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The use of multivariate Gaussian process emulation in making projections of land ice contributions to sea level rise

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Better understanding changes in the cryosphere is key to predicting future global sea level rise, as is being done in the PROTECT project (<https://protect-slr.eu>). There are large uncertainties around how these changes will present over the next few centuries, with the Antarctic ice sheet being the component with the most varied predictions of potential mass change; statistical methods are required in order to quantify this uncertainty and estimate more robust projections.

We present here results from a multivariate Gaussian process emulator (Rougier, 2008; Rougier et al., 2009) of an ensemble of ice sheet and glacier models. We build projections of contributions to global sea level rise over several centuries from the Antarctic and Greenland ice sheets, and the world's glaciers, emulating them individually in order to better understand the biases and internal variability each model contains. Our use of an outer-product emulator allows us to model multivariate output, resulting in projections over several centuries rather than a single year at a time. We predict changes for different Shared Socioeconomic Pathways (SSPs) to show how different emissions scenarios will affect land ice contributions to sea level rise, and demonstrate the differing sensitivity to parameters and forcings of the ensemble of models used.

References

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