Geophysical Research Abstracts, Vol. 7, 03560, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03560


# An integrated model for conjunctive simulation of hydrological processes and water resources management in river basins

**A. Efstratiadis** (1), E. Rozos (1), A. Koukouvinos (1), I. Nalbantis (1), G. Karavokiros (1) and D. Koutsoyiannis (1)

(1) Department of Water Resources, School of Civil Engineering, National Technical University of Athens, Greece [Contact Email: andreas@itia.ntua.gr /Fax: +30 210 7722832]

In complex hydrosystems, where natural processes are significantly affected by human interventions, a holistic modelling concept is required, to ensure a more faithful representation of mechanisms and hence a rational water resource management. An integrated scheme, comprising a conjunctive (i.e., surface and groundwater) hydrological model and a systems-oriented management model, was developed, based on a semi-distributed approach. Geographical input data include the river network, the sub-basins upstream of each river node and the aquifer discretization in the form of groundwater cells of arbitrary geometry. Additional layers of distributed geographical information, such as geology, land cover and terrain slope, are used to define the hydrological response units (HRUs); the latter are spatial components that correspond to areas of homogenous hydrological characteristics. On the other hand, input data for artificial components include reservoirs, water abstraction facilities, aqueducts and demand points. Dynamic input data consist of precipitation and potential evapotranspiration series, given at a sub-basin scale, and target demand series. Targets refer not only to water needs but also to various water management constraints, such as the preservation of minimum flows across the river network. Various modules are combined to represent the key processes in the watershed, i.e. (a) a conceptual soil moisture accounting model, with different parameters assigned to each HRU; (b) a groundwater model, based on a modified finite-volume numerical method; (c) a routing model, that implements the water movement across the river network; and (d) a water management model, inspired from the graph theory, which estimates the optimal hydrosystem fluxes, satisfying both physical constraints and target priorities and simultaneously minimising costs. Model outputs include discharges through the river network, spring flows, groundwater levels and water abstractions. The calibration employs an automatic procedure, based on multiple error criteria and a robust global optimisation algorithm. The model was applied to a meso-scale (˜2000 km2) watershed in Greece, characterised by a complex physical system (a karstified background, with extended losses to the sea) and conflicting water uses. 10-year monthly discharge series from seven gauging stations were used to evaluate the model performance. Extended analysis proved that the exploitation of spatially distributed input information, in addition to the usage of a reasonable number of control variables that are fitted to multiple observed responses, ensures more realistic model parameters, also reducing prediction uncertainty, in comparison to earlier (both fully conceptual and fully distributed) approaches. Moreover, the incorporation of the water resource management scheme within the hydrological simulator makes the model suitable for operational use.