**[Breaking the Adriatic Plate: Adjoint 3D Tomography for the Italian Lithosphere](https://agu.confex.com/agu/fm21/webprogrampreliminary/Paper947545.html)**

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The evolution and state of geological structure at Earth’s surface is best understood with an accurate characterization of the subsurface.
We present high-resolution seismic tomographic images of tectonic and geological structures of the Italian lithosphere.
Enhanced accuracy is enabled by state-of-the-art methods, including three-dimensional wavefield simulations in combination with an adjoint-state method.
The procedure iteratively improves an initial 3D traveltime tomography model of the region using full waveforms from 163 earthquakes recorded by 412 stations.
Model *Im25*, resulting from 25 iterations, characterizes the subsurface structure in terms of compressional and shear wavespeeds at a resolution corresponding to a minimum period ~10 s.
We discuss three primary findings of *Im25* model: a) images of the lithospheric structure in Central Italy highlight the role of fluids and gas (CO2) and their correlation with seismicity, b)
images of Southern Italy illuminates the plumbing system of Mt. Etna volcano, c)  images of the Adriatic plate explore its complex lithosphere and tectonic evolution.