IGPP Virtual Seminar Series

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Deep mantle melting, global water circulation and its implications for the stability of the ocean mass

Date: Tuesday, June 23, 2020
Time: 12:30 pm, Pacific Time
Host: Shunguo Wang, s4wang@ucsd.edu
Zoom (*email host for password*):
https://ucsd.zoom.us/j/92645247758?pwd=bXV2RUR6SWZJU2FXMmxDMlNSNVlaQT09

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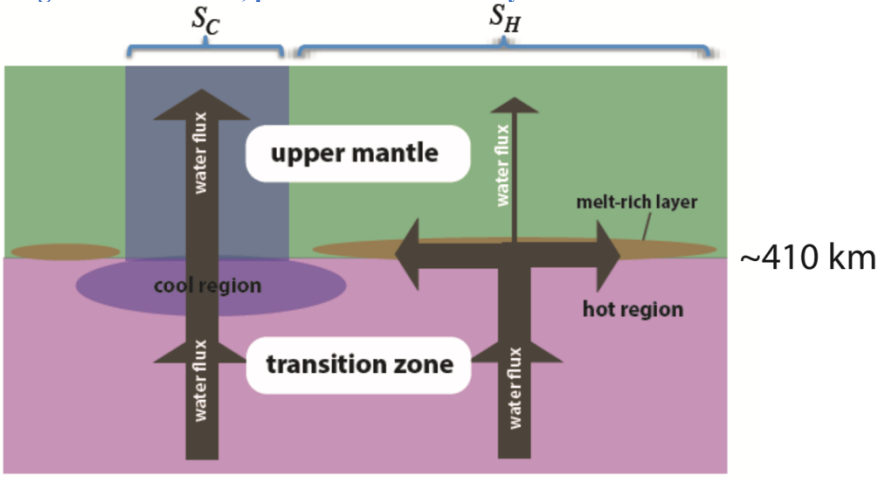

Stable presence of oceans is the necessary condition for the habitability of a terrestrial planet like Earth. Global water circulation involving Earth's interior controls the ocean mass. Most previous studies on global water circulation focused on shallow mantle processes such as degassing at mid-ocean ridges, but recent studies suggest the importance of the mantle transition zone. We review evidence for melting across the mantle transition zone producing hydrous melts. Results of studies on melt density under the deep mantle conditions show that, in most cases, melts are denser than the surrounding materials just above the transition zone, whereas melts are lighter below the transition zone. Accordingly most melts go back to the transition zone to make the transition zone water rich. However, in cold regions, melting will occur only when water content of the mantle transition zone exceeds a critical value that produces highly hydrous and buoyant melts that remove water from the mantle transition zone, acting as a water-valve to regulate the transition zone water content. The area where water-valve volcanism (deep melt-induced degasing) needed to explain the inferred negative feedback in the sea level is estimated. Due to the high water content and the rapid ascent of hydrated and buoyant materials in the deep mantle, only a small area (~1 % of mid-ocean ridge system) is enough to explain the efficient negative feedback. This model provides a mechanism by which the water content of the mantle transition zone and hence the ocean mass are regulated.