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Enhanced storm surge forecasting services

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Bureau Warning Services

Moving towards **impacts based** messaging and risk based warnings

- Internationally
  - WMO;
  - UKMO;
  - CMA…….
- Nationally
  - AFAC
  - ANZEMC

ØNational Review of Warnings and Information

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Drivers for Operational Storm Surge Service

- Government mandated warning service (Met Act 1955)
  - Ø Safety of coastal communities
  - Ø Protection of property and infrastructure
  - Ø Economic prosperity
- Enhancements to address:
  - Ø Identified user requirements
    - Past TC events
    - Extensive user/stakeholder consultation
  - Ø Operational efficiencies and effectiveness for Bureau forecasters

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Storm Surge Project
(2013 - 2017)

<u>Objective:</u> To develop and implement a nationally consistent operational storm surge and aggregate sea level forecasting service:

- Enhancing the existing storm surge forecasting and warning capabilities and practices
- Based on solid science including the latest approaches to dynamical storm surge forecasting
- Utilising synergies with existing operational forecast systems available at the Bureau
- Integrated within existing tropical cyclone, severe weather, tide prediction, tsunami warning services

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Forecast System Components

1. TC Storm Surge

- Tropics (including offshore territories)
- Storm surge due TC events
- Probabilistic à uncertainty estimates
- Run specifically for events

2. National Storm Surge

- Whole country (including offshore territories)
- Storm surge due synoptic scale storm events
- Deterministic
- Run routinely every 12/24 hours

NB: At this stage no inundation modelling/forecasts

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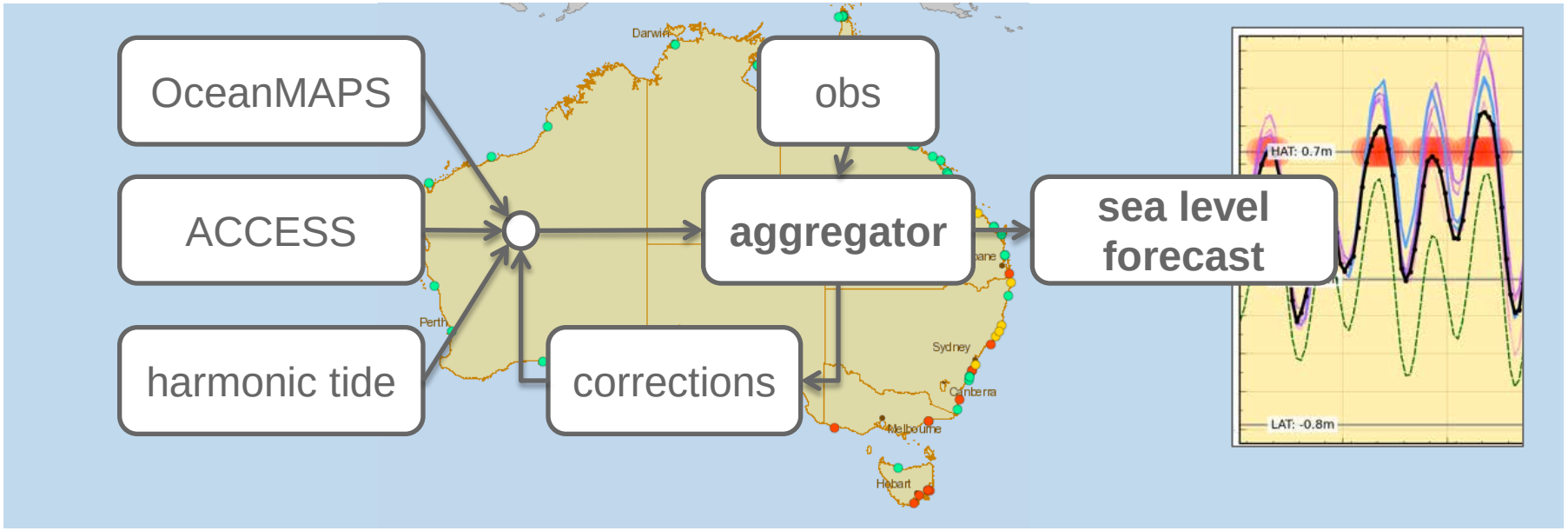
Experimental Aggregate Sea Level System

Realisation of 'total sea level'

- Forecast observable quantity
- National scope
- Tide gauge locations with R/T data
- User perspective

Exploit existing BoM systems

- Astronomical tide
- Sea level (OceanMAPS)
- Atmospheric pressure (NWP)
- Bias correction via observation



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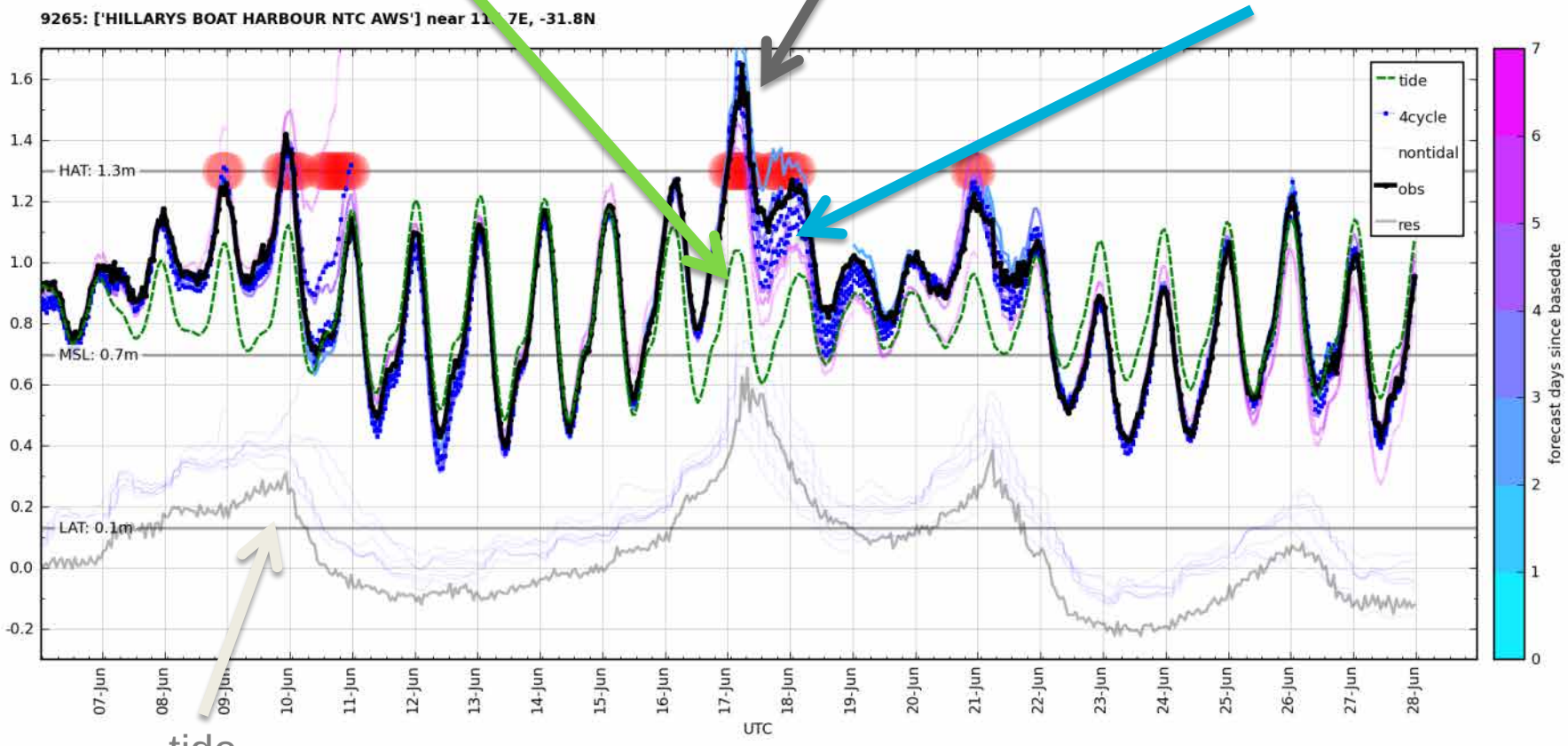
Perth June 2014 Event

astronomical tide

observed

aggregate forecasts
(colours lead time)



tide residual

Dynamical forecast system

Forced by

- TC ensembles => Tropical probabilistic storm surge, event based
- Deterministic (NWP) events => National deterministic storm surge, routinely operating

Delivers

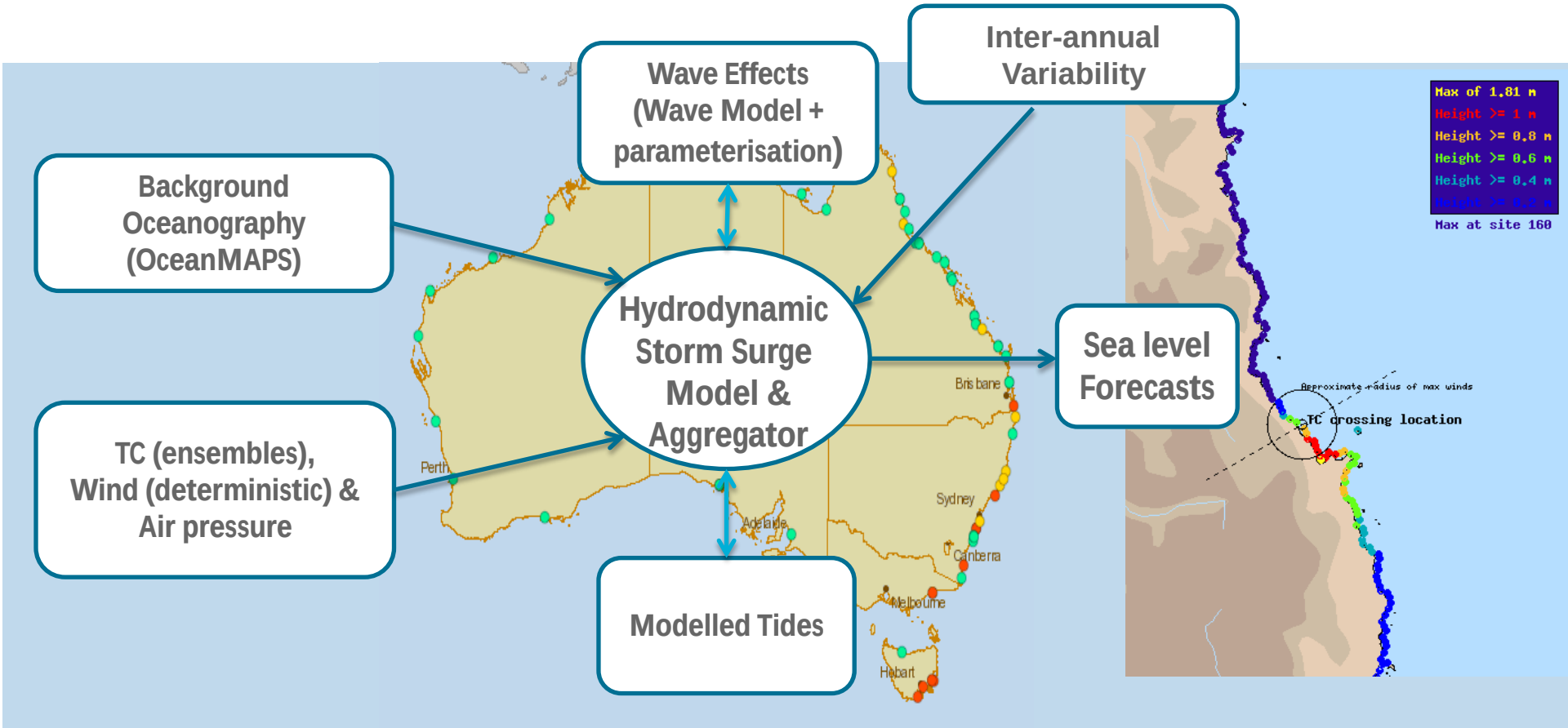
- Sea level predictions at all coastal locations

Includes

- Tides
- Waves
- Background Oceanography

Builds on

- Aggregate sea level product



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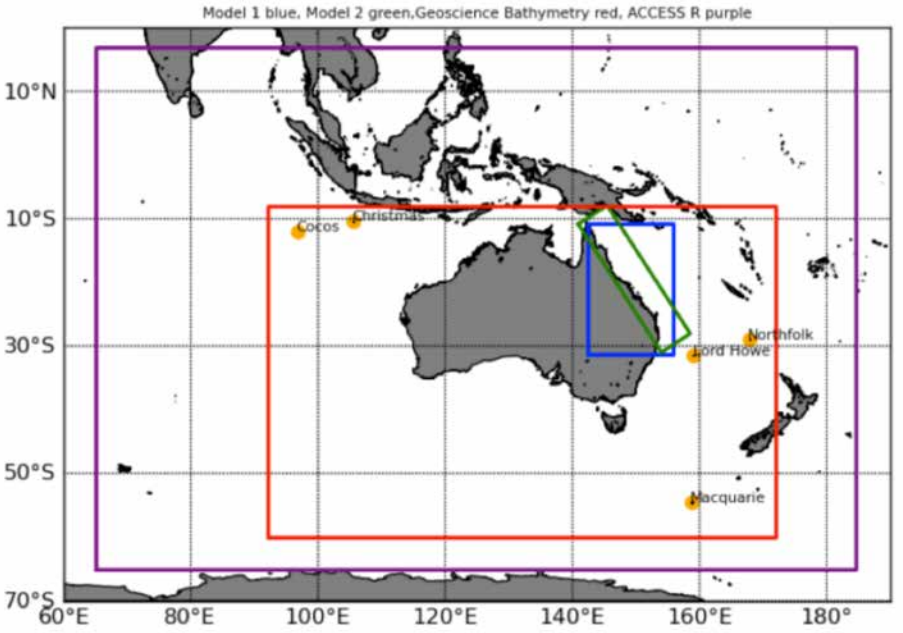
Hydrodynamic model

- Regional Ocean Model System (ROMS)
- 2-D model (depth integrated)
- Bathymetry: GA 500m national product
- Horizontal resolution around 1km
- 2-3 day forecasts
- Forced with wind stress and air pressure
- No nesting at boundaries – yet
- Models wind/pressure forced sea level predictions at all grid locations
- No tide or wave coupling



ACCESS-R
GA Bathy
SS grid-5km
SS grid-1km

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100 member ensemble
72 hour forecast tracks for TC Yasi

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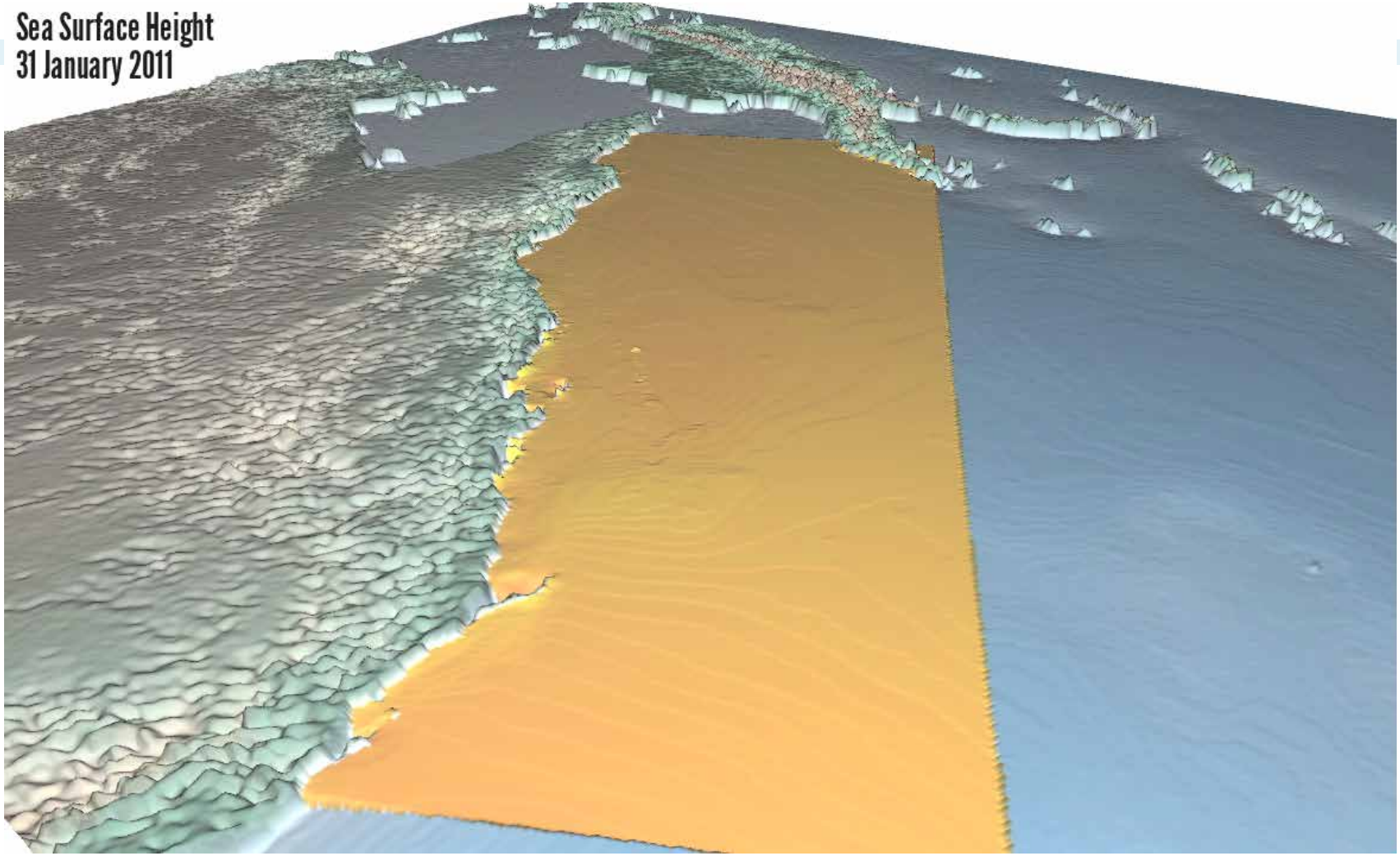
TC Yasi



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Verification Policy

Verification is critical to our operations. It provides objective information on forecast accuracy, reliability and value to:

- Government, industry, emergency management and the public to aid decision making in response to forecasts and warnings
- Bureau to measure the level of service quality, identify and address deficiencies in warning and forecast processes;
- Operational forecasters, to strengthen in real time, the robustness of the forecast process;
- Developers of forecast and warning applications to guide model and product development.

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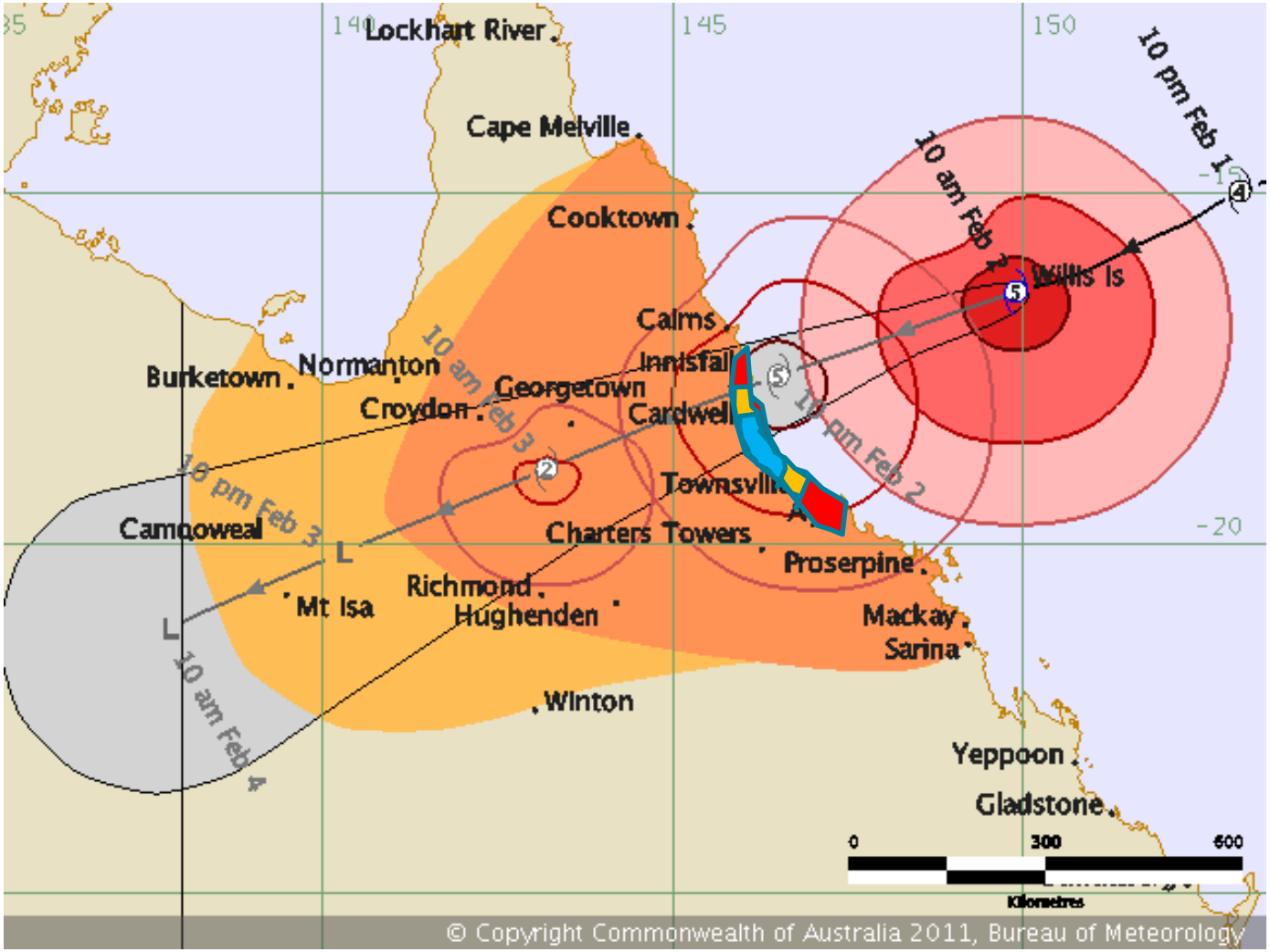
TC track, intensity and storm surge



Dangerous storm tide possible

Colours consistent with Qld Evacuation zones

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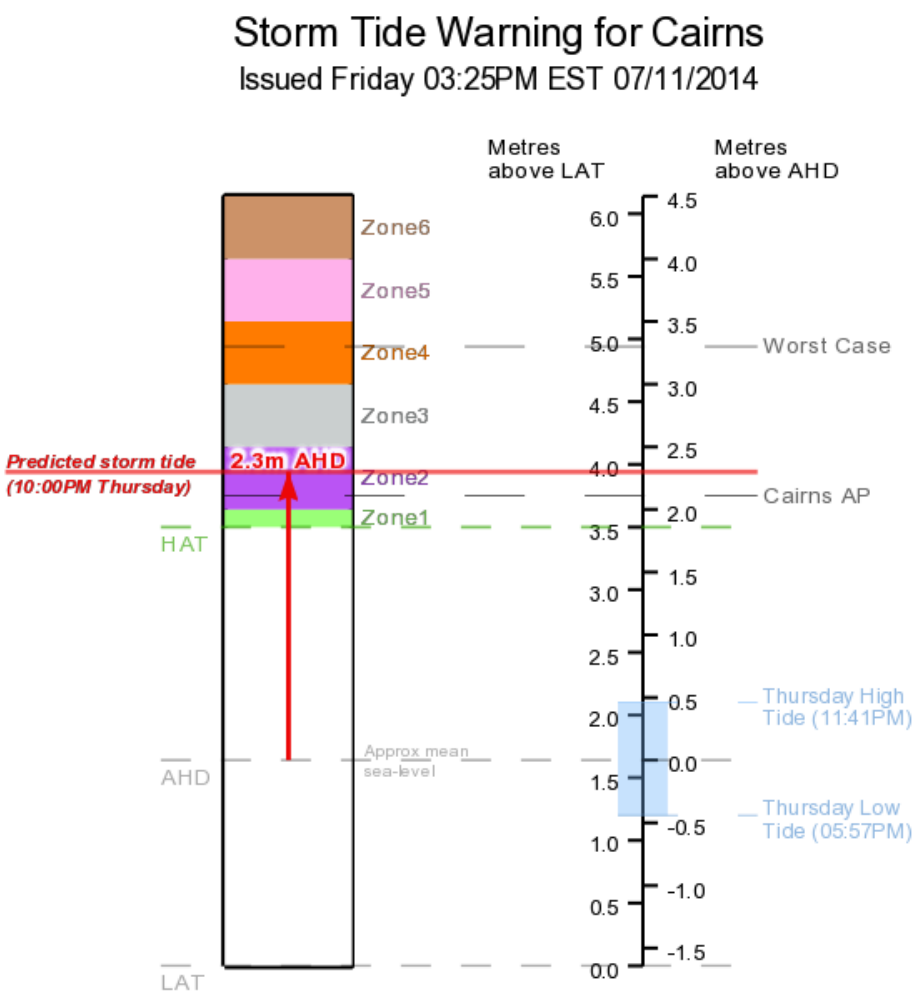
"Totem poles"



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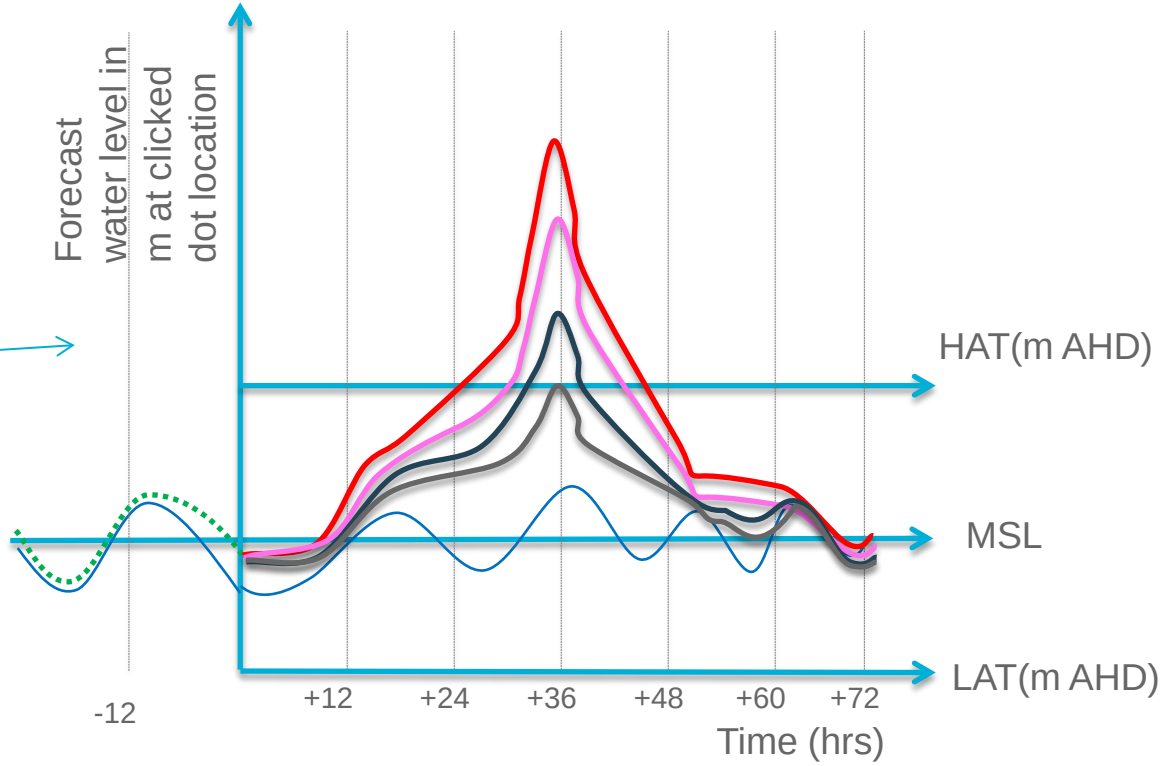
Storm Tide-grams

Water level at coastline during forecast period

- observed water level (tide gauge data, where applicable)
- astronomical tide
- most likely storm tide (consensus track)
- 50th % exceedance prob storm tide
- 10th % exceedance prob storm tide
- 0th % exceedance prob storm tide

HAT: highest astronomical tide
MSL: mean sea level (0 m AHD approx)



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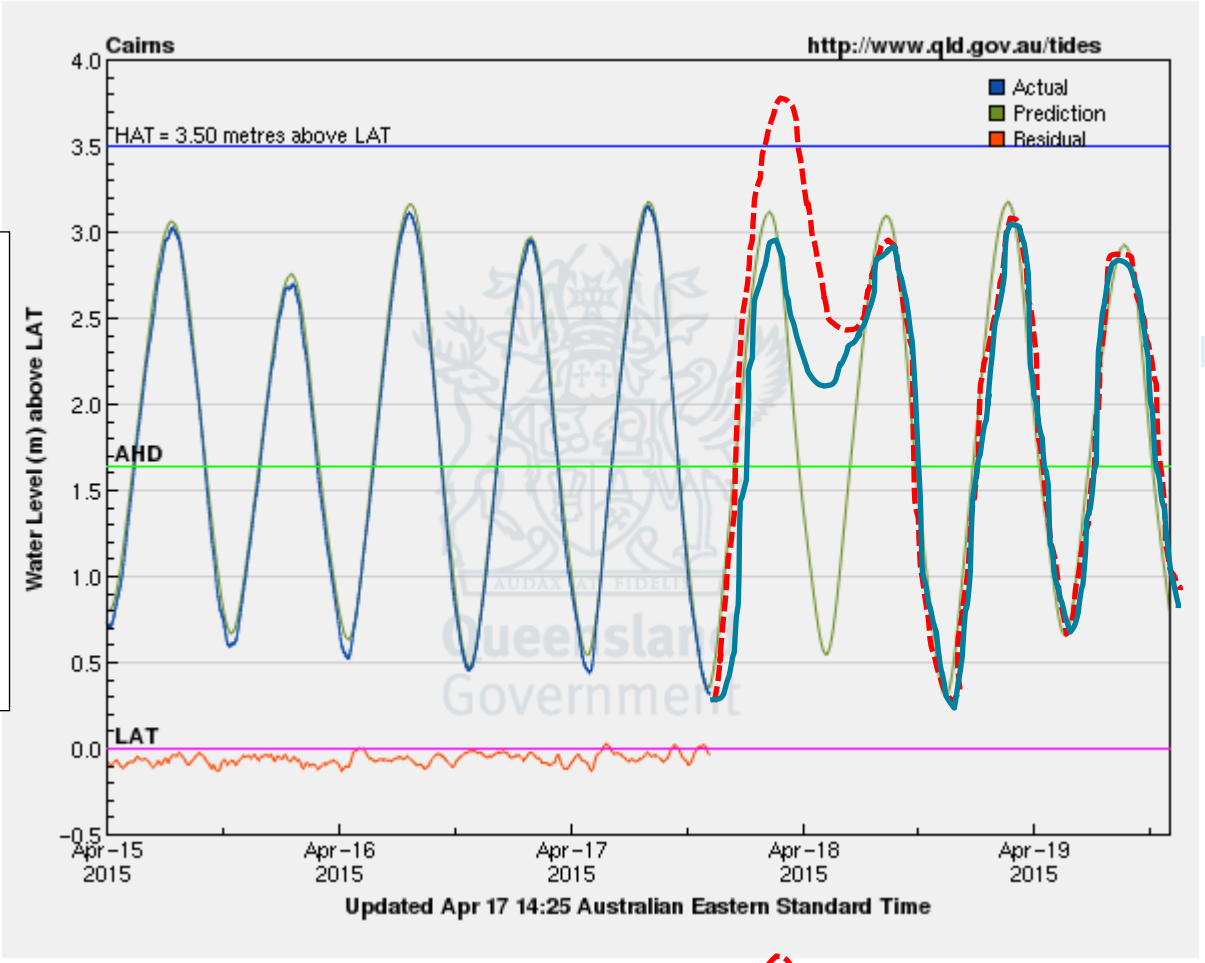
Storm surge time series:

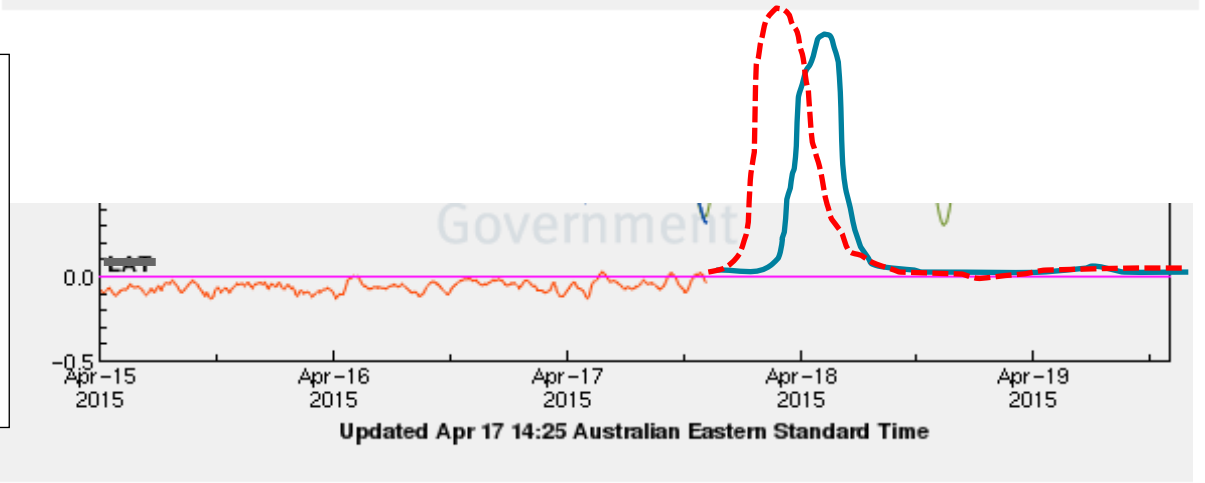
Most likely vs worst case

Forecast track scenario
Worst case scenario

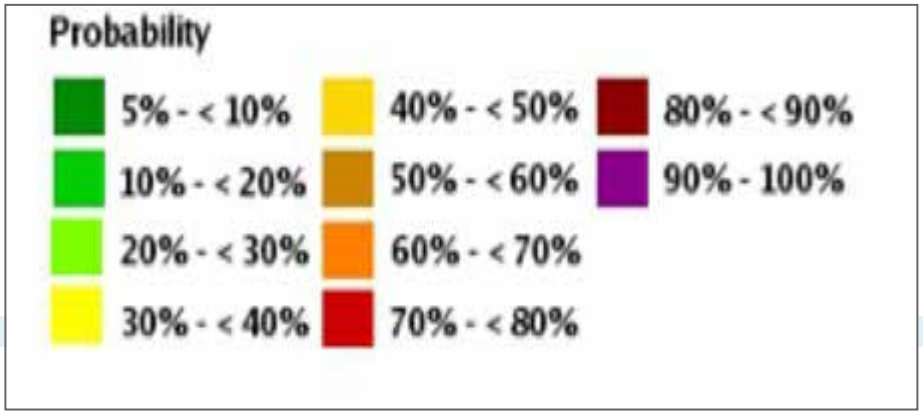
Storm surge plus setup plus tide

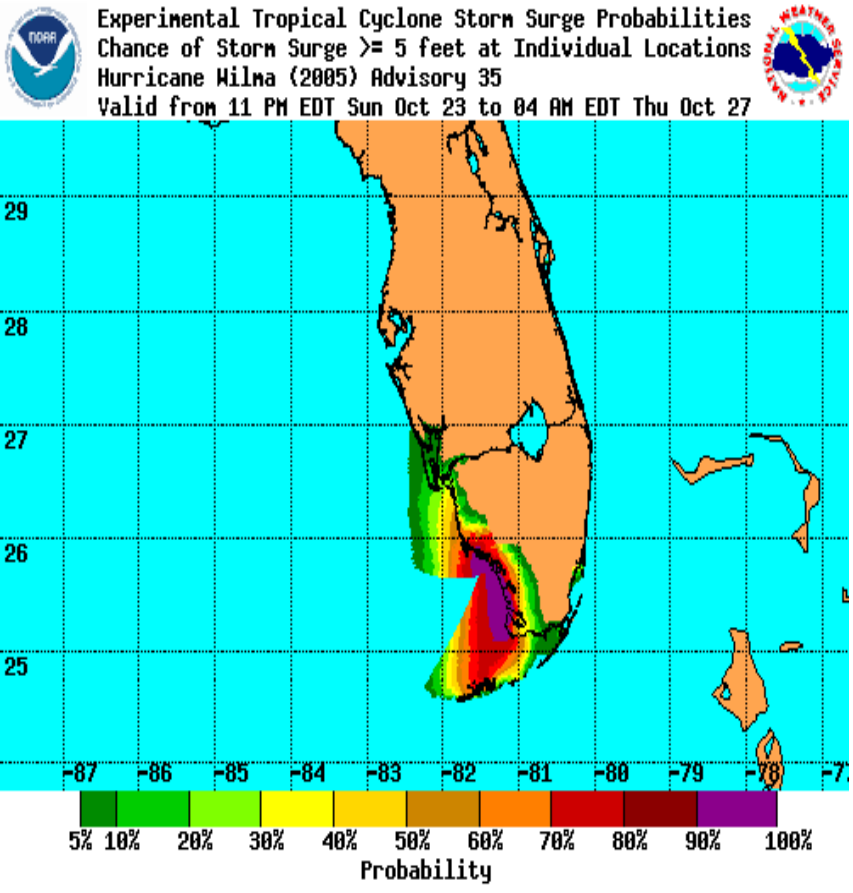


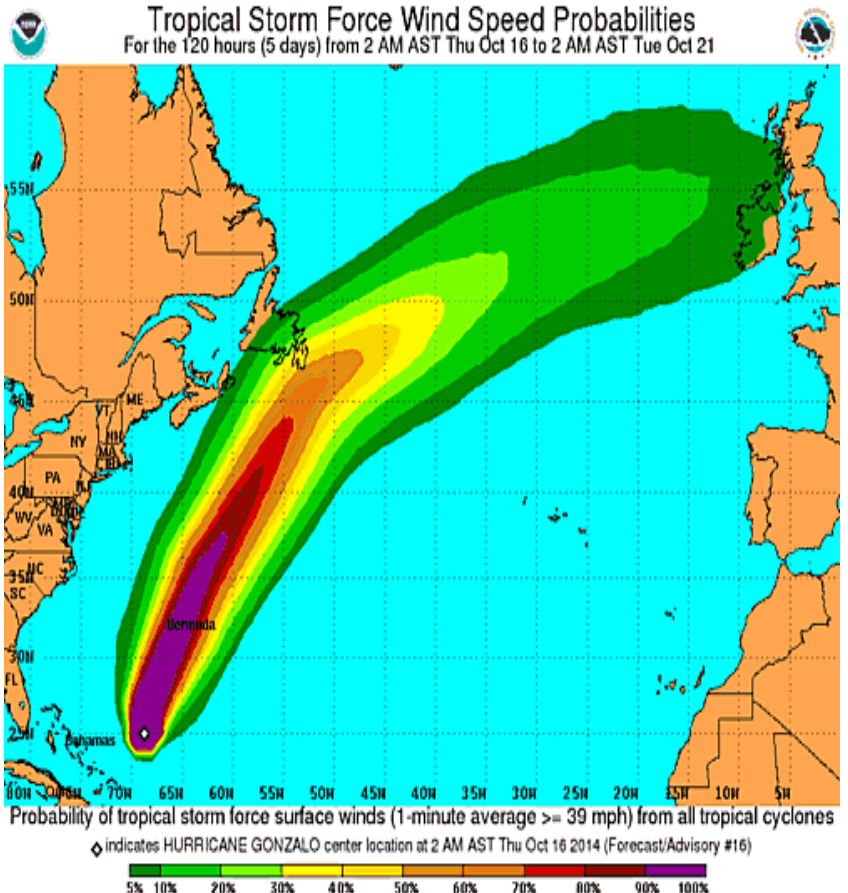
Storm surge plus setup



USA NOAA:2014







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Operational Service Implementation 2017

- Verified, tested & documented
- Robust
- Dedicated 24/7 support
- Business continuity plans
- Quality assured
- Performance monitored
- Staff competency training

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THANK YOU!