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A comparative study of the volcanic-related geothermal potential of Sumatra and Java: first result from a regional tectonic analysis and 3D temperature modelling

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Regional tectonic settings such as terranes and sutures, subducted slabs, and convergence angles are scrutinized in order to explain the seemingly different geothermal prospectivity along volcanic arc of Sumatra and Java, which together form the southern margins of Sundaland. Although volcanic arc occurs continuously as expression of current subduction along its southern margins, Sundaland itself is formed by core craton and several additional terranes amalgamated during Late Mesozoic. Therefore, intraplate heterogeneity and pre-existing structures are expected to play significant role controlling volcanism and associated geothermal systems. Based on tectonic features and qualitative characteristic of geothermal system, five geothermal provinces are recognized along the southern edges of Sundaland, from Sumatra to Java and Lesser Sunda islands. Three different provinces in Sumatra are correlated well with structural domains proposed by Sieh and Natawidjaja (2000). Northern and central domain have more irregular distribution of volcanoes and geothermal systems due to exhumation of crystalline basements and more complex structural setting, while the geothermal systems in southern domain are regularly distributed, strongly controlled by interplay between strike-slip faulting and Quaternary volcanism, and can be considered as mix between magmatic/plutonic plays and extensional plays according to the classification of Moeck and Beardsmore (2014). Large volcanic complex and clusters of impressive associated geothermal systems generally characterize West Java geothermal province. In contrast, that feature is absent in eastern part of the island. It is hypothesized that those two geothermal provinces in Java are located in different tectonic terranes and separated by northeast-southwest sutures.
To further investigate the hypothesis, we have set up preliminary 3D numerical model of temperature distribution in the lithosphere of study area. The model incorporates lateral variations in crustal and lithospheric thicknesses, and also account for differences in composition, thus also in radiogenic heat production. Thermal boundary conditions are based on available observation.