What are the Sources of Sea Level Rise?
- Results from a 50 year hindcast with a global OGCM -

J. Schröter, M. Wenzel, J. Staneva, Ch. Reick, S. Danilov
Alfred Wegener Institute for Polar and Marine Research
PO Box 120161, D-27515 Bremerhaven, Germany

The Models:
For this investigation the Hamburg LSg model is used with a 2° horizontal resolution, 23 layers in the vertical and a timestep of 10 days. It is run for 50 years from 1950 to 1999.

The model is forced at the surface by:
- air temperature
  - COADS data blended with NCEP re-analysis
- windstress
  - from NCEP re-analysis surface winds
- freshwater flux (P-E):
  - precipitation from NCEP re-analysis
  - evaporation via latent surface heat flux
- spin-up
  - 1600 years perpetual 1950 starting from an optimal climatological annual cycle

\[
\frac{\partial \zeta}{\partial t} = P - E + \nabla \cdot \zeta \hat{\theta} \, dz + A_s \Delta \zeta + \int_{H}^{\infty} \frac{1}{\alpha} \frac{\partial \alpha}{\partial T} \frac{\partial T}{\partial t} \, dz + \int_{H}^{\infty} \frac{1}{\alpha} \frac{\partial \alpha}{\partial S} \frac{\partial S}{\partial t} \, dz
\]

steric contributions:
non-steric effects and steric effects
- freshwater flux
- divergence
- subgrid gravity waves
- thermosteric
- halosteric

Difference between the decadal mean SSH from the 70s and the 90s:

\[\Delta \text{SSH} + \text{total}\]

Non-steric contributions:
- \(\Delta \text{SSH} + \text{total non-steric}\)
- \(\Delta \text{SSH} + P - E\)
- \(\Delta \text{SSH} + \text{diffusion (sub-grid effects)}\)
- \(\Delta \text{SSH} + \text{mass divergence}\)
temporal evolution of the area mean sea level

model regions

global ocean

North Atlantic

western tropical Pacific

eastern tropical Pacific

thermosteric contribution

halosteric contribution