Need to measure fluxes of CO_2, CH_4 or H_2O at your site?

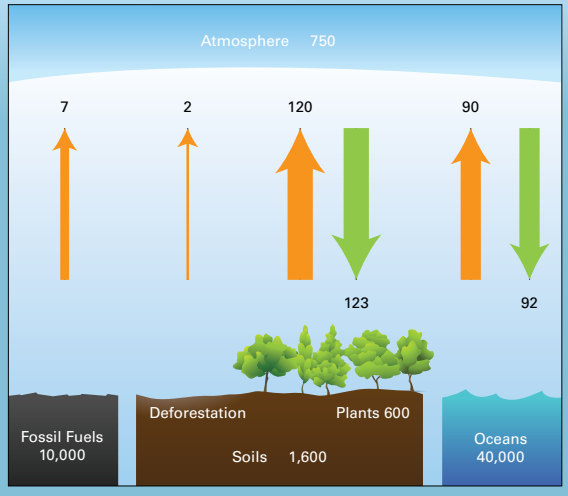
A Brief Introduction to the Eddy Covariance Method

- Monitoring greenhouse gas emissions is important for global climate models and regulatory compliance.
- Eddy covariance is a widely used, well established, and practical method for measuring greenhouse gas emissions.
- The eddy covariance method can be used to monitor greenhouse gas exchange from natural environments and industrial facilities, including landfills, feedlots, and others.

Since the turn of the industrial revolution, atmospheric CO_2 concentrations have increased by nearly 40% and continue to rise, putting more carbon into circulation in the global carbon cycle. The exchange of carbon between the atmosphere and ecosystems through photosynthesis and respiration accounts for roughly 120 gigatons of carbon annually. This is more than 10 times the combined exchange due to fossil fuel use and deforestation (Fig 1). Because of the magnitude of these exchanges and the continued increase in atmospheric CO_2 concentration, much research over the past several decades has focused on attempting to quantify carbon fluxes from ecosystems.

Traditionally, this research used static techniques such as chamber-based measurements, which are both labor intensive and limited in their application. While these techniques have provided valuable insight into ecosystem processes, they lack the ability to truly capture the dynamics of ecosystem-level carbon fluxes.

Fig. 1. Global Carbon Flux (Gt/yr) and Storage (Gt)



Data Sources: USGS, DOE, and IPCC.

With the introduction of compact, high speed, high precision gas analyzers in recent years it became possible to measure ecosystem-level fluxes continuously using the eddy covariance method. Eddy covariance determines fluxes by looking at the covariance between gas concentration and air turbulence (i.e., eddies) over an area. This method has marked advantages over other flux measurement techniques for large scale applications, including: (i) measurement systems can be deployed with little impact to the study area; (ii) simultaneous measurements of net ecosystem exchange of CO_2, CH_4, H_2O and energy are possible; (iii) measurements can be automated, continuous, and require little user involvement. Given these advantages, and the fact the eddy covariance technique is presently the most accurate and direct method for quantifying ecosystem level fluxes of carbon, water and energy, it is no wonder why it is the most widely used method among the research community.

While much of the development of the eddy covariance method has occurred in natural ecosystems, the applicability of the method is far reaching. Scientists have successfully applied this technique to quantify emissions from industrial sites such as feedlots and landfills, in agricultural fields, and in urban environments.

For more information on the eddy covariance method and the instrumentation required, visit:
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11/2010 982-11615