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Nowcasting the Orbit Decay of Earth orbiting Satellites

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The FFG funded project SWEETS (space weather effects on low Earth orbiting satellites) covers the analysis of a large sample of more than 300 ICMEs (interplanetary coronal mass ejections) from 2002 to 2017 and how they relate to the orbit decay of satellites. Based on the results by Krauss et al. (2018, 2020), we investigate the correlation between the interplanetary magnetic field of ICMEs and the variation of the neutral density in the thermosphere. So far, the satellite drops were calculated from either accelerometer measurements or kinematic orbits for the satellite GRACE at a height of approximately 490 km. Presently, we are working on constructing kinematic orbits for satellites in various heights so we will be able to cover altitudes between 300 to 800 km and a wider timeframe. The algorithm is also going to be improved with respect to multiple ICME events and the calculation of a so-called “effective B_z” component and its duration.

With the correlation and the real-time in-situ magnetic field data from satellites at L1 we were able to construct a nowcast. The nowcast algorithm is the basis of a new service called SODA (Satellite Orbit DecAy) which will be implemented in the ESA Space Safety Program (Ionospheric Weather Expert Service Center).