THE EFFECTS OF IRRIGATED AGRICULTURAL EXPANSION ON REGIONAL HYDROLOGY IN SOUTHEASTERN TURKEY

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ABSTRACT

The goal of this research is to determine the water resource impacts of land use and land cover change that are occurring as part of the large scale water development and irrigation projects in the Southeastern region of Turkey (the GAP project). To this end, a multidisciplinary research program involving change detection analysis of Landsat imagery, statistical analyses of long-term meteorological and river discharge observations, application of models of evaporation specifically suited to changing soil moisture supply, and simulation analyses with a meso-scale climate model is proposed. To address the issue of impact on water balance partitioning, each of these tasks will be integrated into a framework based on the complementary hypothesis for evaporation estimation first put forth by Bouchet (1963). Together, the research has the objective of answering the following three important questions, as the relate to understanding the impacts of the GAP project on region's hydrology

a) How has the irrigated area changed over the course of the last 10 years?

b) What is the impact of irrigation on the regional hydrology? More specifically, how might the partitioning of input (precipitation and irrigation) between drainage and evapotranspiration change as a function of area being irrigated? Such scale dependence in partitioning could result from feedbacks with the atmosphere, which will be addressed in the context of the complementary hypothesis (Bouchet, 1963 and others) between potential and actual evaporation.

c) What is the long-term impact of irrigation both on hydrology and regional climate as simulated by a regional climate model?

The proposed research has important implications for water budget estimates, a keystone for sustainability of water resources, and could quantify whether economies of scale of water resource exist due to scale dependencies of physical water balance mechanisms. Such economies could arise, for example, if atmospheric evaporation demand decreases as irrigation increases, as can be inferred from the complementary hypothesis. Since the greatest impact upon the hydrologic cycle occurs when irrigation is practiced, adequate water management practices, developed by accurate understanding of hydrologic budget, could lead to significant water savings upstream. In turn this could allow additional water developments downstream, mitigating potential regional conflicts.