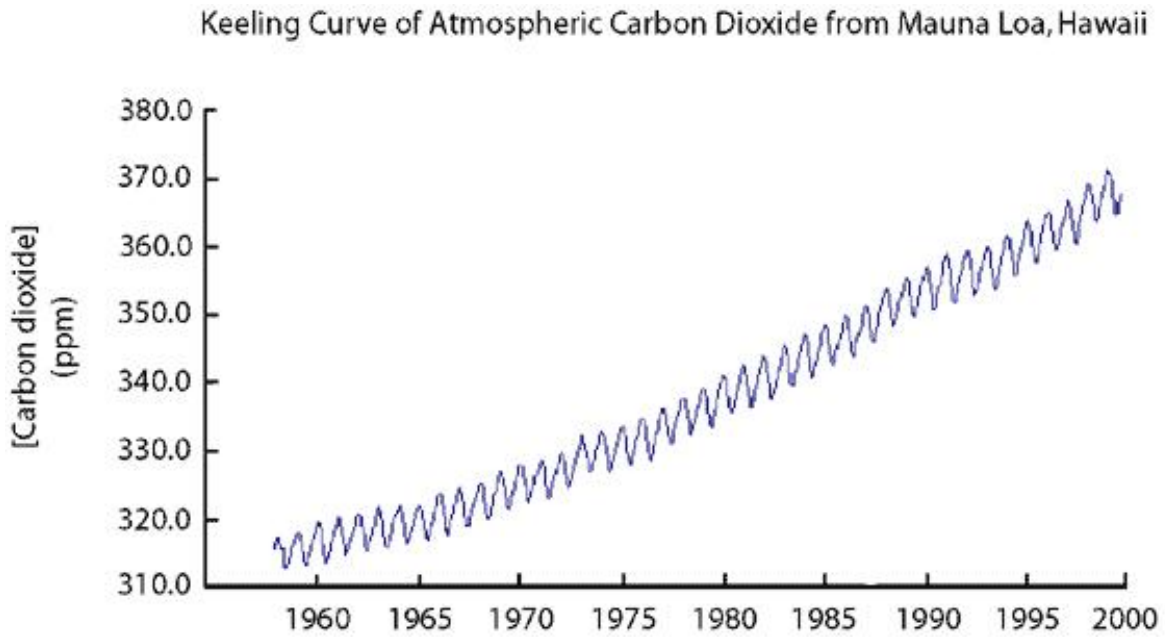
The Human Earth (MAE 124/ESYS 103)
Lecture 1

Introduction to the course (examples)

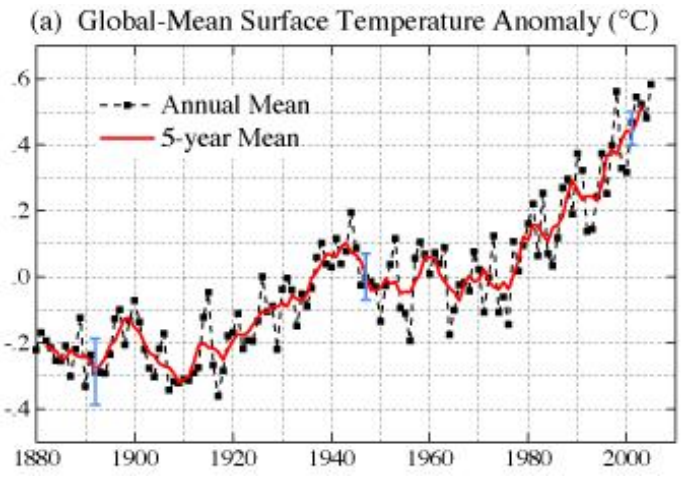
[copyrighted cartoon http://www.goma.demon.co.uk/eco/hourglass.html]

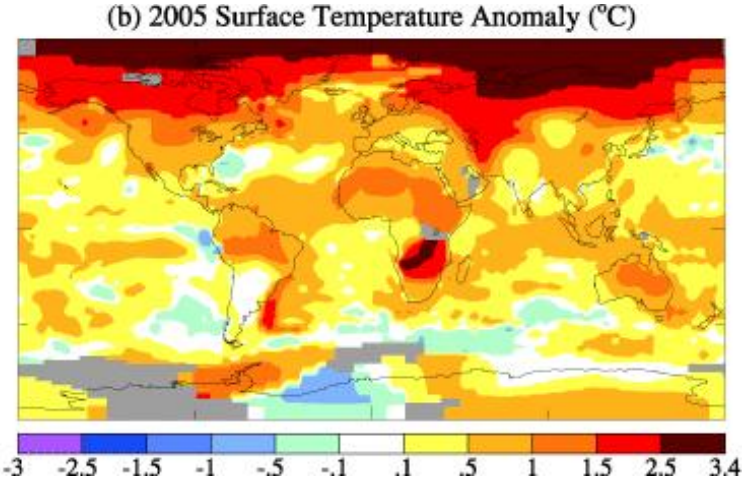
A brief science background: environmental challenges

Rising carbon dioxide

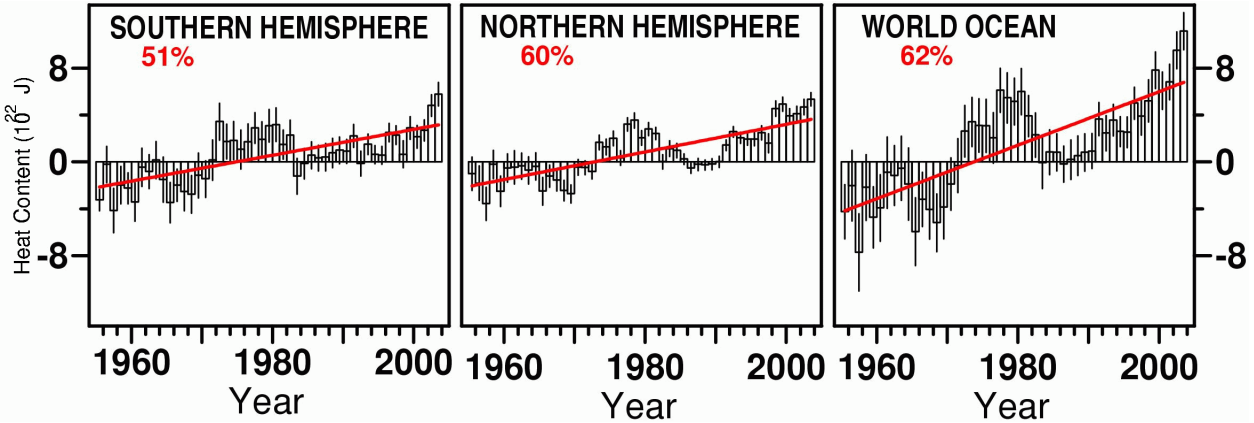


CO_2 rise linked to air temperature increases



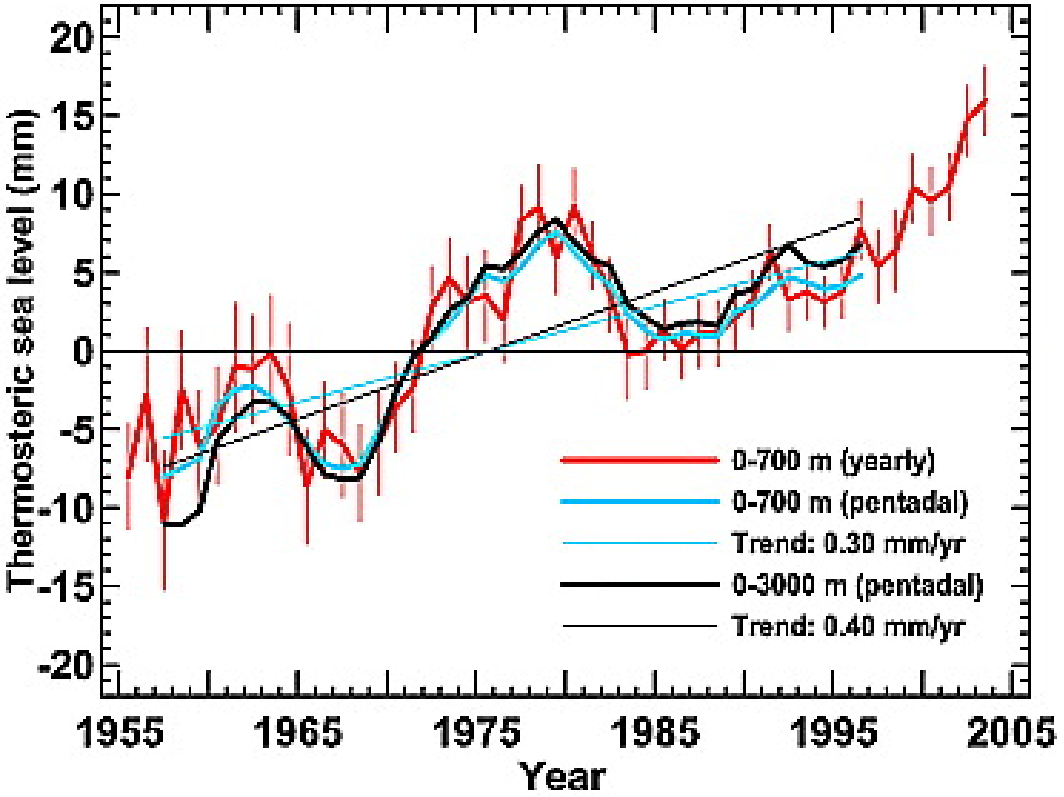


Warming in the ocean



(Levitus et al., Geophysical Research Letters, 2005)

Warming in the ocean implies sea level rise

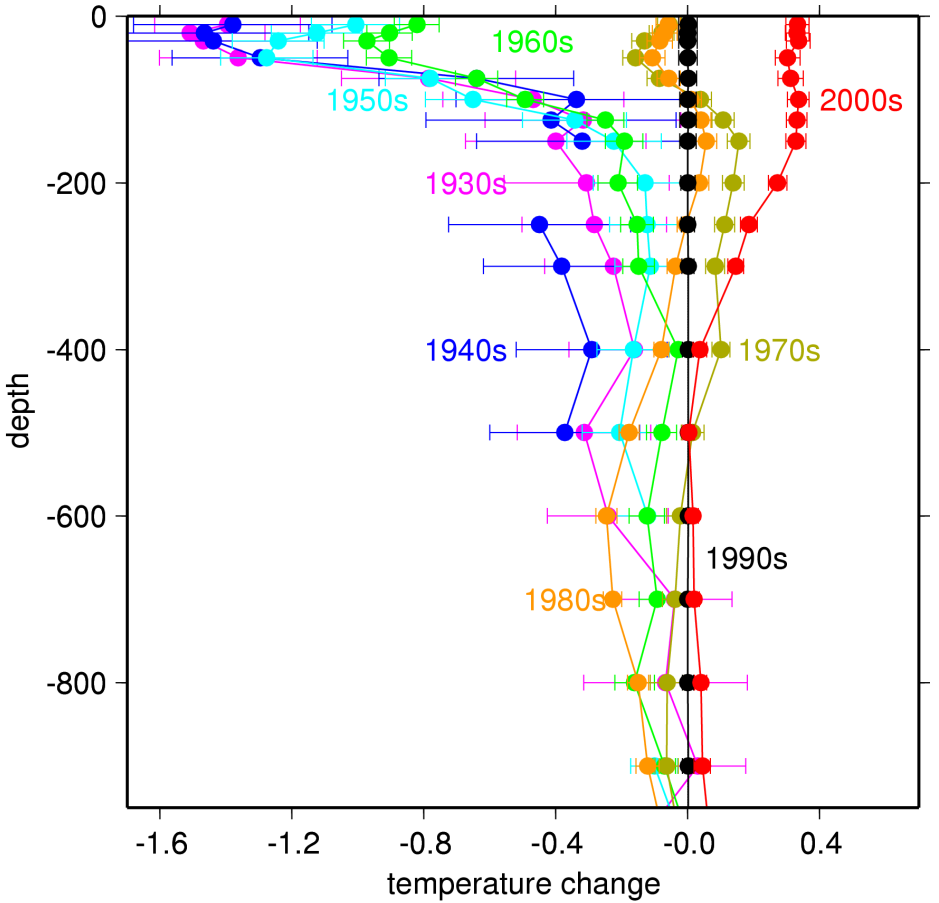


(Antonov et al., Geophysical Research Letters, 2005)

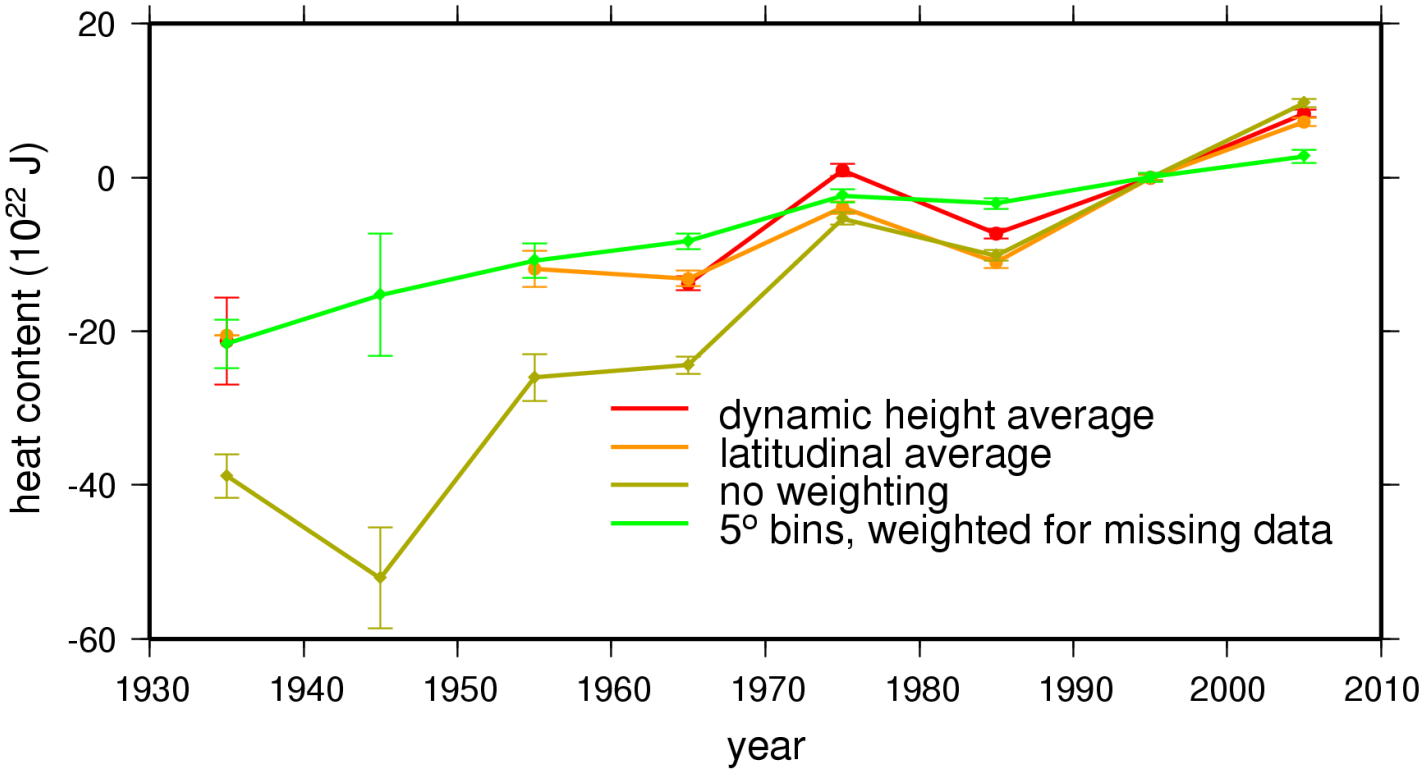
An alternate look at heat content

- Data
  - — World Ocean Database (2001): CTD, bottle (OSD), XBT
  - — Profiling ALACE floats (PRF)
  - — Argo floats (ARG)
- Summer only (November to March)

Changes in upper ocean temperature (°C)

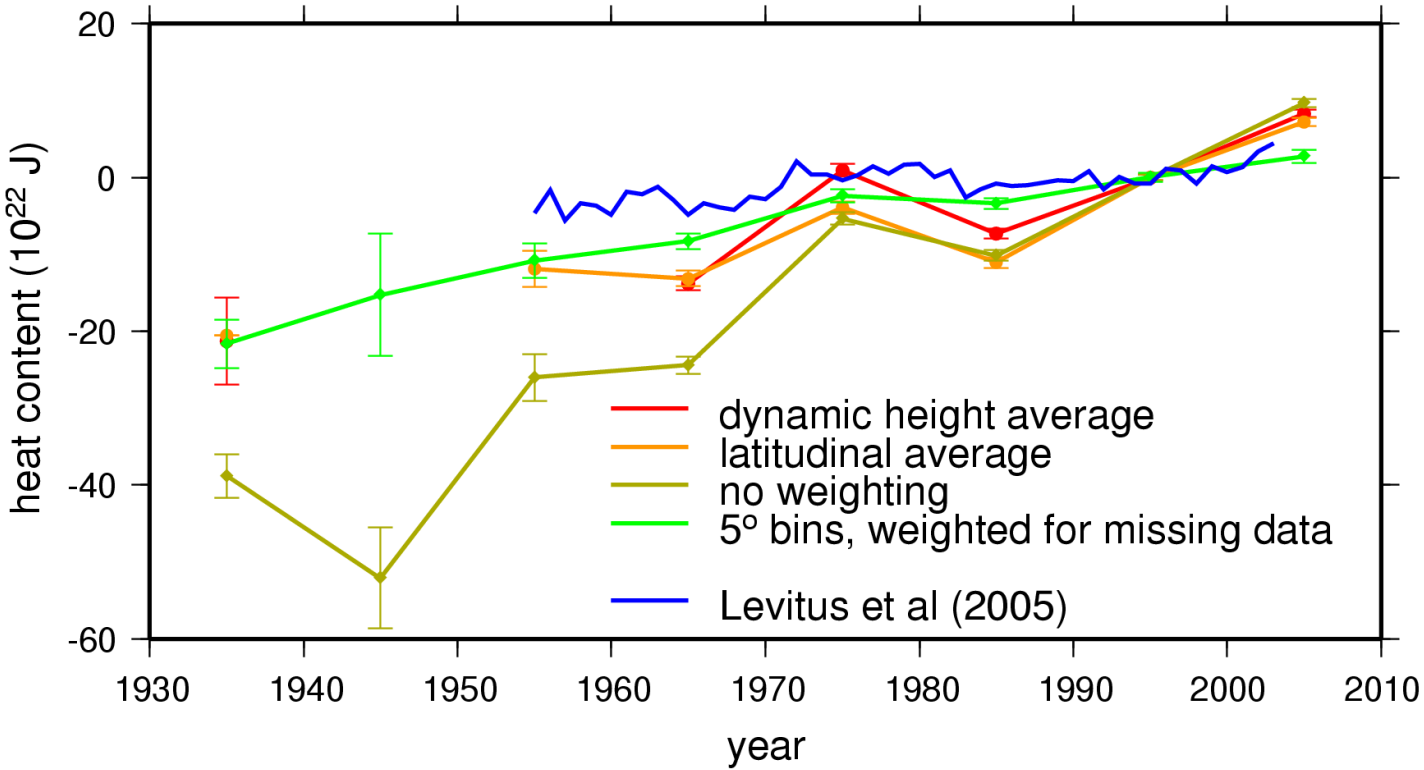


Heat content changes



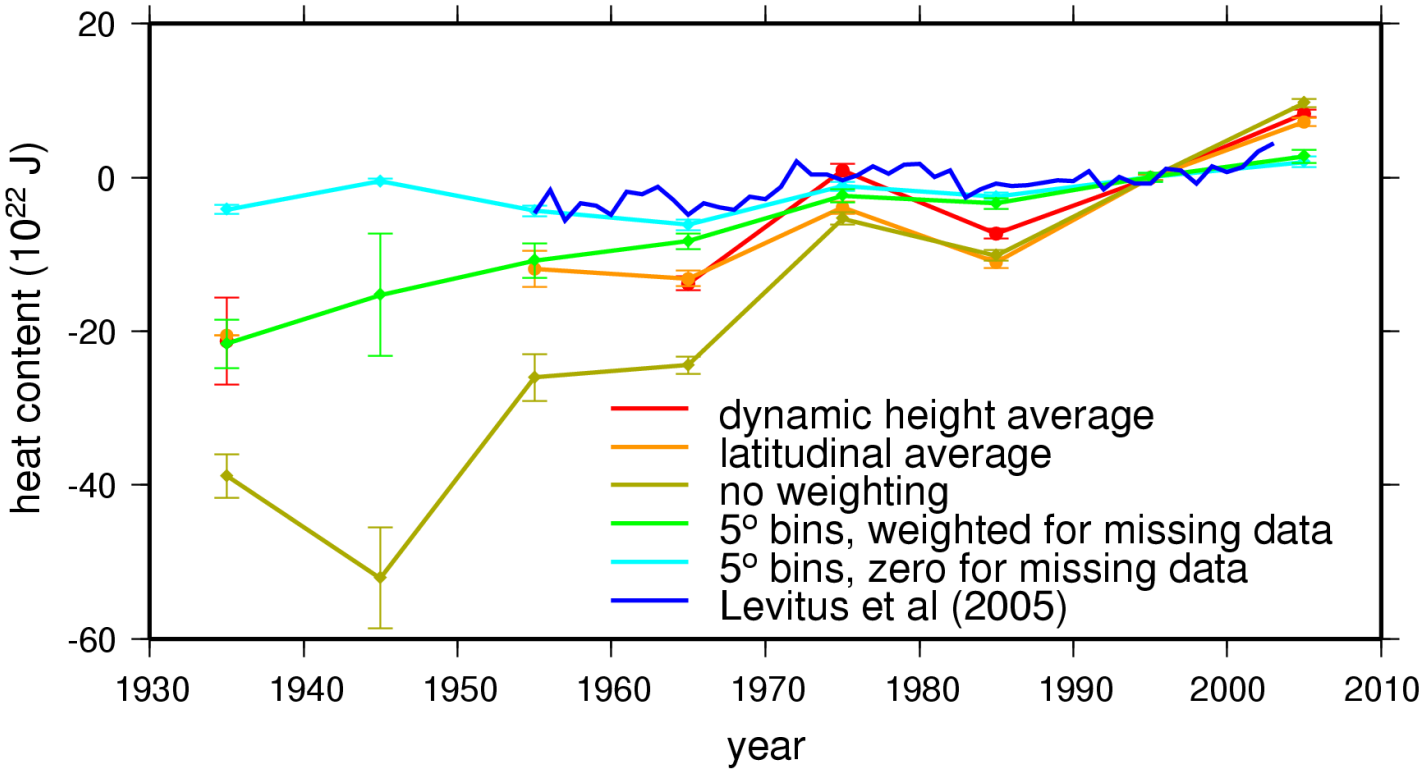
- $O(25 \times 10^{22})$ J rise in heat content, regardless of averaging.

Heat content changes



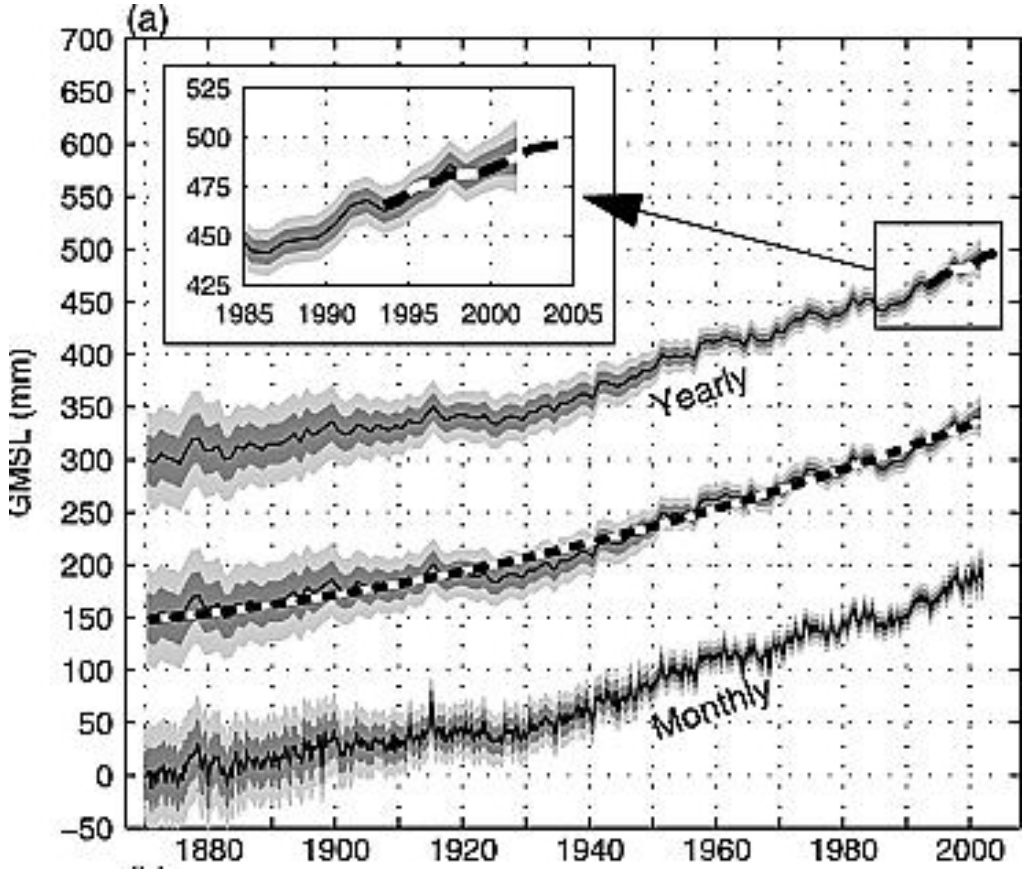
- $O(25 \times 10^{22})$ J rise in heat content, regardless of averaging.
- Levitus et al (2005) shows smaller trend.

Heat content changes



- $O(25 \times 10^{22})$ J rise in heat content, regardless of averaging.
- Levitus et al (2005) shows smaller trend.
- Levitus trend duplicated if zero trend assumed for 5° bins with no data.

Observed sea level rise

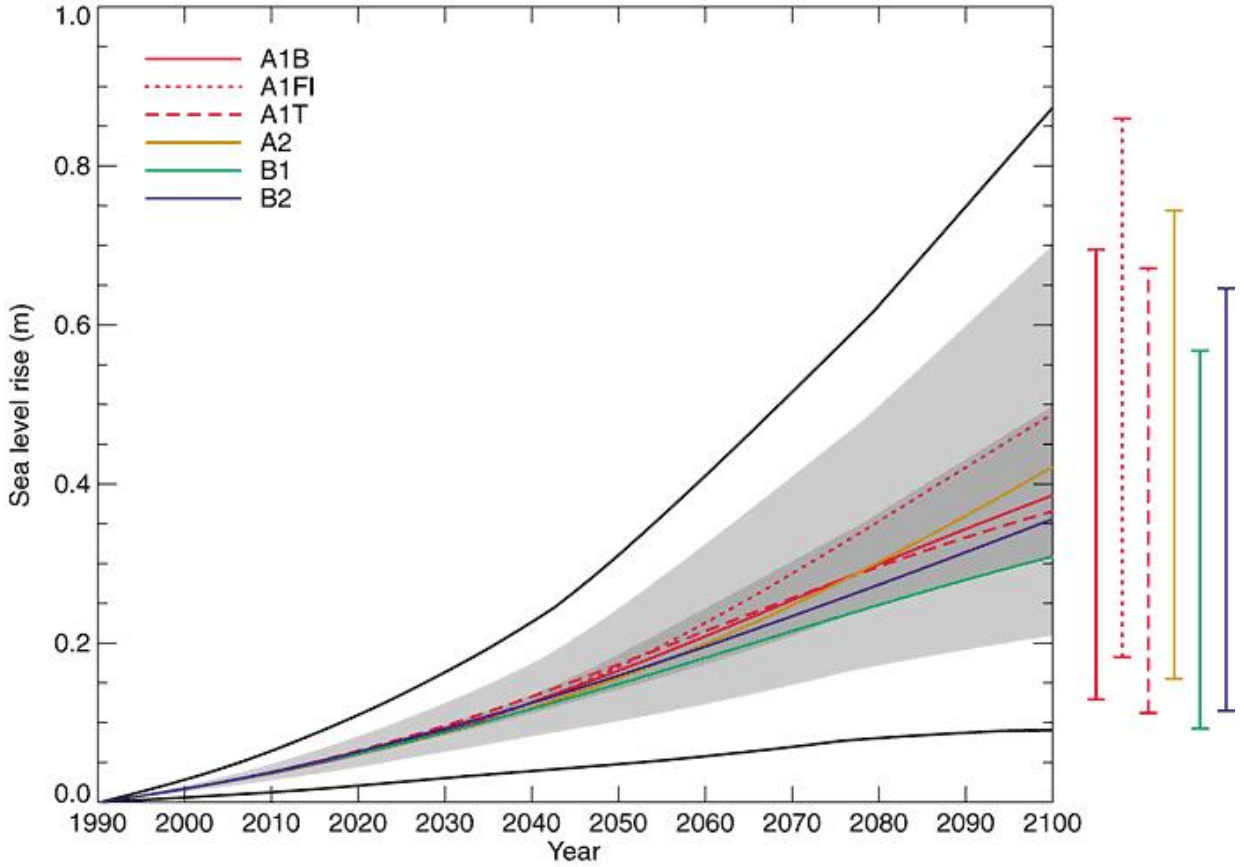


average rise: 1.7 mm/yr and accelerating (Church and White, Geophysical Research Letters, 2006)

Ice melt contributes to sea level rise

www.hi.is/~oi/svalbard_photos.htm

Predicted future sea level rise



IPCC report (2001)

[copyrighted political cartoon; see http://www.cartoonistgroup.com/store/add.php?iid=13037]