Geophysical Research Abstracts
Vol. 16, EGU2014-6907, 2014
EGU General Assembly 2014

Agricultural water management scenarios to protect groundwater-dependent ecosystems

Laura Foglia (1) and Thomas Harter (2)

(1) Technische Universität Darmstadt, Institute of Applied Geosciences, Darmstadt, Germany (foglia@geo.tu-darmstadt.de),
(2) University of California, Davis, Land, Air and Water Resources Department

Groundwater pumping, even if only seasonal, may significantly impact groundwater dependent ecosystems through increased streamflow depletion, particularly in semi-arid and arid regions. The effects are exacerbated, under some conditions, by climate change. In this work we combine different tools to evaluate impact of water management scenarios in an agricultural basin.
Here we first develop a spatio-temporally distributed soil water budget model that we couple with an analytical model for stream depletion from groundwater pumping to rapidly assess seasonal impacts of groundwater pumping on streamflow during critical low flow periods. In a second step, the water budget model is used to provide recharge and pumping values for each field as input for a valley-wide groundwater model developed with MODFLOW-2005. Results of the simulations obtained by means of the simple coupled soil water budget model/analytical model have been used to select and design with the engagement of stakeholders feasible management scenarios. The latter have been implemented in the numerical groundwater model. Results and insights from both modelling approaches are discussed. We demonstrate the applicability of the analysis for the Scott Valley in Northern California, where protected salmon depend on summer streamflow fed by cool groundwater. In this example, simulations obtained with the two approaches suggest that increased recharge in the period immediately preceding the critical low streamflow season, and transfer of groundwater pumping away from the stream are potentially promising tools to address ecosystem concerns, albeit raising difficult infrastructure and water trading issues. In contrast, additional winter recharge at the expense of later spring recharge, whether intentional or driven by climate may reduce summer streamflows. Results suggests that the coupled soil water mass balance – stream depletion function approach provides a viable tool for scenario development among stakeholders, to constructively inform the search for potential solutions, and to direct more detailed, complex site specific feasibility studies. The further implementation of the management scenarios into the numerical groundwater model provides details on the local impact of the results and more insights about specific data collection and needed infrastructures in order to practically develop the management scenarios.