
Next-generation adjoint-based ECCO v3 — Forward Model

▶ Basic features

- Mass vs. volume-conserving (Boussinesq) configuration
Marshall et al. [2004], Adcroft and Campin [2004], Losch et al. [2004]
- Free-surface treatment and tracer conservation
*Campin et al. [2004], Griffies et al. [2001],
Roullet and Madec [2000], Losch and Heimbach [2005]*
- The grid: global, polar cap
Ed Hill, Chris Hill
- Time-stepping and advection schemes
Adcroft et al. [2002]

Next-generation adjoint-based ECCO v3 — Forward Model (cont'd)

▶ Parameterization schemes

- K-Profile Parameterization (KPP)
- Gent-McWilliams/Redi (GM/Redi)
- Variable horizontal viscosity
- Sea-ice I:
Zhang and Rothrock [2003, 2000]
- Sea-ice II:
Hunke and Lipscomb [2004], Kim et al. [2006]
- Topographic mixing, overflows, bottom boundary layer
Campin and Goosse [1999], Simmons et al. [2004], Kösters et al. [2004]
- Gravitational self-attraction and loading
Hendershott [1972], Condi and Wunsch [2004], Stepanov and Hughes [2004]

Next-generation adjoint-based ECCO v3 — Forward Model (cont'd)

▶ Forcing

- atmospheric boundary layer scheme (bulk formulae)
- Improved run-off
- Ice-shelf parameterization?
- Atmospheric loading?

▶ Other aspects

- Passive tracers
- Biogeochemistry
- Line search

Next-generation adjoint-based ECCO v3 — Adjoint Model

▶ The control vector

- by now “standard”:
 - initial T , S
 - time-dependent fields of atmospheric state, i.e. surface air temperature, specific humidity, U_{10} wind speed vector, precipitation, shortwave radiation
- beyond “standard”:
 - isopycnal, diapycnal mixing coefficients (e.g. Bugnion, 2001, Stammer, 2005, Forget, in preparation)
 - eddy-induced stress (e.g. Ferreira et al., 2005)
 - bottom topography or lateral boundary conditions (e.g. Losch and Heimbach, 2005)

Next-generation adjoint-based ECCO v3 — Adjoint Model (cont'd)

▶ The cost function, observations

- Spatial averaging and smoothing (consistent data operators and representations);
- Treatment of in-situ data: enable daily profile-by-profile treatment;
- Surface drifter data: incorporate new data set by Maximenko & Niiler, 2004
- geoid error covariance (soon to be issued for GRACE?)
- TOGA/TAO buoy array
- tomography (B. Cornuelle)
- tide gauge data (S. Vinogradov)
- ...

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