EGU22-11544
https://doi.org/10.5194/egusphere-egu22-11544
EGU General Assembly 2022

Delineating driving mechanisms of Phanerozoic climate: building a habitable Earth

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The fundamental drivers of Phanerozoic climate change over geological timescales (10–100s of Ma) are well recognised: degassing from the deep-earth puts carbon into the atmosphere, silicate weathering takes carbon from the atmosphere and traps it in carbonate minerals. A number of variables are purported to control or exert influence on these two mechanisms, such as the motion of tectonic plates varying the amount of degassing, the palaeogeogrpahic distribution of continents and oceans, the colonisation of land by plants and preservation of more weatherable material, such as ophiolites. We present a framework, *pySCION,* that integrates these drivers into a single analysis, connecting solid earth with climate and biogeochemistry. Further, our framework allows us to isolate individual drivers to determine their importance, and how it changes through time. Our model, with all drivers active, successfully reproduces the key aspects and trends of Phanerozoic temperature, to a much greater extent than previous models. We find that no single driver can explain Phanerozoic temperature with any degree of confidence, and that the most important driver varies for each geological period.