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Integrating astronomical solutions and geological observations

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Some of the large climatic changes of the past originate in the variations of the Earth's orbit and of its spin axis resulting from the gravitational pull of the planets and the Moon. These variations can be traced over several millions of years back in time (Ma) in the geological sedimentary records (e.g. Milankovitch cycles). Over the last decades, the Earth's orbital and spin solutions have been used to establish a geological timescale based on the astronomical solutions. Nevertheless, extending this procedure through the Mesozoic Era (66-252 Ma) and beyond is difficult, as the solar system motion is chaotic. It will thus not be possible to retrieve the precise orbital motion of the planets beyond 60 Ma from their present state.

Astrogeo, a project funded by the European Research Council (ERC), will use the geological record as an input to break the horizon of predictability of 60 Ma resulting from the chaotic motion of the planets. This will be achieved by considering statistical methods and by using ancient geological data as an additional constraint in obtaining astronomical solutions. Astrogeo aims to provide a template orbital solution for the Earth that could be used for paleoclimate studies over any geological time. This will open a new era where the geological records will be used to retrieve the orbital evolution of the solar system. It will thus open a new observational window for retrieving not only the history of the Earth, but of the entire solar system. Here, we want to reach out to the broader cyclostratigraphic community to discuss suitable procedures and data sets to couple both theoretical solutions and geological observations. In particular, we are interested in examining high-quality data sets with clear and well-constrained (single or combined) expressions of the astronomical parameters of eccentricity, precession and obliquity.