111

ANTARCTIC PRECIPITATION

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The snow that falls on Antarctica sustains the ice sheet. It is delivered by the atmosphere and amounts to the equivalent of 7.5 mm of global sea level each year. Thus modest changes in snowfall have the potential to impact sea level immediately while ice-sheet discharges have a much longer time scale of change. An overview of what is known about Antarctic precipitation is presented.

First the available approaches for precipitation estimation are summarized and these range from snow accumulation observations (ice cores, snow pits, and stake arrays) to satellite remote sensing (passive microwave, optical and radar altimetry) to atmospheric diagnosis and numerical modeling (atmospheric moisture budget, global and regional models). The key aspects of the annual spatial distribution are that the rates decrease by a factor of 10 from the coast to the interior and that most of East Antarctica is classified as a polar desert, with annual accumulation amounts being less than 25 cm/yr water equivalent.

The middle and high latitudes of the southern oceans provide the moisture that is delivered to the ice sheet by cyclones and fronts near the coast and by the semi-continuous clear sky (diamond dust) precipitation over the high interior. Annually, amounts are smallest in the summer and largest in winter when the atmospheric circulation is most vigorous. The large-scale modes of atmospheric behavior (the Southern Hemisphere Annular Mode, the El Nino-Southern Oscillation, and the semi-annual oscillation) exhibit marked decadal variability and result in complex spatial and temporal patterns of precipitation variability.

A reconstruction of the time-varying precipitation and accumulation distribution over Antarctica since the International Geophysical Year is presented. The spatio-temporal precipitation variability is compared with the simulations by global and limited area models for the past 5 decades to evaluate the skill of contemporary global warming projections.