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Regional sea level changes: the role of internal variability in ocean dynamics and the worlds glaciers

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Global sea level has been rising by about 20 cm during the last century and is expected to continue to rise in the 21st century in response to anthropogenic forcing. Sea level rise and variability are not spatially uniform but vary significantly, with some regions experiencing a rise larger than the global mean while sea level rises more slowly or decreases in other regions.
In addition, internal climate variability may induce significant temporary trends in regional sea level even in the absence of external forcing and has therefore the potential to mask a forced signal for a certain amount of time. It is important to consider the magnitude of internal variability, particularly when interpreting sea level trends obtained from rather short observations such as the 20-yr long altimeter record

Here, we estimate the magnitude of internally generated sea level trends due to changes in the ocean dynamics and changes in global glacier volume on various time scales. Firstly, we analyze the output of the constant-forcing control simulations of 18 climate models used in the IPCC Fifth Assessment Report to quantify sea surface height variability due to variability in ocean dynamics.
Secondly, the output from the same control simulations is used to force a global mass balance glacier model to quantify the variability in regional glacier volume due to internal climate variability, and the corresponding sea surface height fingerprints are computed.
The rather long control simulations (250 – 1000 years) allow for detection of internal variability on multi-decadal to centennial time scales. Both contributions, oceanic and glacier volume internal variability, are compared to observations and modeled sea level trends in historical and future scenarios. Regions with enhanced internal variability are identified and it is assessed when local long term trends become distinguishable from internal variability.