Phasing between δD_{ice} records at Dome Fuji and Dome C in Antarctica over the past 216 kyr

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Two deep ice cores, Dome Fuji (DF) and EPICA Dome C (EDC) (see Figure 1), drilled at remote dome summits in Antarctica, were volcanically synchronized to improve our understanding of their chronologies. Within the past 216 kyr, 1401 volcanic tie points have been identified (see a poster in this conference). Based on this synchronization, we discuss phasing between the 216-kyr-long δD_{ice} records in the DF and EDC cores. Our intention is to investigate possible differences in timing in the δD_{ice} records from the two remote dome sites in East Antarctica. δD_{ice} records at DF and EDC are from Uemura et al. (2012) and Jouzel et al. (2007), respectively. In order to see the average phasing over the 216 kyr, the correlation coefficient of the δD_{ice} records, shifted by x years, was calculated. The result is shown in Figure 2. The correlation coefficient has a maximum when DF leads by 60 years. To investigate this feature more closely and as a function of time, the correlation coefficient of the δD_{ice} records, shifted by x years, was calculated on 20,000 yr time windows. The calculation was repeated at every 10,000 yr. In Figure 3, the maximum of correlation on each 20,000 yr time windows are given. It is remarkable in this graph that the lead of DF is between ~+710 years at 120 kyr BP (at MIS 5d) and -230 years at 200 kyr BP (at MIS 7a). On average, the lead of DF is +98 years. This averaged lead (+98 years) is consistent to the lead of the peak value (+60 years) and to the actual peak centre (+126 years). We observe some systematic features: (i) peaks of the DF lead tend to appear over colder periods (180 kyr BP at beginning of MIS 6, 120 kyr BP at MIS 5d and 60-80 kyr BP at MIS 4); (ii) The lead of DF is weak at some cold periods such as LGM, end of MIS 6 and so on; (iii) The lead of DF is very weak, or, the lead of EDC appears several times during warm periods, at the Holocene, MIS 5a-5b, MIS 5e and MIS 7a. If we assume that most of the millennial scale changes are following the bipolar seesaw pattern, then the Southern Ocean signal likely has a delay in it (WAIS Divide Project Members, 2015) compared to the northern hemisphere signal. It seems plausible that the delay is a little less in the Atlantic compared to the Indian and Pacific sectors. We therefore suggest that an average delay as small as +60-+126 years can occur naturally. In future studies, we clearly need further exploration of the time-dependent variations of the phasing.

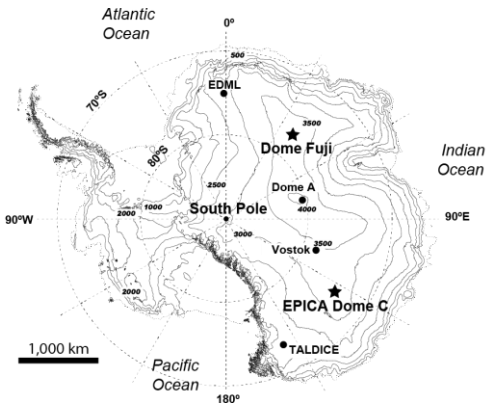

Figure 1: Map of the continent of Antarctica with elevation contours every 500 m. The two ice coring sites used in this study, Dome C and Dome Fuji, are marked with stars.

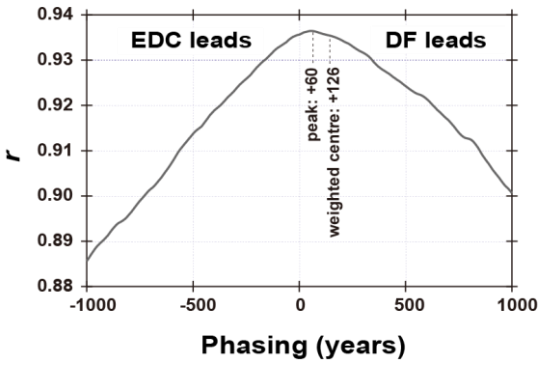

Figure 2: In order to see the average phasing over the 216 kyr, the correlation coefficient (*r* in the left axis) of the δD_{ice} records, shifted by x years (bottom axis), was calculated. *r* has a peak value when DF leads by +60 years. Considering the asymmetry of the peak shape, weighted centre was calculated to be +126 years.

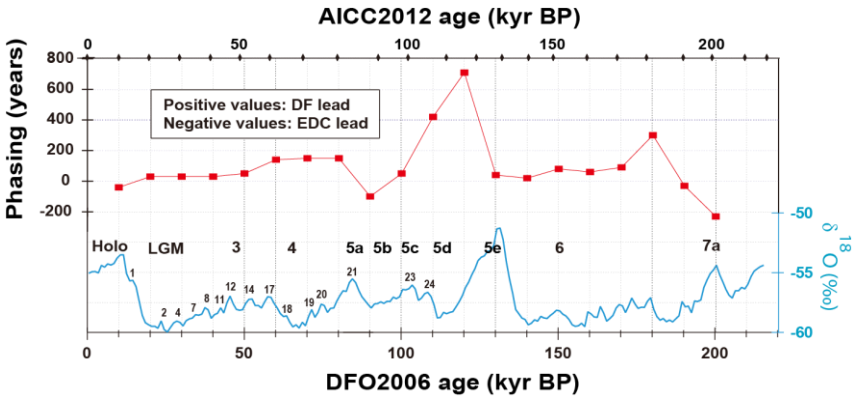

Figure 3: To investigate features of the phasing between the δD_{ice} records as a function of time, the correlation coefficient of the δD_{ice} records, shifted by x years, was calculated on 20,000 yr time windows. The calculation was repeated at every 10,000 yr. The maximum of correlation on each 20,000 yr time windows are given with red marker symbols and lines. Positive and negative values mean lead of DF and EDC, respectively. Blue trace with indications of the Marine Isotope Stages and Antarctic Isotope Maxima (AIM) is δD_{ice} of DF core averaged over every 1 kyr for reference (Uemura et al., 2012).

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