RC2: 'Comment on egusphere-2023-1641', Francisco Artigas, 16 Aug 2023

C1: Does the paper address relevant scientific questions within the scope of the journal?

The content fits under either Atmospheric Sciences, Biogeosciences, or Climate. It addresses salt marsh ecosystem vulnerability to rising sea levels via assessing carbon sink potential in a temperate salt marsh. It also addresses relevant questions regarding coastal wetlands, the carbon cycle, and the effect of micrometeorological parameters in net ecosystem exchange and net primary production of coastal wetlands.

We are grateful to Referee#2 for his positive feedback. Referee#2 highlighted the importance of our work concerning the assessment of the atmospheric CO_2 uptake capacity of salt marshes under changing environmental conditions and during tidal immersion. In blue carbon systems like salt marshes (coastal wetlands vulnerable to climate changes), it is needed to accurately measured net ecosystem CO_2 exchanges through long-term CO_2 flux timeseries to better understand the influence of biotic and abiotic controlling factors, especially water height levels, in order to include these coastal systems in global carbon budgets and predict future marsh carbon sinks.

C2: Does the paper present novel concepts, ideas, tools, or data?

It is novel in that it looks at inundation length as a potential indicator for future carbon sink loss due to rising sea levels. It is also interesting that the presence of succulent evergreens can maintain the carbon sink profile over the winter when most of the tidal marshes turn into sources. Using random forest models to fill gaps in the CO2 flux data is also a relatively new concept.

We are grateful to Referee#2 for his positive feedbacks on our manuscript. Referee#2 is right, although many studies have yet used the eddy covariance method to assess NEE fluxes over salt marshes, only a limited number have quantified the tidal effects on marsh CO_2 uptake. Moreover, the utilization of a random forest model to gap fill removed data is relatively new though adapted with atmospheric Eddy Covariance (EC) data (Bartolomeis et al., 2023; https://egusphere.copernicus.org/preprints/2023/egusphere-2023-1826/egusphere-2023-1826.pdf). Using an atmospheric EC system to measured continuously NEE fluxes, we highlighted an annual carbon sink mainly due to photosynthesis of the productive evergreen plants. Our study also provides relevant information on NEE fluxes during marsh immersion by decreasing daytime CO_2 uptake and night-time CO_2 emissions at the daily scale whereas the immersion did not affect the annual marsh C balance.

C3: Are the scientific methods and assumptions valid and clearly outlined?

The authors did a thorough literature review. The introduction is logically constructed, and the study's objectives are clear.

We are grateful to Referee#2 for his positive feedbacks on the introduction and literature review of our manuscript.

The study design raises some questions as there is a high percent cover of mud in the sampled area. The biofilm cover on these mud flats can occasionally act as sinks and are more susceptible to tidal fluctuation than vascular plants regarding carbon fixation. The mud effect and vegetation assemblage pattern should have more discussion. Is the study site representative of the Bossys perdus marsh? Would an area with significantly less mud flat cover give similar results?

The study site is representative of the Bossys perdus salt marsh characterized by a particularly complex assemblage of halophytic plants (*Halimione portulacoides*, *Spartina maritima* and *Suaeda vera*), mudflat areas and secondary channel networks as described in the submitted MS (p11, L299-305, Table 1) due to the site history in particular (see Referee#1 comment responses).

Referee#2 comment with regards to potential vascular plants *versus* mud areas relative contributions to EC measured CO_2 fluxes is entirely right and was already on our mind and reflexion. In the revised manuscript, we have more specifically studied these habitat effects (vascular plants *vs.* microphytobenthos) on NEE fluxes, through a new figure (Fig. 7) assessing spatial NEE variations according to each wind sectors, during emersion periods only and during daytime and night-time (see revised sections below). During emersion, we showed a low biofilm metabolism on muds (production and respiration) with lower daytime CO_2 uptake and lower night-time CO_2 emission than respective CO_2 fluxes coming from halophyle plants (Table 1 and Fig. 7). Moreover, in the revised manuscript, we discussed the mudflat's role in carbon fixation/emission under tidal influence and more generally, on the contribution of microphytobenthos on the coastal carbon cycle (see revised sections below).

Section 3.4. Influence of environmental drivers on temporal NEE variations (this paragraph was added in the revised MS)

p18, L435-447: "For wind directions, a spatial heterogeneity of NEE was recorded according to wind sectors both during daytime and night-time (Fig. 6-F). Within the footprint area composed of an assemblage of plants and muds (Fig. 2), the highest CO_2 uptakes were generally recorded from the Southern sectors (high vegetation:mud ratios) whereas, the lowest CO_2 uptakes were generally recorded from the Northern sectors (low vegetation:mud ratios; Fig. 7). For instance, our sectorial NEE analysis during daytime emersion showed that SSE sector (vegetation:mud ratio of 2.4; Table 1) uptaked 32% (winter), 25% (spring) and 50% (fall) times more atmospheric CO_2 than NNW sector (vegetation:mud ratio of 0.8; Table 1). Moreover, in winter and fall, we highlighted that CO_2 uptake rates of *H. portulacoides* (C3 specie) were significantly higher than *S. maritima* (C4 specie) ones by comparing SSE (60% of *H.*

portulacoides and 9% of *S. maritima*) and WSW (33% of *H. portulacoides* and 35% of *S. maritima*) sectors during daytime emersion (Mann-Whitney tests, $p < 0.0001$). To the contrary, in summer, no significant difference in NEE fluxes was recorded between these two sectors (Mann-Whitney test, $p = 0.06$; Fig. 7) and more generally, between the different wind sectors (Table 1 and Fig. 7). For all seasons, during night-time emersion, we recorded that Southern sectors (ESE, SSE and SSW) emitted higher atmospheric CO_2 than Northern sectors (NNE and ENE), especially in winter and fall (Table 1 and Fig. 7)."

Section 4.1. Marsh CO_2 uptake and influence of management practices (this paragraph was modified in the revised MS)

p26, L554-567: "Moreover, despite of a lower benthic metabolism (photosynthesis and respiration) of muds than evergreen plants (Fig. 7), the microphytobenthos which can developed on mudflats (27% of the footprint area) could also significantly contribute to marsh production during daytime emersion, as highlighted in our studied salt marsh where static chamber measurements performed in March 2023 at midday showed a CO_2 uptake to a non-vegetated mudflat (NEE mean of -2.92 µmol m^{-2} s^{-1}; unpublished results) and confirmed in an estuarine wetland in China (Xi et al., 2019). On an intertidal flat (France), EC measurements even showed a higher daily benthic metabolism with microphytobenthos (1.72 g C m^{-2} d^{-1}; September/October 2007) than with *Zostera noltii* (1.25 g C m^{-2} d^{-1}; July and September 2008), confirming the high biological productivity of mudflats (Polsenaere et al., 2012). Thus, the microphytobenthos could play a significant role in the atmospheric CO_2 uptake of salt marshes but also, more generally, in the carbon cycle of the coastal ocean because the resuspension of the microphytobenthos primary production during tidal immersion induce a large export of organic carbon from muds to coastal waters (up to 60% of the benthic primary production in a nearby tidal flat; Savelli et al., 2019). These fast-growing producers with high labile organic carbon could also be quickly degraded locally by microbial remineralization (Brouwer & Stal, 2001; Morelle et al., 2022) contrary to evergreen plants contributing to long-term "blue carbon" burial in sediments (Mcleod et al., 2011)."

C4: Are the results sufficient to support the interpretations and conclusions?

Mainly yes, although more than one year of data would be better.

We agree with Referee#2, more than one year of continuous EC data would be better. However, in this study, with solely the year 2020, we showed that (i) the temperate salt marsh was an annual carbon sink (-483 g C m^{-2} yr^{-1}) mainly due to photosynthesis of halophile evergreen plants, (ii) light and temperature are the main controlling factors of NEE fluxes at long and short timescales, (iii) tidal marsh immersion reduced daytime CO_2 uptake and night-time CO_2 emissions and (iiii) the tidal rhythm did not affect the annual net C balance of the studied salt marsh. We felt that a year's worth of continuous data was sufficient to meet our initial objectives and add new information to the scientific literature. As mentioned in the submitted discussion, the other years of EC measurements (especially, year 2021) will be used to study specific processes and marsh CO_2 fluxes in relationship with the aquatic compartment (Mayen et al., in prep.) and the soil compartment (Arnaud et al., submitted 2022). Please refer to the submitted

MS, in the section 4.4. salt marsh carbon budgets for future research perspectives (p27-28, L628-646).

Would an area with more vascular plant cover give the same results?

The NEE analysis according to wind directions on daytime emersion periods showed that wind sectors with a higher vegetation density (South sectors) uptaked more atmospheric CO_2 than wind sectors with a high mudflat density (North sectors). Thus, based on this sectoral analysis of fluxes, a marsh area with more vascular plant cover could have a higher CO_2 sink capacity due to a higher benthic production rate than benthic microalgae on muds (microphytobenthos). However, due to the specific assemblage of our studied marsh (halophytic plants, mudflats and channels; Table 1), it remains complex to accurately study these habitat effects (vascular plants *vs.* microphytobenthos) on NEE fluxes at the marsh scale and draw more general conclusions. Ongoing atmospheric CO_2 exchange measurements are actually carried out since January 2023 up north over the Aiguillon intertidal Bay (France) where we precisely deployed an EC station at the edge between the tidal mud flat on the West side and salt marsh habitats on the East side of the footprint along with benthic chamber flux and water, sediment, soil carbon measurements and satellite analysis at each season to specially address these questions on relative habitat (mudflat *versus* salt marshes) influence on atmospheric CO_2 exchanges (Polsenaere, personal communication).

In light of sea level rise, marshes may turn into mudflats and have little primary production potential. Assessing areas with significant mud cover without comparing them to more densely vegetated areas may falsely highlight mudflats as a “desirable management practice.”

We agree with Referee#2, it is important to assess the mudflat NEE fluxes on long-term series to better understand their capacity of net CO_2 uptake in intertidal systems such as salt marshes and tidal flats (Polsenaere et al., 2012; Savelli et al., 2019).

In our study, we showed a low benthic metabolism of mudflats during emersion with lower daytime CO_2 uptake than halophyle plants. With our EC approach, we did not directly show the role of mudflats in the metabolic fluxes of the marsh, since mudflats represents only 20% of the overall footprint and a maximum of 56% in the NNW sector. Moreover, microphytobenthos (fast-growing producers) is mostly constituted of labile organic carbon that could be quickly mineralised by heterotroph respiration locally whereas, evergreen pants (slow-growing producers) are mostly constituted of refractory organic carbon allowing significant long-term blue carbon burial. Thus, unlike microphytobenthos, a high density of vascular plants over salt marshes can be view of “desirable management practice” for carbon sequestration. In the revised manuscript, we discussed the mudflat’s role in carbon fixation/emission and more generally, on the contribution of microphytobenthos on the coastal carbon cycle (see comment C3 responses above).

To better discuss the microphytobenthos *versus* salt marsh habitat influence of NEE fluxes, we will also add to our revised discussion first results concerning ongoing EC measurements currently carried out on a nearby intertidal bay (Aiguillon intertidal, France), at the edge between the tidal mud flat (on the West side) and the salt marsh habitats (on the East side of the footprint) (see responses above).

C5: Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

Yes, indubitably! The settings of the EC tower, instrumentation, gap-filling methods, preprocessing, and post-processing are described well.

We are grateful to Referee#2 for his positive feedback on the description of our EC measurements (section 2.2), EC data processing and quality control (section 2.4), and flux gap filling (2.5). Supplementary information on gap-filling method of EC data are done in the answers of Referee#1.

The methods sections could be shortened since the methods and techniques used are well-established in the literature. In many cases, citing the original authors of the methods and techniques should suffice.

In the revised manuscript, we reduced and summarised the section on the EC theory in the beginning of the section 2.2. Eddy Covariance and micrometeorological measurements (see also reviewer#1's responses). The EC methods and techniques are well-established in terrestrial ecosystem (Aubinet et al., 1999; Baldocchi, 2003; Aubinet et al., 2012; Burba, 2021) but not enough yet in intertidal ecosystems like tidal bays and salt marshes. Supplementary clarifications of the EC methodology were then added in the revised manuscript (footprint estimation, displacement height calculation, time average of turbulent EC data, etc.; see also reviewer#1's responses).

Assumptions regarding water elevation and time of inundation may be challenging to replicate the way it occurred in this study.

In the revised manuscript, we moved the explanation of water elevation and time inundation in the footprint analysis section (see 2.3. from L205 to L217). Due to our one-location water height measurements, we know that there is an incertitude related to the immersion of wind sectors within the footprint area but this important consideration was taken into account in our interpretations and further specified in the revised manuscript (see also reviewer#1's responses).

C6: Do the authors properly credit related work and indicate their new/original contribution?

Yes, the literature review is thorough; all the relevant and current papers are cited.

We thank Referee#2 for his positive feedbacks on the literature review and on the highlighting on the original contribution of our manuscript.

C7: Does the title clearly reflect the contents of the paper?

Yes, I have no problem with the title.

We thank Referee#2 for his positive feedbacks on the title of our manuscript.

C8: Does the abstract provide a concise and complete summary?

The Abstract is sufficient to raise curiosity about the study and reflects the content well.

We thank Referee#2 for his positive feedbacks on the abstract of our manuscript.

C9: Is the overall presentation well-structured and clear? Is the language fluent and precise?

The narrative is manageable with mathematical expressions and jargon. The authors take care to spell out the methods succinctly and efficiently.

We thank Referee#2 for his positive feedbacks on the overall presentation of our manuscript (structure, language, methods, etc).

The word immerged is used many times and needs to be checked. The correct word should be immersed.

In our revised manuscript, we replaced the word "immerged" by the word "immersed".

C10: Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

Yes, the representation is unambiguous and well-explained.

We thank Referee#2 for his positive feedbacks on the representation of mathematical formulae, symbols, abbreviations, and unit in our manuscript.

C11: Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

The colors of Figure 2 are hard to read in the legend. Patterns rather than colors better distinguish the plant species and cover types.

We have decided to retain the colours shown in Figure 2, as we believe they are sufficiently visible to be easily distinguished. However, we added additional pictures of different wind sectors in figure 2 to better visualize the plant species and cover types.

Figure 3 – The X-axis needs to be more legible

In the revised manuscript, x-axis of the figure 3 was modified to be more legible.

Figure 6 is the most crucial in the paper and needs to be better presented. It needs to be clearer and more readable. Clarify what the X values represent in this figure.

Referee#2 is right, figure 6 is important in our study to assess the influence of meteorological and hydrological drivers on NEE fluxes within five PAR groups. In the revised manuscript, x-axis of the figure 6 were modified and we have made significant efforts to better clarify this figure. Moreover, in this figure, we replaced RH by VPD (see Referee#1's response; Fig. 7-B).

The study area is diverse and mudflat covers a significant percent of the study area, especially in the ESE and WNW sections. Regarding the mudflat's role in carbon fixation/emission, it would be revealing how these areas compare to the more densely vegetated areas.

Referee#2 is right (see responses above), our studied salt marsh in terms of habitats in particular is diverse and complex, whose 27% of the studied footprint area was composed of mudflats. According to the land-use map, the highest mudflat covers are in the WNW (56%) and ENE (37%) wind sectors (Table 1; Fig. 2).

We agree with Referee#2, it is important to assess the metabolic fluxes of mudflats to better understand their CO_2 uptake capacity in intertidal systems such as salt marshes (see responses above). In the revised manuscript, the spatial NEE analysis according to wind directions during emersion periods showed that, generally, wind sectors with a high vegetation density (South sectors) uptaked and emitted more atmospheric CO_2 during daytime and night-time, respectively, than wind sectors with a high mudflat density (North sectors; Table 1 and Fig. 7). Thus, based on this sectoral analysis of NEE fluxes, mudflats areas on the Bossys perdus salt marsh could have a lower benthic metabolism in terms of production and respiration in comparison with more densely vegetated areas (Fig. 7). Moreover, in winter and fall at emersion, we highlighted significant higher CO_2 uptake rates of *H. portulacoides* than *S. maritima* whereas in summer, no significant difference was recorded between these two species. This seasonal difference could be related to the plant phenology with *H. portulacoides* as evergreen plant throughout the year whereas, the growing season for *S. maritima* was shorter associated with a flowering period only from August to October. In the revised MS, we discussed more the mudflat's role in carbon fixation/emission in comparison with the marsh plant metabolism at emersion (see revised sections below).

Section 3.4. Influence of environmental drivers on temporal NEE variations (this paragraph was added in the revised MS)

p18, L435-447: "For wind directions, a spatial heterogeneity of NEE was recorded according to wind sectors both during daytime and night-time (Fig. 6-F). Within the footprint area composed of an assemblage of plants and muds (Fig. 2), the highest CO_2 uptakes were generally recorded from the Southern sectors (high vegetation:mud ratios) whereas, the lowest CO_2 uptakes were generally recorded from the Northern sectors (low vegetation:mud ratios; Fig. 7). For instance, our sectorial NEE analysis during daytime emersion showed that SSE sector (vegetation:mud ratio of 2.4; Table 1) uptaked 32% (winter), 25% (spring) and 50% (fall) times more atmospheric CO_2 than NNW sector (vegetation:mud ratio of 0.8; Table 1). Moreover, in winter and fall, we highlighted that CO_2 uptake rates of *H. portulacoides* (C3 specie) were significantly higher than *S. maritima* (C4 specie) ones by comparing SSE (60% of *H. portulacoides* and 9% of *S. maritima*) and WSW (33% of *H. portulacoides* and 35% of *S. maritima*) sectors during daytime emersion (Mann-Whitney tests, $p < 0.0001$). To the contrary, in summer, no significant difference in NEE fluxes was recorded between these two sectors (Mann-Whitney test, $p = 0.06$; Fig. 7) and more generally, between the different wind sectors (Table 1 and Fig. 7). For all seasons, during night-time emersion, we recorded that Southern sectors (ESE, SSE and SSW) emitted higher atmospheric CO_2 than Northern sectors (NNE and ENE), especially in winter and fall (Table 1 and Fig. 7)."

Section 4.1. Marsh CO_2 uptake and influence of management practices (this paragraph was modified in the revised MS)

p26, L554-567: "Moreover, despite of a lower benthic metabolism (photosynthesis and respiration) of muds than evergreen plants (Fig. 7), the microphytobenthos which can developed on mudflats (27% of the footprint area) could also significantly contribute to marsh production during daytime emersion, as highlighted in our studied salt marsh where static chamber measurements performed in March 2023 at midday showed a CO_2 uptake to a non-vegetated mudflat (NEE mean of -2.92 µmol m^{-2} s^{-1}; unpublished results) and confirmed in an estuarine wetland in China (Xi et al., 2019). On an intertidal flat (France), EC measurements even showed a higher daily benthic metabolism with microphytobenthos (1.72 g C m^{-2} d^{-1}; September/October 2007) than with *Zostera noltii* (1.25 g C m^{-2} d^{-1}; July and September 2008), confirming the high biological productivity of mudflats (Polsenaere et al., 2012). Thus, the microphytobenthos could play a significant role in the atmospheric CO_2 uptake of salt marshes but also, more generally, in the carbon cycle of the coastal ocean because the resuspension of the microphytobenthos primary production during tidal immersion induce a large export of organic carbon from muds to coastal waters (up to 60% of the benthic primary production in a nearby tidal flat; Savelli et al., 2019). These fast-growing producers with high labile organic carbon could also be quickly degraded locally by microbial remineralization (Brouwer & Stal, 2001; Morelle et al., 2022) contrary to evergreen plants contributing to long-term "blue carbon" burial in sediments (Mcleod et al., 2011)."

Section 4.2. Metabolism processes and controlling factors at multiple timescales (this paragraph was modified in the revised MS)

p26-27, L574-581: "In our studied marsh, the halophyle vegetation, mostly composed of evergreen species, was autotrophic throughout the year allowing a net C uptake from the atmosphere during both the growing and non-growing seasons (between 9 g C m^{-2} in December and 73 g C m^{-2} in July) whereas, the senescence of smooth cordgrass plants in some salt marshes (*S. alterniflora* and *S. cynosuroides* for instance) from October produced a marsh heterotrophy and a net C source to the atmosphere in winter and fall (Schafer et al., 2014; Artigas et al. 2015; Forbrich et al., 2018). In our case, *S. maritima* is a perennial specie with a relatively short growing period, thus during winter and fall, the benthic metabolism of this halophytic plant could have a significant lower influence on marsh C uptake than *H. portulacoides* and *S. vera*."

I would welcome an assessment of the different cover types in the discussion. As Figure 2 and Table 1 show, wind direction is a sound basis for differentiating between the different mixture ratios of mud: water: vegetation – Figure 6E should be discussed in light of the numbers represented in Table 1.

In the revised manuscript, accordingly, we now present a sectorial analysis of NEE fluxes during daytime and night-time emersions (see figure 7 in the revised MS) to compare metabolic fluxes between high density plant areas (high plant:mud ratio) and high-density mudflat areas (low plant:mud ratio). Please refer to responses below (see sections 3.4. and 4.1. in the revised MS).

Also, it would be exciting to look at the plants in terms of C3, C4, or CAM and see if this affects their respective carbon assimilation rates.

In the revised MS, we added the metabolic pathways of our plants in term of C3 and C4 and discussed if this affect their carbon assimilation rates (see revised sections below).

Section 2.1. Study site (this paragraph was modified in the revised MS)

p6, L134-139: "The marsh vegetation assemblage was mainly composed by three halophytic species as perennial plants (*Halimione portulacoides*, *Spartina maritima* and *Suaeda vera*; Fig. 2) that associated with different metabolic pathways (the C3-type photosynthesis for *H. portulacoides* and *S. vera* and the C4-type photosynthesis for *S. maritima*; Duarte et al., 2013, 2014). Whereas *H. portulacoides* and *S. vera* are evergreen plants throughout the year, the growing season for *S. maritima* was shorter (from spring) with a flowering period between August and October (plants persist only in the form of rhizomes in winter and fall; Gernigon, personal communication)."

Section 3.4. Influence of environmental drivers on temporal NEE variations (these sentences were added in the revised MS)

p18, L441-447: "Moreover, in winter and fall, we highlighted that CO_2 uptake rates of *H. portulacoides* (C3 specie) were significantly higher than *S. maritima* (C4 specie) ones by comparing SSE (60% of *H. portulacoides* and 9% of *S. maritima*) and WSW (33% of *H. portulacoides* and 35% of *S. maritima*) sectors during daytime emersion (Mann-Whitney tests, $p < 0.0001$). To the contrary, in summer, no significant difference in NEE fluxes was recorded between these two sectors (Mann-Whitney test, $p = 0.06$; Fig. 7) and more generally, between the different wind sectors (Table 1 and Fig. 7). For all seasons, during night-time emersion, we recorded that Southern sectors (ESE, SSE and SSW) emitted higher atmospheric CO_2 than Northern sectors (NNE and ENE), especially in winter and fall (Table 1 and Fig. 7)."

Section 4.1. Marsh CO_2 uptake and influence of management practices (this paragraph was added in the revised MS)

p26, L547-553: "In salt marshes *H. portulacoides* (C3 specie) have high ability to acclimation to temperature variations and elevated CO_2, contrarily to *S. maritima* (C4 specie; Sousa et al., 2010). Indeed, increasing atmospheric CO_2 concentrations (from 380 to 760 ppm) produced an improvement of the light harvesting mechanisms and photosynthetic efficiency for C3 species whereas, negative impacts on photosynthetic ability of C4 species were recorded through photochemical and oxidative stress (Duarte et al., 2014). Thus, under future environmental conditions, the continuous atmospheric CO_2 increases due to human activities will favour the development of C3 species to the detriment of C4 species."

Section 4.2. Metabolism processes and controlling factors at multiple timescales (this paragraph was modified in the revised MS)

p26-27, L574-581: "In our studied marsh, the halophyle vegetation, mostly composed of evergreen species, was autotrophic throughout the year allowing a net C uptake from the atmosphere during both the growing and non-growing seasons (between 9 g C m^{-2} in December and 73 g C m^{-2} in July) whereas, the senescence of smooth cordgrass plants in some salt marshes (*S. alterniflora* and *S. cynosuroides* for instance) from October produced a marsh heterotrophy and a net C source to the atmosphere in winter and fall (Schafer et al., 2014; Artigas et al. 2015; Forbrich et al., 2018). In our case, *S. maritima* is a perennial specie with a relatively short growing period, thus during winter and fall, the benthic metabolism of this halophytic plant could have a significant lower influence on marsh C uptake than *H. portulacoides* and *S. vera*."

I would also welcome more discussion regarding the fact that the marsh – according to the data – remains a carbon sink over the winter month and what the expectations would be when the marsh is fully restored to its natural state.

The Bossys perdus salt marsh is not under on-going restoration. For several centuries, it was used for salt farming and oyster farming but since 1981, the salt marsh is protected within the maritime part of the national natural reserve (NNR) with natural site hydrodynamics and marsh halophile vegetation preservation without major restoration work here (see Referee#1 comment responses). We modified our revised manuscript (see the revised section below) to give readers a better understanding of the history of the site and its current management practice.

Section 2.1. Study site (this paragraph was modified in the revised MS)

p4, L109-115: "The study was conducted at the Bossys perdus salt marsh situated along the French Atlantic coast on Ré Island (Fig. 1). It corresponds to a vegetated intertidal area of 52.5 ha that has been protected inside the National Natural Reserve (NNR) (Fig. 1). Between the 17th and 20th centuries, the salt marsh has experienced successive periods of intensive land-use (salt harvesting, oyster farming) and returns to natural conditions before becoming a permanent part of the NNR since 1981 for the biodiversity protection without major marsh restoration work (Gernigon, personal communication). It is currently managed to restore its natural hydrodynamics while conserving the site's specific typology due to past human activities (channel network, humps and dykes; Fig. 2)."

As suggested by Referee#2's comment, we further discussed the capacity of our halophytic vegetation to keep an atmospheric carbon sink over the winter month. Thus, in the revised manuscript, we discussed that our evergreen vegetation in the Bossys perdus salt marsh was mainly autotrophic throughout the year allowing a net CO_2 uptake during both the growing and non-growing seasons whereas the smooth cordgrasses as *S. alterniflora* in some tidal salt marshes was heterotrophic during winter and fall due to the plant senescence, producing, in turn, atmospheric CO_2 emissions during these periods of the year. However, the CO_2 sink in winter was mainly provided by the benthic metabolism of *H. portulacoides* rather than one of *S. maritima* due to its low growth activity during this period. Please refer to responses and revised sections above

C12: Are the number and quality of references appropriate?

Yes, it is well-balanced.

We thank Referee#2 for his positive feedbacks on the literature review in our manuscript.

C13: Is the amount and quality of supplementary material appropriate?

Yes, it is adequate for the study.

We are grateful to Referee#2 for his positive feedbacks on the supplementary materials of our manuscript.