Unraveling the signals of sea level and storminess in the southern North Sea of the past millennium

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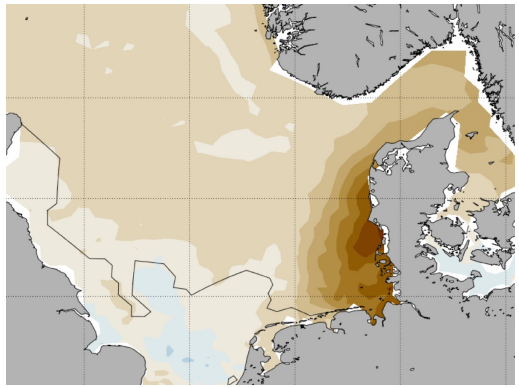
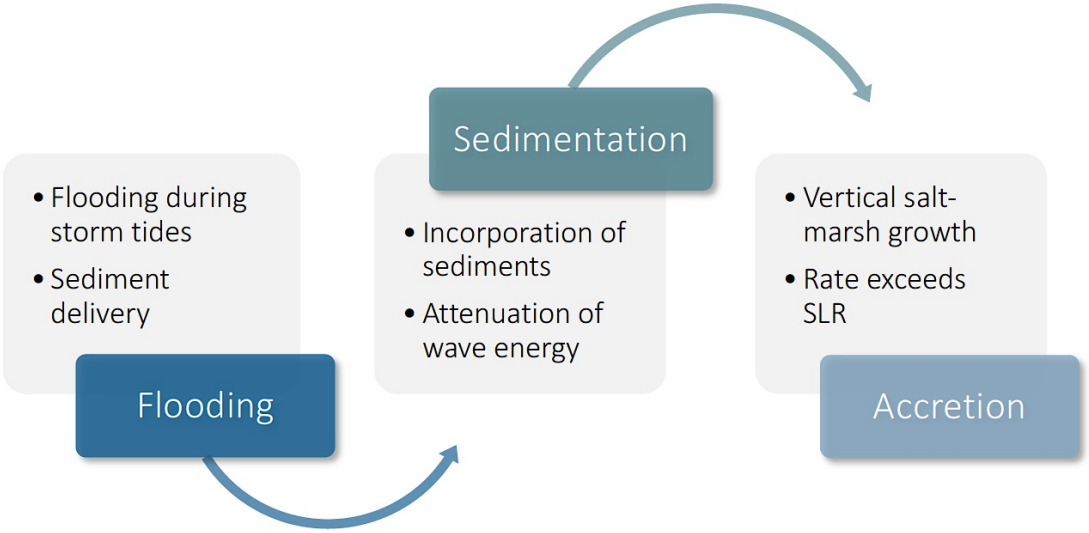
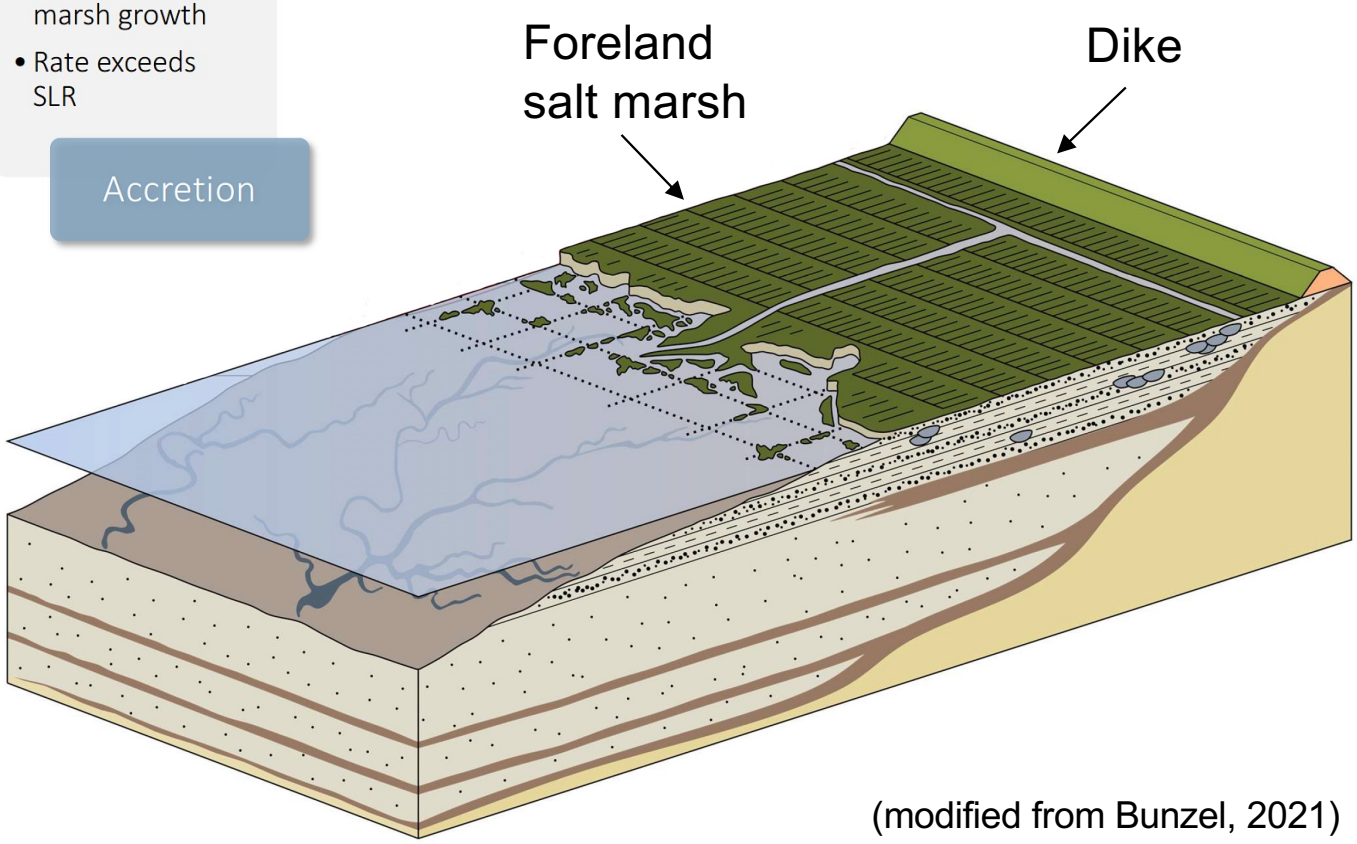


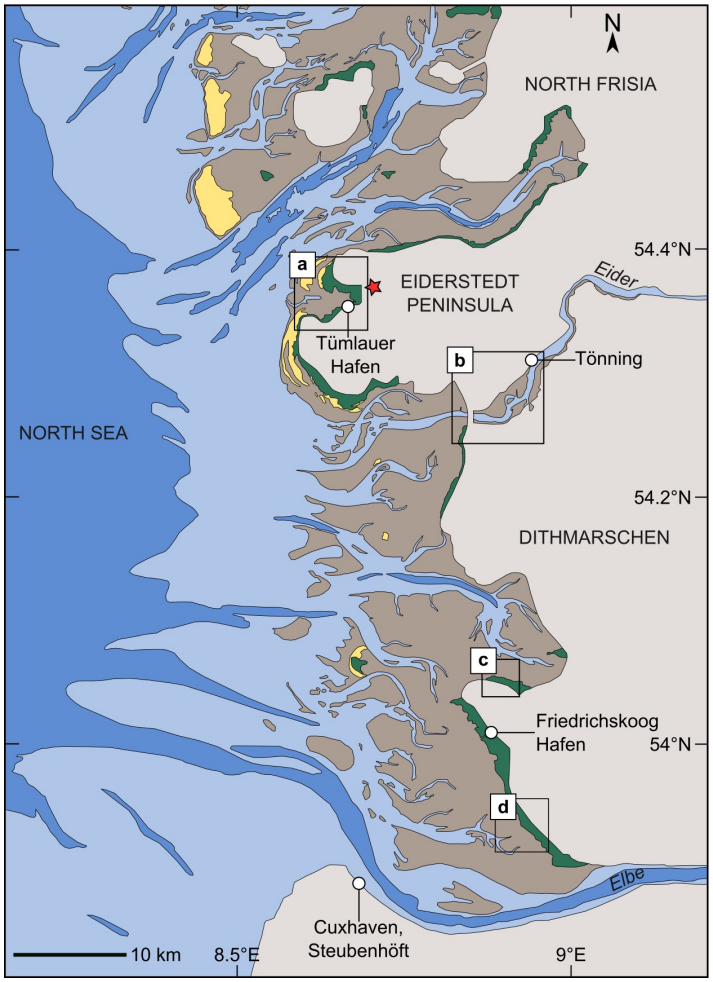
Sedimentation and accretion in human-modified salt marshes





(modified from Bunzel, 2021)

Salt-marsh archive



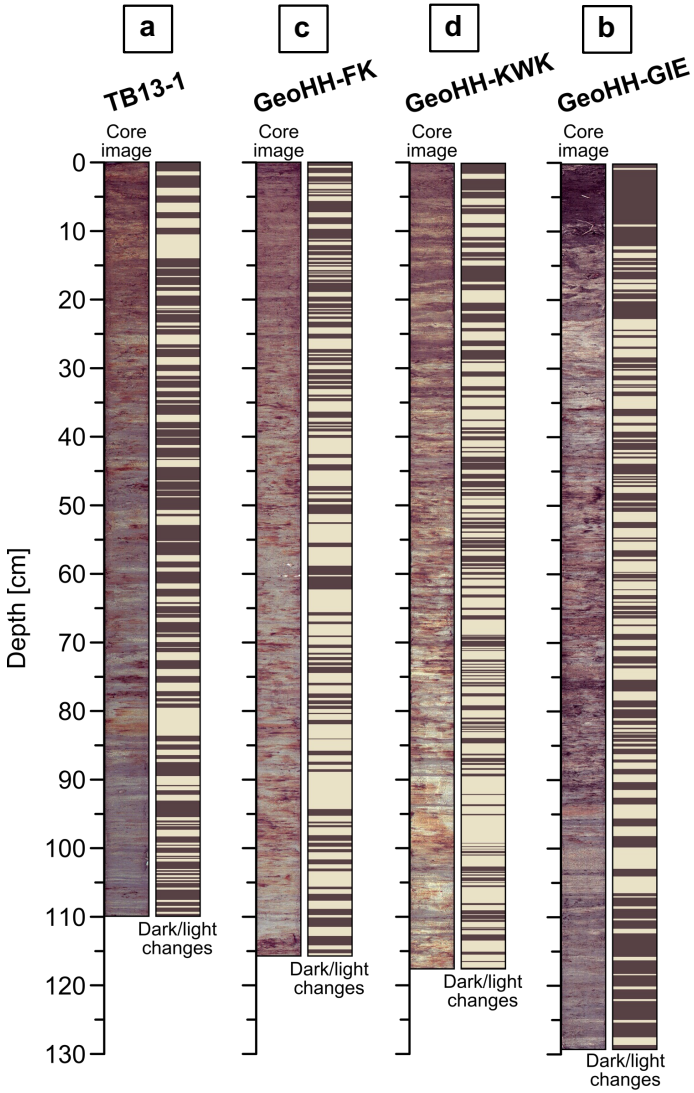


Foto: G. Schmiedl

after the Common Wadden Sea Secretariat (CWSS, 2009) and Bunzel et al. (2020)

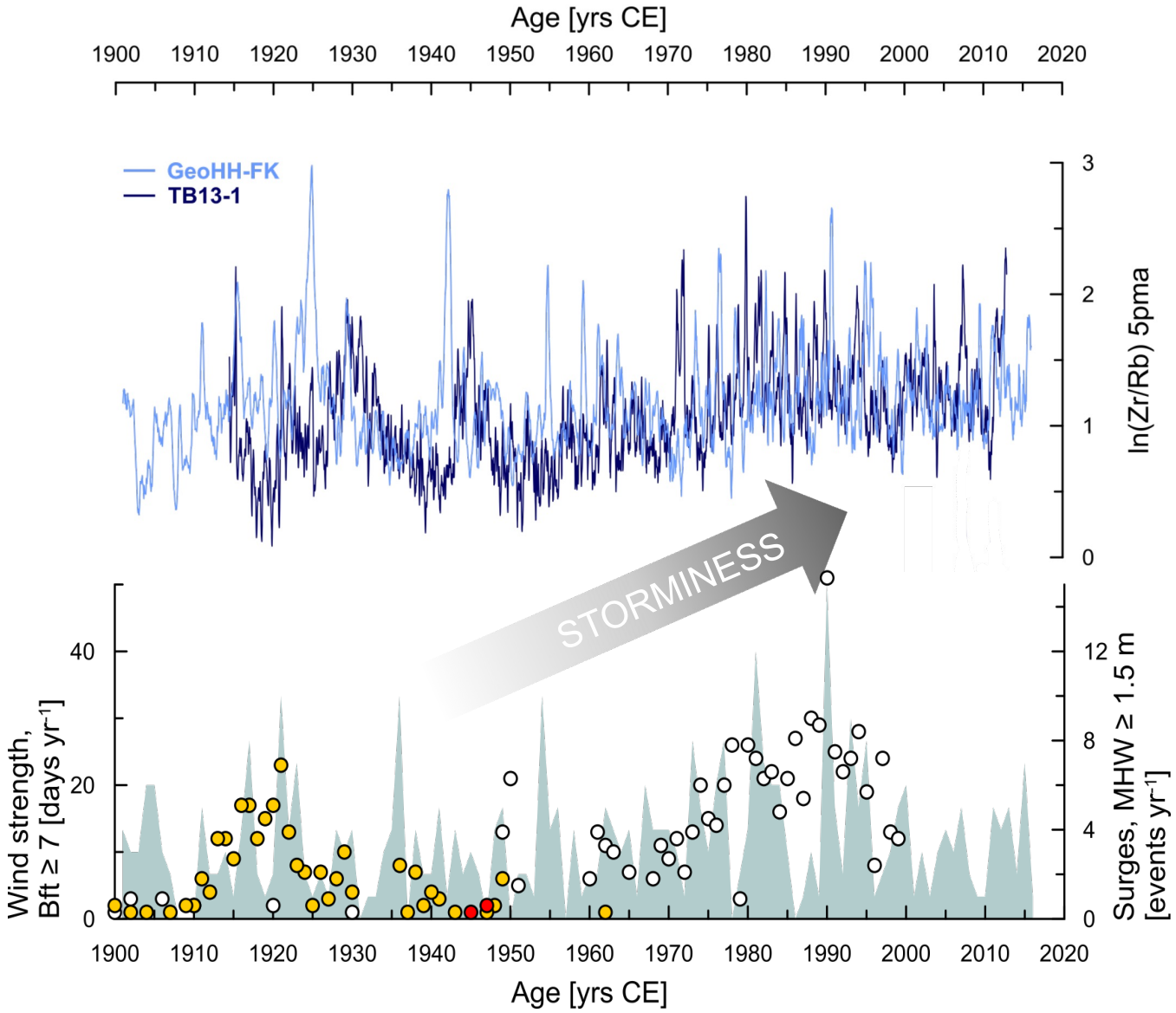
Past storminess

ln(Zr/Rb) ratio:

indicator for relative changes in the particle-size spectrum

Long-term increase starting from ~1950 CE towards recent times

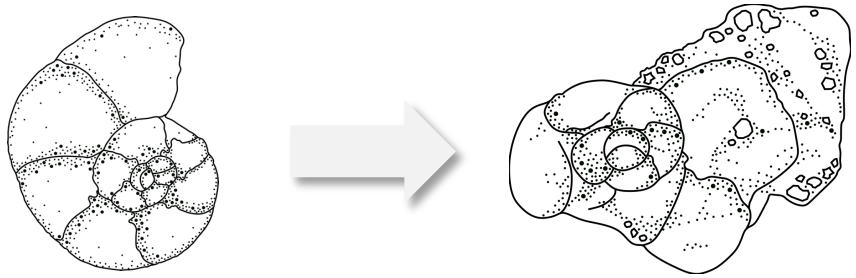
→ Similarity to the observed amplification in North Sea storminess

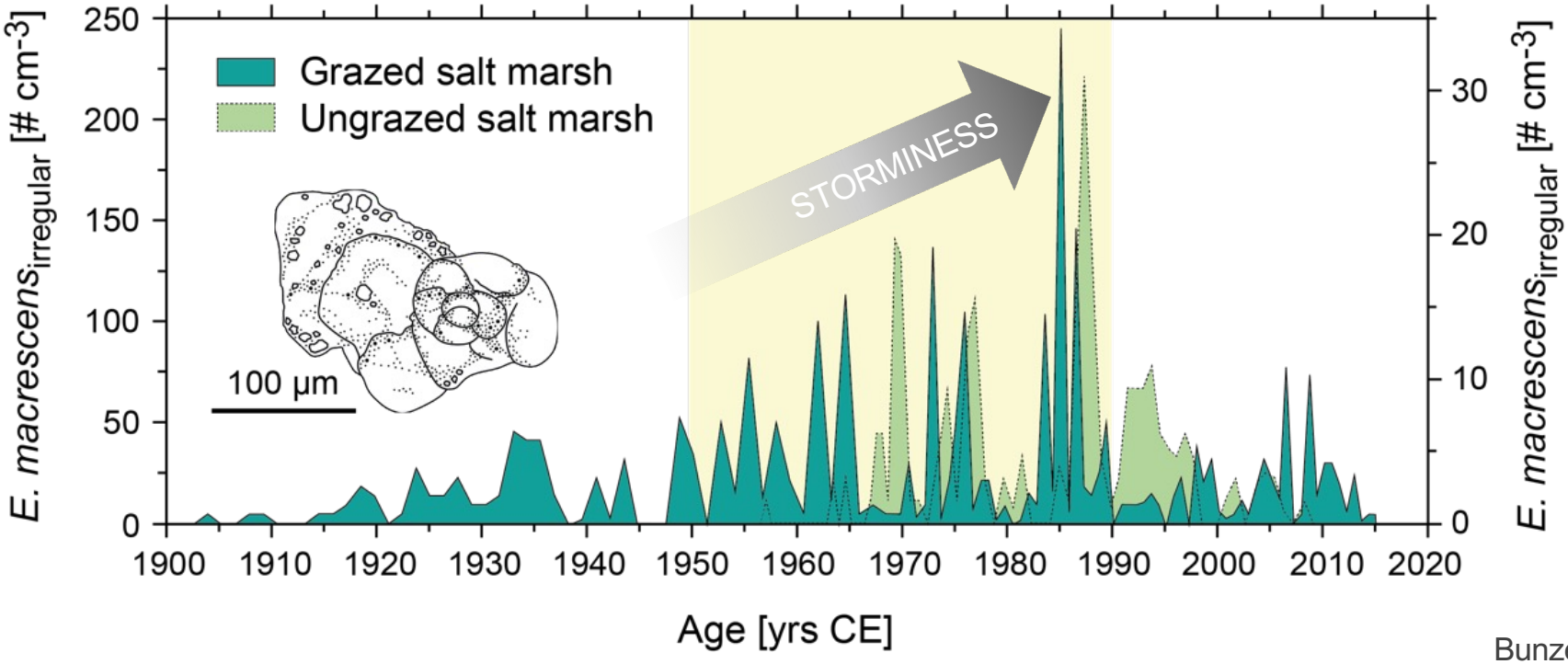


Bunzel et al. (2021)

Storminess and environmental stress

Salt-marsh foraminifera → test deformation





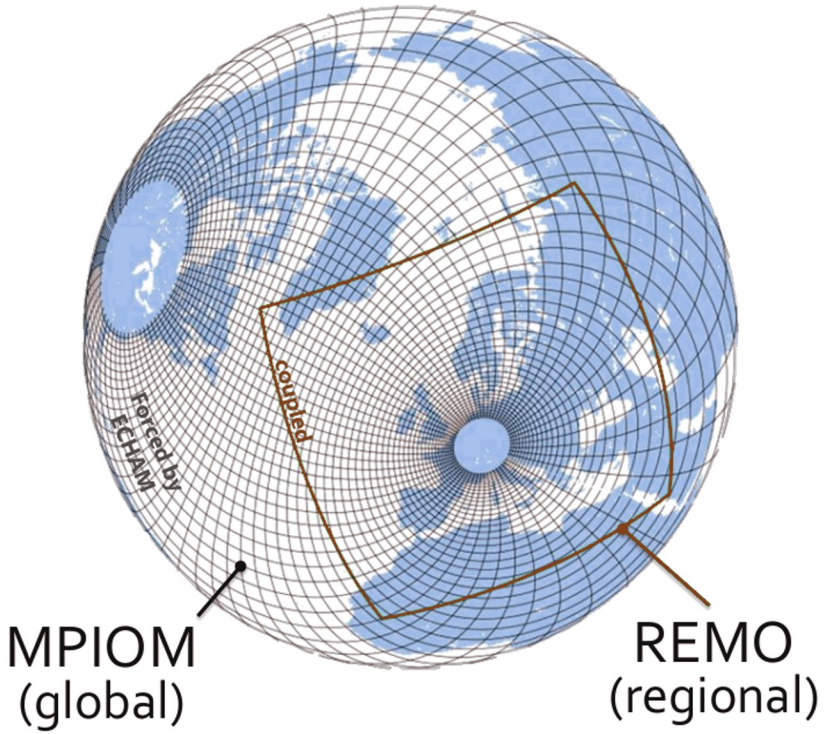
Bunzel (2021)

Modelling extreme sea level events in the German Bight

- Downscaling results from an ensemble of global MPI-ESM-LR simulations (32 ensemble members)
- Regional model:
  - REMO regional atmosphere model
  - MPIOM global ocean model with a zoom on the North Sea/German Bight with tides

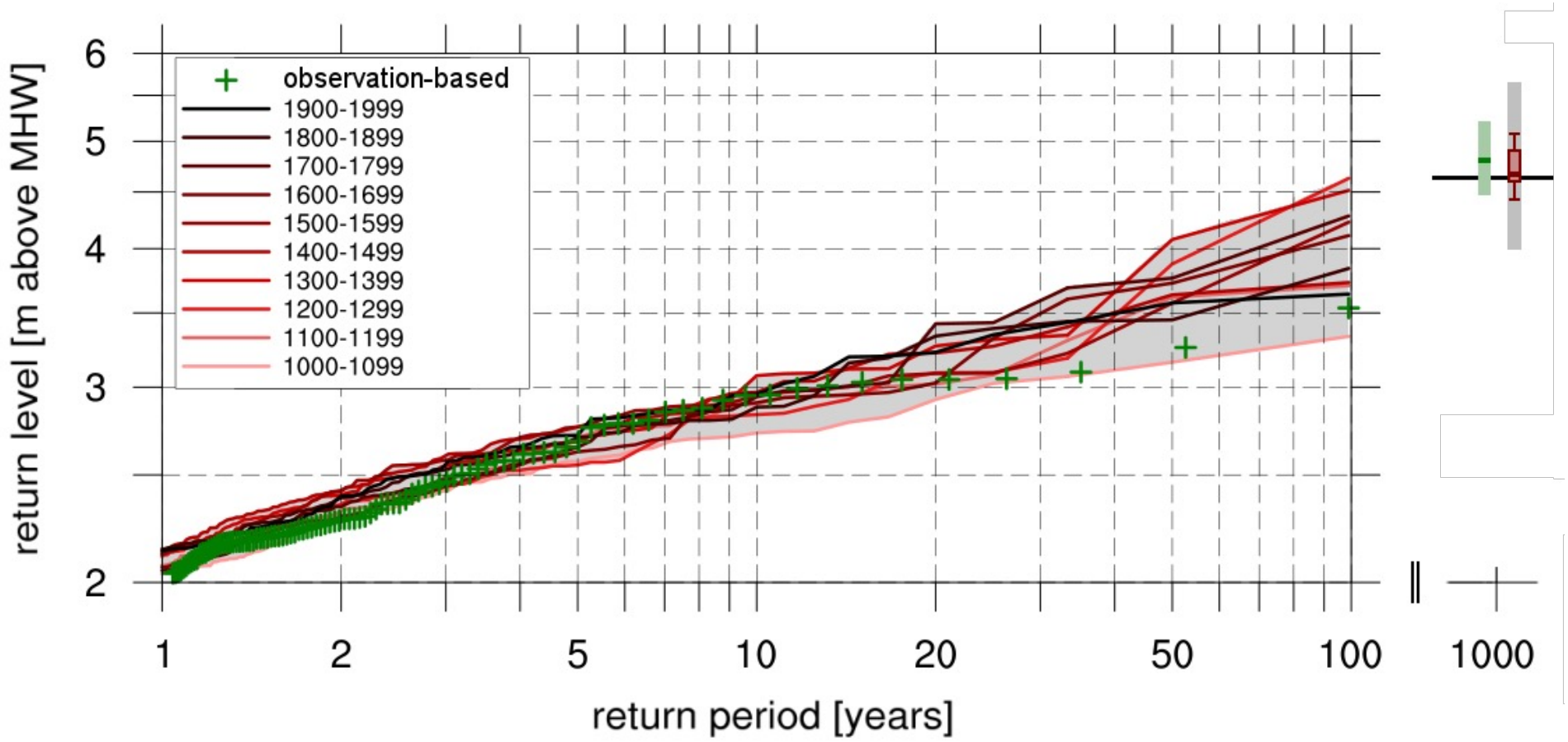
Research Question:

- Does the intensity of extreme storm floods change?
- All data relative to the mean sea level (which is changing in a warming climate)



Lang & Mikolajewicz (2019, 2020)

Changes in return values, Cuxhaven

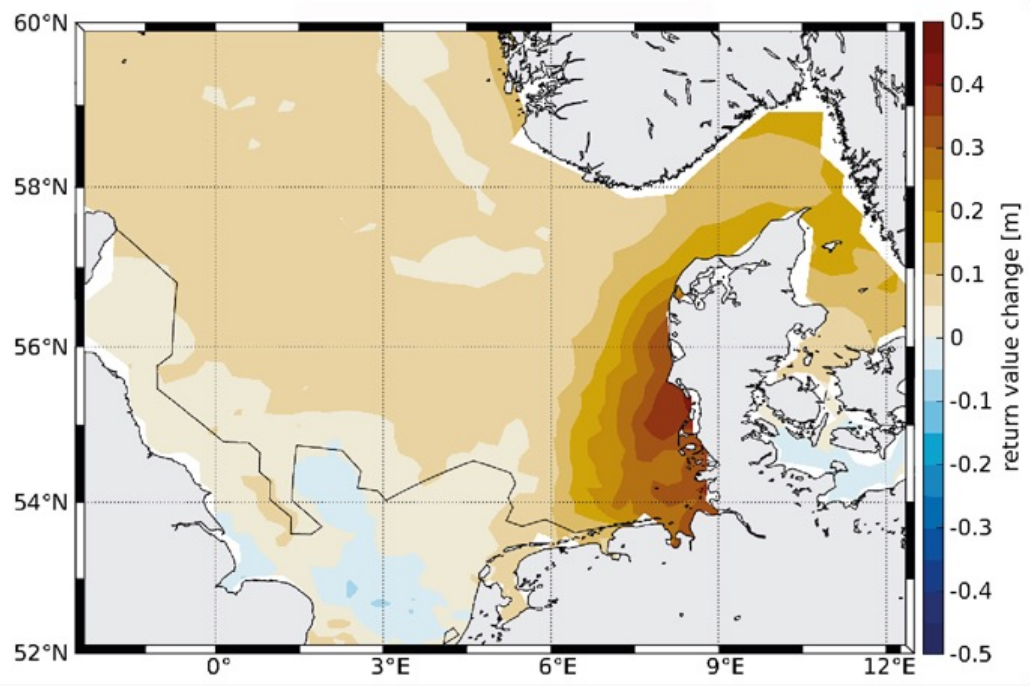


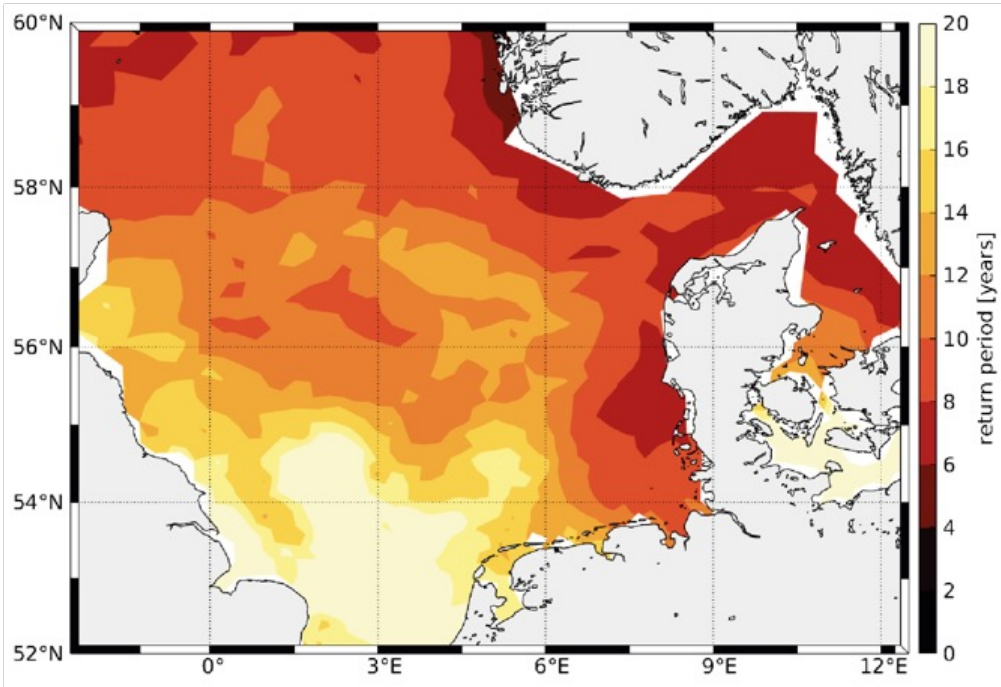
Lang & Mikolajewicz (2019)

Spatial distribution of extreme sea level change in a high CO_2 world

Simulated change of 20 yr return values (relative to mean sea level)

Preindustrial 20 yr return values in a high CO_2 world (changes in mean sea level are not included)





Thin black line indicates statistical significance at 95% level

Lang & Mikolajewicz (2020)

Conclusions

- Existing proxy-based sea-level reconstructions bear a so far underestimated storm-climate component.
- Mean accretion rates of 1.2-1.8 cm yr^{-1} suggest a high resilience of salt marshes to ongoing sea-level rise as long as sediment availability and natural flooding dynamics are maintained.
- Downscaling of a a large ensemble of anthropogenic climate change simulations suggest increasing extreme sea-levels along the North Frisian coast with rising atmospheric CO_2 levels.