



## **A unified sea-level response function to global warming**

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Linear response functions provide an alternative to process-based models to project future sea-level rise. They are designed to capture the sea-level response to a certain forcing in a comprehensive manner without relying on the full understanding but comprising all processes involved.

Here, we propose one unified sea-level response function to global warming as a synthesis of different response functions of the major contributors: oceanic thermal expansion, ice loss from mountain glaciers as well as ice loss from the two ice-sheets on Greenland and Antarctica both through changes in the surface mass balance and dynamic discharge. Except for surface mass balance changes of the ice sheets which occur instantaneously, each response function is inherently time-dependent and accounts for the fact that past climate change will continue to influence sea-level rise in the future. The proposed functions separately estimate the contributions from the main sea-level components on a centennial time scale. The validity of the approach is assessed by comparing the sea-level estimates obtained via the response functions to observations as well as projections from comprehensive models. Total sea level rise and the observed contributions in the past decades are reasonably well reproduced by our approach. Provided that the underlying dynamic mechanisms do not undergo a qualitative change within the 21st century, the response functions found for the individual components can therefore be merged into a single response function in order to project global sea-level rise for a given global mean temperature anomaly.