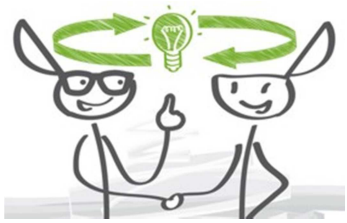

Application Note PE008

Basics

Our Earth is a gigantic magnet, with north and south poles and surrounded by a magnetic field like a permanent magnet. Since the north pole of a magnet is the north-facing pole and attracts opposite polarity magnets, the geographic North Pole is a magnetic south pole.

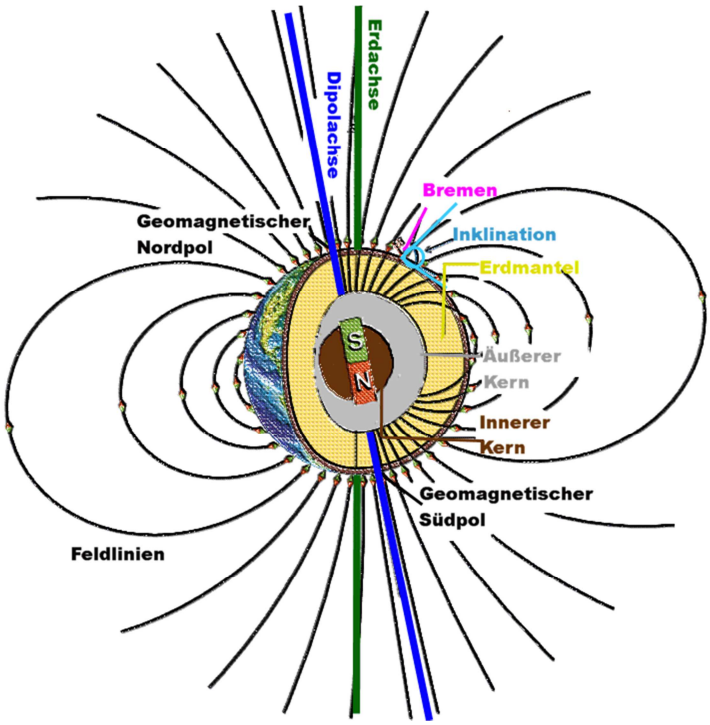

Figure 1: The earth as a magnet (source: Wikipedia)

Geographic and magnetic poles are not in the same place. The magnetic south pole is located in northern Canada, about 1600 km from the geographic North Pole.

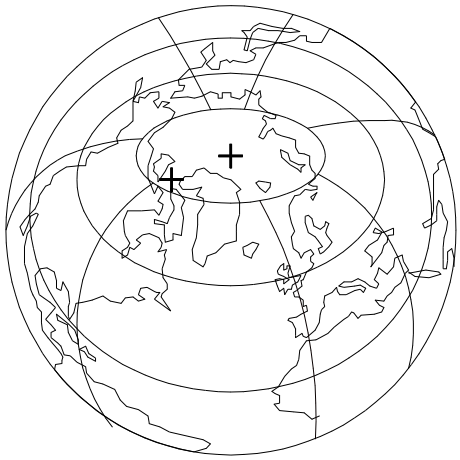

Figure 2: Location of the geographic and magnetic North Pole

The compass needle therefore does not point exactly to the north. This misalignment of the compass needle is different at each location. It is called the declination angle. In Berlin, the declination angle is currently about 2.3 ° and decreases every year by 0.15 °.

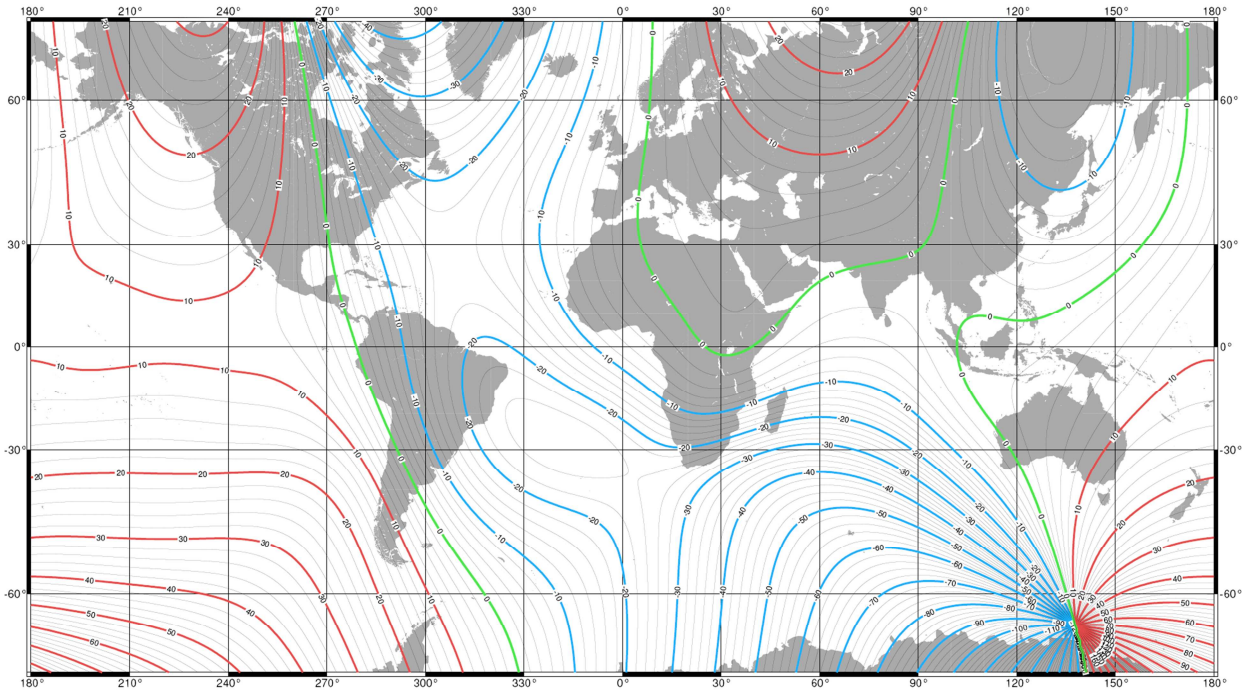

Figure 3: Declination in 2005 (source: Wikipedia, NOAA)

This change in angle is caused by the constant and slow migration of the magnetic poles. Thus, it was measured that the magnetic South Pole has moved within 5 years from 1955 to 1960 over 110 km to NW. It is known today through investigations of volcanic rocks that the Earth's magnetic field has reversed several times in the course of Earth's history.

The magnetic field lines of the geomagnetic field occur on the earth's surface at a different angle to the earth's axis. This angle is called the inclination angle.

The inclination, like the declination, is subject to local and temporal variations. In Germany, it is currently about 65 °.

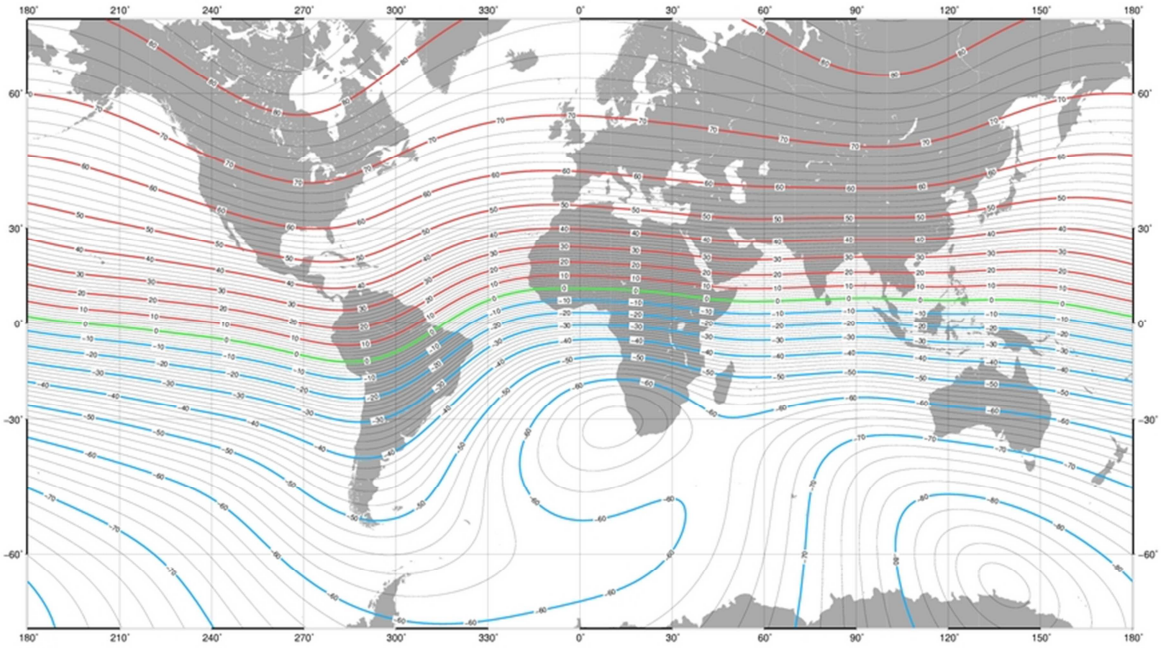

Figure 4: Inclination in 2005 (source: NOAA)

The Earth's magnetic field varies in its intensity across the Earth's surface. It is deflected or shielded by magnetically conductive metals such as nickel, iron and cobalt contained in the earth's crust. At the poles, the magnetic field is strongest. However, the earth's magnetic field is very weak compared to the magnetic field of a permanent magnet. In Germany, the strength of the earth's magnetic field is currently around 49µT

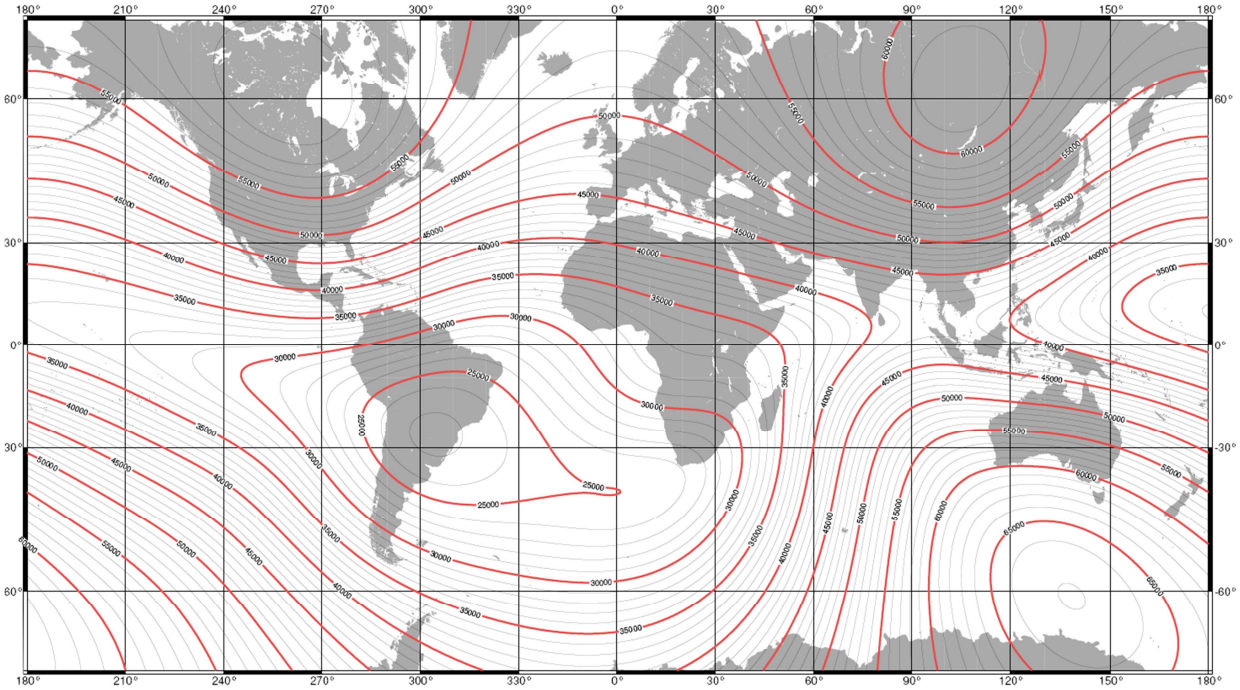

Figure 5: Earth's magnetic field strength in 2005 (source: Wikipedia, NOAA)

Inhomogeneities of the Earth's Magnetic Field

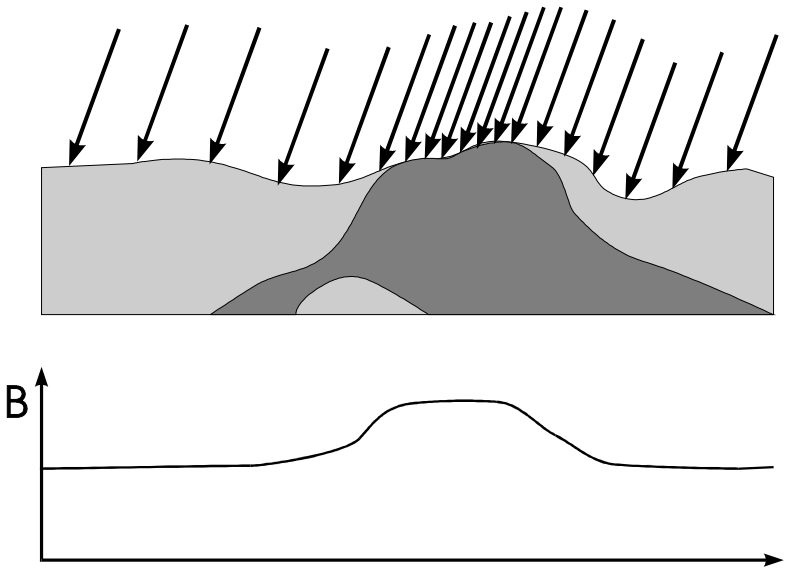

Figure 6: Inhomogeneities of the Earth's magnetic field

Inhomogeneity refers to the local disturbance of the otherwise homogeneous geomagnetic field. Particularly geological faults, magnetic materials, caves and reinforced concrete produce changes of up to 50% of the undisturbed geomagnetic field value.

Inhomogeneities increase or decrease the value of the earth's magnetic field at the measuring location and can thus also be determined as a change in the vertical component or the horizontal component.

Which component is measured depends on the angle at which the used probe is positioned to the ground.