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Chemistry with KROME: Dynamical photochemical solver coupled to chemical disequilibrium and sulfur isotopes

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The study of chemical networks of Earth's geological past such as the Archean and Exoplanetary atmospheres requires the resolutions larges number of chemical reactions. This necessity is based on the lack of observational parameters abundant in today's planet Earth or neighbor planets in the solar system. The aim of this work is to construct a planetary atmosphere chemical network solver that relies on a minimal number of observational parameters.

We present here the latest development in our effort to develop such model. Our previous report presented the efficiency of the chemical solver for a large number of chemical species and reaction networks. In this report we present a photochemical dynamic core capable of solving ultraviolet opacities and photo-dissociation reaction rates at each step of the calculation. Additionally the model has been equipped with a set of equations to calculate disequilibrium effects on the chemical network. The stability and robustness of the code has been tested for a large network with more than 500 reactions interlinking more than 40 chemical species. The results obtained so far have been contrasted with the most common chemical codes available in the literature for benchmark.

Keywords: Archean Atmosphere, Sulfur Isotopes