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# Borehole log cyclostratigraphy: towards systematic probing for Milankovic cycles in logging data

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Cyclostratigraphy is an integral part of many scientific studies on the age and duration of outcrop- and core material from sedimentary geoarchives. Yet, borehole data are not systematically assessed using cyclostratigraphic methods. This has various reasons, including (a) a specific resolution and commonly no possibility to increase data resolution after logging, (b) logging proxy data cannot be connected to the sedimentary environment as easily as core investigations, (c) commonly cyclostratigraphic studies focus on one lithostratigraphical unit, but borehole logs may comprise several (d) some data generated from core material (e.g. stable isotope ratios) cannot be acquired in boreholes directly.

To obtain a reliable understanding of (long) borehole logging datasets, a good understanding of the potential and specifics of relevant (time/depth) evolutive methods in cyclostratigraphy are an essential prerequisite. Therefore, initially we test a suite of evolutive cyclostratigraphic methods using several artificial datasets consisting of modelled Milankovic signals and noise. The principles of spectral moments, or other types of signal characterizations, can be used for initial assessment of signal properties over the entire record. Wavelet analysis and evolutive harmonic analysis (EHA) represent windowed approaches of assessing cyclicity, where wavelet analysis can assess amplitude variations. Evolutive average spectral misfit (eASM) and evolutionary correlation coefficient analysis (eCOCO) assess the similarity of power spectra (eCOCO) and significant cyclic variations (ASM) in geological datasets against Milankovic targets. The TimeOpt method investigates precession- and eccentricity amplitude modulations and aims at finding a best fit through assessing various sedimentation rates. The astronomical component estimation (ACE) approach can be used to extract Milankovic signals from the datasets.

In a second step, we apply these methods to rather well understood borehole logging data. Test-data include ODP Site 926 (Ceara Rise), where core material has been studied for astrochronology. From this site various logging data are available in the ODP Log Database. Density data have the highest resolution of mostly 2.5 cm. This allows assessment of precession scale cycles at this locality.

Aim of our work is the comparison of different evolutive cyclostratigraphic methods for an understanding of which methods perform good under specific conditions. This work represents an initial step towards a systematic assessment of method suitability for real borehole logging data.