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THE INFLUENCE OF SOLAR AND GEOMAGNETIC ACTIVITY MODELLING ON THE COST OF END-OF-LIFE DISPOSAL: APPLICATIONS TO EUROPEAN EARTH OBSERVATION MISSIONS

Abstract

All ESA missions shall be compliant with various Space Debris policy guidelines, including the European Code of Conduct for Space Debris Mitigation, the European Space Debris Safety and Mitigation Standard, the ESA Space Debris Mitigation Handbook, and the IADC Space Debris Mitigation Guidelines. Furthermore, all ESA missions shall be compliant with ECSS standards.

Since most ESA Earth Observation (EO) missions are conducted from LEO, the disposal strategy shall envision a manoeuvre to lower the orbit perigee to an altitude that assures a safe uncontrolled decay within 25 years. This end-of-life (EOL) perigee altitude, and thus the size of the lowering manoeuvre, is driven by the atmospheric drag that affects the satellite during the re-entry phase, which depends mainly on atmospheric density and spacecraft ballistic coefficient.

A study performed at DEIMOS Space has analysed the impact of the assumptions provided by the ECSS and the space debris guideline documents about how to perform the end-of-life disposal analysis, highlighting that the possible range of compliant assumptions leads to a significant dispersion of the results obtained. In particular, the hypotheses on the modelling of solar and geomagnetic activity greatly affect the magnitude of the EOL delta-V budget.

This paper presents an overview of the models and tools that are used in the EO mission studies carried out at DEIMOS Space, and it performs an analysis of the impact of the models and assumptions on the EOL results obtained for the main present and future European EO missions (including ERS, ENVISAT, the Earth Explorers and the GMES Sentinels).

These results are also compared with those obtained with dedicated ESA and NASA tools for EOL analysis, respectively DRAMA and DAS.

The outcomes of the study bring to the fore the need for a more precise indication on how to define the assumptions for the EOL disposal analysis for LEO missions. Such assumptions have turned out to be a driver for the delta-V budget assessment, with major impacts on mission and spacecraft design.