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## Building probabilistic projections of the Antarctic contribution to global sea level rise using a random forests emulator

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In order to predict future global sea level rise, it is key for us to have better understanding of the changes in the cryosphere, as is being done in the PROTECT project (<https://protect-slr.eu>). Large uncertainties exist around how these changes will present over the coming centuries, with the Antarctic ice sheet being the most uncertain component with regards to predicted mass changes. It is therefore necessary to turn to statistical techniques to create more robust predictions.

Here, we present results from a random forests emulator simultaneously trained on two ice sheet models, Kori and PISM, forced by four global climate models. We emulate the relationship between inputs, namely climate change and ice sheet model settings, and an output, sea level contribution. The use of random forests allows us to improve on previous Gaussian Process emulators (Edwards et al., 2021) in speed and the treatment of factor inputs. We also transform the multi-centennial output in order to allow us to model the whole time series, rather than each year individually. The emulator allows us to interpolate (and extrapolate slightly) in order to build probabilistic projections of sea level contribution to 2300 that include climate and ice sheet modelling uncertainties under all five Shared Socioeconomic Pathways (SSPs), despite only two being used in the ensemble of simulations.

### References

Edwards, T. L., Nowicki, S., Marzeion, B., Hock, R., Goelzer, H., Seroussi, H., Jourdain, N. C., Slater, D. A., Turner, F. E., Smith, C. J., et al. (2021). Projected land ice contributions to twenty-first-century sea level rise. *Nature*, 593(7857):74–82.

