hydrosolutions Ltd.

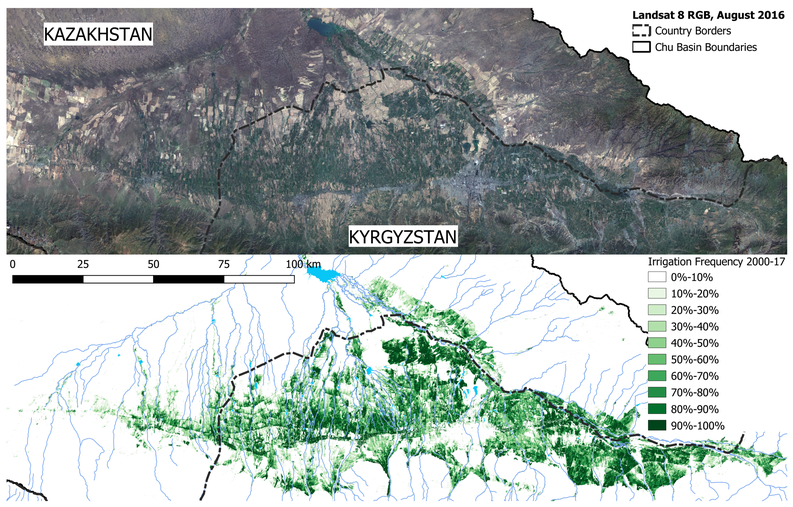
Solving Water Challenges in a Changing World

Remotely Sensing Irrigation AG

Remote sensing technology can assist with the planning and management of irrigated agricultural systems :

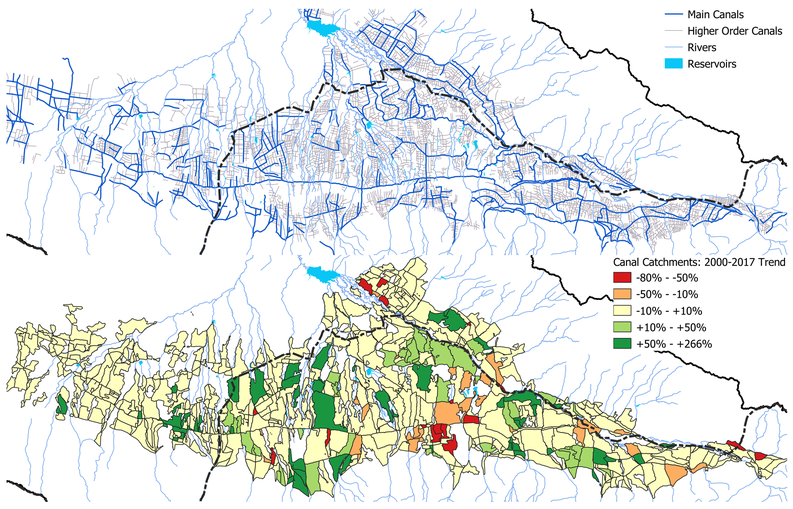
- Operational production of high-resolution irrigation maps to assess water use and productivity
- Execution of performance diagnoses and impact assessments
- Strategic planning, ease operations, control water rights

High-Resolution, Inter-Temporal Mapping of Irrigated Areas with Google Earth Engine



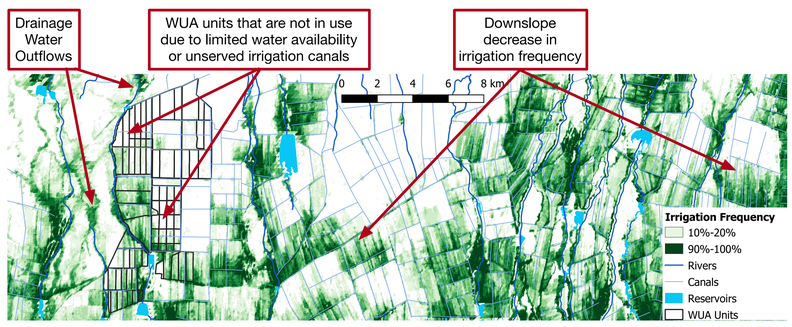
The annual irrigation maps can help local stakeholders to study the performance of the vast and complex irrigation systems and help in monitoring irrigation activities at all scales, i.e. from field scales up to transboundary levels.

Transboundary-Scale Monitoring and Management of Irrigation Networks

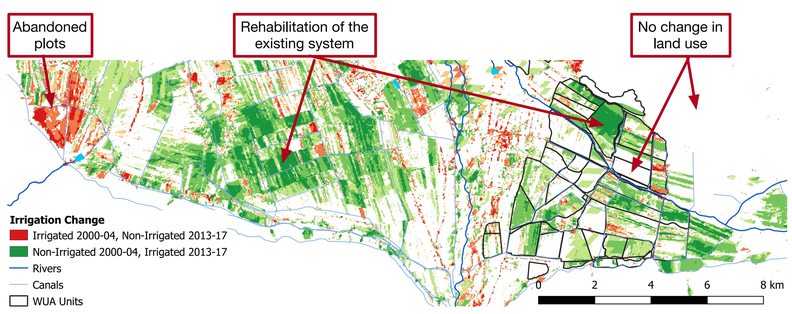


Monitoring Irr. Activities at Field Scales

Water user associations at the tail of large irrigation canals suffer from inadequate and highly erratic water supplies.



In the Kyrgyz side of the Talas Basin our results reflect the gradual infrastructure rehabilitation and improvement of management practices in the existing systems after the collapse of the Soviet Union.



Reference: Ragettli S., Herberz, T. and T. Siegfried (2018): *An unsupervised classification algorithm for multi-temporal irrigation mapping in the Chu and Talas River Basins in Central Asia.* Submitted to Remote Sensing of Environment.

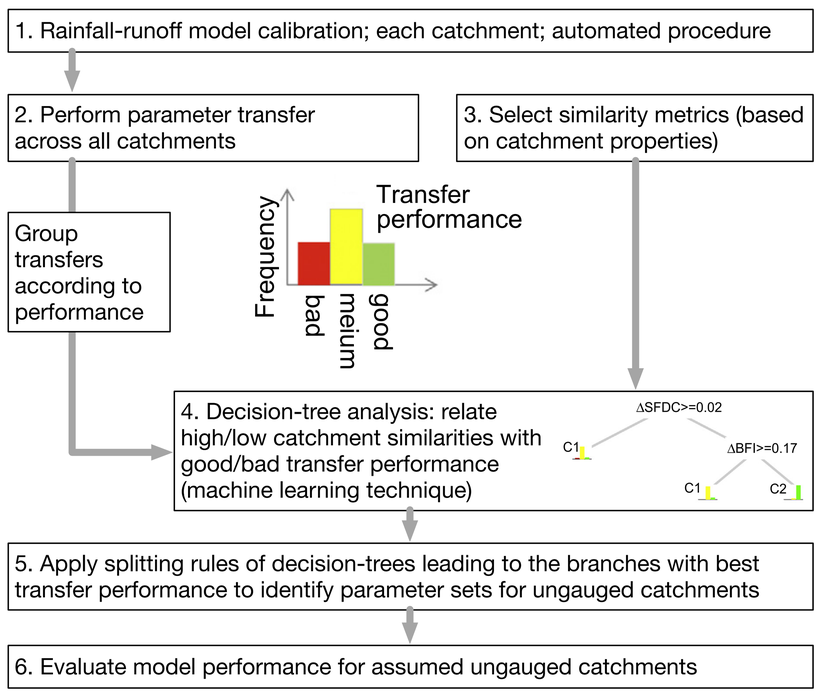
Predictions in Ungauged Basins

1970-2010 flash flood disaster areas in China cover more than 12% of the total land area. Hydrological models can be a useful tool for the anticipation of these events and the issuing of timely warnings. hydrosolutions Ltd. designed a modelling strategy for flood predictions in ungauged Chinese mountain catchments.

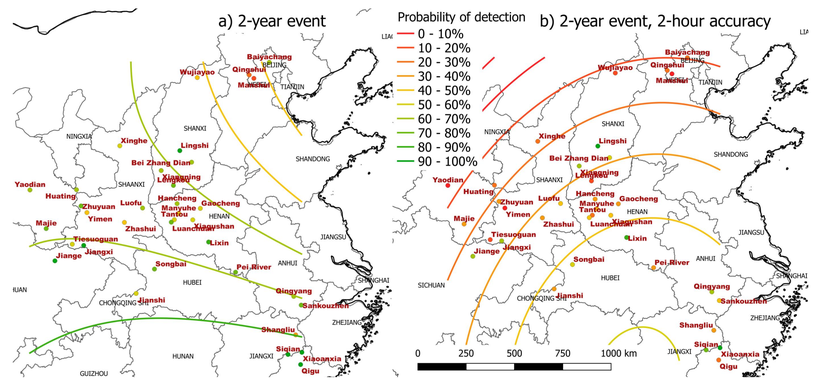
- 35 catchments in 10 provinces Catchment areas: 14 - 1700 km^2
- 6 - 72 storm events per catchment
- Annual precipitation: 380 - 2500 mm (increasing towards south)

The strategy involves data mining and machine learning to identify optimal model parameters.

Detection of Flash-Floods in Ungauged Mountain Basins with a Rainfall-Runoff Model



The modeling strategy presented here can be applied to any ungauged mountain catchment in China. Our results reveal a detection probability (POD) of flash-floods with a 2-year return period of 71-76% In South China. In North China, the POD is on average 5-10% lower due to the more challenging hydrological conditions of semi-arid catchments with a complex topography.



Reference: Ragettli S., Zhou J, Wang H, Liu C, Guo L. (2017): *Modeling flash floods in ungauged mountain catchments of China: A decision tree learning approach for parameter regionalization.* Journal of Hydrology, Vol. 555, 330-346

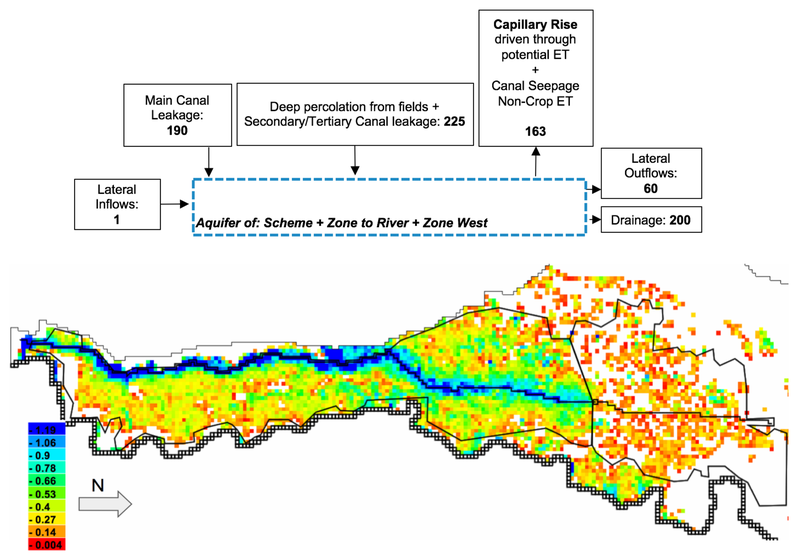
Remediating Soil Salinisation

More than one third of the world's irrigated land is affected by water logging & salinisation. The situation in Central Asia is particularly concerning, incl. in the vast irrigation schemes in southern Kazakhstan such as the Kyzylkum Irrigation Massive.

With its 74'000 ha of irrigated land poor maintenance has led to advanced deterioration of irrigation and drainage infrastructure in the scheme. Cost-effective strategies are needed to avert the further deterioration of soil and groundwater quality for the preservation of yields!

Water Balance Modeling

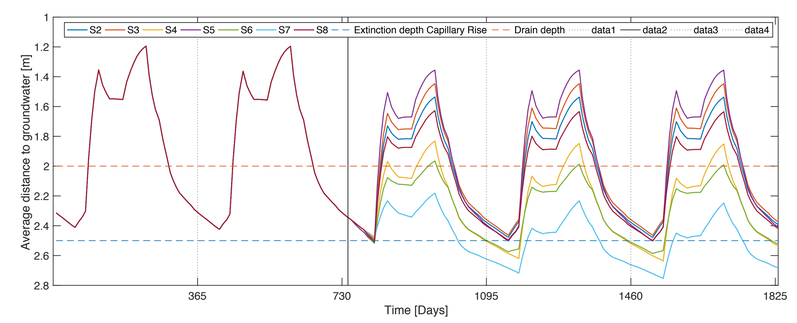
A numerical finite difference groundwater model (grid-cell size: 500mx500m) was set up using the software Modflow-2005. With decadal head observation data at 154 boreholes, river-level fluctuations and the irrigation regime of the years 2011 to 2015, steady-state and transient models were calibrated. The scheme below shows the steady-state water balance for the year 2015. Fluxes are in million cubic meters [MCM].



Spatial distribution of capillary rise rates in mm/day. Green blue colours indicate high rates that are mainly driven by very shallow groundwater tables and insufficient drainage.

Investigating Remediation Strategies

To prevent salinisation of soils, groundwater levels must be maintained at permissible levels below which no significant adverse effects on soil properties and salinity levels are expected. There are different options to do so, incl. the decrease of main canal leakage (S2) & secondary canals (S4), an improved capacity of the drainage collectors (S5) and vertical drainage pumps as well as any combination of these (S6, S7).



Conjunctive use of surface- and groundwater through the operation of drainage pumps and canal leakage reduction of 50% is the most effective mitigation scenario.

Further Information: www.hydrosolutions.ch, siegfried@hydrosolutions.ch