



On the origin of the 100-kyr astronomical cycles

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Investigations during the last twenty-five years have demonstrated that the astronomically related 19, 23 and 41-kyr quasi-periodicities actually occur in long records of the Quaternary climate. But the same investigations identified also the largest climatic cycle as being about 100 kyr long. Different sources for this so-called 100-kyr cycle have been found in the astronomical parameters and in the insolation itself. The most popular one is certainly the eccentricity with the largest spectral components around 100-kyr being 94 945, 123 297, 99 590 and 131 248 yr (Berger, 1978). The first eccentricity cycle is however 400-kyr long and instability of the 100-kyr cycle is related to it. The derivative of eccentricity is definitely showing a spectrum which is, contrary to e , dominated by the 100-kyr cycle with the same spectral components around 100 kyr as in e itself. The inclination of the Earth orbital plane on the ecliptic does not display any 100-kyr cycle, but it is not the case for its inclination on the reference plane for which cycles of 98 046 and 107 478 years appear. Finally the frequency modulation of obliquity is characterized by cycles 171 kyr and 97 kyr long. For insolation, it is known that there is only a very weak signal around 100-kyr coming from e itself. However, if we consider the seasonal cycle at the equator, its amplitude varies with cycles around 400 kyr, 100 kyr, 10 kyr and 5 kyr, all related to e . Although all these cycles are close to the 100-kyr cycle found in geological data, five independent astronomical values are found between 95 and 107 kyr and a wavelet signature is suggested to test possible relationships between the astronomical and climatic variables and hopefully to identify the source of the 100-kyr cycle found in proxy climate records.