Geophysical Research Abstracts
Vol. 19, EGU2017-10893, 2017
EGU General Assembly 2017

Using the Community Firn Model to investigate the water isotope record in an ice core from the South Pole

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Firn models can be used to replicate conditions at ice core sites and investigate the past climate histories that resulted in the ice core record. The diffusion of water isotope ratios in ice cores can provide information about past firn conditions. We use the Community Firn Model (CFM) to compare theoretical and observational estimates of isotope diffusion in firn. We use the CFM to simulate possible past climate conditions at the South Pole, and compare the results with observational data from SPICEcore, the recently completed, 1751-meter ice core drilled at 90 degrees S. The CFM incorporates a collection of firn models into a single model framework, to facilitate comparison among different formulations of the densification process. We have incorporated water isotope diffusion into the CFM, following the well-established method of Johnsen. We produce vertical profiles of water isotope ratios using a range of reasonable temperature and accumulation rate histories for the site. Water isotope spectra of the model output are compared with those of the ice core data, with the ultimate goal of finding the optimal combination of climate parameters that best reproduces the observed spectra.