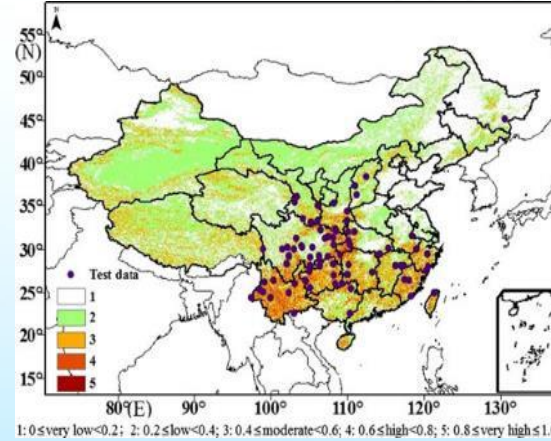**Aerospace Information Research Institute (AIR)**
Chinese Academy of Sciences (CAS)

Progress for CEOS Landslide Pilot in Chinese Region

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Objective：

- Feature database construction for the perception of slow and rapid evolutionary change in the cryosphere;

- Build algorithms for the perception of slow and rapid evolutionary change;

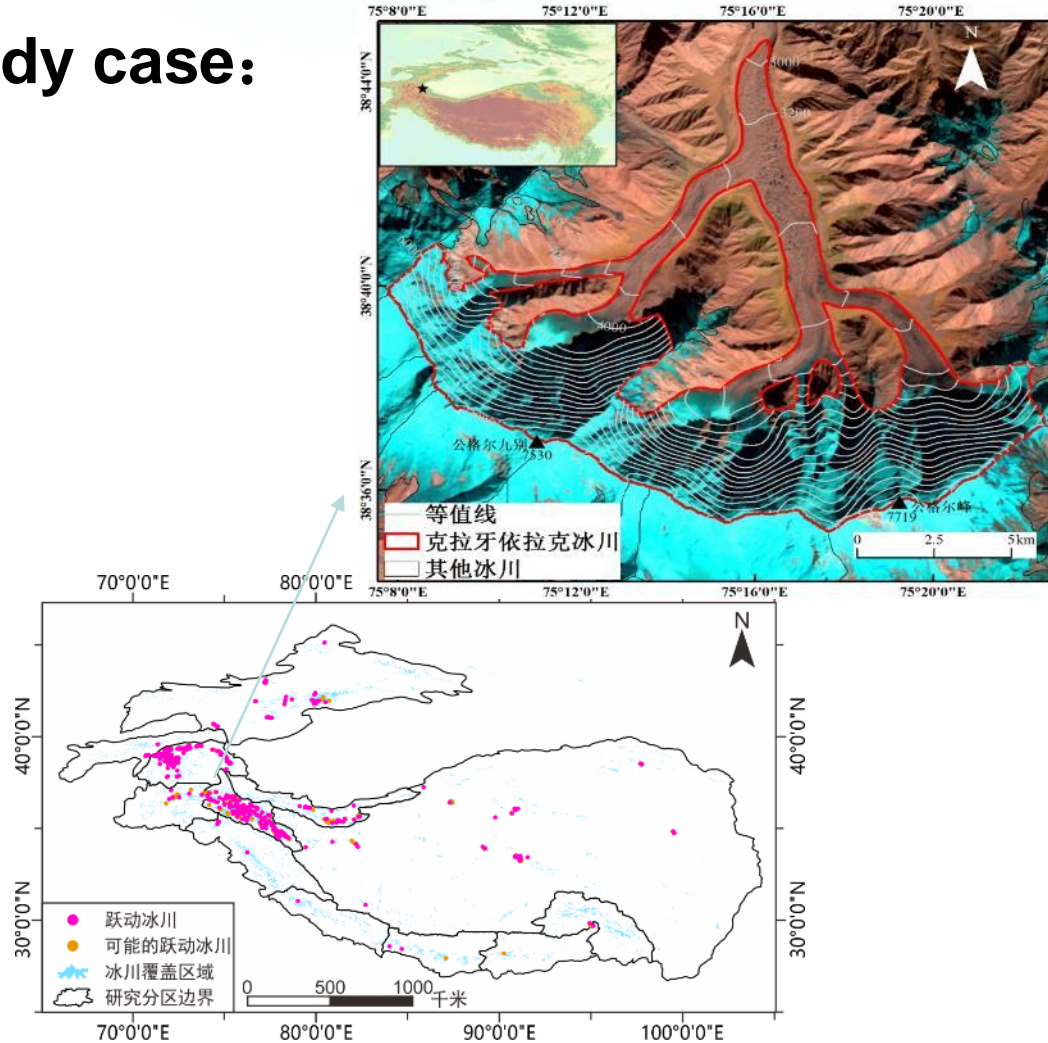- Develop software for cryosphere environmental evolution perception

Key Variables:

- Cryosphere features: Glaciers, permafrost, deserts, snow

- Cryosphere environment: Ecology, hydrology, disasters, meteorology

- Cryosphere disasters: Glacier jumps, glacial mudslides, freeze-thaw landslides

On-going project about cryosphere revolutionary

Study case：

- Date: May, 2015
- Location: Xinjiang province
- Landslide type: Glacier Mudslides
- Pastures and some houses were submerged by ice

Target achievement:

◆ Algorithm of evolution perception model for cryosphere deformation

◆ Software of evolution perception for cryosphere deformation

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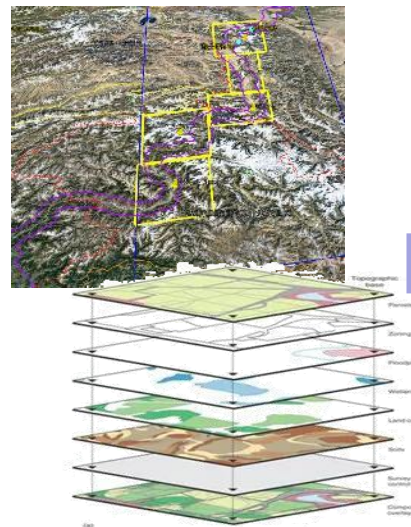
Steps:

● Sites selection: according to the frequency of disasters in local areas;

● Data normalization: Multiple source of data, meet the input requirement of the perception model;

● Perception model build: perception model based on test data, software;

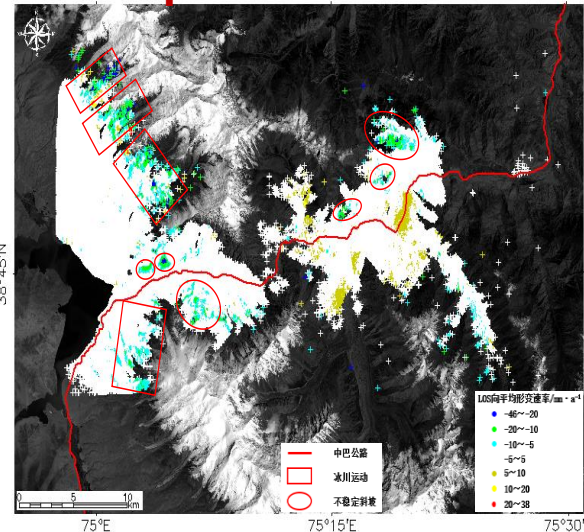● Validation: ground-based data applied, support the modification of the perception model.
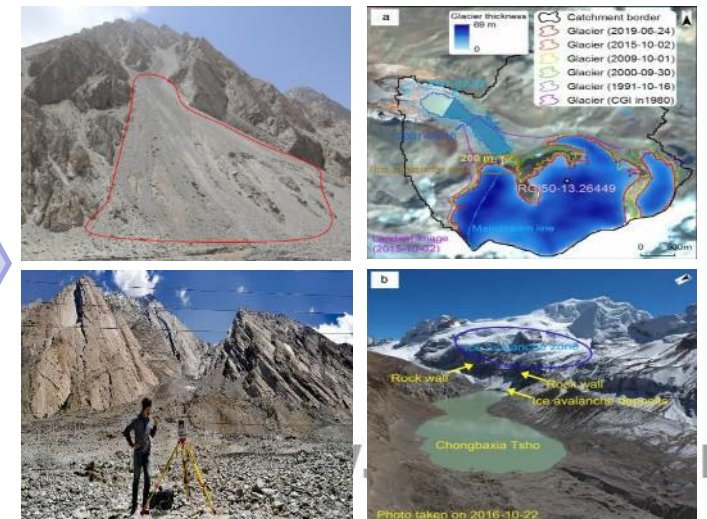
Site selection   **Data normalization**   **Perception model build**   **Validation**

Data collected：

Assistant data	Meteorological data	Near-ground meteorological data of study region
	Geographic data	soil texture data of study region
		Second Glacier inventory in China
		Plant functional types map in China
Satellite data	SAR data	Sentinel-1 SAR
	HR optical data	GF, Sentinel-2, Landsat
	MR optical data	MODIS,VIIRS
Validation data	Ground observation data	Snow depth data
	Other regional database	Frozen soil map in study region
		Dataset of glacier changes in study region
		Ice triggered disasters catalogue

On-going project about cryosphere revolutionary

Key strategy for optical images

◆ Analyzing the temporal and the spectral features of a time series images

◆ Rapid revolutionary detection

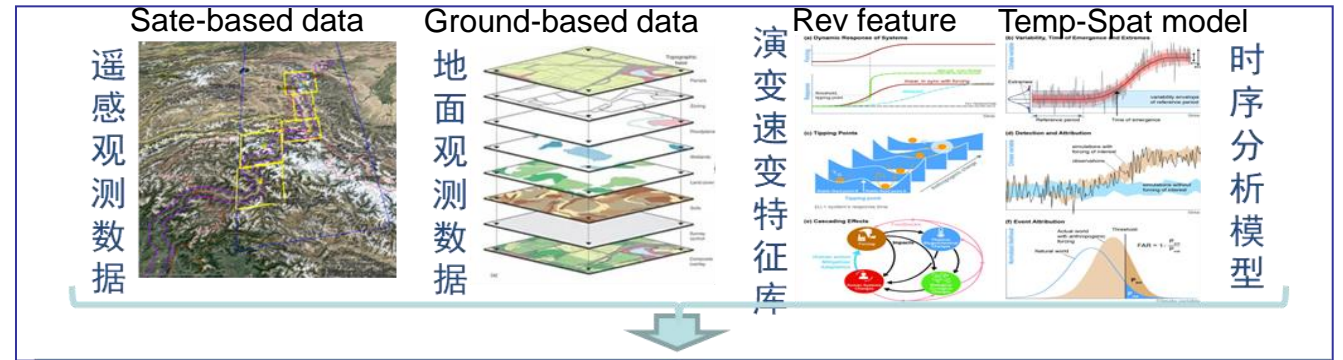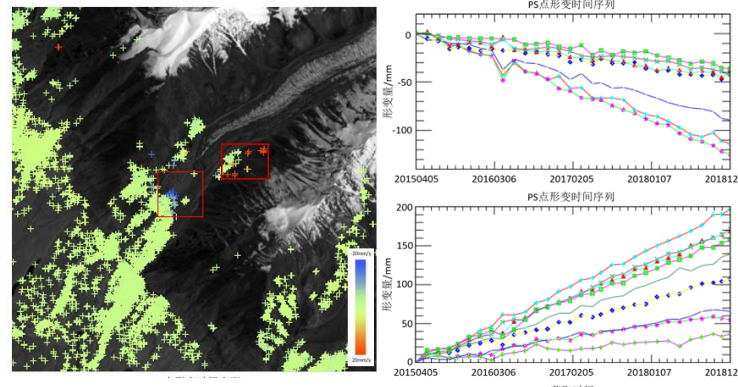◆ The accuracy of the detection is up to 84 percent due to our previous study
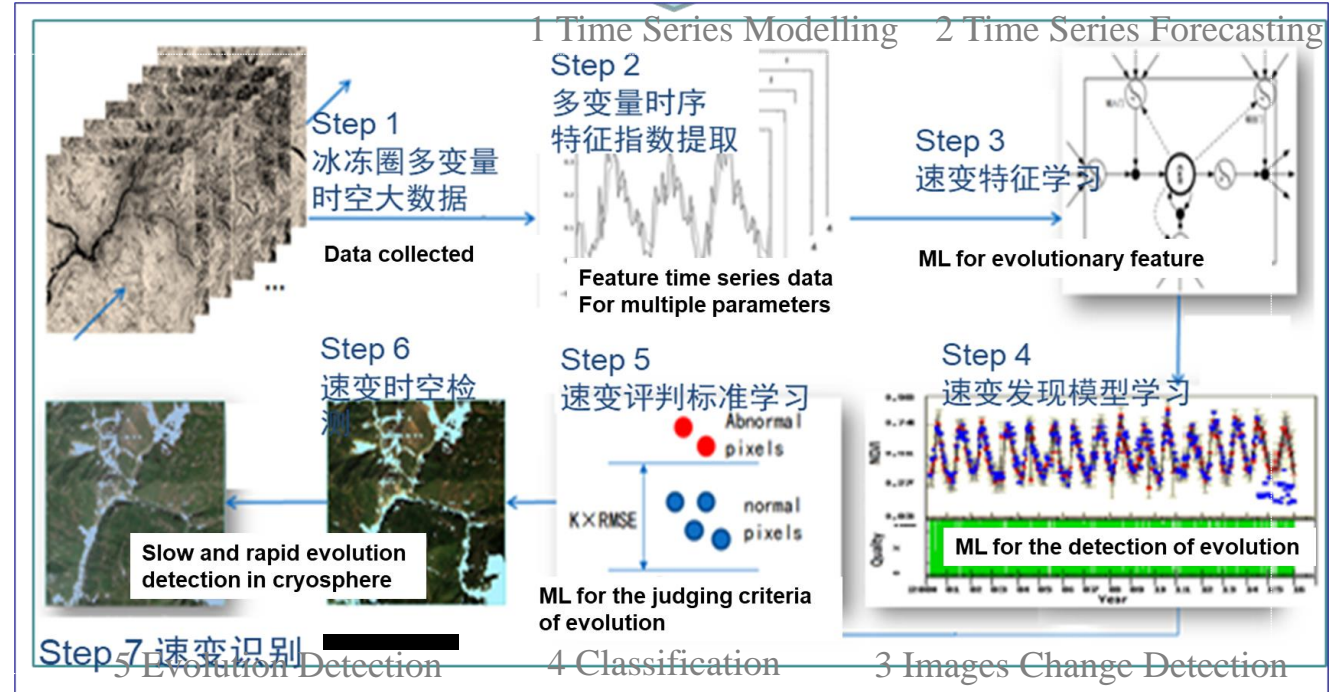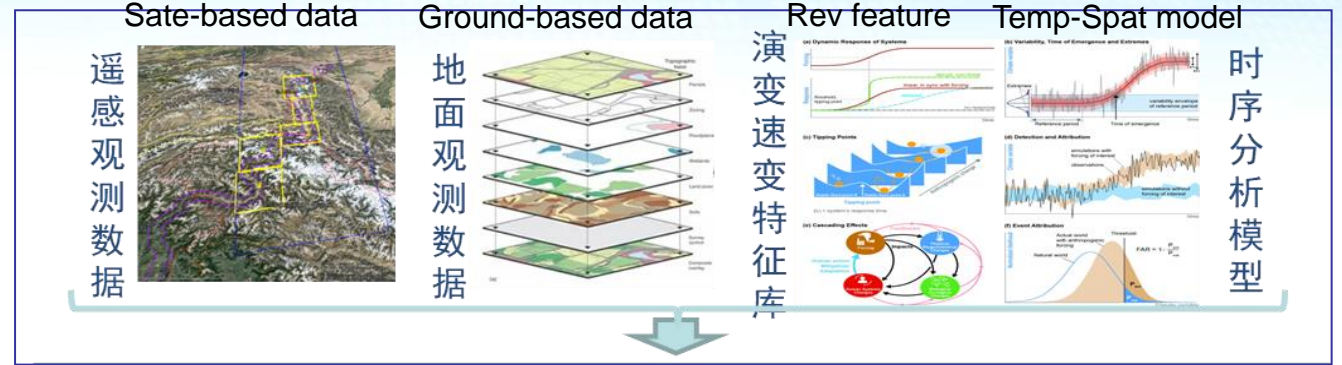
Key strategy for SAR images

◆ PS-InSAR and SBAS-InSAR methods are both applied;

◆ Mainly for the slow revolutionary conception.

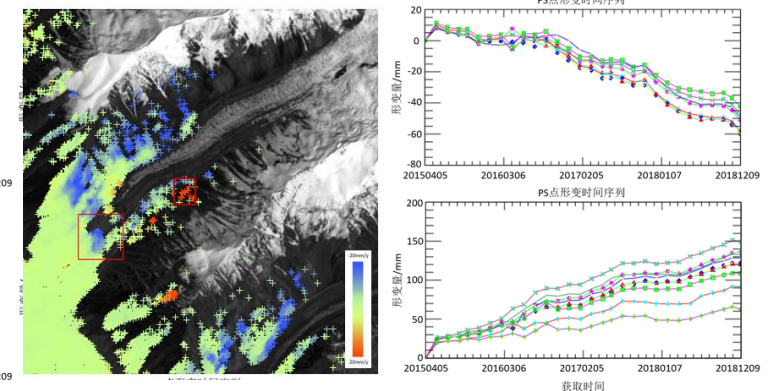Sate-based data　　Ground-based data　　Rev feature　　Temp-Spat model

遥感观测数据　　地面观测数据　　演变速变特征库　　时序分析模型

PS-InSAR　　　　　　　　　**SBAS-InSAR**

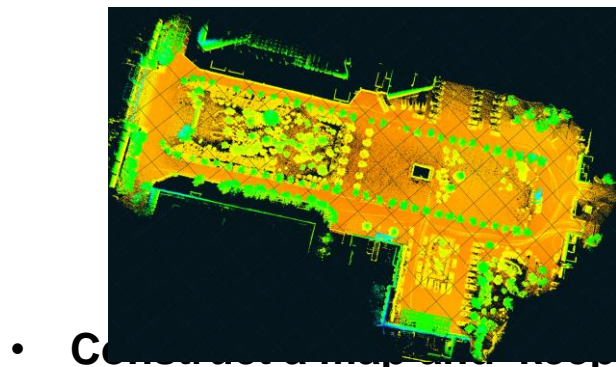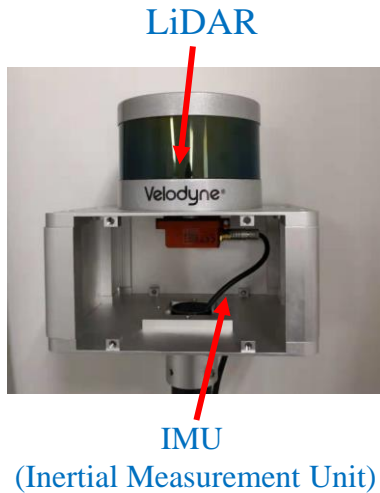1 PS Points　　　　2 Deformation Monitoring　　1 PS Points　　　　2 Deformation Monitoring

On-going project about cryosphere deformation detection

Ground Validation Methods:

Simultaneous localization and Mapping (SLAM) technology

LiDAR

SLAM

IMU
(Inertial Measurement Unit)

- Construct a map and keep track of the location

Topographic Deformation Monitor

The Beidou /GNSS Monitoring System

北斗抛投式滑坡监测点BP01累计位移时间曲线

Deformation Capture

Hour
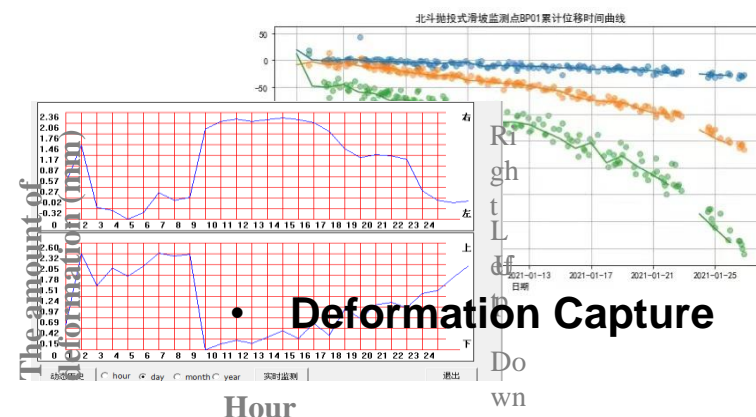
UAV-borne lidar

AOEagle
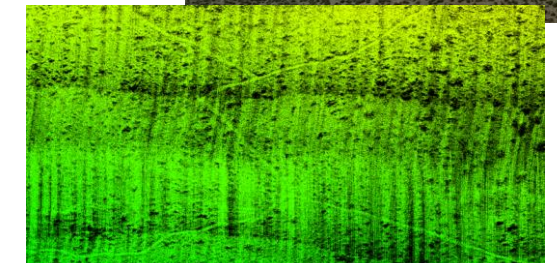
- Elevation point cloud mapping

On-going project about cryosphere deformation detection

☐ Timeline

2022.11-2023.10(Year 1)

2023.11-2024.10(Year 2)

2024.11-2025.10(Year 3)

◆ **Scheme** ◆ **Model algorithm** ◆ **Software prototyping**	◆ **Key technology** ◆ **Software prototype testing**	◆ **Iterative optimization** ◆ **Application demonstration**

☐ Milestones

2024. 5
- ■ **Algorithm library and Core model**
- ■ **Software prototype**

2025. 4
- ■ **Model application and Validation**

2025. 10
- ■ **Software delivery**
- ■ **Project closure**

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Next Steps

- **Landslide Deformation detection algorithm**

- Develop an algorithm for synergetic use of optical, SAR, UAV derived information to obtain a complete picture of the landslide situation

- **Landslide detection system**

- Establish a landslide detection system based on satellite and UAV observation for disaster management

Thank you！

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