Non-tidal high frequency (HF) variability

General Discussion

ECCO Meeting, California Institute of Technology, Pasadena

November 6-8, 2017

HF ~ sub-monthly periods

- **Some motivation for improving HF variability**
- **Forcing issues (missing fields, resolution)**
- **Modeling issues (physics, parameterizations, numerics)**
- **Discussion of future plans (what is feasible and most useful, near-term and more long-term)**

Some motivation

- Influence of large scale HF ocean variability on geophysical signals (length-of-day, polar motion)…not many high quality products available
- Aliasing of HF variability in geophysical records (satellite gravity but also altimetry) and the need for high quality corrections
- Potential nonlinear effects leading to direct influence of HF variability on lower frequencies (e.g., convection regions, diurnal cycle, inertial waves)...improving solutions on climate scales?
- Interpreting HF ocean records (e.g., bottom pressure recorders, tide gauges, moorings)

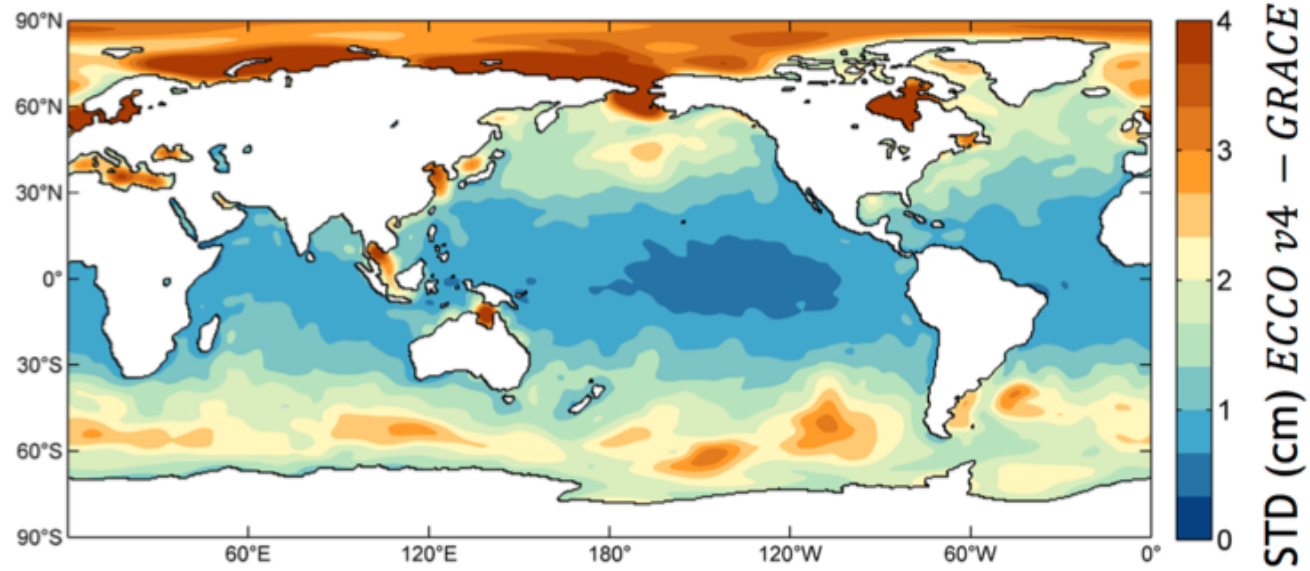
Forcing issues

- Missing surface atmospheric pressure, which becomes more relevant than wind stress as a forcing field with increasing frequency…other fields?
- Poor HF resolution (in v4r3, using 6 hourly fields interpolated linearly to 1-hour time step)…spatial resolution can be also an issue
- Controlling 14-day averaged forcing fields (which makes sense given lack of HF data, but could be reconsidered together with data treatment)

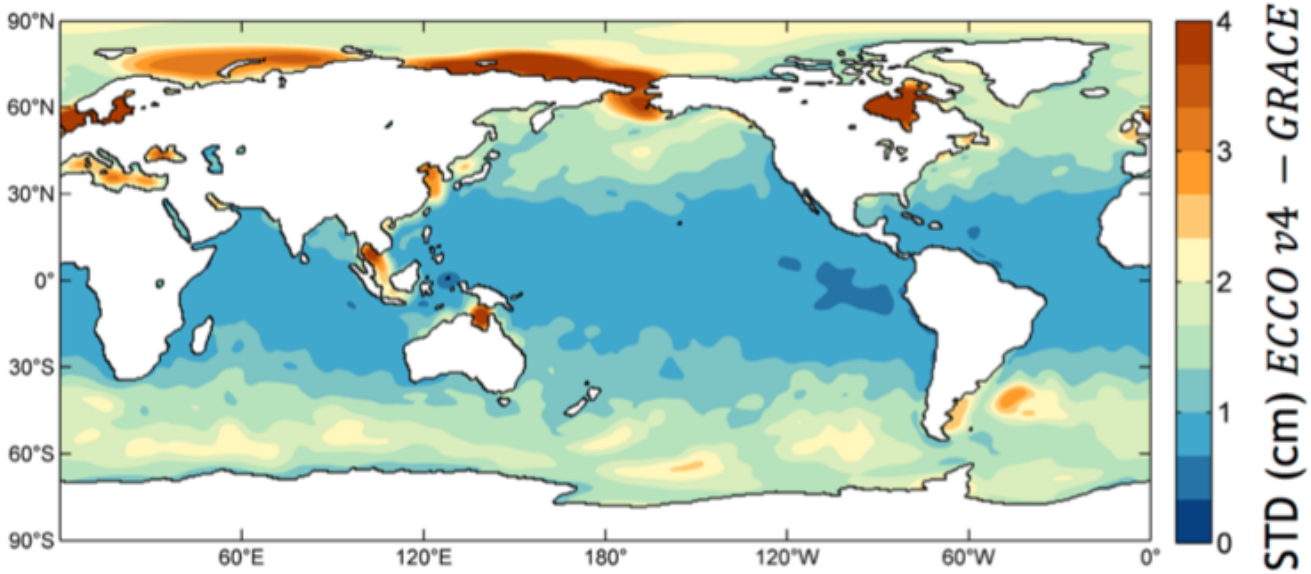
Modeling issues

- Missing important physics of self-attraction and loading
- Fine tuning for HF (dependence on time step size and stepping scheme, parameterization of dissipation)

- $\Delta t = 5\,min$, without pressure forcing



- $\Delta t = 5\,min$, pressure loading added



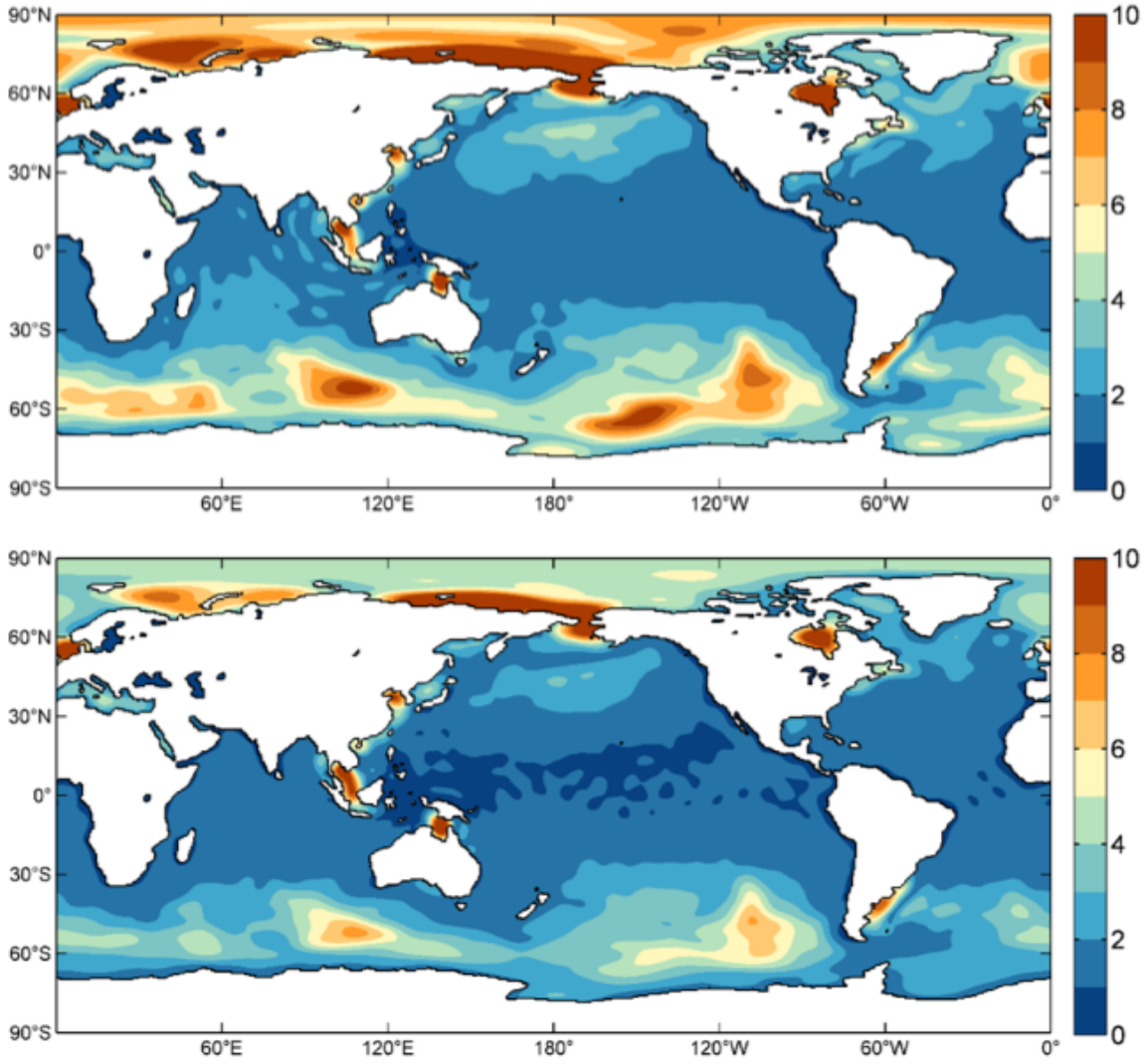
- Incorporating pressure loading reduces RMS differences with observed OBP by $\sim 0.5 - 1.0\,cm$

Effects of pressure-driven signals in comparison with GRACE data

M. Schindelegger, Tech. Univ. Vienna

ECCO v4 high-frequency content

Change in the model variance with a shorter time step?



- $\Delta t = 60\,min$
- Pressure forcing

Plots show **standard deviations of** ζ^b (cm) from ECCOv4 ($n \leq 40$)

- $\Delta t = 5\,min$
- Pressure forcing

M. Schindelegger, Tech. Univ. Vienna

Future plans

- Include surface atmospheric pressure forcing … can do it a posteriori … carry an extra sea level field for either dynamic or static component … might have to use suboptimal pressure forcing fields to deal with poorly represented barometric tides
- Test results against available data (bottom pressure recorder, tide gauge, daily GRACE,…)
- Implement option to use SAL codes (issues of regional domain application)
- Assess forcing fields with higher resolution, including better representation of the semi/diurnal barometric tides
- Assess dependence on numerics, parameterizations,…
- Changing data constraints and controls