

This notebook imports SES images from a single directory and calculates the mean intensity of each image to get a relative measurement of how much sediment was between the light source and the camera. This essentially uses the SES as a transmissometer.

First get all the file names from a directory of images from Pulse 60.

```
fnames = FileNames["*", "/Volumes/PBC/SES/Pulse\ 60/Images"];
```

```
Length[fnames]
```

```
608
```

We need to find which images use the external light versus the internal ring light.

```
fnames[[300 ;; 310]]
```

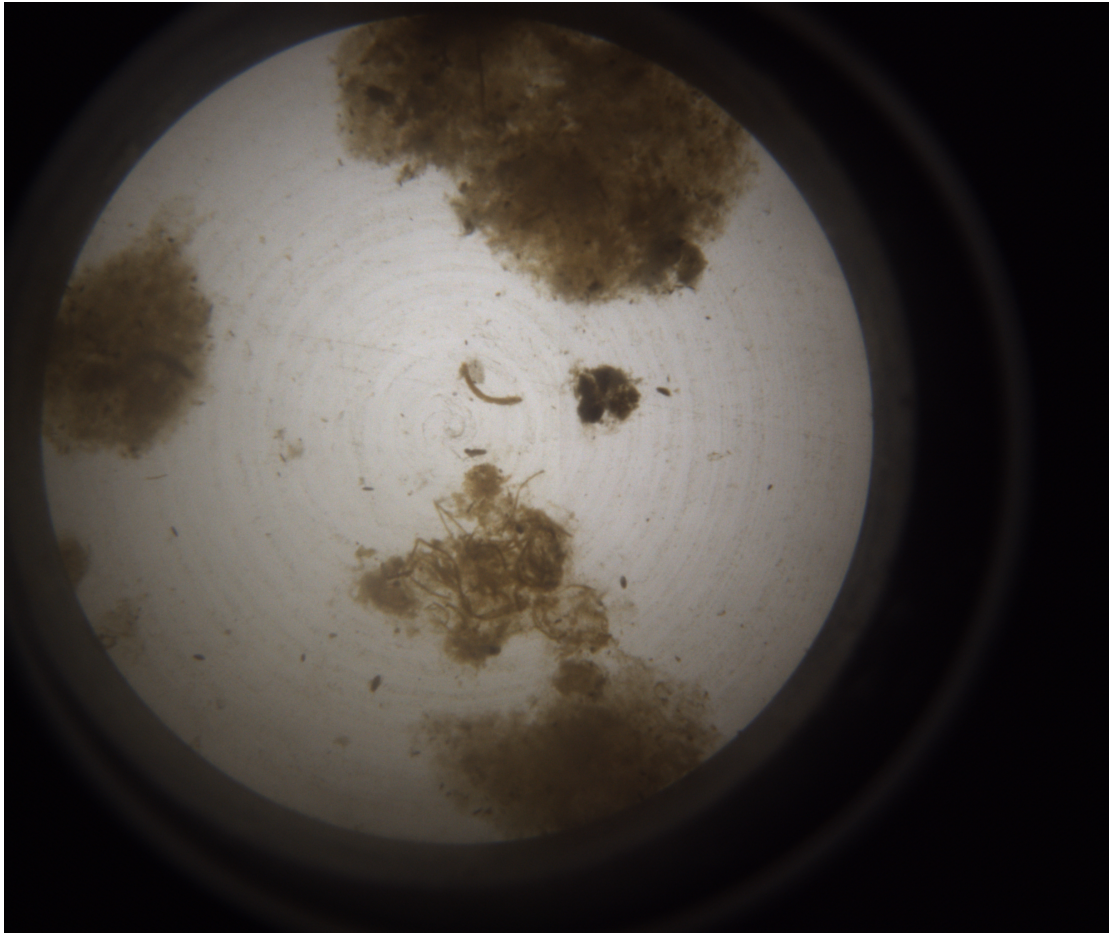
```
{/Volumes/PBC/SES/Pulse 60/Images/fluoro_ext_stM_121108-001112.tiff,  
/Volumes/PBC/SES/Pulse 60/Images/fluoro_ext_stM_121108-121111.tiff,  
/Volumes/PBC/SES/Pulse 60/Images/fluoro_ext_stM_121109-001140.tiff,  
/Volumes/PBC/SES/Pulse 60/Images/fluoro_ext_stM_121109-121137.tiff,  
/Volumes/PBC/SES/Pulse 60/Images/fluoro_ext_stM_121110-001111.tiff,  
/Volumes/PBC/SES/Pulse 60/Images/fluoro_rng_stM_120611-121129.tiff,  
/Volumes/PBC/SES/Pulse 60/Images/fluoro_rng_stM_120612-001157.tiff,  
/Volumes/PBC/SES/Pulse 60/Images/fluoro_rng_stM_120612-121157.tiff,  
/Volumes/PBC/SES/Pulse 60/Images/fluoro_rng_stM_120613-001130.tiff,  
/Volumes/PBC/SES/Pulse 60/Images/fluoro_rng_stM_120613-121130.tiff,  
/Volumes/PBC/SES/Pulse 60/Images/fluoro_rng_stM_120614-001156.tiff}
```

The first 304 images use the external light.

```
fnames[[82]]
```

```
/Volumes/PBC/SES/Pulse 60/Images/fluoro_ext_stM_120722-001110.tiff
```

```
image = Import[fnames[[200]]]
```



Total intensity sums the intensity of each pixel in the image, so the total is a large number.

```
totalIntensity = ImageMeasurements[image, "TotalIntensity"]
```

1.2833×10^6

Mean intensity calculates the average intensity over the whole image. White pixels raise the mean, black pixels lower it.

```
totalIntensity = ImageMeasurements[image, "MeanIntensity"]
```

0.255719

We can map the MeanIntensity measurement function over a number of images.

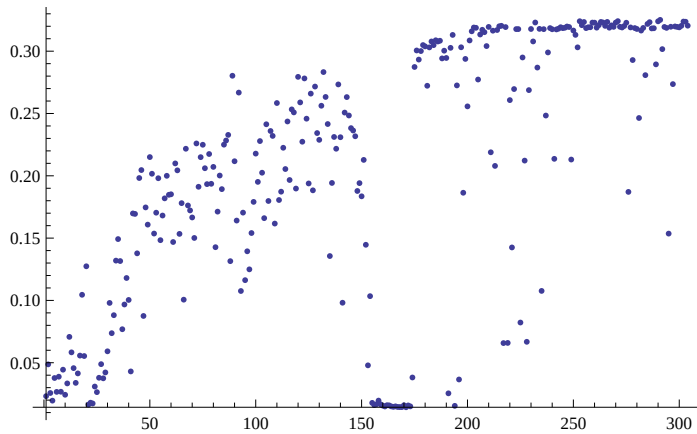
```
meanInts = ImageMeasurements[Import[fnames[#[#]]], "MeanIntensity"] & /@ Range[41, 51]
{0.0430149, 0.169798, 0.169422, 0.137788, 0.198216,
 0.204611, 0.0875302, 0.174635, 0.160825, 0.215022, 0.20165}
```

Measure the mean intensity for all of the external light images.

```
meanInts =
  ImageMeasurements[Import[fnames[#[#]]], "MeanIntensity"] & /@ Range[1, 304];
```

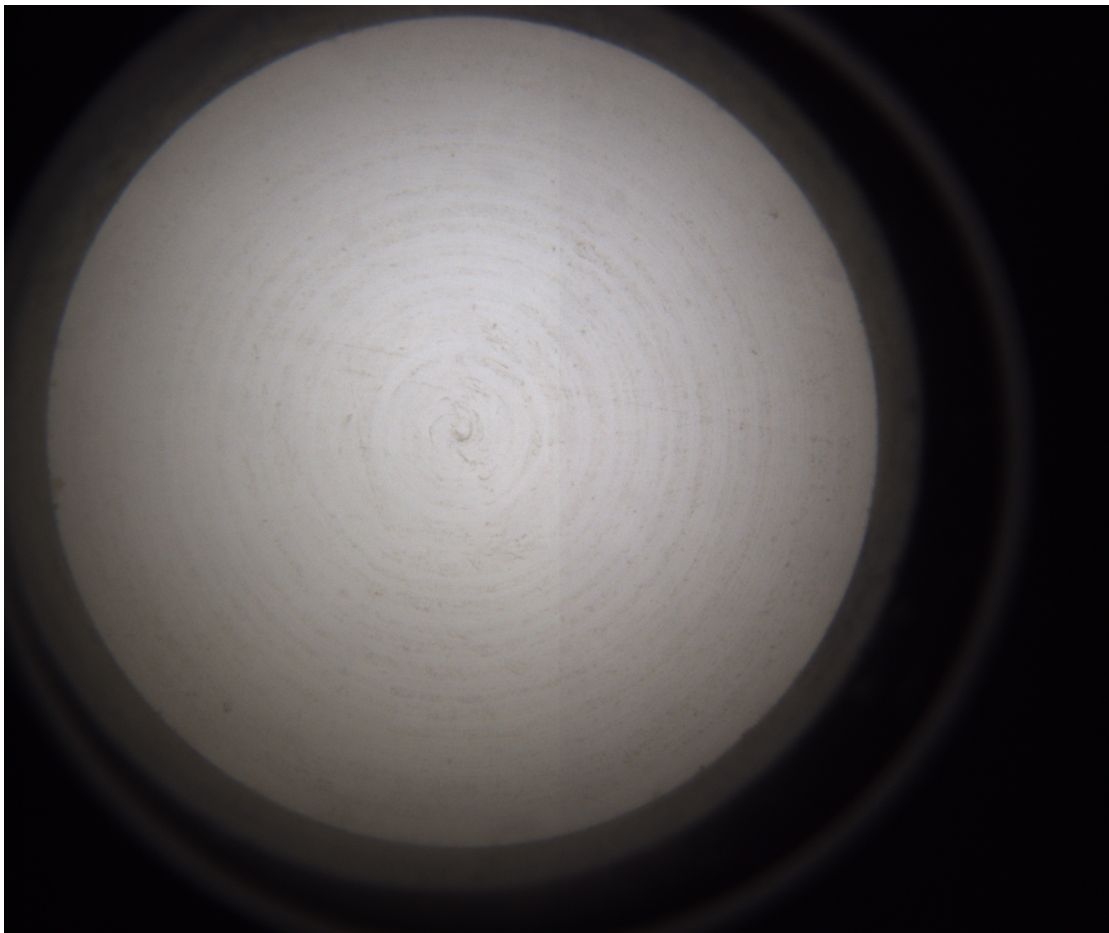
```
Export["P60meanInts.dat", meanInts];
```

```
ListPlot[meanInts[[1 ;; 304]], PlotRange -> All]
```



We want to use the brightest image to establish our scale at 100%.

```
image = Import[fnames[[304]]]
```



```
scale = Max[meanInts]
```

```
0.325121
```

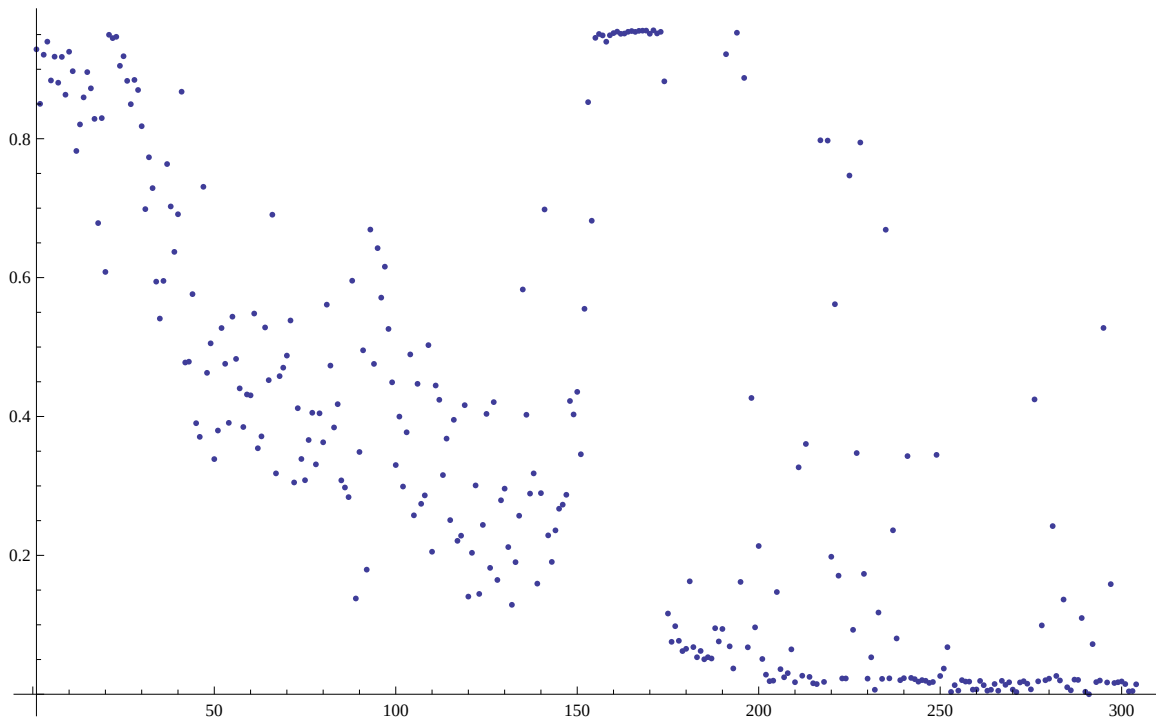
Scale all the brightnesses from 1 being the darkest to 0 being the brightest. This is now a proxy for the quantity of sediment on the sample slide.

```
scaledMeanInts = 1 - (meanInts / scale);
```

```
Max[scaledMeanInts]
```

```
0.956117
```

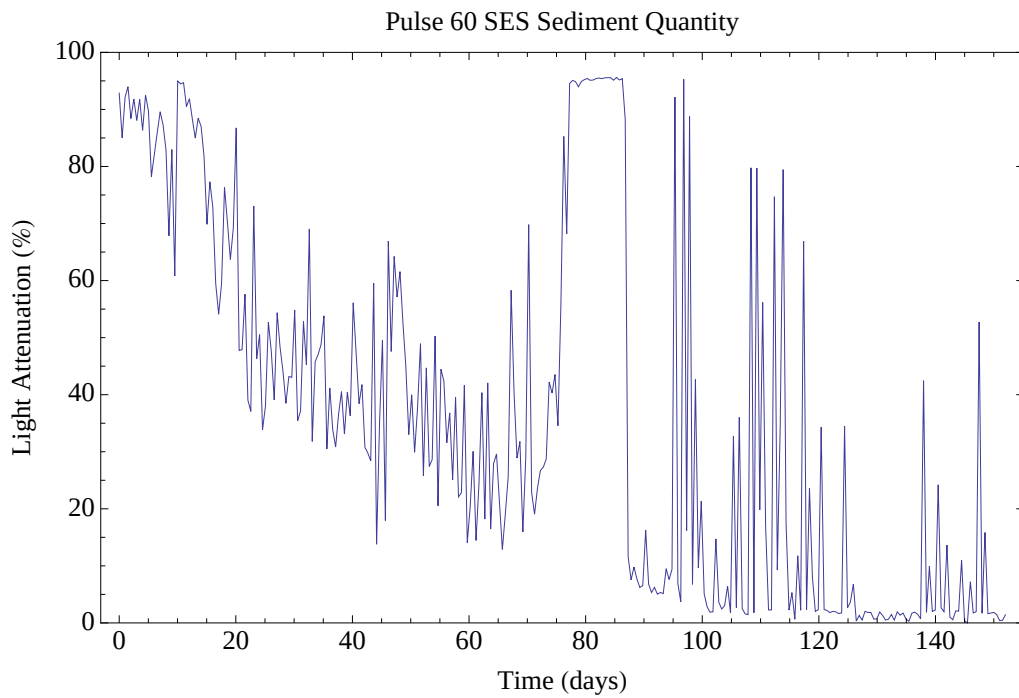
```
ListPlot[scaledMeanInts, PlotRange -> All]
```



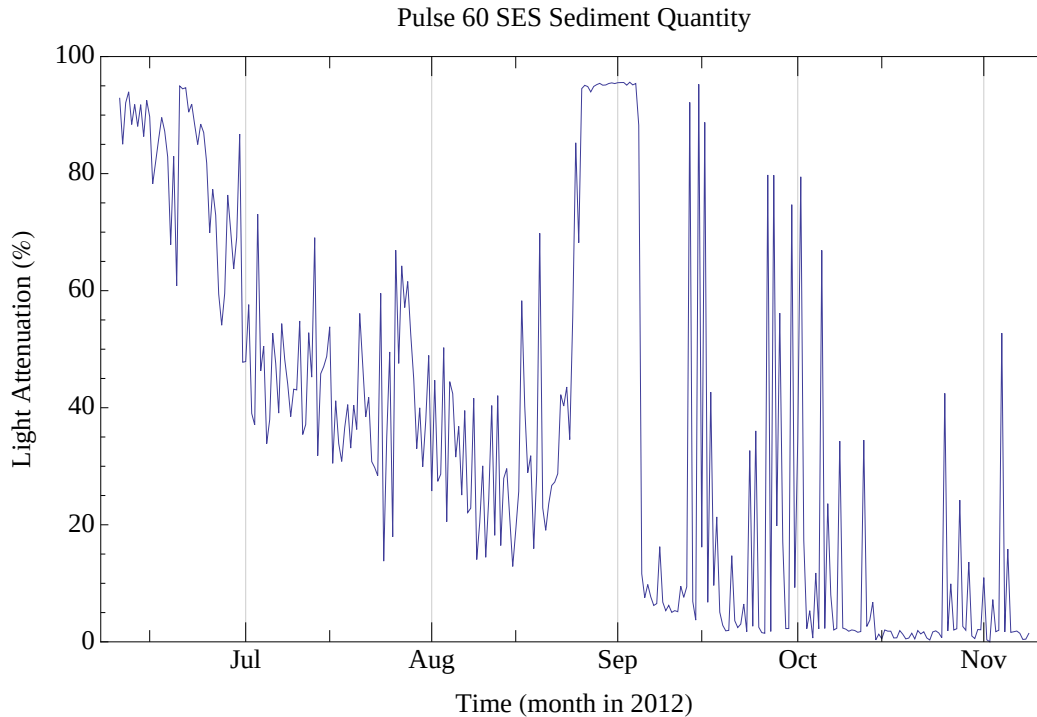

```

ListPlot[scaledMeanInts 100, {DataRange -> {0, 152}, PlotRange -> {All, {0, 100}},
Frame -> True, Joined -> True, BaseStyle -> {FontWeight -> "Normal", FontSize -> 14},
FrameLabel -> {{ "Light Attenuation (%)", ""},
{"Time (days)", "Pulse 60 SES Sediment Quantity"}}}]

```



```
laplot = DateListPlot[scaledMeanInts 100,
  {{2012, 6, 10}, Automatic, {0, 0, 0, 12, 0, 0}}, {PlotRange -> {All, {0, 100}},
  Frame -> True, Joined -> True, BaseStyle -> {FontWeight -> "Normal", FontSize -> 14},
  FrameLabel -> {{ "Light Attenuation (%)", ""},
    {"Time (month in 2012)", "Pulse 60 SES Sediment Quantity"}}}]
```



```
Clear[flux]
```

```
flux = Import["/Users/mcgill/Documents/My\
  Projects/Sedimentation\ Event\ Sensor/P60_61\ Sed\ Trap\ Flux.csv"]
{{Date, Mass Flux, Mean Org C}, {14-Jun-12, 871.616, 125.55},
 {24-Jun-12, 163.282, 39.75}, {4-Jul-12, 137.586, 15.66},
 {14-Jul-12, 55.3215, 7.73}, {24-Jul-12, 72.7724, 7.29}, {3-Aug-12, 51.5539, 6.06},
 {13-Aug-12, 39.6218, 8.3}, {23-Aug-12, 55.7674, 4.38}, {2-Sep-12, 362.147, 29.93},
 {11-Nov-12, 248.116, 29.25}, {16-Nov-12, 206.274, 9.53}}

flux = Drop[flux, 1]
{{14-Jun-12, 871.616, 125.55}, {24-Jun-12, 163.282, 39.75},
 {4-Jul-12, 137.586, 15.66}, {14-Jul-12, 55.3215, 7.73}, {24-Jul-12, 72.7724, 7.29},
 {3-Aug-12, 51.5539, 6.06}, {13-Aug-12, 39.6218, 8.3}, {23-Aug-12, 55.7674, 4.38},
 {2-Sep-12, 362.147, 29.93}, {11-Nov-12, 248.116, 29.25}, {16-Nov-12, 206.274, 9.53}}

flux = Drop[flux, -1]
{{14-Jun-12, 871.616, 125.55}, {24-Jun-12, 163.282, 39.75},
 {4-Jul-12, 137.586, 15.66}, {14-Jul-12, 55.3215, 7.73}, {24-Jul-12, 72.7724, 7.29},
 {3-Aug-12, 51.5539, 6.06}, {13-Aug-12, 39.6218, 8.3}, {23-Aug-12, 55.7674, 4.38},
 {2-Sep-12, 362.147, 29.93}, {11-Nov-12, 248.116, 29.25}}
```

```
flux[All, {1, 2}]]
```

```
{ {14-Jun-12, 871.616}, {24-Jun-12, 163.282},  
  {4-Jul-12, 137.586}, {14-Jul-12, 55.3215},  
  {24-Jul-12, 72.7724}, {3-Aug-12, 51.5539}, {13-Aug-12, 39.6218},  
  {23-Aug-12, 55.7674}, {2-Sep-12, 362.147}, {11-Nov-12, 248.116} }
```

```
dates = DateRange[{2012, 6, 10}, {2012, 11, 8, 12}, {12, "Hour"}];
```

```
Length[dates]
```

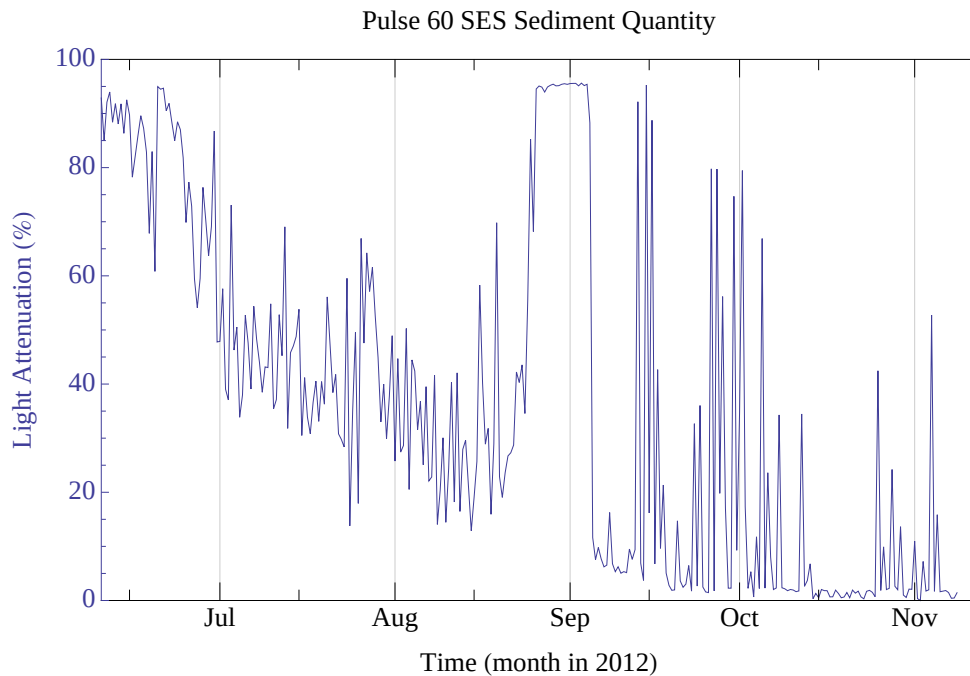
```
304
```

```
SESP60 = Partition[Riffle[dates, scaledMeanInts 100], 2];
```

```
SESP60[[1 ;; 10]]
```

```
{{ {2012, 6, 10, 0}, 92.8716}, { {2012, 6, 10, 12}, 85.023}, { {2012, 6, 11, 0}, 92.0958},  
  { {2012, 6, 11, 12}, 93.9782}, { {2012, 6, 12, 0}, 88.391}, { {2012, 6, 12, 12}, 91.8179},  
  { {2012, 6, 13, 0}, 88.0681}, { {2012, 6, 13, 12}, 91.7844},  
  { {2012, 6, 14, 0}, 86.3383}, { {2012, 6, 14, 12}, 92.5277} }
```

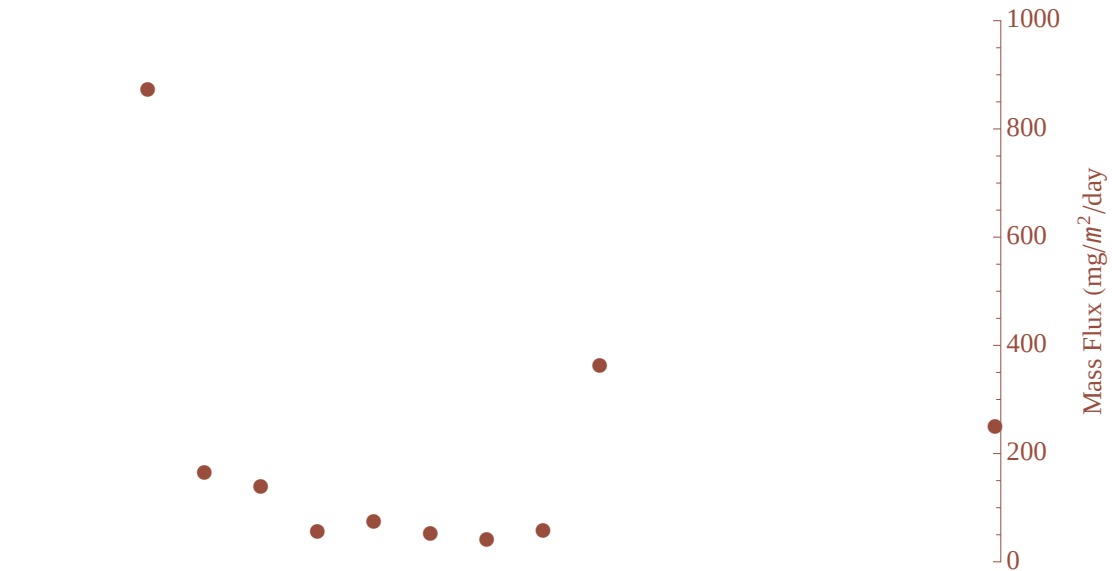
```
plot1 = DateListPlot[SESP60, ImagePadding -> 60, BaseStyle ->  
  {FontWeight -> "Normal", FontSize -> 14}, Frame -> {True, True, True, False},  
  FrameStyle -> {Automatic, ColorData[1, 1], Automatic, Automatic},  
  FrameLabel -> {{ "Light Attenuation (%)", "" },  
    { "Time (month in 2012)", "Pulse 60 SES Sediment Quantity" }}, Joined -> True,  
  PlotRange -> {{ {2012, 6, 10}, {2012, 11, 12}}, {0, 100}}, ImageSize -> Large]
```



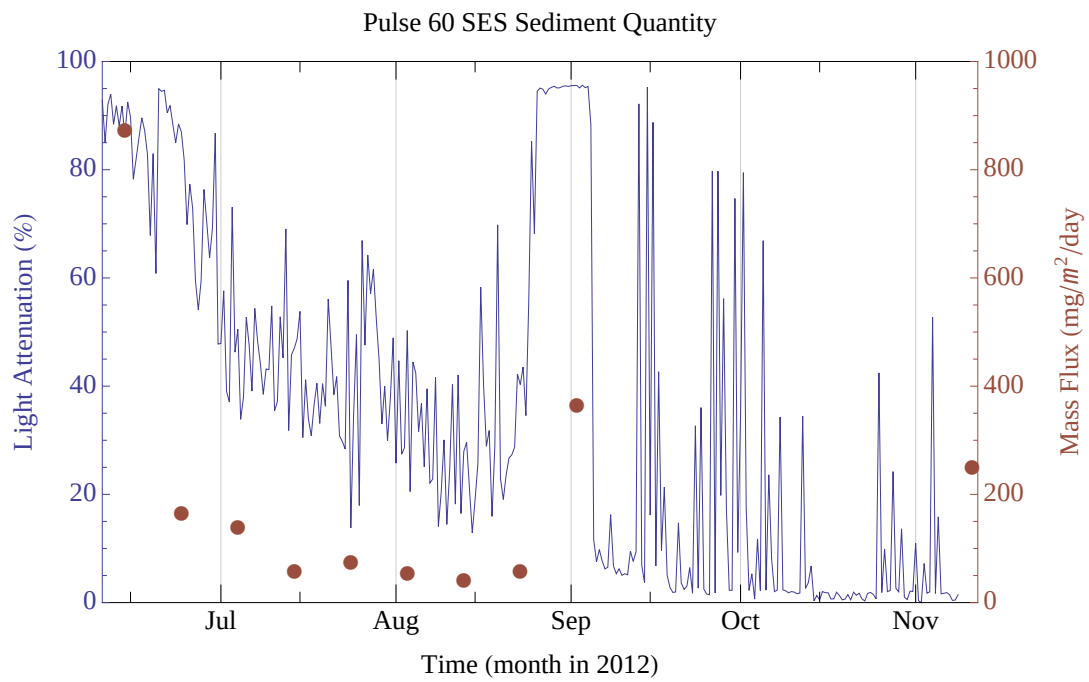
```

plot2 = DateListPlot[flux[[All, {1, 2}]], PlotStyle -> ColorData[1, 11],
  PlotMarkers -> {Automatic, Medium}, ImagePadding -> 60,
  BaseStyle -> {FontWeight -> "Normal", FontSize -> 14}, Axes -> False,
  Frame -> {False, False, False, True}, FrameTicks -> {None, None, None, All},
  FrameStyle -> {Automatic, Automatic, Automatic, ColorData[1, 11]},
  FrameLabel -> {{ "", "Mass Flux (mg/m2/day)", { "", "" }},
  PlotRange -> {{ {2012, 6, 10}, {2012, 11, 12}}, {0, 1000}}, ImageSize -> Large]

```



```
comboplot = Overlay[{plot1, plot2}]
```



```
Export["comboplot.pdf", comboplot]
```

```
comboplot.pdf
```