

Investigation on PMC variations in the Southern Hemisphere observed by Himawari-8/AHI

*Sayaka Karigane¹, Takuo T. Tsuda¹, Yasunobu Miyoshi², Yuta Hozumi³, Yoshiaki Ando¹, Keisuke Hosokawa¹, Hidehiko Suzuki⁴, Ken T. Murata³

1. University of Electro-Communications, 2. Kyushu University, 3. National Institute of Information and Communications Technology, 4. Meiji University

Polar mesospheric clouds (PMCs) or noctilucent clouds (NLCs) are clouds that can form in the predominantly high-latitude summer mesopause region. These clouds are considered to be composed of water-ice particles caused by condensation of water vapor under extremely low temperatures. The production and loss of such water-ice particles could be largely influenced by the background atmospheric conditions, such as temperature, water vapor, etc., and thus PMC observations can be used as an excellent tool to investigate atmospheric dynamics and chemistry in the Earth's mesosphere. As a recent advance in PMC observations, a PMC detection method was developed using full-disk images by Advanced Himawari Imager (AHI) onboard the Japanese geostationary-Earth-orbit (GEO) meteorological satellite Himawari-8. By analyzing the detected PMC data, we have been investigating PMC variations.

In the present work, we focus on PMC variations in the Southern Hemisphere (SH). PMC variations observed in SH seem to be more complex, compared with those in the Northern Hemisphere (NH), and there may be several different important factors to control such PMC variations in SH. One of them could be the interhemispheric coupling, i.e., the coupling between summer SH and winter NH. A previous paper by another research group reported a relationship between summer PMC variations and winter stratospheric temperatures with a time lag of 2-8 days, analyzing observational data obtained for a single year. For further understanding, we have performed a multi-year data analysis on this issue, using Himawari-8/AHI PMC data from 2015 to the present. The dataset includes eight Arctic winters, i.e., eight Antarctic summers. Among them, we have selected four events, i.e., four NH-winters/SH-summers, which showed significant temperature increases in the stratosphere at high latitudes in NH, based on temperature data from Aura/ Microwave Limb Sounder (MLS). In the analyzed four events, the observed temperature increases at 81°N reached up to 36-48 K at 45 km altitude. After that, 5.6-24% decreases in PMC occurrence rates (ORs) were observed at 70-80°S in the four events. The observed PMC responses would imply temperature increases in the mesopause region in SH, which could be due to the interhemispheric coupling. Furthermore, to determine time lags in the interhemispheric coupling, we have performed the cross-correlation analysis between the NH temperatures and SH PMC ORs. As a result, negative correlations were found in the four events, and the calculated time lags in the interhemispheric coupling were 5-26 days. In the presentation, we will show these results, and discuss the observed time lags with comparisons to previous observations and model simulations.

Keywords: PMC, NLC, Interhemispheric coupling, Himawari-8/AHI, Aura/MLS