QOS2016-61-3, 2016
Quadrennial Ozone Symposium of the International Ozone Commission

Influences of QBO and solar cycle on the Arctic ozone

Y. Yamashita (1,2) and H. Akiyoshi (1)

(1) National Institute for Environmental Studies, Tsukuba, Japan, (2) Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan

It is well known that the intensity of the NH polar vortex is related to the QBO and 11-year solar cycle. In this study, the influences of westerly phase of the QBO (QBO-W) and solar minimum (Smin) on the Arctic ozone in February–March are analyzed from satellite observation, reanalysis data, and outputs of a chemistry climate model (CCM) from 1979–2011. The composite mean for QBO-W/Smin years shows negative anomaly of total ozone in February–March compared to the 1979–2011 average for the satellite observation, reanalysis data, and the CCM output. The outputs of CCM are also analyzed for vertical profile of ozone concentration, which indicates negative anomaly of the Arctic ozone around 70–100 hPa for the QBO-W/Smin condition. We analyze a passive ozone tracer and estimate the ozone anomaly by the effects of ozone transport. The passive ozone tracer is set equal to the ozone in 1 December, and the difference between the ozone concentration and the passive ozone tracer means an accumulation of chemical change of ozone from 1 December. The difference between the ozone concentration and the passive ozone tracer is negligibly small around 70–100 hPa, indicating that the negative ozone anomaly around 70–100 hPa is mainly created by the accumulative effect of ozone transport. Moreover, we analyze the CCM outputs of chemical ozone tendency and dynamical ozone tendency (the difference between ozone tendency and chemical ozone tendency). Both of them indicate the negative anomalies compared to the 1979–2011 average in February, while the chemical ozone tendency indicates the negative anomaly and the dynamical ozone tendency indicates the positive anomaly in March. However, the ozone concentration is still the negative anomaly. We will show this reason in the presentation. Since the number density of ozone has its maximum magnitude around 70–100 hPa, the ozone anomaly around 70–100 hPa is dominantly reflected in the anomaly of total ozone. These results suggest that the small Arctic ozone amount for QBO-W/Smin in February–March is mainly caused by the ozone transport change.