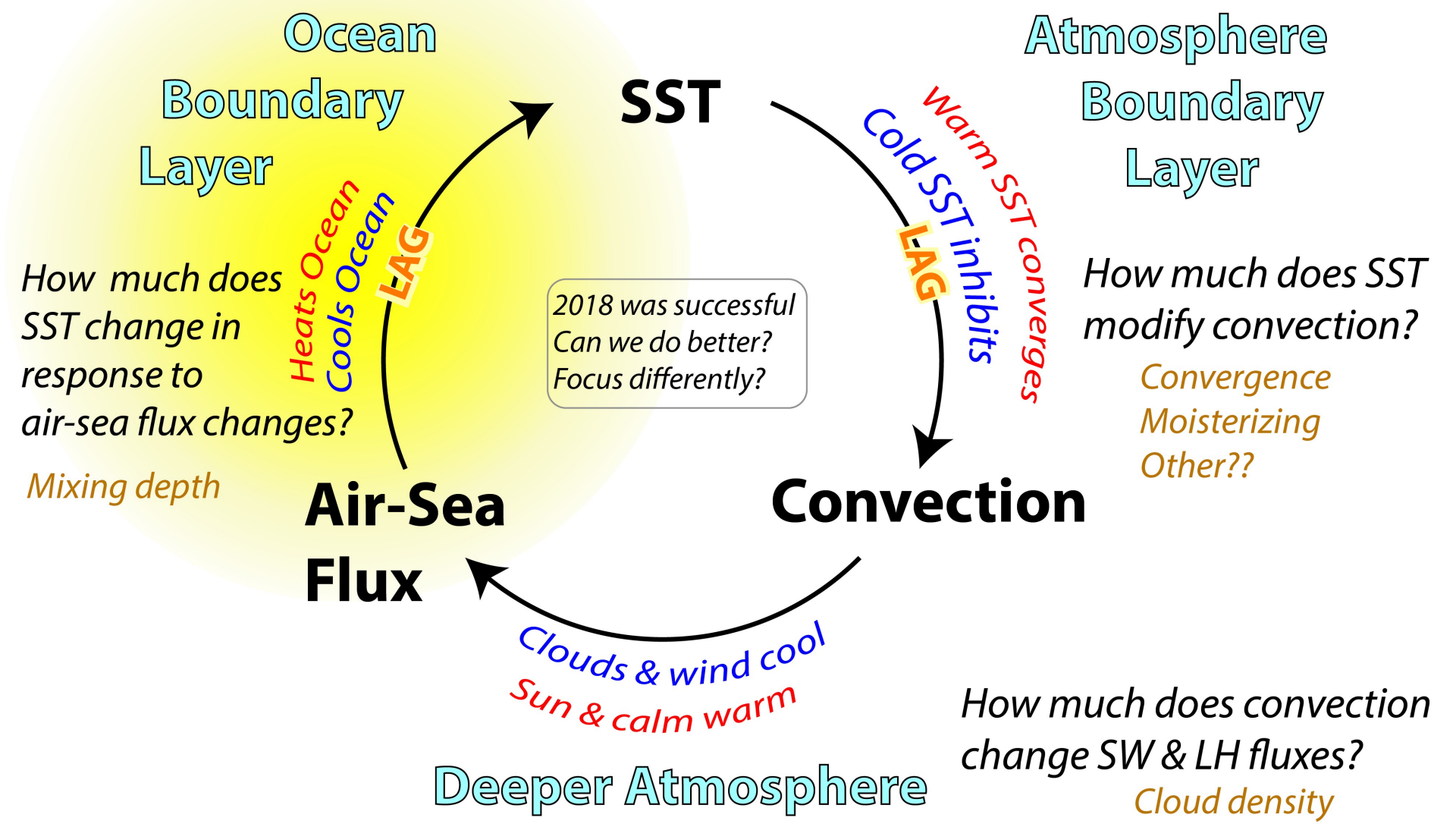
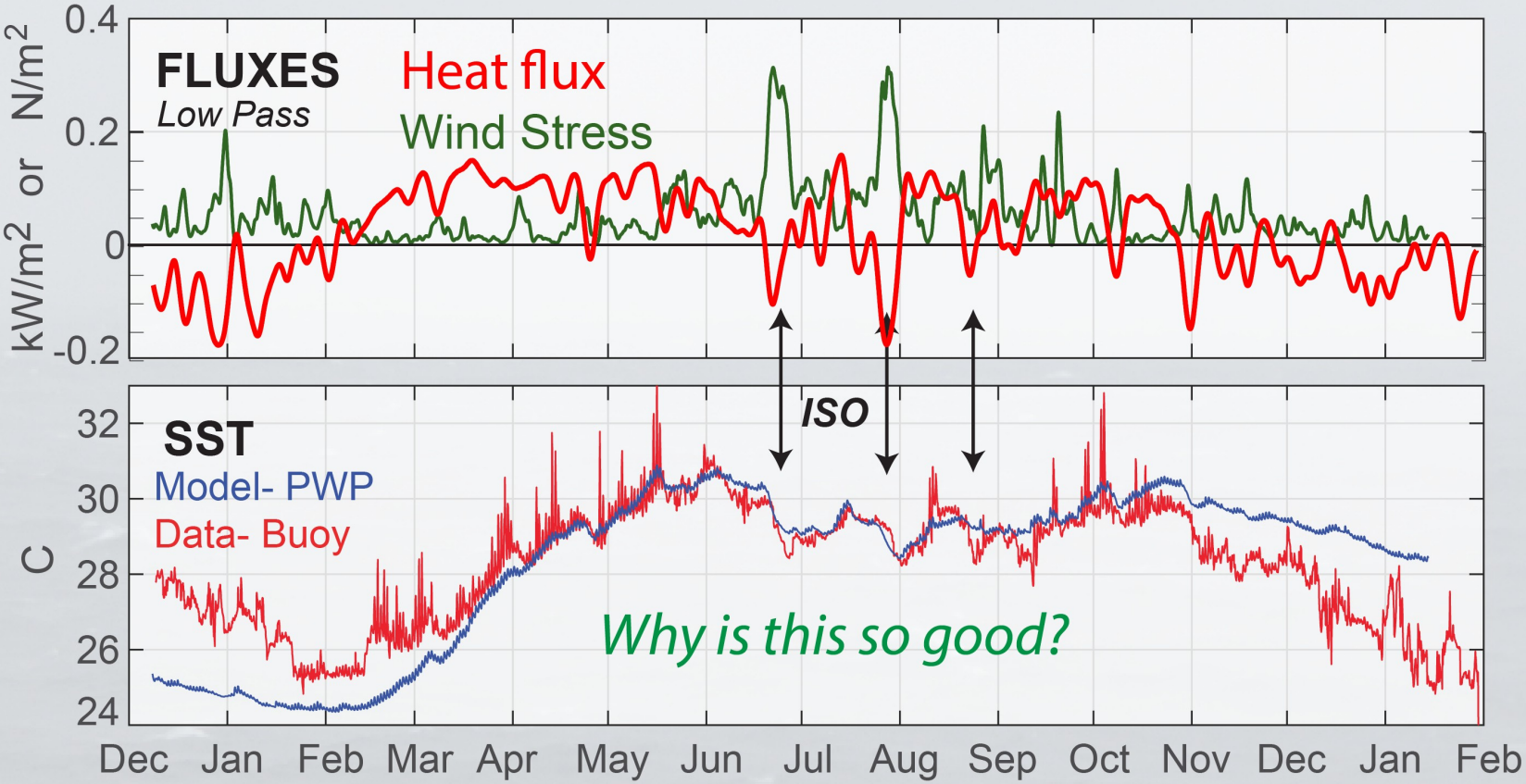
Air-Sea Coupling Feedbacks For MISO

Eric D'Asaro APL/UW ICTS Feb 2019



1-D Mixed Layer Models at 18N - *What I got wrong!*



A. 1-D models work really well (Wrong)

B. There's something wrong (Right)

Air-sea fluxes were computed using model SST
This nudges SST to air temperature

That's the difference between a meeting talk and a published paper!

This doesn't necessarily invalidate mixing models
See Jared Buckley's talk tomorrow

INCOIS Lagrangian Float Deployments

2015-2018

6 deployments, 197 days total
T, S, velocity, optics
Upper 150m

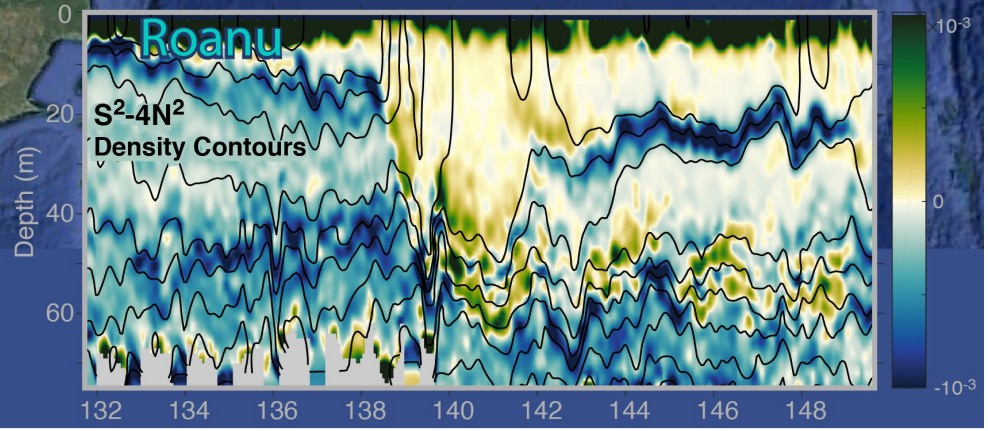
Arabian Sea
January 2018

Late-Monsoon
Aug/Sep 2015

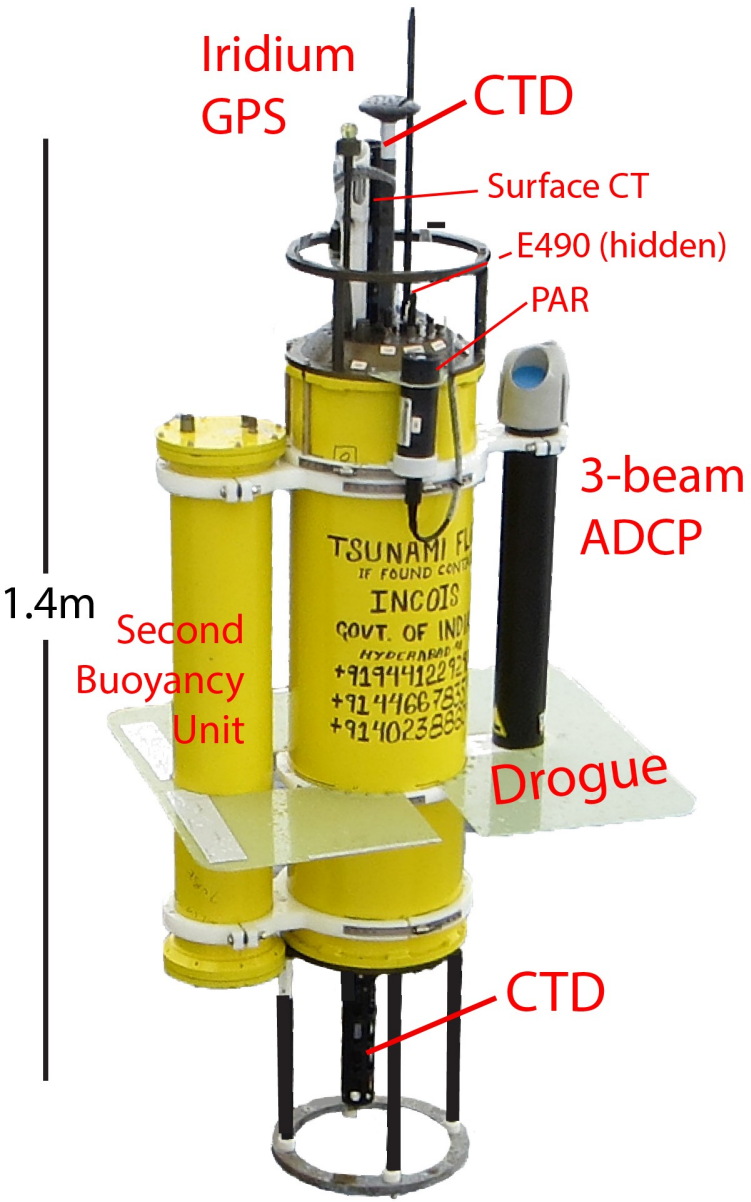
Cyclone Roanu
May 2016

Monsoon
July 2018

Long Monsoon
May-Sep 2016

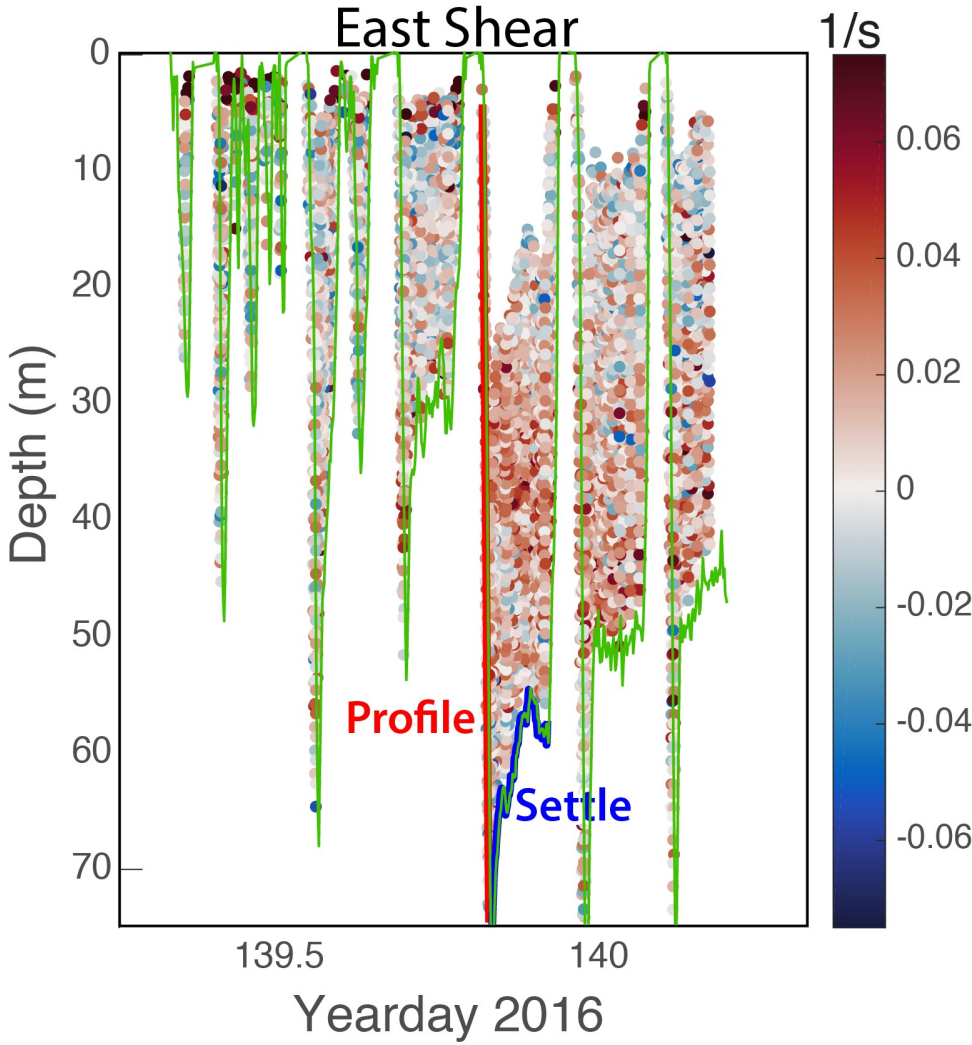


Lagrangian Float with ADCP



Typical Sampling

Map onto a uniform grid (Scales: 2m 2.4 hours)



Cyclone Roanu 2016

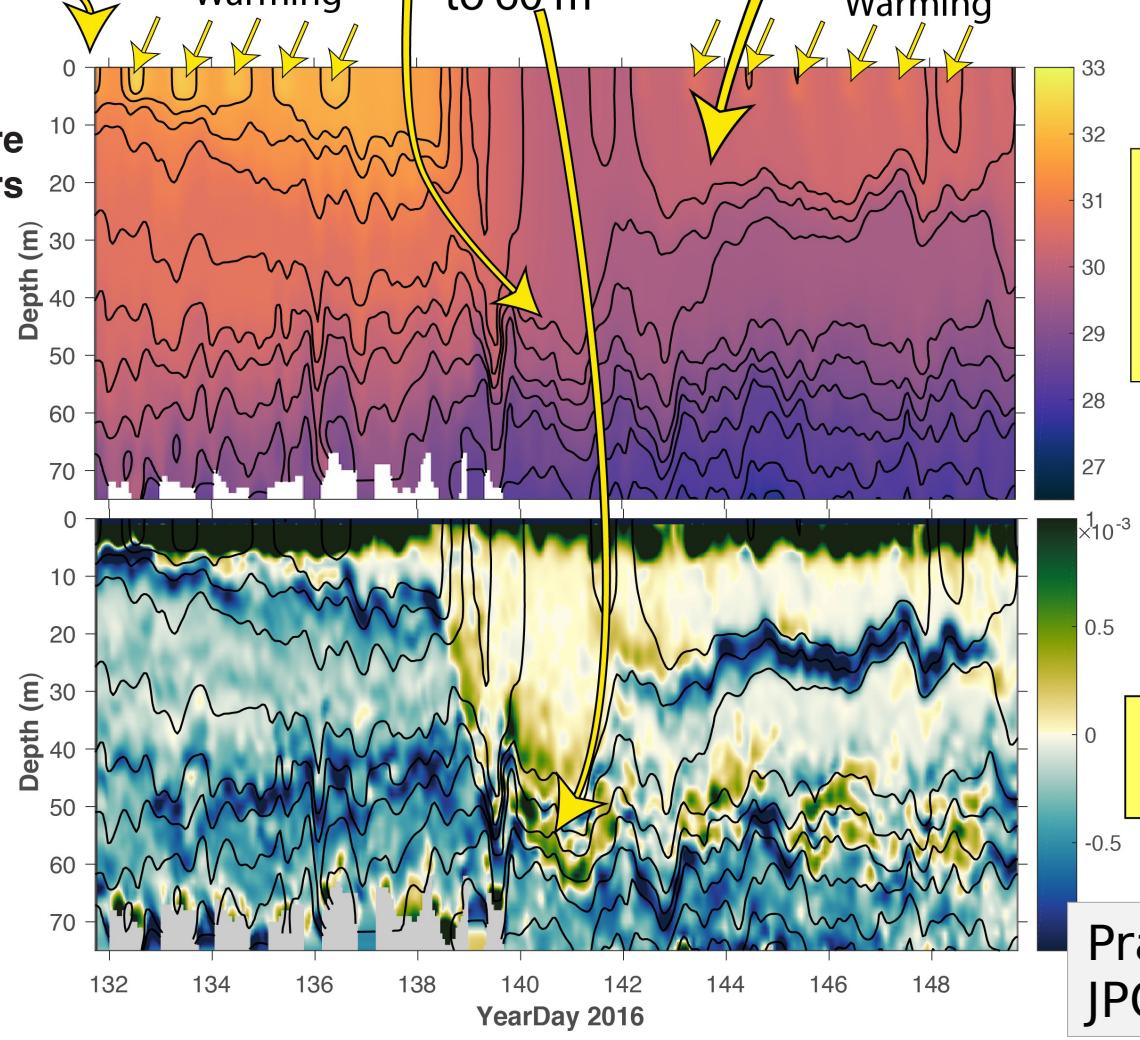
Similar to start of 2018 Monsoon

1 Sunshine! for months
"Indian Summer" *Grishma Ritu*
Strong thermal stratification

2 Storm!
Strong winds
45m Mixed layer
Shear mixing to 60 m

3 Sunshine!
Restratification

4
Monsoon



Similar cooling occurs across most of Central BoB

Qualitatively True
Can we model it?

Praveen et al. 201
JPO submitted

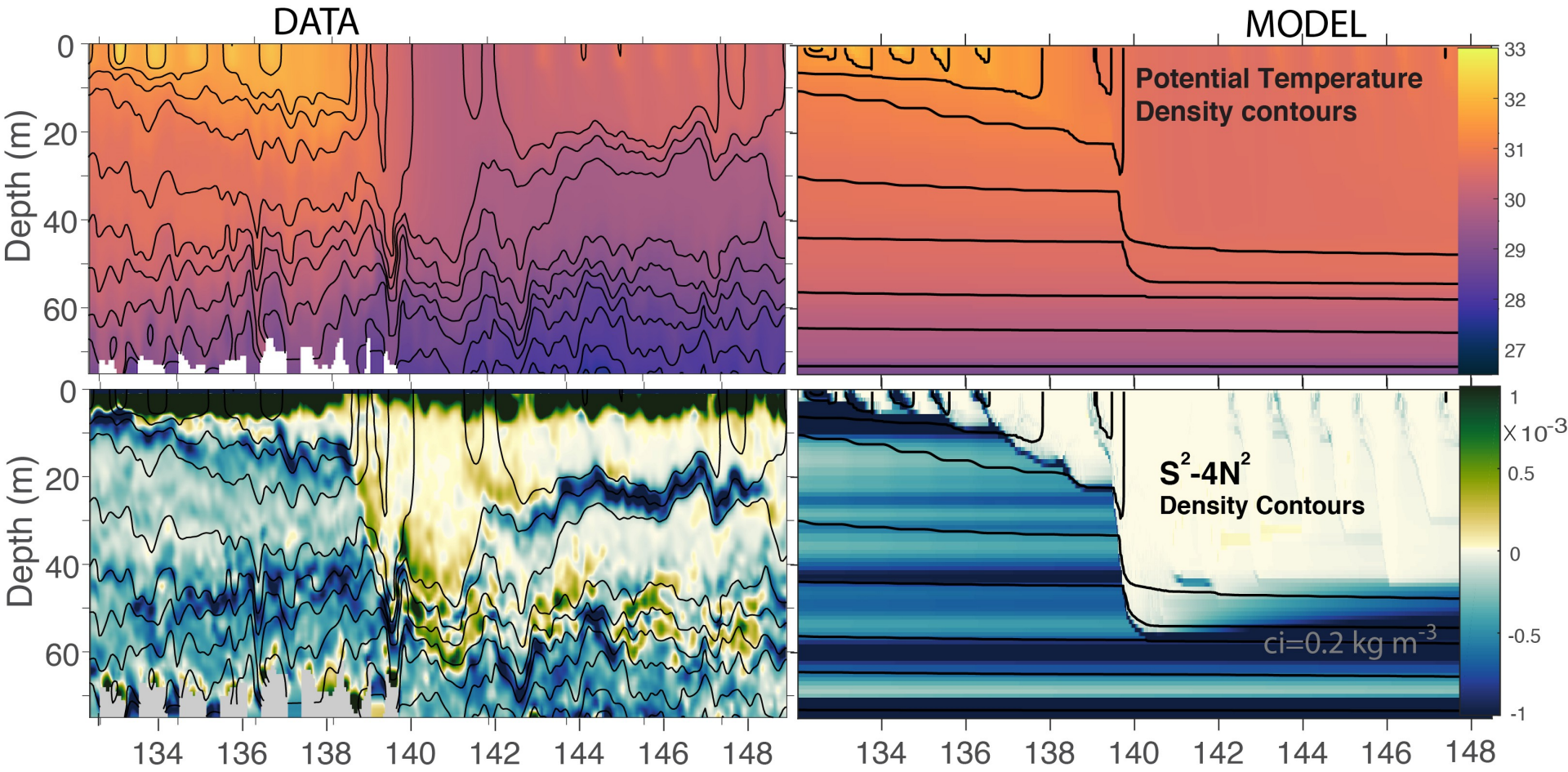
PWP Model

Simple, well-tested, vertical boundary layer mixing only

Mixed layer: Bulk Richardson # = 0.6

Mixing depth: Gradient Richardson # >0.25

Initialize with data, force with ERA-5 flux, CCMP wind

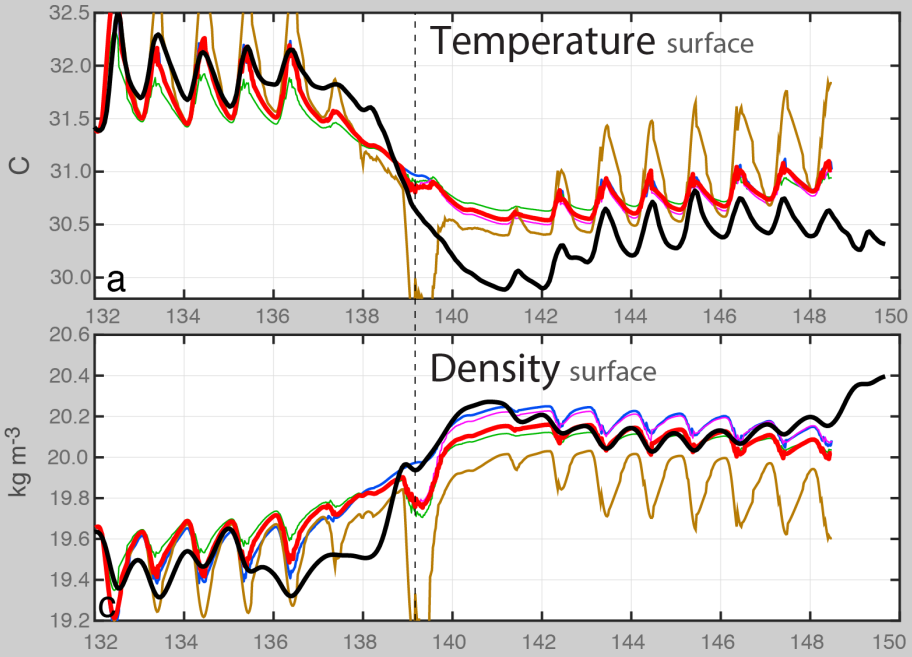


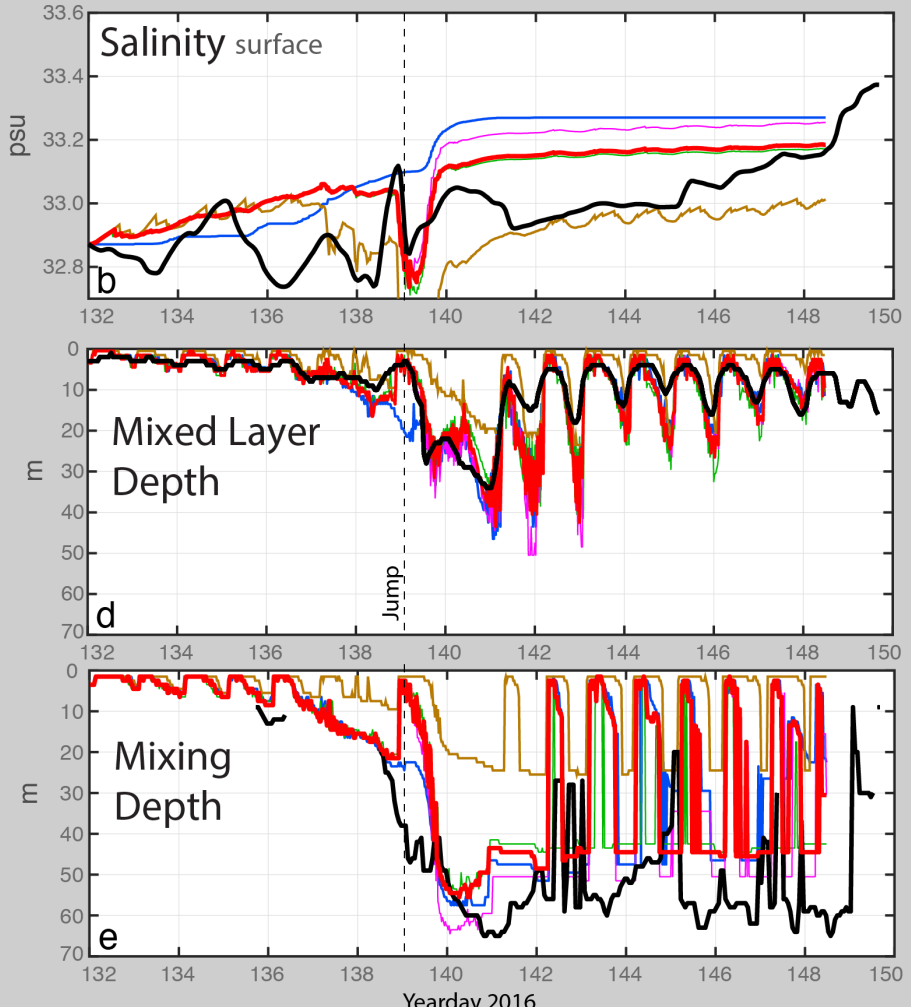
Mixes to right depth
Restratification is completely wrong

Model / Data Metrics

Mixing depths are good to 5-10m
(that's all it's supposed to do)
Density is OK, T and S are poor
(compensated T/S variability)

Not very sensitive to flux errors
Rain has big temporary effect





Data
Model Baseline

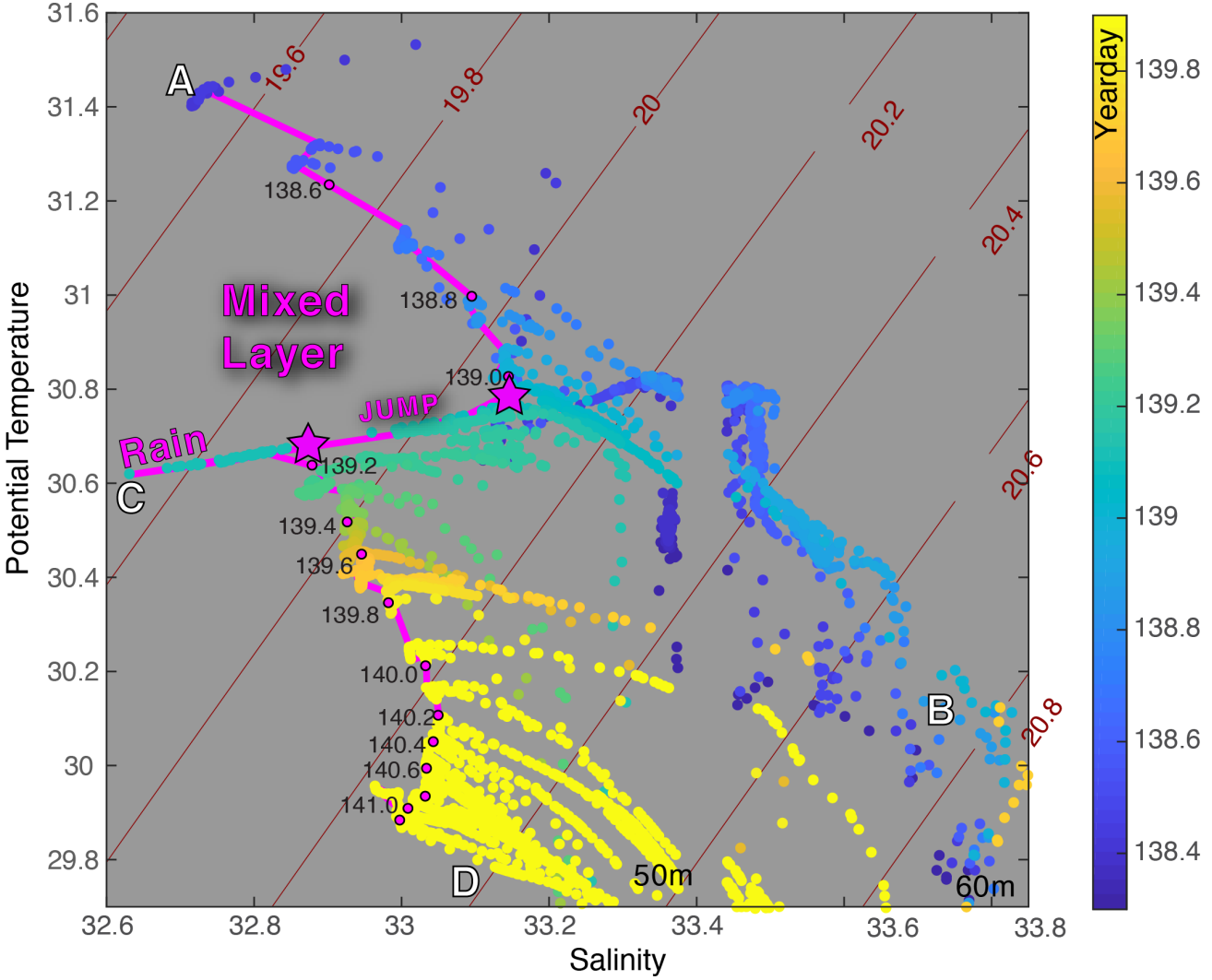
No Rain
70% Heat Flux
150% Storm Stress
10% Stress

Complex T/S structure

Like most of the BoB

Big jump in water mass properties at the same time as the storm

Upper ocean heat budgets will be difficult



O-Bob likely to improve boundary layer model

NO

- Complex T/S & small lateral scales will be challenging
- Need detailed turbulence and surface waves to do it right

Spatially averaged SST changes

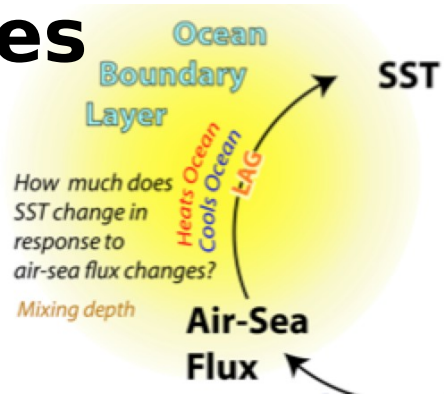
native:

et scale is “25 km” *(Microwave SST pixel)*

ommonly used product

oks through clouds (with issues)

orrected’ for diurnal warming – *correctly?*



does averaged SST change in response to A/S flu

hat is effective average mixing depth?

hat are space/time scales of SST, mixing depth etc?

hat causes this variability?

Fronts, lateral mixing, cold pools, rain, clouds…

an we understand/model these