Reply to reviewer #1:

General comments:

In this study, the authors analyse the alongshore coastal current intraseasonal variability and associated hydrodynamic and biogeochemical changes at 12S off the coast of Peru using in-situ measurements acquired during the mars-July 2017 shipboard sampling program. The manuscript shows some interesting results. It allows documenting the alongshore circulation during the propagation of a downwelling CTW mode 1 using real observations. The results are in agreement with recent modelling studies carried out over a longer period of time. Also, they look at the effect of the intensified poleward flow on the coastal hydrological and biogeochemical ocean properties. The major weakness of the paper is that the authors can't extract the intraseasonal variations from the interannual/seasonal variations using the ship measurements making the interpretation of the results more difficult. I would advise the authors to provide a more throughout discussion of their results using remote sensed data (when possible). Also, having a model study will back up their hypothesis. Finally, one additional issue is that the manuscript is sloppily written (sometimes hard to get the sense), with clumsy wording and need proper editing. I will try to give some examples of this below. I will suggest to proof-read the manuscript by a native English speaker. Also, the figures are of good quality but the captions need to be reworked. Sentences in the captions are too long and some basics information are missing (full dates, units etc...). Overall, I find the manuscript worthy for publication in Ocean Science, after a major revision. Please find below a list of comments followed the flow of the text, that the authors should address in the revised manuscript.

We would like to thank reviewer #1 for his/her critical review of our manuscript as well as the corrections and suggestions to improve the manuscript. We believe to have significantly improved the revised version of the manuscript upon his/her remarks and suggestions.

As detailed below, major changes in the revised version include a detailed analysis of the wind forcing and sea level anomaly using satellite observations, a rewritten introduction, a more throughout discussion of the results and a better reasoning as far biogeochemical processes are concerned. We also corrected sloppy wording and figure captions.

In our detailed response below, comments by the reviewer are in bold letters and changes in the manuscript are expressed in italic letter.

Specific/technical comments:

1) In the Abstract, what is meant by less fixed nitrogen loss? I am not a biogeochemist and so I might misinterpret what is saying here but in reading this part

of the paper (and also the conclusion), I got the impression that the change in Nitrate was driven by changes in the rate biogeochemical processes. But, later on (in reading the results and the discussion), this does not appear to be the case?

Thank you for pointing this out. Indeed, the increase in nitrate is not due to changes in the rate of biogeochemical processes but due to the shortened residence time of the water masses in the Peruvian Upwelling System (PUS). The shortened residence time in turn is due to increased alongshore advection of the water masses within the Peru-Chile Undercurrent. We have reformulated the abstract and explain this in more detail later in the manuscript to be more clear about this result. The abstract now reads

An intensified poleward flow increases water mass advection from the equatorial current system to the study site. The impact of the elevated advection was mostly noticed in the nitrogen cycle. Shorter transit times between the equator and the coast off central Peru led to a strong increase in nitrate concentrations, less fixed nitrogen loss to N_2*, and a decrease in the nitrogen deficit.*

2) l21-22: The introduction could be better structured and clearer. As an example try to define Peru Upwelling System (PUS) at the beginning of your introduction.

Thank you. We now define the Peru Upwelling System at the beginning of the introduction. Additionally, we restructured the introduction at several places to improve its clarity. The introduction now starts as

The Peruvian Upwelling System (PUS) is one of the biologically most productive regions in the world's ocean resulting in economically important fish catches (e.g. Carr, 2002; Chavez et al., 2008). Located in the Eastern Tropical South Pacific (ETSP), the high surface productivity of the PUS is most pronounced within 100 km off the Peruvian coast between 4 and 16° S (Pennington et al., 2006).

3) l22: Fig1: Too many details. Simplify to highlight only the surface and subsurface current mentioned in the text.

Agreed, we removed from figure 1 currents not mentioned in the text.

4) l34, l52: Be careful when defining acronyms to put the initial letter of each word in Capital. Re-check all over the manuscript.

Thank you, we have changed the spelling of words when introducing acronyms according to the suggestions.

Located in the Eastern Tropical South Pacific (ETSP), the high surface productivity … (Note that this acronym is now defined in the first paragraph due to the restructuring of the introduction.)

5) l48, l65, l168: timescales (try to be consistent over the manuscript)

Thank you for pointing out the inconsistent spelling. We changed *time scales* to *timescales* throughout the manuscript.

6) l50-53: Explain more how local wind modulate the intraseasonal variability (upwelling intensity, local CTW..)

Thank you, we agree with your comment and added a paragraph to the introduction explaining how local wind variability leads to variability of the PCUC. We also added a detailed analysis of local and remote wind forcing to the manuscript as suggested in your later comments. In the introduction we now state:

Intraseasonal variability of the eastern boundary circulation is either forced locally by changes of the wind system above the PUS or forced remotely by variability of the wind system at the equator. Strengthening (weakening) of the local alongshore winds causes intensified (reduced) Ekman divergence close to the coast that accelerates (decelerates) the coastal surface jet (e.g. Philander and Yonn, 1982; Yoon and Philander, 1982; McCreary et al., 1987; Fennel et al., 2012). At the same time, Coastal Trapped Waves (CTWs) are excited propagating poleward to set up an alongshore pressure gradient balancing the accelerating (decelerating) alongshore flow (Yoon and Philander, 1982). Due to differences in vertical structure of the surface jet and the excited CTWs, the poleward flowing PCUC accelerates (decelerates). Likewise, variability of local wind stress curl forces variability of the poleward undercurrent through enhancing or reducing Sverdrup transport in the eastern boundary current regime (e.g. McCreary and Chao, 1985; Marchesiello et al., 2003; Junker et al., 2015; Klenz et al., 2018). Local wind-forced variability of eastern boundary poleward undercurrents has been reported from the Californian, Mauritanian and Benguela eastern boundary upwelling regions on time scales from intraseasonal to seasonal (e.g. Allen and Smith, 1981; Marchesiello et al., 2003; Junker et al., 2015; Klenz et al., 2018).

7) l52: Coastal Trapped Waves (CTW). Also, be consistent over the manuscript on the use of CTW or CTWs

Thank you. We are now consistent in using CTW/CTWs over the manuscript.

8) l54: The sentence is incorrect, rephrase.

Indeed. We have rephrased the sentence ("Wind events in the equatorial Pacific can generate equatorial Kelvin waves that propagate eastward ") to

Variability of zonal winds in the equatorial Pacific forces equatorial Kelvin waves that propagate eastward.

9) l55: Not reflected but transmitted. "Upon reaching the continental margin, part of the EKW bounces back along the equatorial waveguide into westward propagating equatorial Rossby waves, while part of incoming energy is transmitted poleward along the southwestern coast of South America as CTW".

Yes, thank you. We have changed the sentence to

Upon reaching the continental margin, part of their incoming energy is transmitted poleward along the southwestern coast of South America as CTWs.

We did not include the Rossby wave part, as their frequency range is limited and particular the energy of high frequency Kelvin waves (i.e. with periods from a week to a month) cannot bounce back into westward propagating equatorial Rossby waves.

10) l56: Poleward propagating CTW modulate the alongshore and vertical currents

Thank you, we extensively revised this part of the introduction. The first sentence of this paragraph now states

While modulating the alongshore circulation and vertical velocities, poleward propagating CTWs produce vertical displacements of the pycnocline of the order of tens of meters and sea level changes of a few centimeters (Leth and Middelton, 2006, Colas et al., 2008, Belmadani et al., 2012).

11) l59: The author should mention the influence of the CTW on SLA as sea level data are used in the Results' section to track CTW

Indeed, please see our reply to comment 10) above.

12) l60: this sentence is incorrect.

We agree. We altered this statement to be clear that local wind forcing and heat fluxes are the most important factors for intraseasonal SST variability and CTW contribution is of less importance.

On the other hand, intraseasonal sea surface temperature (SST) variability is suggested to be mainly driven by local winds and heat fluxes while CTWs play only a minor role (Dewitte et al., 2011; Illig et al., 2014).

13) l62/63: The influence of remotely-forced CTW

Changed

14) l63: an individual propagating CTW

Changed

15) l67: Rephrase

This part of the introduction was completely rewritten and this sentence is no longer in the text.

16) In the Data section, the description of the ERSSTv5 data used in Figure 1 is missing.

We have added a paragraph on the ERSST data to section 2.

Sea surface temperature from the NOAA Extended Reconstructed Sea Surface Temperature, Version 5 (ERSSTv5) dataset (Huang et al., 2017a) was used. This dataset provides monthly *values of SST on a 2°x2° grid based on in-situ temperature observations from several sources (Huang et al., 2017b).*

17) l92- the investigation

Changed.

18) l168- were smoothed

Changed.

19) I will suggest to remove the position of the isopycnals from figure 2 and figure 3 as there are not useful for this section.

Indeed, the isopycnals do not contribute to the analysis of circulation variability in section 4.1. However, we find it helpful for comparing the velocity distributions with the hydrographic sections and nutrient distributions shown in figures 8 and 10. These figures depict the same isopycnal surfaces. Therefore, we decided to keep the isopycnals in the figures.

20) l209: Check the notation figure for Ocean Science: Fig. 2b and not Fig. 2(b)

Thank you for this comment. We have changed the notation throughout the manuscript.

21) l208 Sea surface height anomaly / SLA?

Indeed, we have changed *sea surface height anomaly* to *Sea Level Anomaly (SLA)* and consistently use the abbreviation throughout the manuscript.

22) l211: The author use cm.s-1 in the text. Change Figure to put the unit in cm.s-1 to be consistent.

Thank you for pointing this out. We have changed the units of velocity to m s^{-1} throughout the manuscript and are now consistent with the units presented in the figures.

23) l218: At these depths and offshore

Changed.

24) l225: data were

Changed as well.

25) l242: the meaning is unclear

Thank you. This section was greatly revised. We now discuss alongshore velocity differences between two periods instead of alongshore velocity itself (also see comment 29) below. The sentence in question referring to a possible superposition of equatorward flow due to the Chile-Peru Deep Coastal Current and the CTW velocity signal is thus obsolete and was removed from the manuscript.

26) l232: The alongshore current modal structure of the three first modes

Changed

27) l227: Need to add the values of the velocity of the climatological alongshore current (Chaigneau et al., 2013) in the text which are necessary for the demonstration of the intensification of the PCUC. Also similarly to Figure 6 and figure 8, I would suggest adding a third panel to figure 3 to show the difference between the two periods of the amplitude of the alongshore current.

Thank you for this suggestion. We added a third panel showing the difference in velocity between both time periods to figure 3. Also, we added a sentence on the climatological alongshore velocities from Chaigneau et al. (2013) to facilitate an evaluation of the observed flow intensification.

The intensified PCUC flow strongly exceeds climatological PCUC flow reported from this region. Mean alongshore flow at 12° S determined from vmADCP data sampled during 22 cruises show maximum PCUC core velocities of 0.1 – 0.15 m s^{-1} (Chaigneau et al., 2013), similar to the situation observed during April 18-25 and June 24 (Fig. 2b and g).

28) l233: And the phase speed? Are they consistent with the theoretical values obtained in Illig et al 2018a?

The phase speeds of the first two modes are consistent with the values obtained by Illig et al. (2018a). However, the phase speed of the third mode is slightly below the range of their reported values. In the text, we now state:

The obtained phase speeds are within the ranges reported by Illig et al. (2018a, their table 1) for the first two modes while the phase speed of the third mode is slightly lower than their results (0.82 ms^{-1} compared to 0.93±0.08 ms^{-1}). The velocity structure of the modes is very similar to their structure reported in their study at 16°S as well.

The structure of section 4. Results was greatly revised. The CTW modes and their phase speeds are now discussed in section 4.1.3 Modal structure of the intensified flow.

29) l236-237: Wouldn't it be more accurate to compare the CTW modal structures to the alongshore velocities anomaly (i.e the difference between the 2 periods chosen)?

Indeed, thank you for this comment. In the revised version, we compare the modal structures to the difference of alongshore velocity between the two time periods and interpret it accordingly. We have modified Fig. 5 accordingly and adapted the text in section 4.1.3 and in the discussion.

30) l255: remove the second "and"

Removed.

31) l257: How are the zonal equatorial and coastal alongshore wind anomalies? Here the authors could add the intraseasonal variations of the winds superimpose to Fig5 or in another figure.

We thank the reviewer for this comment. In the revised version, we are including a detailed analysis of local and equatorial wind stress and wind stress curl variability in the results section and include a discussion of the results in the section 5. Summary and discussion. We show that local wind stress and wind stress curl forcing cannot explain the intensification of the PCUC. However, CTWs excited by local wind stress and Sverdrup transport likely have contributed to enhancing poleward flow later in May. We now show that an elevated westerly wind burst at the equator during April 2017 is likely responsible for the generation of a Kelvin wave that reached the eastern boundary beginning of May 2017. Here, it transmitted parts of its energy to a CTW moving poleward along the continental margin of South America. We have added the following sections to the results:

4.2.1 Role of local wind stress

A potential local forcing mechanism of the intensified PCUC flow are anomalies of local wind stress curl. An increase in the magnitude of near-coastal negative wind stress curl leads to increased poleward flow along the eastern boundary through Sverdrup dynamics (e.g., Marchesiello et al., 2003). The adjustment of the circulation to changes in the wind stress curl at the eastern boundary is rather fast and occurs within a few days (Klenz et al., 2018). Wind stress curl along the Peruvian continental margin between 10° S and 14° S was negative throughout the observational period (Fig. 4), continuously forcing poleward flow. However, during the period of PCUC acceleration between end of April and mid-May, the magnitude of negative wind stress curl decreased (Fig. 4c, d, e, f). It can thus be ruled out that local wind stress curl forcing is responsible for the observed intensified PCUC. Nevertheless, elevated negative wind stress curl was observed from May 18 – 22, which may have contributed to maintaining a strong PCUC in late-May.

Variability of near-coastal alongshore wind stress excites CTWs which propagate poleward (e.g. Yoon and Philander, 1982) and thereby enhance or decrease poleward flow within the depth range of the PCUC. Model studies show that CTWs are excited near the equatorward edge of the region of wind variability (e.g. Fennel et al., 2012). In Mid-April through May 2017, alongshore wind stress between 5° S and 15° S was variable (Fig. 5). While moderate wind stress (0.03-0.06 N m^{-2}) prevailed from mid-April to May 3, it was weak during the first two weeks of May (Fig. 5d,e, g). However, during the later period the strong acceleration of the poleward flow occurred, requiring an intensification of alongshore wind stress. Thus, the initial acceleration of the PCUC during this period (Fig. 2d, e) cannot be related to local wind stress variability. Alongshore wind stress did significantly strengthen on May 15 and remained elevated for a period of about 5 days. This wind event was intense between 15° and 5° S, but did not occur north of 8° S. CTWs were likely excited in the region between 12° and 8° S that contributed to the elevated poleward velocities observed in the later phase between May 17 and 26 (Fig. 2f).

4.2.2 Equatorial winds and wave response.

A weakening of the trade winds at the equator by e.g. westerly wind events forces downwelling on the equator which in turn generates an eastward propagating equatorial Kelvin waves, which in turn may have transmitted parts of its energy to a CTW at the eastern boundary. Indeed, *several westerly wind anomalies occurred in the central and eastern equatorial Pacific during the first 6 month of 2017 (Fig. 6). A particularly elevated westerly wind anomaly between the date line and 120° W occurred during the first two weeks of April (Fig. 6a). At the same time, a positive SLA propagating along the equator appears to the east of the wind event at about 100° W (Fig. 6b).*

32) l258: suggests

Changed.

33) Section 4.3 and 4.4: This section describes the cross-shore structure of the hydrographic and biogeochemical tracers to the PCUC intensification during the two selected period. The text is too detailed which make it heavy to read. I think the major problem with the writing overall is simply too many words. Please simply.

We have shortened and simplified the manuscript throughout these sections.

34) l264-265: You do not look at the processes in this study. Rephrase

Thank you for pointing this out. We have rephrased this sentence to

In the following we analyse the changes in hydrographic conditions co-occurring with the increase of alongshore flow.

35) l266-269: This is an example of sentences that could be shortened. Please rephrase

We significantly shortened this section and removed repeated and unnecessary information. Former lines 266-269 now read:

Lower near-surface conservative temperatures near the coast compared to offshore (Fig. 8a, b) indicated active upwelling during the observational program. While the upwelling signal was restricted to the upper 50 m, near-coastal water masses between 50 and 300m were significantly warmer compared to water masses offshore (8a).

36) l277: I will found clearer to put the description related to the oxygen in section 4.4 (Response of the biogeochemical conditions to the PCUC intensification)

We agree that oxygen concentration may also be classified as a biogeochemical parameter. However, in the manuscript we discuss oxygen distributions analogously to temperature and salinity while in section 4.4 (discussion of biogeochemical parameters) we describe nutrient distributions and related parameters. The later discussion does not require linking to the distribution of oxygen concentrations. For us, it thus seems more clear to keep the current subsection separation. However, to make clearer that section 4.4 is restricted to the nutrient biogeochemistry we rename it as *“4.4 Response of nutrient biogeochemistry to the PCUC intensification”.*

37) l285: Not many readers are familiar with the water masses characteristics off Peru. Please remind the reader what are the characteristics of the ESSW water masses (ESSW: T < 17◦C and S > 35; Silva and Neshyba, 1979; Chaigneau et al., 2013) in the text. Also, the authors may want to add a (small) panel with the position of the observations on a wider T/S diagram, with the T/S characteristics of the main water masses illustrated?

Thank you, we have added the T and S characteristics of ESSW and ESPIW to the text, in both cases we have relied on the most recent classification by Grados et al. (2018).

ESSW originates from the equatorial current system. It is characterized by a linear relationship of temperature and salinity in the temperature range 8 – 14 °C and absolute salinity range 34.6 – 35.0 (e.g. Grados et al., 2018). Lower salinity Eastern South Pacific Intermediate Water (temperature range 12 – 14 °C, salinity 34.8 (Grados et al., 2018)), which is also situated in the depth range mentioned above was only observed in the hydrographic data from two offshore stations (Fig. 10a).

38) l267: dates on Figure 6 are wrong

Thank you. An erroneous date was actually inserted in former Figure 3 and 7. We corrected the dates in the figures throughout the manuscript.

39) l303: an increase of 5 ...

Changed.

40) l358: The authors are looking at the total current vertical structure, not the anomaly.

Indeed, thank you. In the revised version we now discuss velocity anomalies that are presented in Figure 3 as suggested by the reviewer. We now highlight our hypothesis that the increase of PCUC velocities in May relative to April was caused by a CTW.

… that occurred simultaneously to the increase of poleward flow at 12 °S.

41) l363: attributed to the second and third CTW modes. They found poleward velocities along the Peruvian.

Changed accordingly.

42) l369: Could you explain how scattering will change the CTW vertical structure.

Scattering of the wave at changing topography will transmit the energy into higher modes. We included a brief explanation in the discussion:

The local topography interacts with the passing CTW as well and such an interaction is neglected in the CTW mode solutions derived here. […] At changes in the topography parts of the wave energy can be transmitted into higher modes or upstream scattering (Wang, 1980; Wilkin and Chapman, 1990; Brunner et al., 2019).

43) l371: the first CTW mode

Changed.

44) l376: show

Changed.

45) l378: alongshore winds

Changed.

46) l383: the advection

Changed.

47) l387-389: Total temperature/salinity cross-shore section during two periods (the initial phase and the peak of the poleward flow) along with the differences between the two periods are shown in figures 6a-f. Figures show an increase in temperature and salinity along the continental shelf under 100m, which is in agreement with the stronger transport/advection of warmer and saltier ESSW, poleward. The surprise is that negative "anomalies (differences between the two periods)" in temperature (Fig.6c) and salinity (Fig. 6f) are found in surface. I agree with the authors, this might result from the interannual/seasonal variations that have not been filtered from the signal analysed. However, this part of the discussion could be further elaborated (see general comment above), by (for example) looking at the SST from the satellites data from which intraseasonal variations can be estimated.

We agree with the reviewer that our discussion of temperature and salinity changes in the surface layer is very rudimentary; however, the main focus of our study is the circulation variability and its effect on hydrography and biogeochemistry. Given that section 4.3 and 4.4 are already quite long and detailed, as pointed out by the reviewer, we do not want to extend the analysis and interpretation of the surface signals.

48) l411: Does N-loss means biogeochemical processes? Could the authors respecified which ones and clarify this sentence?

Yes, the N-loss is a biogeochemical process that occurs within the ocean when there is no oxygen available (see e.g. Kalvelage et al., 2013). Bacteria use the oxygen atoms from nitrate (NO_3) and nitrate (NO_2) "to respire" and thus convert nitrogen nutrients to N_2 gas while consuming organic matter (i.e. they reduce nitrate and nitrite). We have added a description of the individual anaerobic biogeochemical processes when discussing the nutrient distribution to make this more clear and state when first mentioning N-loss:

The increasing nitrogen deficit is caused by the microbially facilitated reduction of nitrate, nitrite and ammonium to N_2 gas which occurs in anoxic waters during the consumption of organic matter (e.g. Kalvelage et al., 2013).

49) l412: Why would you expect this? Is the increase of Nitrate (and then, the reduce nitrogen deficit) not related to the stronger transport poleward in the PUS of high nutrient ESSW as shown by Echevin et al., 2014? You may want to re-specified (or show?) the mean Nitrate characteristics and provide the mean alongshore gradient of Nitrate to support your demonstration.

Indeed, the increase of nitrate is due to the advection of water with higher concentrations, but this spatial gradient is set by the biogeochemical N-loss. We state this more clearly now in the manuscript. In the T-S diagram we see an increase of nitrate for unchanged T-S conditions in the ESSW range, therefore the properties of the ESSW itself have changed.

Along the ESSW pathway within the PCUC from the equator to 12° S, the nitrogen deficit increases while nitrate concentrations decrease (Silva et al., 2009; Zamora et al., 2012; Kalvelage et al., 2013). The increasing nitrogen deficit is caused by the microbially facilitated reduction of nitrate, nitrite and ammonium to N_2 gas which occurs in anoxic waters during the consumption of organic matter (e.g. Kalvelage et al., 2013). The resulting nitrogen deficit accumulates with time during the poleward advection.

50) l423-425: the meaning is unclear

We have changed the sentence to be clear.

However, the increase of nitrate (and the sum of inorganic nitrogen species) exceeds the phosphate decrease by a ratio higher than the nitrogen to phosphorus relation implied in equation 1, therefore the nitrate change is more important than the phosphate change for the nitrogen deficit reduction.

51) l432: It won't be the case if equatorial waters were less rich in nutrients than the PUS. The sign of the anomaly depends on the sign of current anomaly and the sign of the gradient of the tracer (temperature or biogeochemical variables).

Indeed this depends on the sign of tracer gradient. As seen in their supplementary material the study by Bachèlery et al. (2016) is done in a setting of poleward nitrate decrease as well, we have added a mention of this to the manuscript.

In a model study in the Atlantic Ocean, were nitrate decreases poleward as well, it was shown that the total effect of CTWs on nitrate concentrations varies regionally …

52) l436: due to

Changed.

53) l438: Do the authors see changes in the coastal ecosystem? I wonder if the nutrient input associated with the downwelling CTW and the change in the N-P ratio is associated with a phytoplankton bloom as describe in Echevin et al., 2014. Have the authors looked at satellites chlorophyll data?

Thank you for this comment. Satellite data suggest a continuous decrease of chlorophyll concentrations from April to June in agreement with the seasonal cycle. An increase, which may have been caused by the nutrient advection due to the CTW was not evident. However, the model results from Echevin et al. (2014) described the simultaneous propagations of several modes of which the fastest mode was associated with the SLA and the velocity signal while CTW modes responsible for productivity change were of higher order.

54) l442- suggests

Changed.

55) l447- Again, at least, the small differences observed in temperature, salinity and oxygen could simply be due to the fact that the seasonal and interannual variations cannot be removed from signal analysed. This statement is too strong for the conclusion.

Yes, thank you. We have weakened this statement to express that in principal, no change of properties due to advection is expected without the existence of a respective horizontal gradient of the property.

For parameters without strong horizontal gradients, an increase in PCUC flow does not cause pronounced changes in the advection. In this study this applies to the conservative properties temperature and salinity as well as for oxygen where alongshore gradients are weak (Zamora et al., 2012). For these parameters there are no large differences between both circulation phases that can be attributed clearly to the altered circulation. Yet concentrations of nutrients are influenced by shorter transit times, being less altered by biogeochemical cycling.

56) l449/451: I do not think that was shown here (or at least not pointed out effectively). This study does not show changes in the rate of N-loss but rather point out the stronger transport of nitrate as the mechanisms for the nitrate/nitrogen deficit anomaly (in line with the results of Echevin et al., 2014). To look at how the biogeochemical cycles are affected by the CTW propagation further analysis are required (for example the use of a model). I will rephrase this to make your point clearer.

We have changed the discussion to highlight our point that the amount of nitrate lost during the transport between the equator and 12 °S is lower for higher current velocities, because constant biogeochemical cycling rates cause less accumulated changes of concentrations during the shorter transit times.

57) l452: "On intraseasonal timescales": From April to May 2017, our results suggest an increase in nitrate due to the passage of an intraseasonal downwelling CTW...

We have changed the manuscript according to the suggestion.

For the period from April to May 2017, our study suggests an increase in nitrate levels due to the passage of an intraseasonal downwelling CTW. This contrasts with the decrease observed previously on interannual timescales caused by downwelling CTWs (Graco et al., 2017).

58) l453: A downwelling CTW?

We have added “downwelling” in the comparison to the study by Graco et al. (2017). See above in the answer to 57.

59) l454 outcomes

Changed.

60) l458: different from

Changed.