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Palaeoclimatic insights and challenges inferred from ice core studies

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Climate change is not new to the world, yet to the burgeoning global population future change may pose unprecedented challenges to human and environmental health. Understanding dynamics of past climate remains the ultimate testing ground for the concepts and models upon which projections of future climate rest. In exploring past climate conditions and in the search for the triggers, processes, and feedbacks that governed past climate change, ice cores have been instrumental. Ice cores provide a highly attractive combination of long records, high temporal resolution, and good dating control. At the same time, measurements of the ice composition, impurity content, and air bubbles make it possible to obtain information about both climate forcings and local, regional, and global climate conditions from the same archive. Recent studies of Greenland ice core records have investigated the dynamics of abrupt climate change at the termination of the last glacial in annual resolution. These studies document a complex relationship between changes at hemispherical and regional scales, and suggest that the extremely rapid climatic changes in the North Atlantic area may have been triggered by changes in low latitudes. The NEEM ice core, currently being drilled in North-West Greenland, will allow similar studies of the climatic transitions into and out of the past interglacial, the Eemian. With Eemian temperatures in Greenland being at least 3 degrees higher than today, the Eemian period represents one of the best analogues to future warming scenarios obtainable from studies of past climate. Analysis of Greenland ice core records thus provides important information on past climate as well as hints on future climate conditions.