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SNOW ACCUMULATION RATES ON LAW DOME, EAST ANTARCTICA FROM ICE CORE MEASUREMENTS

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Snow accumulation rates at the summit of Law Dome are examined on three different timescales. For the full record covering the last ~ 90,000 years accumulation rate is determined as an output of the model used for ice core dating. The results show low accumulation rates during the Glacial increasing by a factor of more than 10 through the Deglaciation and the early part of the Holocene. Along with the increase is a change in precipitation mechanism from the inland clear sky, ice crystal mode to the present cyclonic mode.

The second timescale covers the last 700 years. Data is obtained from ice core annual layer thickness by correcting for firn density and thinning due to ice flow. The thickness for any individual year has a large uncertainty due to the arbitrary selection of the maximum in the isotope record as the year start however the thickness smoothed over several years is highly accurate because the stable isotope and trace chemical analysis at sub-seasonal resolution allow unambiguous identification of annual layers.

The 700 year record shows variability on decadal and longer timescales amounting to surface elevation changes of several metres. There is little correlation between accumulation variability on any timescale and isotope ratio.

The third timescale is the last 45 years of ice core data that overlaps the instrumental record from Casey Station. We find a reasonably strong correlation between accumulation and local temperature but a poor correlation between accumulation and isotope ratio. This is consistent with precipitation from cyclonic events in which the amount of precipitation is principally dependant on the frequency of the events. Since cyclones bring warm air to the coast of Antarctica, average temperature correlates with cyclone frequency.