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Overriding plate controls spatial distribution of magathrust earthquakes in the Sunda-Andaman subduction zone

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Along the Sunda Arc trench parallel gravity anomalies (TPGA) seem to govern the seismogenic behavior. Negative anomalies correlate with more vigorous and larger earthquakes (Mw>6.4), while positive anomalies indicated lower seismic potential. To explain this distribution of megathrust earthquakes and of gravity Bouguer anomalies in the Sunda subduction zone and to assess future earthquake hazards for Java and Sumatra thermal models and structural constraints derived from seismic and gravity data are used. With respect to Java, oblique subduction of young oceanic crust shifts the seismogenic coupling zone roughly 40 km trenchward offshore northern Sumatra and thus facilitates tsunamigenic earthquakes. The prominent positive TPGA offshore Java is caused by a shallow mantle wedge underlying the forearc basin. Thus, differences in TPGA are not caused by spatial variations in frictional properties as previously suggested, but are related to high density mantle material occurring at shallow depth. However, a serpentinized mantle would limit the width of the coupling zone to only 30-40 km, compared to >120 km offshore Sumatra. Sumatra remains therefore the most favorable site for future megathrust earthquakes, while the shallow mantle wedge off Java is likely to limit the violence of rupture.