EGU21-10643
https://doi.org/10.5194/egusphere-egu21-10643
EGU General Assembly 2021

Key role of overlooked twilight zone towards climate buffering

Himanshu Saxena, Deepika Sahoo, Sipai Nazirahmed, Deepak Kumar Rai, Mohammad Atif Khan, Niharika Sharma, Sanjeev Kumar, Athiyarath K Sudheer, and Arvind Singh
Physical Research Laboratory, Geosciences Division, Ahmedabad, India (himanshu@prl.res.in)

The twilight zone of the oceans layering between the bottom of the sunlit ocean and 1000 m depth, is one of the largest continuous ecosystems on the Earth, yet remains least explored. While the sunlit ocean is well-studied for its major role in sequestering CO_2 from the atmosphere, the role of twilight zone in CO_2 sequestration remains a mystery. The twilight zone of the Arabian Sea, north-western part of the Indian Ocean inarguably possesses an active nitrogen□cycle owing to abundant chemoautotrophic (anammox, nitrite oxidising, nitrifying) microorganisms and heterotrophic (denitrifying) microorganisms. However, these microorganisms with ramifications for the nitrogen cycle, incentivize the carbon cycle. Since chemoautotrophy is a light-independent autotrophic process, a significant amount of dissolved CO_2 may be assimilated rather than released in the Arabian Sea twilight zone by these organisms. With this supposition, we commenced the expedition in the off-shore and the central Arabian Sea during winter monsoon (Dec-Jan 2019) to measure carbon fixation rates in its sunlit and twilight zone using ^{13}C tracer incubation technique. The sunlit zone and twilight zone carbon fixation rates ranged from 6.8 to 40 mmol C m^{-2} d^{-1} and 0.4 to1.6 mmol C m^{-2} d^{-1}, respectively. The twilight zone carbon fixation did not vary spatially much, unlike sunlit zone which showed a sharp decreasing trend of carbon fixation from northern to the southern Arabian Sea. Notably, the twilight zone contribution to water column carbon fixation ranged from 2 to 10% during the study period. This study corroborates that the twilight zone forms an integral component of the carbon cycle; implying, the overlooked twilight zone can significantly contribute CO_2 drawdown. Therefore, the role of twilight zone towards climate buffering is bigger than previously assumed, demanding a review of its role in the current paradigm of the Earth's climate.