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ICE CORE CHEMISTRY – STABLE ISOTOPE CONNECTIONS

D.P. Schneider[1], T.D. van Ommen[2], M.A.J. Curran[2], E Steig[1]

[1]Univeristy of Washington, Seattle, WA, United States, [2]Antarctic Climate and Ecosystems CRC and Australian Antarctic Division, Hobart, Tas, Australia

Stable isotope measurements from ice cores have long been regarded as proxies for local temperature, and recent work shows that a strong isotope-temperature relationship exists even on interannual timescales, especially if multiple cores are used and a regional (rather than local) temperature comparison is made. Various ice core chemistry ion species have most often been regarded as proxies for the atmospheric circulation on some regional scale. Here, using isotope and chemistry records from the high resolution Law Dome and US-ITASE ice cores, we show that the isotope and chemistry records have in common a correlation with the Southern Hemisphere Annular Mode (SAM), a major component of the atmospheric circulation. It is shown that the best proxy timeseries of the SAM is derived with a multiple-core, multiple-proxy multivariate analysis. Some of the relationships of individual species with the SAM are complex, however, and vary in and out of phase through time. Thus we explore the options for isolating various components of the chemistry and isotope signals due to e.g. source (open ocean or sea-ice zone for chemistry, latitude/temperature for isotopes), local affects, seasonality, and transport. The SAM is most relevant to the transport.

A second isotope-chemistry connection is presented, showing that the MSA sea-ice proxy of Curran and others, when extended back to 1800, is anti-correlated with the isotope-based Antarctic temperature reconstruction of Schneider and others (see accompanying presentation) on decadal timescales. This suggests the first documented long-term relationship of Antarctic temperature trends and sea-ice conditions.