Effects of rheological parameters on continental drift and water cycling in 3D mantle convection

*柳 竜之介[1]、吉田 晶樹[2]、岩森 光[1,2]
*Ryunosuke Yanagi[1], Masaki Yoshida[2], Hikaru Iwamori[1,2]

1. 東京工業大学、2. 国立研究開発法人海洋研究開発機構
1. Tokyo Institute of Technology, 2. Japan Agency for Marine-Earth Science and Technology

The Earth is unique among the solar terrestrial planets, having the continents and the abundant liquid water on its surface. From some previous studies (e.g., Iwamori and Nakamura, 2015, Gondwana Res.; Yanagi et al., 2016, Abstr. of JpGU Meeting), it has been thought that the continental dispersal and coalescence are in a close relationship with water distribution in the mantle. However, there are some problems for reproducing continental dispersal and coalescence. One of the fundamental problems concerns the mechanism of continental dispersal and coalescence. For instance, we do not know when and how the continent would be broken up. In this study, we have varied the values of a yield stress of the lithosphere and an activation energy of the mantle rock, which are thought to be key parameters for mantle convection. The reason we selected these two parameters is that yield stress controls the vulnerability of lithosphere and the activation energy is related to viscosity variation in the mantle, both of which affect the pattern of the continental dispersal and coalescence. The model used in this study is a three-dimensional (3-D) mantle convection model incorporating presence of the continental materials. In this numerical simulation of 3-D spherical mantle convection, the supercontinent is introduced in the initial state of the simulation run in order to study how continental dispersal and coalescence occurs and affect the structure of the Earth’s interior. This study will test a hypothesis that there is a close relationship between the mechanisms of continental drift and the lithospheric conditions that depend on the yield stress and the activation energy. In addition, the water solubility of the mantle rock is considered in this model for understanding the effect of continental drift on water transportation in the mantle. Our studies will also examine global structures for water distribution in the mantle as proposed by Iwamori and Nakamura (2015) and Yanagi et al. (2016).

キーワード：3次元マントル対流、大陸の離合集散、水循環、降伏応力、粘性率
Keywords: three-dimensional mantle convection, continental dispersal and coalescence, water cycling, yield stress, viscosity

