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Improved Astronomically Tuned Timescales for the Late Neogene

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Recent attempts to tune geological timescales to Milankovitch-type cycles rely on matching features in proxy records to astronomically calculated obliquity and precession cycles. They often use tuning targets such as the 65°N summer insolation curve. It has been shown (Laskar 1993) that the exact position of insolation peaks in time depends on the parameters chosen for dynamical ellipticity and tidal dissipation (the Earth model). Hence a better knowledge of these parameters is needed before precise timescales for the pre Pliocene can be developed using traditional methods (Lourens, 1996).

High quality geological records that have been tuned to an astronomical target have been published from both the Pacific (especially ODP Leg 138; Shackleton et al., 1995) and the Atlantic (especially ODP Leg 154; Shackleton and Crowhurst, 1997) although two different astronomical solutions have been used for the two studies. We have re-examined these data sets to place them in a consistent time scale, and to improve signal-to-noise ratio by stacking different data sets. Our objective is to optimise the separation in the data of that variability that is independent of the chosen Earth model (the amplitude modulation of the precession and obliquity components, extracted by complex demodulation) from the components that do depend on the chosen Earth model (the mean frequencies for obliquity and climatic precession). This operation can be performed iteratively on older sequences to optimise the astronomical solution for longer time intervals.

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