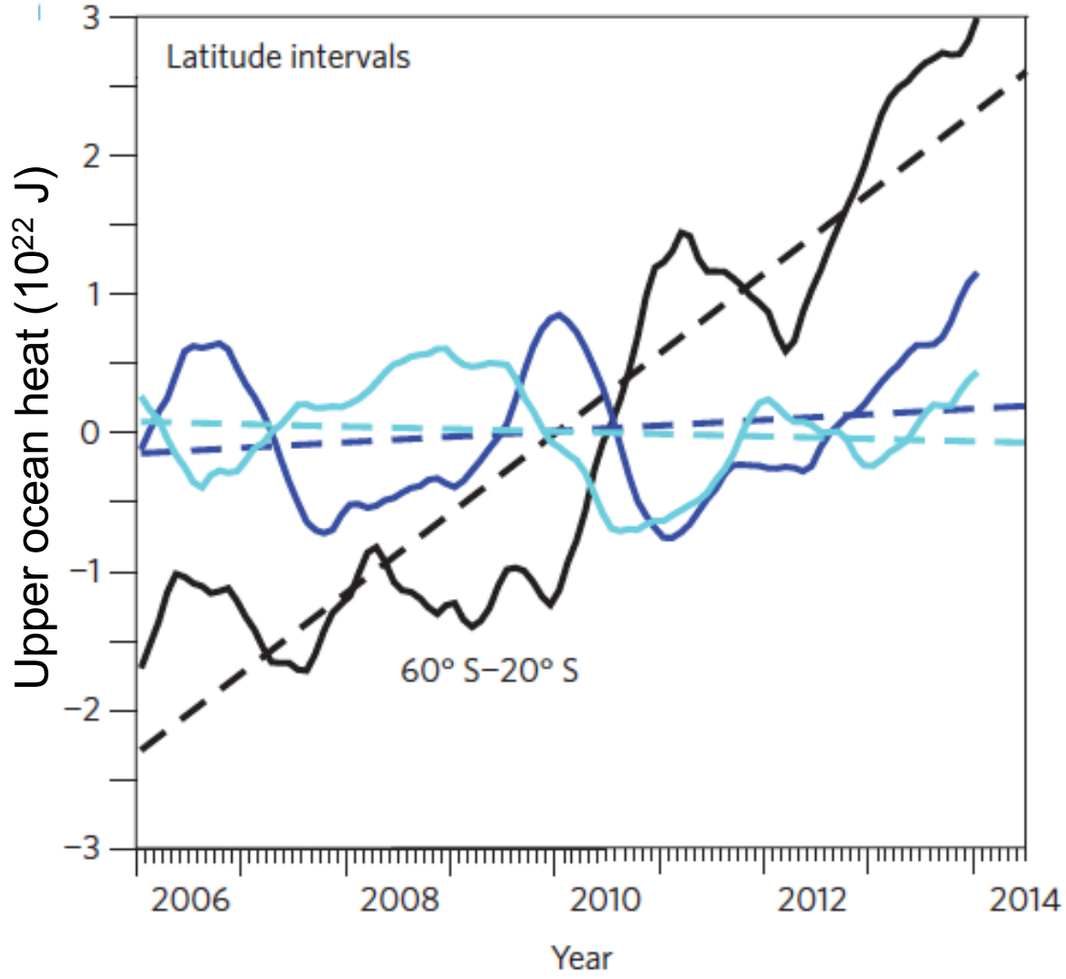
Objectives of an Air-Sea Interaction Observing Strategy: If we can't close the ocean heat budget, what can we do?

Sarah Gille, Meghan Cronin, Chelle Gentemann, Carol Anne Clayson, Mark Bourassa, Shannon Brown, Tom Farrar, Tong Lee, Kelly Lombardo, Rhys Parfitt, Hyodae Seo, Aneesh Subramanian, and Victor Zlotnicki

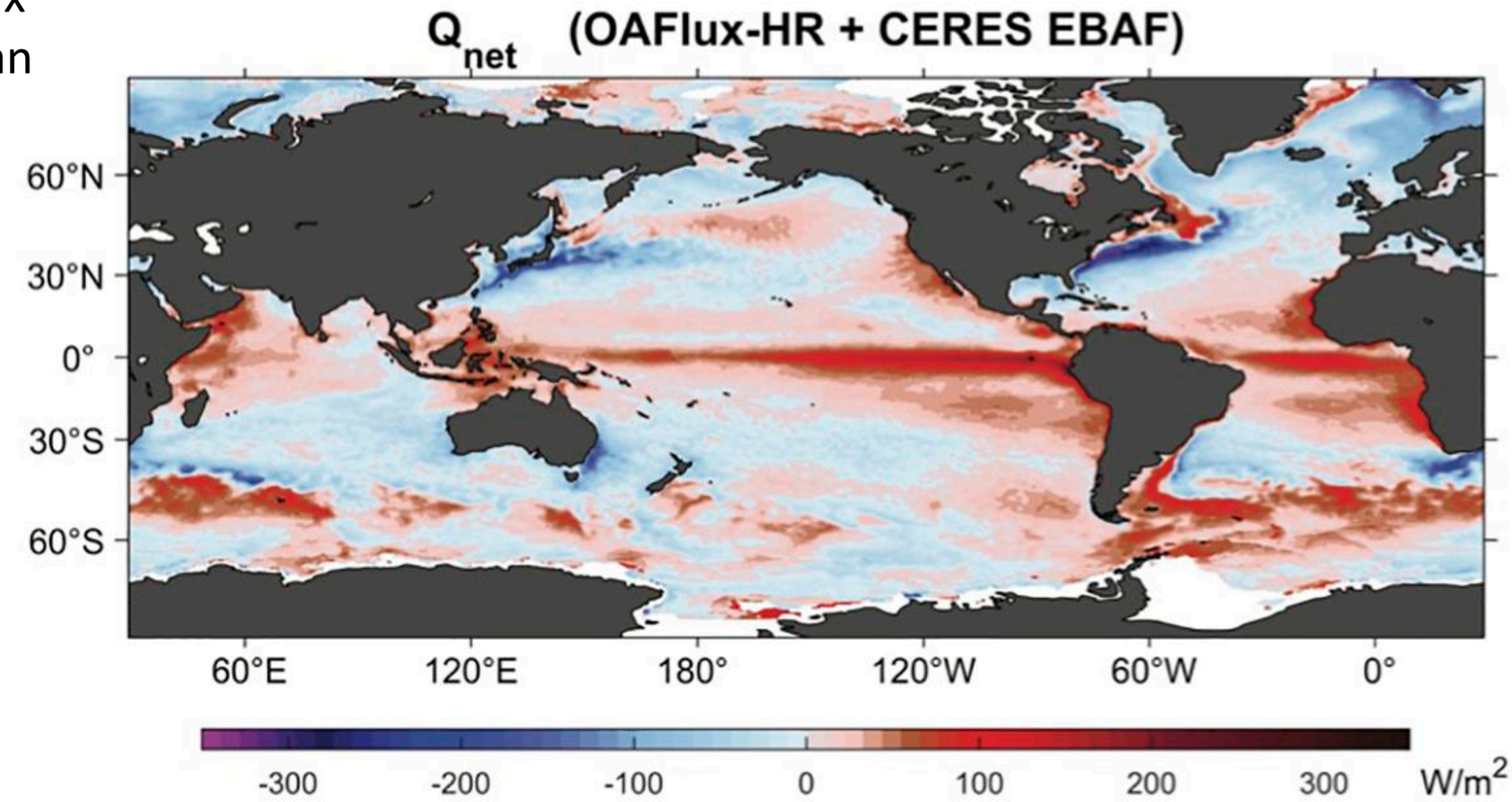


Argo data show that ocean warming corresponds to about 0.5 W m^{-2} net heat uptake by ocean

Roemmich et al, *Nature Climate Change*, 2015

NET AIR-SEA HEAT FLUX IS VASTLY MORE THAN 0.5 W m^{-2}

Net heat flux
Annual mean

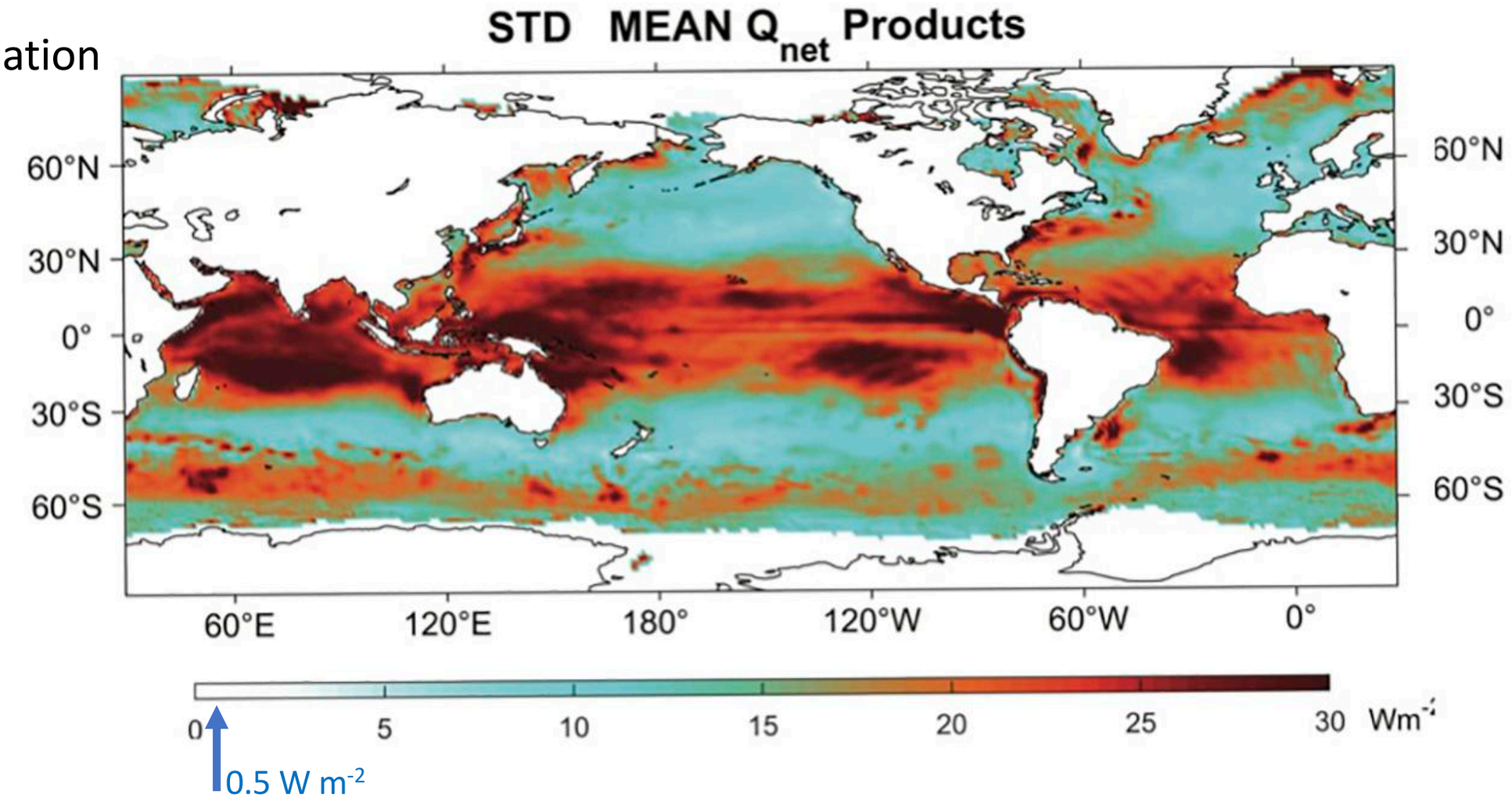


OAFlux-HR + CERES EBAf

Cronin et al, 2019.

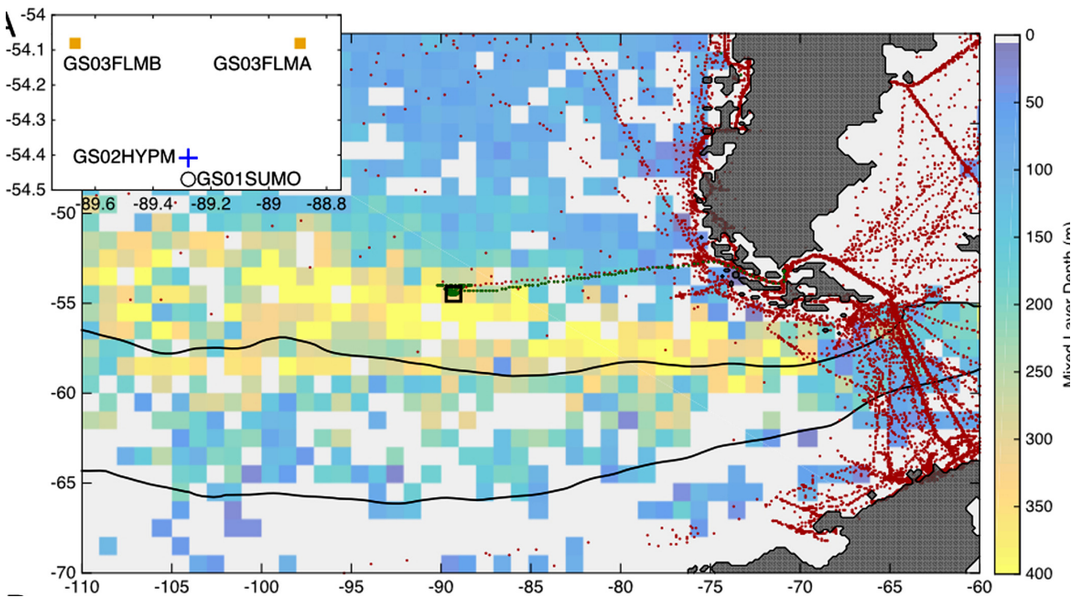
HOW WELL DO WE ESTIMATE AIR-SEA HEAT FLUX?

Net heat flux
Standard deviation

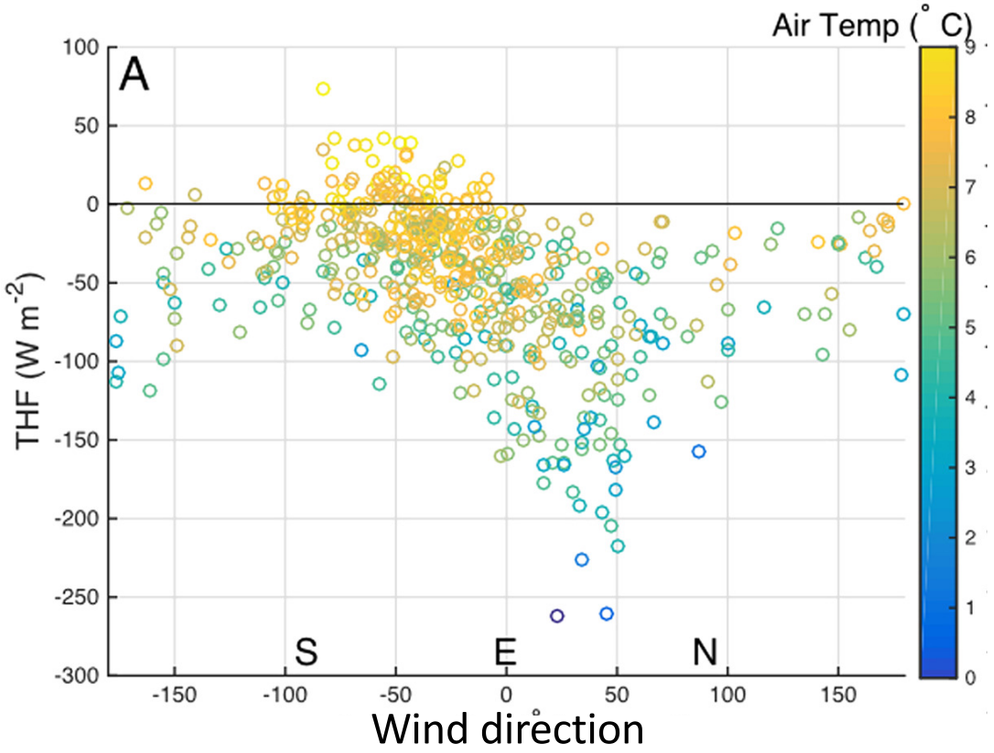


Standard deviation of annual mean from 12 products *(Cronin et al, 2019).*

ISOLATED EVENTS LEAD TO HEAT FLUX AND MIXED LAYER DEEPENING



Southern Ocean (OOI) Mooring at a location of deep winter mixed layers.



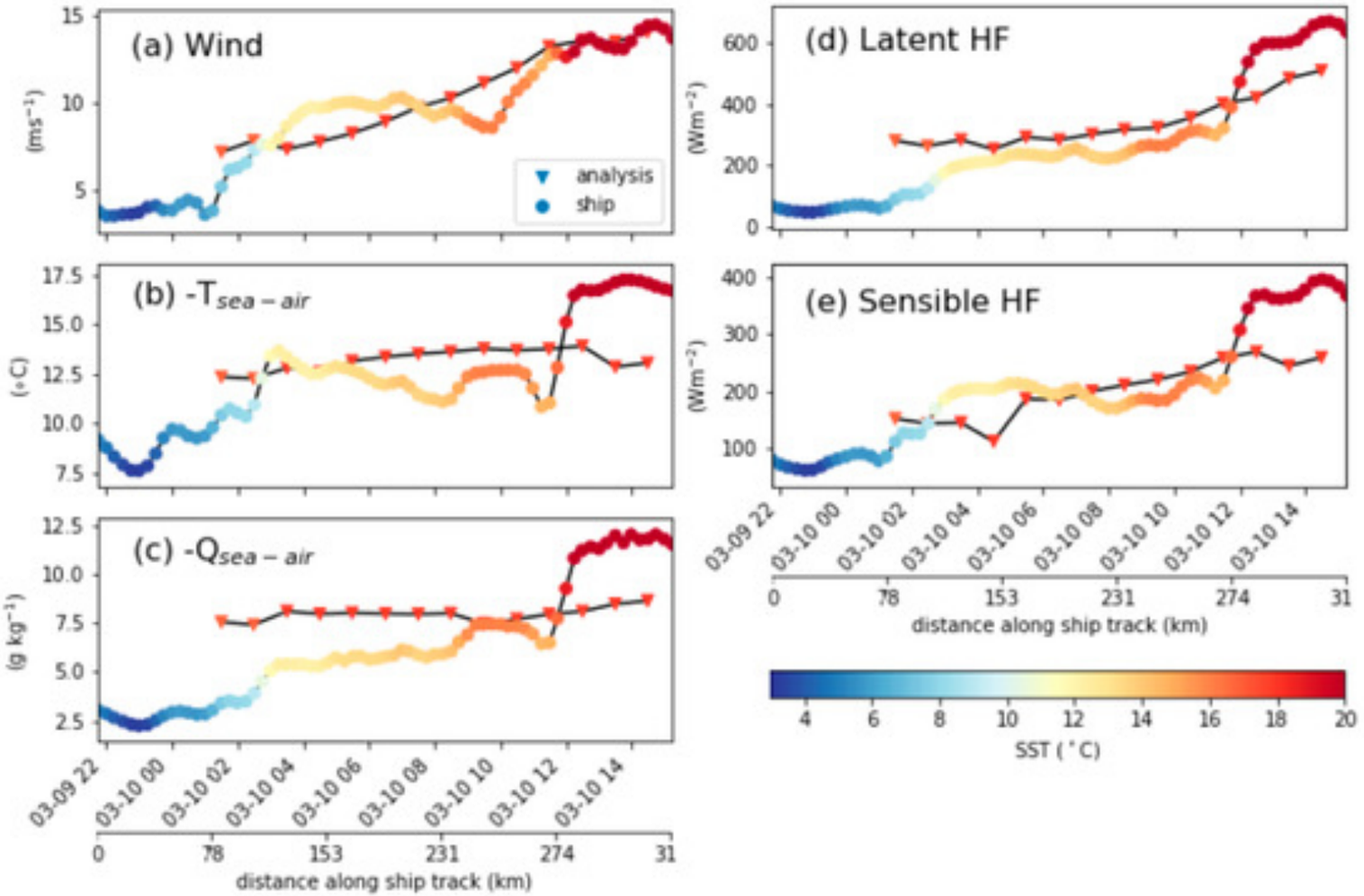
Strong cooling heat fluxes coincide with winds from the south; single events deepen the mixed layer.

Ogle et al, *GRL*, 2018

FLUXES VARY ON SPATIAL SCALES OF OCEANIC FRONTS

Gulf Stream in situ observations (circles) differ from satellite-based analysis.

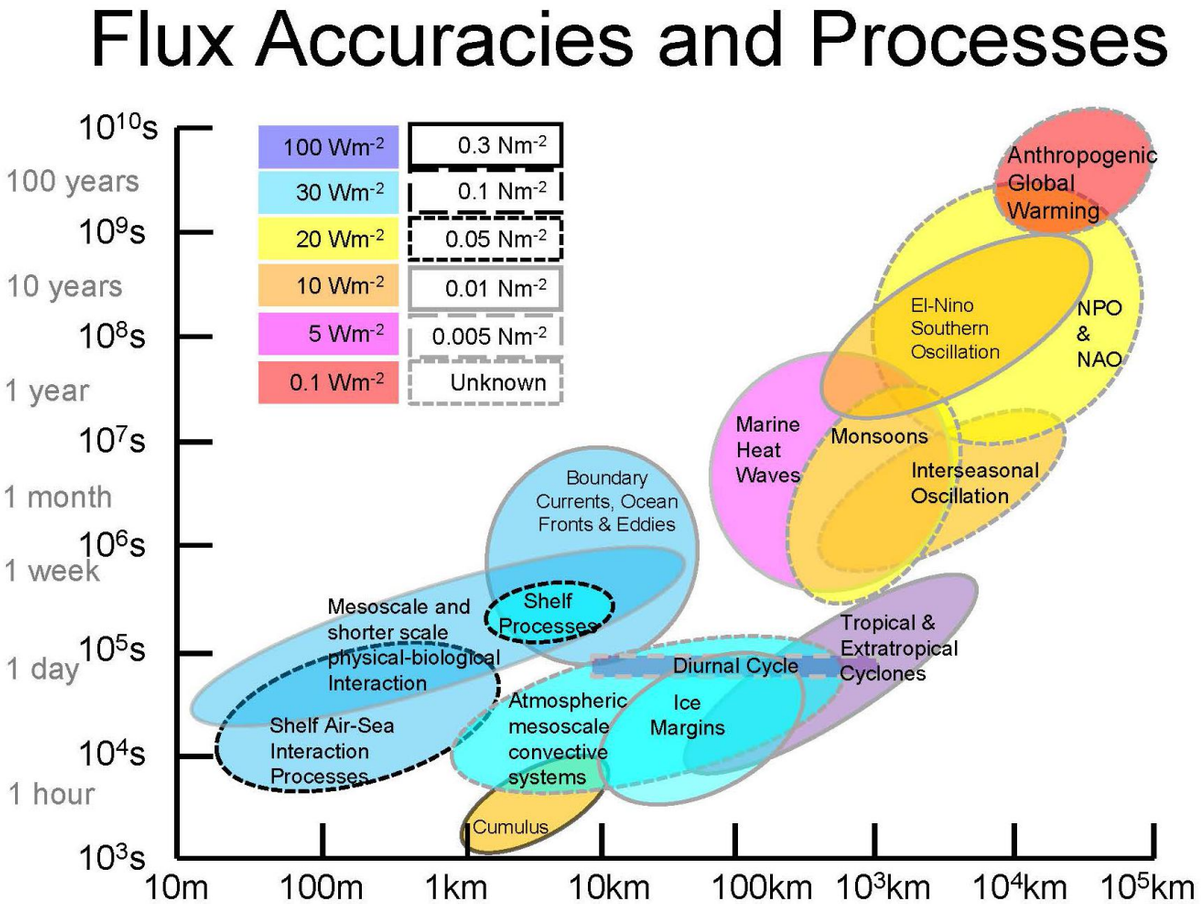
Ship data show sharp gradient as ship crosses Gulf Stream, not resolved by existing satellite products



Gentemann et al, *Remote Sensing*, 2020

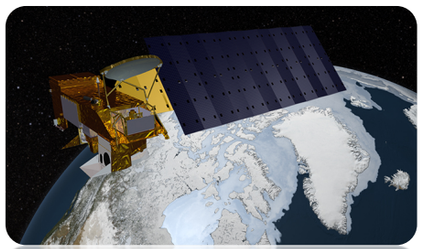
GOAL IN MEASURING FLUXES: CHARACTERIZE PHYSICS

- Surface fluxes (heat, freshwater, momentum, gas) elucidate a broad range of processes
- Key components: fluxes across fronts, interactions of storms (tropical and extratropical) with ocean surface, processes that drive changes in the planetary boundary layer and the ocean mixed layer.
- Mandate: resolve spatial scales of fronts, time scales of storms

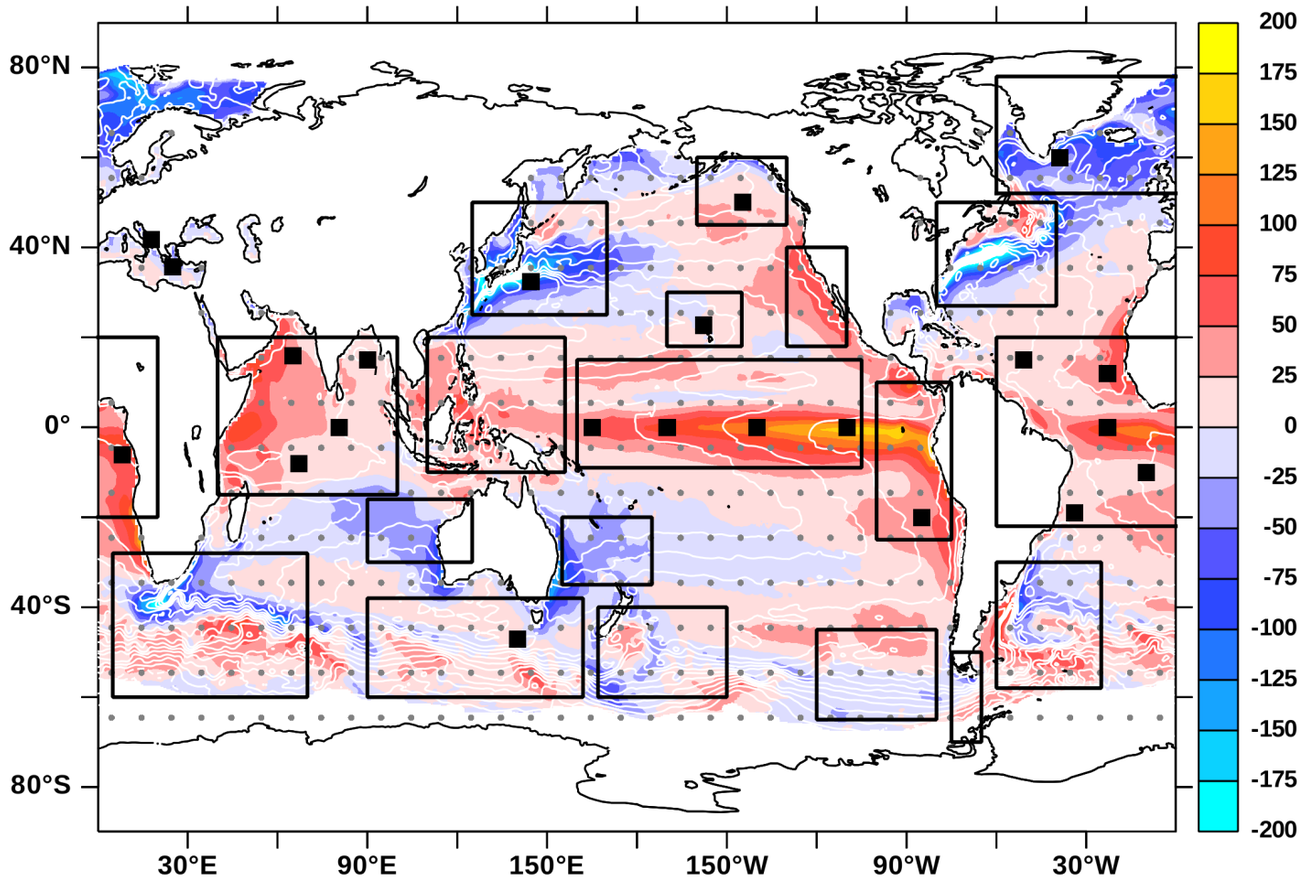


Cronin et al, 2019

Global Surface Ocean Observing System: 500-1000 drifting or mobile platforms and more reference stations (squares) in kev (boxed) regions

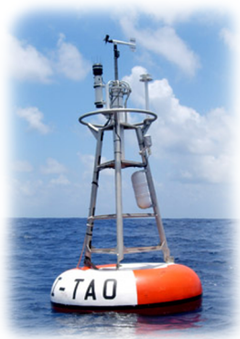


Drifting and Mobile Flux Platforms (examples)



Mean Net Surface Heat Flux (Wm^{-2})

Reference Stations (examples)



Cronin et al, *Frontiers in Marine Science*, 2019

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New SCOR working group co-chaired by
Meghan Cronin and Seb Swart
OBSERVING AIR-SEA
INTERACTIONS
STRATEGY
About
The surface of the ocean is the portion of the ocean felt by the atmosphere, viewed from space, and
experienced most directly by people and most other life on Earth. The ocean modulates the Earth's
weather and climate through exchanges of heat, moisture, momentum, greenhouse gasses, aerosol