

Light Attenuation Information Sheet

Last updated 12 September 2017 by Ken Sandilands

This information sheet describes the collection and calculation of light attenuation data collected at the Experimental Lakes Area. Light data from NOLSS (Northern Ontario Lake Size Series) is also in the ELA data retriever (Collection methods may be the same?). This information sheet applies to Light Transparency Profile data, and Light Attenuation Coefficients.

Related Information sheets:

Lake Sampling Observations and Chemistry Sampling Information Sheet

Data reported in retriever:

Location, Sublocation, Station
Date and Time
Attenuation Coefficient – best fit
R² best fit
of Points – best fit
Atten. Coeff. – all points
R² all points fit
of points – all points fit
Depth (m)
% of Surface Light
Light Value (PAR) ($\mu\text{mol}/\text{m}^2/\text{s}$)
Dropped for best fit?
Collection Method
Dataset ID

Collection Method:

Photosynthetically Active Radiation (PAR) is measured with an underwater Licor PAR sensor (model LI 192 Underwater Quantum Sensor), and a LI-1400 logger for reading out the values. The sensor is lowered into the water with the sensor pointing up on a frame which keeps the sensor level when suspended from the data cable. Light readings are measured on the sunny side of the boat, or on cloudy days, the side of the boat facing where the sun would be. PAR is measured just above the water surface at arms length to avoid reflection off the boat. Surface readings are taken at the start and the end of the profile, and if they differ by more than 10%, the profile is redone. Underwater PAR measurements are taken at 0.5m, 1m, then every metre interval until the reading is less than 1% of the surface PAR. The depth at which $\leq 1\%$ of surface

light occurs is considered to be the bottom of the metalimnion for integrated sampling purposes (see Lake Sampling Observations and Water Sampling Methods Information Sheet for a description of integrated sampling methods). Readings are recorded in a field book and later entered into the PAR database, where the best fit curve is determined, and light attenuation calculated.

Calculations:

Once the data is entered, the R² of the Log values is calculated. If the R² is not close to 1, then outlying points are excluded manually from the calculation to achieve a higher R². The ELA data retriever has Attenuation coefficients calculated on both the best fit (where outliers have been excluded if necessary) and R² best fit is reported, and on all the data points (where no points have been excluded), and R² all points is reported. In each calculation, the number of points used in the calculation is reported. If points are excluded, this is indicated as “Dropped for best fit” in the light transparency profiles.

Light Attenuation is calculated as follows:

Light Attenuation Coefficient=

$$\frac{n * \sum(\text{Depth} * \ln\% \text{light}) - (\sum \text{depth} * \sum \ln\% \text{light})}{n * \sum \text{depth}^2 - (\sum \text{depth})^2}$$

where: ln% light is the natural log of the percent of surface light at each depth
n = number of points used in calculation

Light attenuation is calculated on both the best fit curve (best R²) and on all the data (all points fit).

Once data for a field season is checked it is exported from the PAR database to the ELA data retriever. All the calculations are done in the PAR database, and results exported to the retriever.

Past Methods and Data:

1969 - 1985

Reported attenuation coefficients for the period 1969 to 1985 are calculated using “best fit” analyses.

“All points best fit” attenuation coefficient values, and the corresponding light profiles are not available.

1986 - 1995

All light profiles are available and reported with “all points best fit” attenuation coefficients values.

Currently attenuation coefficient values “using best fit” are only available for select lakes and dates.

1996 – 2003

All light attenuation coefficient fields are available.