AOMSUC-15 2025 FYSUC

THE 15TH ASIA-OCEANIA METEOROLOGICAL SATELLITE USERS' CONFERENCE (AOMSUC-15)
2025 FENGYUN SATELLITE USER CONFERENCE (2025 FYSUC)

The MAZU-Agric Platform: From Agricultural Remote Sensing in Shaanxi to Broader Applications

LIU Yadong

Shaanxi Provincial Meteorological Bureau

CONTENTS

1 Brief Introduction to MAZU-Agric

2 Application of Satellite Remote Sensing in Shaanxi Province

The Challenge

- Currently, only half of the the WMO members have multi-hazard early warning systems
- One-third of the global population still lacks access to early warning information, representing a major challenge in responding to meteorological disasters

The EW4All initiative

- Launched by UN Secretary-General António Guterres in 2022
- To ensure everyone is protected from extreme weather, water, or climate events through early warning systems by the end of 2027

MAZU：China’s Joint Action for EW4All

- **Launched by CMA** at the opening ceremony of the World AI Conference on July 26 2025
- “Ensuring universal access to meteorological early warning systems is not only a shared vision of the global community, but also an important mission of China‘s meteorological departments.”

——CHEN Zhenlin, Administrator of CMA

MAZU-Agric: Extending MAZU to Agriculture

Deployed Versions of MAZU

MAZU-Agric

With a focus on agriculture, it establishes a technological foundation “Zhi Tian (知天）”, and an application service “Er Zuo（而作）”

MAZU-Agric Launch Events

- **24 Sep 2025, Yangling:** Launched at the National Conference on Agricultural and Meteorological S&T Innovation Exchange and Promotion
- **25 Oct 2025, Yanling:** Launched at the SCO Modern Agriculture Development Roundtable

2025年全国农业与气象科学技术创新交流推广会

2025年上海合作组织现代农业发展圆桌会议

Core Services of MAZU-Agric

AI-Powered Forecast Model

FengYun Earth Asia Monitoring

Full-Cycle Agricultural Production Monitoring

Cross-Border Logistics Meteorological Service

CONTENTS

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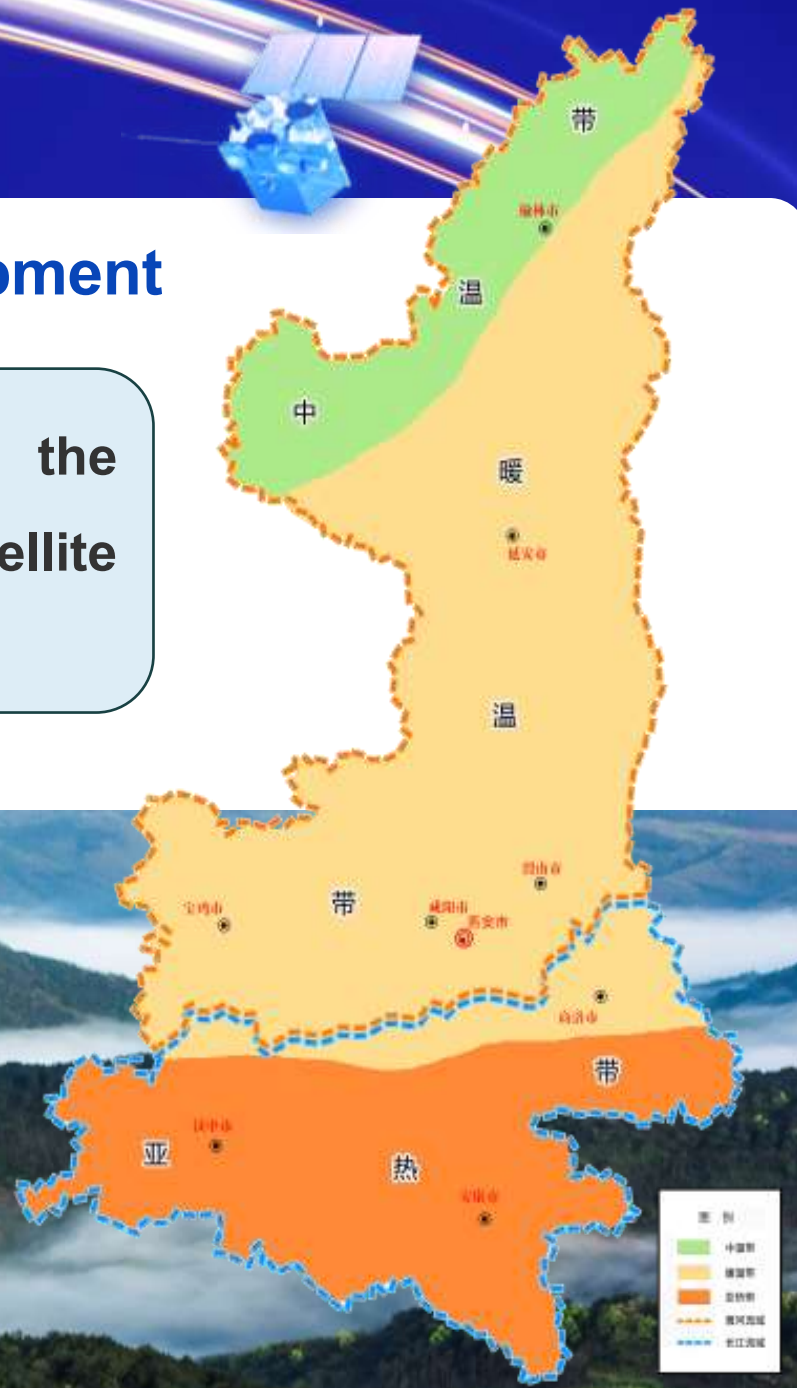
2 Application of Satellite Remote Sensing in Shaanxi Province

Leveraging Satellite Technology for Sustainable Development

Shaanxi Province, with its unique geography encompassing the Qinling Mountains and the Loess Plateau, has adopted satellite technology to promote sustainable development.

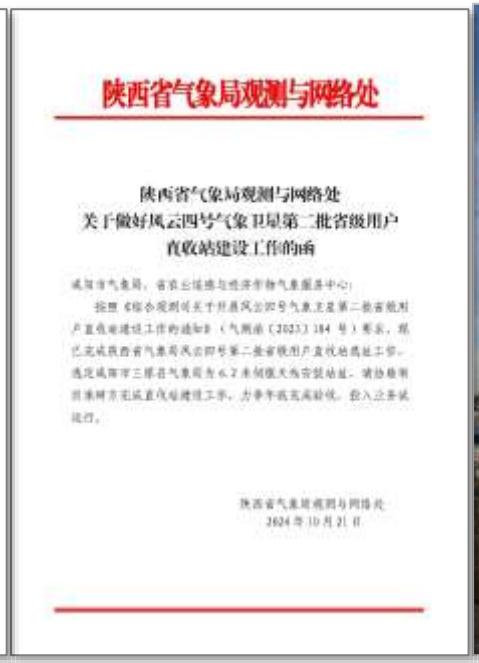


Key Infrastructure

- **Receiving Stations:** 1 polar-orbiting and 2 geostationary satellite direct receiving stations
- **Validation Sites:** 3 validation sites in Shenmu (Yulin), Songduo Mountain (Shangluo), and Taibai (Baoji)
- **Processing Platform:** a multi-source satellite data preprocessing and validation platform

陕西省气象局观测与网络处

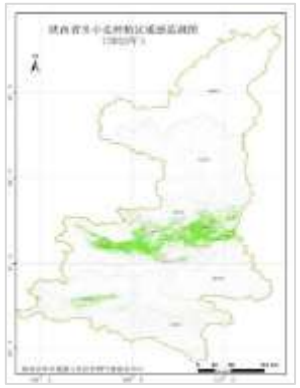
陕西省气象局观测与网络处
关于进一步加强卫星遥感综合应用体系建设
服务地方发展的通知

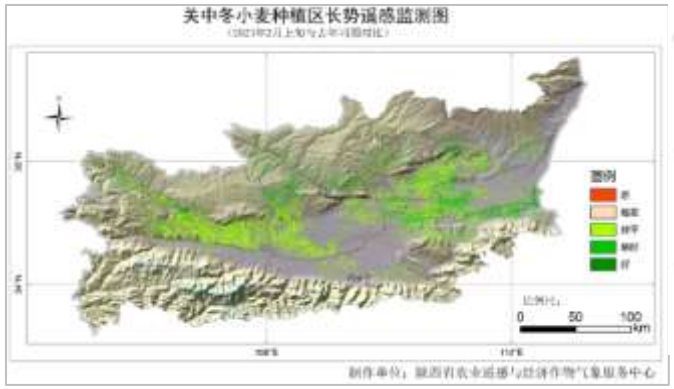

陕西省气象局观测与网络处

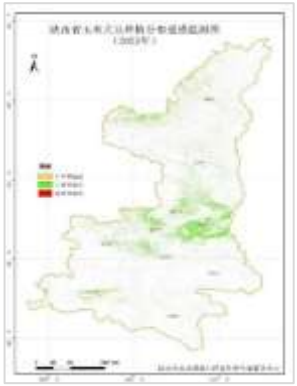
陕西省气象局观测与网络处
关于做好风云四号气象卫星第二批省级用户
直收站建设工作的函

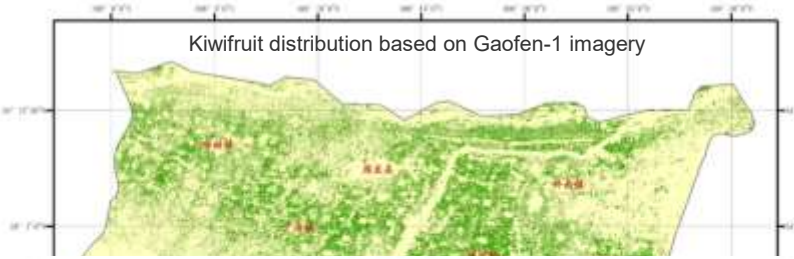
➢ Mission 1: Food Security & Specialized Agriculture

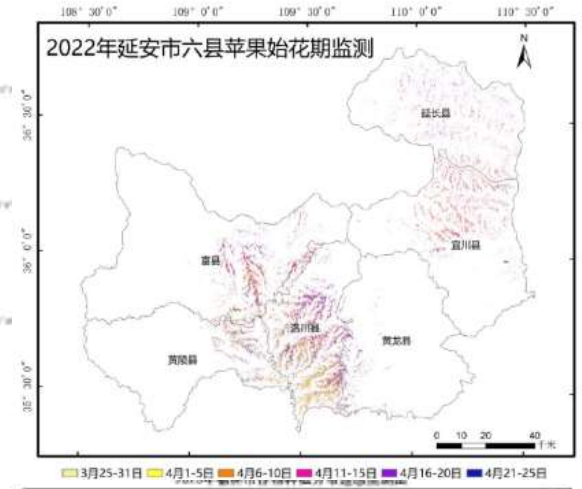
- **Staple Crop Monitoring:** Distribution, growth status and harvest progress of **winter wheat, corn, and soybean**
- **Specialized Crop Monitoring:** Apple flowering and quality (hyperspectral remote sensing); distribution of **apple and kiwifruit**









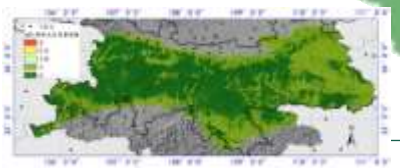


➢ Mission 2: Ecological Conservation & Development

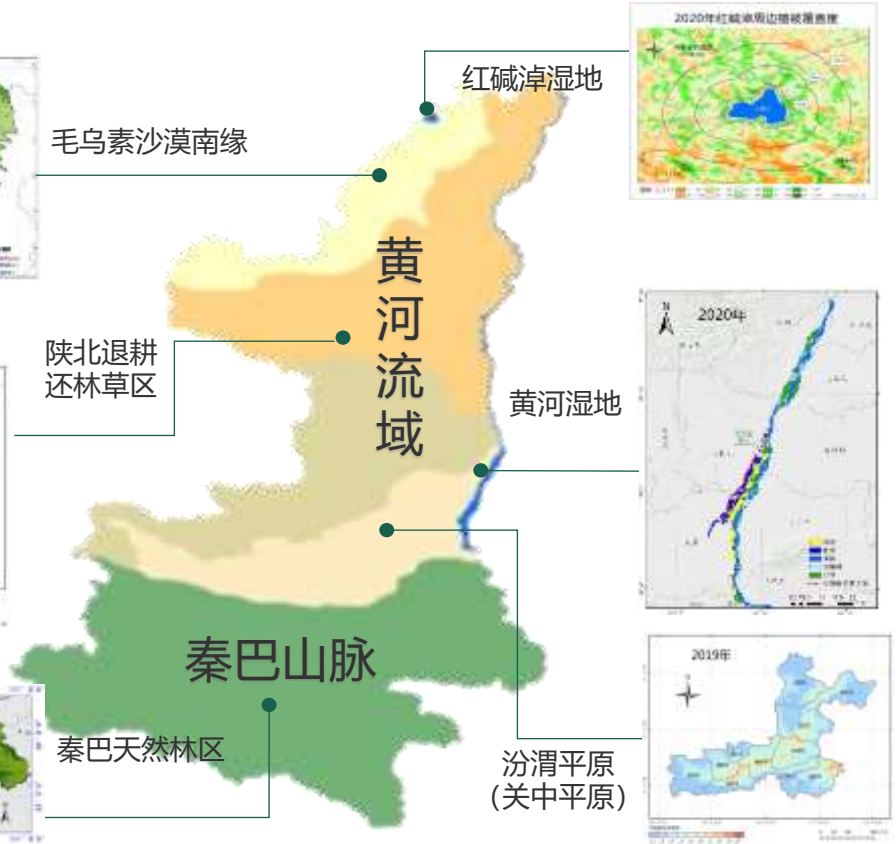
Focus on the **Qinling Mountains** and the **"Ji Zi Wan" area of the Yellow River**, conducting **green project evaluations** to support Shaanxi's ecological promotion

防风固沙监测

水土流失监测



碳汇、水源涵养监测



毛乌素沙漠南缘

陕北退耕还林草区

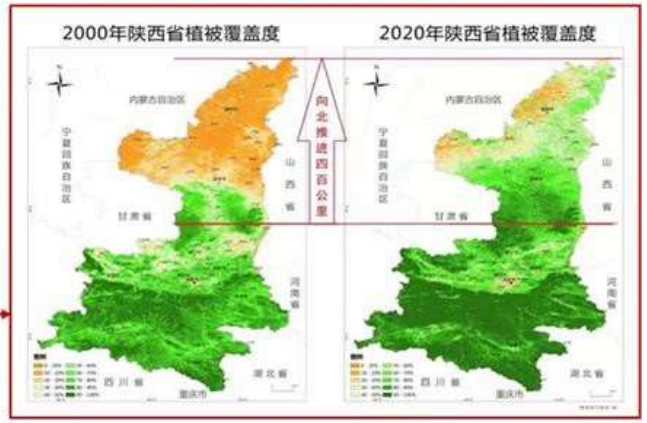
秦巴天然林区

红碱淖湿地

黄河湿地

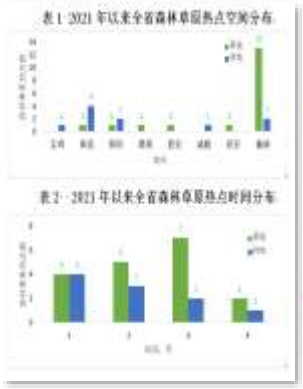
汾渭平原（关中平原）

大气环境监测

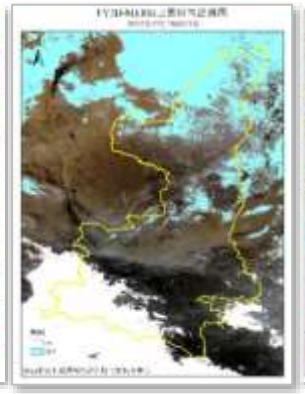


➢ Mission 3: Disaster Prevention and Mitigation

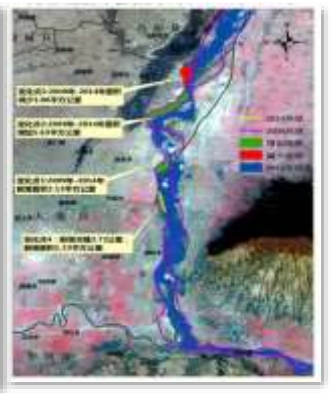
To address Shaanxi's regional characteristics and key concerns, we conduct satellite remote sensing monitoring for **fire hotspot, ice floods, high land surface temperature (LST), snow cover, heavy fog, dust, haze**



森林草原热点

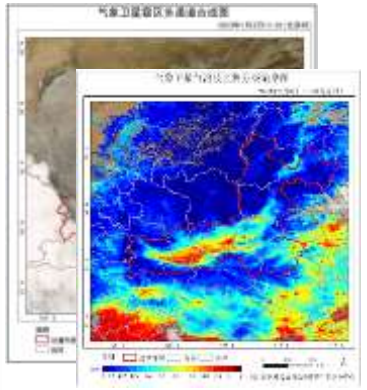


积雪



黄河河道摆动

黄河凌汛



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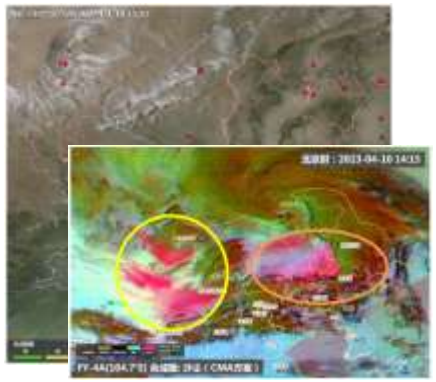

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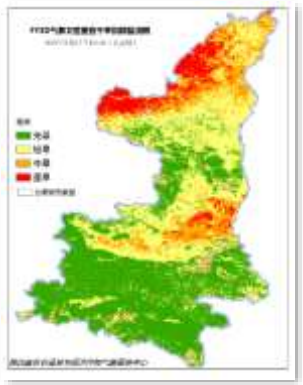
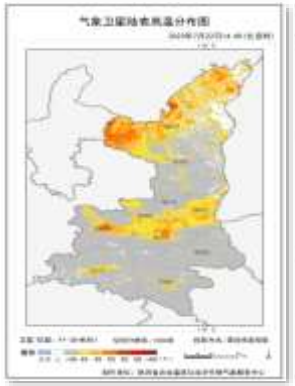
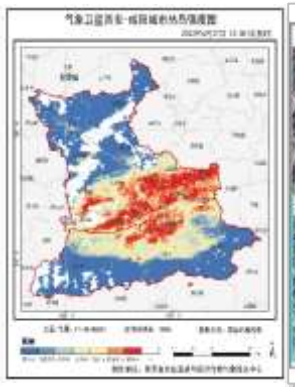


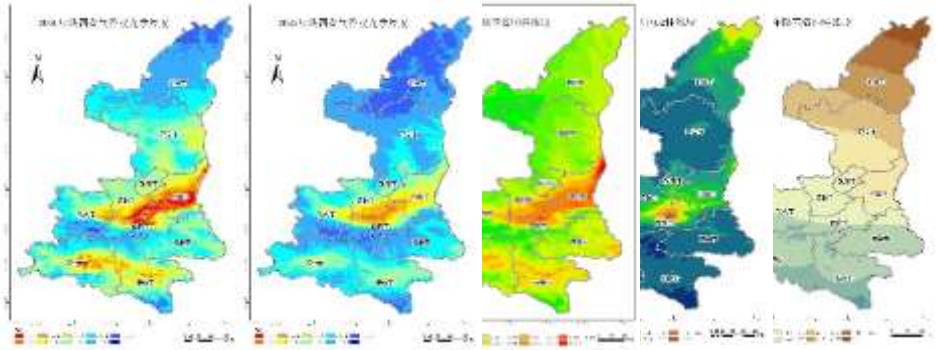




干旱

陆表高温与城市热岛

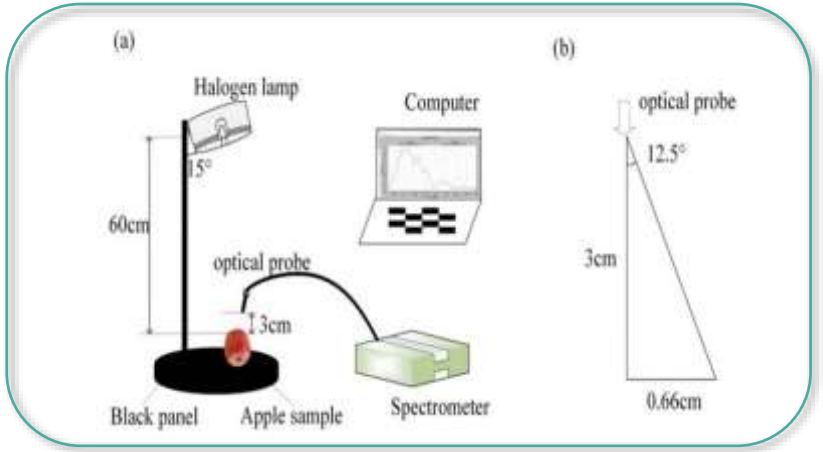
水情

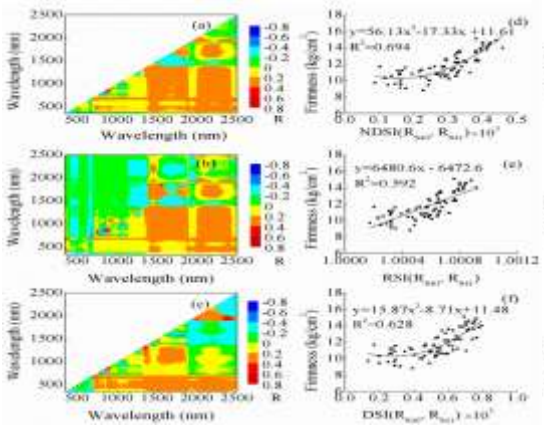


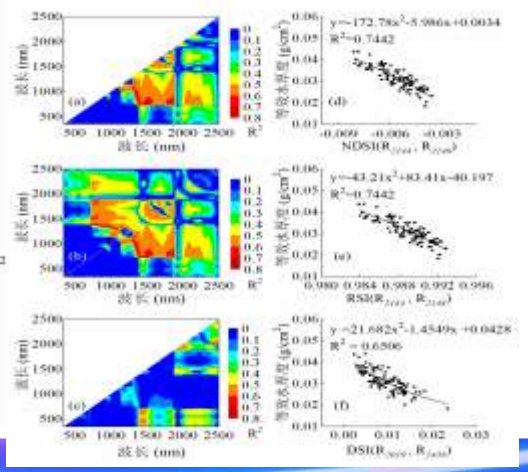
气溶胶光学厚度、CO柱浓度、NO_2柱浓度、O_3柱浓度

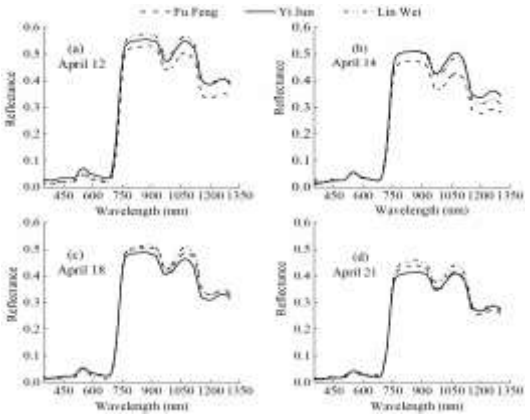
➢ Application Scenario 1: Hyperspectral Remote Sensing in Agriculture

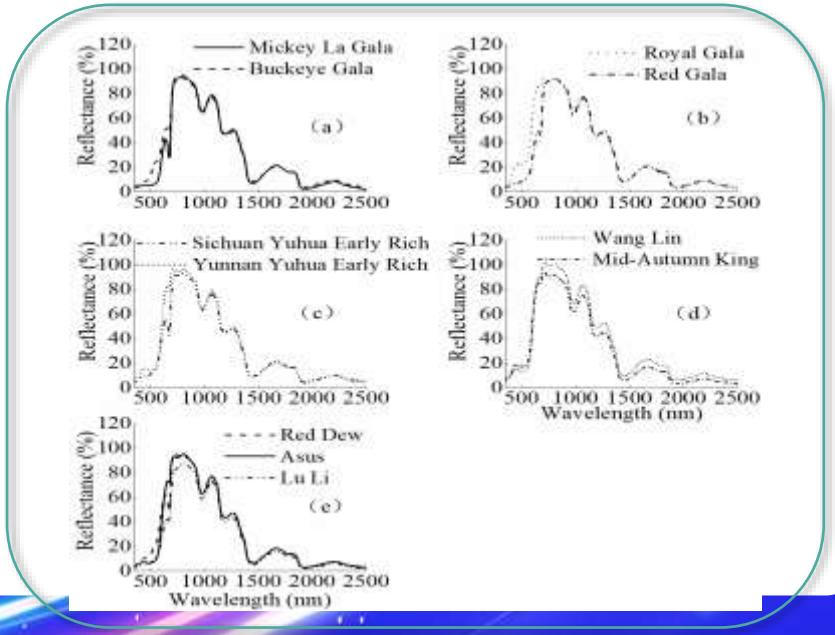
- **Developing a Kiwifruit Heat Stress Assessment Model**
  Using data mining techniques to explore the relationship between hyperspectral remote sensing responses and kiwifruit physiological indicators under heat stress, identifying spectral-biochemical correlations.
- **Building an Apple Quality Estimation Model**
  Combining hyperspectral technology with advanced algorithms to measure spectral features and internal quality parameters (soluble solids, acidity, firmness), developing climate-specific spectral indices for quality prediction.
- **Creating a Winter Wheat Phenology Monitoring Model**
  Developing spectral indices sensitive to growth stages, and enabling rapid, non-destructive monitoring of key phenological phases.





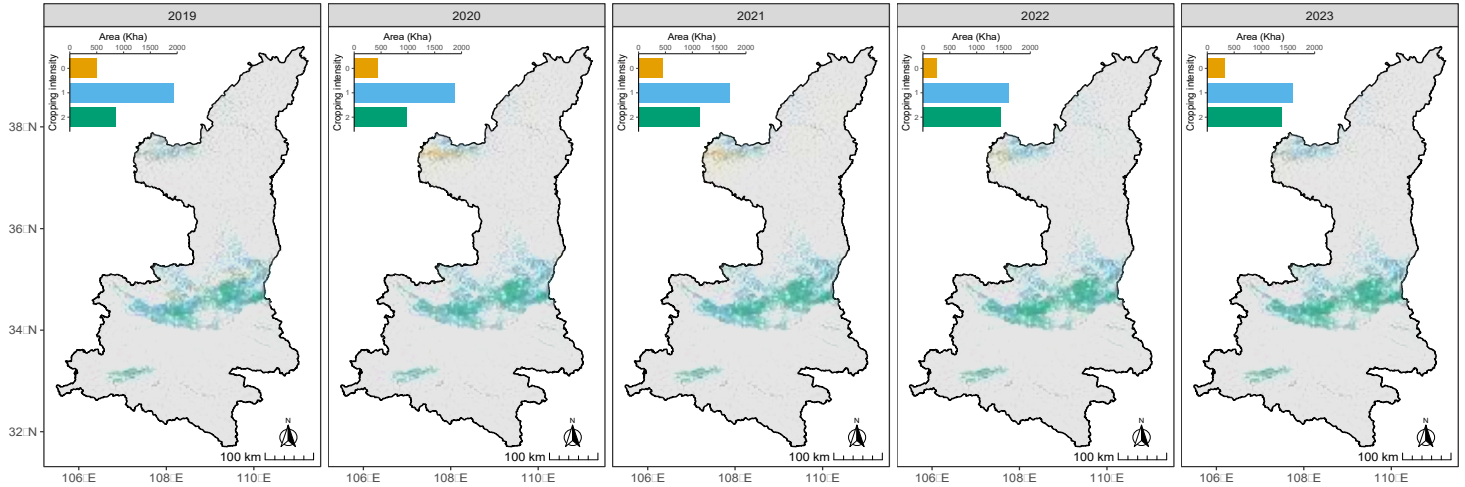


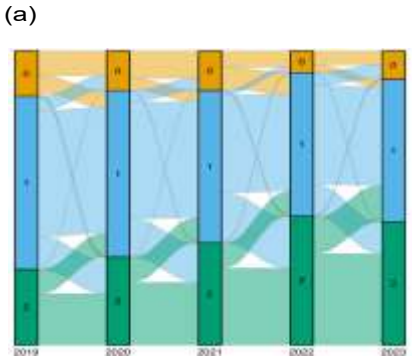


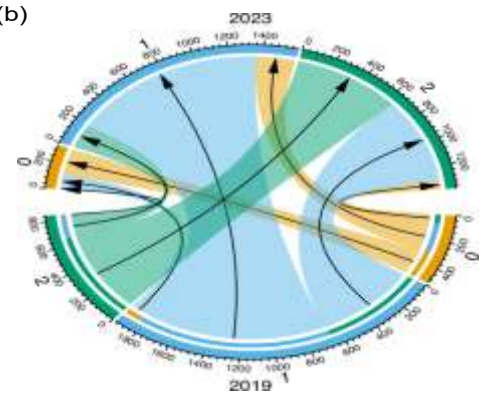


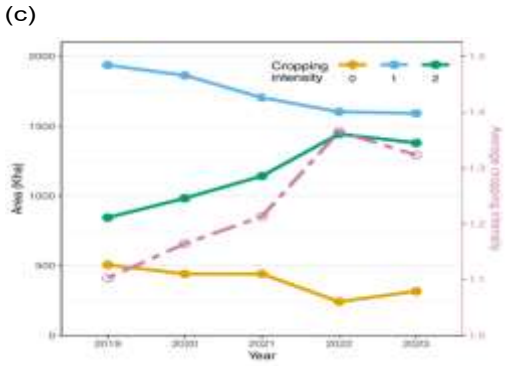
➢ Application Scenario 2: Monitoring Cropping Intensity

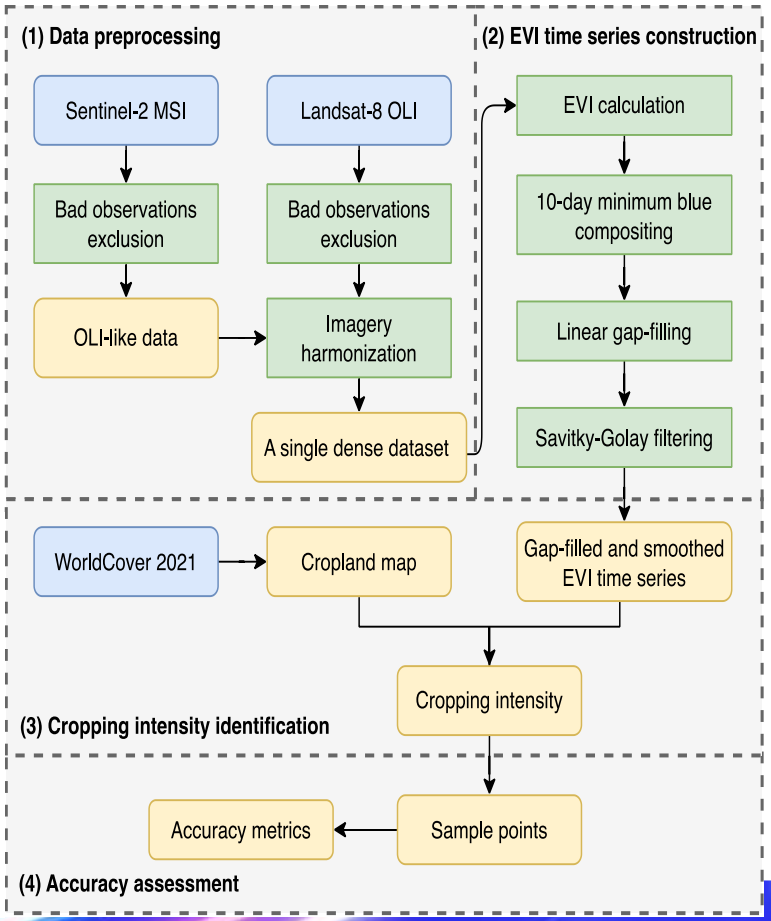
- **Enhanced Vegetation Index (EVI) Dataset**: Integrated **multi-source high-resolution satellite data** to generate a long-term seamless EVI dataset
- **High-Precision Monitoring**: Achieved **>96% identification accuracy** using machine learning





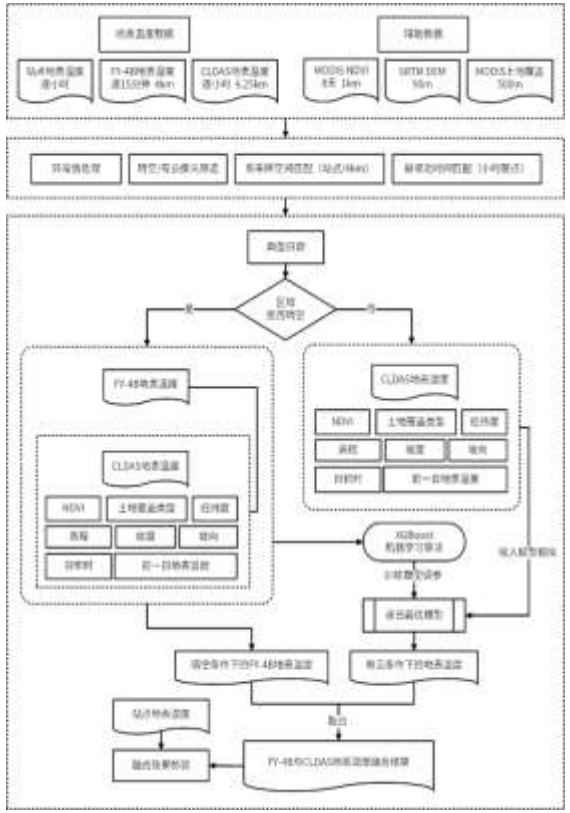


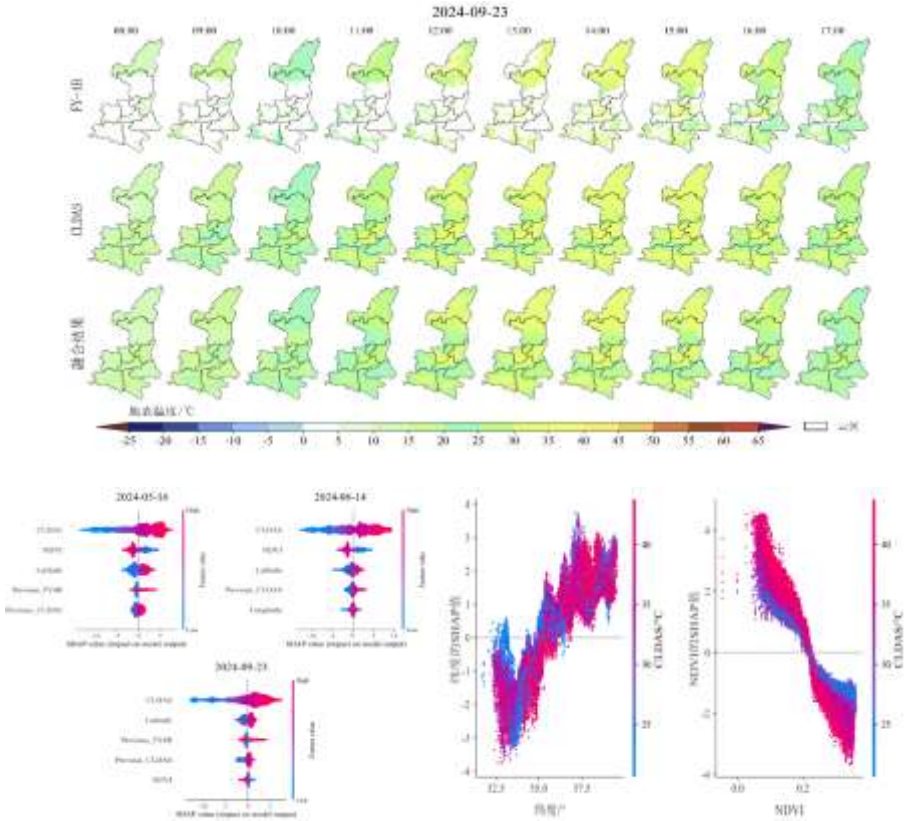


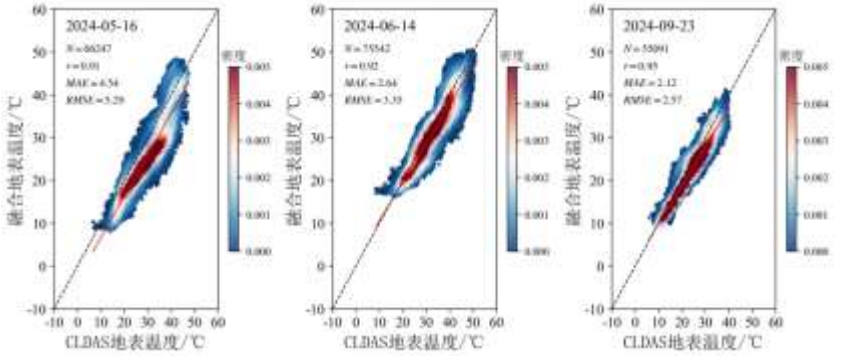


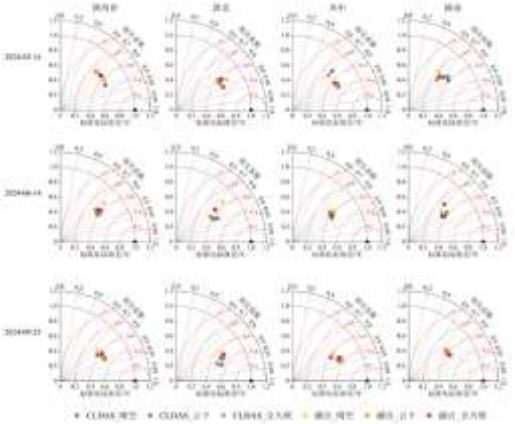
➢ Application Scenario 3: FY-4B LST Validation and Application

- **Multi-Source Data Foundation:** Combines FY-4B LST products, CLDAS, NDVI, DEM, land cover, and ground observations for robust LST reconstruction
- **XGBoost Algorithm for Cloud Obscuration:** Fusion with clear-sky data enhances data completeness and accuracy
- **All-Weather Monitoring**: Validated fusion methods enable operational, all-weather LST monitoring





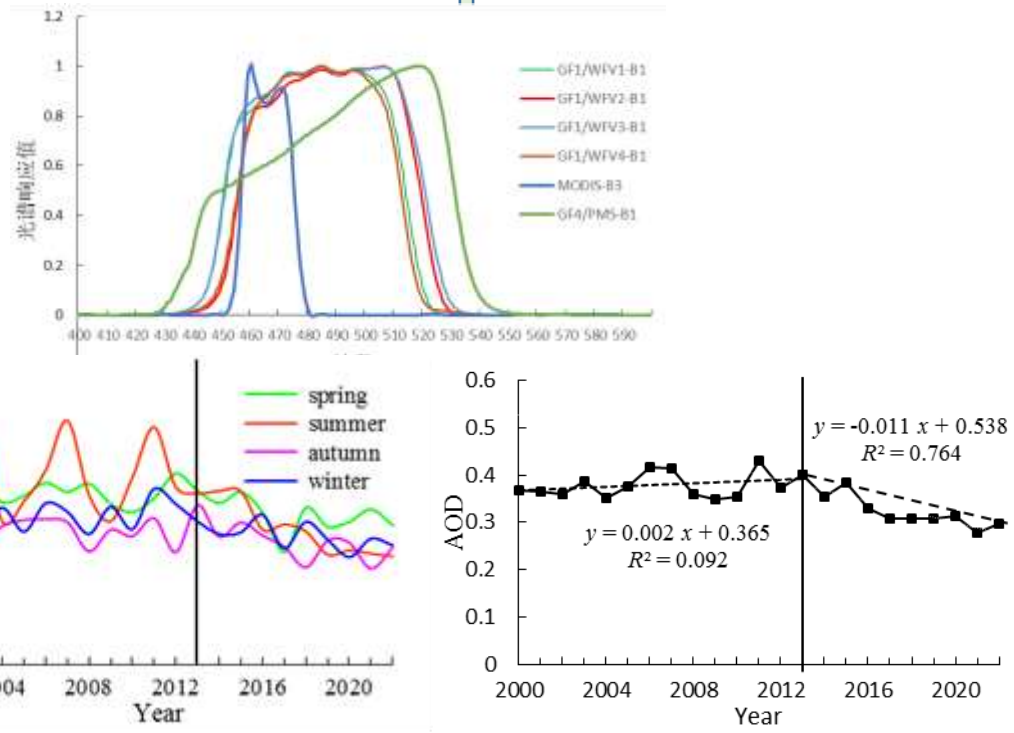




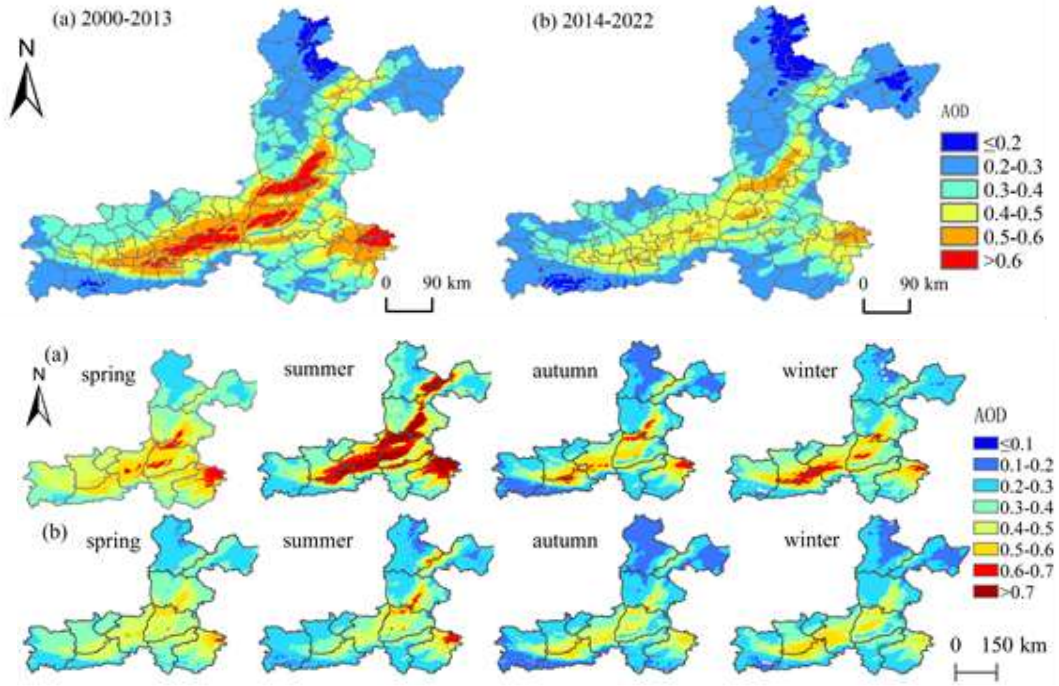
➢ Application Scenario 4: Aerosol Optical Depth (AOD) Retrieval

- **AOD Retrieval Method:** Utilizes **Gaofen data** (GF-1/WFV, GF-4/PMS), through radiometric calibration, apparent reflectance calculation, solar-satellite-earth geometry determination, and look-up table construction
- **Accuracy Assessment:** High consistency (R^2 >0.85) with MODIS (Aqua/Terra) products

Spectral Response Function of the Gaofen Satellite sensors



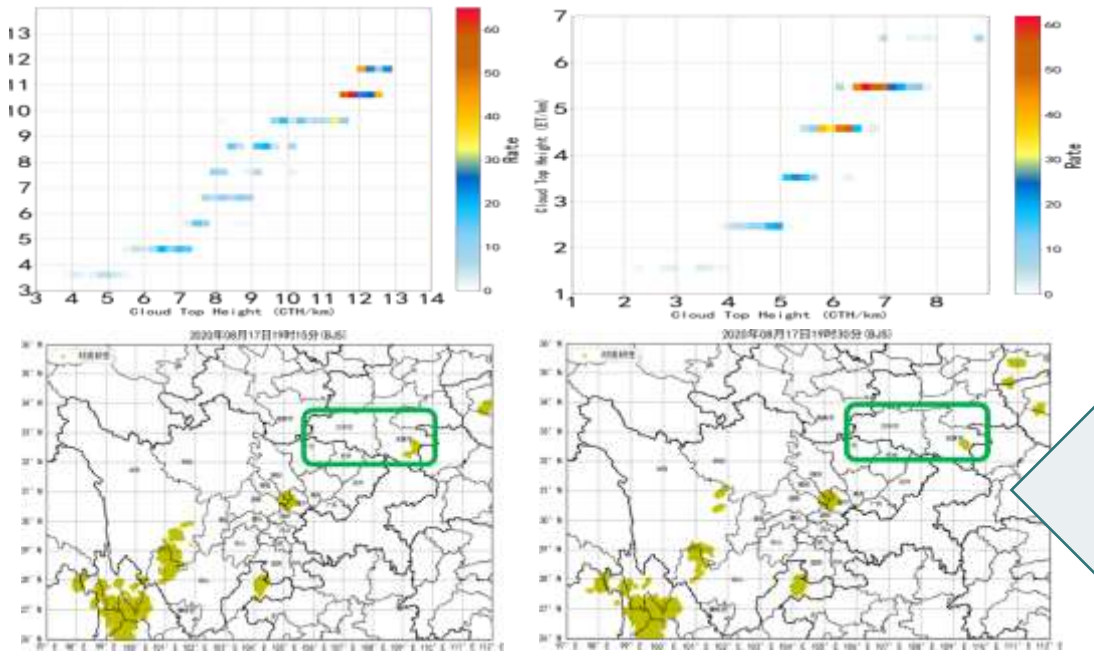
Mean AOD Distribution in the Fenwei Plain (2000-2022)



➢ Application Scenario 5: Convective Initiation (CI) Detection

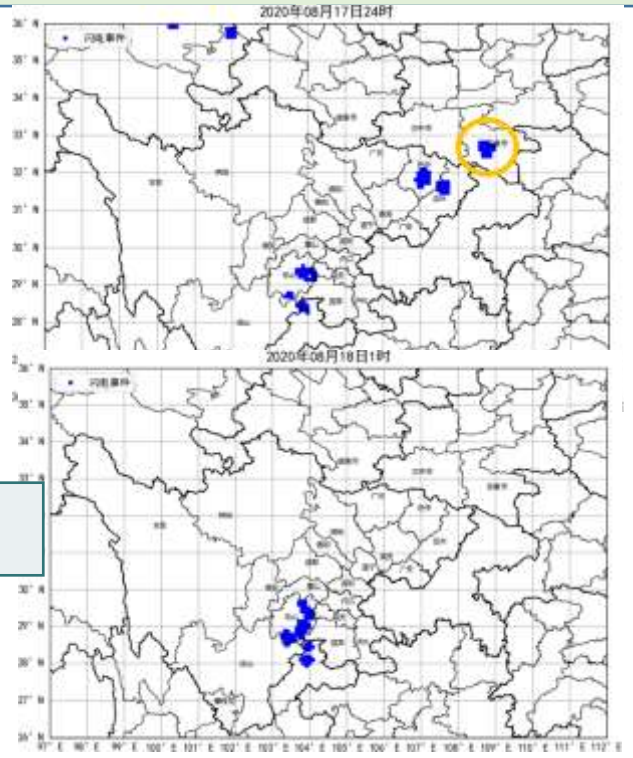
- FY-4A Cloud Top Height (CTH) products enhance monitoring of heavy precipitation clouds in Qinling Mountains
- Developed key technologies for CI identification in megacities using FY-4A, integrating deep learning with a localized adaptation of the SAFNWC/PPS CI monitoring algorithms
- Achieving a **<30% False Alarm Rate (FAR)** of for mesoscale convective systems

Scatter Density of Weather Radar ET and FY-4A CTH



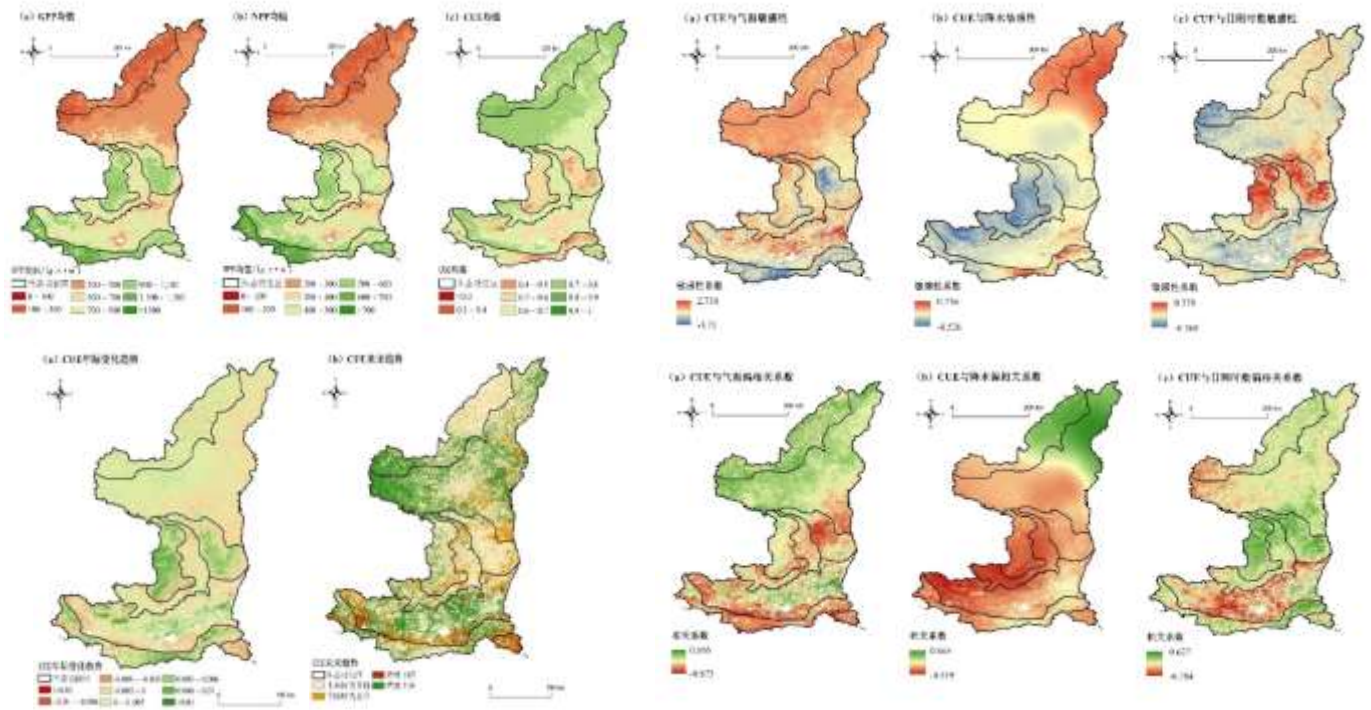
Detection of CI Using FY-4A Satellite

FY-4A Detection of Lightning Associated with Heavy Precipitation



➢ Application Scenario 6: Vegetation Carbon Use Efficiency (CUE)

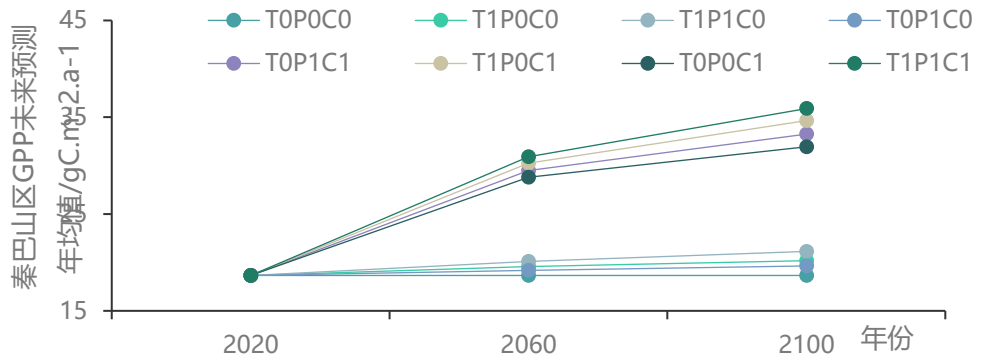
- **Spatiotemporal Patterns of Vegetation CUE**: Analyzed temporal-spatial characteristics and future trends of vegetation CUE in the Shaanxi section of the Yellow River Basin.
- **Climate Sensitivity of Vegetation CUE**: Derived **sensitivity coefficients** for temperature/precipitation, and identified **sensitivity thresholds** (Temperature: 0.68°C/CUE unit; Precipitation: 12 mm/CUE unit)

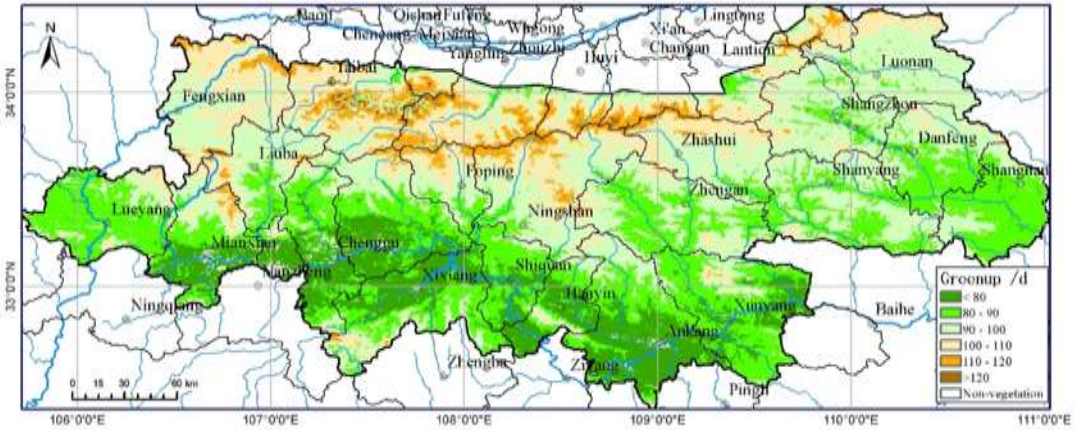


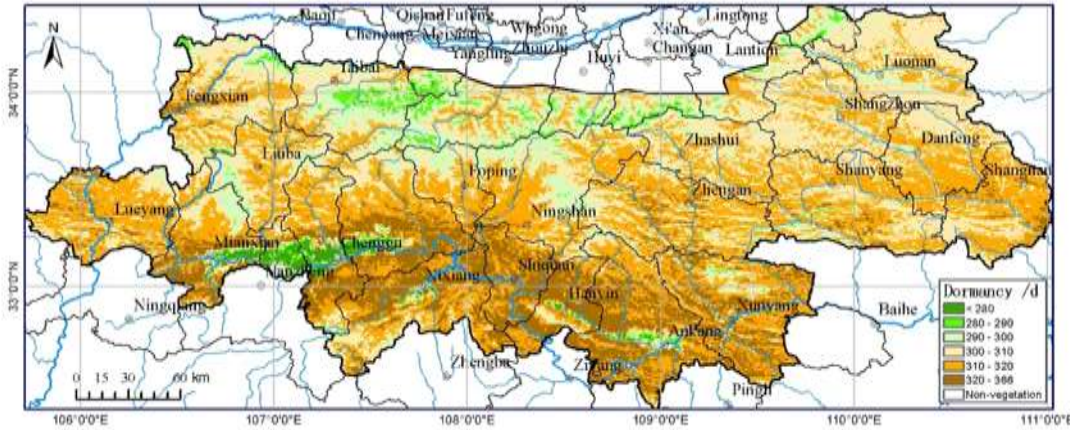
Temperature ℃	Sensitivity of Temperature εtem	Precipitation mm	Sensitivity of Precipitation εpre
<9	0.108	<400	0.002
9~9.5	0.276	400~450	0.065
9.5~10	0.049	450~500	0.055
10~10.5	-0.233	500~550	-0.025
10.5~11	-0.371	550~600	-0.065
11~11.5	-0.408	600~650	-0.095
11.5~12	-0.425	650~700	-0.021
12~12.5	-0.441	700~750	-0.013
12.5~13	-0.479	750~800	-0.002
>13	-0.493	>800	-0.039

➢ Application Scenario 7: Climate and Eco-environmental Changes in Qinling

- Utilized climate and eco-environmental data from ground observations and satellite retrievals
- **Established region-specific monitoring** indicators suitable for Eco-environment assessment in the Qinling Mountains
- **Investigated trends of key eco-environmental factors:** carbon sequestration capacity in forested areas, water conservation capacity, and the upper distribution limit of Larix potaninii (Taibai larch)







Thanks for your attention!