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Thermal modeling of the seismogenic zone: a new view of end-member subduction zones (flat slabs, ultra-slow subduction) in P-T-t space

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Assessing the pressure and temperature conditions along megathrust plate boundaries is crucial to understanding the rheology and the mineralogical transformations that occur here and can be expected to have a major impact on seismogenic behavior. Numerical modeling of forearc thermal structure has been applied to most subduction zones around the world (Syracuse et al., 2010, PEPI). Though their work examined a vast range of subducting plate ages and subduction velocities, most P-T paths were in fact shown to rather similar, with strong increases in temperature occuring in the 80-100 km depth range, as the convecting corner of asthenosphere is reached. Two groups of end-member subduction zones (undersampled in existing work), however, show consistently different P-T paths: flat-slabs and ultra-slow subduction zones. Their P-T paths are flatter, with temperatures increasing at shallower depths. Even more interesting is to examine the P-T conditions in P-T-t space along a time axis. For a flat-slab, pressure conditions remain constant over a much longer period, and depending on the exact depth this can have a strong impact on the seismogenic zone. Ultra-slow subduction zones are unique in the first place due to the very slow transit time of sediments along the plate interface. Secondly, because most ultra-slow subduction zones are marked by very thick, broad accretionary wedges, this also strongly impacts the thermal structure along the upper portion of the seismogenic zone.