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Dynamical Processes Governing Transport of Atmospheric Sulfur to the South Pole

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Although the general correspondence between atmospheric sulfur and that found in Antarctic ice cores has been established for at least two decades now, the details regarding when and how it reaches the plateau each year are still not well understood. In general, with marine emissions of DMS being the central source of > 90% of non-seasalt sulfur arriving on the plateau, possible factors controlling the transfer flux include the yearly trends in marine primary productivity and sea ice extent, as well as seasonal trends in the dynamical properties of the plateau and coastal atmospheres. Complicating this picture still further, however, are the many chemical processes that take place at different stages of the transit process, each of which can alter the final speciation of deposited sulfur (e.g., nss-sulfate versus methane-sulfonate). These include reactions within the marine boundary layer, within the free troposphere, within the plateau atmospheric boundary-layer and quite likely even within plateau ice structures. This study was initiated in January of 2005 and was completed in January 2007. In this talk we will focus on the meteorological factors affecting transport to the South Pole from coastal regions: these include the seasonal cycle of large scale dynamics affecting trajectory origins in coastal areas, the seasonal reduction of sea ice extent in combination with seasonal changes in the zonal winds around the continent (possibly related to the Southern Annular Mode), and ultimately, boundary layer processes governing the release of constituents from the ice-free ocean surface and ultimately deposition to the surface over the interior.