INTERNATIONAL RESEARCH CENTER OF BIG DATA FOR SUSTAINABLE DEVELOPMENT GOALS
可持续发展大数据国际研究中心

A river discharge remote sensing estimation method for no data regions

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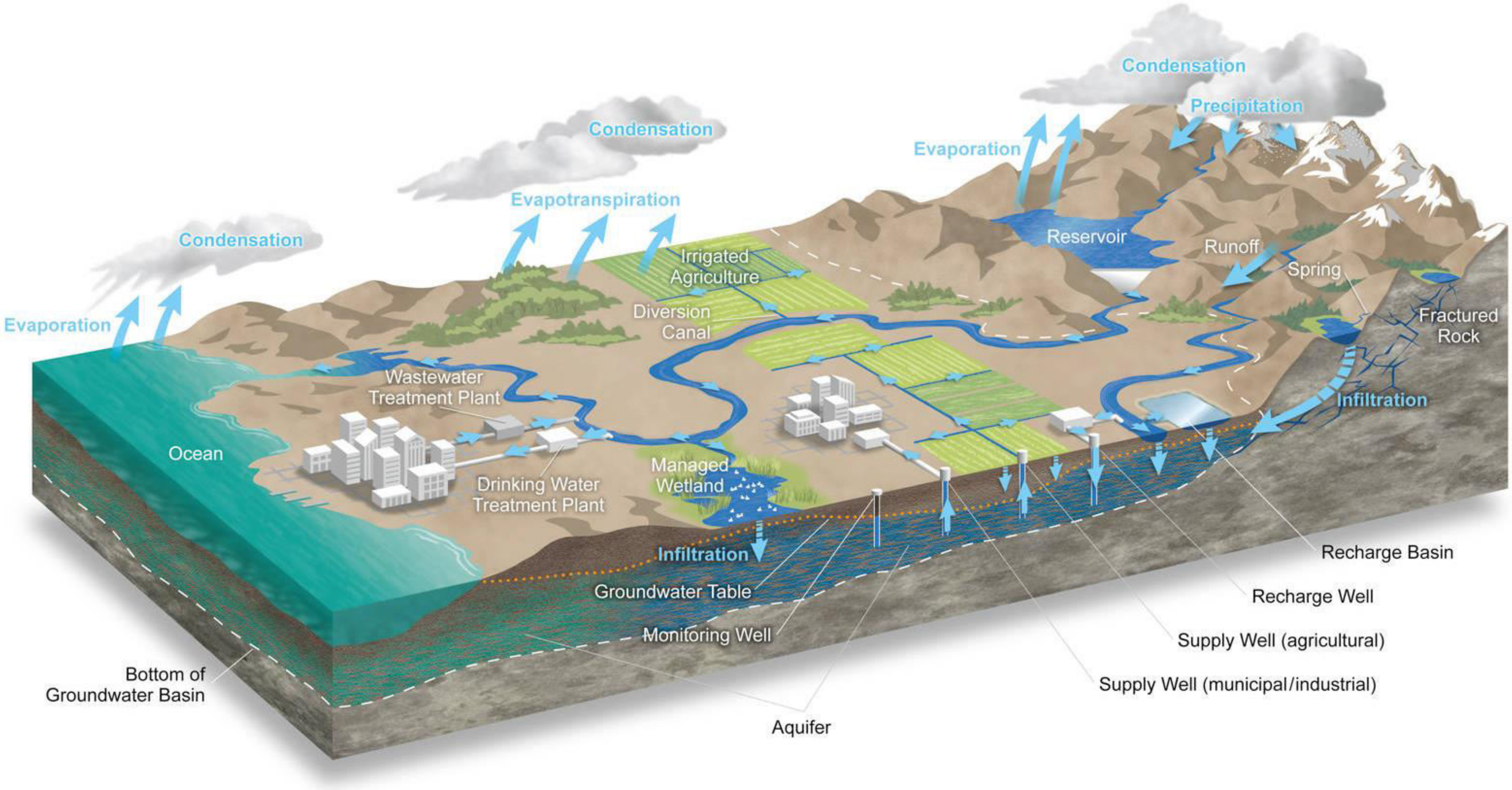
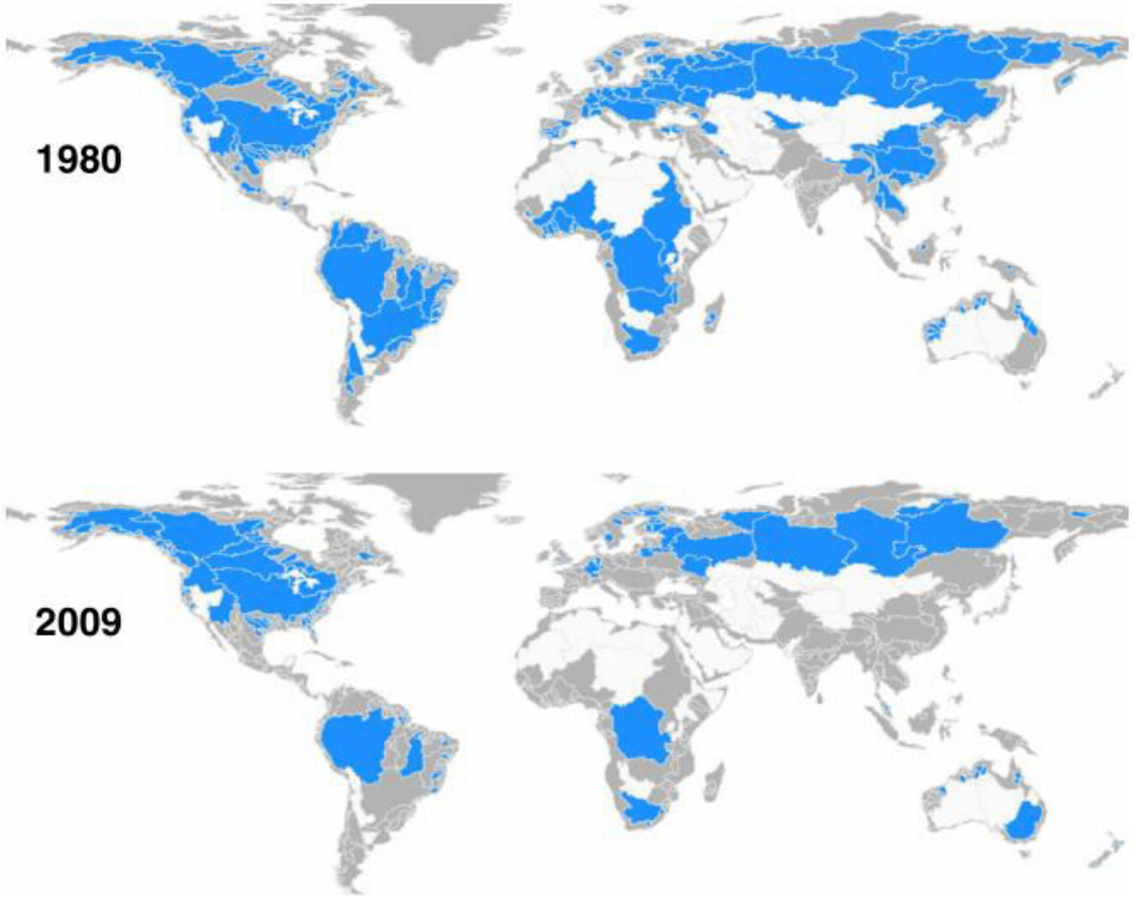
River discharge & River Basin Water Resources

An important link of water cycle and the basic element of water balance



Background



Sneeuw et al., 2014, Surv Geophys

- The publicly available global runoff database (e.g., Global Runoff Data Center, GRDC) is very limited in its spatial and temporal coverage of basins worldwide.
- The acquisition of discharge data and their delivery to the database decreased since the late 1970s, due to economical, political or other reasons. The number of publicly available stations went down from about 8,000 (pre-1970) to roughly 2,000 (around the year 2010).

River discharge observation method

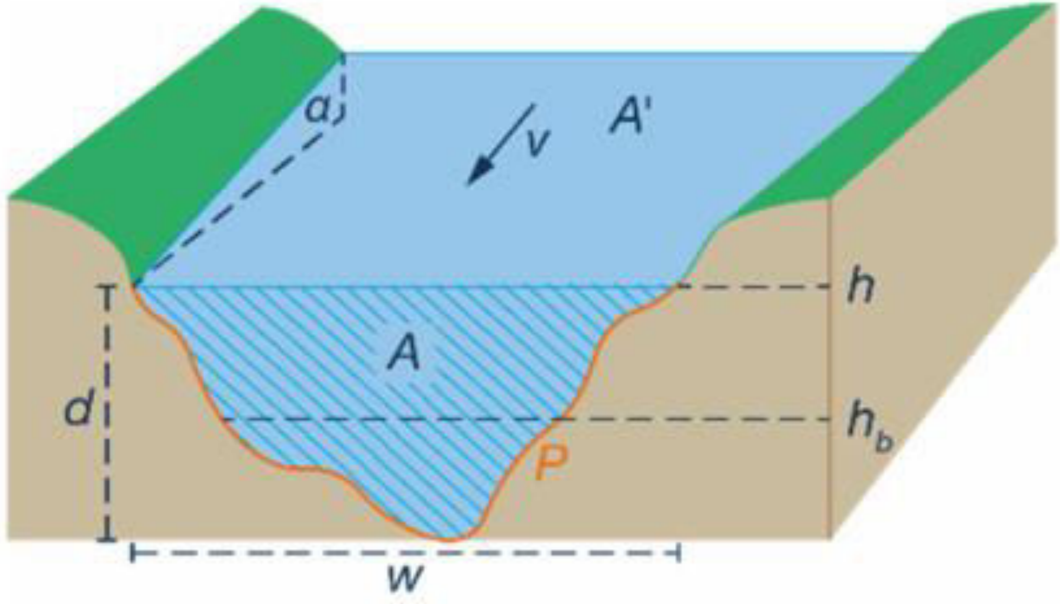
Traditional method: Measured water velocity and water level in standard hydrological section

The surface water velocity of the river is measured by high frequency radar system.

In the area with bridges or aerial ropeways, the high-frequency radar system is placed on the shore based communication vehicle.

River discharge calculation method

Gauckler-Manning-Strickler formula



A	Cross-Sectional Area
A'	Surface Area
P	Wetted Perimeter
h	Water-Level
h_b	Baseflow
w	Surface Width
d	Depth
v	Velocity
tan(α)	Slope

$$Q = \bar{v} \cdot A$$

$$\bar{v} = n \cdot R^{\frac{2}{3}} \cdot S^{\frac{1}{2}}$$

Q **is the discharge;**

$\bar{v}$ **is the depth-averaged flow velocity [m/s];**

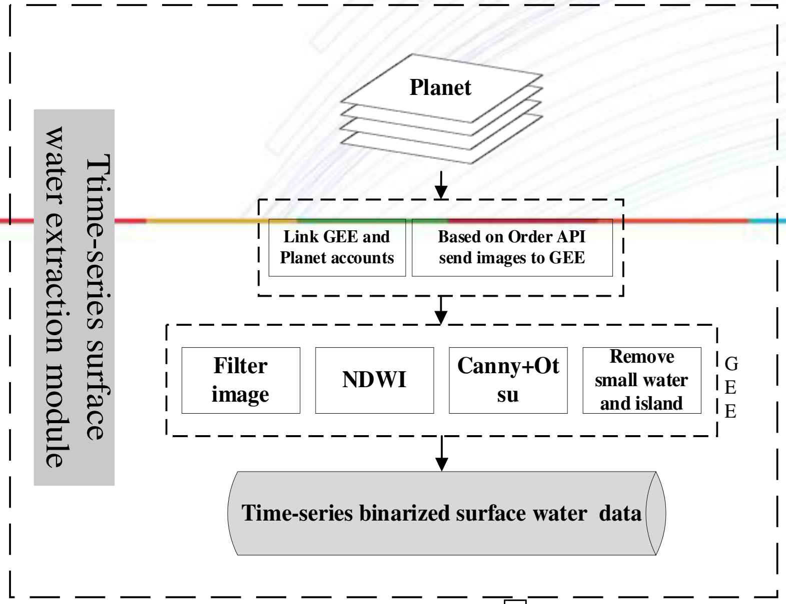
A **is the cross-sectional area [m²];**

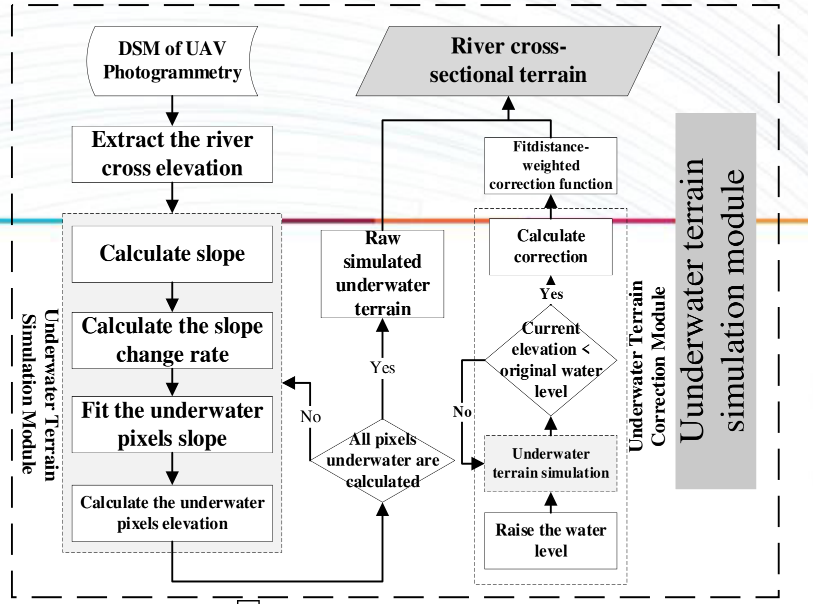
n **is the roughness coefficient** $[m^{\frac{1}{3}}/s]$**;**

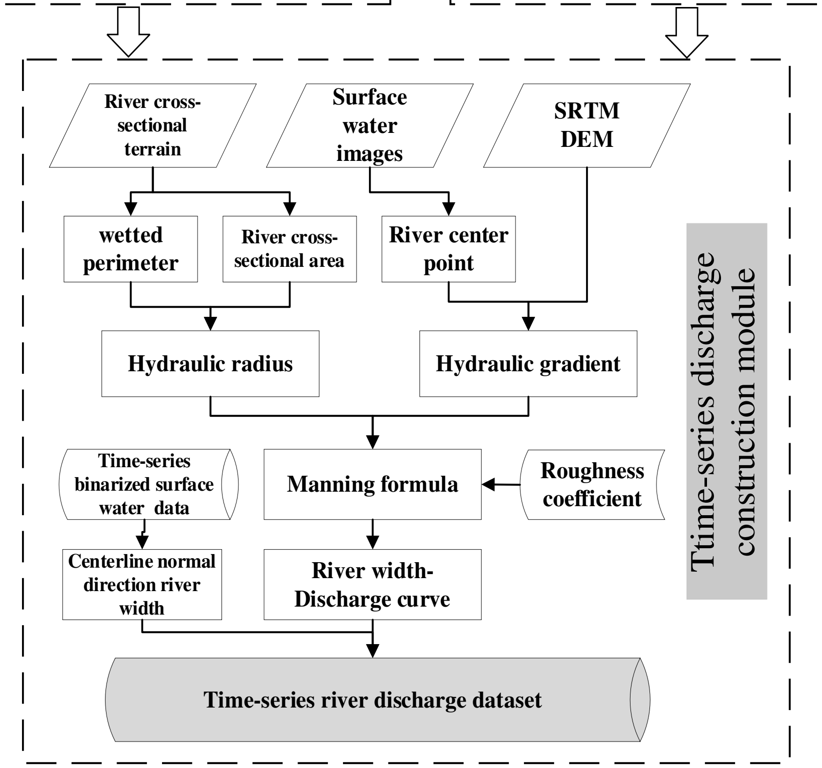
S **the flow gradient and R is the hydraulic radius [m];**

$R = A/P$ **, with** P **as the wetted perimeter [m].**

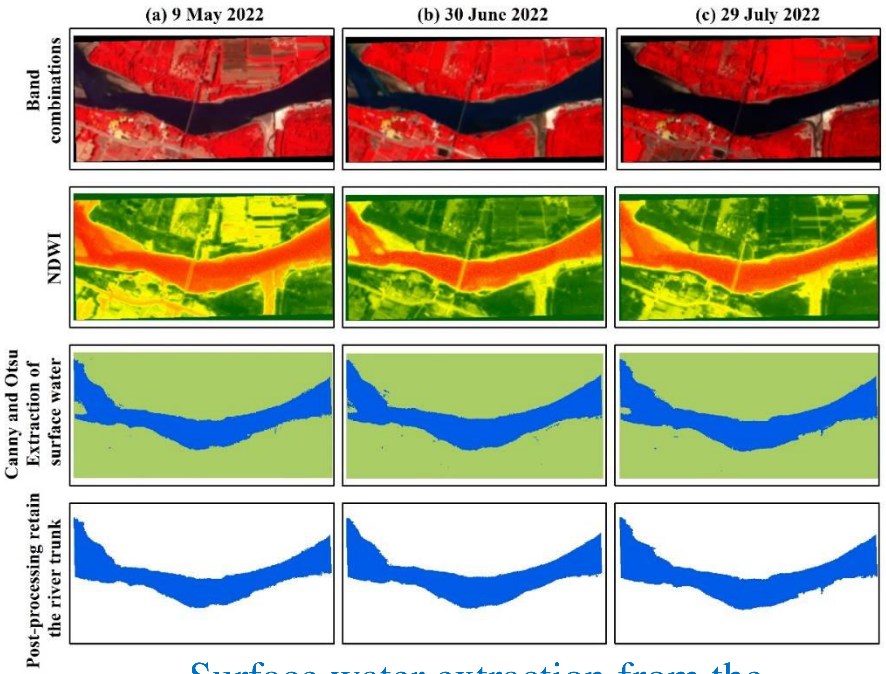
Daniel et al., 2020, DGPF



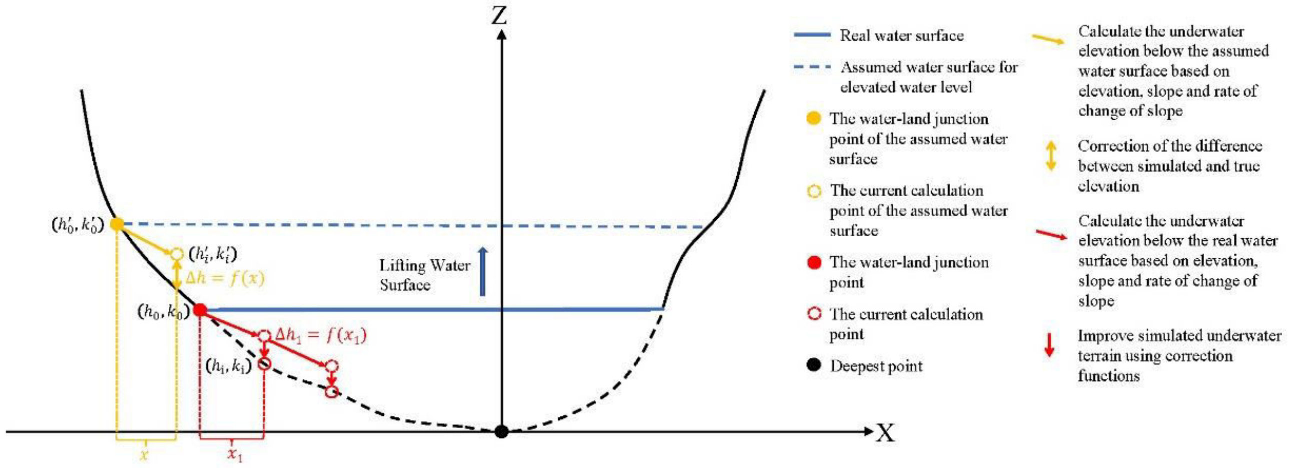




Remote sensing estimation method

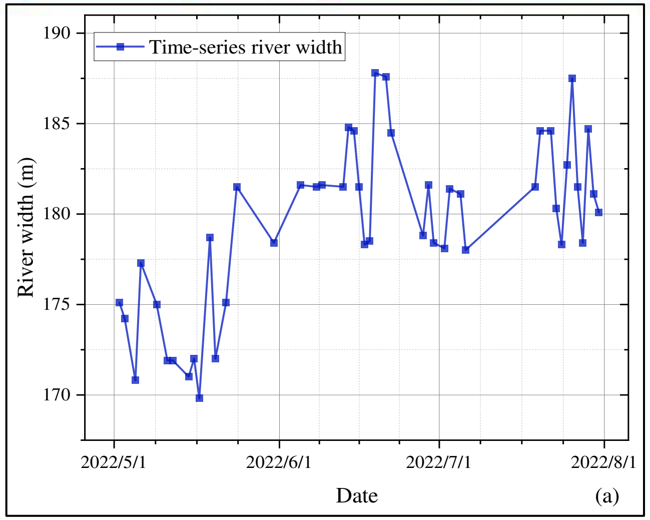


Surface water extraction from the PlanetScope images

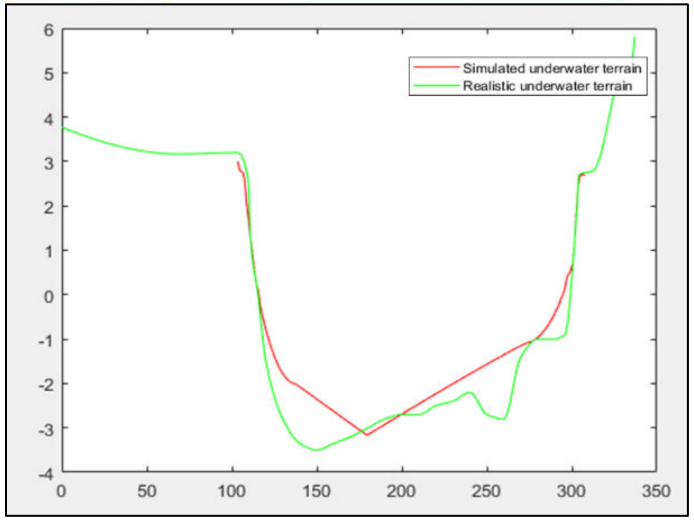


Schematic diagram of the underwater terrain simulation method

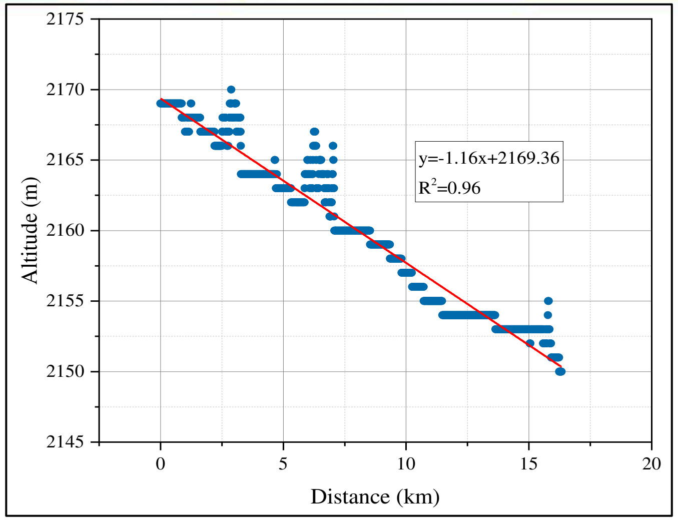
Case study: Guide river reach, Yellow River



River width



Cross section

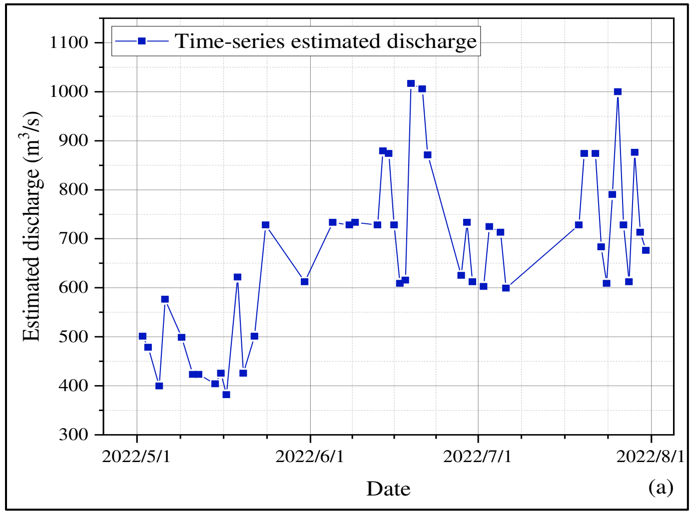


Flow gradient

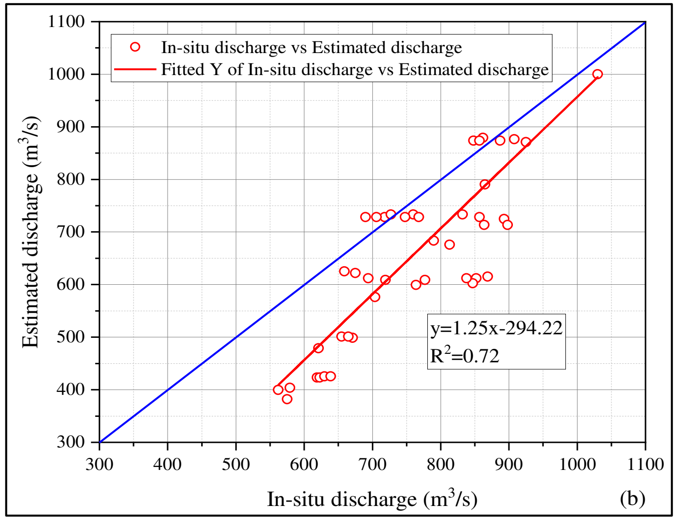
Channel conditions			Values
Material involved	Earth	n_0	0.020
Degree of irregularity	Minor	n_1	0.005
Variation of channel cross-section	Gradual	n_2	0.000
Relative effect of obstructions	Negligible	n_3	0.000
Vegetation	Low	n_4	0.005
Degree of meandering	Minor	m_5	1.000

$$n = m5\ (n0+ n2+ n3+ n4) = 0.03$$

Roughness

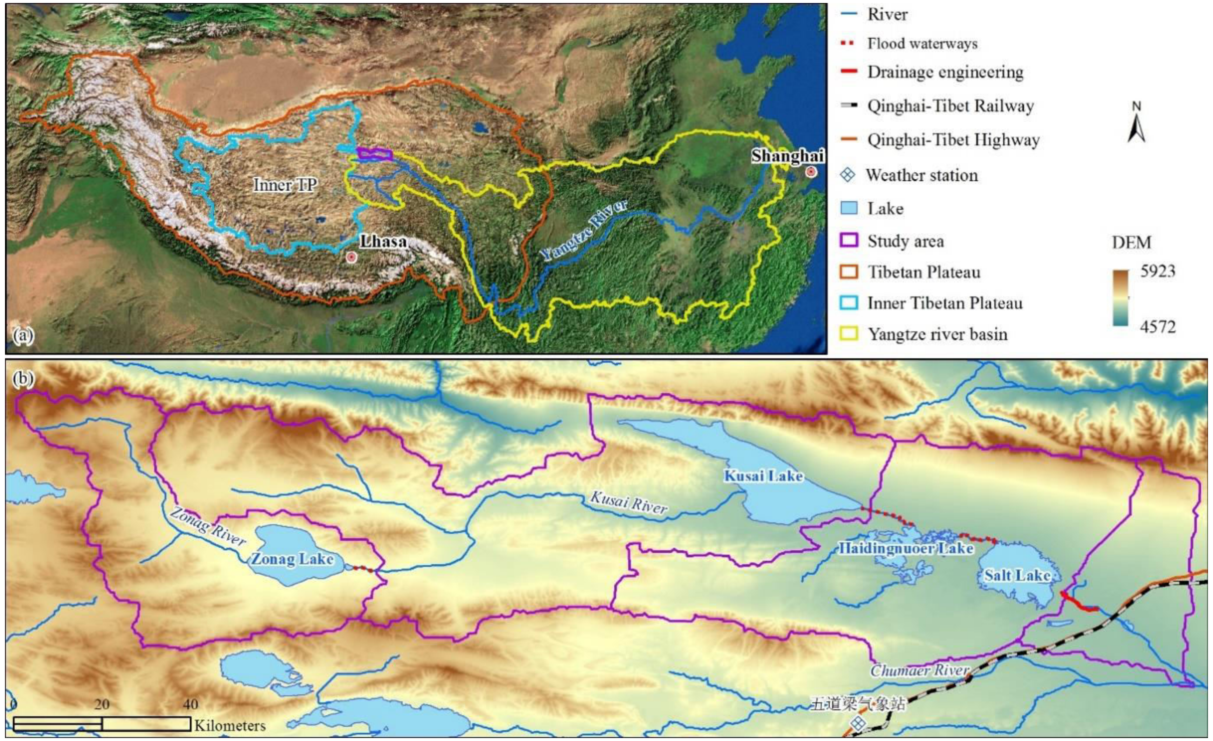


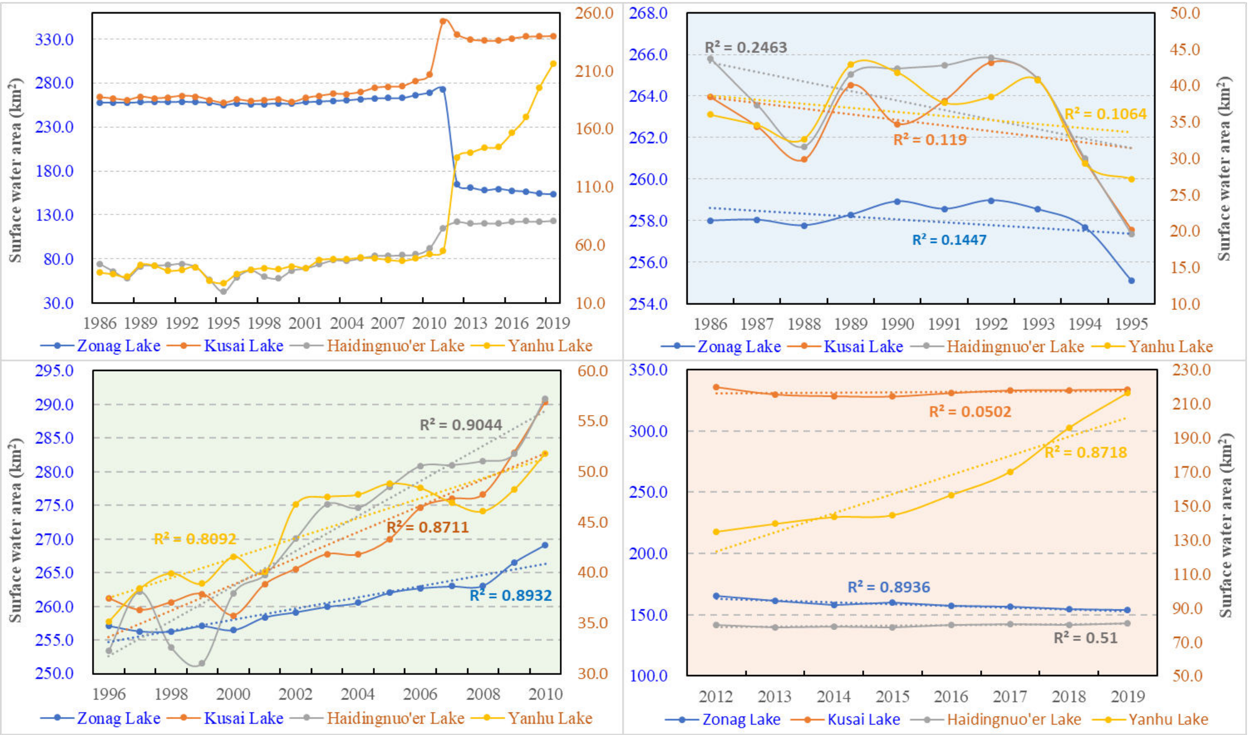
River discharge

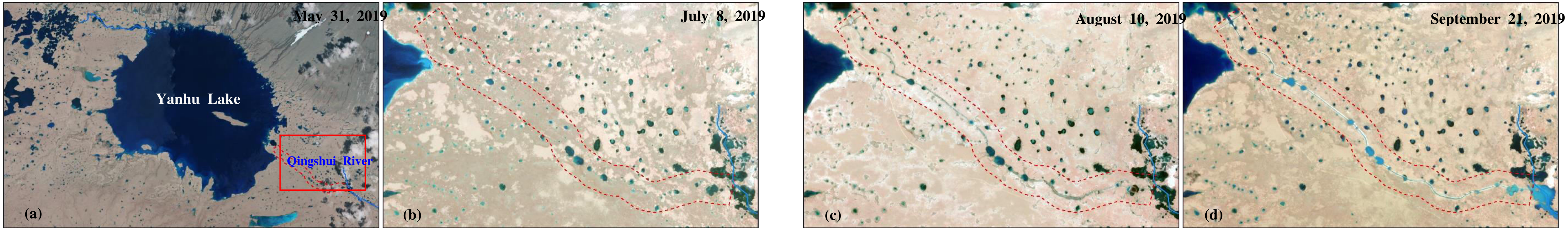


Result accuracy

Application of Basin Water Resource Management







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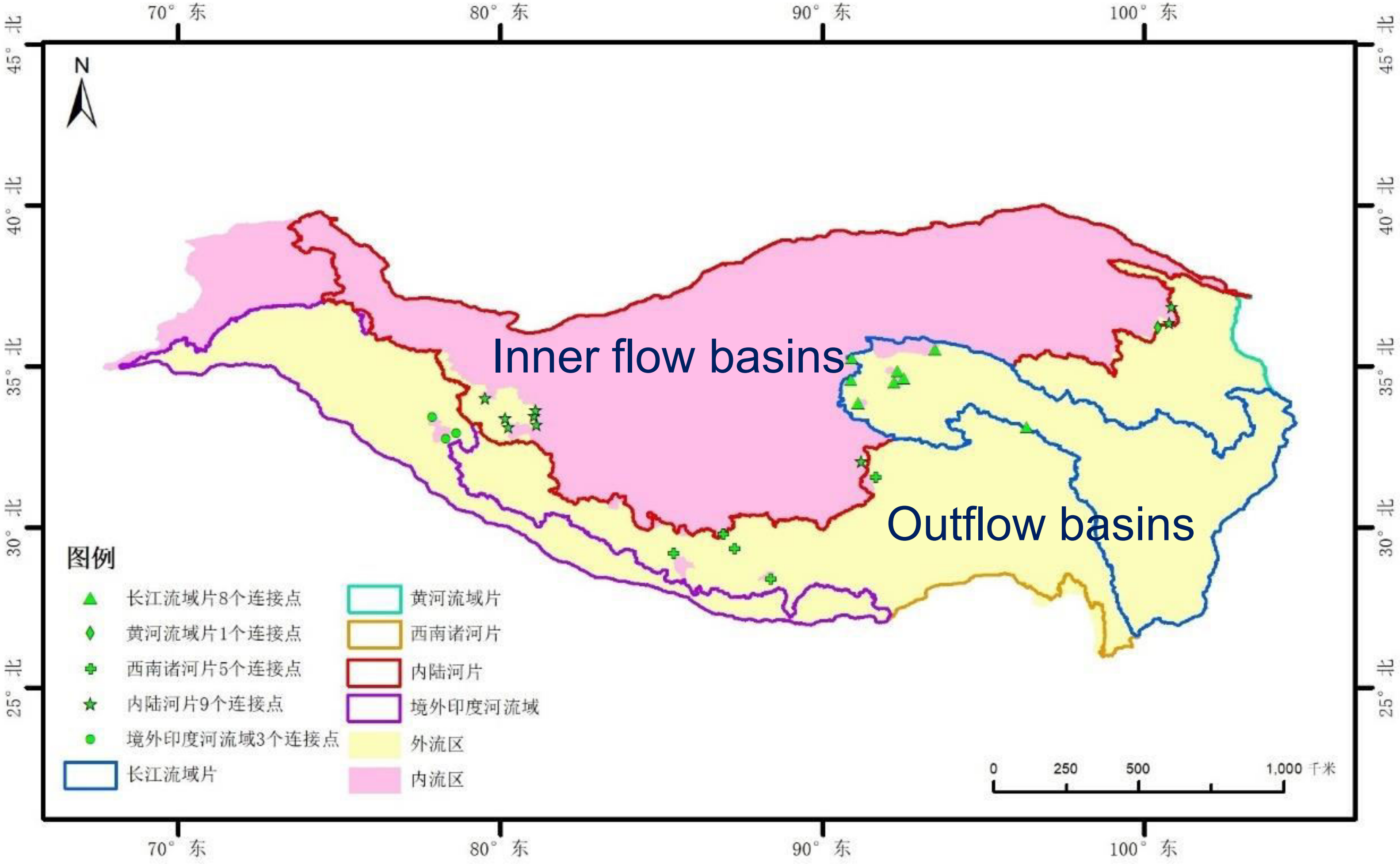

There are 17 lakes have been showing an increasing trend from 1984 to 2018

The acquisition of river discharge is the key to monitoring and evaluating the safety of lake basin water systems.

Thanks

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