


Synthesis Results

Geomag v4.0

Model: IGRF2000

Latitude: 45.44 deg 

Longitude: 5.43 deg

Elevation: 0.60 km

Date of Interest: 2/6/2004

<u>D</u> (+ East)	<u>I</u> (+ Down)	<u>H</u>	<u>X</u> (+ N)	<u>Y</u> (+ E)	<u>Z</u> (+ D)	<u>F</u>
(deg)	(deg)	(nt)	(nt)	(nt)	(nt)	(nt)
0d -9m	61d 17m	22447	22447	-61	40965	46712
<u>dD</u>	<u>dI</u>	<u>dH</u>	<u>dX</u>	<u>dY</u>	<u>dZ</u>	<u>dF</u>
(min/yr)	(min/yr)	(nT/yr)	(nT/yr)	(nT/yr)	(nT/yr)	(nT/yr)
7	0	11	11	44	20	22

For additional information about this output, click on the variables above.

[Declination](#) | [Magnetic Field Values](#) | [F A Q](#) |
[Models & Software](#) | [WMM Home](#) | [Web Links](#)
[Space Physics Interactive Data Resource \(SPIDR\)](#)
[Today's Space Weather](#) | Images [interactive](#) and [ftp](#)

Definitions

D: Magnetic Declination

Magnetic declination is sometimes referred to as the magnetic variation or the magnetic compass correction. It is the angle formed between true north and the projection of the [magnetic field vector](#) on the horizontal plane. **By convention, declination is measured positive east and negative west** (i.e. D -6 means 6 degrees west of north). For surveying practices, magnetic declination is the angle through which a magnetic compass bearing must be rotated in order to point to the true bearing as opposed to the magnetic bearing. Here the true bearing is taken as the angle measured from true North.

Declination is reported in units of degrees and minutes. One degree is made up of 60 minutes.

If west declinations are assumed to be negative while east declination are considered positive then

$$\text{True bearing} = \text{Magnetic bearing} + \text{Magnetic declination}$$

An example: The magnetic bearing of a property line has an azimuth of 72 degrees East. What is the true bearing of the property line if the magnetic declination at the place in question is 12 degrees West?

A magnetic declination of 12 degrees West means that magnetic North lies 12 degrees West of true North.

$$\begin{aligned} \text{True bearing} &= 72 \text{ degrees} + (-12 \text{ degrees declination}) \\ &= 72 \text{ degrees} - 12 \text{ degrees declination} = 60 \text{ degrees East} \end{aligned}$$

It should be noted that the magnetic declination becomes undefined at the North and South magnetic poles. These poles are by definition the two places where the magnetic field is vertical. Magnetic compasses become quite unreliable when the [magnetic field vector](#) becomes steeply inclined. **For more information on magnetic field elements and compasses see our [FAQ](#) page.**

D is defined as $D = \text{arc tangent}(Y / X)$.

dD: The change in declination with respect to time.

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I: Magnetic Inclination

Also called magnetic dip, this is the angle measured from from the horizontal plane to the magnetic field vector . **I is measured positive down.** If the vector components of F are X, Y, and Z then

$$I = \text{arc tangent}(Z/\text{square root}(X*X + Y*Y))$$

or

$$I = \text{arc tangent}(Z/H)$$

The north magnetic pole is defined as that position where $I=90$ degrees i.e. straight down. Similarly, the south magnetic pole is defined as that position where $I=-90$ degrees i.e. straight up.

dI : The change in inclination with respect to time.

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H: Horizontal Component of the Magnetic Field.

This is the magnitude of vector constructed by projecting the total field vector onto the local horizontal plane. In terms of the [vector components](#) of the field

$$H = \text{square root}(X^2 + Y^2)$$

dH : The change in the horizontal component with respect to time

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X: North Component of the Magnetic Field.

This is the magnitude of vector constructed by projecting the total field vector onto an axis lying in the direction of the Earth's rotational pole or true North. **X is measured positive in the north direction.**

dX : The change in X with respect to time.

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Y: East Component of the Magnetic Field.

This is the magnitude of vector constructed by projecting the total field vector onto an axis in the Eastward direction i.e. perpendicular to the X-axis. **Y is measured positive in the east direction.**

dY : The change in Y with respect to time.

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Z: Vertical Component of the Magnetic Field.

This is the magnitude of vector constructed by projecting the total field vector onto an axis in the local vertical direction i.e. perpendicular to the horizontal plane. **Z is measured positive down.**

dZ: The change in Z with respect to time.

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F: Magnetic Field Vector

The Earth's magnetic field, referred to as the Geomagnetic field is a vector field i.e. at each point in space this field has a strength and a direction. This vector, F is referenced to a local coordinate system as follows: the vector is decomposed into three mutually perpendicular (orthogonal) vector components, which are referred to as the X, Y, and Z components of the field, where the X and the Y components lie in the horizontal plane with X lying in the northward direction, Y lying in the eastward direction, while the Z component is taken in the local vertical direction. The strength of the magnetic field is usually given in units of nanoteslas (nT) and is taken in the usual mathematical fashion i.e.

$$\text{magnitude} (F) = \text{square root}(X*X + Y*Y + Z*Z)$$

The X, Y, and Z components completely describe the magnetic field vector, F however in the study of the Earth's magnetic field it is often convenient to describe this vector's direction through the use of two so-called "angular components" called the [declination](#) and the [inclination](#). In addition the strength of the projection of the vector F onto the horizontal plane or the [H](#) component is often studied.

dF: The change in F with respect to time.

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Magnetic Field Components

There are seven magnetic field elements. The total field vector (F), the X component or northward component, the Y component or eastward component, the Z component or vertical component, and the H or horizontal component. These five elements are often referred to as the force elements while the last two components, the declination and the inclination are referred to as the angular elements.

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