

Intraseasonal and interannual variability of sea temperature in the Arabian Sea Warm Pool

The study focused on the intraseasonal and interannual variability of the ASWP, and explored the causes of the intraseasonal variability in the ASWP using heat budget analysis, and explored the relationship between the interannual variability of ASWP and large-scale modes such as IOD and ENSO using lead lag correlation. Though the study is interesting, the study isn't fully ready for publication at this stage. Authors need to focus on improving their results. It isn't clear whether authors have discussed SST or mixed layer temperature in the study. Authors should understand main difference between these two, and can't use these terms interchangeably. This ambiguity continued in the entire text. Similarly, there are ambiguities in their presentation of few sentences and hard to understand what authors want to convey. It is advisable to go through the text carefully for corrections including the language corrections. Below are my comments.

Review comments:

1. Ln 12: "Indian Ocean summer monsoon." - Please change it to "Indian summer monsoon".
2. Ln 26: "The ASWP was more significant (insignificant) in the following year before the summer monsoon after an El Niño (La Niña) event that peaked in the previous winter." - Please rewrite the sentence for better clarity.
3. Ln 33-38: - Please provide appropriate references for example, <https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/asl.596>
<https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/qj.49712555503>
4. Ln 41: "(SST >30.5°C) in the southeastern AS" - please specify the aswp area averaged to get this value. Because of the large variability in the ASWP area, the SST values would change based on the area considered.
5. Ln 42: "Krishnamurt et al. (1988)" - please check the author name carefully.
6. Ln 43: "Joseph (1990) also suggested that SST maxima occurred one week before the summer monsoon outbreak in the southeastern AS during 1961–1972." - It is a regular phenomena to have higher SSTs during the summer time due to high insolation and transport of warm coastal waters towards southeastern AS. The question here is whether and how these higher SST values are associated with phase of the ASWP and are consistant with the size and duration of the ASWP.
7. Ln 48: "Arabian Sea" - Please be consistent with using the short and full form of the words. The author may consider using AS here as it was already specified in the above paragraph.
8. Ln 49: "In the second phase," - Please describe the phase. The sentence is inconsistent.
9. Ln 51: "He found that" - it is a good practice to avoid gender classification, instead, one can use "the author".

10. Ln 57: "They found that the Western Ghats' orographic impact decreased wind speed in the Arabian Sea's southeast and, consequently, latent heat loss, resulting in a positive heat flux into the ocean." - Please rephrase the sentence.
11. Ln 60: "Sabu and Revichandran (2011)" - Please check the spellings of author names carefully.
12. Ln 62: "intermonsoon " - a new term?
13. Ln 66: "in Peninsular India" - Please change it to "tropical Indian Ocean".
14. Ln 69: "According to Lau (2000) and Chowdary et al. (2007)" - How does the mechanism explained by Lau (2000) and Chowdary (2007) affect the ASWP as this is mostly confined to eastern TIO, whereas ASWP centered at the central TIO?
15. Ln 73: "The response of the warm pool intensity to ENSO does not reach its peak until about 5 months after ENSO peaks." - Please provide a reference.
16. Ln 82: "IOD was more significant and persistent during the years of cooccurrence, and it was characterized by both eastern cooling and western warming." - Please provide a reference.
17. Ln 90-92: - Please rewrite the sentence for better clarity.
18. Ln 109: " JRA-55, the forcing field used in SODA 3.7.2," - Please provide appropriate citation.
19. Ln 114: " The data time period is from 1958 to the present." - Please provide available spatial resolution information also.
20. Ln 114-115: "day-115 by-day" - Please change it to "daily".
21. Ln 131: " $\partial T / \partial x$ and $\partial T / \partial y$ represent the latitudinal and longitudinal spatial variation of mixed layer temperature, respectively." - isn't it opposite? Please change the wording to zonal and meridional variation, which makes it unambiguous.
22. Ln 135: " In this paper, the mixed layer depth has been defined as the depth at which the seawater is 0.03 kg/m³ higher than the surface density." - Please provide reference for the MLD criteria considered and justify the same. Please check <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2004JC002378>.
23. Ln 136: " T_h is the temperature at the bottom 10 m of the mixed layer;" - Not clear. please elaborate.
24. Ln 141: "This study also used empirical orthogonal function (EOF) analysis to separate the spatial and temporal characteristics of the ASWP and study the relationship between the ASWP and IOD/ENSO using lead lag correlation." - Please cite any earlier studies done using the similar approach.
25. Figure 1: Please modify the figure 1 and 2 titles by including the details of the sub-plot titles/labels and data used. I don't see the need of including June month's climatology because it is very well known that onset of southwest monsoon in the 1st week of June eventually leads to ASWP decay. You may cite a relevant work on the same in the text. Instead authors can show the March month's conditions.
26. Figure 2: Please mention in the figure title or in the text, how the area was calculated.

27. Ln 151: “ its area and maximum temperature were calculated” - Please specify how the area and maximum temperature calculation are made.
28. Ln 154-155: “when the warm pools were in a strong stage.” - Please replace "strong" with "matured" or "developed".
29. Ln 155: “Thereafter, the warm pools decayed rapidly and disappeared almost completely in early June.” - Please provide a citation.
30. Ln 155-158: - Please rewrite/rephrase the sentence for clarity.
31. Ln 167: “Throughout the evolution of ASWP, the sums of SHF, ADV, and ENT were basically consistent with the trend of mixed layer temperature.” - This is a strong statement. Authors can notice that, temperature change due to advection is almost constant and only SHF and ENT terms cause temperature to decrease. Authors can draw another line with only SHF and ENT to check their impact. Notice that their trends are not similar as stated by authors. Please give their trend values in the figure.
32. Ln 172: “mixed layer SST” - Can't be seen from the figure. I am afraid that it is not mixed layer SST, but mixed layer temperature. Please do the necessary corrections elsewhere.
33. Ln 173-157: - Not clear whether authors are discussing about SST or mixed layer temperature. Please take care of wording.
34. Ln 181: “net sea air heat flux” - Please check.
35. Ln 194-196: - This will be true most of the time in the tropical oceans with barotropic weather being a dominated phenomenon. There are exceptions like tropical cyclones during which the loss will be higher than the SHF_net.
36. Ln 200-203: - Not true always. A persistent cloud cover may increase the longwave radiation flux. Please check and cite the following articles.
<https://spj.science.org/doi/full/10.34133/olar.0003>
<https://link.springer.com/article/10.1007/s42452-019-1172-2>
Please check for contribution of downwelling longwave radiation also.
37. Ln 209: “variation of SST was roughly” - SST or mixed layer temperature? Please check and modify elsewhere in the following text.
38. Ln 217-221: Authors can discuss the impact of cloud cover and the entrainment and vertical velocity increasing cool subsurface water to change the mixed layer temperature. Here comes the impact of the MLD criteria one would choose.
39. Ln 231: “SST” - mixed layer temperature?
40. Ln 244: “non-solar radiation flux” - Authors may elaborate what do they mean by "non-solar radiation flux".
41. Ln 264-267: - Can't understand what do author's want to convey. Please rewrite and provide reason in this section to support using more appropriate citations.
42. Figure 9: Not clear whether area calculated is monthly or pentade? Please provide details.

43. Figure 10: Not clear if this is a pentade mean? Please give more details on the figure to make it clear.
44. Ln 311: “The first mode variance contribution for April, May, and June was all greater than 50%.” - Where is it shown?
45. Ln 315: “1987, 1991, 1998, 2010, and 2016” - How do you explain the change in peaks for June month? Similarly explain the negative peaks in PC.
46. Ln 320-322: - Not clear what do the author's mean here?
47. Ln 325: “The IOB is the first mode of the Indian Ocean and characterized as a consistent warming or cooling at the Indian Ocean basin scale (Xie et al., 2009).”- Please rewrite. Can't understand what do author's want to convey?
48. Ln 331: “The left panel of Figure 13 shows that the PC-1 of ASWP was positively correlated with the IOD most of the time.” - It is a strong statement. Can't be seen in the figure. There are many undulation in the correlations which contradicts this statement.
49. Ln 336-338: “ You can cite the most recent research on this topic. Please refer following articles.
<https://www.nature.com/articles/s41598-023-32840-w>
<https://www.nature.com/articles/s41612-020-0127-z>
<https://www.nature.com/articles/s41598-018-30552-0>
50. Ln 342: “It can be seen that the ASWP was most correlated with a lag of 5–7 months in the niño3.4 index, indicating that it was modulated by the ENSO.” - From figure 12 and 13, the ENSO impact is stronger than IOD and leading the correlations. How can authors explain this. Also, please describe 3 peaks in the IOD correlation in relation to a smooth decay in ENSO correlation.
51. Ln 349: “Can changes in the ENSO affect the role of different processes in the evolution of the ASWP? “ - Interesting. can you also include similar analysis with positive and negative IOD years?
52. Ln 354: “SST warmed” - still not clear. Is it SST or mixed layer temperature?
53. Ln 354-356: “still not clear. Is it SST or mixed layer temperature?” - Please explain this in detail with appropriate citations?
54. Ln 366: “SHFQnet was related to SWR,” - Not entirely true. Please check and modify.
55. Ln 368: “SHFQloss was related to the depth of the mixed layer and increases with the onset of the summer monsoon.” - Also on the stratification/properties of the subsurface water including halocline and thermocline variability.
56. Ln 382: “which is consistent with the strength of the IOWP peaking about five months after the ENSO peaked.” - Please give proper citations.