Swarm’s Absolute Magnetometer (ASM) Experimental Vector Mode, a Unique Capability With Considerable Potential

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Abstract:
In addition to providing the reference absolute scalar measurements on the three Alpha, Bravo and Charlie satellites of the Swarm mission, each Absolute Scalar Magnetometer (ASM) can also, and simultaneously, provide independent experimental vector field measurements. These experimental data appear to be of the expected quality (though somewhat less so on Charlie). In addition, comparisons of these measurements with readings from the Vector Field Magnetometer (VFM, located some distance away along the boom and used to produce the nominal Swarm Level1b vector data) show that the mechanical link between both instruments is very stable on all three satellites. These remarkable circumstances make it possible not only to compare the output of the VFM and ASM instruments for cross-validation purposes, but also to compute geomagnetic field models using only ASM scalar and vector mode data, without resorting to VFM data. Such models can then be compared to models computed in exactly the same way from VFM data (using exactly the same data distribution in time and space for both models, which thus only differ by the fact that the data are provided by either the ASM experimental vector mode, or the nominal L1b calibrated VFM data). As we shall illustrate in this presentation, such comparisons provide extremely valuable information. Not only do they show that ASM experimental vector mode data can indeed be used to produce high-degree geomagnetic field models, but they also provide a very interesting perspective on what may be the cause of undesired perturbations on either of the ASM and VFM instruments.