EPSC Abstracts
Vol. 13, EPSC-DPS2019-2027, 2019
EPSC-DPS Joint Meeting 2019

EPSC
EPSC-DPS Joint Meeting 2019
15–20 September 2019 | Geneva, Switzerland

Geochemistry of Carbon Cycles on Rocky Exoplanets

Kaustubh Hakim (1), Pierre Auclair-Desrotour (1), Russell Deitrick (1), Daniel Kitzmann (1), Dan J. Bower (1), Caroline Dorn (2), Kevin Heng (1)
(1) Center for Space and Habitability, University of Bern, Gesellschaftsstrasse 6, 3012 Bern, Switzerland (kaustubh.hakim@csh.unibe.ch)
(2) Institute of Computational Sciences, University of Zurich, Winterthurerstrasse 190, 8057, Zurich, Switzerland

Abstract

The long-term carbon cycle (also known as the silicate-carbonate cycle) acting on a timescale of the order of hundreds of thousands of years provides the essential negative feedback to maintain temperate climates on Earth. With the discovery of almost a thousand rocky exoplanets and ongoing hunts for an Earth-twin, it is imperative to understand the working of the carbon cycle on such planets.

The aim is to investigate the factors of the Earth's carbon cycle that are critical to stabilize and destabilize carbon cycles on rocky exoplanets. These factors could be dependent on the orbital, planetary and stellar parameters as well as planet-specific properties such as rock composition, land and ocean fractions, among other factors.

In this study, we focus on modeling the chemical kinetics of rock-water interaction for different rock types (depending on the planet's surface composition), as well as pH. We incorporate a set of silicate weathering reactions leading to the formation of carbonates. In addition to continental silicate weathering, we explore the effects of seafloor weathering especially in the context of varying land-mass fractions, and shallow and deep ocean fractions. Other components of the carbon cycle such as subduction, ridge and arc volcanism are parameterized based on previous studies. The effects of planet size, oxidation states, and tidal locking are also investigated.

Acknowledgements

We acknowledge financial support from the European Research Council via Consolidator Grant ERC-2017-CoG-771620-EXOKLEIN (awarded to Kevin Heng).