

EGU22-8361

<https://doi.org/10.5194/egusphere-egu22-8361>

EGU General Assembly 2022

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Response of water isotopes in precipitation to a collapse of the West Antarctic Ice Sheet in high resolution simulations with the Weather Research and Forecasting and Community Atmosphere Models

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The West Antarctic Ice Sheet (WAIS) may have collapsed during the last interglacial period, between 132,000 and 116,000 years ago. The changes in topography resulting from WAIS collapse would be accompanied by significant changes in Antarctic surface climate, atmospheric circulation and ocean surface conditions. Evidence of these changes may be recorded in water-isotope ratios in precipitation archived in the ice. We conducted high-resolution simulations with an isotope-enabled version of the Weather Research and Forecasting Model over Antarctica, using boundary conditions provided by climate-model simulations with both present-day and lowered WAIS topography. The results show that while there is significant spatial variability, WAIS collapse would cause detectable isotopic changes at several locations where ice-core records have been obtained or could be obtained in the future. The most robust signals include lower $\delta^{18}\text{O}$ at Mount Moulton Blue Ice Area and higher $\delta^{18}\text{O}$ at SkyTrain Ice Rise in West Antarctica, and higher deuterium excess at Hercules Dome, East Antarctica. A combination of records from multiple sites would provide the strongest constraint on the timing and magnitude of past WAIS collapse.