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Climate cyclicity revealed from X-ray CT images of deep offshore sediments

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We present a methodology to assess climate variability by using X-ray computed tomography (CT) images along with laboratory velocity measurements and borehole logs and apply it to a specific stratigraphic interval in deep water Campos Basin, offshore Brazil.

The higher resolution of sampling in the core data (extracted from 2.8km depth) overcomes the aliasing and smoothing effect of log-based measurements and enables the delineation of stratigraphic cycles. The mineralogy variation in these rocks, which we interpret as a response to astronomically-forced climatic cycles, leads to pronounced and rhythmic variations in physical properties. In addition, we observe a good correlation between X-ray CT value and ultrasonic velocity.

We demonstrate that there is spatial cyclicity that cannot be revealed even using high resolution logs. The understanding of the cyclicity characteristics in the area under study allowed us to identify Milankovich cycles, which we interpret as precession cycles (19ky periodicity). We conclude that there is a potential for using X-ray CT tools combined with ultrasonic measurements to assess small scale rock physical properties from deeply buried sediments. Consequently, this new methodology broadens the spectrum of data to be used in paleo-climate studies.