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Pressure-Dependent Viscosity on Sub-Earths and Super-Earths

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Due to new technologies the number of terrestrial extrasolar planets found in the past few years increased very fast, and the habitability of these planets is a widely discussed topic of the last years.

In the present study we investigate the mantle dynamics of planets of Earth-like composition with masses ranging from 0.1 to 10 Earth masses. We consider temperature- and pressure-dependent viscosity using the Arrhenius formulation of the viscosity and a radioactive heat source density similar to present Earth. Physical parameters like gravity and ratio of core to planet radius have been rescaled using the parametrizations of Valencia et al. [2006]. The choice of the core temperature is important for the mantle dynamics and here we use the core temperatures of Papuc and Davies [2008] for reason of comparison with other model results [Papuc and Davies, 2008; Valencia et al. 2007], which are slightly warmer than in other studies of exo-planets like [Valencia et al. 2007].

The convective pattern and the heat transport in a terrestrial planet depend on the viscosity of the mantle material, which defines the flowability of the material. The viscosity on the other hand depends strongly on temperature and pressure, i.e., the viscosity decreases with increasing temperature but increases with increasing pressure. Thus, the larger the planet the stronger is the influence of the pressure on the viscosity and a stagnant lid at the core-mantle boundary (CMB) can arise. To distinguish this layer from the lid at the surface, we introduced the notations *low-lid* and *up-lid* [Noack et al. 2009, Stamenkovic et al. 2010].

We investigate the influence of increasing planetary mass and hence increasing pressure on the emerging stagnant low-lid at the CMB and its influence on the convection of Earth-like planets for Super-Earths (with masses larger than one Earth mass) and so-called *Sub-Earths* (which are smaller than Earth).

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