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Space Debris Detection, Tracking and Characterization (1)

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INFRARED DETECTION OF SPACE DEBRIS AND THE APPLICABILITY OF OBSERVATION DATA

Abstract

Detection and observation od low Earth objects are essential for the knowledge of the space situation. Observations can be done by telescopes or radars. Optical telescopes have various advantages over the radar. Such as low acquisition and operating costs at high precision.

Thus, a significant disadvantage of optical systems is their limited availability, since they rely on clear skies and operation only during the twilight phase. The latter is due to the fact that objects for optical visibility must be illuminated by the sun while the station is obscure.

However, if the optical observations are shifted to the infrared range, it becomes possible to observe objects in the shadow of the earth. Depending on the material properties and trajectory, the object can also emit infrared radiation in the Earth's shadow (reflected radiation from the earth or its own thermal radiation). So the number of optical detections can be increased by additional detections in the IR range. This has been proven in a research study.

For this purpose, an IR detection model was developed by the TU Braunschweig in cooperation with the DLR Stuttgart. This model includes:

- Emission-Model: To determine the IR signature of objects in space
- Disturbance-Model: To calculate the background IR radiation and absorption of Earth atmosphere
- Sensor-Model: To simulate specific IR sensors (variant ranges)

With the help of the developed model, it is possible to simulate and evaluate measurement campaigns. To compare the information gain by IR sensors compared to the conventional use of telescopes and radars.

For the simulation campaigns are the technical properties of the sensor and local conditions varied. So it is possible to make qualitative statements regarding the positioning of an IR sensor. This analysis is based on known locations of relevant existing facilities for the acquisition of the space situation.

The results of the simulated campaigns and the IR simulation model shall be presented in this publication