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S/N estimation for Lithium release experiments under daytime and moonlight conditions

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In order to measure thermospheric wind profile, chemical release experiments by sounding rockets have been used in these decades. Tri-methyl-aluminum (TMA) is usually used in E-region wind measurements, however, for the F-region altitude, it cannot be adapted because of its fast diffusion in the upper thermosphere higher than 160 km. One of the promising methods to measure the F-region wind profile is chemical release of Lithium. The Lithium release has an advantage for its brightness with sunlit condition at a target altitude range, but in a dark sky condition on ground. Thus, we have conducted the Lithium release experiments by using JAXA sounding rockets in these years under twilight sky conditions in evening and dawn. However, the advantage of using Lithium can be extended to the daytime and midnight conditions, when good S/N of the Lithium emission can be proven.

In 2011, we tried to measure the Lithium emission in daytime by using a NASA sounding rocket at Wallops islands, Virginia (VA), U.S., but it failed. The problem has been gradually understood by ground tests and estimation and it might be occurred by failure of Lithium release itself by the on-board Lithium Ejection System (LES) as well as unexpected dense haze over east coast of VA. By improving the LES especially for its burning system by Termite reaction as well as newly applying a small airplane of NASA (named NASA-8) for photographing from 7,500 m altitude, we conducted a test experiment by using NASA Terrior-Improved-Orion sounding rocket (41.107).

The Lithium release experiment of the test flight rocket was successful. Based on the preliminary analyses, the emission in an altitude range of 115-130 km was brighter than 1.5 MR that was obtained by the WIND-1 campaign in Japan at about 230 km altitude. In Japan, we have a plan to observe midnight wind profile at about 200 km altitude by using moonlight of full moon condition with using an airplane of JAXA in summer of 2013. In this talk, we will introduce our results and findings for Lithium release experiments and the S/N of the imaging will be discussed.

Keywords: Lithium release, sounding rocket, thermospheric neutral wind, S/N ratio