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The influence of metastable phases on the dynamics of subduction

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Global seismic studies show variations near the base of mantle transition zone, where some slabs penetrate straight into the lower mantle, whereas others seem flatten. Slab stagnation is often attributed to an increase in viscosity and phase transformations in the olivine system. Recent mineral physics studies showed that due to extremely low transformational diffusion rates, low-density metastable pyroxene may persist in subduction zones over large volumes and to great depths.
A self-consistent subduction model has been used to investigate the influence of metastable phases on the dynamics of subducting oceanic lithosphere.
Results show that metastable pyroxene affects slab buoyancy at least as much as olivine metastability. However, unlike metastable olivine, which can inhibit slab penetration in the lower mantle only for cold, old, and fast slabs, metastable pyroxene is likely to also affect sinking of relatively young and slow slabs.