st**ER**ic **IN**vestigations **(ERIN)**: how well does ECCO capture the steric sea-level signal?

Erin Robson

AIM = to compare the steric sea-level component from ECCO to that from the most recent global mean sea level (GMSL) reconstruction from Dangendorf et al. (2024)

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Two ways to estimate global (and regional) sea level changes

GMSL reconstruction (Dangendorf et al., 2024)

- Uses reduced spatial optimal interpolation (RSOI) to fit leading EOFs of sea surface height from altimetry to tide gauges

- Kalman Smoother to fit pre-described estimates of barystatic (contemporary GRD and GIA) and sterodynamic contributions to tide-gauge records

ECCO state estimate

- Assimilates observations with models to produce sustained estimates that are dynamically consistent with the physics

Due to the different methods, wanted to see how consistent the results of the two approaches were…

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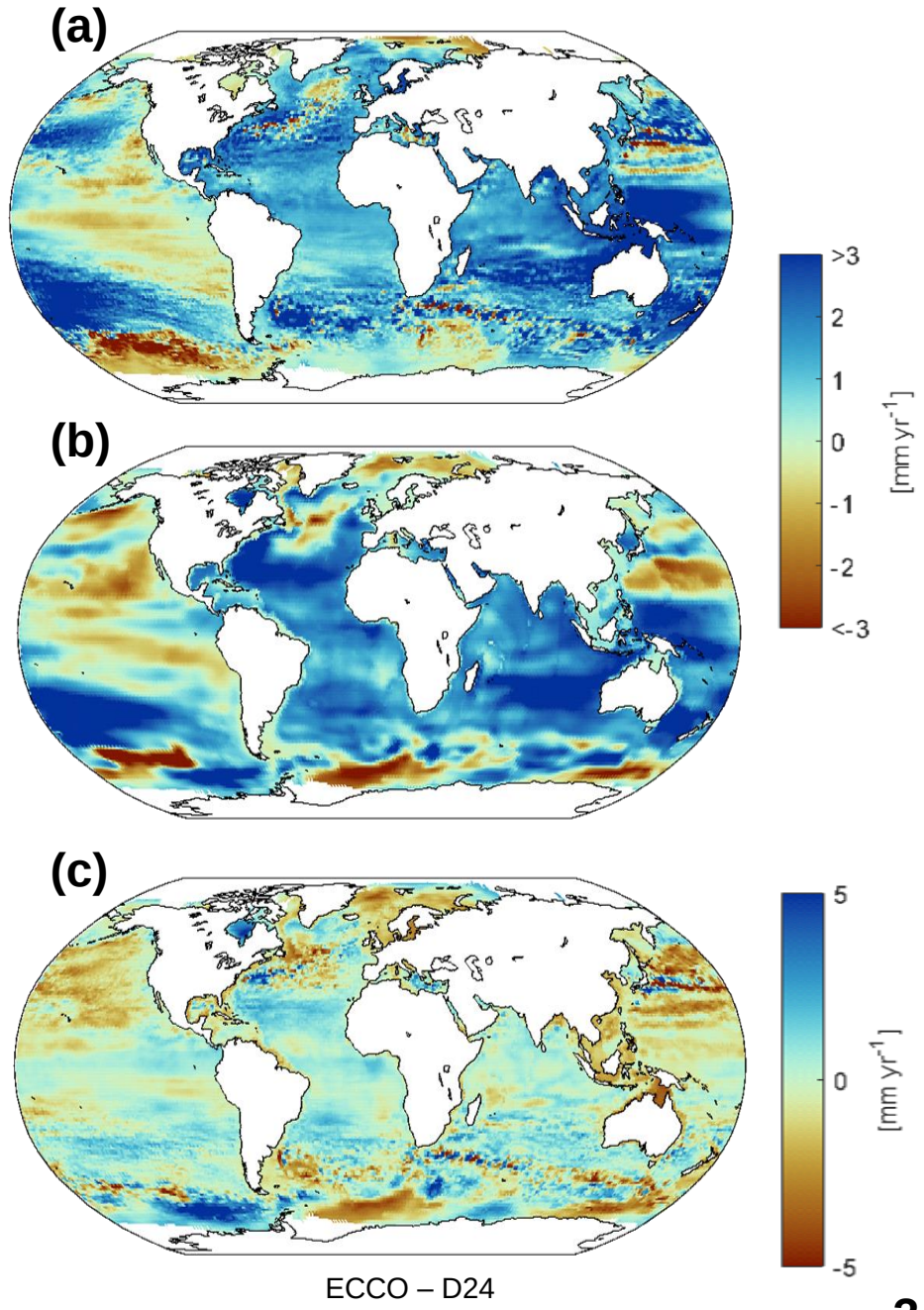
D24:
sterodynamic sea level (SDSL) = RSOI – GRD – GIA - IB

ECCO:
steric sea level = absolute sea level [SSHDYN] – (manometric – IB [OBPNOPAB])

- Spatial patterns are moderately consistent, but ECCO is mostly underestimating the steric sea-level trend in key locations
  - Likely due to missing key processes contributing to sea-level changes at the coast

Pattern correlation = 0.51

Annual trend differences (1992-2017)



ECCO – D24

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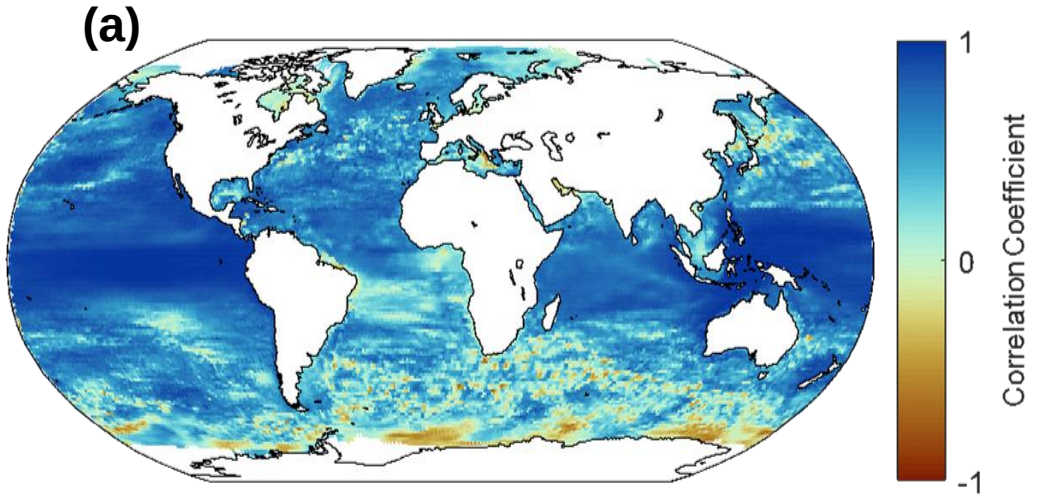

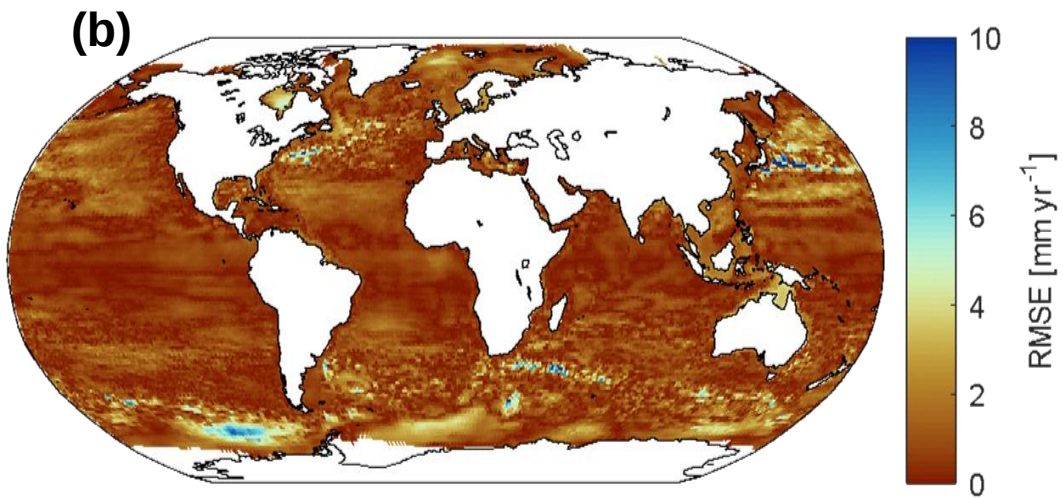

Temporal correlation

- Strong positive correlations in the open ocean
- Less correlated at coasts, boundary current regions, and the Southern Ocean

RMSE

- Follows a similar pattern to correlation – RMSE considerably higher at coasts, boundary current regions, and in the Southern Ocean

- Likely that differences are due to coastal sea level being better constrained by integration of tide gauges in D24
- Model resolution
- Lack of observations to constrain results in the Southern Ocean

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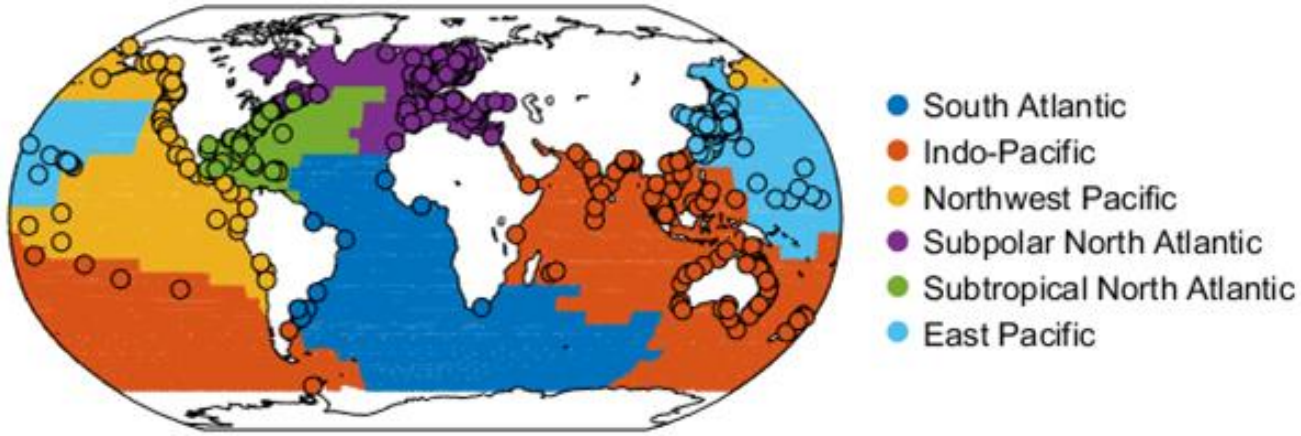
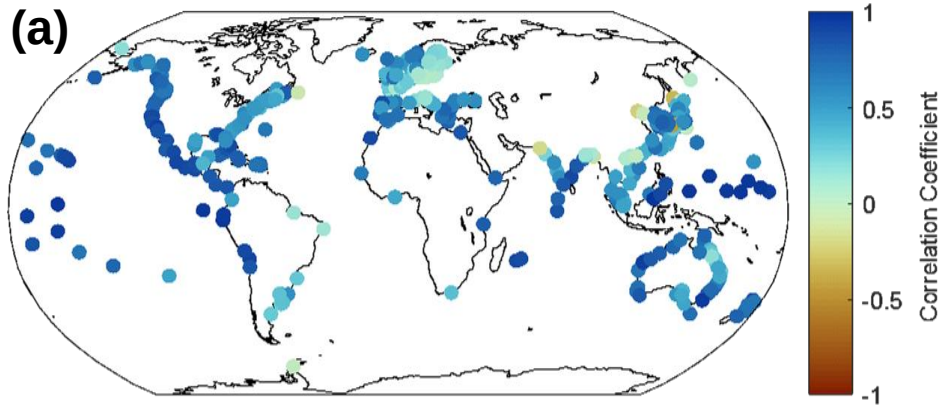


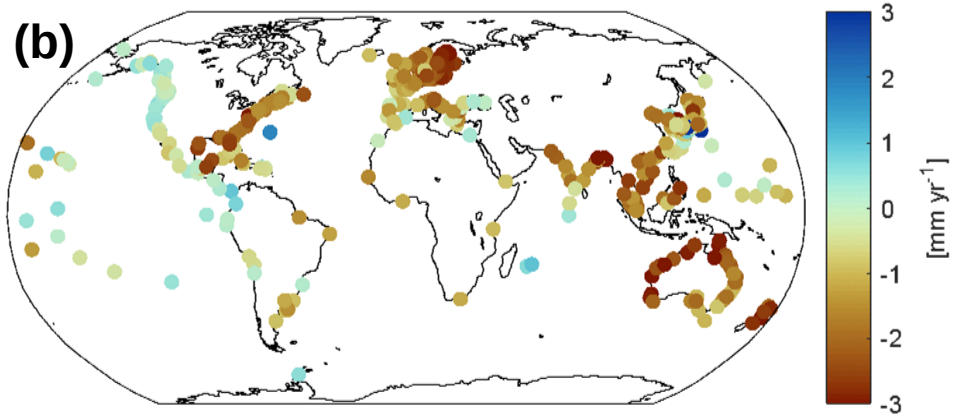
Correlation at tide-gauge locations



Spatially-averaged correlation

Region	Correlation	Median trend difference (mm yr^{-1})
South Atlantic	0.37	-1.12
Indo-Pacific	0.78	-1.83
Northwest Pacific	0.98	0.08
Subpolar North Atlantic	0.72	-1.77
Subtropical North Atlantic	0.91	-1.53
East Pacific	0.94	-0.73

Trend differences at tide-gauge locations



Mostly consistent that in regions with lower trend differences at tide gauges, models are better correlated

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Challenges:
- Python (who is she???)
- Maths has never been my strongest point (*but that's a me problem*)

New skills/what I've learned:
- Now I actually know what ECCO is and how to access information related to it

What I would do if I had more time:
- Look into the specific timeseries at some tide-gauge locations
- Look into what is happening specifically at the boundary currents