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Hydro-climatic Effects of Present and Future Land Cover / Land Use Changes in the Upper Mesopotamia

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The Southeastern Anatolia Project (SAP) of Turkey, one of the largest regional development projects in the world, aims to irrigate the vast semi-arid plains of the upper Mesopotamia by transferring water from the Euphrates and Tigris rivers. At the current realization level of irrigation projects (about 25%), it has already caused extensive land cover / land use (LCLU) changes in the region. Thus, the aim of this study is to assess the resultant hydro-climatic changes using a state-of-the-art regional climate model (RegCM4). The simulations include a reference one with a LCLU map reflecting the pre-SAP conditions, and two sensitivity simulations incorporating the current and future LCLU maps for the region, the latter being the situation upon the completion of the project. The model is driven with the NCEP/NCAR Reanalysis for the 20-year period between 1991 and 2010. The sensitivity experiment involves two nesting domains with 48 and 12 km resolutions, respectively, the latter being downscaled to 3 km resolution with the subgrid feature of the land surface model. The performance analysis of the model yields that it is able to reproduce the temperature and precipitation fields fairly well. The preliminary results indicate that, on annual basis, the LCLU change in the region will decrease the surface temperatures by about 0.4-0.8 °C and will increase specific humidity by about 8-17%. Furthermore, these changes will lead to 3-7% precipitation increase in the region, and much of this increase will occur in spring. The evapotranspiration increase estimated by the model amounts to 51-114% over the pre-SAP conditions. Given the fact that the water of the region is primarily partitioned between energy production, irrigation and release for the downstream countries, Syria and Iraq, the dramatic increase in water loss through evapotranspiration has potential to alter the water management practices and policy measures in the larger region.

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