



**WEBER STATE
UNIVERSITY**

MEASUREMENT OF STRATOSPHERIC OZONE

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Ozone Measurement Types

Scientists have been measuring ozone since the 1920s, and since then the instruments have evolved. There are several methods of measuring it nowadays, from ground based spectrometers to balloons, aircraft, rockets, and satellites.

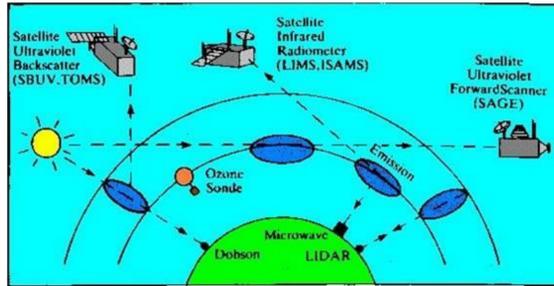
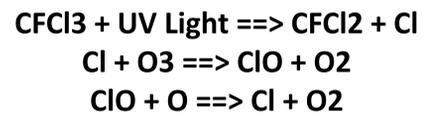


Figure 1. The primary methods used for ozone measurement (<http://www.albany.edu>)

Ozone depletion and reconstitution process

A single CFC molecule can destroy 100,000 ozone molecules.



The atomic Cl is again free to destroy another ozone molecule.

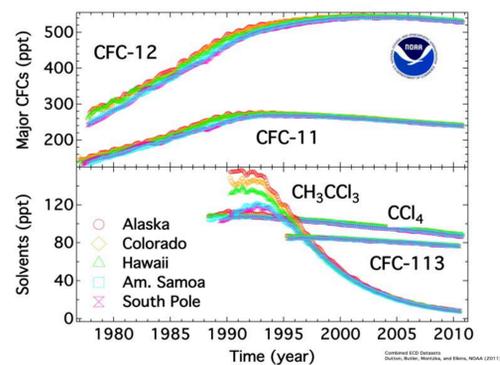


Figure 2. Atmospheric concentration of CFCs (NOAA).

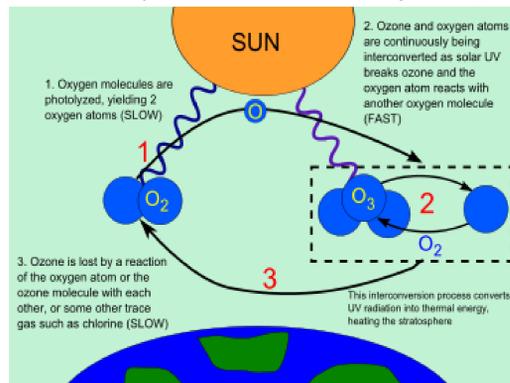


Figure 3. The formation of ozone from oxygen by sunlight (Wikimedia Commons).

Abstract

Although well publicized, measurements of Earth's ozone layer are actually very limited. We have assembled a system to fly an ozonesonde along with other instrumentation into the stratosphere with the goal of measuring ozone to approximately 35km above sea level. We currently have a live telemetry system that relies on the sound card of the computer being used, which varies in efficiency from one computer to another. We are working on replacing that method by using a modem. The radiosonde SNR is being tested by assessing possible changes in the geometry and length of its current antenna for better transmission. Our last season's flights data is comparable to the one provided to us by NASA HASP in October 2012. Results, current methodology being used and status of systems and antenna testing will be presented in details.

Our method for measuring ozone concentration

We fly a modified ECC Ozonesonde, which is designed to detect ozone molecules by utilizing a chemical cell that reacts with a dilute solution of potassium iodide to produce a weak electrical current proportional to the ozone concentration of the sampled air. We have preflight tested the system in a vacuum chamber and do system performance tests before every flight. Calibration methods are being developed.



Figure 4. HARBOR'S ECC Ozonesonde

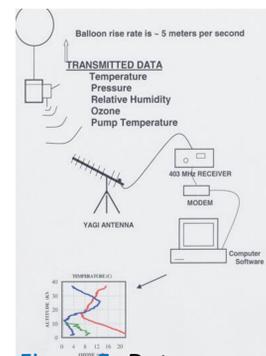


Figure 5. Data acquisition and analysis process (diagram by Dr. H.Volmer).

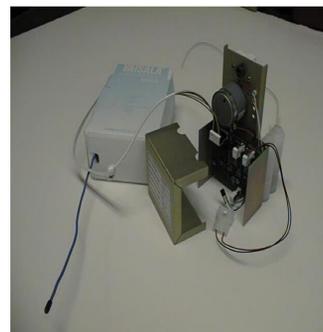


Figure 6. ECC Ozonesonde (picture by Dr. H.Volmer).

Results from 2012 season flight and tests performed in lab

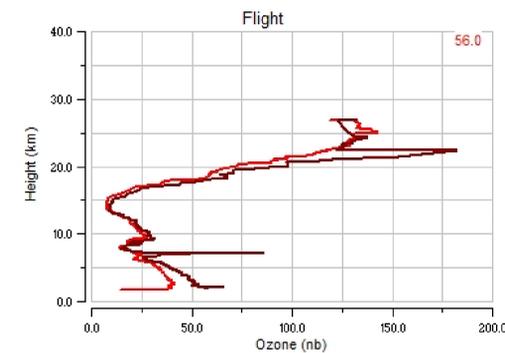


Figure 7. August 2012 data collected with our instrumentation. Red line = flight up, Brown line = return to Earth.

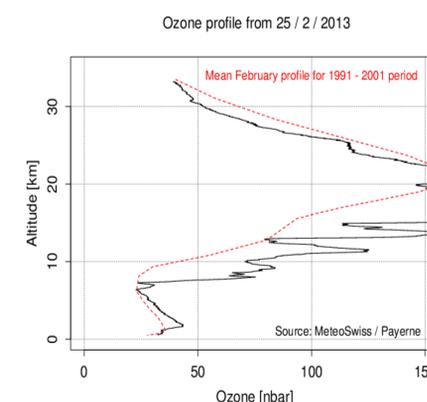


Figure 8. Typical data from other researchers. (<http://www.meteoschweiz.admin.ch>)

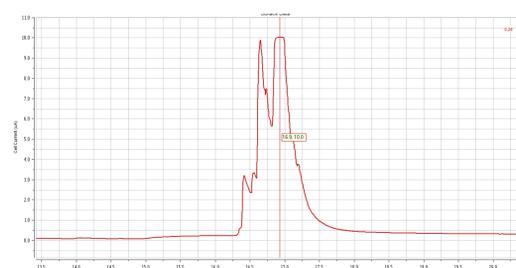


Figure 9. Preflight performance test performed in the vacuum chamber.

Improvements in the ground system and Results from 2013 season

Based on the results from the 2012 season, our team decided to try a new Yagi antenna and a pre-amplifier that are designed for 403MHz band. We had transmission at all times and therefore were able to receive expected data. Follow below the most relevant: ozone, temperature, humidity.

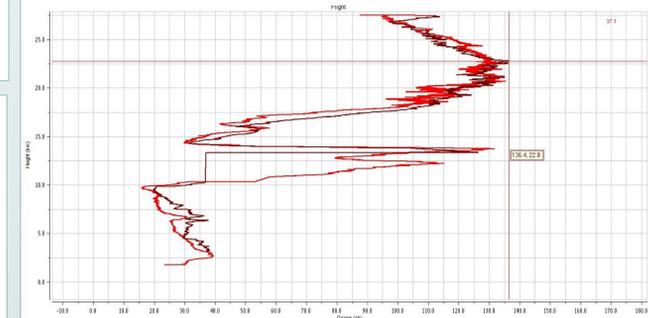


Figure 10. Ozone profile in Duschene County (05-04-2013) showing the peak of stratospheric ozone.

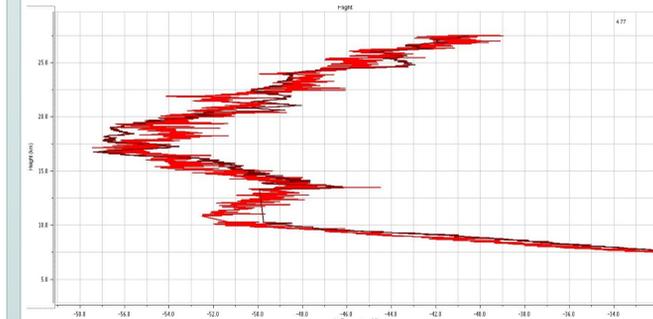


Figure 11. Stratospheric temperature profile in Duschene County (05-04-2013).

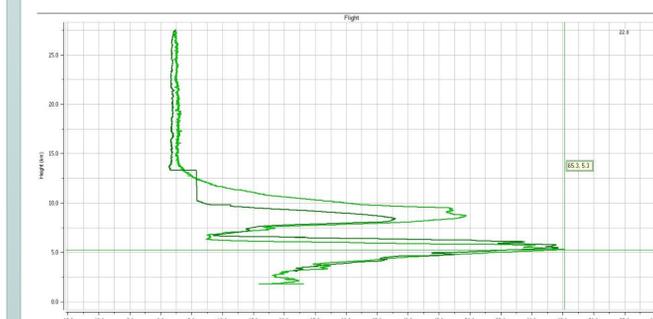


Figure 12. Humidity profile in Duschene County (05-04-2013).

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