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Representation of crustal structures and surface-wave modeling

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The strong heterogeneities that characterize the Earth's crust heavily affects the propagation of seismic waves —such as short-period surface waves— at regional distance. The knowledge and the representation of crustal structure are crucial points in surface-wave modeling and tomography studies.
At continental scale, $2^\circ \times 2^\circ$ global crustal model CRUST2.0 (Bassin et al., 2000) is frequently used to correct for shallow structure. However, this model is not entirely satisfactory to fulfill the needs of modern seismic-wave propagation modeling. Apart from its limited lateral resolution —rather insufficient when used at continental scale— CRUST2.0 has a rather complex vertical layering and discontinuous lateral steps, that make it difficult either to represent the model with fidelity in numerical codes, or to smooth it laterally.
We therefore derive the parametrically simplest model, that can be considered equivalent to CRUST2.0 in modeling surface waves in the period range from 6 s to 200 s. Our simple, 4-km layered model, within acceptable accuracy, is equivalent to CRUST2.0 and can be easily smoothed laterally. We show the impact of crustal structure in numerical seismograms computed in the wide European domain, and compare synthetics with recorded data. We emphasize that defective knowledge, and inaccurate numerical representation of shallow structure may have strong repercussions on modeling seismograms in this environment.