Natural Hazards Research Australia

The Bureau of Meteorology

Long-Range Flood Outlook

NHRA Project T4 – A3

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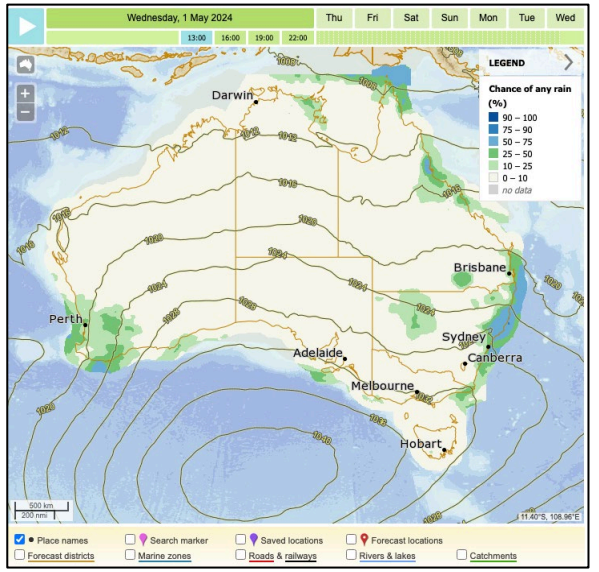
Current forecasting capability at the Bureau

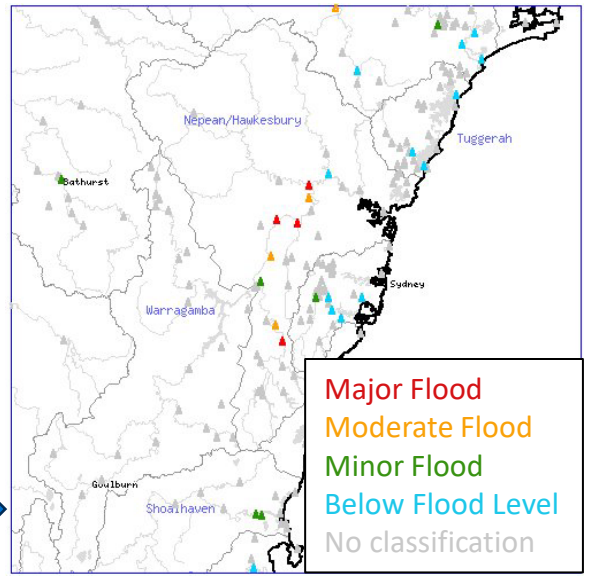
Short-term forecast products (< 3 days)

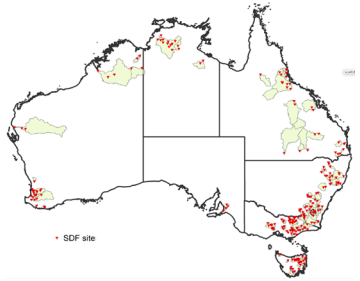
- NWP Weather Forecasts & Warnings
  - National coverage!
- Flood Watch & Warnings
  - Point-based
- 7-Day Streamflow forecasts
  - Point-based

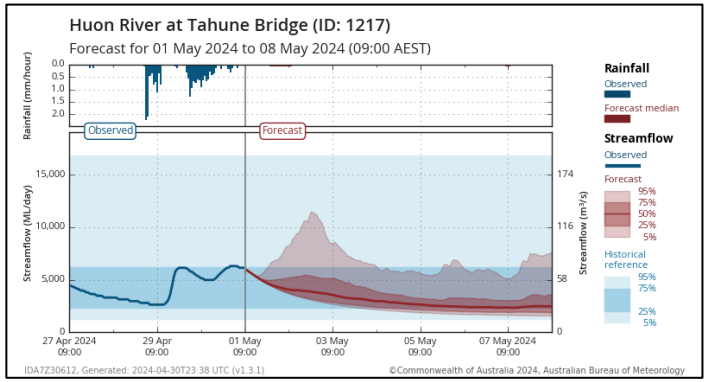


7-day Rainfall forecast

Current flood warnings



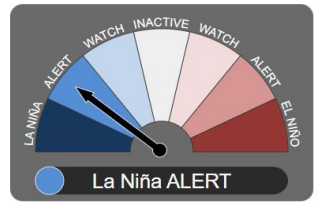


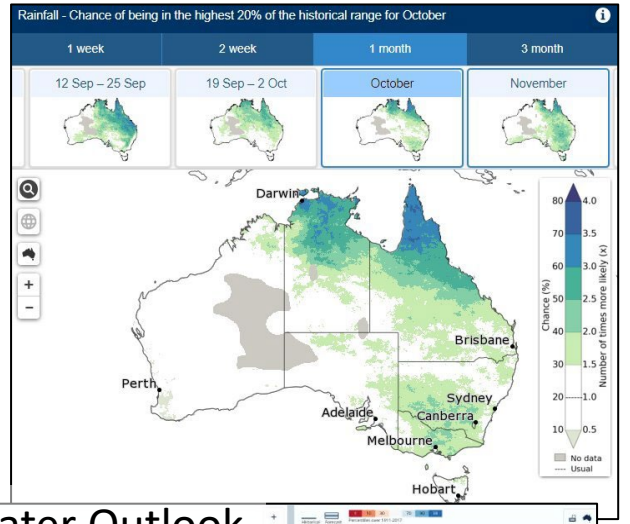


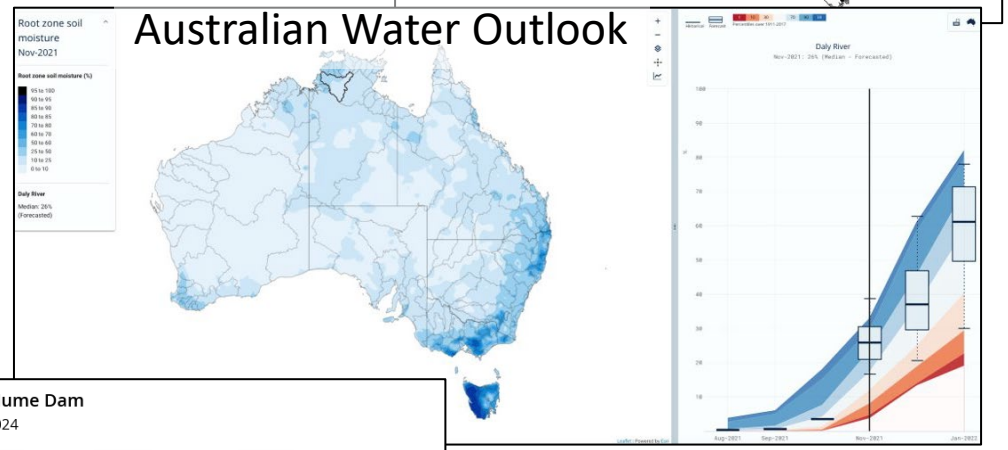
Current forecasting capability at the Bureau

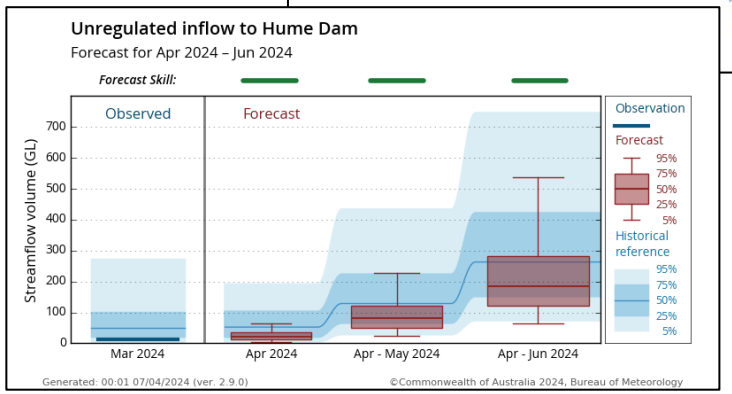
Long-term forecast products (weekly to seasonal)

- Seasonal climate forecasting (precip, temp, extremes)
- Surface water balance (soil-moisture, runoff, ET)
- Fire risk (Australian Fire Danger Rating System)
- Seasonal (3-month) Streamflow Forecasts
  - Point-based





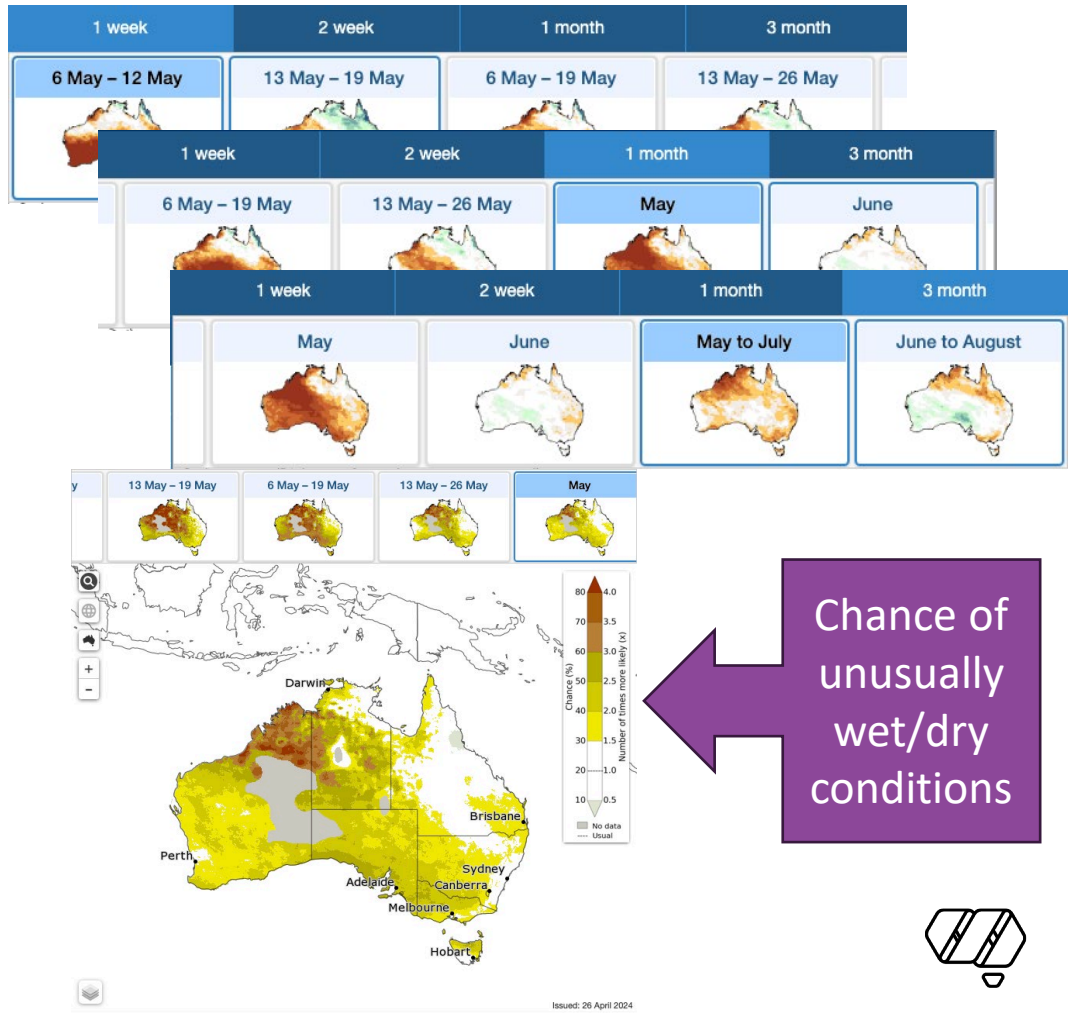




Gaps in Forecasting Capability

Not all forecasting services are truly seamless

- No multi-week forecast products for hydrology exist, as they do for the climate forecasting service
- No hydrology forecast products exist that focus on extremes, as they exist for climate forecasts
- **A need for a multi-week to seasonal outlook of flood risk**

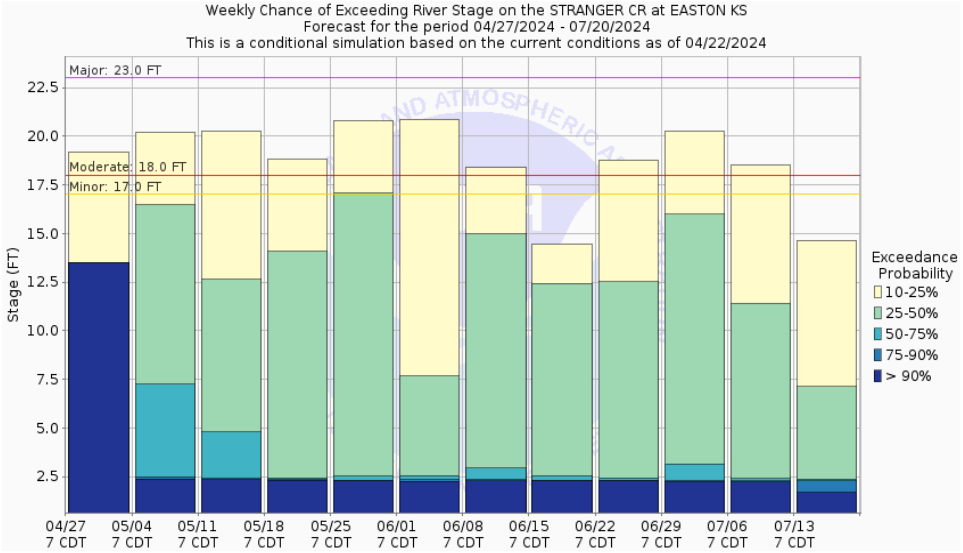


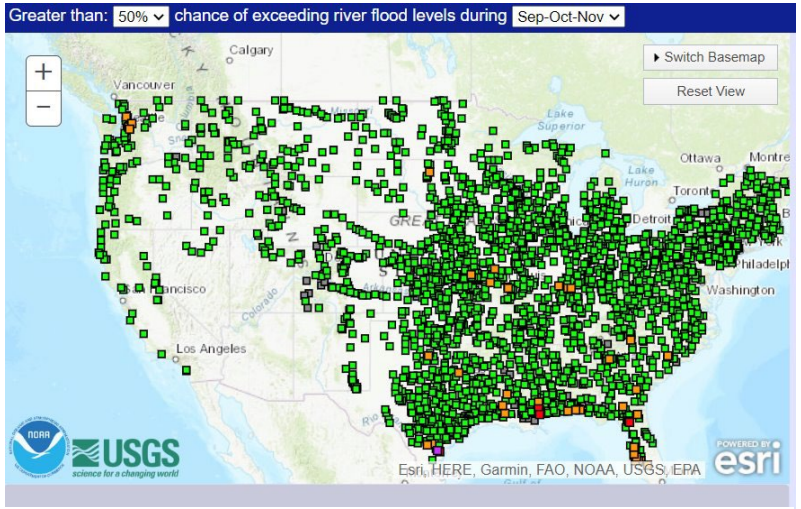
Long-Range Flood Outlook

Examples from overseas

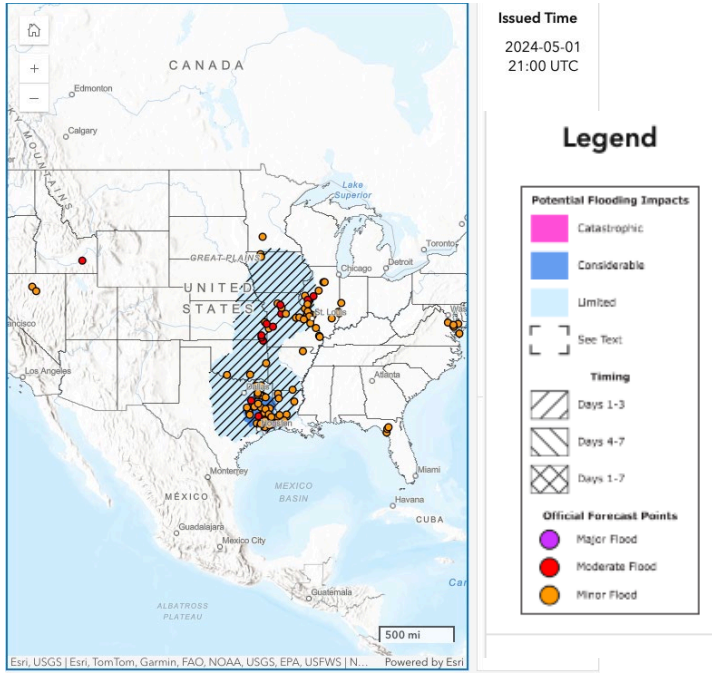
- NOAA in the United States

  (source)





US National Weather Service Long-Range Flood Outlook products (NOAA)



Experimental Flood Hazard Outlook (source)

Exceedance Probability

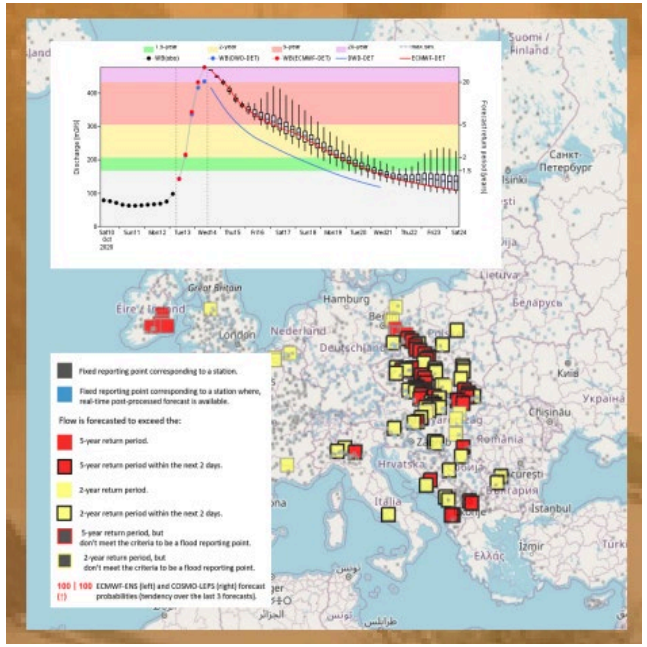
10-25%
25-50%
50-75%
75-90%
> 90%

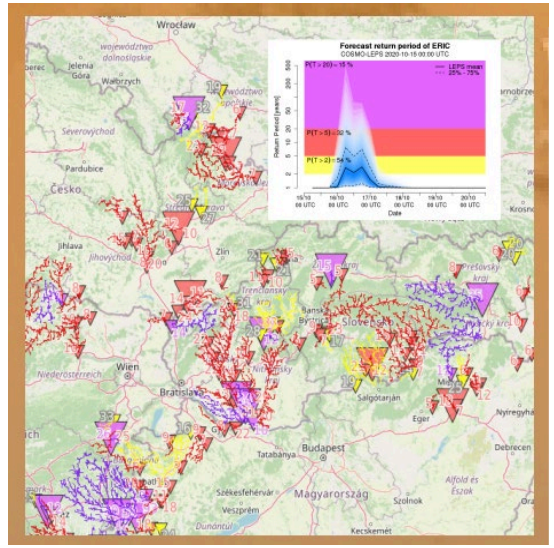
Major
Moderate
Minor

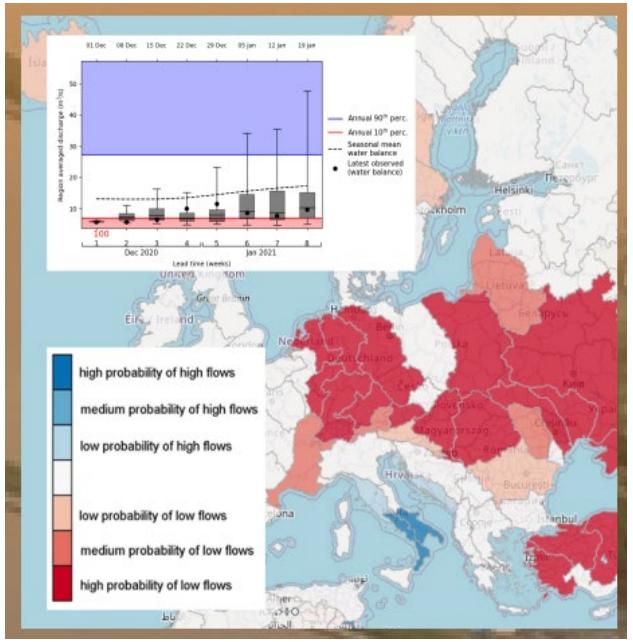
Long-Range Flood Outlook

Examples from overseas

- European Flood Awareness System (source)
  - "Pan-European Probabilistic Early Warning System for Flood Risk and Hazards"
  - Part of the Copernicus Early Warning & Monitoring service (Floods, Fire, Drought)





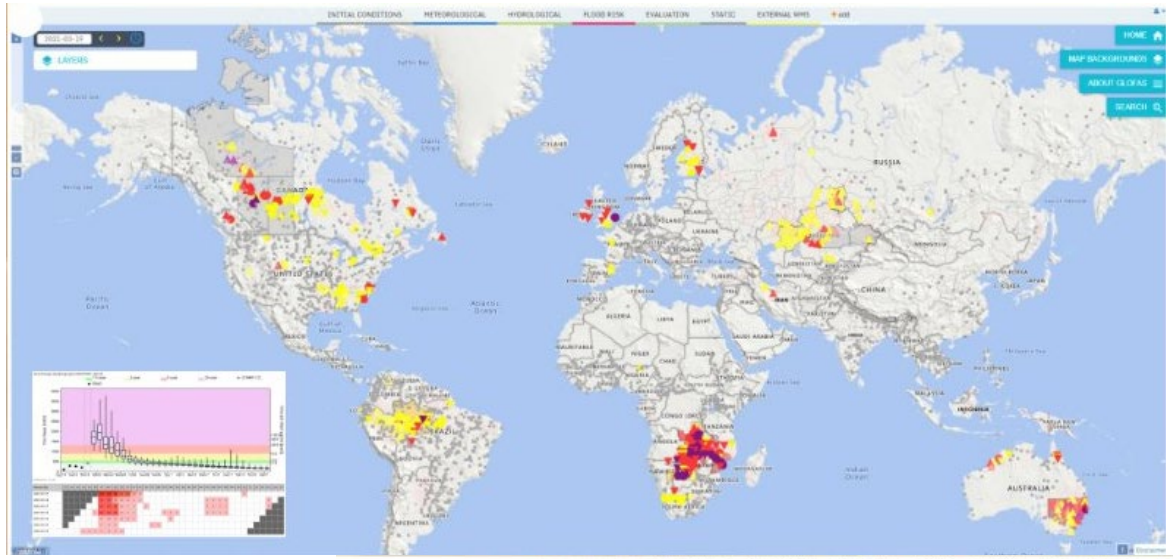


Source

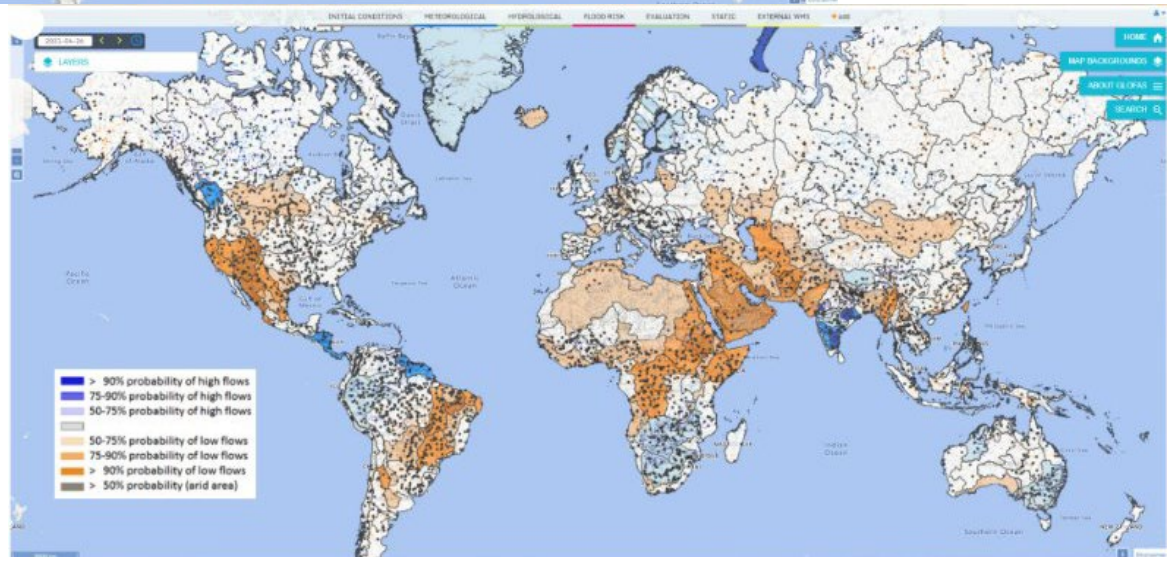
Long-Range Flood Outlook

Examples from overseas

- Global Flood Awareness System (GloFAS)
  - "...designed to support preparatory measures for flood events worldwide, particularly in large trans-national river basins"



Medium-range flood forecasts



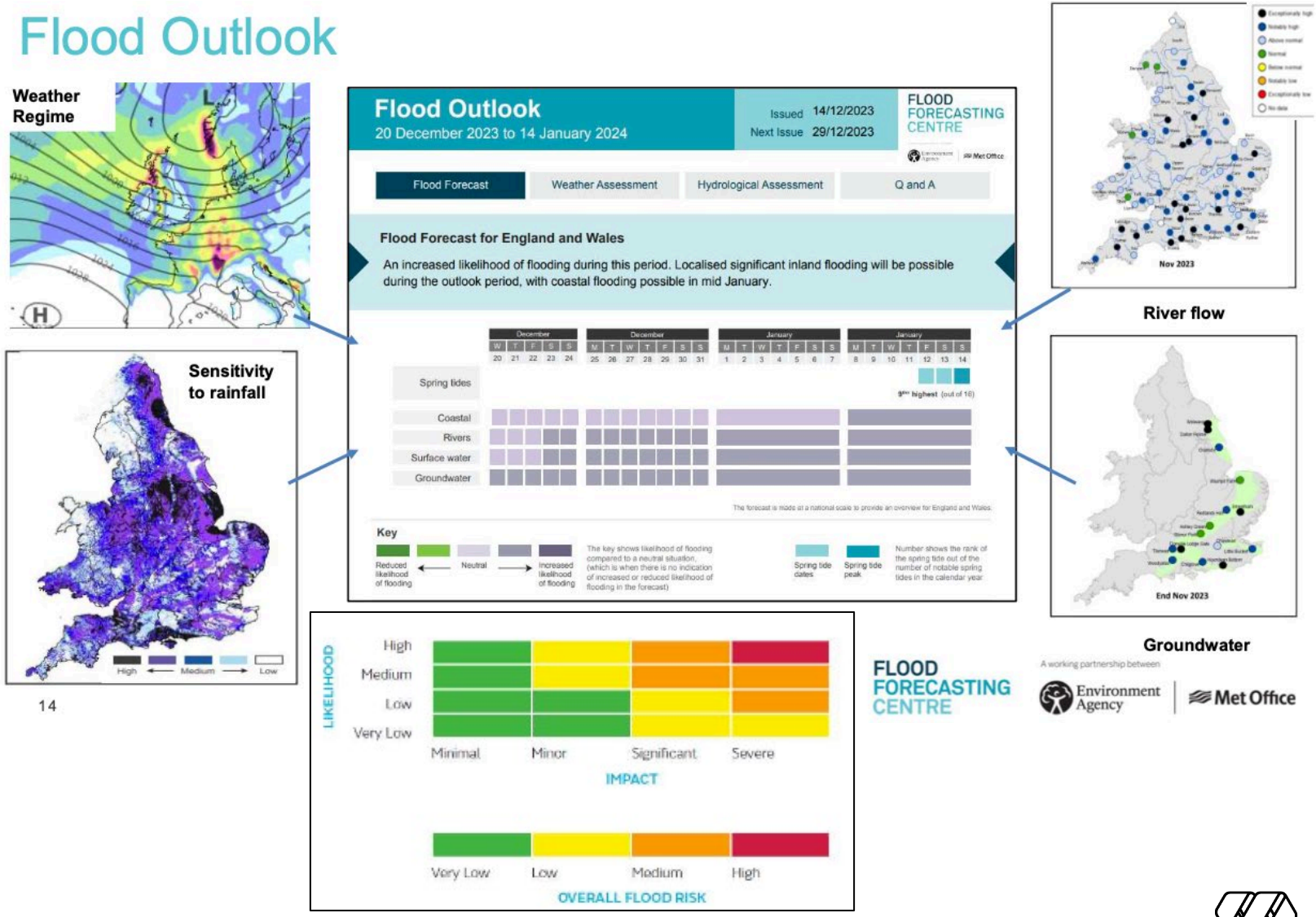
Seasonal hydrological outlook

Source

Long-Range Flood Outlook

Examples from overseas

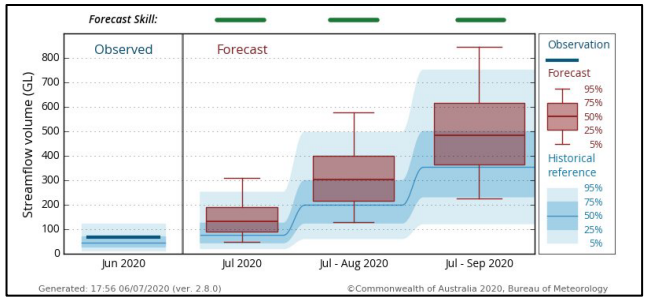
- Flood Forecasting Centre
  - UK Met-Office & the UK Environment Agency
  - Flood guidance (0-5 days)
  - Flood outlook (6-30 days)
  - Online Information
  - Information curtesy of Charlie Pilling (UK Met Office)

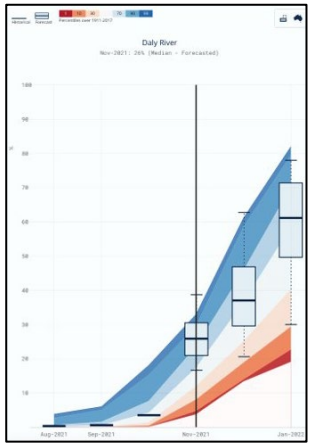


Long-Range Flood Outlook

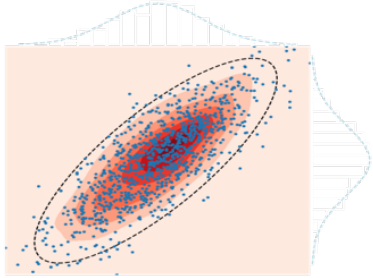
Concept:

- Provide a probabilistic outlook (level of risk) of a flood event given:
  - Current conditions (e.g. catchment conditions)
  - Forecast river discharge over a defined period (e.g. week, fortnight, month, 3-months)
- Outlook will be point-based (defined locations)
- Outlook will provide the probability of exceedance



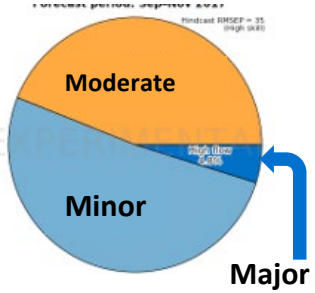


Input Forecast



Statistical model or ML

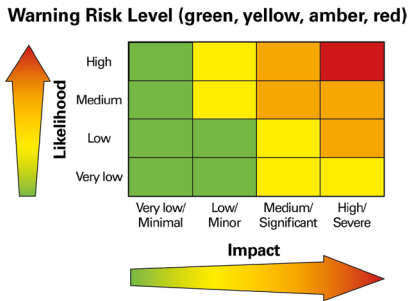
Risk of Flooding



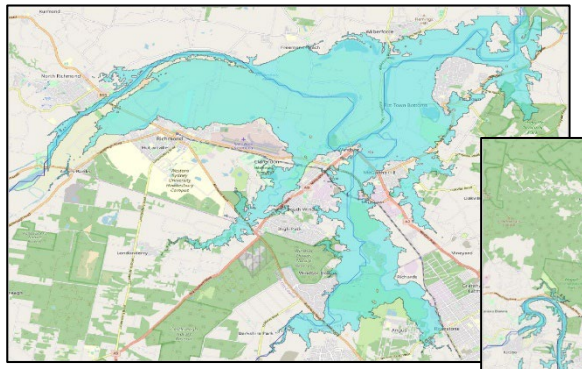
Long-Range Flood Outlook

Project Outcomes

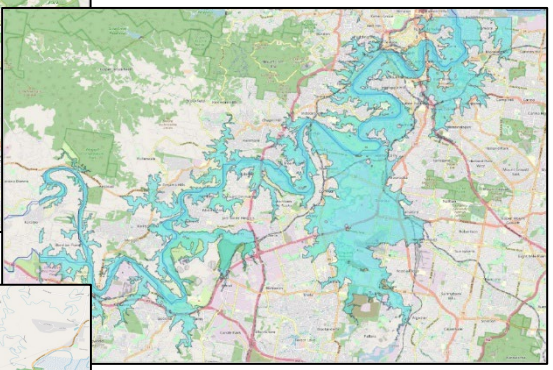
- Long range river information (probability of exceedance)
- Long-range spatial information (e.g. inundation maps)
- Uncertainty in long-range outlook
  - Likelihood vs. impact



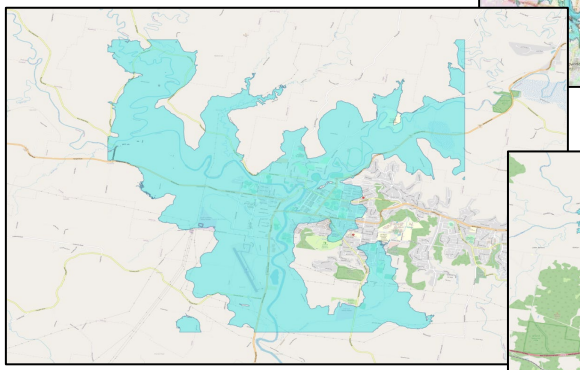
Hawkesbury March 2022



Brisbane March 2022



Lismore February 2022

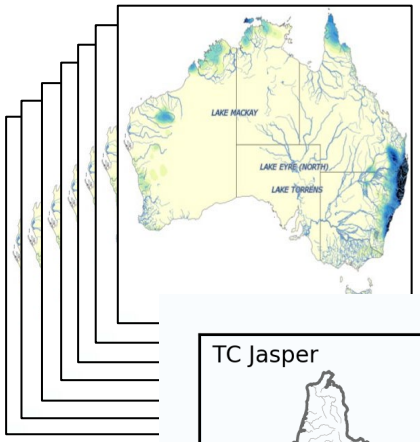


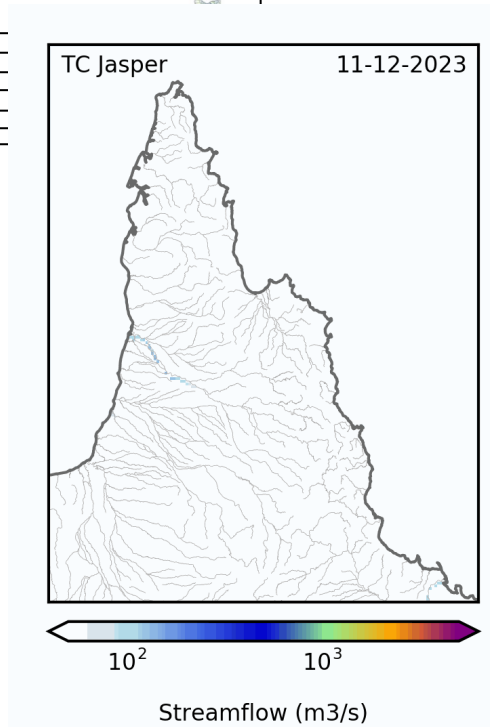
Hunter July 2022

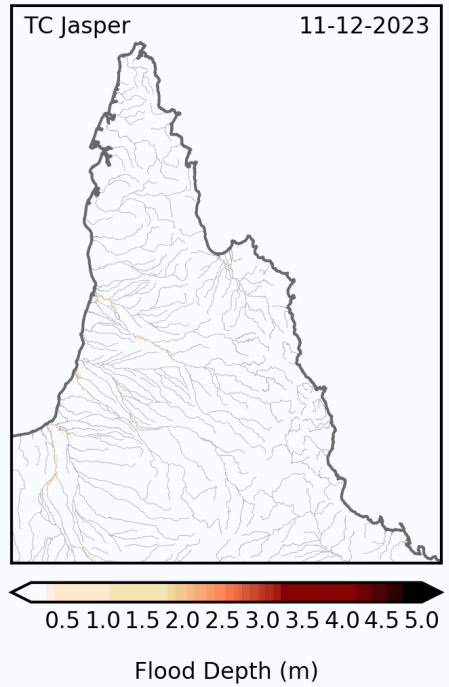
Long-Range Flood Outlook

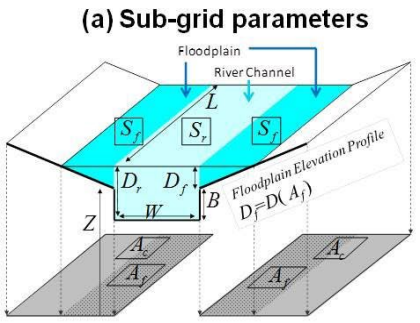
Methods to determine flood inundation

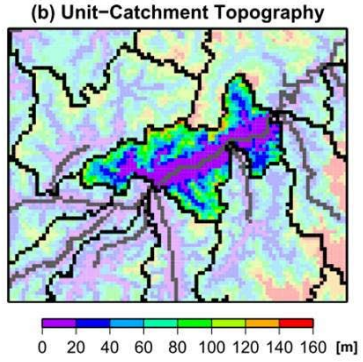
- Hydrological modelling
- River routing (hydrolic) modelling
- Error post-processing

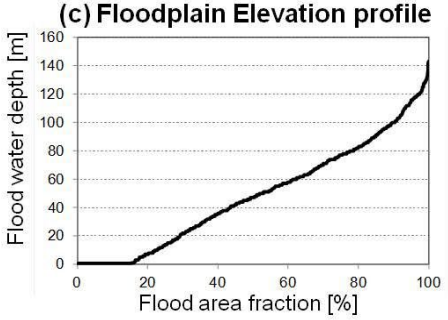








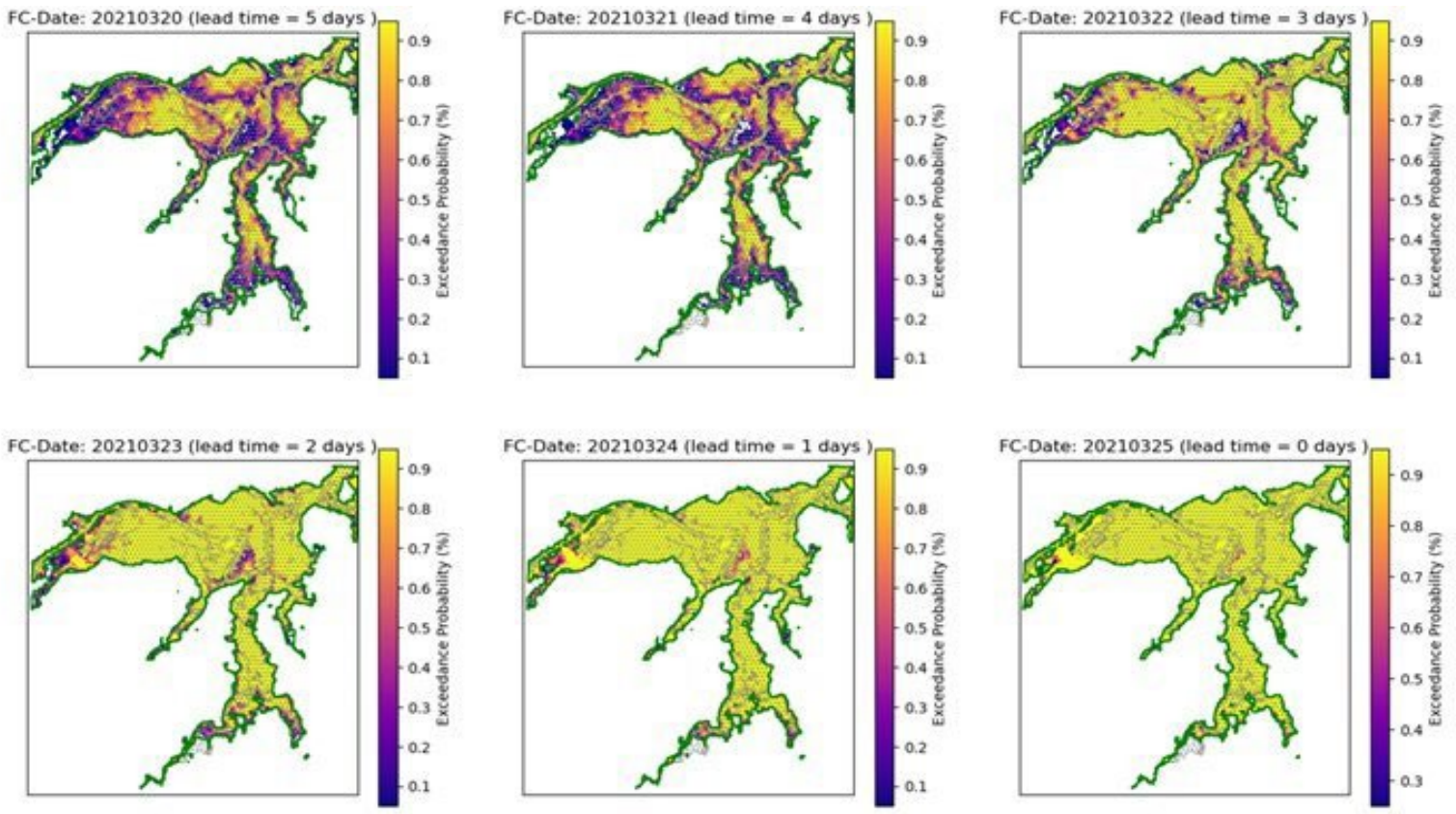




Long-Range Flood Outlook

Flood inundation outlook

- Forecast inundation risk informed by forecast flood exceedance likelihood



Selection of study sites

Selection of study sites constrained by:

- Sufficient availability of historical hydrological data (> 30 years)
- Availability of flood-thresholds (minor, moderate, major)
- Hindcast data availability from a suitable hydrological model
- Necessary ancillary data available for inundation modelling

Hawkesbury-Nepean River

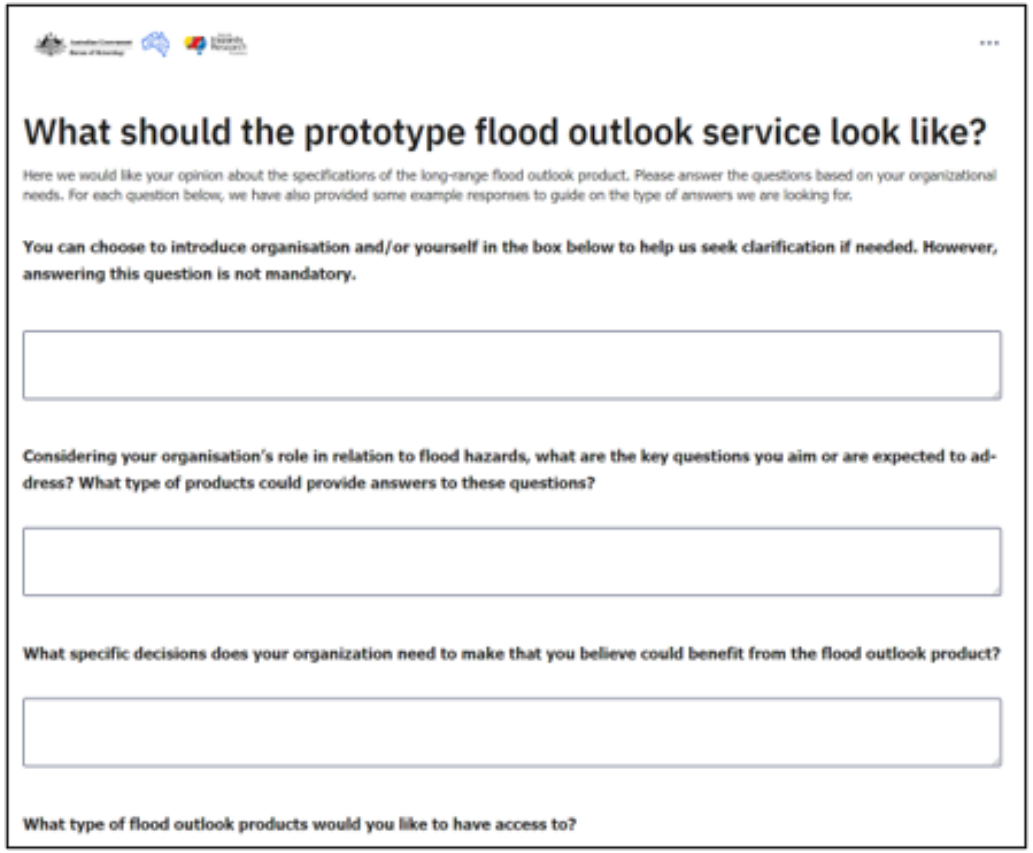
Co-design approach with NHRA

What should the prototype service look like?

Criteria	T4-A3 customer needs
Accuracy	E.g. High, medium, low chance of flooding/inundation
Lead time	E.g. Disaster Response Preparedness Timeline (weeks to months)
Uncertainty	E.g. Probabilistic – likelihood vs impact
Consistency with other Bureau products	E.g. High, medium, low importance
Spatial coverage	E.g. National - case study areas to start with
Spatial resolution	E.g. LGA
Output formats	E.g. Grids of depth and hazard, hydrographs, gauge PoE, case studies?
Delivery pathways	E.g. Demo portal with multiple map layers, APIs, apps

Co-design approach with NHRA

We need your input by participating in our survey!!!



What should the prototype flood outlook service look like?

Here we would like your opinion about the specifications of the long-range flood outlook product. Please answer the questions based on your organizational needs. For each question below, we have also provided some example responses to guide on the type of answers we are looking for.

You can choose to introduce organisation and/or yourself in the box below to help us seek clarification if needed. However, answering this question is not mandatory.

Considering your organisation's role in relation to flood hazards, what are the key questions you aim or are expected to address? What type of products could provide answers to these questions?

What specific decisions does your organization need to make that you believe could benefit from the flood outlook product?

What type of flood outlook products would you like to have access to?

Scan the QR or follow the link to participate
https://flood.limesurvey.net/237521?lang=en

Co-design workshop with FSWISTG:
28-29 May

Co-design survey questions

- Introduce yourself and your organisation (submission may be anonymous)
  - Identity of survey participant is kept confidential
- What key questions do your organisation face in the context of flood hazard preparedness?
  - What products from the Bureau would help address these questions?
- What specific decisions does your organisation make during an event related to flood hazards and how might a flood outlook help inform these decisions?
- What type of outlook products would suite your needs?
  - Spatial, temporal, point-based, area-based (grid-based)
- What level of characterisation of flood likelihood would suite your needs?
- What data formats best suite your needs? What level of spatial discretisation do you need?
- What are your preferred product delivery pathways?

Thank you…

Hydrological Applications - Bureau of Meteorology

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