# SWOT OCEANOGRAPHY APPLICATIONS

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AUSWOT

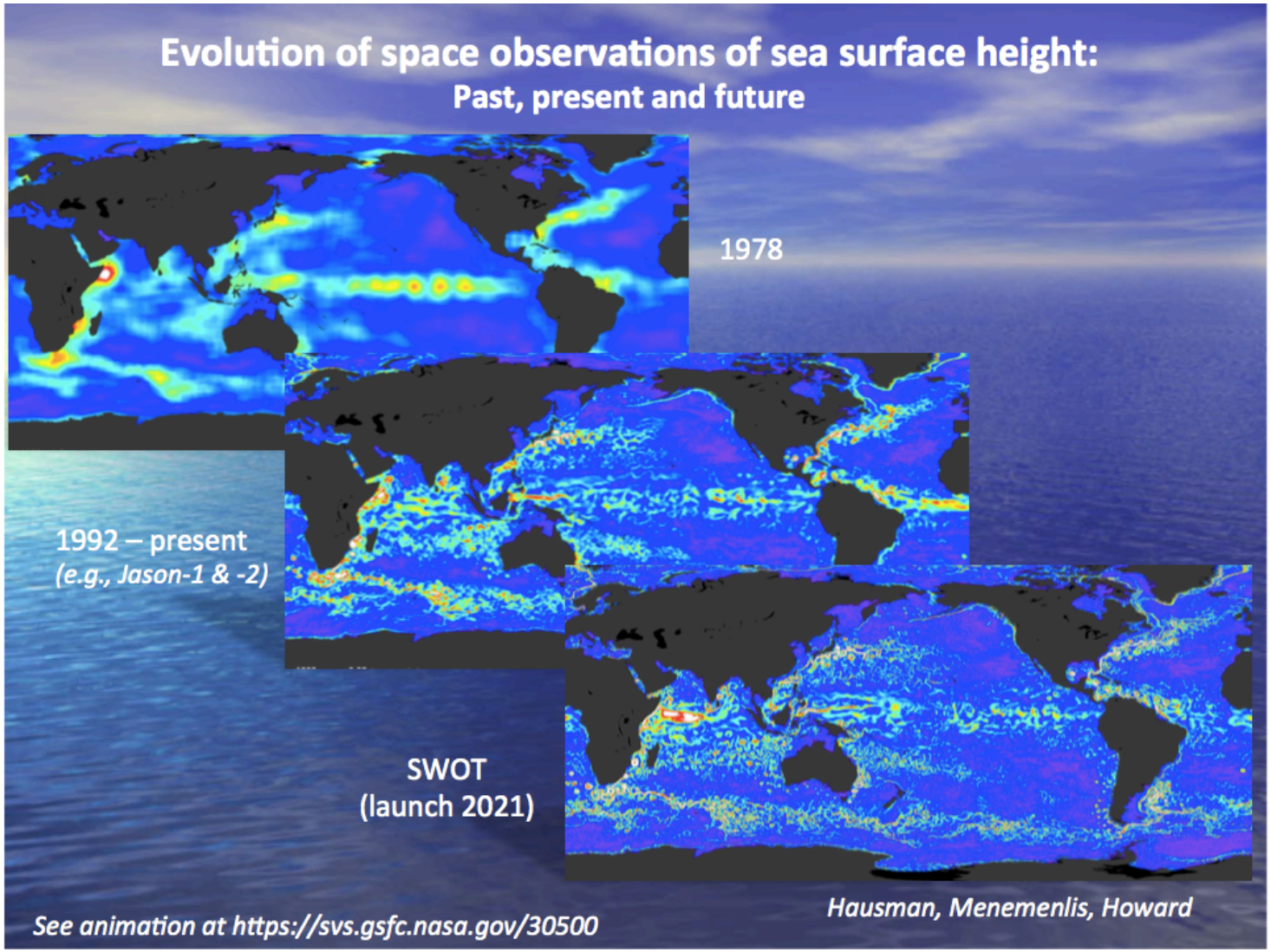
Australian Surface Water and Ocean Topography working group

Australian Government

Bureau of Meteorology

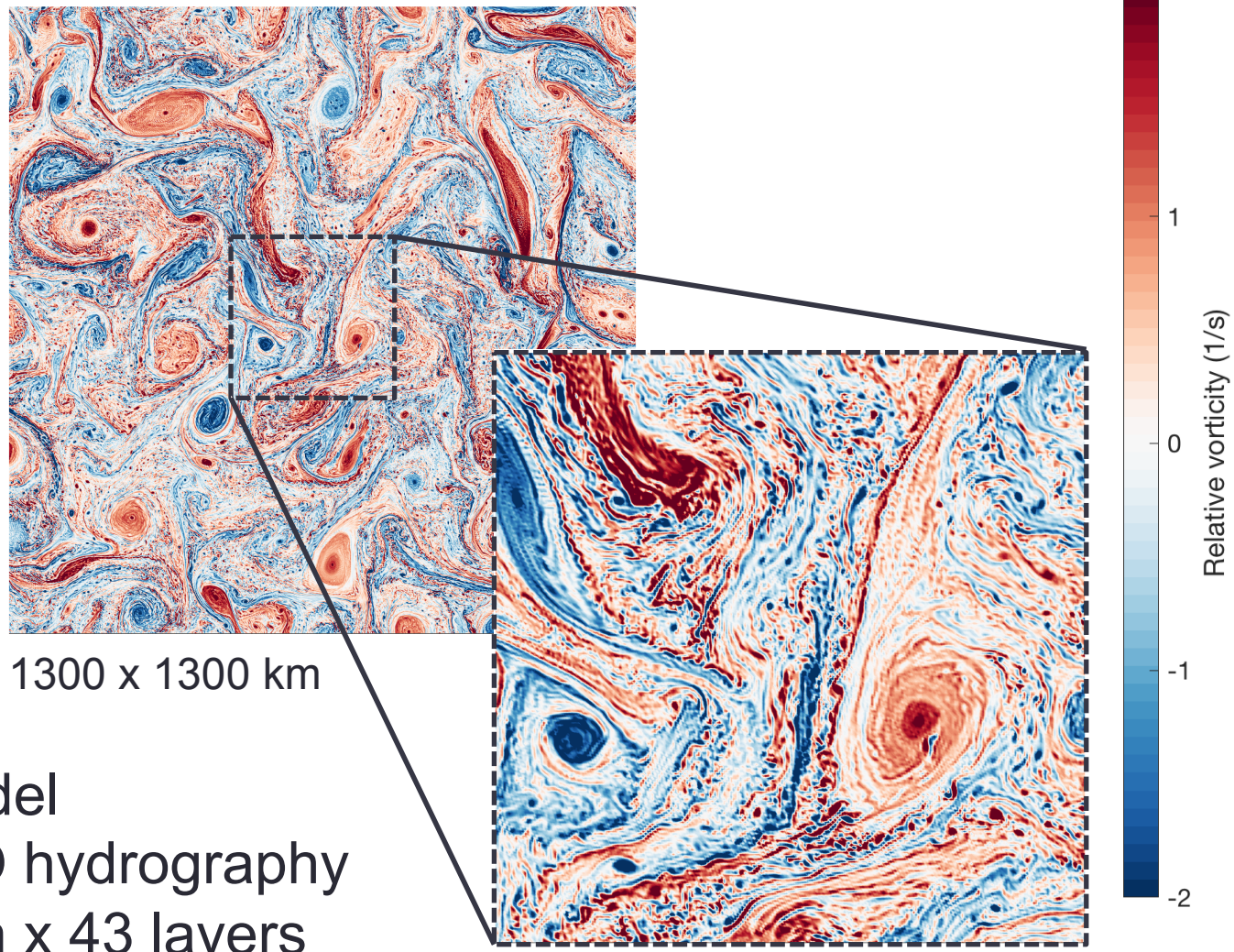
UNSW SYDNEY

# An unprecedented view of our ocean



# Eddies all the way down

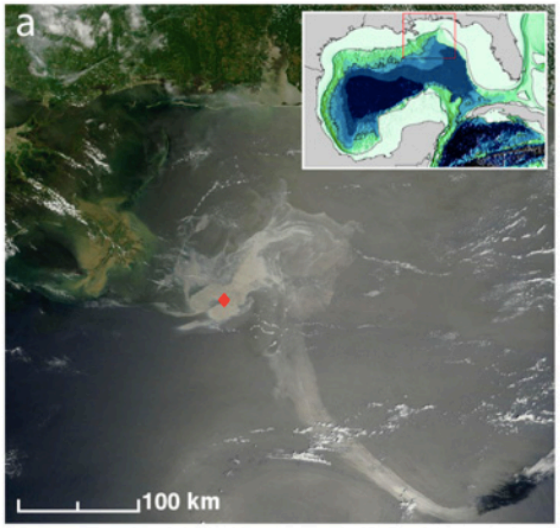
Latmix region



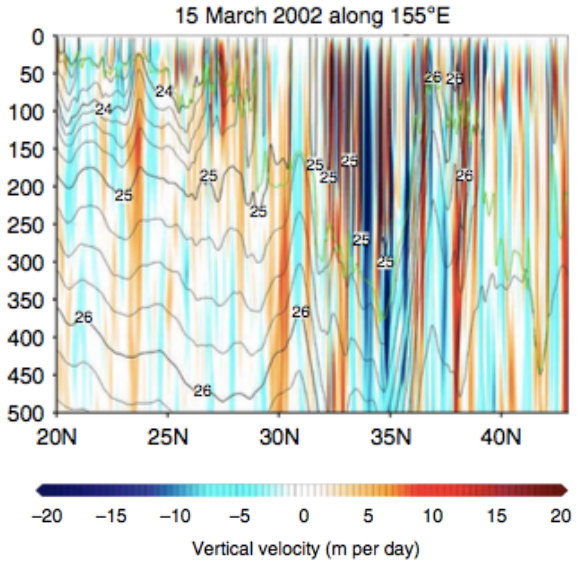

Spectral QG model
Forced by ECCO hydrography
1.3 km resolution x 43 layers

# From plankton to planet

- Lateral dispersion of pollutants, biota, heat
- “Lungs” of the ocean: vertical exchange of heat and carbon with deep ocean (Ferrari, *Science* 2011)
- 20-30% of vertical transport of biogeochemical properties in submesoscale fronts (Sasaki et al. *Nat. Comm.* 2014)
- Submesoscale eddies play key role in productivity, top predators, fisheries

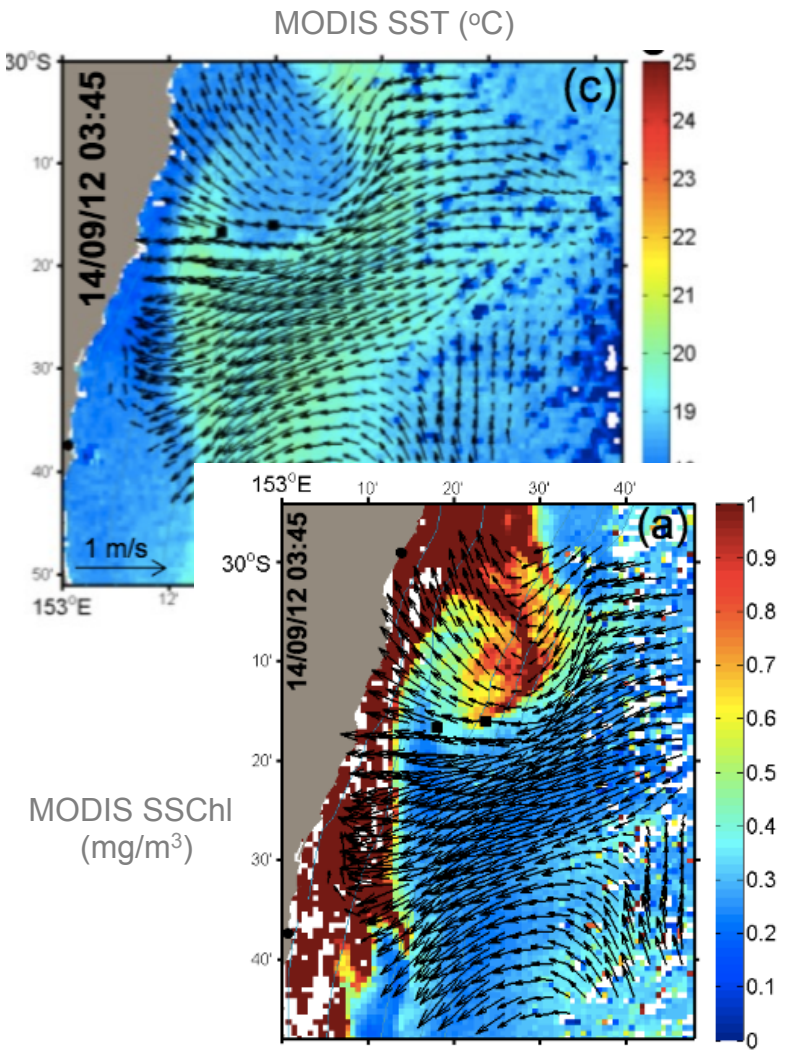



Poje et al. (2014)




Sasaki et al. (2014)

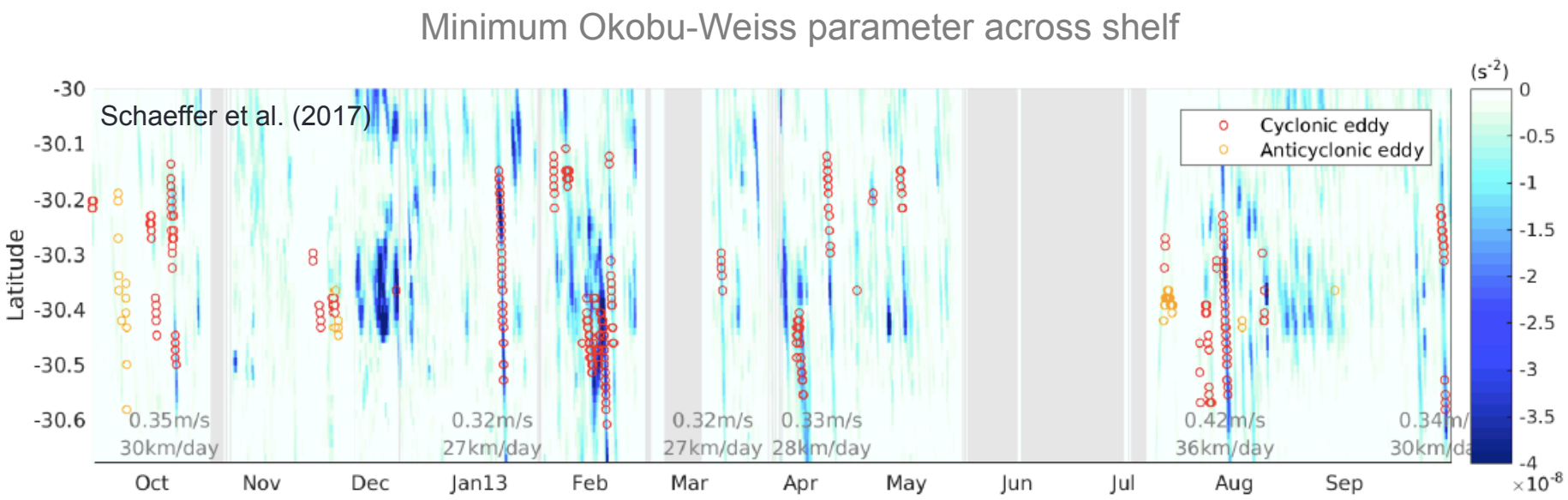
# Frontal Eddies in the EAC




Mantovanelli et al. (2017)

- Form as a frontal instability on landward side of thermal front
- Observed in Gulf Stream, Kuroshio and the EAC
- Form frequently (weekly) with diameters of 10-40 km and lifetimes 1-4 weeks
- Cold-core cyclonic freddies are highly productive
- Transports nutrients, larval fish, etc. offshore by entraining shelf water

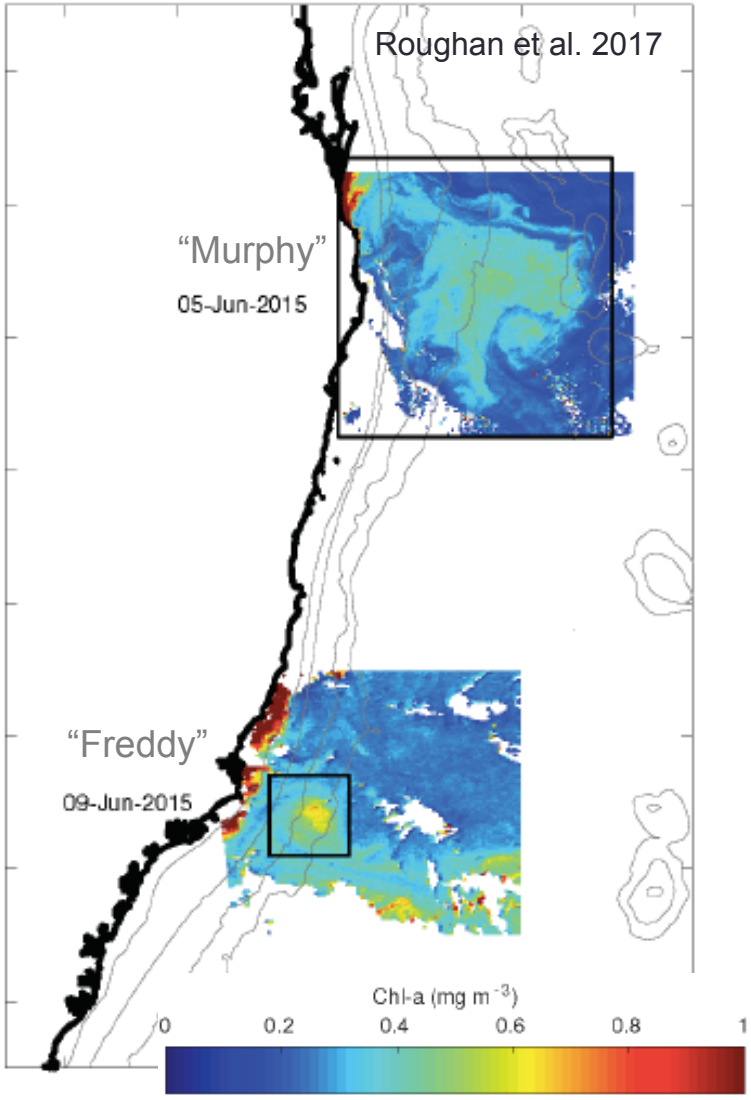
# High-frequency radar



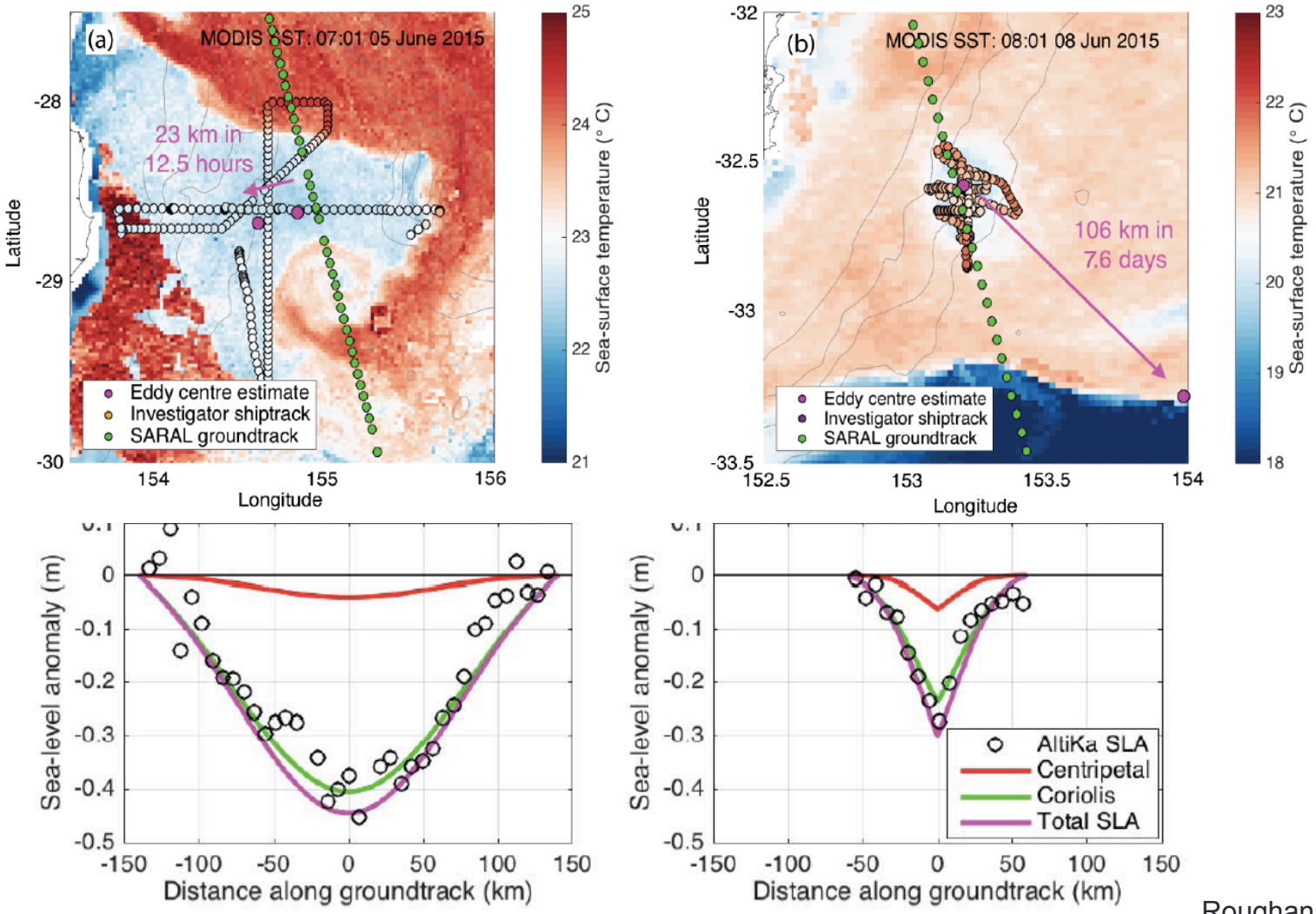

- HF radar near EAC separation point: 1.5 km/10 min resolution
- Freddies propagating through HF radar domain can be identified, tracked, and analyzed
- Approximately one eddy every 2 weeks, with Rossby numbers up to 1.7 and propagation speeds of up to 0.4 m/s

# R/V Investigator cruise (June 2015)

- Austral winter 2015: Dedicated research cruise to study frontal eddies in the EAC
- Extensively sampled two contrasting cyclonic eddies: one mesoscale (~160 km) and one submesoscale (~35 km)
- Vertical structure measured with shipboard Acoustic Doppler Current Profiler, lowered CTD, and Triaxus

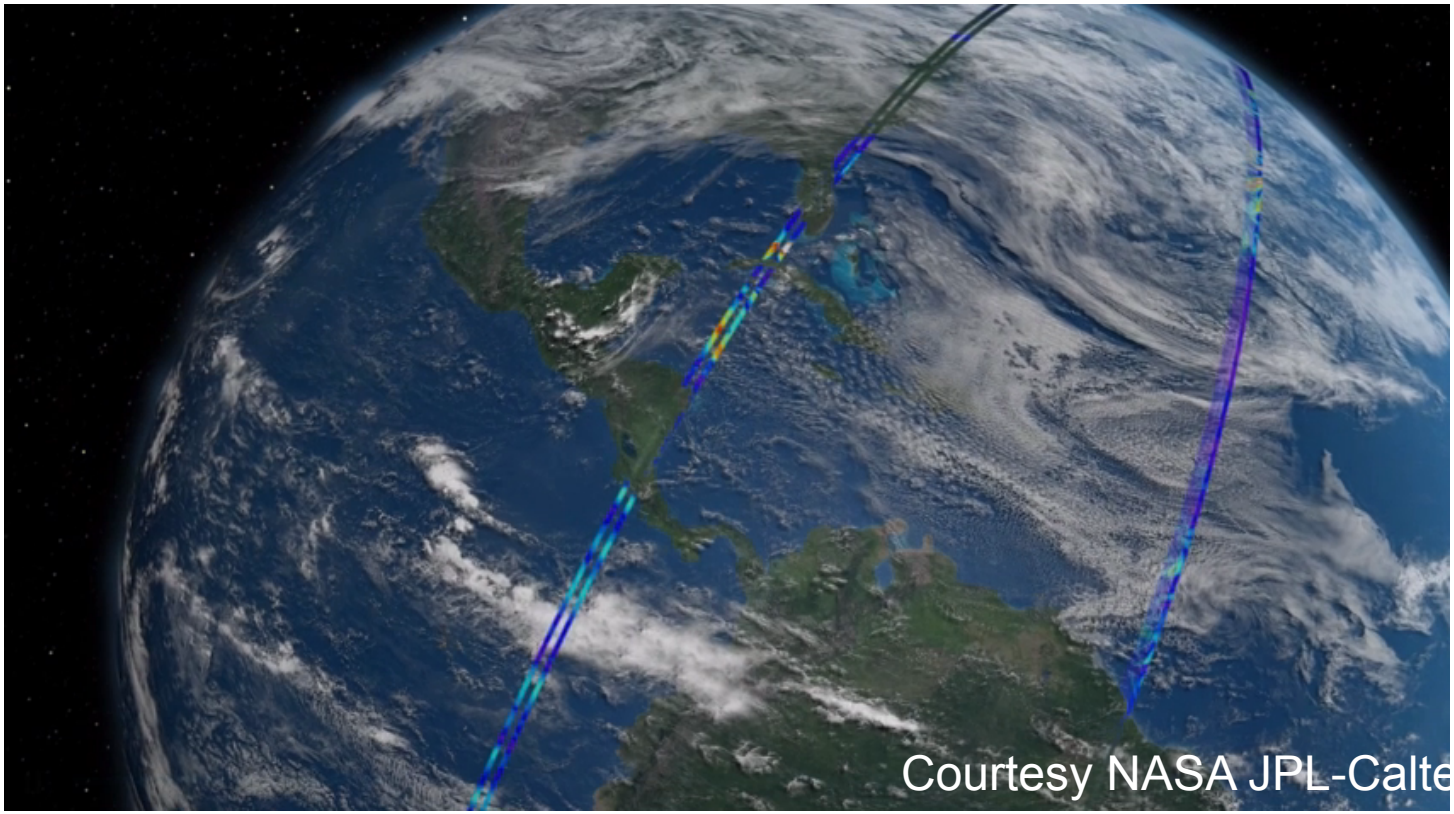


# AltiKa sea-surface height



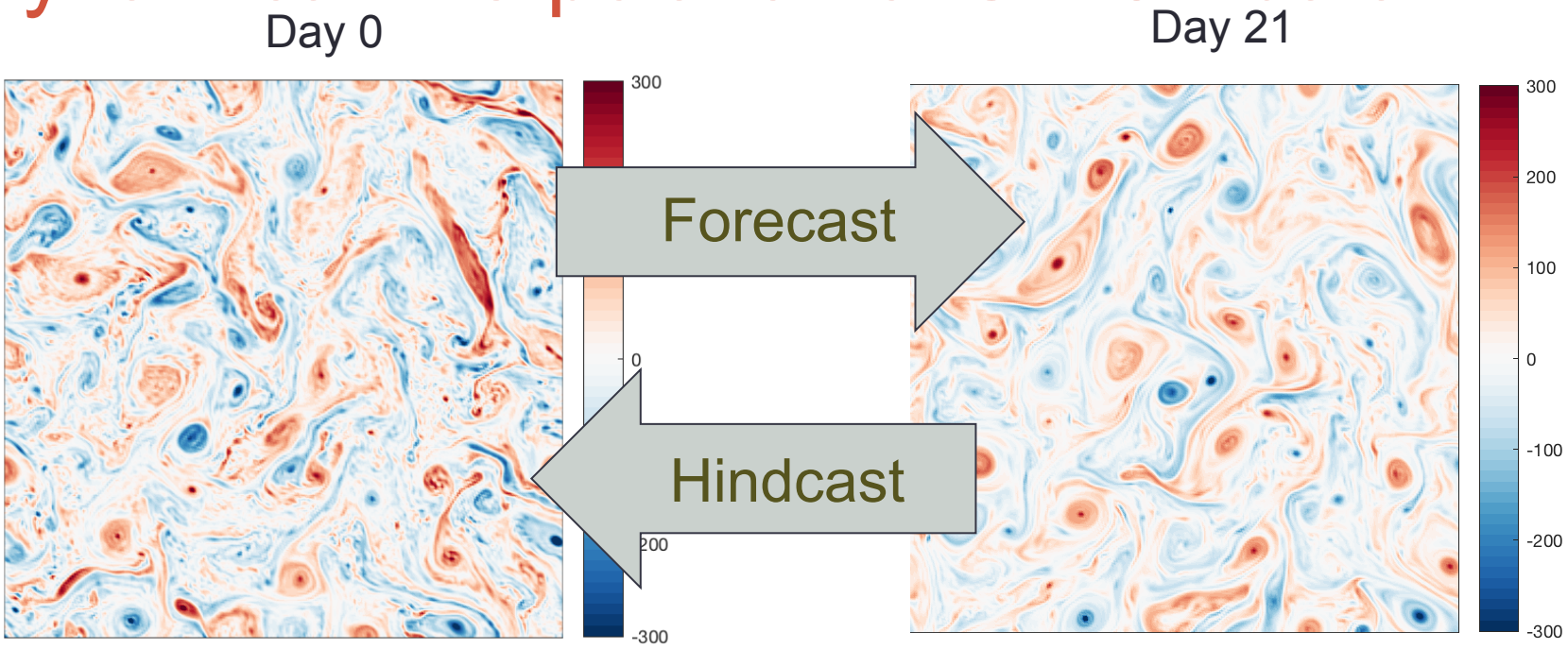

Roughan et al. 2017

# A Grand Challenge for remote sensing




- Spatial resolution: x10 current altimeters
- Temporal resolution: 20.86 day science orbit

# Dynamical interpolation of SWOT data




- Forecast (forward) and hindcast (backward) SWOT observations to daily SSH maps
- Represent submesoscales, unresolved physics, noise *statistically* as a stochastic process

# Dynamical interpolation of SWOT data