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High resolution carbon isotope of Crassostrea cuttakensis: A proxy for seasonally varying carbon dynamics in a tropical delta-estuary system

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The exponential increase in the atmospheric CO_2 concentration and global temperature is becoming a major threat to the existence of the mankind. It has been proposed that the $\sim$2 $^{\circ}$C rise in the average global temperature may lead to a point of no-return where the balance between the climate and the ecosystem collapses. Therefore, detailed understanding of the major carbon reservoirs and their mutual interactions is needed for better future climate prediction. Among all the reservoirs, ocean holds $\sim$90 % of the exogenic carbon and promotes long term storage in sediments. However, the majority of the sedimentary carbon is of terrestrial origin and transported through rivers, which play an important role in carbon exchange between the atmosphere, terrestrial biosphere, and oceans. The transportation of organic carbon through river does not follow a simple conveyer belt model. Various organic and inorganic reactions (i.e., organic carbon degradation, inorganic carbon precipitation, primary production, community respiration) modify the state of the carbon to form a major sub-reservoir in the river, i.e., Dissolved Inorganic Carbon (DIC). So, identifying the source/s of the DIC is crucial to understand the carbon dynamics in the river. Stable carbon isotopic composition of the DIC ($\delta^{13}C_{DIC}$) has long been extensively used to reveal the dominant source/s of the DIC. The majority of the large rivers, being situated in the tropical belts, show seasonal fluctuation in the DIC sources. However, seasonal sampling in the remotest reaches of these rivers hindered our thorough understanding of the seasonally varying source/s of DIC in these rivers. Many calcifying organisms precipitate their shell carbonate in equilibrium with water and hence likely to record the $\delta^{13}C_{DIC}$of ambient water in their shell. In this study, a living oyster (*Crassostrea cuttakensis*) was collected from Matla River, which is part of the Ganges Brahmaputra river delta system, and analyzed for its stable isotopic composition ($\delta^{13}C_{shell}$and $\delta^{18}O_{shell}$). The oyster shell was cut along the maximum growth line and the umbo of the oyster was analyzed for the stable isotopic measurement. An online laser ablation system, attached to a Delta V Advantage Mass Spectrometer via. Gas-bench II, was used for very high resolution ($\sim$125μm, equivalent to $\sim$6 days) isotope data. Additionally, water samples were collected from the study area in different seasons and the $\delta^{13}C_{DIC}$of the ambient water was analyzed. The shell carbonate δ^{13}C profile shows excellent seasonal variation and very good correlation with the measured $\delta^{13}C_{DIC}$. Though more water samples from different seasons are needed to accurately calibrate the vital effect of this species, it can be suggested from the limited dataset that the carbonate shell of this species was precipitated in equilibrium with the ambient water and can be used as a reliable proxy for the $\delta^{13}C_{DIC}$.