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Antarctic accumulation changes investigated with water tracers in two climate models

Content

The diagnosis of snow accumulation changes is key to understanding both Antarctic surface mass balance changes and ice core measurements. Here we set out to use two climate models to explore the drivers of Antarctic accumulation changes. We implement new water tracer code in the UK HadGEM3 and German AWI-ESM-2.1 models. Our passive water tracers, also known as water tagging, are initialised according to evaporative source properties, e.g. location, and follow the normal aerial hydrological cycle until precipitation. The presence of equivalent water tracing facility within two models is a particularly beneficial part of this work: it allows us to explore structural uncertainties; and, where results are robust across the models, adds confidence.

Pre-industrial and historical simulations, using our new water tracer facilities are performed with each model. We use these simulations to explore: (i) evaporative conditions of Antarctic precipitation – whether ice core precipitation originates from the same locations for the HadGEM3 and AWI-ESM-2.1 models; (ii) whether the seasonal cycle of Antarctic precipitation is significantly different between the models; and (iii) the role of thermodynamic and dynamic drivers of Antarctic accumulation changes. The answers to these questions are of significant value to those who seek to interpret water isotope measurements from Antarctic ice cores.

Primary author: Mr GAO, Qinggang (Ice Dynamics and Paleoclimate, British Antarctic Survey, Cambridge, United Kingdom)

Co-authors: Dr MCLAREN, Alison (Ice Dynamics and Paleoclimate, British Antarctic Survey, Cambridge, United Kingdom); Dr SHI, Xiaoxu (Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany); Dr STEEN-LARSEN, Hans Christian (Geophysical Institute, University of Bergen and Bjerknes Centre for Climate Research, Bergen, Norway); Dr CAPRON, Emilie (Université Grenoble Alpes, CNRS, Grenoble, France); Dr RHODES, Rachael H. (Department of Earth Sciences, University of Cambridge, Cambridge, United Kingdom); Dr WERNER, Martin (Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany); Dr SIME, Louise (Ice Dynamics and Paleoclimate, British Antarctic Survey, Cambridge, United Kingdom)

Presenter: Mr GAO, Qinggang (Ice Dynamics and Paleoclimate, British Antarctic Survey, Cambridge, United Kingdom)

Track Classification: Progress in proxy development and interpretation