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Current status and future direction of sounding rocket experiments in Japan

ABE, Takumi[1*]

[1]Japan Aerospace Exploration Agency

Sounding rocket is an effective platform which provides opportunity to make a vertical sounding for a short period through the thermosphere, ionosphere and magnetosphere while satellite generally flies in a horizontal direction. In short, the sounding rocket has a great advantage in conducting an instantaneous survey of the upper atmosphere in the vertical direction. The primary objectives of Japanese rocket experiments include various topics; studies of thermospheric, ionospheric, magnetospheric physics, and astrophysics, microgravity experiment, demonstration of various instrument and technique, and advanced engineering experiments. Among these topics, the upper atmospheric physics is one of the most frequently explored targets.

For further understanding the upper atmosphere and ionosphere, sounding rocket will be inevitably needed. In particular, it is the most effective platform to investigate a coupling between neutral atmosphere and plasma, in other words, coupling between thermosphere and ionosphere, because it is only a platform which enables in-situ observation at 100-250 km altitudes where a role of collision rapidly changes. Advanced ground-based instruments to observe thermosphere and ionosphere are deployed and now operational in many places in Japan, and those capability has a great advantage compared to other countries. Making use of such an advantage, it becomes possible for Japan to conduct the most advanced experiment by coordinating the sounding rocket and the ground-based observations. However, we cannot expect too much progress as long as we repeat similar observations. It is highly required to adapt a new perspective to the future experiment to proceed to the next step from our current understanding. Furthermore, it is desired to develop a new type of instrument which enables us to study the thermospheric and ionospheric physics from a new point of view.

Another advantage of sounding rocket is that a proposed experiment can be achieved within a few years after a mission proposal is approved, while it takes more than three time longer in the satellite project. On the other hand, it should be noted that it also takes several years to develop a new instrument. Therefore, it is necessary to make a plan by closely coordinating a future experiment of the sounding rocket and the instrument development. In this presentation, we will also discuss what kind of instrument should be developed in the future.

Keywords: souding rocket, Upper atmosphere, ionosphere