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Lake Baikal's magnetic record of the climate response to orbital forcing: advancing toward the continental climate reference curve for the last 1.1 million years

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Petromagnetic parameters of sediment cores from Lake Baikal show variations that are strongly connected to Quaternary climate change. Interglacial intervals are characterized by low magnetic mineral concentrations and a composition that is dominated by low coercivity minerals. Glacial intervals are characterized by high magnetic mineral concentrations and increased amounts of high coercivity minerals. The variation in magnetic concentration is consistent with dilution by diatomite during interglacial periods. Using this conceptual model a new composite magnetic susceptibility record from three deep drilling cores was constructed for the last 1.1 million years. A new tuned age model is calculated based on beryllium dating, magnetostratigraphy and correlation of the susceptibility to the insolation assuming non-linear variations of the sedimentation rate between correlation points. Previous models were built using correlation with the oceanic oxygen isotope curve and linear interpolation between paleomagnetic events. These models were too crude to resolve high-frequency orbital precession. Spectral analysis of the new composite record shows strong oscillatory signals in the precession and obliquity bands, thus confirming the presence of Milankovitch periodicities. These results also validate that the climatic response in the continental interior is different from the oceanic one where the eccentricity cycle is most prominent. Presence of non-Milankovitch periodicities demonstrate that the tuning procedure did not destroy the original climatic signal that contains information on processes not related to the orbital dynamic. Our study reveals a huge potential for the application of the petromagnetic technique for continental climate reconstruction. Our new composite magnetic susceptibility record could serve as a reference curve for dating cores and sections from the continental interior.