Non-tidal high frequency (HF) variability

General Discussion

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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)
Effects of pressure-driven signals in comparison with GRACE data

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

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

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

M. Schindelegger, Tech. Univ. Vienna
ECCO v4 high-frequency content

Change in the model variance with a shorter time step?

- $\Delta t = 60 \text{ min}$
- Pressure forcing

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

- $\Delta t = 5 \text{ min}$
- Pressure forcing

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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