# The effect of life on Earth's atmosphere: a disequilibrium analysis during history

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The study of the habitability of planetary atmospheres is gaining an increasing interest in the last decades, due to the discovery of many extrasolar planets.
It has long been observed that Earth's atmosphere is uniquely far from its thermochemical equilibrium state in terms of its chemical composition. Studying this state of disequilibrium is important for its potential role in the detection of life on other suitable planets.

A methodology to calculate the extent of atmospheric chemical disequilibrium has been developed [1, 2]. This research allows us to understand how life affected geochemical processes on Earth, leading a thermodynamic tool able to be applied to other planets, moons and exoplanet to deeper study their habitability.
This methodology has been developed using the KROME package to solve chemical kinetics [3].

In this work we present an analysis of Earth's atmospheric disequilibrium during its geological history, showing the decreasing contribution of photochemistry due to the rise of a biosphere. Further, we tested different model of simplified ecosystems in order to study the effect of the complexity of trophic chains on the atmospheric disequilibrium.

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[2] Simoncini E., Virgo N., Kleidon A., 2013, Earth System Dynamics, 4, 1-15.
[3] Grassi, T., Bovino, S., Schleicher, D. R. G., Prieto, J., Seifried, D., Simoncini, E., Gianturco, F. A., Mon. Not. R. Astron. Soc. MN-13-2848-MJ.R1.

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