

An analysis on the momentum budget in the MLT region based on satellite and whole atmosphere model data

Ryosuke Yasui¹, Kaoru Sato¹, and Yasunobu Miyoshi²

¹ *Graduate School of Science, The University of Tokyo, Tokyo, Japan*

² *Faculty of Science, Kyushu University, Fukuoka, Japan*

The momentum budgets in the MLT including piecewise contribution by gravity waves (GWs), tides (TWs), and Rossby waves (RWs) are examined by analyzing Aura MLS observation data (MLS data) and GAIA data, which include a coupled neutral and ionized atmospheres from ground to upper thermosphere. An interplay of RWs and GWs is also focused on for the formation of barotropic (BT) / baroclinic (BC) instability.

First, each magnitude of potential vorticity (PV) in MLS data and GAIA data maximizes in low and middle (high) latitudes in the summer (winter) mesosphere. In the poleward of these maxima, meridional gradient of PV (PV_y) is negative, which is a necessary condition of BT/BC instability. EP flux (EPF) of RW component is strongly upward and EPF divergence (EPFD) is positive slightly poleward and above the PV maximum (PVM) in the summer mesosphere. From a spectral analysis in this upward EPF region using GAIA data, it is seen that westward propagating waves having a 1.8-day period and $s = 2-4$ are dominant. This feature is similar to that of quasi-two day waves detected by previous observations. Moreover, the feature that strong upward and equatorward EPF is observed above the negative PV_y region suggests that these waves are generated through BT/BC instability.

Next, the relation between the forcing of subgrid-scale GWs (GWFP), which is parameterized in the GAIA model, and negative PV_y region is examined. It is shown that the PVM is mainly contributed to by N^2 in WH and by both N^2 and relative vorticity in SH. In addition, the rate of change of PV due to GWFP is directly estimated. The result indicates that the GWFP is likely responsible for the formation of PVM.

Key words: MLT region, Rossby wave, Gravity wave, Barotropic/baroclinic instability, Momentum budget