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MAGAL CONSTELLATION: SMALL SATELLITES FOR OCEAN RADAR ALTIMETRY

Abstract

The Earth's climate greatly depends on the oceans' parameters, such as temperature, mass distribution, salinity, etc. They can be measured locally, e.g. using the special floats as in Argo international program, but the number of currently available floats is rather limited. Alternatively, some ocean parameters might be determined using the measurements of surface topography provided by Satellite Altimetry. There have been several missions dedicated to this purpose, e.g. Envisat and the Jason series of satellites, or the currently operational Sentinel 3A/B and Sentinel-6 MF.

MAGAL constellation aims to increase the temporal and spatial resolutions of the data already available. Four main use cases were selected, that require sampling of the ocean with higher spatial and temporal resolutions : better characterization of the mesoscale variability at local and regional scales to support operational oceanography; eddy detection and tracking; monitoring of marine debris pathways, and the monitoring of the water level of inland water bodies.

In order to achieve the required spatial and temporal resolution, six satellites are planned to be launched at the same Sun-synchronous orbit. Orbit's inclination is about 97.4 degrees, and its height is about 500 km. With a 5-day repetition cycle, the distance between the satellites' ground tracks at the equator, i.e. the spatial sampling, is about 88 km.

The MAGAL mission is supposed to be based on six identical small satellites (24U CubeSats). Utilization of COTS components, small mass and unification would allow to significantly decrease the cost of the constellation. Specifically for this mission, we have developed the power-effective Radar Altimeter. It is a single-frequency altimeter, operating at a frequency of 13 GHz, with a Frequency Modulated Continuous Wave architecture. To ensure an adequate observation footprint, a deployable dish antenna of at least 1.5 m diameter is required. The radar altimeter also embeds and provides additional data for range accuracy improvement and validation. Its prototype is already available and has passed several ground tests.

The gathered data will be stored and processed in the Data Analysis Center (DAC) to produce scientific and commercial information. The DAC front-end layer will also allow the display of the data in various graphical interfaces.