Earthquakes, tsunamis, volcanic eruptions: all are dramatic consequences of plate tectonics with important societal impact. They remind us of the powerful internal forces that drive the motions of plates at the surface of the earth. Many questions remain on the detailed morphology of convection patterns in the earth’s mantle that drive plate motions. In order to understand these flow patterns, seismic imaging, which uses seismic waves generated by natural earthquakes to illuminate the earth’s internal structure, is an ever improving tool for mapping regions of upwelling and downwelling flow (i.e. "plumes" and "slabs"), greatly facilitated in recent years by access to high performance computing. In particular, I will show how we can now resolve that lower mantle upwelling regions take the form of broad, vertically elongated columnar structures that are deflected and become narrower around 1000 km depth, meandering through the upper parts of the mantle towards the location of major hotspot volcanoes at the surface. I will discuss how the sharper global scale images thus obtained inform our thinking about mantle dynamics.