Comments/changes, Referee #2:
The referee will see that his or her suggestions have been incorporated in this revised version of the manuscript. We are in agreement with the reviewer's comments regarding this manuscript as being very technical in nature, with relatively little data presentation, and no data interpretation. The intent of this paper is to lay the foundation for future publications that will come as these systems are put to use throughout the Arctic region. This first detailed documentation is very important, given that there are very few historical measurements of any of these key species in the Arctic Ocean region, which is currently undergoing rapid and large scale change. We intend to begin a program that involves multiple buoys around the Arctic Ocean region.

As the system has been deployed for less than one year we do not yet have enough information to fully answer all of the reviewer's comments/concerns, but the results from two deployments to date, one of which continues as of this writing, paint a very encouraging picture regarding the robust character of the O-Buoy and instrumentation, as indicated in the revised manuscript. To the best of our abilities, we respond to the reviewer's comments below.

- This system underwent extensive cold testing before its deployment in the Beaufort Sea. The instruments were tested at CRREL for two months, and then underwent another test phase in Barrow, AK from December 2008 – May 2009 (thereby enduring the most harsh portion of the Arctic winter). The data from the spring 2009 test in Barrow were compared to data collected by NOAA and the Institute of Environmental Physics Bremen in Barrow during the same time. The buoy data are in good agreement with these independent measurements (see pp. 11, 16, and 19-20, lines 273-275, 401-402, and 465-475, respectively, in the revised manuscript). From this we believe the inlets and sample tubing remained open for the duration, and continue to be open during the current deployment. Additionally, there are no exposed parts of the DOAS's head, thereby prohibiting it from freezing in place, as described on p. 18 lines 438-445 of the revised manuscript. From these test phases, the quality of the data from the current Beaufort deployment, and the data comparisons, we are confident that the system is capable of surviving a full year cycle.

- In the event of a temporary power failure, the SC will reboot itself from firmware upon restoration of power. The SC goes through a series of system checks to ensure the integrity of its file structure on its solid-state "disk drive" before it performs a full reboot of its Linux operating system. Upon restoration of the operating system it uses the buoy's GPS device to update the day-date clock on the SC. This datum is used to restore the data taking and power management schedule for each instrument. Each instrument is re-initialized as it is returned to its default experimental status. Further, if the operating system can reboot as described above, the system can go into an emergency mode. It will report this state via its satellite link. Most operational software and experimental scripts can be reloaded via the satellite link by direct intervention. The link operates at 2400 bits per second (as mentioned on page 22, line 517 of the revision), thus this process could require several days to complete and verify.

  As a final emergency measure, the buoy will continue to function if the satellite link is completely lost. In this case, all data are stored in non-volatile memory on the SC. If this situation were to happen, the buoy could be recovered at a convenient time. The memory module would be physically removed to access the data. This information was added on p. 21-22 lines 508-519 of the revised manuscript.
- With regard to the accuracy and precision of the chemical measurements after a period of one year: The only chemical sensor that does not have an on-board calibration source is the ozone monitor. The ozone monitor's slope and y-intercept of the calibration curve (calibration performed at deployment) was not

statistically significantly different (the two slopes differed by 5%) from that done under laboratory conditions one year previously. We note that when we recover buoys in the future, we will re-calibrate, and the information regarding calibration changes will be reflected in the data posted on the O-Buoy data web site.

- Information regarding the accuracy/precision requirements for each instrument have been added to their respective sections. See: pp. 8, 12, lines 206-208, 289-293, respectively, in the revised manuscript.
- Additional information regarding the ozone monitor's calibration and stability was added on p. 10-11 lines 253-275.
- All of the data collected in 2009 have been presented in Figures 7 and 8. As we discussed in the original submission, the data collected near Barrow, AK were compared to data collected by independent sources, at the NOAA lab. The two sets of data were in good agreement with one another, as now discussed quantitatively on page 11 line 275 of the revised manuscript. Because of the additional information in Figure 7 from the second Beaufort Sea deployment, we removed the actual NOAA data from Figure 7, for improved clarity of presentation of the O-Buoy data.
- Figures 7 and 8 have been corrected to be more easily readable.