Inferring the seasonality of past precipitation from ice core impurity records

Mai Winstrup[1,2], Eric Steig[1], Jihong Cole-Dai[3]
1: Earth and Space Sciences, University of Washington, Seattle, Washington
2: Centre for Ice and Climate, Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark
4: Ice Core and Environmental Chemistry Lab, South Dakota State University, Brookings, South Dakota

Impurity records from the WAIS Divide ice core, West Antarctica, have preserved seasonal information far back in time. These data contain information on the timing of past precipitation events: Each snowfall event leaves a chemical imprint in the ice core record, and the composition is controlled primarily by the time of year of deposition, because most chemical species measured in ice cores have seasonally varying sources. By means of a novel statistical approach with an origin in algorithms for machine speech-recognition, the inter-annual variability in snowfall seasonality can be inferred in a probabilistic manner. We will present the preliminary results when applying this method to chemistry data from the upper part of the WAIS Divide ice core.

Changes in seasonality of past precipitation have important influence on the ice core stable water isotope records. Inevitably, the isotopes only records paleoclimatic information during snowfall events, and consequently their mean values are biased towards the temperature at the time of year with most precipitation. Knowing how to disentangle the effect of precipitation seasonality in the ice core climate records will enrich our understanding of the isotopic signal in these, and allow for better estimates of e.g. past climate variability to be made. Such knowledge is likely to further our insights into the underlying mechanisms responsible for climate change, in the past as well as in the future.