TESTIMONIALS TO ISC

International Seismological Centre

5. Imaging of stagnant slabs

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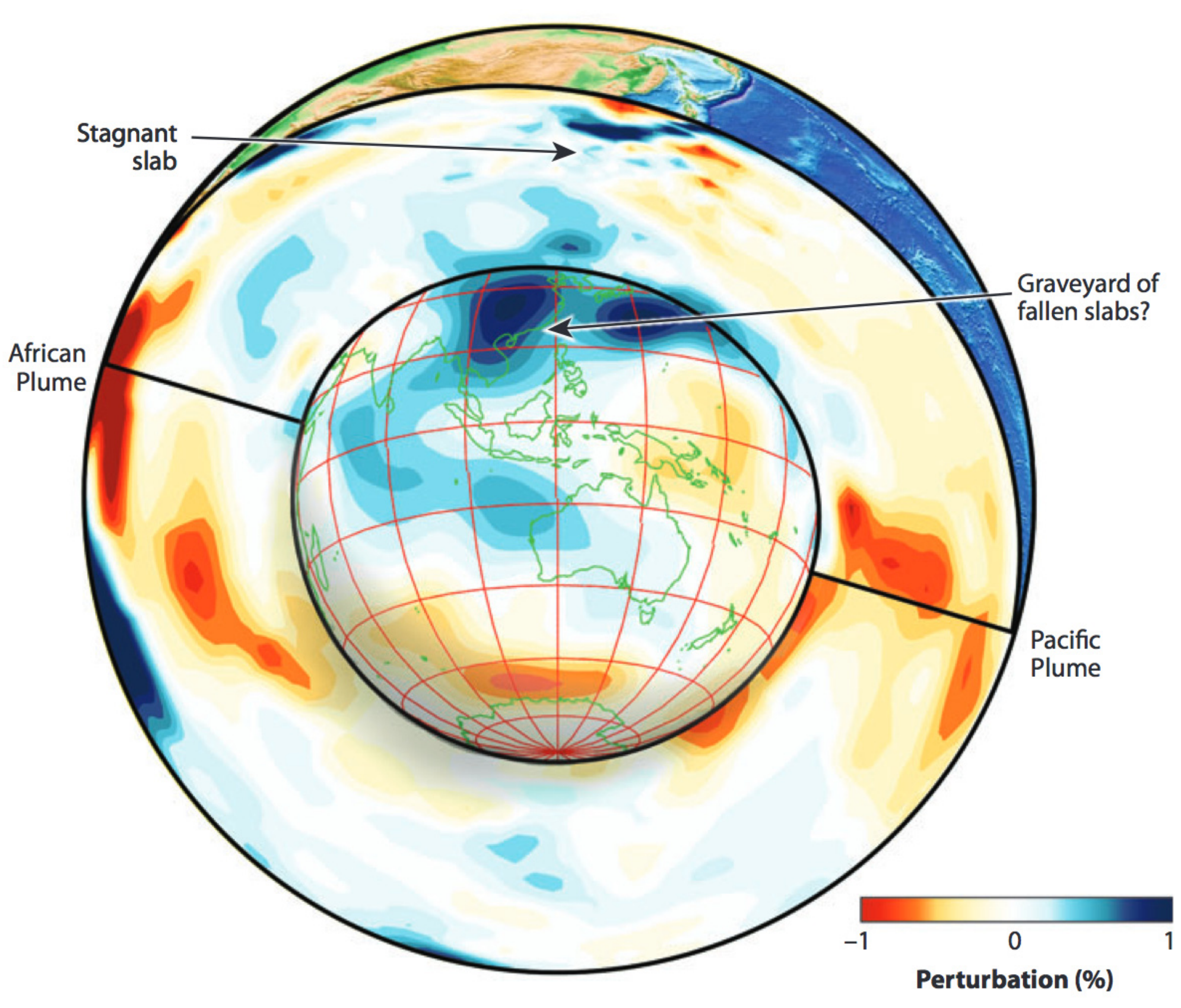

Stagnant slab is a subducted slab being trapped in the transition region between the upper and lower mantle. Tomographic images of stagnant slabs were first obtained in the early 1990s using the ISC data. The images have become progressively sharpened with the increasing number of ISC data. The recent finding in this direction is 'tearing' of the stagnant slab at an arc-arc junction (Obayashi et al., 2009). Figure shows the ISC-based images of the stagnant slab and the graveyard of fallen slabs beneath Japan.

Reference: Yoshio Fukao, Masayuki Obayashi, Tomoeki Nakakuki and the Deep Slab Project Group. Stagnant slabs: A review. *Annu. Rev. Earth Planet. Sci.* , 2009, 37, 19–46 (2009).

6. Geometry of Subducting Slabs

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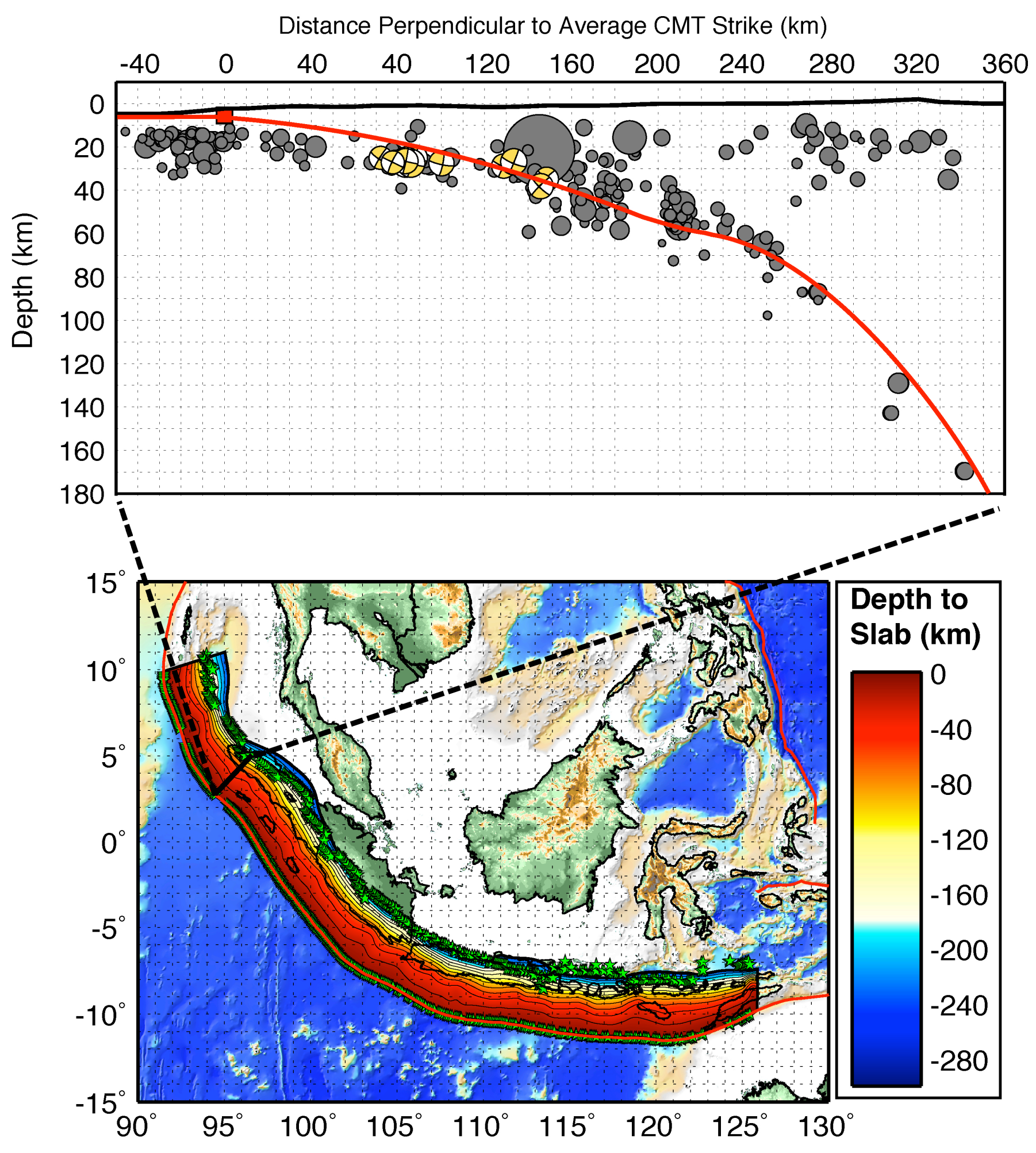
To constrain the geometry of subducting slabs worldwide, Hayes & Wald (2009) and Hayes et al. (2009) use well-determined earthquake locations from the EHB dataset, a significant component of the ISC catalogue. Without the high accuracy provided by these data (as much as a factor of 10 reduction in vertical location error over other catalogs in some cases), our interpretations of 3D slab surfaces would themselves contain broad uncertainties, in turn making them less useful. Through the use of EHB locations, we are able to define the detailed structure of subducting slabs both in the down-dip direction and along strike, where these plate boundary interfaces are well sampled by seismicity. This a priori modeling becomes very important in the rapid determination of hazard resulting from earthquakes in subduction zones, and can reduce the time required to estimate slip distributions and shaking hazards resulting from these events.



References: Hayes, G. P., and D. J. Wald (2009). Developing framework to constrain the geometry of the seismic rupture plane in subduction zones a priori — a probabilistic approach. Geophys. J. Int., 176, p. 951-964.

Hayes, G. P., Wald, D. J., and Keranen, K (2009). Advancing techniques to constrain the geometry of the seismic rupture plane on subduction interfaces a priori: highest order functional fits. Geochem. Geophys. Geosyst.,

7. Modelling lithosphere-asthenosphere boundary and upper mantle structure

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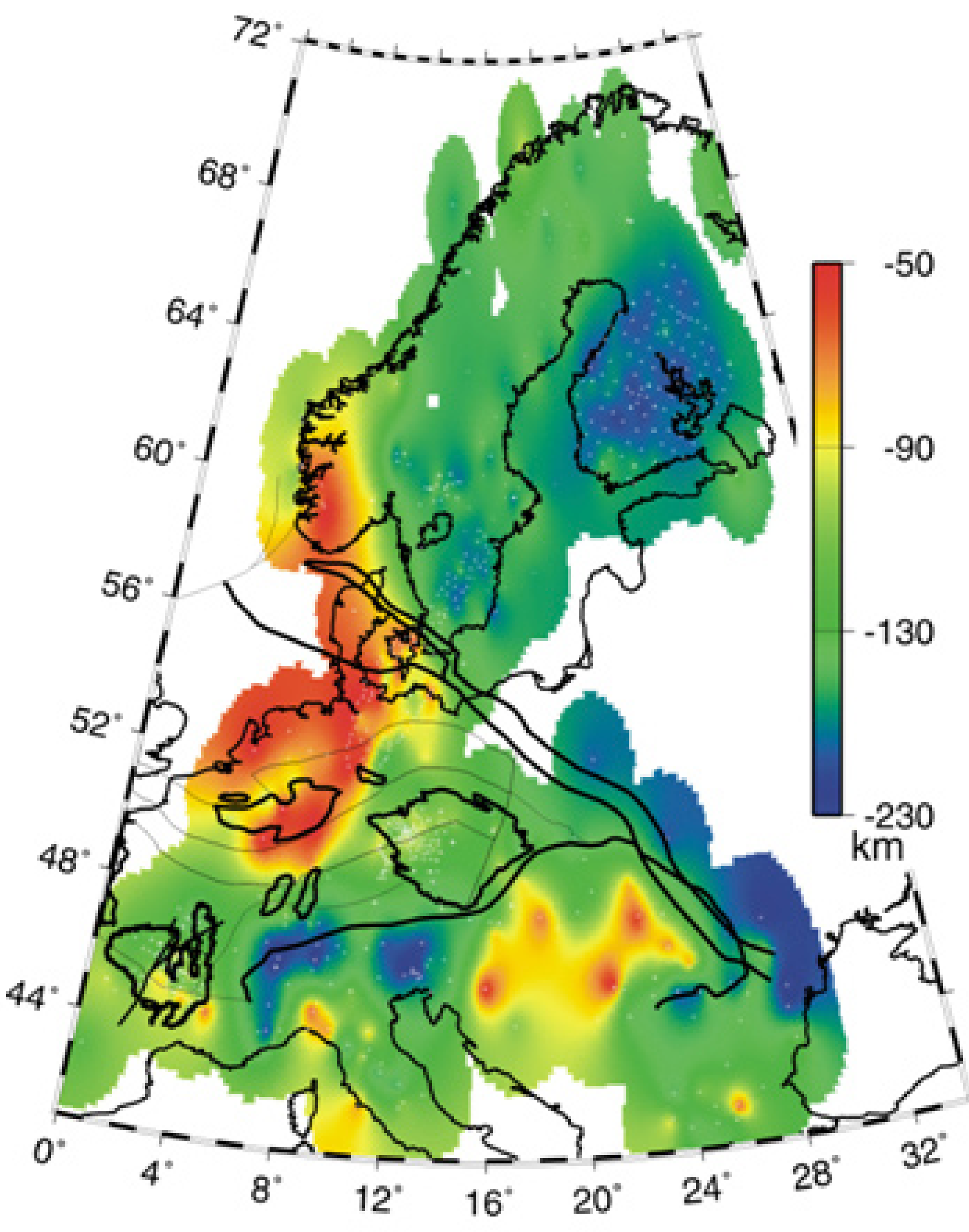
An intensive and broad debate on the nature of lithosphere tectonics and formation, stabilization and preservation of continents since Archean, continues to be the topical target of many geological, geophysical and geochemical studies. The ISC database, comprising homogeneous locations of earthquakes and arrival times of waves recorded all over the Earth, represents a long term source of travel times used in various seismological studies, which include modelling of the lithosphere-asthenosphere transition (LAB) and the upper mantle structure. Figure shows a model of the LAB based on arrival times and earthquake locations extracted from the ISC database (annual Bulletins since 1972) complemented in some regions by data published in national bulletins (for stations not reporting P arrival times to the ISC) or by data from several passive experiments - e.g., French Massif Central (Granet e al., 1995; Babuška et al., 2002), TOR (Gregersen et al., 2002; Plomerová et al., 2002) or SVEKALAPKO (Hjelt et al., 2006; Plomerová et al., 2008). In the model, we relate lateral changes of relative P-wave travel time deviations with changes of the lithosphere thickness assuming an empirical relation (Babuška and Plomerová, 1992) that incorporates velocity contrast on the LAB, enhanced due to seismic anisotropy relative to a contrast between isotropic averages of velocities above and beneath the LAB. Step by step constructing of the model requires to combine data from different networks operated during different time period and to incorporate data from newly installed observatories or from temporary stations (field experiments). Continuous flow of data in the ISC bulletins provides a stable reference level allowing links between the different complementary measurements with the fundamental (primary) model derived completely from the ISC data (Babuška et al., 1987). Processing of the long-term time series from the ISC database allows for eliminating accidental outliers among travel-time residuals or to detect from time to time occuring instabilities in station timing.

Figure: Relief of the lithosphere-asthenosphere boundary beneath central and northern Europe derived from P-wave travel-time residuals. Two separate roots of the Western and Eastern Alps, and a root of the southern Carpathians sink into asthenosphere down to about 220 km below the Phanerozoic Europe - west of the Trans-European suture Zone (TESZ). The Phanerozoic Europe is much thinner on average in comparison with up to 250 km thick large portions of the Precambrian Europe - east of the TESZ – the Baltic Shield of Fennoscandia and the East European Craton. Extensive lithosphere thinning dominates the western rim of the model (Belgo-Dutch platform and the SW of Sveconorwegian) and mark the Pannonian Basin in the SE. the LAB shallows also beneath the Po Plain, southern French Massif Central and the Quaternary Depression in the Balkan, east of the Rhodopean Massif. White triangles mark stations. This map of LAB beneath Europe was compiled from several regional models (for a review we refer to Babuška et., 1987, Babuška and Plomerová 2006; Plomerová et al., 2008).



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