Geophysical Research Abstracts, Vol. 9, 06962, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06962

Ecohydrology in mediterranean areas: a numerical model to describe growing seasons out of phase with precipitations.

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The most common ecohydrological models start from the water balance equation, a stochastic differential equation constituted by a stochastic part and by a deterministic part. The unknown quantity of this equation is the function of the soil moisture, depending both on space and time. The existing solutions in literature have been obtained in a probabilistic framework and under a steady-state condition; even though this last condition allows the analytical handling of the problem, it has considerably simplified the problem by subtracting generalities from it. The steady-state hypothesis, used in the most of ecohydrological works, appears perfectly applicable in arid and semiarid climatic areas like those of African's or middle American's savannas, but it seems to be no more valid in semiarid Mediterranean regimes, like those of south Italy where, notoriously, wet season foregoes growing season, thus recharging the moisture of the soil. For plants physiology, especially for tree vegetation, this initial soil moisture condition has a capital importance by enabling survival in absence of rainfalls during the growing season and, however, keeping low the water stress during his first period. The aim of this paper is to investigate on above topics through a simple non steady numerical ecohydrological model. The proposed model is able to reproduce soil moisture probability density function (pdf) obtained analytically from other authors for different climate and soil conditions in steady-state. The numerical model take in account for initial condition superimposing a value extracted from a Gaussian distribution. This assumption allows to get soil moisture pdf, which can be compared with those obtained in steady-state. Dynamic water stress is computed directly on soil moisture traces, implicitly taking into consideration initial soil moisture condition, without any artifice. The simple numerical model proposed here was applied in the forested river basin of the Euleterio (Sicily, Italy).