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JAPANESE SOUNDING ROCKET EXPERIMENTS IN THE ARCTIC

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Enormous amount of mass and energy are transported into the ionosphere from the magnetosphere and the solar wind along the geomagnetic field via various physical processes. Such mass/energy inflow is observed to exist most intensively in the polar ionosphere, which is known as an open window of the Earth atmosphere to the outer space. Because of this situation, there exist numerous unique and unrevealed phenomena in this region.

Sounding rocket is an effective platform which provides opportunity to make a vertical sounding for a short period through the lower 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 Institute of Space and Astronautical Science (ISAS) of Japan Aerospace Exploration Agency (JAXA) has conducted sounding rocket experiments in the arctic to investigate the vertical coupling in the polar upper atmosphere as well as the upper atmospheric dynamics and energetics attributed to the auroral energy input. The primary objectives of the past experiments include various topics; pulsating aurora, ozone chemistry affected by the auroral activity, fine structure of the auroral arc, and the cusp ion outflow. These subjects are derived from phenomena that is caused by interaction between the solar wind or magnetospheric plasma and the upper atmosphere. It is necessary to make a comprehensive observation of the mass and energy transport, the response and consequences for better understanding of the causal relationship.

We are considering several possibilities of sounding rocket experiments to investigate a relationship between the mass/energy input from higher altitudes and the ionospheric response in the auroral region. In particular, the ion outflow originated from the ionospheric cusp region, which is one of the most significant phenomena of the magnetosphere-ionosphere (M-I) coupling, is one of the targets which are most extensively discussed as science target of the rocket experiment. It is important to obtain the high-time resolution data by the sounding rocket equipped with instruments for plasma and magnetic/electric fields, because this phenomena may be highly structured. For such an experiment, it will be a key to get information on the wave-particle interaction which may play an important role in accelerating ionospheric ions.

The energetics and dynamics in the polar lower thermosphere is also important subject to understand the upper atmospheric response to auroral energy input from higher altitudes. It is presumed that energy inputs from the magnetosphere is brought in the form of electric fields or energetic particles. It is, therefore, necessary to make in-situ measurements of neutral wind, thermal plasma, and low energy particles to understand quantitatively the momentum transfer between the neutrals and plasma. The sounding rocket experiment to elucidate such a neutral-plasma coupling is also under consideration.

Thus, we are considering several candidates of the sounding rocket experiments which should be conducted in the arctic to investigate a vertical coupling of the magnetosphere and ionosphere. In this presentation, we will briefly introduce some of the promising rocket experiments.