Geophysical Research Abstracts, Vol. 7, 08467, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08467

Energy and Water Fluxes in Heterogeneous Mediterranean Water-limited Ecosystems

M. Detto (1), N. Montaldo (1), J. D. Albertson (2), M. Mancini (1), G. Katul (3), and P. Botti (4)

(1) Dipartimento di Ingegneria Idraulica, Ambientale, Infrastrutture viarie, e del Rilevamento, Politecnico di Milano, Italy

(2) Department of Civil and Environmental Engineering, Pratt School of Engineering, Duke University, USA

(3) Nicholas School of the Environment and Earth Sciences, Duke University, USA

(4) Ente Autonomo del Flumendosa, Cagliari, Italy

For stationary and planar homogeneous atmospheric surface layer (ASL) turbulent flows, eddy-covariance (EC) flux measurements can be readily used to infer surface fluxes thereby permitting quantification of how biological and physical controls regulate the exchange of matter and energy. However, the vegetation cover of many ecosystems is far from uniform thereby frustrating the linkage between EC measurements and biological controls of biosphere-atmosphere mass and energy exchange rates. Using satellite imagery and scalar source-weight function calculations over a heterogeneous ecosystem dominated by bare soil, grass, shrubs, and trees, we propose a methodology for 1) separating surface energy sources contributions of the various land cover types from single tower measurements, and 2) estimating differential responses of the various land cover types to water stress.

The experiment commenced in April of 2003 at the Orroli experimental field of the Flumendosa basin in Sardinia, Italy. Sardinia is a region that suffers from water scarcity, and the Flumendosa basin plays a primary role in the water supply for much of southern Sardinia, including the island's biggest city, Cagliari. The site is representative of a typical Mediterranean heterogeneous ecosystem covered by trees and dense shrubs, which become sparse following grazing. The EC fluxes and agrometeorological data from a single tower, and surface temperatures of each main land

cover type were monitored at half-hour time resolution. Soil moisture profiles were also monitored at half-hour time resolution using water content reflectometers, and leaf area index of each main land cover type were also estimated by a ceptometer at weekly to monthly time steps. Furthermore, two high spatial resolution (2.8 m) Quickbird satellite images were acquired in August of 2003 and March 2004 for defining the spatial organization of the main land cover types (bare soil, grass and trees) around the tower for two contrasting seasons of the year (Summer and Spring). The land cover type components were obtained by a supervised classification of the visible and near infrared bands. The approximate analytical footprint model of Hsieh et al. (2000), modified to include the lateral dispersion, estimates the contribution of each source (i.e. land cover type) according to distance from the tower and wind direction.