Natural Hazards Research Australia

The Bureau of Meteorology

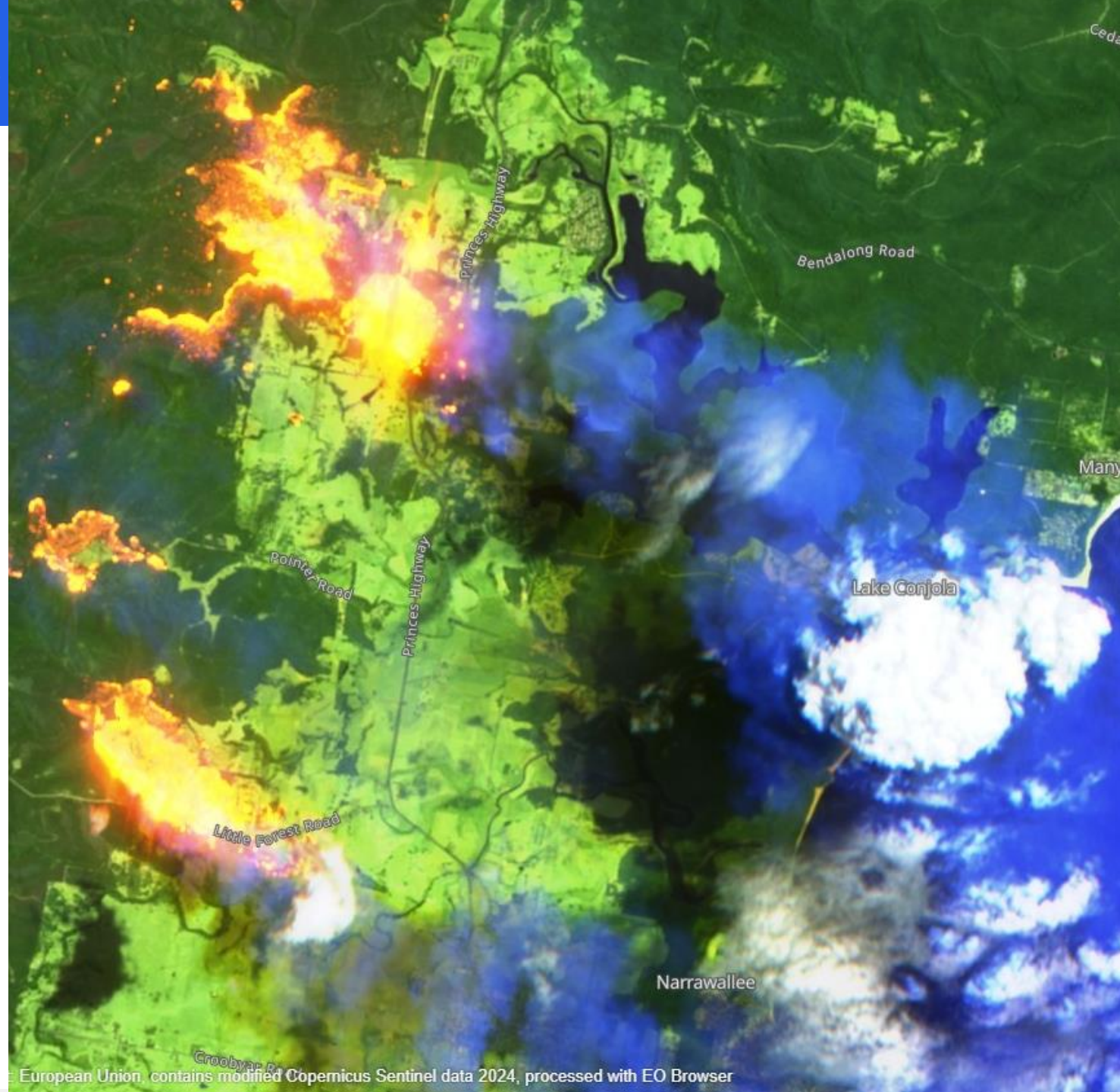
Fire Case Studies

Learning (quickly) from impactful weather events

High Impact Weather,
Bureau of Meteorology Research

Mika Peace, Harvey Ye, Melanie Webb, Dragana Zovko-Rajak, Kevin Tory.

In collaboration with radar and satellite research teams, RFS, DFES, AFAC and others.



Fire Case Studies
Project Outline

Impacts of climate change are manifesting in increased intensity and frequency of synoptic and mesoscale weather events

Fire Case Study Project > data capture and analysis of a significant event

Standardise and streamline visualisation and analysis for:

ACCESS-Fire (coupled fire-atmosphere model), satellite and radar data = **Visuals** (+ interpretation)

Two case studies : Currowan (NSW) and Wooroloo (WA)

Framework and tools are hazard-agnostic: ***"Use cases are popping out of the woodwork"***

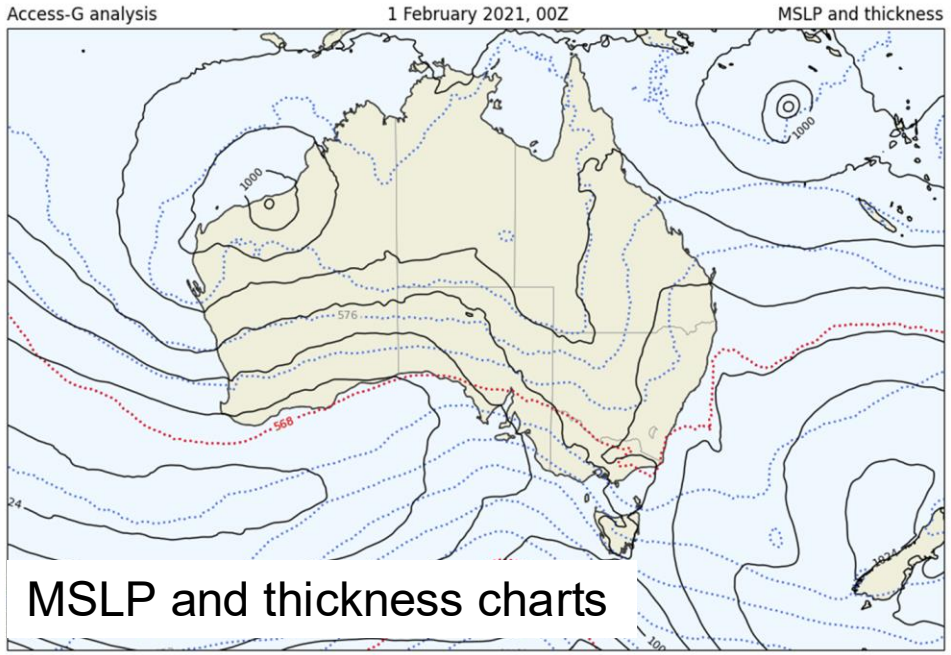
(Climate Attribution, NHRA Flood project, Fire & Thunderstorm teams)

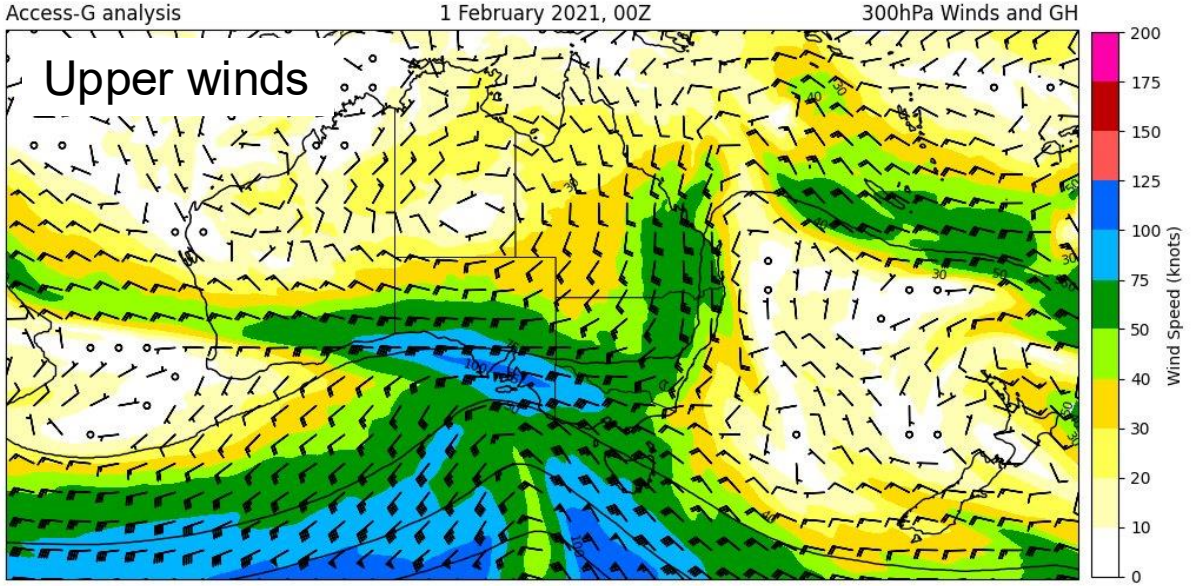
Benefits of the project:

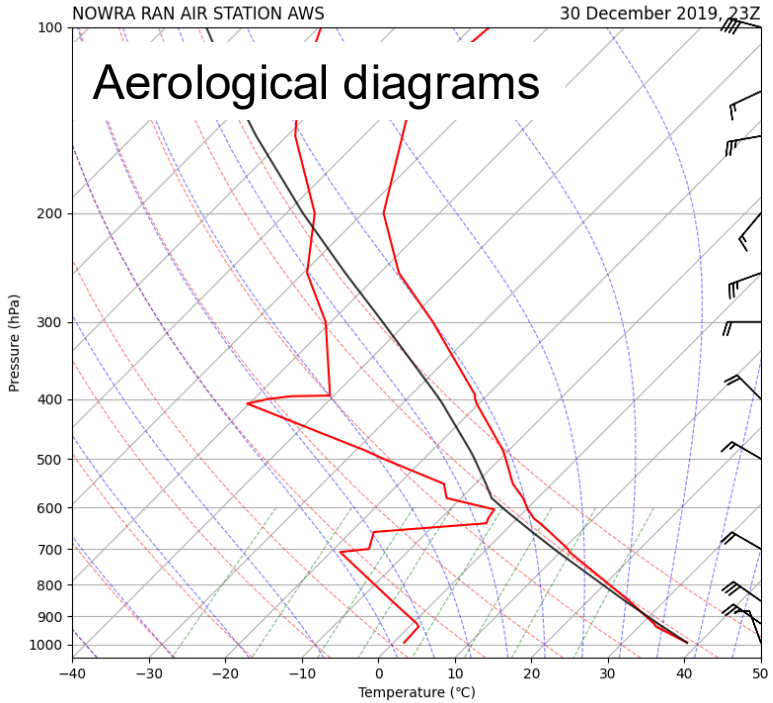
Rapid turnaround case studies for internal and external stakeholders and input to inquiries

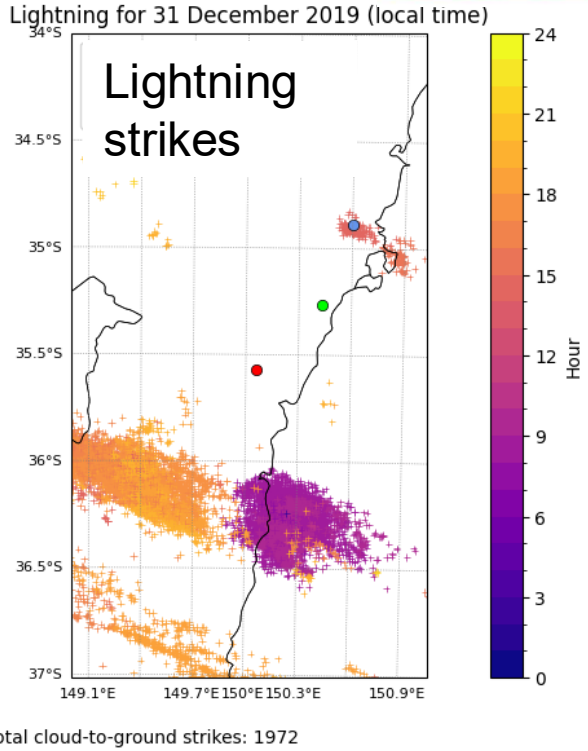
Rich, multi-disciplinary approach to data collection and analysis and narrative = deeper context for learnings

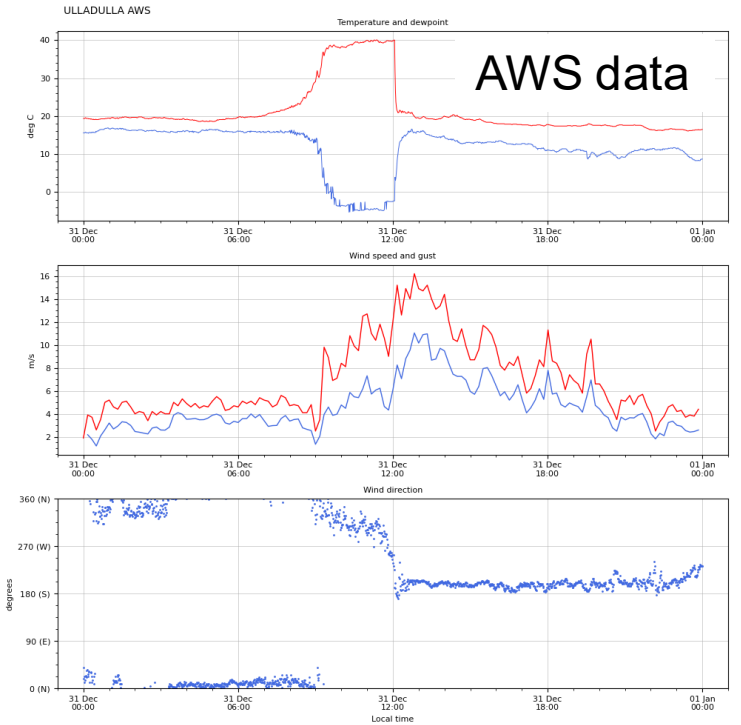
Meteorological context 'setting the scene'



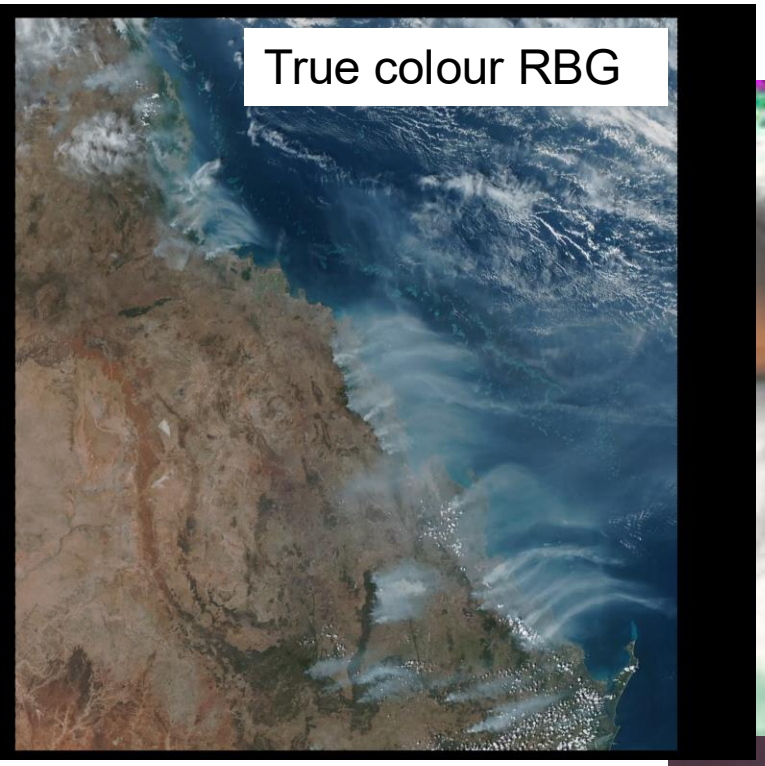


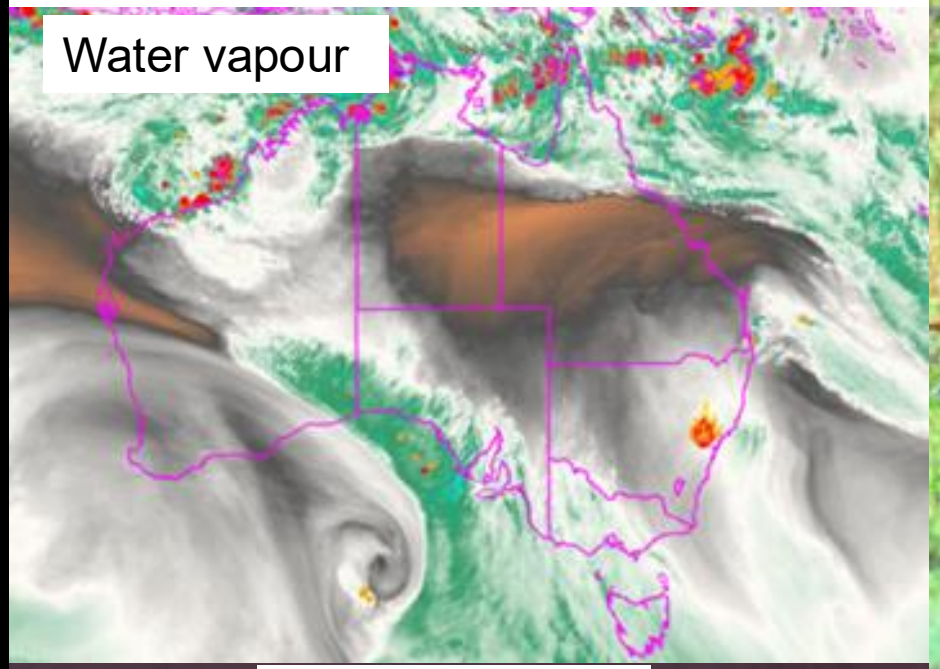


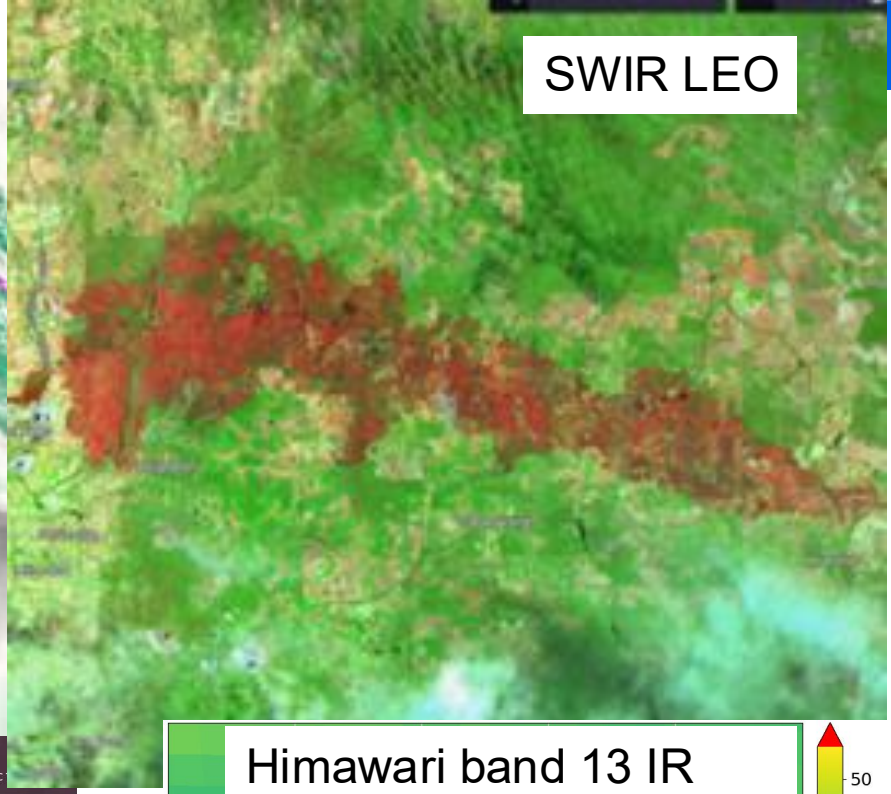


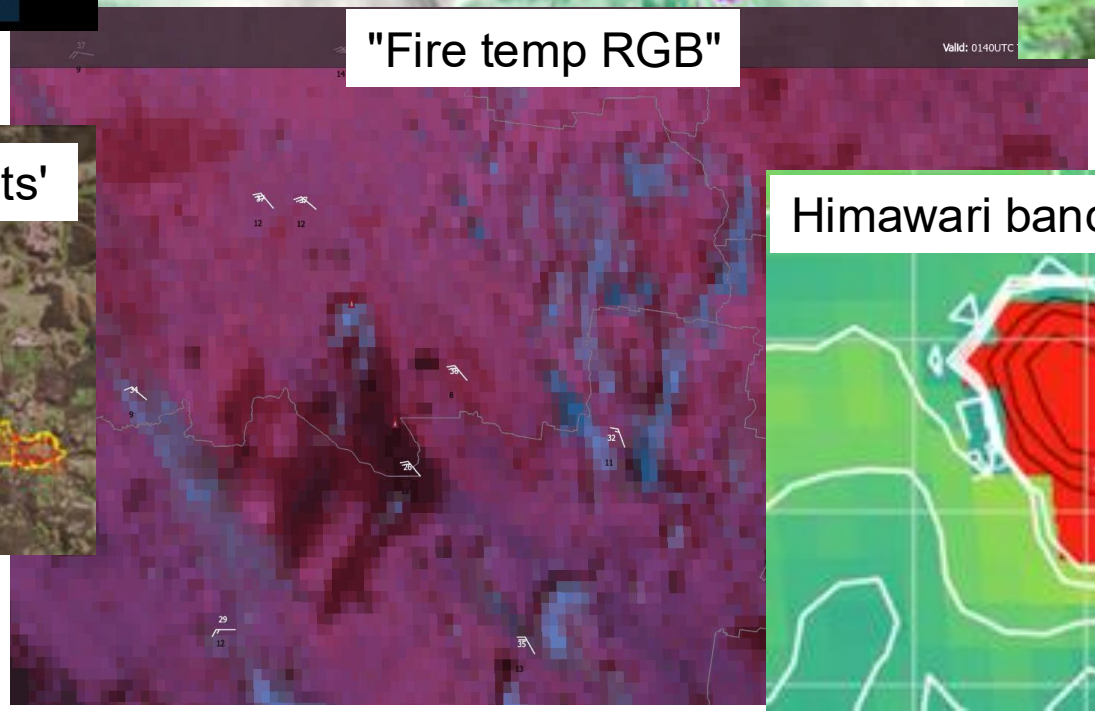


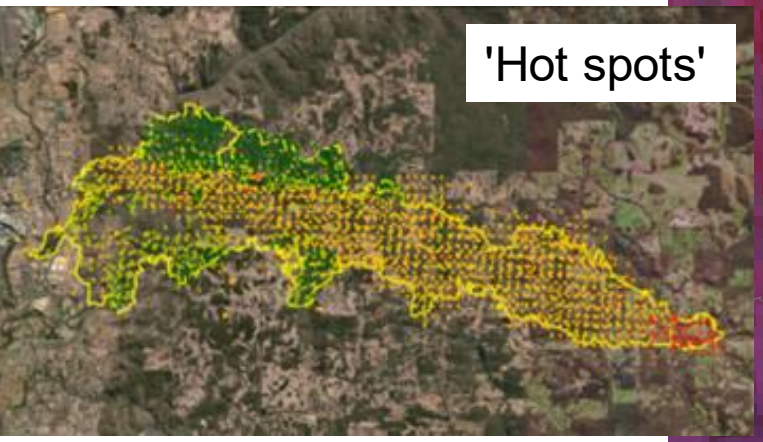
Satellite data from 'NCI' archive

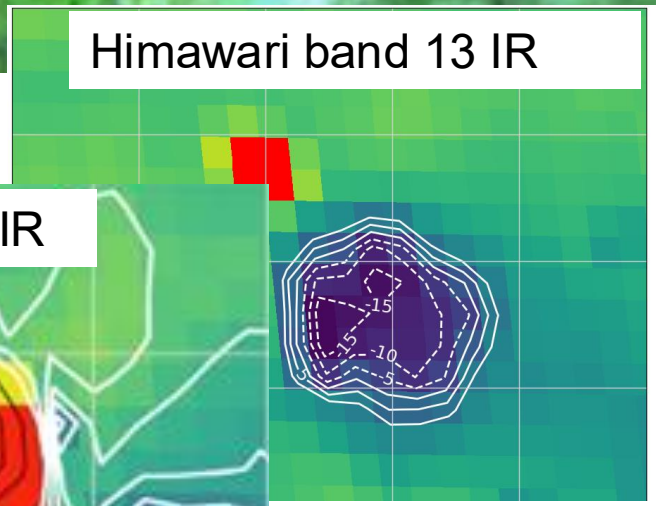


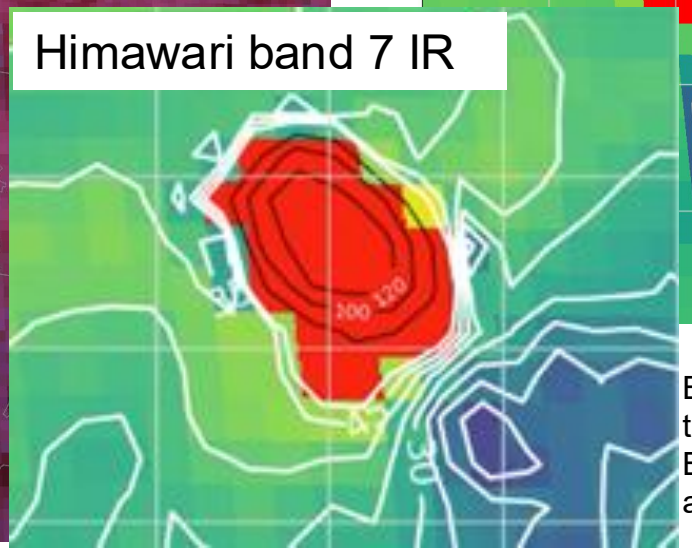






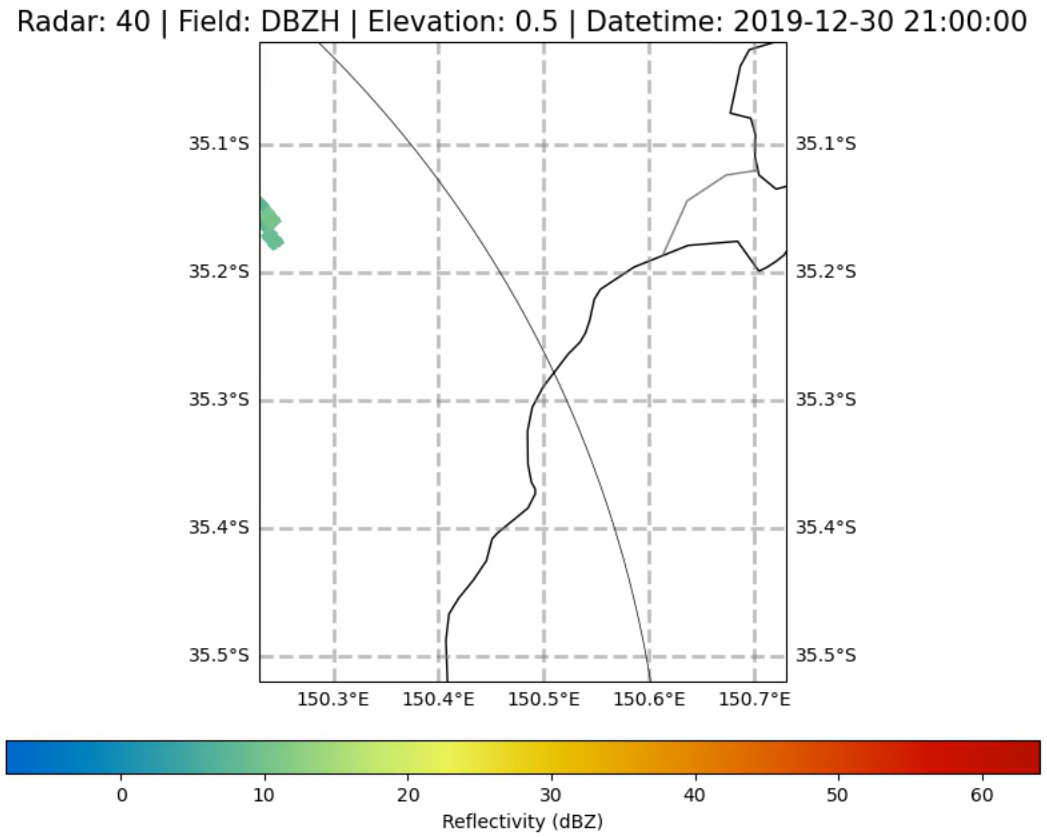


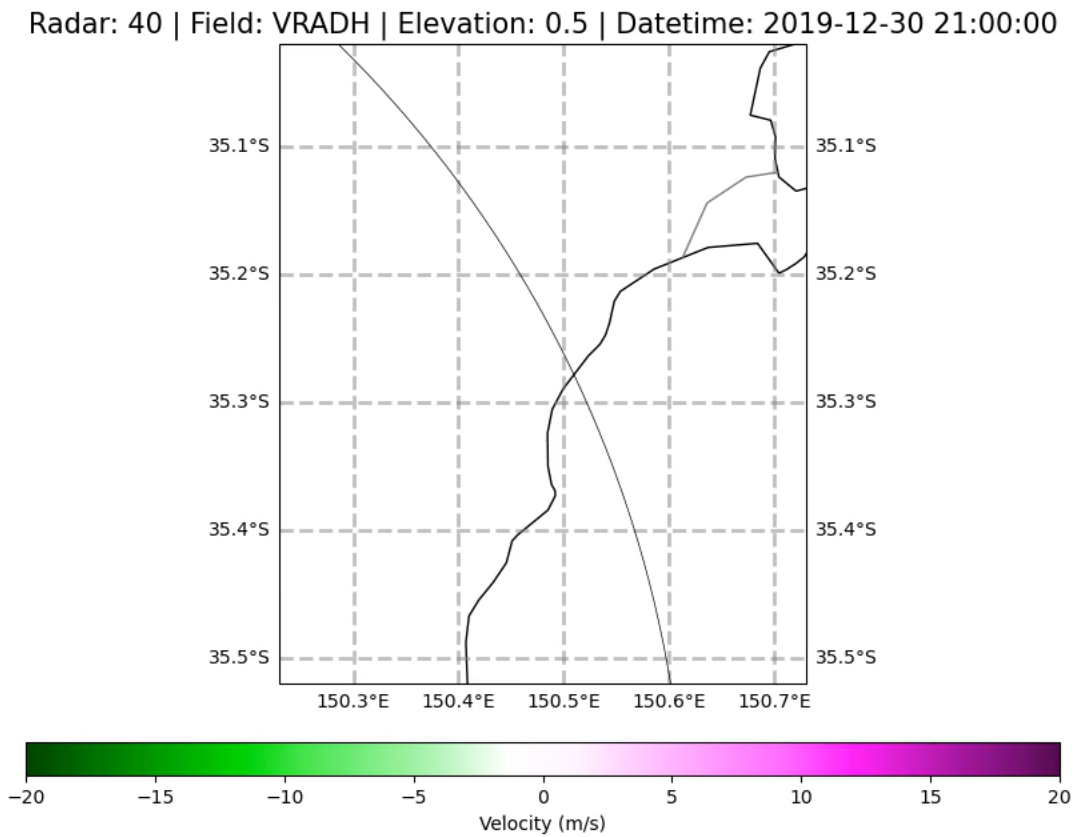




Band 7 has greater sensitivity at the surface.
Band 13 has greater sensitivity at cloud top

Radar data from 'NCI' archive
Reflectivity, Velocity, PPI, RHI
Currowan fire



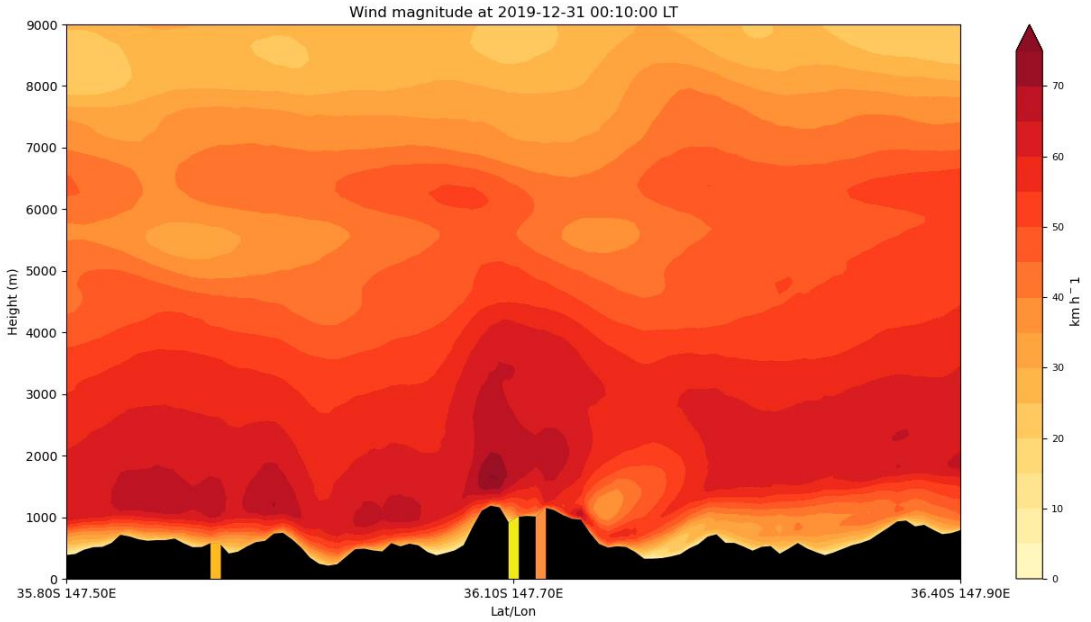


Reflectivity

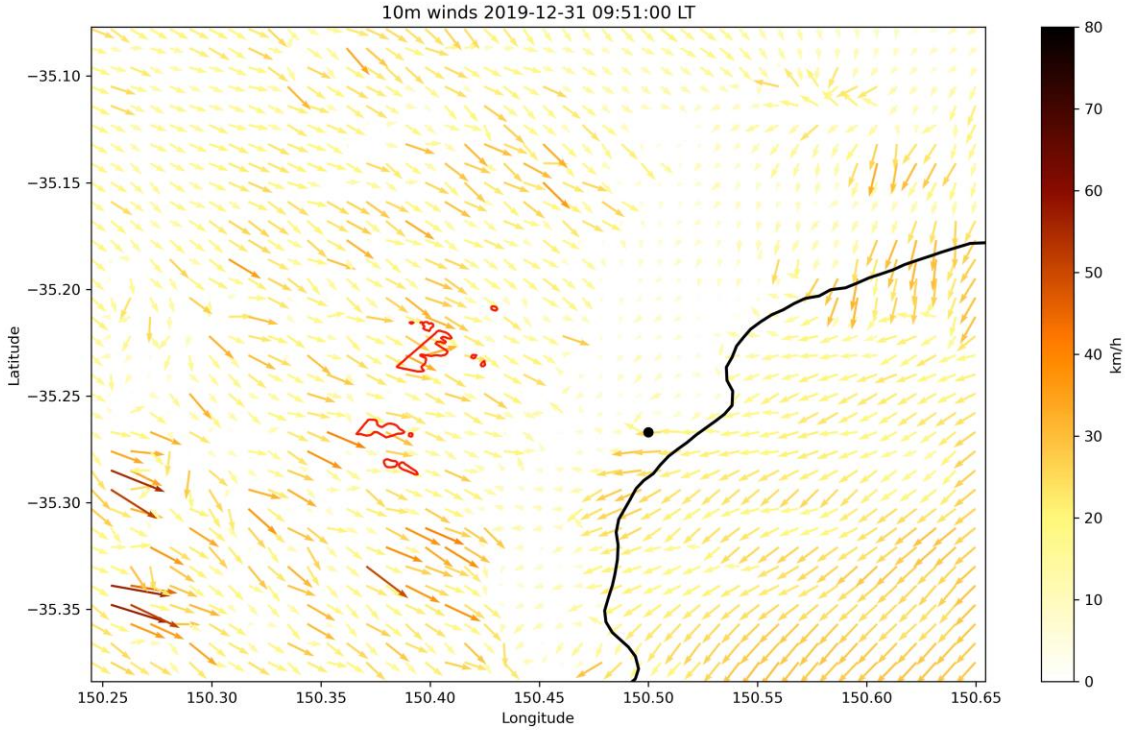
Velocity

ACCESS-Fire coupled fire-atmosphere model
Heat released by the fire changes surrounding atmosphere
Streamlined run settings and plotting scripts

Corryong fire



Currowan fire



Natural Hazards Research Australia

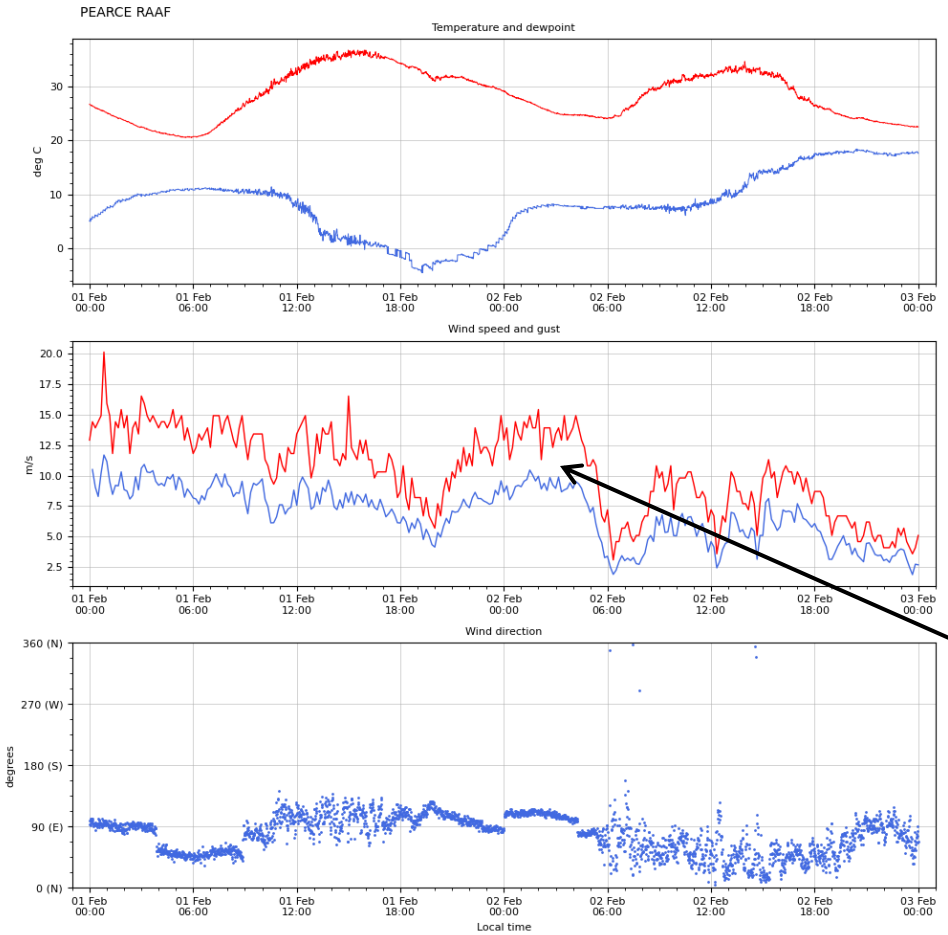
Wooroloo fire

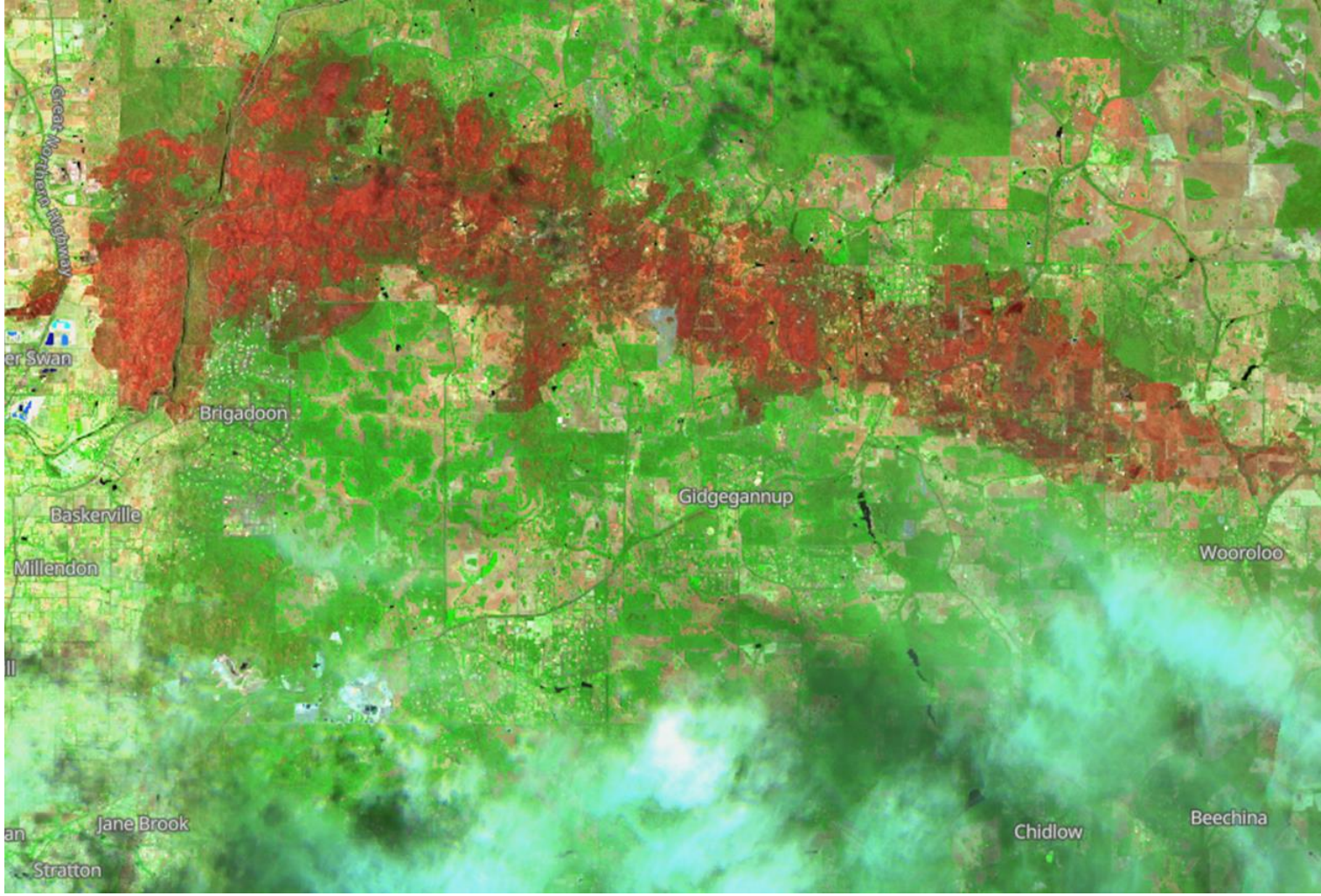
Northeast of Perth. February 2021

10,900 ha burned, 86 properties lost

Significant overnight fire run

Substantial firefighting resources from Perth.





Extended period of windy conditions and active fire spread overnight

Natural Hazards Research Australia

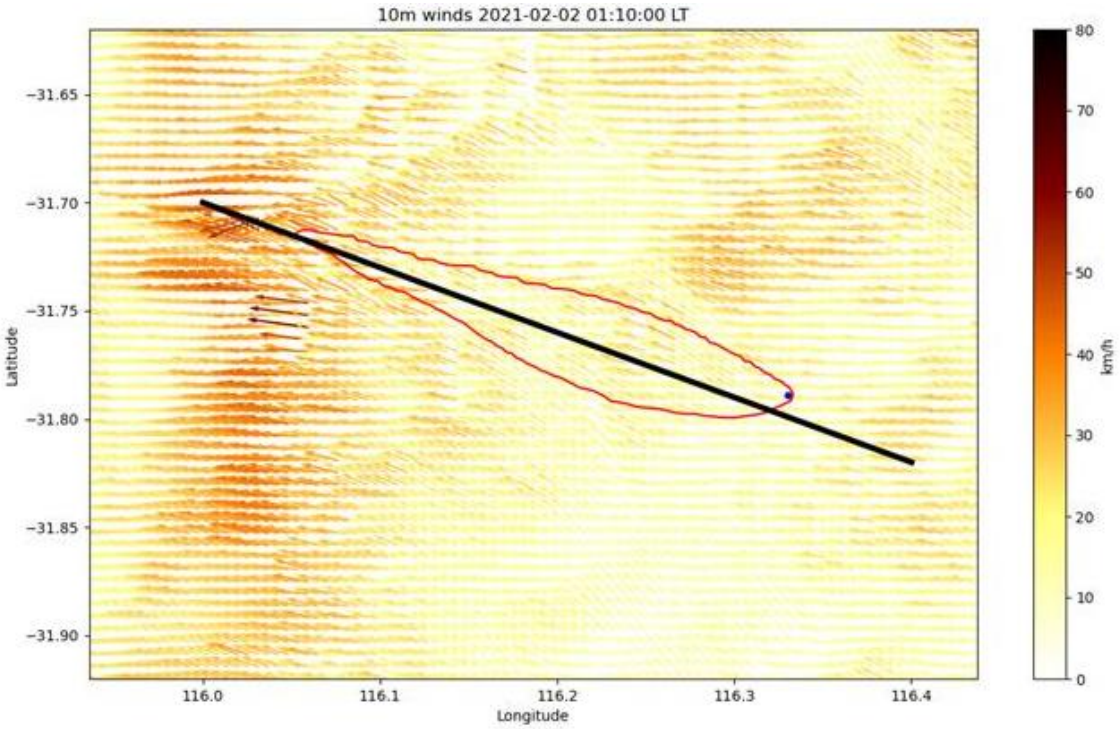
Natural Hazards Research Australia

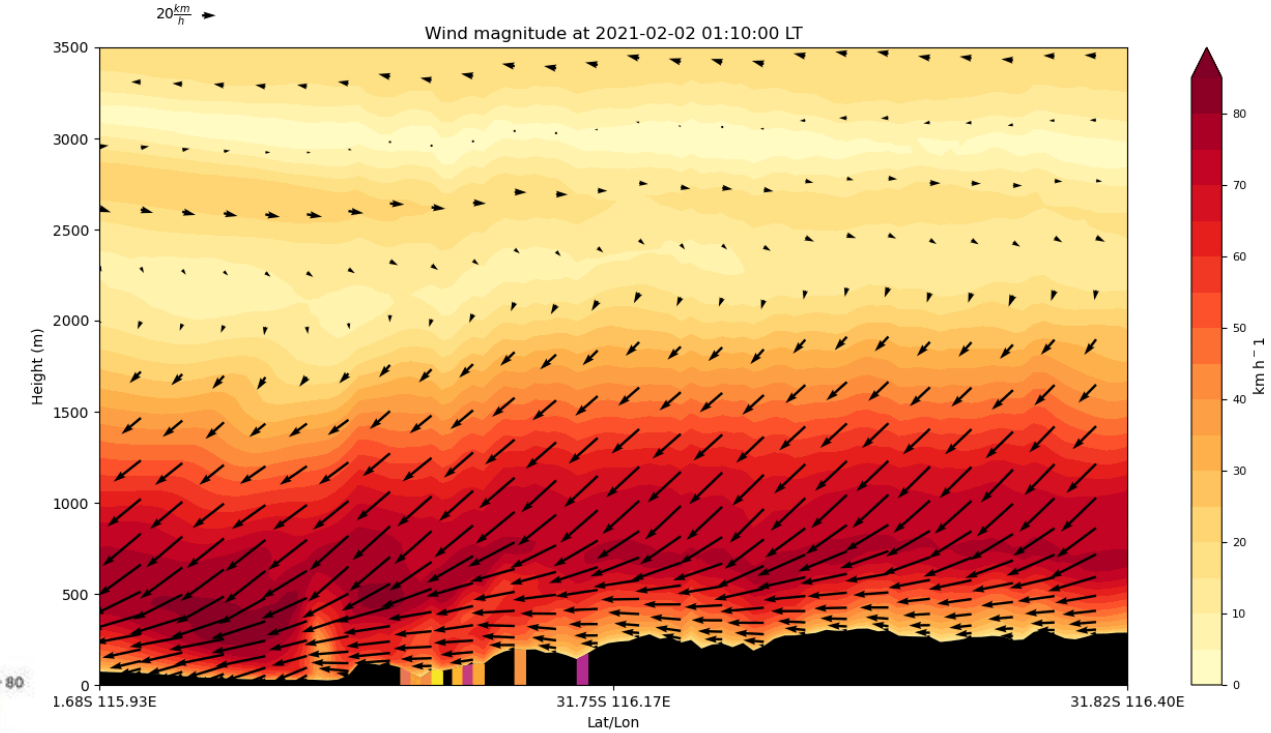
Wooroloo fire – key finding #1

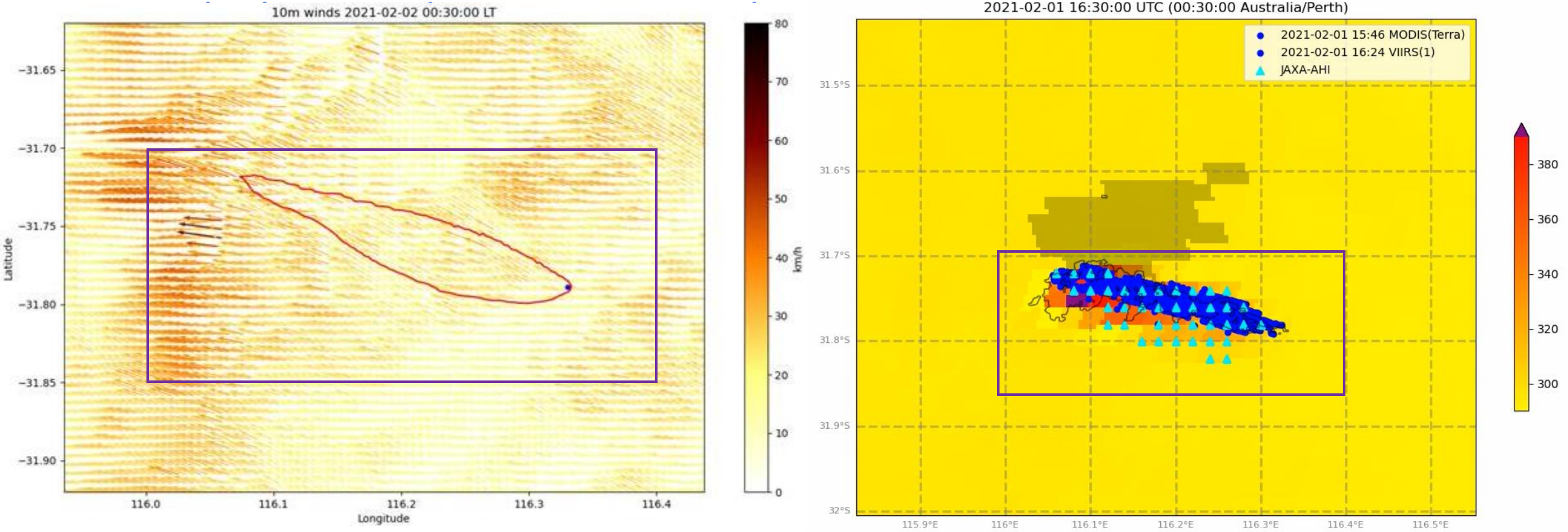
Low Level Jet below ~ 500m elevation above topography

Wind speed 65 km/h within ~100 m of surface

Driver of overnight fire spread







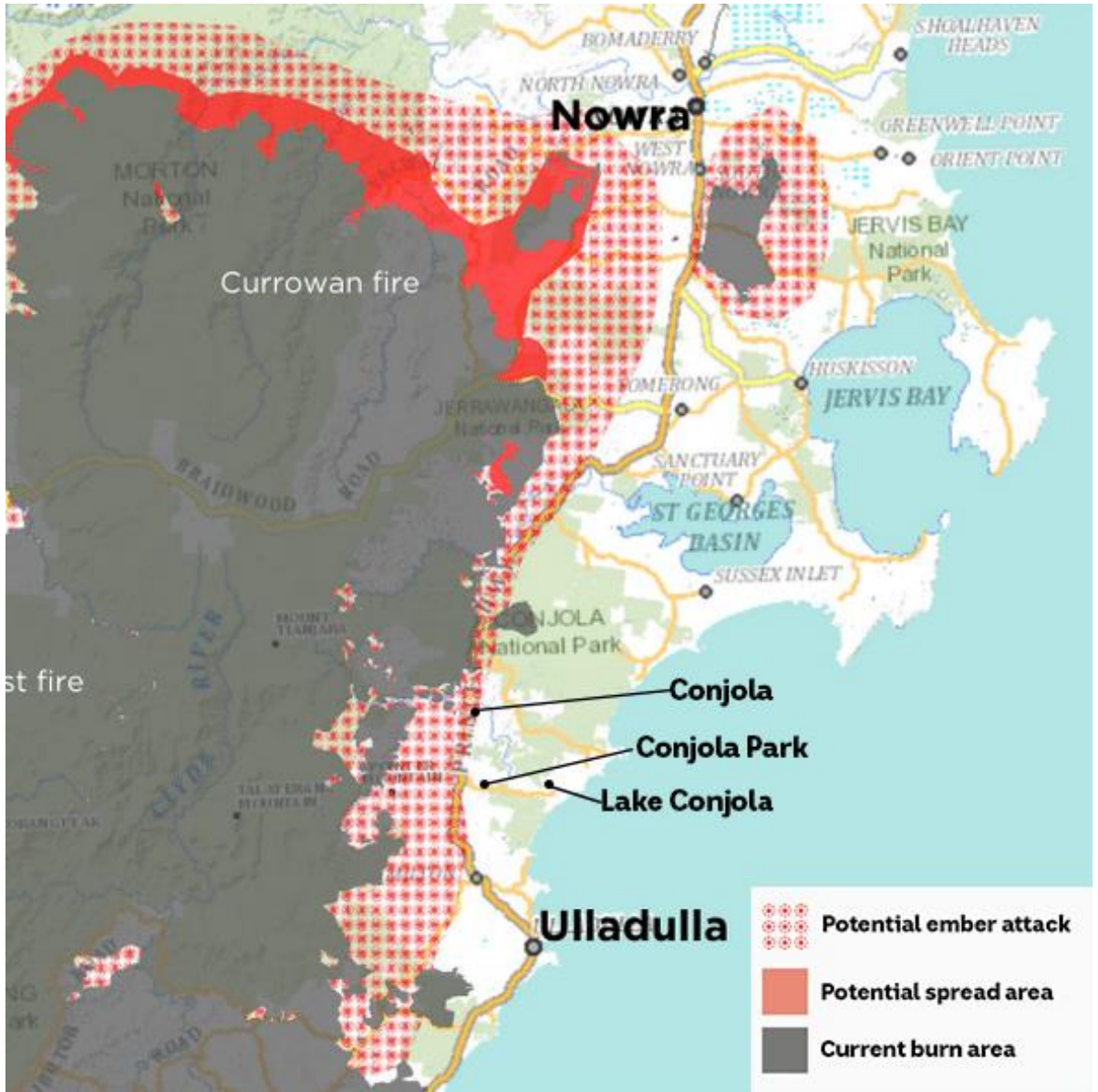
Wooroloo fire – key finding #2

ACCESS-Fire simulation/ heatflux and MODIS/ VIIRS satellite hot spots at 00:30 WST
Optimal use of satellite channels for fire detection and temporal evolution from LEO and GEO platforms in near-real and real time.

Natural Hazards Research Australia

Natural Hazards Research Australia

Currowan fire



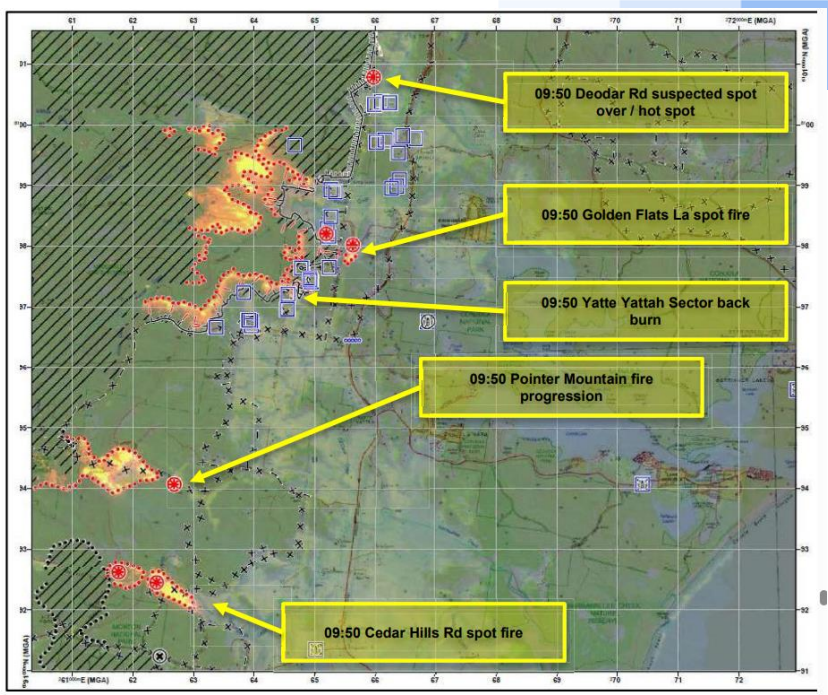
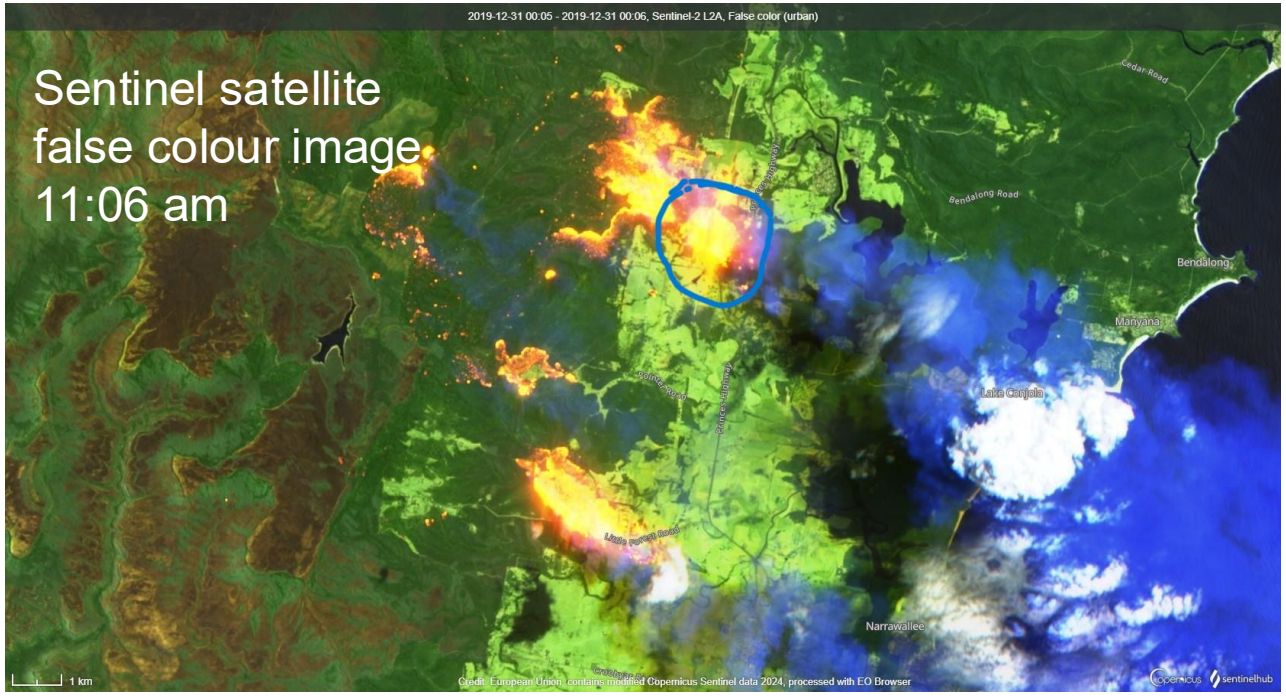
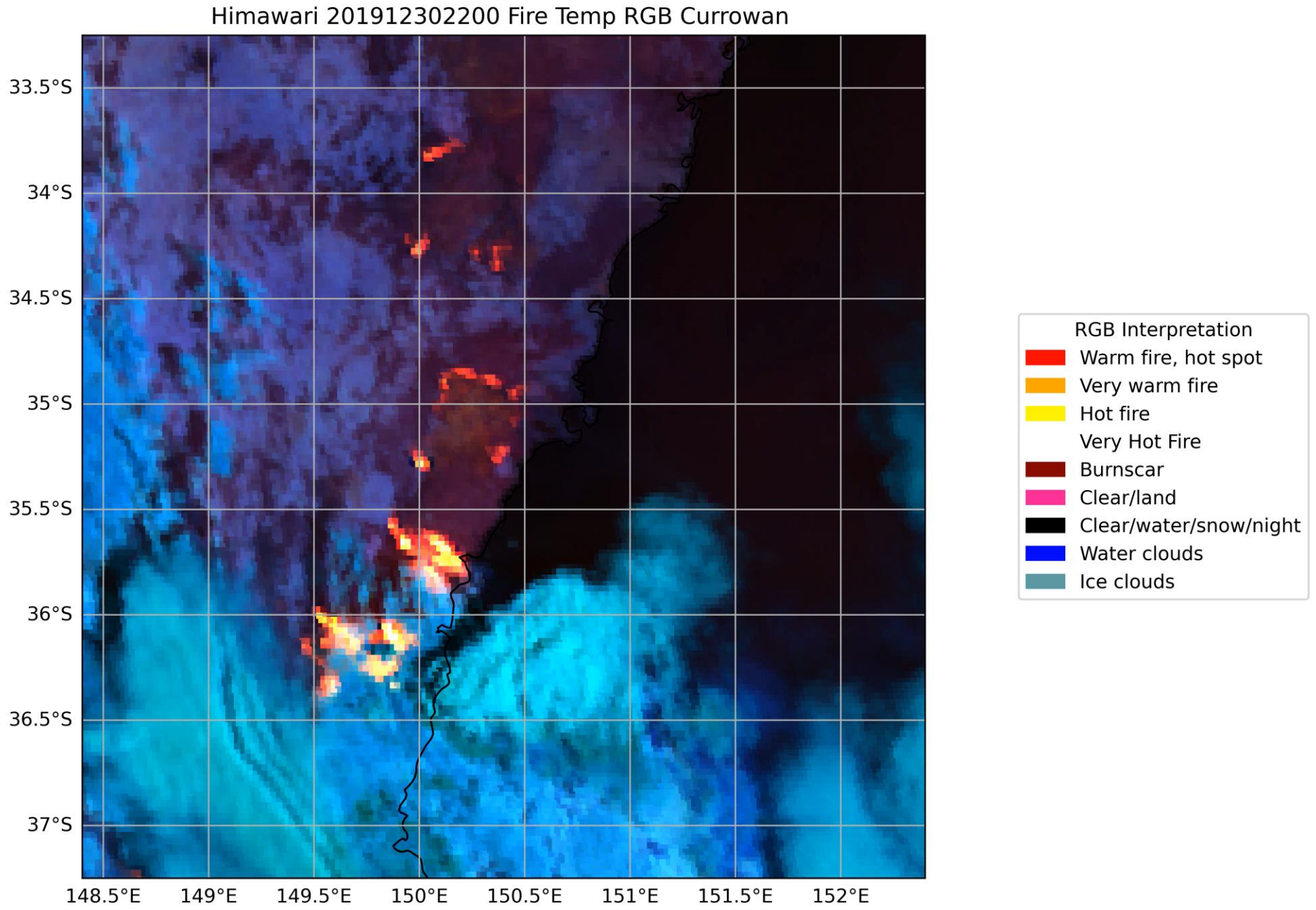


Figure 28: Currowan Fire – Yatte Yattah Sector – 31/12/2019 09:50



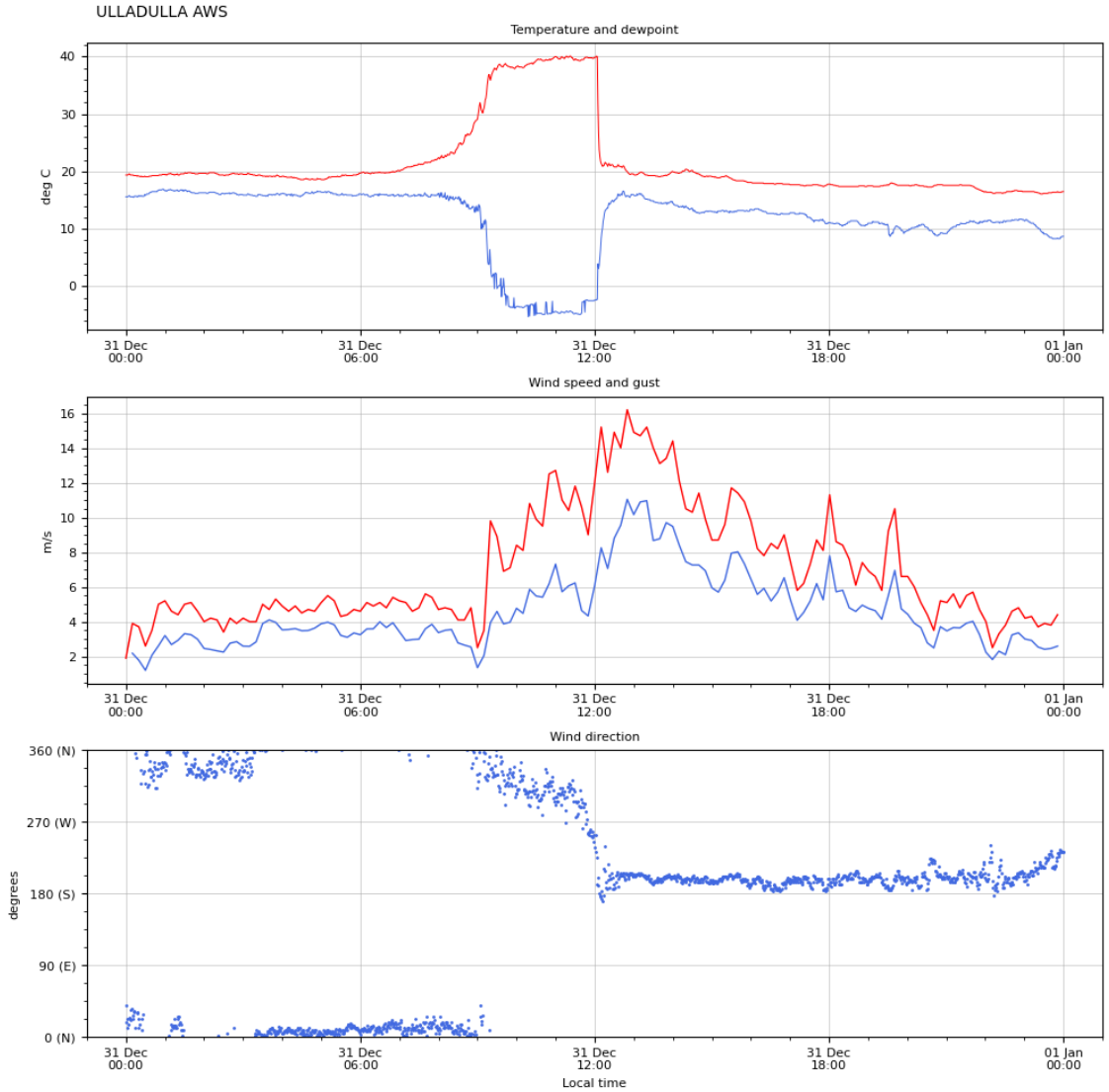
Currowan fire - 'Fire Temp RGB'

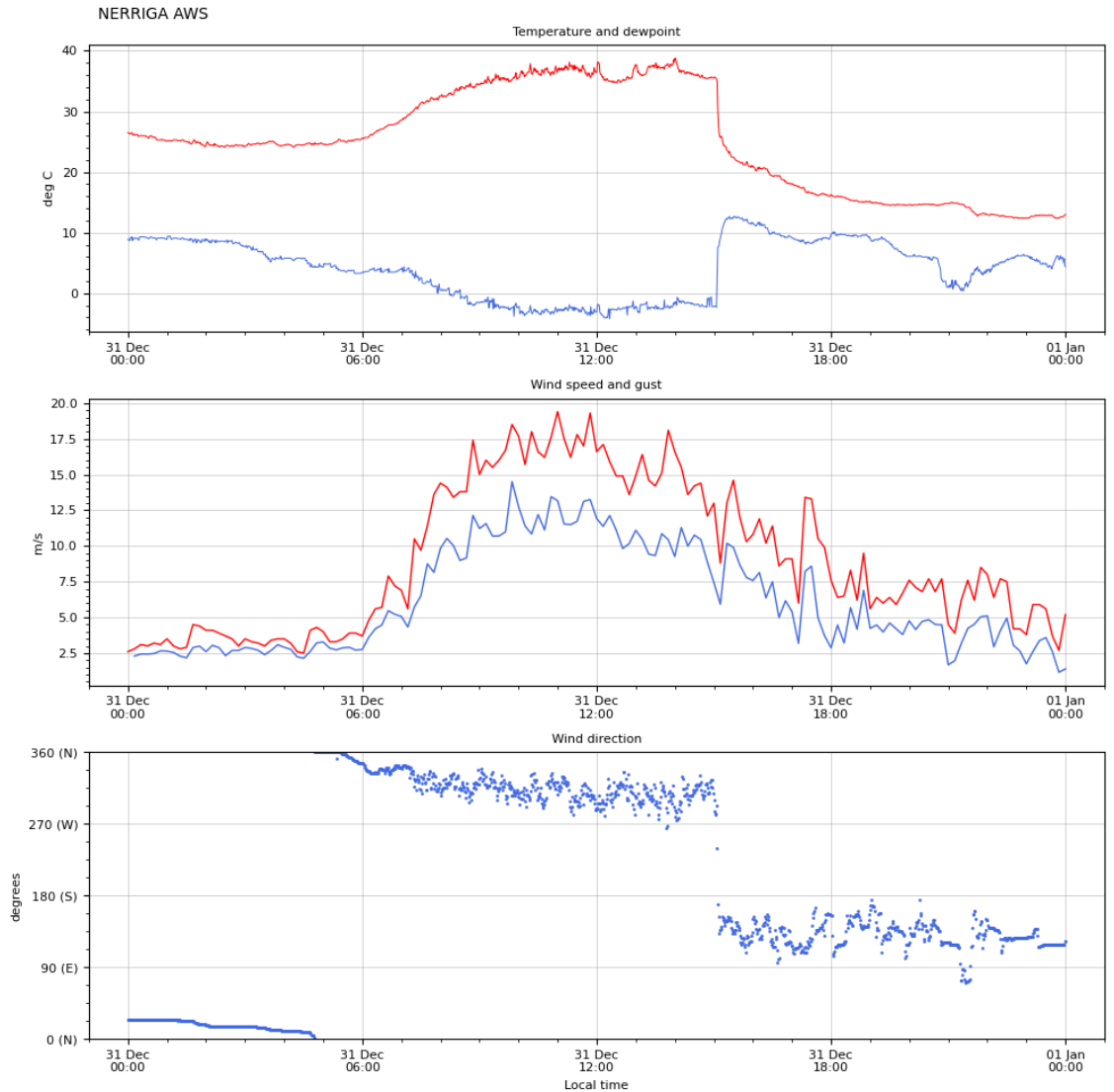
Natural Hazards Research Australia



Currowan fire

Automatic weather stations did not capture weather conditions at the fire ground

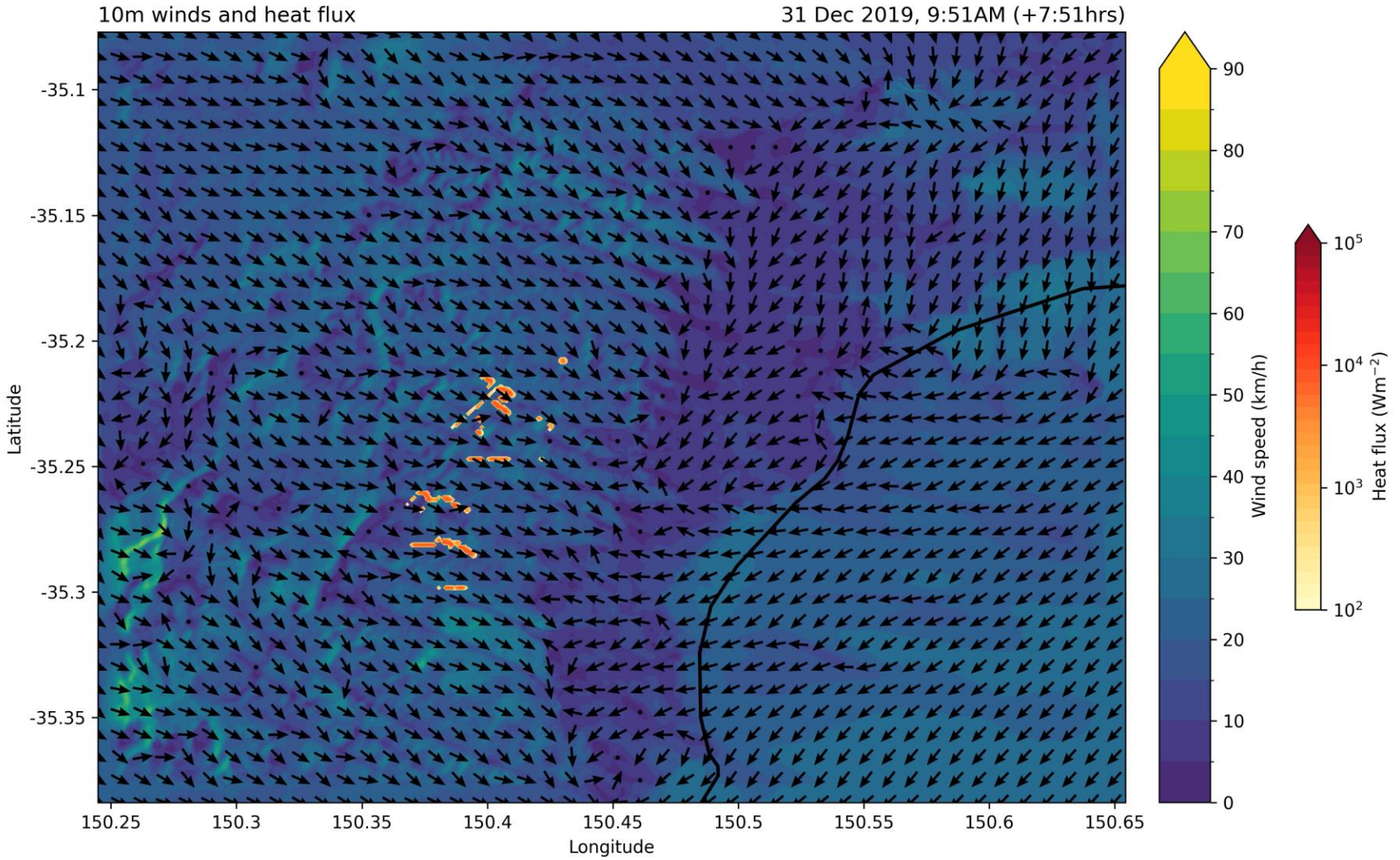




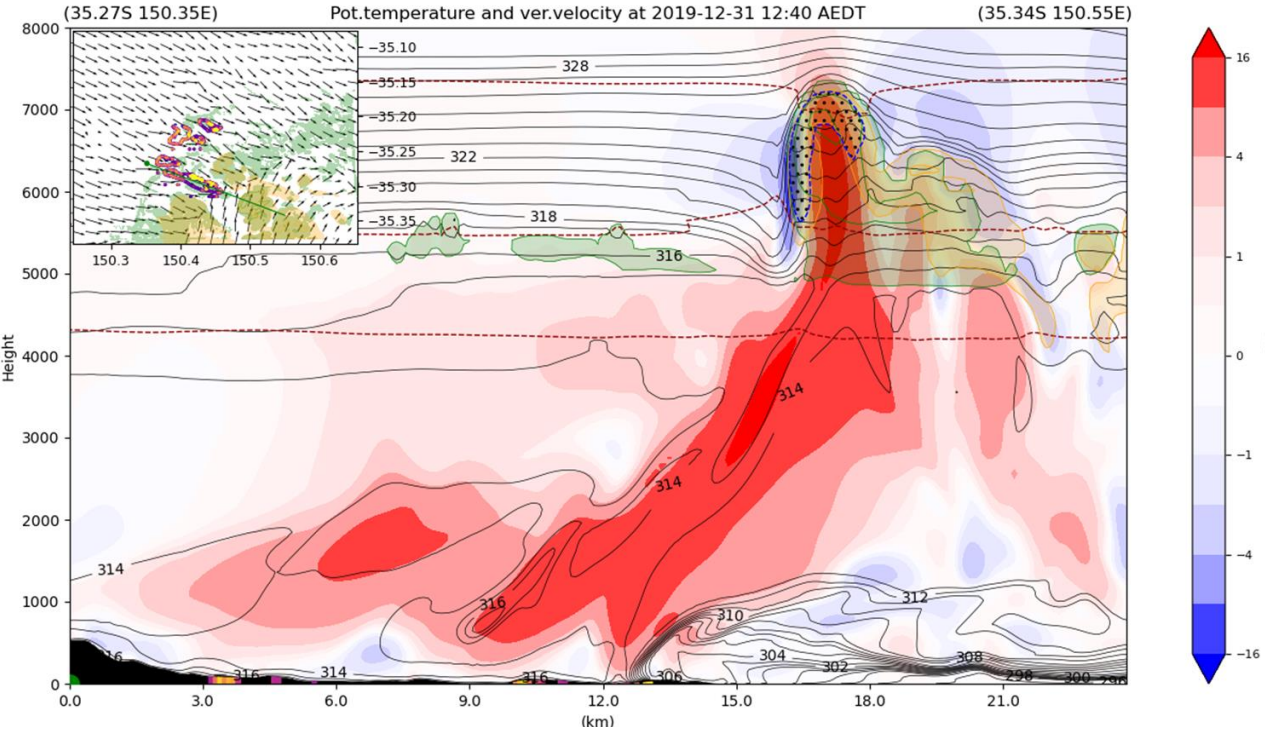
Ulladulla – exposed coastal

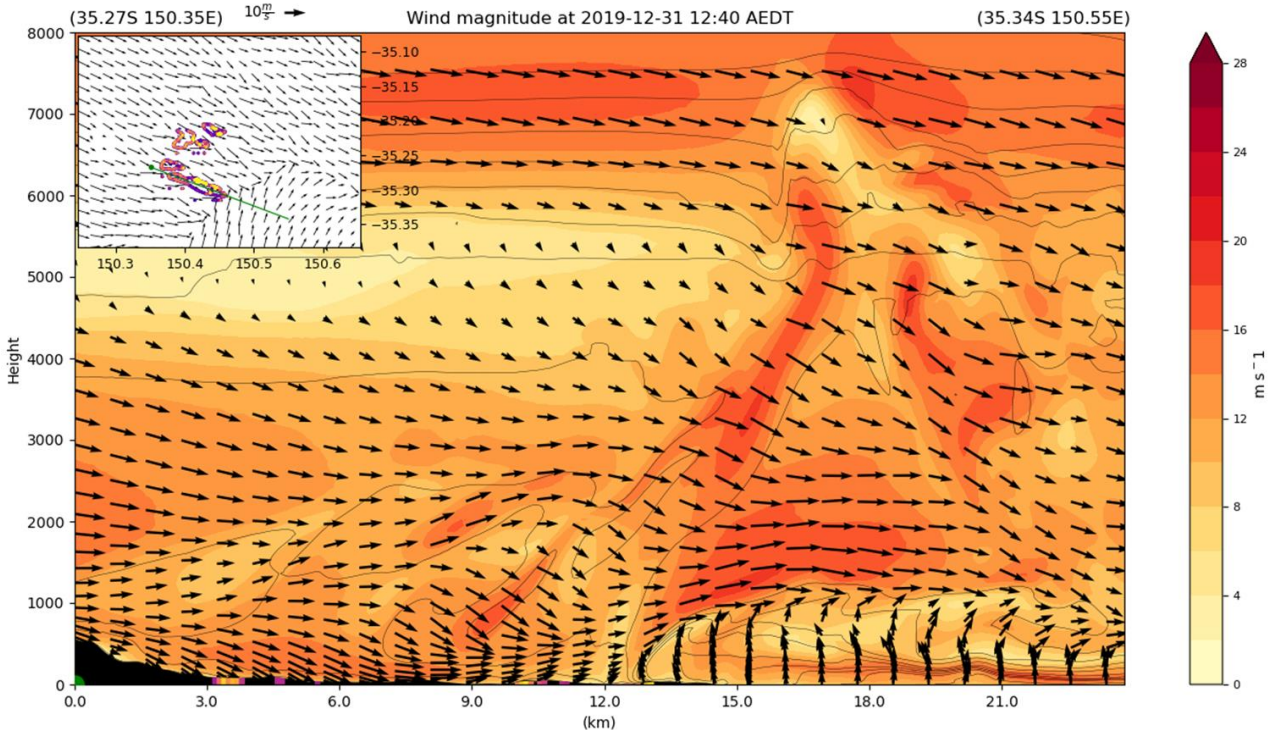
Nerriga – inland

Currowan fire - key finding #1
Detail in local surface coastal winds
Initial simulation to be re-run



Currowan fire - key finding #2
Plume and boundary layer and cloud structure
Initial simulation to be re-run

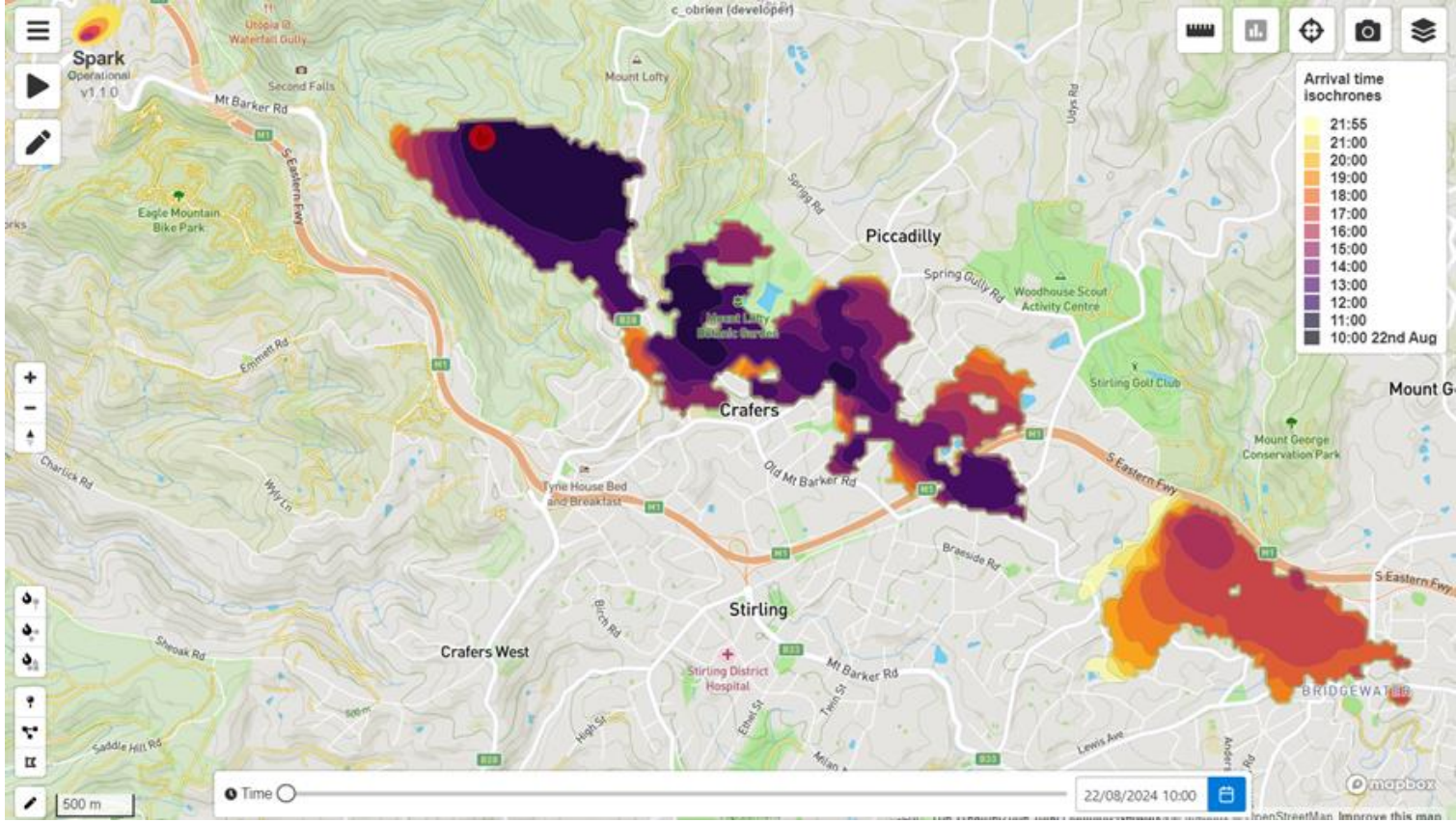




Natural Hazards Research Australia

Spark and ACCESS-Fire

With AFAC and Data 61 teams



HIW Spark licence and installed on NCI.

Currowan simulations ACCESS-Fire do not include spotting

(1) run Spark with high resolution ACCESS grids (2) extract spot fire locations (3) re-run ACCESS-Fire with Spark embers as new ignitions

Complimentary use of modelling frameworks. Different tools in the toolkit.

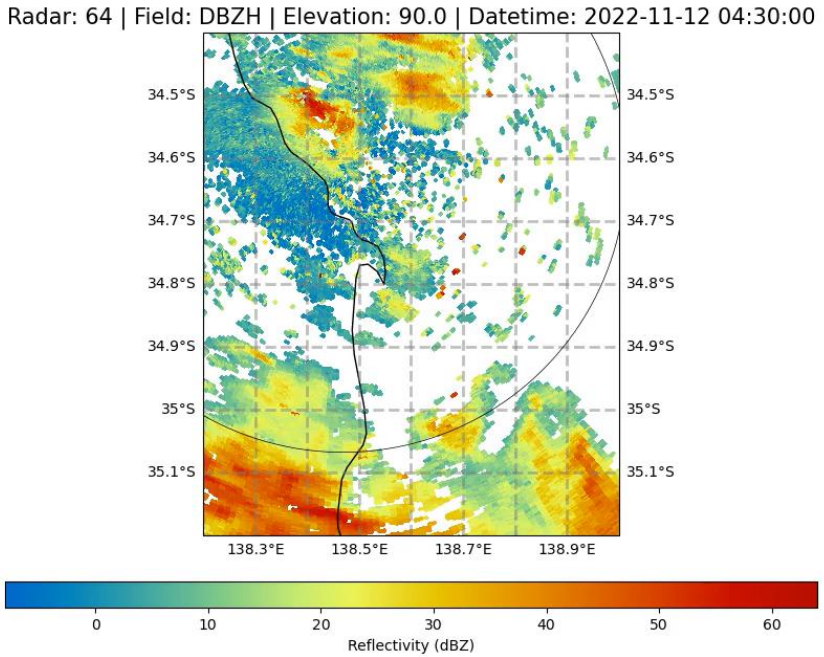
Test sensitivity of Spark to wind resolution at 300 m, 100 m, deterministic and ensemble

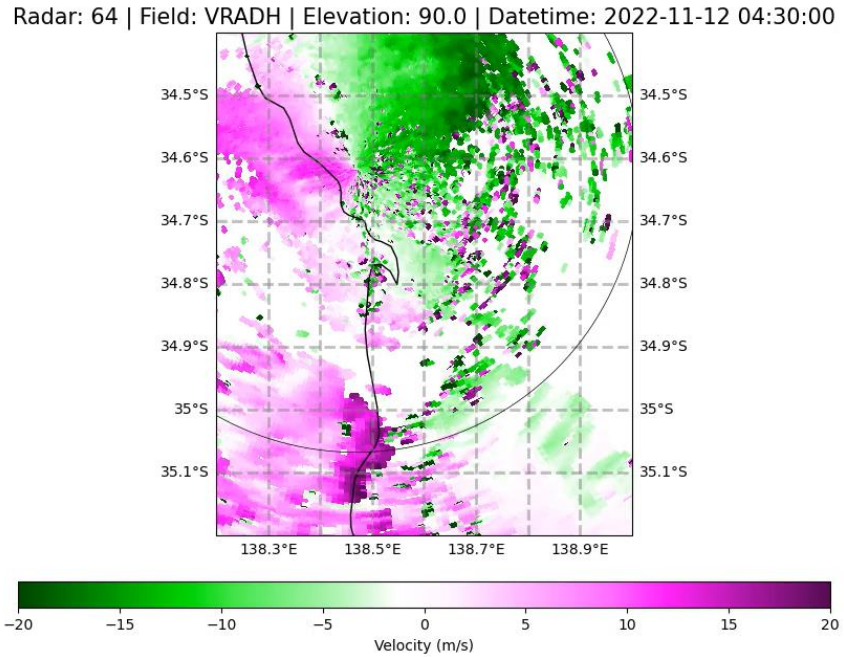
Hazard Agnostic Methodology

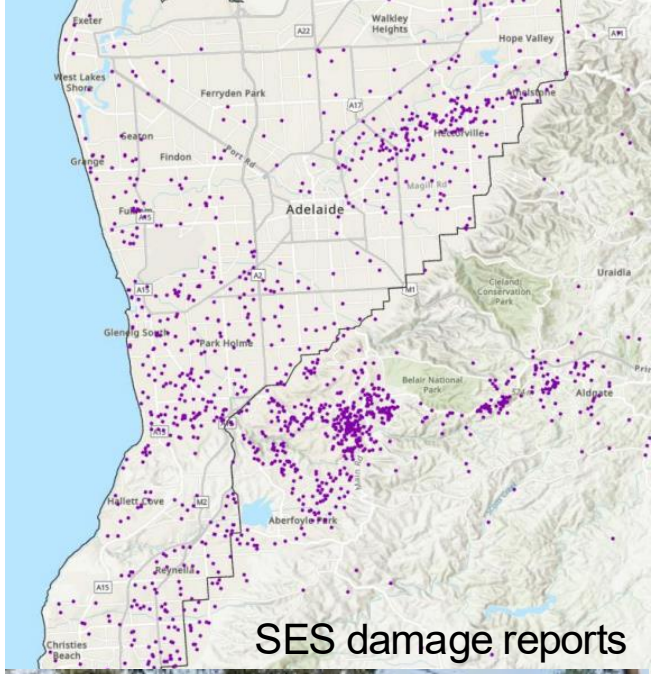
Severe thunderstorm and squall line mesovortices November 2022

Leverages off BNHCRC 2016 SA tornado case study ACCESS high resolution simulations

Fire Case Study Framework applied to 'other' weather events







The Bureau of Meteorology

Natural Hazards Research Australia

2025-2026 Fire Season Aim = one or two cases in near real-time

Conclusions

Impacts of climate change are manifesting in increased intensity and frequency of synoptic and mesoscale weather events

Case studies capture and share learnings post-event

T3-A4 Project is developing a suite of tools and techniques to rapidly capture data, run high resolution simulations and prepare a narrative following impactful fire (and other) weather events

Data and visuals consistent with the operational environment > effective translation through familiarity

Collaboration with practitioners and other researchers > multidisciplinary approach, enhance knowledge and lift capability

Robust science in the hands of emergency management partners = weather intelligence that informs better decisions

Thank you