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Demand driven decision support for efficient water resources allocation in irrigated agriculture

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Due to climate change, extreme weather conditions, such as longer dry spells in the summer months, may have an increasing impact on the agriculture in Saxony (Eastern Germany). For this reason, and, additionally, declining amounts of rainfall during the growing season the use of irrigation will be more important in future in Eastern Germany. To cope with this higher demand of water, a new decision support framework is developed which focuses on an integrated management of both irrigation water supply and demand. For modeling the regional water demand, local (and site-specific) water demand functions are used which are derived from the optimized agronomic response at farms scale. To account for climate variability the agronomic response is represented by stochastic crop water production functions (SCWPF) which provide the estimated yield subject to the minimum amount of irrigation water. These functions take into account the different soil types, crops and stochastically generated climate scenarios. By applying mathematical interpolation and optimization techniques, the SCWPF's are used to compute the water demand considering different constraints, for instance variable and fix costs or the producer price. This generic approach enables the computation for both multiple crops at farm scale as well as of the aggregated response to water pricing at a regional scale for full and deficit irrigation systems.
Within the SAPHIR (SAxonian Platform for High Performance Irrigation) project a prototype of a decision support system is developed which helps to evaluate combined water supply and demand management policies for an effective and efficient utilization of water in order to meet future demands. The prototype is implemented as a web-based decision support system and it is based on a service-oriented geo-database architecture.