The evolution of sea-level rates along the Norwegian coast from 1960 to 2100

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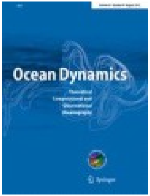
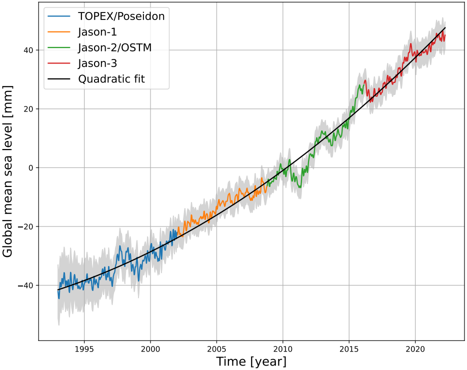


Breili, K. (2022). Evolution of sea-level trends along the Norwegian coast from 1960 to 2100. *Ocean Dynamics*, **72**, 115–136. https://doi.org/10.1007/s10236-021-01492-7

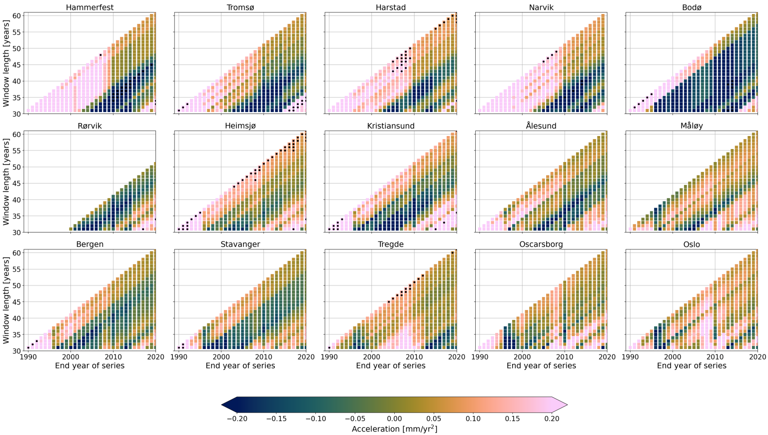
Satellite altimetry indicates that the global mean sea level has accelerated by 0.1 mm/yr^2 from 1992 to 2022



IPCC AR6:
It is *likely* that GMSL has accelerated since the early 1900s

See poster #13:
An almost 30 year long time series of global mean sea level from satellite altimetry

Quadratic coefficients in regression models do not provide robust estimates of accelerating sea level along the Norwegian coast



Kartverket

Black markers indicate estimates that are significant at the 95% level

The best ranked regression model included reanalysis of sea-level pressure and wind-speed as regressors

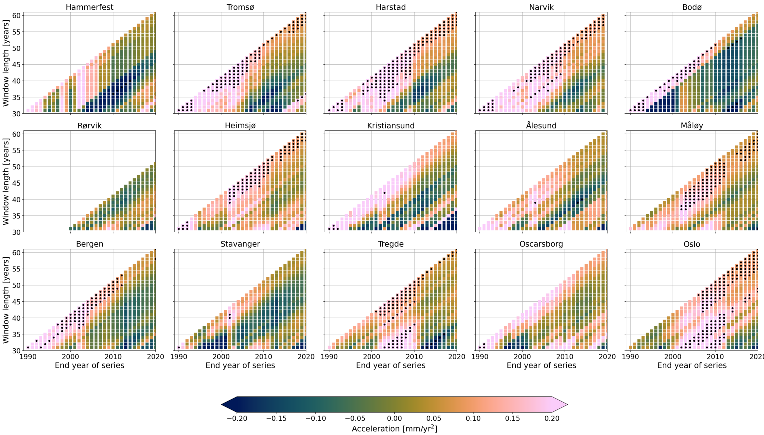
$$z_i = \beta_0 + \beta_1 t_i + \frac{1}{2}\beta_2 t_i^2 + \beta_p p_i + \beta_u u_i + \beta_v v_i + \varepsilon_i$$

p_i: sea-level pressure

u_i, v_i: wind speed in the east and north directions

- Sea-level pressure is the most important regressor, while the effect of wind speed varies significantly along the Norwegian coast

Also with meteorological regressors, potential climate related acceleration is masked by non-climate variability in the tide-gauge records



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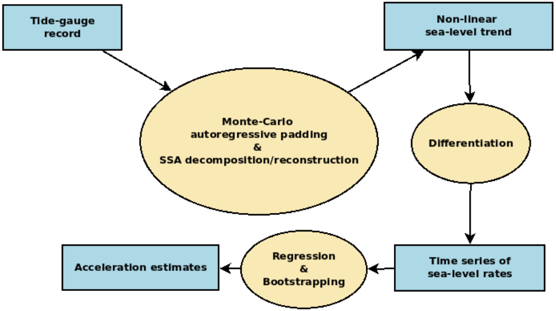
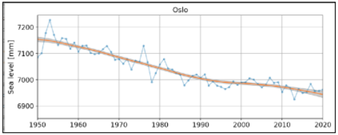
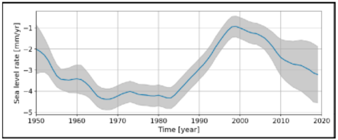
Black markers indicate estimates that are significant at the 95% level

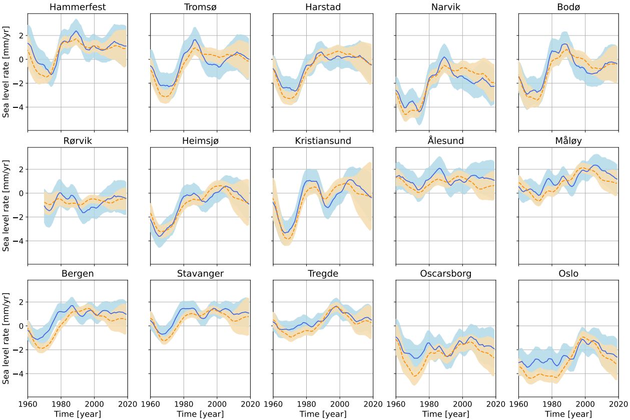
Non-linear trends in tide-gauge records can be identified by Singular Spectrum Analysis







Sea-level rates were low around 1970, at maximum around 1990, and high with a declining tendency for recent years



Blue: Raw tide gauge observations

Orange: Corrected tide gauge observations

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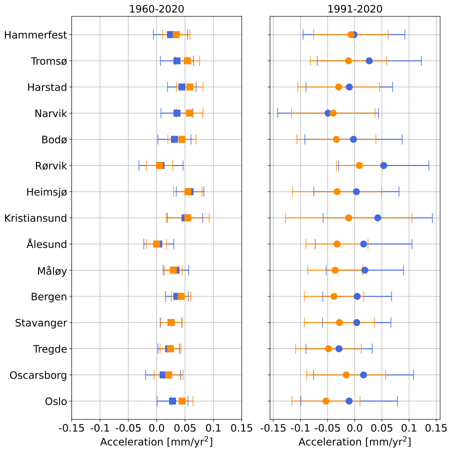
Significant positive acceleration appears at most tide gauges for the period from 1960 to 2020

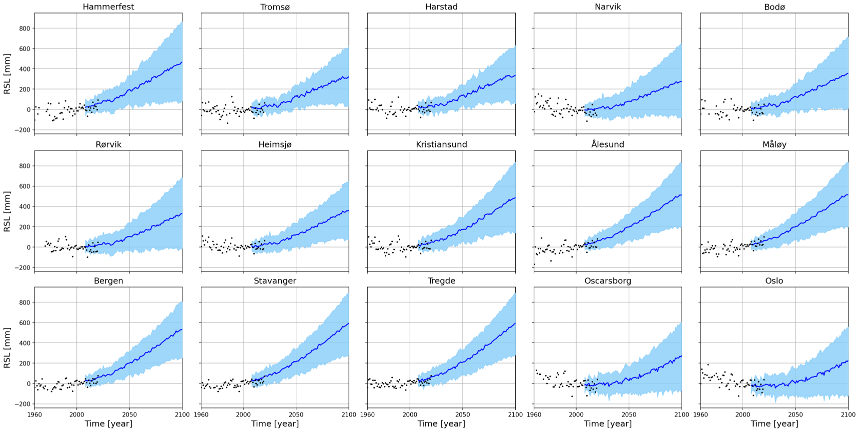


Coastal averages:

	1960–2020 [mm/yr²]	1991–2020 [mm/yr²]
Raw	0.030±0.004	0.005±0.007
Corrected	0.036±0.005	-0.027±0.004

Blue: Raw tide gauge observations
Orange: Corrected tide gauge observations

Future sea-level rates can be assessed by extending the tide-gauge records with sea-level projections



Tide gauge observations (black) and RCP8.5 relative sea-level projections (blue)

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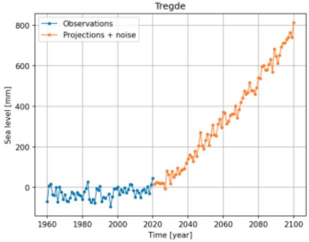
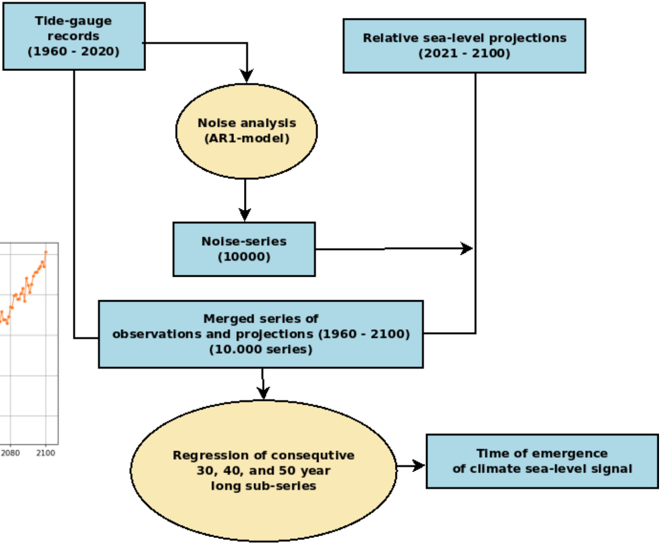
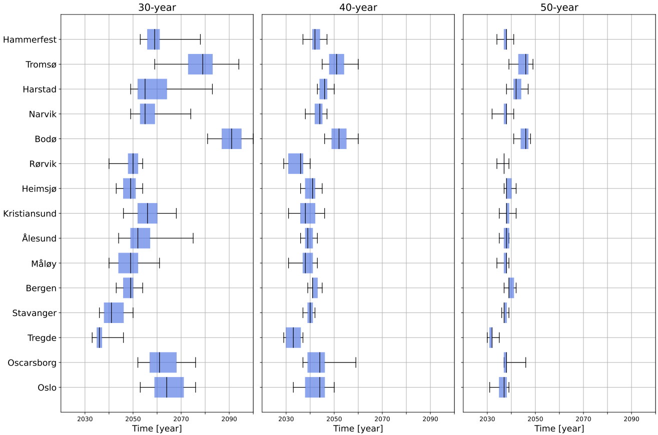
Time of emergence: The year when the rate is first (and remains) significantly higher than all rates in the past





For study periods of 50 years, we expect sea-level rates that are significantly higher than those in the past at the earliest late in the 2030s



Time of emergence with the 95th percentile of RCP8.5

To summarize, recent sea-level rates along the Norwegian coast are not record high, and we expect the climate signal to emerge at earliest in the late 2030s

- The relative sea-level rates have increased significantly between 1970 and 1990.
- Decadal variation makes the acceleration estimates sensitive to the choice of study period