Impact evaluation of long term space weather activities on space debris environment evolutionary model

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Space debris is the collection of defunct objects in space made by human activities (payload, rocket body, mission related debris, and so on). It is very important to reduce amount of space debris around the Earth, because they put serious crimps in space developments. Kyushu University and JAXA developed the space debris environment evolutionary model, named NEODEEM (Near-Earth Orbital Debris Environment Evolutionary Model) for evaluating current and future conditions of space debris on geospace and validities of space debris reduction measures. Atmospheric drag force is one of the main causes of space debris orbit change. Atmospheric density change is affected from space weather, for example, solar and geomagnetic activities. It is essential for development of space debris evolutionary model to consider the impact of space weather. We improved atmospheric density model in our space debris evolutionary model to incorporate many kind of space weather related parameters and calculate more precise density. We performed some simulations under different solar and geomagnetic parameters to evaluate long term effects of these activities. In the result, we found that space debris environment would also become significantly worse because of collision cascading even with no launches in the case of low solar activity, like as solar cycle 24. Space debris environment would become worse under low geomagnetic activity caused by low joule heating and atmospheric drag. These effects are different between Kp and Dst indexes. In this presentation, we will introduce improved atmospheric density model and its responses to space weather activities in term of space debris environment evaluation.