Seismogenesis of Double Subduction Beneath Kanto, Central Japan Controlled by Fluid Release

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Double subduction represents an unusual case of subduction where one oceanic plate subducts on top of another, creating a highly complex tectonic setting. Because of the complex interaction between the two subducted plates, the origin of seismicity in such region is still not fully understood. Here we investigate the thermal structure of dual subduction beneath Kanto, central Japan formed as a consequence of a unique case of triple trench junction.

Using high-resolution three-dimensional thermo-mechanical models tailored for the specific dual subduction settings beneath Kanto, we show that, compared with single-plate subduction systems, subduction of double slabs produces a strong variation of mantle flow, thermal and fluid release pattern that strongly controls the regional seismicity distribution (Figure 1). Here the deepening of seismicity in the Pacific slab located under the Philippine Sea slab is explained by delaying at greater depths (~150 km depth) of the eclogitization front in this region.

On the other hand, the shallower seismicity observed in the Philippine Sea slab is related to a young and warm plate subduction and probably to the presence of a hot mantle flow traveling underneath the slab and then moving upward on top of the slab.

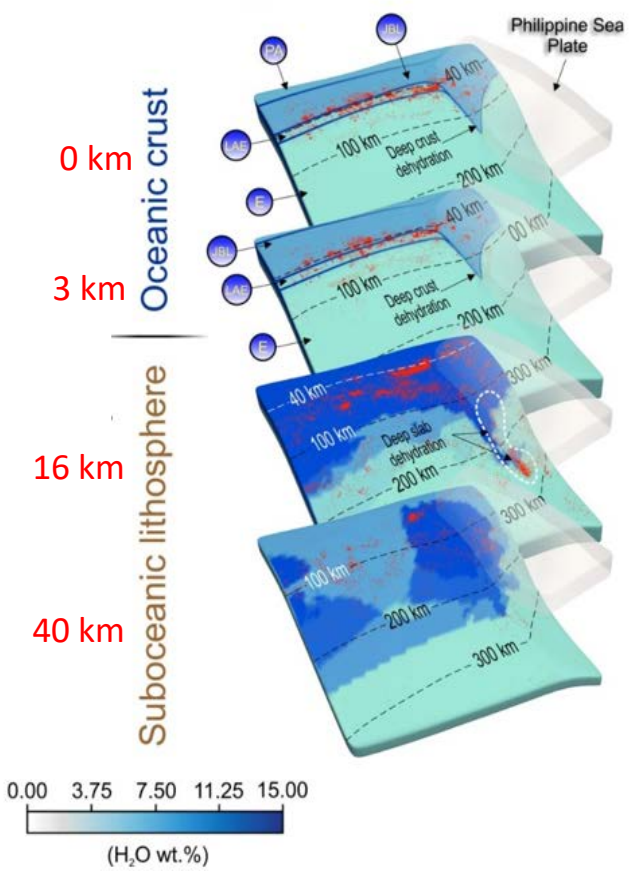

Figure 1. Distributions of seismicity (red dots) and the calculated Pacific slab H_2O (blue color) at different slab depth levels from the slab surface. Light blue bands mark the metamorphic facies corresponding to the Pacific slab: PA – pumpellyite actinolite, JBL - jadeite blueschist lawsonite, LAE - lawsonite amphibole eclogite, E–eclogite. The Philippine Sea plate is shown as a semi-transparent surface. White dashed contour defines the location of a deep intraslab earthquake cluster inside the Pacific slab. At each slice the seismicity corresponds to ±2 km measured from the slice surface for the oceanic crust, and ±4 km for the suboceanic lithosphere.