Title: Effect of light on N_2 fixation and net nitrogen release by Trichodesmium in a field study

Abstract. Dinitrogen fixation (NF) by marine cyanobacteria is ~~a crucial~~ an important pathway to replenish the oceanic bioavailable nitrogen inventory. Light is the key to modulate NF, however, field studies ~~regarding~~ investigating light response curve (NF-I curve) of NF rate and the effect of light on diazotroph derived nitrogen (DDN) net release are ~~missing that may~~ relatively sparse in the literature hampering ~~an accurate nitrogen model~~ prediction by the models. ~~Uncontaminated $^{15}N_2$ gas~~ A dissolution method was applied using uncontaminated $^{15}N_2$ gas to examine how the light changes may influence the NF intensity and DDN net release in the oligotrophic ocean. Experiments were conducted at stations with diazotrophs dominated by filamentous cyanobacterium *Trichodesmium spp.* in the Western Pacific and the South China Sea. The ~~light~~ effect of light on carbon fixation (CF) was measured in parallel using the ^{13}C ~~labelling~~ tracer method specifically for a station characterized by *Trichodesmium* bloom. Both NF-I and CF-I curves showed *Ik* (light saturation coefficient) range of 193 to 315 μE m^{-2} s^{-1} with ~~saturation~~ light saturation at around 400 μE m^{-2} s^{-1}. The proportion of DDN net release ranged from ~6% to ~50% ~~revealing~~ suggesting an increasing trend as the light intensity decreased. 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 200 μE m^{-2} s^{-1}. NF pathway was most likely ~~preferentially~~ blocked under low light to conserve energy for photosynthesis, thus, there is a metabolism tradeoff between carbon and nitrogen fixation pathways under light stress. Results showed that short-term (<24h) light change modulates the physiological state, which subsequently determined the C/N metabolism and DDN net release ~~of field~~ by *Trichodesmium*. ~~Energy~~ Reallocation of energy associated with the variation~~s~~ ~~of~~ ~~field~~ in light intensity would be helpful for ~~model~~ prediction of global biogeochemical cycle of N by models ~~involved with~~ involving *Trichodesmium* bloom.