

Statistics of ozone mini-holes over the Tibetan plateau

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Based on the total column ozone data provided by Total Ozone Mapping Spectrometer, the statistics of the ozone mini-hole events over the Tibetan Plateau are analyzed. The data cover November 1978 through April 1994, and August 1996 through December 2003. There are totally 13 events found during 1978-2001, and 9 events with time duration longer than 1 day. The number of the events is 1(0, time duration > 1day), 3(2), 5(4), 2(1), and 2(2) in October, November, December, January, and February, respectively. And the number with area (with total column ozone < 220 DU) larger than 700,000 km² is 0, 2, 3, 1, and 1 in October, November, December, January, and February, respectively. The largest event happened during December 14-17, 2003, during which the area with total ozone smaller than 220 DU is over 2,500,000 km², and the minimum value is only 190DU. Another large ozone mini-hole event happened during December 9-12, 1987, during which the area is over 1,800,000 km², and the minimum value is only 194DU.

All the events seem to be related to the adjustment of the subtropical westerly jet near the Tibetan Plateau. Climatologically, the westerly jet locates near the southern slope of the Tibetan Plateau. When the jet moves northward, the tropical tropopause to the south of the jet will dominate the Tibetan Plateau, and the flows in the mid- and upper-troposphere have to climb the high mountains. Because of the horizontal advection from subtropics with lower ozone concentration and the vertical transportation from the lower troposphere with low ozone, the total ozone over the Tibetan Plateau decreases rapidly.

Based on the ozone profiles from SCIAMACHY provided by IUP of University of Bremen, the vertical ozone change in the event during December 14-17, 2003 is analyzed. During this event, the ozone vertical profile changes from extra-tropical type before the event to tropical type, and large decreases are seen between 15-23 km levels. Compared to the profile at the same latitude, the ozone over the Tibetan is significantly smaller below 25km level.