Interaction and synergism management of Water and Ecosystem in Aral Sea basin

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Outline

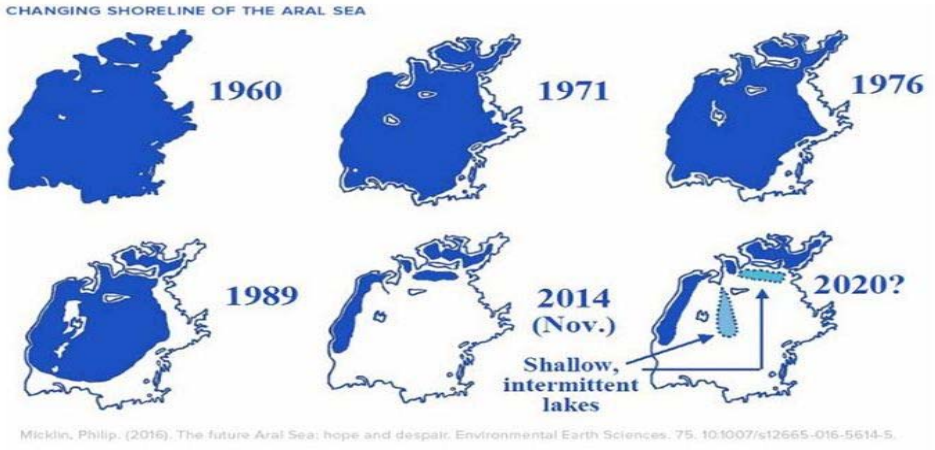
01 Background

02 Major Achievement

03 Future proposal

What happened in Aral Sea ?

Since 1960, the Aral Sea has greatly changed ,the area of Aral Sea from 67,000km^2 to 3000km^2, with frequent salt dust storms and ecosystem collapse



- 10 june 2017 the UN Secretary General Mr.Guterres Visited the Aral Sea and said this is probably the biggest ecological catastrophe of our time,the men can destroy the planet.

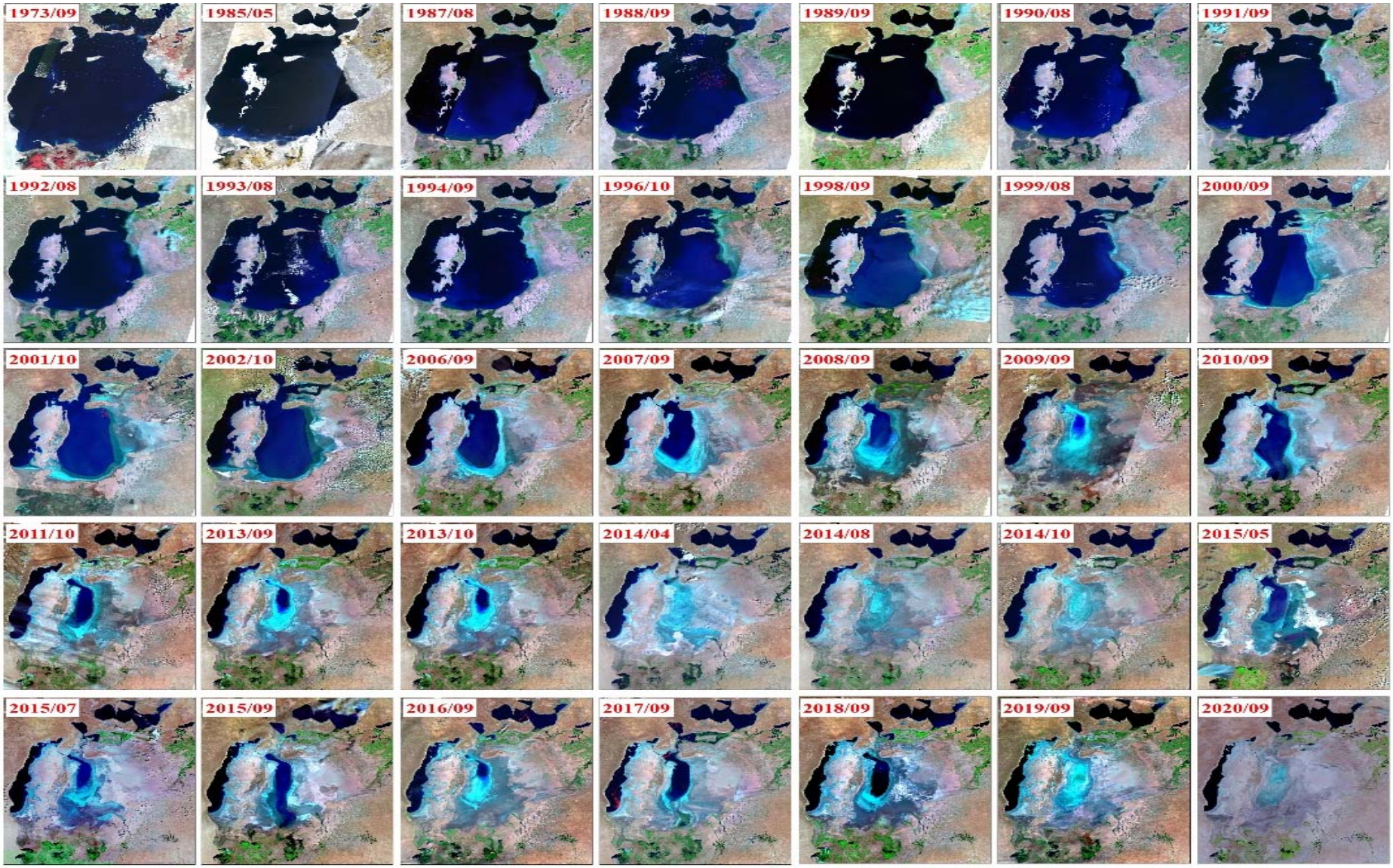
Calling on the international community to collaboration between the UN and the countries in the Sustainable Development Goals (SDGs) for Aral Sea

Research topics

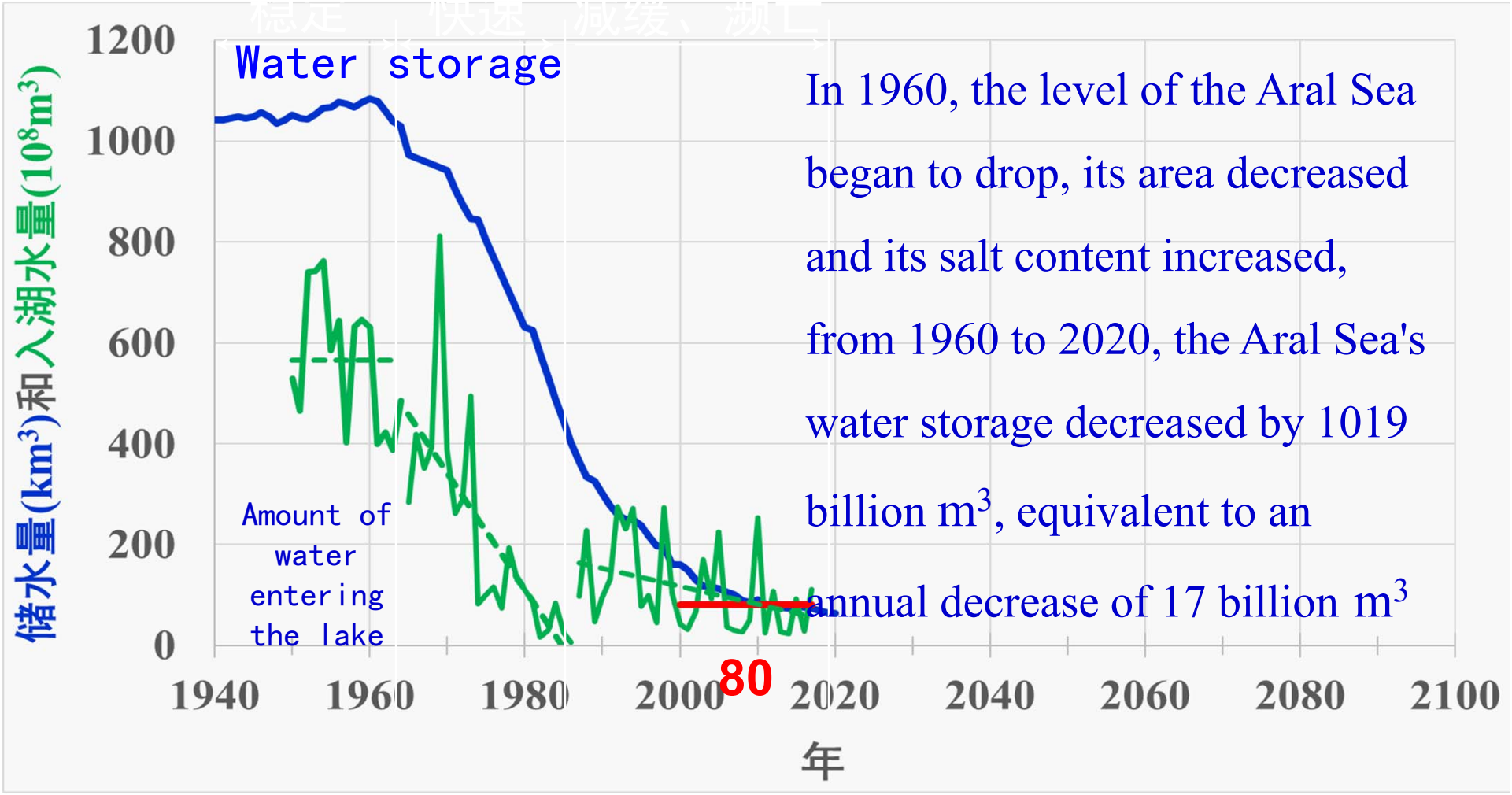
- The process of change in the Aral Sea? Why is the Aral Sea shrinking?
- The interaction between water-socio-economic systems-ecosystems in the Aral Sea basin
- Strategies, road maps and technical solutions for sustainable development in the Aral Sea basin

1. To research the process of change in the Aral Sea

First, we used remote sensing technology to reverse the changes in the Aral Sea every month from 1973 to 2020

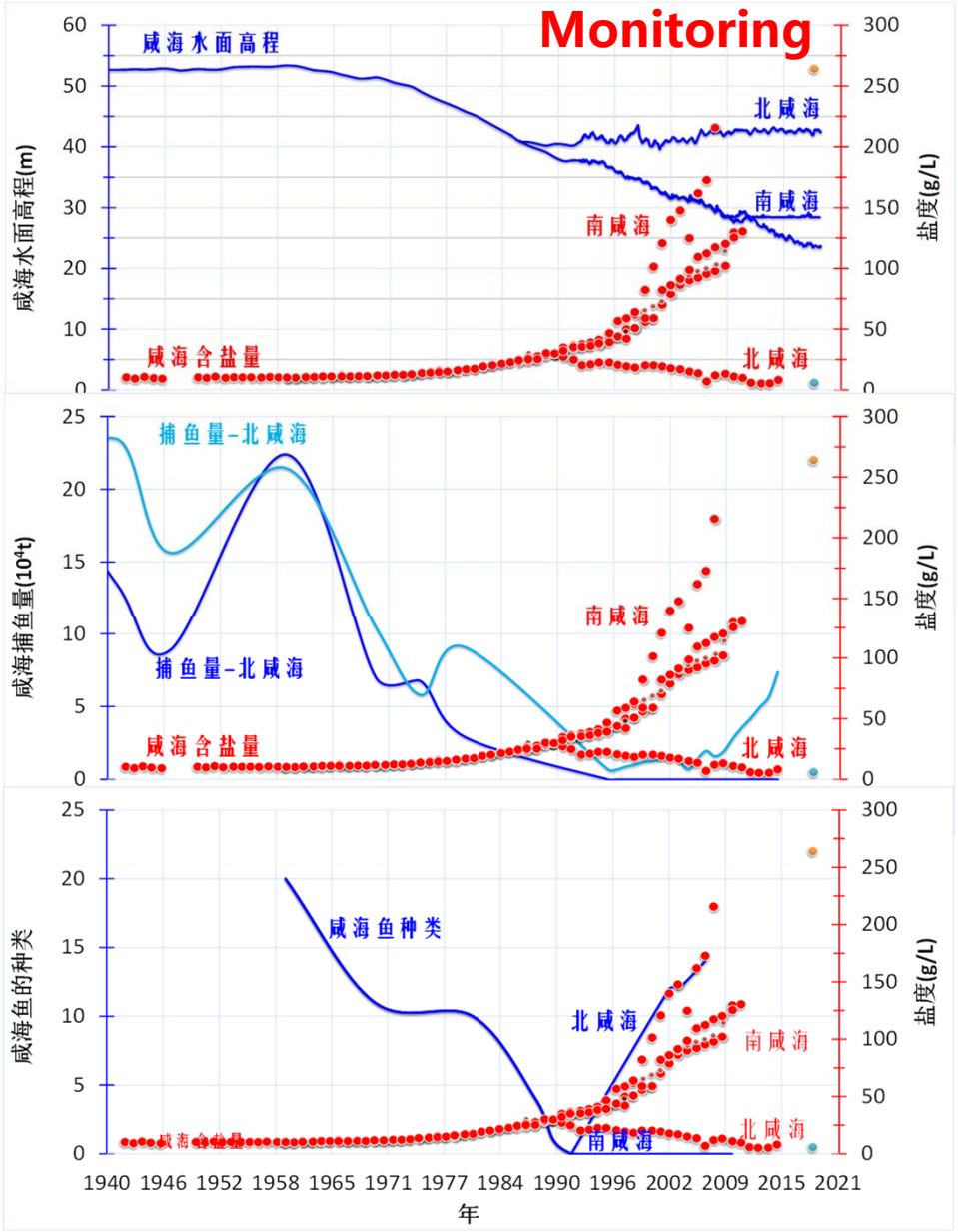


water storage change

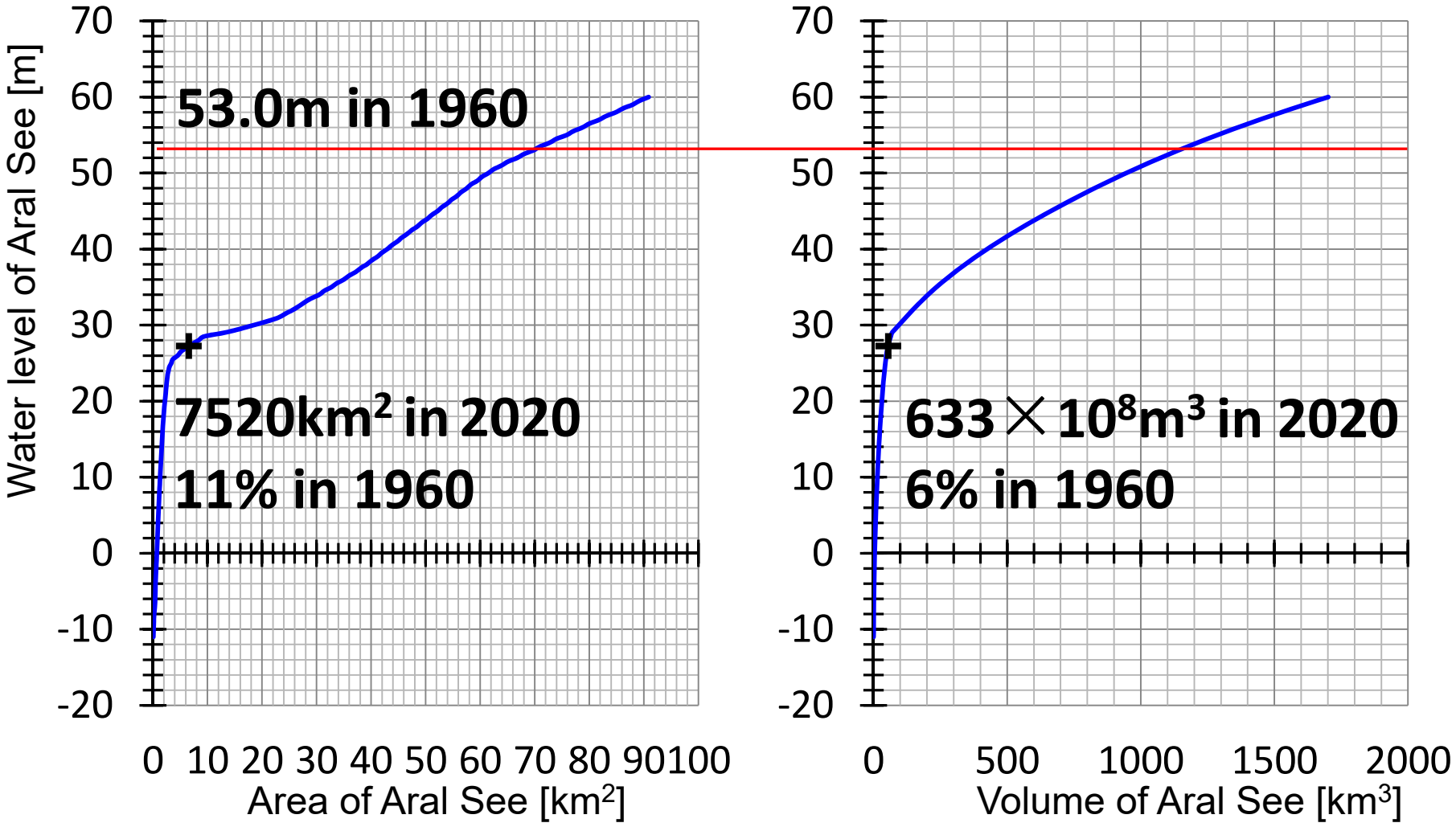


The Aral Sea change is divided into three stages, 1940-1960 stable period, 1960-1990 rapid decline period, 1990-2020 slow decline period, Aral Sea reduction is fundamentally due to the sharp decline in the amount of water into the lake.

- In 1990, Kazakhstan built dams to divide the north and South Aral Sea into two parts. The area of the North Aral Sea increased year by year, the salt content returned to the level before 1960, and the fish species and fishing quantity returned to the level of 1970.
- In 1990, most of the salty sea areas in Uzbekistan were extinct.
- The ecological states of the Aral Sea is directly related to the national water resources management



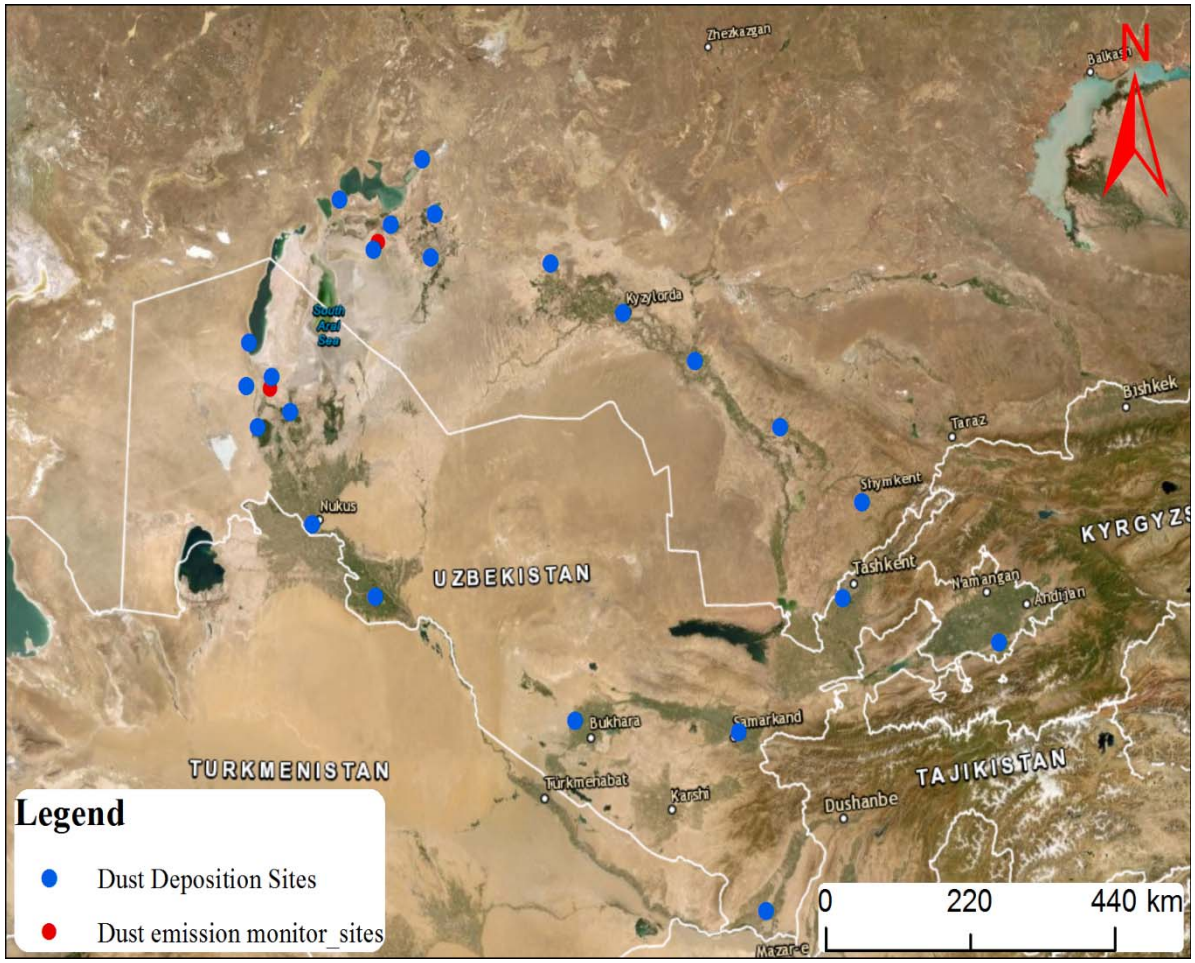
Survey of Submarine topography for Aral Sea was performed for higher accuracy. More than 10000 ground samples were collected.



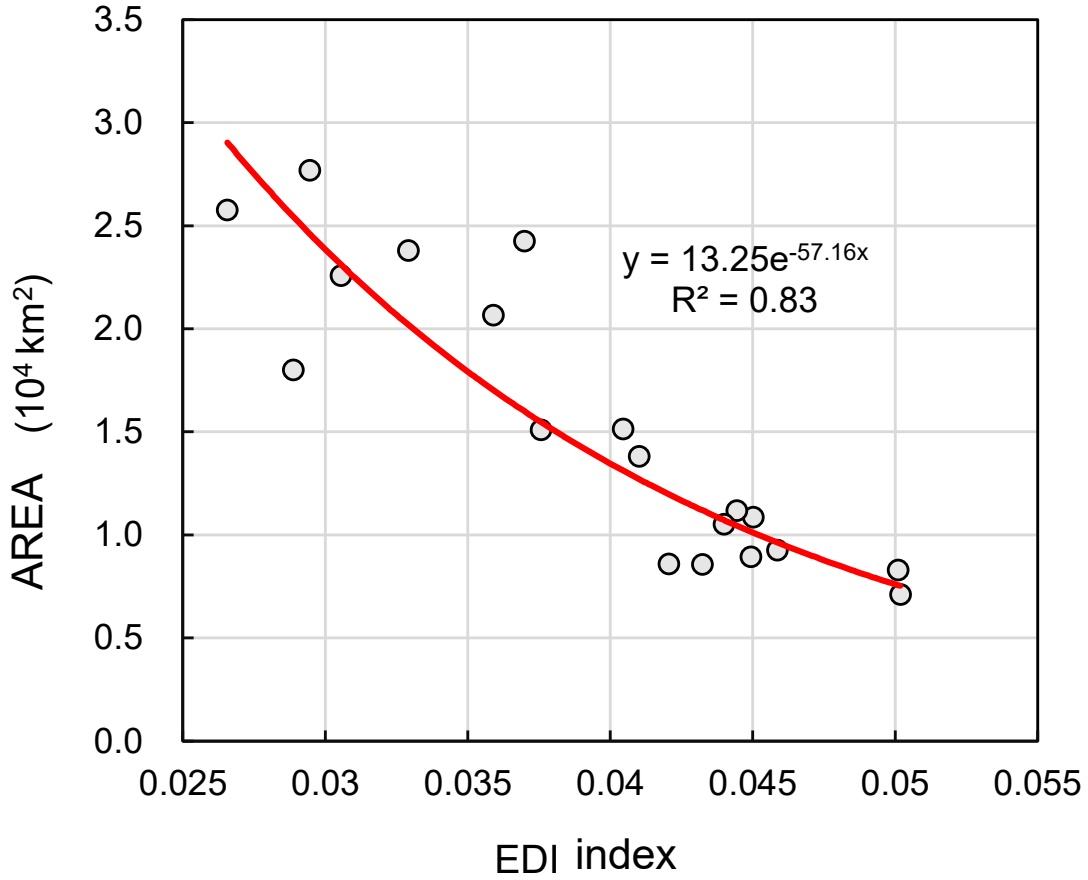
2. To research the Salt dust change

Quantified the key threshold of relieving salt-dust:

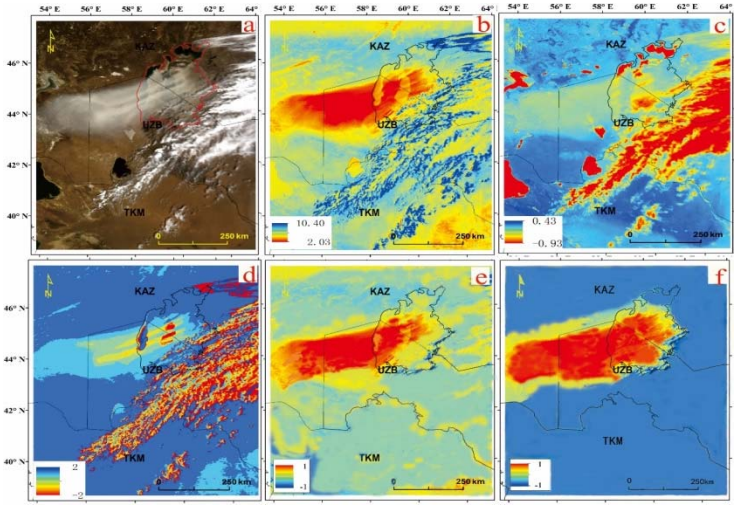
In order to reveal the initiation mechanism of sandstorm and its characters, the observation network (more then 20 sites) was established in the basin

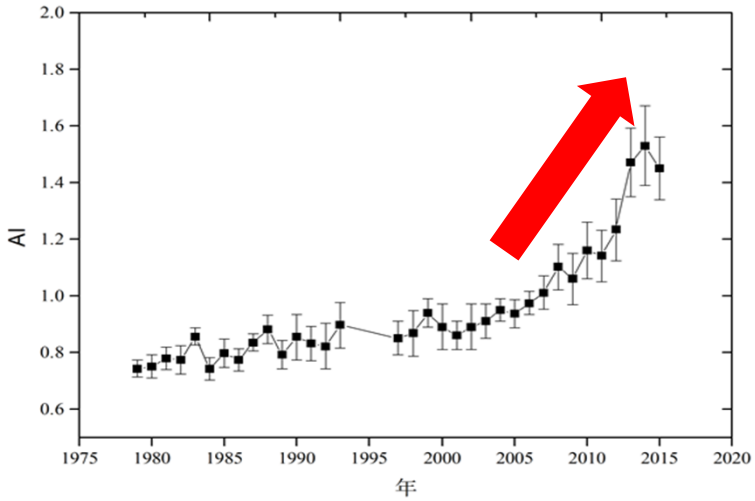


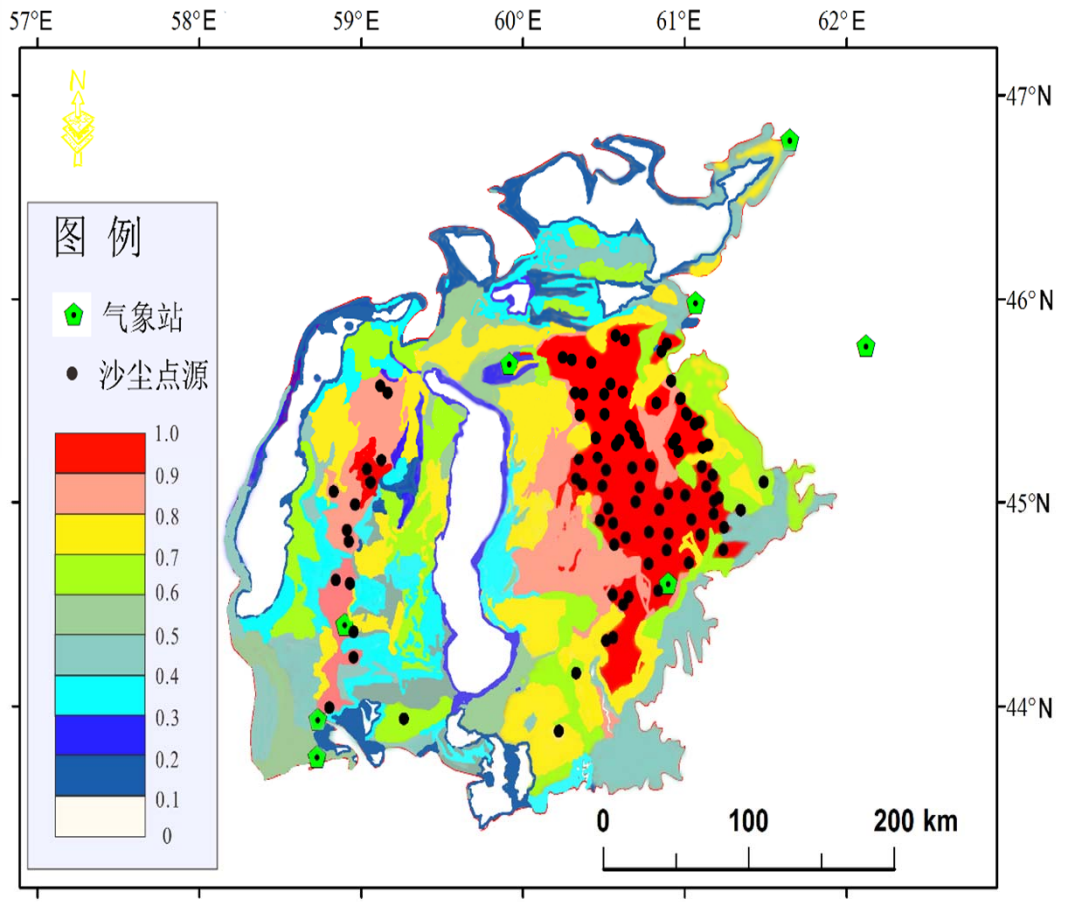
Find out the relation between sandstorm and dry seabed. during 1977- 2015, large area of salty surface layer was formed directly in the retreating Aral Sea waters. The desertification area accounts for 70% and the vegetation coverage only reminds 15%. After 1996, with the rapid shrinkage of water body, the proportion of saline soil increased significantly. Sandstrom effects 100 million people and 1500km surrounding area.



By the remote sensing ,ground monitoring and model simulation, the salt dust mainly causeed in east part of shriking Aral Sea, examining the correlation between aerosol dust and environment variables, Salt dust can be reduced by more than 70% by keeping 8000-10000km^2 East Lake area or the 28-30m sea water level or using the vegetation covering.





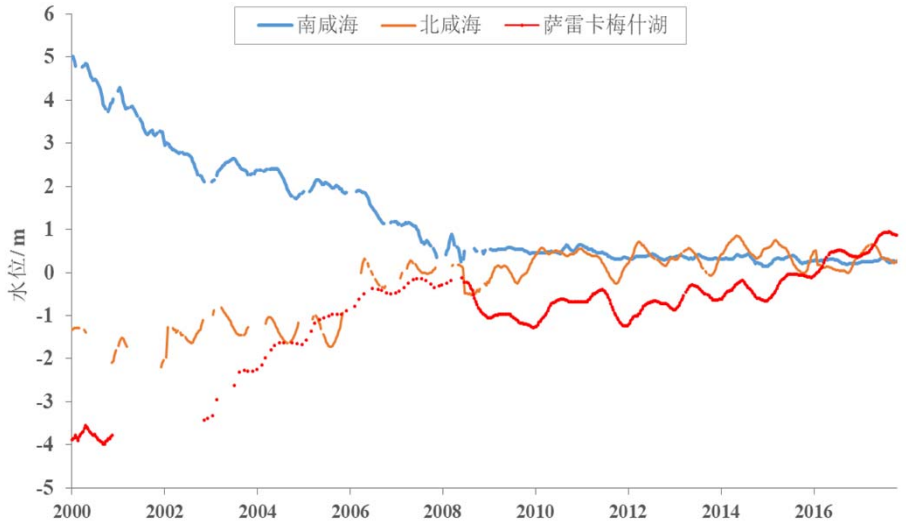


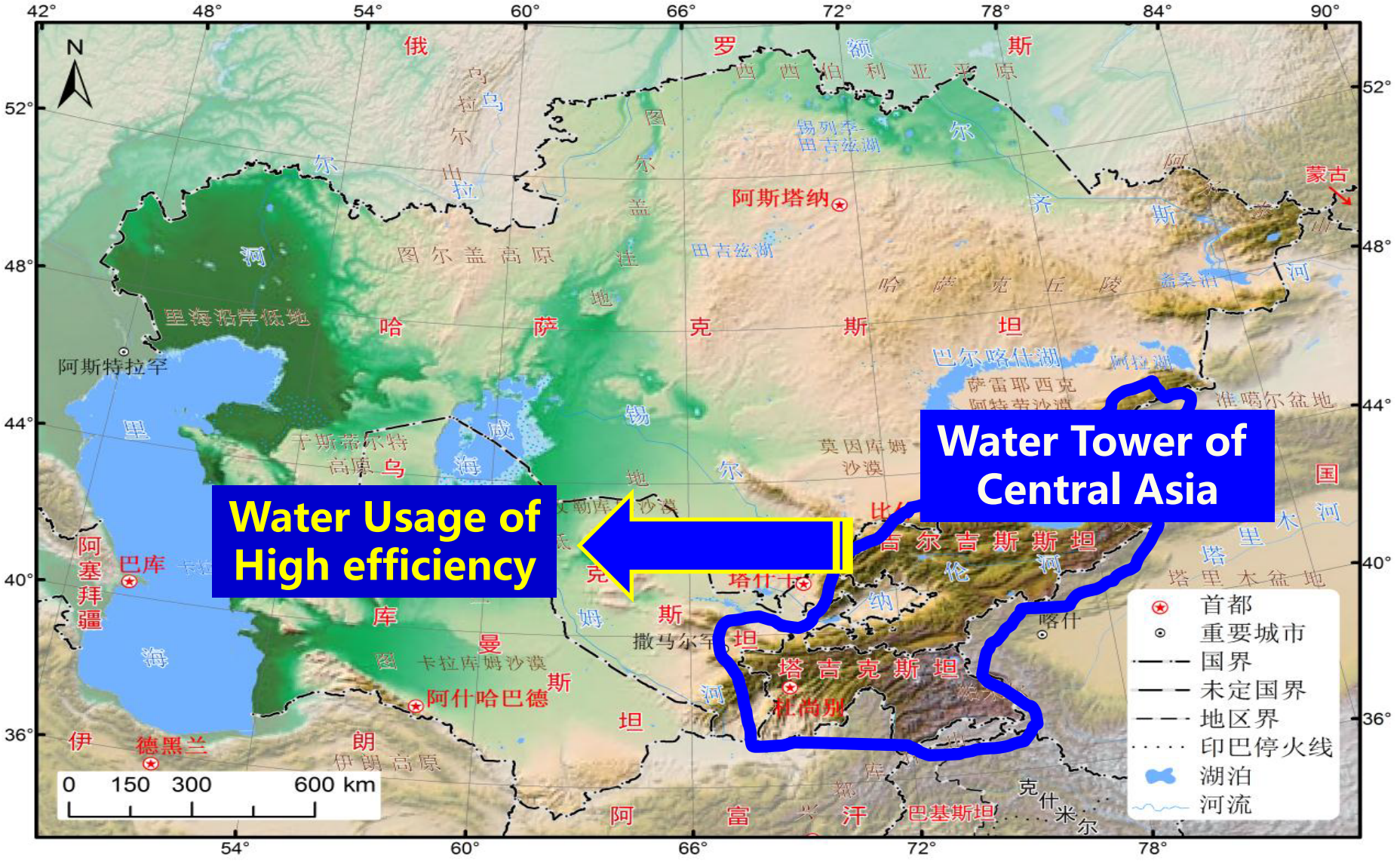
Risk analysis of wind erosion in the bed of Aral Sea

3. To research the reasons of rapid shrinkage in Aral Sea

We used remote sensing technology to reverse the land use and land change of Aral Sea basin from 1960 to 2015 ,and find out the water management took more responsibility rather than increasing population or farmland. Area Sea disaster is strongly related to the lack of the joint motivation and cohesion from the surrounding countries

- 1960 ~1990, cultivated land ↑ significantly, Aral Sea ↓ by nearly 50%.
- 1990 ~ 2015, Aral Sea ↓ by 45%, but cultivated land ↘ or ↗ slowly. internal water body and wetland ↑ significantly, and less water entering Aral Sea

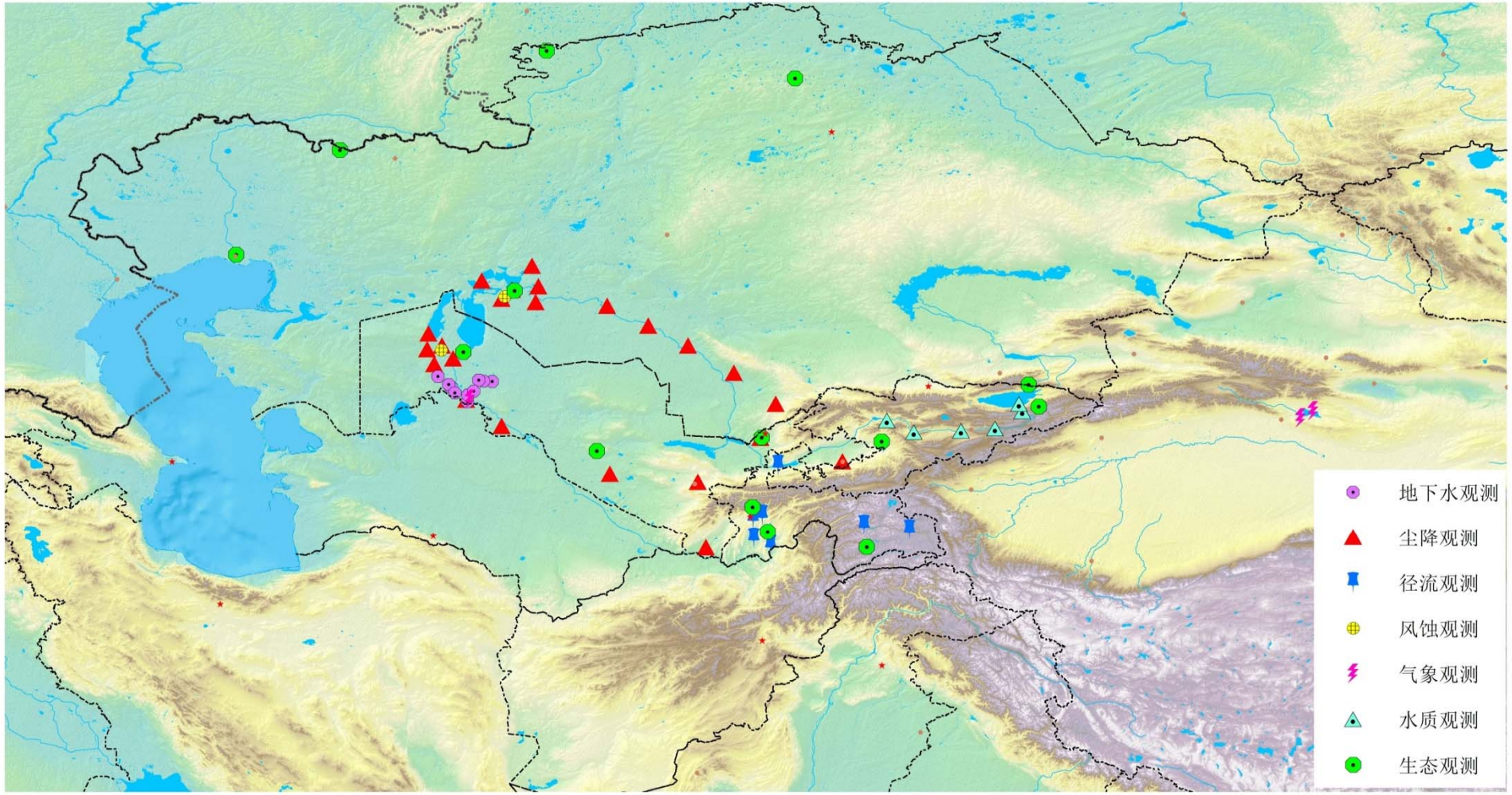


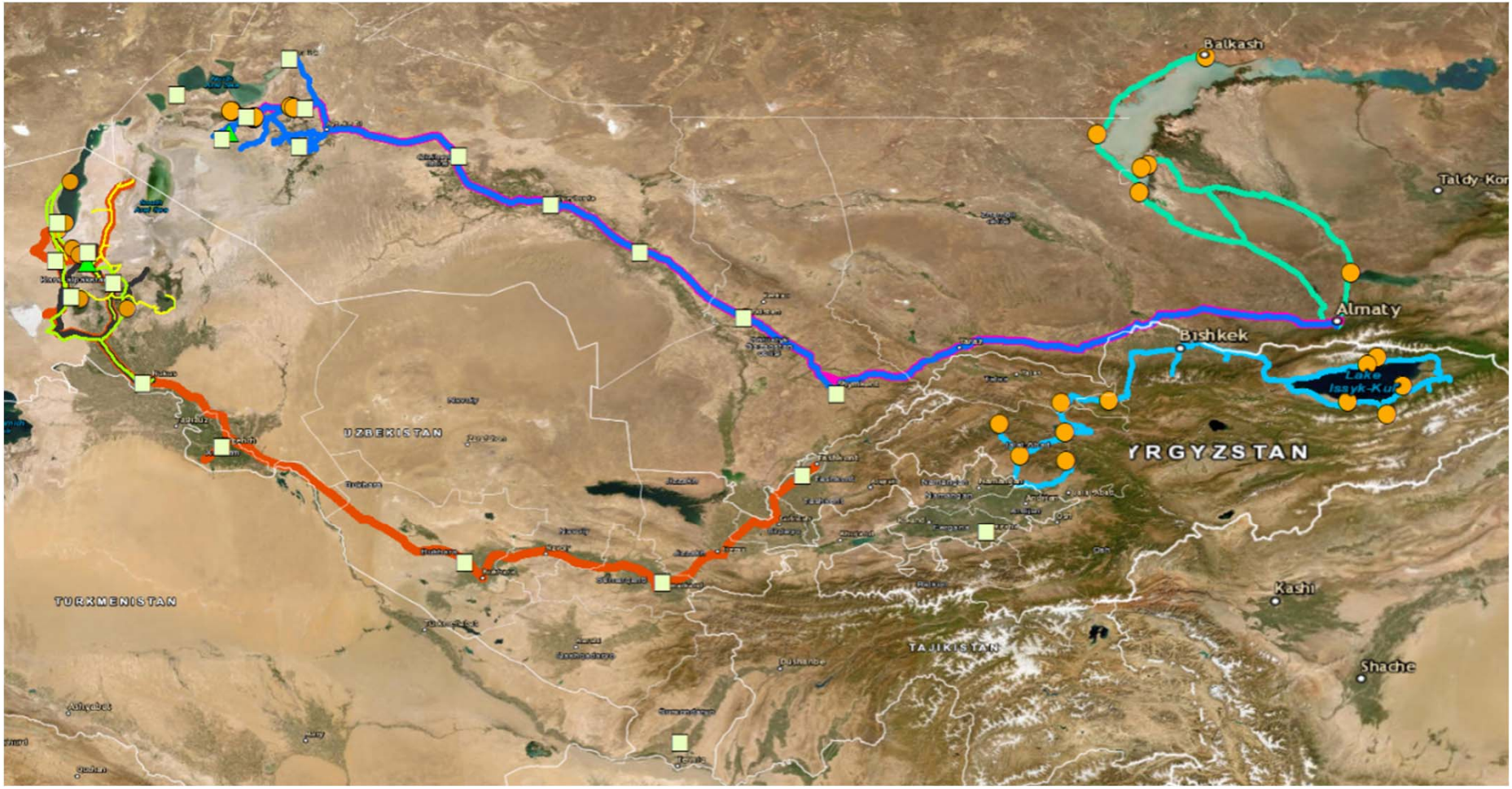


Synergism developing mode of water, ecology and social economy in Aral Sea basin

4. To Establish Monitoring network

In cooperation with the water conservancy and environmental protection departments of the TJK, UZB, KAZ and KYR, 80 real-time monitoring stations for water and ecology in Aral Sea basin have been built.

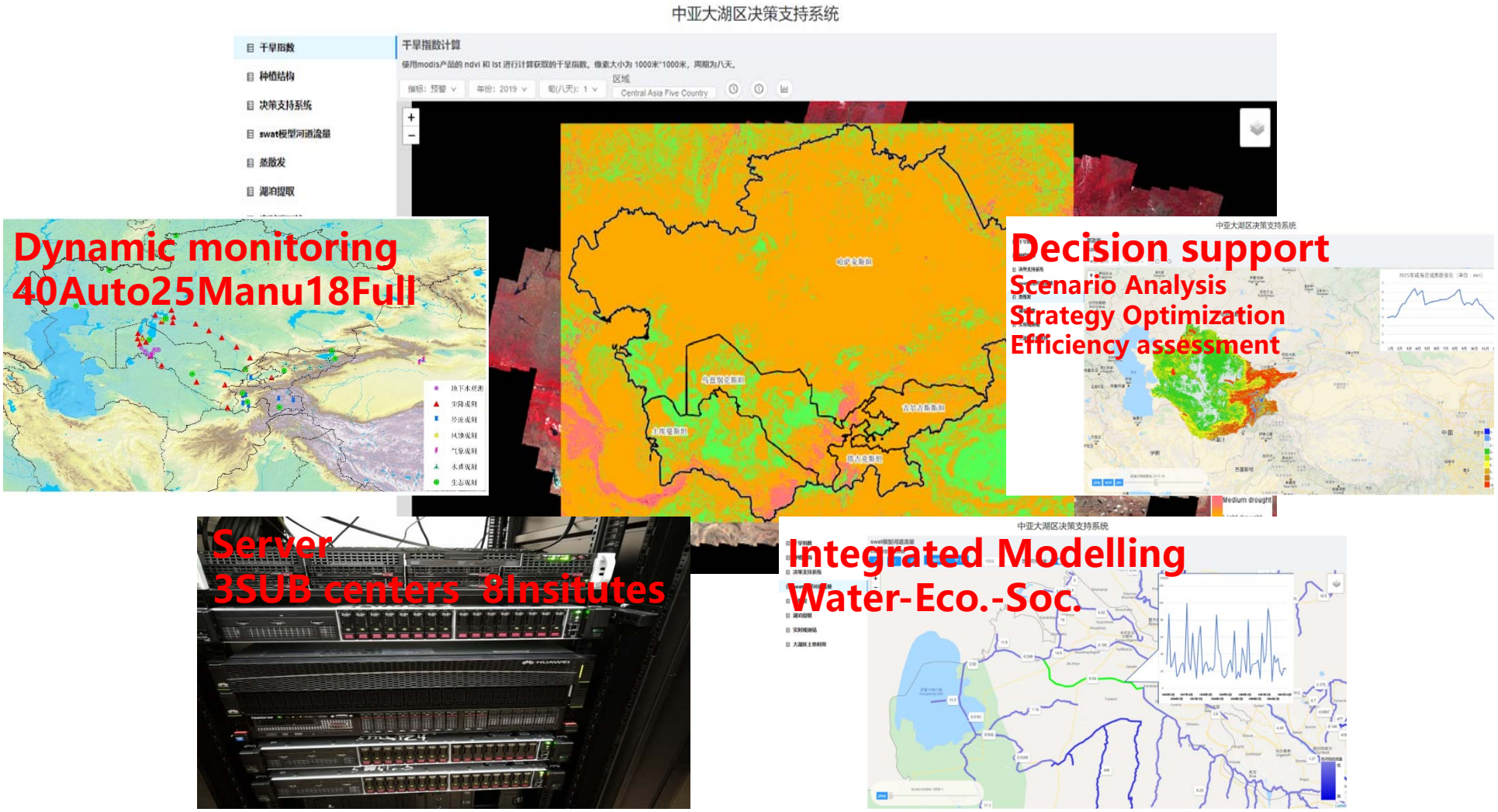




- 19 field joint scientific surveys were organized
- More than 2000 water, soil, gas and biological samples were collected
- Anylized the hydrological, meteorological, socio-economic and water resources utilization change of Aral Sea

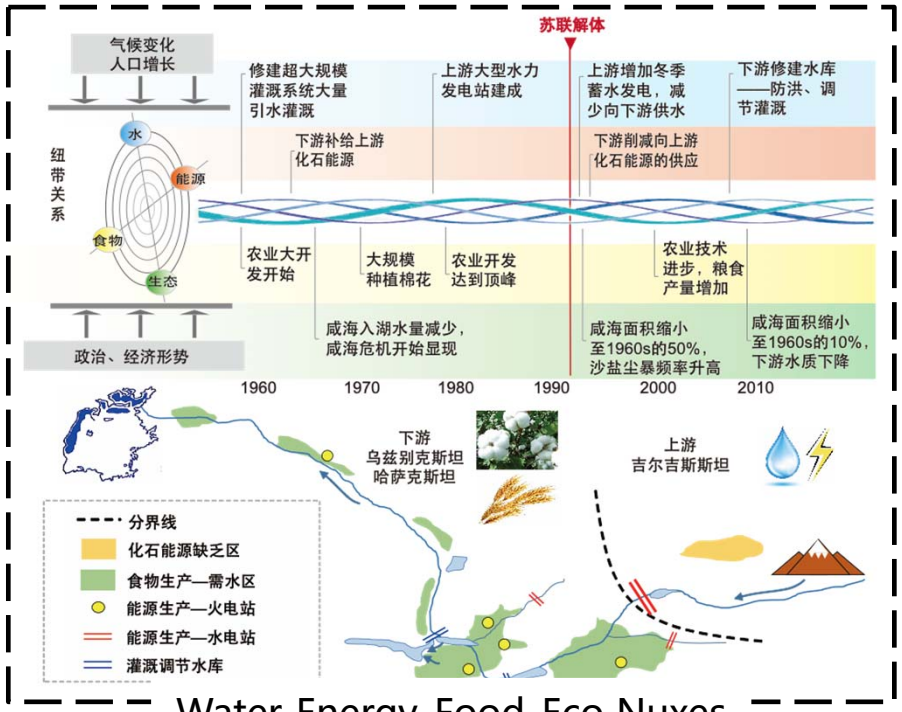
5. To develop the decision making support system

With the Ministry of water resources of Uzbekistan and Ministry of agriculture of Kazakhstan ,the water-ecology-socio-economic simulation and decision support system is established with superior performance and real-time operation.

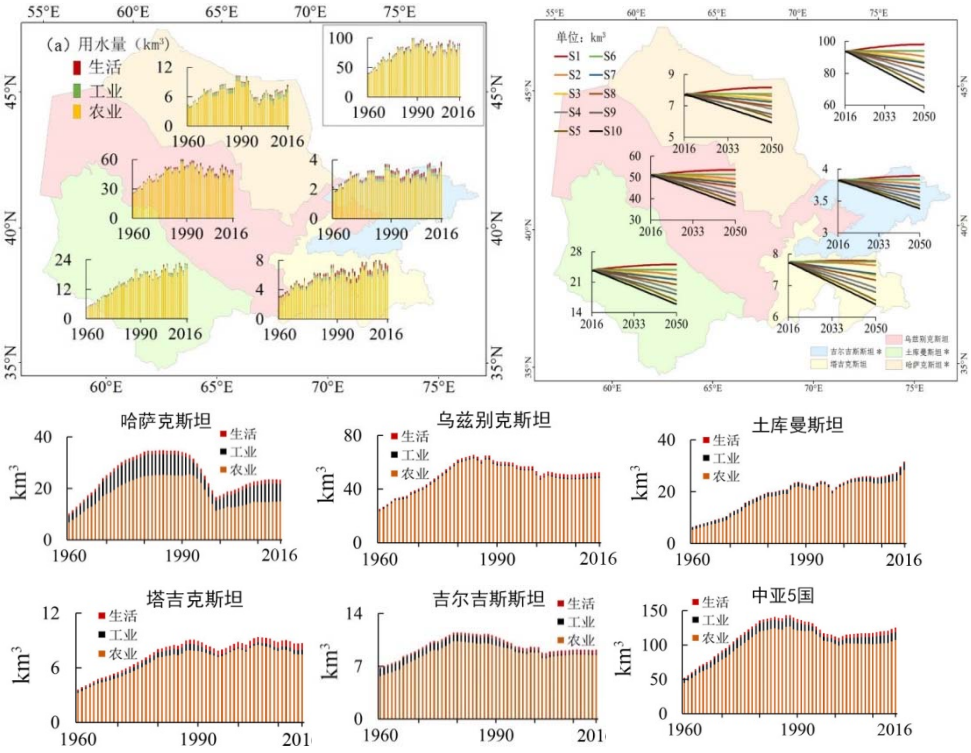


(1) Optimal allocation scheme of water resources utilization in the Aral Sea Basin for future management

- Four developing stages: growth period (1960-1980), peak period (1980-1990), reduction period (1990-2000) and stable growth period (2000-2016);
- Central Asian countries have low water utilize efficiency and need to be improved;
- The demand of sustainable development can be maintained through optimal allocation.

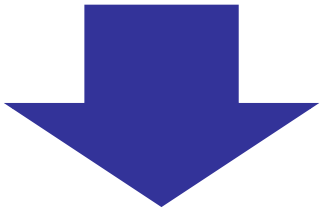


Water-Energy-Food-Eco Nuxes



(2) Proposed the synergism mode of water resources, social economy and ecosystem for Aral Sea basin

- Improving agricultural water use efficiency in UZB, TKM, TJK and KAZ is the priority of control in the Aral Sea (water saving scheme);
- Coordination among countries, increasing the inflow of Amu Darya River and reducing reservoir interception and agricultural water use are the second key factors (water allocation scheme);



- Near future (2030): inflow into Aral Sea is expected to 13.1km^3 /a, and the East Lake will be recovered initially
- Medium term (2040): inflow into Aral Sea is expected to 17.6 km^3/a, ecological situation similar to 1990s;
- Long term (2050): inflow into Aral Sea is expected to 20.8 km^3/a, ecological situation similar to 1970s

Improving irrigation technology and industrial water efficiency, reasonably manage the reservoir storage, To restore the ecological situation of Aral Sea.

(3)Established the decision-making strategies of Ecological-Economic-Water usage in the future.

Based on 2021-2050, 54 climate change RCP4.5 scenarios, our team provide the strategies to response the climate change, social economy, ecological environment, incoming water, water demand, water consumption, inflow, upstream/downstream coordination and trade-off plan.

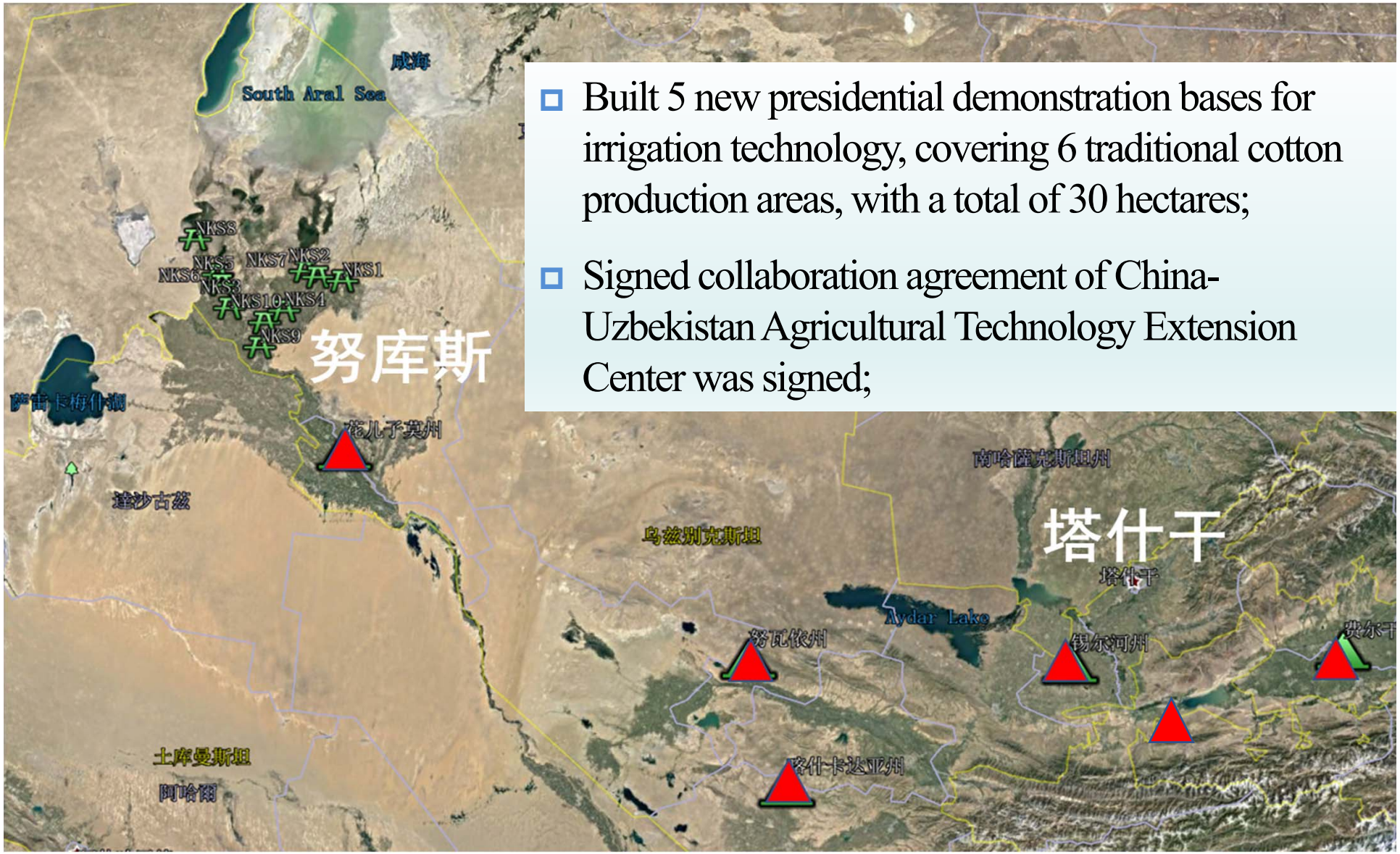
	Water demand		Ecological responding index			
Contr. Water level (m)	**($10^8 m^3$)**		Salty(g/L)	Fishes	NDVI	Soil salinity
	Average	**SDV**				(g/kg)
50	527	25	13	15	0.32	3.4
45	445	22	20	6	0.21	5.3
40	364	18	33	1	0.14	8.7
35	**274**	**13**	**58**	**0**	**0.09**	**16.6**
30	**149**	**7**	**110**	**0**	**0.06**	**42.6**

6. To demonstrate water saving technology in KAZ/UZB

Rice Irr. Demo. In KAZ

Cotton Irr. Demo. In UZB

The technology of drip irrigation with organic film meets , It can reduce salt content by 20%, increase humus by 47%, increase yield by 100%, save water by 47.8%, and save water resources by 11000 m^3/ha.



- Built 5 new presidential demonstration bases for irrigation technology, covering 6 traditional cotton production areas, with a total of 30 hectares;
- Signed collaboration agreement of China-Uzbekistan Agricultural Technology Extension Center was signed;

- In 24 Dec. 2019, Kazakh President Tokayev visited our Aral Sea decision support system of Kazakstan Astana office , fully affirmed the cooperation between China and Kazakhstan, and hoped to promote it in Kazakhstan
- The water saving irrigation demonstration site of Uzbekitan was listed as the experimental area directly under the president of Uzbekistan

With the 2 years research

1. **Find out** the causes of repide shriking in Aral Sea
2. **Built up** the monitoring network for salt dust storm ,water use and ecosystem
3. **Provide** the optimized solution for the decision makers for Aral Sea basin
4. **Established** the water saving technology demonstration site

7. Future Plan:

Objectives

- Multi objective synergism mode of water resources and ecological management in Aral Sea basin
- Road map of water and ecological for green development in Aral Sea basin
- Assessment on water ecology socio economic security

Key technique issues:

- Operation of integrated decision support system
- Large scale extension and demonstration of high efficiency water saving irrigation technology
- Water ecology social economy coordination theory and method innovation

Key deployment:

- The achievements are applied to the governments of Central Asian countries, SCO and the United Nations

Welcome to Xinjiang