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Interactive comment on "Optical properties of size and chemical fractions of suspended particulate matter in littoral waters of Quebec" *by* Gholamreza Mohammadpour et al.

Anonymous Referee #1

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General comment

This study looks at the variations of particulate optical properties (light absorption and scattering coefficients) as a function of the size and chemical composition (mineral/organic fractions) of the suspended particulate matter (SPM). Test sites are contrasted coastal waters: the Saint Lawrence Estuary and one adjacent fjord. Surface water samples were collected in the field and filtered into different size fractions: <0.2 m, 0.2-0.4 m, 0.4-0.7 m, 0.7-10 m and >10 m. For each size fraction, the concentration of suspended solids and optical properties (spectral (400-700) absorption and scattering coefficients) were measured. Covariations between optical proxies and biogeo-

chemical properties of SPM were examined and analysed. It is a potentially interesting experimental study which is based on a sound methodology (but several clarifications are necessary: see specific comments). The Discussion section highlights the limits of such a study due to measurement uncertainties. Unfortunately, there is no direct conclusion for ocean colour remote sensing purposes as there is no particulate backscattering measurements. The manuscript is well and clearly written. Its organization is a bit confusing with few Figures (3+1), many Tables (6+3), one Appendix.

The main comments are:

> the 'data and methods' section can be significantly improved by: (1) presenting in more details the processing of the data (notably the particle size measurements and assessment of measurement uncertainties (SPM and PIM concentrations, spectral slopes of the absorption and scattering coefficients, slope of the particle size distribution); this will highlight the quality of the dataset and give confidence to the readers (2) explaining/justifying the choice of biogeo-optical indices (BOI) (3) analysing further the relationships between the spectral slopes of the SPM optical properties (attenuation, absorption and scattering spectral slopes) and SPM size/composition (4) considering theoretical calculations (e.g., Mie theory) to support and complement the observations made on the experimental measurements (optional).

> as it, results are mainly presented as tables summarizing the observed covariations between SPM biogeochemical and optical properties, so that the study almost appears as a report of an experimental study. There is(are) no real striking result(s) highlighted in the study.

My recommendation is to improve the 'data and Methods' section partly re-organize the manuscript (no Appendix) and re-inforce the results section, notably based on my general and specific comments hereafter.

Specific comments

1. Introduction: while the objectives are clear the general methodology is not. It should be introduced and explained.

2.1 Are you the first ones measuring IOPs in this study area? If not please review past measurements.

2.2 At last you introduce here the methodology: field or lab measurements on water samples collected in the field. Why not also considering computations (e.g., Mie theory) to complement your measurements?

2.3 Uncertainties (or precisions?) on SPM and PIM concentrations (15 and 25%) seem quite high. . .Can you comment on this and remind your protocol? How did you estimate these 15% and 25% measurement errors?

2.4 Unclear how you measured CDOM absorption? Bench spectrophotometer? Wetlabs ac-s?

2.4 “Optical measurements were corrected by applying a flat baseline at a referene wavelength of 715 nm (Bricaud and Stramski)”: why using this old correction method? R. Zaneveld then Rottgers et al. (2014) have developed new correction methods. . .please explain

2.4 “Particle size spectra were measured by using a LISST-100X sensor”: field measurements or measurements in the lab using the LISST as a bench sensor? Please clarify/justify. Describe how you processed the data (assuming spherical or non-spherical particles, particle size distribution, Junge exponent, etc).

2.5 Equation 1: the IOPs related to the water reflectance are the absorption and backscattering coefficients, while you measured the absorption and scattering coefficients. Therefore, I do not think your measurements/results can be directly used for remote sensing purposes.

2.5 Equations 3-5: can you explain/justify the choice of these biogeo-optical indices (BOI)? Notably the selection of the wavelengths?

2.5 “Values of aSPM were derived by subtracting the contributions of CDOM and seawater to a.” So aCDOM was measured using the ac-s. The ac-s sensor is calibrated in pure water, no need to subtract the contribution of seawater.

2.6 “Spectral values of mass-specific absorption and scattering cross sections for mineral and organic fractions of SPM” Please provide equations for these two parameters and physical units.

Equations 6-7: m is a concentration, not a mass

3.1 Is ‘gamma’ the spectral slope of particulate scattering or the Junge slope of particle size distribution? Please clarify and if possible relate these two parameters. Were Junge-type size distributions representative of the measured particle size distributions?

3.3 Mass-specific SPM absorption coefficient at 40 nm up to 4,6 m2/g: can you explain such high value? Has it been already reported in the literature?

4.1 Lines 25-30: the assumption of a negligible light absorption in the NIR (here 715 nm) is also a potential source of error (e.g., see Estapa et al. 2012, Rottgers et al. 2014). Please discuss this issue in more details.

4.1 Lines 5-10: Assuming such larges errors (>50%) on particle-related IOPs and mass-specific optical coefficients, the objective should be first to minimize these errors before analysing the results. Can you propose solutions for more accurate measurements?

4.4 ‘In summary, our results indicate that size (chemical composition) of suspended particulates has a major influence on spatial variability of SPM mass-specific scattering (absorption) coefficients in SLE-SF waters.’ Interesting but not really a new finding.

5. Rather short conclusions as there is not many striking results presented in this study. Predicting mass-specific IOPs based on satellite remote sensing measurements is only a perspective.