HASP 2014
UND-UNF Payload
Monthly Status Report for October 2014

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UND-UNF team did the following work during October 2014:

(1) UNF student's team presented their research work of HASP2014 at the University of North Florida students research poster session held on Friday, October 24, 2014. Please refer attached file for the poster.
(2) Data analysis work of HASP 2014 balloon flight is completed. We got good science results. Team gas started writing the science report. We are hopeful to submit our science report in the next month November 2014.
(3) We are highlighting some of our results by following plots.

Fig.1 shows the details of HASP 2014 balloon flight profile. The altitude profile was measured by the initially by HASP GPS. This flight profile has few missing data due to bad or mixed communication data during flight. We are thankful to Mr. Doug Granger (LSU) for sharing GPS data after termination of balloon.

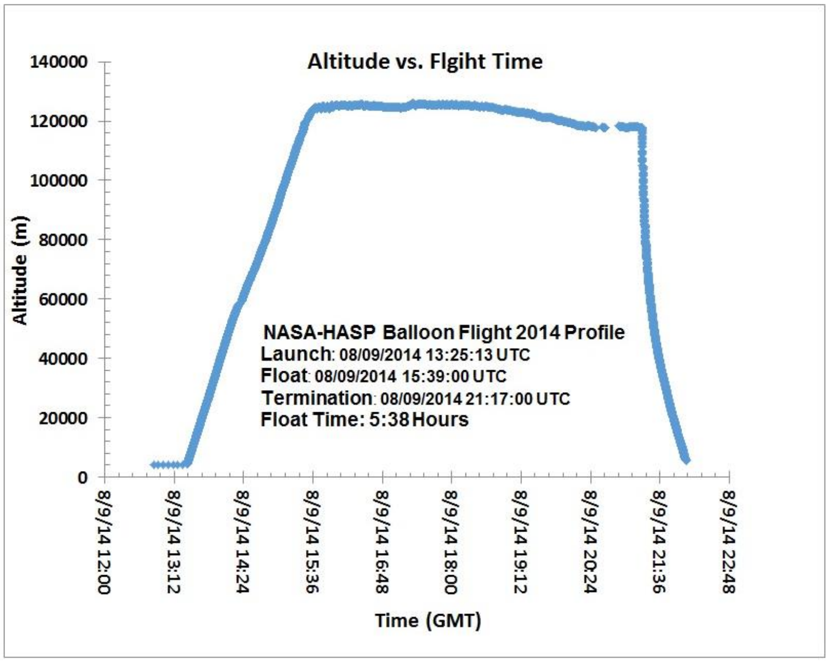

Fig.1 HASP2014 balloon flight profile

Fig. 2 shows the response of nanocrystalline thin film ITO sensor (S1-1) and ZnO+ITO sensor (S3-4) for measurement of ozone at the different altitude. Small peak of ozone was observed during ascending of balloon flight at the altitude below 15000 m i.e. in the troposphere. This ozone peak is known as the bad ozone, which is mainly due to the generation of smog in the early morning due to pollution by the automobile vehicles and industries. The bigger peak of ozone is observed at altitude above 15000 m and up. This is due to the ozone in the stratosphere. This ozone is known as good ozone. In the presence of ultra violet light from Sun, oxygen converted into ozone gas. The concentration of ozone is higher in the middle of stratosphere in the presence of ultra violet light. Ozone is oxidizing gas and its concentration depends on amount of available Sun light. Upon adsorption of charge accepting molecules at the vacancy sites from ozone oxidizing gas, the electrons are effectively depleted from the conduction band of n-type Indium tin oxide (ITO) semiconductor sensor. Thus, this leads to an increase in the electrical resistance of n-type ITO gas sensor. At the maximum float of balloon, the concentration of ozone should be constant, but it may vary due to mixing ratio and availability of ultra violet rays from the sunlight. After termination of balloon, the payload again entered into the middle of stratosphere, the resistance of sensor should again increase and then decrease. The data on plot needs to zoom in to find this observation. That peak is not so large to observe in the fig.2 due to fact that the payload was dropping at the higher speed than that of the upward journey and none availability of ultra violet during night time. This region is labeled as "Descend" in the fig.2. We have also observed similar observations in the sensor box #3, which is shown in the fig.3.

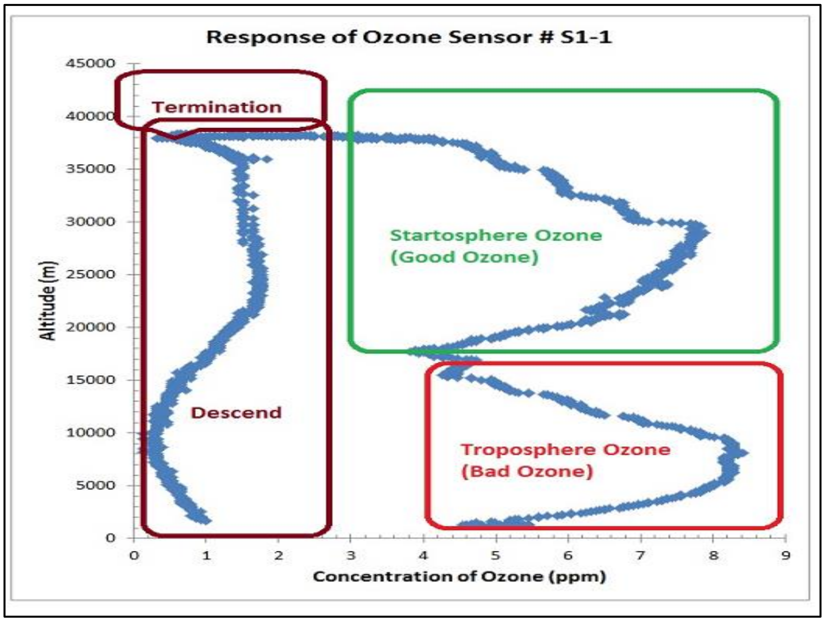

Fig.2 Response of ITO sensor (Box#S1, Sensors# S1-1) with altitude

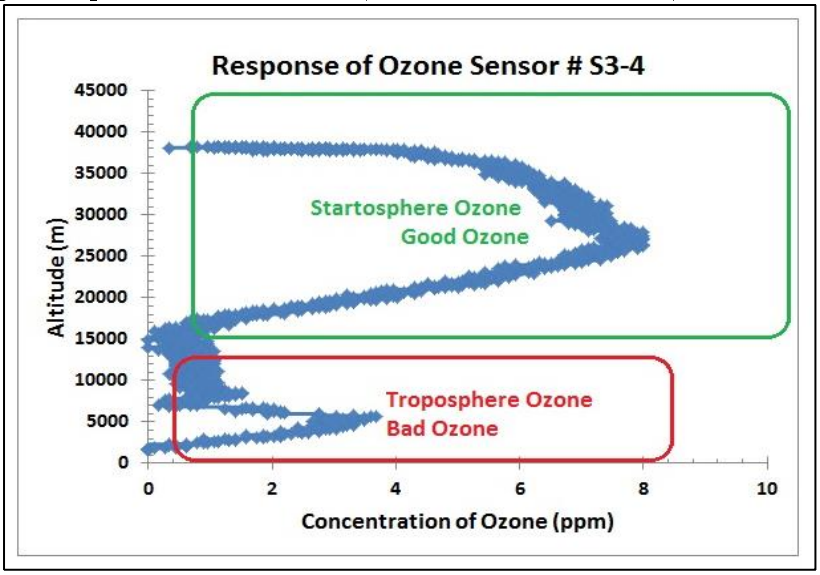

Fig.3 Response of ZnO+ITO sensor (Box#S3, Sensor# S3-4) with altitude

Based on this discussion and fact, we filtered out the data of troposphere and data generated after termination of flight or during descend and worked further over the data generated in the stratosphere only.

Fig.4 shows the response of ozone sensors of Box#S1 in the stratosphere.

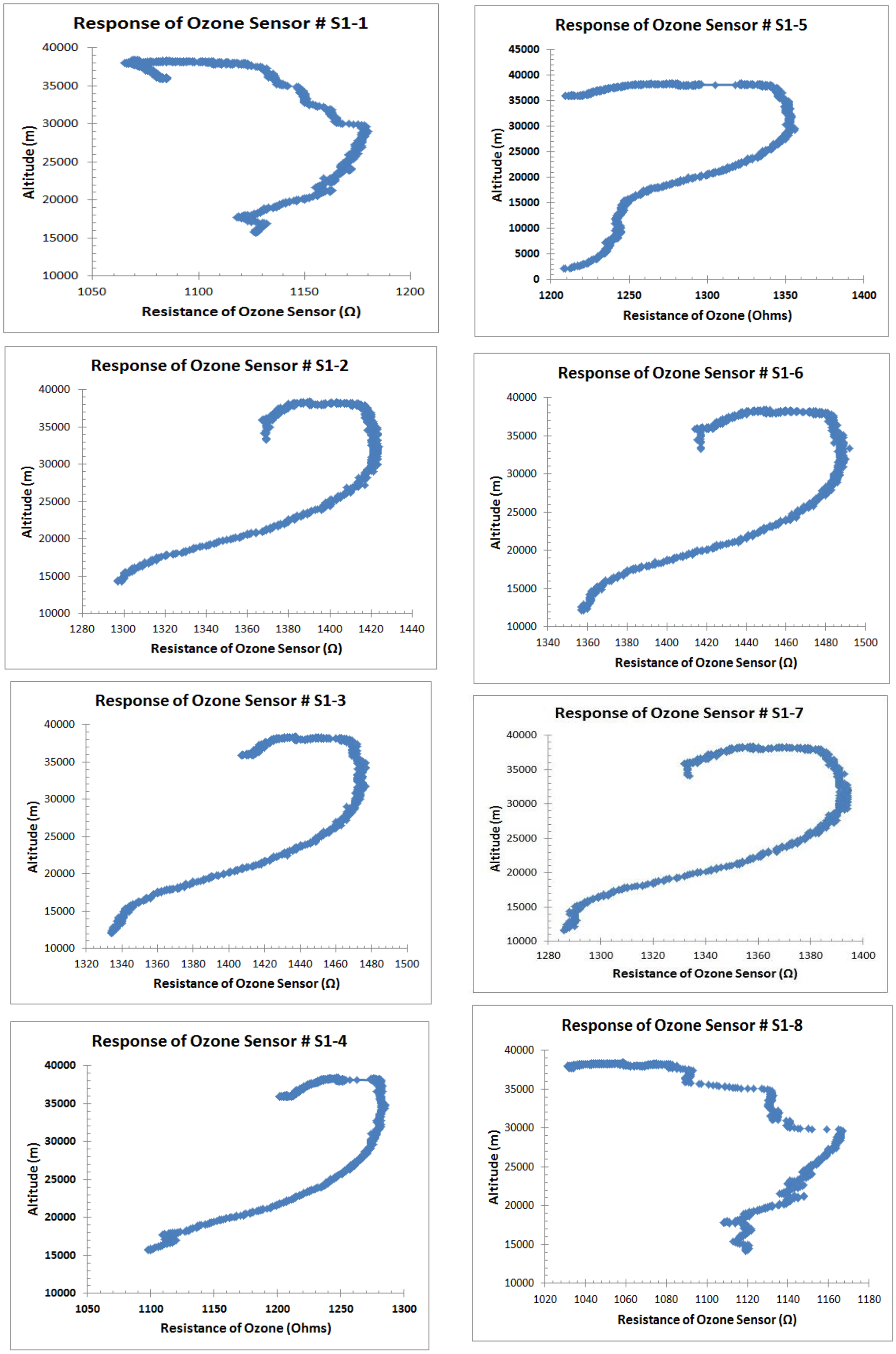

Fig.4 shows the response of ozone sensors of Box#S1 in the stratosphere

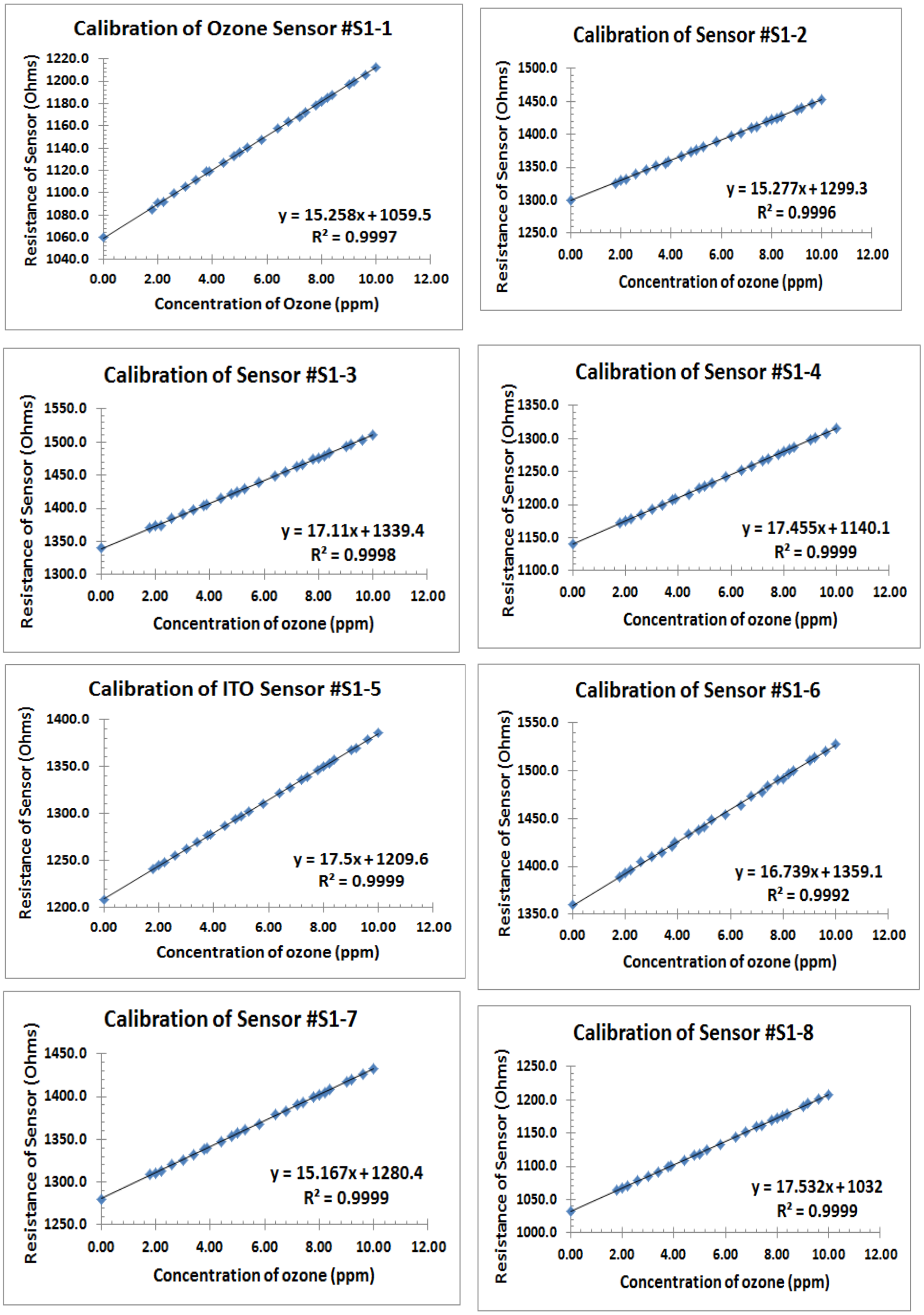

Fig.5 shows the calibration of ITO sensors of Box#S1

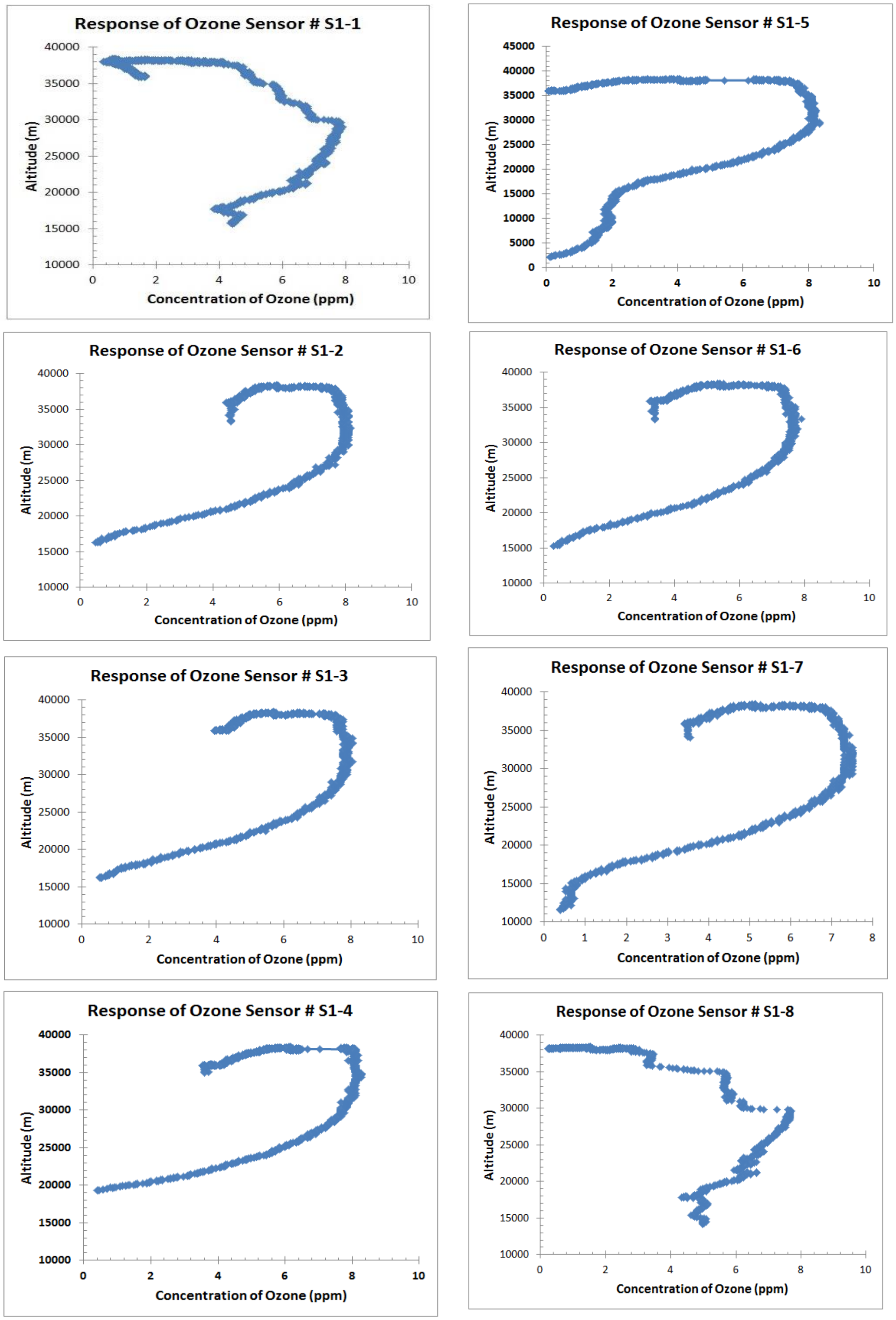

Fig.6 shows the measurements of the ozone profile in the stratosphere by ITO sensors box #S1

The nature of ozone profiles measured by ITO sensors box #1 is nearly matched with the theoretically profile measured and quoted by various research groups, which are shown in Fig. 7 to 9 for the comparison purpose. The measured value of maximum concentration of ozone was observed from 7.5 to 8.0 ppm, which is very close to the expected values.

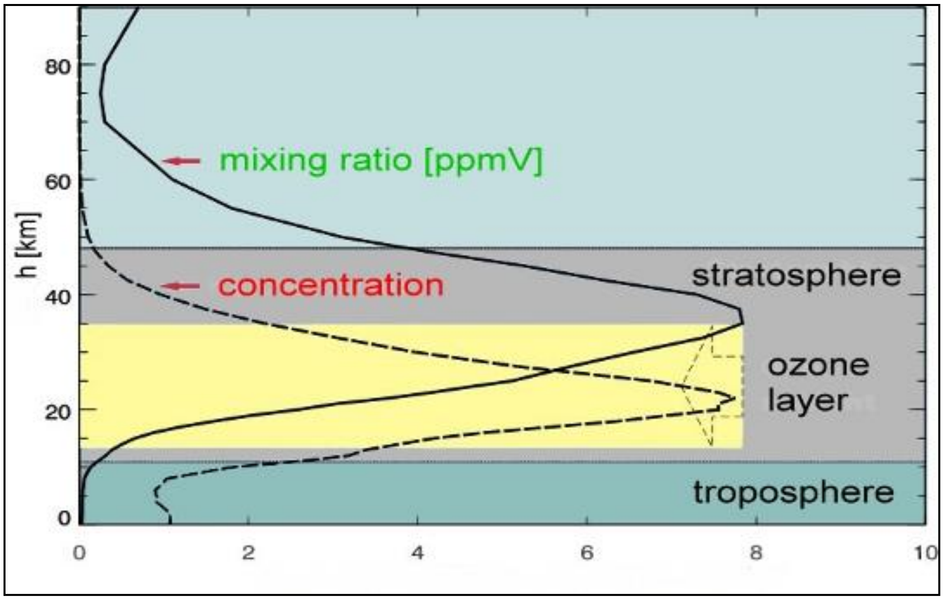

Fig.7 Theoretical ozone profile in stratosphere

(http://www.atmosphere.mpg.de/enid/1yy.html)

(ppmv = parts per million by volume = volume mixing ratio)

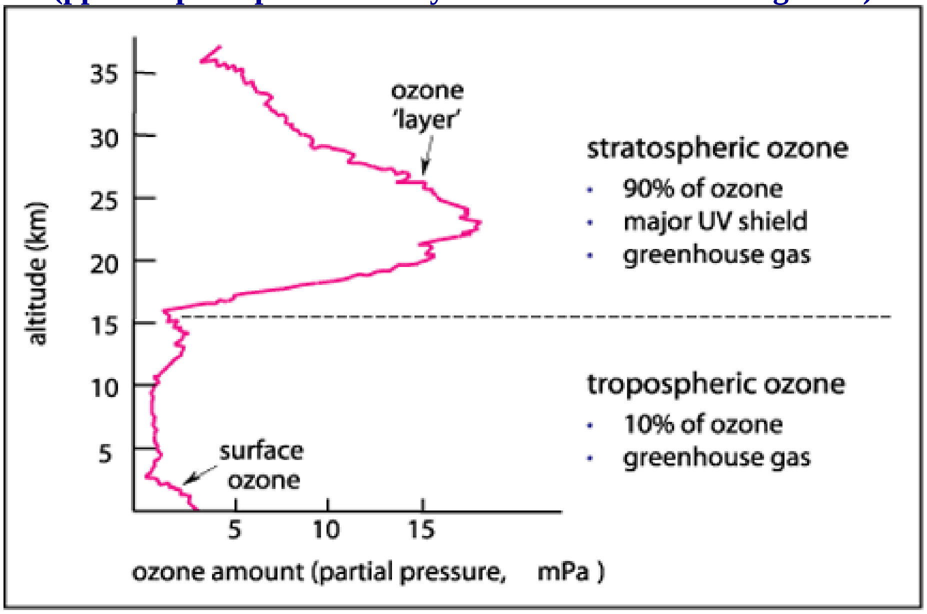

Fig. 8 Ozone in the atmosphere

http://www.environment.gov.au/soe/2001/publications/theme-reports/atmosphere/atmosphere03-1.html

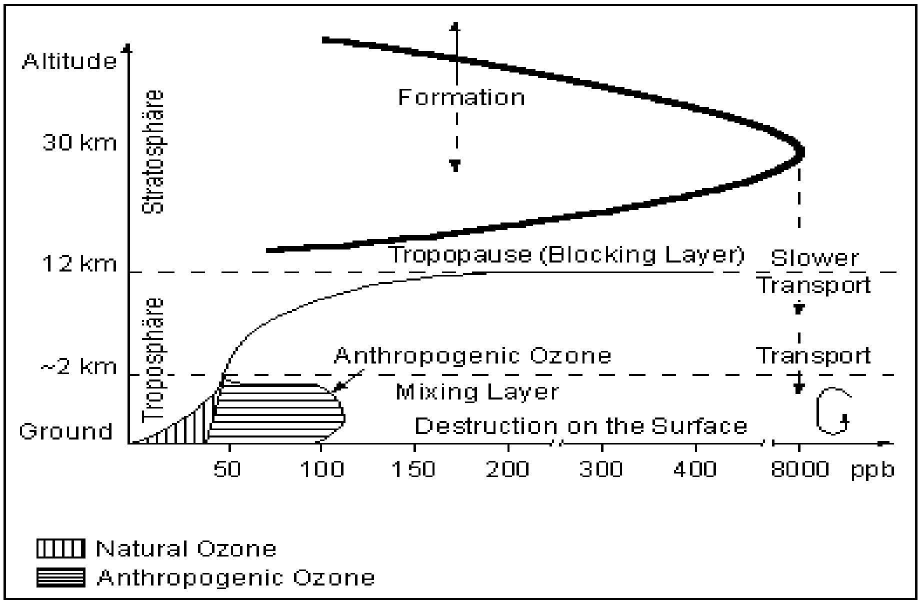

Fig. 9 Ozone profile
http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/ed306_01.htm

Sensors box # 3 also measured the ozone profile. Sensors box #4 measured the reducing gas in atmosphere and troposphere. The results of box #3and 4 will be reported in the next month.