Natural Hazards Research Australia

Developing an integrated predictive capability for extreme rainfall and inundation

T4-A7

Paul Fox-Hughes and Carlos Velasco-Forero
Research Program
Bureau of Meteorology

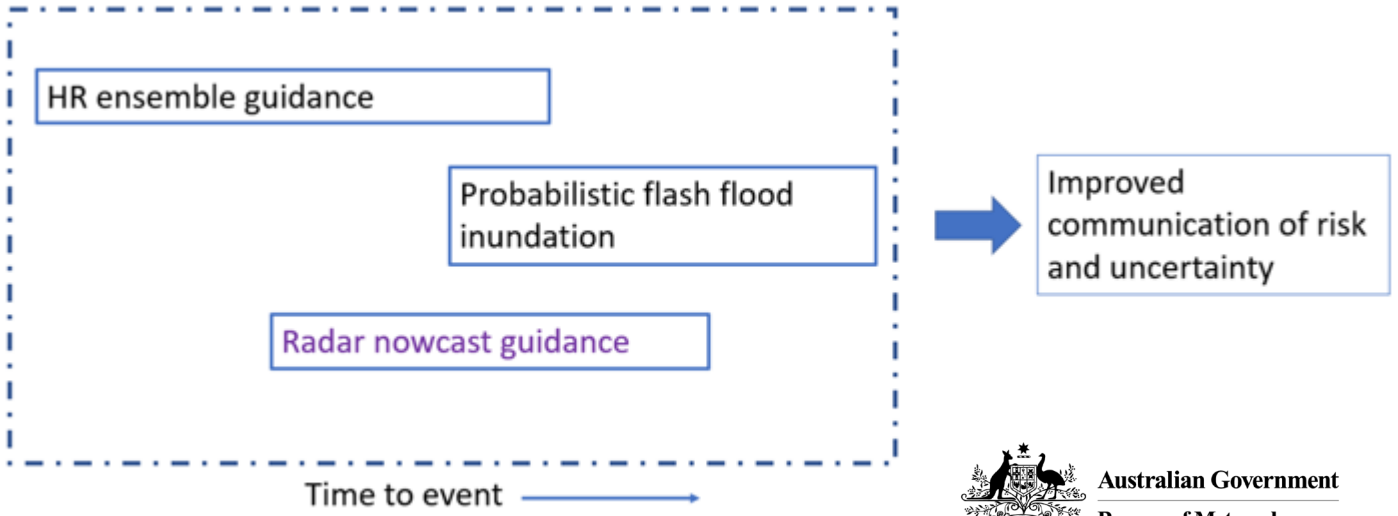
Australian Government
Bureau of Meteorology

Overview

Project components working together across timescales to:

1. Improve predictions of heavy rainfall;
2. Identify locations at risk of flash flooding and inundation;
3. Quantify and communicate uncertainty in forecasts (leveraging heavily off T2-A2).
4. Noting longer timescales (weeks/months) are focus of T4-A3.

Project formally commenced in last few weeks.



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Improvements in ensemble guidance

Project lead: Dr Paul Fox-Hughes

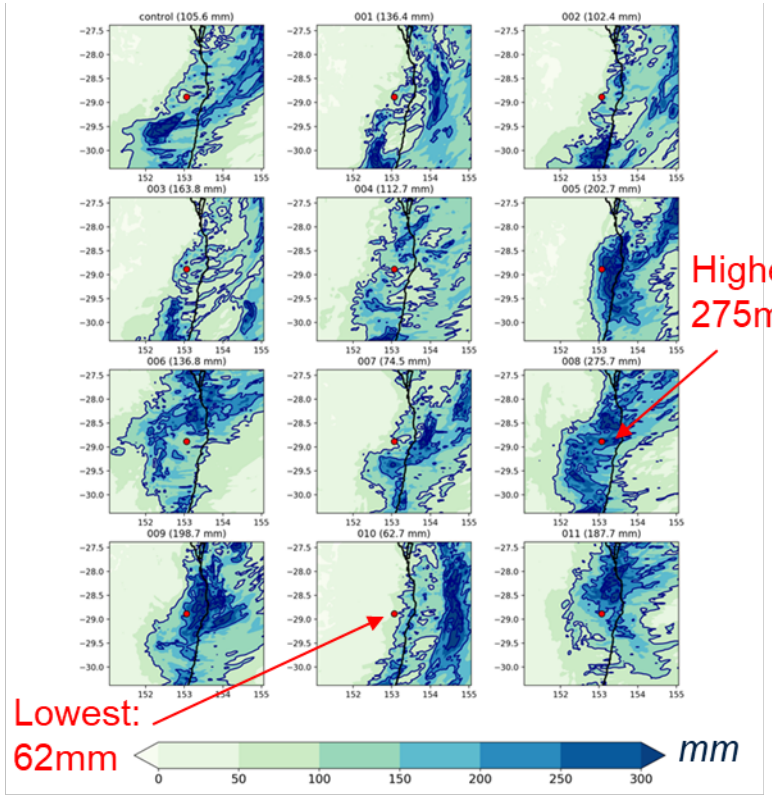
Description:

Using mainly **high-resolution operational ensemble weather models**, investigate cases and climatologies of heavy rainfall that can lead to flash flooding including **better representing and communicating to users** the large volumes of data involved.

Expected outcomes:

Enhanced forecasting tools for heavy rainfall/flash flooding.

Better communication to EM of probabilistic forecasts.



Spread in ensemble 36-hr rainfall from 11am, 28th March 2022 near Lismore.

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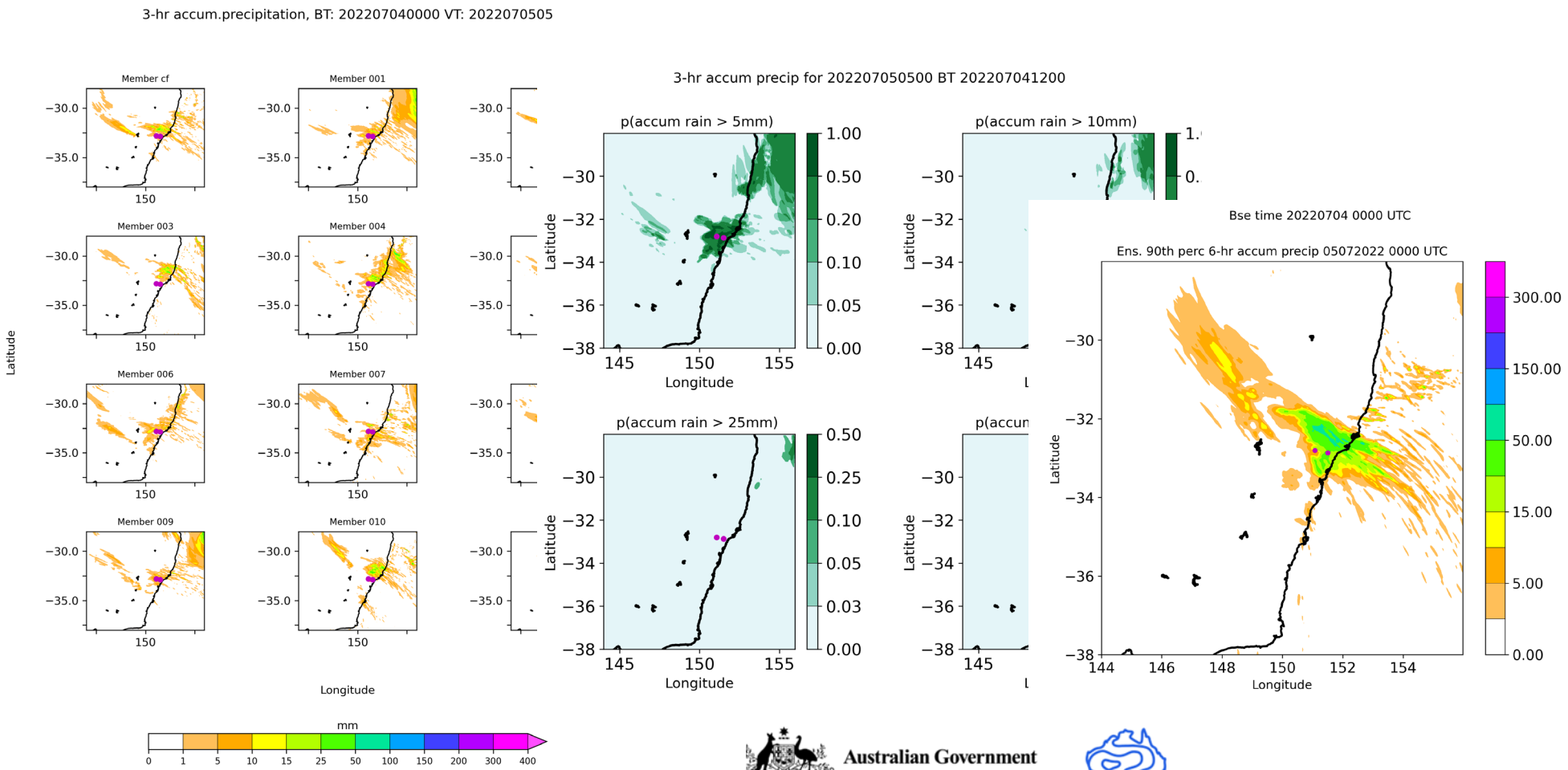
And how to present ensemble guidance…



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Radar Rainfall nowcasting tools

Project lead: Dr Carlos Velasco-Forero

Description:

Using **weather radars** to assess in real-time the risk of flash flooding across vast regions of Australia including all capital cities and major urban areas.

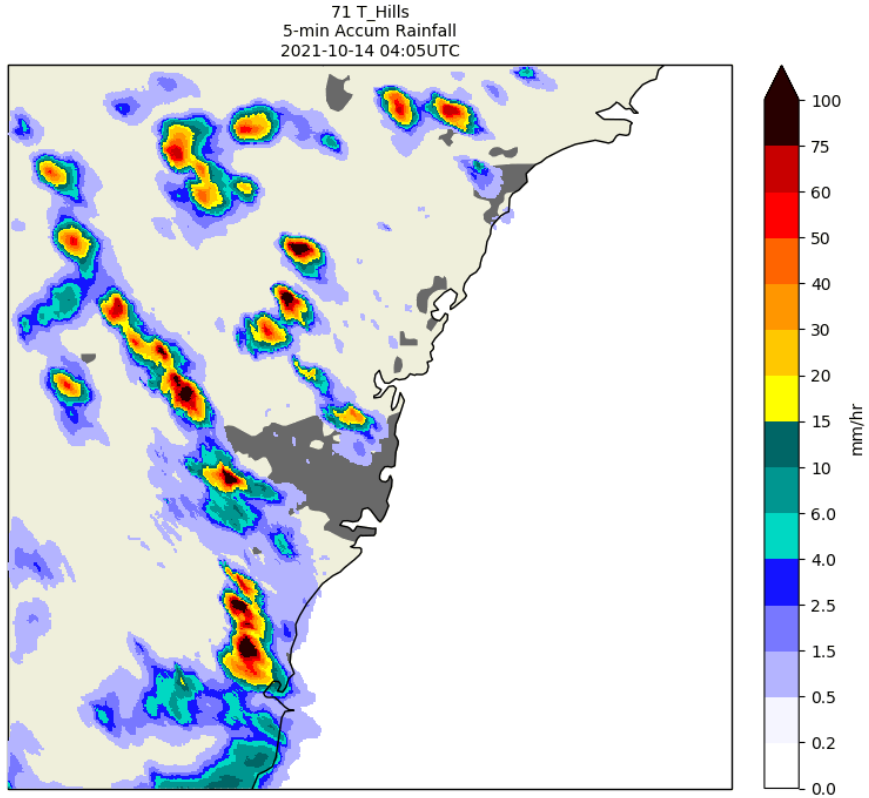
Expected outcomes:

Real-time tools to assess and map the risk of flash flooding based on radar rainfall ensembles over the next 12 hours.

Pilot studies across multiple areas to demonstrate feasibility.

Potential national expansion to all regions with radar coverage.

Example of Rainfields Nowcast Product (STEPS 0-90min) Sydney Radar 2021-10-14T05:05UTC



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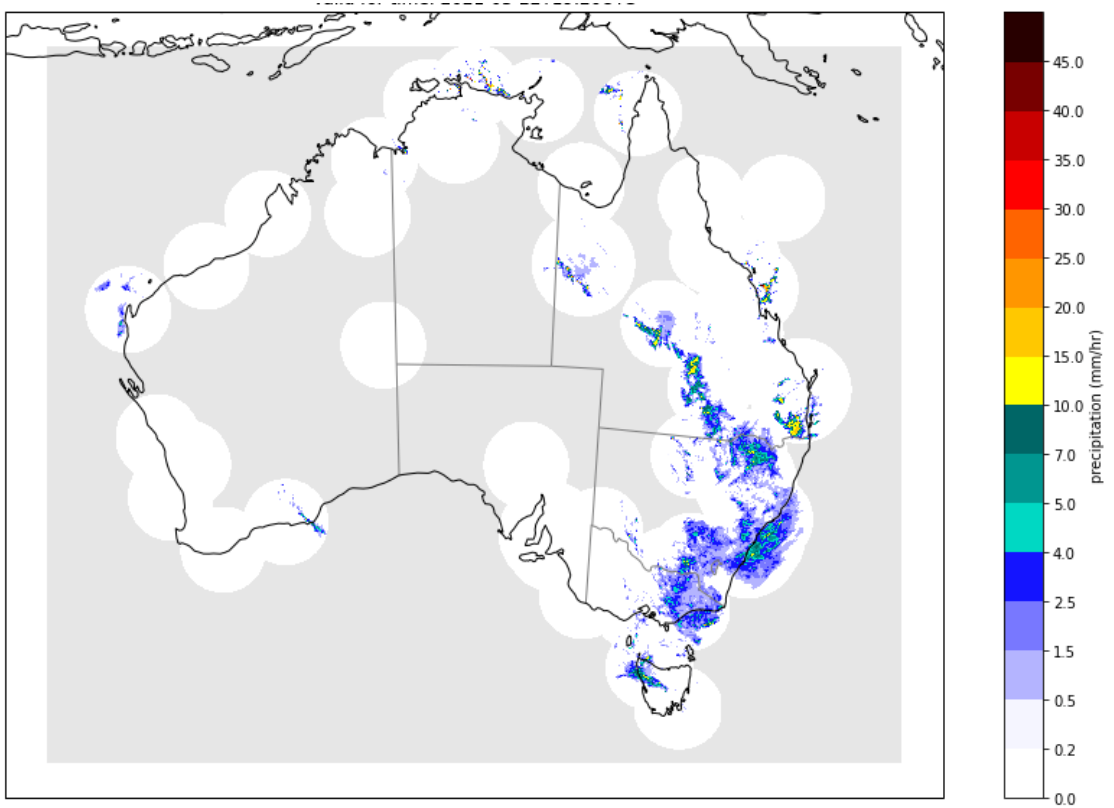
Example of Rainfields Nowcast Product (STEPS 0-90min) National Mosaic 2021-03-22T19:15UTC



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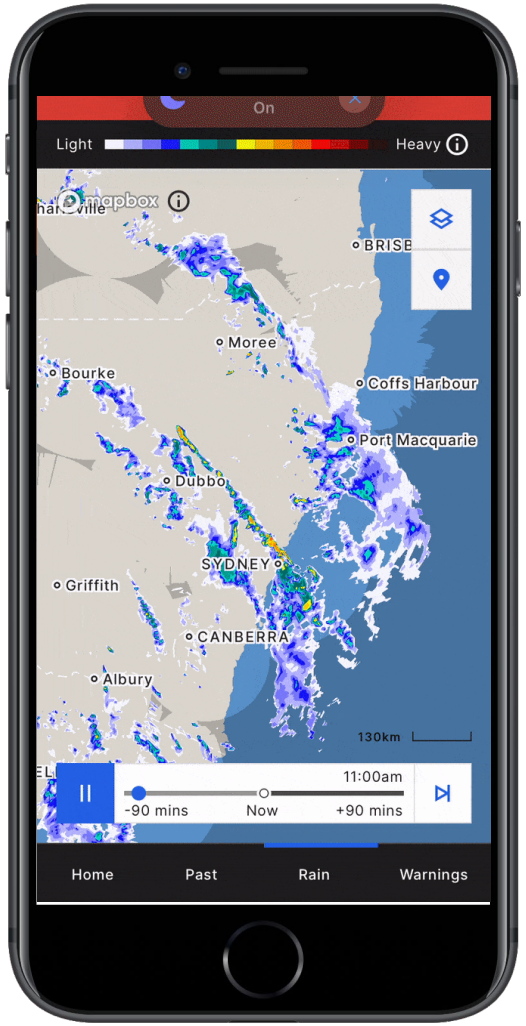
The Bureau Weather Apps

Australia's official weather app

Rainfall: last 90 minutes followed by next 90 minutes

Only one member of 32 is displayed



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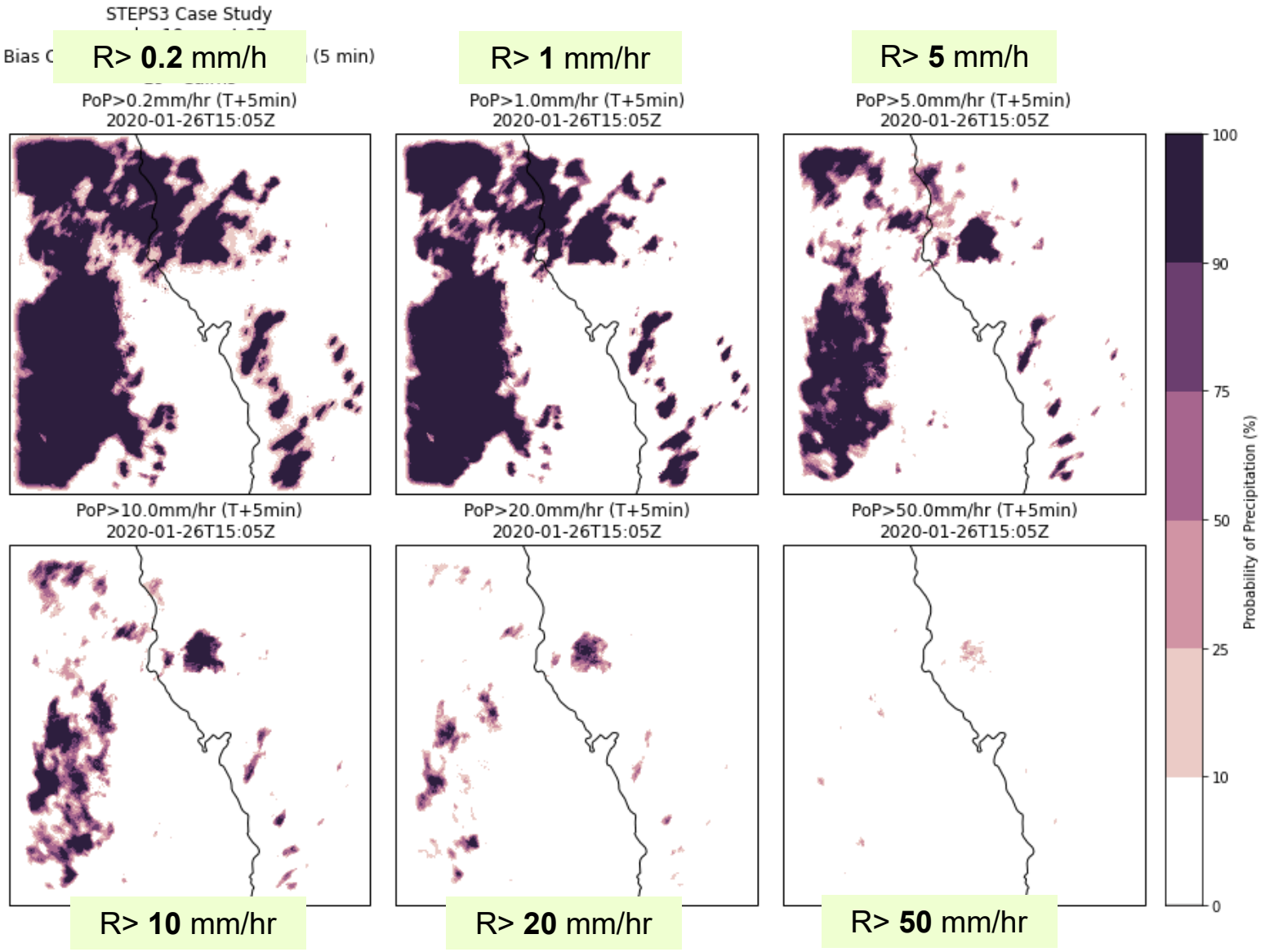
Rainfall Analysis and Nowcasting using STEPS



Probability of Precipitation (PoP)

5-min STEPS3-ADV
96-members

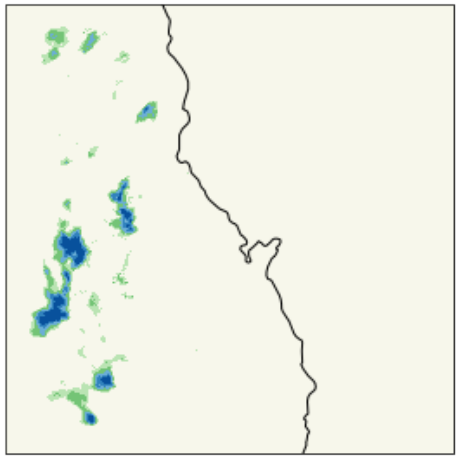
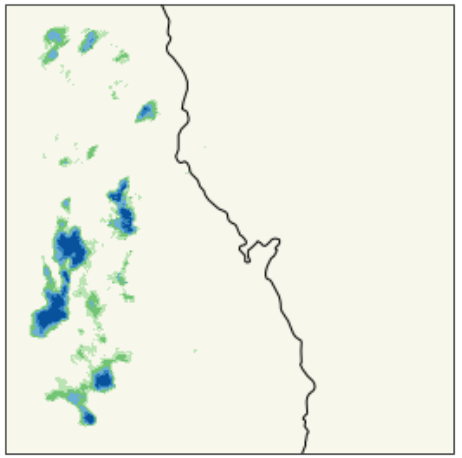
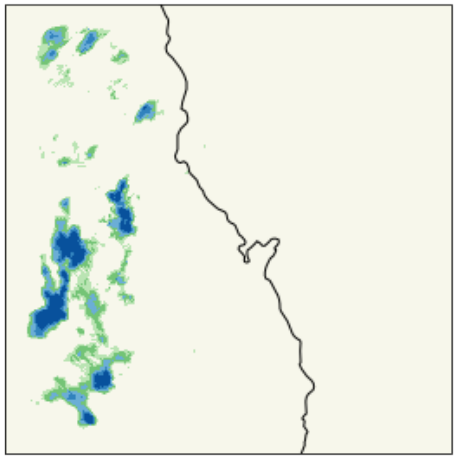
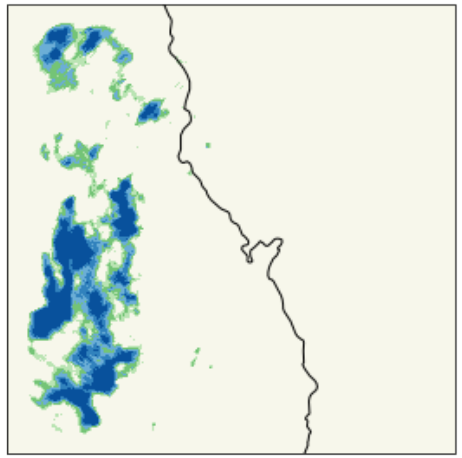
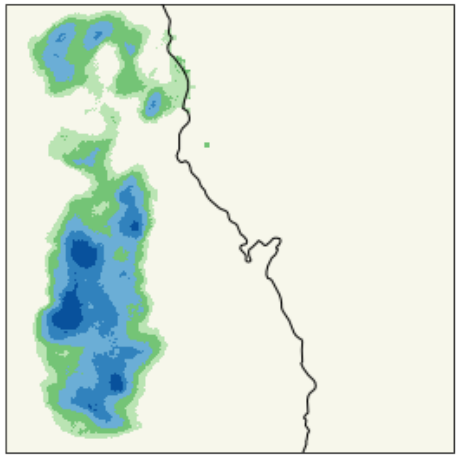
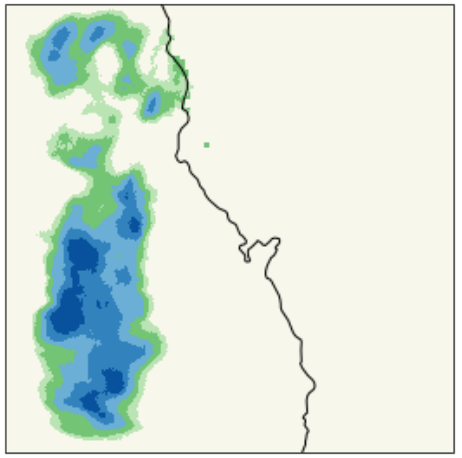
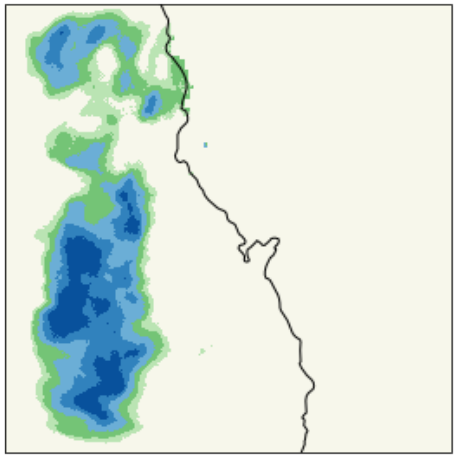
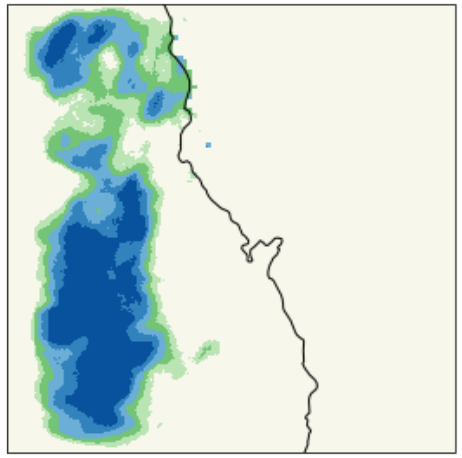
Cairns Radar

January 2020

Nowcasts from
5-min to 90-min

Rainfall Nowcasting using STEPS

Chance of Exceeding AEP depth

	2.0% AEP	5.0% AEP	10% AEP	50% AEP
5-min				
60-min				

Mock-ups

Illustration purpose only

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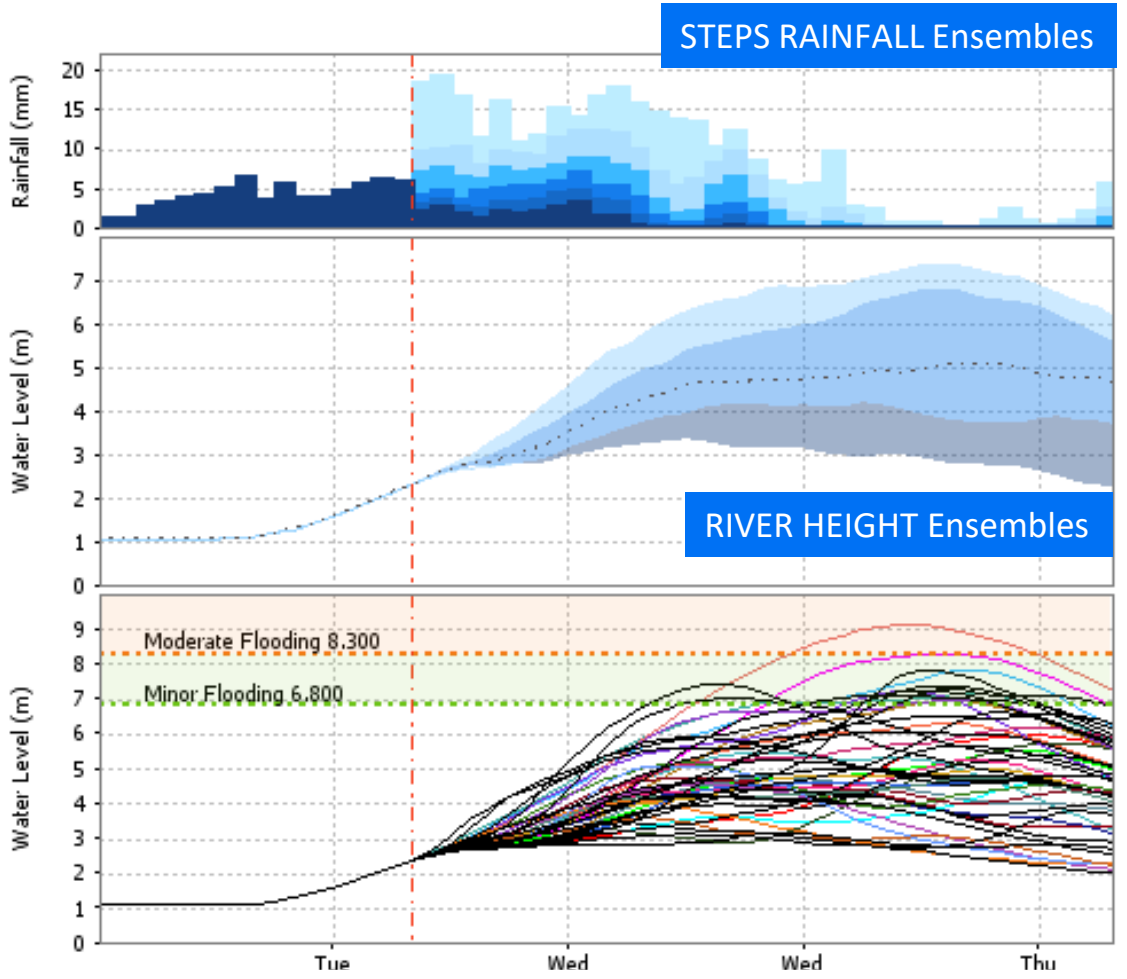

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Flood inundation mapping

Project lead: Dr Wendy Sharples

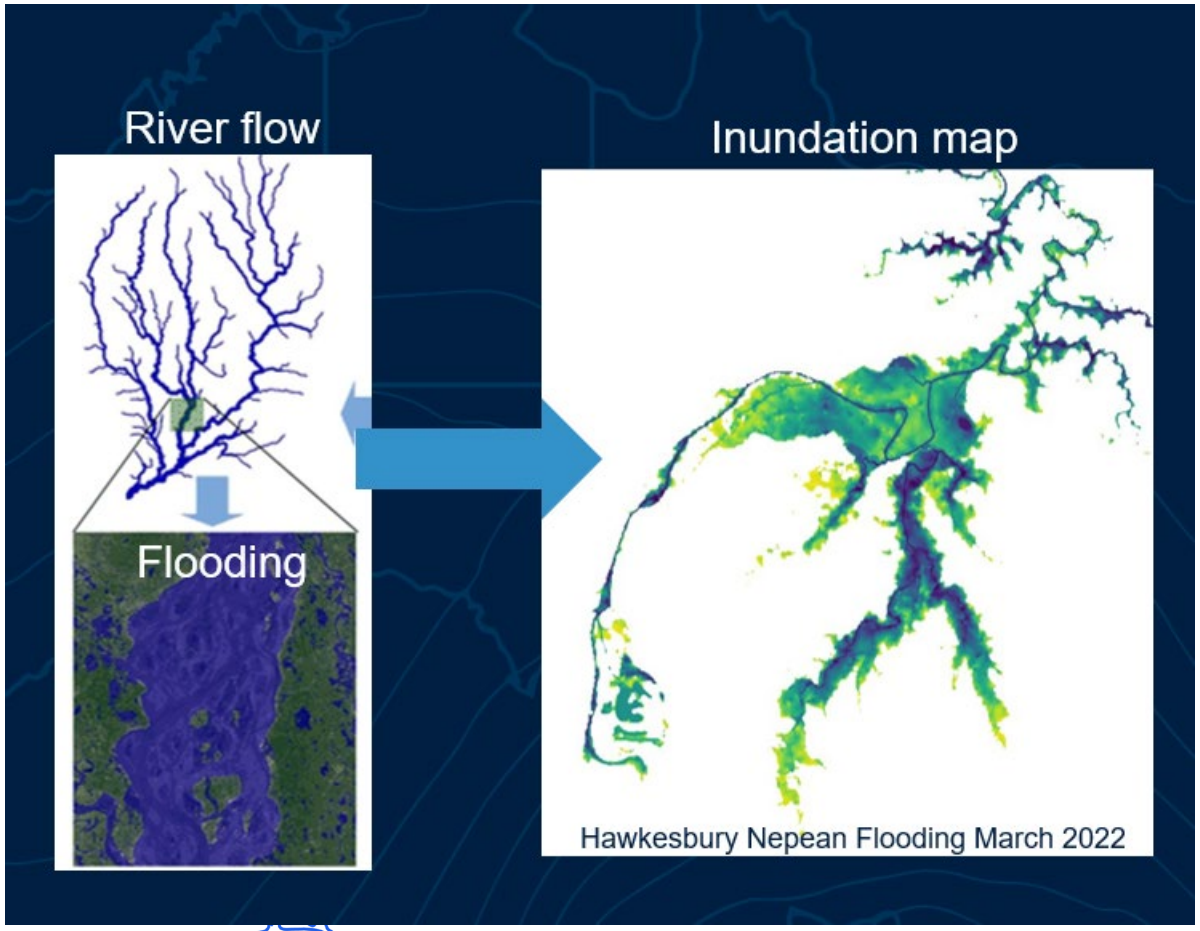
Description:

Flood inundation maps generated from ensemble rainfall guidance (both radar and model) for minutes to weeks ahead.

Expected outcomes:

→ National scale, with pilot study locations.

→ Inundation maps with probabilistic depth and extent.



Implications of quantitative probabilistic forecasts/guidance(?)

- → Capacity to implement action thresholds for different timeframes (x days/y hours…)
- → And different probabilities of event occurrences e.g.:
  - 40% probability of 100 mm in catchment/area in next 24-26 hours
  - 70% probability of 80 mm in catchment/area in next 6-12 hours
  - 80% probability of 50 mm in catchment/area in next 1-2 hours
- → Allowing nuanced responses/preparation
- → How to frame forecasts to facilitate more targeted/nuanced responses?
- → Can/should such a framework be national (given limited capacity to refine locally)?

Thank you!

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