Coherence of the Antarctic ice core data from the Vostok station and EPICA

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Consistency of the Antarctic ice core data for temperature and CO_2, CH_4 and dust (D) concentrations in the atmosphere from the Russian Vostok station [1] and EPICA Dome C (EDC) [2] for the past more than 400 thousand years (kyr) is estimated with the use of cross-wavelet analysis and linear regressions [3] (see also [4-7]).

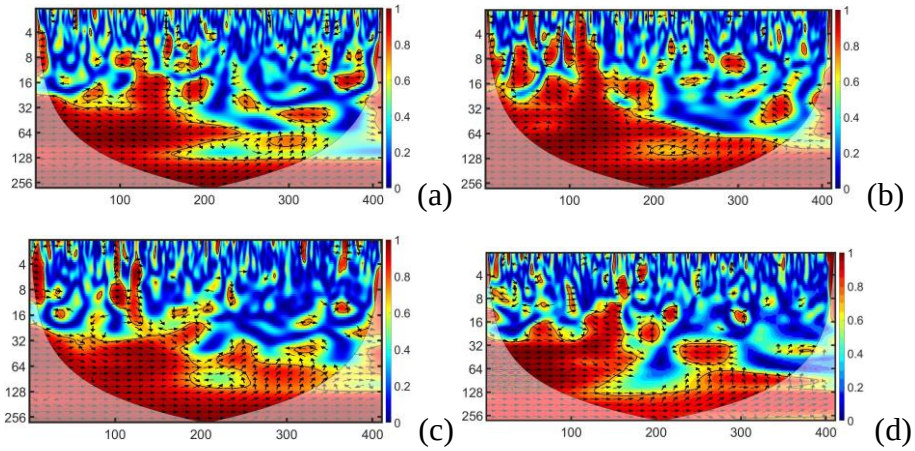

Figure 1. Coherence of variations of temperature (a), CO_2 (b), CH_4 (c) and dust (d) concentrations in the atmosphere from EDC and Vostok ice core records. Ordinates – periods in kyr before present (BP). Areas with significant coherence (95%) are highlighted, arrows characterize the phase shift (right-pointing arrow - in-phase, left-pointing arrow - antiphase). The boundaries of manifestation of edge effects are also marked.

Figure 1 shows coherence of variations of temperature T (a), q_{CO2} (b), q_{CH4} (c) and q_D (d) concentrations in the atmosphere from EDC and Vostok ice core records. The obtained results show a more significant agreement between the paleoreconstructions of EPICA and Vostok for the longest-term variations with a period of about 100 kyr or more. For shorter periods, the consistency of different data is best within the past 200 kyr.

Table 1. Coefficients of linear regressions of EPICA data (T, q_{CO2}, q_{CH4}, q_D) on corresponding Vostok data for different 100 kyr time intervals BP (I, II, III, IV and I+II+III+IV): k – regression coefficients, r – correlation coefficients.

		I+II+III+IV 0-400 kyr BP	I 0-100 kyr BP	II 100-200 kyr BP	III 200-300 kyr BP	IV 300-400 kyr BP
k (r)	T	1.32 (0.72)	1.49 (0.90)	1.73 (0.94)	0.78 (0.45)	0.79 (0.41)
	CO_2	0.83 (0.86)	0.98 (0.94)	0.93 (0.97)	0.52 (0.54)	0.74 (0.77)
	CH_4	0.73 (0.71)	0.77 (0.74)	0.76 (0.86)	0.42 (0.40)	0.54 (0.51)
	D	0.54 (0.51)	0.87 (0.79)	0.76 (0.74)	0.07 (0.06)	0.46 (0.38)

Table 1 shows coefficients of linear regressions of EPICA data (T, q_{CO2}, q_{CH4}, q_D) on corresponding Vostok data for different 100 kyr time intervals BP (I, II, III, IV and I+II+III+IV): k – regression coefficients, r – correlation coefficients. According to Table 1 the best agreement of different data is displayed for the past 200 kyr (I,II).

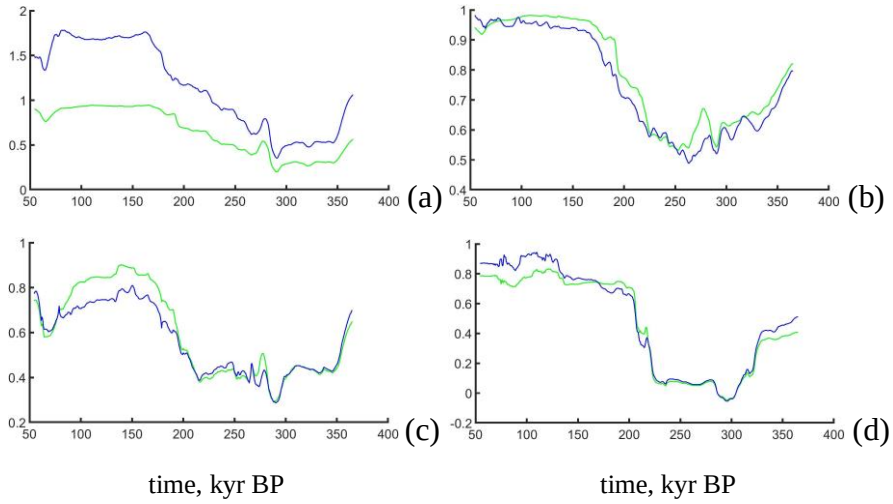

Figure 2. Coefficients of linear regressions of EPICA data on corresponding Vostok data for moving 100 kyr time intervals in dependence on time (kyr BP): (a) T, (b) q_{CO2}, (c) q_{CH4}, (d) q_D . Blue lines - coefficients of regression, green lines – coefficients of correlation.

Figure 2 shows coefficients of linear regressions of EPICA data on corresponding Vostok data for moving 100 kyr time intervals in dependence on time: (a) T, (b) q_{CO2}, (c) q_{CH4}, (d) q_D. According to Fig. 2 the best consistency of different data is exhibited within the past 200 kyr, especially for q_{CO2}.

As a whole, the results obtained show the best agreement between EPICA and Vostok data within the past 200 kyr.

References

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