

Towards CMIP5-based Multi-Century Regional Sea Level Projections

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Regional sea level change is one of the key socio-economic challenges facing humankind in a warming world. While many users of sea level information are focussed on potential changes over the 21st Century there are some sectors that require projections beyond this time horizon. We present exploratory projections of global and regional sea level rise out to 2300 under RCP2.6, RCP4.5 and RCP8.5 based on the use of simple climate models as emulators for the CMIP5 ensemble. Global thermal expansion is inferred directly from the model, while the emulated global surface temperature is used to inform changes in surface mass balance for ice sheets and glaciers using simple relationships, such as those in IPCC AR5. A series of assumptions are made for the time-evolution of other mass addition terms. Our regional projections also make use of CMIP5 model output, gravitational fingerprints and an estimate of glacial isostatic adjustment. Variations in the emergent pattern of sea level change in CMIP5 models are accounted for by establishing relationships between local dynamic sea level and global thermal expansion. These relationships are found to be largely insensitive to choice of scenario and timescale (thus information from models that only simulate to 2100 can be used to 2300). The work highlights the fundamentally different responses of global surface temperature and sea level rise to the evolution of greenhouse gas emissions and the inherently large uncertainties associated with multi-century time horizons. As a horizon-scanning exercise the results may be useful to motivate stakeholders to think beyond 2100 and provide an approximate set of sea level change values against which vulnerabilities might be analysed and compared. The use of simple climate models and the pattern-scaling approach opens up the possibility of future impact and adaptation assessments using a much wider range of climate change scenarios.

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