



# EdiSol

## in Tropical Forests

EdiSol

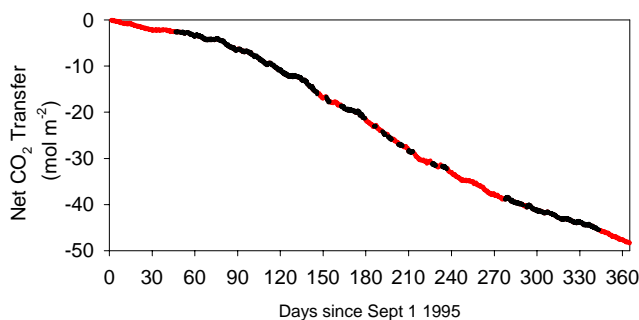
A system to measure surface fluxes by eddy covariance



Since 1992, several *EdiSol* systems have been in use in the Brazilian Amazon rain forest to address the question of whether the tropical rain forests of the world could be substantial sinks for carbon. Several published studies have attempted to close the global carbon balance and it has been hypothesised that the world's land areas sequester about 1.3 Gt of carbon per annum, or approximately 20 % of man-made emissions. It had been thought that tropical forests were 'carbon neutral' and that they would not be

responsible for the missing carbon sink. Direct measurements over several years by *EdiSol* systems indicate this may not, in fact, be the case and that tropical forests can be net absorbers of a substantial fraction of the carbon required to close the carbon balance.

Campaigns in both wet- and dry seasons at Reserva Jaru, Rondonia were conducted with an *EdiSol* system placed 15 m above a 30 m-tall forest. In conjunction with a model to scale up data to a whole year, the use of *EdiSol* suggests an ecosystem carbon sink of about 1 ton C ha<sup>-1</sup> y<sup>-1</sup>. Later work at Manaus with *EdiSol* systems suggest an even larger sink. Brazilian savannah or *cerrado* is about one-third the areal extent of the Brazilian rain forest and accounts for about 5% of terrestrial primary productivity. *EdiSol* has also been



used to produce the first estimates of fluxes of energy, water and carbon measured at intervals over a whole year in this ecosystem. Results suggest that *cerrado* can be a sink for CO<sub>2</sub> in the wet season and a brief source during the dry season. The conversion of rain forest to farm land is also important in

Brazil and *EdiSol* systems have been deployed to monitor the changes to carbon, water and energy balances on a seasonal basis

**Some publications describing the contribution of *EdiSol* to the Amazon study**

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- Grace, J., Lloyd, J., McIntyre, J., Miranda, A., Meir, P., Miranda, H., Moncrieff, J.B., Massheder, J.M., Wright, I. and Gash, J.C. (1995) Fluxes of carbon dioxide and water vapour over an undisturbed tropical forest in south-west Amazonia. *Global Change Biology* **1**, 1-12.
- Grace, J., Lloyd, J., McIntyre, J., Miranda, A., Meir, P., Miranda, H., Nobre, C., Moncrieff, J.B., Massheder, J.M., Malhi, Y., Wright, I. and Gash, J.C. (1995) Carbon dioxide uptake by an undisturbed tropical rain forest in south-west Amazonia, 1992 to 1993. *Science* **270**, 778-780
- Lloyd, J., Grace, J., Miranda, P., Meir, A.C., Wong, S.C., Miranda, H., Wright, I., Gash, J.H.C. and McIntyre, J. (1995) A simple calibrated model of Amazon rain forest productivity based on leaf biochemical properties. *Plant, Cell and Environment* **18**, 1129-1145.
- Moncrieff, J.B., Malhi, Y. and Leuning, R. (1996) The propagation of errors in long-term measurements of land-atmosphere fluxes of carbon and water. *Global Change Biology* **2**, 231-240.
- Da Rocha, H.R., Sellers, P.J., Collatz, G.J., Wright, I.R. and Grace, J. (1996)



- Calibration and use of the SiB2 model to estimate water vapour and carbon exchange at the ABRACOS forest sites. in: Gash, J.H.C., Nobre, c.A., Roberts, J.M. and Victoria, R.L. (eds.) *Amazonian deforestation and Climate*. Wiley.Chichester.
- Kruijt, B., Lloyd, J., Grace, J., McIntyre, J.A., Farquhar, G.D., Miranda, A.C. and McCracken, P. (1996) Sources and sinks of CO<sub>2</sub> in Rondonia tropical rain forest. in: Gash, J.H.C., Nobre, C.A., Roberts, J.M. and Victoria, R.L. (eds.) *Amazonian deforestation and Climate*. Wiley. Chichester
  - Grace, J., Malhi, Y., Lloyd, J., McIntyre, J., Miranda, A.C., Meir, P. and Miranda, H.S. (1996) The use of eddy covariance to infer the net carbon uptake of Brazilian rain forest. *Global Change Biology* **2**, 209-218.
  - Miranda, A.C., Miranda, H.S., Lloyd, J., Grace, J., Francey, R.J., McIntyre, J.A., Meir, P., Riggan, P., Lockwood, R. and Brass, J. (1997) Fluxes of water and energy over Brazilian cerrado: an analysis using eddy covariance and stable isotopes. *Plant, Cell and Environment* **20**, 315-328
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are housed in an environmentally sealed enclosure.

*EdiSol* is a system for measuring the surface fluxes of momentum, heat CO<sub>2</sub> and H<sub>2</sub>O by eddy covariance. *EdiSol* uses commercially-available instrumentation: a 3-axis sonic anemometer (Gill A1012R) and an infra-red gas analyser (LI-COR 6262). Air to be sampled is brought to the optical bench by being ducted down a sampling tube from a point near the sonic anemometer. The system is controlled by specially-written software which calculates the surface fluxes of momentum, sensible and latent heat and carbon dioxide and displays them in real time on a PC screen. The IRGA, PC and associated plumbing and flow control systems

