



Characteristics of springtime profiles and sources of ozone in the low troposphere over northern Taiwan: data analysis and modeling study

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To quantify the possible sources of the high ambient ozone concentration in the low troposphere over Taiwan, ozone sounding data from a two-year intensive field measurement program conducted in April and early May of 2004 and 2005 in northern Taiwan has been examined. We found that the vertical ozone distributions and occurrence of enhanced ozone in the lower troposphere (below 6 km) mainly resulted from (1)Type NE: the long-range transport of ozone controlled by the prevailing northeasterly winds below 2 km, (2)Type LO: the local photochemical ozone production process, and (3)Type SW: the strong southwest/westerly winds aloft (2-6 km). In the boundary layer (BL), where Asian continental outflow prevails, the average profile for type NE is characterized by a peak ozone concentration of nearly 65 ppb at about 1500 m altitude. For type LO, high ozone concentration with an average ozone concentration greater than 80 ppb was also found in the BL in the case of stagnant atmospheric and sunny weather conditions dominated. For type SW, significant ozone enhancement with average ozone concentration of 70~85 ppb was found at around 4 km altitude. It is about 10 ppb greater than that of the types NE and LO at the same troposphere layer owing to the contribution of the biomass burning over Indochina.

In our WRF-Chem tracer modeling study for a SW case, we identify a new mechanism transporting the tracer over Indochina that is significantly contributing a high ozone episode in the lower troposphere (4 km) over northern Taiwan. Simulation results demonstrate that the leeside troughs over Indochina play a dominant role in the uplift of the tracer below 3 km, and that the strong westerlies prevailing above 3 km transport the tracer. These fundamental mechanisms have a major impact on the ozone concentration in the low troposphere downwind from Indochina over northern Taiwan and even the East Asia.