

EGU22-4733

<https://doi.org/10.5194/egusphere-egu22-4733>

EGU General Assembly 2022

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Swarm Fast Track spherical harmonic model of the external magnetic field to degree and order 3

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The development of satellite measurements over the past four decades has allowed us to understand the magnetic field in the Earth environment at higher temporal and spatial resolution than before. This is most evident for satellite ensembles such as ESA's Swarm constellation which allows simultaneous global coverage with three independent satellites.

Thanks to Swarm's particular configuration, we can take advantage of the Local Time sampling difference between Swarm A/C and Swarm B in order to estimate the low degree variation of the external magnetic field in latitude and longitude. We separate the external and induced fields measured at satellite altitude, and obtain the spherical harmonic decomposition of each source to degree and order 3 twice per day. However, there is a trade-off between spatial and temporal resolution and clear disadvantages occur when the measured field varies rapidly during a geomagnetic storm, since the method used will result in coefficients of the averaged field over the chosen time interval rather than the peaks.

We compare our results with previous models of the external field during the St Patrick storm 2015, which used up to four different local time simultaneous coverage, as well as during quiet times and lesser storms using our own solutions. We find good agreement in each case.

In this talk we will describe the algorithm and methodology used and show results over the lifetime of the Swarm mission to date (2013-). A new daily product for the Swarm mission (MMA_SHA_2E) is being developed.