

How to use geomagnetic field data from the INTERMAGNET network

Exercise

Find out how big the influence of a strong magnetic storm on the geomagnetic field (H component) in your region is. Give a percentage of the change.

Background

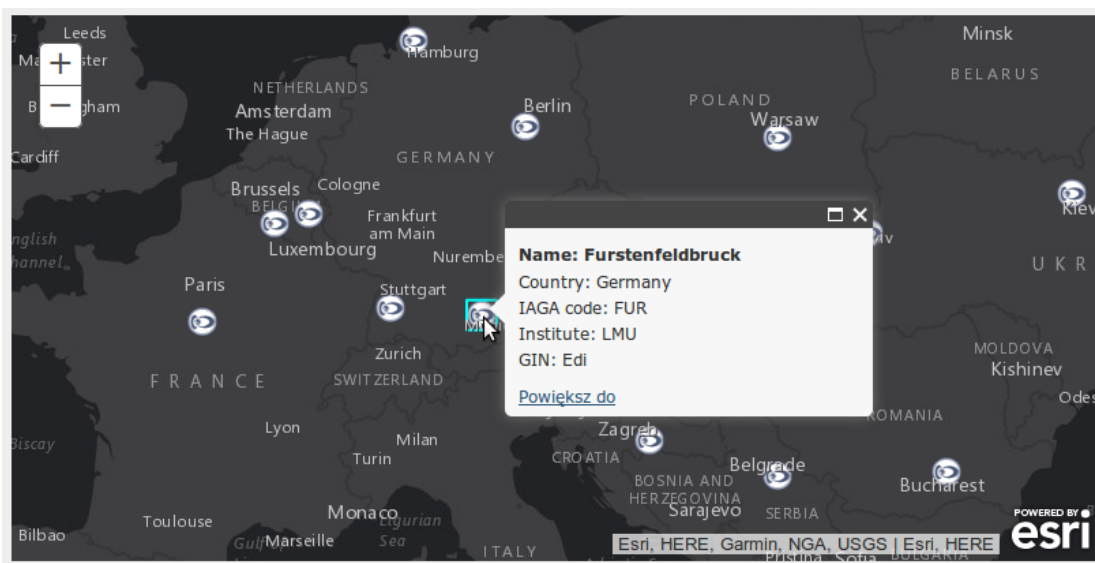
Geomagnetic field data from all over the world are collected in observatories. Many observatories have joined in the INTERMAGNET network. INTERMAGNET publishes these data online, and everybody can access and use them for non-commercial purposes.

During quiet periods the geomagnetic field produced by the geodynamo is a more or less static dipole field. This means that it changes only very little during a day. However, during strong magnetic storms the solar wind deflected from the geomagnetic field flows around the Earth, creating a so-called ring current. This ring current has its own magnetic field which is directed opposite to the geomagnetic one. So the total magnetic field measured in the observatories is smaller during a magnetic storm, because the ring current field decreases the geodynamo's field.

The strongest geomagnetic storm in our century so far (this means until September 2017) took place on Halloween 2003.

Instruction

Go to the webpage <http://www.intermagnet.org/imos/imomap-eng.php>. There you can find a world map with positions of INTERMAGNET observatories. Scroll into your region and find the observatory mark that is nearest to the place where you live (here the south German observatory Furstenfeldbruck will be used as an example). Click on the symbol of your observatory. A field with information will pop up. Keep in mind the three-letter IAGA code written there for your observatory (FUR for Furstenfeldbruck).



Now go to the webpage <http://www.intermagnet.org/data-donnee/dataplot-eng.php>. A form will appear. Select the following options (see also the picture below). Start date 2003-10-31, Available observatories – your observatory (in our example FUR), Type of plot - Magnetic Field (HDZ), the other fields remain unchanged. Then click the Plot data button.

Data - Plotting Service

Start Date (YYYY-mm-dd)	2003 10 31
Time range (Start/End)	00 24
Filter observatories by	Regions Latitudes
Sort observatories by	IAGA code
Available Observatories (required)	EBR, Ebro, 40.957/0.333 ESK, Eskdalemuir, 55.32/356.8 EYR, Eyrewell, -43.474/172.393 FCC, Fort Churchill, 58.759/265.912 FRD, Fredericksburg, 38.2/282.63 FRN, Fresno, 37.09/240.28 FUR, Furstenfeldbruck, 48.17/11.28 GDH, Qeqertarsuaq (Godhavn), 69.252/306.467 GLN, Glenlea, 49.645/262.880 GNA, Gwangara, -31.8/116.0 GLA, Guam, 13.59/144.87
Type of Plot	Magnetic Field (HDZ)
Type of Scale	Fixed
Output Format	Portable Network Graphic (PNG)
Plot data	

There will appear a plot of the variations of four elements of the geomagnetic field during that day (see picture below). Only the uppermost panel with the H component is interesting for us. On the right-hand side of the panel you can find the base value for that component (20 800.19 nanotesla, nT). This number will be necessary to calculate the percentage later.

Now read the minimum value for H, which appears on the left-hand side of the curve (here: between 00:00 and 01:00 o'clock of the day, the value is about -290 nT). This is the difference to the base value caused by the ring current.

If you find it difficult to read this number exactly, you can return to the form and select Accessible HTML table as Output format. A table with values for all times and components will appear, from which you can pick the minimum value for H (in our example it is 20509.91 nT at 2003-10-31 00:25). So the difference to the base value is

$$20509.91 \text{ nT} - 20800.19 \text{ nT} = -290.28 \text{ nT},$$

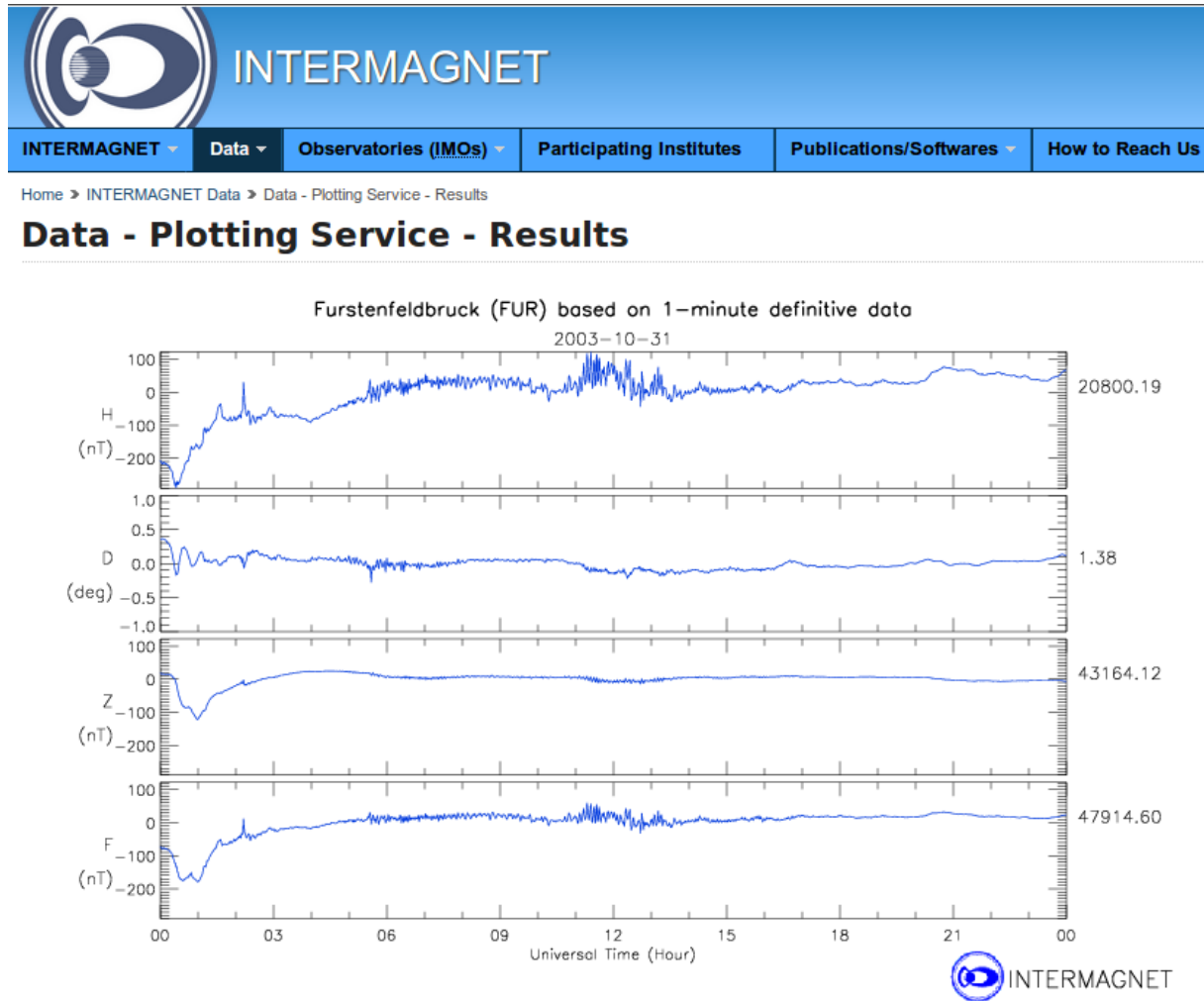
this is almost the same value that we have read from the diagram before.

Now we calculate the ratio of this difference to the base value

$$-290.28 \text{ nT} / 20800.19 \text{ nT} = -0.013955$$

and multiply by 100 to get the percentage

$$-0.013955 * 100 = -1.3955.$$



[Return to the Data - Plotting Service](#)

So the answer is that the H component of the geomagnetic field in south Germany decreased by about 1.4 percent during the Halloween magnetic storm in 2003.