TURN ON THE TIDES (ToTs)

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

With great help of: **Dimitris Menemenlis and Jean-Michel Campin**

WHAT HAPPENS WHEN WE TURN ON THE TIDES IN ECCOV4R5 ?

WHY AND HOW TURNING ON THE TIDES ?

MOTIVATION: Tides are cool!

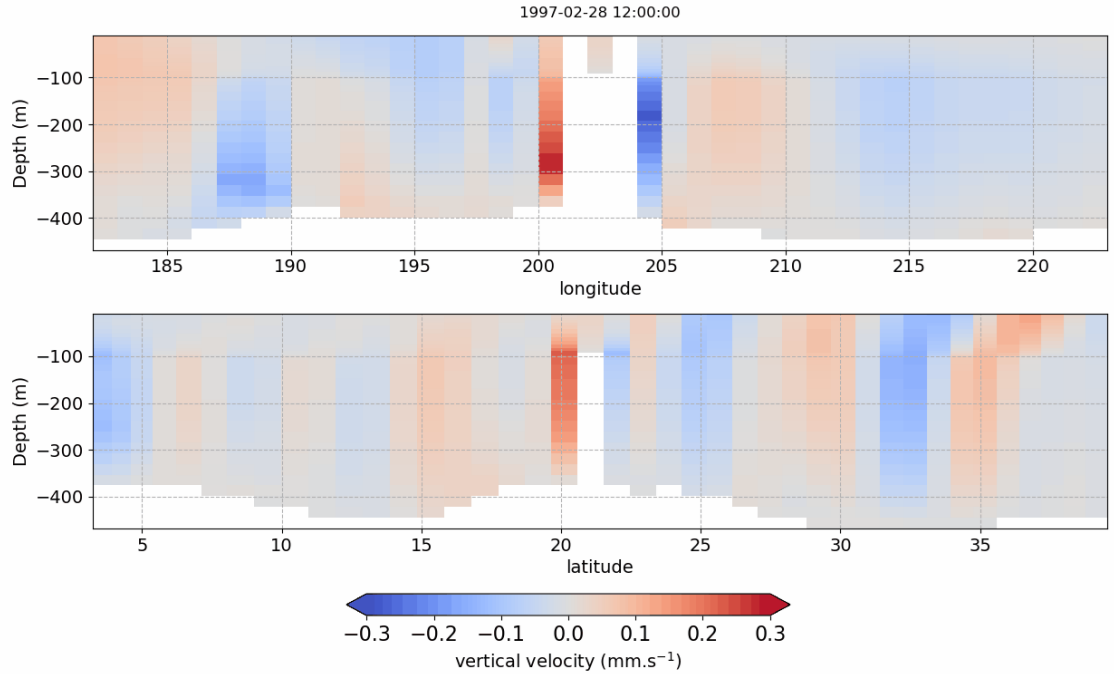
It has never been fully assessed on ECCO coarse solution (llc90)

DEVELOPMENTS:

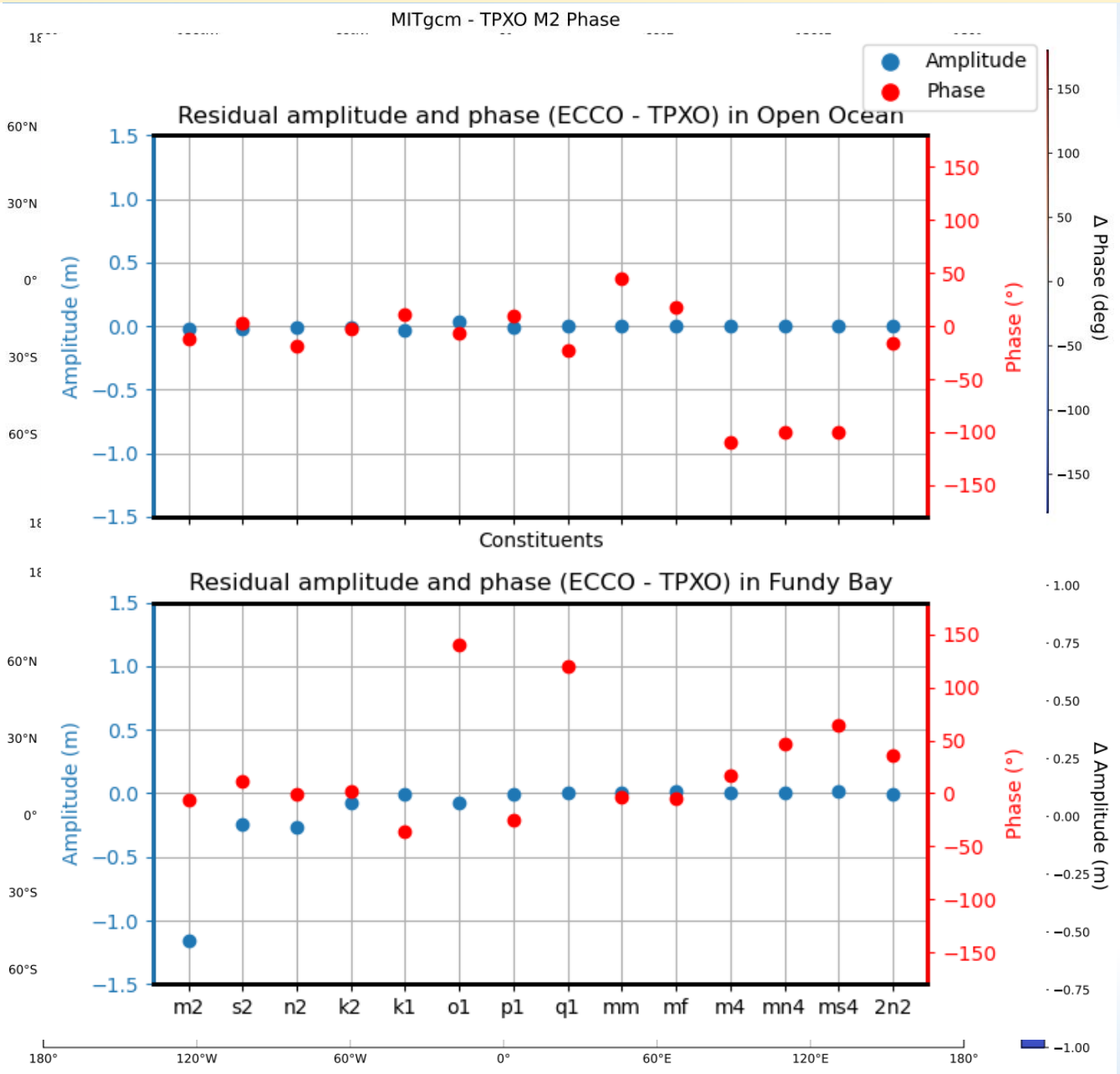
- Add spice tidal Toolkit developed by Oliver Jahn at MIT and port it to ECCOv4r5 solution + Debugging

SIMULATIONS:

- **5 years** with **monthly** diagnostics
- **1 year** with **hourly** diagnostics



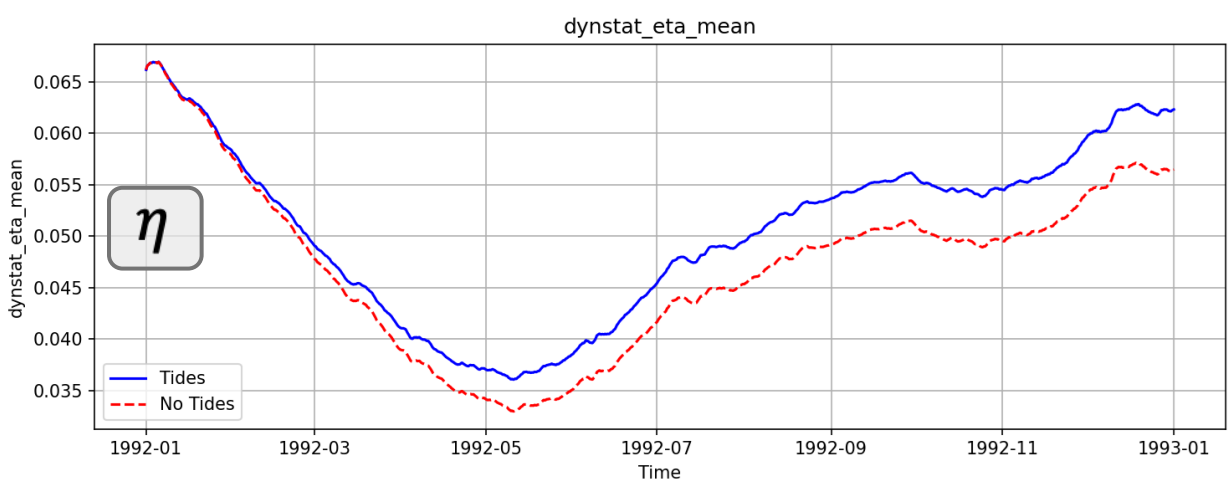
TIDAL SIGNAL COMPARISON



- Amphidromic point are well represented
- Capture tidal amplitude and phase in the open ocean.
- Coastal ocean less accurate

Comp.	TPXO (cm)	ECCCO (cm)	
M2	24.62	19.91	-19.1
S2	9.65	9.05	-6.2
N2	3.77	3.37	-10.4
K1	6.64	1.70	-74.3
O1	1.96	5.14	162.0
Mf	4.00	1.71	-57.2
Total	58.1	49.0	-15.7

CHANGE IN THE WATER VOLUME

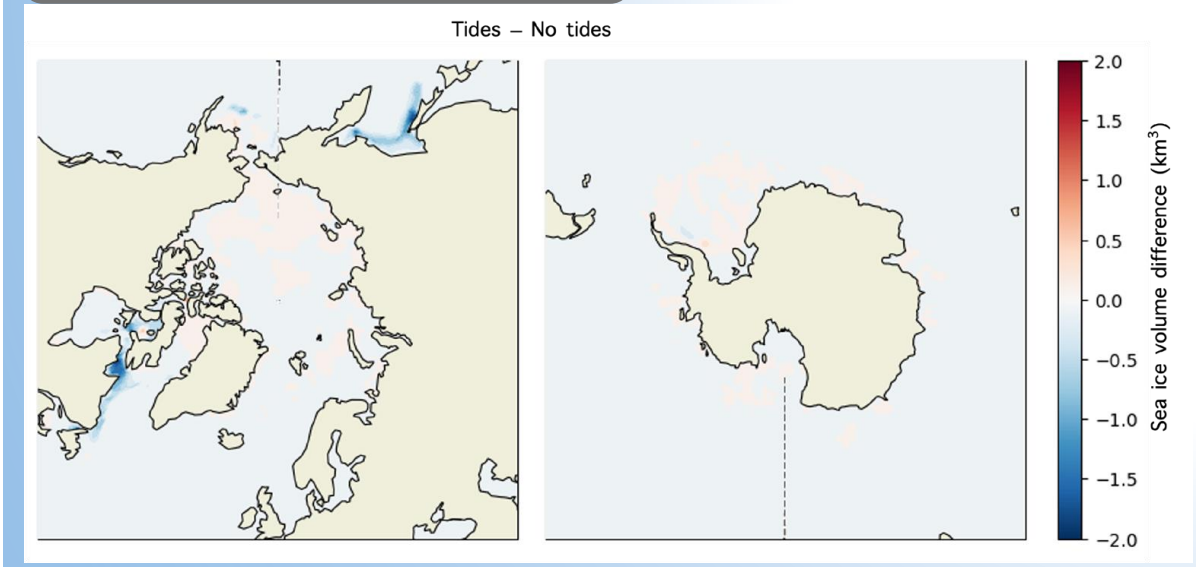


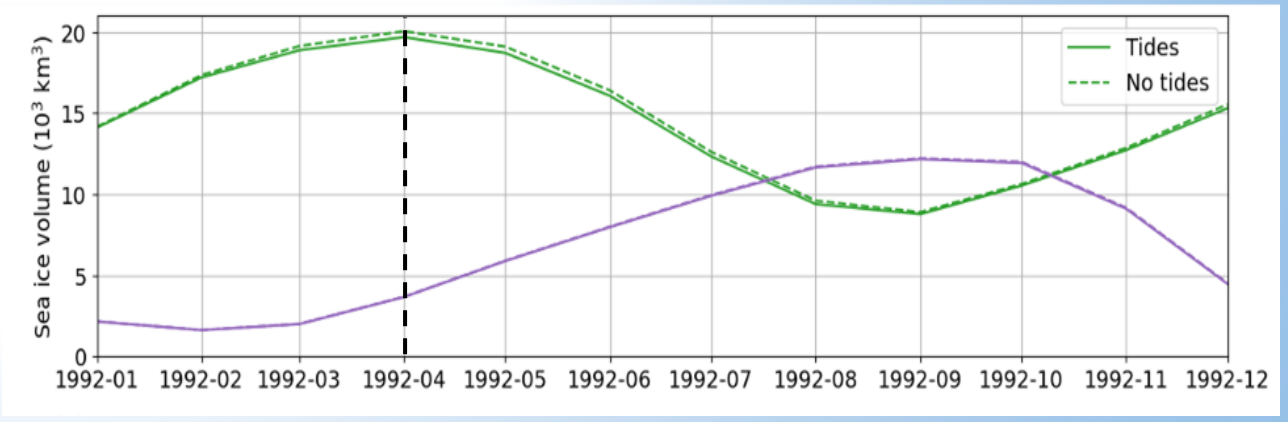
Increase in ocean water volume.
Why?

Differences in the sea ice volume

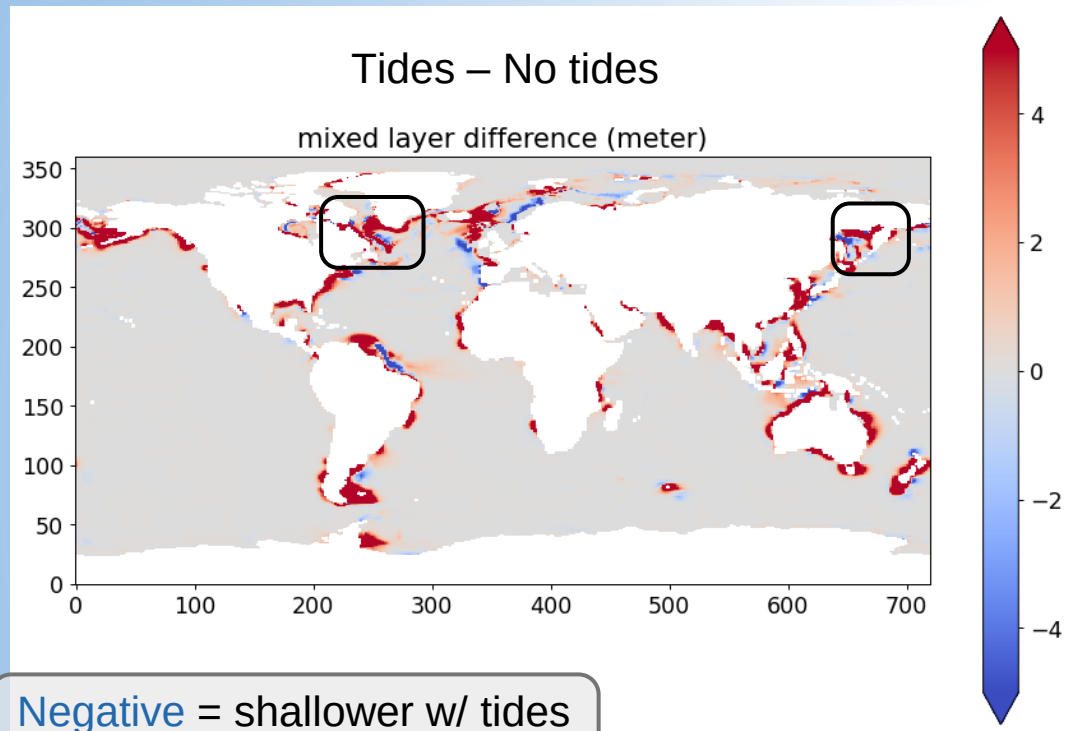
Mainly occurring in the Arctic Ocean

Negative = less sea ice w/ tides
Positive = more sea ice w/ tides





RESULTING FROM CHANGE IN HEAT CONTENT



Negative = shallower w/ tides
Positive = deeper MLD w/ tides

- In Arctic region tides enhance vertical mixing resulting in:

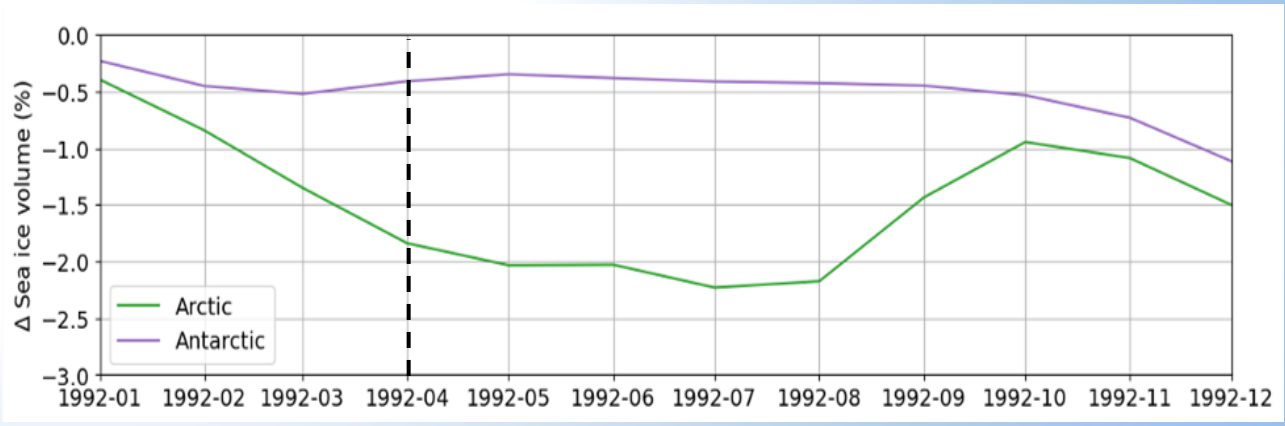
Deeper MLD

↓

Increased heat flux

↓

less ice formation / **increased melting** (similar to An publication)



PROJECT REFLECTION

CHALLENGES:

- Porting tidal Toolkit to ECCOv4r5
- Using PyTMD tidal analysis package

LEARNING:

- Runing ECCOv4r5 simulation with an additional scheme
- Using ecco_v4_py and PyTMD packages
- What parameters are important to accurately model tides

SKILLS:

- Data analysis / Visualization / Dasking
- Runing ECCOv4r5
- Bothering Dimitris (skill mastered by Hinne and Clem but learned by Rebecca, Yumi and Hugo)

PROJECT CONTINUATION:

- Further analyze bottom drag to improve parametrization of the tides in LLC90
- Optimize the model and analyze impact on the controls