Oh nodes!: rapid seismic deployments from field to data

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What is a seismic node?

A seismic node is a compact, self-contained, battery-powered seismometer and data logger. UTEP has a seismic node system with ~110 Fairfield seismic nodes. Each node contains three geophones recording 3 components of motion (one vertical, two horizontal components of motion).

White three-component seismic node (left) and yellow handheld terminal (HHT) controller (right).

Fairfield seismic node specifications:

- Geophone corner frequency is 5-Hz
- Data logger is 24 bit analog-to-digital converter (ADC)
- Power source: Lithium ion battery with ~30 day lifespan
- Dimensions: 6.4in x 4.6in with a 4.6in central spike
- Weight: 6.2 lbs
- Sample rate: 250, 500, 1000, or 2000 samples per second (sps)
- Storage capacity: 32GB (~400 Mb used per 24 hrs)

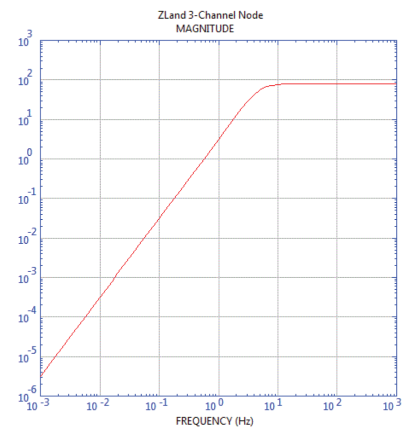
How do I use these nodes?

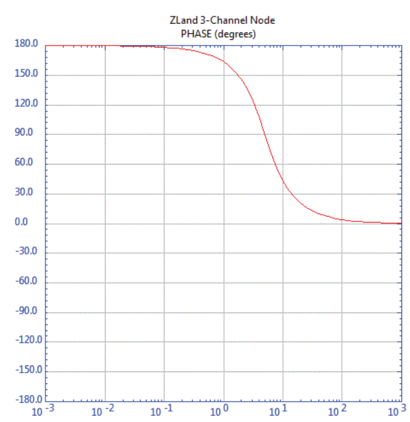
Use of UTEP's seismic nodes requires creating a deployment plan in advance with UTEP's seismology group for charging the nodes and programming the handheld terminals ("HHTs") used to deploy them. The nodes need to be sent back to UTEP for data offload.

For more information, please contact the seismic node management team: Dr. Solymar Ayala-Cortez (sayalacortez2@utep.edu), Dr. Marianne Karplus (mkarplus@utep.edu), and/ or Dr. Julien Chaput (jachaput@utep.edu).

What do I need to deploy them in the field?

- Permit from the property owner granting permission for deployment
- Shovel, hand spade, and/ or rock pick (if you will bury them)
- Fairfield nodes
- Handheld Terminal (HHT)
- HHT to node cable (serial to red node connector)
- Compass
- Bubble level
- External GPS (handheld Garmin or similar)
- Deployment sheets, writing utensil, clipboard



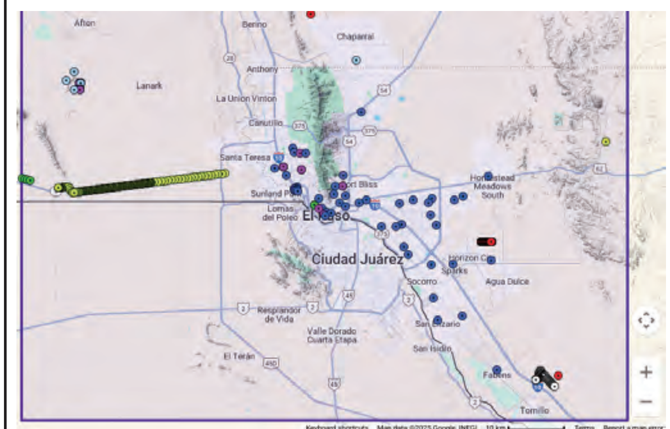


Magnitude and phase response information for Fairfield seismic nodes.

May I use seismic node data without doing any field work?

Yes! The Earthscope Data Center has archived many node datasets, so you can find data for many areas, including El Paso!

The data are available for free, but please acknowledge the teams that collected the data and the Earthscope Data Center if you use the data for publications. Those groups spend a lot of time and energy to collect and archive the data.



Seismic stations with data available in El Paso area. From https://ds.iris.edu/gmap/ with a location box in El Paso area.

How do I access the data?

If you worked with the UTEP seismology group to collect the data, then you will work with them to gain access to the seismic data files. Eventually the data will be accessible in Earthscope, but it may take some time.

If you want to download archived data from Earthscope, we will provide instructions for that later in this activity.

Seismic data is typically downloaded in miniseed or Seismic Analysis Code (SAC) format. It can be viewed using MATLAB, Python, or a variety of other software tools.

Introduction to magnetic declination for orienting scientific instruments

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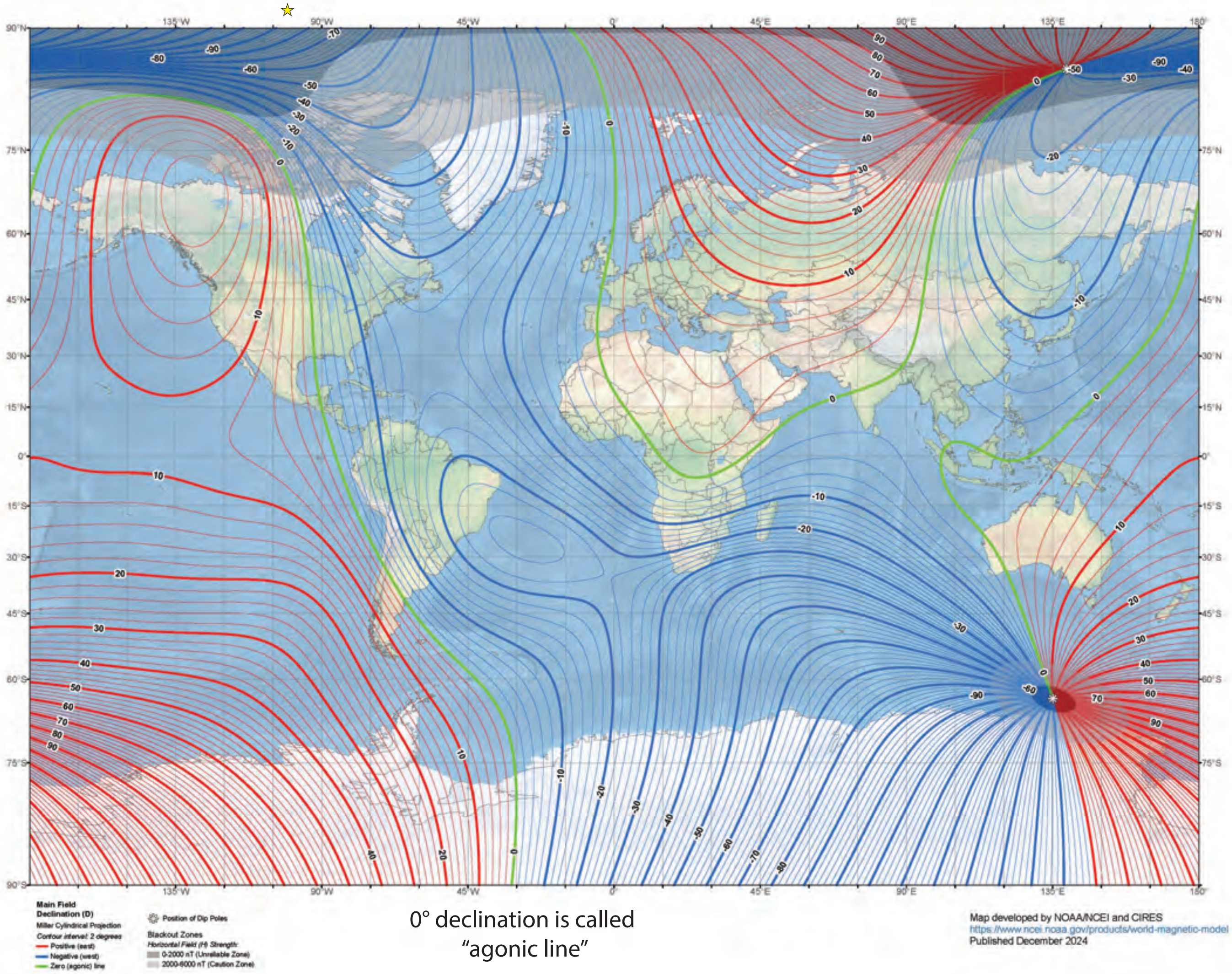
What is magnetic declination?

Magnetic declination is the angle between true north (geographic north) and magnetic north at a specific location on Earth's surface.

Why do we need to know this to orient a seismometer to true north?

Often we want to use a compass to orient a seismometer to true north, but the compass only knows where is magnetic north. We need the declination to find true north from magnetic north with a compass.

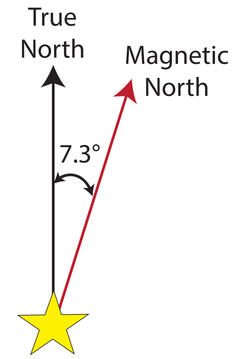
STEP 1. LOOK UP DECLINATION USING NOAA WORLD MAGNETIC MODEL 2025

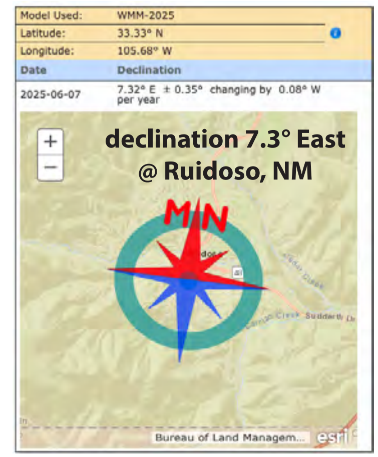


0° declination is called "agonic line"

Check the declination for your location at:
https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml#declination

STEP 2. SET DECLINATION ON A COMPASS





True North is 352.7° (360°-7.3°) relative to Magnetic North @ Ruidoso, NM

Note: declination is 7.5° East @ El Paso, TX

STEP 3. ORIENT YOUR SEISMIC NODE