Far interaction in the upper mantle through 3D-BEMFEM

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Slow creeping materials as mantle rocks flow through quasi-static equilibrium states, meaning that every part of the systems deforms depending on all the surrounding motions. However analytical solutions of Stokes flow indicate that two-dimensional immersed bodies interact with any far field boundary, while three-dimensional interactions decade as the inverse of the distance. This implies that slabs or plumes could have a far distance interaction but that this does not necessarily happen, depending on the regional conditions. Possible cases study are the meso-scale systems as the Mediterranean region or Tonga-Fiji trench system.

We present here the next development of a technique for Boundary Element-Finite Element coupling presented in (Morra and Regenauer-Lieb, 2005), where a two-dimensional setup has been applied to the analysis of the local effects of mantle-lithosphere coupling in subduction. The three-dimensional version of the same setup has been implemented using a combination of Python and C languages. The advantages of the technique are the possibility to model large deformation in a lagrangian framework and the efficiency of the approach, independent by the interaction distance. The next step will be the coupling of 3D BEMFEM with particles libraries.

References:

Morra G. and Regenauer-Lieb K., A Coupled Solid-Fluid Method for Modeling Subduction, Phil. Mag., 2005, in print.