LONG PERIOD SCATTERING OF SEISMIC WAVES IN SPHERICAL RANDOM MEDIA

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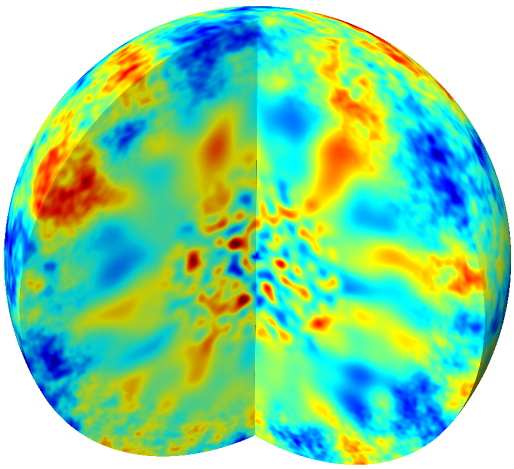
We analyze scattering of seismic waves in the Earth due to structure that is beyond the resolution limit of current global tomographic mantle models. To this end, we use statistically defined models and examine scattered waves in the numerically computed wavefield.

We define the statistics of the small scale structure using a non-stationary covariance matrix that covers a range of distributions that are guided by the statistics of larger scale heterogeneities and the properties of regional high resolution models. A non-stationary second order model realisation can then be generated from the eigenbasis of the covariance matrix.

We find that scattering at the long periods (100s) is relatively small and has only limited influence on measurements of e.g. attenuation or travel times. However, it is noticeable in the simulations and data and can be used to constrain the amount of small scale variations of Earth's elastic structure.

Finally, we present a method to invert statistically for small random perturbations using standard Born (single scattering) waveform sensitivity kernels.



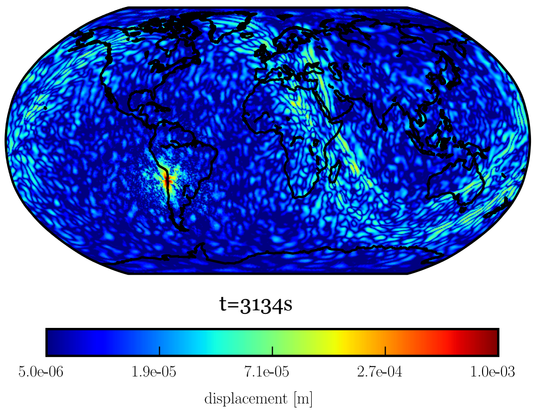


Figure 1.
Left: non-stationary spherical, second order (Gaussian) random model.
Right: long period ($T = 100s, \lambda_{\text{hor}} \approx 400km$) scattered wavefield generated in a tomographic model (resolution > 600km) that has been extended with different distributions of randomly located small scale structure.