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Wandering of the Geomagnetic poles

Geomagnetic poles

Magnetic poles are defined in different ways. They are commonly understood as positions on the Earth's surface where the geomagnetic field is vertical (i.e., perpendicular) to the ellipsoid. These north and south positions, called dip poles, do not need to be (and are not currently) antipodal. In principle the dip poles can be found by conducting a magnetic survey to determine where the field is vertical. Other definitions of geomagnetic poles depend on the way the poles are computed from a geomagnetic model. In practice the geomagnetic field is vertical on oval-shaped loci traced on a daily basis, with considerable variation from one day to the next.

Experimental observations of dip poles

It has been long understood that dip poles migrate over time. In 1831, James Clark Ross located the north dip pole position in northern Canada. Natural Resources Canada (NRCan) tracked the North Magnetic Pole, which is slowly drifting across the Canadian Arctic, by periodically carrying out magnetic surveys to reestablish the Pole's location from 1948 to 1994. An international collaboration, led by a French fundraising association, Poly-Arctique, and involving NRCan, Institut de Physique du Globe de Paris and Bureau de Recherche Geologique et Minière, added two locations of the North Magnetic Pole in 2001 and 2007. The most recent survey determined that the Pole is moving approximately north-northwest at 55 km per year.

A [web based portal](#) views both the experimental and modeled pole locations.

 [North dip poles](#)

Observed north dip poles during 1831 - 2007 are yellow squares. Modeled pole locations from 1590 to 2020 are circles progressing from blue to yellow.

 [South dip poles](#)

Observed south dip poles during 1903 - 2000 are yellow squares. Modeled pole locations from 1590 to 2020 are circles progressing from blue to yellow.

Model derived geomagnetic poles

Geomagnetic field models can also define **geomagnetic poles**. The geomagnetic poles, or geocentric dipole, can be computed from the first three Gauss coefficients from a main field model, such as the World Magnetic Model (WMM) or International Geomagnetic Reference Field (IGRF). The WMM representation of the field includes a magnetic dipole at the center of the Earth. This dipole defines an axis that intersects the Earth's surface at two antipodal points called geomagnetic poles. Based on the WMM2015 coefficients for 2015.0 the geomagnetic north pole is at 72.62°W longitude and 80.31°N latitude, and the geomagnetic south pole is at 107.38°E longitude and 80.31°S latitude. The axis of the dipole is currently inclined at 9.69° to the Earth's rotation axis. The same dipole is the basis for the simple geomagnetic coordinate system of geomagnetic latitude and longitude. Scientists, map makers and polar explorers have an interest in the locations of the dip and geomagnetic poles. Although geomagnetic pole positions cannot be observed, they are arguably of greater significance than the dip poles because the auroral ovals (approximate 5° latitude bands where the spectacular aurora is likely visible) are closely centered on the geomagnetic poles. They are usually displaced slightly to the night-side of the geomagnetic poles and greatly vary in size: bands of greatest activity occur between 15° and 25° from the geomagnetic poles.

A software for computing the locations of geomagnetic pole is available [here](#).

Movement of magnetic poles from 1590 to 2020

The **magnetic poles or dip pole** are computed from all the Gauss coefficients using an iterative method. Magnetic poles derived in this fashion are geographically closer to the experimentally observed poles. Based on the current WMM model, the 2015 location of the north magnetic pole is 86.27°N and 159.18°W and the south magnetic pole is 64.26°S and 136.59°E.

The locations of the poles (1590-2020) are available for download here: [North Pole](#), [South Pole](#).