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Episodic occurrence of high precipitation events in Dronning Maud Land, Antarctica

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The precipitation regime of Dronning Maud Land (DML), Antarctica, was studied using Antarctic Mesoscale Prediction System (AMPS) archive data. Precipitation is the most important component of the mass balance of the Antarctic ice sheet. Precipitation studies of DML are particularly interesting because two deep ice core drilling sites, Kohnen Station and Dome Fuji, are located in this region. For the correct interpretation of the ice core properties a thorough understanding of the precipitation regime is necessary. The high-resolution AMPS archive data for the year 2001-2006 were used to study spatial and temporal distribution of precipitation. AMPS has been developed by the Mesoscale and Microscale Division of NCAR (National Center for Atmospheric Research) and the Polar Meteorology Group of Byrd Polar Research Center (BPRC) of The Ohio State University. For the investigated time period AMPS employed the Polar MM5, a version of the Fifth Generation Pennsylvania State University/NCAR Mesoscale Model optimized for use over ice sheets.

Whereas diamond dust is the prevailing type of precipitation with regard to time, several episodically occurring, synoptically induced precipitation events per year can bring unusually high amounts of precipitation and thus a large part of the total annual accumulation. This can cause a strong bias in the ice core data. Additionally, increased temperature and wind speeds during these events need to be taken into account for a correct climatic interpretation of ice cores. A better understanding of the frequency and cause of occurence of such intermittent precipitation in the interior of Antarctica in past and future climates is necessary for both paleoclimatological studies and estimates of future sea level change.

We investigated the synoptic situtation for 49 „high precipitation events“ that occurred during the time period 2001-2006 at Kohnen Station. The majority of the events was caused by an amplifying of Rossby waves with a strong northwesterly to northeasterly flow between a trough above the Weddell Sea and a blocking high above eastern DML. This synoptic pattern seems to be the most efficient one for bringing large amounts of moisture to the continent. Other, less frequently occuring synoptic situations include a flow from the southwest over the Weddell Sea connected to an upper air low above the Filchner-Ronne-Schelfeis. The model data are also used for a quantitative estimate of the ratio of diamond dust to synoptically induced precipitation.