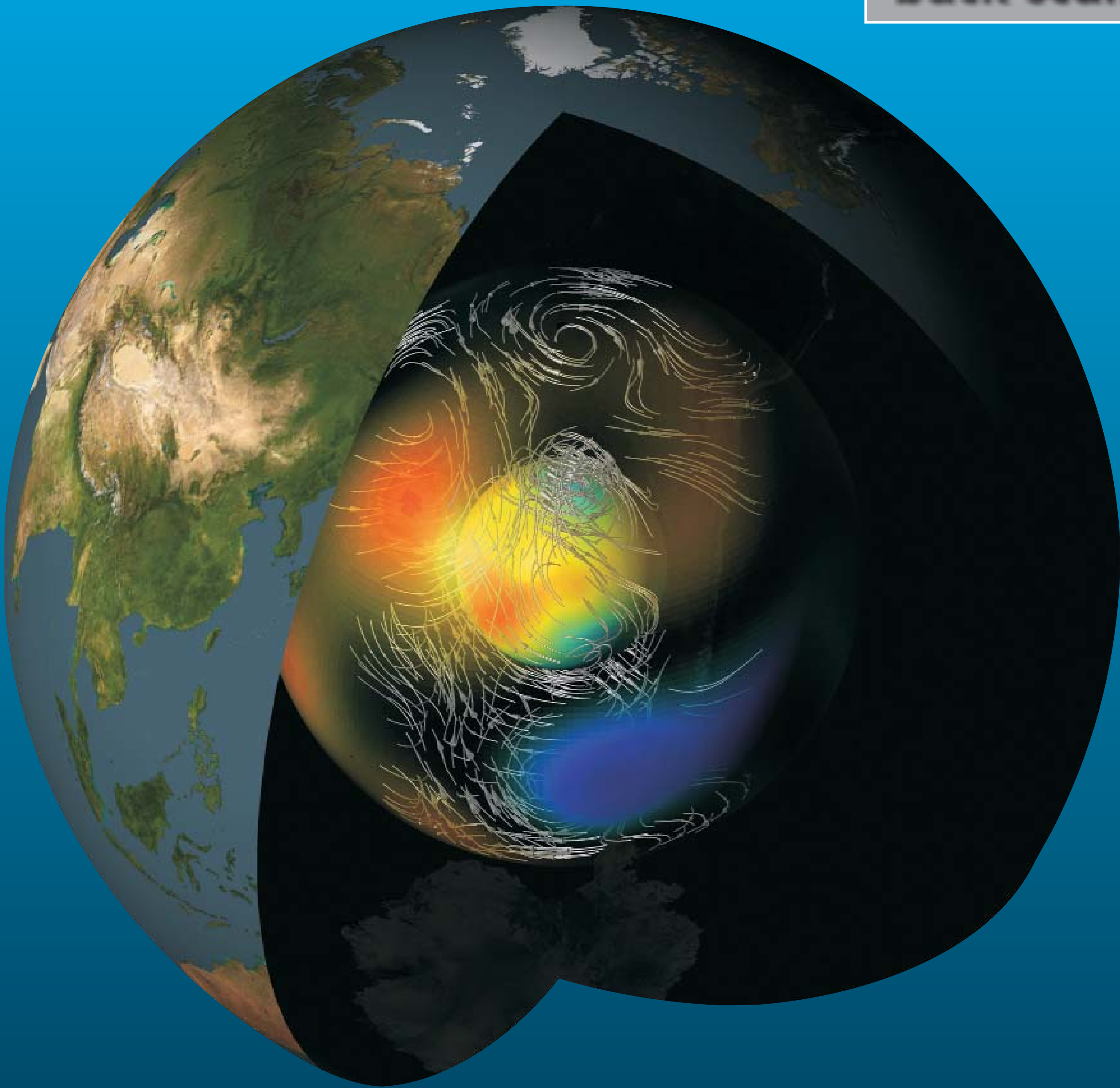

Earth's coupled interior

Earth is asymmetric. Some aspects of that asymmetry are evident on the surface—the continents are concentrated in the Northern and Eastern Hemispheres, and the magnetic poles aren't aligned with the rotational poles. But the asymmetry persists down to the solid inner core, where seismic waves have been found to travel faster, more isotropically, and with more attenuation in its eastern hemisphere than in the western hemisphere. New work by Julien Aubert and colleagues at CNRS's Institut de Physique du Globe de Paris and the Johns Hopkins University shows that those differences at the planet's outermost and innermost scales are all connected, thanks to thermal and chemical convection in the molten outer core that couples the heterogeneities of the inner core to those of the mantle.

In this visualization of Earth's interior, the core–mantle boundary is transparent and color coded: Red areas, like the one below central Asia, indicate above-average heat flow; blue regions, below-average. Those boundary conditions, determined by the locations of mantle subduction zones and plumes, dictate the flow (indicated by streamlines) and dynamo activity in the outer core. A primary effect of the temperature gradients is a helical convective flow down to the surface of the inner core. That results in regions of faster (red) and slower (blue) solidification that are offset from the heat-flux variations above. Concentration gradients caused by the preferential depletion of iron during solidification further contribute to the outer core's convection. (J. Aubert et al., *Nature* **454**, 758, 2008. Image courtesy of Julien Aubert/CNRS-IPGP and the Visible Earth team/NASA.)

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