

PSS Light Attenuance/TSM Metadata

The PSS team (Vanderploeg, Johengen, Lang, Ruberg, Agy, Liebig) compared the natural log of PSS light attenuation ($\text{Ln}[\text{LA}]$) output from the mini optical plankton counter (mini OPC, Model 2T with 10 cm beam path length, Focal Technologies) with discrete total suspended matter (TSM) samples (Johengen, Nalepa et al. 2000) taken at different depths at stations among the various transects during “pre-plume” (January-February), “plume” (March) and “post-plume” (early and late April) cruises 1998-2000 to develop a set of TSM vs. $\text{Ln}(\text{LA})$ regressions that would be used to transform continuous LA profiles to TSM profiles along the transects.

The horizontal distance from shore and sample depth were used to match the discrete grab samples with the corresponding PSS response. A search area of ± 0.2 km in the horizontal and ± 0.5 m in the vertical was established around the discrete sample. The PSS readings within this window were averaged to determine the PSS response. If no PSS readings were found, the search area was incrementally expanded. If no PSS readings were found within the maximum search area, ± 2 km in the horizontal and ± 3 m in the vertical, then the discrete grab sample was not used in the regression analysis. Over the three years, the average search window size was ± 0.48 km in the horizontal and ± 0.59 m in the vertical, and the average number of PSS values within the search window was 8.7. There were only 2 occurrences in 1998 where no PSS values were found within the maximum search window; 22 in 1999; and 8 in 2000. The distance between undulations are short in shallow water and longer in deeper water because of the standard method of raising and lowering the tow body at about 0.25 m/s. As a result, close match (small window) between grab samples and PSS recordings are highly probable nearshore. Since greater gradients in chlorophyll and TSM are found inshore rather than offshore, we believe the sampling window adequately captures the spatial pattern of chlorophyll and TSM.

During the plume event of 1998, we discovered that the OPC could not detect zooplankton at TSM concentrations $> 20 \text{ mg} \cdot \text{L}^{-1}$ (Ruberg, Vanderploeg et al. 2001). To

overcome this difficulty, we increased light intensity of the diodes of the OPC by a factor of 9.3 in 1999 and 2000. This decreased the range of LA values registered by the OPC by a factor of 9.3. To make all data comparable, we divided the 1998 LA values by 9.3. We developed a TSM vs. Ln(LA) regression for each year, and these regressions exhibited high r^2 values, indicating a good fit to the data (Fig. 1). This is the first application of the OPC of which we are aware that uses the LA meter to predict TSM of sediment plumes. Regressions for 1998 and 2000 were virtually identical. The regression for 1999 had a greater slope, which implies that LA/TSS is lower in 1999. That light scattering, the major mechanism of light attenuation in plumes, is greater in 1999 may imply the particles in suspension were larger in 1999, because LA/TSM would be greater for small than for large particles (Kirk 1994). When time permits, regressions will be developed for the summer/fall cruises.

The regressions used for the different years were:

- 1) Jan/Feb and March 1998, $\text{TSM (mg/L)} = 38.89 * [\text{Ln(LA)}] - 183.96$
- 2) Feb, Mar, Apr 1999, $\text{TSM (mg/L)} = 43.60 * [\text{Ln(LA)}] - 203.05$
- 3) Feb, Mar, Apr 2000, $\text{TSM (mg/L)} = 30.51 * [\text{Ln(LA)}] - 142.77$

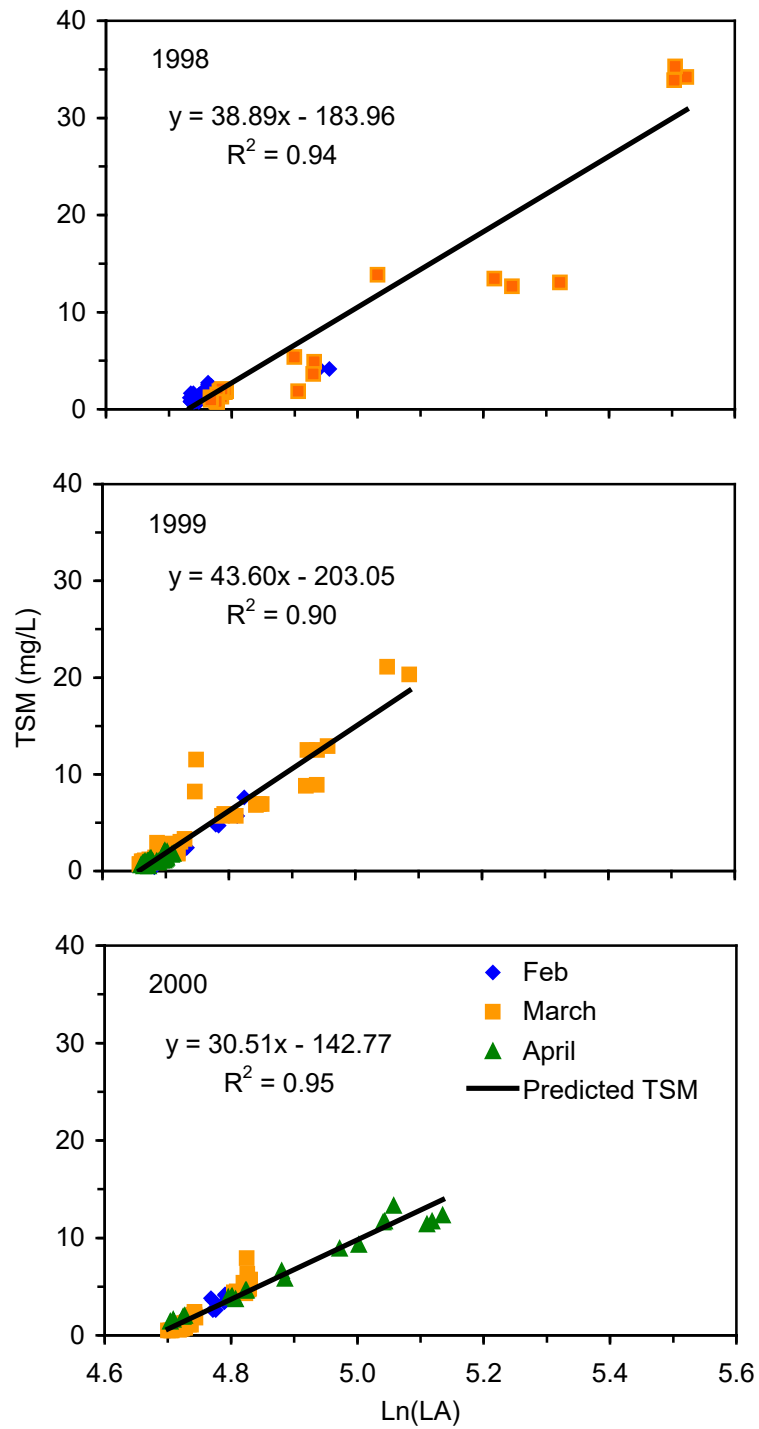


Fig. 1. TSM vs. LA during Winter & Spring in Lake Michigan

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