Comparison between the KOMPSAT-1 drag derived density and the MSISE-90 model density during strong solar and/or geomagnetic activities

J. Park[1,2], Y. -J. Moon[1], K. -H. Kim[1], K. -S. Cho[1],
H. -D. Kim[3], Y. -H. Kim[1], Y. -D. Park[1], and Y. Yi[2]

[1] Korea Astronomy and Space science Institute
[2] Dept. of Astronomy and Space Science, Chung-nam National University
[3] Korea Aerospace Research Institute

We have compared the Korea Multi-Purpose Satellite-1 (KOMPSAT-1) drag derived density with the MSISE-90 atmospheric model density during strong solar and/or geomagnetic activities. It is well known that there are two major mechanisms to induce satellite drags caused by atmospheric density enhancement: the heating by solar EUV radiation and joule heating associated with local geomagnetic current enhancements during geomagnetic storms. For this work we select five events dominated by the radiation effect and/or the geomagnetic effect. For these events we compared the satellite drag derived density with the MSISE-90 model density. The major results can be summarized as follows. (1) The density predicted from the MSISE-90 model during radiation dominated periods is comparable to the drag derived density but the model density during strong geomagnetic storms is significantly different. (2) The ratio of the KOMPSAT-1 (around 685 km) drag derived density to the MSISE-90 model density during a strong geomagnetic storm is abruptly enhanced up to a factor of 8, which is much larger than the previous estimates from low altitude (around 400 km) satellites. (3) There is a possible correlation between daily drag enhancement and daily Dst variation. We note that there is a remarkable difference in daily drag enhancement although solar and geomagnetic activities are quite similar to each other. We suggest that such a difference should be explained by the accumulation of solar radiation effect depending on solar activity cycle. Moreover, the MSISE-90 model is not able to account for the density enhancement caused by the long-term solar radiation effect.