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Witnessing variations in the Earth magnetic field by means of Nanosat-1B COTS AMR magnetic sensor

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The magnetometer of the attitude control system of NANOSAT-1B, made up of Commercial Off-The-Shelf (COTS) Anisotropic Magnetoresistive (AMR) sensors, could be capable of detecting deviations of the Earth magnetic field coming from some of the different sources.
This capability is a secondary objective, since the magnetometer was not designed as a scientific payload, but as a part of the Attitude Control Subsystem (ACS) of the spacecraft.
But after the recent in orbit calibration of the magnetic sensors, it seems that we could take advantage of the measurements for scientific purposes as well. This fact can be specially interesting to be used in constellations of small satellites for space weather.

1. INTRODUCTION

NANOSAT-1B AMR magnetic sensor is a four axes magnetometer designed for the ACS of the spacecraft. Since the objective of the mission was not formerly scientific, no magnetic cleanliness program was foreseen. As a result, an in-orbit calibration of the sensor had to be performed [1, 2].
Our challenge was to check if we could observe variations in the Earth magnetic field. This purpose is achievable since the magnetic sensors have a precision in the order of 10 nT and thus some of the variations of the Earth's magnetic field can be observed.
The study of space weather at low Earth orbits can add extra information in order to be prepared for contingencies of any kind and preserve our technologies from catastrophes. [3, 4].

2. DETECTED MAGNETIC SOURCES

Making use of the magnetic data obtained since the launch of NANOSAT-1B, and comparing them with the magnetic models (IGRF-11, WMM 2010.0), we could observe some irregularities at certain moments and places.
Not every unexpected contribution to the magnetic field would be observable, so we just focused on a few magnetic sources: solar storms, day-night variations and ionospheric events.
We try to correlate the measurements that presented a poor fit in the calibration process with the models (differences higher than 50 nT) with the special events registered the days of the measurements, such as solar flares or geomagnetic storms of any kind, and look for some clues in our data.
Having a proton monitor (LDT) embarked in NANOSAT-1B [5], we will take advantage of its measurements to search for a fine correlation between events and collected data.

3. RESULTS

In both cases, the comparisons resulted in a success. The effects of these external magnetic sources were actually detected by our magnetometer, validating not only the COTS components but also the calibration method itself.
This new capability opens up a wide range of new space missions, cheaper and more efficient, that could have a profit from a lower investment.

4. REFERENCES

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