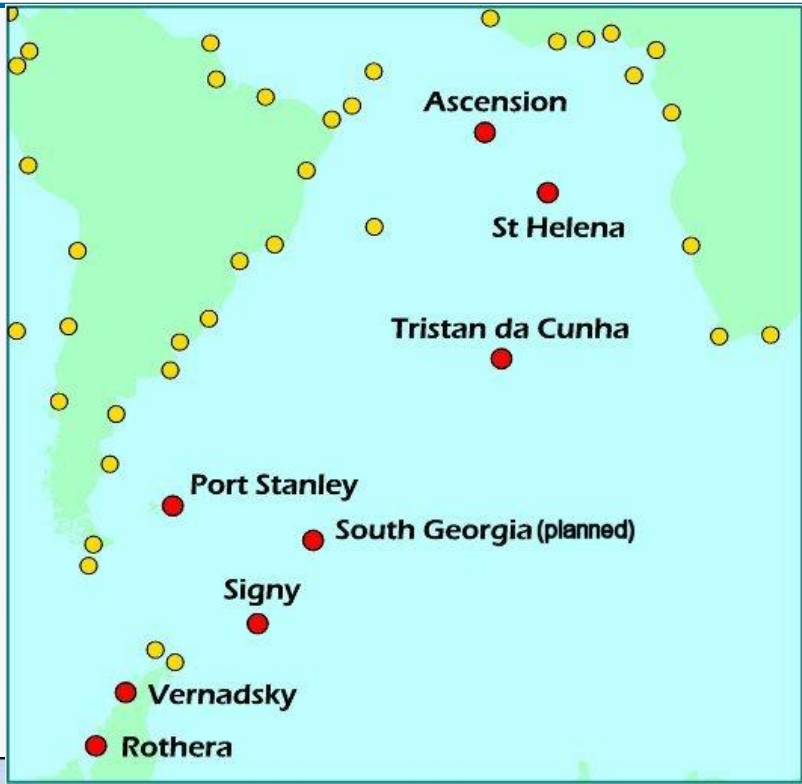
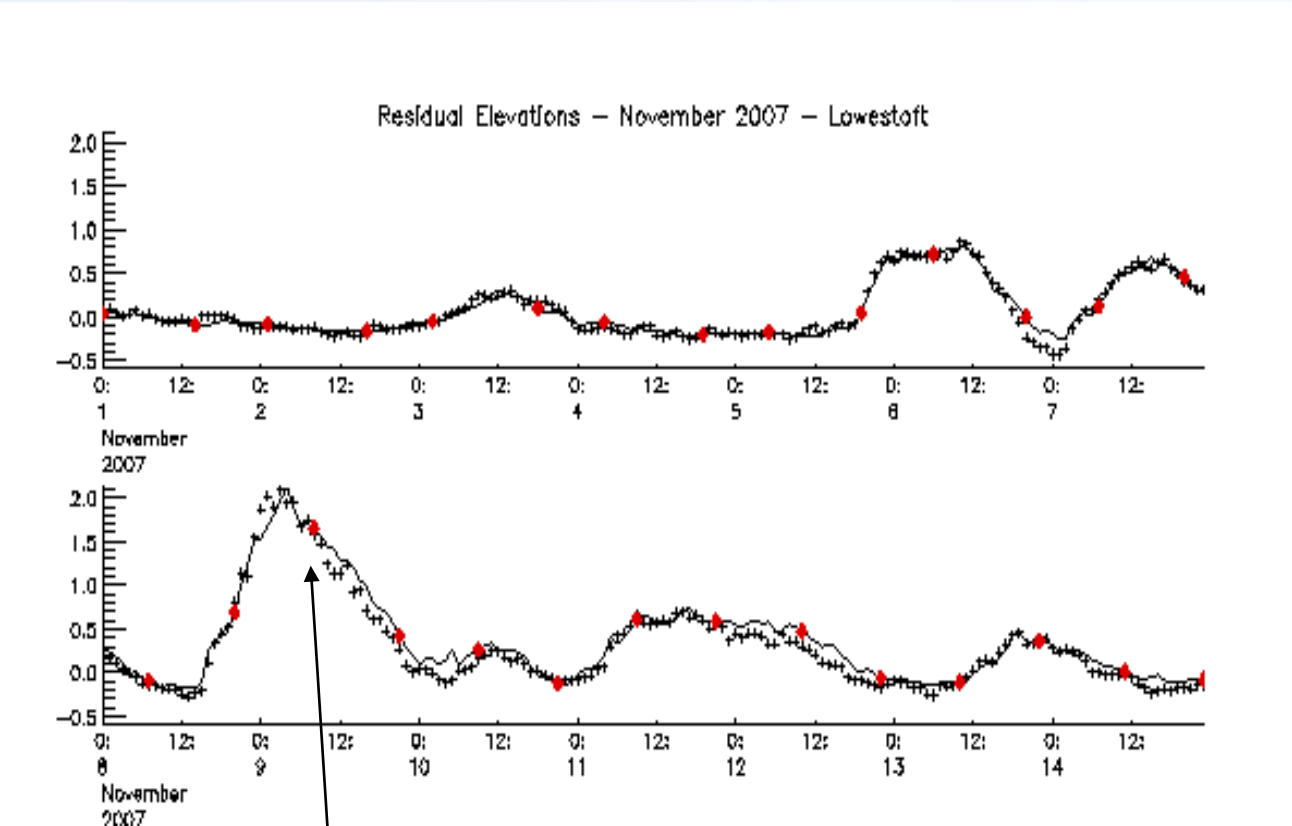


Sea Level Science

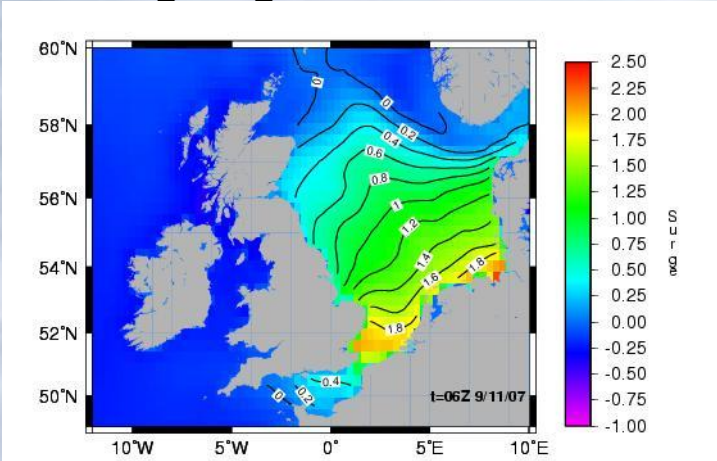
Chris W. Hughes (cwh@pol.ac.uk)

National Tidal and Sea Level Facility

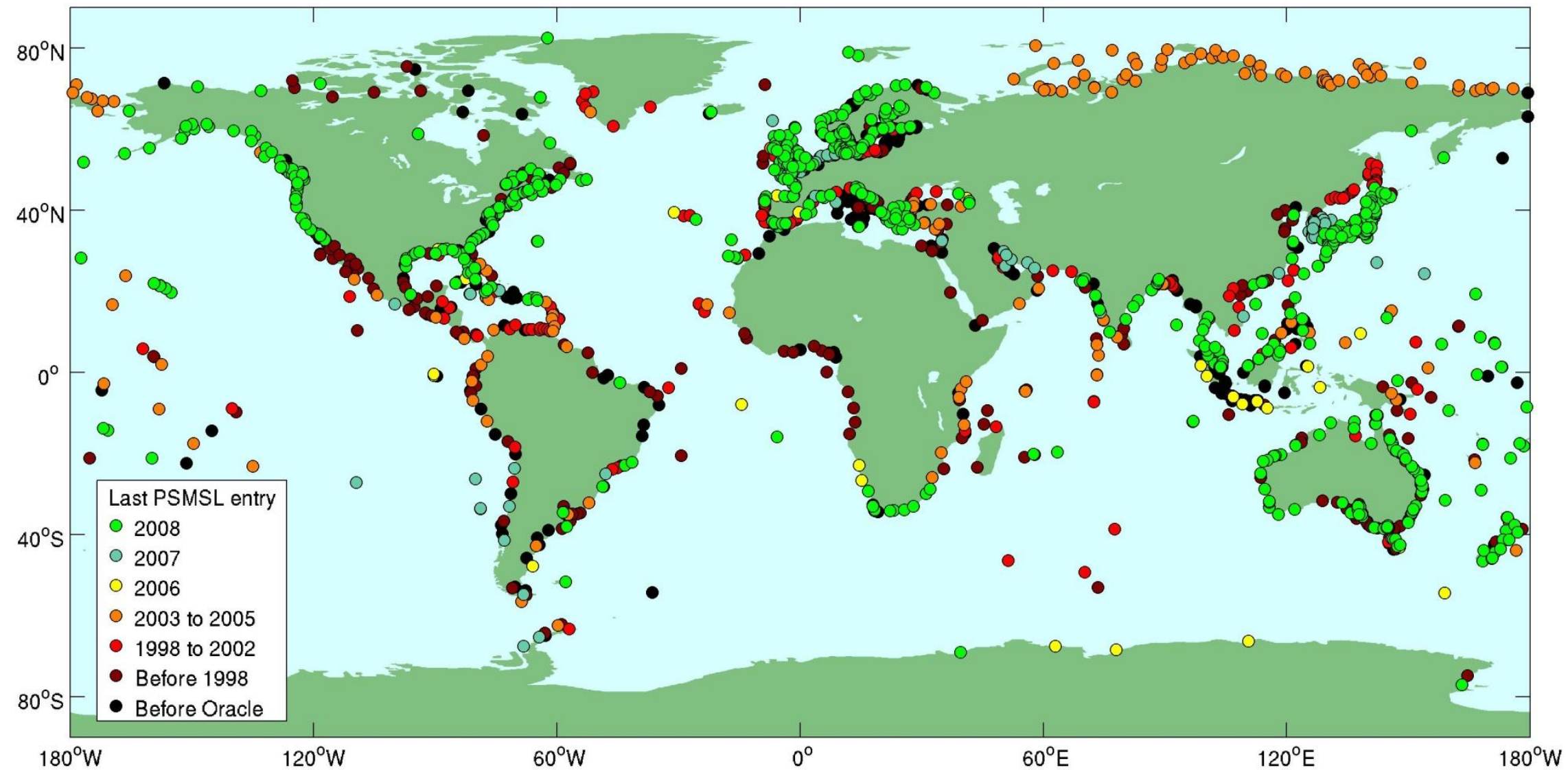


44 tide gauge sites in the UK

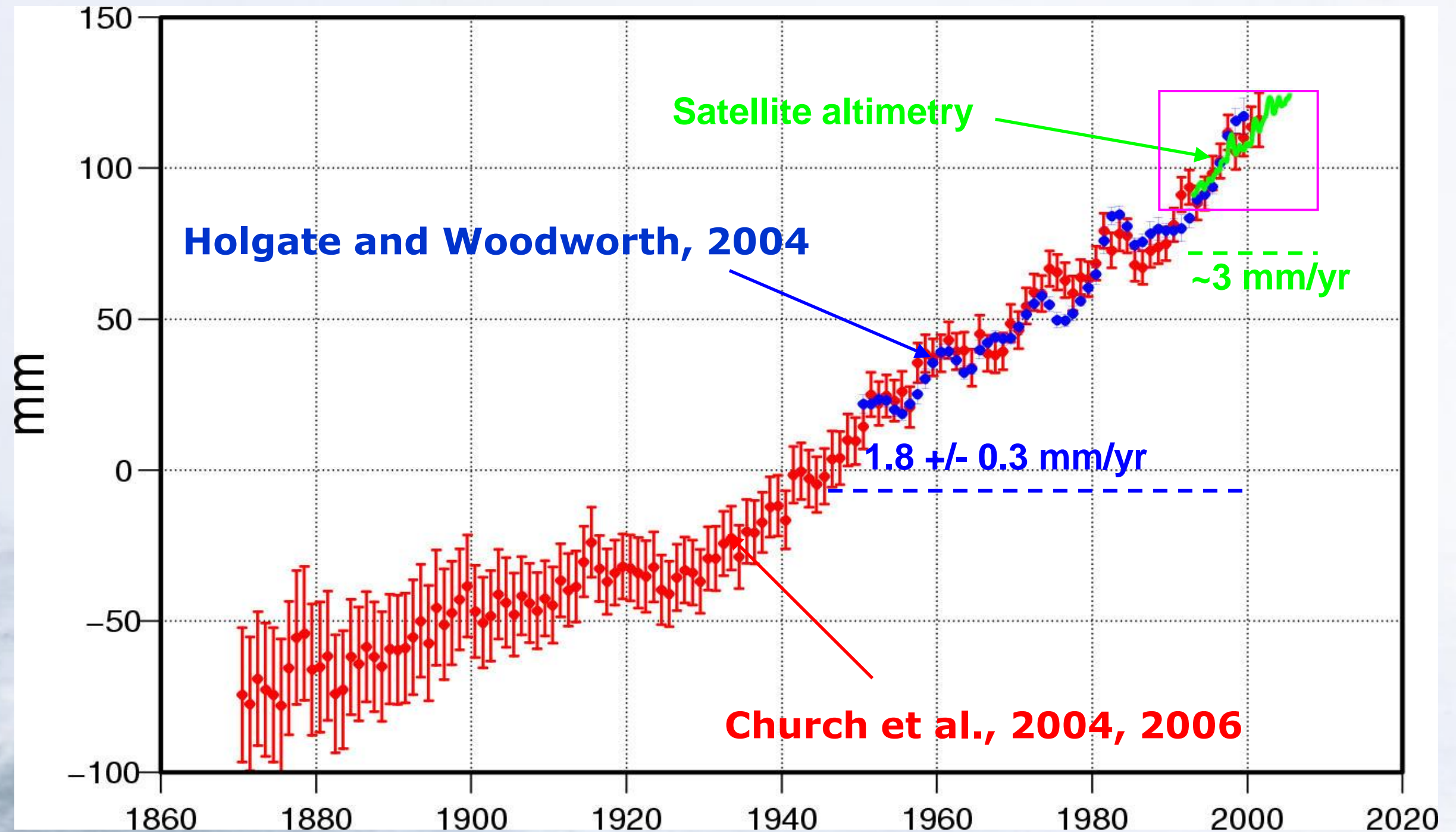
9 Nov 2007



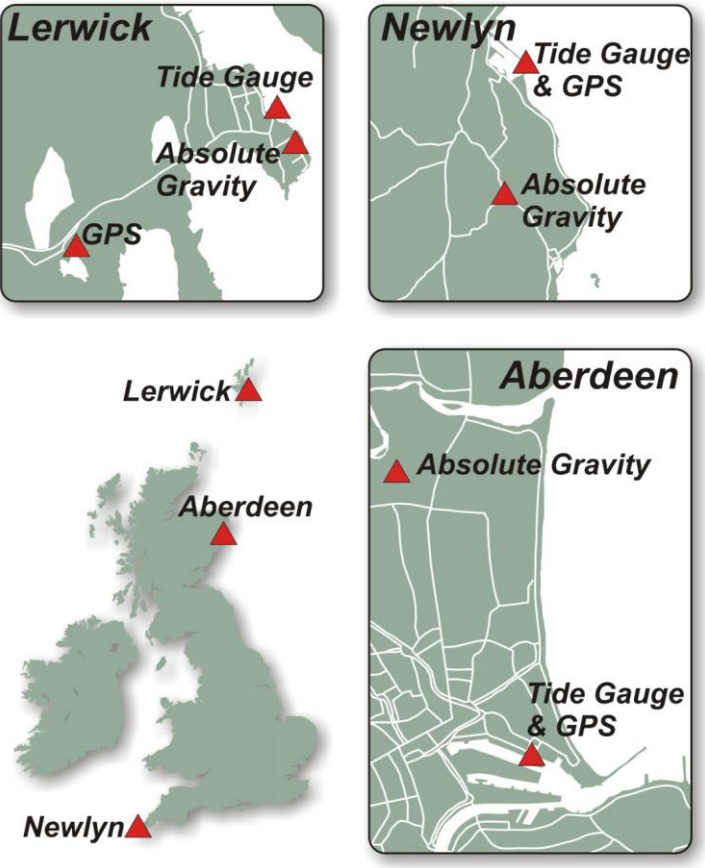
The Permanent Service for Mean Sea Level (since 1933)



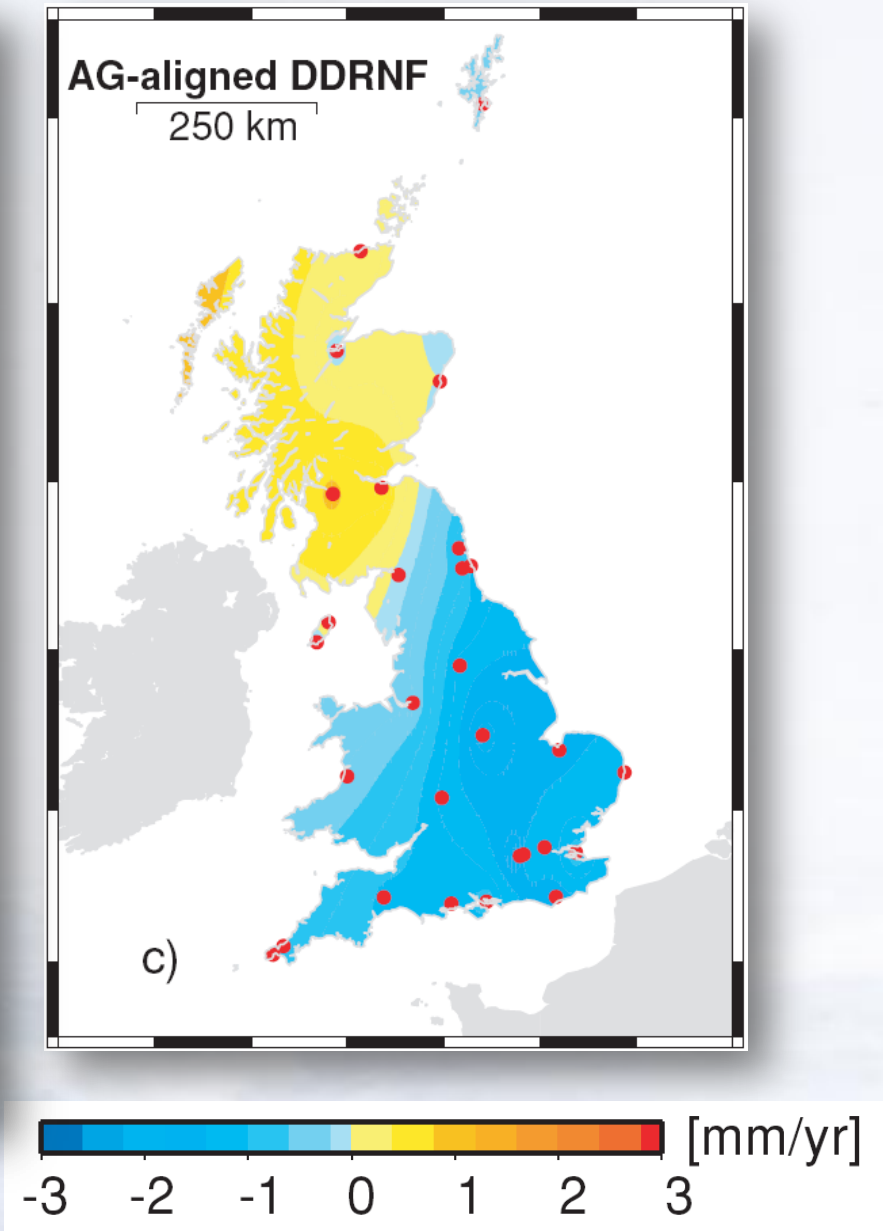
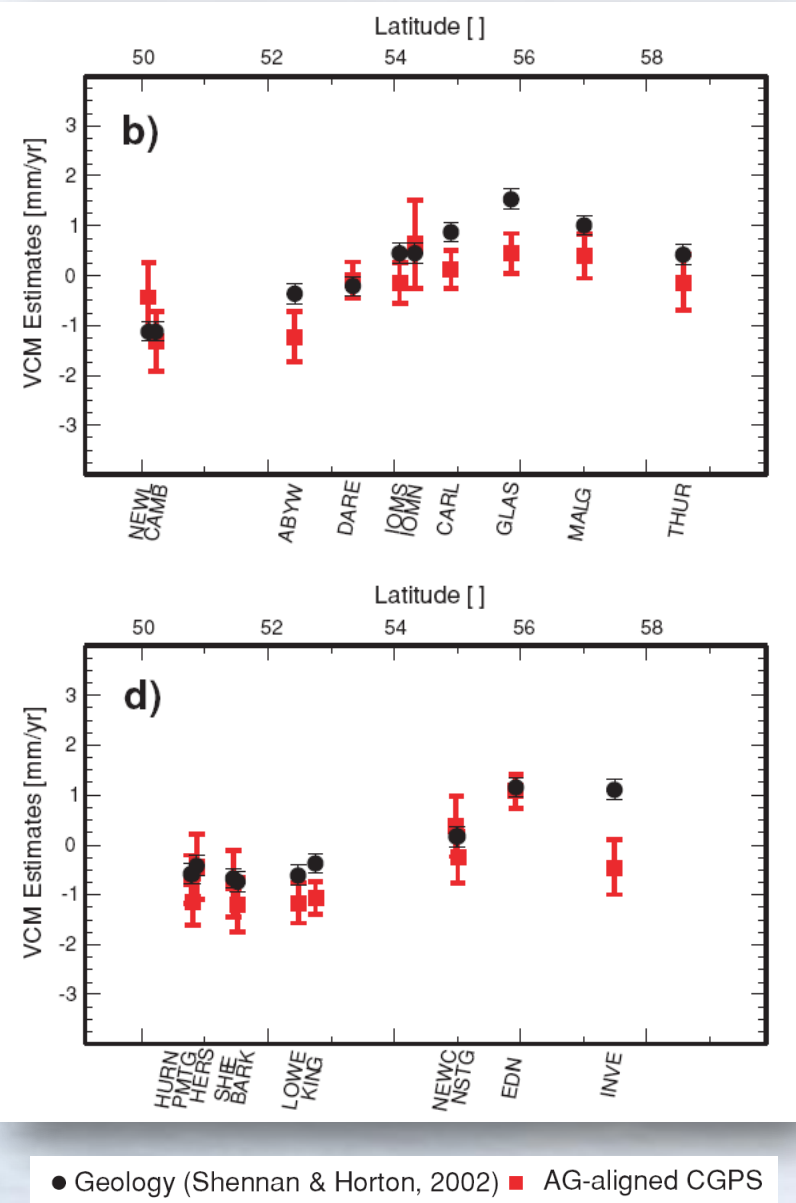
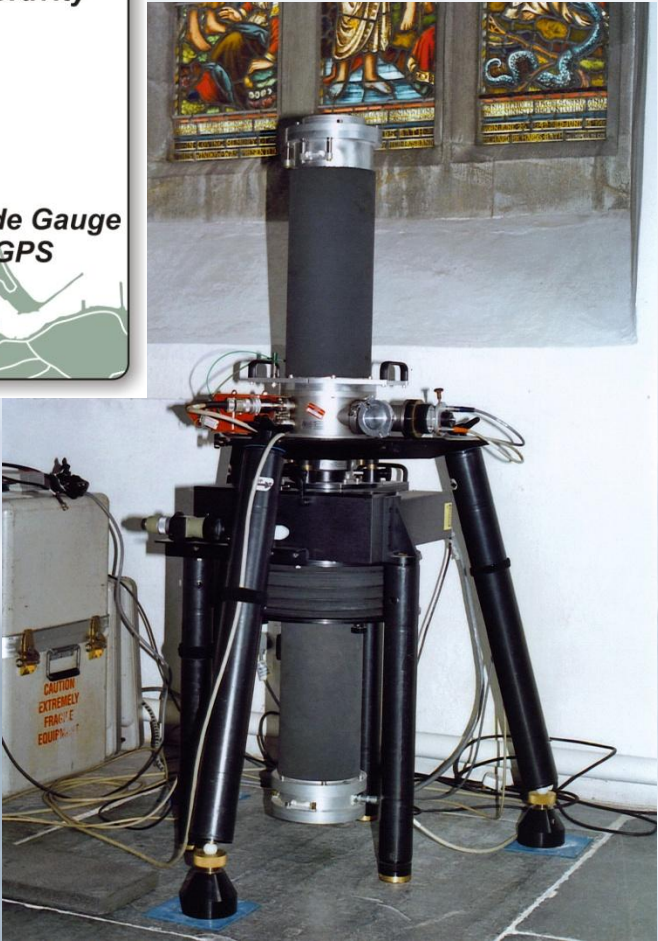
Measurements



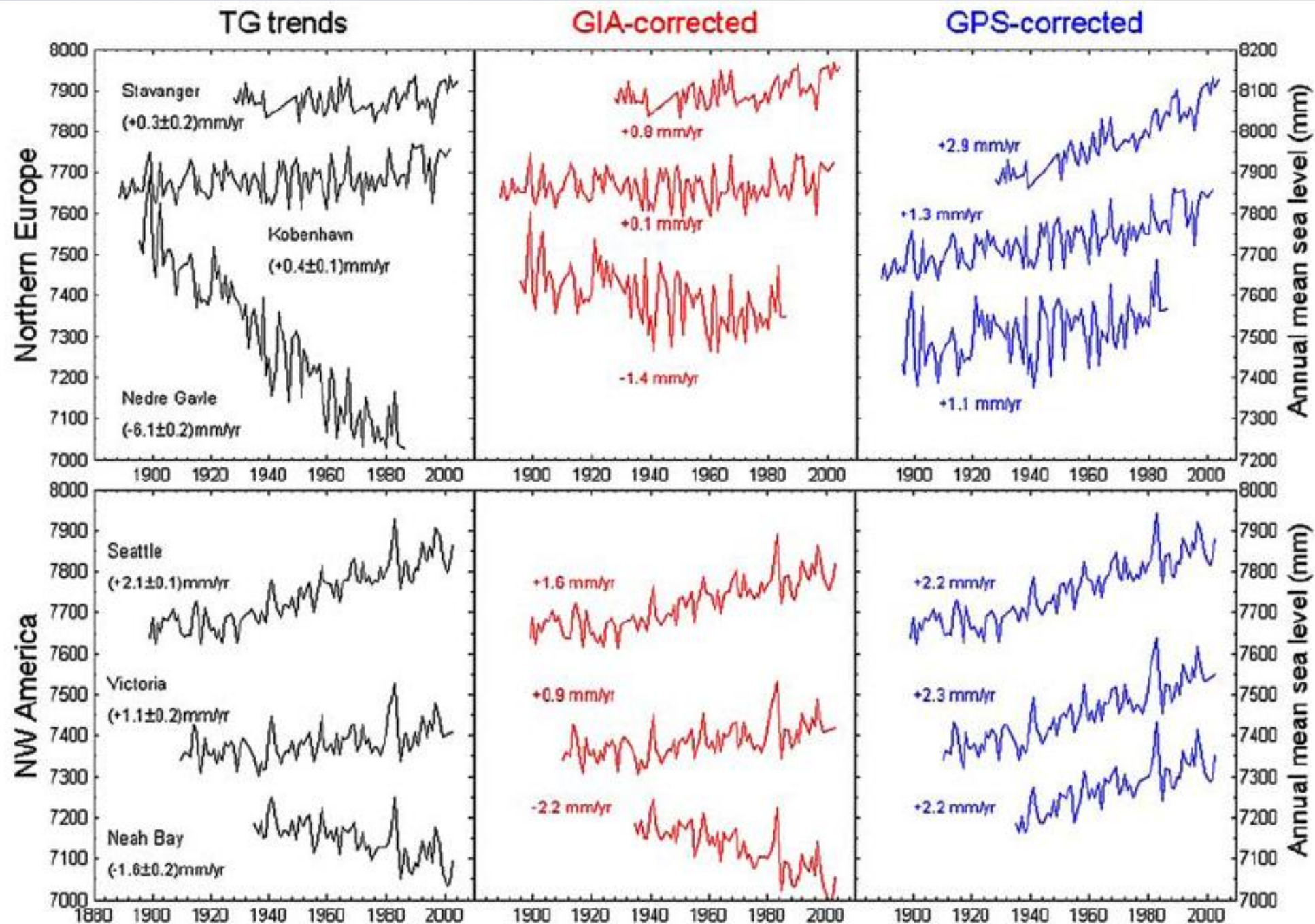
Vertical land movement, GPS and gravity



$10^{-9}g$
accuracy



Vertical land movement: global (with University of La Rochelle)



**Regional
scatter of
trends**

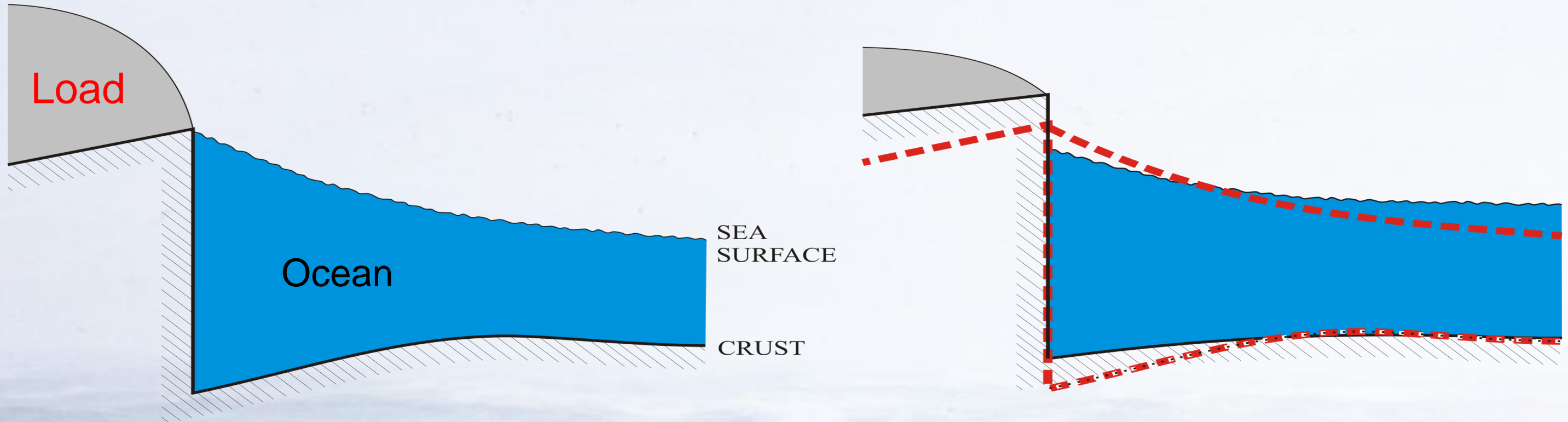
1.37

0.98

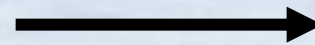
0.62

mm/yr

Vertical land movement and gravity

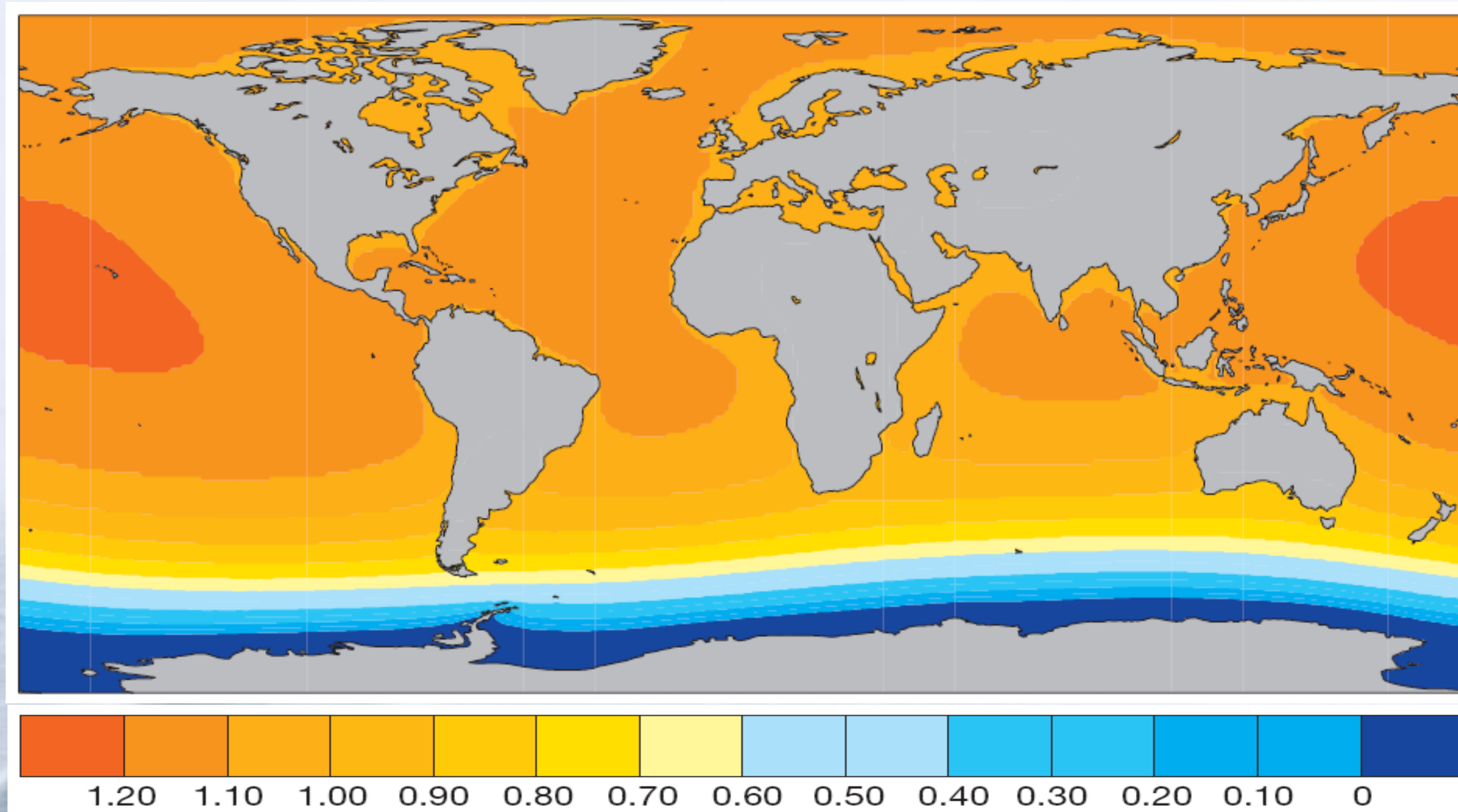


Ice sheet melts
-- or --
River basin loses water

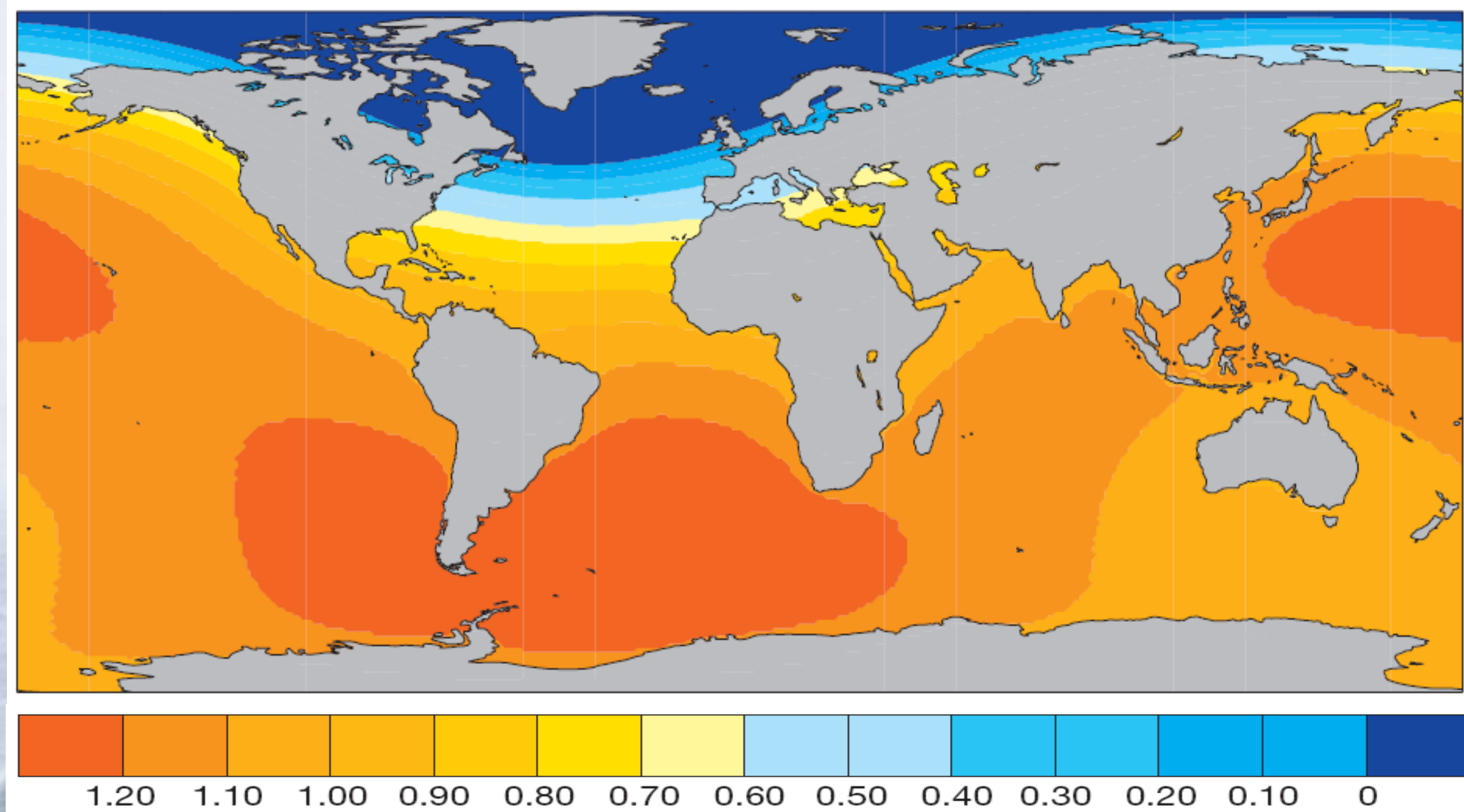


- More water in ocean
- Crust and sea surface adjust to the changing mass load

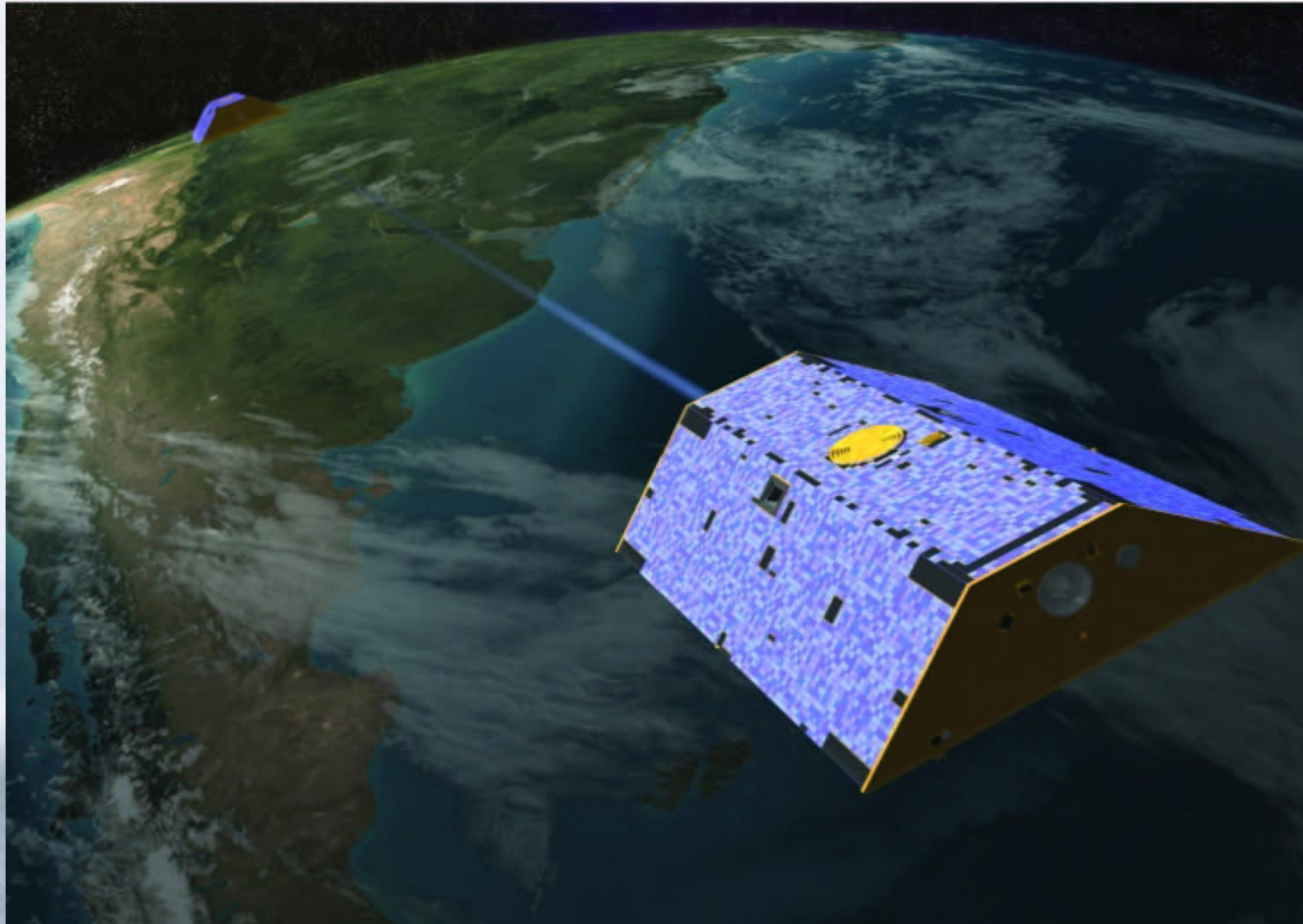
Pattern of sea level rise due to Antarctic melt



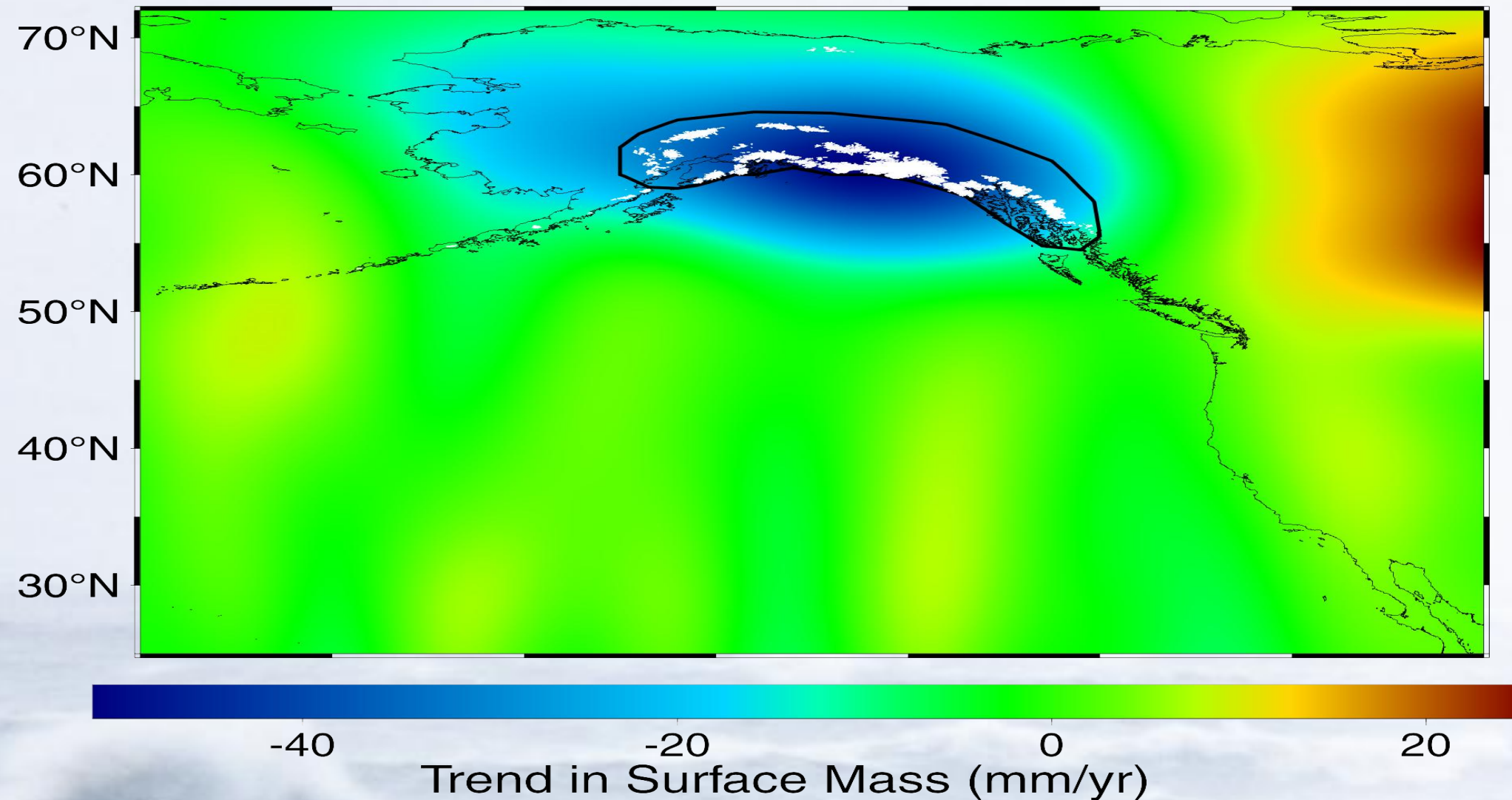
Pattern of sea level rise due to Greenland melt



GRACE – launched March 2002

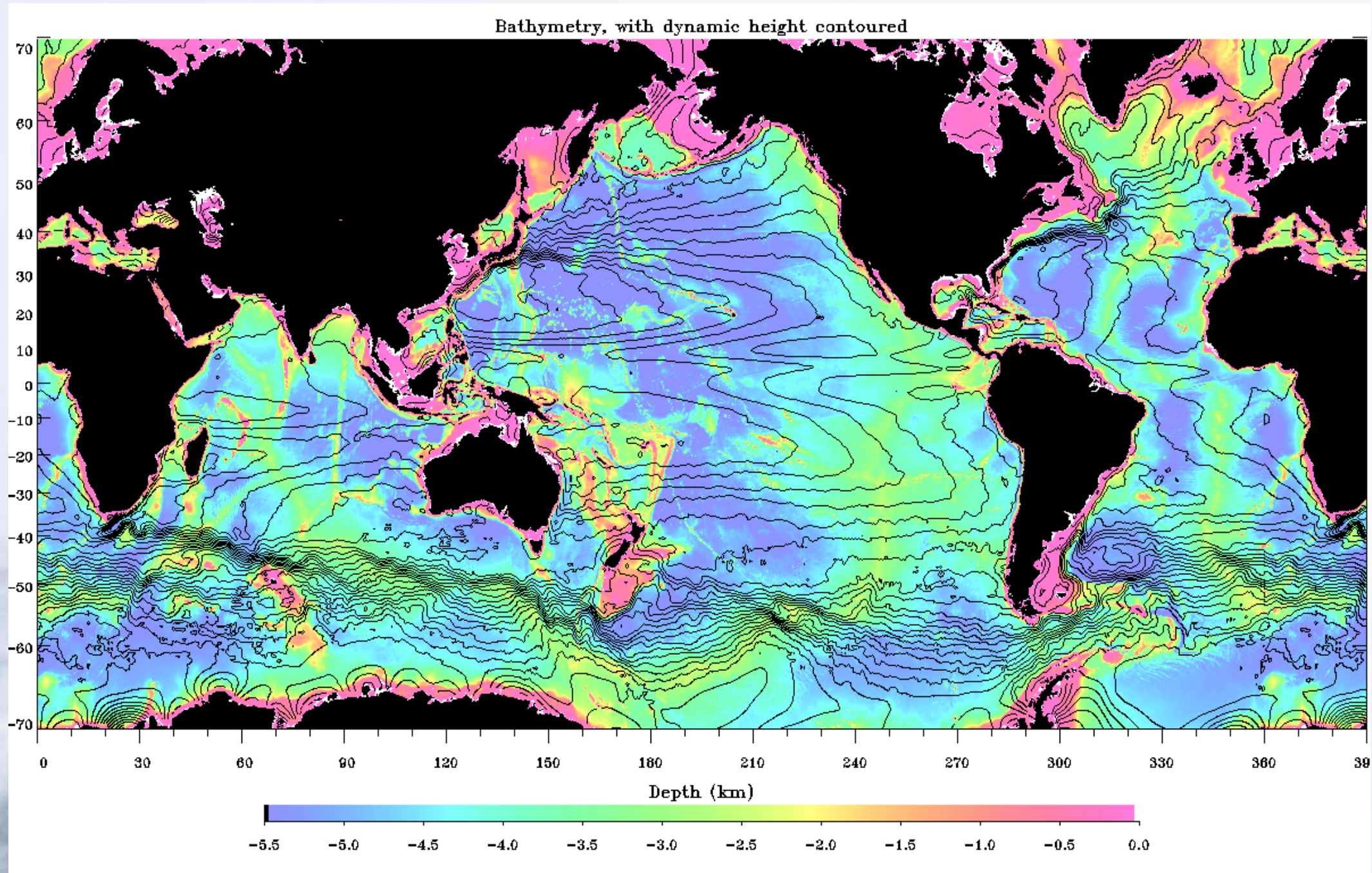


GRACE – melting Alaskan glaciers

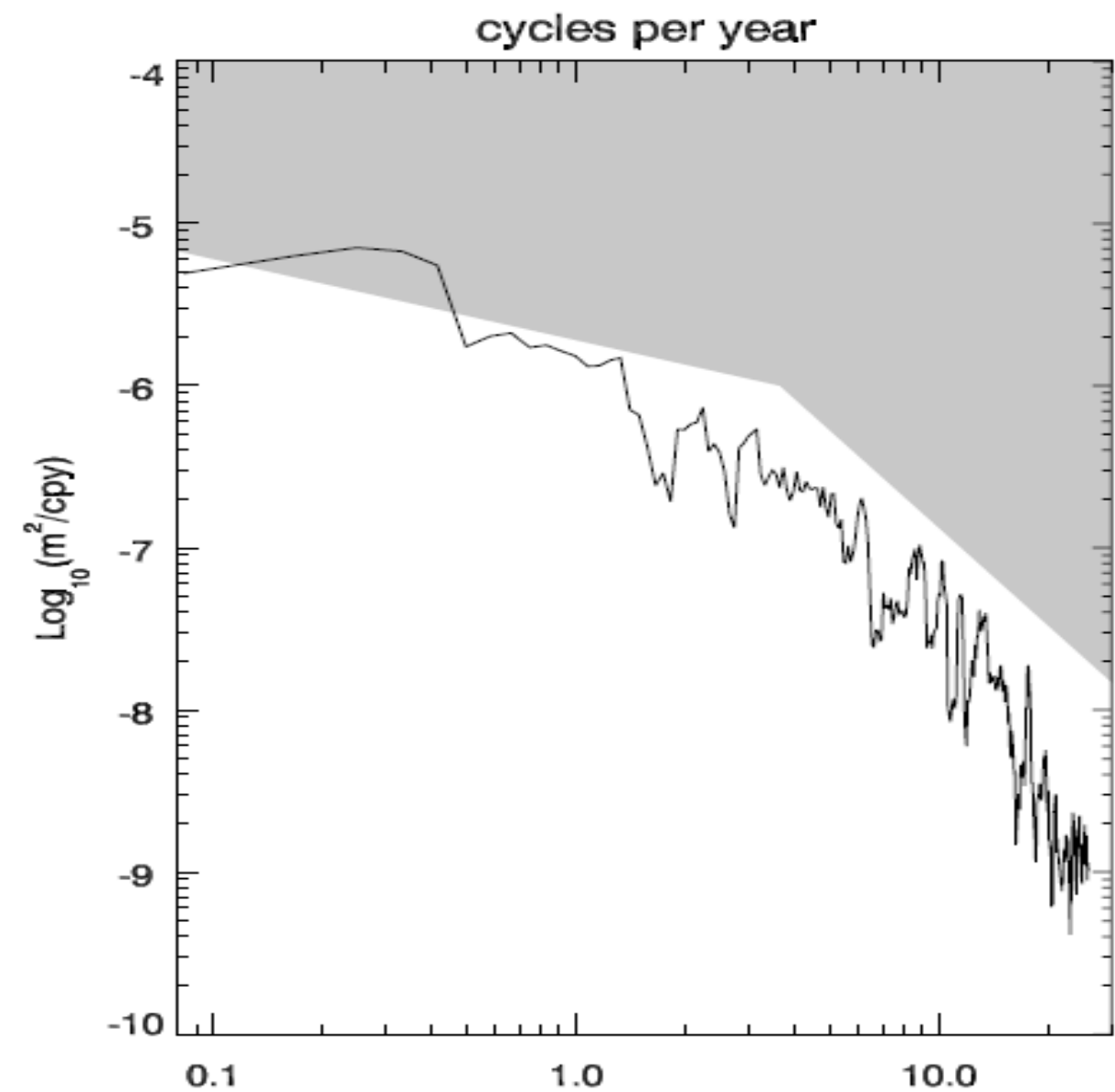
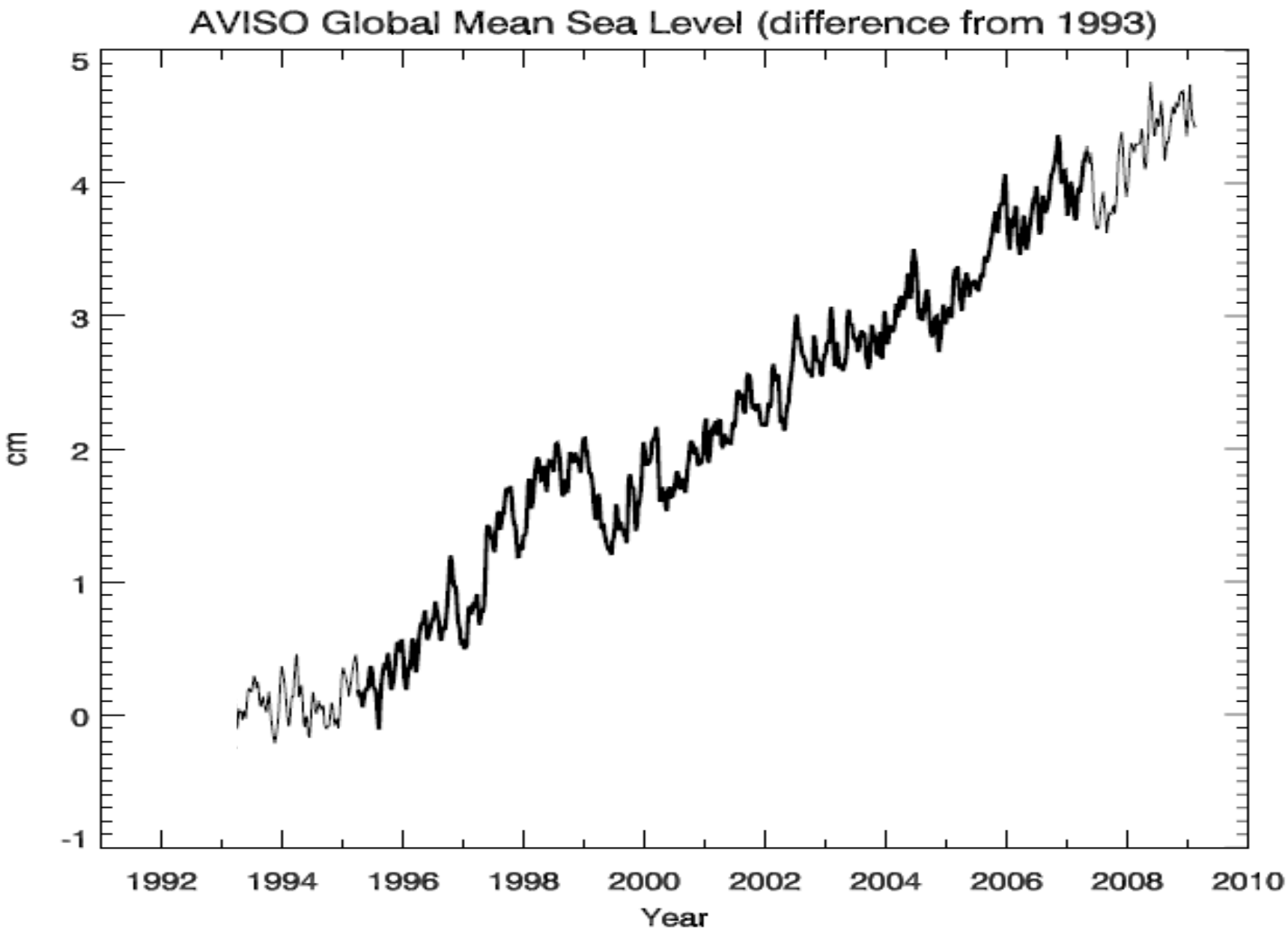


Rate of mass loss from Alaskan glaciers calculated from satellite gravity measurements

Sea level from ocean dynamics



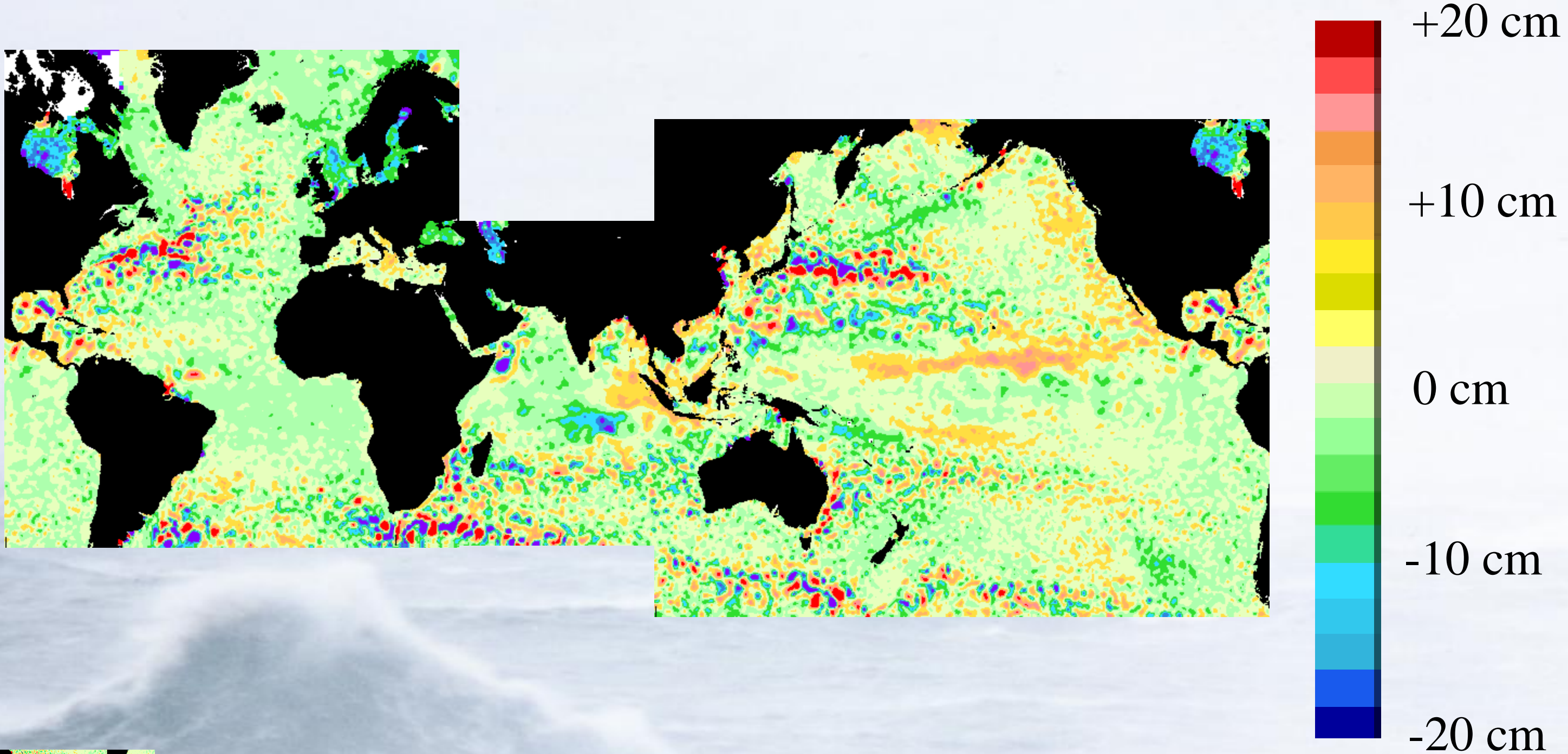
Spectrum of the global mean



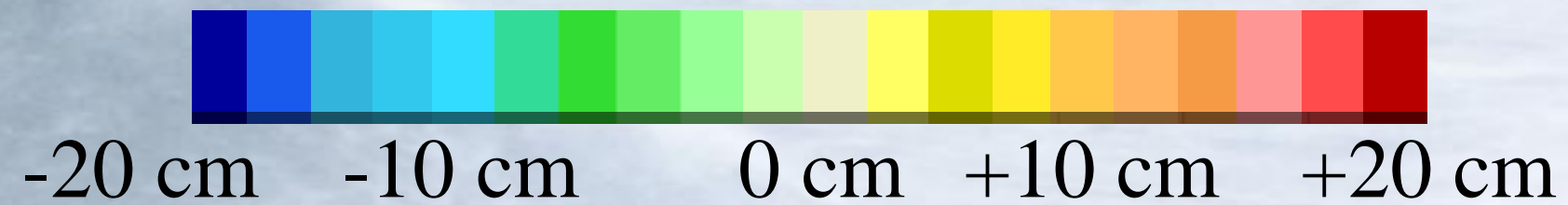
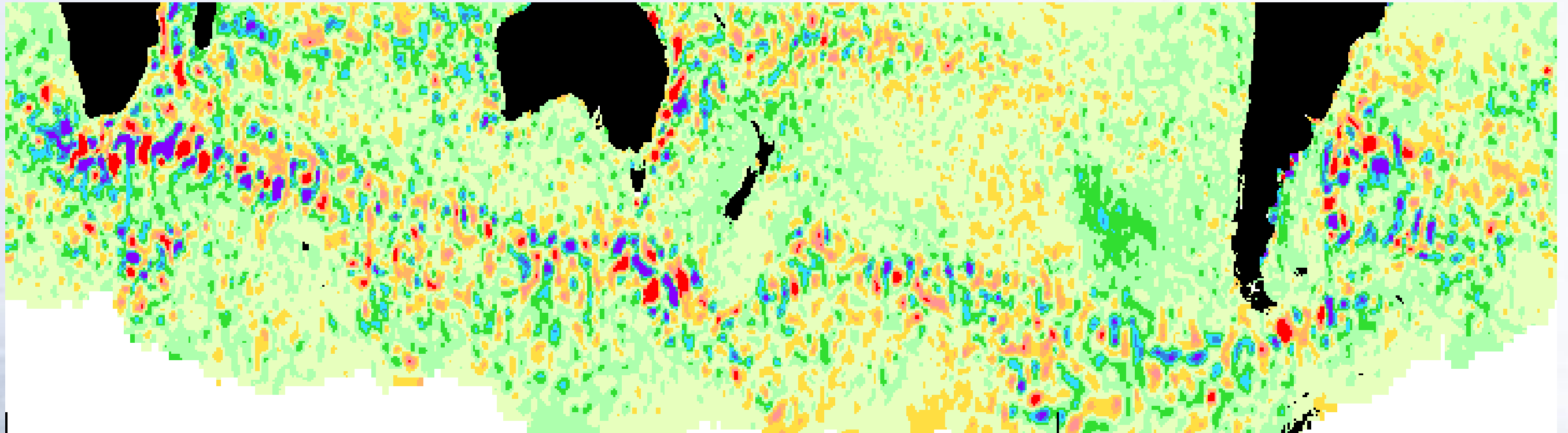
Trend 3.2 mm/yr.

Statistical error: 0.1 mm/yr , systematic error 0.4 mm/yr

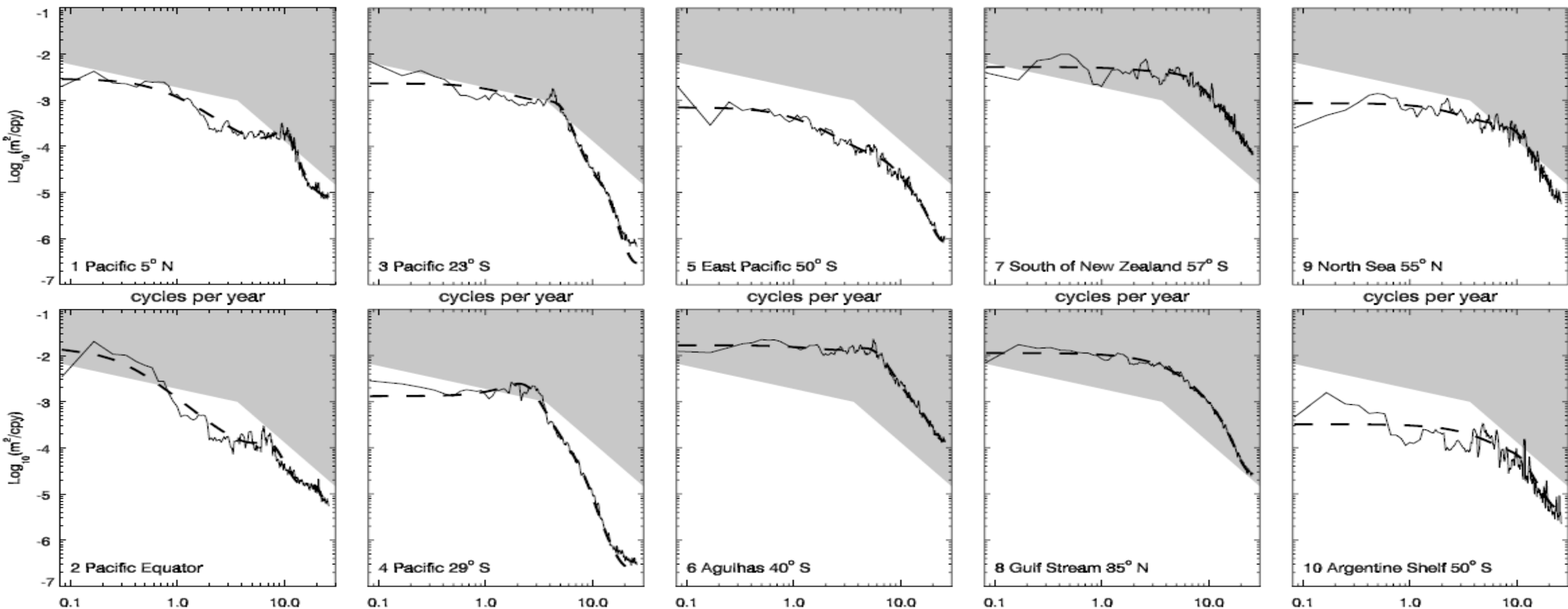
Dynamical variability of sea level



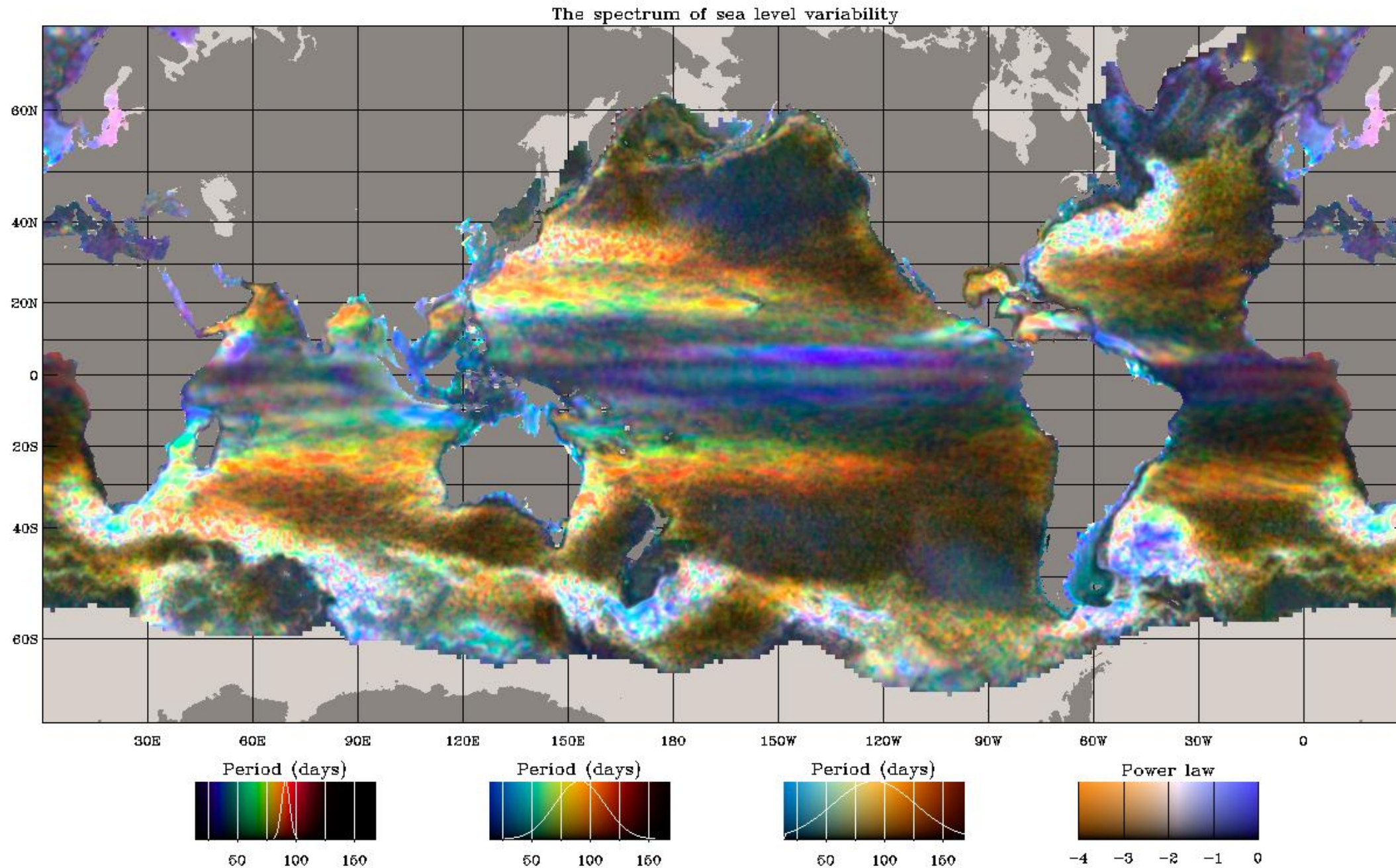
Dynamical variability of sea level



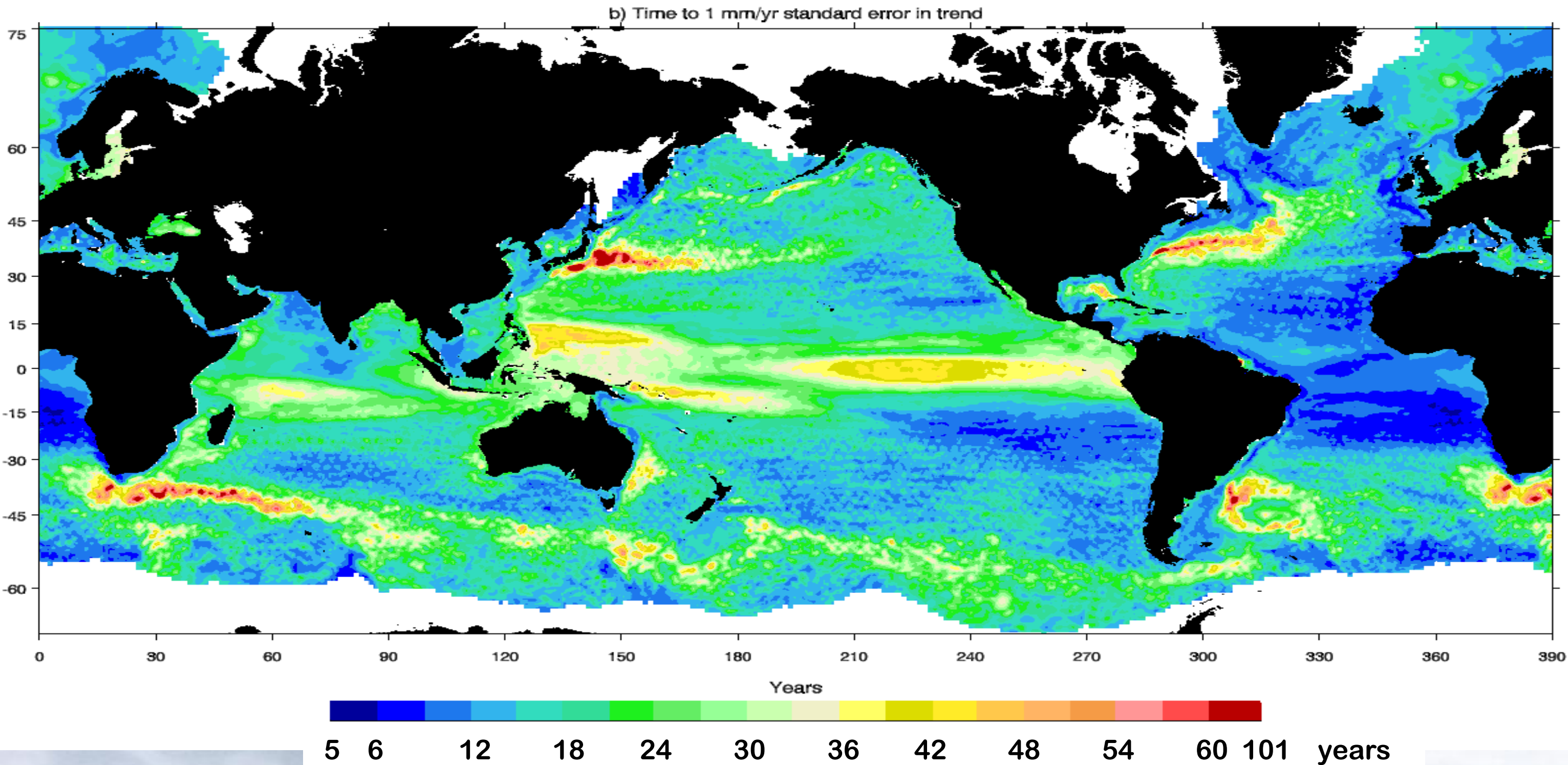
Spectra + AR5 model fit



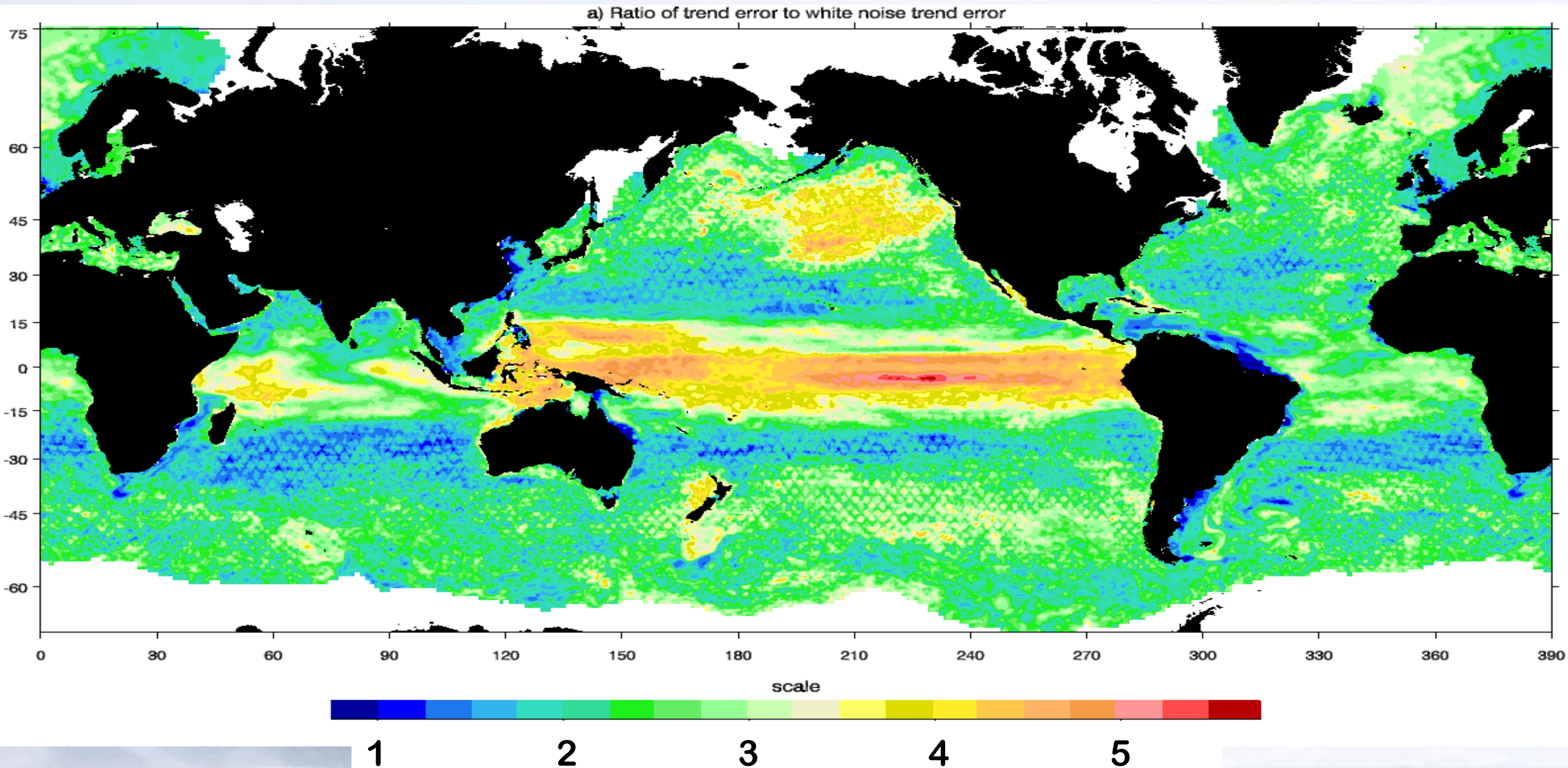
Different frequencies of sea level variability



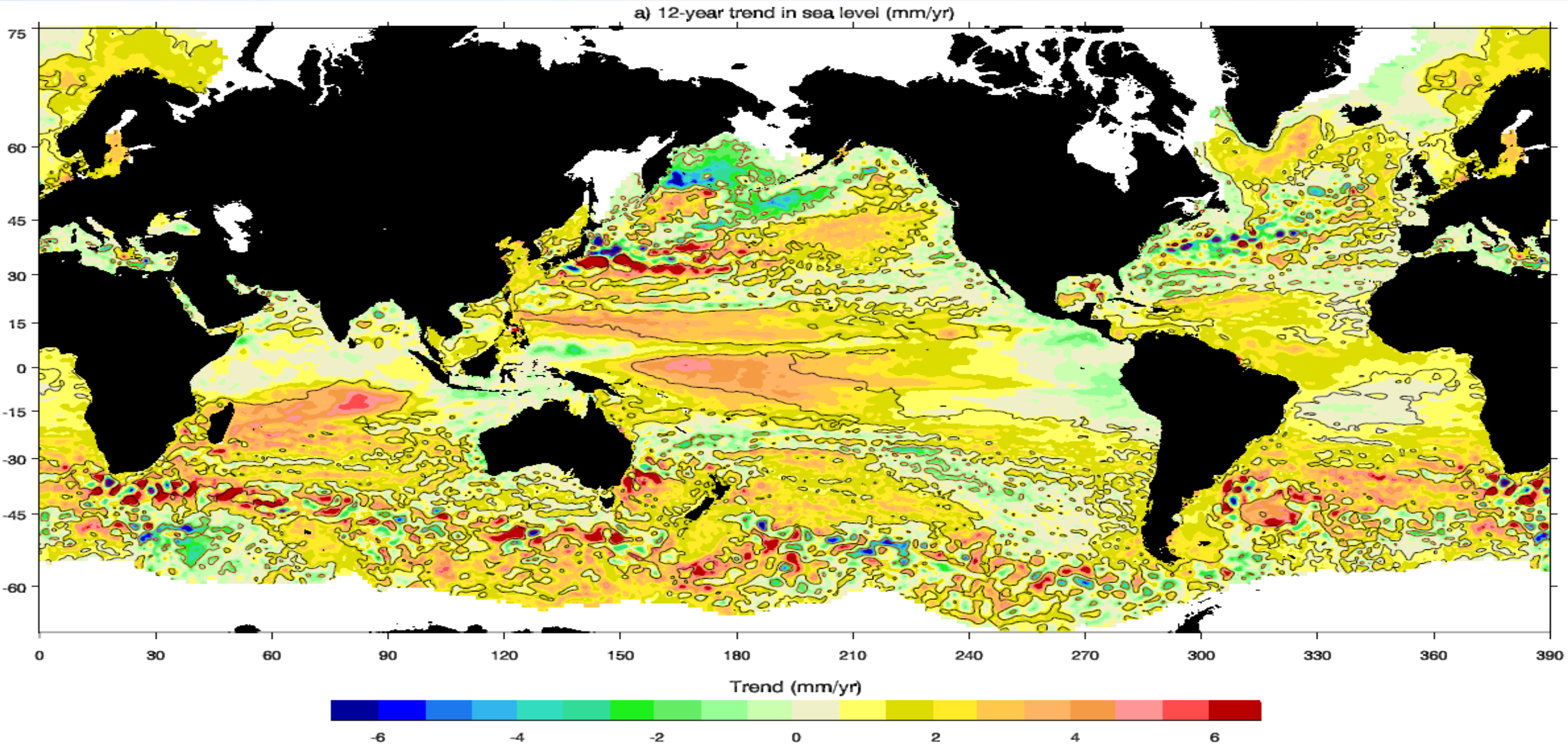
Time needed for error in trend to reduce to 1 mm/yr



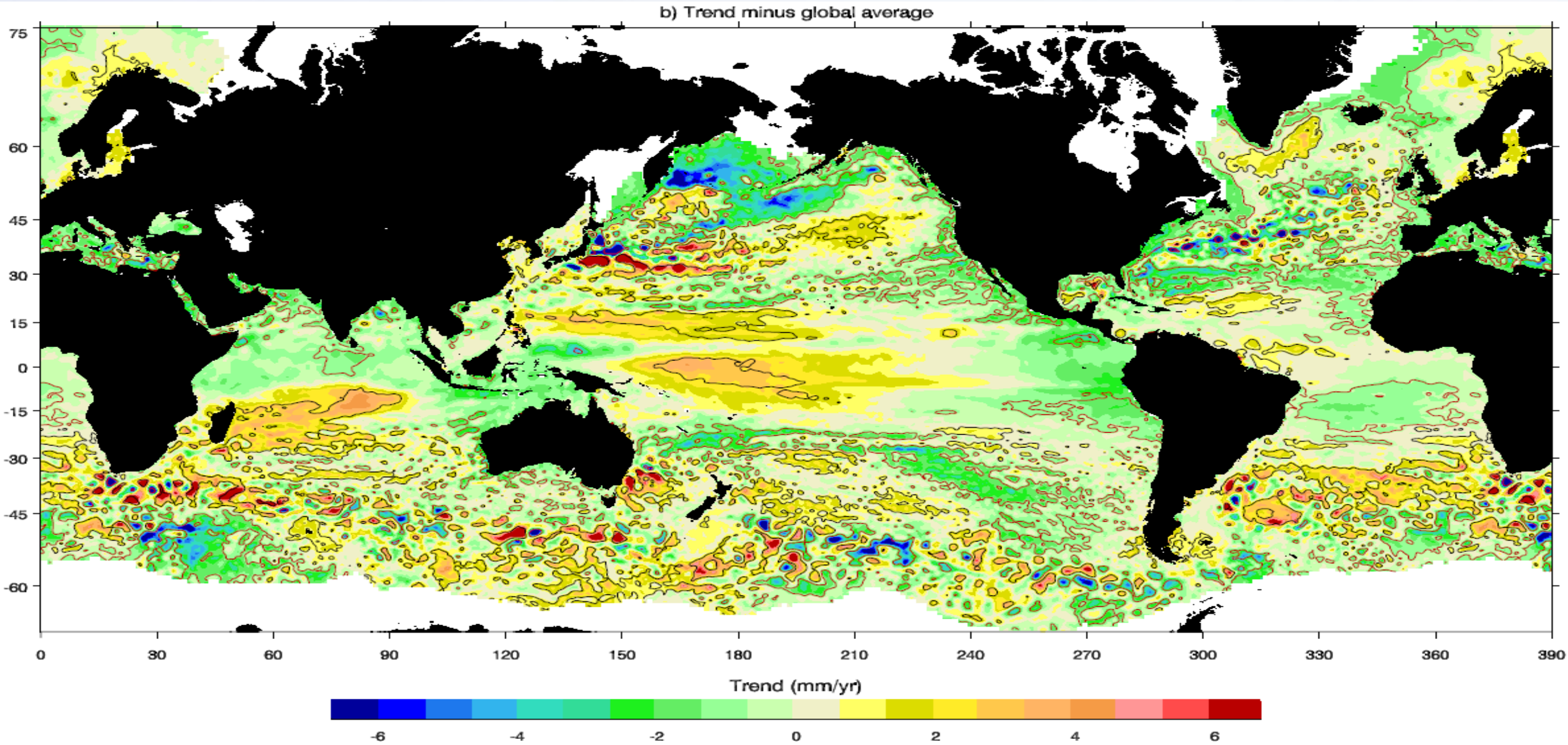
Trend error ratio: True spectrum / white noise



Observed trend, contoured where significant (2σ)



Observed trend, difference from mean



Thank you for your attention

Proudman Oceanographic Laboratory
Joseph Proudman Building
6 Brownlow Street, Liverpool L3 5DA UK

Tel: +44 (0)151 795 4800
enquiries@pol.ac.uk