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Electrochemical Concentration Cell (ECC) ozonesonde evaluation: in situ and laboratory comparisons

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The measurement of atmospheric ozone is the prescribed method for determining ozone abundance in the atmosphere, for understanding the morphology of stratospheric change, as a tracer of atmospheric transport, and for evaluating the rate at which changes occur. This presumes that the instruments used to make the assessment are accurate. The Electrochemical Concentration Cell (ECC) ozonesonde, developed in the mid- to late 1960's, has had improvement made to it, but it basically is a 50 year old instrument that may not yet be fully understood. Uncertainties in the ozonesonde absolute calibration have made instrumental tests and evaluations necessary throughout the years that continue today. Quantifying the accuracy of the balloon-borne ozonesonde instrument over the altitude range of the measurement has been managed through in situ instrument comparisons performed by NASA, NOAA, MeteoSwiss, and other laboratories, such as located in Jülich, Germany and the occasional flight where a reference instrument was included with the balloon package, such as BOIC, STOIC, and BESOS. When varying results occur, questions arise such as, whether the instruments have changed? Whether calibrations are different? Whether preparation procedures are different, or, whether there has been a change in the method of data analysis? Measurement disagreement seems to be an historical problem.

Recently, a "Digital Preparation and Calibration Workbench" was developed and put into use at Wallops Island. This workbench enables refined analysis of the ECC using computer-controlled methods. Simultaneous preparation of two ECC's is possible as well as the ability to compare cell performance. This workbench, referred to as a 'calibration standard' also enables different potassium iodide (KI) solution concentrations

to be compared simultaneously. Uncertainty in selecting the proper KI concentration since development of the ECC led to changes being periodically implemented that today still contains uncertainty. Through the Wallops calibration standard workbench we were encouraged to compare calibration profiles resulting from different solution concentrations, i.e., 2.0, 1.5, 1.0, and 0.5 percent potassium iodide. These results are discussed. Carrying our tests further, we will demonstrate that even the 0.5 percent solution may be too high.