3-D numerical simulations of mantle flow beneath mid-ocean ridges separated by transform faults

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Several observations on Earth, such as short-wavelength geoid undulations lined up in the seafloor spreading direction (Haxby and Wessel, 1986) or complex pattern of seismic anisotropy in the uppermost mantle that do not correlate simply with plate motions (Leveque et al., 1998; Becker et al., 2003), suggested the presence of small-scale convection at the base of oceanic lithospheres.
The development of thermal instabilities under a moving boundary layer has already been widely studied (Marquart, 2001; Van Hunen et al., 2003). In the present study, we foccused on the influence of ridge geometry on the development of instabilities and its impact on the large-scale flow. Two different 3D numerical codes have been used (Albers, 2000; Choblet and Parmentier, 2001). In the first part of this study, the ridge is separated by numerous transform faults into pieces perpendicular to the plate motion, but with a mean orientation strongly oblique to plate motion. In the second part, we used a unique transform fault, in order to study with more details the impact of the coexistence of two lithospheres of different ages on small-scale convection, large-scale flow and surface observables.

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