Relationships between Antarctic Ozone Hole and Dynamical Fields

Guangyu Liu[1], Toshihiko Hirooka [1], Nawo Eguchi [2]

[1] *Department of Earth and Planetary Sciences, Kyushu University, Fukuoka, Japan*

[2] *Research Institute for Applied Mechanics, Kyushu University, Fukuoka, Japan*

The extreme Antarctic ozone depletion during early austral spring, i.e., Antarctic ozone hole, shows large interannual changes in its area as well as its ozone depletion amount. In recent years, the ozone hole in 2012 was in the largest level. In addition, last year in 2017, the size of ozone hole was smaller than that in 2012 and became the smallest in the 21th century. So in this study, we use the Aura Microwave Limb Sounder (MLS) observations and the Japanese 55-year Reanalysis (JRA-55) data to try to find plausible mechanisms to bring about such small ozone hole in the two years. Resultantly, our ozone volume mixing ratio analyses show that in the polar region clear positive anomalies appeared during early spring in both 2012 and 2017, which is consistent with the observed tendency of ozone hole changes. In order to find mechanisms that brought about the insufficient ozone hole development of the two years, we examined the dynamical analyses base on the Eliassen-Palm (E-P) flux and the residual mean meridional circulation by using MLS and JRA-55 data sets. It is found that the wave activity was stronger than that in other years. Associated with the strong wave activity, the downward motion was enhanced, which might bring an enhanced downward advection of ozone-rich air, leading to the small size of ozone hole. In the presentaion, we will discuss observed eastward traveling waves of zonal wavenumber 2, as one of the plausible factors which could cause the positive ozone mixing ratio anomalies in the polar stratosphere of the two years. We will also discuss the results of quantitative analyses for the meridional ozone transport, which could estimate the role of dynamical processes in the development of the insufficient ozone hole years.

Key words: Antarctic ozone hole, planetary wave, MLS data, JRA-55 reanalysis