DISSOLVED CARBON DIOXIDE AND METHANE IN ESTUARIES AND WATERS SURROUNDING MANGROVES ON THE EAST COAST OF INDIA AND THE ANDAMAN ISLANDS

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ABSTRACT

This study reconsiders our current understanding of $C0_2$ and CH_4 emissions from coastal margins especially from estuaries and mangroves surrounding waters. Though coastal areas occupy lesser surface area when compared to the oceans their contribution to greenhouse gas emissions are significantly higher. Due to the intense biogeochemical transformations that take place in coastal zones these regions play an important role in the cycling of carbon and emissions of important greenhouse gases. Most of our understanding of coastal biogeochemical processes is from studies in temperate areas and very few targeted studies have been carried out to date in tropical zones. The higher temperature in the tropics would suggest significant atmospheric fluxes from the tropical coastal ecosystems. $C0_2$ and CH_4 concentrations and fluxes in three different mangrove (Andaman, Sundarbans and Pichavaram) ecosystems and two different estuarine (Hooghly and Adyar) zones on the east coast of India and the Andaman Islands were estimated. The study sites were chosen based on the different environmental settings and degree of anthropogenic impact.

All the sites showed high $pC0_2$ and dissolved CH_4 concentrations and were a source of these gases to the atmosphere. The heavily impacted Adyar River showed the highest $C0_2$ and CH_4 fluxes followed the pristine Andaman mangroves. There appear to be no direct impact of anthropogenic activity on the emissions of these gases. The concentrations, distribution and subsequent emissions depend on rates of organic matter supply and burial, tidal pumping of porewaters, redox status of sediment and overlying water, dilution with coastal waters, and in the case of CH_4 levels of sulphates.

Global scaling of the emissions of $C0_2$ and CH_4 (as $C0_2$ equivalents calculated based on global warming potentials) from the mangrove waters in this study, are lower than the $C0_2$ fixed by mangroves through primary production. The mangrove ecosystems are however contributors to greenhouse gas forcing equivalent to about 90 x 10^{12} g of $C0_2$ annually. Though this study incorporated a range of mangrove ecosystems the fluxes reported worldwide span several magnitudes higher and lower than fluxes obtained in the present study. Also if the emissions from different sub ecosystems were taken into account the emissions are likely to be higher. Moreover this estimate is likely to increase due to loss of mangrove ecosystems owing to loss of stored mangrove biomass. Further work is needed in a wider range of environments with different sub ecosystem components also taken into account to better quantify the overall greenhouse gas emissions from mangrove and estuarine environments. Such data from are imperative to understand the net carbon balance in coastal ecosystems especially because mangroves and estuaries play a critical role in determining the direction and magnitude of air

- sea exchange for the global shallow water coastal oceans. Such information would aid in evaluating $C0_2$ mitigation strategies involving mangrove replanting.