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A remote sensing based monitoring concept for irrigation systems in Central Asia

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The Aral Sea Crisis is a text book example of ill-managed land and water resources which started during the Soviet period in entire Central Asia. However, the remote sensing approach has not been introduced yet by the water administrations of the five Central Asian countries. This study outlines the concept for a remote sensing based monitoring system for the large irrigation systems of Central Asia and discusses the requirements, opportunities and constraints for its implementation.

The proposed concept summarizes experiences from a long-term research project addressing land and water use in the upper Amu Darya Delta. For 270.000 ha of irrigated land in the province Khorezm, Uzbekistan, located south of the Aral Sea, a wide range of remote sensing data and methods was developed for regional and local assessment of the irrigation-dominated agriculture. A hierarchical object-oriented land use classification approach based on high resolution SPOT 5, IRS-P6, and MODIS data was designed for frequent and contemporary updates of the vegetation period. Based on this, a variant of the SEBAL model had been developed to derive seasonal actual evapotranspiration (ET) at 1km MODIS scale. MODIS vegetation indices and (FPAR) have been integrated in agro-meteorological models for annual estimations of crop yields and in particular of the predominating crop cotton. Experimental satellites like Proba-1/CHRIS or ASTER and ground measurements allowed adequate validation and calibration of the models and estimation of further crop parameters such

as leaf chlorophyll status for improving fertilizer application. Next, the remote sensing results were integrated into regional water balances and performance indicators to measure sustainability, adequacy and productivity of irrigation water supply. GIS-analysis disclosed spatial and temporal patterns of water consumption and weaknesses of the irrigation and drainage network. At present, the speed of processing and distribution of ET maps is assessed to identify possibilities for supporting water saving and reallocation in the operational irrigation process.

The final model can be used as a comprehensive standard routine for irrigation water monitoring based on qualitative and quantitative information about water resources collected by remote sensing. It can be applied to all irrigated areas in the Aral Sea Basin, in particular in those regions where good atmospheric conditions permit multiple optical and thermal observations from space.