Strategic Radar Enhancement Project (SREP)

Forecast Demonstration Project (FDP)

The future is here and now

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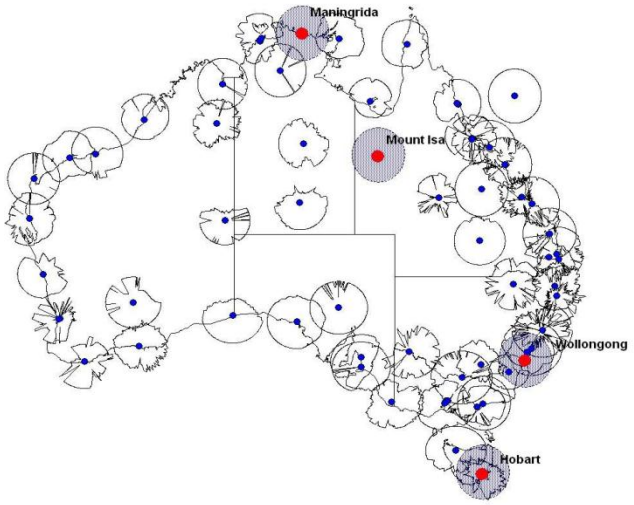
Strategic Radar Enhancement Project

5-year project began in 2009

- Infrastructure : 4 new Doppler radars + network upgrades
- Science: Develop and improve the underlying science to support an enhanced weather forecasts and warning capability

New science capability developed

- Improved radar data processing
  - Rainfields QPE/QPF
  - Quality control algorithms
  - Radar mosaic visualisation
- Assimilation of radar into a prototype rapid update 1.5km ACCESS model



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Sydney Forecast Demonstration Project:
October – December 2014

Aim To evaluate NWP and radar products

Aviation - to improve operational forecasts and warnings, particularly in the 0-12 hour lead time range

How Aviation forecasters participated in the project trial, real-time, in parallel with the operational forecasters

Why Use the feedback to improve the design of the products and plan implementation into operations

Aviation – to use the product output to apply to the optimisation of airport capacity and airline operations.

Rapid Update Cycle (RUC)

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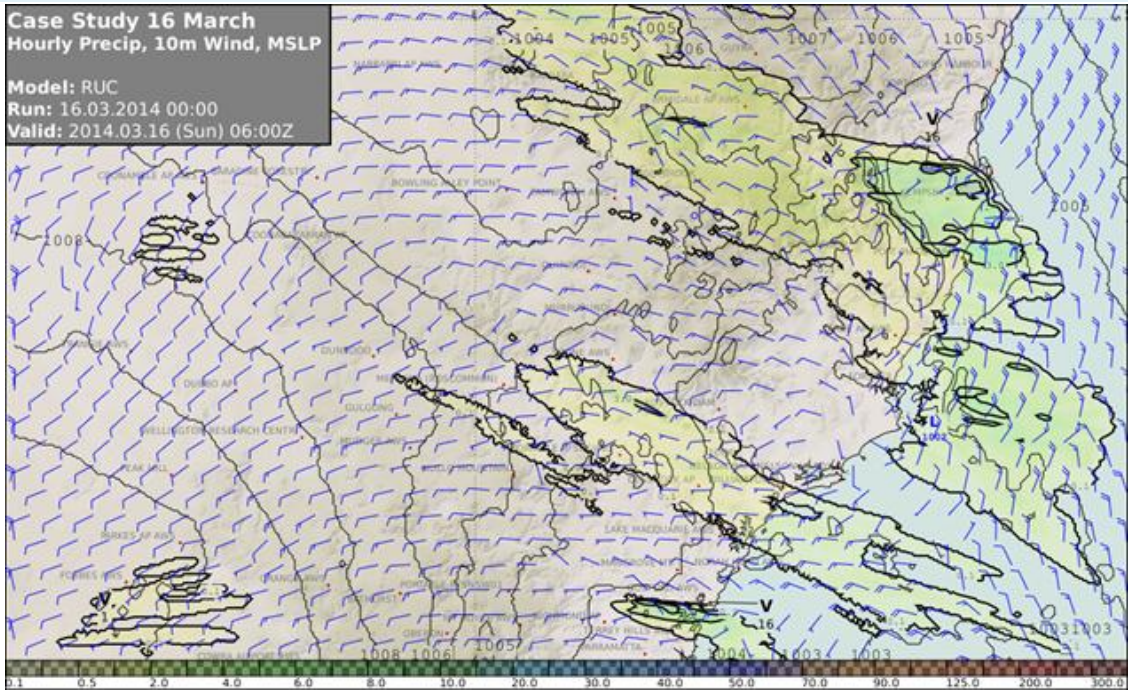
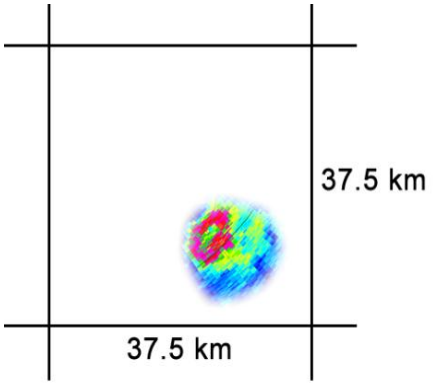
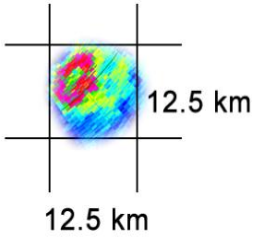
RUC:

- 1hr model runs
- 10min time steps
- 1.5km grid

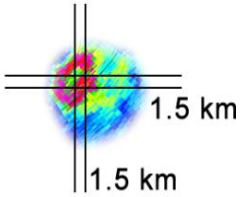




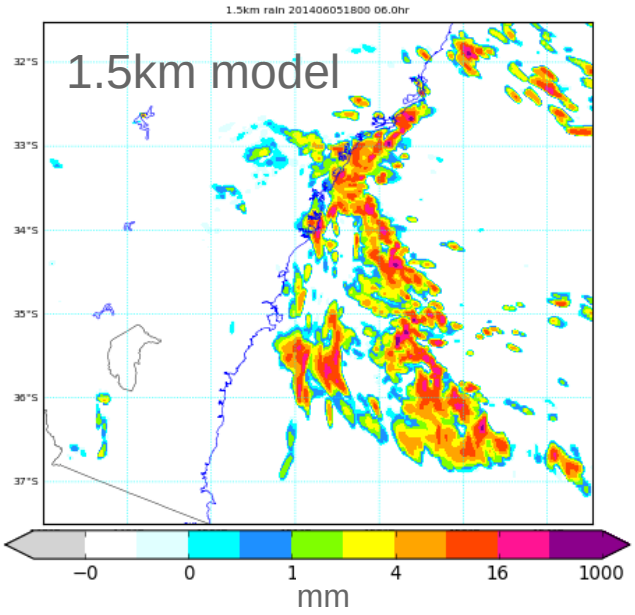
ACCESS-R Model



ACCESS-R12 Model

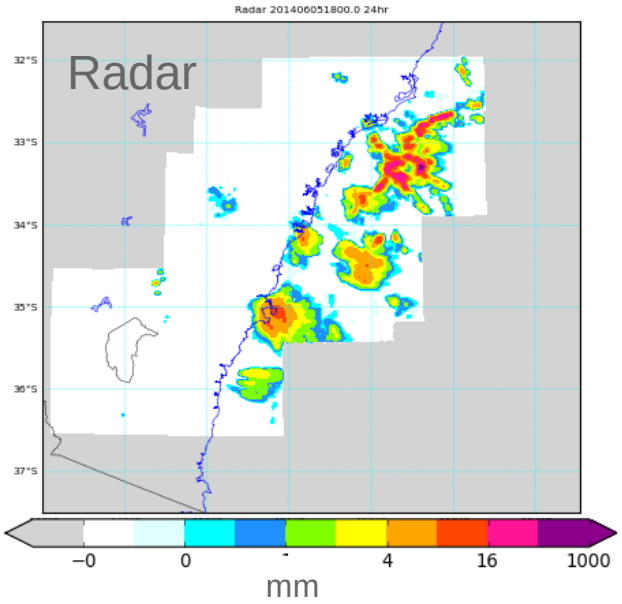


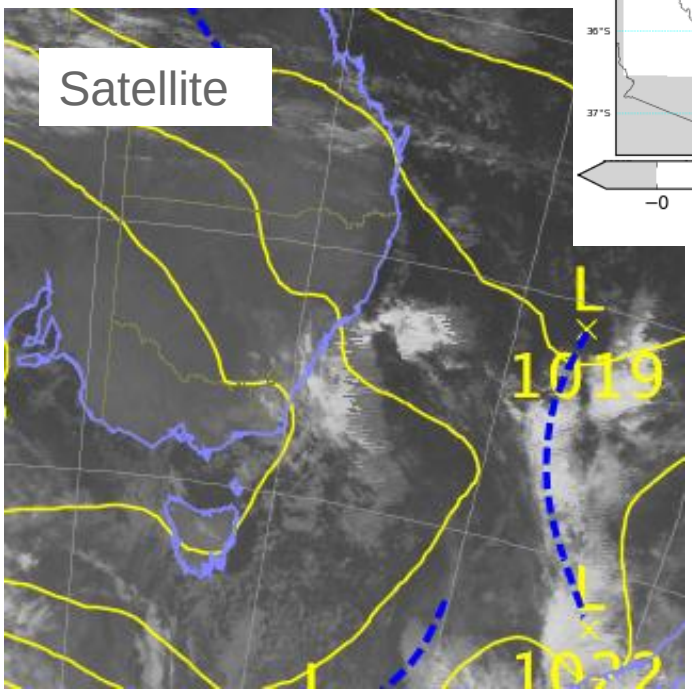
RUC 1.5km Model

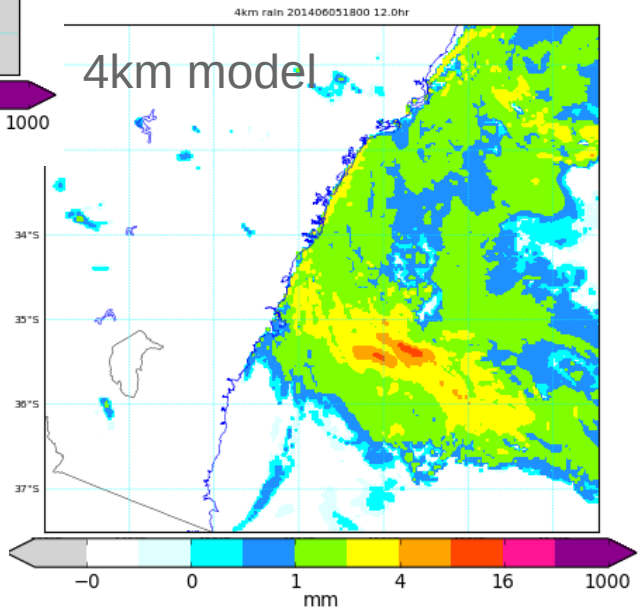


1.5km structure ✓

1.5km position –







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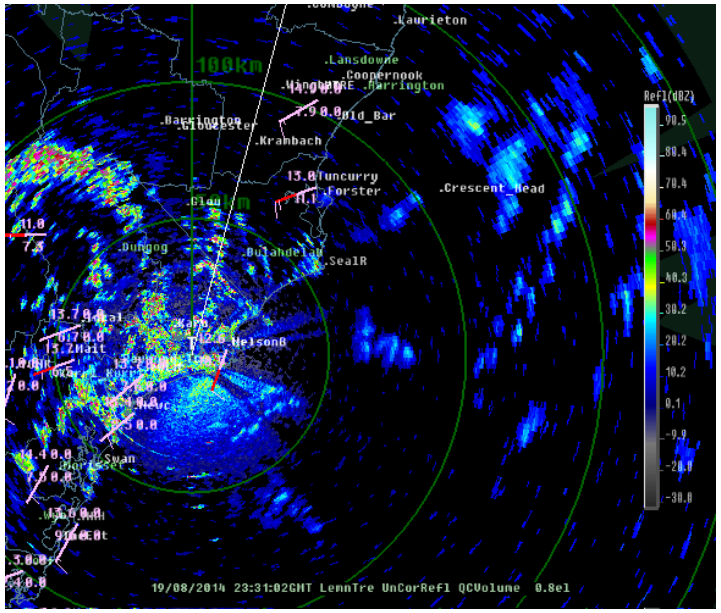
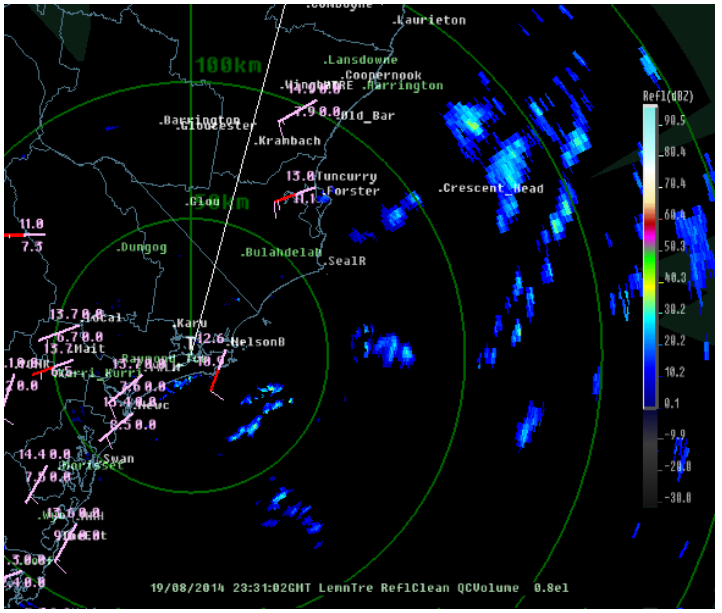
Rainfields3 & 3D-Rapic

Improved quality control of Doppler winds and reflectivity producing high quality radar mosaics; international data format



Raw radar reflectivity



Radar reflectivity – raining echoes only

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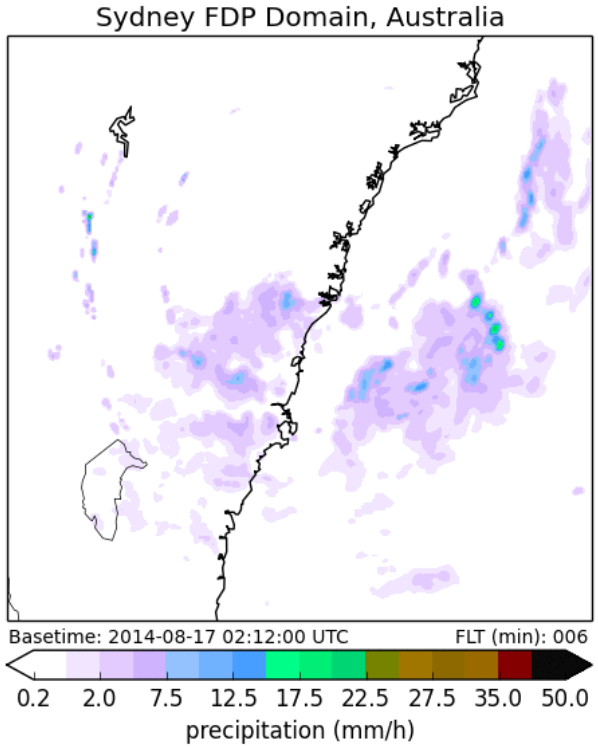
Short Term Ensemble Prediction System (STEPS)

Rainfields3 blended with ACCESS1.5 to generate STEPS 30-member rainfall ensembles out to 6hrs with 6 min 1 km resolution, updated every 6 minutes



x 30

STEPS

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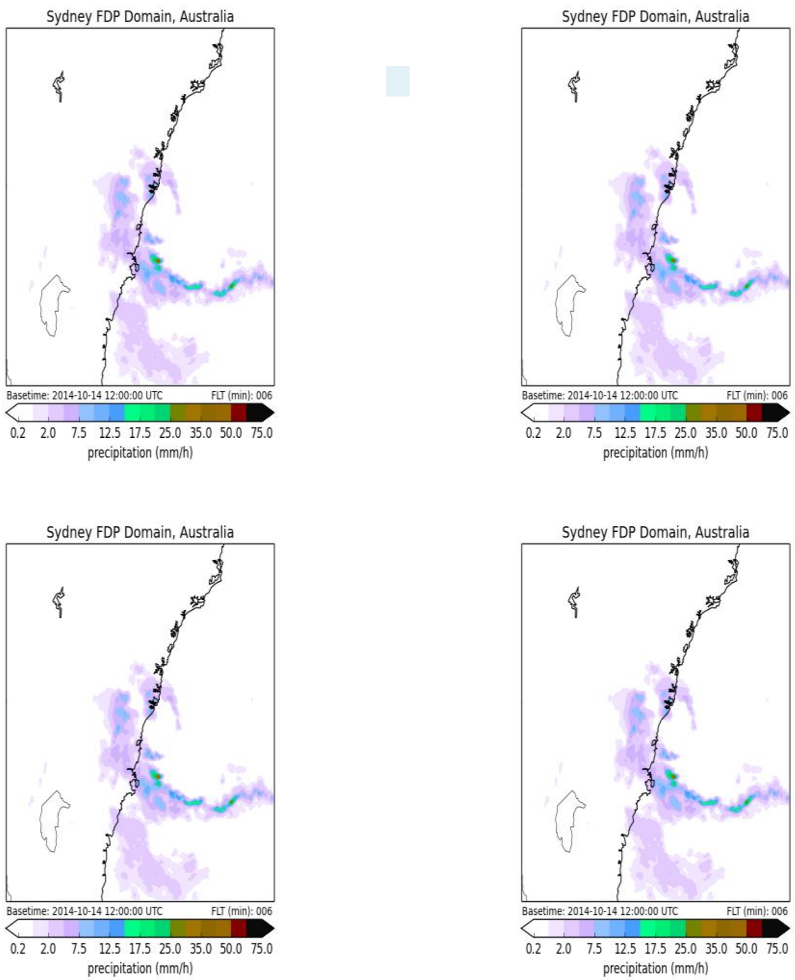

- Blends radar and model
- 30 member ensemble
- 6 minute, 1km resolution, 6 hrs
- 6 minute updates

- Can be adapted for aviation
  - Use vertically integrated liquid water (VIL) to represent convection
  - Probability of VIL exceeding a threshold within an area or along a route
  - Allows for a risk-based approach

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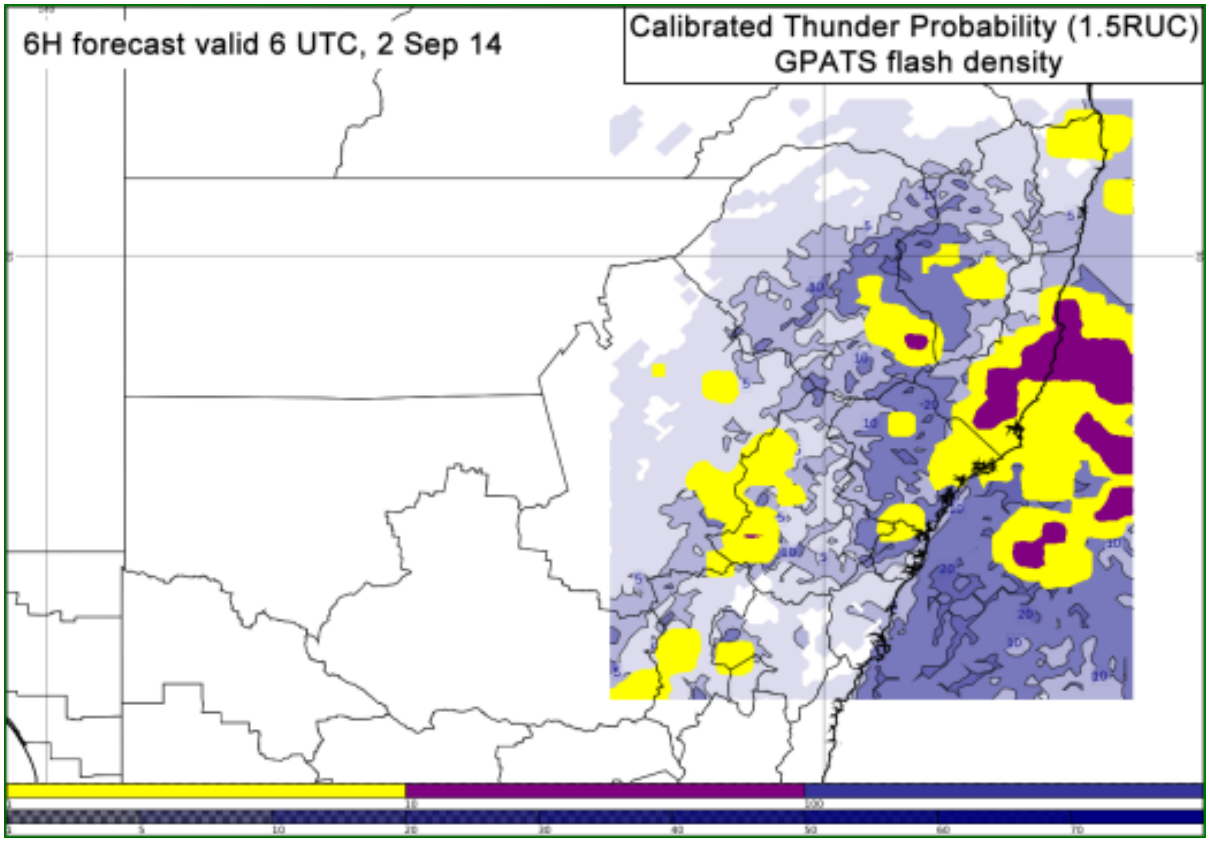
Calibrated Thunderstorm Guidance

Use lagged ensemble ACCESS1.5 to generate convective weather outlooks



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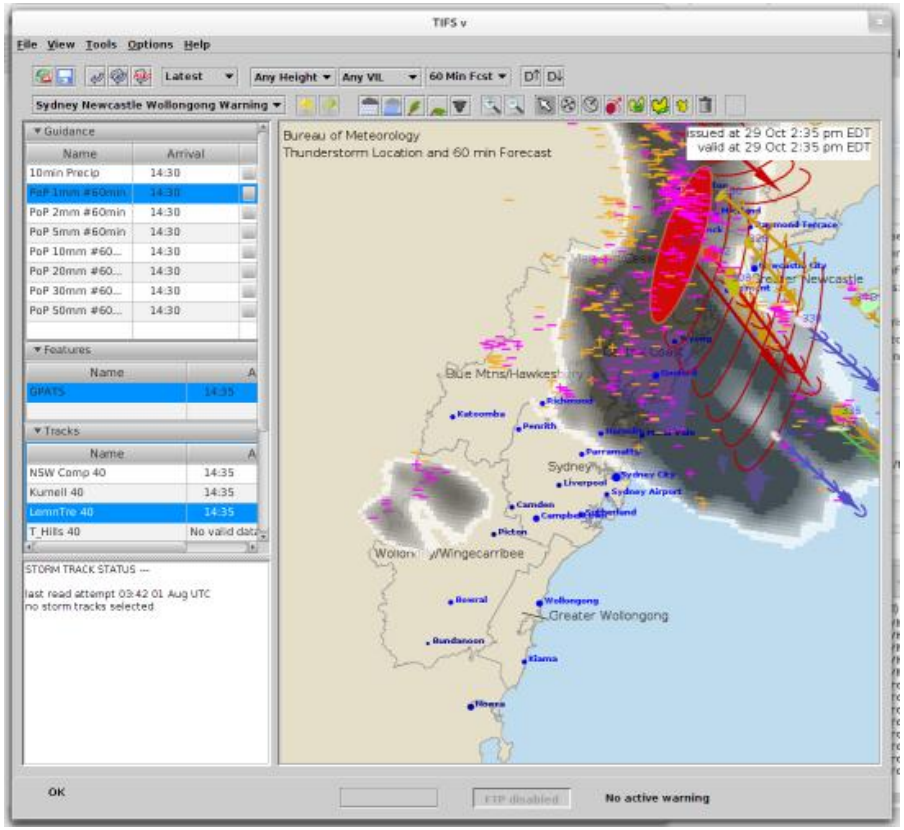
Thunderstorm Interactive Forecast System (TIFS)

- Thunderstorm cell tracks using STEPS motion vectors
- Rainfields3 rain probability forecasts for areas of imminent storm threat
- Pixel-scale verification
- Forecaster layer control



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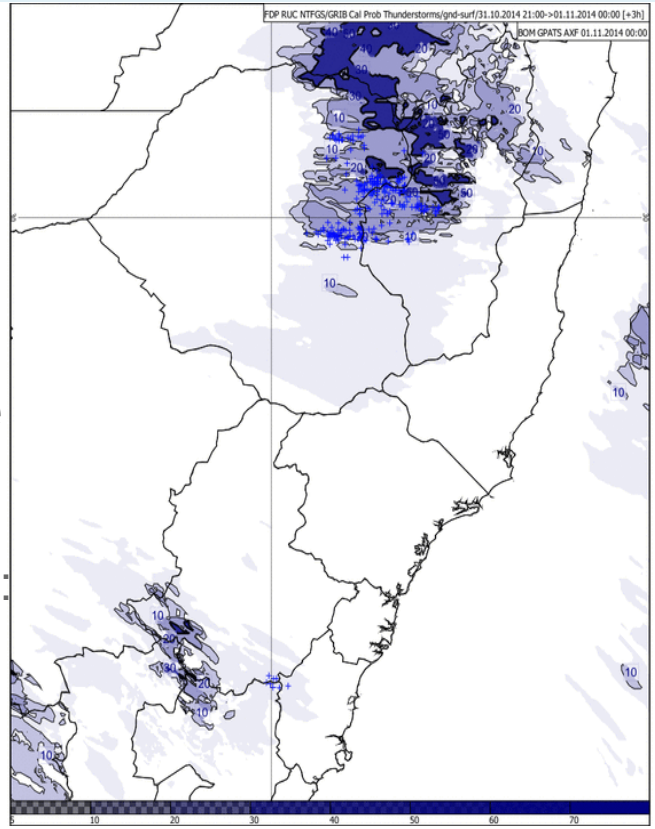
Thunderstorm– Findings

- National Thunderstorm Forecast Guidance System (NTFGS) - RUC Calibrated Thunderstorms was able to pick areas of convection that were not picked well by other models.
- The model appeared to excel in the timing of onset and clearance of thunderstorms from the metro area, as well as the general trend in intensity.
- Issues that require further investigation include:
  - Overestimation of thunderstorm probabilities.
  - Slightly optimistic on clearance times.
- There is a requirement to see how the model handles heat-based convection vs synoptically forced convection.



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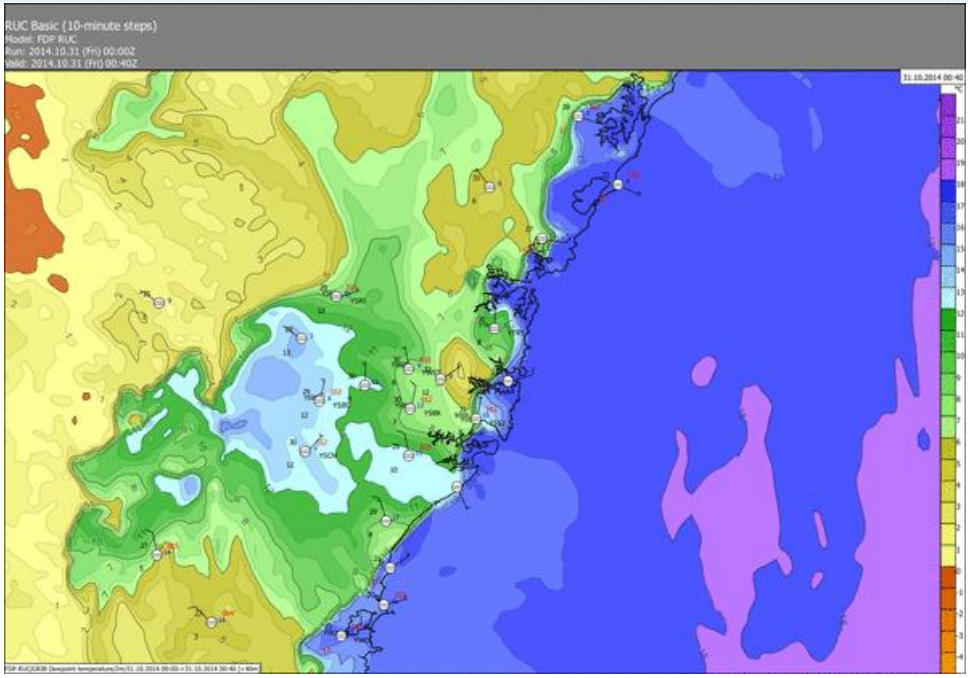
Sea breeze - Findings

- Model performed well on timing the sea breeze wind shift towards the coast.
- Some issues with correctly propagating the wind shift inland.
- There is a requirement to investigate propagation of seabreeze inland and frictional factors.

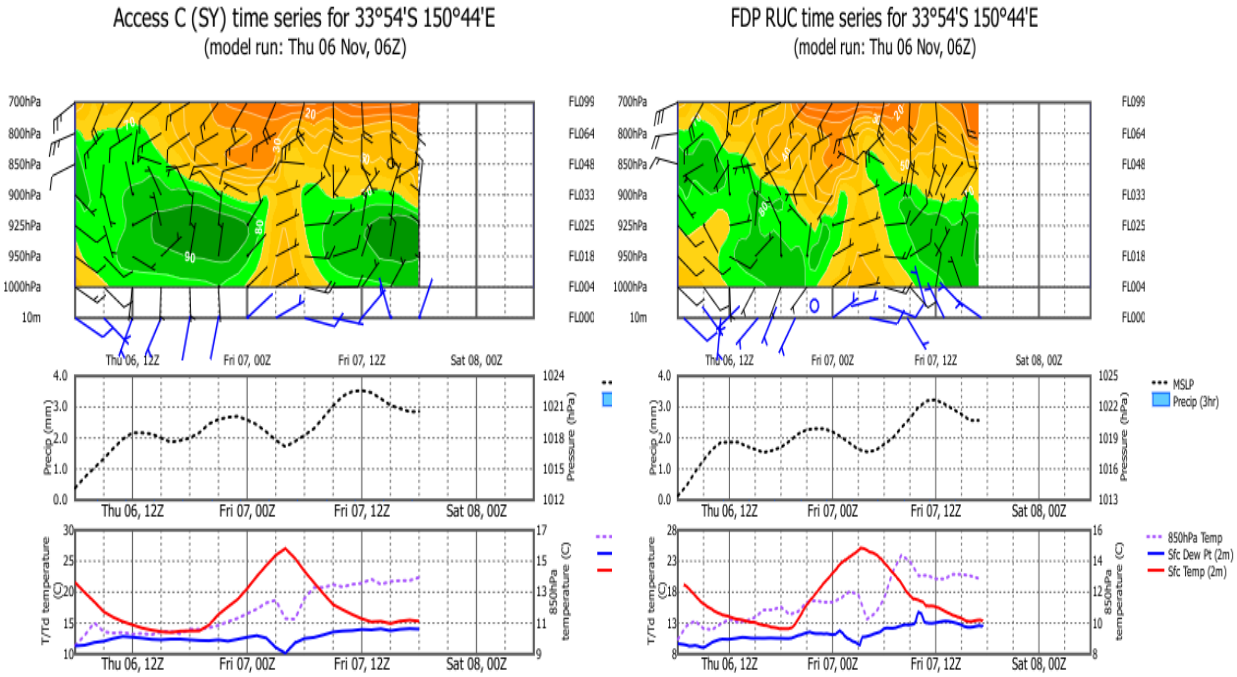


Fog - Findings

- RUC appears to be able to pick the difference between fog and low cloud well.

- To some extent the RUC appears to be able to differentiate between mist from fog.

- RUC was able to pick a post-rain fog event. However, this capability needs to be further examined using a few more events.



- There is required to further verify the capability of the model in during an additional fog season.

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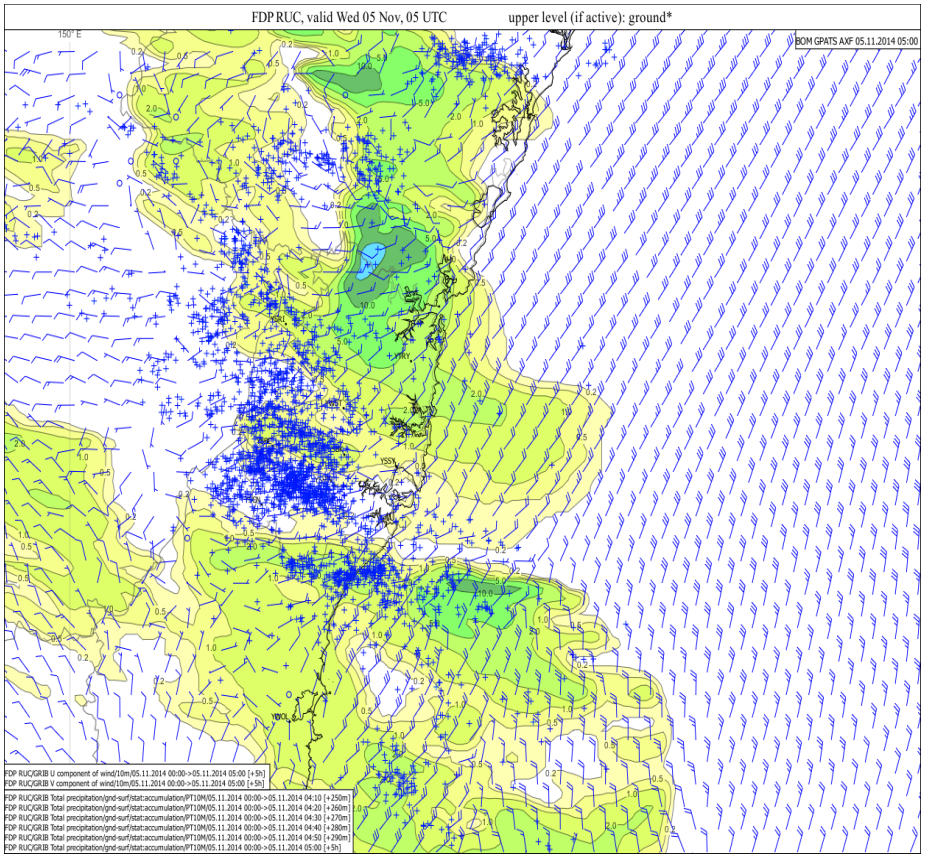
Precipitation - Findings

- Limited data was examined with respect to precipitation
- The RUC performed well in specific scenarios however, there is a need to further investigate precipitation fields and additional scenarios.
- RUC seemed to pick precipitation types, however forecasters need to be careful of precipitation output



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Aviation Forecasting

- Principally focussed on thunderstorm and wind change
- Evaluated ACCESS1.5 at Sydney airport
- Generation and verification of TAFs

Strategies for Meeting Aviation Requirements

- Base the services on high resolution NWP rather than empirical algorithms, e.g. fog.
- Structured evaluation of NWP updates from an aviation perspective will allow the NWP scientists to calibrate their models appropriately.
- Will still have some error in the forecasts so need to develop risk based approaches.
- Need to integrate high resolution NWP with high resolution satellite and radar imageries.

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Future Research

- Thunderstorms: Further investigate how the model handles heat-based convection vs synoptically forced convection.
- Seabreeze: Investigate the propagation of seabreeze inland and frictional factors.
- Strong coastal wind changes: Further investigate the parameters in the model which are causing timing issues on major wind changes.
- Upper Winds: The model appears to handle upper-wind well but there is a requirement to see further evidence.
- Precipitation: these fields require further investigation in different scenarios.
- Fog forecasting: There is a requirement to verify the capability further in a fog season. Further investigation is required for post-fog event.
- Low level temperatures, dewpoint temperatures and surface inversions: fine tuning of surface temperatures and dewpoints may lead to improvements in forecasting inversions; however further investigation is required to address moisture profile.