Soil evaporation : a new parameterisation of the soil resistance based on soil surface measurements

Andre Chanzy

EVALUATION OF EVAPOTRANSPIRATION IN MOUNTAIN AREAS

L. Falappi, G. Grossi, R. Ranzi, B. Bacchi
Università degli Studi di Brescia, Dipartimento di Ingegneria Civile, via Branze, 38, 25123 Brescia, Italy, falappi@bsing.ing.unibs.it

The correct evaluation of the areal evapotranspiration (ET) in mountain areas is often difficult because complex physical phenomena are involved and due to the limited number of operational meteorological stations available at high altitudes. As a consequence large uncertainties exist in the estimates of the areal ET losses which are fundamental, for instance to close the hydrological water balance.
To achieve a more realistic estimate of these losses, Penman-Monteith potential evapotranspiration (PM-PET) values, computed at several sites with complete meteorological measurements, have been compared with pan evaporation data available at two sites in the Upper Adda valley (Valtellina) in the central Italian Alps. Vegetation cover data derived from remote sensing are also used to assess the spatial variability of stomatal resistance, through leaf area index. PM-PET estimates are compared also with results reported in literature for other areas of the Alps with similar topography, land use and climatology.
The correlation between potential evapotranspiration estimates, aggregated at different temporal scales, with the meteorological variables is analyzed. Also the relative importance of the radiative and the aerodynamic terms in the PM-PET equation is investigated. The results are useful for extrapolations to sites where only a few meteorological variables, typically air temperature and wind speed, are measured.

SOIL EVAPORATION : A NEW PARAMETERISATION OF THE SOIL RESISTANCE BASED ON SOIL SURFACE MEASUREMENTS.

A. Chanzy
INRA, Laboratoire de Science du Sol, 84914 Avignon Cédex 9, France
achanzy@avignon.inra.fr

Soil evaporation is often modelled using semi-empirical approaches as with the Penman-monteith model. It provides the evaporation flux at an instantaneous time scale. The soil processes which limits the evaporation rate in comparison to the climate demand are governed by a surface resistance (R_s) which is generally linked to soil surface moisture (θ_s). The $R_s=f(\theta_s)$ is given by an empirical relation which depends on the soil type. However, the temporal validity of these relations is generally short. It has been shown that the climatic demand itself influences the relation. Thus, the diurnal cycle and the seasonal cycles of the climatic demand need to be accounted for. Based on a large set of data simulated by a mechanistic model of heat and mass flow, we establish a new parameterisation of R_s, that integrates the variations of the climatic demand. The R_s model only involves soil-dependant parameters which determination is discussed. With a given set of parameters we can estimate the evaporation through the year.
The validity of the approach is then evaluate against experimental data collected on different soil and climatic conditions.

SIMPLIFIED MODELS OF ACTUAL EVAPOTRANSPIRATION FOR USE IN DISTRIBUTED HYDROLOGICAL MODELS

A.C.Armstrong[1], K.Schmidt[2], A.M.Matthews[1] & D.R.Solomon[1]
[1] ADAS Hydrology, Gleadthorpe Research Centre, Mansfield NG20 9PF UK
[2] ADAS Boxworth, Cambridge, CB3 8NN, UK

Implementation of models of water resources requires models of water use by crops. Normally, these models use a process based simulation of the combination of crop, soil and meteorology. However, for distributed models, the number of possible combinations of soil, crop and climate is potentially vast. In order to meet the requirements of a distributed water resource model, a simplified meta-model of actual evaporation is required. This uses an empirical parameterisation of the outputs from a full simulation model. We used the IRRIGUIDE simulation model to define the actual water use by month for a combination of crops and soil types. The meta-model is then calibrated using this training data set, and then can be sued to examine the consequences of changes in land use patterns on water resources.

HSA5

HSA5 Hydrological processes and distributed hydrological modelling - Poster Session

Convener: Venneker, R.
Co-Convener: Scherrer, S.

DISTRIBUTED HYDROLOGICAL MODELLING IN AGRICULTURAL AREAS WITH DENSE DITCHES NETWORK

S. Le Forner, R. Moussa, M. Voltz, P. Andrieux and P. Lagacherie (1)
(1) Institut National de la Recherche Agronomique, U.R. Science du Sol, 2 Pl. Viala, 34060 Montpellier Cedex 2, France.

Mediterranean agricultural zone presents a high degree of variability of hydrological processes in both space and time. This variability is imposed by the presence of a dense man-made ditches network, the tillage practices of the soil during the year, and intense rainfall regimes. These problems are expected to influence basin hydrological response during flood events. For that, a spatially distributed hydrological model linked to a Geographical Information System was developed and applied to assess the complex hydrological processes in the Roujan basin (1km²) located southern France. The model considers the catchment as a series of interconnected hydrological units delimited according to the catchment geomorphology in agricultural zone such as limits of field parts, terraces and ditches network. Detailed descriptions are provided for the main hydrological processes: Hortonian runoff processes, infiltration, baseflow and hydrograph routing through the ditches network taking into account the interaction between groundwater and the ditches. The model enables to simulate hydrographs at different nodes of the ditches network corresponding to different scales of subbasins (0.01 to 1km²) and enables to quantify over each hydrological unit the different hydrological fluxes. Results show that the ditches network infiltrates runoff to the aquifer and that tillage practices favour infiltration and reduce runoff volumes.

20/04/99 . La Haye