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Contribution of the Southern Annular Mode to Variations in Water Isotopes of Daily Precipitation at Dome Fuji, East Antarctica

Content

Water isotopes measured in Antarctic ice cores enable reconstruction at the first order of the past temperature variations. However, the seasonality of the precipitation and episodic events, including synoptic-scale disturbances, influence the isotopic signals recorded in ice cores. In this study, we adopted an isotope-enabled atmospheric general circulation model from 1981 to 2010 to investigate variations in climatic factors in $\delta^{18}\text{O}$ of precipitation ($\delta^{18}\text{O}_p$) at Dome Fuji, East Antarctica. The Southern Annular Mode (SAM), the primary mode of atmospheric circulation in the southern mid-high latitudes, significantly contributes to the isotope signals. Positive $\delta^{18}\text{O}_p$ anomalies, especially in the austral winter, are linked to the negative polarity of the SAM, which weakens westerly winds and increases the southward inflow of water vapor flux. Daily variations in temperature and $\delta^{18}\text{O}_p$ in Dome Fuji are significantly small in the austral summer, and their contribution to the annual signals is limited. The isotope signals driven by the SAM are a locational feature of Dome Fuji, related to the asymmetric component of the large-scale atmospheric pattern.

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Track Classification: Progress in proxy development and interpretation