

## ***Interactive comment on “Tracing the sources of dissolved organic carbon occurring in a coastal bay surrounded by heavily industrialized cities using stable carbon isotopes” by Shin-Ah Lee et al.***

### **Anonymous Referee #2**

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Review of bg-2019-229 Authors use DOM fluorescence,  $\delta^{13}\text{C}$  ratios, and C:N ratios in an attempt to apportion sources of DOM to Masan Bay, near a heavily industrialized region of Korea. Two samplings were conducted in 2011 and again 2016, axial transects along the bay. Results are presented largely as geospatial plots of parameters and against salinity in a binary conservative mixing focused analysis. Over these 2 samplings, 3 groups of DOM were identified by visual inspection of plots against salinity. Discussion delves in to mixing and potential inclusion of non-conservative sources and concludes that an urban influence was not definable and that local primary production

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likely explained the general non-conservative behavior of  $\delta^{13}\text{C}$  and C:N whereas humic fluorescence was largely conservative. The topic of the manuscript is relevant for BGD but the data presentation and analysis need work. The data are certainly interesting and comprised of measurements that are now being combined to understand better the sources and cycling of DOM in coastal waters beyond any one or two of these measurements alone. So the data are solid and appear to provide some insight into this particular region. I have the following suggestions the authors might consider to improve the manuscript. Title – Barring any new insight from further data analysis, it is misleading to have “heavy industrialized cities” in the title. There is no evidence provided and discussed that an urbanization effect was found, only speculation. I think further work is needed on this argument for urban inputs. Writing – overall the writing is good but there are many awkward or unclear phrasings which should be revised to improve readability and clarity. Figure 2 and 3 would benefit from a border around each panel (map) in each figure. \*\*Overall I thought the figures were very good. Data analysis would be improved by biplots beyond property vs salinity. For example, the classic  $\delta^{13}\text{C}$  vs C:N plot could be done (see Lamb, A. L., Wilson, G. P., & Leng, M. J. (2006). A review of coastal palaeoclimate and relative sea-level reconstructions using  $\delta^{13}\text{C}$  and C/N ratios in organic material. *Earth-Science Reviews*, 75(1-4), 29-57.) to clarify a key uncertainty in the manuscript which is determining inputs of urban runoff DOM vs in-situ generation of phytoplankton DOM. One could imagine  $\delta^{13}\text{C}$  vs FDOMp biplot may elucidate the urban source. Specific comments (line number indicated): L60 – Phytoplankton  $\delta^{13}\text{C}$  values are based on the value of the C they fix; the range specified is for marine phytoplankton. This point should be clarified and considered in lieu of the production in the estuary. L75 – Sentence should be the concluding sentence of the preceding paragraph or otherwise this point should be expanded upon. For example, has there been no prior work on DOM in the region? What are the probable sources of urban DOM that could confound a simple binary mixing analysis? L84 – From satellite imagery, it appears this bay is in a mountainous region, but are there any salt marsh inputs to the bay? This is important because of the effect that C4 plants

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such as *Spartina* might have on DOM inputs. L103 – I am confused by DIN as “inorganic nutrients”. First, no nutrient data are shown. Second, DIN typically refers to dissolved inorganic nitrogen (sum of  $\text{NH}_4^+$ ,  $\text{NO}_2^-/\text{NO}_3^-$ ). Please clarify. L112 – “qualitatively” instead of “entirely” L136 – equivalents NOTE: More information is needed about the PARAFAC analysis; split-half validated spectra; Plots of the components and distribution of components across stations. Please test the components against the OpenFluor database for matches with other coastal waters. Otherwise does it matter to do PARAFAC? What do BIX and HIX and other derived parameters from fluorescence provide that might obviate the need for PARAFAC? L149: give values when specifying these maxima and minima L156: EEM “PARAFAC” analyses L174: By how much does the freshwater end member vary in its DOC concentration? A freshwater input at 300  $\mu\text{M}$  DOC could produce conservative mixing patterns (just freshwater and seawater mixing) with a changing freshwater end member value. L177: Explain what is meant here in more detail L180: Seems to argue for multicomponent mixing models L182: Please clarify the evidence for this L188: period missing or otherwise this needs revising to clarify L196: what does “relatively well” mean? Please be specific. Only 2 points fall on the mixing line. L197: -34‰ – is this meant to be terrestrial? It is too depleted a value without some reference to the riverine input or other terrestrial runoff. However, it is possible to be riverine or estuarine phytoplankton with DIC values <-5‰. L215: This is not convincing and the implications of urbanization need to be thought through some more. I would perhaps argue that phytoplankton DOM, enabled by nutrient runoff from land, is the major effect on DOM rather than specifying some non-quantifiable (i.e., according to the manuscript, the data do not exist) urbanized DOM input. L218: Are these tidal creeks with marsh/wetland habitat? How much DOM do they export? L233: What does “natural level” mean? L245-247: Why?? Support this final point; I don’t understand how the authors arrive at this conclusion. L251: high and lower than what? L253: This is not correct; refractory nature of DOM cannot be determined by C:N ratios L266: This statement is very clear and summarizes what should be made clearer in the discussion. Tie together these points in the Discussion and the manuscript will be

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far more convincing based on the results. I think this is where the biplots I mention above could be very useful. L267: Unclear; please explain in the discussion how the island can influence DOM. L272: I don’t understand this last statement in context of this study. Please revise.

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