Distributed Hydrological Modelling for Ungauged Watersheds: the Case of the Seyhan River Basin

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Abstract

A realistic distributed hydrological modeling is hard to deal with for ungauged watersheds due to the lack of systematic hydrological gauging records of sufficient spatial and temporal lengths. These data are needed for identifying the characteristics of a watershed statistically (inference or predictive), initiation, calibration and validation of hydrological modelling. This study presents: (1) distributed hydrological characteristics of an ungauged watershed; topography, geometry, surface runoff flow directions, and hydrological parameters, (2) distributed hydroclimatic variables; precipitation, runoff, evaporation, snowmelt, ..etc, (3) reservoir routing algorithms. The objective of this study are; (1) to use HydroBEAM, distributed rainfall-runoff model (Fig. 1), for the case of the Seyhan River basin, Turkey. (2) to evaluate the impact of climate change by simulating the interaction between the hydroclimatic variables and the dynamic behavior of land use. (3) to evaluate the performance of distributed hydrological modelling by comparing the results from HydroBEAM with those derived from the hydrological model which will be used by the hydrology team from Turkey. In order to achieve these objectives, topographic data for the Seyhan River basin are selected from GTOPO30, a global DEM, with a horizontal grid spacing of 30 seconds, then an eight-directions based surface runoff flow routing is applied in order to delineate an approximated boundaries of the basin. The hydroclimatic variables can be derived from GCM-daily hydroclimatic data by using bilinear interpolation, or the available gauged data can be used to identify the spatial and temporal variability of parameters such as lapse rate and threshold snowfall occurrence temperature, also an interpolation pressure-gradient surface is introduced in order to calculate the distributed atmosphere pressure and wind velocity. The surface runoff flow is simulated by simplifying the mass balance equation in the kinematic wave model.

Keywords: ungauged, distributed, hydroclimatic, runoff, reservoir

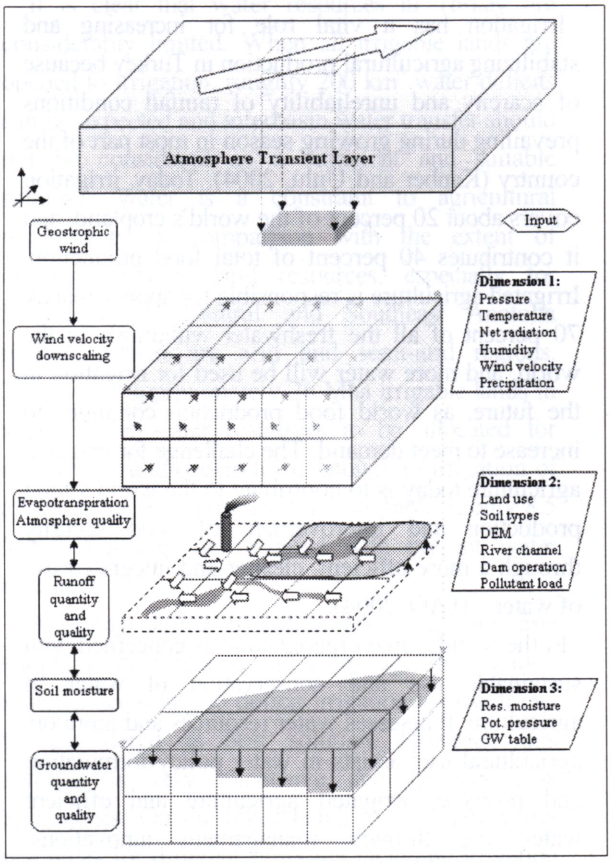

Figure 1 3D-HydroBEAM flowchart.