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The role of geomagnetic observatory data during the Swarm mission

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The scientific use of Swarm magnetic data and Swarm-derived products is greatly enhanced through combination with observatory data and indices. The strength of observatory data is their long-term accuracy, with great care being taken to ensure temperature control and correction, platform stability and magnetic cleanliness at each site.

Observatory data are being distributed with Swarm data as an auxiliary product. We describe the preparation of the data set of ground observatory hourly mean values, including procedures to check and select observatory data spanning the modern magnetic survey satellite era. Existing collaborations, such as INTERMAGNET and the World Data Centres for Geomagnetism, are proving invaluable for this.

We also discuss how observatory measurements are being used to ground-truth Swarm data as part of the Calibration/Validation effort. Recent efforts to improve the coverage and timeliness of observatory data have been encouraged and now over 60 INTERMAGNET observatories and several other high-quality observatories are providing close-to-definitive data within 3 months of measurement. During the Calibration/Validation period these data are gathered and homogenised on a regular basis by BGS. We then identify measurements collected during overhead passes of the Swarm satellites. For each pass, we remove an estimate of the main field from both the data collected at altitude and that collected on the ground. Both sets of data are then normalised relative to the data variance during all passes in the Calibration/Validation period. The absolute differences of the two sets of normalised data can be used as a metric of satellite data quality relative to observatory data quality. This can be examined by universal time, local time, disturbance level and geomagnetic latitude, for example.

A preliminary study of CHAMP data, using definitive minute mean observatory data, has shown how this approach can provide a baseline for detecting abnormalities at all local times and at different disturbance levels. Though it is difficult to predict how quasi-definitive data might affect the analysis, we present the results obtained for each Swarm satellite and compare these results with those found for CHAMP.