

High Resolution Sea Level Projections In The 21st Century

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Sea levels have been rising globally during the 20th century, and are projected to continue to rise during the 21st century and beyond, with significant regional differences. Based on CMIP5 climate models, regional sea level projections have been produced, which include all components contributing to sea level changes, such as regional dynamic changes, ocean thermal expansion, glaciers, Greenland and Antarctic ice sheets, terrestrial water storage and Glacial Isostatic Adjustment (GIA). However, these regional projections have coarse resolution of 1o (~100 km), while sea level adaptation and mitigation planners demand information on local sea level changes at finer spatial scales. To address this issue, we try to develop regional sea level projections at much higher resolution than currently available. First, dynamical downscaling methodology is used to downscale future climate changes derived from the ensemble of 17 CMIP5 models under a high emission scenario (RCP8.5) using a quasi-global 0.1o ocean model. Second, higher-resolution sea level fingerprints associated with land ice mass loss and terrestrial water storage changes are produced by upgrading the sea-level equation model. Third, a recent GIA product at 0.2o resolution is adopted here, which is based on the ICE-6G deglaciation history and the earth model with VM5a viscosity profile. All components are regridded to a common 0.2o global grid, and then summed up to produce the total sea-level projections in the 21st century. The differences between coarse- and high-resolution sea level projections are examined, both globally and regionally. Using Australian region as an example, the high-resolution projection provides a much detailed representation of high sea level rise off Australian southeast coast and associated gyre circulation and boundary current changes there. This high-resolution regional sea level projection product should be a valuable and timely guidance for coastal adaptation and mitigation planning to address ongoing sea level changes.

Keywords: sea-level projection, high-resolution, dynamical downscaling, sea-level fingerprint