The Eddy Covariance Method

IRRI's climate change research covers various aspects of adaptation and mitigation in rice production systems. Mitigation research focuses on developing technologies and crop management practices that can reduce methane (CH_4, a potent greenhouse gas) emissions, and increase the carbon (C) sequestration in biomass and soil to reduce the carbon footprint of irrigated rice.

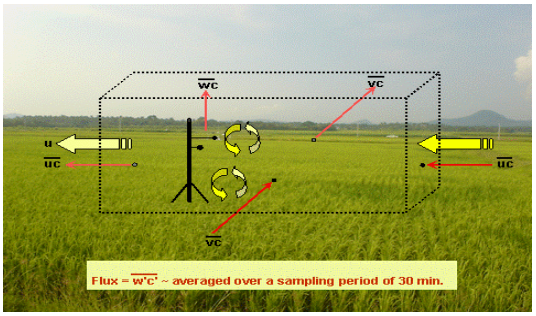
The eddy covariance (EC) system is an effective tool that IRRI uses in ensuring that the mitigation and adaptation options that the institute develops to minimize the impacts of climate change on rice production have also minimal environmental footprints. It is widely employed as the standard micrometeorological method that directly measures carbon dioxide (CO_2), CH_4, water vapor, and heat fluxes over a large area. On the minimum, the EC can cover a 100-m radius, which corresponds to a field size of 4 hectares.

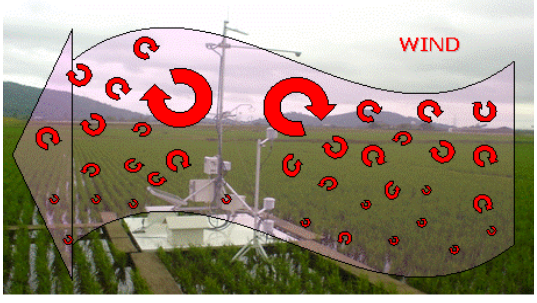
What does the EC system do?

- It monitors the impacts of land-use change in terms of greenhouse gas (GHG) emissions (i.e., CH_4 and CO_2) and heat fluxes.
- It provides continuous and simultaneous measurements of CH_4 and CO_2 emissions over a larger part of the landscape and over all ecosystem processes without disturbing the gas exchange between the soil surface and the atmosphere.
- It directly measures CH_4 and CO_2 fluxes at an extremely high temporal resolution (10 Hz) of 36,000 measurements per hour. The continuous EC data generation over time gives a good representation of the variability of the temporal (diurnal and seasonal) patterns of CH_4 and CO_2 fluxes as affected by different technologies and crop management practices.
- It takes measurements of CH_4 and CO_2 fluxes over the entire cropping period, in all processes (encompassing land preparation, growing, and fallow). The information generated by this technique is essential to improve the understanding not only of the global warming potential (GWP), but more so, of the net greenhouse gas budget (NGHGB) and the net ecosystem C budget (NECB) of rice-based ecosystems. More broadly, this information is relevant for process-oriented models of CH_4 fluxes and the assessment of future climate change impacts due to CH_4 emissions.

Flux measurement

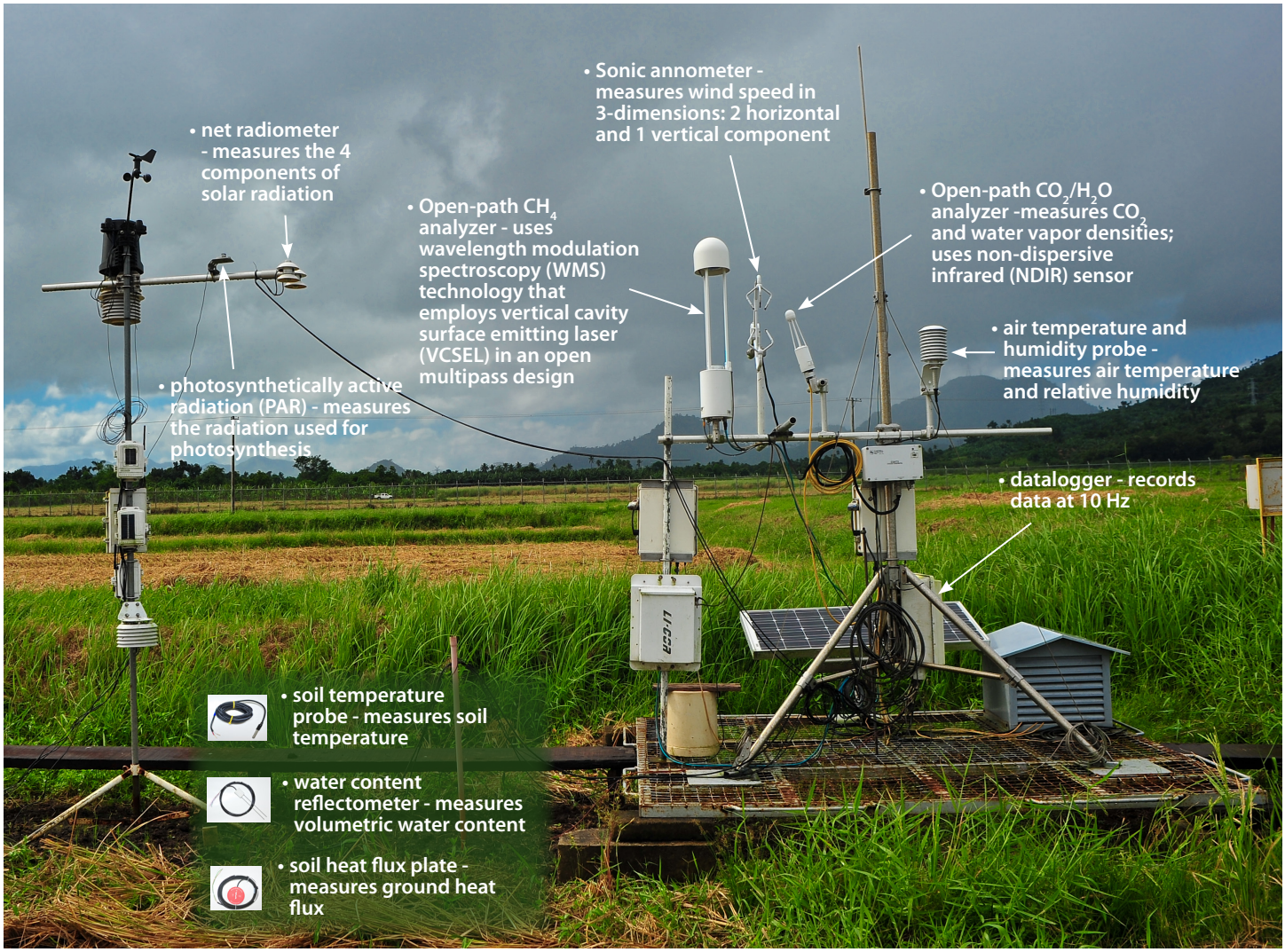
Airflow is the horizontal flow of numerous turbulent rotating eddies. The EC system can simultaneously measure the different components of the eddies (e.g., gas concentration, temperature, humidity etc.) including the vertical wind speed. Flux is determined as the mean covariance between the deviations in instantaneous vertical wind speed (w') and gas intensity (c').





The EC system

The EC system consists of fast-response sensors as sonic anemometer, CO_2/H_2O and CH_4 analyzers that can record 10 data per second. It also consists of ancillary sensors for biometric measurements.



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International Rice Research Institute (IRRI)

The International Rice Research Institute (IRRI) is the world's premier research organization dedicated to reducing poverty and hunger through rice science; improving the health and welfare of rice farmers and consumers; and protecting the rice-growing environment for future generations. IRRI is an independent, nonprofit research and educational institute founded in 1960 by the Ford and Rockefeller foundations, with support from the Philippine government. The institute, headquartered in Los Baños, Philippines, has offices in 15 rice-growing countries in Asia and Africa, and about 1,000 staff members.

Working with in-country partners, IRRI develops advanced rice varieties that yield more grain and better withstand pests and disease as well as flooding, drought, and other destructive effects of climate change. More than half of the rice area in Asia is planted to IRRI-bred varieties or their progenies. The institute develops new and improved methods and technologies that enable farmers to manage their farms profitably and sustainably, and recommends rice varieties and agricultural practices suitable to particular farm conditions as well as consumer preferences. IRRI assists national agricultural research and extension systems in formulating and implementing country rice sector strategies.