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A single geophone to locate seismic events on Mars

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Knowing the structure of Mars is a key point in understanding the formation of Earth-like planets as plate tectonics and erosion have erased the original suface of the Earth formation. Installing a seismometer on Mars surface makes it possible to identify its structure.

An important step in the identification of the structure of a planet is the epicenter's location of a seismic source, typically a meteoric impact or an earthquake. On Earth, the classical way of locating epicenters is triangulation, which requires at least 3 stations. The Mars InSight Project plans to set a single station with 3 components. We propose a software to locate seismic sources on Mars thanks to the 3-components simulated data of an earthquake given by Geoazur (Nice Sophia-Antipolis University, CNRS) researchers.

Instrumental response of a sensor is crucial for data interpretation. We study the oscillations of geophone in several situations so as to awaken students to the meaning of damping in second order modeling. In physics, car shock absorbers are often used to illustrate the principle of damping but rarely in practical experiments. We propose the use of a simple seismometer (a string with a mass and a damper) that allows changing several parameters (inductive damping, temperature and pressure) so as to see the effects of these parameters on the impulse response and, in particular, on the damping coefficient. In a second step, we illustrate the effect of damping on a seismogram with the difficulty of identifying and interpreting the different phase arrival times with low damping.