Swarm's Absolute Scalar Magnetometer can do more

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Abstract

Each of the three ESA Swarm satellites, hopefully to be launched by the end of the year, carries a vector field magnetometer (VFM) and an absolute scalar magnetometer (ASM), positioned on a boom away from the body of the satellite to minimize undesired magnetic perturbations, and distant enough from each other to avoid crosstalk between instruments. The VFM further shares an optical bench with a star imager (STR), to which it is thus rigidly attached. The rational behind this set-up is that the ASM will provide very accurate absolute field intensity measurements,
while the combination of the VFM with the STR will provide vector field measurements oriented in the terrestrial frame of reference. The ASM will also provide the values needed to calibrate and improve the accuracy of the three components of the field measured by the VFM. It is the output of this procedure (using the implemented baseline Swarm level 1b algorithms, also correcting for known satellite perturbations) that will provide the very accurate level 1b data the Swarm mission is aiming at. The above procedure is entirely based on the baseline 1 Hz scalar ASM outputs. But the ASM instruments can do more. Following an agreement between ESA and CNES, each instrument will also be able to provide two additional, non-nominal, types of data: 250 Hz measurements provided by a "burst mode" to be operated during the commissioning phase, and 1 Hz absolute vector field measurements produced as a by-product by the ASM and synchronized with the nominal 1 Hz scalar measurements. The burst mode will be used to explore the spectral content of the field encountered by each satellite. It will also be used to identify the frequency bands within which three modulations must be operated to produce the experimental absolute vector field ASM data, which would then provide a second set of vector field measurements (in addition to that provided by the VFM) on board each satellite. In this talk, we will discuss the possibility offered by these two additional ASM modes, for both validation and science purposes.