Response to review

Respect Anonymous Referee #2

We want to begin by thanking Referee #2 for writing that "I think that the paper adds novel information to our knowledge of the Se cycle." We are extremely grateful for his/her insightful advice and elaborate revisions of the manuscript. We addressed all the points raised by the referee, as summarized below.

General Comments:

Overall, I think that the paper adds novel information to our knowledge of the Se cycle. However, it has largely a descriptive character, which could be changed by coming up with a number of hypotheses that can be tested with the data. Moreover, the original results are shown in too much detail, which obscures the general findings. I suggest to come up with figures that combine the results from several or all studied locations and move the original data to the supplementary information. As already indicated in my preliminary review, the paper suffers from a number (of minor) technical problems. It should be strictly structured according to the objectives, which is not the case in the introduction where the state-of-the-art concerning Objective 3 is not introduced. It is also not the case in the discussion and conclusion sections. The discussion sections includes results referring to Figs. 7 and 8, which need to be moved to the results section. Finally, the manuscript should be shortened, e.g., by moving all content that is mainly of local interest to the supplementary information.

Response: Thanks for the great advice. We have carefully revised the manuscripts based on the comments.

We have come up three hypotheses, 1) the DOSe is the major species in those peatland- draining rivers; 2) the source of DOSe probably is peat soils and 3) Large amounts of TDSe from peatland-draining rivers were delivered to the coastal water. Those hypotheses were tested with data, as shown in results 3.2 and discussion 4.1, DOSe/TDSe ratios ranged from 0.56 to 0.99, indicating that DOSe was the major species of Se in the peat-draining rivers and estuaries (Fig. 2). The relationship between DOSe and HIX, humic-like CDOM components, $S_{275-295}$ and $SUVA_{254}$ (Fig. 4, Fig 5) indicating that peat soils is inferred to be the major source of DOSe in our sampled rivers and DOSe may be associated with with high-molecular-weight and highly humic substances. These was demonstrated in results 3.4 and discussion 4.2. The TDSe flux was estimated in the discussion 4.3. The results showed that TDSe delivered from Rajang were less than those large rivers, but exceeded other small rivers reported so far (Table 2). As for DOSe yields for Rajang and Maludam were one or even two orders of magnitude higher than other reported rivers so far (Table 2). This indicates that the numerous small blackwater rivers draining from peatland are very efficient TDSe and DOSe sources for the coastal waters.

We have deleted some details of the results and simplified the manuscripts. The result 3.1 to 3.3 were down sized from 145 to 84 lines for now, and the figures were downsized from nine to six by moving two original figures (Fig. 2 and 4) to supplementary, and we also have combed two original figures (Fig. 3 and 5) to one figure by presenting the three typical salinity-concentrations relationships (detailed response was shown in comment 17).

We have revised the objectives and reorganized the discussions according to the objectives. The three objectives were 1) evaluate the fate of Se species during estuarine mixing in peatland-draining estuaries; 2) characterize the DOSe fractions; and 3) estimate the magnitude of Se fluxes delivered from peatland-draining rivers to coastal ocean. The objective 2 (i.e. the original objective 3) is about the character of DOSe, which were added in the introduction (Lines 94 to 104, detailed response was shown in comment 11). The discussion sections were structured to three parts according to the objectives, as following: 4.1) Fate of Se species during estuarine mixing; 4.2) Character of the DOSe fractions; and 4.3) TDSe flux. The conclusion also reorganized to fit to the three objectives and an outlook, detail were shown in response 31.

We have moved Figs. 7 and 8 to the results in section “3.4 Correlation between Se species with DO, pH and DOM”, detail was shown in response 19.

The content that is mainly of local interest was moved to the supplementary information and the original detailed results was deleted. We have shorted the manuscripts from 1025 lines to 768 lines.

Comment 1. l. 25 and l. 52: Please be clear about which organisms really need Se. I know that mammals and humans need it. At the same time plants do not need Se. I am not familiar with marine organisms. Please specify, which marine organisms need Se. I would not have expected that Se is essential for phytoplankton (because it is not for plants). This question is important and should be clearly addressed.

Comment l. 54-67: About which organisms are you talking? This cannot be generalized!

Comment l.57-59: Please explain this hypothesis. Its understanding is related with my above criticsm, that there is no detailed explanation for which organisms Se is necessary and for which not.

Comment l. 68: Does phytoplankton really need Se?

Response: Similar comments were responded together.

Se is required for biosynthesis of selenocysteine, the twenty first naturally occurring amino acid in protein (Lobanov et al., 2009). As reviewed by Lobanov et al (2009), selenoproteins show a mosaic occurrence, with many organisms, such as vertebrates and algae, having dozens of these proteins, while other organisms, such as higher plants and fungi, having lost all selenoproteins during evolution.

Selenium is an essential microelement for all aquatic organisms-microorganisms, algae, higher aquatic plants and animals (Bodnar et al, 2014). In photosynthetic microorganisms, the essential requirement for selenium has been reported in 33 species belonging to six phyla (Table R1, Araie and Shiraiw, 2016). Price and Harrison (1988) found selenoproteins compounds (GSH-Px) in *Thalassiosira pseudonana* and confirmed obligate requirement for Se in marine diatom. When Se was added to the culture medium, growth was stimulated in the diatom *Thalassiosira pseudonana*, *Chysochromulina breviturrita* in Haptophyceae, the dinoflagellates *Gymnodinium catenatum* and *Alexandrium minutum*, and other algae (Table R1, Araie and Shiraiw, 2016). Studies showed that diatom (*Thalassiosira pseudonana, Chaetoceros*) cultures deprived of Se(IV) in seawater for more than 5 days did not recover even when Se(IV) was added afterwards (Harrison et al., 1988). The study concluded that it was more difficult for these Se-dependent microorganisms to recover after exposure to Se depletion than from exposure to nitrogen or phosphorus limitation. Similar results are found in Doblin et al. (1999) where three marine phytoplankton species (*Gymnodinium catenatum, Alexandrium minutum, Chaetoceros cf. tenuissimus*) showed rapid decline in Se deficient seawater, resulting in cessation of cell division after eight weeks of Se(IV) depletion. However, studies on the effect of selenite in the unicellular green alga *Chlamydomonas* *reinhardtii*, showed only a little simulative effect on growth (Novoselov et al; 2002). Marine phytoplankton show a stronger trend to a preference for Se than freshwater phytoplankton do (Araie and Shiraiw, 2016).

Geochemical analyses of trace elements in Phanerozoic marine pyrite that sustained periods of severe Se depletion in the past oceans correlate closely with three major mass extinction events, at the end of the Ordovician, Devonian and Triassic periods (Long et al., 2016). Considering the essential of Se for marine phytoplankton, the authors assumed that Se depletion may have been one of several factors in these complex extinction scenarios (Long et al., 2016).

We have changed to “Selenium (Se) is an essential micronutrient for aquatic organisms”, and “marine” have been added before phytoplankton in the manuscript.

Table R1. Phytoplankton species that were demonstrated to require selenium for their growth. [a]

Phylum	Species
Diatoms	*Amphiprora hyalina*
	Chaetoceros debilis
	Chaetoceros pelagicus
	Chaetoceros vixvisibilis
	Coscinodiscus asteromphalus
	Corethron criophilum
	Ditylum brightwellii
	Skeletonema costatum (strain 18c NEPCC)
	Skeletonema costatum (strain 611 NEPCC)
	Skeletonema costatum (strain 616 NEPCC)
	Stephanopyxis palmeriana
	Thalassiosira pseudonana
	Thalassiosira oceanica
	Thalassiosira rotula
	Thalassiosira aestivalis
Dinoflagellates	*Alexandrium minnutum*[b]
	Gymnodinium catenatum[b]
	Gymnodinium nagasakiense[b]
	Peridinium cinctum fa. *Westii*

	Pyrodinium bahamense[b]
Prymnesiophytes	*Chrysochromulina breviturrita*
	Chrysochromulina kappa
	Chrysochromulina brevefilum
	Chrysochromulina strobilus
	Chrysochromulina polylepis[b]
	Helladosphaera sp
	Emiliania huxleyi
	Gephyrocapsa oceanica
Raphidophytes	*Chattonella verruculosa*[b]
Chlorophytes	*Platymonas subcordiformis*
Chrysophytes	*Aureococcus anophagefferens*[b]

[a] Modified from Araie and Shiraiw, 2016

[b] Harmful algae.

Comment 2 l. 37: What do you mean by “extremely”? Add numbers.

Response: We have changed to “the concentrations of DISe were extremely low (near or below the detection limits, i.e. 0.0063 nmol L^{-1})”.

Comment 3 l. 47: I am not sure if the introduction of Se can generally promote productivity. This would only be possible, if Se was an essential nutrient for the considered organism. Furthermore, growth would only be promoted if Se was the limiting element, but other limitations are more likely (e.g., by P or Fe).

Response: The essential requirement for selenium has been reported in 33 species belonging to six phyla (Table R1, Araie and Shiraiw, 2016). The dominant phytoplankton species was diatom in Sarawak coasts (Saifullah et al., 2014). When Se was added to the culture medium, growth was stimulated for diatom, and when it cultures deprived of Se(IV) in seawater for more than 5 days did not recover even when Se(IV) was added afterwards (Harrison et al., 1988). Se-limiting for diatom growth were not found in the filed study, although a study in Huon Estuary found that low level Se could be limiting for growth and production of dinoflagellate (Doblin et al., 1999).

We are not sure whether Se could be a limiting element in the Malaysia coastal waters, thus we have deleted those sentence.

Comment 4 l. 48-49: I don't understand this conclusion. I would prefer a conclusions, which is derived from your results.

Response: Thanks. We have deleted the "The results of this study suggest that the impacts of Se discharges on coastal ecosystems should be evaluated in the future", and have changed to "The TDSe flux delivered by the peat-draining rivers exceeded other small rivers, and it is quantitatively more significant than previously thought".

Comment 5. l. 64: Why is "organic selenide" mentioned separately? It is included in the oxidation state –II.

Response: We have deleted the "organic selenide".

Comment 6 l. 88: What do you mean by "various", the previously cited studies? Perhaps better cite them again.

Response: We have cited the previously mentioned studies again.

Comment 7 l. 94: Do you mean that "Se speciation" was controlled?

Response: Yes, we have changed to "Chang et al. (2016) found that Se speciation was controlled by biological, physical, and redox processes in the estuaries".

Comment 8 l. 97: "formation" or "generation" instead of "regeneration

Response: We have changed to "generation of particulate organic selenide in the water."

Comment 9 l. 106: How does organic matter influence the bioavailability and fate of Se?

Response: We have revised the introduction greatly, and "It is also known that organic matter plays an important role in the bioavailability and fate of Se in the environment" was deleted.

Comment 10 l. 110: What do you mean by "behaviour"?

Response: We have deleted "the behavior", changed to "More studies of Se in fluvial systems in Southeast Asia are therefore needed"

Comment 11 l. 122: The third objective "falls from heaven".

Response: Thanks for the great advices. We have revised the introduction, and added the DOSe research (i.e. objective 2 in the revised manuscript) status as followed.

"In the high-latitude peatland-draining rivers, dissolved Se concentrations are spatial variable, with concentrations of up to 13 nmol L^{-1} being observed in northern Minnesota, US (Clausen and Brooks, 1983), from 0.38 to 5 nmol L^{-1} in the Krycklan catchment, Sweden (Lidman et al., 2011) and from 0.25 to 1.25 in the Siberian (Pokrovsky et al., 2018). Although these various studies did not report different species of Se (Clausen and Brooks, 1983; Lidman et al., 2011; Pokrovsky et al., 2018), the DOSe probably the dominated species in peatland-draining river. In the open ocean, DOSe was assumed mainly associate with soluble peptides with low molecule weight in surface waters and were relatively refractory (Cutter and Cutter, 1995; 2004). Substantial amounts of dissolved Se also are known to be associated humic substances, Gustafsson and Johnsson (1994) assumed that Se was preferentially incorporated into low molecular weight humic substances fractions by means of microbial reductive incorporation, while Kamei-Ishikawa et al. (2008) found that Se associated with high molecular weights humic acid fractions. The current paucity of information on DOSe characteristics and its export by rivers from tropical peat-draining rivers remains a major gap in our understanding of Se biogeochemical cycling. Highest concentrations of dissolved organic carbon (DOC) globally were reported in tropical peat-draining rivers in Borneo (Moore et al., 2013; Wit et al., 2015). More works of Se in the fluvial systems of this region are therefore needed to provide an improved understanding of the biogeochemical processing of Se and the associations with organic matter."

Comment 12 l. 176: Why did you remove the colloids from the seawater samples? Doesn't this result in a rather artificial experiment in which some chemical transformations that can occur in the environment are ruled out? Please explain. Furthermore, I suggest to come up with a hypothesis, e.g., pure mixing vs. chemical transformations (which?).

Response: Thanks for the advices. The research aim of this experiment is to evaluate the impact of particle-free (i.e. dissolved phase) seawater and river water mixing process on Se species, whether transformation of DISe between DOSe occurs along salinity gradient. Here, the filter (0.45 micrometer pore size) could retain a significant portion of colloids while only remove particles.

The results were shown in Fig. R1. The measured DISe, DOSe and TDSe concentrations were comparable with theoretical values, indicating pure mixing in Rajang estuary. However, in Maludam estuary, the measured DISe and TDSe concentrations were lower than the theoretical values, while the measured DOSe concentrations were comparable with the theoretical value. The losses of DISe were not balanced by increasing in DOSe, indicating that chemical transformations between DISe and DOSe did not occur in Maludam. Other studies have reported removal of the humic fractions of DOM, colloidal iron, and phosphorus by flocculation in the river–sea mixing zones (Eckert and Sholkovitz, 1976; Forsgren et al., 1996; Asmala et al., 2014). Some of the DISe may exist in colloidal form in natural water (Takayanagi and Wong, 1984), and DISe may be removed by flocculation. The removal of DISe were probably be flocculated to Se particulate form.

This mixing experiment indeed ruled out the impact of particle and part of colloids on the Se transformations. In the future, we would add another set of mixing experiment without filtration, particle-free and particle-included would be designed to the determine the influence of riverine particles and colloids on Se chemical cycling. Thus, considering the incompleteness, this section was deleted here.

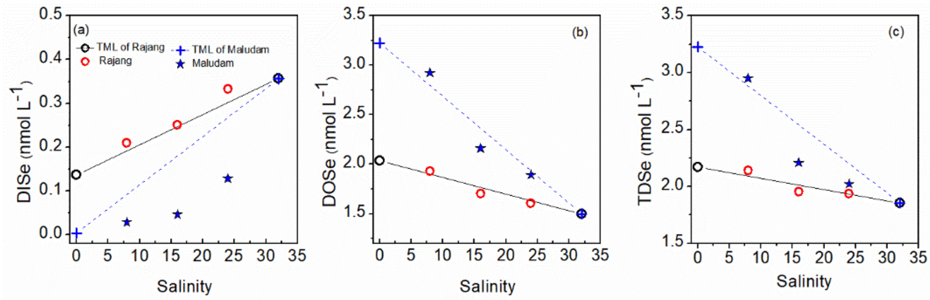

Fig. R1. Results of laboratory mixing experiments showing variation in DISe, DOSe, and TDSe concentrations as a function of salinity using filtered riverine water from the Rajang and Maludam rivers and filtered coastal seawater. TML refers to theoretical mixing line.

Comment 13. l. 210: Did you check for normal distribution and transform the data if necessary?

Response: We have checked the normal distribution, and if the data doesn't comply with the normal distribution, Mann Whitney U test were used instead of t-test.

Comment 14 l.214-235: I am a bit lost here. Perhaps, this can be concentrated to the information in aggregated form that is really necessary to understand the results, thereby shortening it.

Response: We have shorted the 3.1 section with main findings from 24 lines to 7 lines. The revised were followed:

"The water chemistry in the freshwater reach of the Maludam, Simunjan, and Sebuyau rivers are typical of blackwater rivers draining from peatland with acidic pH and low DO concentrations, and the mixing with coastal water increased the pH and DO (Table S1, Fig. S1). Values of pH and DO concentrations in the Sematan and Lundu, which drain mostly mineral soils, were higher than those in the blackwater rivers (Fig. S1). In the Rajang estuary, values of pH and DO were lower in the riverine side, especially in the distributaries where covered by the peat (Fig. S2)".

Comment 15 l 223 and 231: Shouldn't the numbers of the supplementary figures be switched (according to the sequence of their reference in the manuscript)?

Response: We have switched the numbers of the supplementary figures as their sequence in the context.

Comment 16 250-268: I suggest to show the results as bar diagram with error and indication of statistically significant difference instead of the current Fig. 2, which I suggest to move to the supplementary information.

Response: We have moved the current Fig. 2 to the supplementary information, and draw box plot of TDSe, DISe and DOSe concentration and DOSe/TDSe ratio in the sampled rivers and estuaries (Fig R2, i.e. Fig. 2 in the manuscript).

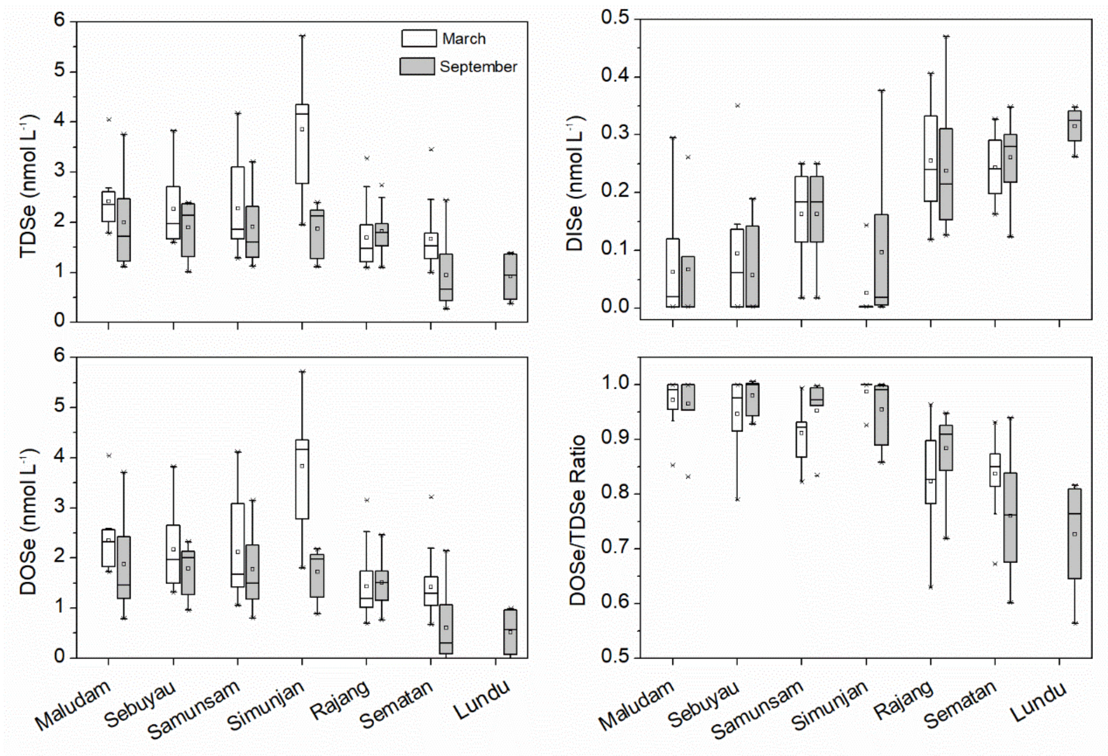

Figure R2 The box plot of TDSe, DISe and DOSe concentration and DOSe/TDSe ratio in the sampled rivers and estuaries in Malaysia in March and September 2017, respectively. In the plot of the upper panel, the ends of the box and the ends of the whiskers, and the line across each box represent the 25th and 75th percentiles, the fifth and 99th percentiles, and the median, respectively; the open square indicates the mean value.

Comment 17 l. 349-358: I suggest to combine the results of each of your three groups into a figure for the group instead of showing all individual results.

Response: We have merged Fig. 3 and Fig. 5 to one figure. Three typical groups of relationships between Se species and salinity were selected to present in Fig. R3 (i.e. Fig 3 in the manuscript), including Rajang, Maludam and Sematan estuaries (Fig. R3), and those for Sebuyau and Samunsam were moved to supplement (Fig. S5 in the supplementary).

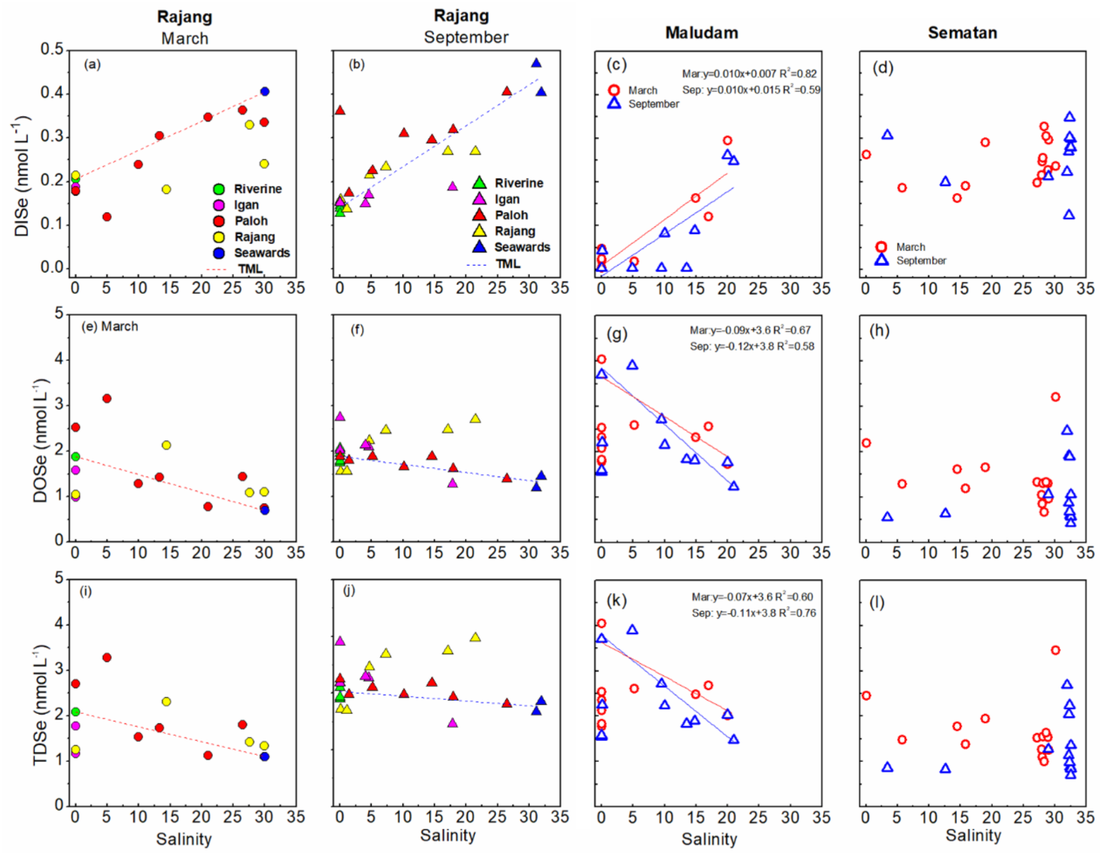

Fig. R3 Relationships between DISe (a - d), DOSe (e - h), and TDSe (i - l) concentrations with salinity in the Rajang and three Rajang tributaries (Igan, Lassa, and Rajang), and in the Maludam and Sematan estuaries in March and September 2017. TML refers to the theoretical mixing line, which was defined using two endmembers: freshwater in the riverine system and seawater.

Comment 18. l. 384ff: The Discussion section should be structured according to the three objectives into three parts. The objectives should be discussed as concisely as possible, i.e. the current discussion should be shortened.

Response: We have revised the objectives and reorganized the discussions according to the objectives. The discussion session was shorted from 280 lines to 152 lines.

The three objectives were 1) evaluate the fate of Se species during estuarine mixing in peatland-draining estuaries; 2) characterize the DOSe fractions; and 3) estimate the magnitude of Se fluxes delivered from peatland-draining rivers to coastal ocean. The discussion and conclusion sections were structured to three parts according to the objectives, as following: 4.1) Fate of

Se species during estuarine mixing; 4.2) Character of the DOSe fractions; and 4.3) TDSe flux.

Comment 19 l. 407-412: This belongs to the results.

Response: We have moved those to the results as section. "3.4 Correlation between Se species with DO, pH and DOM", as following:

"For the freshwaters ($S < 1$) of the studied rivers, DISe concentrations were positively correlated with the DO concentrations and pH values, and the DISe/DOSe ratio was negatively related to DOC concentration (data from Martin et al., 2018) (Fig R4a, R4b; i.e. Fig. 4 in the manuscript) DOSe concentrations correlated positively with the humification index (HIX) and the sum of the humic-like chromophoric dissolved organic matter (CDOM components, C1, C2, C3, and C4) ($p < 0.05$) (data from Zhou et al., 2019) (Fig R4c, R4d; i.e. Fig. 4 in the manuscript).

In the Maludam Estuary, DOSe concentrations were negatively correlated with the CDOM spectral slope from 275 to 295 nm ($S_{275\text{-}295}$) and were positively correlated with the humic-like C3 component and specific UV absorbance at 254 nm ($SUVA_{254}$) during estuarine mixing in both seasons (data from Martin et al., 2018; Zhou et al., 2019) (Fig R5a-c; i.e. Fig. 5 in the manuscript). In addition, DOSe/DOC and DOSe/DISe ratios were negatively correlated with C2/C1 components ratios (Fig R5d; R5e; i.e. Fig. 5 in the manuscript)."

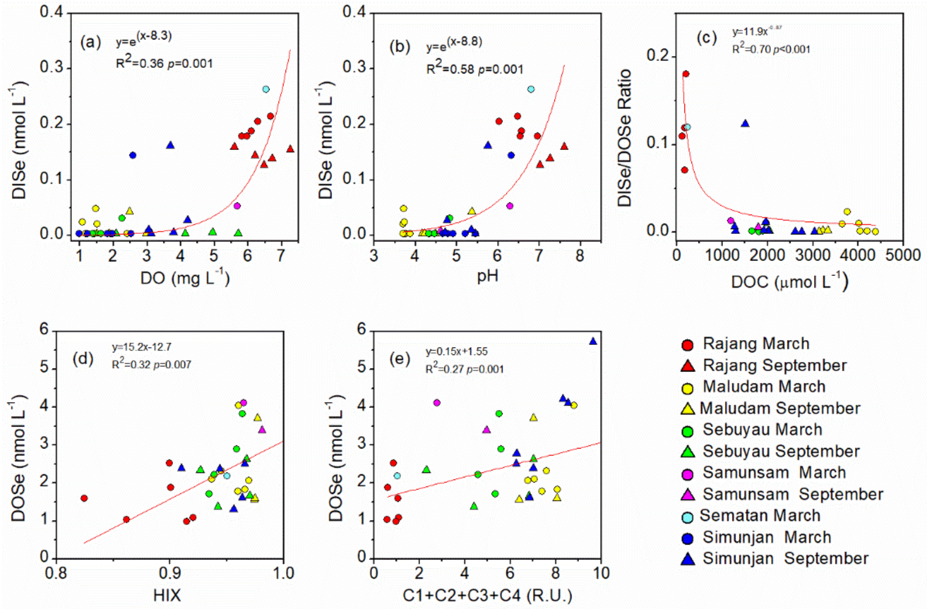

Figure R4. Relationships between (a, b) DISe concentrations and DO and pH values, (c) DISe/DOSe ratios and DOC concentration values, and (d–e) DOSe concentrations with the humification index (HIX) and the sum of humic-like CDOM components (C1, C2, C3, and C4) in freshwater (Salinity < 1) for the Rajang, Sematan, Maludam, Sebuyau, Samunsam, and Simunjan rivers in March and September. The HIX and C1, C2, C3, and C4 components are from Zhou et al. (2019) from the same cruises. DO concentrations and pH values were not available for the Sematan River for September, and the HIX and CDOM components were not available for the Rajang River for September.

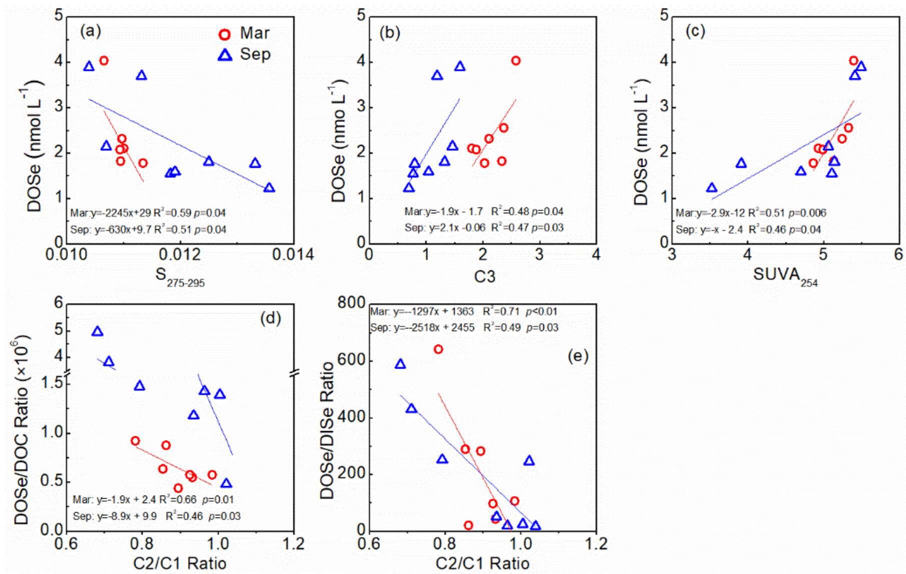

Figure R5. Relationships between DOSe concentrations and $S_{275\text{-}295}$, C3 components and $SUVA_{254}$, DOSe/DOC ratio and C2/C1 component ratios, and DOSe/DISe ratios and C2/C1 component ratios in the Rajang and Maludam estuaries. The $S_{275\text{-}295}$, $SUVA_{254}$, C1, C2, and C3 components are from Martin et al. (2018) and Zhou et al. (2019) from the same cruises.

Comment 20 l. 432-433:Why is this information important? I suggest to delete it.

Response: We have deleted the "Se sorption kinetics on humic acids can be expressed by a pseudo-second-order equation (Kamei-Ishikawa et al., 2007)."

Comment 21 l434-441: This is a repetition. Delete and focus on the important statement in l. 441-442.

Response: We have deleted the "The Maludam, Sebuyau, and Simunjan catchments are mainly peat, whereas the Samunsam River drains an extensive area of peatland in its upper reaches (Müller et al., 2016; Martin et al., 2018). The Rajang catchment is dominated by mineral soils, with peatland being found only in the delta surrounding the distributaries (Staub et al., 1994, 2000)"

Comment 22 l. 469: You can omit "as follows" and directly start with the numbered list.

Response: We have deleted the "as follows"

Comment 23 l. 479: Combine 4.1 and 4.2 as joint contribution to Objective 1.

Response: Thanks for the great advice. We have combined the 4.1 and 4.2 to "4.1 Fate of Se species during estuarine mixing", as joint of contribution to Objective 1.

Comment 24 l. 541/545: Isn't the Rhone forming a delta? Or don't you talk about the French Rhone?

Response: Thanks, it's the French Rhone, we have changed to Rhone delta.

Comment 25 l. 549: Skip this heading to avoid overstructuring.

Response: We have reorganized the discussion, skip the heading that mentioned.

Comment 26 l. 562: I am confused by the simultaneous use of delta and estuary, because I think that these are two contrasting geomorphological forms, mainly driven by the strength of the tide.

Response: We have unified the expression of estuary in the manuscripts to avoid confusion.

Comment 27 l. 563-573: I would move large parts of this and the associated figure to the results section.

Response: We have moved those to the results as section. “3.4 Correlation between Se species with DO, pH and DOM”, detailed response was shown in comment 19.

Comment 28 l. 588-589: The numbers should be subscripts.

Response: In the FDOM area, the C1 represents Component 1 that decomposed from the excitation-emission matrix. In the previous publications, C1 and C2 were widely used. For example, Table 1 in Osburn et al. (2012), Table 1 and Figure 2 in Dainard et al. (2015), there is no need to be subscripts.

Comment 29 l. 593-601: I would again move large parts of this and the associated figure to the results section.

Response: We have moved those to the results as section. “3.4 Correlation between Se species with DO, pH and DOM”, detailed response was shown in comment 19.

Comment 30. l. 622: Will photodegradation really be important in the dark DOM-rich waters? Possibly, it is restricted to the uppermost surface-near few mm.

Response: Martin et al (2018) found that DOM from the Rajang and Samunsam rivers was photolabile, with DOC and CDOM decreasing after sunlight exposure. In addition, the peatland-derived DOM probably has too short a residence time in rivers for significant photodegradation to occur in the rivers before it reaches the sea, thus the authors suggested that most photochemical transformations of tDOC in Sarawak likely take place after tDOC reaches the sea rather than inside the rivers and estuaries.

We have changed to “As suggested by Martin et al (2018) that most photochemical transformations of DOM in Sarawak likely take place after DOM reaches the sea. Thus, once transported to offshore, photodegradation plays an important role in DOSe processing, and DOSe might contain a significant photoreactive fraction that facilitates photodegradation of DOSe into lower mean molecular weights or gaseous Se or photomineralization to DISe.”

Comment 31 l. 665-678: The conclusions should fit to the objectives, i.e. there should be three main conclusions and perhaps a kind of outlook.

Response: Thanks for the great advices. We have revised the three objectives, were 1) evaluate the fate of Se species during estuarine mixing in peatland-draining estuaries; 2) characterize the DOSe fractions; and 3) estimate the magnitude of Se fluxes delivered from peatland-draining rivers to coastal ocean. The conclusions were reorganized to fit the objectives and have an outlook.

“To the best of our knowledge, this is the first study of seasonal variations in Se speciation in peat-draining rivers and estuaries in Southeast Asia.

Contrary to the results from studies elsewhere, DOSe, not DISe, was the major species in the peat-draining rivers and estuaries of Sarawak, Malaysia. Contrary to our expectations, reversed DISe concentration–salinity relationships were observed in those estuaries, indicating a marine origin, while DOSe concentrations decreased with salinity, indicating terrestrial sources. The DOSe fractions may be associated with high-molecular-weight peatland-derived aromatic and black carbon compounds and may photodegrade to more bioavailable forms once transported to oligotrophic coastal waters, where they may stimulate the growth of phytoplankton. The DOSe yields in the peatland-draining rivers were one or even two orders of magnitude higher than other reported rivers. The TDSe flux delivered by the exceeded other small rivers, and it is quantitatively more significant than previously thought. The impact of the sizable Se from increasing anthropogenic disturbing of peat to the ecosystem should be evaluated in the future”

Comment 32. l 678: See my previous comments to the role of Se for biological productivity.

Response: The detailed response was shown in comment 3. We have changed to “may stimulate the growth of phytoplankton”.

Comment 33 Figs. 3-5 show all individual results. I suggest to aggregate these data in a way that clearly illustrates your main points.

Response: We have moved Fig. 2 and Fig. 4 to the supplement, and Fig. 3 and Fig. 5 were merged to one figure. Three groups of the relationships between Se species and salinity were selected to present in Fig. 3, including Rajang, Maludam and Sematan estuaries (Fig. R3), and those for Sebuyau and Samunsam were moved to supplement.

Comment 34 Figs. 7 and 8 should be included in the Results section.

Response: We have moved those figures to the results in section. "3.4 Correlation between Se species with DO, pH and DOM". The detailed response was shown in comment 19, and figures were show as Fig R4 (i.e. Fig. 4 in the manuscript) and Fig R5 (i.e. Fig. 5 in the manuscript).

Reference:

Asmala, E., Bowers, D. G., Autio, R., Kaartokallio, H., and Thomas, D. N.: Qualitative changes of riverine dissolved organic matter at low salinities due to flocculation, Journal of Geophysical Research: Biogeosciences, 119, 1919-1933, 2014.

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Chang, Y., Zhang, J., Qu, J., Zhang, G., Zhang, A., and Zhang, R.: The behavior of dissolved inorganic selenium in the Changjiang Estuary, Journal of Marine Systems, 154, 110-121, 2016.

Clausen, J. C., and Brooks, K. N.: Quality of runoff from Minnesota peatlands: I. A Characterization, Water Resources Bulletin, 19, 769-772, 1983.

Cutter, G. A., and Cutter, L. S.: Behavior of dissolved antimony, arsenic, and selenium in the Atlantic Ocean, Marine Chemistry, 49, 295-306, 1995.

Cutter, G. A., and Cutter, L. S.: Selenium biogeochemistry in the San Francisco Bay estuary: changes in water column behavior, Estuarine Coastal & Shelf Science, 61, 463-476, 2004.

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