Comparison of ozone profiles from DIAL, MLS, and chemical transport model simulations over Río Gallegos, Argentina in the 2009 spring

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This paper evaluates the agreement of ozone profiles from the ground-based DIfferential Absorption Lidar (DIAL), the satellite-borne Aura Microwave Limb Sounder (MLS), and the 3-D chemical transport model simulations (CTM) over the South Patagonian Atmospheric Observatory (OAPA, 51.6˚S, 69.3˚W) in Río Gallegos, Argentina for the period from September to November 2009. We focus on this period, because a persistent ozone decrease for three weeks was found over the area around the southern tip in South America. Such the long-lasting decrease over the area was unusual (e.g., de Laat et al., GRL, 2010; Wolfram et al., Ann. Geophys., 2012). To compare the ozone profiles from DIAL with MLS retrievals, the averaging kernel matrix of MLS and the a priori profiles are used for converting the high-resolution DIAL profiles to the retrieval pressure levels of MLS. The comparison was done for pressure levels between 86 hPa and 5 hPa with the coincidence criteria of <500 km spatially and <24 hrs temporally. CTM used here incorporates a chemical module into MIROC3.2-GCM using horizontal winds and temperature nudged toward ERA-Interim data (e.g., Akiyoshi et al., JGR, 2016). The result shows a good agreement between DIAL and MLS with mean differences of ±0.1 ppmv (n=180), except for the 86 hPa level. CTM also agrees to DIAL with the mean differences of ±0.3 ppmv (n=23) between 56 hPa and 10 hPa. The root-mean-square differences increase with increasing altitudes from ~0.5 ppmv at the 32-56 hPa levels to 1.3 ppmv at the 5 hPa level for both the two comparisons. Both of the two comparisons give mean differences of 0.5 to 0.7 ppmv at the 83 hPa level. It seems that DIAL tends to underestimate the ozone values only for this lower altitude region or some small scale differences in the ozone field cause the biases.

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