



Australian Government

Australian Climate Service

ACS – Flood Intelligence

Delft – FEWS User Days

Shoni Maguire and Chris Leahy

Acknowledgements:

Simone De Kleermaeker
(Deltares)

Luke Balasingham, Mark Dyll
and Mark Menzel (ACS)



Deltares



waterRIDE™

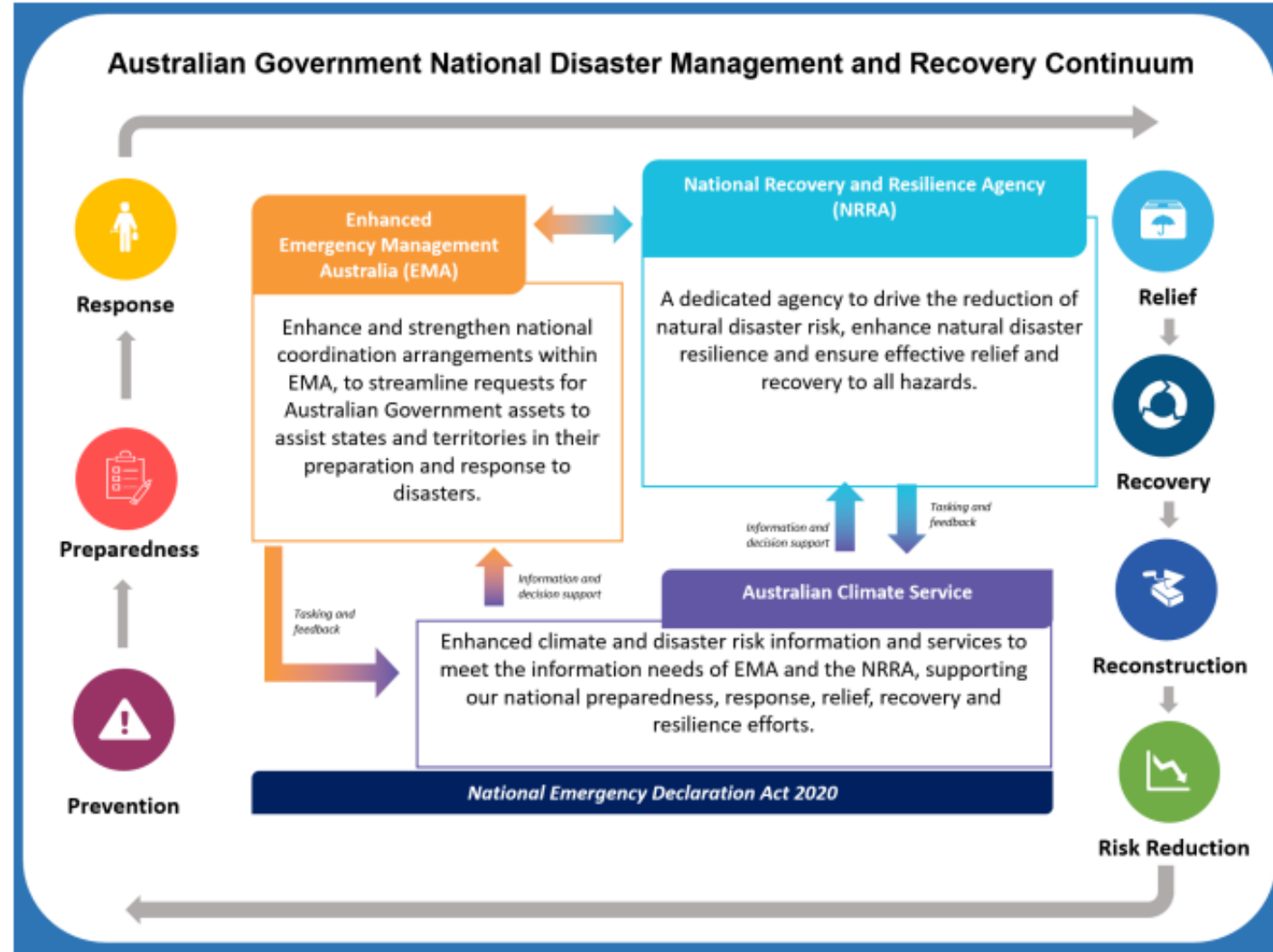
The service is a partnership of world leading science, information and expertise from the Bureau of Meteorology, Geoscience Australia, CSIRO and Australian Bureau of Statistics. It brings the Commonwealth's extensive climate and natural hazard information into a single national view.



Australian Government
Bureau of Meteorology



Australian Government
Geoscience Australia



Customer Request

- National Emergency Management Agency provided an initial request for Flood Intelligence. This service is needed to allow the Australian Government to make informed decisions before, during and after the flood events.
- Before and during events forecast areas of likely inundation are required to assist tactical decisions to protect lives and property.
- After an event accurate inundation footprints to inform relief, short-term and longer-term recovery activities.
- The solution needed to be:
 - Able to be shared across governments and more widely
 - Linked to official forecasts/warnings where possible
 - Provide an open approach to modelling



Western Sydney

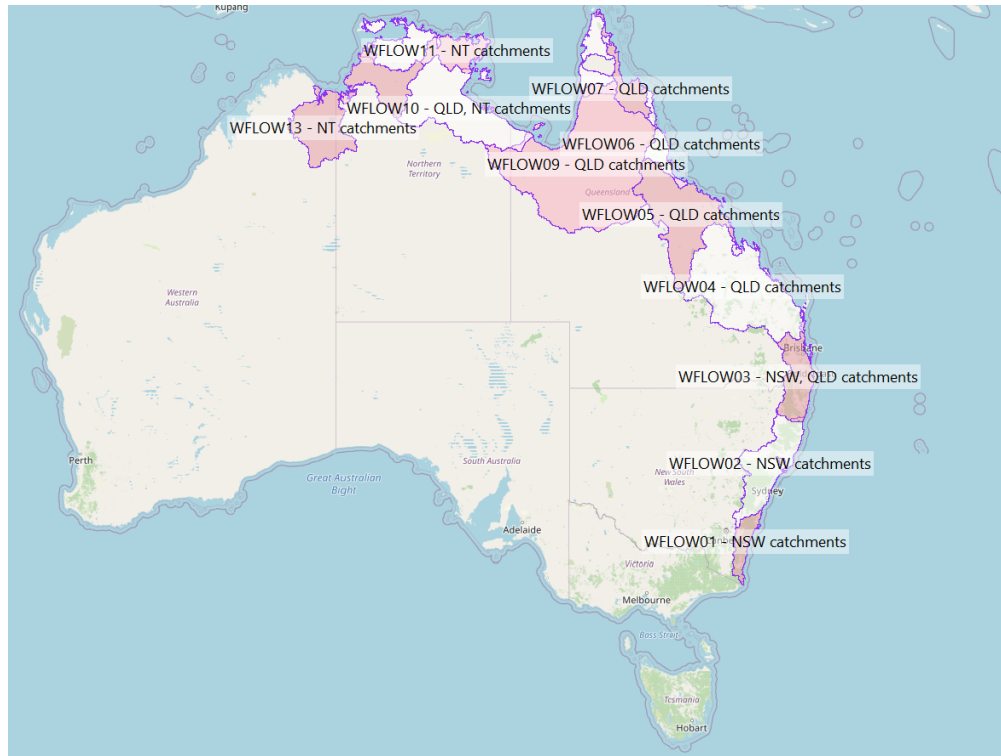
Models

- A multi-model system approach is chosen to be able to provide the “best” forecast in any location. The definition of “best” depends on the location:
 - High-population areas typically already have detailed flood studies and flood maps available, albeit for relatively small urban areas. The waterRIDE model can combine these flood maps together with the official Bureau flood forecast to provide detailed and accurate flood maps.
 - Everywhere else SFINCS models can provide an inundation forecast which accuracy is in large part dependent on the underlying DEM information. SFINCS models includes both the inflow from the rivers and streams as the tide and storm surge impacts on the coast (i.e. compound flooding). The hydrology forecast is provided by Wflow models (gridded hydrology), the coastal boundary conditions are provided by a coastal SFINCS model.
 - Regional areas where there’s not a lot of infrastructure typically also do not have very accurate DEM data. In these areas a simpler fit-for-purpose approach can be used (not part of the PoC).

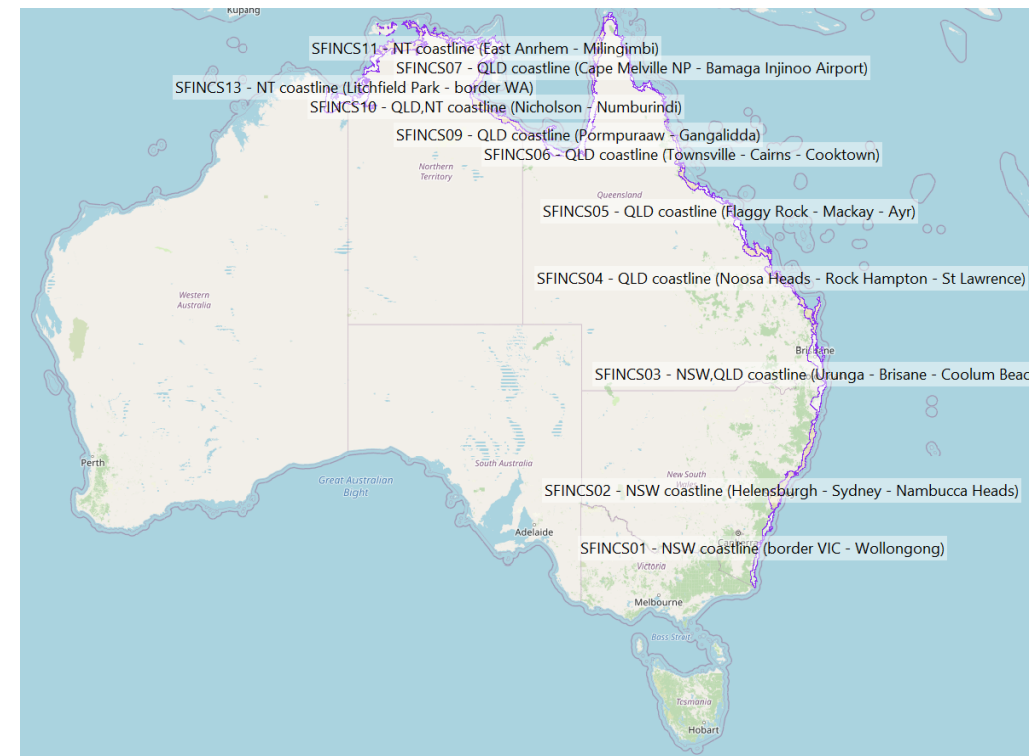


The FliFS system is made up of the following models:

- Implementation of WFLOW (hydrology) models for all coastal catchments of QLD, NSW and NT.
- Implementation of a SFINCS (inundation) models for all coastal catchments of QLD, NSW and NT.



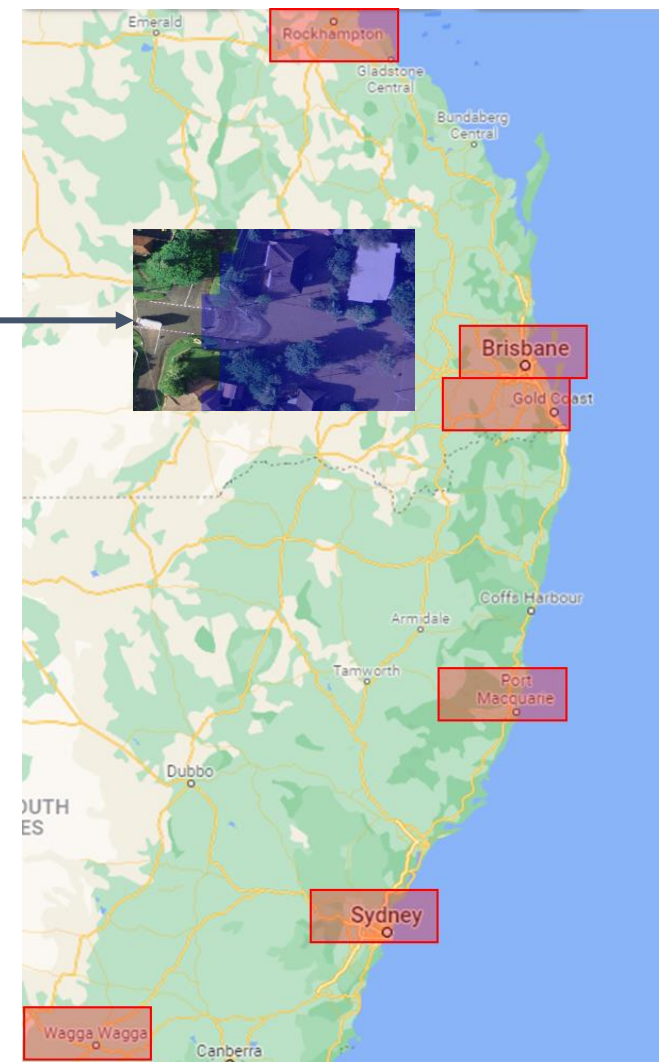
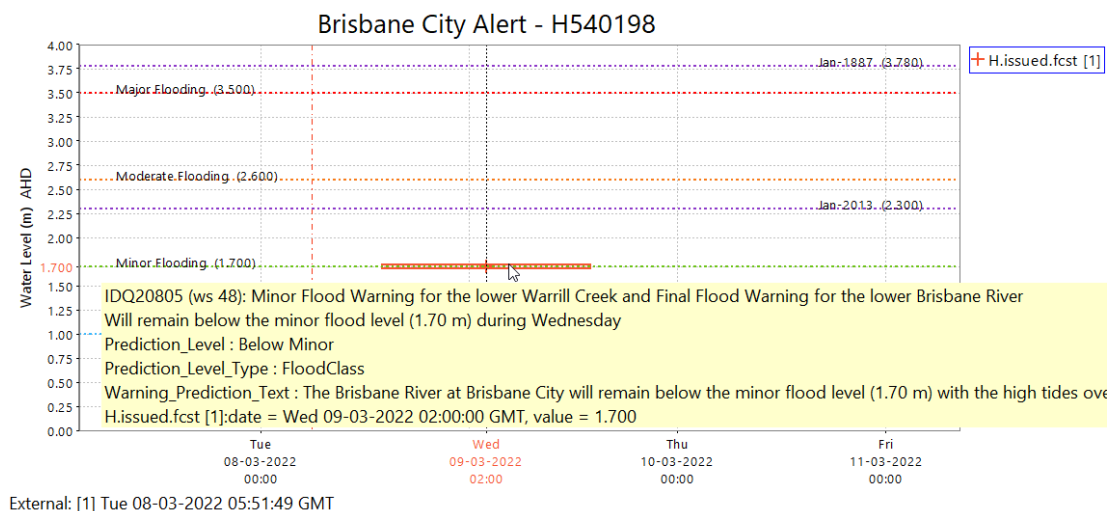
WFLOW coverage



SFINCS coverage



waterRIDE

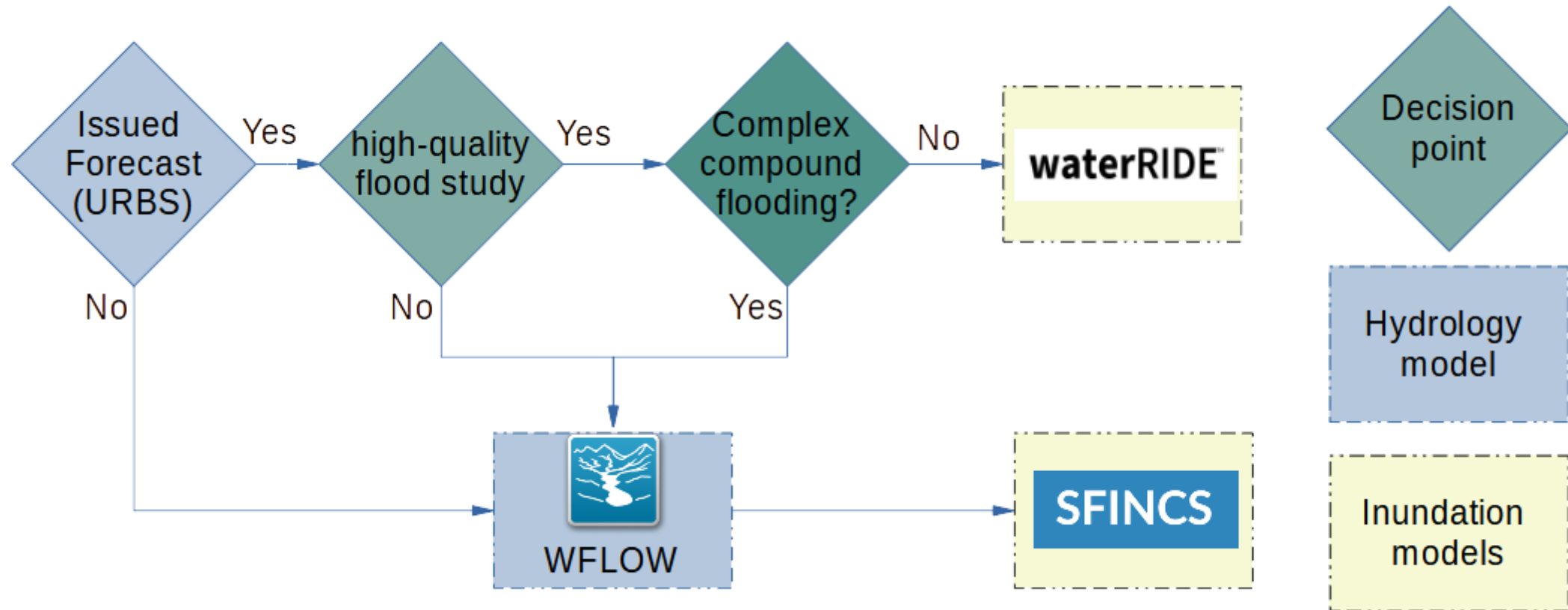


7 models in QLD and NSW, run automatically based on current warning

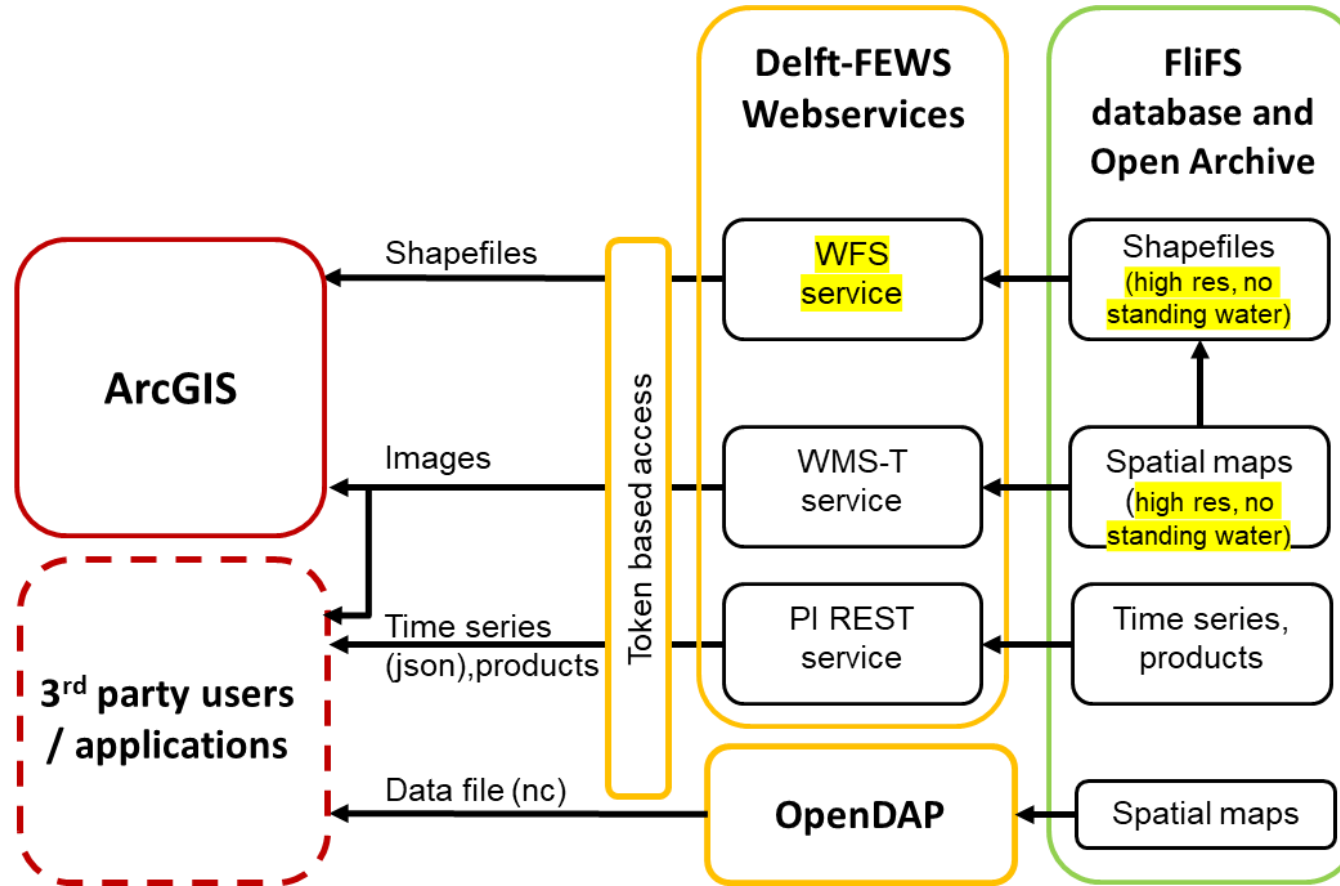
- Fitzroy (Rockhampton) - very large coastal catchment
- Brisbane River - large, linear river system with flood gates
- Logan/Albert - large, multi-tributary catchment
- Hastings (Port Macquarie) - medium sized, faster responding catchment
- Georges River (Sydney) - medium sized catchment, multi-jurisdiction
- Murrumbidgee (Wagga Wagga) - large inland river
- Tweed River (Tweed Heads) - large coastal river



Modelling Framework – Work Flow



Modelling Framework – Components

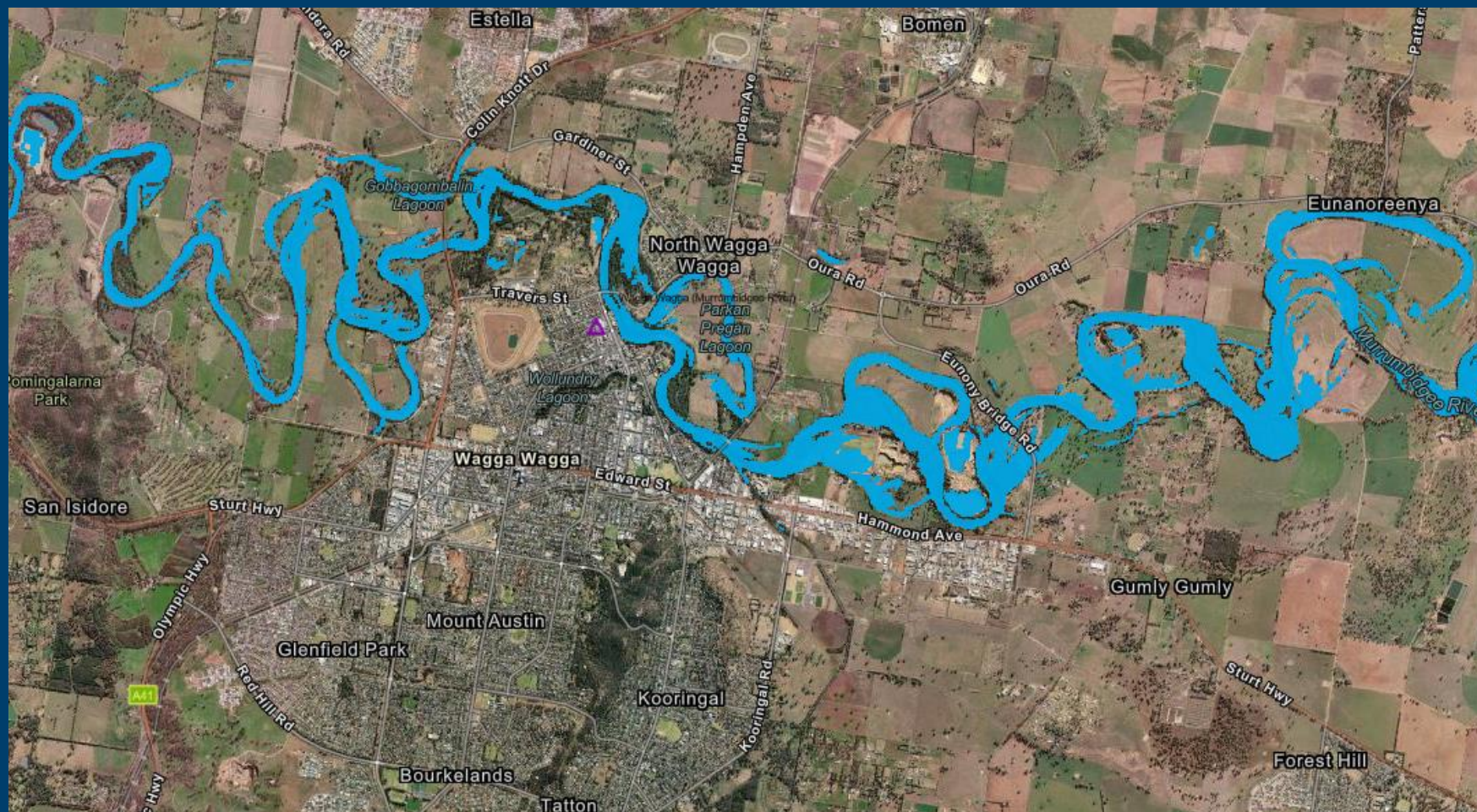


	WMS	WFS	WCS
Data provision	Image of geographic data	The actual feature with geometry and attribute(s)	The actual raster data/values
Data visualization	Includes pre-defined symbology	Only data, doesn't include symbology	Only data, doesn't include symbology
Loading speed	Loads faster, size and format of input dataset doesn't matter	Loads slower than WMS, speed depends on size of dataset requested	Loads slower than WMS, speed depends on size of dataset requested
Editing	Can't be edited	Can edit and make changes if WFS-T (<i>but not in ArcGIS</i>)	
Data type	Both vector data and raster data (as image)	Limited to vector data only	Limited to raster data only
Download options	Can't download actual dataset	Possible to download actual data	Possible to download actual data
Spatial subset	Can request rectangular area with e.g. BBOX (as image)	Can request features that intersect certain areas (<i>but does not clip features</i>)	Can request rectangular area with e.g. BBOX (as raster data)
Possible in Delft-FEWS?	Yes, already implemented: Project WMS in Delft-FEWS	Not yet, would need to be developed	Not yet, would need to be developed



09 OCT 22

Wagga Wagga (Murrumbidgee River)



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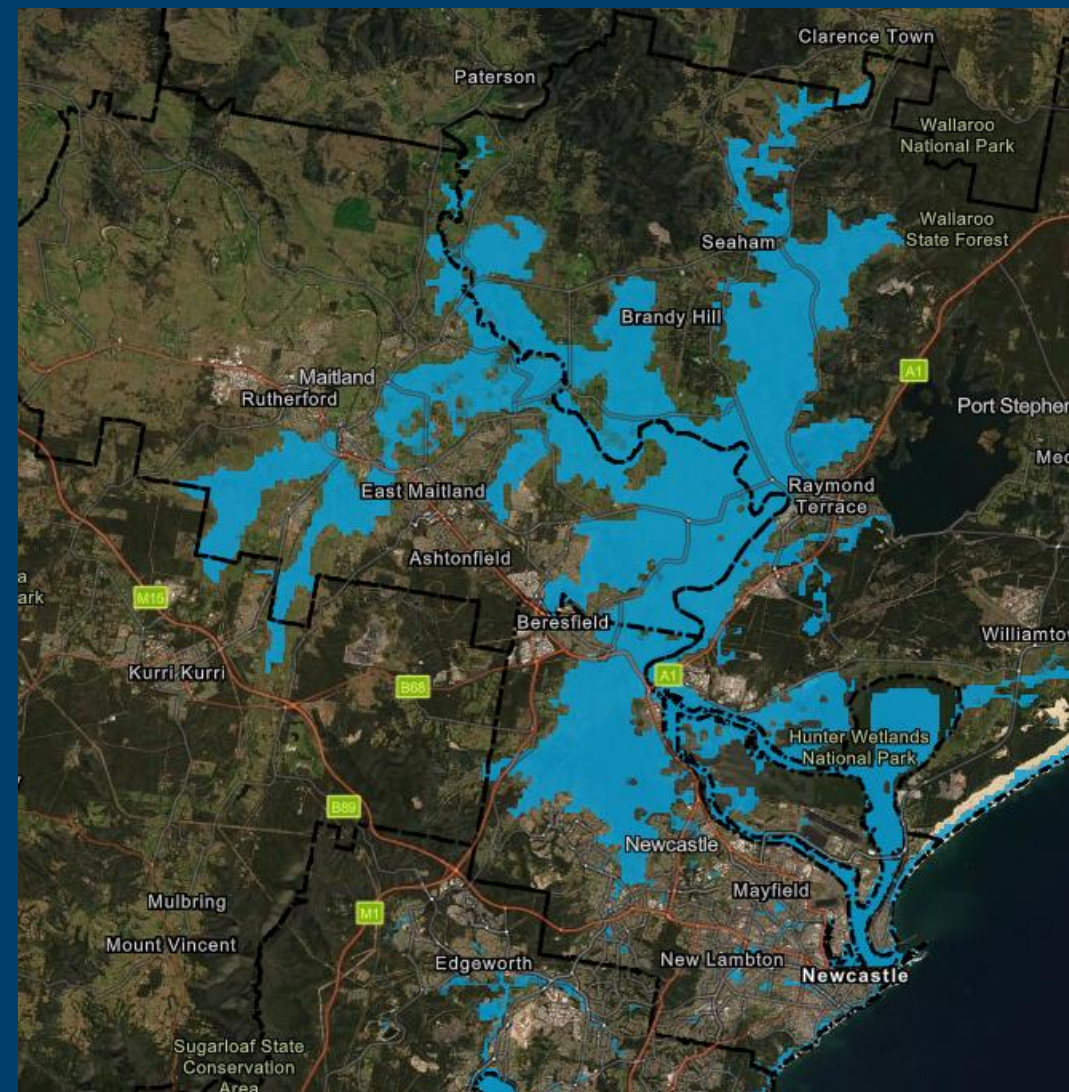
DATA UPDATE: 0010 hrs 08 OCT 22

11

Hunter River

5 day maximum extent forecast:

Fri 2200 hrs 7/10/2022 – Wed 2200 hrs 12/10/2022

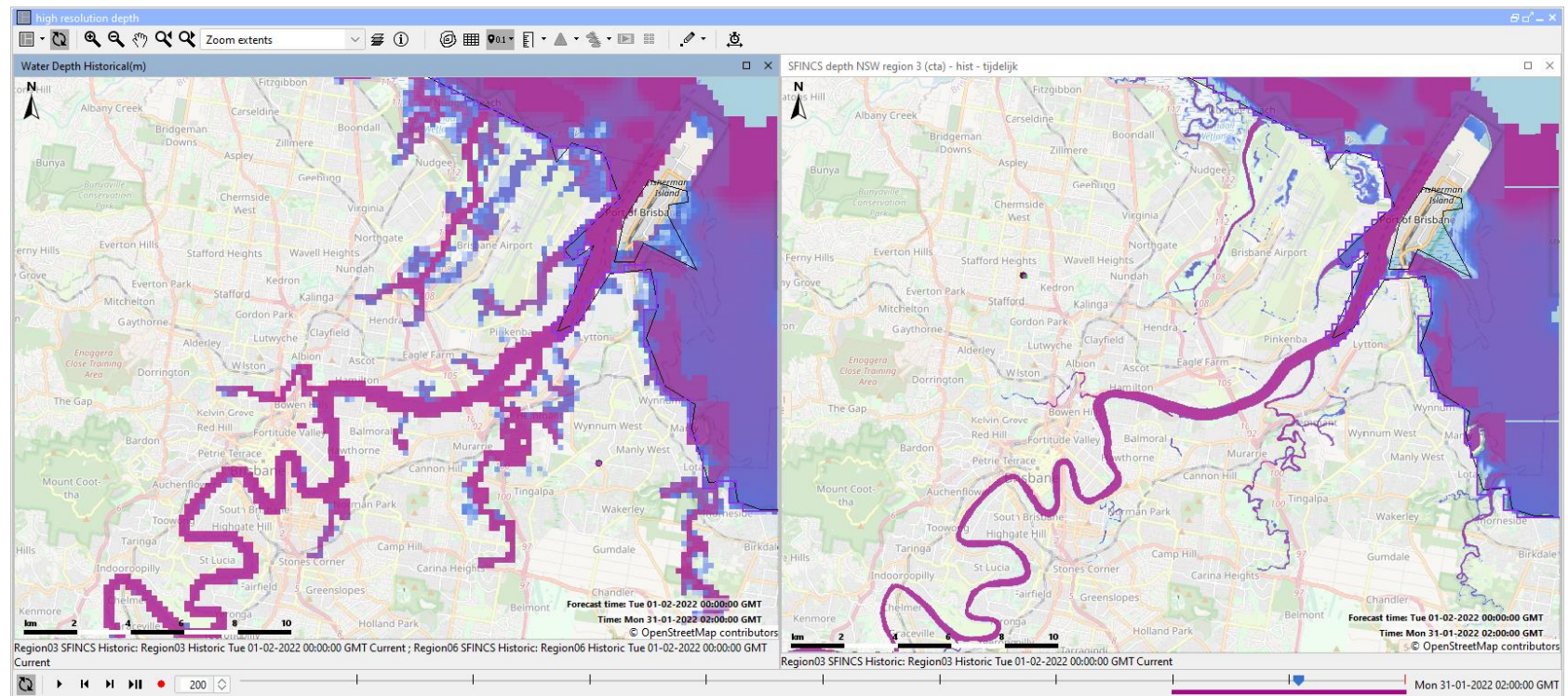


Usability - High resolution inundation extents using current DEM

in FliFS OC

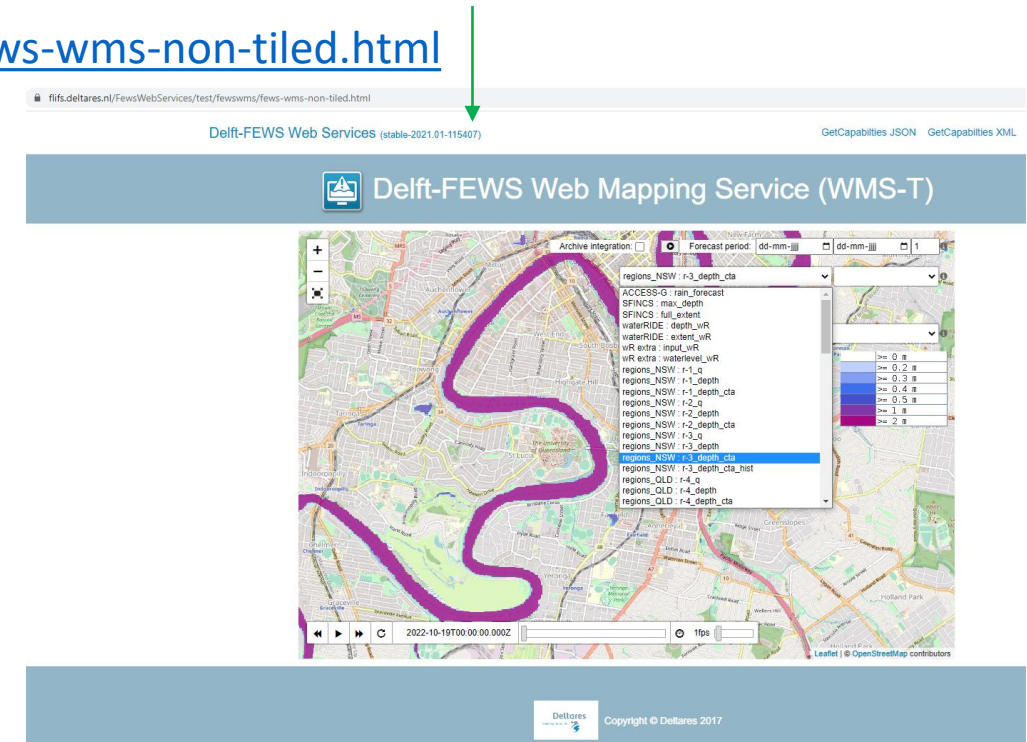
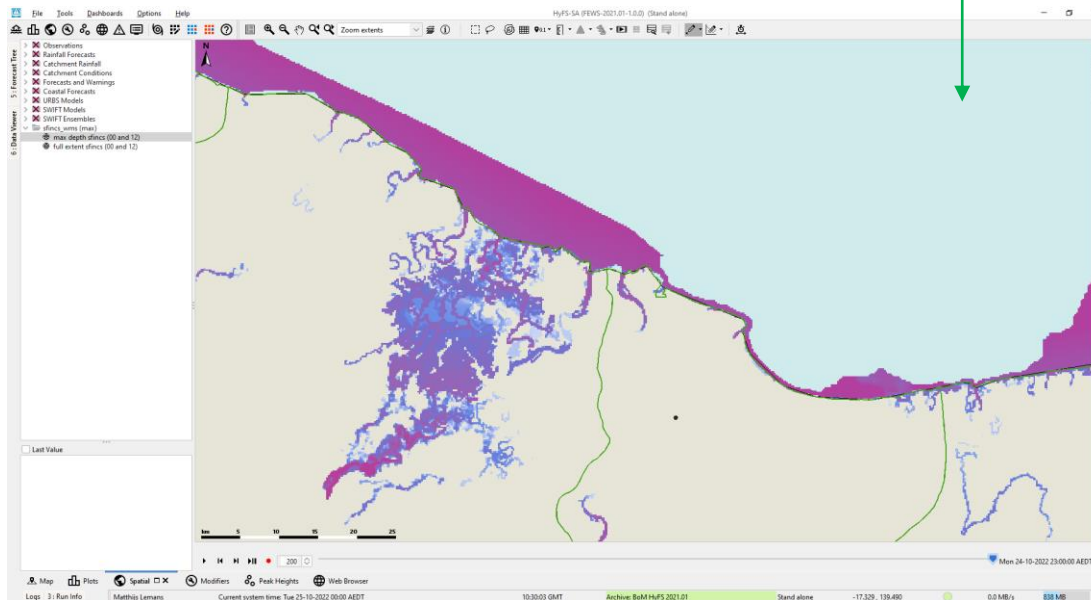
The SFINCS *gridded* results now use a Coverage Tile Archive file in the GridDisplay.xml to improve water depth resolution from original (left) to new (right) by subtracting the high-resolution elevation from the water level grid.

Note: This does not yet include higher resolution *shapefiles*. This functionality is expected for the November release



Usability - High resolution inundation extents using current DEM through WMS in for example HyFS OC

- The *gridded* high-resolution water depth is available as image file per zoom level through the Delft-FEWS Web Mapping Service (WMS). The Delft-FEWS Web Mapping Service with time support follows the WMS-T OGC standard and allows requesting images for plots that have been configured in the Delft-FEWS grid display.
- Access: <https://flifs.deltares.nl/FewsWebServices/test/fewswms/fews-wms-non-tiled.html>
- The HyFS application can also access those images through WMS



Initial learnings from the POC and next steps

- PoC has shown viability of extent and depth forecasts from a multiple models (SFINCS/water RIDE) particularly over large areas
- Applying to whole country is a massive job involving:
 - Model development/calibration
 - Working with states and territories to define the service
- The calibrated waterRide models have been well used
- Web Feature Service (WFS) or shapefile (vector) is the desirable output format of our customers, to enable integration and analysis with other key data sets
 - Population and business information
 - Roads and supply chain
 - Building information
- An independent review of the system is about to start, which will provide feedback on options for future developments



Tuggerah Lake

Exploration of key data inputs – current activity

Hydrology

- Soil data base
Standard GIS data format, e.g. ascii, netcdf, or geotiff (preferably not ARCGIS)
- Hydrographic data
GIS data (shp, raster) with slope, width, and depth of river(sections), inc. small upstream streams.
In the PoC this information was generated from the DEM and other global datasets.

Inundation

- High-res DEM
Vertical accuracy is essential (e.g. 10-30cm); Horizontal resolution is preferred (e.g. 1-10m)
Clear definition of vertical datum (e.g. MSL) and coordinate sys. (e.g. WGS1984)
- Bathymetry Ocean / bay
Bathymetry of features like river mouths and bays are important for accurate results
- Bathymetry River
If available (for specific areas), otherwise cross sections will suffice
- Land use data
GIS data (shp, raster) and ideally information (e.g. height) of important line elements in the landscape, such as roads, railways, levees, that might influence flow patterns.



Shoni Maguire and Chris Leahy
Australian Climate Service and Bureau of
Meteorology



Camden, Western Sydney

