A simple 'vote map' methodology for imaging mantle features across alternative tomography models

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Numerous seismic tomography models exist in the public domain, each constructed with choices of data input, resolution, parameterization and reference model. The broader geoscience community is increasingly utilizing these models, or a selection thereof, to interpret Earth's mantle structure and processes. For instance, seismically identified remnants of subducted slabs or mantle plume conduits have been used to refine plate motions, understand global mantle convection dynamics, and test geochemical cycles. With an increasing number of tomography models to include, or exclude, a question arises - how consistent is a given anomaly across a given suite of tomography models? Here we present a recently published framework (Shephard et al., 2017) that can generate a series of "vote maps" for the upper and lower mantle. The maps combine up to 14 seismic tomography models, including 7 S-wave and 7 P-wave anomaly models. A higher vote count represents a location with increased agreement between the constituent models, whereas a low count represents more disagreement. Vote maps at different depths can be tailored by extracting anomalies (i.e. % δ lnVs, % δ lnVp) within a given parameter space and can be reproduced with a range of alternative visualization options online at http://submachine.earth.ox.ac.uk. Results will be presented that address the time-depth dependence, location and degree of agreement between seismic tomography models for both slab and plume features. For the slab maps, the identification of a maximum in agreement between 1000-1400 km and a minimum at 2000 km could represent an increased in subduction flux and/or a mid-mantle density and/or viscosity increase. While the maps are only as good as the inherent models and cannot provide a measure of the existence of an actual slab (nor intend to critique any individual tomography model), they provide an intuitive, open and useful framework for imaging mantle features.

Reference: Shephard, G.E., Matthews, K.J., Hosseini, K., Domeier, M. 2017. On the consistency of seismically imaged lower mantle slabs. Nature Scientific Reports v7. doi:10.1038/s41598-017-11039-w

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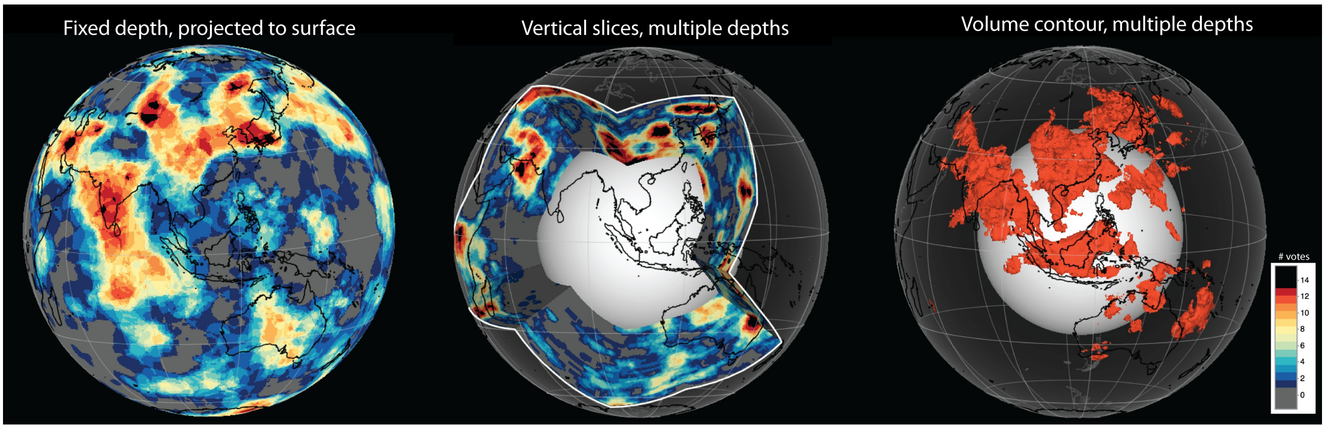
Fixed depth, projected to surface
Vertical slices, multiple depths
Volume contour, multiple depths
votes
14
12
10
8
6
4
2
0