中国科学院遥感与数字地球研究所
Institute of Remote Sensing and Digital Earth ,CAS

Natural Disaster Monitoring in Heritage Sites based on Remote Sensing

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2018/11/2

CONTENT

自然灾害种类


农作物灾害
Crop Disaster
森林灾害
Forest Disasters
气象灾害
Meteorological Disaster
海洋灾害
Marine Disaster
自然灾害
Disaster
地质灾害
Geological Disaster
洪水灾害
Flood
Earthquake
地震灾害

灾害监测的工作需求：

Disaster Forecast

Forecast potential disasters, including occurrence time, scope and scale

Emergency Disaster Relief

When disaster occurs, it is necessary to provide information quickly and accurately

Disaster Monitoring

It helps to understand the situation and changes about disasters.

Post-disaster Reconstruction

Accurate disaster assessment is one of the most important basis for post-disaster reconstruction.

卫星遥感工具

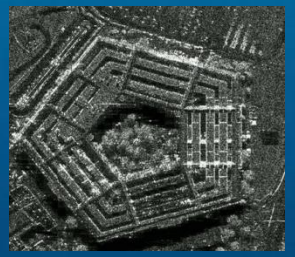
Optical DATA

- visible spectrum : high-resolution, easy to interpret
- near-infrared : Vegetation and water
- Short wave infrared : less affected by the atmosphere
- Thermal infrared : land surface temperature




SAR DATA

- no interference from cloud and rain
- Continuous dynamic monitoring
- sensitive to abrupt changes such as buildings and water

CONTENT

Disaster monitoring

Monitoring and Forecasting

For the disaster that can be predicted in advance (such as landslide, flood, etc.), continuous monitoring is necessary, and according to the monitoring data, we can analyze the trend of disaster and give early warning.

Emergency Monitoring

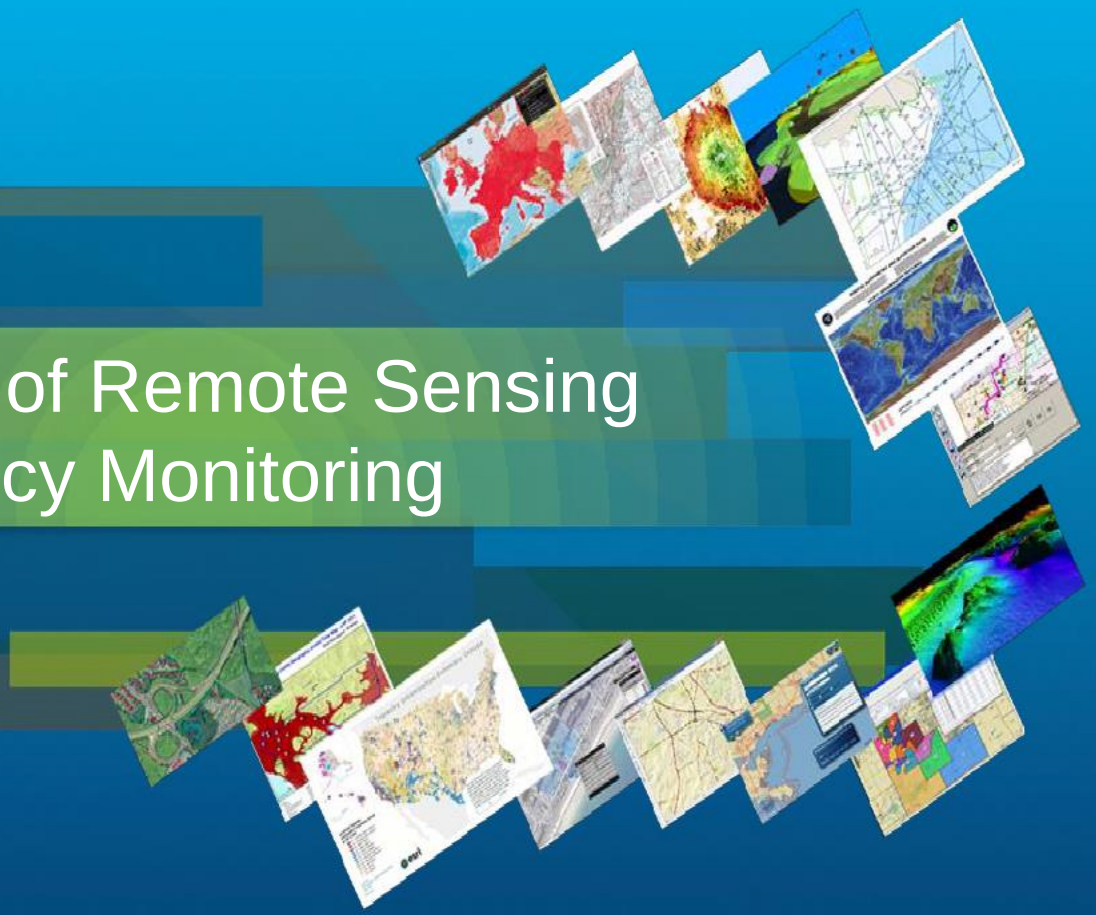
After a disaster occurs, the emergency monitoring of disaster areas is carried out at the first time. Through the analysis of disaster situation and trend, we can make corresponding decisions and rescue.

Keep Tracking

After the emergency , the disaster area will be continuously monitored and analyzed. This is important for rebuilding after the disaster.

Three steps for disaster prevention

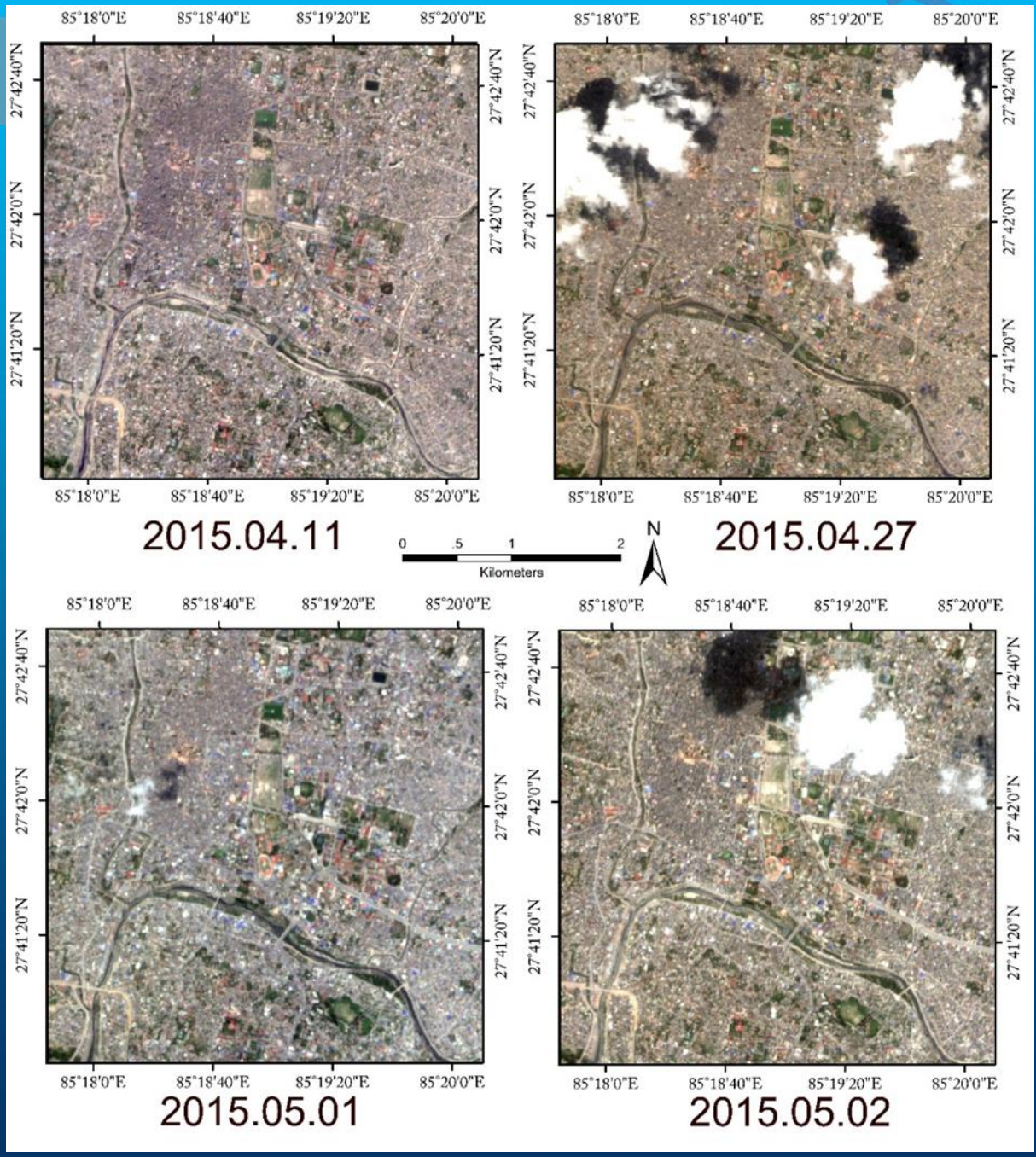
Application of Remote Sensing in Emergency Monitoring



Rapid Change Monitoring after Disaster

(Nepal earthquake)

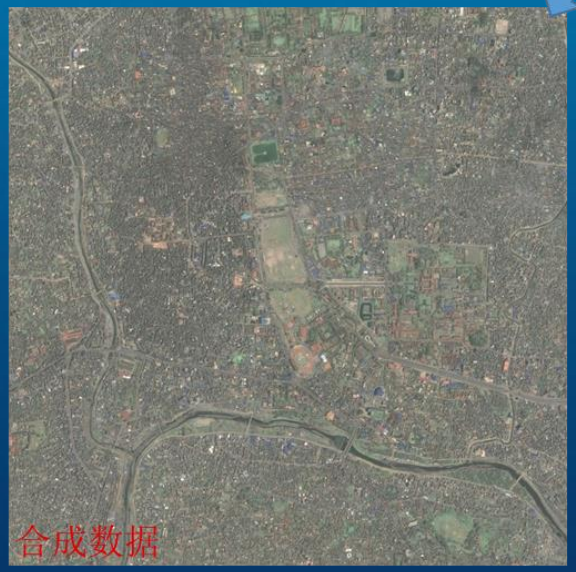
At 14:11 am on April 25, 2015, Nepal (28.2ºN, 84.7ºE) was hit by an 8.1 earthquake with a depth of 20 km. At least 8,786 people were killed and 2,2303 injured . The figure on the right(GF-1, 2m) shows the urban area of Kathmandu after the earthquake.



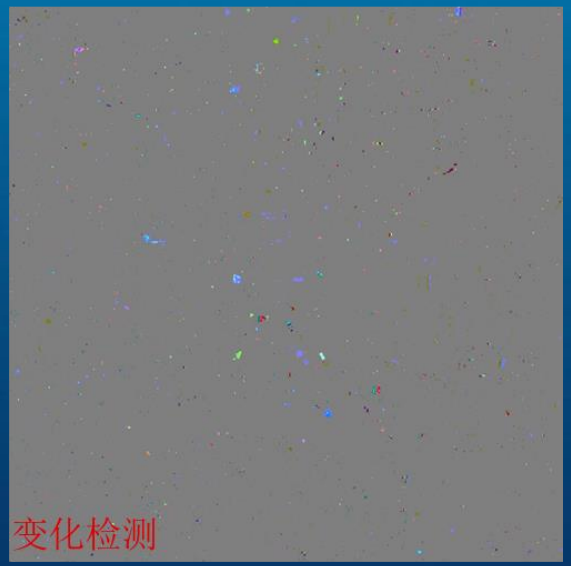
Rapid Change Monitoring after Disaster
(Nepal earthquake)

The overall process

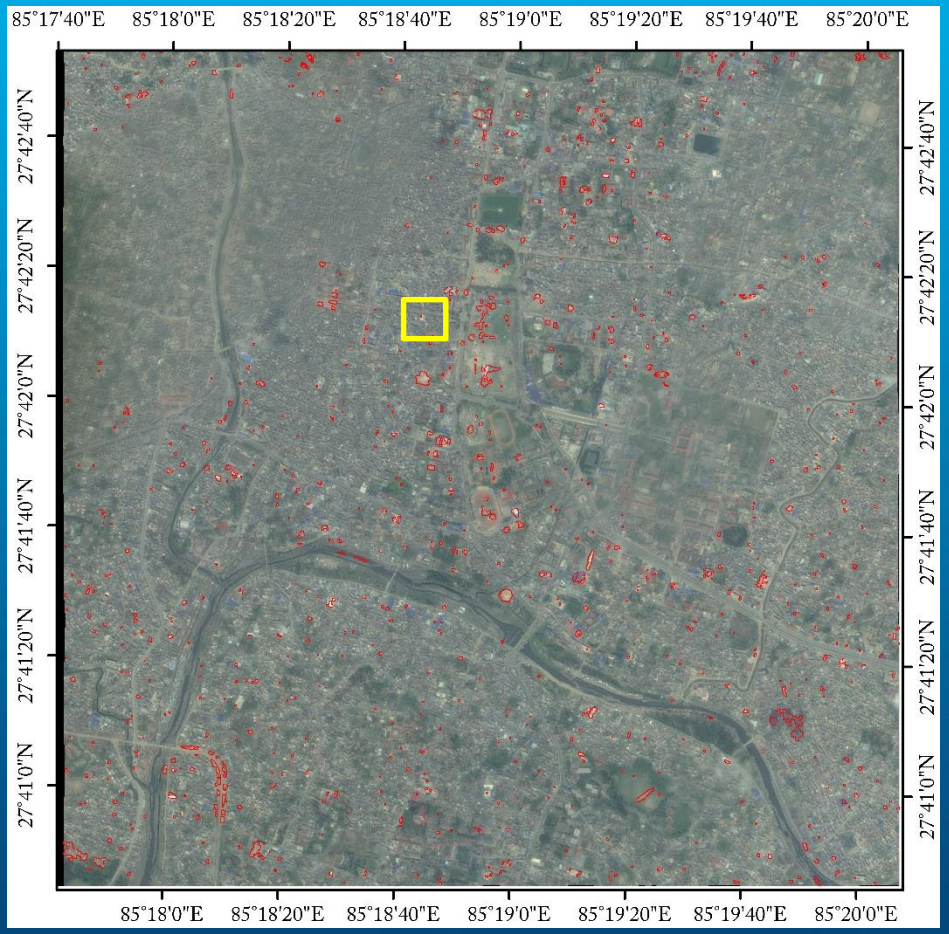
去云 融合

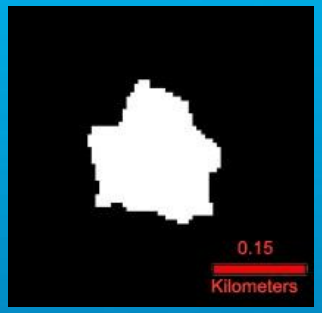


变化 检测



Rapid Change Monitoring after Disaster
(Nepal earthquake)





Change MASK

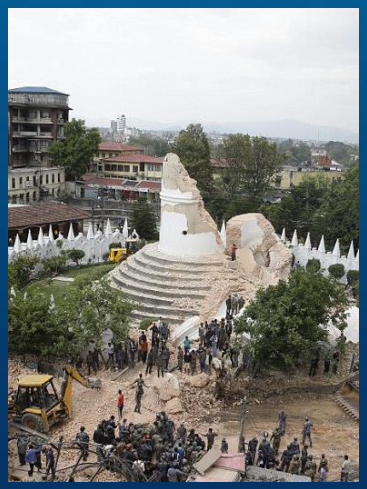
2015.04.11

2015.04.27

2015.05.01

2015.05.02

The yellow frame shows the world heritage site **Bhimsen Tower**
Completely collapsed

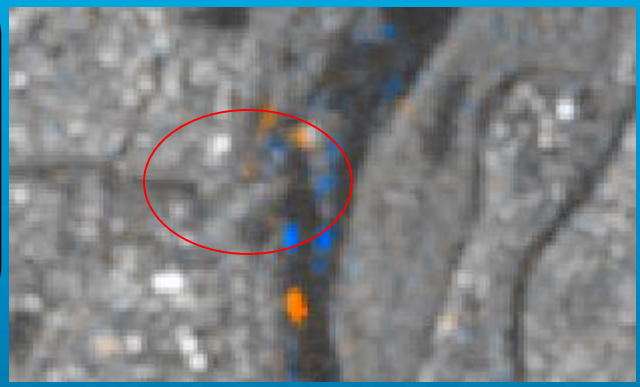


New models for change monitoring--
Active and Passive Collaborative monitoring

Active Remote sensing（SAR）

Advantages: no interference from cloud and rain, all day, the observation angle is relatively fixed, sensitive to abrupt changes

Disadvantages: greater noise, difficult to interpret



Active and Passive Collaborative

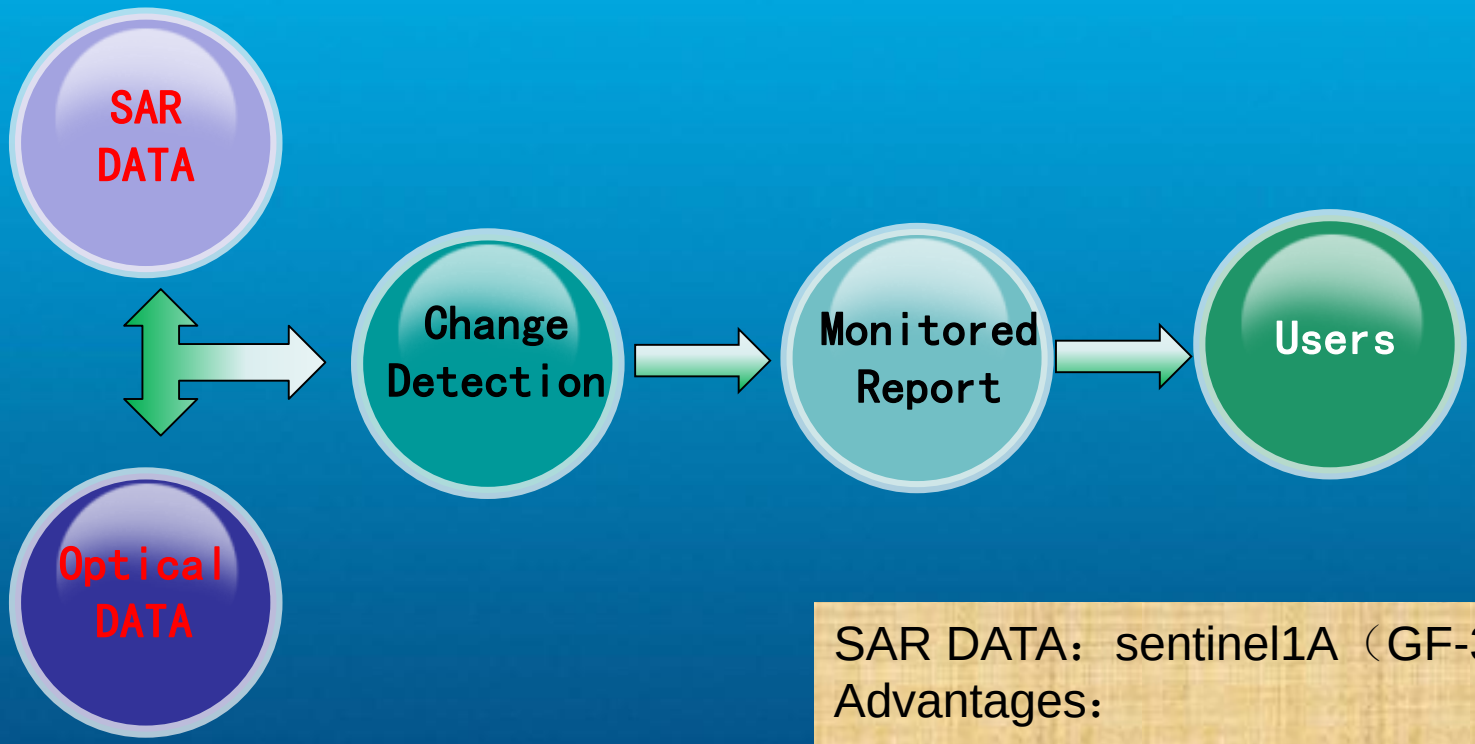
GUILIN Xiangshan Park

Passive Remote sensing (Visible to infrared)

Advantages: easy to interpret, rich band

Disadvantages: large interference by the atmosphere, cloud and rain, not sensitive to changes in certain features

New models for change monitoring--
Active and Passive Collaborative monitoring



Optical data: GF-1, GF-2, SPOT and other available high-resolution data,

- Interpret Change spot classification

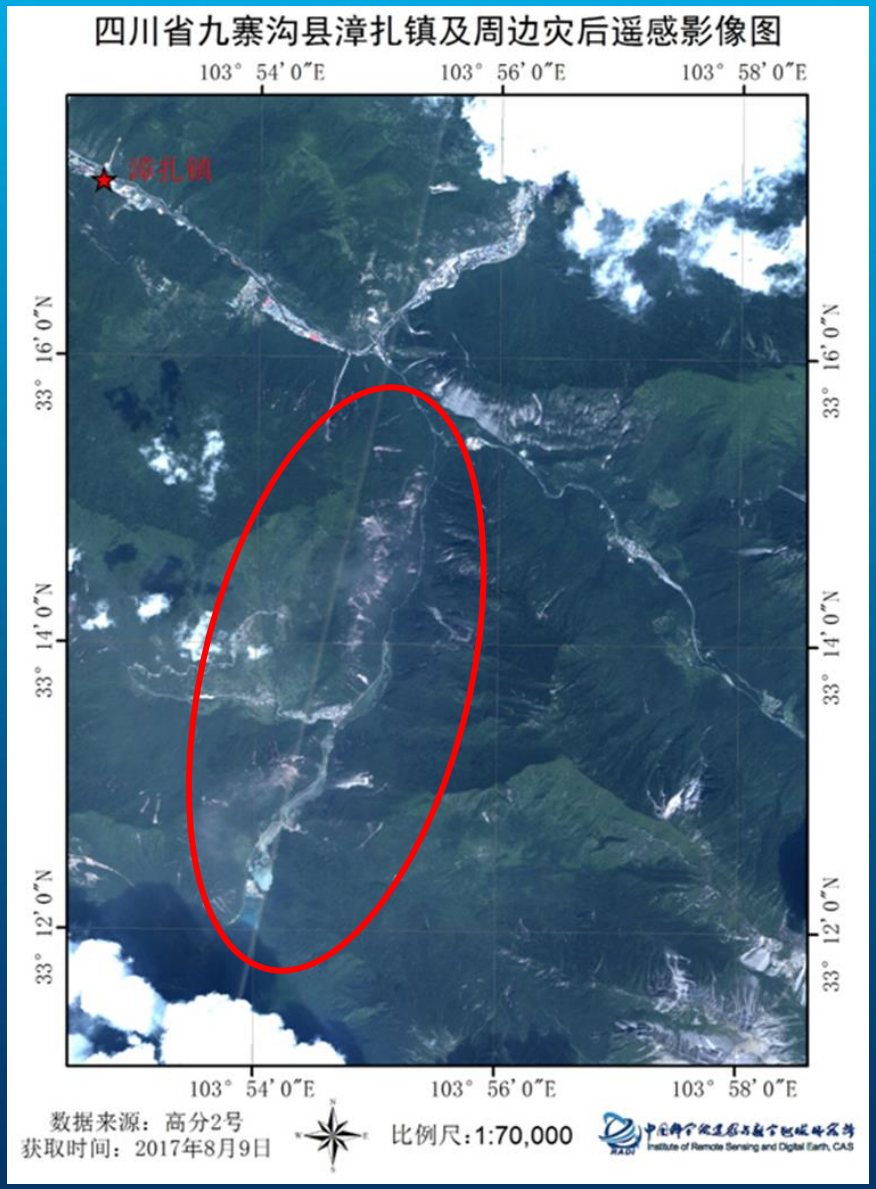
SAR DATA：sentinel1A（GF-3）

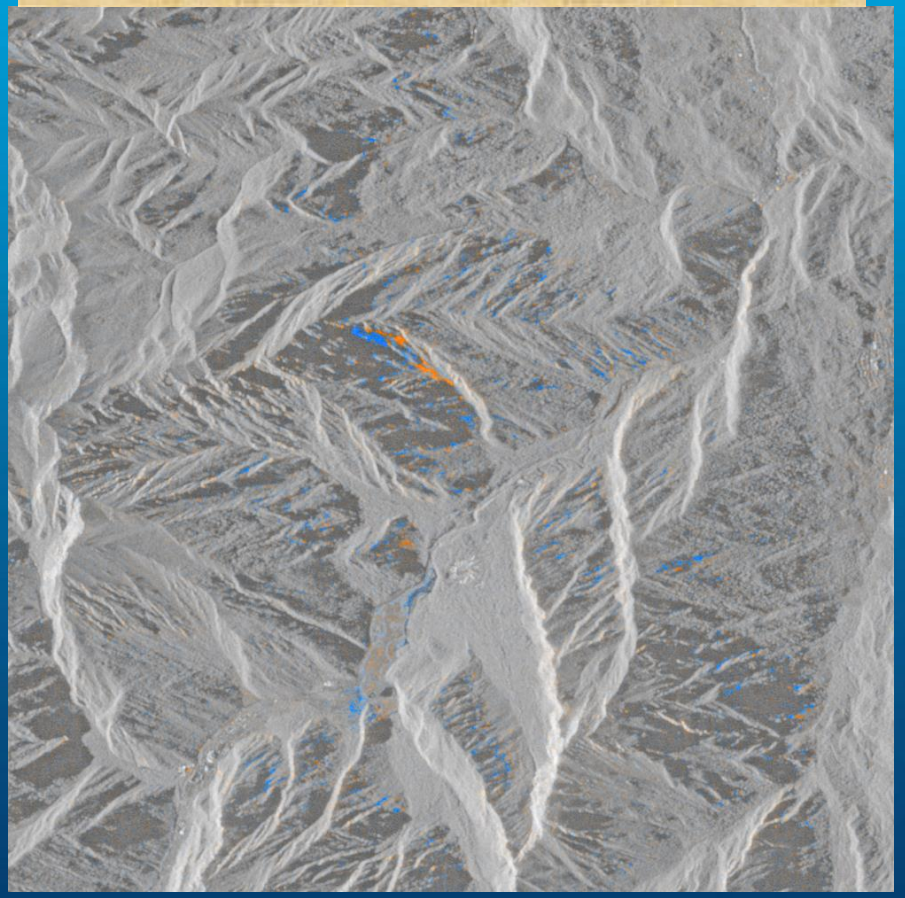
Advantages：

- The viewing angle and pattern are fixed
- Repeat cycle fixed (6/12 days)
- Continuous dynamic monitoring, resolution up to 10m (Metal can be smaller)

Jiuzhaigou Valley

A 7.0-magnitude earthquake struck jiuzhaigou county, aba prefecture, north of sichuan province, at 21:19 minute 46 second on August 8, 2017, causing major damage to the jiuzhaigou natural and cultural heritage area.





Change detection chart near ruyi dam
(the blue and yellow areas in the figure are mainly landslide areas)

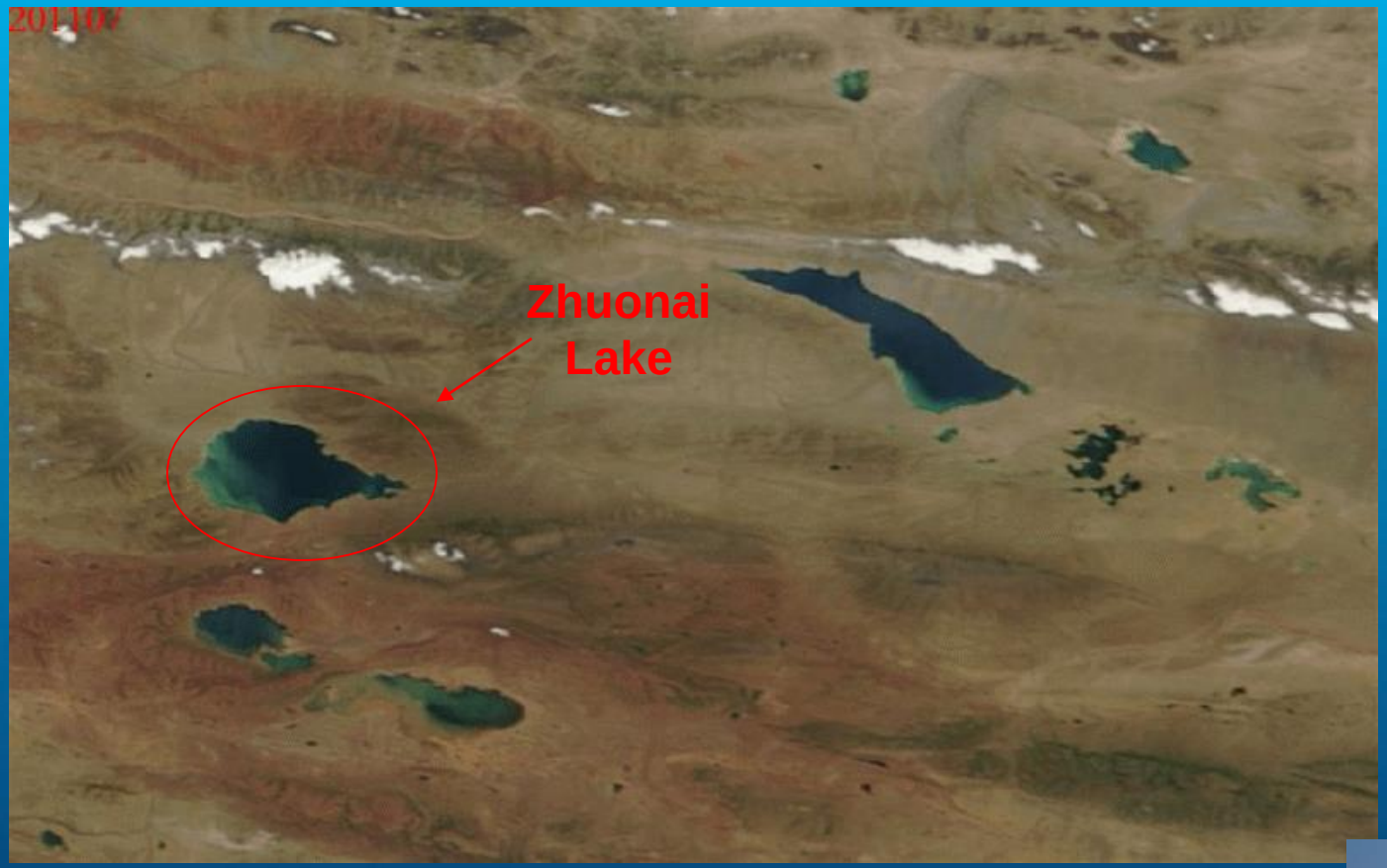
Jiuzhaigou Valley

Change detection images before and after the earthquake in Jiuzhaigou Spark Sea Scenic Spot

Jiuzhaigou Valley

Change detection images before and after the earthquake in Jiuzhaigou Ruyi Area

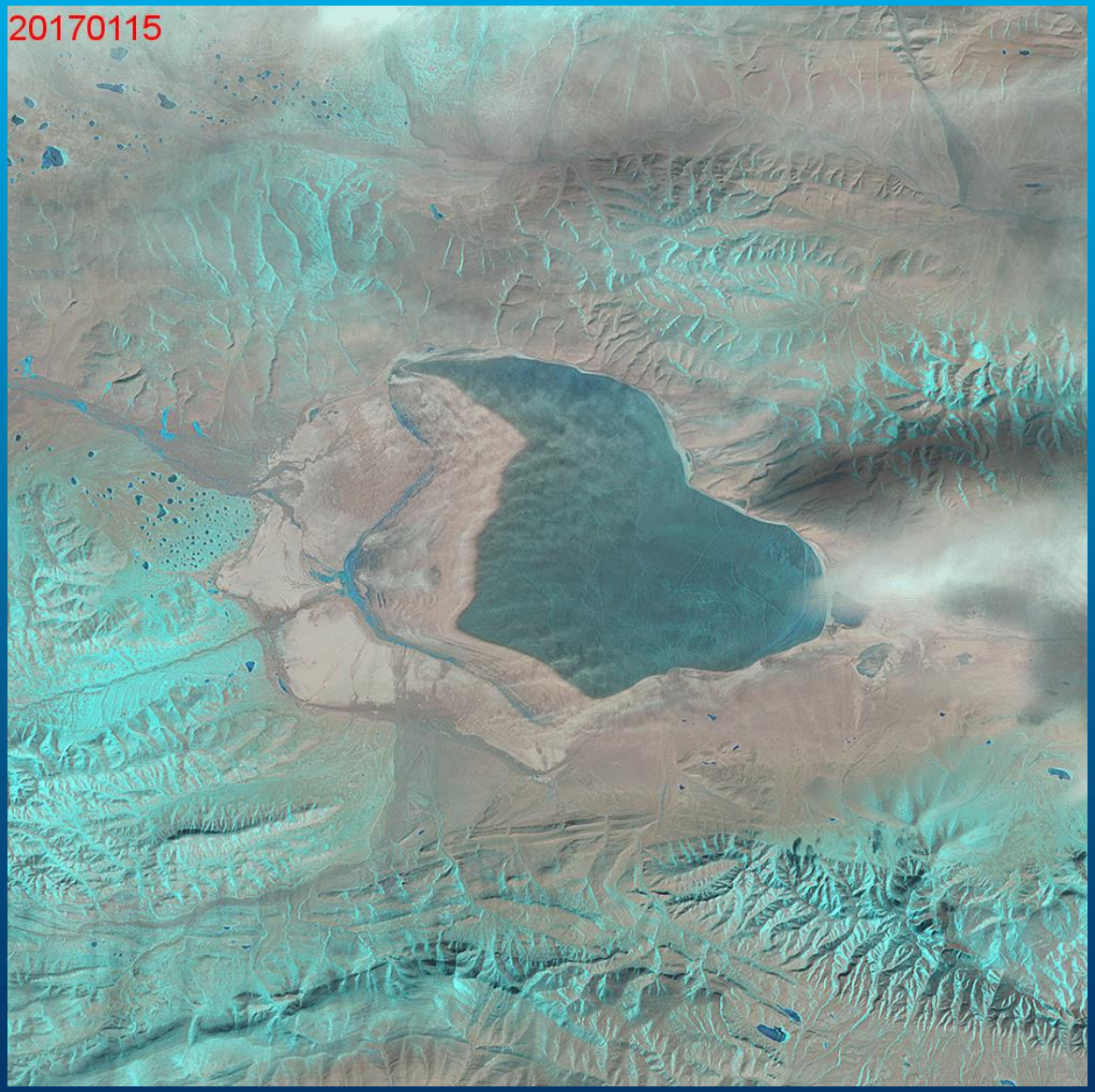
Zhuonai Lake



From August to September 2011, due to continuous heavy rainfall in Kekexili , the lake surface of Zhuonai rose rapidly, resulting in a outburst on the east bank of the lake. Therefore, the area of Zhuonai lake was reduced from 280 square kilometers to 168 square kilometers.

Because a new river has formed between lake Zhuonai and lake Kusai , some Tibetan antelopes cannot find their way to lake Zhuonai.

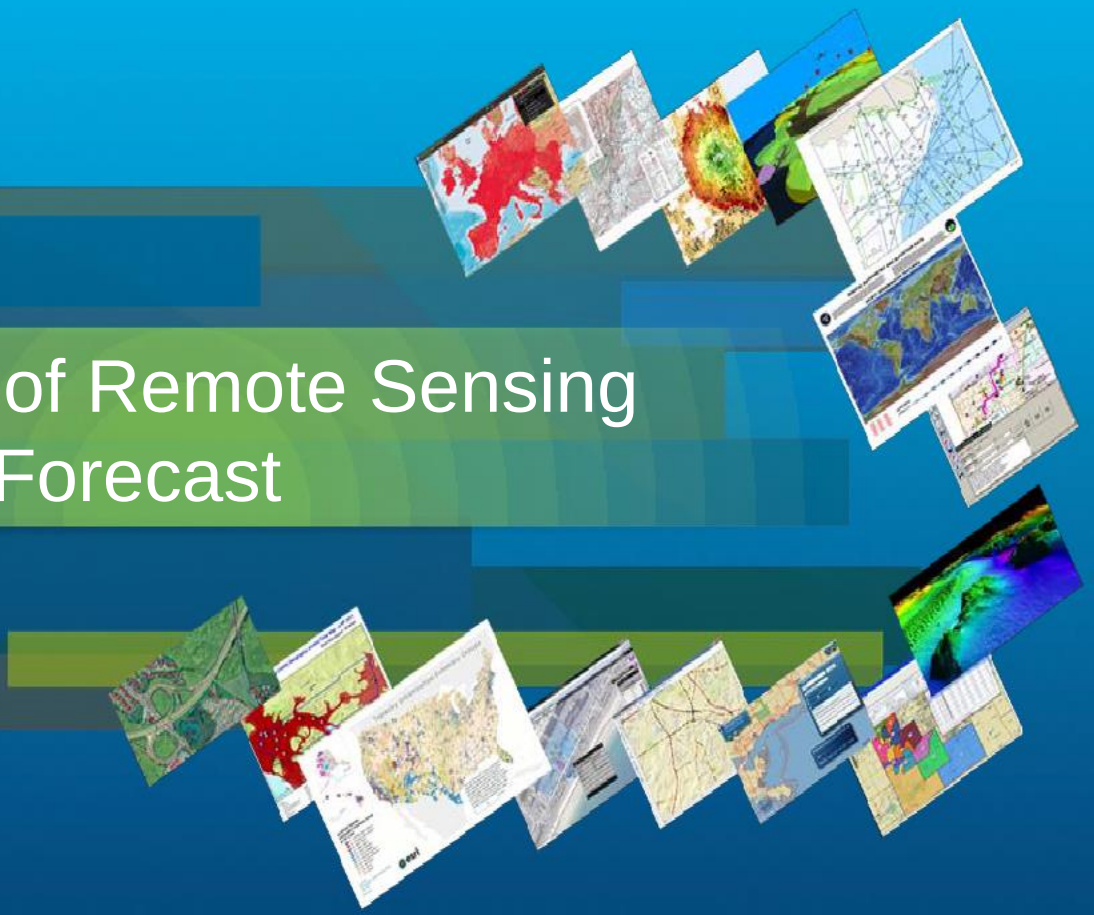
Zhuonai Lake



The newly exposed sandy soil at the bottom of the lake does not have any vegetation attached to it. This leads to more sandstorms.

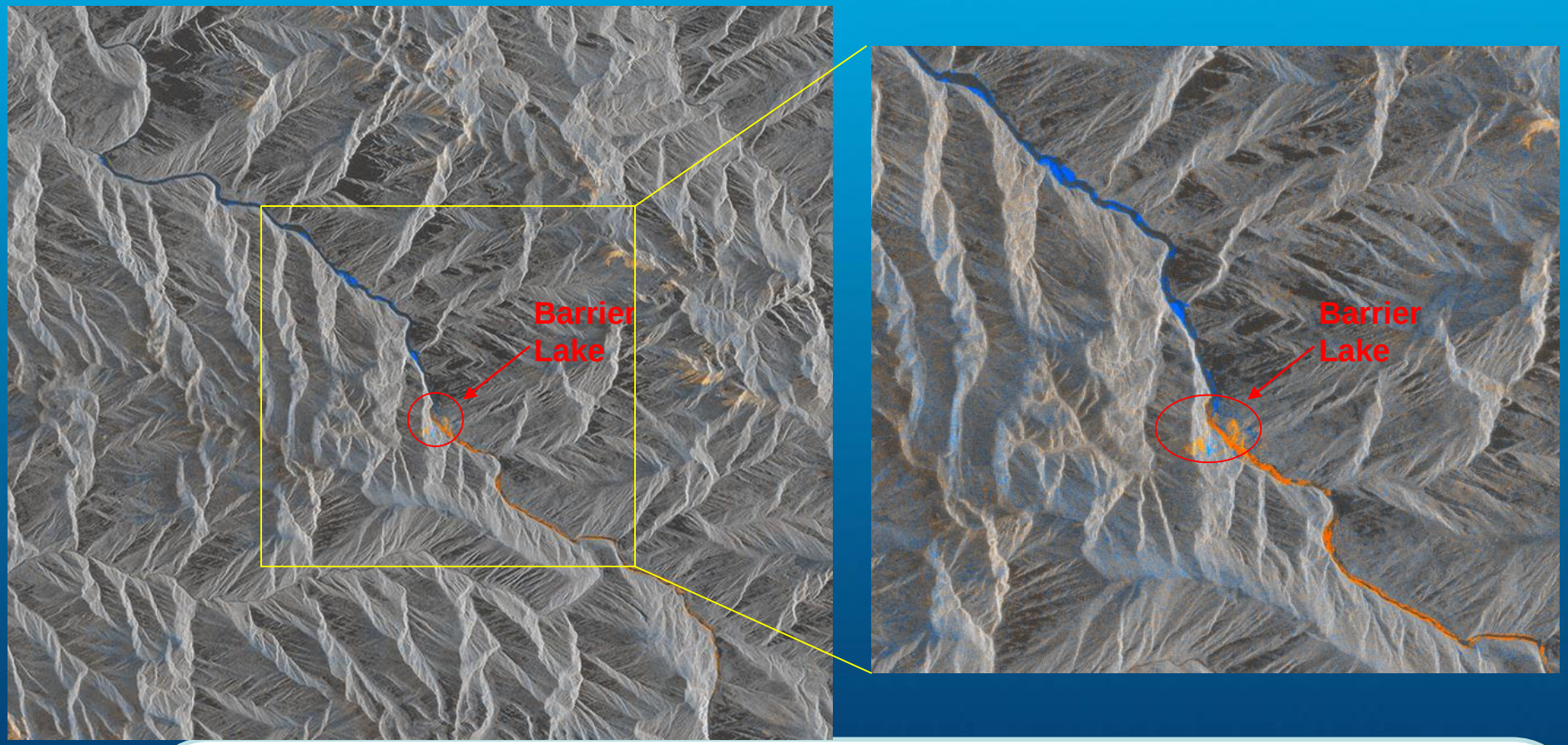
On the left is the time-series dynamic map of Zhuonai lake from 2017 to 2018.

Application of Remote Sensing in Disaster Forecast



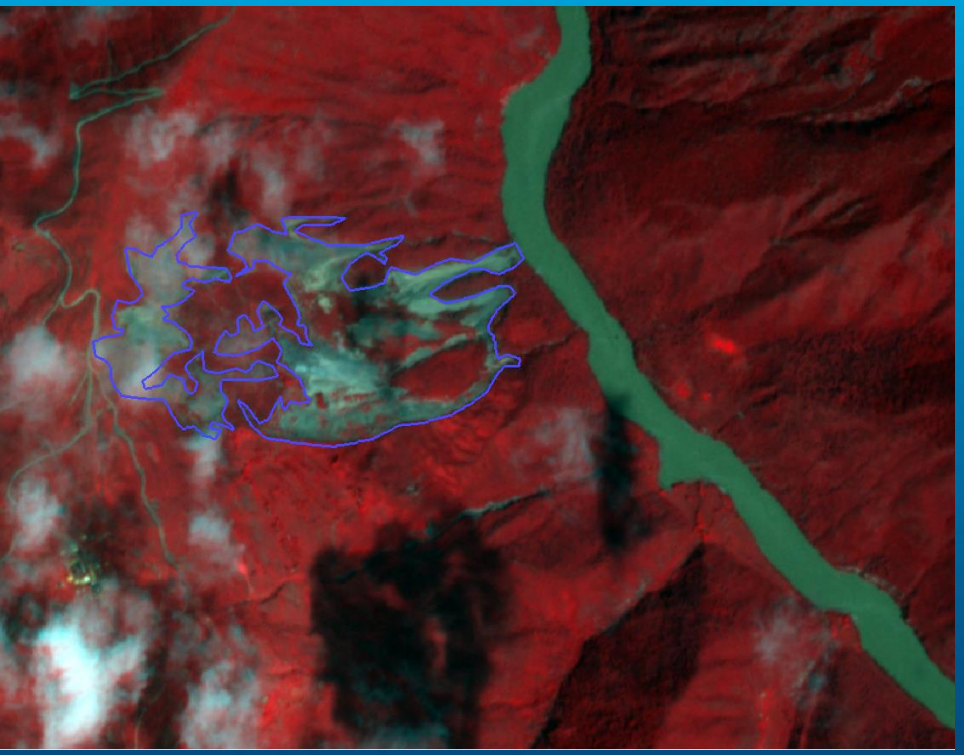
Disaster Forecast - Jinsha river (landslide)

Beijing time October 11, 2018 post-disaster image and September 28 pre-disaster image radar change detection

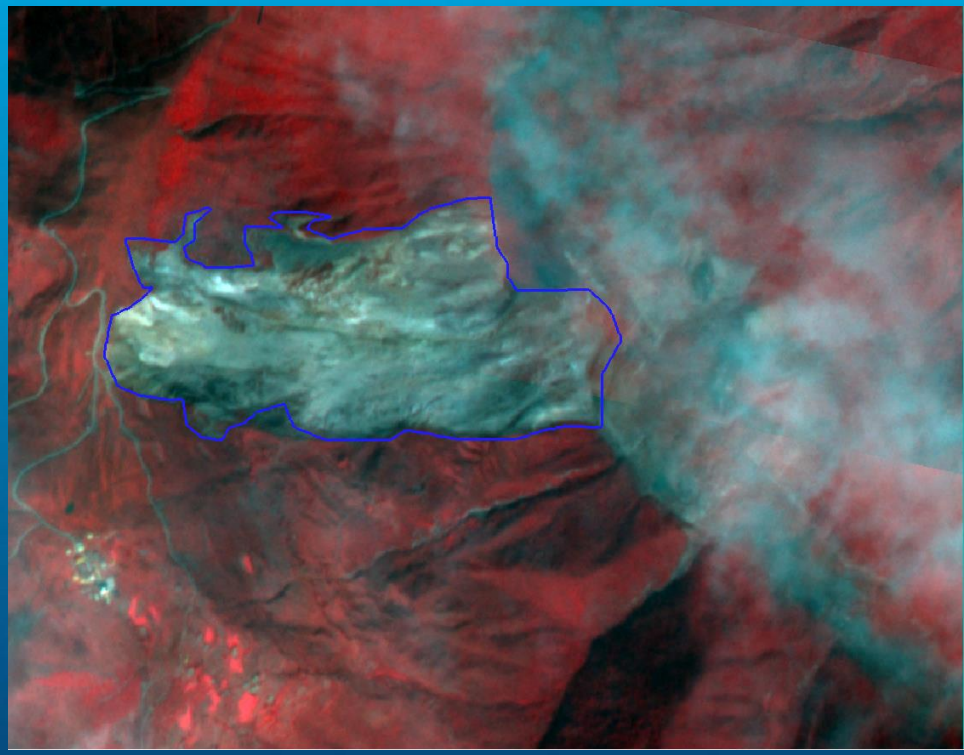


The gray areas in the figure are the unchanging areas, the blue and yellow areas are the changing areas. In the upstream river, the blue areas means the water surface expended. In the downstream, the yellow areas means water flow dropped and riverbed was exposed.

Disaster Forecast - Jinsha river (landslide)



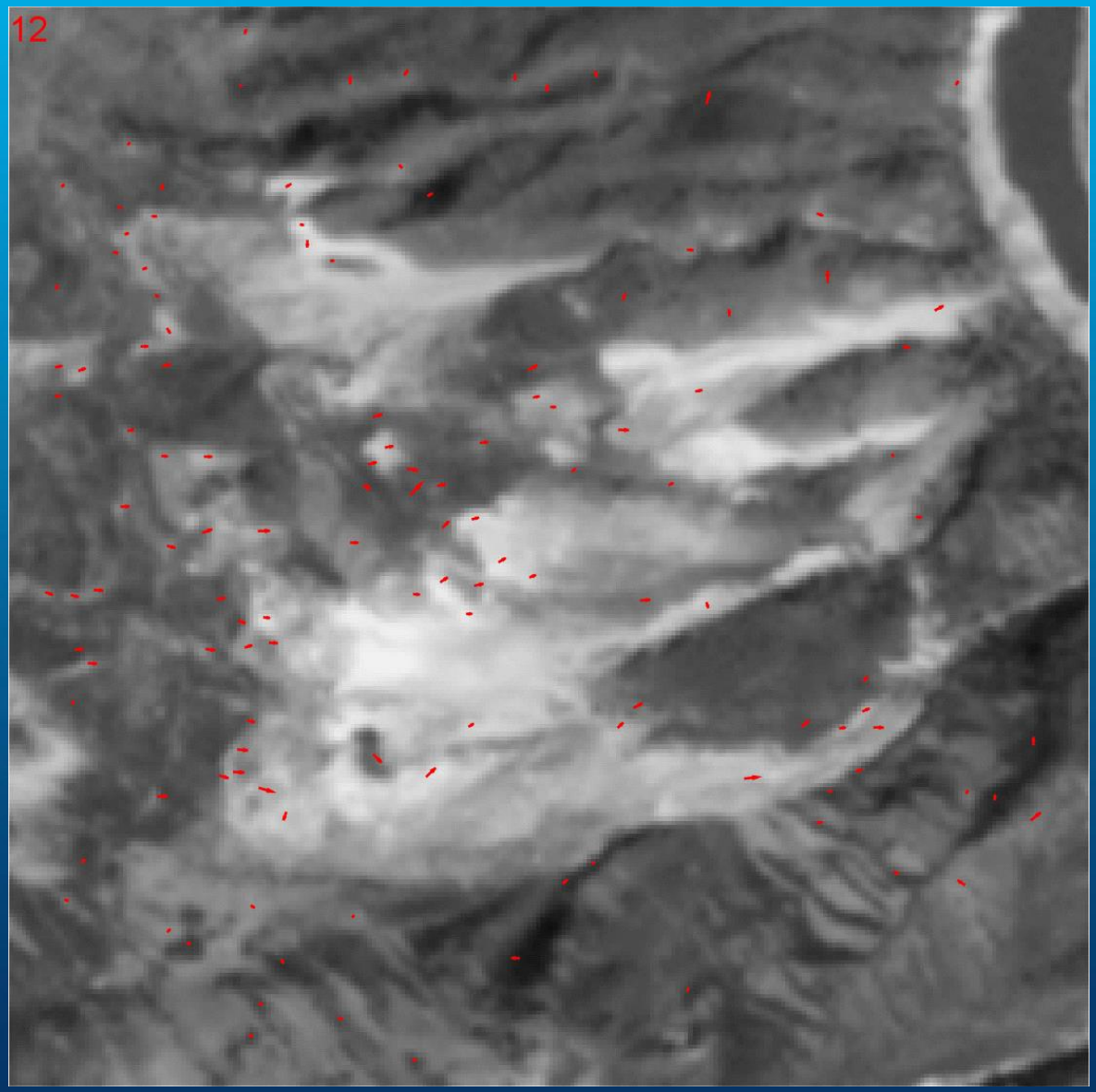
September 3, 2018



October 12, 2018

Disaster Forecast - Jinsha river (landslide)

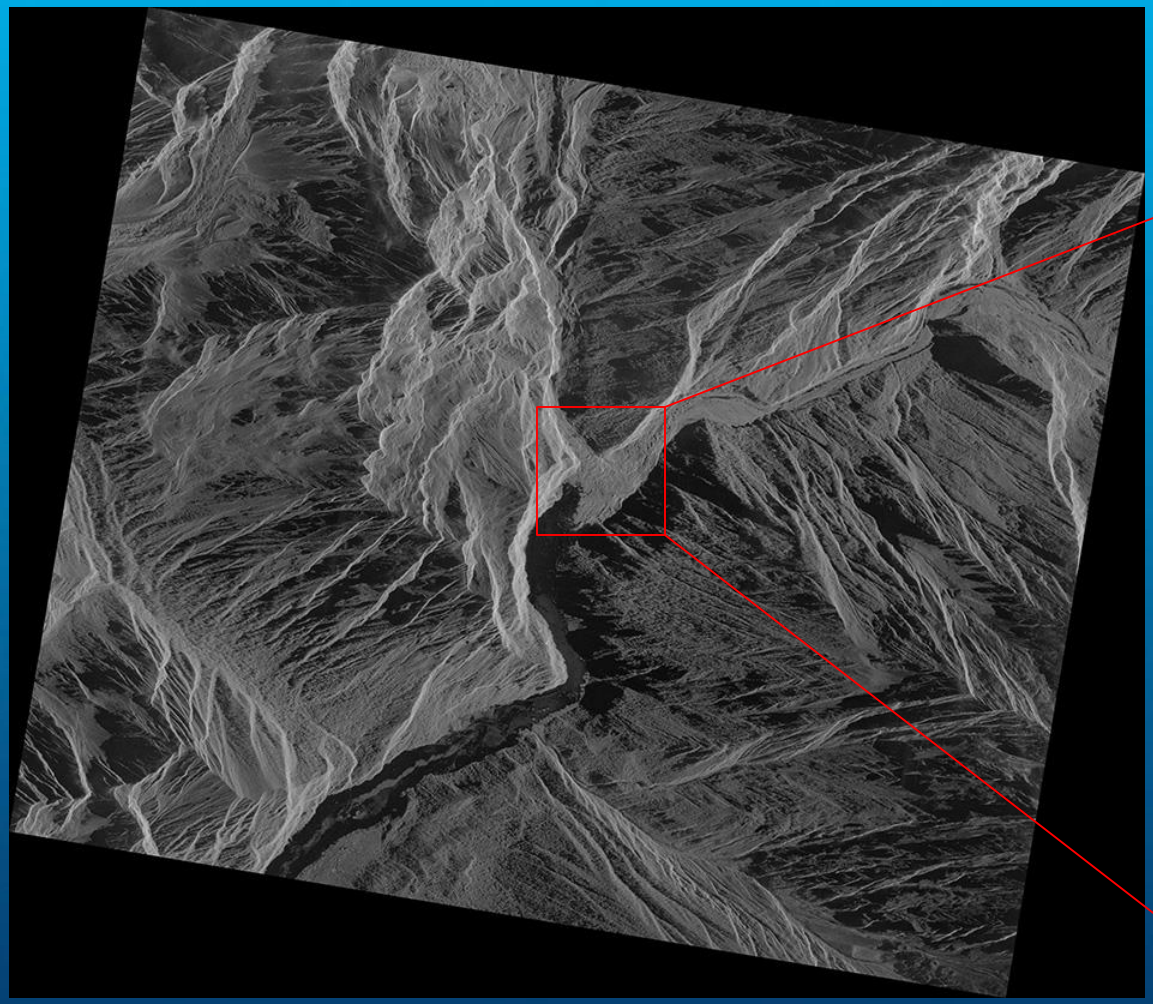
Disaster Forecast - Jinsha river (landslide)



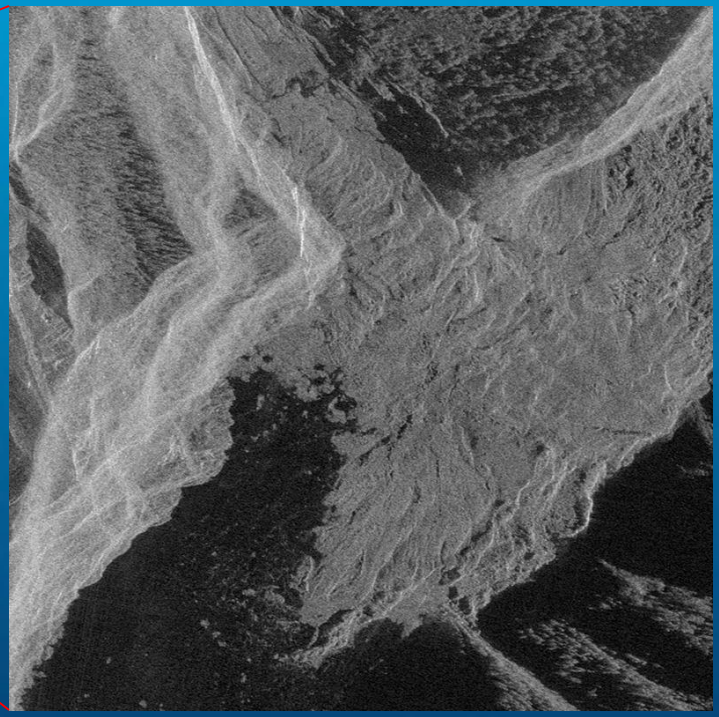
The average displacement was calculated using the four periods of data in March, may, July and September 2018.

The median value of displacement:
March to may: 5.4m
May to July: 9.3m
July to September: 11.8m

Disaster Forecast - Brahmaputra (landslide barrier lake)

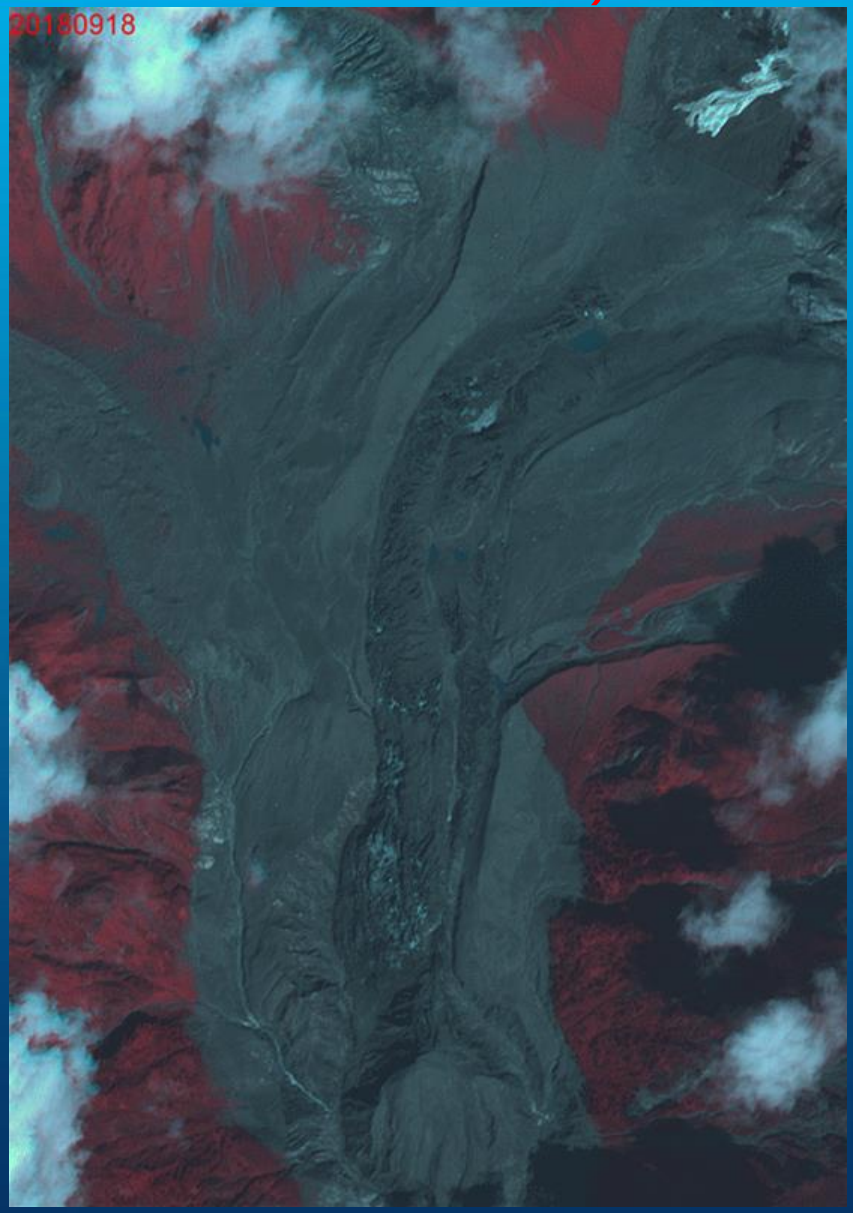


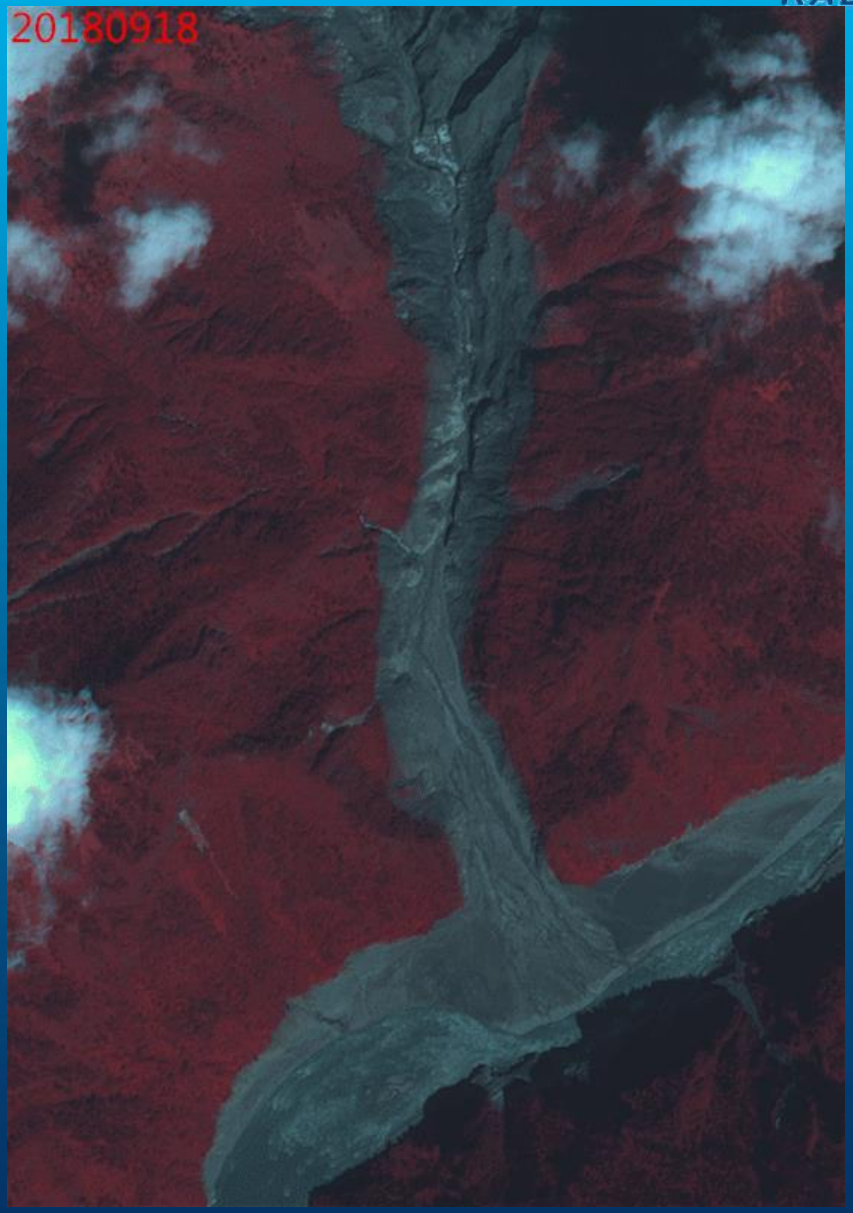
The lake was formed by a landslide in the Milin section of the Brahmaputra in the night of October 16 to 17.



Radar images of the barrier lake area (GF-3,1m, SLC, 2018.10.17)

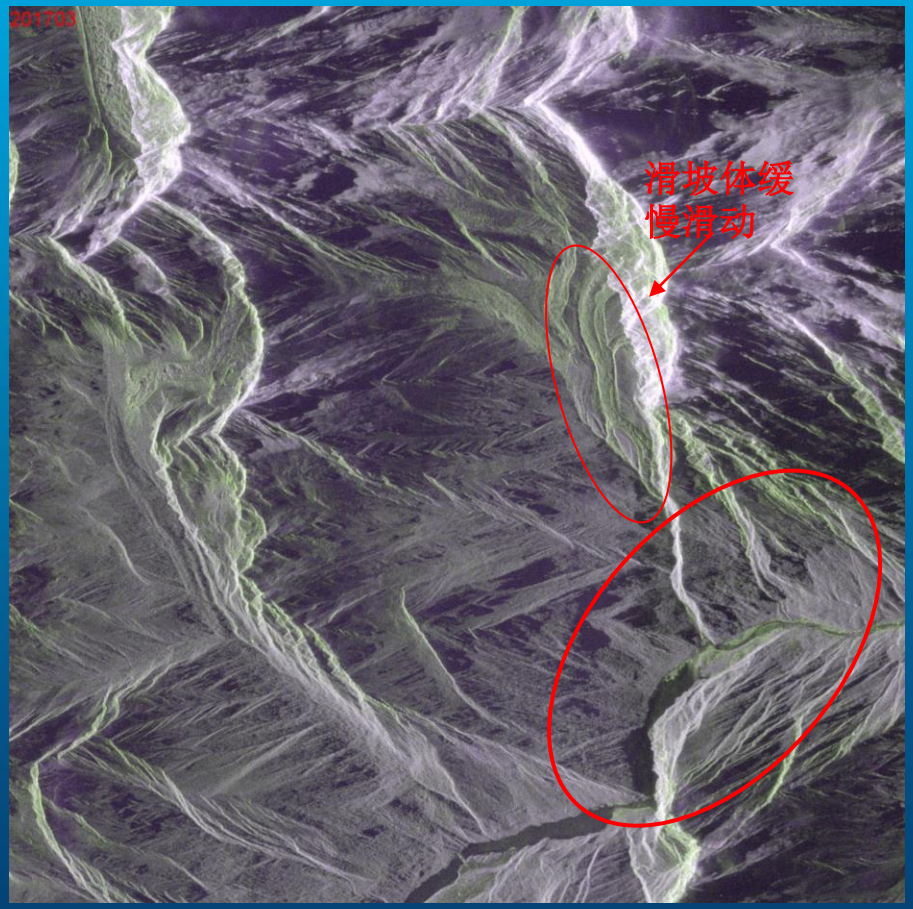
Disaster Forecast - Brahmaputra (landslide barrier lake)



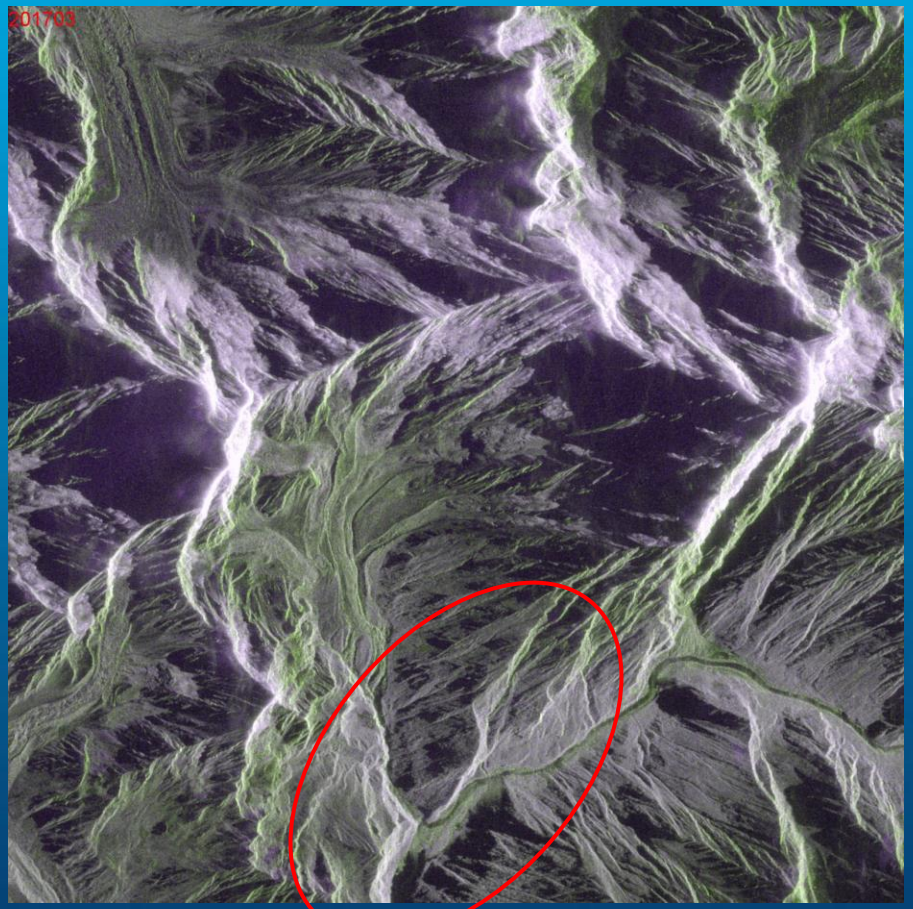


Disaster Forecast - Brahmaputra (landslide barrier lake)

Ascending

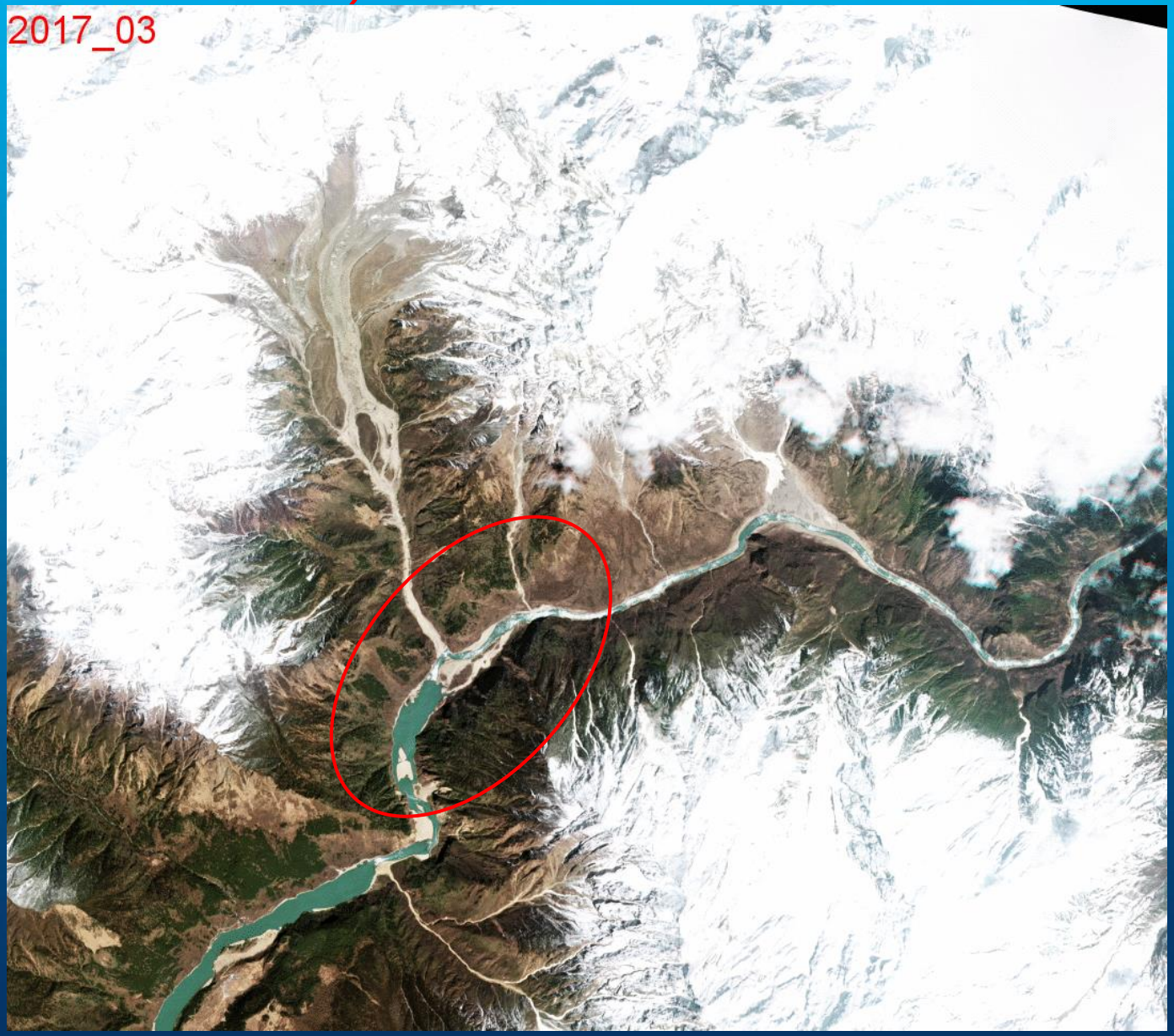


Descending



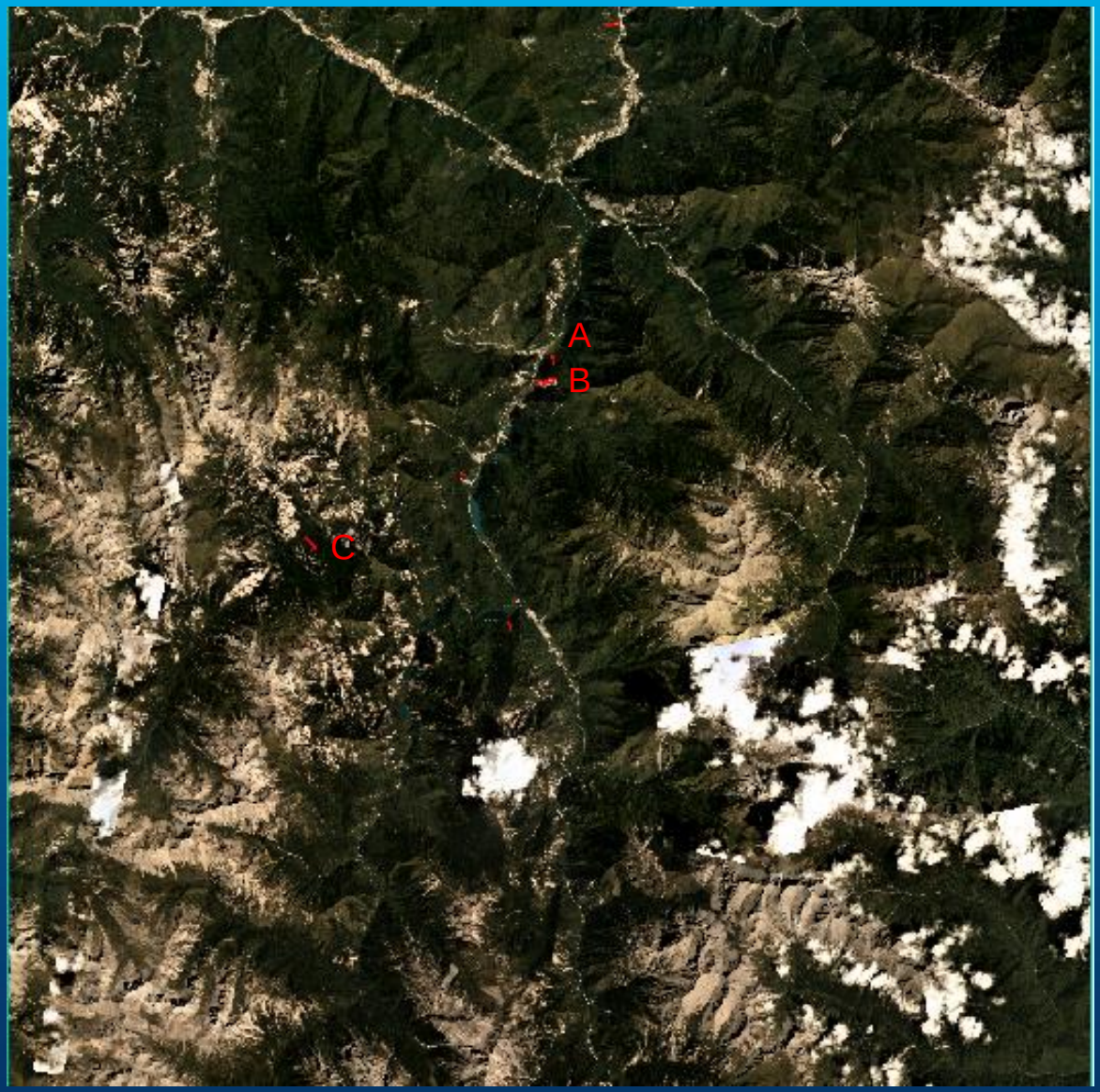
Time-series dynamic map of barrier lake
(March 2017 to October 2018)

Disaster Forecast - Brahmaputra (landslide barrier lake)



Application of Remote Sensing in Continuous Tracking After Disasters

Continuous Tracking After Disasters--Jiuzhaigou (small landslide)



Some small landslides were still occurring in local areas during September 2018 to September 2017.

Continuous Tracking After Disasters--Jiuzhaigou (small landslide)

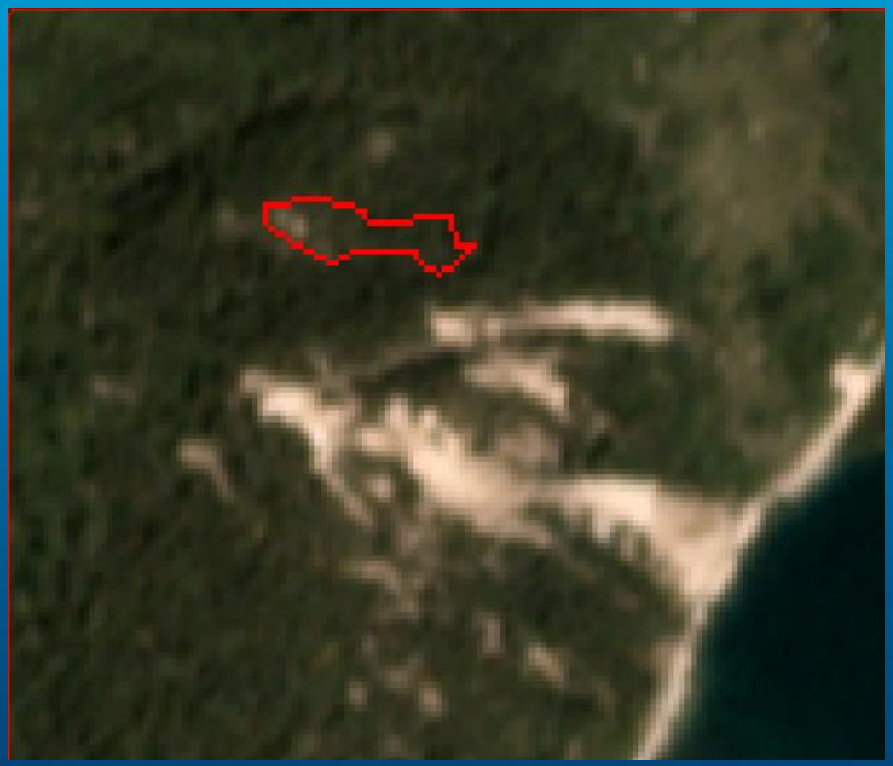
A is a new landslide. B is an expanded landslide on the basis of the original landslide

September 2017

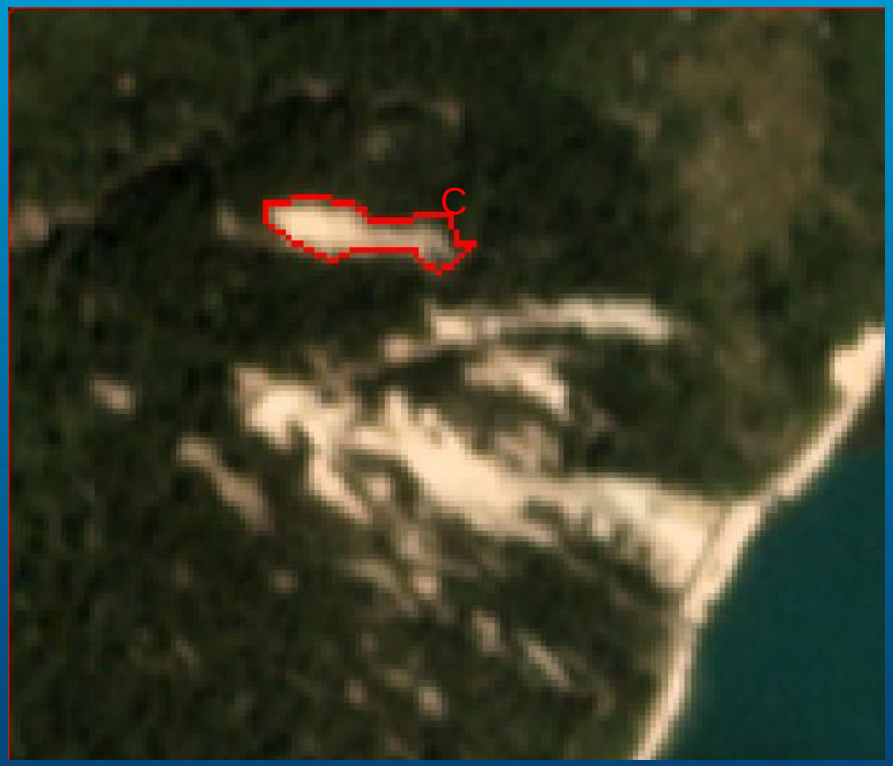
September 2018

Continuous Tracking After Disasters--Jiuzhaigou (small landslide)

C is a new landslide

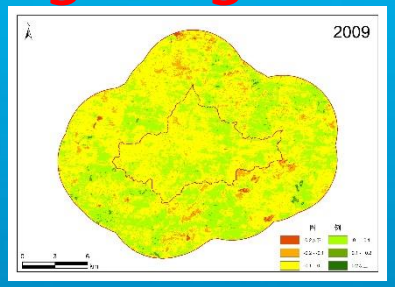


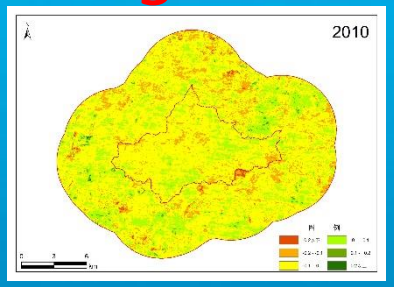
September 2017

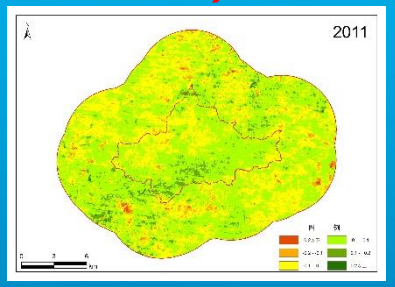


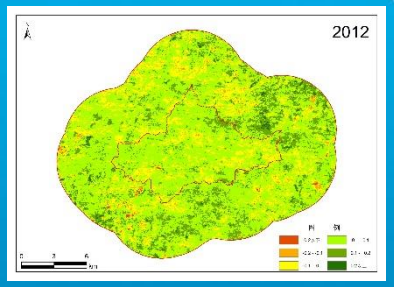
September 2018

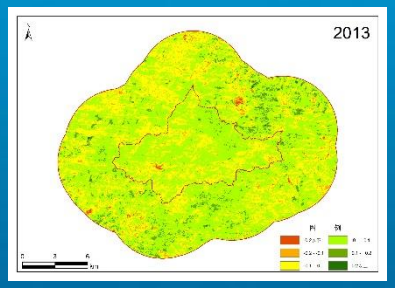
Recovery after freezing disaster (Guangdong Chebaling nature reserve)

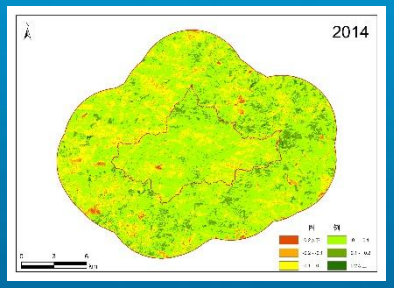


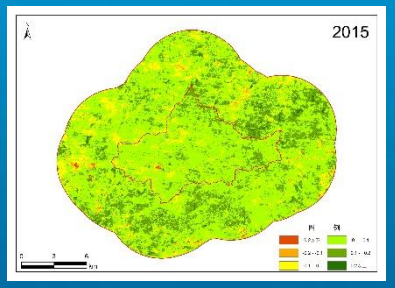


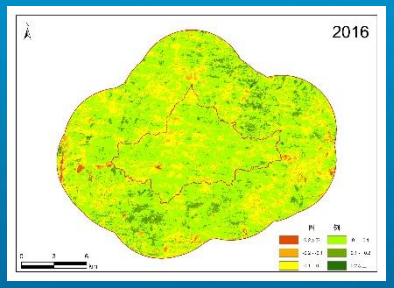


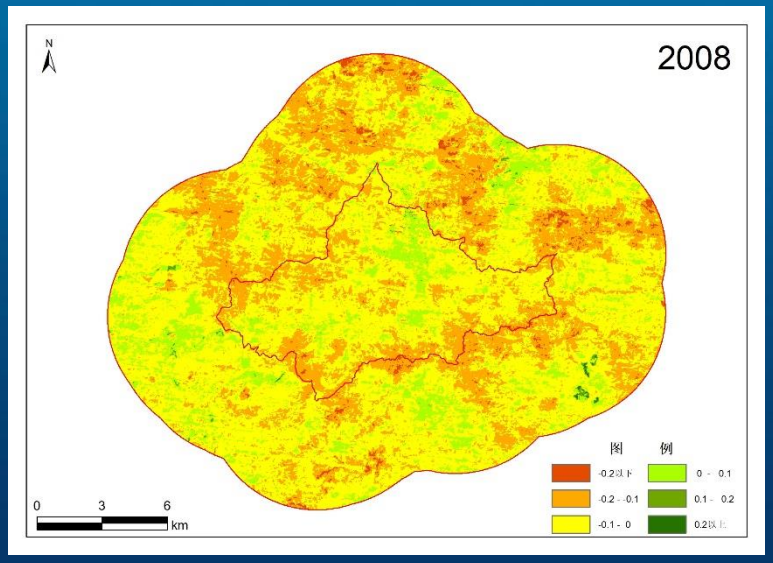


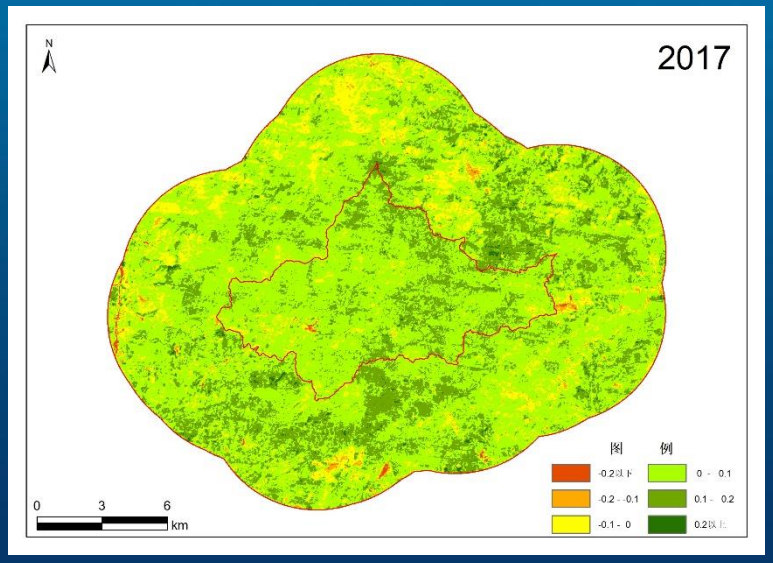




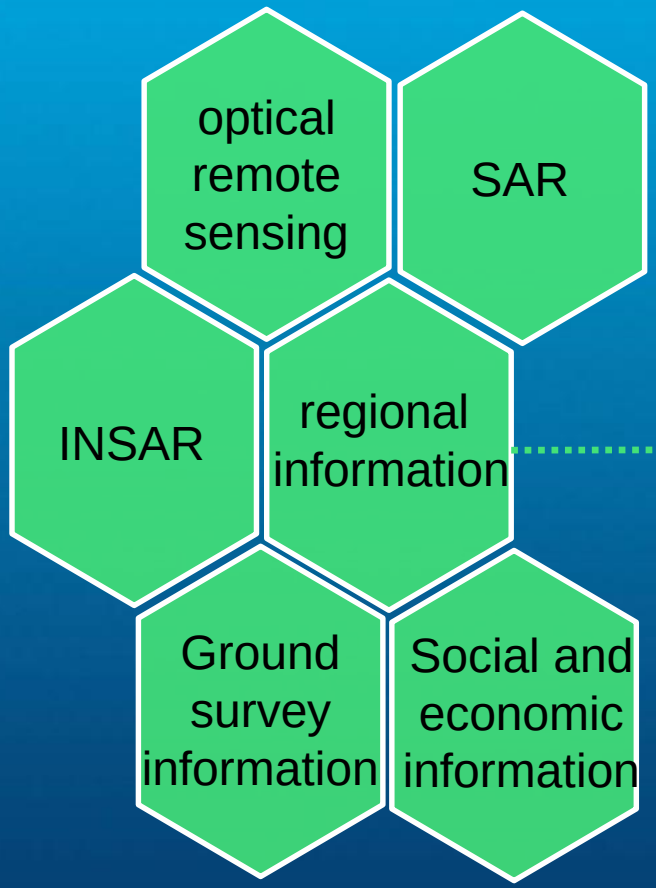






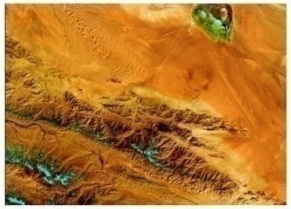


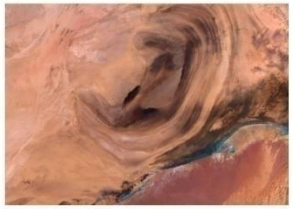
Disaster Monitoring--Big Data Analysis



Monitoring and analyzing key regions with multi-source and multi-temporal data can break through the disadvantage of single data. On the basis of complement-ary advantages, combined with big data analysis technology, we can analyze the trend and rule of regional disaster.

谢 谢 ！



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