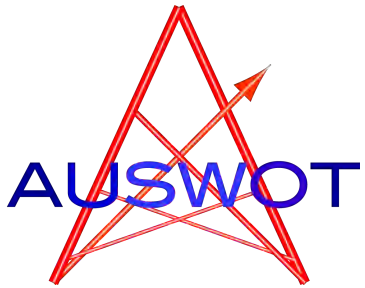


Australian Surface Water
Ocean Topography working group

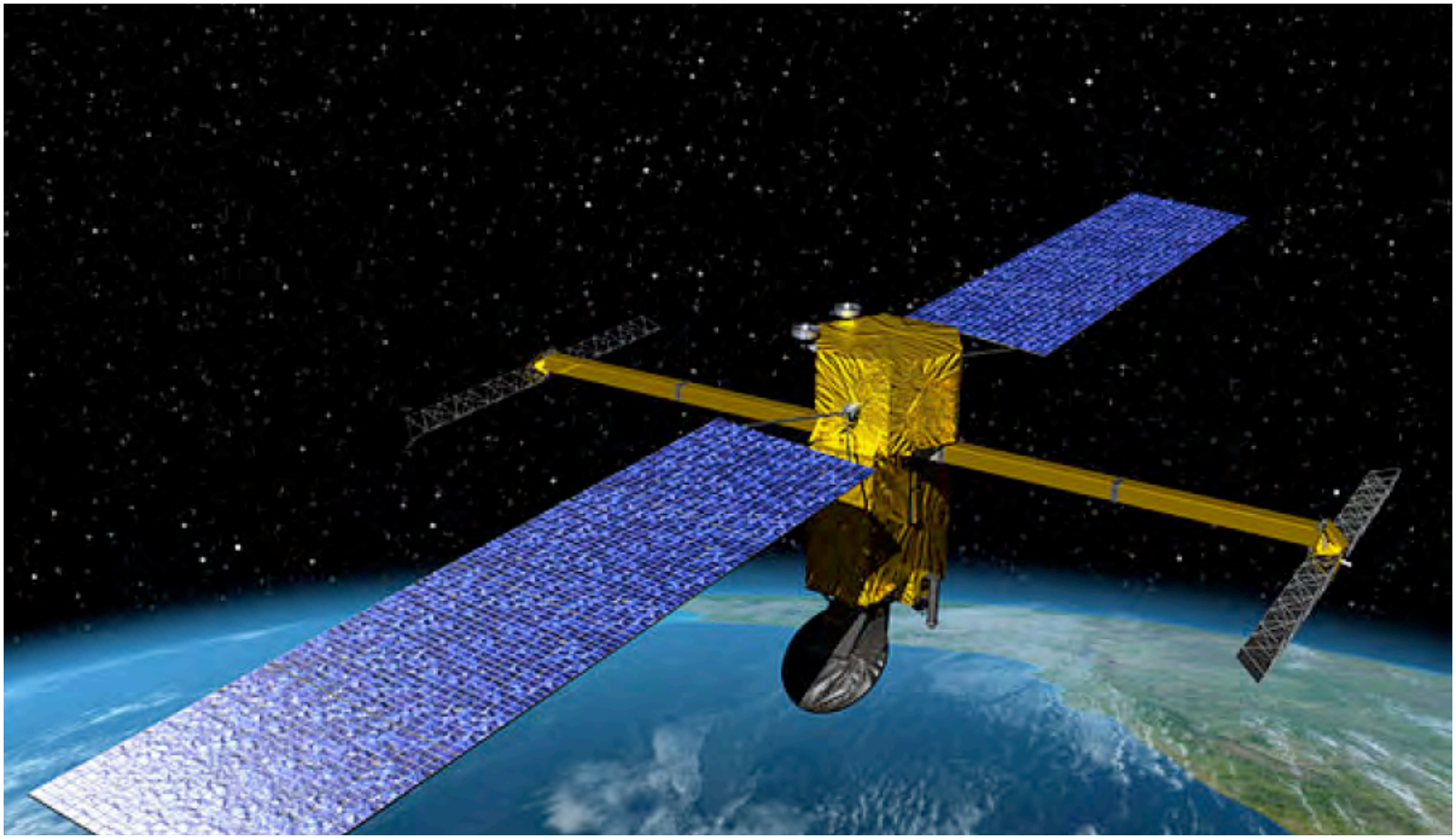
THE SWOT MISSION:
OPPORTUNITIES AND CHALLENGES

SHANE KEATING, UNSW SYDNEY

FORUM FOR OPERATIONAL OCEANOGRAPHY

MELBOURNE, 15 OCTOBER 2019

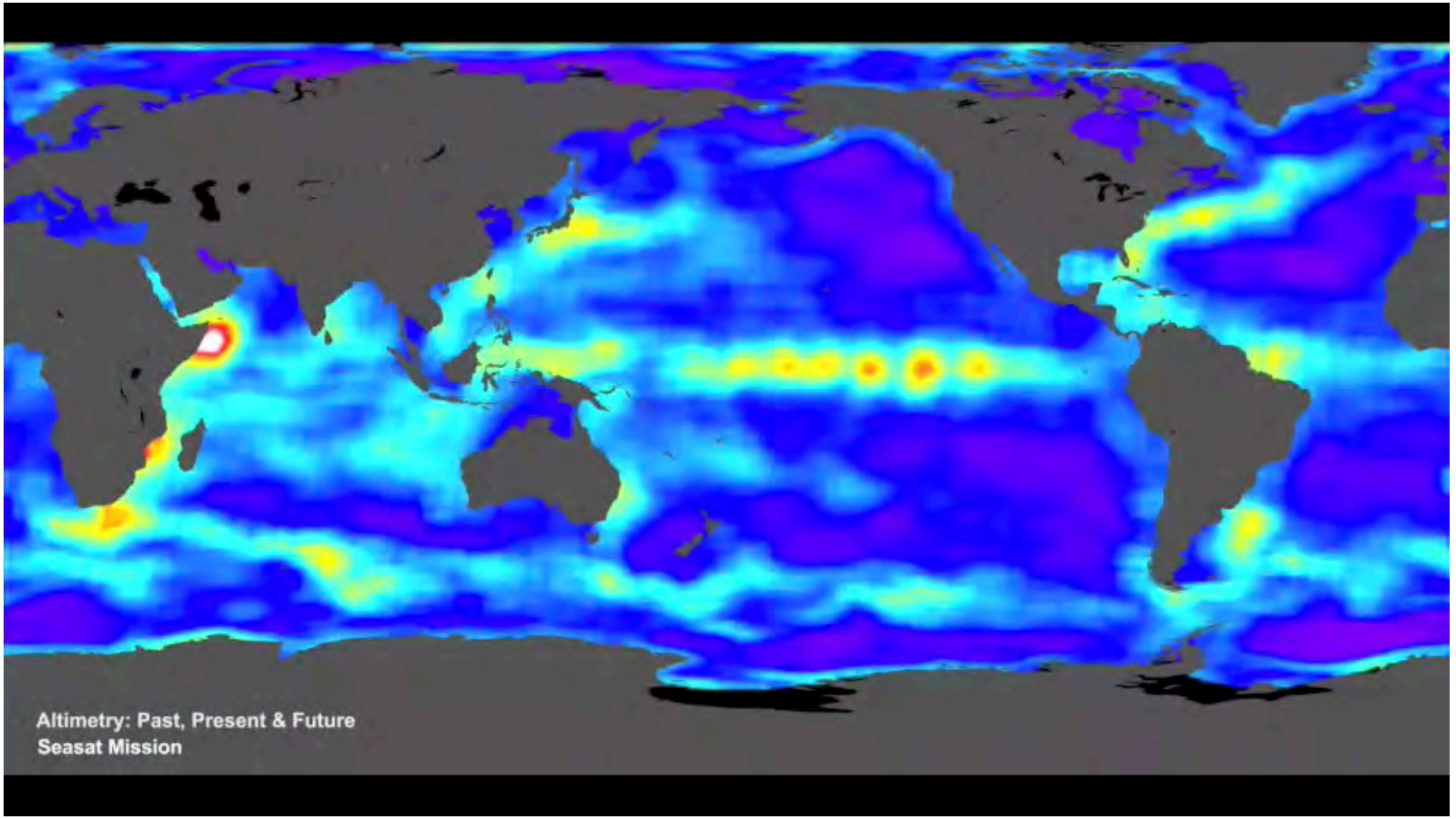
THE SURFACE WATER OCEAN TOPOGRAPHY (SWOT) MISSION



THE SURFACE WATER OCEAN TOPOGRAPHY (SWOT) MISSION

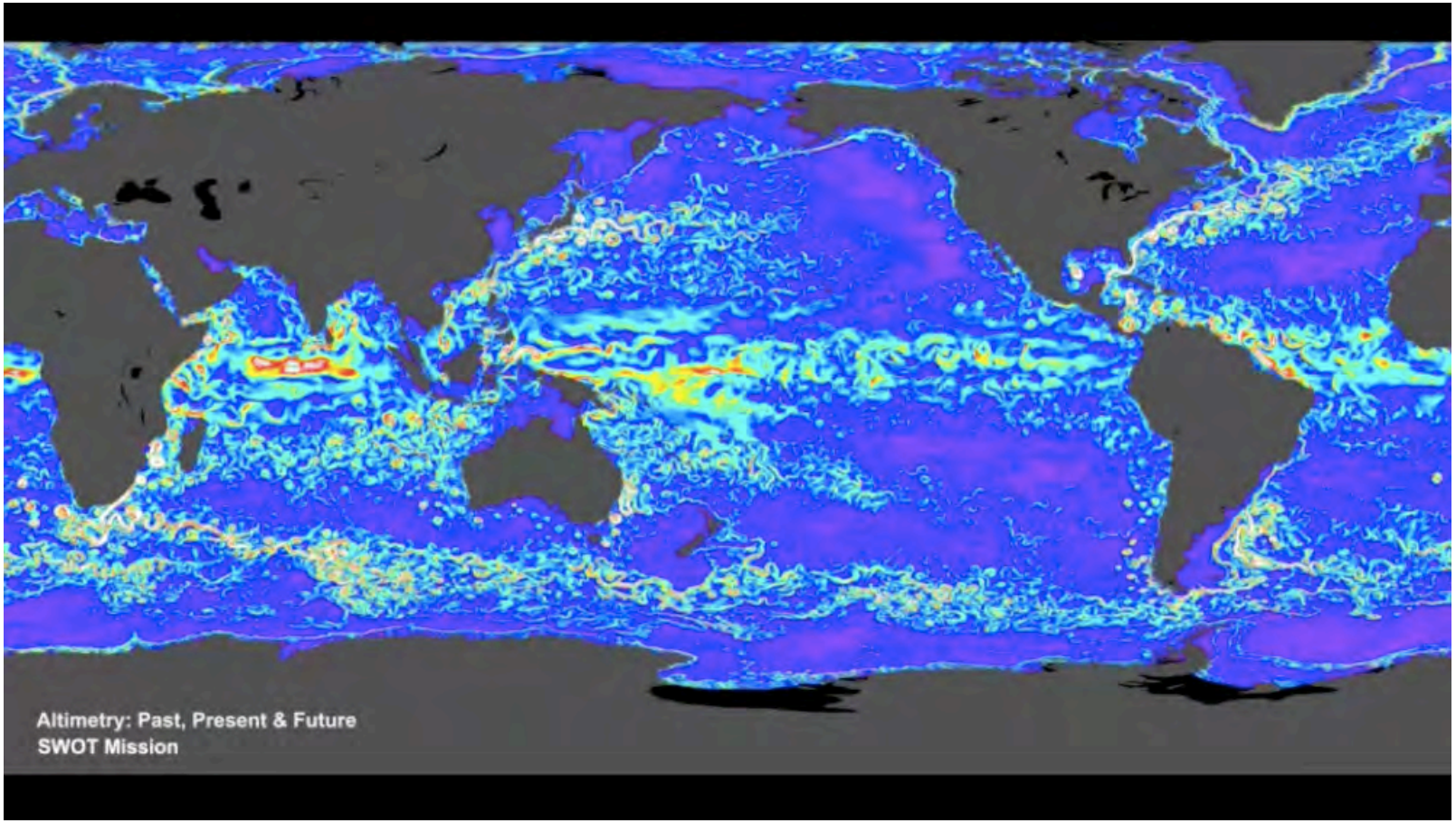
- Joint NASA/CNES project scheduled for launch **Sept 2021**
  - **Wide-swath radar interferometry** + nadir altimeter
  - **2D maps** of water elevation over 120 km swath
  - **10 times** the resolution of current generation altimeters
  - Australian government investment of $2.3M through IMOS/UTAS/CSIRO support for cal/val.
- Scientific objectives:
  - Monitor (terrestrial) **surface water** for the first time
  - Observe **ocean mesoscales and submesoscales** > 15 km
  - Coastal and high-latitude **tides and internal tides**
- Technological objective:
  - Set a new standard for **future altimetry missions**

THE SURFACE WATER OCEAN TOPOGRAPHY (SWOT) MISSION



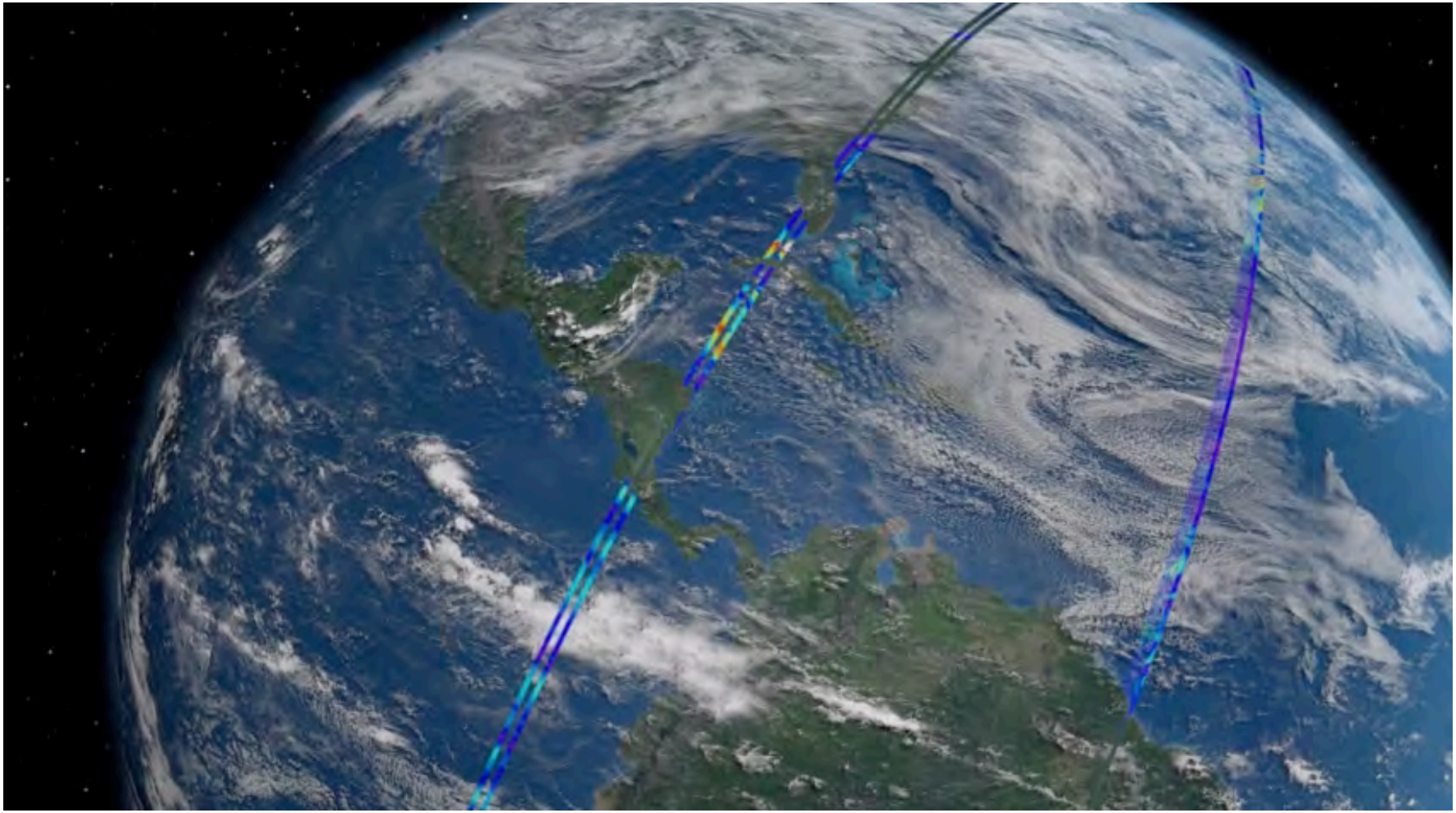
Credit: NASA JPL

THE SURFACE WATER OCEAN TOPOGRAPHY (SWOT) MISSION



Credit: NASA JPL

THE SURFACE WATER OCEAN TOPOGRAPHY (SWOT) MISSION

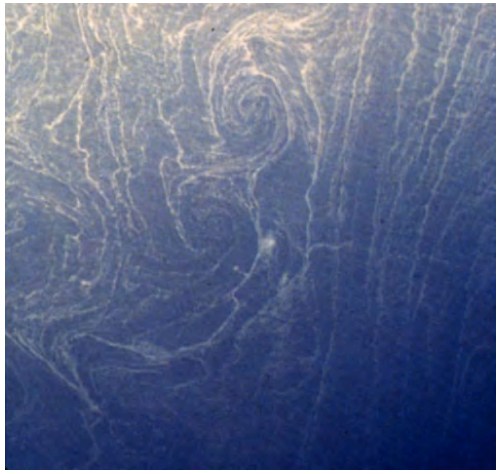


THE SURFACE WATER OCEAN TOPOGRAPHY (SWOT) MISSION

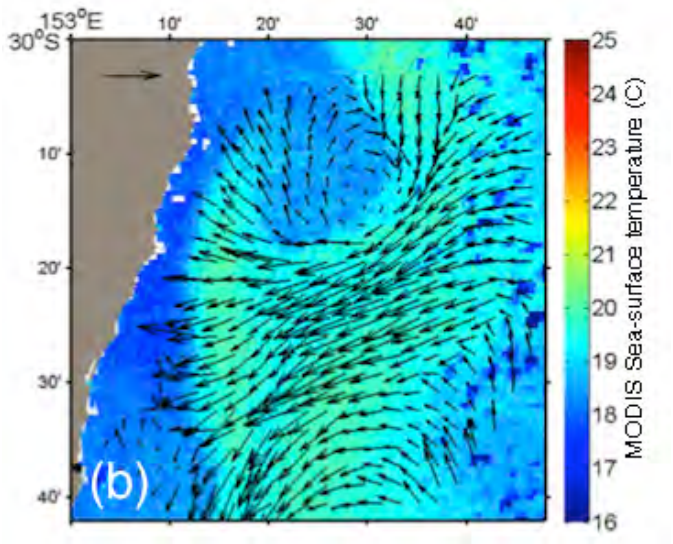
- **Nominal launch date:** September 2021 (SpaceX)
- **First 3 months** (~Sep-Nov 2021): instrument checkout
- **Second 3 months** (~Dec 2021-Feb 2022): 1-day repeat fast-sampling phase over limited groundtrack
  - Ideal for studies of rapidly evolving small mesoscales, submesoscales, and internal tides/waves
- **3-year science orbit** (~Mar 2022-Mar 2025): 21-day repeat orbit with full global coverage
  - 2km resolution SSH + corrections + wind/waves (3-4 Gb/day)
- **Future SAR interferometry missions** (2025+): Guanlan, WiSA

OPPORTUNITIES FOR OPERATIONAL OCEANOGRAPHY

- **Fully resolve mesoscale eddies** in the open ocean
- **Coastal and shelf dynamics**, marginal seas, rivers/estuaries
- Ubiquitous **small mesoscale and submesoscale** ocean processes



Sea spirals (~5 km)

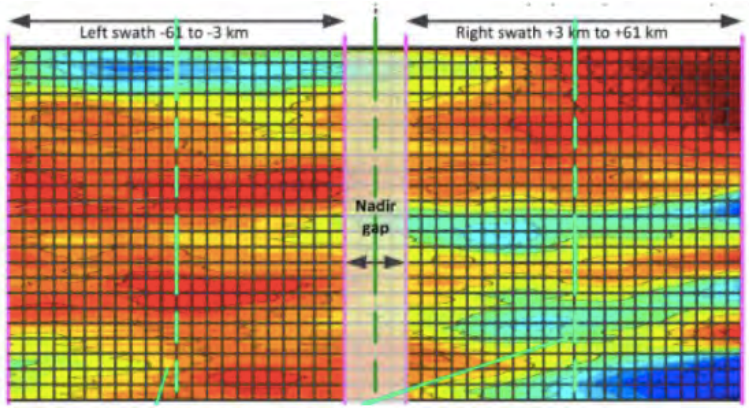


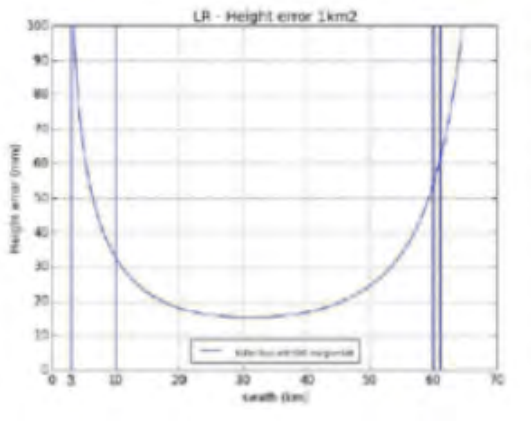
Frontal eddies (~40 km)

Pollutant dispersal

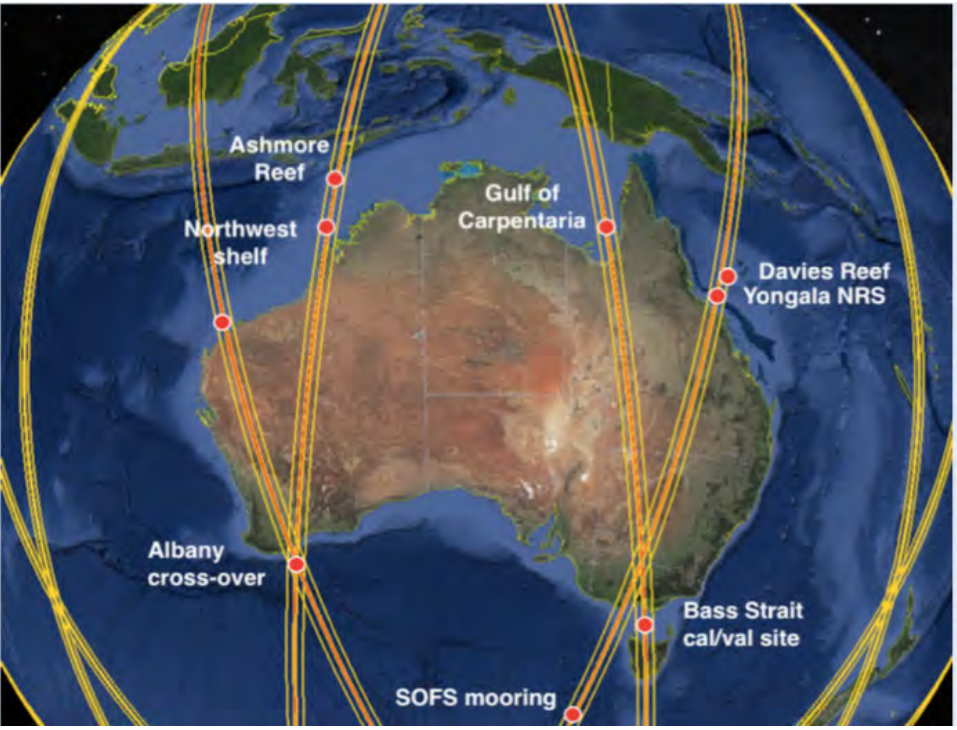
CHALLENGES FOR OPERATIONAL OCEANOGRAPHY

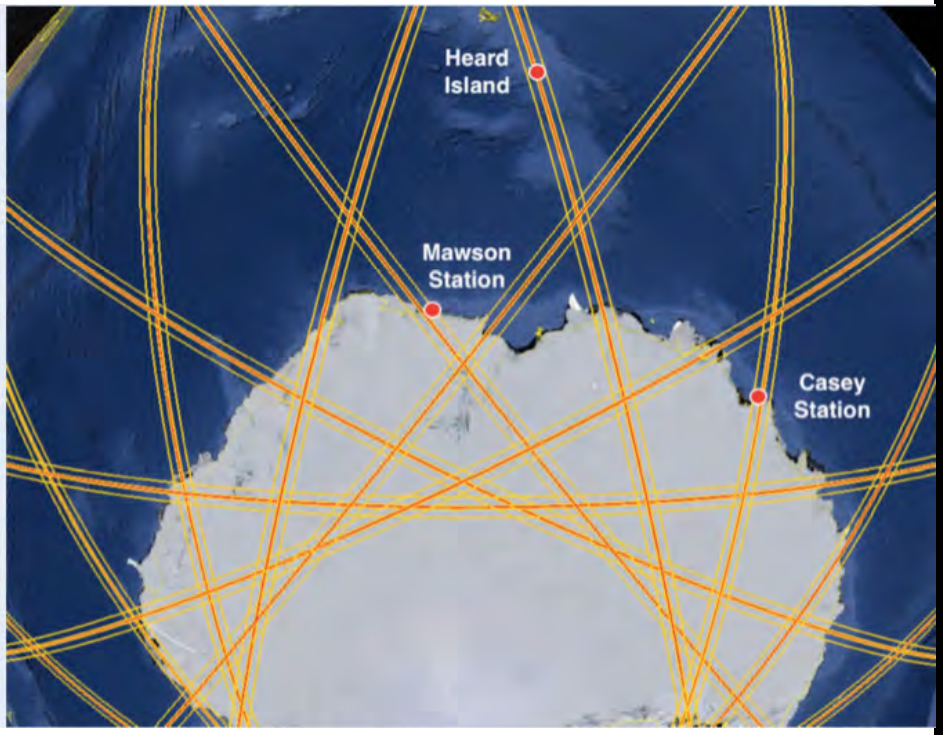
- **Observational error** varies across swath, depends on sea-state
- Estimating currents from SWOT SSH depends on **separation of tides and internal tides from geostrophic currents**
- **Mismatch** between spatial and temporal sampling scales
- Deriving **vertical velocities and surface vorticities**: a “Grand Challenge for ocean remote sensing”



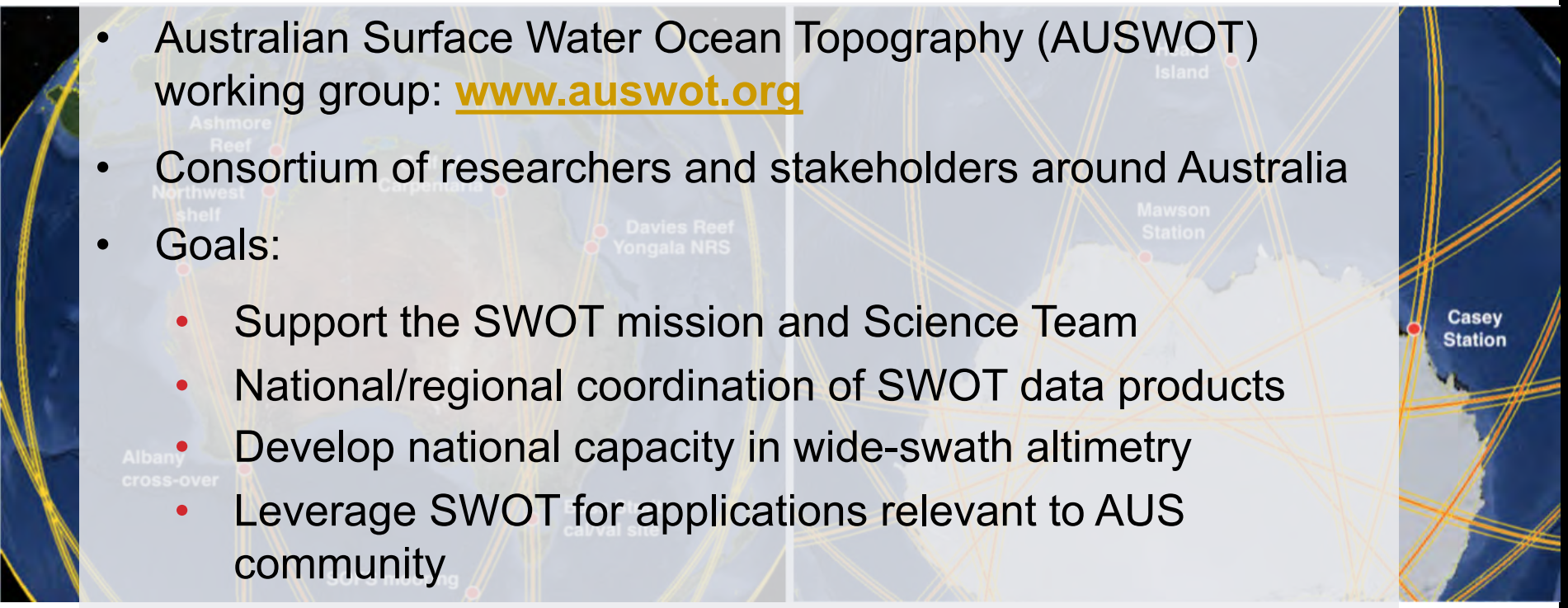


AUSWOT WORKING GROUP



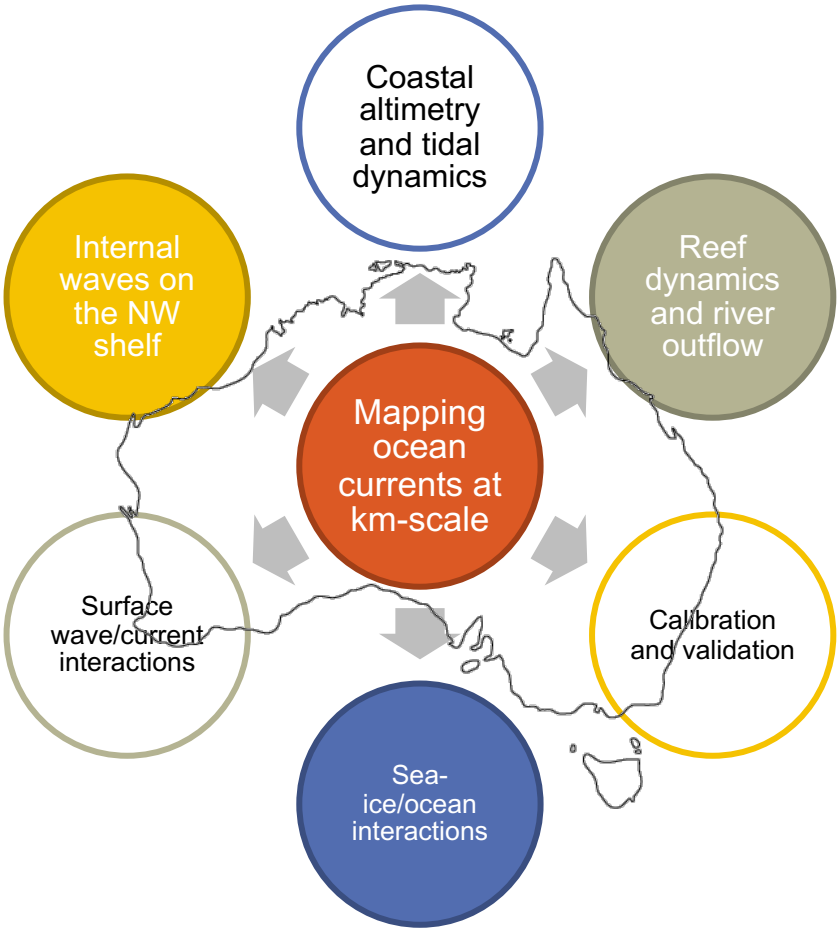


AUSWOT WORKING GROUP

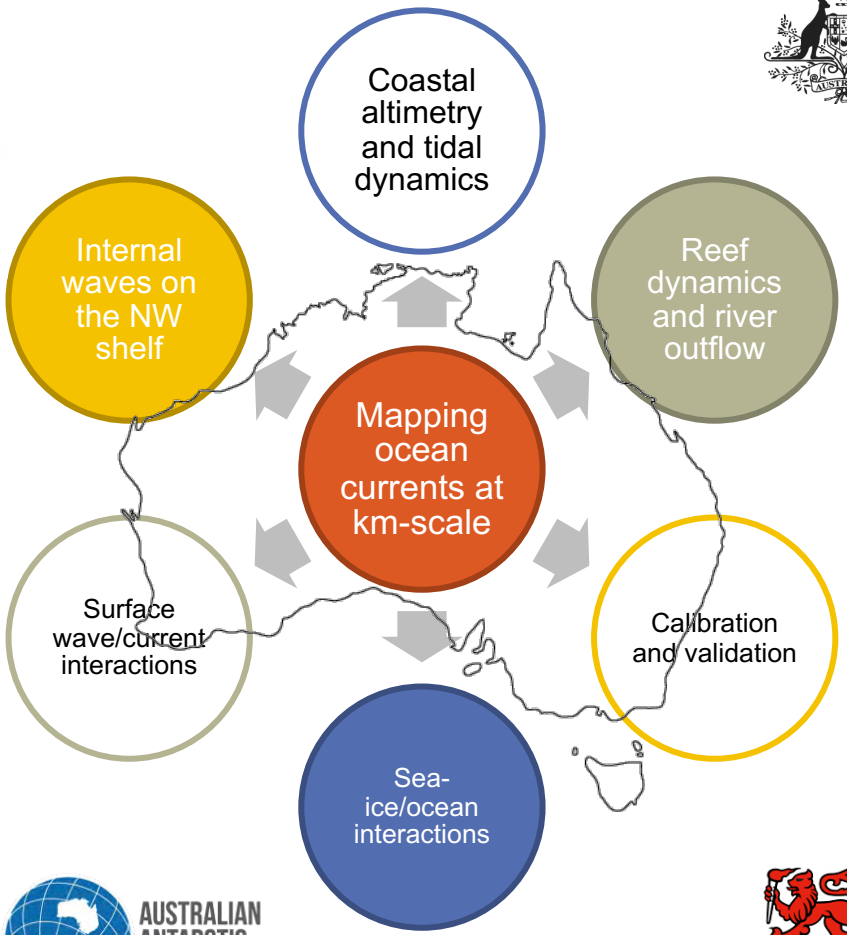


- Australian Surface Water Ocean Topography (AUSWOT) working group: www.auswot.org
- Consortium of researchers and stakeholders around Australia
- Goals:
  - Support the SWOT mission and Science Team
  - National/regional coordination of SWOT data products
  - Develop national capacity in wide-swath altimetry
  - Leverage SWOT for applications relevant to AUS community

AUSWOT ACTIVITIES



AUSWOT ACTIVITIES



NAVY

Australian Government
Bureau of Meteorology

Australian Institute of Marine Science

The University of Western Australia

UNSW Sydney

CSIRO

IMOS
Integrated Marine Observing System

Australian Government
Department of the Environment and Energy
Australian Antarctic Division

Australian Antarctic Program

The University of Adelaide

University of Tasmania

AUSWOT ACTIVITIES

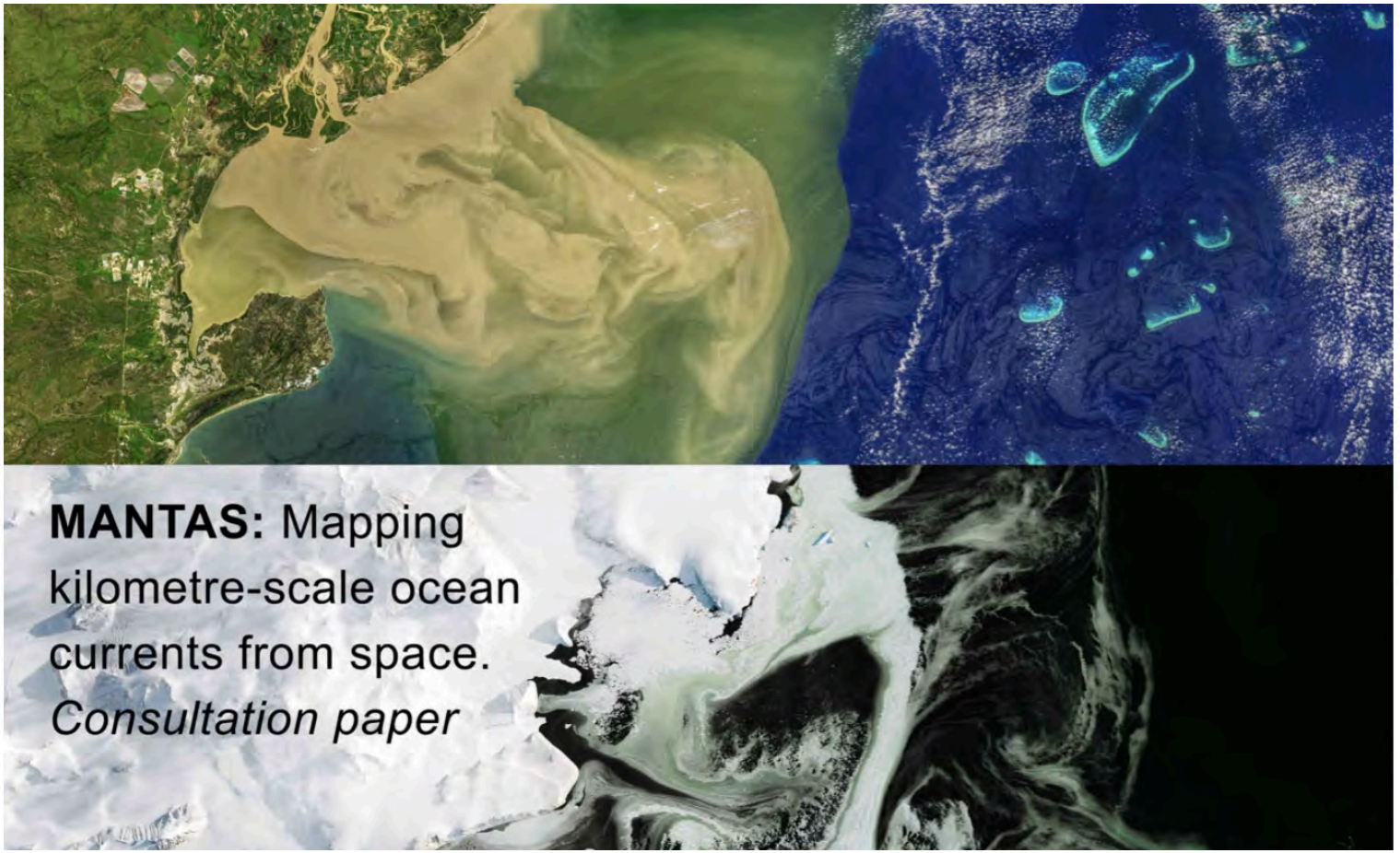
- **MANTAS** (Mapping oceaN Topography at Submesoscales)
- Develop capacity to **map and forecast** high-resolution upper ocean currents
- Complement efforts by CSIRO/OceanCurrent
- **Support scientific activities** of other groups and partners around Australia

Mapping ocean currents at km-scale

Australian Government
Bureau of Meteorology

UNSW SYDNEY

AUSWOT ACTIVITIES



Consultation paper available at **https://auswot.org/activities/**

PLANNED ACTIVITIES

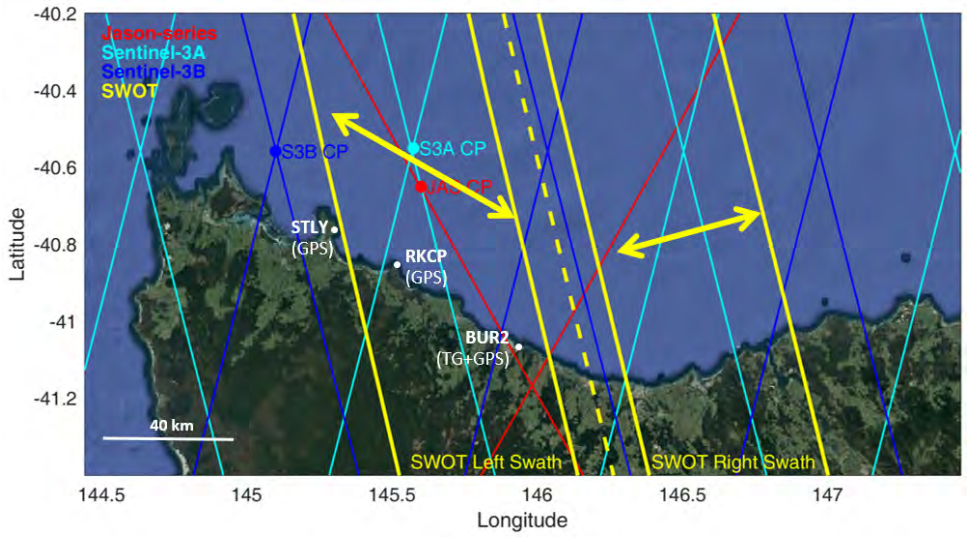
- Chris Watson (UTas) and Benoit Legresy (CSIRO)
- $2.3M support through IMOS:
  - Bass Strait altimetry cal/val site
  - SOFS mooring (Southern Ocean)
  - Yongala NRS (Great Barrier Reef)

Calibration and validation

UNIVERSITY of TASMANIA

CSIRO

IMOS
Integrated Marine Observing System



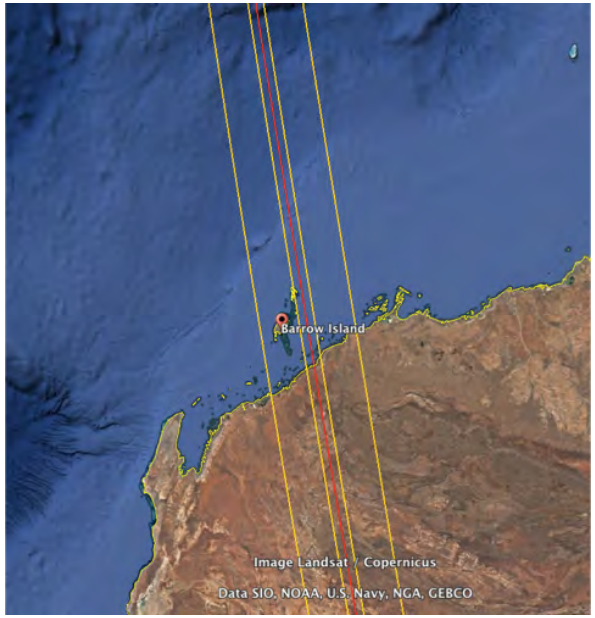
PLANNED ACTIVITIES

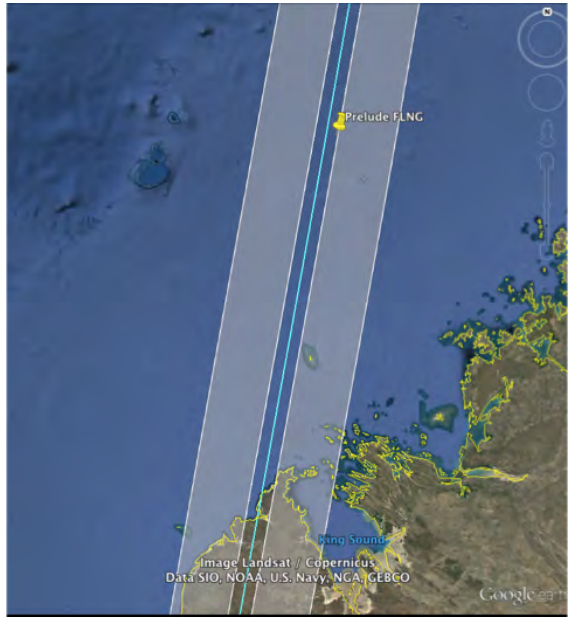
- Matt Rayson and Nicole Jones (UWA)
- Understanding and predicting internal gravity waves and interaction with background flow
- WA-IMOS to deploy mooring in Browse Basin

Internal waves on NW shelf

THE UNIVERSITY OF WESTERN AUSTRALIA

IMOS Integrated Marine Observing System

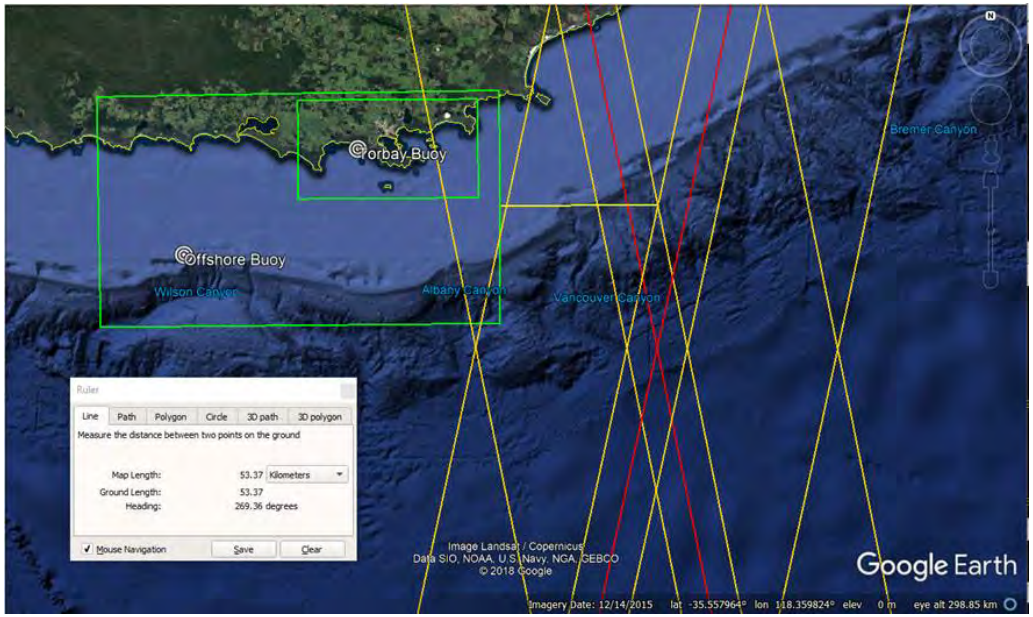




PLANNED ACTIVITIES

Surface wave-current interactions

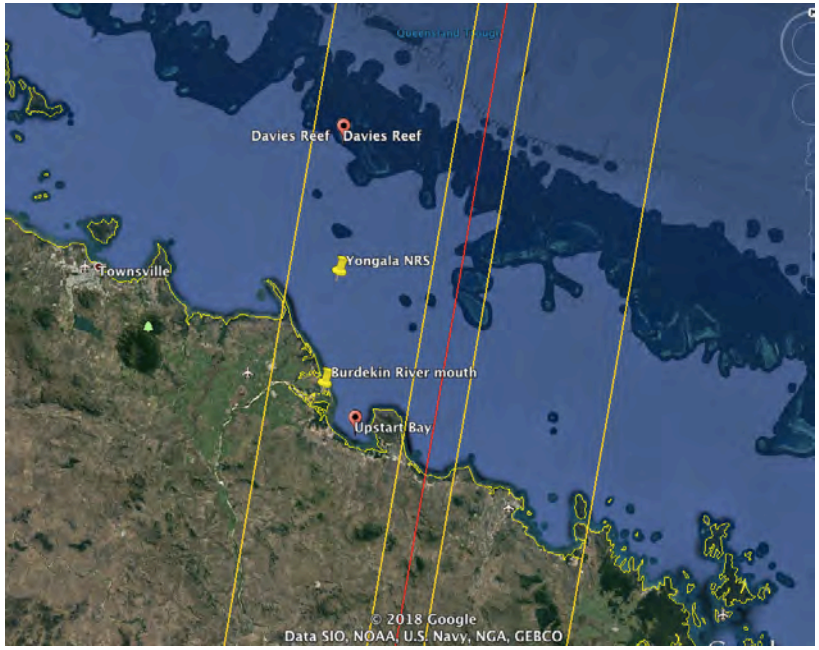
- Ryan Lowe, Jeff Hansen, Nicole Jones, Mark Buckley (UWA)
  - Observing and modeling coastal hydro-dynamics and surface waves in Albany region
- Mark Hemer and Salman Khan (CSIRO)
  - SAR directional surface wave observations in wave-current interaction case studies



PROPOSED ACTIVITIES

- Daily flyover of Burdekin river outflow in flood months (0-3 floods in Jan-Mar)
- Submesoscale current/river plume dynamics
- Davies reef weather station (AIMS)
- Sediment transport onto reef

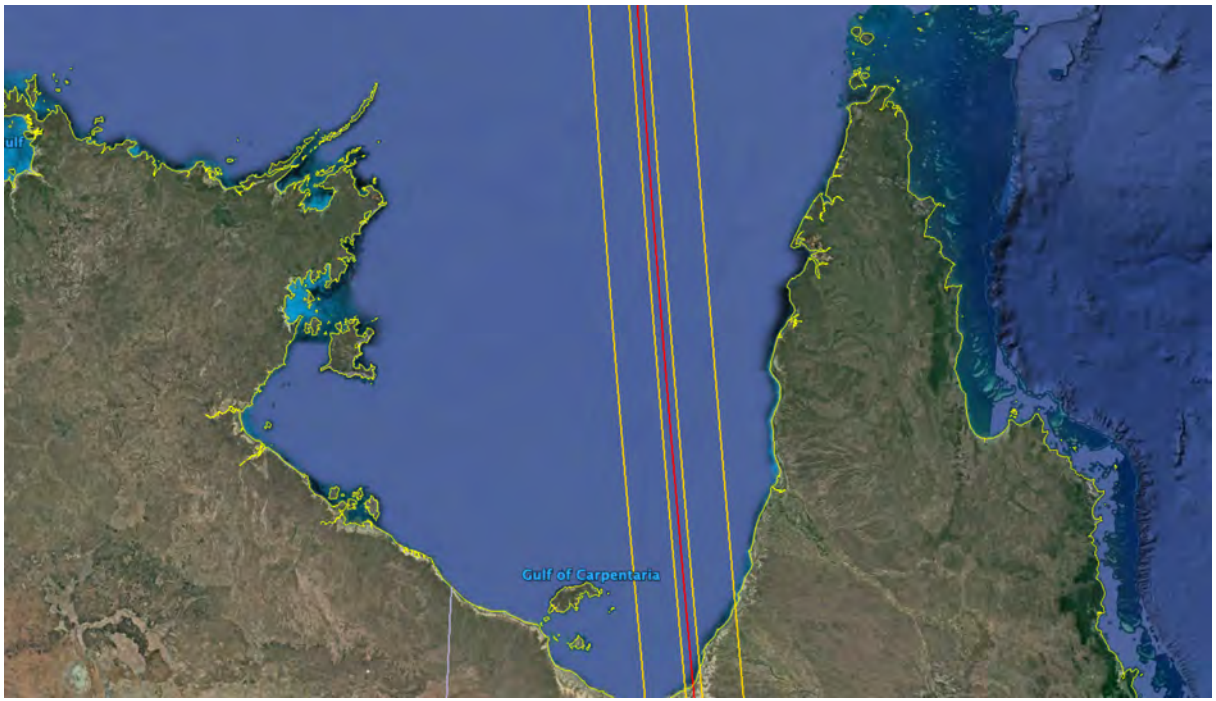
Reef dynamics and river outflow



PROPOSED ACTIVITIES

- Tidal dynamics very important to fisheries in shallow Gulf of Carpentaria
- Charles Darwin University: assimilating regional model of Gulf

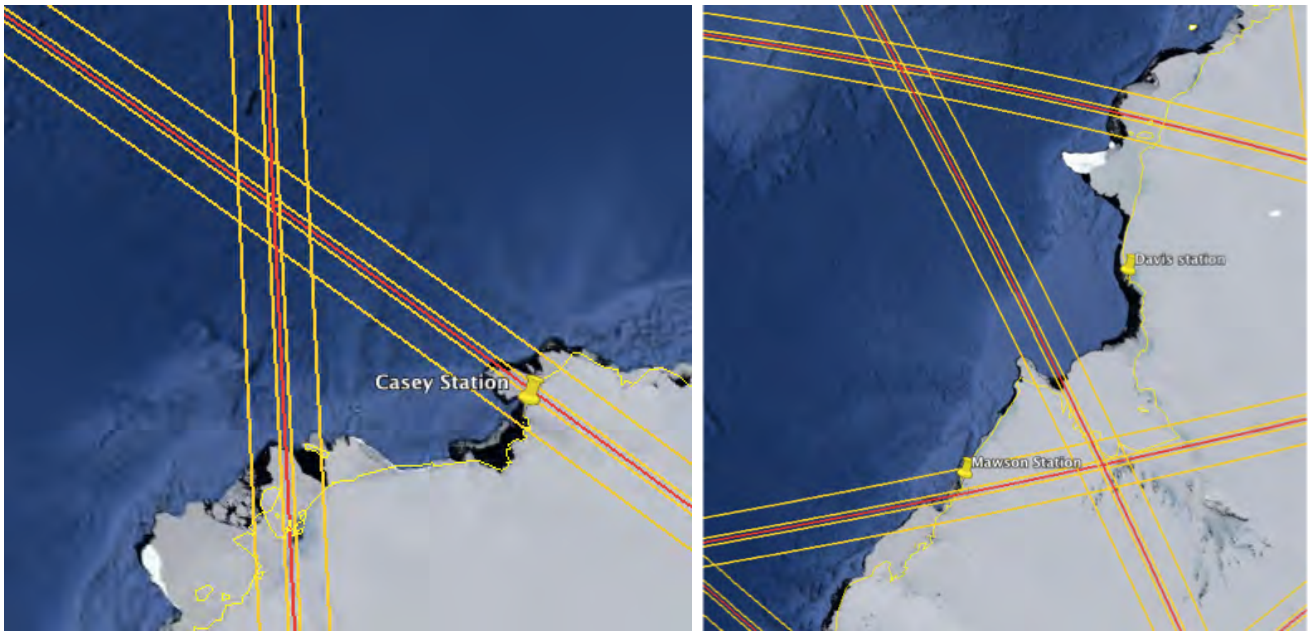
Coastal altimetry and tidal dynamics



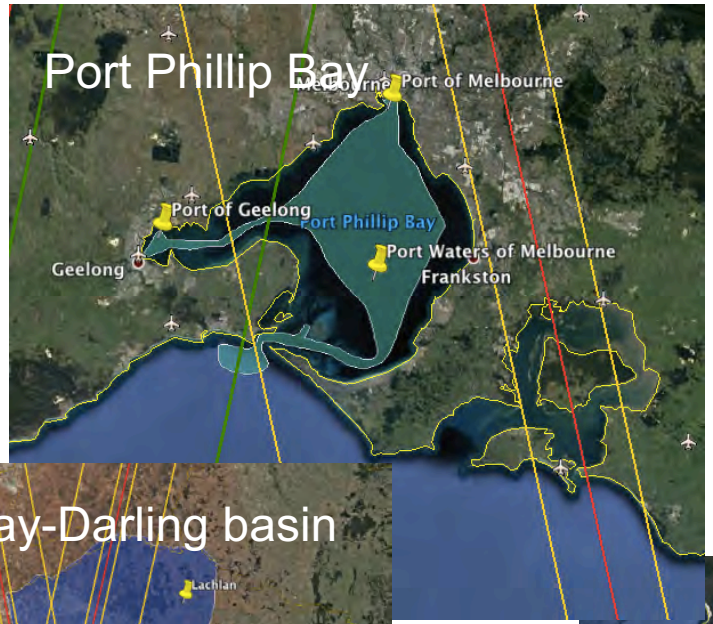
PROPOSED ACTIVITIES

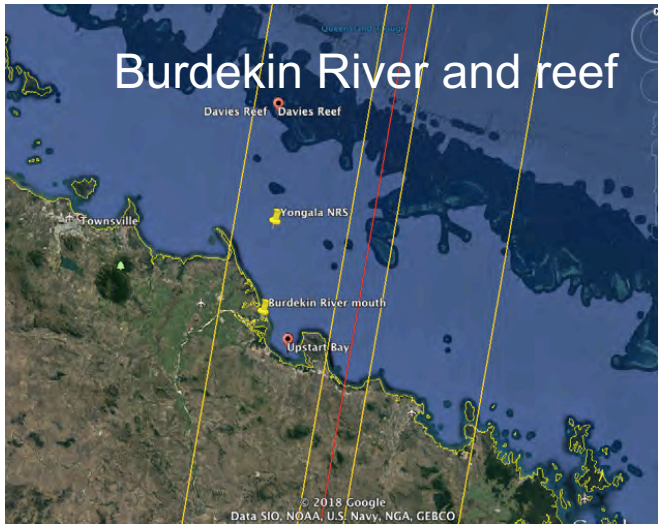
- Daily flyover of Casey and Mawson Station
- Study waves and small-scale features in marginal ice zone (MIZ)
- Complement Arctic campaign (Ron Kwok, JPL) with summer sea ice observations

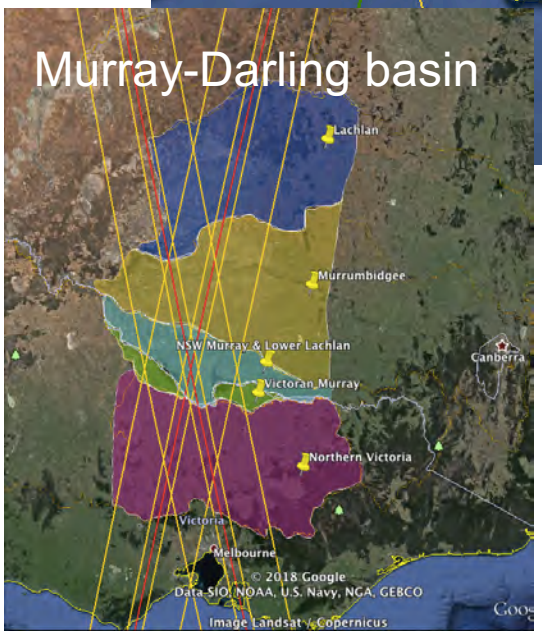
Sea-ice/ocean interactions in the MIZ



OPPORTUNITIES FOR AUSTRALIAN HYDROLOGY

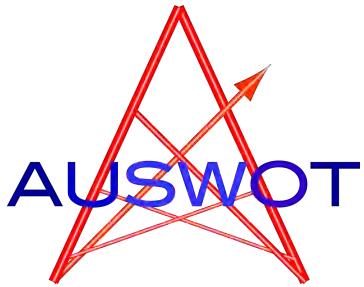






GET INVOLVED

- **Fast-sampling and science orbit** KMZ files available through https://swot.jpl.nasa.gov
- Visit www.auswot.org and sign up for the **AUSWOT newsletter**
- Comment on the **MANTAS consultation paper**
- Email me at **s.keating@unsw.edu.au**



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