

## Lithium release experiment in Japan: thermospheric neutral wind in wide altitude range

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### 1.Introduction

On September 2, 2007, the S-520-23 sounding rocket was launched from Uchinoura, Kagosima, Japan (131.08 E, 31.25 N). The purpose of our experiment is to obtain thermospheric neutral wind by using resonance scattering luminescence of Lithium vapor released from the rocket. Taking images of 670.8 nm resonance scattering light of Lithium in the evening sky, neutral wind velocities at 230 km, 193 km, and 144 km altitudes were measured from 4 independent ground sites of Shionomisaki, Miyazaki, Uchinoura, and Amami as motions of three Lithium clouds.

### 2.Observation equipment

Four digital cameras of Canon EOS Kiss Digital N are prepared for optical observation of Lithium clouds. As the 670.8 nm light is difficult to be taken by usual digital cameras because of its infrared cut filter, we removed it for the imager. Special telecentric lenses of FOV=110 degrees with 20 nm band-pass filter at 671 nm for taking high S/N images of the likely wide-spread Lithium clouds have been developed by Photocoding and Kochi University of Technology in order to resolve the problem arisen from the both wide FOV and narrow band width conditions.

### 3.Results

The resonance scattering luminescence of Lithium was clearly observed more than 40 minutes from the 4 sites and, at a time of 1st release, luminescence intensity more than 1M Rayleigh was artificially generated by a 125 g Lithium. As a preliminary result of the thermospheric neutral winds for 4 altitudes, SE-ward wind of 80 m/s or more at 250 km altitude, SSW-ward wind of 100 m/s or more at 200 km, SSW-ward wind of 80 m/s or more at 150 km, and NNE-ward wind of 60 m/s or more at 120 km were obtained, respectively.

Initial rate of Lithium diffusion speed was 3.2 km/s at 237 km, 1.4 km/s at 187km, and 450 m/s at 143 km as well as they were decelerated rapidly and converged into 250 m/s at 237 km, 200m/s at 187km, 50 m/s at 143km, respectively.

### 4.Discussion

It is found that neutral wind profile had strong wind shear in comparison between 120 km and 150 km altitudes. It is necessary to analyze high-accuracy thermospheric neutral wind in wide altitude range.

Flight velocity of the rocket might affect on the motion of the Lithium vapor until about 150 s after the launch. In order to analyze thermospheric neutral wind, we may have to use data about 150 s after the launch.

Initial rate of Lithium diffusion speed of 3.2 km/s at 237 km altitude was comparable to the theoretical diffusion speed of 3.67 km/s in a temperature condition of 1600K. As the Lithium luminescence area at 250 km altitude at 50 s after the release was 100 km narrower than a model prediction, neutral density at the altitude might be controlled by a condition of higher solar activities.

### 5.Conclusion

The Lithium release experiment was successfully carried out. Now, we analyze high-accuracy thermospheric neutral wind in wide altitude range by using triangulation method.

In this talk, the neutral wind velocity profile and the Lithium diffusion in wide altitude range in the thermosphere will be discussed in detail.