North Wyke Farm Platform

Case study no. 17

Developing an Eddy Covariance System

Laura Cardenas, Nadine Loick, Bruce Griffith

Eddy covariance (EC) has provided environmental researchers with key insights into the diel, intra-annual and inter-annual dynamics of Earth's surface processes. Significant insights have been gained into the global carbon cycle and the functioning of key ecosystem processes (e.g. photosynthesis and respiration). However, in stark contrast to most measurements, the replication of EC studies is typically low, or non-existent. Together with Rob Clement (University of Edinburgh), Dr Hill has developed a low cost Eddy Covariance system that promises to reduce the cost of Eddy Covariance by an order of magnitude, making replication economically feasible. This work is in early developmental stages. Early prototypes of the system have undergone some testing at field sites in Morecambe Bay and Dumfries and Galloway. The second generation system now needs testing, and the technique must be proven at a wider range of field sites.

We aim to test a new pump-based version of this developmental EC system alongside our conventional system as well as the first generation fan-based version of the system. The overall aim of the test will be to provide a long-term (i.e. annual) dataset comparison of the systems. We will corroborate the performance of the inexpensive systems and quantify their accuracy.

The installation of the equipment will be undertaken by Tim Hill and Rob Clement. Ongoing maintenance will be undertaken by Tim Hill.

Two additional masts will be installed at the farm platform site. These masts will be 4 m tall and they will be supported by 4 guy ropes. The masts will be located in the wind shadow of the existing EC system (to avoid any turbulent disturbance to the existing system).

Current Eddy covariance system in Great Field

Mast 1: This system will use a Gill Wind Master Pro anemometer. Also on this mast we will mount three IRGAs. 1) the original inexpensive EC system, which is a 'fan'- based system, 2) the second generation inexpensive EC system, which is a pump based system, and 3) a LI-COR LI7500 for corroboration. Data will be recorded by a Campbell Scientific Cr3000. The total power draw for this mast will be ~15-20 W.

Mast 2: This system will use a Gill Wind Master (not Pro) anemometer and a pump base inexpensive EC system. The data for this system will be record by an inexpensive Arduino data logger. The total power draw will be ~5W.

The equipment on Mast 1 will provide a comparison of the core system (i.e. the IRGA). The second mast will provide a test of the complete inexpensive pump-based system (i.e. an inexpensive anemometer, IRGA and data logger).

The installation of the system is expected to take two days. Regular maintenance is expected to be repeated every month.