

Mag-01H DI used in Absolute Declination and Inclination Measurements

Objectives

To calculate absolute values of declination and inclination in the Earth's magnetic field at a specific location, for accuracy of magnetic measurements.

Instrumentation

- Mag-01H single axis fluxgate magnetometer
- Mag Probe A: a theodolite mounted, high precision, single axis fluxgate magnetometer.

Applications

Magnetic observatories need an absolute measurement of magnetic declination and inclination of the Earth's field, for correction of continuous recording baseline. Mapping agencies require a determination of the magnetic field's declination in a local region, for compass correction by users.

Background

The Earth's magnetic field does not have the same magnitude or direction everywhere. Magnetic North (the maximum field intensity in horizontal plane H) varies from Geographic North. This variation can be measured as a horizontal angle between the two, referred to as the declination D. The vertical angle between the horizontal field H and the total field F is known as the inclination I.

Magnetic observatories continuously monitor variations of the Earth's magnetic field, and use absolute measurement of D and I to correct for baseline variations in continuous monitoring instruments.

Mapping agencies need to calculate the error between Magnetic North and Geographic North for the region they are mapping, to ensure that declination information provided is kept accurate for use in compass correction.

Method

The Mag A probe from the Mag-01H is fitted to a non-magnetic theodolite. The azimuth of a known target is measured using the theodolite as a reference for the other readings.

Four measurements are taken to calculate the declination. First, with the theodolite perfectly horizontal, the Mag A probe is rotated to obtain a zero reading in the East-West direction on the Mag-01H. The theodolite and Mag A probe are then rotated 180° in the horizontal circle and the zero field is found in the opposite direction. The telescope is then rotated 180° in the vertical plane (with the Mag A probe inverted) and measurements are taken in both directions again.



The time of each measurement is recorded. The four angular measurements are used to find the horizontal field position H. Using the known reference previously measured, the declination angle D can be calculated.

Inclination is then calculated with a further four measurements. The Mag A probe and theodolite are rotated in the vertical circle until a zero measurement is found for the horizontal field H. The probe is inverted to find the zero measurement in the opposite direction. The theodolite is then rotated 180° in the horizontal circle, and the two measurements repeated. As with declination, the time is taken with each angular measurement. The four angles are then used to find the inclination angle I.

To measure the total intensity of the field F, the theodolite and Mag A probe are set exactly to D, I. The measured value on the Mag-01H is the total field strength at that location.

References

Newitt L.R. et al, 1996, IAGA Guide for Magnetic Repeat Station Surveys