Geophysical Research Abstracts
Vol. 21, EGU2019-937, 2019
EGU General Assembly 2019

Particulate organic matter and δ^{13}C variability in the coastal and central Arabian Sea associated with summer monsoon induced upwelling

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Arabian Sea (AS), one of the highest productive zones in the global oceans, is under a marked influence of the Indian monsoon system. During June- September the low pressure over Indian subcontinent gives rise to south-westerly winds which causes strong upwelling along the coasts of Somalia and southwestern India. A low level atmospheric jet, (Findlater) blows almost perpendicular to the coast of Somalia towards the coast of Gujarat in India and results in an open ocean upwelling to its north. These strong physical forcings associated with coastal as well as Open Ocean upwelling significantly make this bay highly productive by mediation of nutrients. In the context of climate change, the accelerated warming trend of the AS and change in upwelling intensity may potentially impact the ecosystem, but the consequences are largely unknown. The present study has been planned to revisit the India-JGOFS track with the aim to compare the present observations with the existing data from the same location collected almost two decades ago. A cruise (RV, Sindhu Sadhana, SSD 40) was conducted in Aug, 2017 (summer monsoon) in order to understand the biogeochemical variability in relation to physical parameters along the west coast of India and in the central AS. Our results clearly indicate a very strong south-north concentration gradient in all physicochemical parameters along with Chl$a$ and particulate organic matter in the coastal AS. The physical features showed that the southern stations seemed to be influenced by coastal upwelling and was also seen by high nutrients, Chl$a$, particulate organic carbon (POC) and nitrogen (PN) concentrations. The scenario was totally different in the northern sector where lack of upwelling was the dominant. All major nutrients (N, Si, P) were significantly ($p<0.05$) lower in the northern transects relative to the south. The average POC concentrations in the southern stations ($76.4\pm27 \mu$mol L^{-1}) were more than 5 times higher than that of northern stations. The salinity and temperature values in the north were nearly 2 units higher ($p<0.05$) than those observed in the south. The average $\delta^{13}C_{POC}$value in the south was -22.5$\pm$2.4‰ which is typical of diatom dominated phytoplankton origin. This value was more depleted in the northern stations ($\approx$ -26.9‰) and was probably due to the dominance of different phytoplankton community with slow growth rate due to nutrient limitation. In the coastal stations C:N ratios ($\approx$9) were within the range of phytoplankton derived organic matter. The central AS along the 64°E also showed upwelling signatures north of the axis of the Findlater Jet coupled with high nutrient and phytoplankton biomass. High POC (15μmol L^{-1}) and PN (2.2μmol L^{-1}) values were noticed throughout the central transect. The average $\delta^{13}C_{POC}$value was close to -25.5‰ and also clearly signifies phytoplankton origin of autochthonous organic matter. The average C:N ratios (6.8) were close to the canonical phytoplankton Redfield values. Our estimated values of POC and PN from this transect were comparable with the earlier reported values by India-JGOFS team.