

EGU2020-10924

<https://doi.org/10.5194/egusphere-egu2020-10924>

EGU General Assembly 2020

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Tropopause folds in North America studied from partial columns of trace gases measured at two ground-based sites

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Tropopause folds can change the composition of the Upper Troposphere (UT) by bringing down stratospheric parcels with different gas abundances. In this work, partial columns of gases with strong vertical gradients near the tropopause are studied during such events. Partial columns were retrieved from high-resolution infrared spectra measured at subtropical and mid-latitude locations. These stations, contributing to the Network for the Detection of Atmospheric Composition Change (NDACC), are the Altzomoni High-altitude Observatory (19.11°N, 98.66°W) in central Mexico, and the University of Toronto Atmospheric Observatory (43.66°N, 79.40°W) in southern Canada. These datasets constitute a valuable tool for studying the effects of folding on UT composition because of their time resolution (~ 1-hourly, during daylight) and the time periods they span (2012–2019 and 2002–2019, respectively). Our study shows that when tropopause folds occur, partial columns below the tropopause are correlated (anti-correlated) for species whose vertical gradients have the same (different) signs. It is also shown that tropospheric carbon monoxide (CO) in layers closest to the tropopause contributes less to the CO tropospheric partial column during folds because the UT receives low-CO air from the stratosphere.