A perspective of Earth's elastic response produced by predicted Glacier Mass Loss

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ABSTRACT

This work presents a new method for computing and combining high-resolution displacement models to evaluate the elastic response of the solid Earth produced by predicted glacier mass loss. Glaciers play a critical role in the water balance but are rapidly losing mass on a global scale. Mass variations cause an elastic response of the solid Earth due to their changing mass load, and quantifying deformation globally is essential to evaluate sea level changes and other geophysical signals. The proposed approach efficiently computes high-resolution displacement models and combines calculations of varying spatial resolution with interpolation to produce a global high-resolution gridded model. We tested our method using LoadDef (Martens *et al.*, 2019) for the Loading computations with a 100-year time span of predicted glacier mass changes for 19 regions and SSP126 scenario for BCC-CSM2-MR based on the PyGEM Glacier Projections (Rounce *et al.,* 2020). The local high-resolution model and sparse global model were combined to produce a global grid model, which is presented at 0.5° spatial resolution, with the potential to increase to 0.1° and the results show the projected rates of vertical displacement for different periods over the 21st century. The generation of a global model based on a combination of a local high-resolution grid and a sparse global grid is feasible and efficient. These calculations are purely elastic and do not yet include the impacts of the sea level redistribution on the load, but that can be computed separately and added by superposition. High-resolution displacement computations are needed for comparison to observed GPS displacements and can be used to predict variations in relative sea level.