



# Tromsø Geophysical Observatory

Near Real-time Geomagnetic Data Provider  
for Space Weather Applications in the European Sector

Magnar Gullikstad Johnsen

## Abstract

Tromsø Geophysical Observatory (TGO) is responsible for making and maintaining long time-series of geomagnetic measurements in Norway. TGO is currently operating 14 magnetometer stations from southern Norway to Svalbard (Figure 01). Data from these are acquired, processed and made available for the user community in near real-time.

TGO is participating in several European Union (EU) and European Space Agency (ESA) space weather related projects where both near real-time data and derived products are provided. In addition the petroleum industry is benefiting from our real-time data services for directional drilling.

Near real-time data from TGO is freely available for non-commercial purposes. TGO is exchanging data in near real-time with several institutions, enabling the presentation of near real-time geomagnetic data from more than 40 different locations in Fennoscandia and Greenland. The open exchange of non real-time geomagnetic data has been successfully going on for many years through services such as the world data center in Kyoto, SuperMAG, IMAGE and SPIDR. **TGO's vision is to take this one step further and make the exchange of near real-time geomagnetic data equally available for the whole community.**

Here we present an overview of TGO, our activities and future aims. Our contribution to the space weather forecasting and nowcasting effort in the EU and ESA is presented with emphasis on our real-time auroral activity index and brand new auroral activity monitor and electrojet tracker.

## Space Weather

TGO is participating in several European Union (EU) and European Space Agency (ESA) space weather related projects where both near real-time data and derived products are provided. In addition the petroleum industry is benefiting from our real-time data services for directional drilling.

Figure 02 shows the real-time (top) and historic (bottom) geomagnetic activity index for Tromsø as provided for the ESA Space Situational Awareness (SSA) program.

## AFFECTS- Advanced Forecast For Ensuring Communications Through Space (EU FP-7 program) - Real-time Auroral Oval (Electrojet oval) tracker

- Associated with the auroral oval there are electrojets. These are latitudinally restricted currents flowing along the oval eastward and westward in the dusk and dawn sectors, respectively.
- In polar regions the ground magnetic field variation owing to the electrojets are observed on a routine basis.
- Using local maxima and minima in the measured magnetic field variation z-component, this can be used in order to determine the location of the electrojets (and thus the auroral oval) in real-time (Figure 03).

The TGO Real-time Auroral Oval tracker may be found at <http://fox.phys.uit.no/AFFECTS/>

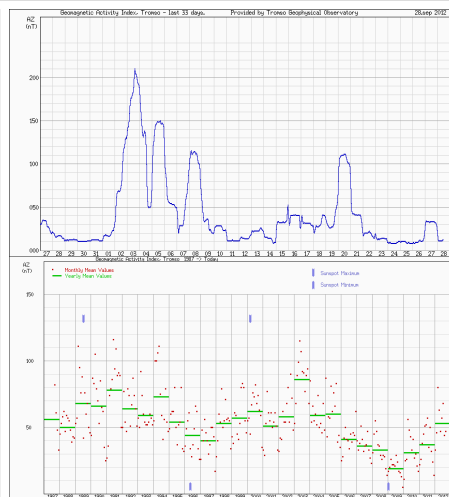


Figure 2: Tromsø geomagnetic activity index, real-time (top) and historic (bottom). Note the 11 year cycle.

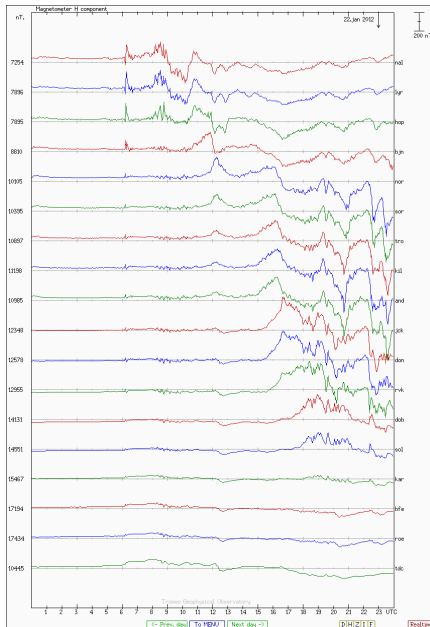


Figure 01: Stackplot of geomagnetic measurements from all TGO stations and several collaborating stations (KIL, BFE, ROE, TDC).

**Contact information for TGO (<http://www.tgo.uit.no>):**  
Truls Lynne Hansen (Observatory leader), [truls.hansen@uit.no](mailto:truls.hansen@uit.no)  
Chris Hall (Scientist), [chris.hall@uit.no](mailto:chris.hall@uit.no)  
Magnar Gullikstad Johnsen (Scientist), [magnar.g.johnsen@uit.no](mailto:magnar.g.johnsen@uit.no)

## Acknowledgements

Daniel R. Weimer is thanked for developing the Weimer 2005 empirical model and making it available. This study received the Weimer 2005 model from the CEDAR Database at the National Center for Atmospheric Research, which is supported by the National Science Foundation of the United States of America.

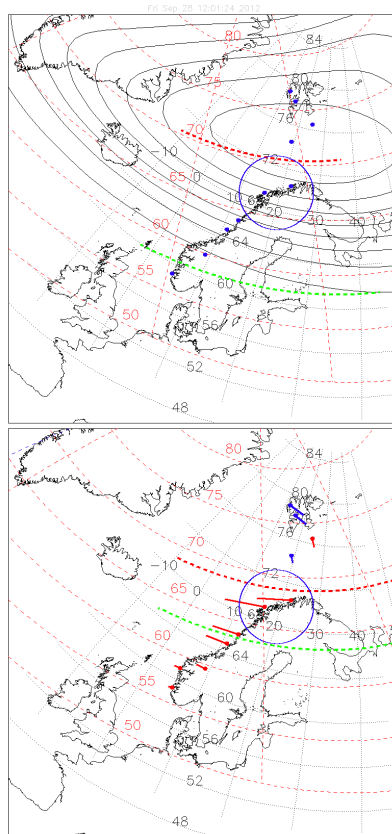
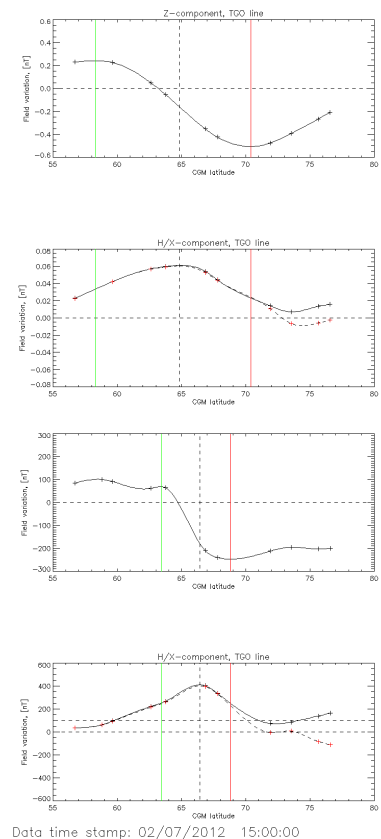


Figure 03: Electrojet oval as obtained from magnetic disturbances calculated using the Weimer 2005 electrical potential and FAC model (top). Electrojet oval obtained from magnetic field variation data on July 2, 2012 at UT 15:00 (bottom). Red and blue arrows indicate direction and strength of magnetic equivalent convection.



Data time stamp: 02/07/2012 15:00:00

