Tropopause Folds: Results from the NOAA Unmanned Aircraft System (UAS) Demo and Network Observations

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The transport of air masses from the troposphere to the stratosphere affects the concentrations of anthropogenic gases, like the chlorofluorocarbons (CFCs) that form catalysts that subsequently destroy stratospheric ozone. Similarly, transport of high ozone and high potential vorticity (PV) stratospheric air downward can increase the concentration of tropospheric ozone, a measure of air quality, and decrease potential vorticity. Tropopause folds are events where incursion of stratospheric air into the troposphere occurs beneath a tropospheric jet stream. Tropospheric folds are the most efficient and dominate short-term (days to week) mechanism for stratosphere-troposphere exchange (STE) in the midlatitudes.

On 19 April 2005, the UAS Altair, observed high ozone, low CFC-11 air (Figure1a.) over Palmdale, California during the NOAA Unmanned Aircraft Systems (UAS) demonstration (http://uas.noaa.gov/altair/index.html). At high altitudes (~12 km), the ozone mixing ratios (Figure 1a, B) resembled values observed in polar stratospheric air after the springtime breakup of the stratospheric polar vortex (Figure 1b.). High ozone and low CFC-11 (Figure 1a, A) mixing ratios were observed at ~4 km. A classical tropopause fold shown in the potential vorticity cross-section plot (Figure 1c.) is the cause of the event.

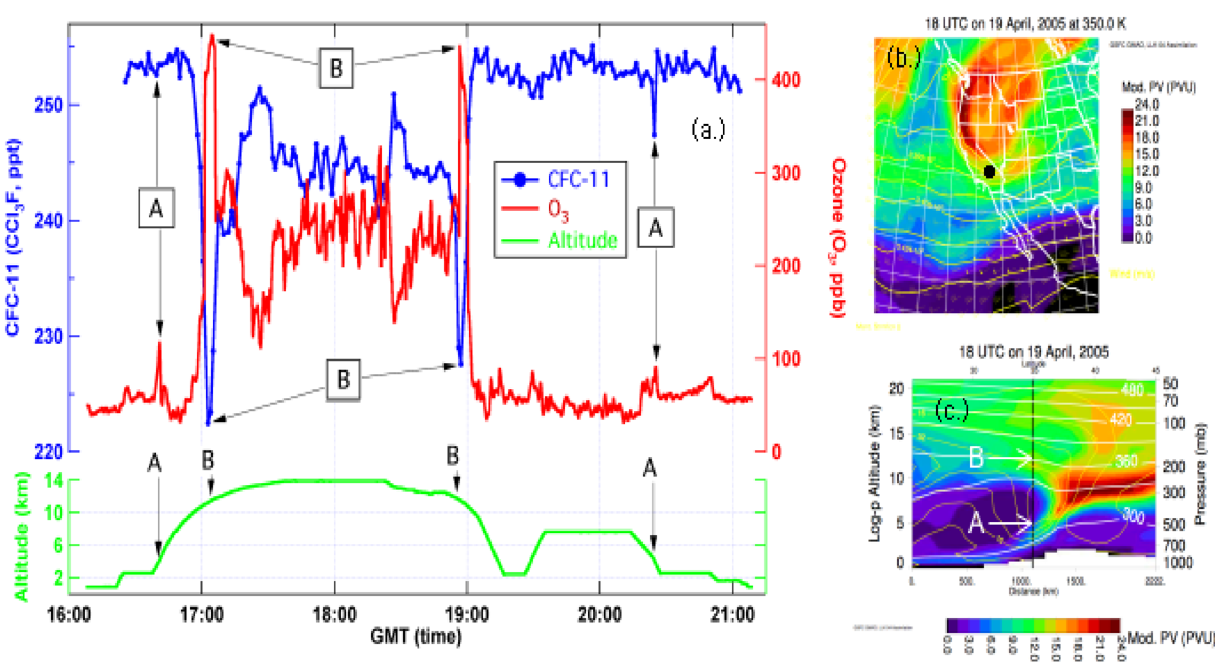

Figure 1. Mixing Ratios of CFC-11 (blue), O_3 (red), and altitude (green) versus time during (b) a polar stratospheric air southern projection of high PV air, and (c) tropopause fold.