

Coupling of atmospheric dynamics from the troposphere to the lower thermosphere - Analysis of GAIA data in 2009-Jan. SSW-

OCHI, Kenta^{1*}, FUJITA, Shigeru¹, MIYOSHI, Yasunobu², FUJIWARA, Hitoshi³, JIN, Hidekatsu⁴, SHINAGAWA, Hiroyuki⁴

¹Meteorological College, ²Department of Earth and Planetary Sciences, Faculty of Sciences, Kyushu University, ³Faculty of Science and Technology, Seikei University, ⁴National Institute of Information and Communications Technology

In order to reveal mechanical interactions among dynamics in the troposphere, in the stratosphere, in the mesosphere, and in the lower thermosphere during the stratospheric sudden warming (SSW) in Jan. 2009, we analyze global atmospheric circulation and its disturbances appearing in the Ground-to-topside model of the Atmosphere and Ionosphere for Aeronomy (GAIA) data [Miyoshi et al., 2011]. We put the JMA/JRA data in the lower atmosphere part of GAIA. Finally, the GAIA data are interpreted by using results from a simplified transformed Euler equation.

It is concluded that the dynamical effects caused by the heating and disturbances in the SSW depend on latitudes. This dependence is derived mainly from latitudinal and meridional non-uniform structures of the $m=2$ planetary wave which propagates up to the lower mesosphere. It is also revealed that, during the 2009-Jan. event, a symmetric atmospheric circulation in the northern hemisphere appears first in the mesosphere and propagates down to the upper troposphere. The downward propagation of the circulation exhibits latitudinal variations in its structure.

The Arctic Oscillation (AO) is related to the SSW. As the present study manifested that the SSW is initiated in the mesosphere, the AO is controlled by the mesospheric dynamics. Because the AO is assumed to be related with the cold winter, it may be concluded that the mesospheric dynamics plays an important role in generating a cold winter.

Miyoshi, Y., H. Fujiwara, H. Jin, H. Shinagawa, H. Liu, and K. Terada (2011), Model study on the formation of the equatorial mass density anomaly in the thermosphere, *J. Geophys. Res.*, 116, A05322, doi:10.1029/2010JA016315.

Keywords: stratospheric sudden warming, mesosphere, troposphere, arctic oscillation, GAIA model