



Water distribution around the mantle transition zone and its implications for the global water cycle

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The mantle transition zone (MTZ; \sim 410 to \sim 660 km depth) can store a large amount of water, up to \sim ten times of the current ocean mass. Consequently, this layer may play an important role in the circulation of water in Earth. However, the role of MTZ in water circulation in Earth has been poorly understood because of the difficulties in determining the water distribution in the deep mantle. Various geochemical and geophysical observations are reviewed including the water contents in basalts as well as electrical conductivity and seismological observations in order to infer the water distribution in the deep mantle of Earth at present. A preferred model consistent with the majority of the observations has a distinct layering in water content: the MTZ has \sim 0.1 wt% of water that is higher than the critical water content for partial melting just above the 410-km discontinuity but is markedly higher than the water content in the asthenosphere (\sim 0.01 wt%). Implications of the inferred water distribution for global material circulation are discussed including the deep mantle melting and the evolution of the ocean mass.