AI reveals first direct observation of rupture propagation during slow quakes

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LOS ALAMOS, N.M., Dec. 9, 2020—Using a trained neural network and data from the North Anatolian Fault in Turkey, a research team led by Los Alamos National Laboratory revealed the first direct observation of rupture propagation during a slow earthquake. The research will be presented Dec. 15, 2020 at the AGU Fall Meeting.

Applying AI to interferometric synthetic aperture radar (InSAR) images opens up a new way to unravel the physics behind tectonic faults and earthquakes, which is key to understanding the full spectrum of earthquake behavior.

“The deep-learning approach we developed makes it possible to automatically detect the small and transient deformation that occurs on faults with unprecedented resolution, paving the way for a systematic study of the interplay between slow and regular earthquakes, at a global scale,” said Bertrand Rouet-Leduc, a geophysicist at Los Alamos National Laboratory and leader of the research team.

The geophysicists from Los Alamos and the École Normale Supérieure in Paris trained the neural network to remove atmospheric “noise” in the data and extract ground deformation from InSAR data. The AI approach works without expert interpretation or previous knowledge of the fault system being studied.

InSAR is a satellite-based mapping technique that uses radar to create images of ground deformation. Unlike optical imaging systems, InSAR can “see” through clouds and works at night, but atmospheric turbulence and other distortions can skew the measurements of details on the earth’s surface. The new deep-learning tool corrects for those distortions, and learns to distinguish signal from noise.

Bertrand Rouet-Leduc is available for an interview.

The presentation: “S056-07 - A deep learning approach for detecting transient deformation in InSAR (Invited),” AGU Fall Meeting, https://agu.confex.com/agu/fm20/meetingapp.cgi/Paper/709566

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