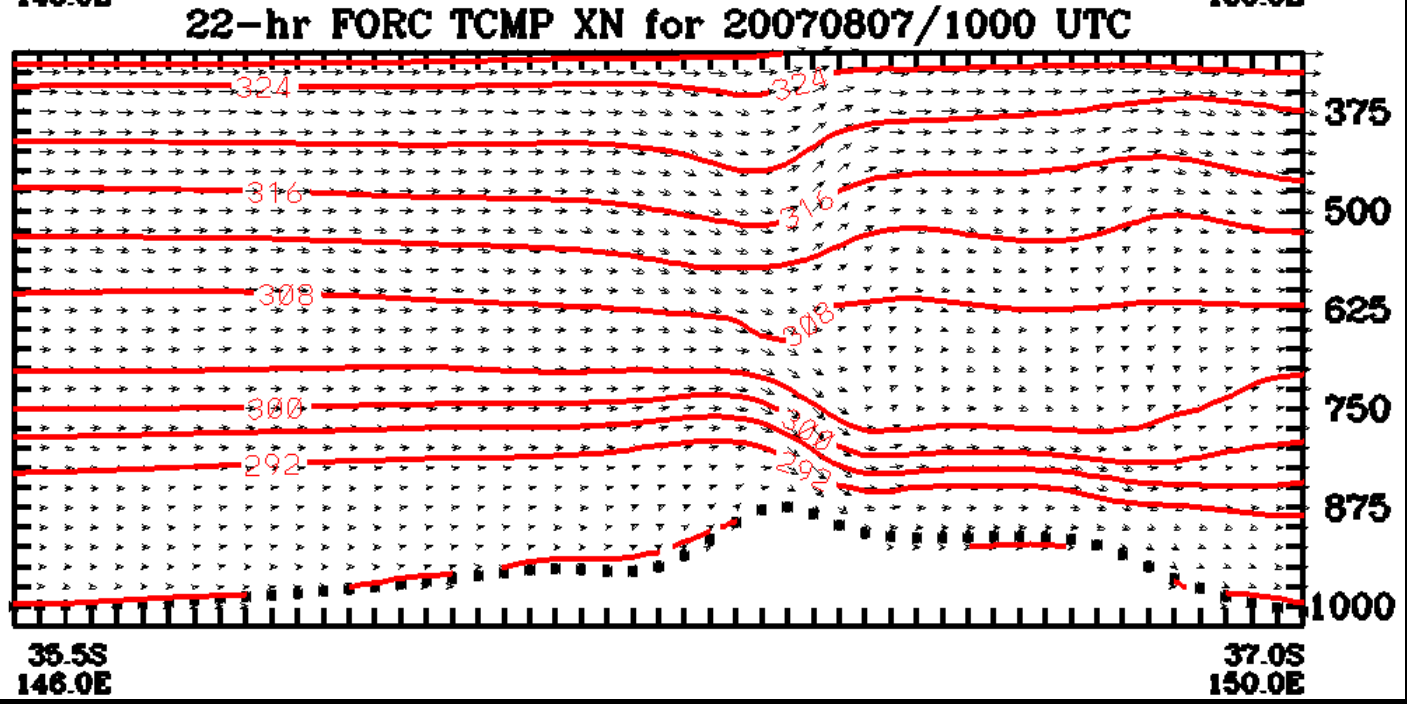
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324
316
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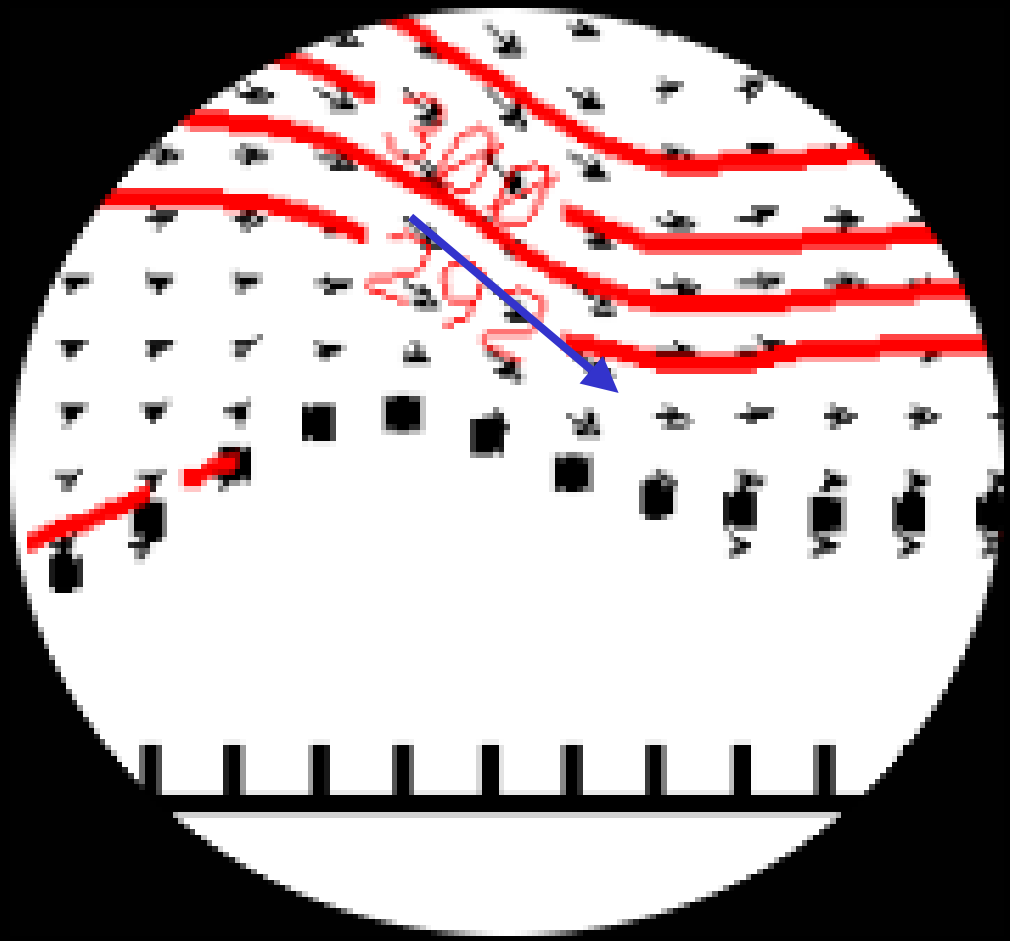
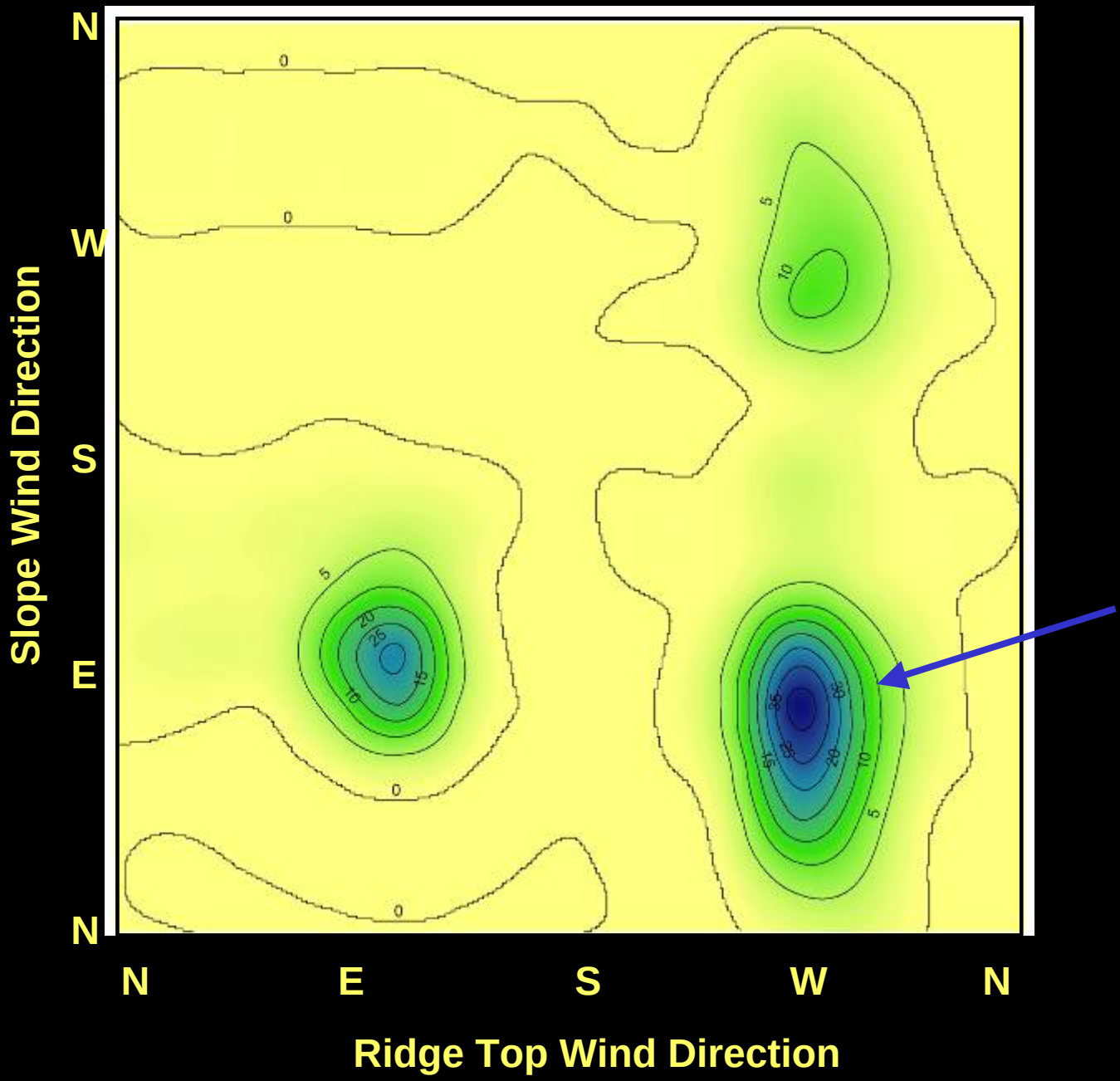
- Downslope winds
- Warming (red lines)



Mountain wind waves in proximity to complex fires, 17 Jan 03. [MODIS]

4) CHANNELLING

- Fires can display dangerous and rapid sideways spread in valleys that lie across the wind direction. This also results in ember storms and landscape-scale conflagrations.


N
W
S
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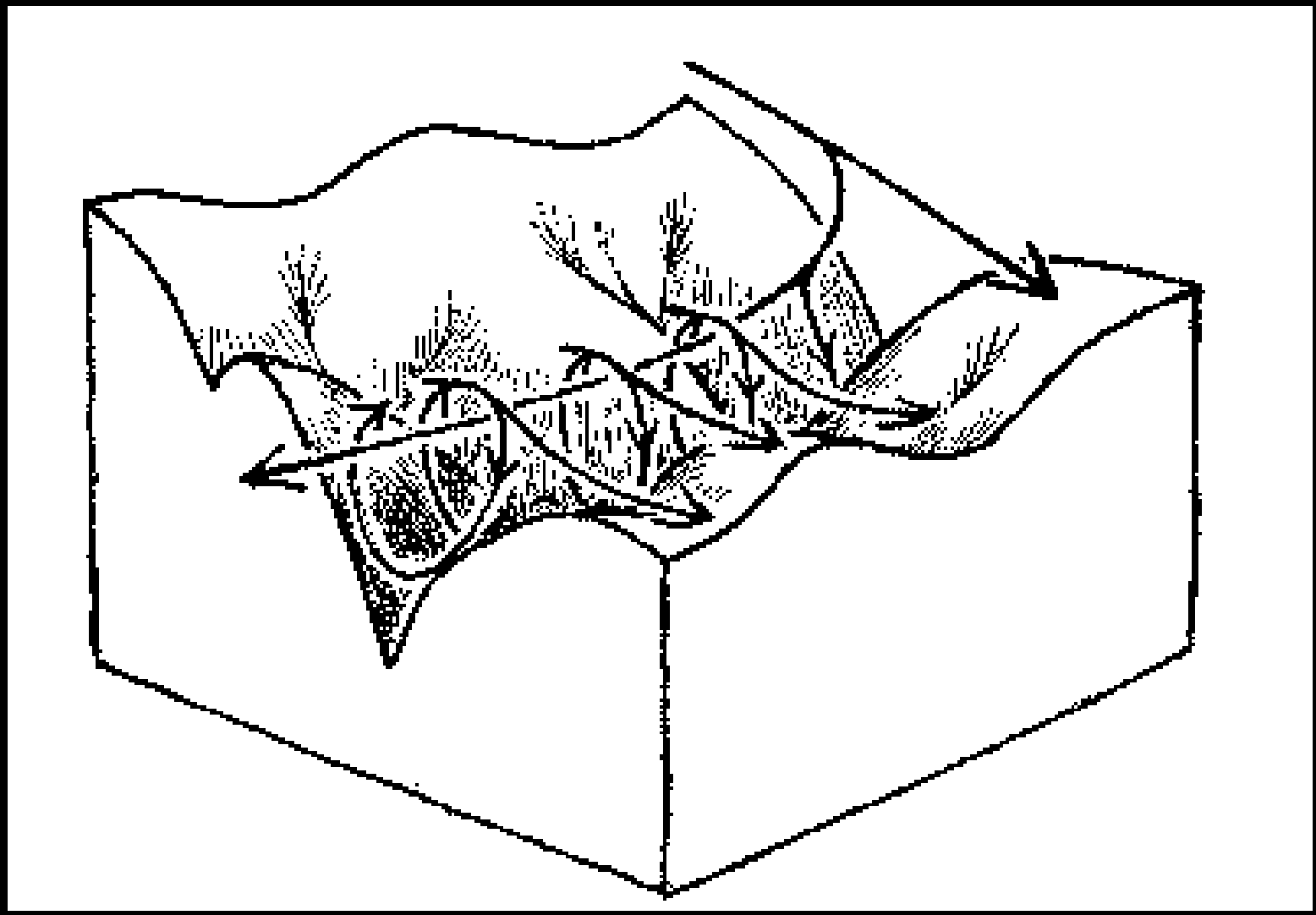
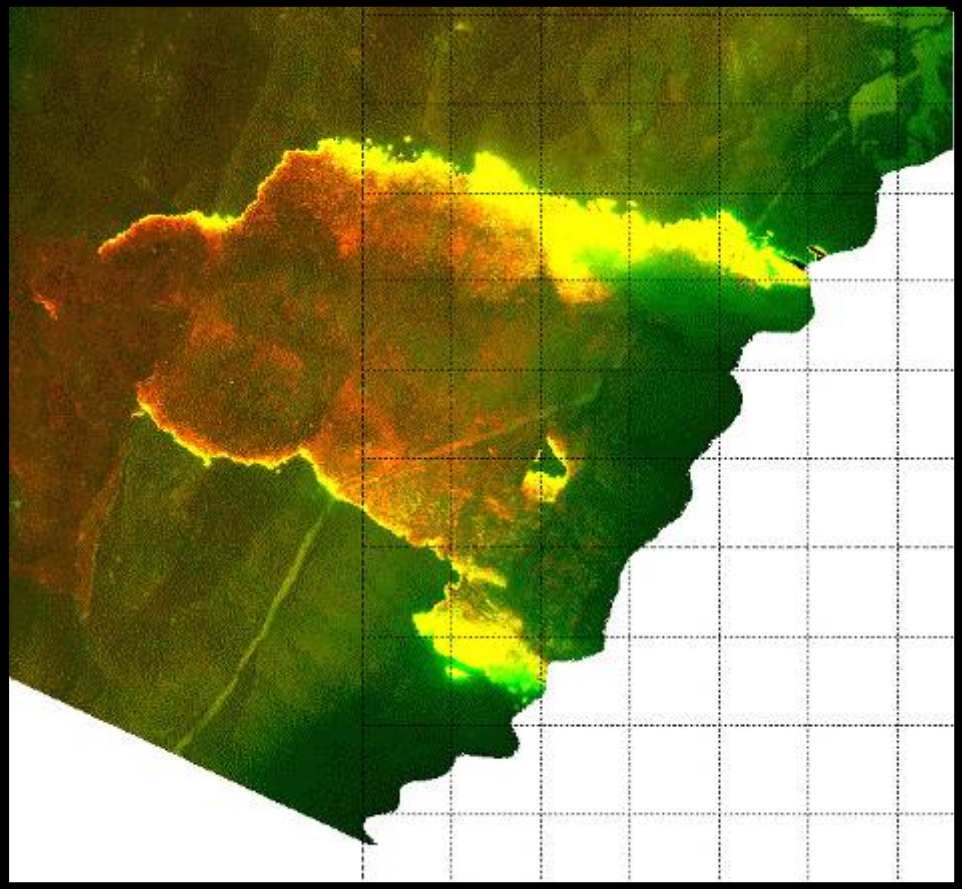
N
Slope Wind Direction
N
E
S
W
N
Ridge Top Wind Direction

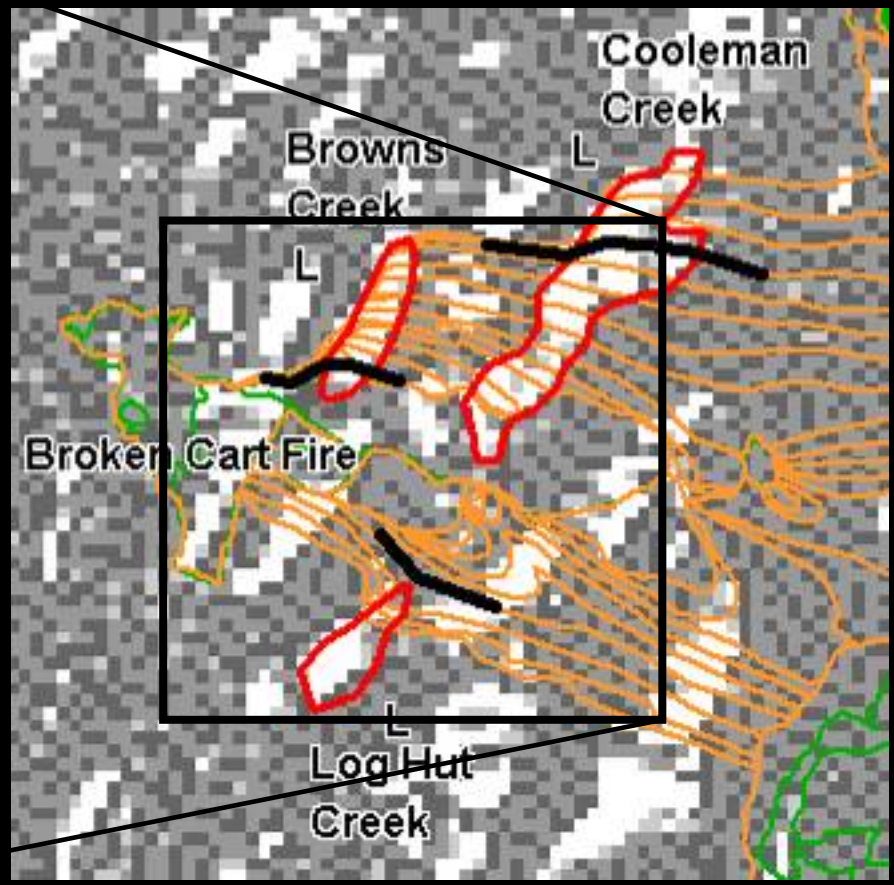
- Joint Wind Direction Distribution for Ridge and East facing slope
- Tidbinbilla ACT
- Data collected in the Brindabella Ranges suggests that separation eddies are a common feature in rugged landscapes!

Dynamic Channelling

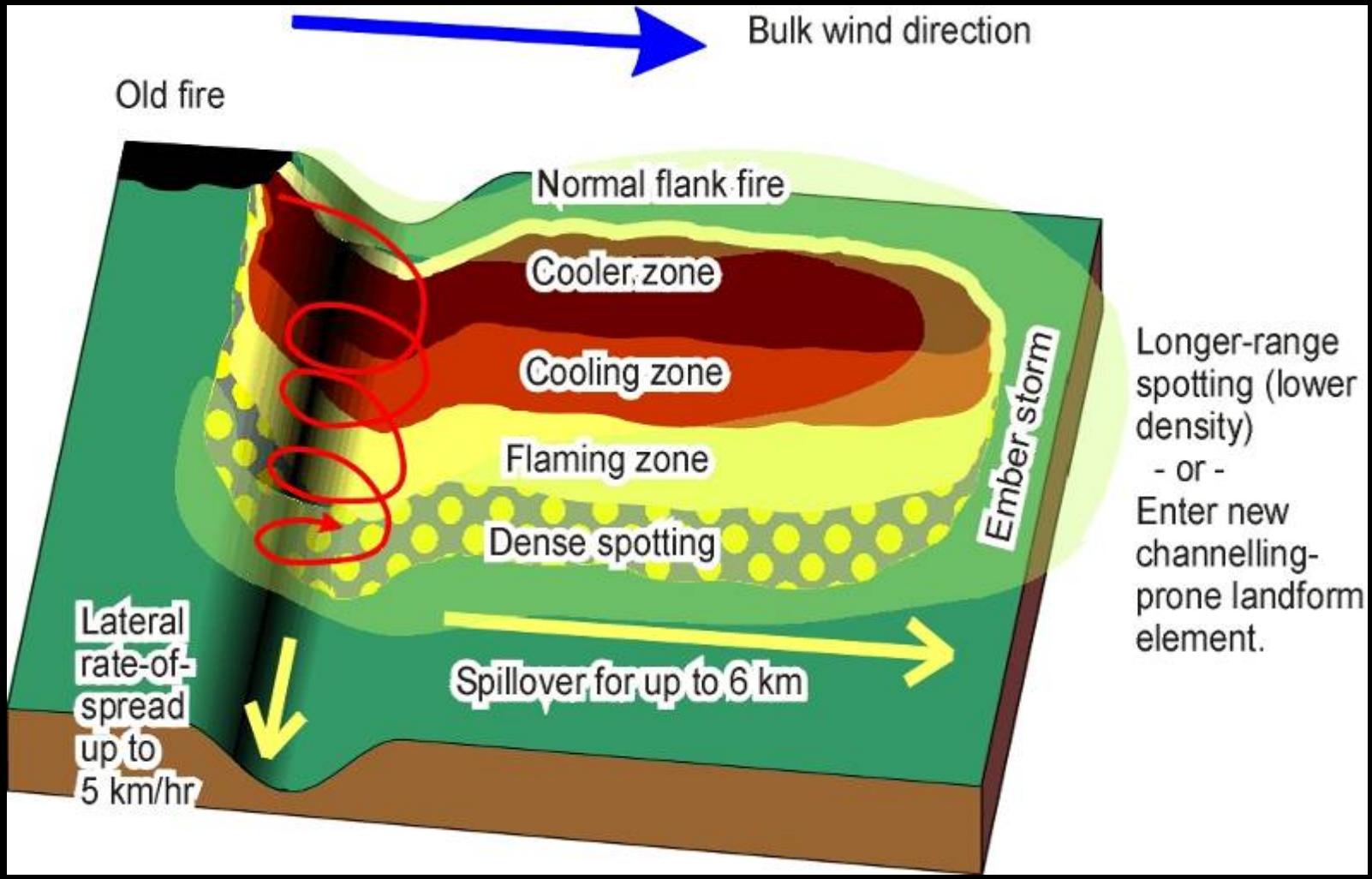


Dynamic Channelling

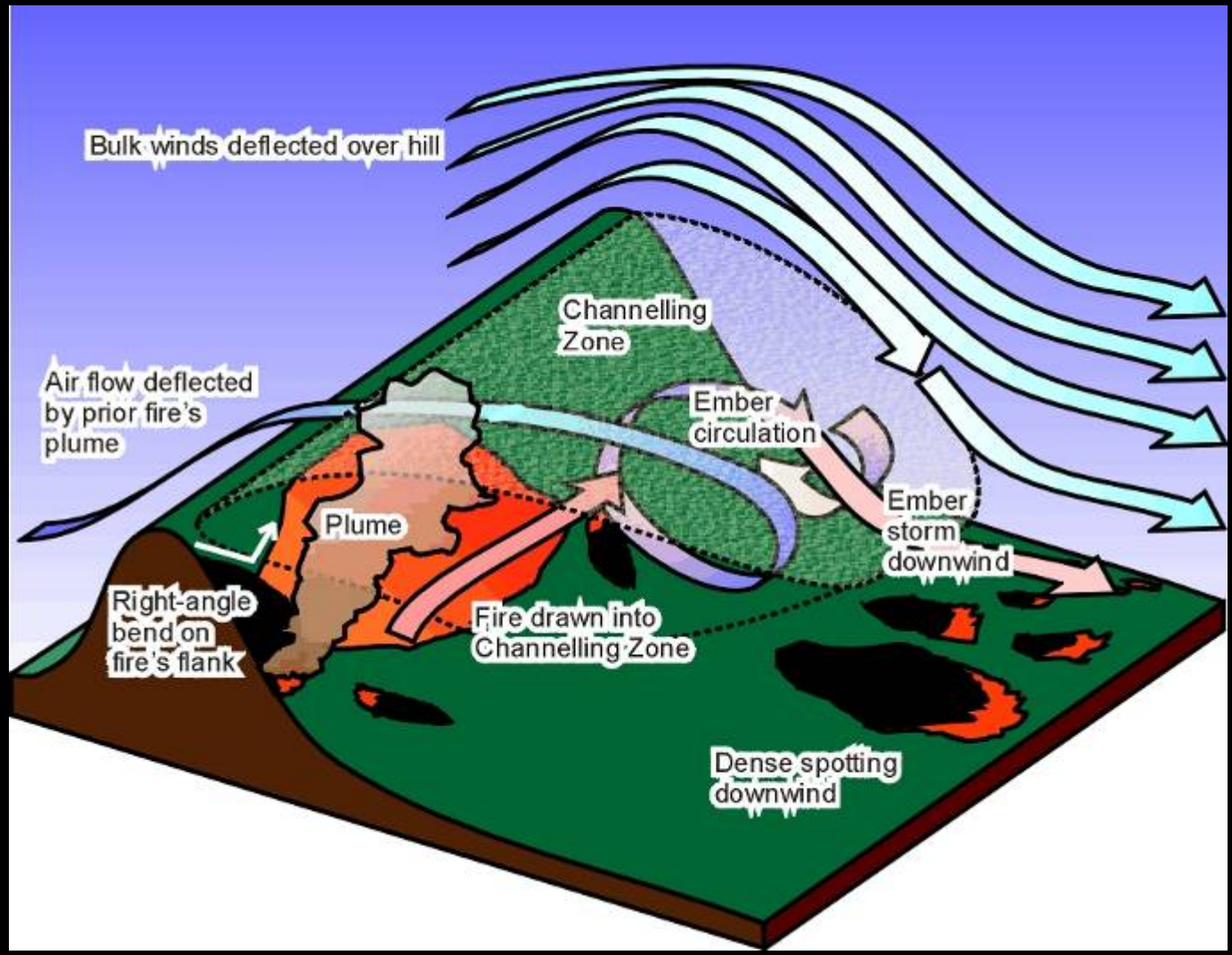




Dynamic Channelling:
- Conceptual model



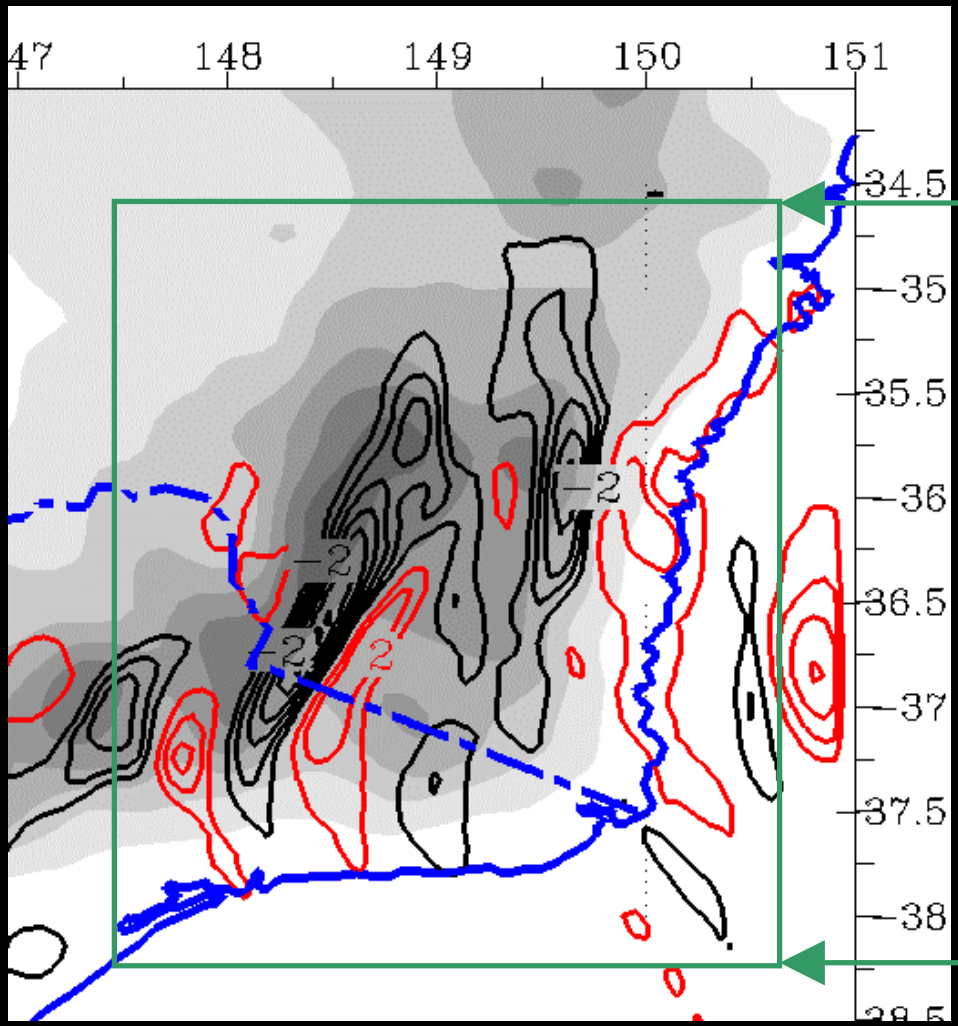
Separation (Lee Slope) Eddies: - Conceptual model



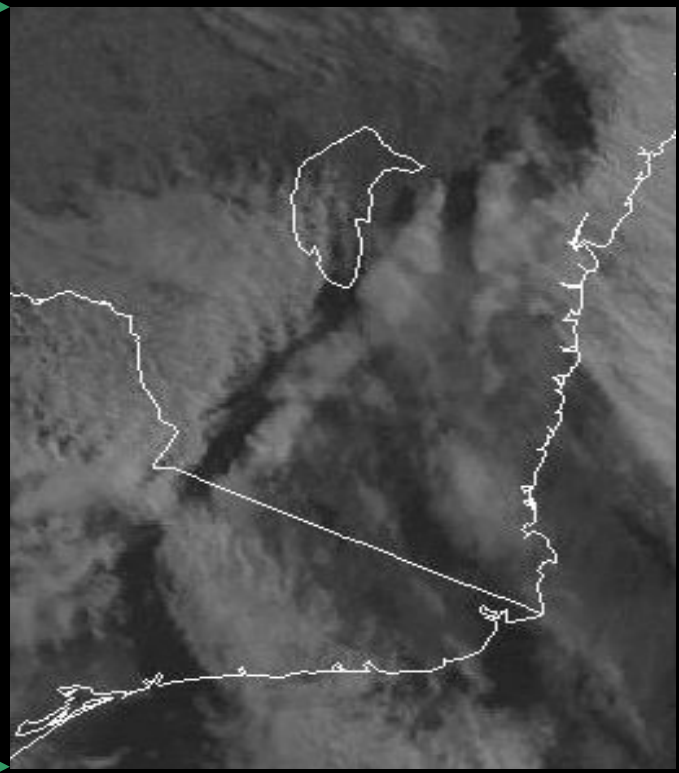
Aerial view of lee-slope channelling event accelerating fire laterally, 18 Jan 03 [Wilkes]

5) FOEHN WINDS

- Dry air descending off ranges – resulting from:
  - Barriers blocking lower moist air
  - Rainfall on windward side removing moisture
- Adiabatic compression = warming
- Acceleration downslope
- Chinook Arch towards coast



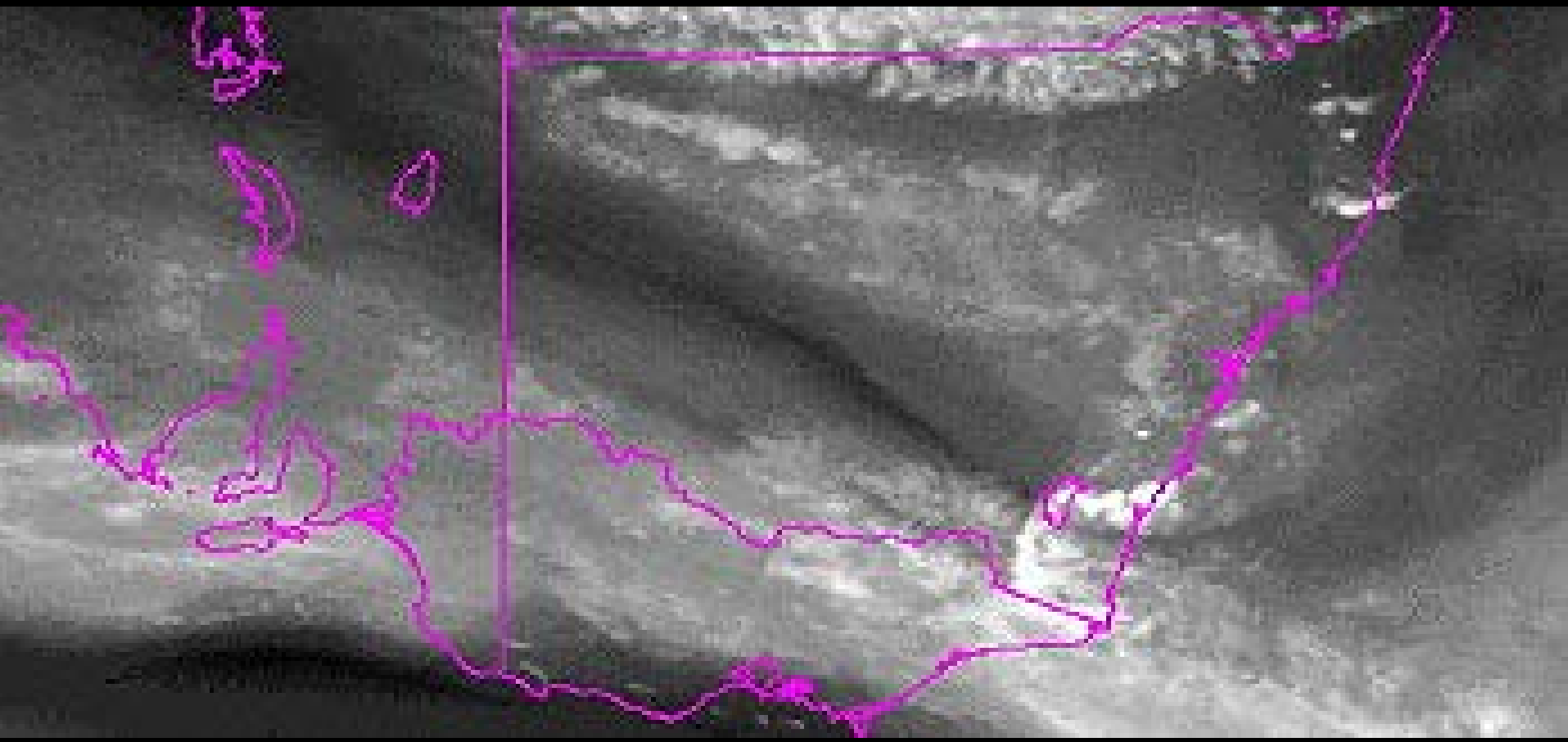
500 hPa ω MesoLAPS model output for 23:00UTC 08-08-07



MTSAT 1km visual image taken at 22:33UTC 08-08-07

6) DRY SLOTS

- Slots of dry upper air can be identified in Water Vapour Imagery.
- On a hot day the mixing depth can be deep enough to bring this dry air down to ground level.
- When these pass over a fire, the FDI can skyrocket, producing catastrophic fire behaviour.

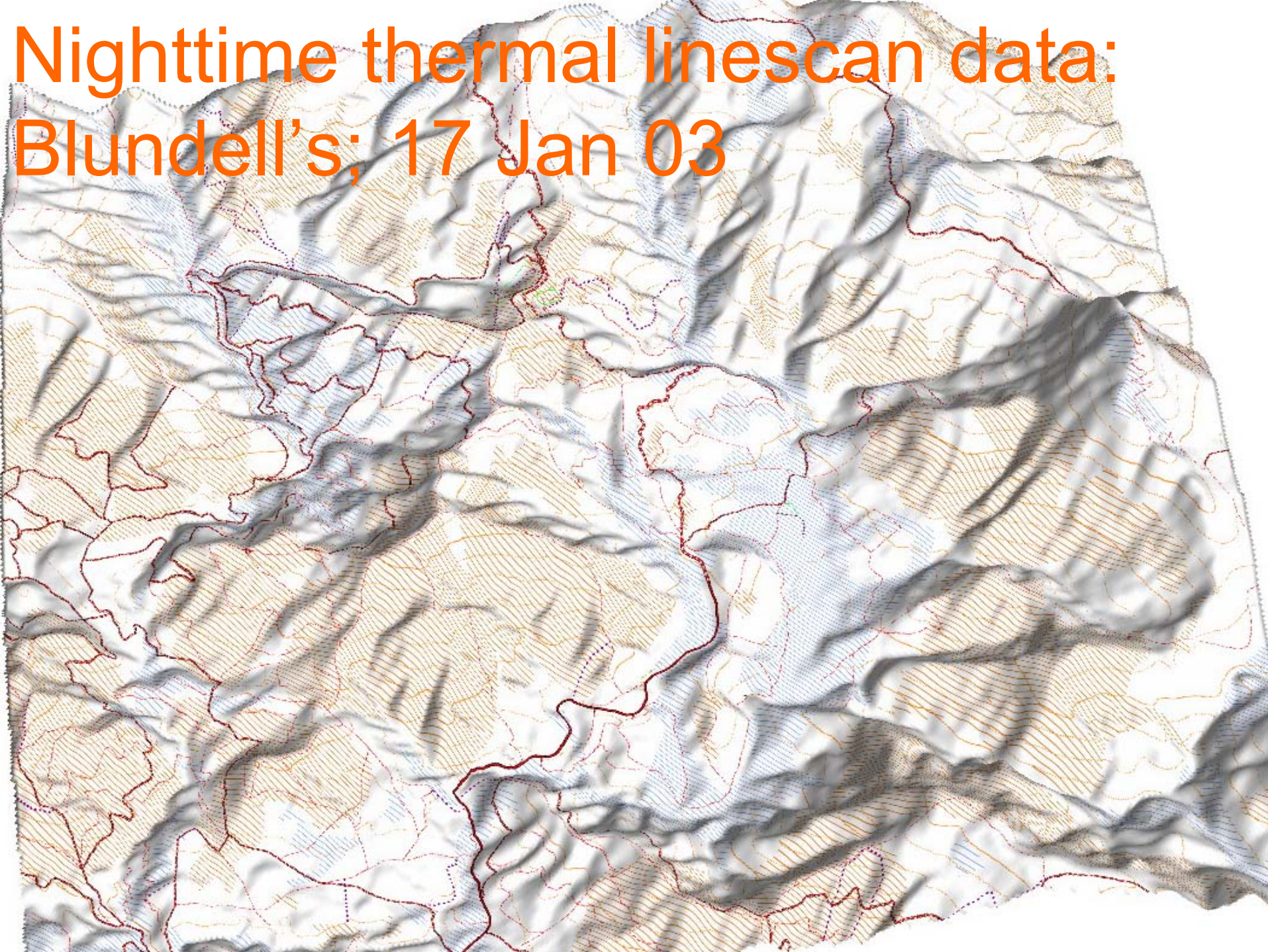


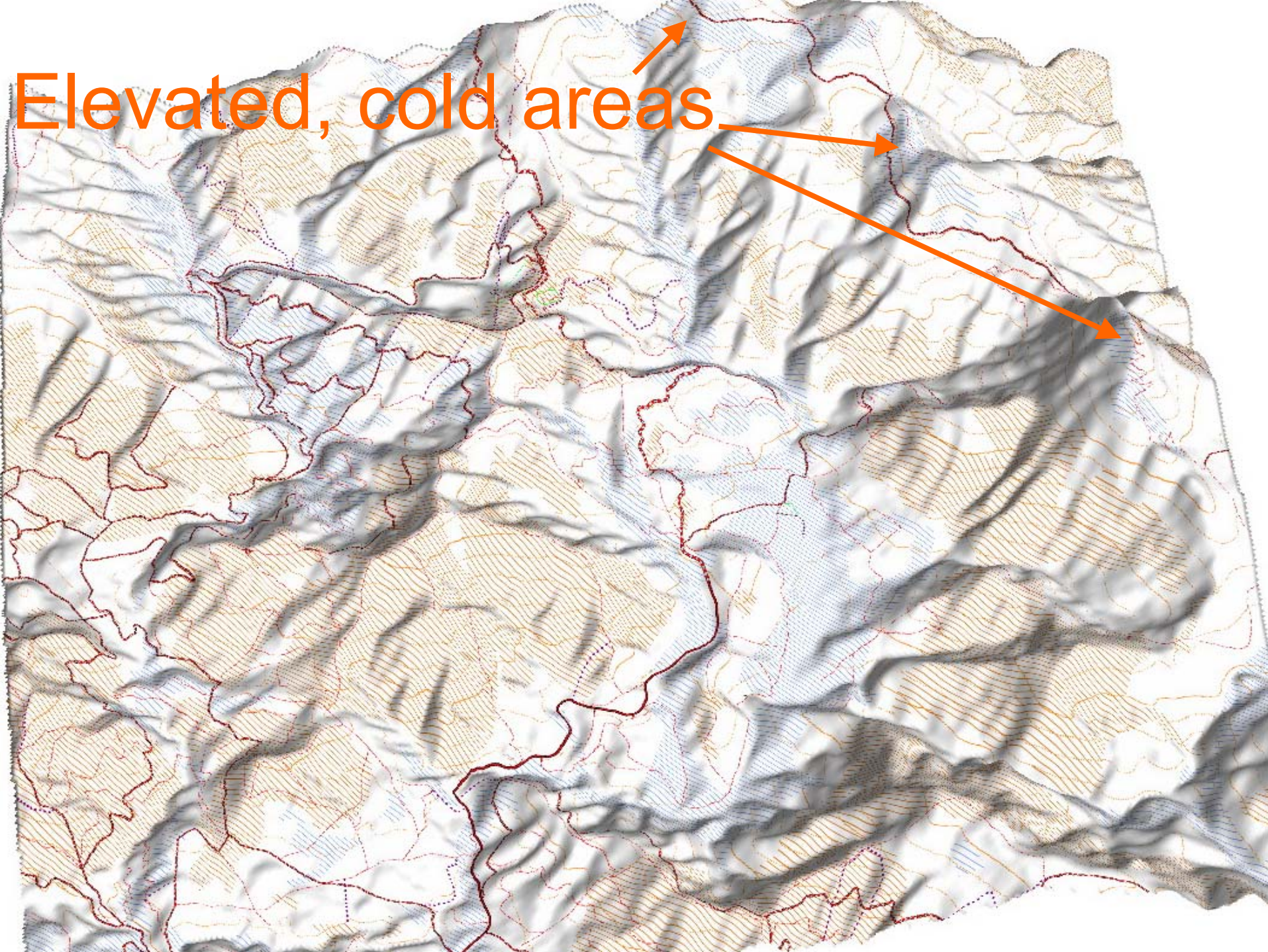
Water vapor imagery, showing dry slot passing over Canberra Fires, 18 Jan 03, Mills, BoM]

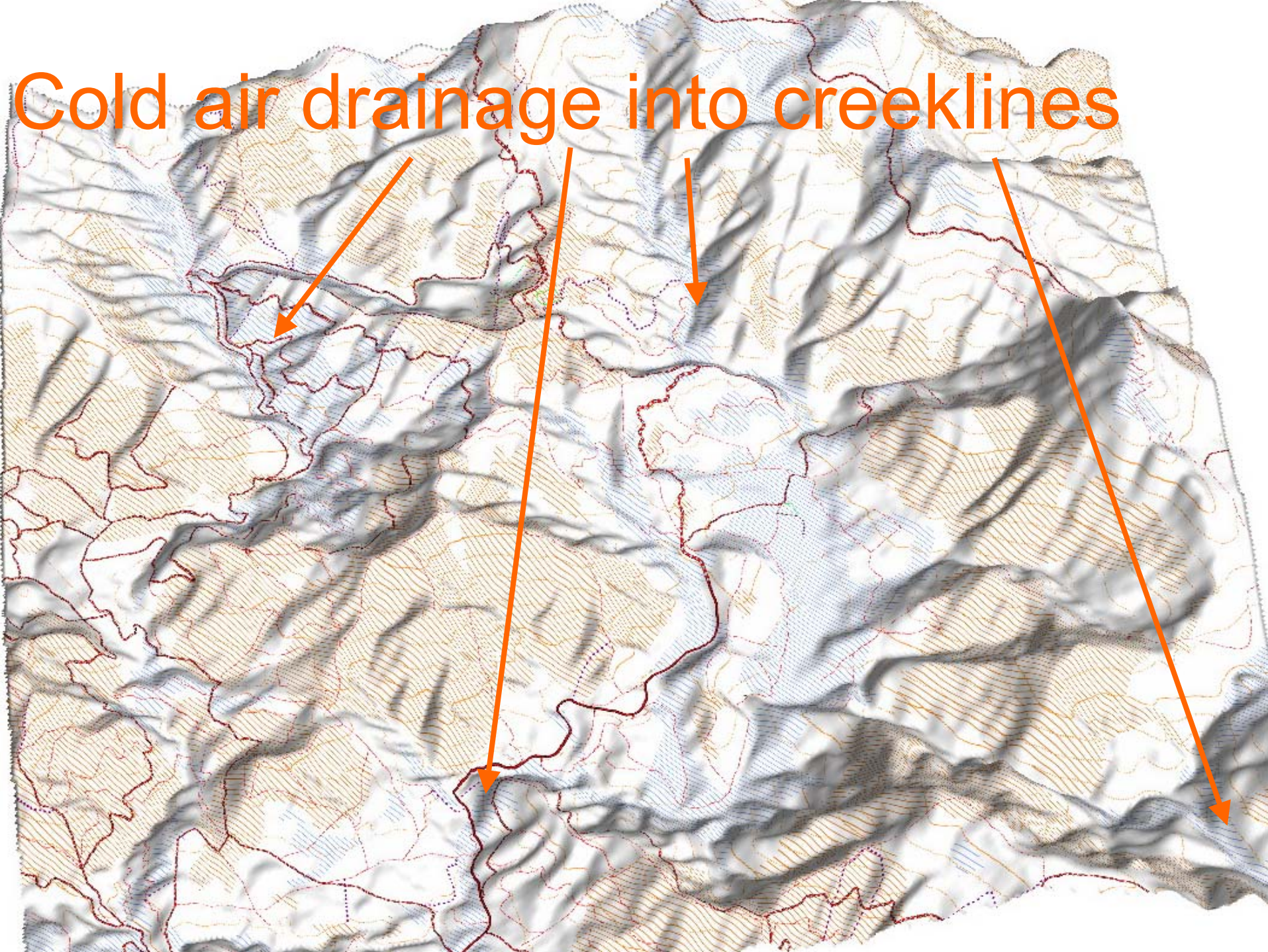
7) THERMAL ZONES

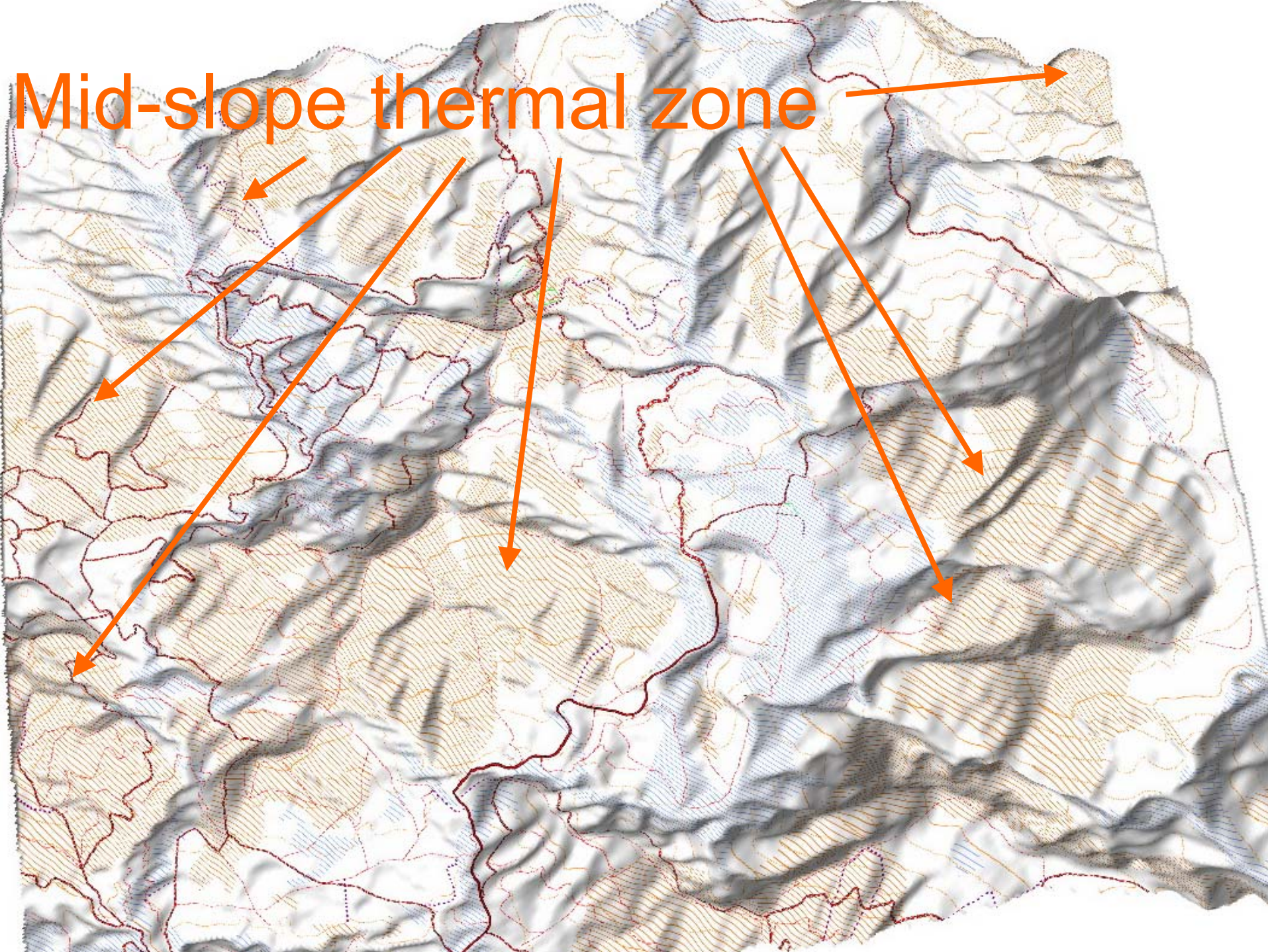
- At nighttime:
  - Air cools with height, and cooler, denser air drains downslope into valley floors.
  - Cooling raises relative humidity.
  - Subsidence can create an inversion.
  - On mid-slopes, warmer, drier air can persist, and perhaps even work its way upslope.
- Thus there can be elevated FDIs mid-slope, exactly where our CC/CP/H/SA are not.

Nighttime thermal linescan data: Blundell's; 17 Jan 03




Elevated, cold areas


Cold air drainage into creeklines


Mid-slope thermal zone

RESOURCES

- POSTER from 2006 AFAC/CRC Conference in Melbourne:
- “HighFire Risk: Bushfire Risk Management in High Country Landscapes”
  J.J. Sharples, R.O. Weber & R. McRae.
- http://www.bushfirecrc.com/documents/poster_progb%20-%20Sharples1.pdf

- POSTER from 2006 AFAC/CRC Conference in Melbourne:
- “HighFire Risk: Fire Size-Class Transition Model.”
  R. McRae, R. Weber & J. Sharples.
- http://www.bushfirecrc.com/documents/poster_progb%20-%20McRae.pdf

- Presentation at HighFire Public Forum in Cooma, April 2007.
- “Bushfire Risk Management in High-Country Landscapes”
  J. Sharples, R. McRae & R. Weber.
- http://www.bushfirecrc.com/fkn/downloads/Jason-Sharples-Cooma.pdf

- Review of HighFire Risk Project.
- http://www.bushfirecrc.com/research/highfire/research/highfirerisk.html