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Measurement and modeling of CO2 exchange over forested landscapes in India: an overview

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The increasing atmospheric CO2 concentration and its potential impact on global climate change is the subject of worldwide studies, political debates and international discussions. The concern led to the establishment of the Kyoto Protocol to curtail emissions and mitigate the possible global warming. The studies so far suggest that terrestrial biological sinks might be the low cost options for carbon sequestration, which can be used to partially offset the industrial CO2 emissions globally. In past, the effectiveness of terrestrial sink and the quantitative estimates of their sink strengths have relied mainly on the measurements of changes in carbon stocks across the world. Recent developments in flux tower based measurement techniques such as Eddy Covariance for assessing the CO2, H2O and energy fluxes provide tools for quantifying the net ecosystem exchange (NEE) of CO2 on a continuous basis. These near real time measurements, when integrated with remote sensing, enable the up-scaling of the carbon fluxes to regional scale. More than 470 towers exist worldwide as of now.

Indian subcontinent was not having any tower-based CO2 flux measurement system so far. The Indian Space Research Organization under its Geosphere Biosphere Programme is funding five eddy covariance towers for terrestrial CO2 flux measurements in different ecological regions of the country. The tower sites already planned are: (i) a mixed forest plantation (Dalbergia sissoo, Acacia catechu, Holoptelia integrifolia) at Haldwani in collaboration with DISAFRI, University of Tuscia, Italy and the Indian Council for Forestry Research and Education (ICFRE), Dehradun, (ii) a sal (Shorea robusta) forest in Doon valley Himalayan state of Uttarakhand in northern India, (ii) a teak (Tectona grandis) mixed forest at Betul in Madhya Pradesh in central India, (iv) an old teak plantation at Dandeli, and (v) a semi-evergreen forest at Nagarhole in Karnataka state in southern India. The three towers have been procured and the eddy covariance equipment installation on Haldwani tower will be completed this month.

The equipment for ground based studies such as soil respiration system, soil moisture and temperature measurement system, PAR sensor, hemi view, light use efficiency measurement system etc. have been already procured. The spatial database containing a variety of information on soil types, rainfall, temperature, forest cover PAR, vegetation indices etc. has been prepared using remote sensing and other means. The temporal ground inventory of the vegetation and soil parameters is also under progress. Each site will involve a team leader, one research student and one master degree student. The Forest Departments of above mentioned states of India are actively collaborating in this research. Various universities and research institutions have also expressed interest to cooperate in the programme.