Towards a standardized approach of analysing magnetic data with MagPy

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International science organisations like Intermagnet and IAGA want to facilitate the exchange of magnetic data by defining standards to collect, clean, analyse and archive magnetic data. Despite these efforts each observatory has, over the years, implemented its own tools and ways to accomplish this. In Belgium, as in many other observatories, these methods were becoming outdated and needed to be adapted to new standards and higher volumes of data. Instead of "reinventing the wheel" by implementing our proprietary software we decided to collaborate on the open-source project MagPy developed at GeoSphere Austria. This collaboration will improve the quality and usability of this software and will make it possible for other observatories to easily comply with new standards without implementing it themselves.

One of the daily duties in a magnetic observatory is assuring that quality data is delivered. Different levels of quality are defined, which can be delivered at different paces: variation (immediately), provisional (weekly), quasi-definitive (monthly) and definitive data (yearly). Therefore, we need to calculate and apply baselines to variometer data, define and remove spikes, apply time shifts, compare different observatories, etc. The way this data analysis and cleaning is done is not standardized and it is up to the observatory to put it in place. In Belgium different software programs, which were developed internally or by Intermagnet, were used to achieve these goals. Most of these tools are very rigid and difficult to adapt when instruments or setups at the observatory are changed. The need of moving forward to process more data, second data and more baseline points with our instrument AutoDIF, have made some of these tools obsolete. For these reasons we started in 2019 to search for how we could simplify this work and make it future proof. MagPy is a tool that is recommended by Intermagnet. Out of the box you can immediately use it in your observatory to convert data to different standard formats or view and compare data. As it is used by the Intermagnet data checkers, it comes with a simple tool to check if your definitive data is correct and compliant with the data quality rules of Intermagnet. As MagPy was initially implemented as a proprietary software package you have the possibility to use it from python scripting (which implies some programming skills) or you can use the graphical interface that comes with it. During evaluation we noticed that the support for baselines of xyz variometers was not working as expected.

But the great thing about the software is, despite it is not perfect at the moment, you can easily alter the code, which is open-source, and help developers to improve the software package. That's how we started a collaboration and in a next release full support of xyz baselines will be available. While collaborating on the code we managed to put a system into place where MagPy is used to adopt baselines, tag spikes, prepare quasi-definitive and definitive data without the hassle that comes with the different needs of standard formats.

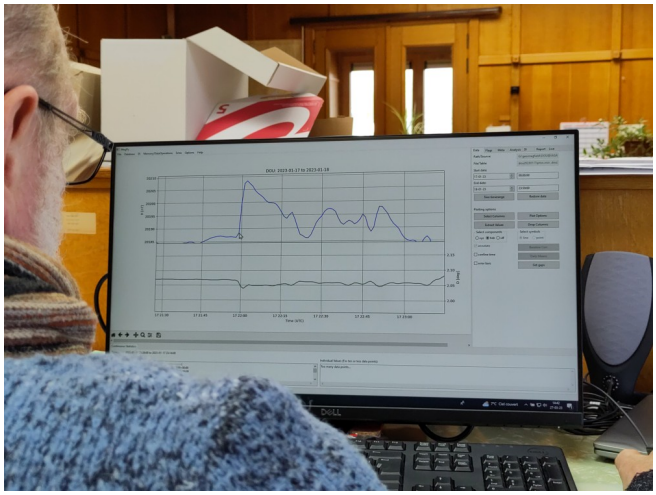

Figure 1: Identifying Sudden Commencement (SC) with MagPy.

Our observer, who isn't a programmer, could easily adapt to the graphical interface that comes with MagPy. He now uses it on a daily basis to prepare quality data and identify sudden commencements. As a software engineer I help to improve software by collaborating on GitHub and I already integrated better support for the AutoDIF baseline calculation. This clears the path towards international collaboration that will improve and facilitate daily work in magnetic observatories.

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