Geophysical Research Abstracts, Vol. 8, 03166, 2006
SRef-ID:

Adsorption of Water Vapour by bare Soil in an Olive Grove in Southern Spain

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Vapour adsorption is an important hydrological phenomenon in arid and semi-arid regions. Under the right atmospheric and soil surface conditions, water is adsorbed from the atmosphere by a thin layer of top soil, generally during the afternoon and evening. The amounts of adsorbed water can be considerable and its quantification is therefore important for agricultural water management, surface energy balance studies, ecological studies, and remote sensing investigations.

Data of water vapour adsorption and evaporation are presented for a bare soil (sandy loam, clay content 15%) in a southern-spanish olive grove. Water losses and gains were measured using eight high-precision mini-lysimeters, placed around an olive tree, which had been irrigated until the soil reached field capacity. They were subsequently left to dry for ten days. A pair of lysimeters was situated at each of the main points of the compass (N, E, S, W), at a distance of one (the inner set of lysimeters, ILS) and two metres (the outer set of lysimeters, OLS), respectively, from the tree trunk.

Distinct periods of moisture loss (evaporation) and moisture gain (vapour adsorption) could be distinguished for each day. Vapour adsorption often started just after noon and generally lasted until the (early) evening. Values of up to 0.7 mm of adsorbed water per day were measured. Adsorption was generally largest for the OLS (up to 100% more on a daily basis), and increased during the dry-down. This was mainly the result of slightly lower (period-average absolute difference < 0.01 m^3 m^{-3}) OLS surface soil moisture contents, as illustrated using various analyses employing a set of micrometeorological equations describing the exchange of water vapour between bare

soil and the atmosphere. These analyses also showed that the amount of water vapour adsorbed by soils is very sensitive to changes in the atmospheric driving and surface variables. The use of empirical equations to estimate vapour adsorption is therefore not recommended.