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Dinitrogen fixation in the Western Tropical South Pacific: a source of nitrogen in excess fot the thermocline waters of the South Pacific

Alain Fumenia, Thierry Moutin, Anne Petrenko, and Sandra Helias Nunige
Aix Marseille, Mediterranean Institute of Oceanography , 13, France (alain.fumenia@mio.osupytheas.fr)

As part of the Oligotrophy to UlTra-oligotrophy PACi?c Experiment (OUTPACE) cruise, which took place in the Western Tropical South Paci?c during the austral summer (March-April 2015), we present data on nitrate, phosphate and on particulate organic matter. The stoichiometric nitrogen-to-phosphorus ratios of the inorganic and organic material and the N* signal, a tracer to visualize the combined effect of denitrification and diazotrophy on nitrogen variations, were examined. We revealed the presence of two oceanic regions that are quite distinct from a biogeochemical point of view. On the one hand, the waters located in the Melanesian Archipelago (160˚ E-170˚ W, 20˚ S) have a deficit of nitrate and phosphate in the productive layer (0-100 dbar), an excess of particulate organic nitrogen relative to particulate organic phosphate compared to the canonical Redfield ratio, associated in part with diazotrophic particulate organic matter formation and a positive N* anomaly in surface and thermocline waters. This nitrogen excess over phosphate measured in the waters of the Melanesian Archipelago was observed in parallel with record rates of dinitrogen fixation. On the other hand, the surface waters of the South Pacific Gyre (170˚ W-160˚ W, 20˚ S) are characterized by undetectable nitrate concentrations, significant phosphate concentrations, a lack of particulate organic nitrogen in excess, and a N* anomaly close to zero or negative. Despite the high concentrations of phosphate in surface waters, the dinitrogen fixation rates are close to zero in the South Pacific Gyre suggesting a limitation by iron availability, preventing an N* signal increase. Exploitation of data from Provor-type Argo floats deployed during OUTACE are underway to complement these results.At the basin scale, calculation of N* signal from the new Global Ocean Data Analysis Project version 2 database showed a strong spatial decoupling between the thermocline waters of the Eastern Tropical South Pacific and those of the Western Tropical South Paci?c. A strongly positive N* anomaly was observed in the thermocline waters of the Western Tropical South Paci?c in the Coral/Tasman Seas and in the southern part of the subtropical gyre between latitude 23˚ S and 32˚ S. A strong negative N* signal was observed in the waters of the Eastern Tropical South Paci?c between latitude 5˚S and 20˚-23˚ S. We hypothesize that the southern branch of the subtropical gyre is probably the main vector of excess nitrogen transport in the thermocline waters showing an influence of nitrogen fixation occurring in the western tropical in a large part of the South Pacific Ocean.