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Large Trajectory Ensembles for understanding Snow Accumulation over the Ross Ice Shelf

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We investigate how differing synoptic weather patterns over Antarctica affect the rate of precipitation. During the 2015/16 field season a 16m firn core was drilled on the Ross Ice Shelf (80.7^o S 174.5^o E). Oxygen ($\delta^{18}O$) and Deuterium ($\delta^{2}H$) isotope analysis of this core allow a 40 year record of snow accumulation and therefore precipitation over the Ross Ice Shelf to be produced. The resulting precipitation record differs significantly in magnitude and trend from climate model precipitation over a similar period of time.

In an effort to interpret this core we have attempted to identify distinctive weather patterns impacting snow accumulation. Lagrangian back trajectories are calculated from reanalysis wind fields to examine the origin of the air. The spatial distribution of trajectories as a function of time over the period of the ice core record are examined in an attempt to relate specific periods of large and small snow accumulation to particular pathways. We also examine how large scale modes of variability (Southern Annular Mode, El Nino Southern Oscillation and the Amundsen Sea Low) impact the spatial distribution of trajectories. Re-analysis humidity data along each trajectory is also considered allowing a more comprehensive identification of the origin of moist air, also helping to identify a representative 'residence time' of moisture for which our trajectory analysis is completed. Similar to previous studies we find that during periods of precipitation, air over the Ross Ice Shelf more frequently originates in the Ross and Amundsen Seas. While during dry periods over the Ross Ice Shelf we find the air originates more frequently from the Bellingshausen and Weddell seas, as well as continental Antarctica.