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Simulating Neoproterozoic climate and redox evolution from first principles using a climate-chemical model

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The Neoproterozoic Era was a time of massive changes in global climate and in the chemistry of the oceans, but the reasons for these changes remain unclear. The SCION climate-chemical model [1] allows us to look further into these questions by producing its own self-consistent reconstruction of biogeochemistry and climate, based on assumptions about the underlying tectonics and the evolution of the biosphere. The model uses a data structure of 3D climate model runs to inform a spatial global biogeochemical scheme which can calculate long-term changes in atmospheric CO_2 and O_2, surface temperature, marine redox and a selection of isotope proxies. We update the model for the Neoproterozoic and explore the predictions here. We assess where they do and do not agree with the geological and geochemical record in order to better understand the controls on Earth's habitability throughout this important Era.

[1] Mills, B. J. W., Donnadieu, Y. & Goddéris, Y. Spatial continuous integration of Phanerozoic global biogeochemistry and climate. Gondwana Research, doi:10.1016/j.gr.2021.02.011 (2021).