MOBY246 Deployment Final Report

Revision Date: June 27, 2011

16 Jun 2010 - 17 Mar 2011

Overview of problems

- Deployment start day was 16 Jun 2010.
- During this deployment the top arm sustained a hit (probably a boat strike) which badly damaged the EdTop collector and bent the arm down by 20 degrees. This occurred between the end of data collection on the June 16th 2010 and the start of data collection on the 17th. The LuTop data looked good but was marked bad because of the angle of the arm.
- Around July 10th the LuBot arm started to decrease, the same as in MOBY244.
- Around Aug 13th the LuTop data started decreasing, soon after LuMid followed.
- On Sept. 30th Terry performed a cleaning which restored the LuTop and Mid data to more reasonable values (barnacles were found in and around the Lu collectors). Also the top arm was straightened to a nearly horizontal orientation and the collectors were rotated 15 degrees to a near vertical position by Terry.
- A second cleaning was performed 1-2 November. After the cleaning I noticed a bump appeared on the LuTop data between ~500-600 nm. It is fairly subtle and is more easily seen in a spectral plot of the KL data.
- A third cleaning on Nov 25th 2010 reduced the ~500-600 nm bump by about half initially. Then it came back up to pre cleaning levels and has continued to rise.
- There have been some really low Es scans occasionally. At first I thought a bird was sitting on the Es collector again. After about 14 such low Es scans I noticed that only the first Es scan was low. It is highly unlikely that it is a bird if it is only the first scan set. Is there possibly a MUX problem? When MOBY is back in the tent we can check for problems.
- On Dec 27th 2010 the MOBY hard drive filled. Data were missing on 27 Dec until 26 Jan.
- On Jan 25 2011 Terry went out to the buoy and deleted a ton of files and preformed a cleaning. Normal data collection resumed on 27 Jan.
- On Dec 27th 2010 some of the MOBY files stopped having GPS information in the file. There was a group of files without GPS data then the GPS data started again and then on Feb 5th 2011 there was another group of files without GPS data. Initially is was thought that is was just that the GPS battery was not charged. We stopped getting GPS data again, on Feb 6th. Some of the MOBY files also came in as incomplete (missing the end file auxiliary), probably due to the GPS problem.
- Buoy was pulled from the water on 17 Mar 2011.
- Once in the tent Mike Feinholz documented the damage he found...
    - Top arm is bent downward severely, with white-wire bail broken off completely, and the white-wire dangling freely. The top arm base is cracked, such that it could potentially have been moving w/ wave motion. The Top arm collectors are rotated off from vertical.
    - EdTop cosine copper bezel smashed in several places, and the diffuser looks maybe cracked, with lots of bio-fouling.
    - LuTop AFT had 2 barnacles growing inside, may be in the field of view.

- The Mid & Bot arm/collectors don't look too bad.
- After cleaning the Lu windows they all had obvious condensation on inside window surface and LuBot looked much worse than others.

Need for mean KL:

During the M246 deployment the Top and Bot arms had major problems. So I created a mean KL for the M246 deployment.

First these arms were marked bad for the specified times:

- LuTop data: marked bad from 17 Jun to the end of the deployment (top arm damaged before day 2)
- LuBot data: marked bad from 10 July to the end of the deployment (KL's were bad and post-cal response down ~30%)
- LuMid: data marked bad from 13 Aug - 30 Sep (barnacles)

I then reprocessed the MOBY246 data so the sensors marked bad would be removed from the calculations of KL and Lw correctly.

Mean KL Calculations

DIR: C:\zflora\mldata\moby\data\Mean_KL
PROGRAM: monthy_mean_kl_M246.m

Next a 14 year mean KL3 (mid-bot) was calculated. These mean KL's will be used to calculate a Lw for M246 LuMid data. MOBY206, 8 and 10 had the low OH fibers and M240 had the large UV problem and were excluded from the mean KL. Odd deployments were interpolated to the M246 deployment wavelengths. Only data from good days were used. Any KL less than clear water (0.0097 at 456 nm) was excluded. A KL was calculated for each hour file (20, 22 and 23 hour) and for each month of the year.

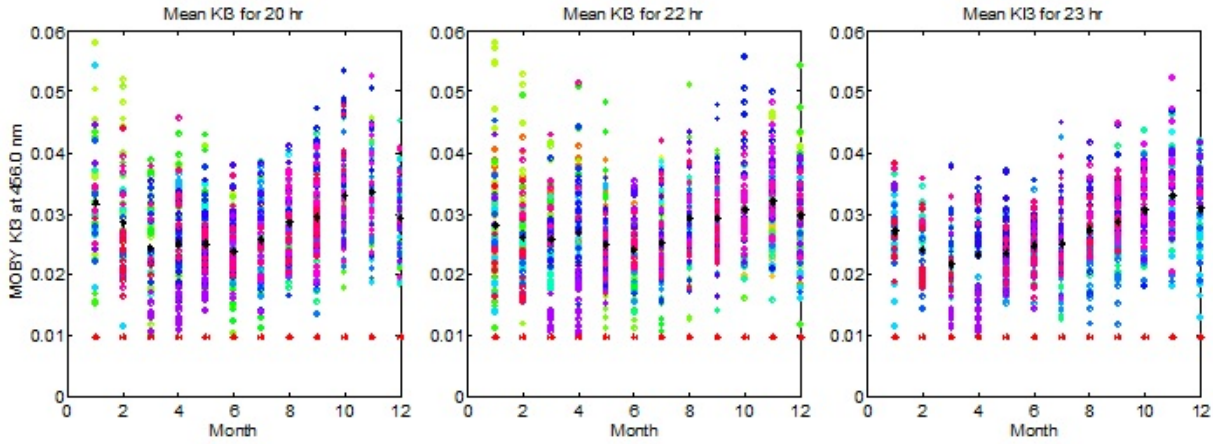

Figure 1. KL's used to calculate the mean KL for each month and hour file. The red stars are the clear water KL values

Figure 1 shows the variability of good KL's chosen to calculate the mean KL for each hour and month. These KL's are from good days only and are greater than clear water KL at 456 nm. The table below shows the number of KL's averaged. Using only even MOBY data would decrease these values by more than a factor of two.

Table 1: Sample numbers for mean KL's

Month	20 hr	22 hr	23 hr
1	49	111	40
2	74	110	51
3	65	111	55
4	102	102	58
5	151	143	73
6	126	118	52
7	125	136	82
8	102	92	81
9	128	105	76
10	82	81	58
11	84	103	71
12	76	119	55

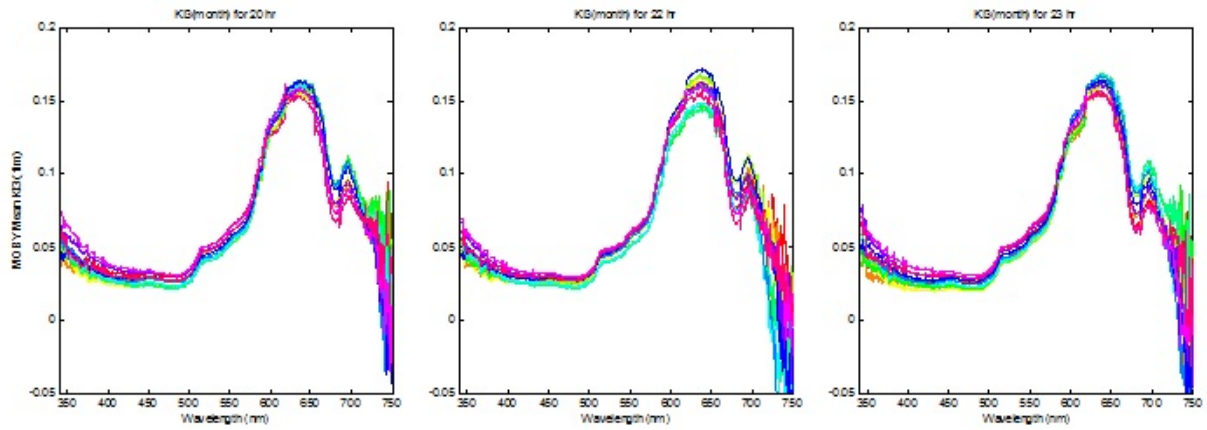

Figure 2. Mean KL (mid,bot)'s for each hour and month. Each month is a different color.

The mean KLs are shown in Figure 2. These are the KL's which are used to propagate the LuMid to the surface.

Which LuMID data are good?

DIR: C:\zflora\mldata\moby\data\moby246\precals
PROGRAM: mkplots_(17)

The next step is determining which LuMid data should be marked good and given to the public. Normally I have used the GOES images, the 3 KL's/Lu's and Es data to decide. In this case I used the GOES images to mark obvious cloudy days as bad. These data were automatically excluded from the below processing, also the LuMid marked bad due to barnacles were also automatically excluded (red dots are bad data, green squares are data kept, Figure 3).

Because of the problems we are left with LuMid data and Es data to decide which files are actually good. I decided to look at all old LuMid data (good data only, even and odd deployments) by hour and calculate the mean and standard deviation (std) by Julian day, at 443 nm (black and blue lines, Figure 3). The values of the standard deviations used to remove the M246 LuMid data were function of Julian day and 20, 22 or 23 hour (green squares are data kept, Figure 3). I also looked at all the good Es data (443 nm) over time and calculated the std/mean for all the Es data and found that most good days had a relative standard deviation (normalized by the mean) value less than 0.05 (black diamonds are data kept, Figure 3). This was added as an extra filter to remove any data which might be cloud contaminated.

Two filters were applied to the remaining LuMid data. The first removed all data more than 1 standard deviation from the mean and with a Es relative standard deviation (normalized by the mean) > 0.05, the second was less strict, all data more than 2 standard deviation from the mean and with a Es relative standard deviation (normalized by the mean) > 0.10 were removed.

Table 2 shows the results of the process. With the more strict filtering parameters 179 LuMid would be made available to the satellite community. The less strict filter results in 274 data points.

Table 2: All possible LuMID files, and the numbers remaining after each filter was applied

Reason	Number left after filter was applied
Total files	714
After LuMid bad data removed	569
After clouds removed	295
LuMid > 1 standard deviation and Es relative standard deviation (normalized by the mean) > 0.05	179 (good data left)
LuMid > 2 standard deviation and Es relative standard deviation (normalized by the mean) > 0.10	274 (good data left)

After comparing the Lw11 data from the two filters, it was decided to use the stricter of the two filters. Given the number of problems during this deployment this seemed the safer route.

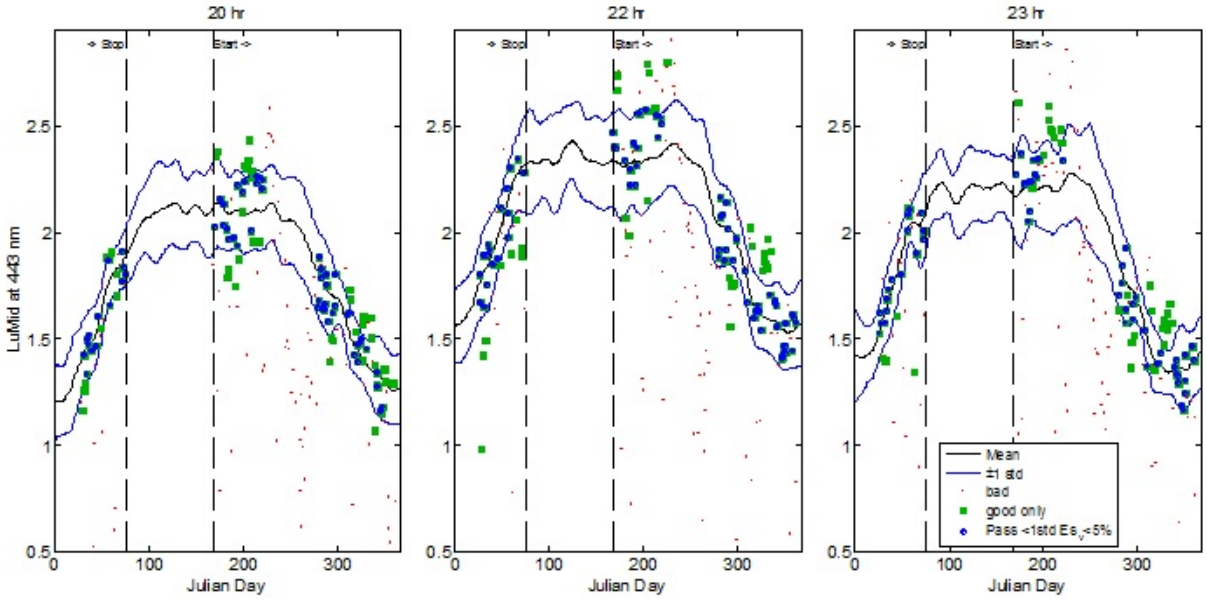

Figure 3. Shows the process used to determine which LuMid data are good. The black and blue lines are the standard deviation and mean calculated from all the good LuMid data (all deployments). The red dots are the M246 LuMid data marked bad because of clouds or barnacles. Green dots (some covered by the other dots) were all the good data left which were run through the two filters. The black circles are the data left after the most conservative filter is applied.

In Figure 3 the black diamonds are the data which passed the stricter filter and are marked good (see Table 2).

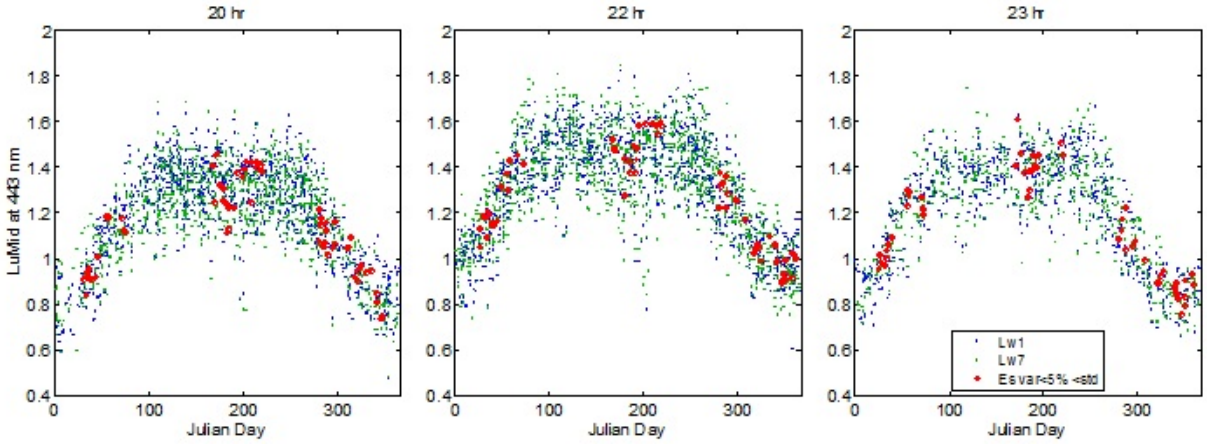

Figure 4. This compares the Lw11 created with the mean KL and LuMid to the good Lw1 (LuTop - KL(top-mid)) and Lw7 (LuMid-KL(mid-bot)) from all deployments. The black symbols show the data points marked good.

This program then marked LuMid as good for these days (red diamonds) in the quality checking file and the deployment was reprocessed.