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## Exploring the possible meridional temperature gradient of Early Eocene Climatic Optimum with an energy balance model

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Early Eocene Climatic Optimum (EECO, ~53-51 million years) is one of the past warm periods, associated with high CO<sub>2</sub> concentrations (~900-2500 ppmv), which can serve as an analogue for our possible future, high CO<sub>2</sub> climate. One notable feature of this hothouse climate state is the weaker meridional temperature gradient relative to pre-industrial values. This has been confirmed by both proxies and models, but the extent of the temperature gradient still requires more research. Models are challenged to reproduce the stronger than present day polar amplification signal, and it is also shown that high latitude proxy data are often influenced by seasonal bias. Thus, there is an uncertainty regarding both the observed and modelled meridional gradient and the mentioned issues complicate also the comparison between modeled and proxy data.

In our work we aim to investigate the EECO period with a simple energy balance box model and apply the maximum entropy production principle to explore the possible scenarios of meridional temperature gradients. We find that the maximum entropy production principle could be beneficial in the paleoclimate context since it has the utility to give an accurate prediction for non-equilibrium systems with the minimal amount of information. We also assess the heat transport signaled by proxy data and by state-of-the-art model outputs in accordance to our theoretical constraints based on the idealized test case.