Shibata, K., and R. Lehmann, 2020: Partitioning of ozone loss pathways in the ozone quasi-biennial oscillation simulated by a chemistry-climate model. *J. Meteor. Soc. Japan*, **98**, 615-636. https://doi.org/10.2151/jmsj.2020-032

Plain Language Summary: Ozone loss pathways due to NO_x, HO_x, ClO_x, O_x, and BrO_x catalytic cycles and their rates in the ozone quasi-biennial oscillation (QBO) simulated by a chemistry-climate model of the Meteorological Research Institute of Japan are evaluated by using an objective pathway analysis program (PAP). The QBO amplitude of the sum of all cycles amounts to about 4 and 14 % of the annual mean of the total ozone loss rate at 10 and 20 hPa, respectively. The contribution of catalytic cycles to the QBO of the ozone loss rate is found to be as follows: NO_x cycles contribute the largest fraction (50-85 %) of the QBO amplitude of the total ozone loss rate; HO_x cycles are the second-largest (20-30 %) below 30 hPa and the third-largest (about 10 %) above 20 hPa; O_x cycles rank third (5-20 %) below 30 hPa and second (about 20 %) above 20 hPa; ClO_x cycles rank fourth (5-10 %); and BrO_x cycles are almost negligible.

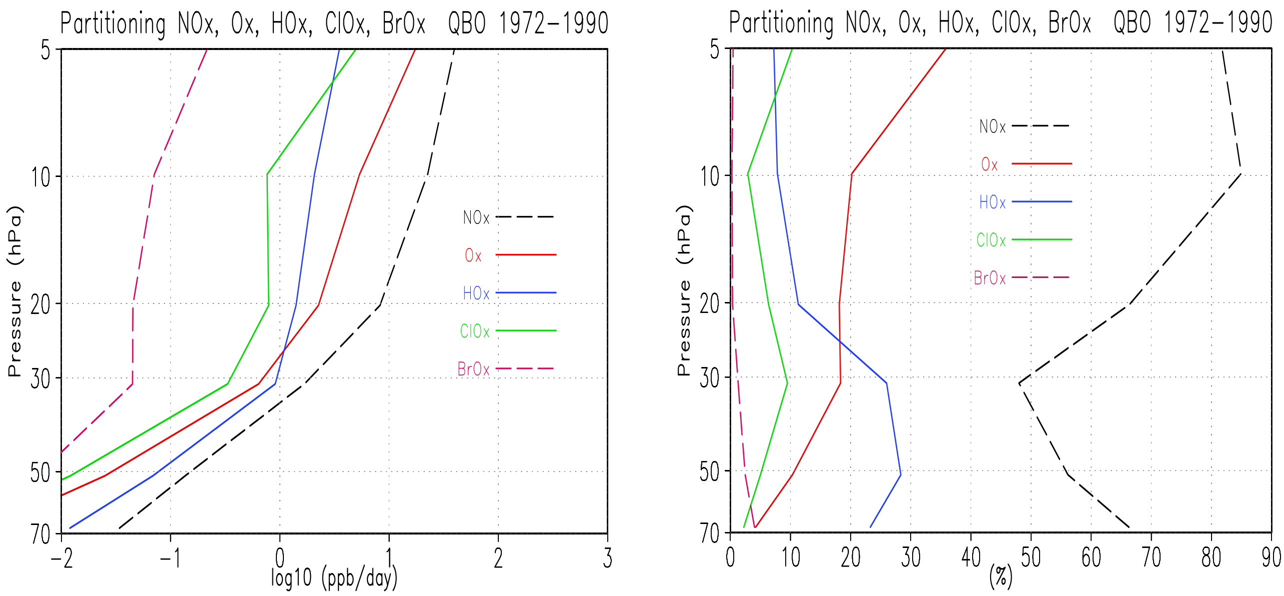

Figure 1. Vertical profiles of QBO ozone loss rate by NO_x, O_x, HO_x, ClO_x, and BrO_x cycles shown as (left) absolute values (ppb day^{-1}) and (right) relative values (%) from 70 to 5 hPa. Absolute values are displayed in logarithmic scale of base 10. Note that the sum of the individual cycles is not necessarily 100 %, because all the cycles are not completely in phase.

- In the photochemically controlled region at 10 hPa, the NO_x cycles contribute about 85 % to the QBO amplitude of the ozone loss rate, in which [NO_x] is the major contributor.
- The main contribution to the NO_x variation originates in the variation of NO_y transport.
- Temperature is the second major contributor through the temperature dependence of [O]/[O_3].
- Minor contributions emerge from the QBO variation of the overhead ozone column, which modulates the ozone photolysis, influencing [O]/[O_3], and the oxygen photolysis, leading to O_3 production.