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Regional Climate Model Inter-Comparison for Antarctica within a Data Science Framework

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Understanding the surface climatology of the Antarctic ice sheet is essential if we are to adequately predict its response to future climate change. This includes both primary impacts such as increased ice melting and secondary impacts such as ice shelf collapse events. Given its size, and inhospitable environment, weather stations on Antarctica are sparse. Thus, we rely on regional climate models to 1) develop our understanding of how the climate of Antarctica varies in both time and space and 2) provide data to use as context for remote sensing studies and forcing for dynamical process models. Given that there are a number of different regional climate models available that explicitly simulate Antarctic climate, understanding inter- and intra model variability is important.

Here, inter- and intra-model variability in Antarctic-wide regional climate model output is assessed for: snowfall; rainfall; snowmelt and near-surface air temperature within a cloud-based virtual lab framework. State-of-the-art regional climate model runs from the Antarctic-CORDEX project using the RACMO, MAR and MetUM models are used, together with the ERA5 and ERA-Interim reanalyses products. Multiple simulations using the same model and domain boundary but run at either different spatial resolutions or with different driving data are used. Traditional analysis techniques are exploited and the question of potential added value from more modern and involved methods such as the use of Gaussian Processes is investigated. The advantages of using a virtual lab in a cloud based environment for increasing transparency and reproducibility, are demonstrated, with a view to ultimately make the code and methods used widely available for other research groups.