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Geoinformation technology for increasing the sustainability of agricultural production and water security in the Aral Sea Basin

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Extensive over-exploitation of land and water resources is characterizing irrigated agriculture in the Aral Sea Basin (ASB). Over decades, inefficient and excessive water use had remarkable negative impacts on the groundwater and soil quality, hence on crop production. The countries sharing to the ASB look for opportunities to increase the sustainability in the water intensive agricultural sector that is of utmost importance for the densely populated oases as well as for the ecosystems along the river systems. This is also of urgent pressure as there is high evidence that climate change will deplete natural storages such as glaciers. One major bottleneck for spatially targeted decision and policy-making is the absence of scientific information and tools that would allow for informed decisions, e.g. on the implementation of water saving technologies, alternative land use options or water allocation. A review on scientific literature published in the period 2008-2019 underpins the potentials of remote sensing technology in combination with climate data and further geospatial information to close this gap. However, the key question is how to increase the sustainability of irrigated agriculture and water security using this technology in reality? This contribution aims to outline requirements and challenges to bring knowledge from remote sensing into practice. This will be done using the example of the online-tool Water Use Efficiency Monitor for Central Asia (WUEMoCA, <http://wuemoca.net/>) developed within the German Water Initiative in Central Asia (<https://www.cawa-project.net/>).

It was observed that remote sensing-based results remain isolated as long as they are not integrated into accessible databases, thus are unlinked from regional knowledge and information platforms, e.g., providing commonly applied approaches to water distribution. The tool WUEMoCA combines the remote sensing knowledge with climate data and socio-economic information and serves as an online database with hydrological and land-use indicators requested by regional decision-makers. To increase the ownership of the WUEMoCA tool by potential users (water management authorities and governments) and to account for the sensitivity of data in transnational water management, a toolbox is integrated allowing for user-specific own calculations and development of local databases. By doing so, users can decide by themselves to share information with others or not. So far, user feedback from the water distribution sector and governmental departments in Uzbekistan, but also from other countries assessed WUEMoCA as an important regional data source and database, but also a calculation tool for supporting informed decisions-making, highlight the tool's relevance for increasing water security in the ASB.

Technically, the next steps may include the development of early warning systems, e.g. for droughts. Yet, it must be clear to the responsible users from the region that long-running tools from research projects can never take over important national tasks. Long-term cooperation is required. In addition, for a sustainable development of such tools, national scientific institutions require a strengthening of the capacity in the application of geoinformation technology. The latter is indicated by the fact that almost all of the published articles were submitted under affiliations from abroad.