Geophysical Research Abstracts
Vol. 20, EGU2018-8656, 2018
EGU General Assembly 2018

Water in geodynamical models of mantle convection and plate tectonics

Juan Rodriguez-Gonzalez (1), Jeroen van Hunen (1), Kiran Chotalia (2), Carolina Lithgow-Bertelloni (2), Antoine Rozel (3), Paul Tackley (3), and Takashi Nakagawa (4)

(1) Durham University, Durham, UK (juan.rodriguez-gonzalez@durham.ac.uk), (2) University College, London, UK, (3) ETH, Zurich, Switzerland, (4) JAMSTEC, Yokosuka, Japan

The presence of water in the the mantle has a significant effect in the dynamical and thermal evolution of Earth, which partially explains the differences with other planets and is a key factor for the presence of life on Earth. First, a small amount of water can decrease the mantle viscosity by a several orders of magnitude, thereby changing the convection regime and affecting the thermal evolution. Second, the presence of water significantly changes the solidus curve, with crucial implications for melting. Third, water in the mantle can change the Clapeyron slope of mantle materials, which changes the depth at which phase transitions take place. The thermal and dynamical evolution of Earth under the presence of water in the mantle has been the focus of recent studies, but many questions remain unanswered.
In this project we intend to investigate how the maximum water capacity of different mantle regions affects water transport and Earth's convective regime. We will study the effect phase transitions under the presence of water, which can change the buoyancy of slabs in the transition zone.
We present preliminary results numerical models of global mantle convection for the whole history of earth using the numerical geodynamics software tool StagYY. We will use a new parametrisation of dehydration processes, obtained from high-resolution numerical simulations, to implement a more accurate description of the water released from the slab as it travels through the mantle. We have integrated recent experimental results of the water capacity of deep mantle minerals to study the water circulation and the total water budget. We use data from the most recent experiments and ab-inito calculations to implement a realistic rheology.