Tasmania: Ecological Research

Campbell AP200 & CPEC200 used for long-term ecological research in eucalyptus forest

Case Study Summary

Application: Long-term ecological studies in wet eucalyptus forest
Location: Warra LTER site, Tasmania, Australia
Owner and operator: Tim Wardlaw, Forestry Tasmania
Integrators: Measurement systems installed by Forestry Tasmania and Campbell Scientific Australia
Products Used: CR3000 with CPEC200, CR1000 with AP200 (8 intakes), CR1000 with soil measurements
Communication: Weekly manual collection of compact flash cards and uploading to PC
Measured Parameters: Vertical profiles of CO₂ density, H₂O density, and temperature for calculation of change in storage; high-frequency measurements of CO₂ density, H₂O density, sonic temperature, and 3D wind used to calculate eddy fluxes; air temperature; humidity; wind speed and direction; rainfall; incoming and outgoing shortwave radiation; net radiation; phenology; soil water content; soil heat flux; soil temperature

• To measure the exchanges of carbon dioxide, water vapour, and energy between the forest and the atmosphere using eddy-covariance micro-meteorological techniques
• To link eco-physiological processes and rates of carbon accumulation and decomposition with the site biota
• To use flux tower measurements, in combination with remote sensing data and land surface models, to upscale and estimate the net exchanges of carbon and water at regional scales

The Warra LTER site includes a flux tower that is part of the OzFlux Network (www.ozflux.org.au) and the Australian Supersites Network (www.supersites.net.au/supersites). The flux tower consists of an 80-metre (262-foot) guyed steel-lattice tower. Turbulent fluxes of heat, water vapour, and carbon dioxide are measured at the top of the tower.
using a Campbell Scientific CPEC200 Closed-Path Eddy-Covariance System with a vortex sample intake. A combination of a Campbell Scientific AP200 profile system with eight intakes and a series of Apogee aspirated temperature sensors provides a vertical profile of water vapour, carbon dioxide, and temperature.

The profiles are used to calculate the change in storage (i.e. accumulation or depletion) of the two gases and heat. The change in storage is added to the turbulent fluxes to determine a total flux or net ecosystem exchange for each scalar. A profile system is particularly useful at a site like Warra where the change in storage is significant in times of lower turbulence intensity (e.g. at night) and within the especially large forest canopy.

Supplementary measurements are also made above the canopy with Campbell Scientific instruments, including temperature and humidity, wind speed and direction, rainfall, incoming and reflected shortwave radiation, and net radiation. At ground level, soil moisture content is measured using time-domain reflectometry (TDR) instruments, while soil heat fluxes and soil temperature are also measured.

Since the Warra LTER site was established, more than 200 research projects have been undertaken at the site, and ten of those projects have been designated icon projects, designed with the specific intent of continuing re-measurement in the long term (more than 15 years). The Warra flux tower is one of these ten icon projects.