

Tucson Magnetic Observatory

Magnetic Monitoring in Saguaro National Park



On a sandy, arid plain, near the Rincon Mountain Visitor Center of Saguaro National Park, tucked in among brittlebush, creosote, and other hardy desert plants, is an unusual type of observatory—a small unmanned station that is used for monitoring the Earth's variable magnetic field. Named for the nearby city of Tucson, Arizona, the observatory is 1 of 14 that the Geomagnetism Program of the U.S. Geological Survey (USGS) operates at various locations across the United States and Territories. Views of the Tucson observatory are shown in figures 1 and 2.

Data from USGS magnetic observatories, including the Tucson observatory, as well as observatories operated by institutions in other countries, record a variety of signals related to a wide diversity of physical phenomena in the Earth's interior and its surrounding outer-space environment. The data are used for geomagnetic mapping and surveying, for fundamental scientific research, and for assessment of magnetic storms, which can be hazardous for the activities and infrastructure of our modern, technologically based society (for example, Love and others, 2008). The USGS observatory service is an integral part of a U.S. national project (National Science and Technology Council, 2015) for monitoring and assessing space weather hazards.

History

The history of the Tucson observatory can be traced back to June 1909, when President William H. Taft signed an executive order setting aside a parcel of Federal property outside the town of Tucson to be used by the Coast and Geodetic Survey of the Department of Commerce and Labor for a magnetic observatory (Hazard, 1913). Soon thereafter, construction began on an office building and a building for



Figure 2. Tucson observatory's electronic building with surrounding flora.



Figure 1. Panoramic view of the Tucson magnetic observatory in Saguaro National Park.

analog magnetometer systems. The first hourly measurements of geomagnetic variation at Tucson were reported in November 1909. In the 1970s, agency reorganizations within the Federal government led to a reassignment of responsibility for operating the observatories to the USGS of the Department of the Interior.

Over the years, the city of Tucson grew, and commercial and residential developments eventually surrounded the Tucson observatory site, interfering with sensitive magnetic instruments. In 1989, the city of Tucson agreed to support the USGS in the search for a new observatory site. A site was identified within Saguaro National Park, and modest facilities were constructed. In January 1996, data from the new observatory site were first reported. The USGS Tucson observatory operates to this day in Saguaro National Park, under terms of a special use permit with the National Park Service. The former observatory site is now part of the city of Tucson's Udall Park.

Data

The compass is a familiar device used for measuring the horizontal direction of the Earth's magnetic field. A subset of the measurements made by a magnetic observatory can be expressed in terms of declination, the difference between the local direction of the compass needle and geographic north. It is interesting that the direction of the needle changes in time. Figure 3 shows a record of the declination at the Tucson observatory since 1909. Slow variation in declination, shown in blue, is caused by fluid motion in the Earth's deep interior—the site of a dynamic process that generates most of the geomagnetic field. More rapid variation, shown in gray, is caused by transient change in the Earth's surrounding space-weather environment, especially during magnetic storms. The offset in declination corresponding to moving the observatory in 1996 is because of a difference in the local magnetization of the rocky crust beneath the observatory site.

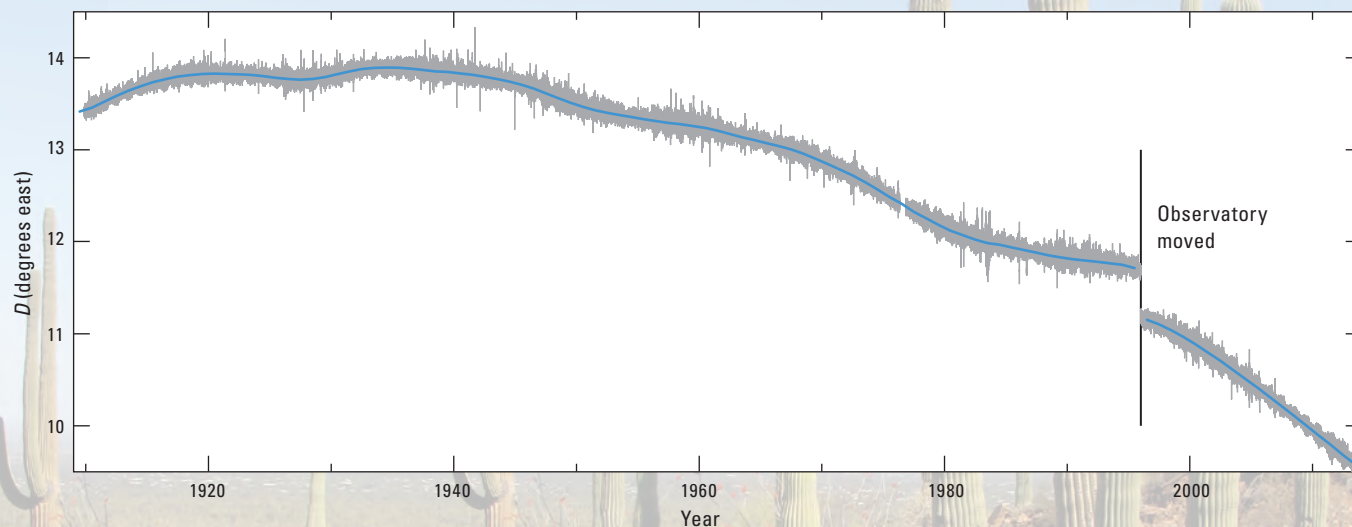


Figure 3. Hourly (gray) and annual (blue) values of magnetic declination recorded at the Tucson (Saguaro) observatory, 1909–2013. The offset at 1996 was caused by relocating the observatory to Saguaro National Park.

References

- Hazard, D.I., 1913, Results of observations made at the Coast and Geodetic Survey magnetic observatory near Tucson, Arizona, 1909 and 1910: Department of Commerce and Labor, p. 1–59, 9 figs.
- Love, J.J., Applegate, David, and Townshend, J.B., 2008, Monitoring the Earth's dynamic magnetic field, U.S. Geological Survey Fact Sheet, 2007–3092, 2 p.
- National Science and Technology Council, 2015, National space weather strategy: Washington, D.C., Executive Office, National Science and Technology Council, p. 1–13.

More Information

USGS Geomagnetism Program, <https://geomag.usgs.gov>
Saguaro National Park, <https://www.nps.gov/sagu/index.htm>