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Relation between subduction megathrust earthquakes, trench sediment thickness and upper plate strain

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Mega-earthquake (MEQ; moment magnitude Mw $\geq$ 8.5) forecasts for subduction zones have been empirically related to both tectonic stresses and geometrical irregularities along the subduction interface. Both of these controls have been suggested as able to tune the ability of rupture to propagate laterally and, in turn, exert an important control on MEQs generation.
Here we test these hypotheses, and their combined influence, by compiling a dataset of trench fill thickness (Tsed; a proxy for sediment input into the subduction channel) and upper plate strain (UPS; a proxy for the tectonic stresses applied to the subduction interface) for 44 segments of the global subduction network. We statistically compare relationships between UPS, Tsed, and maximal earthquake magnitude (Mmax), and find that the combination of both large trench fill ($\geq$1 km) and neutral UPS produce favourable conditions for MEQs occurrence. The concert of these factors is more well-correlated with MEQ occurrence than either factor on its own. Less frequent MEQs of lower magnitude are also possible at subduction zones with thinner Tsed and compressive UPS. Extensional UPS and Tsed < 0.5 km 2 appear to be unfavourable conditions, as MEQs have not been observed in these geodynamical environments during the last 111 years.