Exploring the Sumatra slab structure using 3D numerical modeling

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The Sumatra Subduction Zone is located at the western margin of Sundaland, characterized by oblique convergence of the Indo-Australian plate and its ability to produce megathrust earthquakes (2004 Mw 9.2, 2007 Mw 8.4, etc.). Due to its high potential hazard and risk, it is also a well-studied subduction zone where abundant datasets are available, including GPS, geophysical imaging, and geochemical data. However, many questions remain about the geometry of the slab. For example, geologic and geophysical data suggest that there may be a slab tear or a slab window beneath northern Sumatra (Liu et al., 2021; Hu et al., 2023), while tomographic data can't perfectly constrain the existence and detailed structure of the rupture. Furthermore, the main factors responsible for the formation and evolution of the rupture are still unclear.

In this study, we expect to test whether comparison between observation and model predictions can distinguish between different slab geometries for the Sumatra Subduction Zone. To this end, we intend to perform regional 3D geodynamic models using a modified version of CitcomCU, which solves the conservation equations of mass, momentum, and energy (Leng and Gurnis, 2015). We, in particular, focus on how the Wharton Fossil Ridge (WFR) and the Investigator Fracture Zone (IFZ) may play a role in the subducting process.

References

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