Topographic Imaging of European Mantle Plumes
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Recent numerical experiments based on tectonically realistic formulation for the lithosphere and representative mantle rheology, have shown that plume-induced undulations exhibit temporal successions of uplift and subsidence at various wavelength lengths (A).

From spectral (Fourier) analyses of the undulations one might expect a few groups of wavelengths (200-400 km and 60-100 km) to predominate. Interestingly, a spectral analysis of Europe’s topography also reveals two dominant groups (B).

To discriminate between tectonically induced undulations (uni-directional deformation) and plume-induced undulations (omni-directional deformation) we use a spectral analysis with a wavelet formulation (C).

The wavelet analysis of Europe’s surface topography confirms that energy distribution of the topographic undulations outside the two main volcanic provinces is homogeneous (D), thus contrasting with the large-scale and medium-scale high-energy features that are obtained for the Massif Central and Eifel areas (E). Similar signatures are also found beneath the northern Sudetes area (F).

Numerical simulation of plume-lithosphere interaction, with a free upper surface, and a tectonically realistic formulation for the lithosphere (G).

The wavelet analysis of Europe’s surface topography confirms that energy distribution of the topographic undulations outside the two main volcanic provinces is homogeneous (H), thus contrasting with the large-scale and medium-scale high-energy features that are obtained for the Massif Central and Eifel areas (I). Similar signatures are also found beneath the northern Sudetes area (J).

For profiles 24 to 26, some medium-scale effects, due to the used medium-energy coefficients seem to be present beneath the Sudetes area.

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For profiles 7 to 11, high-energy coefficients are identified at medium-scale length scales.

For profiles 33 to 38, high-energy coefficients are identified at medium-scale length scales.