Geophysical Research Abstracts
Vol. 14, EGU2012-3544, 2012
EGU General Assembly 2012

Stratospheric sudden warming impact on the tropical troposphereseen in NICAM - a global non-hydrostatic model

N. Eguchi (1), K. Kodera (2,3), and T. Nasuno (4)

(1) Research Institute for Applied Mechanics, Kyushu University, Kasuga, Japan (nawo@riam.kyushu-u.ac.jp), (2) Solar-Terrestrial Environment Laboratory, Nagoya University, Nagoya, Japan (kodera@stelab.nagoya-u.ac.jp), (3) Climate Research Department, Meteorological Research Institute, Tsukuba Japan, (4) Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan (nasuno@jamstec.go.jp)

To investigate the dynamical interaction between the stratosphere and troposphere through the tropical transition layer (TTL), the impact of stratospheric sudden warming (SSW) on the tropical troposphere has been discussed mainly by using the observational data [e.g., Kodera and Yamada, 2004; Eguchi and Kodera, 2007; Eguchi and Kodera, 2010]. During the SSW period, the abrupt upward motion in the tropics associated with the stronger meridional circulation due to SSW induces adiabatic cooling not only in the lower stratosphere but also in the upper troposphere. In addition, the convection in the tropics is active over the major three tropical convective regions and the cirrus clouds occur frequently. It also suggested by a couple of SSW event studies that the internal effect in the troposphere (e.g., induced by the wave propagation) is small. In recently, Kodera et al. [2011] has shown by the model simulation data that the meridional circulation between troposphere and stratosphere at the tropical region is strongly connected and the tropical tropospheric meridional circulation becomes stronger after the onset of SSW. These studies show clearly that the stratospheric dynamics affects the distributions of the tropospheric parameters, especially in the tropics.

The aim of the present study is to investigate the mechanism of the interaction between the stratosphere and troposphere during the SSW by using a simulation data with a global nonhydrostatic model, Nonhydrostatic ICosahedral Atmospheric Model (NICAM) [Satoh, et al 2008]. The simulation period is December 2009 to February 2010, and the horizontal mesh size of 14 km and vertically stretched 40-layers (z= 0 $\sim$38 km) are used. Three hourly (hourly) outputs for 3D (2D) variables are analyzed in the present study.

During the analysis period, the SSW occurred in the northern hemisphere around the middle of January (the date of the SSW is 15 January). The onset date is defined by the temperature tendency at 10 hPa polar region (80N-90N). The NICAM simulation reproduced the SSW event and increase in the wave activity prior to the event, although the date of onset was approximately 5 days earlier (10 January) than that in the real atmosphere. The center of active convective area moves from the northern hemisphere to the southern hemisphere.

In the presentation, the mechanism of the convective variability during the SSW event will be discussed by using the NICAM simulation data.