The Quasi-Biennial and Semi-Annual Oscillation Features of Tropical O3, NO2, and NO3 revealed by GOMOS Satellite Observations for 2002~2008

Liu, Yi[1]; Lu, ChunHui[1]; Wang, Yong[1]; Kyrola, Erkki[2]

[1]Institute of Atmospheric Physics, Chinese Academy of Sciences, CHINA; [2]Finnish Meteorological Institute, Earth Observation, FINLAND

The quasi-biennial oscillation (QBO) and semi-annual oscillation (SAO) characteristics of O3, NO2, and NO3 from 2002 to 2008 were analyzed using Global Ozone Monitoring by Occultation of Stars (GOMOS) satellite observations. From investigations of the vertical and latitudinal structures of interannual anomalies for O3 and the vertical velocity of the residual circulation (w-star), we conclude that dynamic transport is the principal factor controlling the QBO pattern of O3. Under the influence of vertical transport, the QBO signals of O3 originate in the middle stratosphere and propagate downward along with the w-star anomalies over the equator. The residual circulation has a significant role in tropical regions, regardless of altitude, while in extratropical regions, dynamic effects are important in some years in the lower stratosphere. In the middle stratosphere, dynamic transport is most efficient in the Southern Hemisphere. We also analyzed NO2 anomalies and found that their QBO pattern was deep and stationary in the middle and upper stratosphere over the equator. This was due to the large depth over which w-star was anomalous. The latitudinal structure of NO2 was asymmetric in extratropical areas in the middle stratosphere, but in the upper layers, the QBO pattern and dynamic influences were only observed in tropical zones. The interannual anomalies of NO3 had an apparent SAO pattern in the tropical upper stratosphere because of different dynamic and chemical effects in different SAO phases. Chemical reactions may also have contributed to the QBO-type distribution of NO2 and the SAO-type distribution of NO3.