

Geophysical Fluid Dynamics Laboratory Review

June 30 - July 2, 2009



Sea Level and Its Components

Presented by
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Sea Level Perspectives

- **Stakeholders & Impacts:** greatest interest in total sea level change at a point; local perspective
(e.g., NOAA Office of Ocean & Coastal Resource Management – OCRM)
- **Modeling & Understanding:** interest in contributions of individual terms & mechanisms; focusing first on the large-scale effects
- **Observations:** (satellites, tide gauges, ARGO, XBTs, etc.)
Questions of uncertainty ranges, time scales, forced vs. natural variability

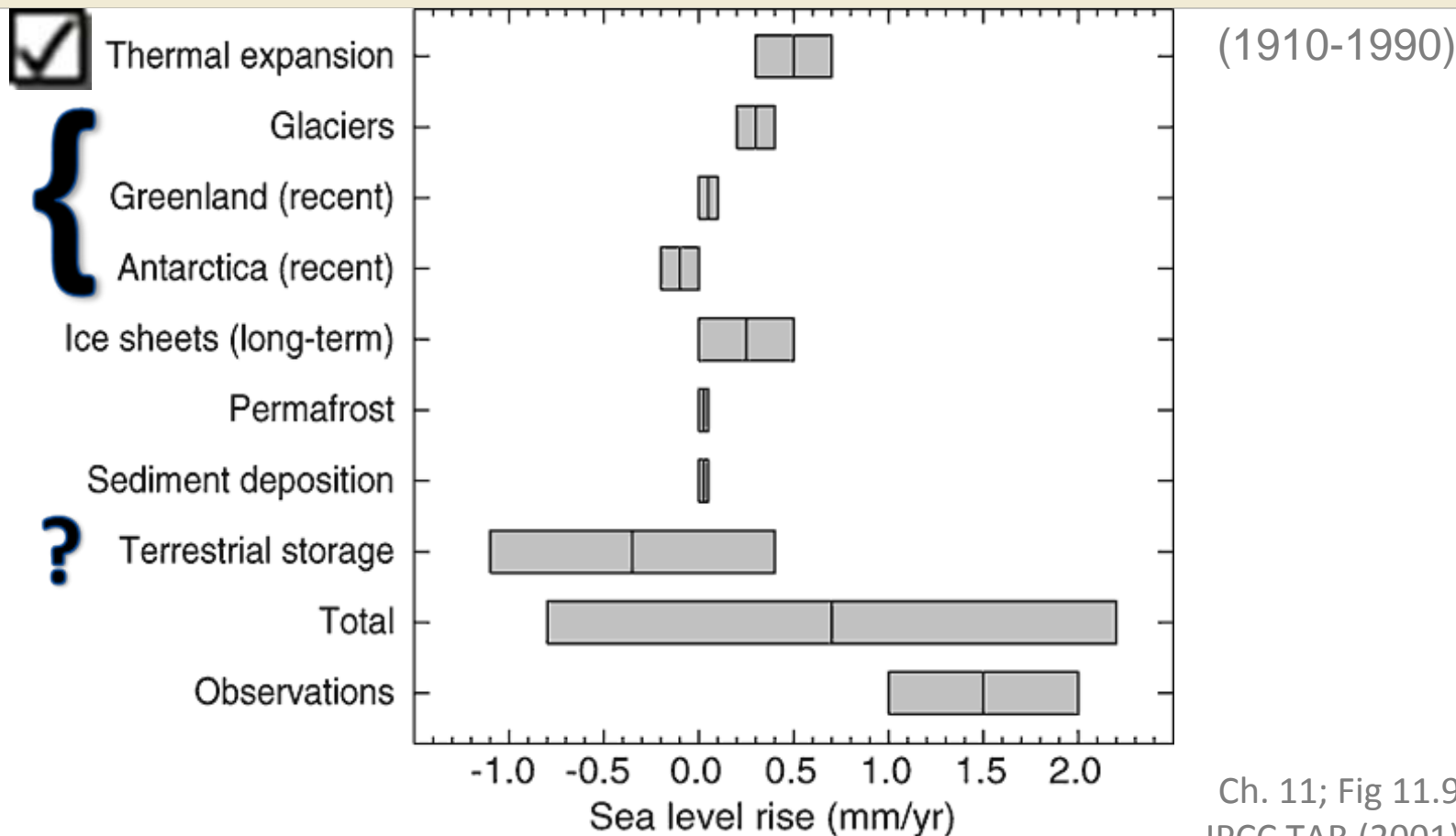
Components of Sea Level Change

Total Sea Level Change = Steric + Change in Mass + Land Movements

- **Steric:** we model it & work with observations
e.g. Delworth et al (2005), Chang, et al. (man. in prep.)
- **Land Ice:** currently only crude offline calculations from our model output. A nascent research topic at GFDL
Olga Sergienko & Daniel Goldberg with M. Oppenheimer (PU)
- **Other mass changes:** we model some terms (e.g., soil moisture), but do not address others (e.g., water mining, dams, reservoirs); large uncertainties in obs of some terms complicate 20th century model-to-obs comparisons
e.g. Lettenmaier and Milly (submitted)
- **Land Movements:** we don't model

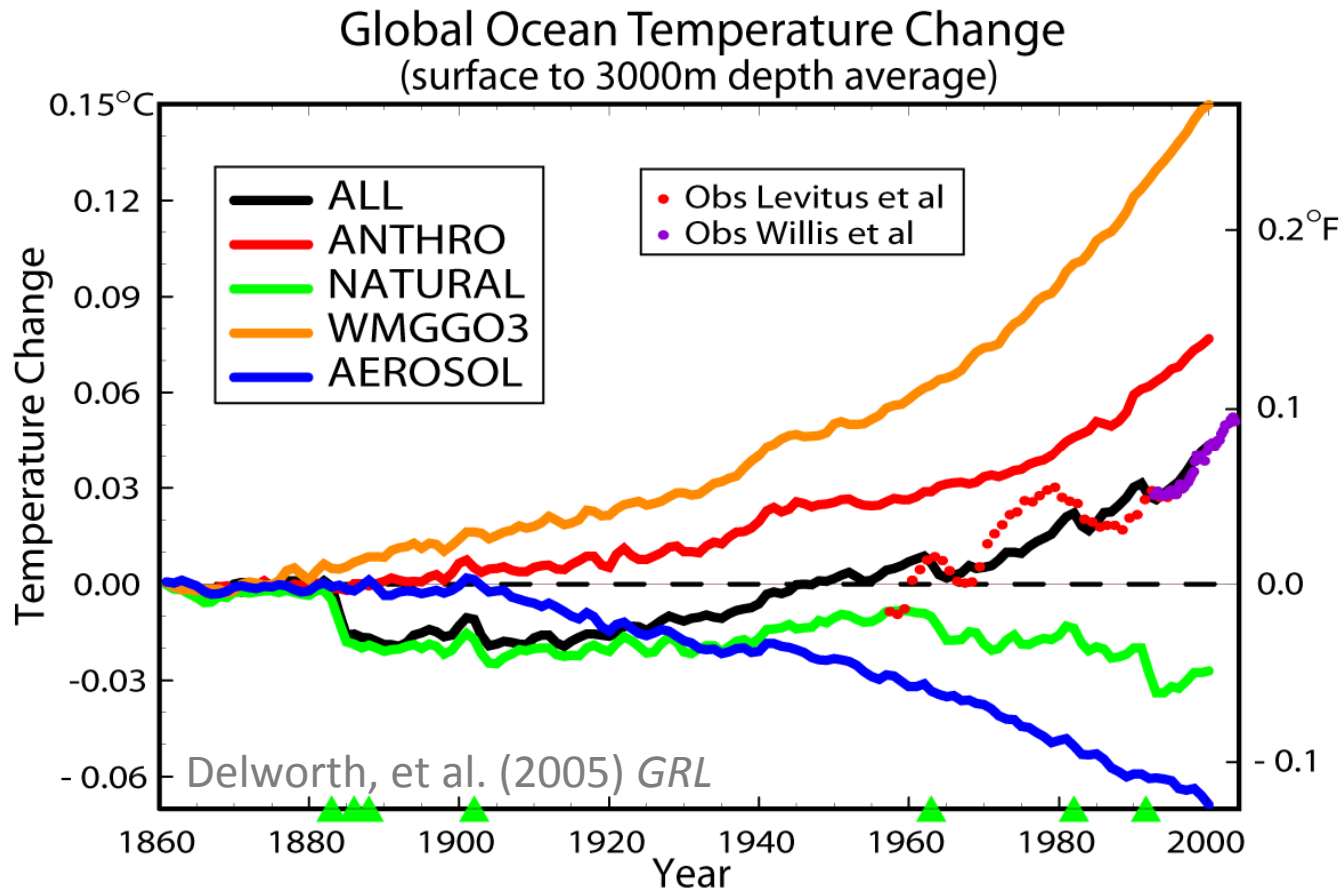
Uncertainties in Sea Level Change

Total Sea Level Change = Steric + Change in Mass + Land Movements



Ch. 11; Fig 11.9
IPCC TAR (2001)

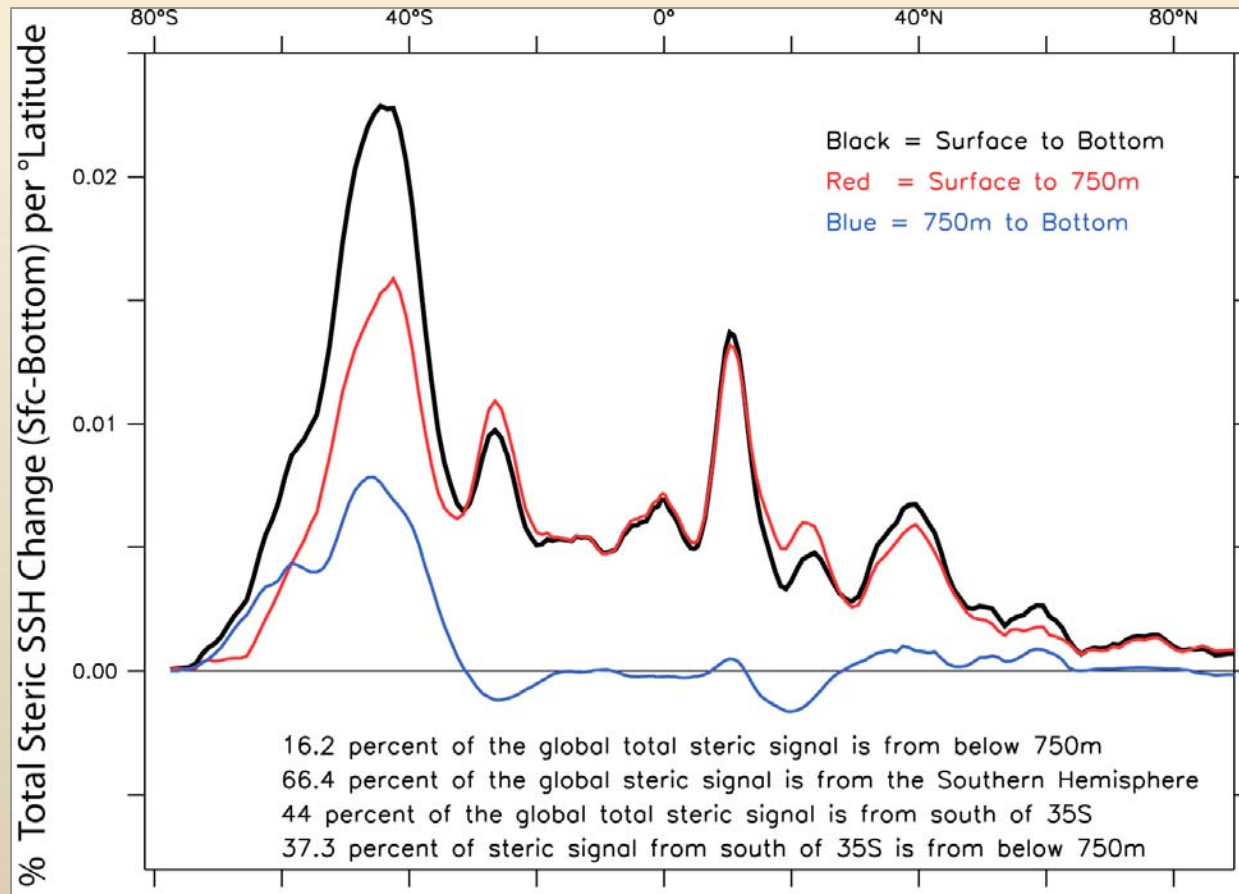
CM2.1 - Ocean Heat Uptake



- CM2.1 realistically simulates observed global ocean warming (1950-2000).

- Aerosols (anthro & volcanic) have offset $\sim 2/3$ of the GHG-induced warming.

CM2.1: Sizable steric signals from poorly observed regions



*Dixon & Vecchi
(man. in prep.)*

- Southern Ocean circulation factors in AR4 models (*Russell, et al. [2006, J Clim]*)
- Basin-scale: does Argo + Grace = or \neq Jason ? (*Chang, et al. [man. in prep.]*)
- Model projections of Sea level: NE US (*Yin, et al. [2009, Nature Geosci.]*)

Sea Level and Its Components - Summary

- **Ongoing efforts to advance the understanding of sea level change and to communicate the relevant findings to stakeholders. Research includes observational analyses and modeling**
- **Significant challenges remain in directly comparing simulated sea level change to observational estimates:**
 - Observational and modeling uncertainties
 - Current models do not represent all processes important for sea level change
- **Ice Sheets: The largest wildcard in sea level change**

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