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Studying the Effect of Runoff Parameterization and Interaction between Atmosphere and Land Surface in Land Surface Schemes Used in NWP Models

M. KHODAMORAD POOR (1) and P. Irannejad (2)

(1) Geophysics, University of Tehran, Meteorology, Tehran, Islamic Republic Of Iran (mkhodamorad@gmail.com), (2) Geophysics,Tehran of Tehran,Meteorology,Tehran,Islamic Republic Of Iran(piran@ut.ac.ir)

Land Surface Schemes that is one of the most important components in climate and numerical weather prediction models (NWP) has concentrated on surface energy and water budgets. Water budget is the hydrologic core of the land surface schemes and it is presented as the precipitation which is divided into evapotranspiration, runoff and changing in soil moisture. It is also introduced by different parameterizations among land surface schemes.
Since Runoff is the major component of the water budget, unrealistic simulation of it can have some effects on the other components used in water budget and hence on the laten heat flux between atmosphere and land surface. Different representations of runoff in NWP models are relatively simple because runoff is conceptually difficult to be parameterized. Regarding that topography has a major control on the distribution of soil moisture and runoff, the main objective in this study is to find the parameterization runoff which is better to be introduced in NWP models.
The algorithm used in Simple TOP Model (SIMTOP) for runoff parameterization is put in NOAH LSM utilized in Weather Research and Forecasting model (WRF). In SIMTOP, surface and subsurface runoff are considered as exponential functions of water table depth, but in NOAH LSM runoff is produced by extra maximum soil infiltration.
The SIMTOP is like TOPMODEL that implemented topographic information (expressed by topographic index) and the nature of soil (indicated by reducing hydraulic conductivity with soil depth). The SIMTOP is simpler than TOPMODEL because of reducing in parameters that are needed to be calibrated. The surface runoff is the sum of two components, the first generated by infiltration excess (Horton mechanism) and the second, referring to variable contributed area, by saturation excess (Dunn mechanism). The subsurface runoff is represented by topographic control, bottom drainage and saturation excess.
Although the river routing is very important for understanding the movement of water in the river, Land Surface Schemes that are used river routing are very rare. Then river routing based on Total Runoff Integrating Pathways (TRIP) algorithm is added to this Land Surface Scheme.
The NOAH-SIMTOP uses four soil layers and unconfined aquifer which is considered as a part below the soil column for the realistic conception of discharge processes. This model results was compared with its uncoupled model (NOAH LSM) and its offline model in Karoon River which is mountainous and located in southern Iran to find out improving runoff parameterization and interaction between atmosphere and land surface in this case study.