



Feedback cycles in planetary evolution including continental growth and mantle hydration, and the impact of life

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The Earth's evolution is significantly affected by several intertwined feedback cycles. One of these feedback loops describes the production and erosion of continental crust. Continents are produced in subduction zones, whose total length in turn is determined by the fraction of continental crust. Furthermore, the fraction of continental crust determines the amount of eroded sediments. These sediments eventually enter subduction zones and affect the water transport into the mantle. As the biosphere enhances weathering and erosion of continental crust, we show how life on Earth can enter this feedback cycle and stabilize the present day state of the Earth. A second feedback loop – coupled to the first one – includes the mantle water cycle. Water in the Earth's mantle reduces its viscosity, and therefore increases the speed of mantle convection and plate subduction.

Here, we present a thermal evolution model of the Earth which reproduces the present day observations. We investigate the influence of the biosphere during the Earth's evolution on continental growth and mantle hydration. Finally, we discuss implications on the evolution of plate-tectonics planets beyond our solar system.