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Turnover pulses, intermittent stability and trends — on the time scales of large mammal evolution

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The Mammal fossil record is long recognized as an excellent source for testing the causality of evolutionary change. The large mammal evolution shows a wide diversity of patterns including so called turnover pulses (high magnitude random impulses of extinctions and originations), periods of taxonomic stasis, while also there is plenty of evidence for long-term trends in morphological traits and taxonomic diversity. The major question is: how can we reconcile such a diversity of dynamical regimes given that we are having a single history of life?In this contribution we approach this question of dynamical regimes from the scaling perspective. The shapes of species diversity curves were reconstructed using spatio-temporal occurences of Perissodactyla, Artiodactyla (excluding Cetacea) and Carnivora (excluding Pinnipedia) from the NOW (New and Old Worlds) database by applying the Bayesian PyRate approach. The derived diversity curves were analyzed applying Haar fluctuations which were used in constructing structure functions, which reveal typical fluctuation magnitudes as a function of time scales.The results reveal that there are three separate time scales characterized by contrasting regimes. At shorter macroevolutionary time scales the episodic events produce turnover pulse patterns with the magnitudes peaking at time scales around 2 Ma. At time scales ranging from 3 to 5 Ma the stabilizing processes dominate. And the longer time scale the positive scaling trends in diversity dominate the biodiversity change. These longest time scale changes in biodiversity are directly coupled with the long-term megaclimate drift. The large mammal evolution is shaped by the superposition of qualitatively different processes operating on three time scales. The separation of time scales is shaped by the climate-macroclimate-megaclimate transitions and internal biotic feedbacks.
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