

# Small Antarctic Ozone Hole in 2012 and 2017 and the Relationship to Dynamical Fields

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The 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 and 2017 were in the smallest level. Hence, we use the Aura Microwave Limb Sounder (MLS) observations and the Japanese 55-year Reanalysis (JRA-55) data to seek plausible mechanisms from a dynamical aspect to bring about such small ozone hole in the two years. In order to find dynamical factors that brought about the insufficient ozone hole development in the two years, we investigated daily Eliassen-Palm (E-P) flux changes and ozone transport due to the residual mean meridional circulation, using MLS and JRA-55 data sets. Resultantly, it is found that the wave activity of zonal wavenumbers 1 and 2 in the two years was stronger than that in other years. In both years, intermittent upsurges of the wave activity were observed during winter in the lower and middle stratosphere. Further analyses show that the upsurges were brought about by upward propagating waves originating from the troposphere as well as those enhanced within the stratosphere. Associated with the strong wave activity, the downward motion was enhanced, which brought an enhanced downward advection of ozone-rich air, leading to the small size of ozone hole.