Detecting acceleration in long time series of Baltic sea level

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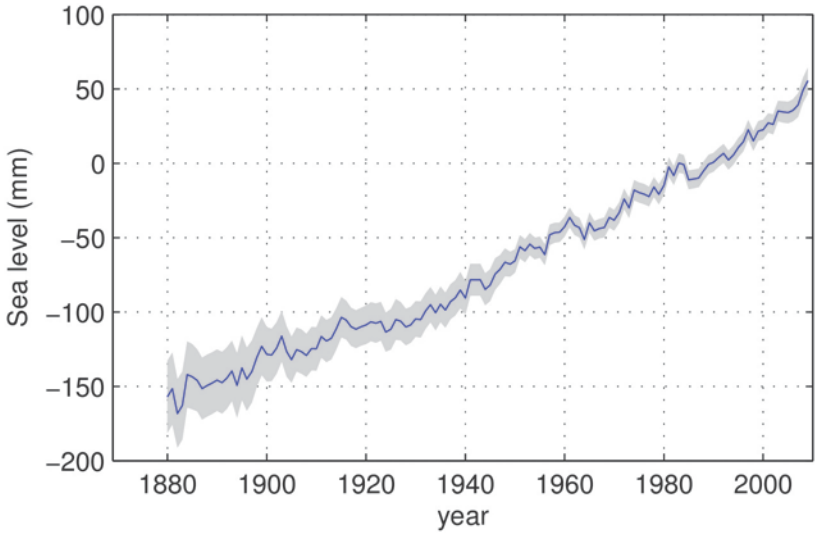
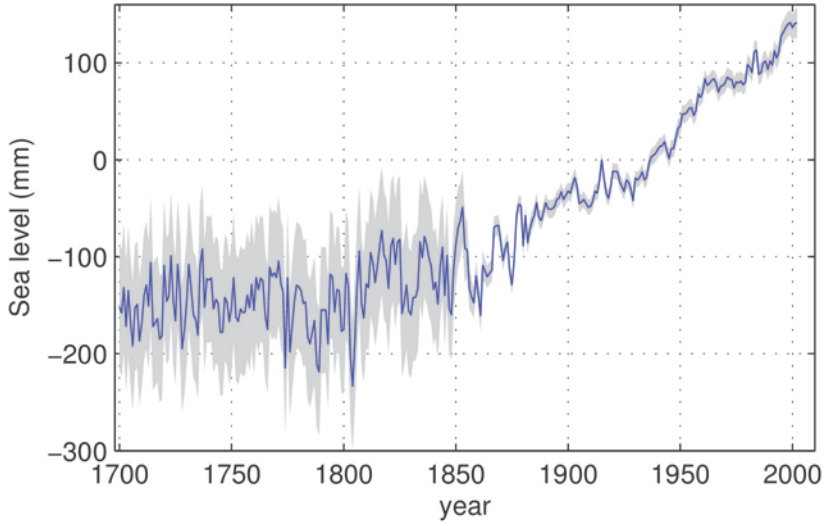
20th century global annual mean sea level ~1.8 mm/year

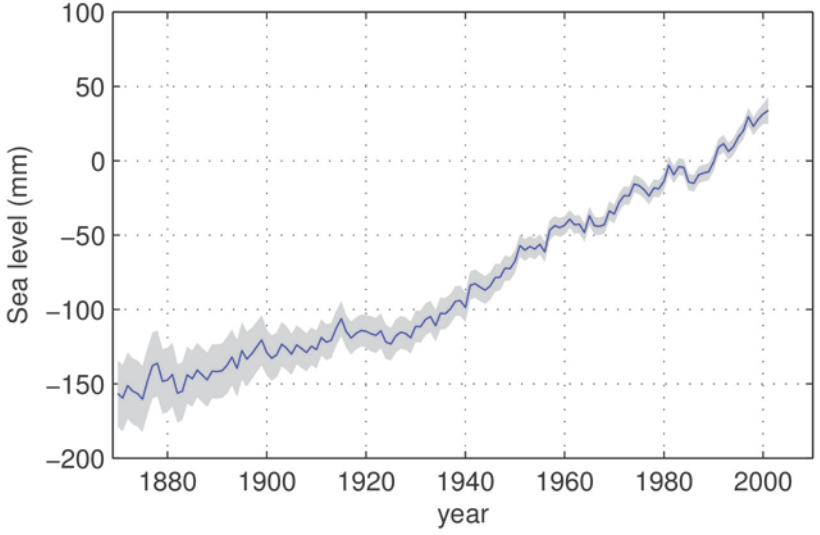
Church and White 2011



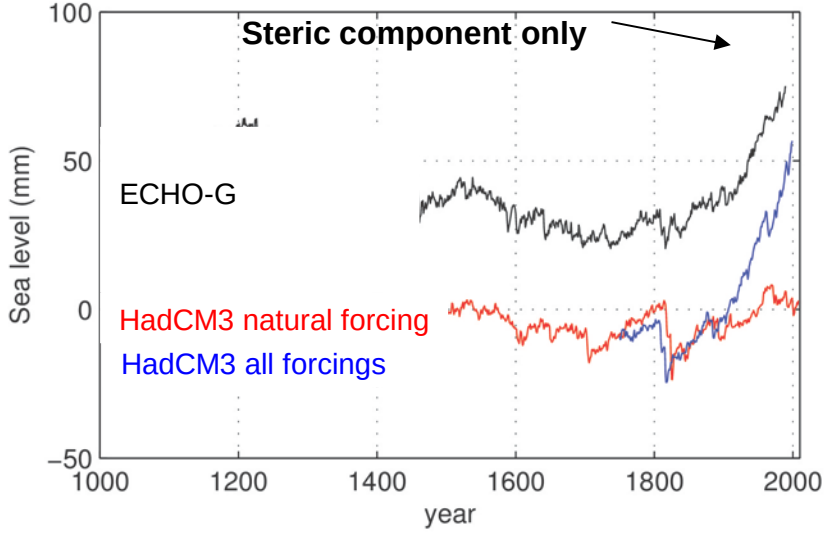
Jevrejeva et al 2008

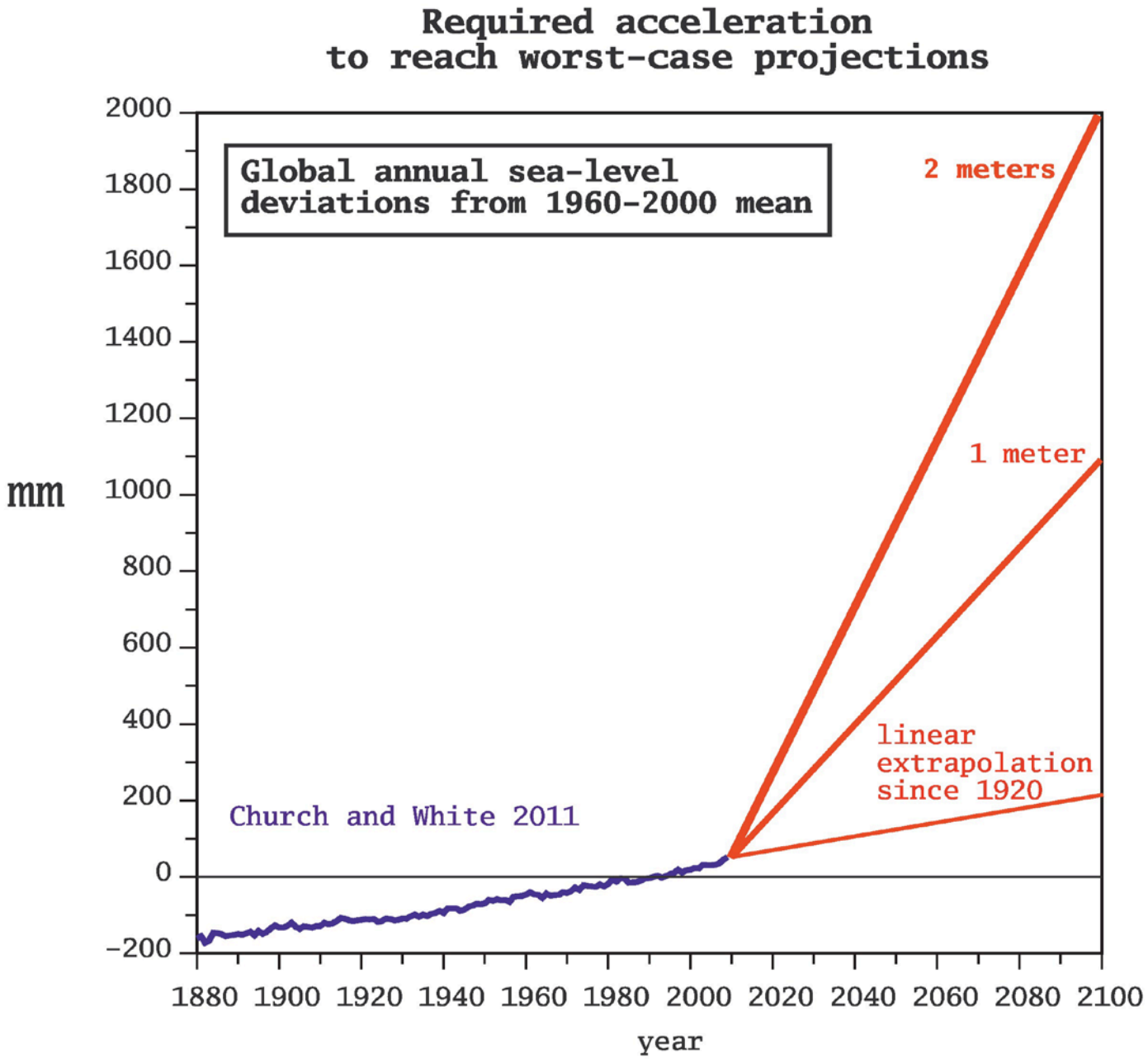


Church and White 2006



OAGCM long-term simulations




Required acceleration
to reach worst-case projections
Global annual sea-level
deviations from 1960-2000 mean
2 meters
1 meter
linear
extrapolation
since 1920
Church and White 2011
mm
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-200
1880 1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100
year

Global acceleration does not necessarily mean Baltic acceleration

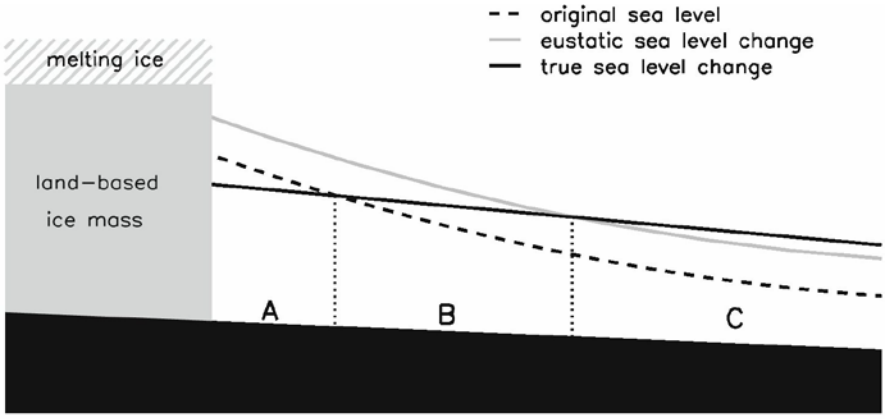
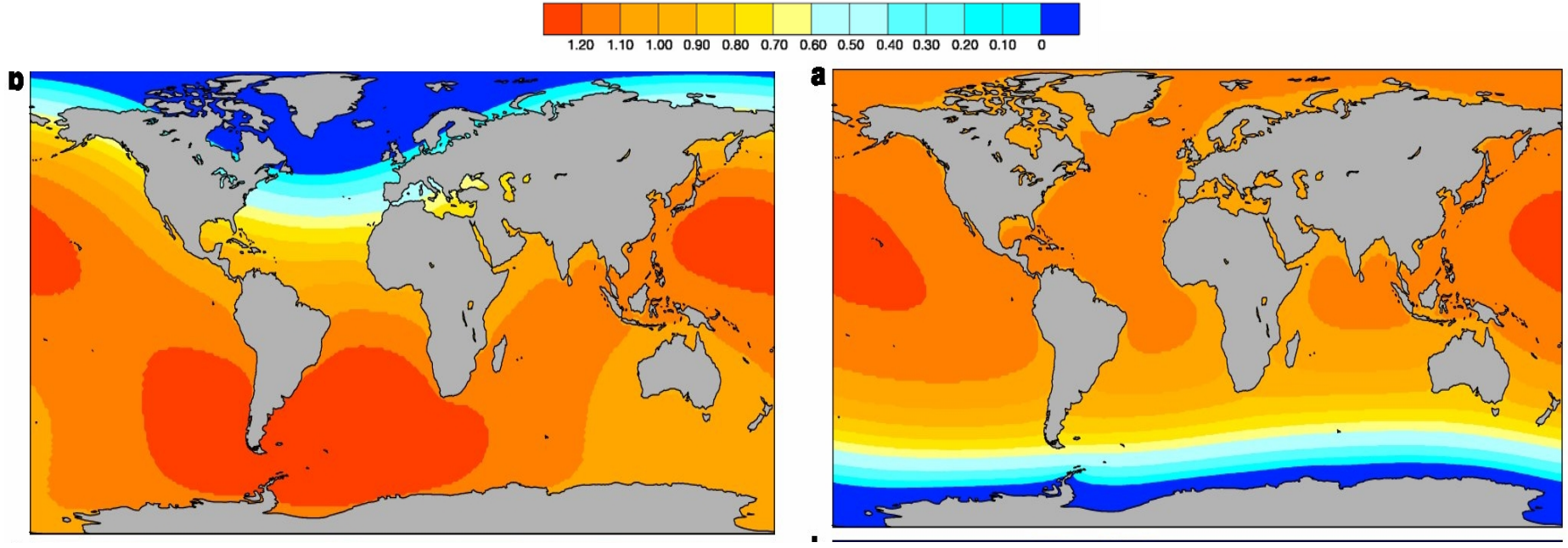
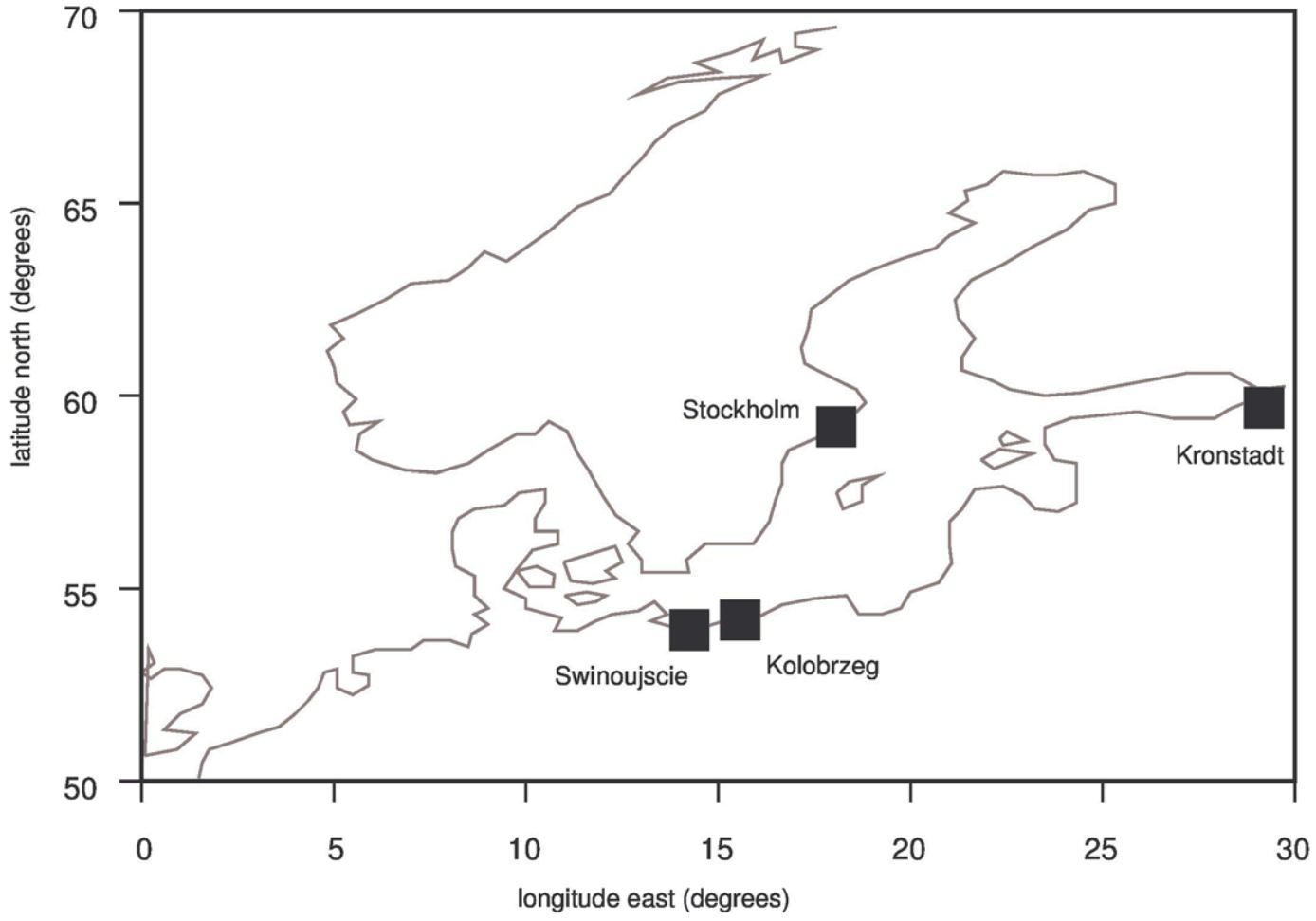


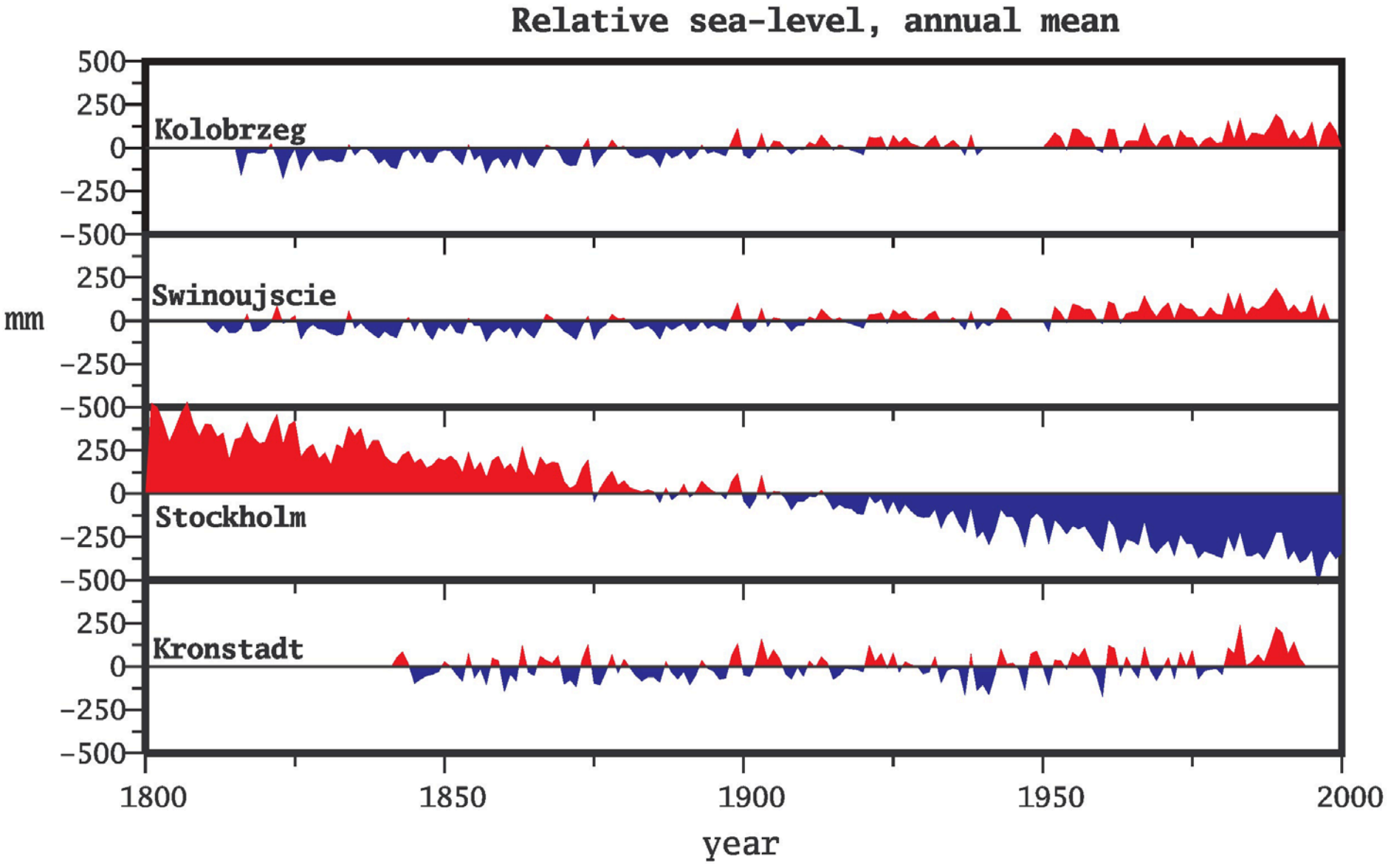
Fig. 6 Illustration of the effect of gravity changes on local sea level induced by a shrinking land-based ice mass

Sea level 'gain factor'
due to modified gravitational field
(Mitrovica, 2001)

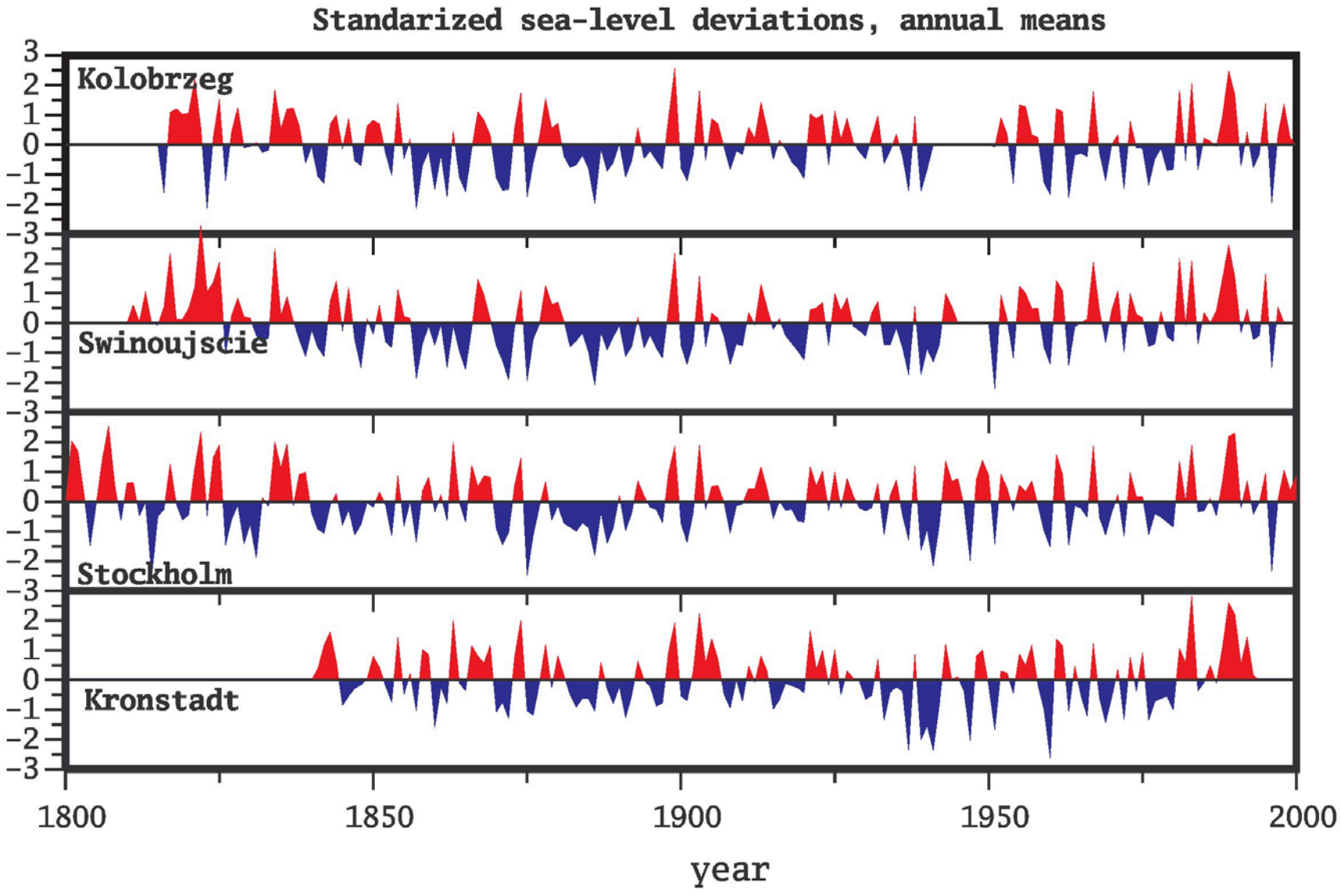


Analysis of four long tide-gauge records




Relative sea-level, annual mean
Kolobrzeg
Swinoujscie
Stockholm
Kronstadt
mm
500
250
0
-250
-500
1800
1850
1900
1950
2000
year

Linearly detrended and standararized to unit standard deviation



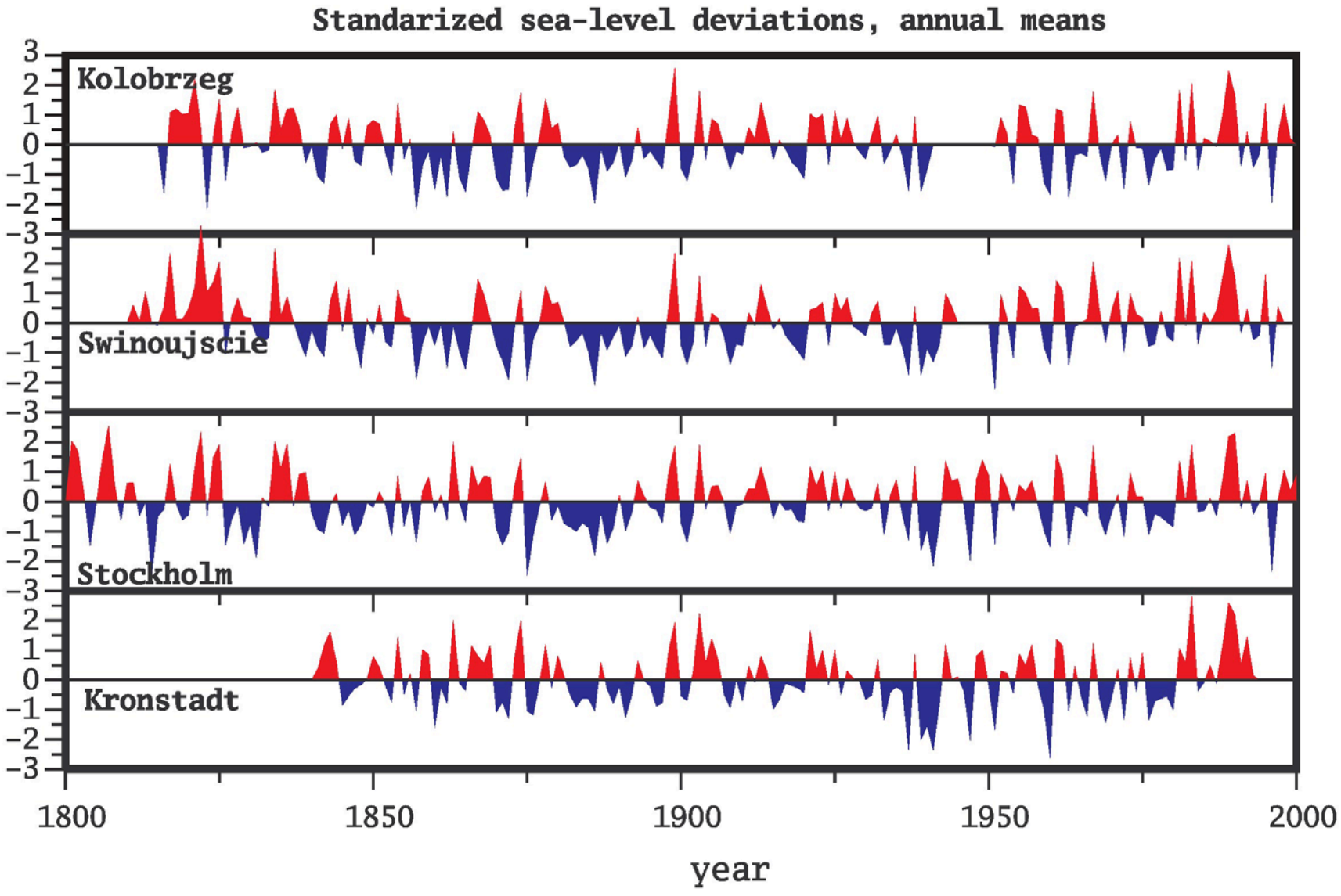
Methods to define (detect) acceleration of sea-level rise (1)

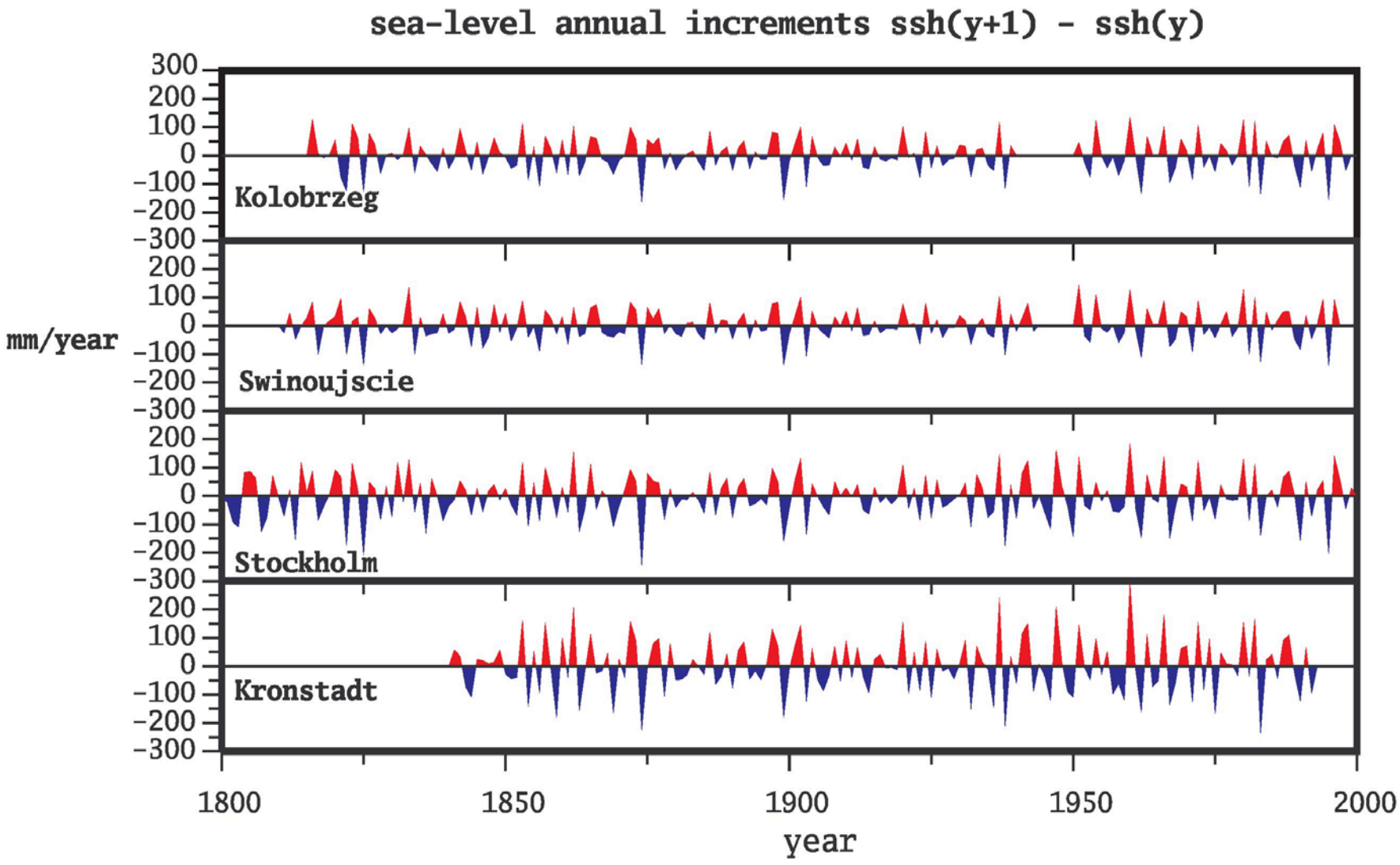
- Examine the annual increments ('time derivatives') ssh(y+1) - ssh (t).

- An acceleration will cause these increments to become larger over time

- Test the presence of a trend in the increments, e.g. with the non-parametric Mann-Kendall test

Linearly detrended and standardized to unit standard deviation

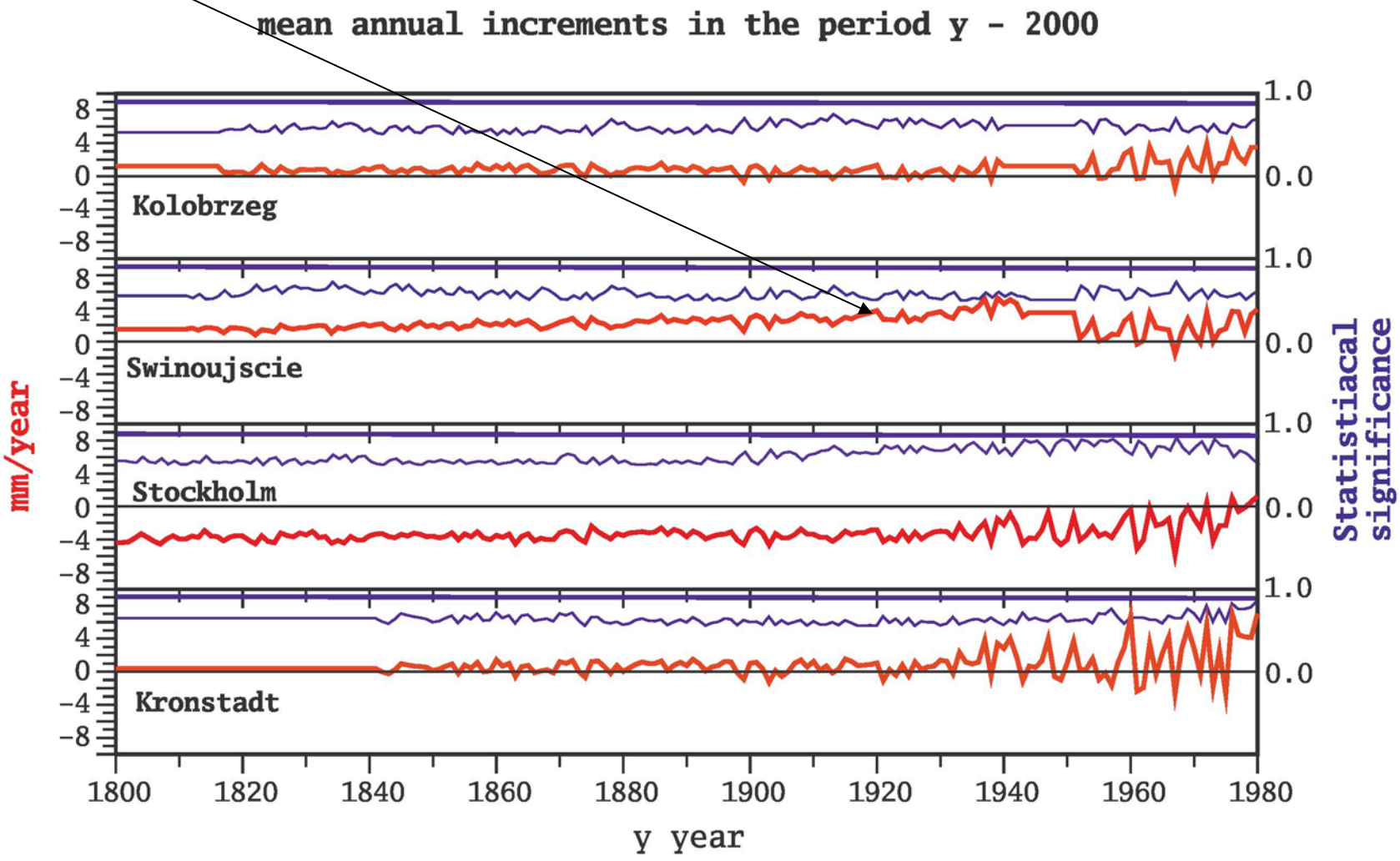




No long- term linear trend

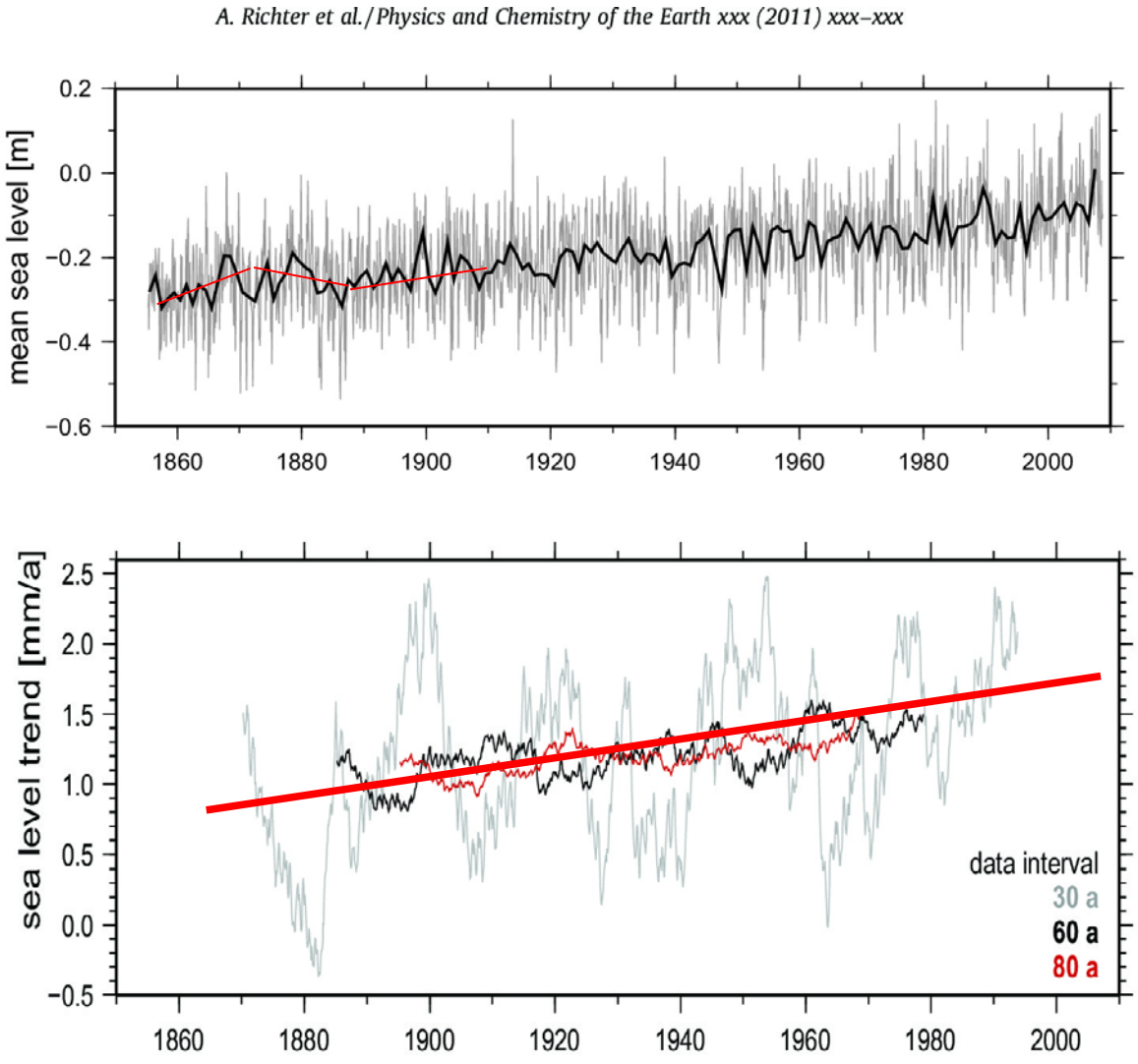
Acceleration may be present only in the recent decades

Mean annual increment in 1920-2000

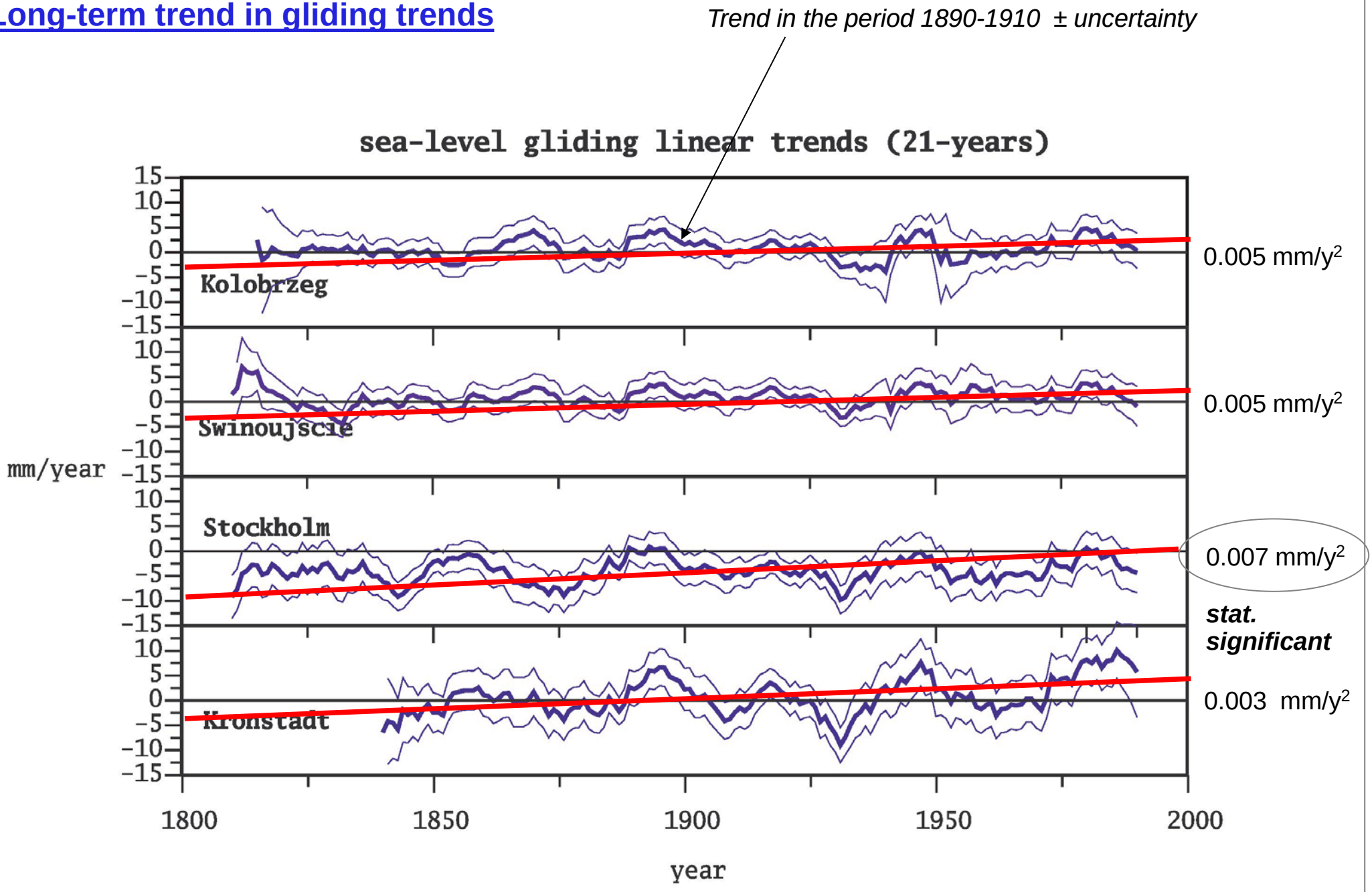


Methods to define (detect) acceleration of sea-level rise (2)

Examine the gliding decadal trends



Long-term trend in gliding trends



Conclusions

In these four long Baltic Sea level records:

- Slightly positive acceleration can be estimated

- It is not clearly statistically significant

-Only Stockholm, among these four records, shows a statistically robust acceleration.

- Its magnitude amounts to additional 10 cm by 2100

Thank you !