Open Access Journal of Physics
Volume-4, Issue-2, 2020, PP 26-34
ISSN 2637-5826

Air-Sea Fluxes Changes Over the North Indian Ocean

S. Venkata Sai and K. Muni Krishna*

Dept of Meteorology and Oceanography, Andhra University, Visakhapatnam, INDIA

***Corresponding Author:** K. Muni Krishna, Dept of Meteorology and Oceanography, Andhra University, Visakhapatnam, India, Email:munikrishnna@andhrauniversity.edu.in*

ABSTRACT

Ocean-atmosphere interaction plays key role on monsoon dynamics, Warm pool and mesoscale processes over the North Indian Ocean. In the present study we investigated the seasonal as well as monthly variability of Net radiative and Heat fluxes using Tropflux and OAflux data. Long terms changes in net shortwave and net longwave radiation are observed in both data sets except pre-monsoon months. Western Arabian Sea shows high variability in both cases. Ocean heat budget is also calculated using two data sets and it show quick contrast between Tropflux and OAflux.

INTRODUCTION

North India ocean is unique ocean basin compared to neighboring oceans because of seasonal reversals of winds, ocean circulation and also strong variability of ocean-atmosphere interactions. The net heat gain into the ocean and some part of this heat is released to the atmosphere in the form of latent heat of evaporation and Infrared radiation. The heat transport and turbulent fluxes modulates both the North Indian Ocean sea surface temperature and also affect the intra-seasonal to interannual variability of the Asian Monsoon (Loschnigg and Webster 2000).

The key role of net radiation as a driver of the summer sea surface temperature variability in the North Indian Ocean (Duncan and Han 2009; Goswami 2012). It is also indicating both in observations and ocean models, where heat flux variability is controlled the summer intraseasonal oscillations of SST and sometimes contributions from vertical mixing and entrainment at the base of the mixed layer (Schiller and Godfrey 2003; Waliser 2006; Sanchez-Franks et al., 2018). It is also a good indicator for the prediction and forecast of active ad break cycles of Indian Monsoon (Vecchi and Harrison 2002; Parampil et al. 2010) For these reasons, a good knowledge of the change in the ocean heat budget and transport is of great importance for understanding the Indian Ocean climate and for predicting its short- and long-term changes. Surface heat fluxes are the key component in determining the oceanic heat budget and transport. Several products are available, but all have uncertainties.

DATA AND METHODOLOGY

In the present study we usedthe following data sets to study the air-sea flux changes

Net Shortwave Radiation, Net longwave radiation, Latent heat flux, Sensible heat flux and wind speed from Tropflux data with a spatial resolution of 1°x1° and temporal resolution is monthly during 1979-2017.Similarly, the above parameters also obtained from Objective Analyzed Air-Sea Fluxes (OAflux) with a spatial resolution of 1°x1° and its temporal resolution is also monthly during 1983-2009. This data is downloaded from Asia Pacific Data Research Centre (http://apdrc.soest Hawaii.edu/)

RESULTS AND DISCUSSIONS

Fig 1&2 shows that the net short wave radiation in tropflux/oaflux it is suggests that high net short wave radiation observed over the Indian ocean during feb, march, April, may in both tropflux/oaflux data especially in the Arabian sea .during the summer monsoon months values of net shortwave radiation seen over the ITCZ(inter tropical convergence zone)/monsoon trough region especially over the head bay of Bengal .it is suggesting that cloudiness over that area. which is not seen in the pre-monsoon season in both tropflux and oaflux data sets .in oaflux data shows less net radiation over the east coast of India which is consistent with north east monsoon however tropflux data is not showing this variability as much as oaflux data

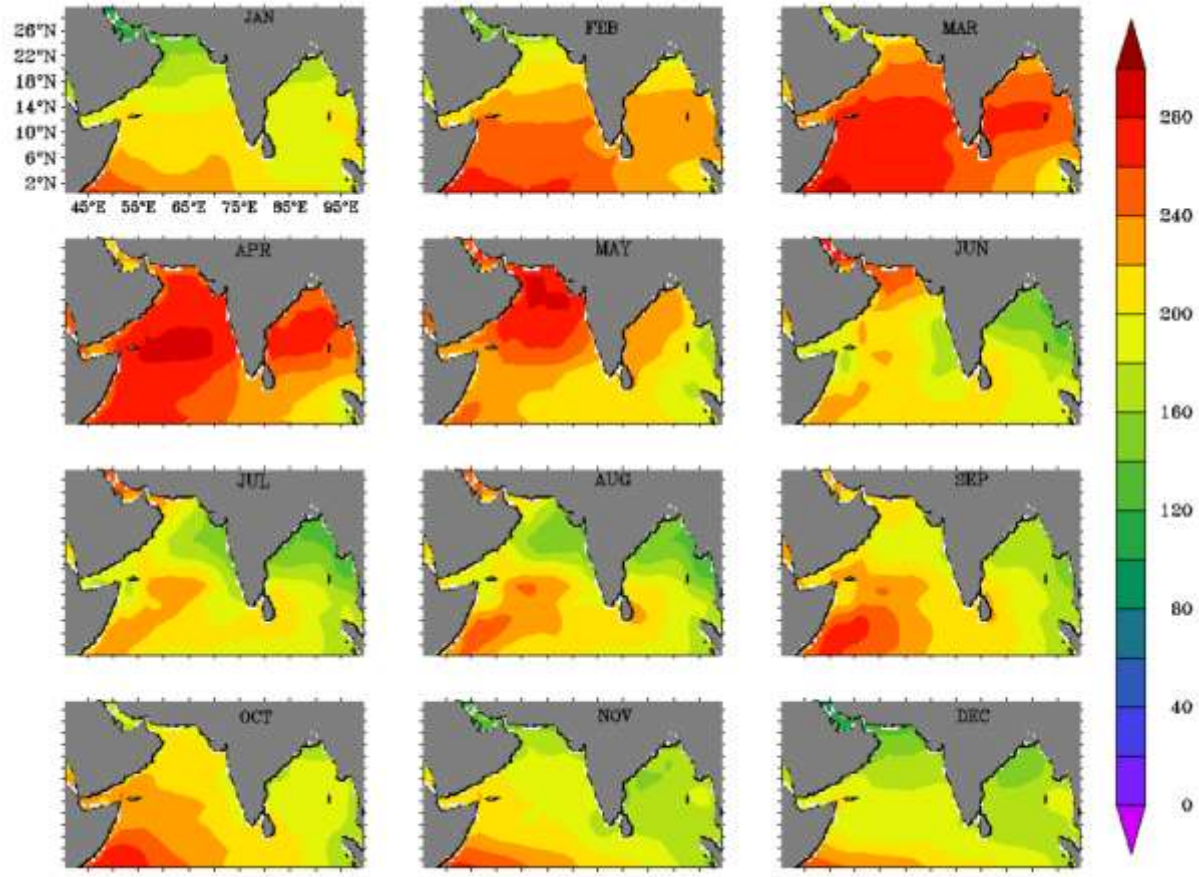

Figure1. *Spatial distribution of Net shortwave radiation over the North Indian Ocean using Tropflux data*

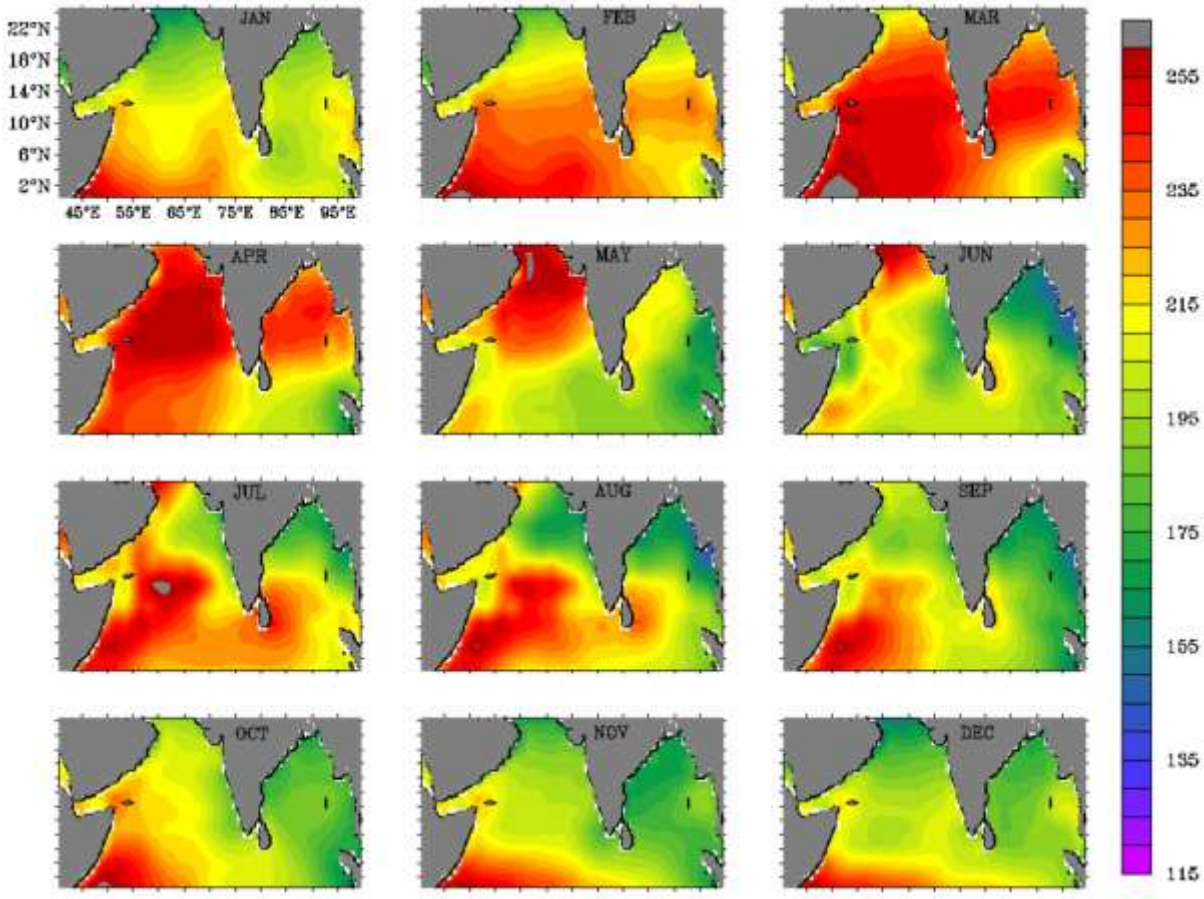

Figure2. *Same as figure 1 using OAflux data*

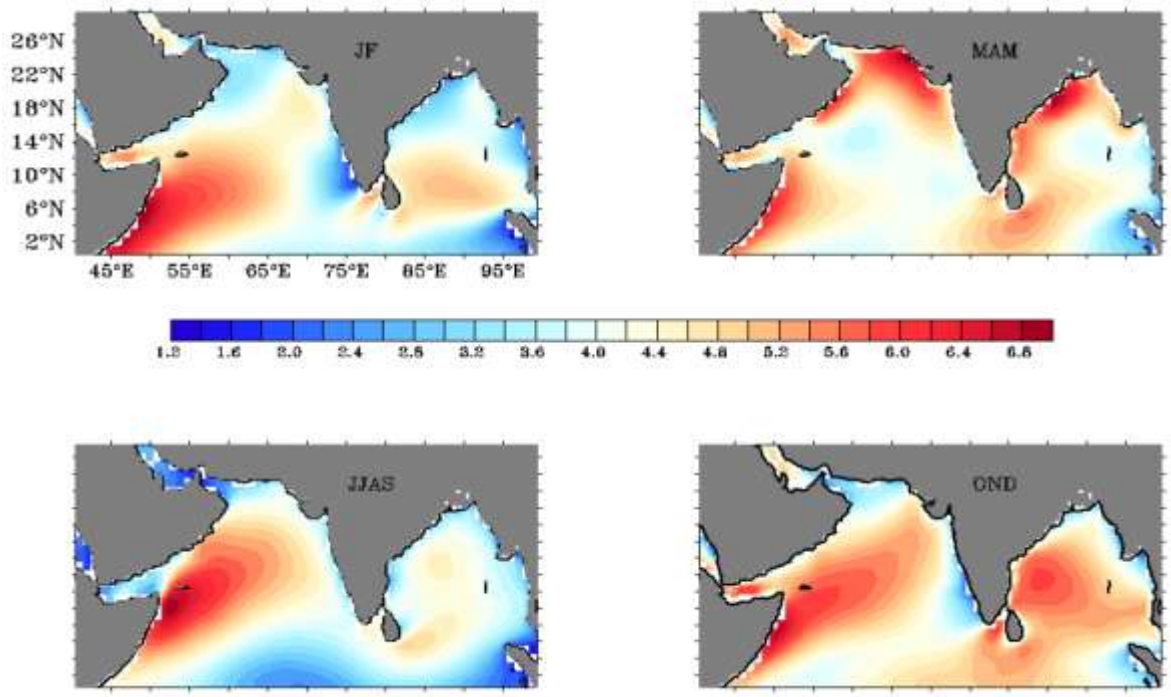

Figure3. *Spatial distribution of seasonal wind speed over the North Indian Ocean*

Fig 2&3 shows the seasonal variation of wind speed and latent heat flux over the north Indian JF, MAM, JJAS, OND ocean revels that high latent heat flux is observed over the Arabian sea and equatorial Indian ocean during the pre-monsoon season Arabian sea and Bay of Bengal during post monsoon season and low latent heat flux are observed during summer monsoon season over the north Indian ocean.

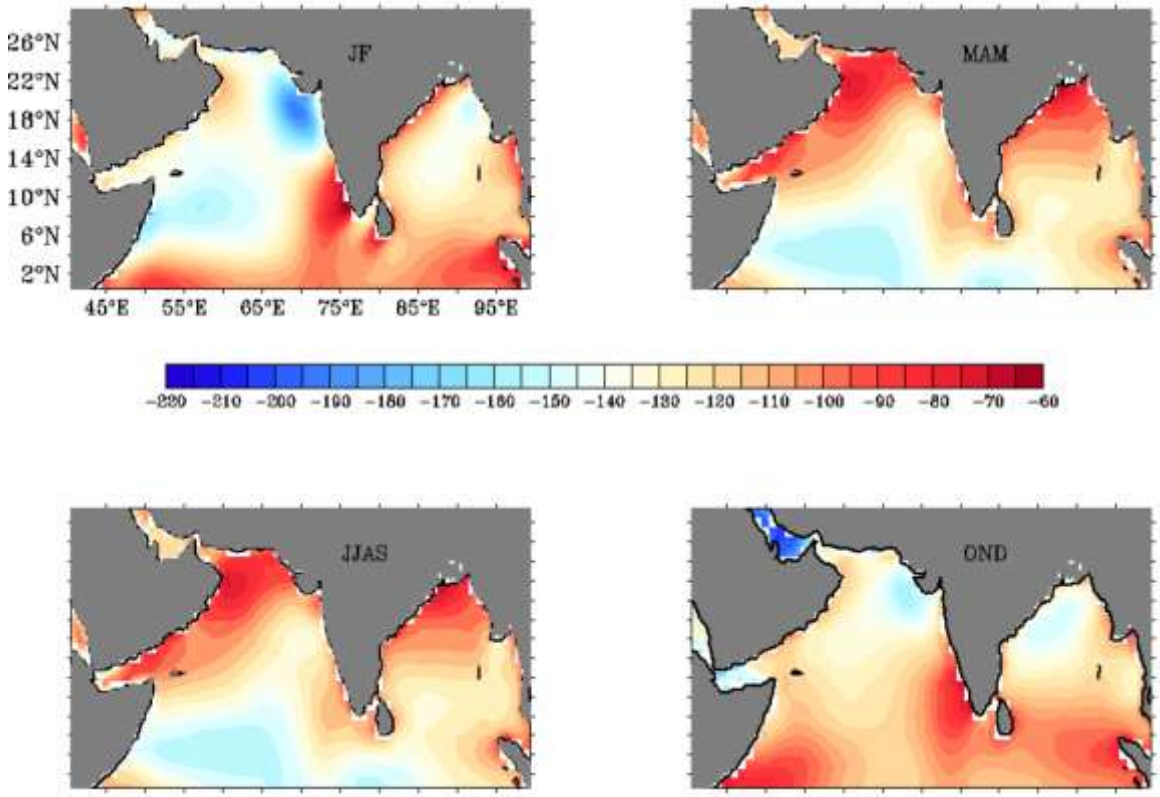

Figure4. *Same as figure 2 but for Latent heat flux.*

Shows the wind speed high Wind speed are observed over the Arabian sea and equatorial Indian ocean during the pre-monsoon season Arabian sea and Bay of Bengal during post monsoon season and low wind speed are observed during summer monsoon season over the north Indian ocean.

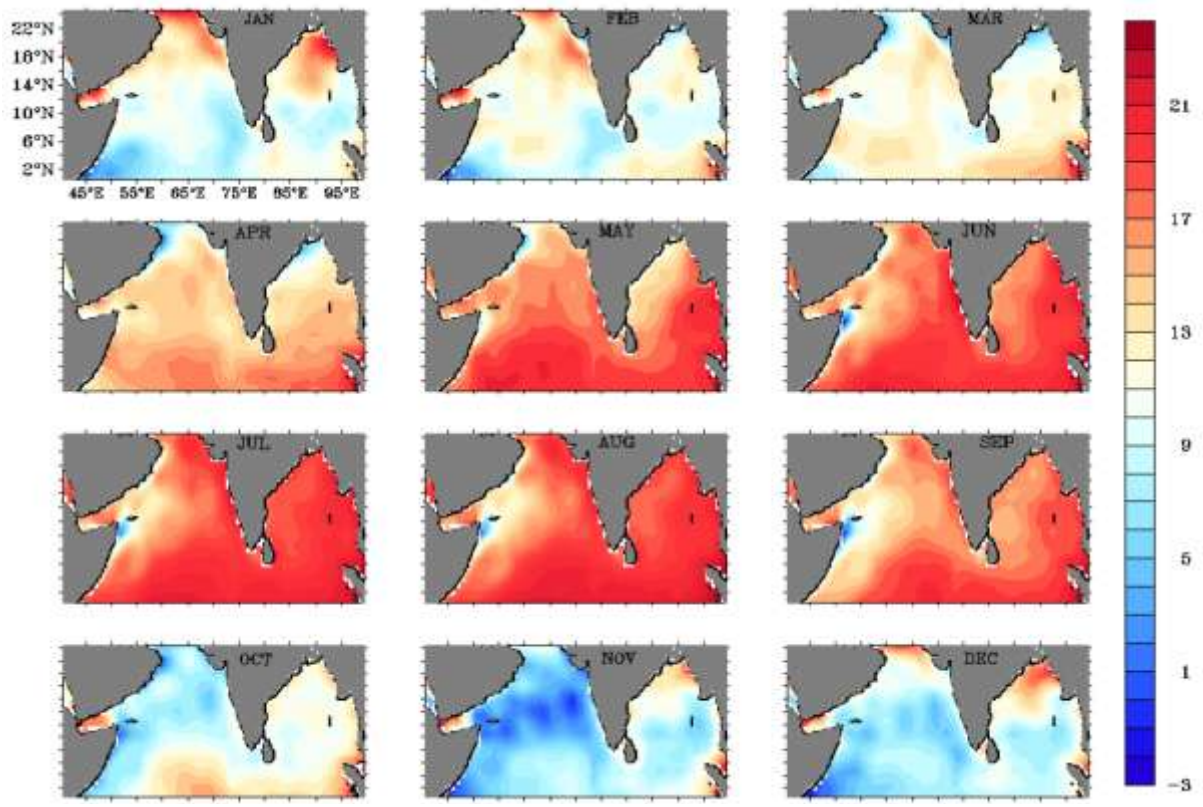

Figure5. *Same as figure 1 but for sensible heat flux using Tropflux data*

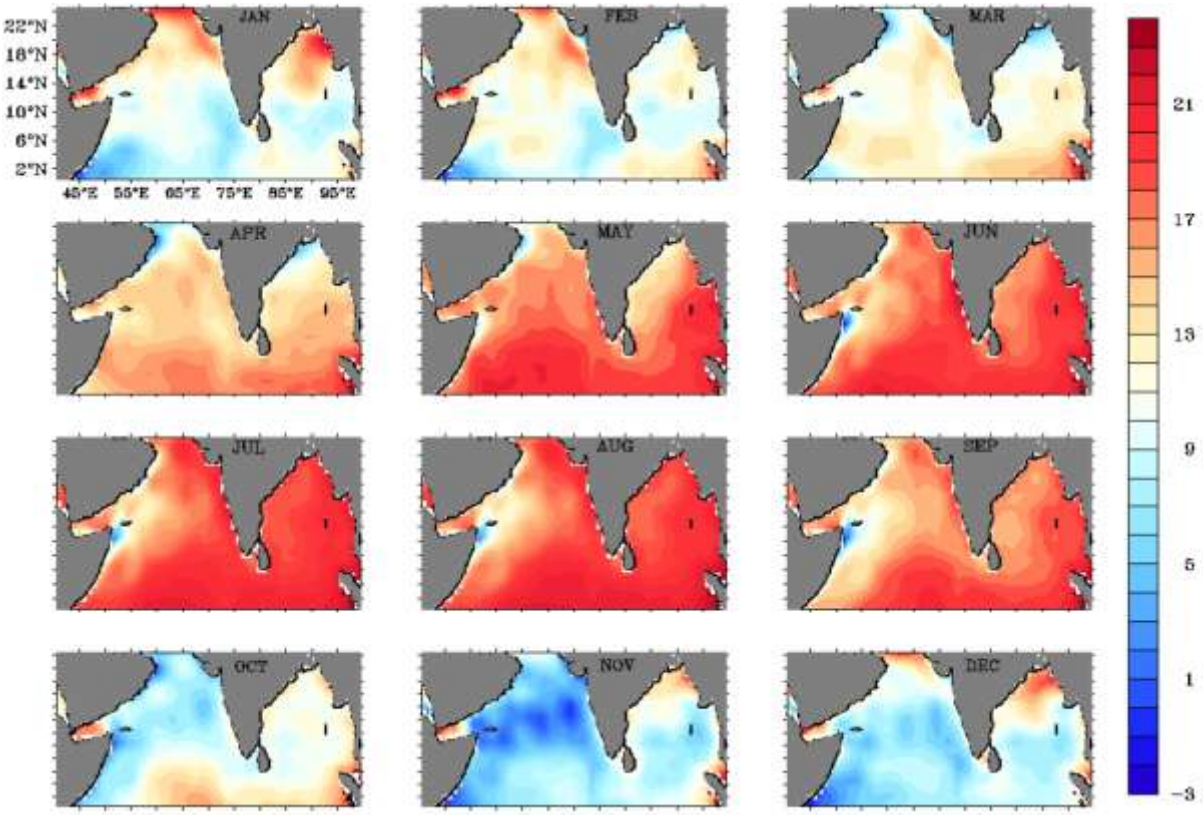

Figure6. *Same as figure 1 but for sensible heat flux using OAflux data*

Fig 5&6 displays monthly variation of sensible heat flux over the north Indian Oceanin both tropflux/oaflux high Sensible heat flux values are observed in both tropflux and oaflux during the months of April to September over the north Indian Ocean. it is suggesting that north Indian ocean is warming Jan and dec shows the high sensible heat flux over the head Bay of Bengal which is not seen in the rest of the monsoon.

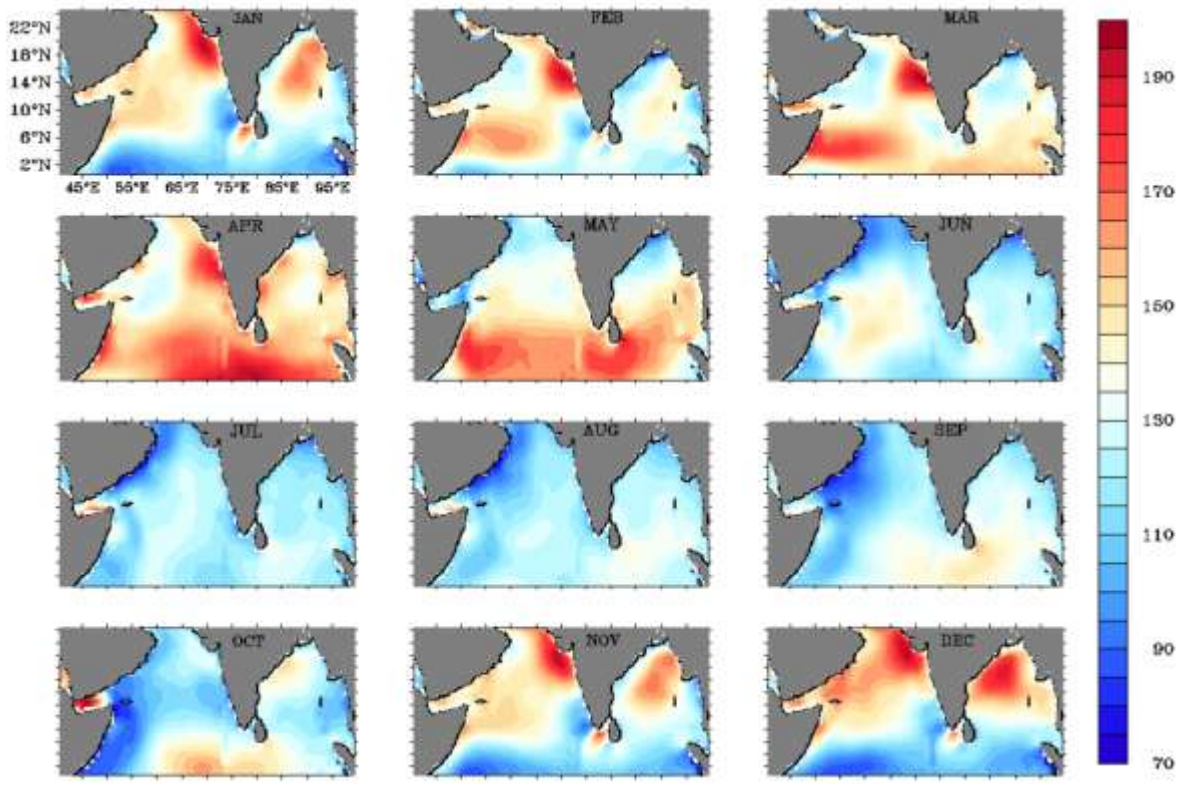

Figure7. *Same as figure 1 but for Latent heat flux using Tropflux data*

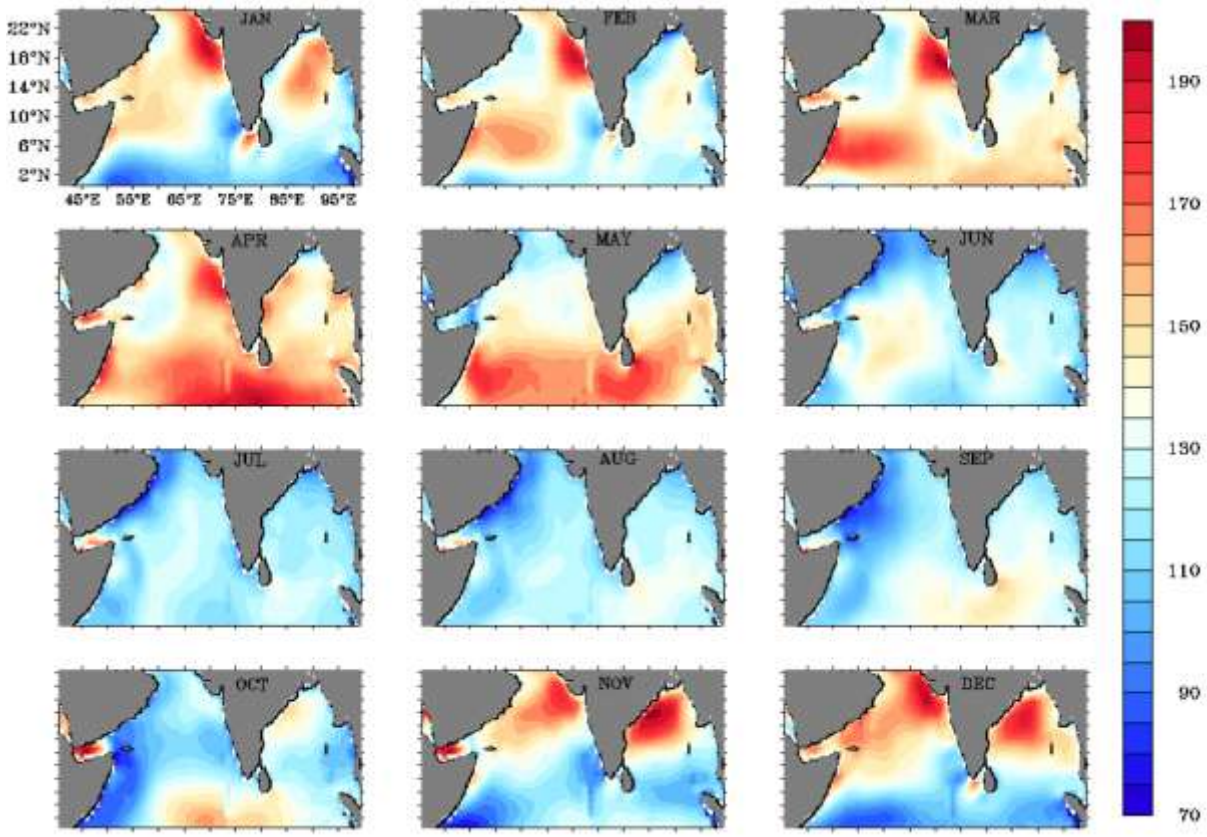

Figure8. *Same as figure 1 but for Latent heat flux using OA flux data.*

Fig 7&8 reveals that high latent heat fluxis observed over the Arabian Sea and equatorial Indian Ocean during the pre-monsoon season. Arabian sea and Bay of Bengal during post monsoon season and low latent heat flux are observed during the summer monsoon season over the north Indian ocean. this analysis suggests that convective activity over the north Indian ocean is more during the pre-monsoon season and post monsoon has compare with summer monsoon season.

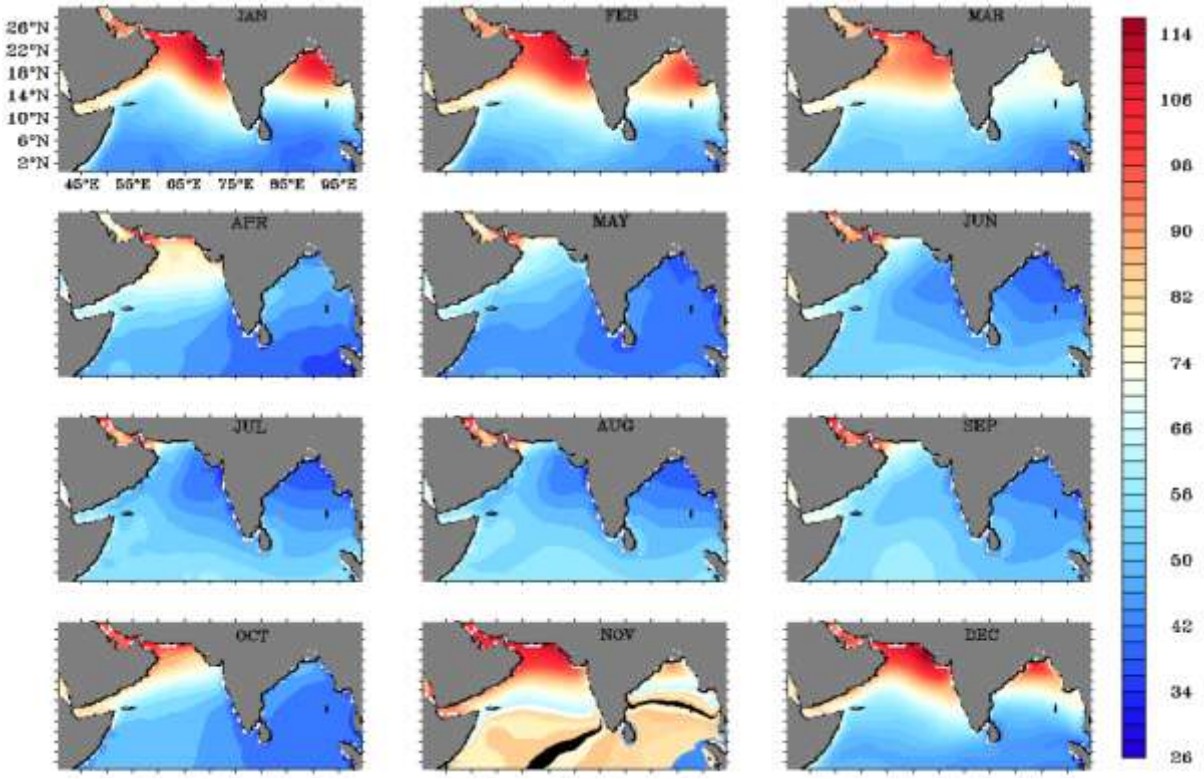

Figure9. *Same as figure 1 but for Net longwave radiation using Tropflux*

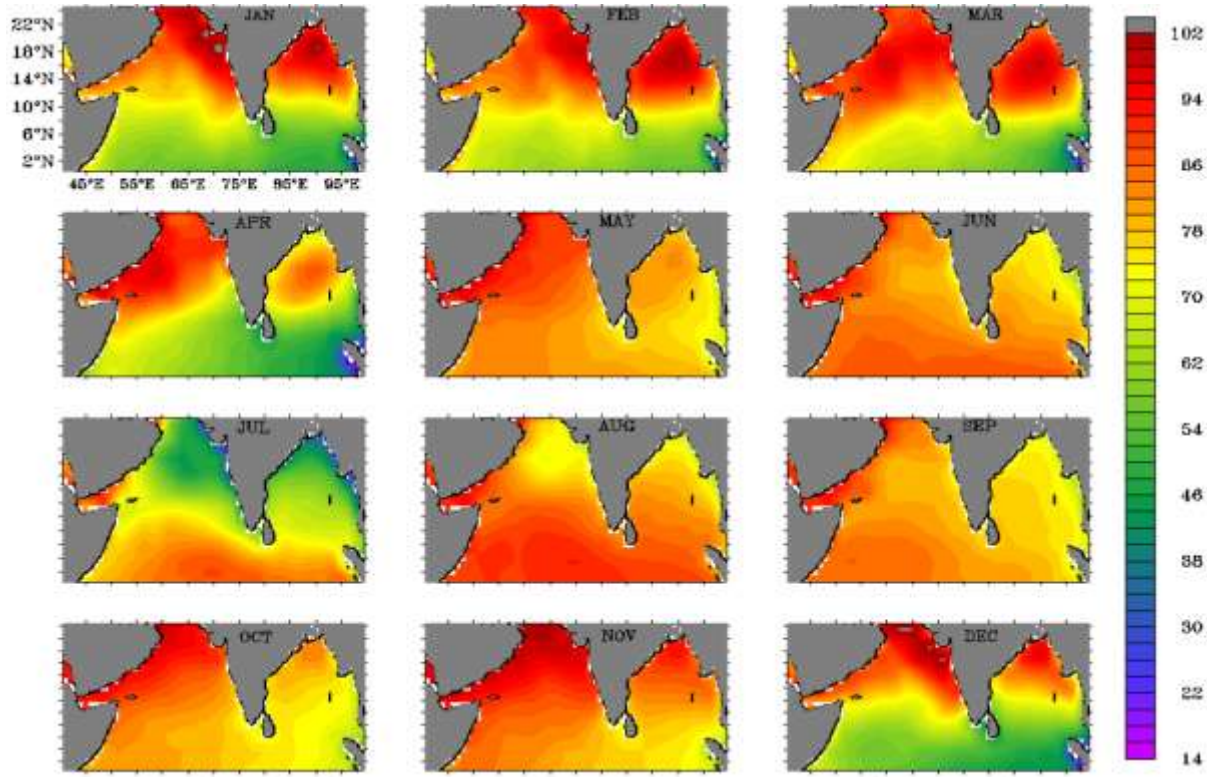

Figure10. *Same as figure 1 but for Net longwave using OAflux data*

Fig 9&10 displayed monthly variation of net long wave radiation over the north Indian ocean in both tropflux and oaflux the figures apparent that high long wave radiation observed over the northern parts of the Arabian coast and head Bay of Bengal during the months Jan, feb, march, nov and dec.

During summer and winter monsoon seasons less net long wave radiation observed over the northern Indian Ocean especially east and west coast of India. It is suggesting that the Indian Ocean is cooling because of the monsoon rainfall this is consisting with Fig 1&2 during the monsoon seasons.

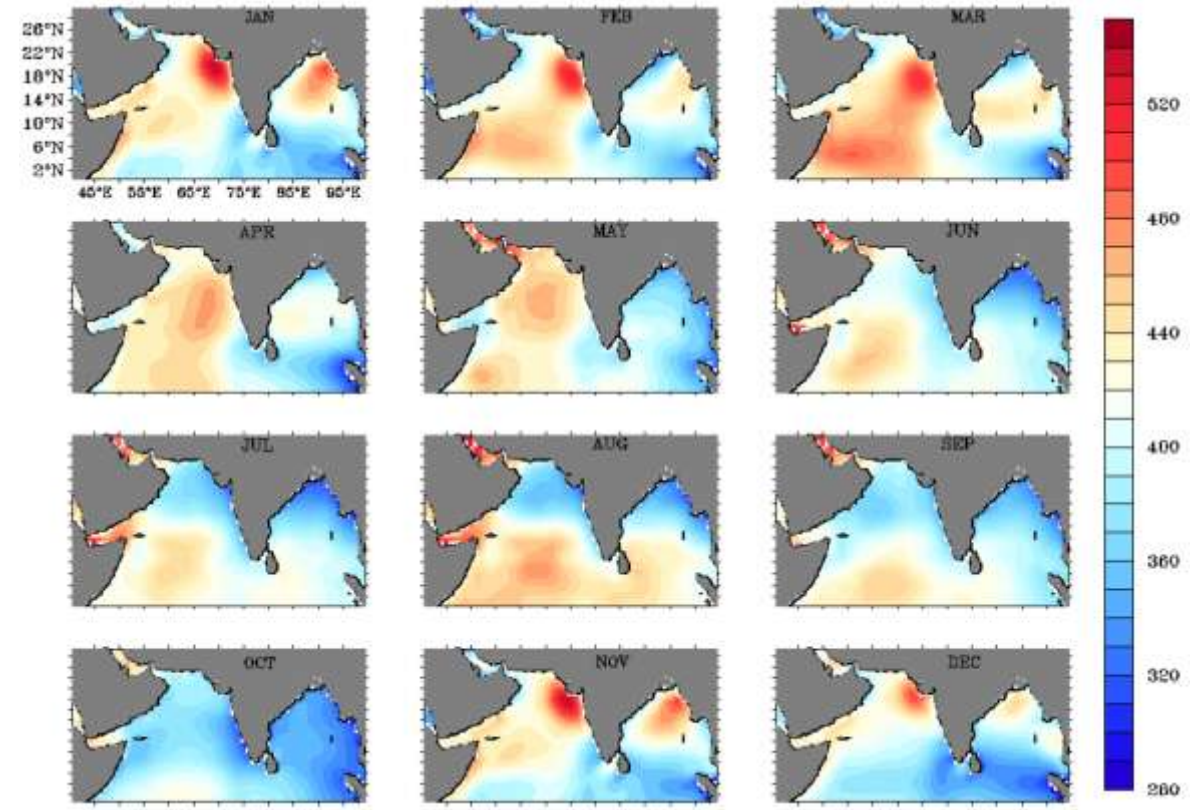

Figure11. *Same as figure 1 but for Ocean heat budget using Tropflux data*

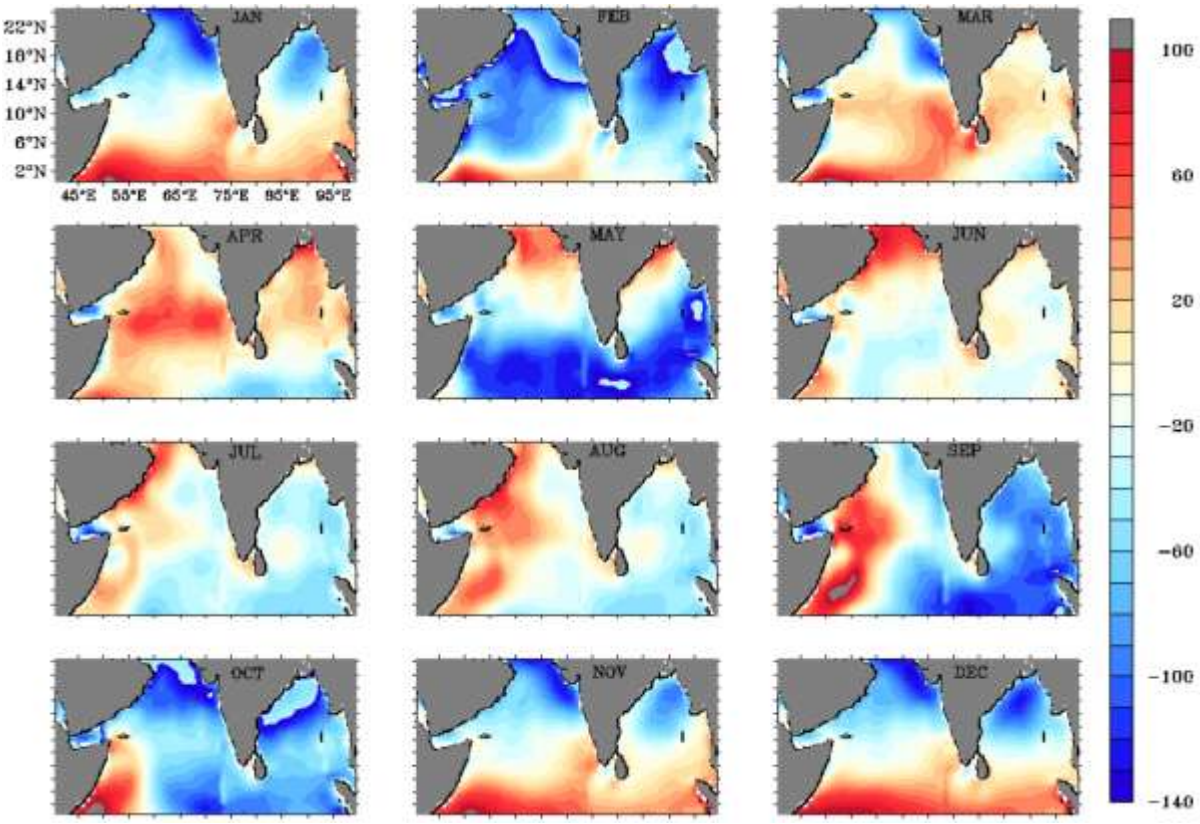

Figure12. *Same as figure 1 but for Ocean heat budget using OAflux data*

Fig 11&12 Advises monthly variation of ocean heat budget over the north Indian ocean high ocean heat budget is observed over the Arabian sea in pre and post monsoon season in both Tropflux and Oaflux .it is suggest that high connectivity over the bay of Bengal during that period this results consisting with previous results whereas during the summer monsoon season, equatorial Indian ocean shows high ocean heat content in both Tropflux and Oaflux.

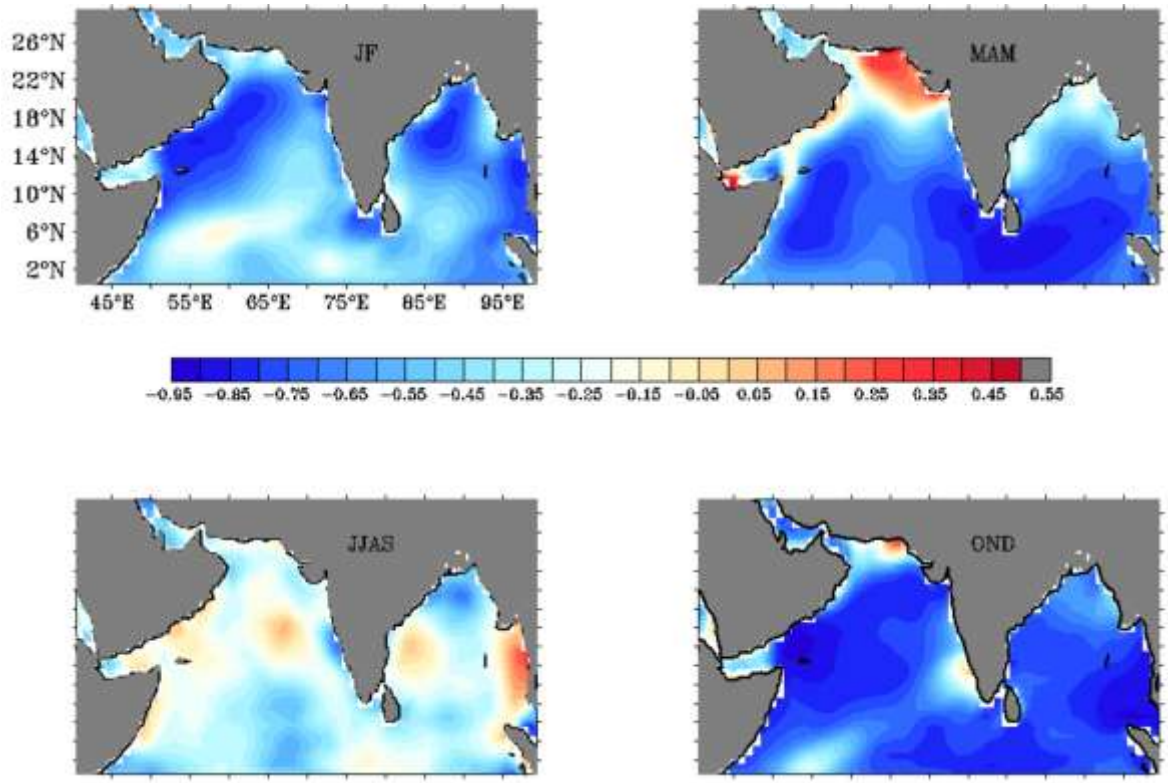

Figure13. *Spatial correlation between Latent heat flux and wind speed over the NIO.*

Fig 13 shows Correlation between latent heat flux and Wind speed seasonal variation over the north Indian Ocean. it suggests that JF(January, February) season high correlation in Arabian sea low correlation in head Bay of Bengal .in MAM(March, April, May) season in equatorial Indian ocean is very high correlation as compare with January and February .in JJAS(June, July, August, September)

High significance value in Arabian Sea and low significance in Bay of Bengal. In OND(October, November, and December) is high in north Indian Ocean, Bay of Bengal.

Summary and Conclusions

Monthly variation of net longwave radiation over the north Indian ocean in both tropflux and oaflux the figures apparent that high long wave radiation observed over the northern parts of the Arabian coast and head Bay of Bengal during the months Jan, feb, march, nov and dec.

During summer and winter monsoon seasons less net long wave radiation observed over the northern Indian Ocean especially east and west coasts of India. It is suggesting that the Indian Ocean is cooling because of the monsoon rainfall this is consisting with Fig 1&2 during the monsoon seasons.

Advises monthly variation of ocean heat budget over the north Indian ocean high ocean heat budget is observed over the Arabian sea in pre and post monsoon season in both Tropflux and Oaflux .it is suggest that high connectivity over the bay of Bengal during that period this results consisting with previous results whereas during the summer monsoon season, equatorial Indian ocean shows high ocean heat content in both Tropflux and Oaflux.

During summer and winter monsoon seasons less net long wave radiation observed over the northern Indian Ocean especially east and west coast of India. It is suggesting that the Indian Ocean is cooling because of the monsoon rainfall this is consisting with Fig 1&2 during the monsoon seasons.

shows that the net short wave radiation in tropflux/oaflux it is suggests that high net short wave radiation observed over the Indian ocean during feb, march, April, may in both tropflux/ oaflux data especially in the Arabian sea .during the summer monsoon months values of net shortwave radiation seen over the ITCZ(inter tropical convergence zone)/monsoon trough region especially over the head bay of Bengal .it is suggests that cloudiness over that area .which is not seen in the pre-monsoon season in both tropflux and oaflux data sets .in oaflux data shows less net radiation over the east coast of India which is consistent with north east monsoon however tropflux data is not showing this variability as much as OAflux data.

ACKNOWLEDGMENT

Our sincere thanks to Director, INCOIS for providing the Tropflux data and also acknowledge to Asia Pacific Data Research Centre for OAflux data.

REFERENCES

[1] Duncan,B., and W. Han, 2009. Indian Ocean intraseasonal sea surface temperature variability during boreal summer: Madden-Julian oscillation versus sub monthly forcing and processes. J.Geophys. Res., 114, C05002

[2] Goswami, B. N., 2012. South Asian monsoon. Intraseasonal Variability in the Atmosphere-Ocean Climate System, W. K.-M. Lau and D. E.Waliser, Eds., Springer, 21–72.

[3] Loschnigg, J., and P.J. Webster, 2000. A coupled ocean-atmosphere system of SST modulation in the Indian Ocean. J. Climate, 13, 3342–3360.

[4] Parampil, S. R., A. Gera, M. Ravichandran, and D. Sengupta, 2010. Intraseasonal response of mixed layer temperature and salinity in the Bay of Bengal to heat and freshwater flux. J.Geophys. Res., 115, C05002

[5] Schiller, A., and J. S. Godfrey, 2003. Indian Ocean intraseasonal variability in an ocean general circulation model. J. Climate,16, 21–39.

[6] Sanchez-Franks, A., E. C. Kent, A. J. Matthews, B. G. M. Webber, S. C. Peatman, and P. N. Vinayachandran, 2018. Intraseasonal Variability of Air–Sea Fluxes over the Bay of Bengal during the Southwest Monsoon. J. Climate, 31, 7087–7109

[7] Vecchi, G. A., and D. E. Harrison, 2002. Monsoon breaks and sub seasonal sea surface temperature variability in the Bay of Bengal. J. Climate, 15, 1485–1493

[8] Waliser, D. E., 2006. Intraseasonal variability. The Asian Monsoon, B. Wang, Ed., Springer, 203–257.

Citation: *S. Venkata Sai and K. Muni Krishna, "Air-Sea Fluxes Changes Over the North Indian Ocean", Open Access Journal of Physics, 4(2), 2020, pp 26-34.*