

The KANTO Project: Recent Progress and Contribution to the SPARC Gravity Wave Momentum Budget for Global Circulation Studies

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We have been running our group study called 'KANTO project' for about one and a half year. The purpose of the project is to understand quantitatively various aspects of small-scale physical processes including gravity waves, trapped Rossby waves, inertial instabilities, fine structure around the tropopause, layered and filamentary structures of tracers, and to elucidate their roles in the large-scale structure, circulations and oscillations of the middle atmosphere, using a high-resolution general circulation model (GCM). We have developed a T213L256 middle atmosphere GCM, which covers from the surface to about 80 km height with a high vertical resolution (300 m). The GCM realistically simulates the extratropical general circulation in the stratosphere and mesosphere such as the polar night jet and summertime easterly jet. The stratopause semi-annual oscillation (S-SAO) and the quasi-biennial oscillation (QBO)-like oscillation in the equatorial lower stratosphere are spontaneously generated in the GCM.

Two papers from the KANTO project have been submitted to *J. Geophys. Res.* *Watanabe et al. (submitted to J. Geophys. Res.)* provided detailed description of the model, and showed basic characteristics of our GCM simulation, i.e., mean wind, temperature, precipitation, and energy spectra of gravity waves. Zonal wind forcing due to dissipation of extratropical planetary waves and small-scale gravity waves was investigated, and importance of meridional propagation of those waves was highlighted. *Tomikawa et al. (submitted to J. Geophys. Res.)* highlighted an isolated temperature maximum observed in the winter subtropics around the stratopause, and proposed a dynamical mechanism to keep such an interesting thermal structure.

Recently, the SPARC Project on the Gravity Wave Momentum Budget for Global Circulation Studies held the first workshop (March 26-27, Tronto). The workshop focused on three research areas. A) Constraints from direct observations of gravity wave momentum flux in the lower stratosphere. B) Constraints of gravity wave mean-flow forcing using assimilation methods. C) Direct simulation of gravity waves and their role in the global momentum budget at middle atmosphere levels. Significant contribution to the area C has been expected from the KANTO project. In this talk, we will introduce the SPARC gravity wave initiative and related contributions from the KANTO project.

Watanabe, S., Y. Kawatani, Y. Tomikawa, K. Miyazaki, M. Takahashi, and K. Sato, General aspects of a T213L256 middle atmosphere general circulation model, *J. Geophys. Res.* (submitted).

Tomikawa, Y., K. Sato, S. Watanabe, Y. Kawatani, K. Miyazaki, and M. Takahashi, Wintertime temperature maximum at the subtropical stratopause in a T213L256 GCM, *J. Geophys. Res.* (submitted).