Coupled Micrometeorological and Biological Processes at the Land-ocean Boundary, NE Coast of India

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Coastal water at the east coast (Bay of Bengal) suffers a major change owing to the huge river runoff during southwest monsoon (Sengupta et al., 1978) while at the west coast (Arabian Sea) upwelling (Sarma, 2003) and the CO_2 released into the atmosphere is a prominent feature of southwest monsoon. Out gassing of CO_2 owing to input of anthropogenic organic and inorganic carbon by rivers (Sarmiento and Sundquist, 1992) could change the behavior of the coastal water from sink to source, affecting the coastal tropospheric CO_2. The ratio (z/L) of Obukhov length (L) to reference height (z) of the atmosphere is an important parameter measuring the relative importance of buoyancy versus shear effects in the stratified surface layer at the land-ocean boundary condition with mangrove vegetation cover. This study reports the role of coupled stability (z/L) in the atmosphere and biological activity in the water during their diurnal and seasonal variations on the atmospheric CO_2 in the coastal water off the Mahanadi estuary, NE coast of India. Coastal water off the Mahanadi estuary was significant and perennial source of atmospheric CO_2, markedly influenced by anthropogenic organic matter run off. The average fluxes were significantly higher during pre-monsoon and monsoon (946.8-329.8 $\mu M\ m^{-2}\ h^{-1}$ than that of post-monsoon (55.9 $\mu M\ m^{-2}\ h^{-1}$). Stability effect was pronounced in pre-monsoon and monsoon. During pre-monsoon, the stability changed from unstable ($-1<z/L<0$) to stable ($0<z/L<1$) in the night at 20:00-04:00 hrs, raising surface (10m) CO_2 concentration by 1.03% (388ppmv) relative to 30m with storage rate of 5.68 mg $m^{-2}h^{-1}$. No land sea-breeze phenomenon was observed and even during the classified land breeze period wind tends to of sea origin. The land-sea breeze on a day – night pattern were present in an extreme form in the monsoon when the wind direction was only from sea. Transition from unstable to stable condition in the night at 22:00-03:00hrs was able to pull up the CO_2 from 367 to 381 ppmv with storage rate of 4.86 mg $m^{-2}h^{-1}$. Lowering of PBL was also observed from 796-700 m in pre-monsoon to 648-622m in monsoon. Once the stability changed from stable to unstable sea breeze pull the CO_2 down by 2.9% at 10m. During post-monsoon, land-sea breeze phenomenon was prominent. There was no swing from unstable condition and elevation PBL height occurred from 716m in day to 733 m in night. Lowering of CO_2 level started with the onset of sea breeze, which was able to pull the CO_2 down by 5.6% at 10m and 2.35% at 30m. Mean landward CO_2 concentration in the night was found to be 391 ±19 ppmv. The extent of land advection was at the mean rate of 29.7 mg $m^{-2}h^{-1}$. A strong influence of continental air mass during northeast monsoon was observed to raise the CO_2 at 30m to 382 ppmv. During the transition from

northeast to southwest monsoon marine advection could pull the CO_2 down to 374 ppmv.

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