

A SUCCESSFUL SEASON FOR THE GEOMAG PROJECT



With Earth's magnetic poles in the Polar Regions, Antarctica is an interesting place to study the planet's magnetic field. Stephan Bracke from the [Belgian Royal Meteorological Institute's Geophysical Center of Dourbes](#) is involved in a project called [GEOMAG](#), which has established a new geomagnetic observatory at the Princess Elisabeth station in Antarctica. Back from Antarctica, Stephan discusses the success of the season.

This is the second of three seasons during which a new geomagnetic observatory for the GEOMAG project is being set up. Last year, your colleague Jean Rasson travelled to the Princess Elisabeth station to conduct surveys to determine an ideal location near the station to build the observatory. What were your objectives this season?

The goals this season were to build a dome-shaped non-magnetic shelter to house the instruments, and to install in the shelter two instruments that can measure Earth's magnetic field.

The station team built the shelter several weeks before I even arrived in Antarctica. The shelter was finished by the end of December, and when I got to the station at the beginning of February, the team was just finishing up the installation of a fiber-optic cable linking the shelter to the Princess Elisabeth station.

Which instruments did you install this season in the shelter?

One instrument we installed this season is called a variometer. It measures the variation in Earth's magnetic field in three directions: north-south, east-west, and up-down, and it takes this measurement once every second. The second instrument I installed is a proton-magnetometer. It measures the strength in Tesla (the SI unit for magnetic flux density) of Earth's magnetic field every second. So with both instruments, one can see how the magnetic field moves in three dimensions and how its strength changes over time.

Data from these instruments is transferred in real time (with a total delay of half a second) to the Geophysical Center of Dourbes in Belgium. Originally, I had only planned to have data transmitted twice a day. But in the end, I managed to set it up so data is collected and transmitted every second. The fiber-optic cable transmits data from the instruments to the station, and from there the data is transmitted via satellite to Belgium. You can log in remotely and observe the data coming in!

How much does Earth's magnetic field vary in Antarctica?

Earth's magnetic field usually varies about 10 or 20 nT (Nano Tesla, or 10 to 20 billionths of a Tesla). But when I was in Antarctica, I noticed that the magnetic field varied by 300 nT.

In Antarctica, it's normal to see larger variation in the magnetic field, as the South Magnetic Pole is located there. Solar activity has greater influence on Earth's magnetic field at the poles.

Are you happy with how the setup of the shelter and instruments went?

Everything went really well this season. The installation of the instruments went very smoothly, and the instruments are working just fine. The station team was very helpful in building the shelter ahead of time and helping me set up the instruments.

What kind of work is planned for next season?

If all goes well, next season we plan to install an instrument that was developed at the Geophysical Center of Dourbes called [Autodif](#) (automatic declination, inclination flux). This instrument will measure the angles of the magnetic field.

A magnetic field is a vector, meaning at each moment in time it has a strength it has strength and a direction. The strength is measured with the proton magnetometer and the direction is measured by two angles : the declination and the inclination. The declination of Earth's magnetic field is the angle between the magnetic field and the Geographic North Pole. The inclination is the angle of the magnetic field relative to a horizontal plane tangent to where you are on Earth's surface (straight down near the North Magnetic Pole, and relatively horizontal in the Tropics, for example).

There's a photo of you from this season using a theodolite to measure the angle of the magnetic field angle. How is Autodif different?

You can use a theodolite to measure the inclination and declination of Earth's magnetic field. But this is a manual process that takes about three quarters of an hour to do.

However the Autodif instrument will take exactly the same kind of measurements, but without any need for a human to be present to take them. This means measurements of Earth's magnetic field declination and inclination can be taken during the eight months of the year that the Princess Elisabeth station is unmanned. Also, it can take the measurements in five minutes - much faster than a human can take the same measurements using a theodolite, and it can take these measurements at regular intervals (Autodif can do it

every half hour but in a normal setup we take a measurement once a day).

Autodif sounds like a very useful device. How many of them are currently in use?

Autodif is a unique device developed in Belgium at the [Geophysical Center of Dourbes](#). There are currently two installed in Dourbes as well as one in Austria at the [Conrad Observatory](#). During the 2015-16 research season, the fourth Autodif in the world will be installed at the Princess Elisabeth Antarctica research station.

Are a lot of the measurements taken of Earth's magnetic field around the world still done mostly by hand?

For the inclination and declination of the magnetic field, it's still done manually. Geomagnetic observatories around the world usually take these kinds of measurements once a week. So if the Autodif instrument can take these measurements at regular intervals, this is a huge improvement.

Are there plans for more Autodif instruments to be installed elsewhere on the planet?

The aim over the next few years is to place more Autodif instruments in other parts of the world. Geomagnetic experts in Japan, Spain, Australia and Italy have already expressed interest in having one.

Was this your first trip to Antarctica?

Yes, it was the first time I went. I really enjoyed it.

Before coming, I was worried about how things would work, and whether it would be too cold. But after a few days in Antarctica, I noticed that while it's cold, if there's sun and no wind, then it's not so bad. It's a nice environment. I enjoyed working there.

The last days I was there it was very windy, and we couldn't go outside much. But we had all the luxuries we needed at the station.

Will you go back next season?

Probably not. I have a colleague who is specialised in the Autodif instrument who will probably go to set it up. But it will be exciting to finally have an Autodif taking measurements of the magnetic field in Antarctica!