

# Sea level studies at Institute of Coastal Research, GKSS, Germany



Eduardo Zorita, Ralf Weisse, Birgit Hünicke, Frauke Albrecht and Hans von Storch

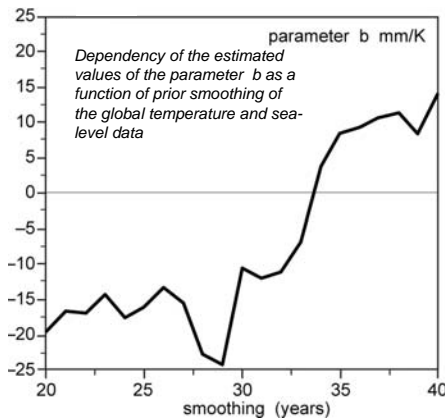
At the Institute of Coastal Research, GKSS Research Center, Germany, two different lines of analysis are conducted with respect to sea level:

- 1) Critical analysis of reconstructions of past sea level, and of empirical models designed to derive scenarios of possible future sea level change
- 2) Analysis and scenarios of ongoing and possible future sea level rise along the coasts of the North Sea and of the Baltic Sea.

Critical examination of empirical schemes to project future global mean sea level, e.g.:

$$dH/dt = r + a T + b dT/dt$$

Parameters  $r$ ,  $a$  and  $b$  are estimated from 1880-2000 time series of reconstructions of GMSL.



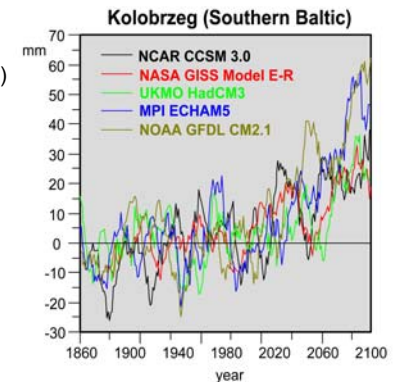
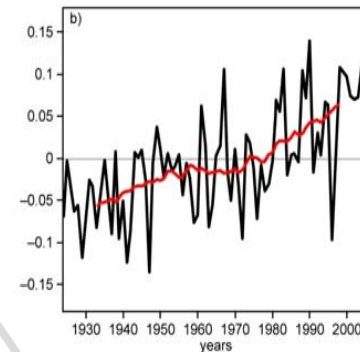
1. Strongly smoothed - at most 8 independent samples are available.
2.  $b$  is negative, meaning that rising temperatures would be associated with declining sea-level rise
3.  $b$  is very sensitive to the prior smoothing of the time series, turning from negative to positive roughly at the time scale of 30 years (see figure on the left)
4. Would another form of the this model (e.g., replacing the temperature derivative by a weakly non-linear term) fit the observations equally good and yet project significantly different long-term futures?

A test of the performance of estimating of the long-term (century) trends can be obtained with the 'perfect model approach' by sub-sampling the output of a coupled model simulations mimicking the availability of observational records. As an example, the figure on the left shows the estimated global sea-level in a millennial climate simulation, together with the hypothetical estimation from a sub-sampled local data mimicking the availability of long-term tide gauges. The sub-sampling generates an underestimation of the rate of sea-level change in historical times, and an overestimate in the 20th century.

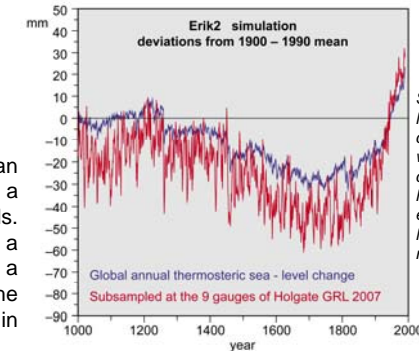
## Regional changes of sea level in the North Sea and Baltic Sea

1. Long records available in the German Bight, but mostly contaminated by non-climatic signals in ports and estuaries; long records in the Baltic reflect mostly isostatic changes.
2. Increase of about 20 cm/100 a in the North Sea.
3. No robust recent acceleration identified so far
4. Baltic Sea sea level variations strongly correlated with atmospheric circulation (north) and precipitation (south) variations

Estimated regional mean sea level (time series of the leading EOF mode of annual mean RMSL) in the German Bight – in red: 19-year moving average. Units: m



Estimation of the contribution of precipitation changes to future winter sea-level change for a tide gauge station in the southern Baltic Sea. Data from five different IPCC GCM climate simulations driven by SRES scenarios A2 were employed.



Simulated sea-level in a millennial climate simulation with a GCM (blue) compared to a hypothetical estimation from a limited tide gauge network (red)