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One-Dimensional Model Focused on Photo-dissociation Reactions applied to the Archean Atmosphere

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Chemical constituents in the atmosphere are governed by chemical and physical processes such as chemical reactions, circulation, emission, and deposition. The variation of concentration of atmospheric chemical species is expressed by time-dependent continuity equations. It is laborious to solve these equations due to its continuity and complexity. We use the one-dimensional plane-parallel model to compute the number densities of each species at each altitude. In this work, we applied our atmospheric model to the Earth atmosphere in the Archean Era.
In particular, we are focusing on the photo-dissociation reactions in which molecules are broken down into smaller units by photons. When the atmosphere contains compounds that can absorb photons from solar radiation, the intensity of actinic flux is getting weaker with falling an altitude down. We computed the optical depth to consider an attenuation of actinic flux, and the reactions coefficients are calculated with the data of molecular absorption cross-section, reactions yield, and actinic flux. This model makes possible dynamical computations of photo-dissociation rate constants sensitive to small changes in the atmospheric chemical composition. Additionally, the code is capable of account for high resolution spectra, which is required to calculate photo-induced isotopic effects.
This work presents the results to applied to reducing type of environment which is characteristic of the atmosphere in the Archean Era.