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Global and local waveform simulations using the VERCE platform

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In recent years the potential to increase resolution of seismic imaging by full waveform inversion has been demonstrated on a range of scales from basin to continental scales. These techniques rely on harnessing the computational power of large supercomputers, and running large parallel codes to simulate the seismic wave field in a three-dimensional geological setting. The VERCE platform is designed to make these full waveform techniques accessible to a far wider spectrum of the seismological community.
The platform supports the two widely used spectral element simulation programs SPECFEM3D Cartesian, and SPECFEM3D globe, allowing users to run a wide range of simulations. In the SPECFEM3D Cartesian implementation the user can run waveform simulations on a range of pre-loaded meshes and velocity models for specific areas, or upload their own velocity model and mesh. In the new SPECFEM3D globe implementation, the user will be able to select from a number of continent scale model regions, or perform waveform simulations for the whole earth. Earthquake focal mechanisms can be downloaded within the platform, for example from the GCMT catalogue, or users can upload their own focal mechanism catalogue through the platform. The simulations can be run on a range of European supercomputers in the PRACE network.
Once a job has been submitted and run through the platform, the simulated waveforms can be manipulated or downloaded for further analysis. The misfit between the simulated and recorded waveforms can then be calculated through the platform through three interoperable workflows, for raw-data access (FDSN) and caching, preprocessing and finally misfit. The last workflow makes use of the Pyflex analysis software. In addition, the VERCE platform can be used to produce animations of waveform propagation through the velocity model, and synthetic shakemaps. All these data-products are made discoverable and re-usable thanks to the VERCE data and metadata management layer.
We demonstrate the functionality of the VERCE platform with two use cases, one using the pre-loaded velocity model and mesh for the Maule area of Chile using the SPECFEM3D Cartesian workflow, and one showing the output of a global simulation using the SPECFEM3D globe workflow. It is envisioned that this tool will allow a much greater range of seismologists to access these full waveform inversion tools, and aid full waveform tomographic and source inversion, synthetic shakemap production and other full waveform applications, in a wide range of tectonic settings.