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Sea Level Change for Norway: Past and Present Observations and Projections to 2100

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Changes to mean sea level and/or sea level extremes (e.g., storm surges) will lead to changes in coastal impacts. These changes represent a changing exposure or risk to our society. Here we try to synthesize our understanding of past and present observed sea level changes for Norway, as well as providing sea level projections up until 2100. Our primary focus is changes to mean sea level but we also give updated return heights for each coastal municipality in Norway.

We first analyse observed sea level changes from the Norwegian tide gauge network and from satellite altimetry. After the tide gauge data have been corrected for the effects of glacial isostatic adjustment, we show that 20th century sea level rise in Norwegian waters is broadly similar to the global average rise. Contributions to the observed sea level change and variability are discussed. We find that rate of sea level rise along the Norwegian coast is significantly higher for the period 1993–2014 than for the period 1960–2010. It is unclear, however, to what extent this higher rate represents natural variability rather than a sustained increase owing to global warming.

Our regional sea level projections are based on findings from the Fifth Assessment Report (AR5) of the Intergovernmental Panel for Climate Change (IPCC), and the Coupled Model Intercomparison Project phase 5 (CMIP5) output. Average projected 21st century relative sea level change in Norway is -0.10–0.35 m (5 to 95% model ranges which is the likely range in AR5; P>66%) for RCP2.6, -0.05–0.45 m for RCP4.5, and 0.10–0.65 m for RCP8.5. The relative sea level projections can differ as much as 0.50 m from place to place. This pattern is governed by the vertical uplift rates. Quantifying the probability of levels above the likely range (i.e. the upper tail of the probability distribution) remains difficult because information is lacking. And of particular concern is that the ice sheet contribution might have a skewed distribution, which would mean values in its upper tail would be quite large.

Finally, we show how the estimated return heights can be combined with our regional sea level projections to provide allowances. Allowances give the height by which an asset needs to be raised so that the probability of flooding remains preserved for a given sea level change. A possible attractive option in planning.