Relative variations of temperature and aerosol concentration in the atmosphere from Antarctic ice cores

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Relative variations of temperature and aerosol concentration in the atmosphere from the Vostok (over the past 420 ka) [1] and EPICA Dome C (EDC, over the past 800 ka) [2] Antarctic ice cores are analyzed with the use of different cross-wavelet methods [3,4] (see also [5-7]).

Figure 1 shows different modes for variations of temperature (T [^{o}C], bold curves) and aerosol (mineral dust) concentration (dust [ppb], thin curves) in the atmosphere from EDC ice core records: a) 100 ka modes, b) 41 ka modes. These modes are corresponding to Milankovich periods. According to Fig. 1a, variations in dust concentration lag behind those in temperature for 100 ka modes. Figure 1b for 41 ka modes shows opposite in sign phase shifts between variations in dust concentration and temperature.

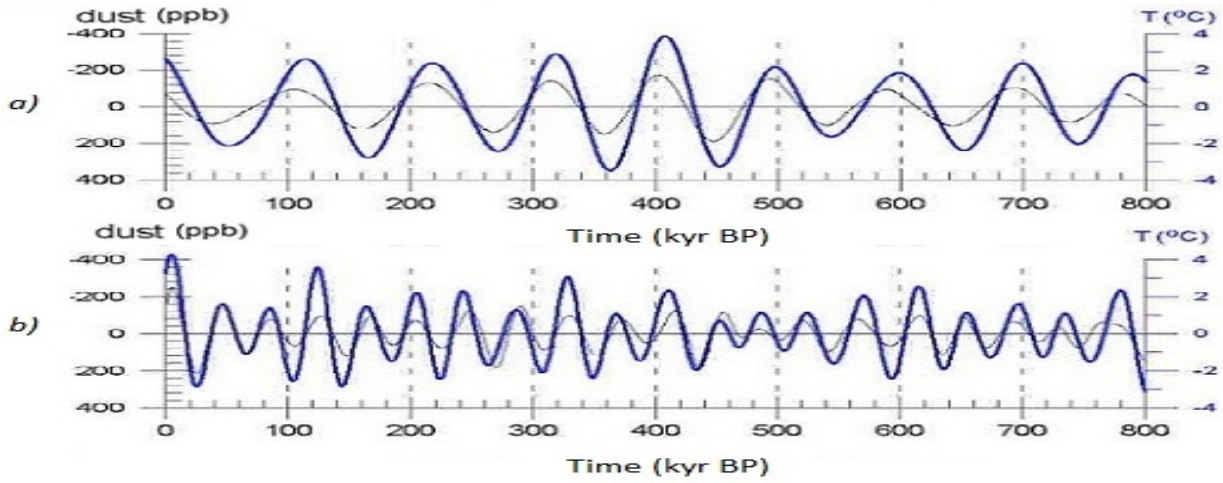

Figure 1. Different modes for variations of temperature T [^{o}C] (bold curves) and aerosol (mineral dust) concentration (dust [ppb], thin curves) in the atmosphere from EDC ice core records: a) 100 ka modes, b) 41 ka modes.

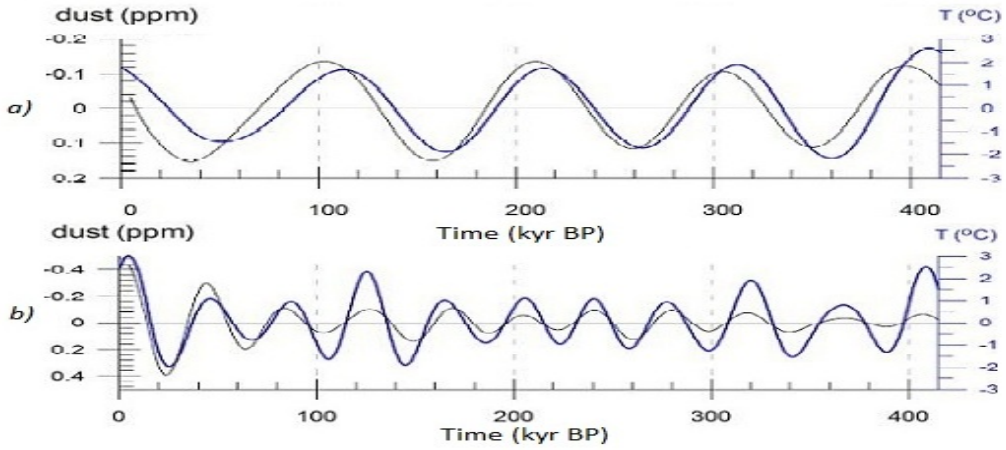

Figure 2. Different modes for variations of temperature (T [^{o}C], bold curves) and aerosol (continental dust) concentration (dust [ppm], thin curves) in the atmosphere from Vostok ice core records: a) 100 ka modes, b) 41 ka modes.

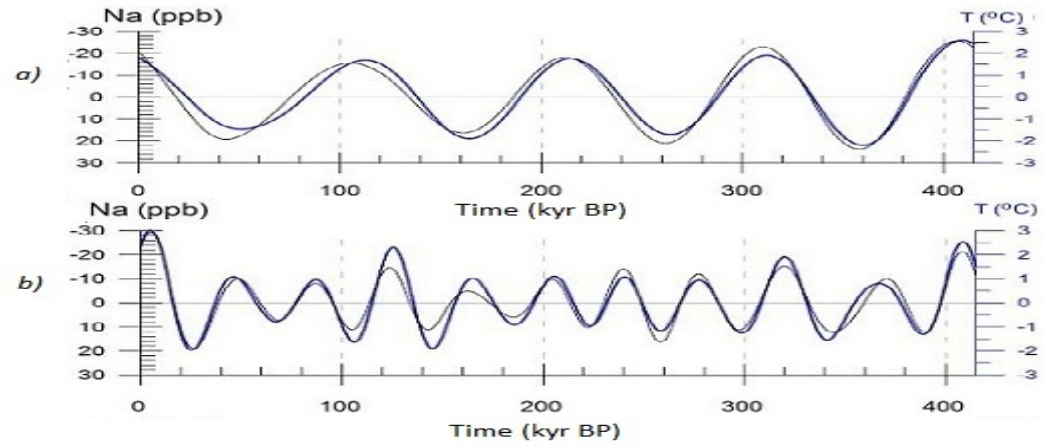

Figure 3. Different modes for variations of temperature (T [^{o}C], bold curves) and marine aerosol concentration (Na [ppb], thin curves) in the atmosphere from Vostok ice core records: a) 100 ka modes, b) 41 ka modes.

Figure 2 and Figure 3 show different modes for variations of temperature and continental dust (Fig. 2) and marine aerosol (Fig. 3) concentration in the atmosphere from Vostok ice core records: a) 100 ka modes, b) 41 ka modes. According to Fig. 2a and Fig. 3a, variations in continental and marine aerosol concentration lag behind those in temperature for 100 ka modes while modes with the period 41 ka display opposite in sign phase shifts between variations in atmospheric aerosol concentration and temperature.

Overall, the results obtained with the use of different methods of cross-wavelet analysis [3-5] reveal the phase lag of temperature variations relative to variations of aerosol concentration for the modes with a period of about 40 ka or less.

References

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