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0.1 Detection of stratospheric ozone intrusions by windprofiler radars

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Stratospheric ozone enters the troposphere primarily through a variety of irreversible eddy exchange phenomena that are small-scale manifestations of the global, wave-driven (Brewer-Dobson) circulation that transports ozone and other chemical species from equator to pole. Although the flux of ozone from the stratosphere is controlled non-locally, by the global circulation, it is sporadic, being associated with tropospheric weather systems, and varies both spatially and with season. Moreover, the importance to the tropospheric budget of stratosphere-troposphere exchange events depends on their distribution with geography and season, and on the fate of the exchanged air parcels, particularly their vertical penetration and residence time. In order to better study these events, we have employed modern VHF windprofiler radars to monitor the height of the tropopause (the stratosphere-troposphere boundary) on an hour-by-hour basis during a series of ozonesonde balloon launches in southern Canada. The ozonesonde releases were at a high temporal density (2-4 per day) in order to achieve good ozone measurement continuity. Intrusions of stratospheric air into the troposphere were often seen. Ozone path-lines have been determined by using a Lagrangian trajectory calculation model, employing wind field analyses from the Canadian operational weather forecast model (GEM), to determine the motions of parcels of ozone during the events observed. On occasions these intrusions reach the ground, and on other occasions they reach altitudes of 2-4 km, whereupon the ozone appears to be dispersed. We find that rapid changes in the radar tropopause height immediately precede intrusion events in 11 of 13 observed cases.