

Simulations of the evolution of an earth-like planetary atmosphere

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Abstract

Our final goal is to simulate the evolution of an earth-like planetary atmosphere considering the effect of biogeochemical cycles for periods before, during and after the rise in oxygen.

We are developing a photochemical column model scheme which includes an array of photochemical reactions (e.g. Kasting et al. 1984, Segura et al. 2003, Grenfell et al. 2007). Instead of fixing the long-lived species O₂, N₂, and CO₂ to constant isoprofile values - a common approach for modern Earth models, we calculate these species interactively. This includes the proper treatment of their photochemical sources and sinks, and the setting of boundary fluxes at the surface (e.g. for O₂, due to life on Earth, for N₂, due to the nitrogen cycle, and for CO₂ due to the carbon cycle).

We present preliminary results reproducing modern Earth with a variable O₂, CO₂ and N₂ photochemistry coupled with a radiative-convective climate model.

References

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