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Long-term perspective for the Wadden Sea



Waddenvereniging

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www.waddenvereniging.nl

Rising sea over a sinking seabed

Study commissioned by the Waddenvereniging.

Context: new plans for gas extraction in the Dutch Wadden Sea.

It is an independent assessment of the 21st century drowning risk (combined effects climate change and gas extraction), based on extensive scientific literature study. It was written by Rolf Schuttenhelm, an Earth scientist/science writer specialized in climate & geosciences - and reviewed by 6 independent experts in the fields of sea level rise, sedimentation and subsidence.



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Main conclusion:

The combined effects of sea level rise and gas-extraction subsidence contribute to a **significant 'drowning risk'** for the area, that has in previous assessments been underestimated, for 3 important reasons.



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1: Sea level rise has been **underestimated**.

Especially new high risk scenarios (2016, 2017) translate to above average sea level rise for the North Sea and Wadden Sea, mostly due to gravitational effects. New high risk scenarios translate to 2,5-3m within the current century, possibly more.

Sea level rise scenarios used by/for the gas industry (Shell & Exxon) are very conservative for long run ($\pm 40\text{cm}$) and (to determine 'acceptable subsidence') focus only on very short timescale (5 years ahead, under an even lower linear trend extrapolation of only $\pm 20\text{cm}/\text{century}$).



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2: Natural sedimentation has been **overestimated**.

Model study reports by/for the gas industry state between 30-60cm relative sea level rise can be compensated by natural sedimentation. Historical reconstruction indicates this critical compensation limit might well be much lower, <15cm/century - in the long run, due to *limited sediment availability*.



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3: Long-term subsidence by gas extraction has been **underestimated**, and is higher in practice than in forecasts by Shell+Exxon.

Locally subsidence runs in several decimeters (Ameland, one of the Frisian islands, also Groningen, Wadden Sea shore).



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Combining these findings leads to conclusion that the Wadden Sea is a global hotspot of sea level rise impacts.

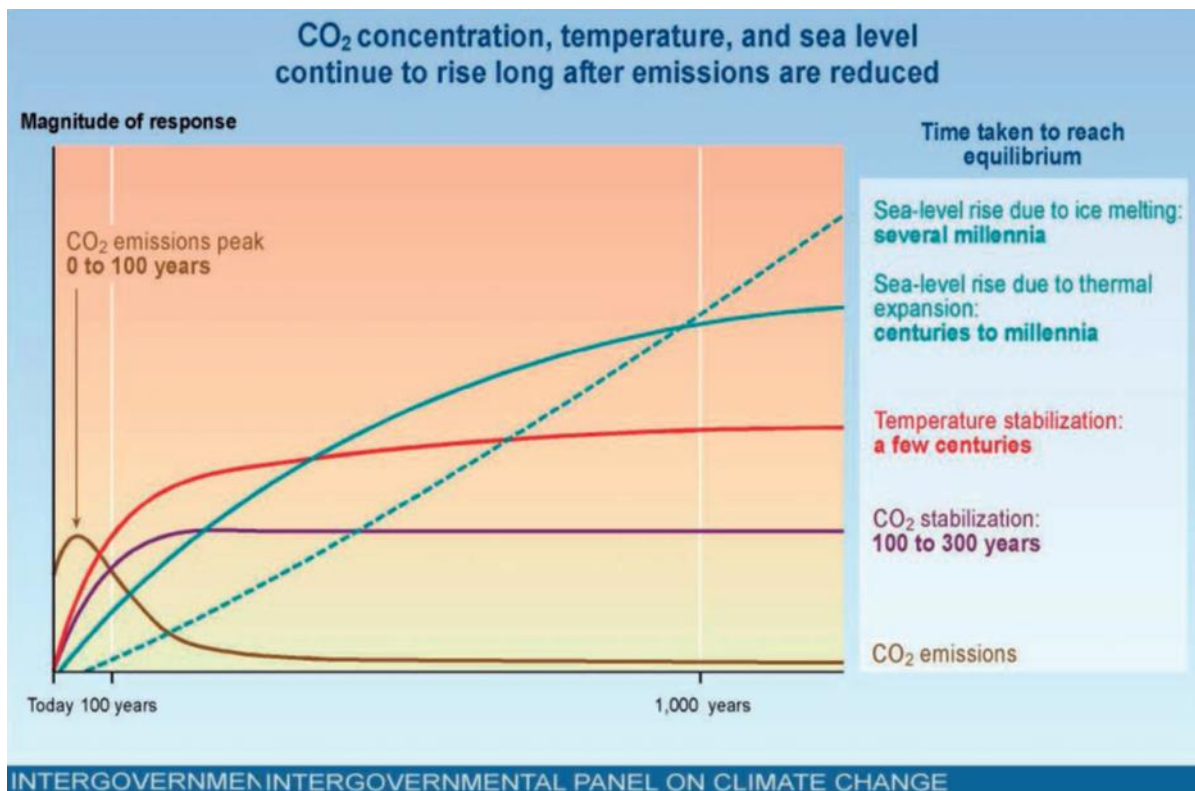
Large-scale drowning of the Wadden Sea ecosystem is **inevitable** within the current century under all higher-end global sea level rise forecasts.

Even in case of lower-end SLR forecasts (combination of low global emissions scenario, low climate sensitivity and **excluding** newly documented Antarctic ice-melting feedbacks) a drowning risk remains within the 21st century, depending on remaining uncertainties for sedimentation and subsidence.



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“We’ve pulled the trigger.” (*Baptist, ISWSS 14, Tonder 2017*)



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The best (policy) scenario is one with ambitious and effective global climate policy (RCP2.6/Paris agreement) and no gas extraction. In this scenario at least large parts of the Wadden Sea ecosystem will survive beyond the 21st century.

The Wadden Sea cannot transgress (migrate) landward due to human inhabitation (dyke enclosures) which would be the natural response to sea level rise.

Drowning therefore translates to **loss of the system.**



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The trilateral Wadden Sea Cooperation needs to consider:

- The implications for the World Heritage site over the coming decades;
- The 'sustainability' of current coastal defence policies;
- Geohydromorphological developments, including the impact of sand nourishment.



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Thank you for your kind attention



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