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Atmospheric comparisons of electrochemical cell ozonesondes with different cathode solution strengths and from different manufacturers: A method to homogenize 0.5% and 1.0% KI measurements

T. Deshler (1), J.L. Mercer (1), H.G.J. Smit (2), R. Stubi (3), G. Levrat (3), B.J. Johnson (4), S.J. Oltmans (4), R. Kivi (5), A.M. Thompson (6), J. Witte (7), J. Davies (8), F. J. Schmidlin (9), G. Brothers (9)

(1) Department of Atmospheric Science, University of Wyoming, Laramie, Wyoming, USA, (2) Institute of Chemistry and Dynamics of the Geosphere II: Troposphere (ICG-II), Research Centre Jülich (FZJ), D-52425 Juelich, Germany, (3) Federal Office of Meteorology and Climatology, MeteoSwiss, Aerological Station Payerne, Payerne, Switzerland, (4) Earth System Research Laboratory, National Oceanic and Atmospheric Administration, Boulder, Colorado, USA, (5) Finnish Meteorological Institute, Arctic Research Centre, Sodankylä, Finland, (6) Pennsylvania State University, Department of Meteorology, University Park, Pennsylvania, USA, (7) SSAI , Lanham, Maryland, USA, also at NASA/Goddard Space Flight Center, Greenbelt, Maryland, USA, (8) Air Quality Research Division, Environment Canada, Ontario, Canada, (9) National Aeronautic and Space Administration, Goddard Space Flight Centre, Wallops Flight Facility, Wallops Island, Virginia, USA (deshler@uwyo.edu / Fax: 307-766-2635)

A balloon flight to compare 18 ozonesondes with an ozone photometer, and with ozone column measurements from Dobson and Brewer spectrophotometers was completed in April 2004. The experiment consisted of 12 electrochemical concentration cell ozonesondes, 6 from Science Pump Corporation (SP) and 6 from ENSCI Corporation (ES), prepared with cathode solution concentrations of 0.5% KI (half buffer) and 1.0% KI (full buffer). Auxiliary ozonesondes consisted of 2 electrochemical concentration cell sondes with 2.0% KI (no buffer), two reconditioned sondes, and two Japanese-KC96 sondes. Precision of each group of similarly prepared ozonesondes

was $<$ 2-3%. The 6 ozonesondes prepared according to the manufacturer's recommendations (SP, 1.0% KI, ES 0.5% KI) overestimated the photometer measurements by 5-10% in the stratosphere, but provided ozone columns in good agreement with the ground-based spectrophotometer measurements. This is consistent with the difference ($\sim$5%) in ozone photometer and column measurements observed during the experiment. Using cathode cell concentrations of 1.0% KI for ES sondes caused overestimates of the photometer by 10-15% and of column ozone by 5-10%. In contrast 0.5% KI in SP sondes led to agreement within 5% with the photometer, but underestimates of column ozone.

Diluting the solution concentration from 1.0% to 0.5% KI causes an approximately linear, pressure dependent, decrease in ozone for both SP and ES sondes. The linear relation, ratio (0.5KI/1.0KI) = 0.9 + 0.024 * $\log_{10}$(Pressure), homogenizes the 0.5% and 1.0% KI measurements for both the ES and SP sondes. Additionally 17 dual ozonesonde flights comparing ES sondes flown with 0.5% KI and 1.0% KI have been completed at high southern latitudes (78ºS) in the period August through October, between 1996 and 2006. For 12 of these 17 comparisons, similar linear transfer functions were successful in converting the 1.0% KI measurements to measurements in agreement with the 0.5% KI measurements. The five measurements when such transfer functions could not homogenize the 0.5% and 1.0% KI were completed on days when there was severe ozone loss. Similar large ozone loss regions were observed on 3 of the 12 comparisons when a linear relation was successful. Averaging the individual fits for the 12 cases where a linear relation could homogenize the 0.5% and 1.0% KI measurements resulted in a fit almost identical to the one observed during the April 2004 intercomparison.