RESEARCH NOTE – COMPARING ENVIRONMENTAL PARAMETERS OF INDIAN OCEAN REGION BETWEEN JANUARY 2010 and MARCH 2020.

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The latest recorded data available in open access during the time of submission, which includes sub surface temperature and salinity profiles is of 2017 [1][2] (World Ocean Dataset & World Ocean Atlas 2018). In our work, we have considered the temperature data of the month march averaged over 2005-2017 (as already mentioned in the paper). This answer therefore draws comparison against environmental parameters of January 2010 [3] and March (2005-2017: considered in paper) and quantifies the similarity in both the environmental parameters.

The environmental factors affecting signal propagation are limited to temperature, salinity and depth (pressure), which allows us to estimate the speed of sound in water and which in turn affects the signal path and transmission loss. Amongst these three parameters,

a) The latest recorded bathymetry data for ETOPO1 dataset is of 2009. Furthermore, it is very unlikely for the **bathymetry** of the region to go through any major change over the period of January 2010 - March 2020.
b) Due to its tropical characteristics, salinity in our area plays a passive role in estimating the sound speed of the region and its value remains nearly constant across all depths and ranges, thus providing minimal to no variation in sound speed with change in salinity. Figure 1(b) below showcases the average monthly salinity across multiple depths for two time periods of January 2010 and March 2005-17 averaged. A more detailed information on the same can be visualized from Figure 3.
c) Due to its tropical characteristics, temperature has maximum impact on sound speed of the region (up to the point of sound speed minimum which in IOR lies around 1500 m). Figure 1(a) below showcases average temperature profile of our area of interest for two different periods (January 2010 and March 2005-17 averaged), at multiple depths, thus validating very minimal fluctuations in the temperature profiles across the two time periods. A more detailed information on the same can be visualized from Figure 2.

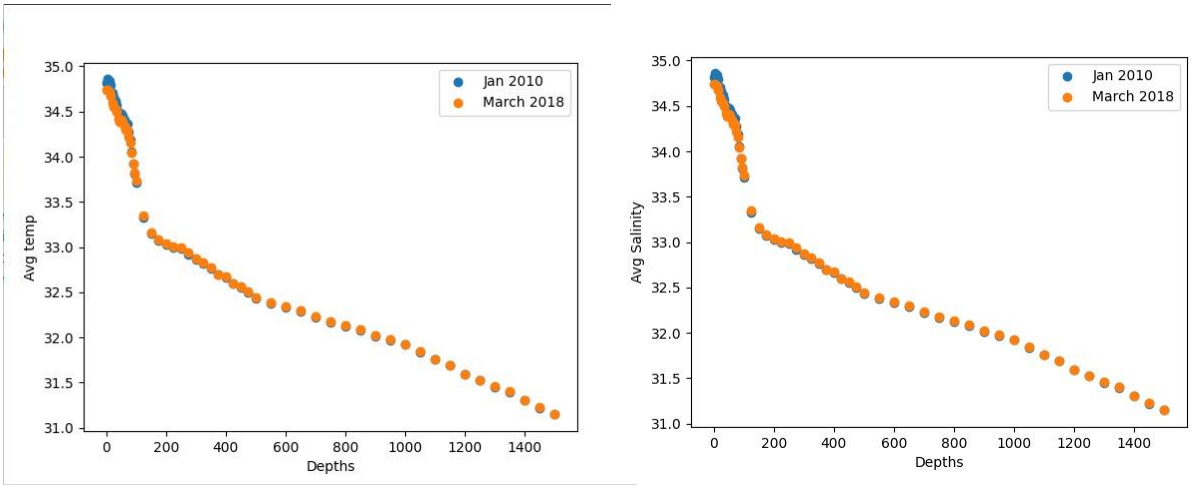

Fig 1. Monthly average sea temperature of our area of interest during January 2010 and March (2005-17).

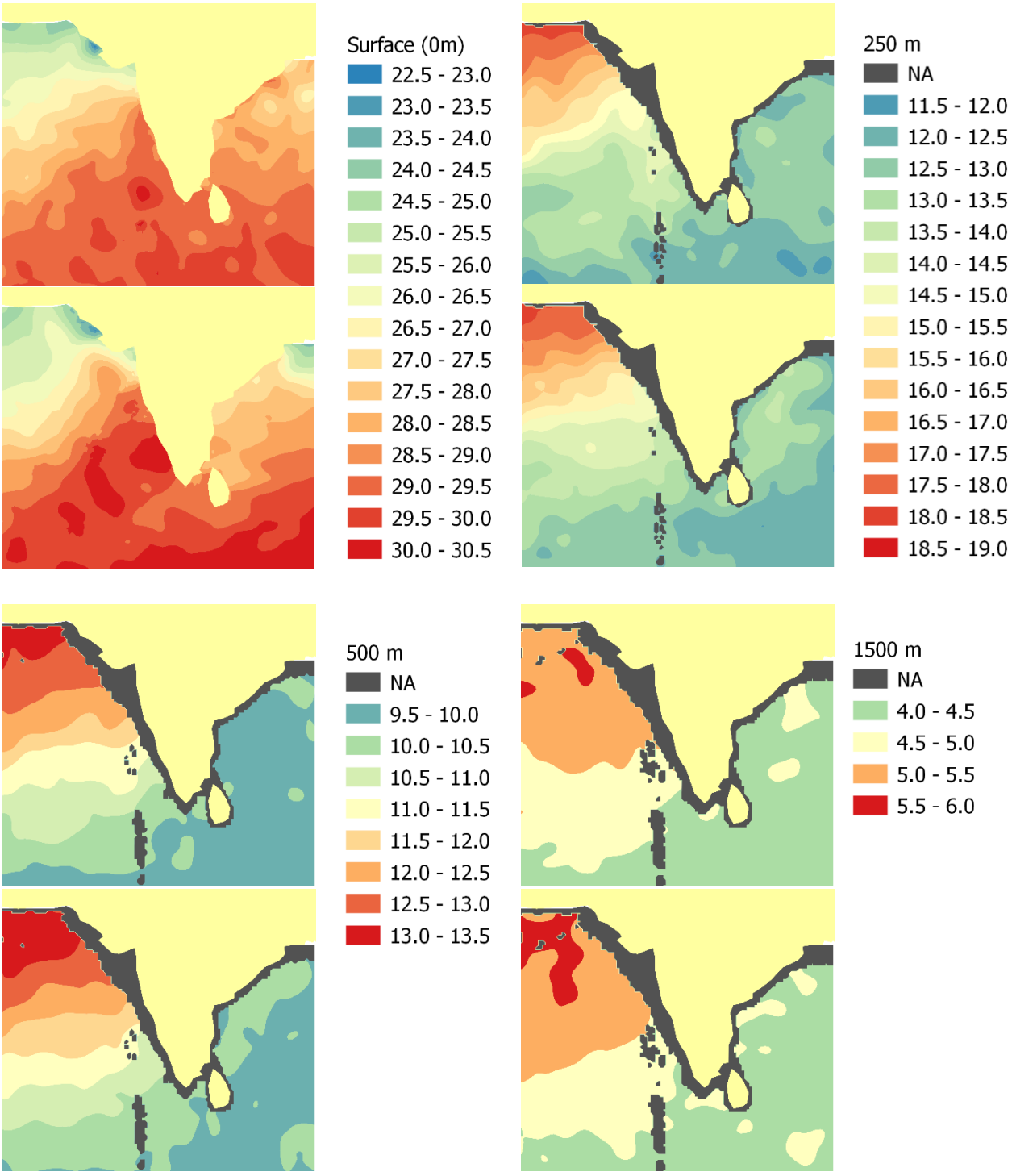

Fig 1. Monthly average sea temperature of our area of interest during January 2010 (above-in each depth) and March (2005-17) (below-in each depth). The temperature profiles at different depths are displayed to establish similarity in the environmental parameters.

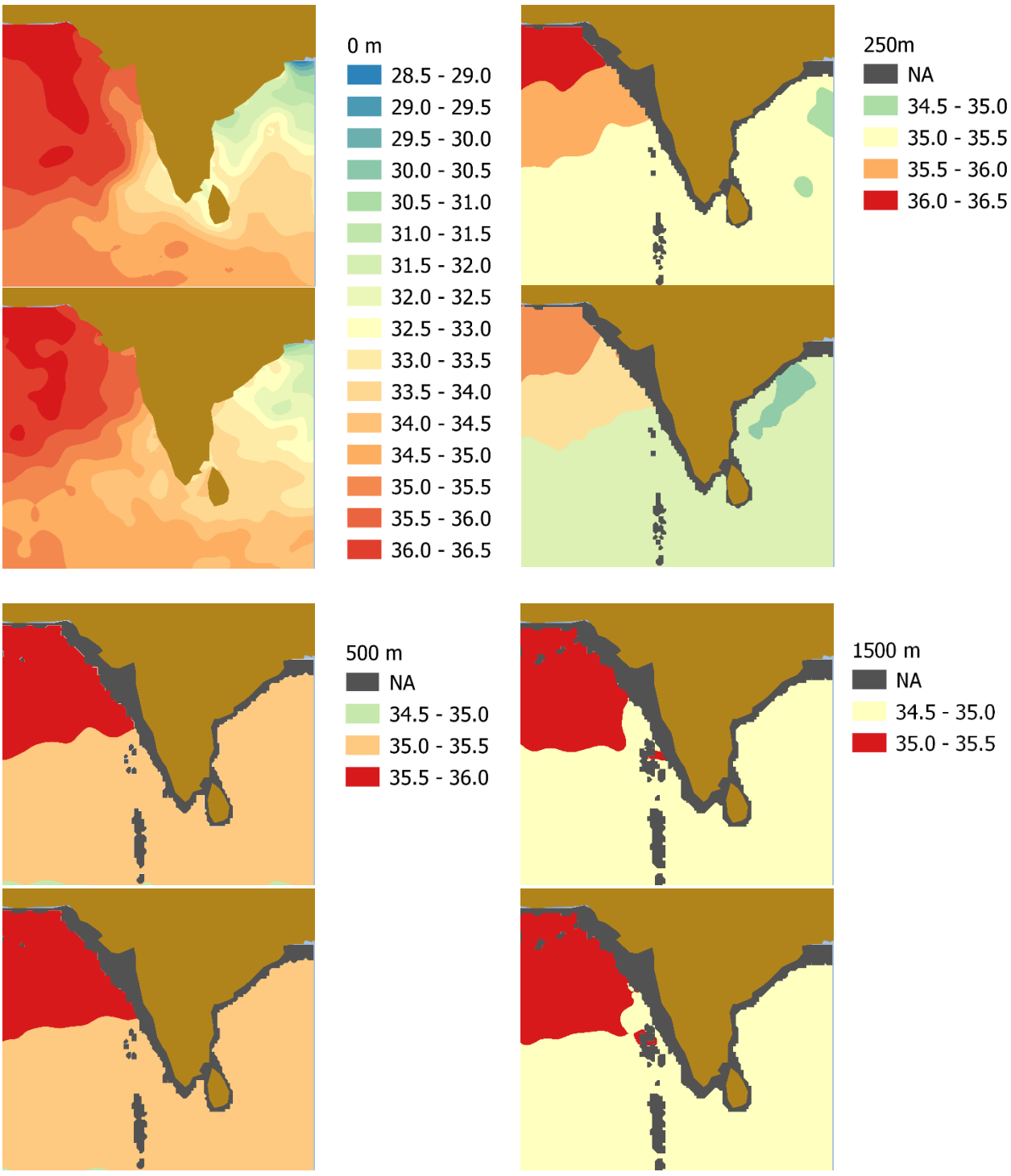

Fig 2. Monthly average sea salinity of our area of interest during January 2010 (above-in each depth) and March (2005-27) (below-in each depth). The salinity profiles at different depths are displayed to establish similarity in the environmental parameters

REFERENCES

[1] Locarnini, R. A., A. V. Mishonov, O. K. Baranova, T. P. Boyer, M. M. Zweng, H. E. Garcia, J. R. Reagan, D. Seidov, K. Weathers, C. R. Paver, and I. Smolyar, 2018. World Ocean Atlas 2018, Volume 1: Temperature. A. Mishonov Technical Ed.; NOAA Atlas NESDIS 81, 52 pp

[2] Zweng, M. M., J. R. Reagan, D. Seidov, T. P. Boyer, R. A. Locarnini, H. E. Garcia, A. V. Mishonov, O. K. Baranova, K. Weathers, C. R. Paver, and I. Smolyar, 2018. World Ocean Atlas 2018, Volume 2: Salinity. A. Mishonov Technical Ed.; NOAA Atlas NESDIS 82, 50 pp.

[3] Boyer, T.P., O. K. Baranova, C. Coleman, H. E. Garcia, A. Grodsky, R. A. Locarnini, A. V. Mishonov, T.D. O'Brien, C.R. Paver, J.R. Reagan, D. Seidov, I. V. Smolyar, K. Weathers, and M. M. Zweng, 2018: World Ocean Database 2018 (in preparation)

[4] Harland, E.J. & Clarke, T.. (2005). SEA 6 Technical report: underwater ambient noise.