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Moving toward a real-time model of groundwater/surface water interactions in two heavily irrigated systems

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Abstract: The drought of 2012 taught us two things about water supply in Illinois: 1) many areas in the state had at-risk water supplies, while others were remarkably resilient and 2) there was a need for more rapid analyses of water resources in periods of extreme stress. To this end, we have established a real-time monitoring network of both groundwater and surface water elevations in the most heavily irrigated county in the state, which also happens to be one of the most resilient water supplies. Furthermore, we have established a monitoring network near the Illinois State Water Survey campus where transducer data can easily be downloaded. This system has much less irrigation than the real-time study area but much larger responses to seasonal pumping due to the confined nature of the aquifer. Using this observed data, we have developed a head-specified MODFLOW model with very fine stress periods that is quickly updated using a Python script and run via the groundwater flow modeling package FloPy. This modeling framework allows for the rapid simulation and animation of different groundwater and surface water conditions in the two study areas. It has been developed with the goal of providing real-time analyses delivered in a web interface, although this work remains on-going, and is intended to be deployable to other at-risk aquifer systems. Furthermore, capturing the real-time dynamics of the hydrogeologic system will assist in understanding the fate and transport of contaminants, and particularly nitrate.

Keywords: Real-time, modelling, monitoring, head-specified, groundwater