

ENSO related variations in fluxes and composition of settling particles in equatorial WPWP

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Settling particles collected by time-series sediment trap moorings, which were deployed in the western Pacific warm pool (WPWP), revealed discrete patterns in total mass flux and labile composition of particulate organic matter (POM) under the El Nino (1991-93, 1994-95) and La Nina (1999) conditions, which prevailed over the equatorial Pacific and overlapped the sampling period. During each deployment of the mooring, samples were collected at an interval of two weeks for about one year, and analysed for total mass and amino acid (AA) fluxes and composition of POM using standard procedures. Results from this study showed that in the hemipelagic zone of the far western equatorial Pacific Ocean, average total mass and AA fluxes were relatively higher during El Nino than during La Nina. However, at the oligotrophic warm pool and upwelling sites (further east from the hemipelagic zone), total mass and AA fluxes were higher during La Nina. Despite these spatial variations, fluxes showed largest range of variations at all sites during La Nina. Influence of El Nino Southern Oscillation (ENSO)-related changes on the settling particle flux was much easily discernible in the hemipelagic zone compared to that in the warm pool. Probably the ENSO brings maximum change in the levels of thermocline and nutricline in the hemipelagic zone, as a result of which the processes of biological particle production in the surface waters are modified to a considerable extent and the overall labile composition of settling particles changes accordingly. The depth of thermocline and nutricline and thickness of mixed water layer, all of them are associated with change in force of easterlies and westerlies trade winds as well as latitudinal shift of the warm water pool.

In general, the total mass flux values recorded in this study are comparable to those reported from other sites in the equatorial Pacific Ocean. Only one site located in the oligotrophic WPWP had the lowest flux recorded so far. Average values of diagenetic and source indicator parameters such as Glucosamine/Galactosamine and amino acids/hexosamines, and bulk parameters like AA carbon and nitrogen contents relative to organic carbon and total nitrogen (THAA-C% and THAA-N%, respectively), and organic carbon normalised AA concentrations indicated that sinking POM was more labile along the equatorial WPWP during La Nina. The ratios Aspartic acid/beta-alanine, Glutamic acid/gama-aminobutyric acid, and relative concentration of non-protein AA (beta-alanine+gama-aminobutyric acid) suggested that POM degradation was more intense during La Nina than during El Nino conditions at all the studied sites. The uniformity in labile nature of the samples collected at all sites during the La Nina event is in contrast with that observed during the El Nino events. In a study on the radiolarians in the equatorial Pacific during warm (El Nino) and cold phases (La Nina) of the 1992 ENSO, it was suggested that environmental forcing can determine community composition. Therefore, the above mentioned uniformity in the AA based parameters may be explained if it is assumed that a particular type of planktonic community existed in surface waters during El Nino event and generated sinking POM, whose AA based parameters were different from what existed there during La Nina event. The equatorial Pacific is considered to be a natural source of carbon dioxide to the atmosphere. However, it also acts as a sink when photosynthetic activity of phytoplankton sequesters some carbon from surface water which gets exported to the deep ocean as sinking POM. Our study shows that ENSO has the capability of shifting carbon sink/source across the equatorial Pacific, and is the main source of interannual variability in the carbon cycle of the equatorial Pacific Ocean. Similar influence of ENSO on the particle flux has also been reported in a few previous studies conducted in the eastern equatorial Pacific Ocean.