



Experience of 1-second magnetometer LEMI-025 use in the INTERMAGNET observatories

Andriy Marusenkov

Lviv Centre of Institute for Space Research of NANU and SSAU, Lviv, Ukraine (marand@isr.lviv.ua)

More than ten years ago INTERMAGNET community decided to commence producing filtered one-second data in addition to traditional one-minute data, hourly, daily, monthly, and annual means. This decision was inspired by the increasing demand of space physics scientists, investigating wave processes in the ionosphere and the magnetosphere of the Earth's.

The first requirements for a geomagnetic data acquisition system capable to acquire 1-second data were compiled during the INTERMAGNET survey, conducted by Jeffrey Love in 2005, investigating the needs of the scientific community using geomagnetic time series data.

The main consensus of the survey is as follows: geomagnetic data acquired at 1 Hz sampling should have 0.01 nT resolution at least, be filtered by a digital filter and be centred onto the UTC second within 0.01 s. Besides, the one-second magnetometer has to have much lower noise than that of 1-minute one, because the natural geomagnetic signals rapidly decay at the higher frequencies. And finally, the one-second instrument has to provide a sufficient level of immunity to manmade (industrial) noise, especially as produced by power lines.

In order to meet these partly conflicting requirements to the frequency response, a new magnetometer functional diagram, which combines analogue and digital filters, was proposed in the Lviv Centre of Institute for Space Research. Basing on this approach the first model LEMI-025 was designed, built, successfully tested and installed in Dourbes geomagnetic observatory (Belgium) since 2008. Later, after considerable modifications, these first commercially available instruments compatible with one-second INTERMAGNET standard were installed in a number of geomagnetic observatories over the Globe. The experience of LEMI-025 operation during the past few years let us evaluate the baseline stability of the new one-second magnetometer (< 5 nT per year), as well as its other important parameters – the noise level (< 10 pT/rtHz @ 0.1 Hz), synchronization accuracy to UTC (typ. 2 ms), the scale factors accuracy and stability ($< 0.02\%$), the linearity of the transfer function ($< 0.005\%$). More details on this topic will be given in the report.