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First results from a full-waveform inversion of the African continent using Salvus

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We present the initial results from an elastic full-waveform inversion (FWI) of the African continent which is melded together within the framework of the Collaborative Seismic Earth Model (CSEM) project. The continent of Africa is one of the most geophysically interesting regions on the planet. More specifically, Africa contains the Afar Depression, which is the only place on Earth where incipient seafloor spreading is sub-aerially exposed, along with other anomalous features such as the topography in the south, and several smaller surface expressions such as the Cameroon Volcanic Line and Congo Basin. Despite its significance, relatively few tomographic images exist of Africa, and, as a result, the debate on the geophysical origins of Africa's anomalies is rich and ongoing.

Tomographic images of Africa present unique challenges due to uneven station coverage: while tectonically active areas such as the Afar rift are well sampled, much of the continent exhibits a severe lack of seismic stations. And, while Africa is mostly surrounded by tectonically active spreading plate boundaries, the interior of the continent is seismically quiet. To mitigate such issues, our simulation domain is extended to include earthquakes occurring in the South Atlantic and along the western edge of South America.

Waveform modelling and inversion is performed using Salvus, a flexible and high-performance software suite based on the spectral-element method. Recently acquired recordings from the AfricaArray and NARS seismic networks are used to complement data obtained from global networks. We hope that this new model presents a fresh high-resolution image of sub-African geodynamic structure, and helps advance the debate regarding the causative mechanisms of its surface anomalies.