

WELCOME

Day 4

ANNOUNCEMENTS

- PO tutorials for XYZ
 - BGC fields for r5 available on /efs-ecco
 - Thank you for not destroying all the files on there
 - Set up team repos and discussion pages
 - Continuation of emi will happen in oak shelter
 - To use daily fields, use s3 reference file method, otherwise use files on efs-ecco/
 - Efs-ecco/ can hiccup if it's being hit by too many simultaneous requests
-
- ROOM WARDEN: Hugo & Yueyang
 - NOTE TAKER: Maria del Milagro

TEAMS

- Team Names
- Create a Slack channel
- 1-slide summary of plan so far
- What you plan to do over next 3 days

Jonathan
Fernando
Anna
Ali
Erin
Noah
Sara
Sofia

ECCOV4r5-Based Analysis of Cooling Trends in the Upper Tropical Eastern Pacific (CROCODILE)

Feng Jiang, Andrea Mosso, Antonio Robles, Suman Shekhar, Zhangzhe Zhao

Motivation

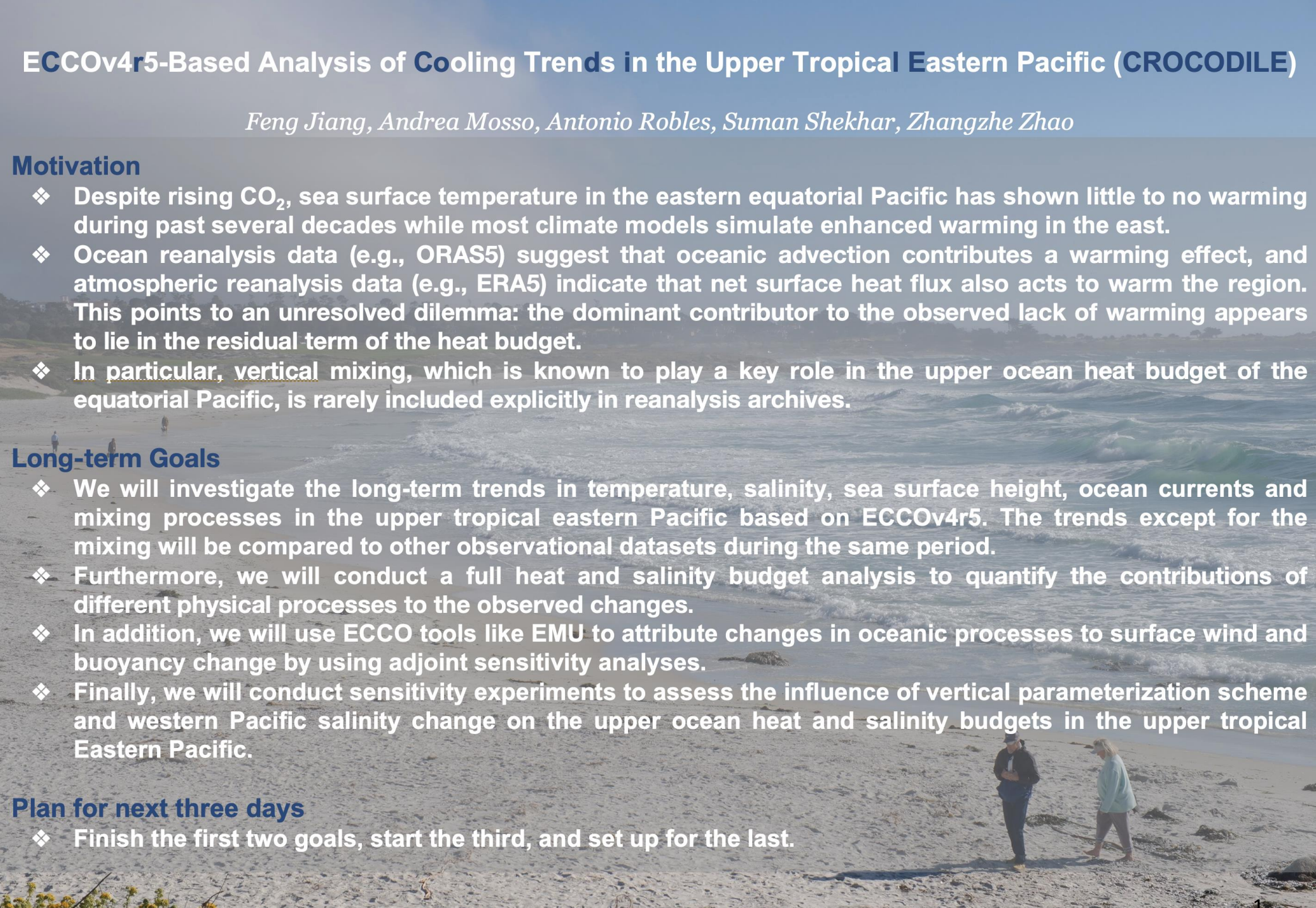
- ❖ Despite rising CO₂, sea surface temperature in the eastern equatorial Pacific has shown little to no warming during past several decades while most climate models simulate enhanced warming in the east.
- ❖ Ocean reanalysis data (e.g., ORAS5) suggest that oceanic advection contributes a warming effect, and atmospheric reanalysis data (e.g., ERA5) indicate that net surface heat flux also acts to warm the region. This points to an unresolved dilemma: the dominant contributor to the observed lack of warming appears to lie in the residual term of the heat budget.
- ❖ In particular, vertical mixing, which is known to play a key role in the upper ocean heat budget of the equatorial Pacific, is rarely included explicitly in reanalysis archives.

Long-term Goals

- ❖ We will investigate the long-term trends in temperature, salinity, sea surface height, ocean currents and mixing processes in the upper tropical eastern Pacific based on ECCOV4r5. The trends except for the mixing will be compared to other observational datasets during the same period.
- ❖ Furthermore, we will conduct a full heat and salinity budget analysis to quantify the contributions of different physical processes to the observed changes.
- ❖ In addition, we will use ECCO tools like EMU to attribute changes in oceanic processes to surface wind and buoyancy change by using adjoint sensitivity analyses.
- ❖ Finally, we will conduct sensitivity experiments to assess the influence of vertical parameterization scheme and western Pacific salinity change on the upper ocean heat and salinity budgets in the upper tropical Eastern Pacific.

Plan for next three days

- ❖ Finish the first two goals, start the third, and set up for the last.





Mackenzie Freshwater Layers Uncover River Runoff-Ice Evolution (McFLURRIE)



Marie Zahn, Cara Williams, Oceanne Bousquet, Mike Wood

Project: *perturbation study to investigate sea ice response to increased freshwater*

SUMMARY

- Run daily mean ECCOv4r5 for 2014–2020 with modified freshwater flux and quantify changes to sea ice onset
- Use EMU tools to quantify gradients for freshwater content in the Mackenzie River plume region



Resources

- EMU tools (Adjoint and Forward Gradient)
- P-Cluster and model configuration files on [efs](#)

Next Three Days

- Set up [Github](#) project page
- Start ECCOv4r5 run (first do 1-month test)
- While model is running, create mask for cost function in Beaufort Sea to begin adjoint and forward gradient tools

PUFFIN: Deep Western Boundary Current Flux and Forcing Mechanisms in ECCO



Lilli Enders



Motivating Question: How do changes in the anomalous atmospheric circulation influence the path of the Gulf Stream?

One (theoretical) pathway:

Changes in the anomalous atmospheric circulation modify the amount of LSW formed by deep convection in the Labrador Sea

Changes in the formation of LSW are reflected in the transport of the DWBC in the LS

The DWBC bifurcates near the TGB: Some portion is retroflected eastward in the NAC, some portion continues southward to the Scotian Shelf

The portion of the DWBC that makes it to the continental shelf of North America influences the GS position by some mechanism (eg., by bottom vortex stretching in the NRG, by spinning up stabilizing recirculation cells near Cape Hatteras)

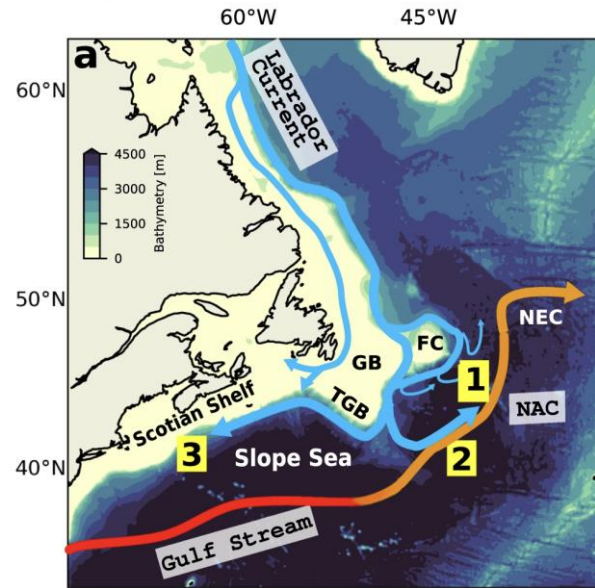


Fig Jutras et al., 2023

The Plan™ (Big Picture):

- Use existing diagnostics to identify LSW pathways (i.e., volume of LSW formed in LS, volume flux across each 'branch')
- Sensitivity analysis of pathway strength using the model adjoint
- Vorticity budget analysis to connect variations in GS path to export strength (beyond the scope for SS 😊)

The Plan™ (This Week):

- Work with model output to plot fields of SSH, vorticity, zonal and meridional velocity
- Compare ECCO output with observations (Line W, AR7W, altimetry)
- Begin metric development: try to fill in gaps for first two pathway steps

Science Questions:

In this project, I'd like to focus on the factors that influence the bifurcation of the DWBC at TGB using ECCO by asking,

1. Does variability in DWBC transport in the LS make it out of the LS and onto the North American continental shelf?
2. What mechanisms impact the bifurcation of the DWBC at the TGB (i.e., local/remote WSC, GS position, GS EKE)?

Tools:

- ECCO v4r4
- EMU (model adjoint)
- ASTE (one day, hopefully)

Adjoint Sensitivities & Heat/Volume Budgets in ECCO for Regional Investigation Over the California Current System (SHERLOCCS)

THE PLAN; MAY 21 – MAY 25

OBJECTIVES; LONG-TERM –

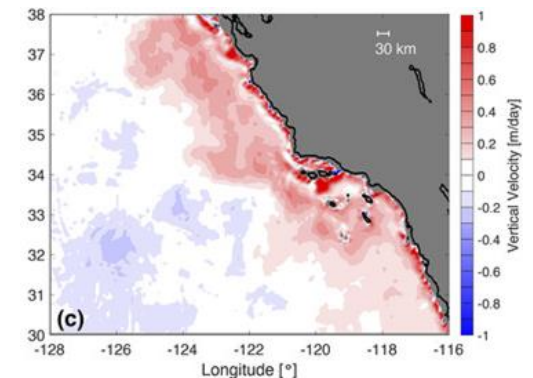
- 1) **Close the volume & heat budgets for Zaba et al. model region & period**, using the ECCO Central Estimate
- 2) Perform a sensitivity analysis to identify drivers of variability in the heat & volume budgets—**do our results agree with Zaba et al. findings?**
- 3) Literature identifies coastally-trapped waves as mechanism for persistent thermoclinic anomaly along California coast—**does this anomaly appear in the Central Estimate?**
- 4) Rinse & repeat steps (1) & (2) for South China Sea—**how are volume & heat budgets affected by model region?**

NEXT STEPS; SHORT-TERM –

- Read/discuss Zaba et al. 2019 & Verdy et al. 2013
- Complete volume & heat budget tutorials (EMU)

DATA / MODEL / TOOLS –

- ECCO Central Estimate
- ECCO Modeling Utilities (EMU)
- ecco_v4_py



Using ECCO to Investigate Coastal UPwelling (ECCO-UP)

Team: Mili, Sree, and Andrew

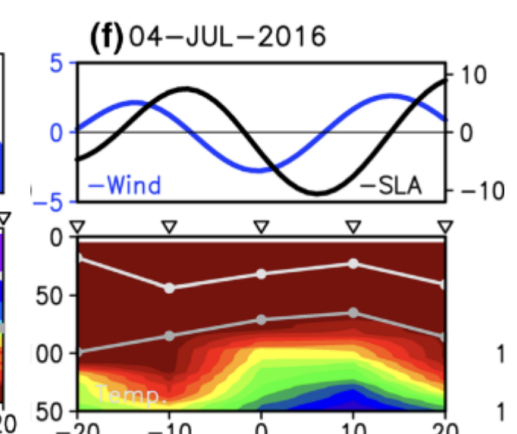
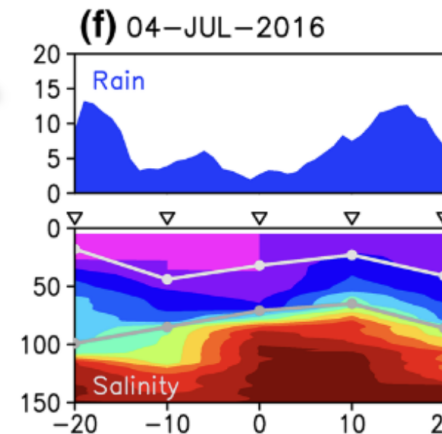
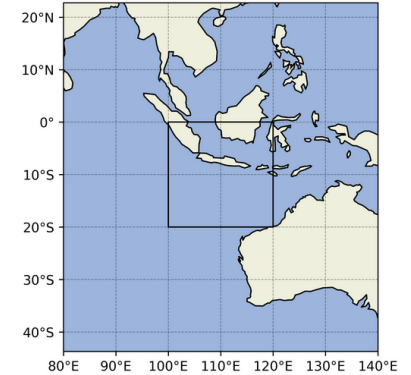
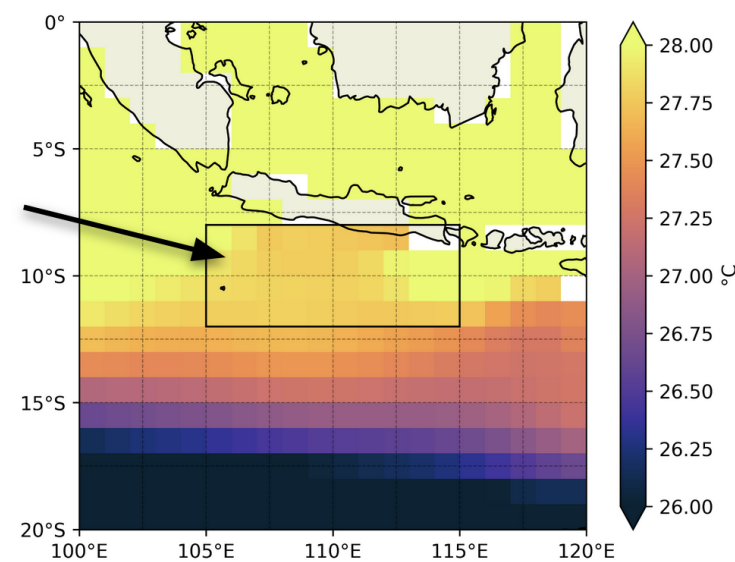
Overall goal: Investigate the role of freshwater induced stratification on the SST cooling and the strength of upwelling off the coast of Java.

3 Day Plan:

1. Validate that ECCO reproduces upwelling event observations of salinity/temperature.
2. Set up and run an adjoint sensitivity analysis on surface salinity and temperature in the upwelling zone.

Tools: P-cluster, EMU Adjoint

1992-2019 V4r5 June-August Mean Sea Surface Temperature



The Day Before Tomorrow

Understand AMOC Variability in the Past 30 Years and Its Impact on Atlantic Heat Transport in ECCOv4r5

Yifei Fan; Tanvir Shahriar; Clark Zimmerman



Research Questions:

- (1) What does the AMOC look like in density space in ECCO v4r5? Is there a decadal trend? Do our results agree with Wunsch & Heimbach (2013) (Day 1-3)
- (2) Which physical forcings have driven AMOC variability over the past few decades? Do our results agree with Pillar et al. (2016) (Day 3+)
- (3) What are the relative contributions of the AMOC and the wind-driven Gyres to the Atlantic OHT at different latitudes? Do different methods of decomposition agree with each other? (Day 3+)
- (4?) (Meridional coherence analysis?) (Day T-2?)

Data: ECCOv4r5 (Velocity, temp, salinity, geometry)
Tools: EMU Adjoint, EMU Convolution, EMU FGrad

TURN ON THE TIDES (ToTs)

Hinne Van Der Zant, Hugo Plombat, Rebecca Zaja, Yumi Abe, Clément Bertin

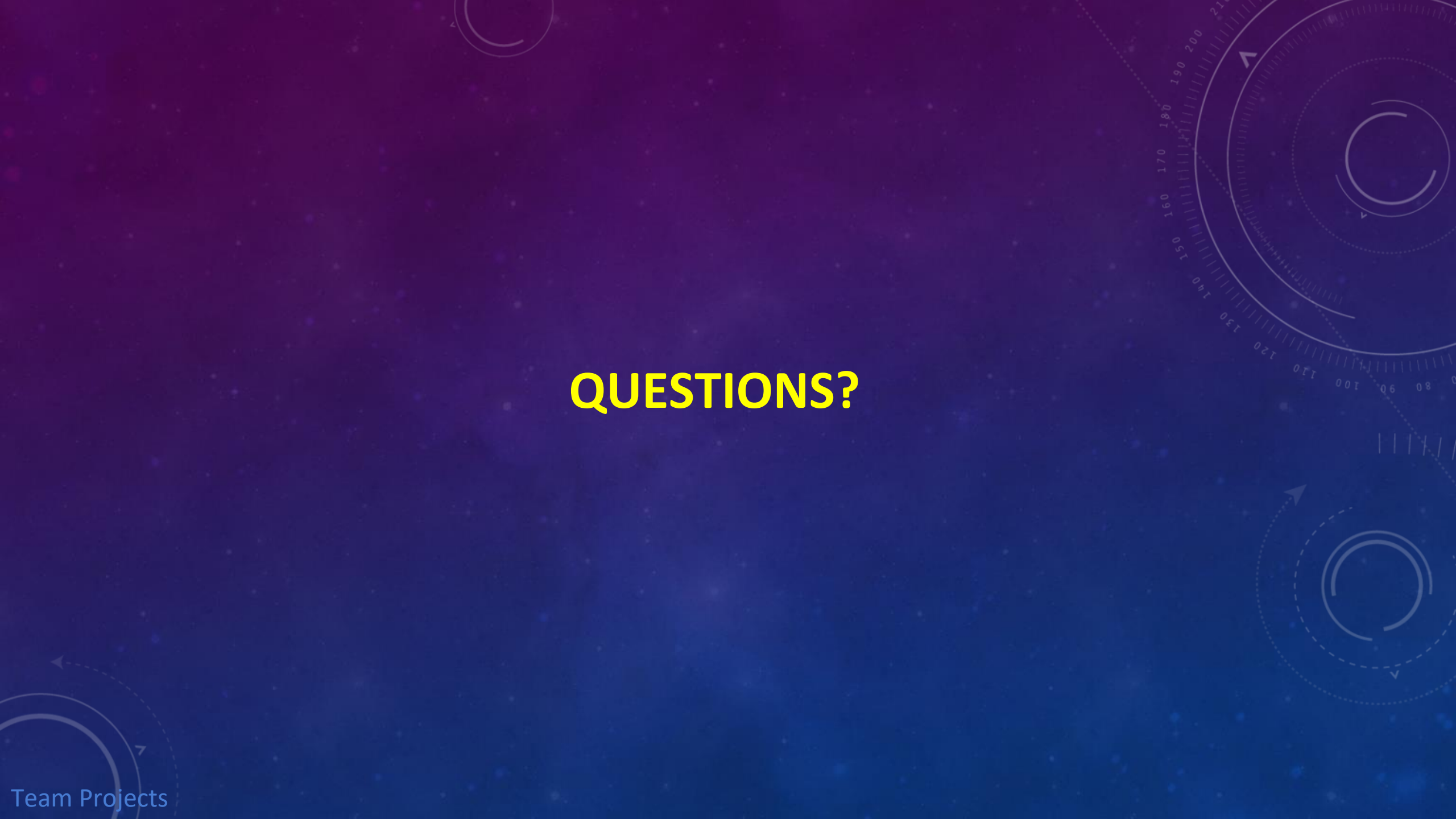
PROJECT: Activate and implement tides in ECCOv4r5

PLAN:

- Clean up and Port tide parameterization implemented by Dimitris on ECCOv4r5
- Run the model forward over 5 years
- improve the parameterization of tides in the low-resolution (1-deg) model

RESOURCES:

- P-Cluster > Run ECCOv4r5
- OSS > Analyse outputs

The background is a gradient of dark blue and purple, overlaid with a pattern of small white stars. Several technical diagrams are visible: a circular gauge with a scale from 0 to 210 in the top right; a circular diagram with concentric circles and arrows in the bottom right; and a circular diagram with a dashed arrow in the bottom left.

QUESTIONS?