3D volume rendering of geophysical data using the yt platform

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We present novel applications of yt, a tool originally designed for analysis of astrophysics datasets, to the geosciences. yt is a python-based platform for volumetric data, which enables semantically meaningful analysis and visualization. As part of a wider effort to bring yt to the geosciences, we present an initial use-case of yt applied to 3D seismic tomography models of the upper mantle from the IRIS Earth Model Collaboration. While the rendering capabilities of yt can in general be applied directly to 3D geoscience data, we add several graphical elements to the 3D rendering to aid in interpretation of volume renderings including latitude/longitude overlays and shapefile suport for plotting political and tectonic boundaries along the Earth's surface. In this notebook, we focus on tomographic models of North America and the Western U.S., where high resolution models and rapidly varying seismic properties provide a rich dataset to explore systematically at a range of lengthscales. The notebook demonstrates loading and rendering of IRIS netcdf models, highlighting interesting 3D features of the Western U.S. upper mantle, and goes on to demonstrate how having direct control of the transfer functions used in creating the final volume rendering allows for a more systematic exploration of the role of the visualization method in our interpretation of 3D volumetric data. Finally, we conclude by demonstrating some of the semantically-aware capabilities of yt for analysis purposes, and demonstrate how these tools have cross-disciplinary functionality.