

SPACE DEBRIS SYMPOSIUM (A6)  
Modeling and Risk Analysis (2)

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A NOVEL APPROACH FOR THE GEO VALIDATION OF THE MASTER MODEL

**Abstract**

The validation of the GEO debris environment modeled by ESA-MASTER has so far been relying on sporadic observation data obtained by dedicated instruments such as the ESA Space Debris Telescope. As the amount of debris detected by those instruments could not be explained by known fragmentation events, additional such events have been introduced. Their parameters were chosen in a manner to reproduce the observations made by the ESA Space Debris Telescope in the MASTER GEO population. The artificially introduced events were not linked to any known or suspected fragmentation events. It will be shown in this paper that this approach may potentially cause large deviations in the model predictions, especially for epochs beyond those for which observation data are available. In order to avoid these shortcomings of the traditional validation approach, a new source of information needed to be used. The analysis of historical space surveillance data could deliver hints to possible spacecraft anomalies in GEO causing slight orbit changes. Using both analytical and numerical tools, the exact times and places of the suspected anomalies could be determined. The initial list consisted of 21 orbit anomalies. In the first step it was assumed that all these anomalies were in fact fragmentation events. The resulting debris population was then compared with ESA Space Debris Telescope observation data in order to confirm or to oppose the assumption that a fragmentation event has occurred. In the following iterations, event parameters defining the amount of large objects generated were fine-tuned. The resulting list of 10 GEO fragmentations will be presented in this paper.