

Interactive comment on “Tidal variability of nutrients in a coastal coral reef system influenced by groundwater” by Guizhi Wang et al.

Anonymous Referee #1

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General Comments

Apart from river and surface water runoff subsurface discharge of groundwater plays a key role in coastal water and nutrient budgets. In this study, the authors discuss about nutrients and ^{228}Ra measurements made during ebb and flood phases of spring and neap tides. Although most of the stations are in close proximity to the coastline, the authors have not reported any data from groundwater or river/stream waters for nutrients and Ra isotopes to substantiate the submarine groundwater input. Ra isotopes are also released by shelf sediments at mid-salinities. If it was measured, this will help in understanding the exchange from land to coastal bay. Some of the results are already published in the papers quoted by the authors.

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Line 14: The authors claim that the diurnal variability in nutrients is due to the mixing of groundwater and offshore water and biological uptake and release. This manuscript does not show any results of biological measurements then how did the authors confirm that it is biological uptake and release during neap tide and groundwater input during spring tide?

Line 17: It is mentioned that nitrite was positively correlated with water depth in the spring and neap tides. This sentence does not convey the authors' message clearly. In general, during spring tide, seawater level (tidal height) in the bay will be high whereas during neap tide, it will be low. How can nitrite be high in both spring and neap tides in order to show positive correlation with water depth? If so, what is the mechanism for this to happen?

Line 18: The ebb flow of the spring tide would have decreased salinity and indicates the receding seawater. What is the significant correlation between nutrients and salinity? Is it positive or negative? This should be explained here briefly and elaborated in the discussion section.

Line 19: "by biological processes based on mixing lines of these nutrients". The deviation from the mixing line need not necessarily represent biological process alone and it may be through any other addition or removal processes in the Bay.

Line 24: "less significant correlations". Quantify them.

Page 2:

Site Description:

This section lacks basic information about the study area viz. (1) the peak rainfall and runoff period of the river and what is the annual river discharge and how it affects the salinity (2) The samples were collected during which season (although it is mentioned as a dry season, in introduction section, more details should be presented in this section) and what are the river and bay conditions during the sampling season (3) Is the

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river regulated by a dam in the upstream (4) Is the river fed by summer or winter monsoon (4) what is the tidal pattern and amplitude in the bay (5) Is there any tide gauge station near the study area (if so, give the location on the map) and give the tidal variations during the study period? (6) At the end of the manuscript it is explained that the region experiences upwelling (Section 3.5; page 9) but not mentioned in this section.

Line 16: (. . .with the maximum tidal range). Provide the tidal range with a reference.

Line 14: It is mentioned that in this reef system, groundwater play a predominant role but there is no measurement of groundwater sample. Any measurement from lake/well/river/water pump will help us to understand the concentration in the groundwater and the exchange with the bay provided with their earlier work. The diurnal variations in nutrients observed during spring and neap tides may relate to mixing reactions like release/adsorption of nutrients as well. The mixing of high saline seawater and less saline freshwater may create mixing zones with different chemical and physical properties that create changes in nutrient concentrations. This is not addressed in the paper.

Page 4:

Line 1: Statistical and Interpolation method. The sentence is not clear. Rewrite this.

Line 7: Why particularly kriging interpolation was done? Give specific reason to use this algorithm.

Results and Discussion:

This section mostly presents the results of the study without much discussion. The first 2 paragraphs explain the results and at the end of the third paragraph, there are a few references cited to just compare these results with other. Not much scientific discussion has been done to explain the reasons for such variations and for identifying processes regulating these changes. The authors should discuss Results and Discussion separately, so that readers can understand the implications of the results.

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Section 3.1 describes nutrients and 228Ra at a time-series station followed by Section 3.2 explaining the nutrients in Sanya Bay and Section 3.3 again on the tidal variations in nutrient at reef station CT. The authors could have explained the results from the time-series station CT, the influence of tides on nutrient variability and then described on Sanya Bay.

Line 13: It is that “in the middle of the lunar month. . .expected”. If this is based on the tidal gauge data, reference to that should be made.

Page 5:

Line 29: How the authors are claiming that freshwater is more during ebb flow of spring tide? Please give supporting information and include reference.

Line 31: “The only source of freshwater at this site in February would be groundwater discharge”. If so, provide reference. If there are earlier studies on turbidity maxima in the bay or the coastal/estuary of the study region, then it would help in discussing the role of suspended sediments in nutrient peaks or groundwater discharge.

Page 6

Line 2: P values mentioned in the manuscript varies from <0.0001 to >0.2 . These are looking unrealistic from the plots. How these values are calculated, by using standard software or by using online calculations? If so, please give reference or web-link.

Line 13: The authors repeatedly mention about biological processes but no biological data has been included. It will be more appropriate to discuss the biological observations and then using mixing or dilution line calculations to identify nutrient removal/addition process. It should also be noted that in the absence of biological information, the differences (addition/removal) observed in nitrite, nitrate and phosphate could be due to sediment re-suspension and mixing. Enough scientific evidence from literature should be provided to support the arguments.

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Line 12: The equations NO_2mix , NO_3mix , Pmix , $\Delta\text{NO}_2\text{bio}$, $\Delta\text{NO}_3\text{bio}$, ΔPbio – there are no references cited for these calculations. If this is presented first time, mention about the assumptions involved in this type of equations.

Page 11:

In the references, Kelly and Moran, 2002 is mentioned while on page 8, this year is mentioned as 2012. This requires correction.

Page 14:

Figure 1 (a) and (b). Can these two be combined as one? The figure caption has repetition. Study area, sampling stations and salinity distribution are repeated.

Page16:

Figure 4-The R^2 values shown for nitrate (0.14) and nitrite (0.18) does not imply any significant relation. Is there any particular reason for the authors to show this trend line and R^2 values?

Page 16:

Figure 5-The figure caption has repetition. Rewrite it.

Page 17:

Figure 6-The information like Hainan Island, Sanya river and Sanya Bay, is given in all the images (a-d). Giving these information in anyone figure will be more appropriate.

Figure 7-Rewrite the figure caption as, Concentrations of (a) NO_x against phosphate and (b) silicate against NO_x during

Page 19:

Figure10-What is the significance to show a trend line with $R^2=0.16$?

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Table 1-Give units for latitude, longitude, temperature.

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