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A chemical pace maker for dating Antarctic deep ice cores

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While ice cores provide a wealth of climatic information, the absolute dating for long sequences covering the late Quaternary represents an important challenge. In this respect, the use of tracers in ice which are dependent on insolation and therefore modulated by orbital periodicity (as ^{18}O from air and total air volume) open interesting perspectives (Dreyfus et al., submitted, Raynaud et al., submitted).

Here we present a model applying for the source and the transport of primary aerosol (dust and sodium) of continental and marine origin. Our approach is based from a first semi-empirical model which was developed to reproduce the glacial/interglacial (G/I) change in dust and sodium concentrations in deep ice cores (Petit and Delmonte, submitted) in which the dominant parameter is the temperature (for sodium) and temperature and source for the dust respectively. The importance of the temperature influencing the concentrations through the *life-time* effect appear supported by the G/I temperature changes we deduced and consistent from the isotope studies.

Remaining source and transport effects are assumed to be included in residuals we deduced from our model. Indeed, the residual signals of EPICA-Dome C (EDC) and Vostok dust and sodium appear not random but embedded with orbital frequencies at precessional timescale. Coherency with insolation is significant for both proxies but their variations are opposite in phase.

Considering their respective seasonal cycle, the early spring sodium residuals could be related to cyclonic activity and transport at high latitudes, while the late summer

dust residuals could be related dust source and the advection of troposphere air from the mid-latitudes. The two types of aerosol would be in opposite way modulated without phase delay by summer insolation at the south middle latitude and dominated by precession. Applied to the EDC ice core, the precessional component of the chemical pacemaker shows high coherency with the insolation component and supports the recently proposed EDC3 chronology over 800.000 years.

The long term insolation-related modulation of terrestrial and marine aerosol input, also observed for the sulphate flux at EDC, provides a “chemical pacemaker” that could be used to refine ice core chronologies.