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Atmospheric teleconnections between the tropics and high southern latitudes during millennial climate change

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Rapid climate changes, known as Dansgaard-Oeschger (DO) events, are ubiquitous over the last glacial period. DO climate anomalies are propagated globally through climatic teleconnections that are incompletely understood and insufficiently constrained by paleoclimatic data. Here we use a high-resolution deuterium excess record from West Antarctica to show that changes in the moisture sources for Antarctic precipitation occurred in-phase with the DO shifts in Northern Hemisphere (NH) climate and tropical hydrology. These results support the hypothesis that the Southern Hemisphere (SH) storm tracks migrate northwards during NH warm periods, in parallel with the well-established northward migration of the intertropical convergence zone.

Variability in the deuterium excess record also suggests that Southern Ocean sea surface temperatures (SST) followed the pattern of Antarctic surface temperatures – out of phase with NH climate, as expected from conceptual and numerical models of the ocean bipolar "seesaw" mechanism. Furthermore, using a physically-based definition of the deuterium excess parameter, we show East Antarctic records are highly coherent with the WAIS Divide record, indicating that the SST changes are zonally uniform. Our data demonstrate that both atmospheric and oceanic teleconnections couple climate variations between the NH and SH high latitudes, and constrain the timescales on which they operate.