Enhanced carbon delivery from the Ganga (Hooghly) river estuary through degradation of organic carbon and carbonate dissolution: Evidence from DIC and $\delta^{13}C_{DIC}$

TARUN K DALAI[1], SAUMIK SAMANTA[1] AND JITENDRA K PATTANAIK[1]

[1]Indian Institute of Science Education and Research Kolkata, Mohanpur 741246, INDIA (dalai@iiserkol.ac.in; saumik1215@iiserkol.ac.in)

Comprehensive investigations have been carried out focusing on major ions, dissolved inorganic carbon (DIC) and its $\delta^{13}C$ ($\delta^{13}C_{DIC}$) in the Ganga (Hooghly) river estuary water sampled in six seasons of contrasting water discharges during 2012 and 2013. These results along with data on dissolved O_2, dissolved Ca and $\delta^{13}C$ of particulate organic carbon have been used to understand the cycling of carbon within the estuary. Mass balance considerations suggest that DIC and $\delta^{13}C_{DIC}$ cannot be explained only by conservative mixing of seawater and river water. Mixing calculations and the observed undersaturated levels of dissolved O_2 indicate that biological respiration and organic carbon degradation dominate over biological production in the estuary. An important outcome of this study is that a significant amount of DIC and dissolved Ca is generated within the estuary at salinity ≥10 particularly in the monsoon period. We contend that the dominant source of DIC generated within the estuary is carbonate dissolution, an idea supported by strong positive correlation between "excess" quantity of DIC and dissolved Ca. Calculations show that ground water is insufficient to account for the observed excess Ca in the high salinity zone.

LOICZ model calculations yield an annual DIC flux of ca. $(3\text{-}4)\times10^{12}$ g from the estuary to the Bay of Bengal out of which ca. (40-50)% is generated within the estuary. In this study, monsoon seasons accounted for a dominant fraction (ca. 70%) of the annual DIC generation within the estuary. The annual DIC flux from the Hooghly estuary accounts for ca. 1% of the global river DIC flux to oceans. This is disproportionately higher than water contribution from the Hooghly river to the oceans (ca. 0.2%). This study brings out the significance of tropical estuarine systems in that they can be important reservoirs capable of supplying large amount of DIC to the oceans via cycling between organic and inorganic carbon.