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Applications of Snowmelt Runoff Model for Upper Euphrates Basin Using Snow Depletion Curves Derived from Optical Satellites

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Water's importance is increasing day by day with decreasing fresh water and energy resources. In the aspect of optimum reservoir management, predicting runoff for large reservoirs by applying hydrologic model is a recent and crucial topic. The most important model input and predictor parameters to estimate runoff for the mountainous regions are to be distribution of rainfall, temperature and snow cover area (SCA). Those predictor variables should be integrated with Geographic Information Systems (GIS) and Remote Sensing Techniques (RS) especially for hydrologic model variable preparation. Satellite products have the potential for obtaining SCA data in near real time. In this study, the changes of SDC are generated by the analysis of optical satellite products and SDC are input to a hydrological model to simulate runoff for Upper Euphrates Basin (10215.7 km2) which is a sub basin of Euphrates Basin in Turkey. There are large dams located within Euphrates Basin like Keban, Karakaya and Atatürk. Optimum operation of these dams depends on forecasting studies in early summer season. Euphrates River is fed mainly from snowmelt in spring or early summer time. In this region, 65-70 % of the annual runoff volume is due to snow melting and rain on snow during March-July months. Main objective of this study is to obtain the spatially and temporally distributed SCA percentages from different optical satellite products and combination of these products, which are required as one of the main input variables of the hydrological model used in the application. SCA percentages and SDC are obtained for snowmelt years 2005-2008 by using high temporal resolution optical remote sensing data: Terra Moderate Resolution Imaging Spectroradiometer (MODIS). In this study, Terra MODIS snow cover map product, MOD10A1 and MOD10A2 which has a spatial resolution of 500 m is used. As a hydrological model Snowmelt Runoff Model (SRM) was applied. SRM was built up on the well-known degree day approach . In this study SRM is simulated for three consecutive years 2006-2008. The simulation results are compared and resultant model parameters are evaluated for future runoff forecast studies. Model simulations are obtained 0.6-0.8 model efficiency and 10-20% volume difference between modeled and observed discharges during snowmelt season.

Keywords: Snow Cover Depletion Curves, Snowmelt Runoff Model, MODIS, Upper Euphrates Basin