On Surface O3 Associated with Long-Range Transport in the Yellow Sea Region

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Abstract

Measurements of surface ozone (O_3) and nitrogen oxides (NO_x) were conducted at Tae-ahn (TAP) and Chongwon (CHN) on the Korean Peninsula, during the Aerosol Characterization Experiment - Asian Pacific region (ACE-Asia) campaign period in March-May 2001. The measurements provide ground-based data at a western remote site of south Korea and characterize the long-range transport of O_3 over the Yellow Sea region during spring. The mean values of O_3 and NO_2 concentration at TAP were 42 ppb and 12 ppb, respectively. The average O_3 diurnal variation of 17 ppb at TAP indicates that the loss of O_3 was not pronounced in night. The higher NO_2 concentrations in average diurnal variation of 8 ppb occurred in the afternoon at 13-15 LST unlike the urban areas with their generally maximum concentrations in the morning. The day-to-day variation of daily O_3 concentrations at TAP is strongly influenced by the movement of synoptic scale weather patterns. In general, the O_3 concentration in a southwesterly airflow tended to increase when a moving anticyclone crossed the site, ahead of a cold front. By contrast, north-northwesterly airflows associated with the passage of a cold front bring fresh continental outflow and decrease O_3

concentrations.

Surface O_3 data at TAP were classified utilizing backward trajectory analysis based on the residence time, as well as the path of the airflows, in the boundary layer (1500 m asl) over the Yellow Sea region. The results show that north-northwest continental airflows, that were transported around Lake Baikal and eastern Mongolia at an altitude of approximately 3 km at relatively high speed and came straight down at TAP, represent continental background O_3 concentrations with a mean value of 29 ppb for this period. These airflows have a short period of residence of less than one day in the boundary layer over the Yellow Sea region. In contrast, the mean O_3 value of 45 ppb was observed in regionally polluted airflows mainly passing through the east-southeast part of China and remaining for 3 days on average in the Yellow Sea region. These three days residence time of the regionally polluted airflows over the Yellow Sea region allowed sufficient time for photochemical O_3 formation.