Geophysical Research Abstracts, Vol. 7, 00102, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00102

High-rate sea-level change during the Mesozoic: New approaches to an old problem

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It is generally assumed that the effects of tectonism, sediment accumulation and compaction, and eustasy on accommodation change cannot be untangled on a regional scale. Hence, most reconstructions of past eustatic change have focused on global correlations. Here, this approach is questioned. In the time domain of few Myr and less, global cycle correlation is often unreliable and the effects of isostasy on sea level show strong provincial variations. In contrast, on a regional scale, cycle correlation is more precise and regional tectonism has predictable limitations. These considerations form the base for an assessment of the poorly understood causes of high-rate sea-level change in the Mesozoic. Three well-documented, regional, semi-quantitative sea-level curves are chosen here for reference (Jurassic of Britain, Cretaceous of Russia, Albian of Oman). The absolute numbers of amplitudes are open to question, but the order of magnitude (rates of several meters to 10's of meters per Myr) is a robust property of all three curves even when considering large error bars. Variable mechanisms that cause these regressive-transgressive cycles are considered but rejected with exception of the controversial issue of glacio-eustasy or unknown mechanisms. Therefore, orbital forcing of glacio-eustasy is assessed. Freezing-melting cycles of higher-altitude ice shields can explain high-rate sea-level change with moderate amplitudes but conclusive evidence is buried beneath three kilometers of East Antarctic ice. Thus, although several ambiguities of 'global' sea-level correlation are avoided by the regional approach, the causes of high-rate Mesozoic sea-level change remain poorly understood.