B-8 Research project on chemical and physical processes of global change of tropospheric ozone and other minor constituents.

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It has been suggested that changes in ozone have potentially important consequences for radiative forcing. In the troposphere, ozone is produced from various short lived precursor gases (CO, CH_4, NMHC, and NO_x). Ozone can also be transported into the troposphere from the stratosphere. In order to elucidate above processes of global change of tropospheric ozone, the following studies were carried out during above fiscal year.

1. Analysis of Regional Characteristics and Source of Seasonal Variation of Tropospheric Ozone Distribution : Tropospheric ozone has been monitored at a continental station, Mondy, West Pacific island stations, Hateruma and Oki, and South-east stations, Sronakarin and Inthanon in Tailand. Surface ozone concentration in the "clean continental" and "regionally polluted continental" air mass shows seasonal maximum in spring and summer, respectively. These features are analogous to those in Europe, while concentration range in Northeast Asia is about 10 ppbv higher than in Europe.

2. Studies on Chemical Reactions Related to Tropospheric Ozone Budget : (1) Gaseous inorganic bromine and chlorine were observed periodically over the North Pacific Ocean for one year. The gaseous halogens showed diurnal and seasonal variations; i.e. high concentrations during the daytime and in winter. (2) The gaseous BrCl and Br_2 were produced by the heterogenous reactions of HOBr on NaCl and KBr, respectively. The uptake coefficient of HOBr on KBr was found to be much larger then that on NaCl. (3) A decrease of photchemical ozone concentration was observed after the injection of halogen molecules such as Cl_2, Br_2, and I_2 in the 6-m^3 photochemical reaction chamber experiment. To observe such decrease in photochemical ozone, it was necessary to inject at least 10-100ppb of halogen.

3. Studies on Chemical Composition and Optical Character for Aerosol Particles in Troposphere : The performance of the Sulfur Chemiluminescence Detector (SCD) for measurement of sulfur content in fine particles was tested and its detection limit was 1.2ppb SO_2. Numerical analysis regarding the radiation budget of global scale for various physical factors was carried out, and it is found that scattering effect of the interrupt of direct radiation influences stronger than the green house effect produced by troposphere aerosol.

4. Research on the Tropospheric Ozone Distribution by Using a Tropospheric Chemical Transport Model : Springtime tropospheric high O_3 episode were evaluated based on the surface O_3 observation data and a tropospheric chemical transport model(CTM). Domain top O_3 concentration was specified by the potential vorticity (PV) value determined from the ECMWF global data set. Then CTM was applied with/without chemical reaction (chemistry/transport only exp). Observational data were well explained by the transport only numerical results. Model revealed that the fraction of photochemical reaction for the observed O_3 concentration ranged 10-25% and this fact indicates that stratospheric O_3 intrusion into troposphere plays an important role for the occurrence of observed high O_3 concentration.