Measuring the Earth’s Magnetic Field from Space: Concepts of Past, Present and Future Missions

Observations of the Earth’s magnetic field from low-Earth orbiting (LEO) satellites started very early on, more than 50 years ago. Continuous such observations, relying on more advanced technology and mission concepts, have however only been available since 1999. The unprecedented time-space coverage of this recent data set opened revolutionary new possibilities for monitoring, understanding and exploring the Earth’s magnetic field. In the near future, the three-satellite Swarm constellation concept to be launched by ESA, will not only ensure continuity of such measurements, but also provide enhanced possibilities to improve on our ability to characterize and understand the many sources that produce this field. In the present paper we review and discuss the advantages and drawbacks of the various LEO space magnetometry concepts that have been used so far, and report on the motivations that led to the latest Swarm constellation concept. We conclude with some considerations about future concepts that could possibly be implemented to ensure the much needed continuity of LEO space magnetometry, possibly with enhanced scientific return, by the time the Swarm mission ends.

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