Light effect on N_2 fixation and diazotroph derived nitrogen net release of field Trichodesmium

YANGYANG LU[1,2], ZUOZHU WEN[1,2], DALIN SHI[1,2], MINGMING CHEN[1,2], YAO ZHANG[1,2], YUHANG LI[3], JIWEI TIAN[4] AND SHUH-JI KAO[1,2]*

[1] State Key Laboratory of Marine Environmental Science, Xiamen University, Xiamen, China
[2] College of Ocean and Earth Sciences, Xiamen University, Xiamen, China
[3] Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China
[4] Physical Oceanography Laboratory, Ocean University of China, Qingdao, China, Qingdao China

Dinitrogen fixation (NF) is a crucial pathway to refuel the oceanic bioavailable nitrogen inventory. Light is the key to modulate dinitrogen fixation, however, field studies regarding light response curve (NF-I curve) of NF rate and light effect on diazotroph derived nitrogen (DDN) net release were missing. We use uncontaminated $^{15}N_2$ gas dissolution method to examine how the light change may influence the intensity of N_2 fixation and DDN net release in oligotrophic ocean. We conducted experiments at three stations in the Western Pacific and the South China Sea where cyanobacterium *Trichodesmium* spp. was dominant diazotroph. The light effect on carbon fixation (CF) was measured in parallel using ^{13}C method specifically for a station with Trichodesmium bloom. Both NF-I and CF-I curves showed I_k (light saturation coefficient) range of 328 to 509 μE m^{-2} s^{-1} with saturation light at around 600 μE m^{-2} s^{-1}. The proportion of DDN net release ranged from ~6% to ~50% showing an increasing trend toward low light. At the Trichodesmium bloom station, we found CF/NF ratio was light-dependent and the ratio started to increase as light was lower than the carbon compensation point of 300 μE m^{-2} s^{-1}. N_2 fixation pathway was likely sacrificed under low light to conserve energy for photosynthesis, thus, there is metabolism tradeoff between carbon and nitrogen fixation pathway under light stress. Results showed that light modulates physiological state, which subsequently determined the C/N metabolism and DDN net release, of field Trichodesmium. Physiological state associated field light parameters would be helpful for model prediction of global biogeochemical cycle associated with Trichodesmium.