SIT40-P11 　　　　　会場:3 階ポスター会場 　　　　　時間:5 月 1 日 18:15-19:30

スラブとともに沈み込む水の移動と全マントル対流への動的効果
Water migration with a subducting slab and the dynamic effects on whole mantle convection

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Existence of liquid water is a characteristic of the earth. The water of interior of the Earths involved with the subducting plate reduces density and viscosity of the crustal and mantle rocks. These effects are essential to emerge the solid Earth activity such as, plate tectonics and island arc volcanism. Although the most of subducted water circulates through upper mantle, there is a possibility that portion of the water penetrates into lower mantle. Where does the water migrate? How much does the water affect mantle dynamics through the rock rheology and property? We performed numerical mantle convection simulation to investigate the water cycle and dynamic effects on the whole mantle convection.

In this study, we use the numerical model based on the model (Tagawa et al., 2007; Nakakuki et al., 2010) including the subducting oceanic plate driven dynamically. This model includes migration of water with the plate motion. We consider influences of reducing density and viscosity due to the water on the mantle flow (Karato and Jung, 2003). The maximum water content in the upper mantle is determined using phase relations of the basalt and the peridotite (Iwamori, 2004; 2007). We use various values of the maximum water content of rocks in the lower mantle, because it has been not clearly defined. We also treated the following physical properties as varying parameters: friction coefficient at the plate boundary, amount of the water injection at the trench, density-water dependence coefficient, and maximum water content in the lower mantle. Addition to we calculated dislocation creep by non-newtonian fluid or newtonian fluid.

A part of subducted water associate with the subducting oceanic plate is absorbed into peridotitic rocks and transported to about 150 km deep mantle. After that, dehydration with the serpentine decomposition occurs, and transported to deeper mantle by hot nominally anhydrous minerals (NAMs). The amount of dehydration at the 660 km phase boundary depends on the maximum water content of lower mantle, when the slab penetrates into lower mantle. The ejected water forms thin and high-water-content layer over the 660 km phase transition. As a result, the buoyancy of this layer induces instability, so that hydrated plumes are generated. We propose that this mechanism is important for the water cycle in the upper mantle. On the other hand, considerable portion of the water is transported into lower mantle with subducting slab, although notable water capacity of the lower mantle much smaller than that of the upper mantle, and reach core-mantle boundary. We have not yet observed notable water influence on mantle convection at lowermost mantle because of the small water concentration. Also, the hydrated materials do not rise to surface with hot plumes generated at the core-mantle boundary.

Keywords: mantle convection, plume, transition zone, water transport