New Volumetric Flow Rate Tests of Ozonesonde Pumps at Reduced Pressures

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New ozonesonde pump flow rate measurements at reduced pressures will be presented here. Balloon-borne, electrochemical concentration cell (ECC) ozonesondes measure high-resolution profiles of ozone concentration from the surface to 35 km (5 hPa) altitude. Regular evaluation of ECC ozonesonde performance are evaluated at the world calibration center in Jülich, Germany. However, measuring the ozonesonde pump efficiency at low pressures is not a part of the calibration experiments. The ozonesonde volumetric flow rate is constant at surface pressure and remains nearly 100% efficient to 300 hPa pressure then steadily decreases with altitude (lower pressure) due to the greater effect of resistance from pumping against the cathode solution fluid head, dead space in the cylinder of the piston pump, and pump leakage. The ozone equation accounts for the decrease in flow rate by multiplying by a pump correction factor (PCF) which is a function of pressure. The PCF value is simply the inverse of the pump efficiency. The most widely used PCF curves are based on experimental measurements by Komhyr (1986, 1995). Several other methods have been used to measure PCF curves. However, the only two methods in use at this time are the bag deflation method (automated version of the University of Wyoming method) by the Japanese Meteorological Agency (JMA) and the oil bubble flow meter by NOAA GMD. Figure 1 shows the 3 PCF curves. The NOAA GMD method has recently been modified and these new results will be presented.

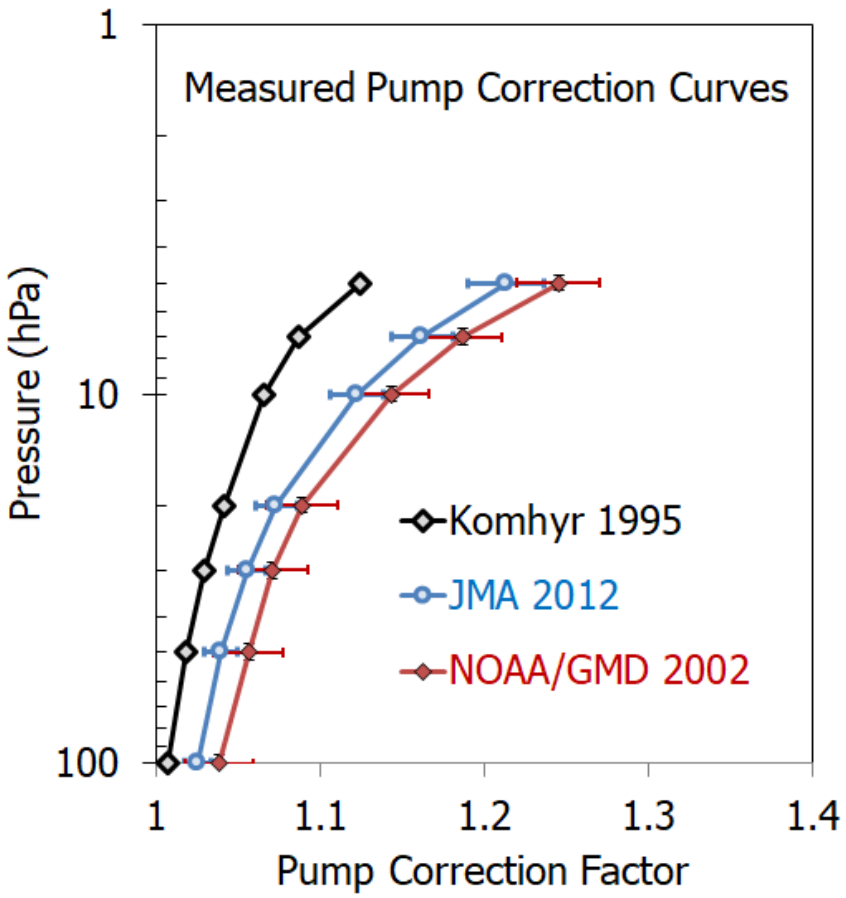

Figure 1. The standard PCF curve from Komhyr (1995) and the average values (±1 standard deviation) of the other two methods by the JMA and the NOAA ozonesonde groups.