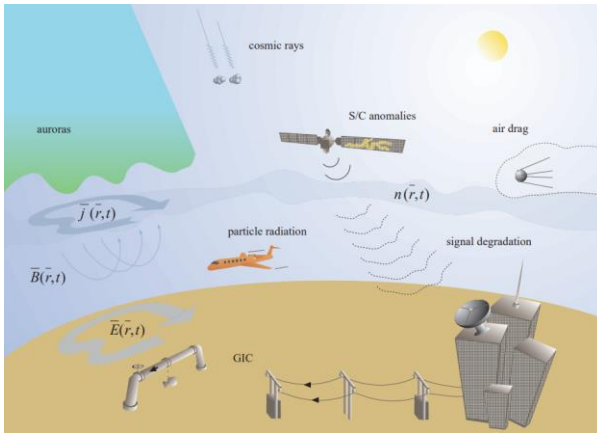
MAGNETOTELLURIC ARRAY 2022 (MTA22) FACT SHEET

What: The Magnetotelluric (MT) method is a passive geophysical technique that utilizes measurements of the Earth's natural electric and magnetic fields. The **magnetic** field is generated high above the Earth in the magnetosphere. The electrical currents known as **telluric** currents, are induced in the subsurface by the temporal variations in the magnetosphere. The magnetospheric currents arise from the interaction of the solar wind with the Earth's primary magnetic field. In our polar regions one can sometimes see the atmosphere effects of the magnetospheric currents in the Aurora Borealis. At lower latitudes, the effects of magnetospheric telluric currents are small and difficult to measure unless we acquire data in culturally quiet areas.



Highlights of space weather. E is the electric field, B the magnetic field, and j the electric current density. MT measures the E & B fields at the Earth's surface.

Why: The MT Array (MTA), formerly known as EarthScope, is an ambitious, multi-faceted program to investigate the structure, dynamics, and history of the North American continent. These MT data are used to image deep geologic structures related to plate tectonics, volcanology and faulting and will provide information about the Earth's crust and upper mantle to depths as great as 30 to 40 miles (www.earthscope.org/).

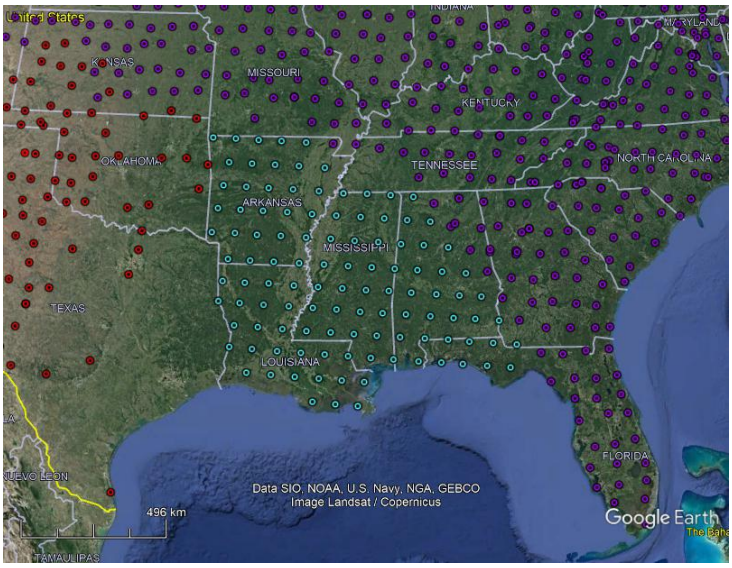
The MTA is also being used to predict possible hazard areas related to geomagnetically induced currents (GIC) that can affect the normal operation of regional electrical infrastructure including power distribution, communication, and pipeline systems (www.usgs.gov/natural-hazards/geomagnetism). GIC are a significant manifestation of space weather at ground level and can have important economic and practical consequences. The sun is the main source of space weather and intense Solar storms can induce destructive current flow at the Earth's surface. These events increase corrosion of steel pipelines, can damage high-voltage power transformers, and produce electromagnetic fields that induce excessive electric current in power and telecommunication lines, sometimes even causing wide-spread blackouts.

Geophysicist installing an MT instrument.

How: The magnetic field is measured with a very, sensitive magnetometer that is housed in a cylindrical tube measuring 18" long and 6" in diameter. The magnetometer must be buried to be thermally and mechanically stable. The electric field is

measured with two orthogonal wires measuring ~100 yards laid on the surface in the north-south and east-west directions and connected to the Earth with small (shovel size) holes at each end. The wires themselves are buried in shallow trenches if cattle in the area. Both the wires and the magnetometer are connected to a data logger that is housed, in a plastic case measuring ~12”x18”x6”.the case, in turn, is connected to a 12-volt battery, which powers the data logger and magnetometer. Both the case and battery are also buried for thermal stability as well as for security.

Where: Acquisition of this national dataset began in 2007. To date MT data have been acquired at several hundreds of sites on a ~50-mile grid throughout much of the country**. The 2022 effort is focused on completing Alabama, Mississippi, Louisiana and possibly Arkansas.** The continental-scale dataset is planned to be complete in 2023.



MT Array: aqua dots represent sites planned for 2022 while red and purple indicate sites where data were acquired from 2007-2021.

How Long: The field crew of two people installs the system components using only hand tools and accessing the installation site on foot, carrying the instruments and tools from the nearest established jeep trail or road. About 10 days after installation, the crew checks the data logger for system performance and replaces the battery. **At ~21 days the equipment is extracted**. If animals have disturbed the site, the crew will repair as needed and leave to record for another week or so. When the system is fully installed only wires, if not trenched, and a small GPS unit that looks like a computer mouse may be visible on the surface. Upon extraction holes are filled and the surface restored to its natural grade.

Who: The MT Array is funded through the Department of the Interior, US Geological Survey (USGS). Oregon State University (OSU) is the lead organization under the guidance of Professor Adam Schultz. Green Geophysics, Inc. a geophysical services company and project sub-awardee, acquires the data.

Point of contact: Louise Pellerin, Ph.D.
Green Geophysics
510-326-7269
pellerin@greengeophysics.com

Please visit https://greengeophysics.com/mt-array to read more about the technical aspects of the project, including instrumentation, and view the photo gallery of the crew working around the country. To learn more about Space Weather and GIC check out
https://www.youtube.com/watch?v=34t7A__pWQA&t=3s