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Spatio-temporal variation in $\delta^{13}C_{DIC}$ of a tropical eutrophic estuary (Cochin estuary, India) and adjacent Arabian Sea

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Abstract

Carbon isotopic composition of dissolved inorganic carbon ($\delta^{13}C_{DIC}$) in the Cochin estuary, a tropical eutrophic estuary along the southwest coast of India, and the adjacent coastal Arabian Sea was measured to understand spatio-temporal variability in sources and processes controlling inorganic carbon (C) dynamics in this estuarine-coastal system. $\delta^{13}C_{DIC}$ in the Cochin estuary showed wide variation during three different seasons (premonsoon: –12.2 to –3.26 ‰; monsoon: –13.6 to –5.69 ‰; and postmonsoon: – 6.34 to +0.79 ‰). Detailed mixing curve approximation modeling along with relationships of $\delta^{13}C_{DIC}$ with dissolved oxygen and nutrients suggest dominant role of freshwater mixing and degassing of CO_2 on DIC dynamics during wet seasons (premonsoon and monsoon). Excess CO_2 brought in by rivers and *in situ* production due to respiration in the Cochin estuary result into one of the highest pCO_2 observed in estuarine systems, leading to its degassing. During postmonsoon, a relatively dry period with high salinity, calcite precipitation was a major process with calcite saturation index > 1 at few locations. Relatively lower average surface values of $\delta^{13}C_{DIC}$ in the coastal Arabian Sea (premonsoon: +0.95‰; monsoon: +0.88 ‰; and postmonsoon: +0.66 ‰) compared to the