MOBY244 Deployment Final Report

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MOBY244 - 7 Aug 2009 - 11 Jan 2010

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Overview of problems

- Deployment start date was 7 Aug 2009.
- Around 26 Sept (Julian day 269) the top three Lu's started to spread from each other causing all three Kl's to rise together.
- Battery number 4 died at the beginning of the deployment.
- Also note there was an error between the controller and MOBY's solid state disc drive which caused MOBY to stop collecting data on Dec 19th, almost a month before the end of the deployment.
- Post Cal notes: LuMid - steep response decrease in near-UV and LuBot a big 10 to 20% response decrease across all wavelengths

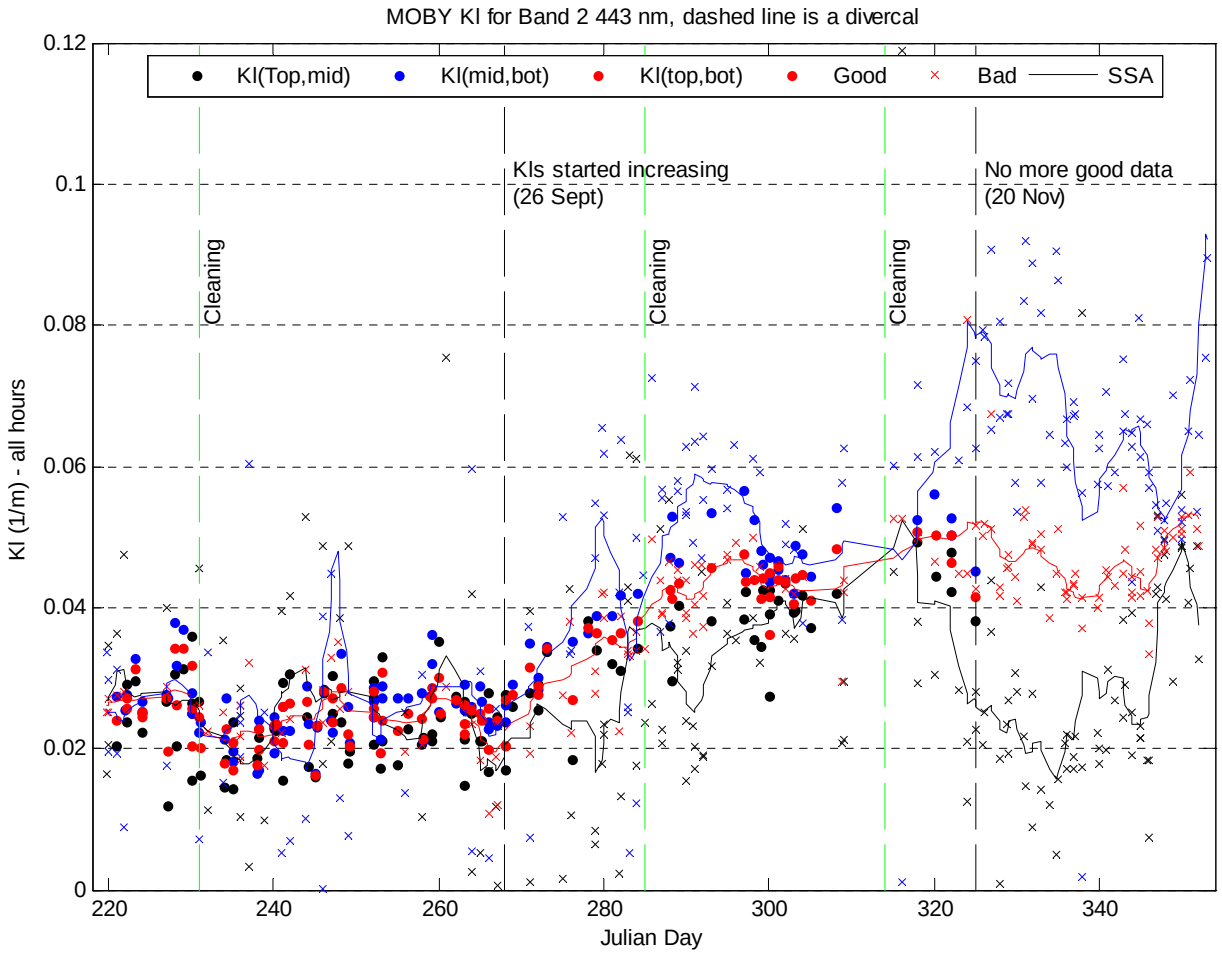

Figure 1. Kl time series for deployment MOBY244.

In Figure 1 we see the deployment starts out with the Kl's looking good. Then around 26 Sept (Julian day 269) the top three Lu's started to spread from each other causing all three Kl's to rise. This is fairly uncommon, usually only one Lu changes, causing two Kl's to diverge and one to stay the same. In this case at least two Lu's shifted causing all three Kl's to increase together.

Two cleanings occurred between 26 Sept and 20 Nov, on 13 Oct and 10 Nov. After the last cleaning on 10 Nov the K_L's started to change again and soon after on Nov 20th (Julian Day 324) no more data were marked good. The K_L(top,mid) returned to more normal values and the K_L's calculated from the LuBot data remained too high.

So after a MOBY team telcon it was decided to mark all the LuBot data from 26 Sep 2009 to the end of the deployment as bad. Mike's post calibration data showed a large change in the pre-post calibrations which confirms that LuBot died during the deployment.

Originally when processing the deployment, much of the data after 26 Sept were marked questionable or bad and all the data after 20 Nov was marked bad. Once we decided LuBot had died after 26 Sept, the result was there will be no Lw7 (Lumid, K_L(mid,bot)) data after 26 Sept. Because Mike saw no large changes when comparing the pre and postcals for LuTop and LuMid (except the in the UV for LuMid) and because the K_L's (top-mid) returned to normal values after Nov 20th we can say LuTop and Mid are good. This means a lot of Lw1 (LuTop, K_L(top,mid)) data that were marked bad or questionable should be remarked as good. So the deployment needed to be reassessed to determine which days after 26 Sept are really good.

Normally I have used the GOES images, the 3 K_L'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 processing detailed below. Because of the problems with LuBot, we are left with LuTop, LuMid, K_L(top,mid) and Es data to determine which days after 26 Sept are really good.

I decided to look at all old LuTop and 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 2). The values of the standard deviations used to remove the M244 LuMid data were function of Julian day and 20, 22 or 23 hour (green squares are data kept, Figure 2). For the data to pass this filter both the LuTop and LuMid data needed to be within 1.5 std of the mean. 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. This was added as an extra filter to remove any data that might be cloud contaminated.

The blue circles in Figure 2 show the LuTop and LuMid data which passed both filters. These will produce Lw1 data for this section of the deployment. After looking at the K_L data I did find two data points (MOBY files 09092722.mob and 09092022.mob) which created K_L's below clear water so they were marked bad as well.

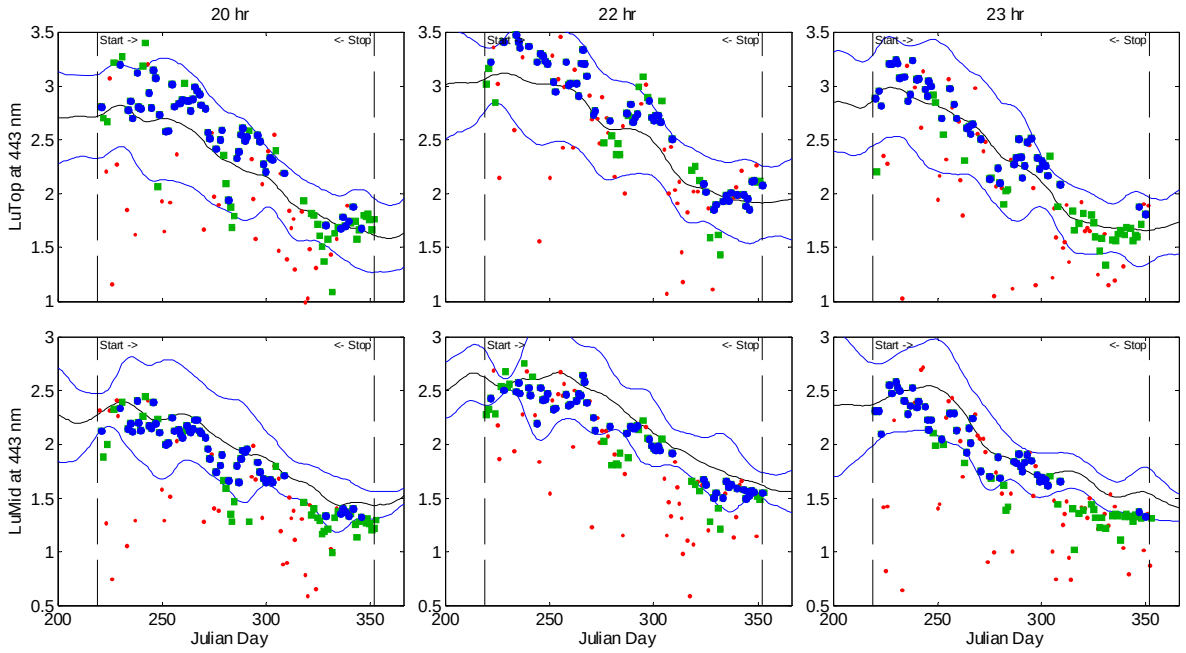

Figure 2. Shows the process used to determine which LuTop and LuMid data are good. The top panels show the LuTop data and the bottom are for LuMid. The black and blue lines are the standard deviation and mean calculated from all the good LuTop or Mid data (all deployments). The red dots are the M244 Lu data marked bad because of clouds. Green dots (some covered by the other dots) were all the good data left which were run through the two filters. Blue squares are the data that passed this filtering.

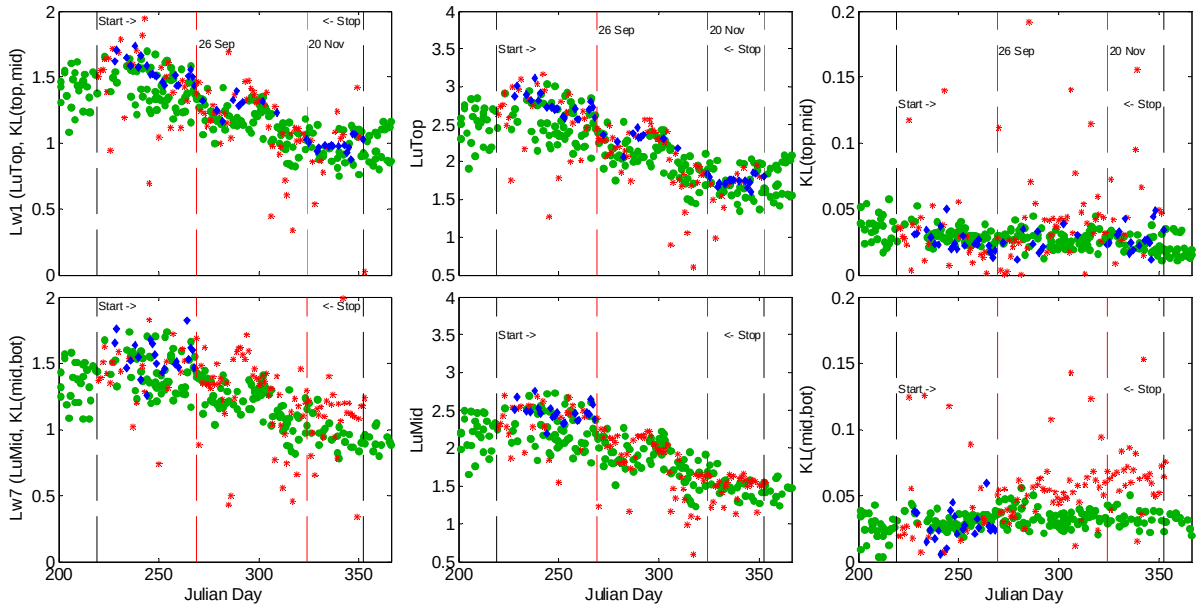

Figure 3. Top panels is the data for Lw1 and the bottom panels it the associated data for Lw7. Green diamonds are all good data for the last 15 deployments, red stars are bad data for M244 and the blue diamonds are the M244 data which are marked good.

In Figure 3 you can see the Lw's which remain (blue diamonds). For Lw7 (bottom panels) there are no data after 26 Sept because LuBot, which is used to calculate the KL(mid,bot), is bad. For Lw1 the filtering algorithm shown in Figure 2 found the MOBY files which should have been marked good. Notice that between 26 Sept and 20 Nov (labeled vertical lines) there are fewer good data sets for Lw1. This is the time period were all three Kl's were too high.

All three K_L's still increases after 26 Sept, even though we think LuTop and LuMid are ok. This is not physical behavior, and we don't have a physical interpretation. Hence these data, from 26 Sept to 20 Nov, are marked questionable.

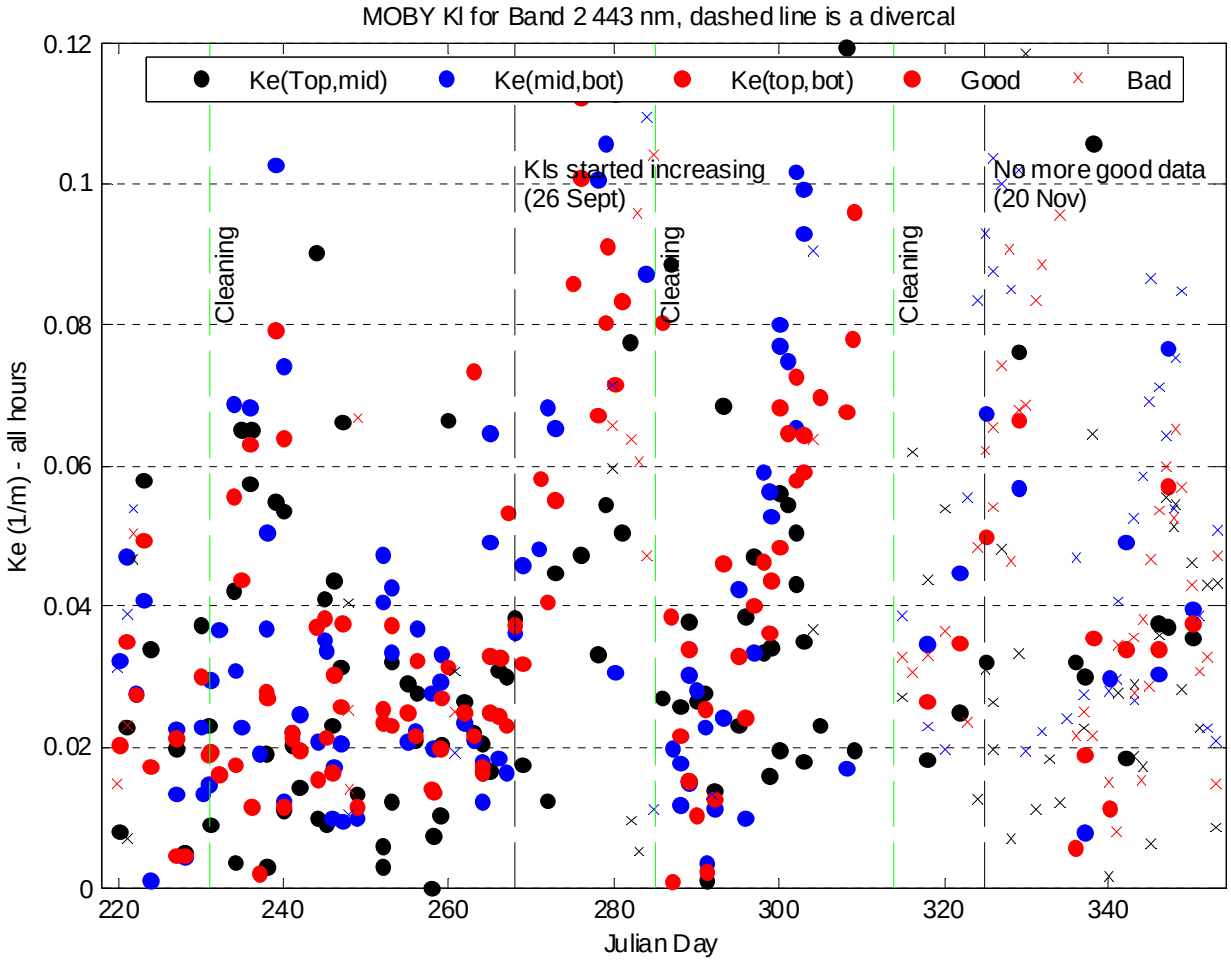

Figure 4. Ke time series for Deployment MOBY244.

During the Jun 28 telcon it was brought up that a plot of the Ke time series might help. So above is the Ke time series for comparison to the Figure 1 K_L time series. For the time period in question is looks like the Ke increased twice and then following each cleaning came back down to lower values. So there appears to have been two fouling events. So the next question is why does the Kl time series show only one increase and the one decrease, which was seen on 20 Nov ,10 days after the second cleaning?

Plots of the remote sensing reflectance (RSR) was also mentioned during the telcon. I decided to plot Lu/Es rather than Lw/Es because the Lw uses Kl which brings LuBot back into the equation.

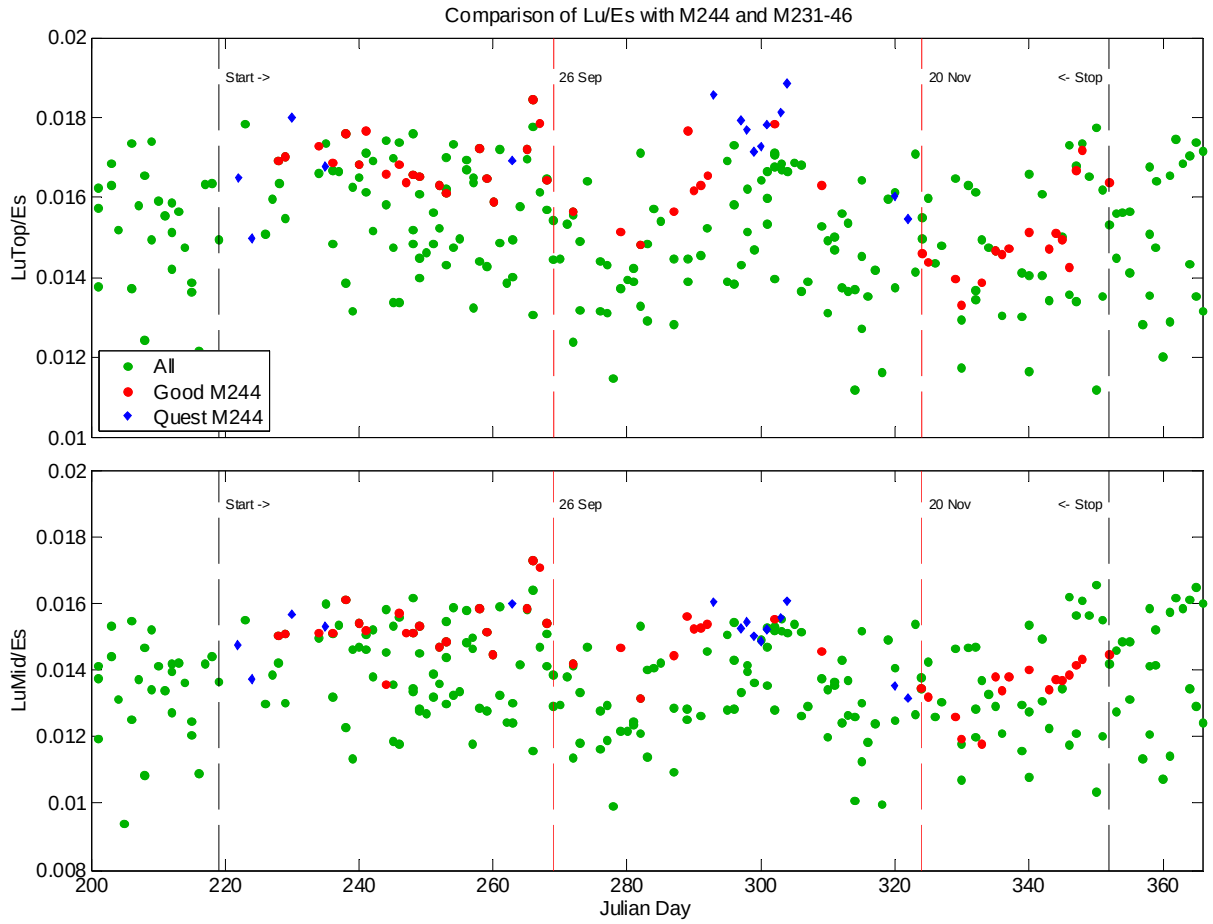

Figure 5. Time series of Lu/Es for 22 hour files, compared to other deployments.

In Figure 5 only 22 hour data is plotted. The green circles are the Lu/Es data from M231-46. The red and blue symbols are from M244. "Good M244" is all the good M244 data, "Quest M244" is all the questionable M244 data. Not sure if this shows anything really clearly.

I don't see any thing jumping out at me. The two Lu's seem to be a little higher compared to the green circles before Sept 26th and after Nov 20th. If there are any changes then they are too subtle to be seen in the Lu/Es ratios. On the other hand is clear that is not a HUGE problem with LuTop and Mid. This is one of the reasons I like K_L's. They show very subtle shifts much better. There are two possible conclusions from Figure 5. One is this graph is not capable of showing the problems and two there is not a problem to show.

The results from this analysis is all the LuBot data after 26 Sept are marked bad. All data from 26 Sept- 20 Nov are marked questionable. M244 was reprocessed and all the data were satellite weighted and uploaded to the MOBY website and Coastwatch gold directory.