A Quantitative Analysis of Catchment Runoff Generation Using Object-Oriented Modelling

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Hydrological conditions including fresh water supplies in mountainous areas are mainly controlled by runoff regimes and its components. For many semi-arid and arid regions, the falling precipitation is allocated to different runoff components including surface and subsurface flow. Runoff generation in mountainous basins are the primary water sources for the large populations and critical components for the continuum of the ecosystems. Therefore determining the amount of runoff using sophisticated techniques is an important benchmark and a necessity in order to use and manage the present and future water resources.

The recent trends in hydrological modeling resulted in the improvement of fully distributed snow models. Spatially distributed hydrological models attempt to quantify the runoff processes by subdividing the catchment into a number of units. The main objective of this study was to carry out a quantitative analysis of catchment runoff generation at basin scale in a semi-arid Mediterranean environment. Goksu Watershed located at the Eastern Mediterranean Part of Turkey is selected as the study area.

The methodology consisted five steps; i) spatial and temporal data analysis, ii) model calibration, iii) implementing process-based J2000 modelling suite, iv) model validation, v) assessing the spatio-temporal variability of runoff dynamics by interpreting the modelling results.

The J2000 is a conceptual hydrological model. It requires air temperature, vapour pressure, wind speed, precipitation, solar radiation, terrain and land cover variables, such as slope, aspect, soil texture, forest cover to simulate hydrological Dynamics at different scales. For the long-term, seasonal, distributed runoff generation of the Goksu Watershed, only a distributed conceptual modeling approach is feasible, given the availability of input data. The main advantage of the model is the ability to initiate model runs and directly compare model predictions with products derived from remote sensing and field measurements. Hydrological quantities such as runoff components are critical factors that can affect the regional ecosystems. Thus, this study has a significant importance to estimate these factors quantitatively that can directly contribute to the regional planning strategies.

Key Words: Hydrology, GIS Integration, Runoff/Hydraulics, Water Resources.