

## Improvement of atmospheric density model in space debris evolutionary model and evaluation associated with space weather activities

\*Shuji Abe<sup>1</sup>, Toshiya Hanada<sup>2</sup>, Akimasa Yoshikawa<sup>1</sup>, Takayuki Hirai<sup>3</sup>, Satomi Kawamoto<sup>3</sup>

1. International Center for Space Weather Science and Education, Kyushu University, 2. Department of Aeronautics and Astronautics, Faculty of Engineering, Kyushu University, 3. Research Unit II, Research and Development Directorate/Japan Aerospace Exploration Agency

Space debris is the collection of defunct objects in space made by human being. It is very important to reduce amount of space debris around the Earth, because they put serious crimps in space developments. To evaluate current and future conditions of space debris on geospace and validities of space debris reduction measures, Kyushu University and JAXA developed the space debris evolutionary model, named NEODEEM (Near-Earth Orbital Debris Environment Evolutionary Model). Atmospheric drag force is one of the main cause of space debris orbit change and disappearance. Atmospheric total density changes are 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. Thus, we made an attempt to improve atmospheric density model to calculate more precise density and apply to our space debris evolutionary model. In the result, we developed atmospheric density model suitable for space debris orbit calculation, which includes various kinds of space weather effects not only long term variations like as solar cycle, but also short time phenomena like as geomagnetic storm. In this presentation, we will introduce improved atmospheric density model and its responses to space weather activities in term of space debris environment evaluation.

Keywords: Space Weather, Space Debris, Space Environment