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History vs. snapshot: how slab morphology relates to slab age evolution

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The age of the subducting plate at the trench ("slab age") spans a wide range, from less than 10 Myr in Central and South America to 150 Myr in the Marianas. The morphology of subducting slab in the upper mantle is also very variable, from slabs stagnating at the top of the lower mantle to slabs penetrating well beyond 1000 km depth.
People have looked rather unsucessfully for correlations between slab morphology and subduction parameters, including age at the trench, on the basic assumption that old (thick) plates are likely to generate a large slab pull force that would influence slab dip.
Thermo-mechanical models reveal complex feedbacks between temperature, strain rate and rheology, and are able to reproduce the evolution of plate ages as a function of time, subducting plate velocity and trench velocity. In particular, we show how initially young subducting plates can rapidly age at the surface because of a slow sinking velocity. As a consequence, different slab morphologies can exhibit similar ages at the trench provided that subduction history is different.
We illustrate how models provide insights into Earth subduction zones for which we have to consider their history (evolution of trench velocity, relative plate ages at time of initiation) in order to unravel their present-day geometry.