



# Practice on a Decade of Using Satellite-based Information for Emergency Response Support in China

Suju Li

[lisuju@ndrcc.gov.cn](mailto:lisuju@ndrcc.gov.cn)

National Disaster Reduction Center of China, MCA

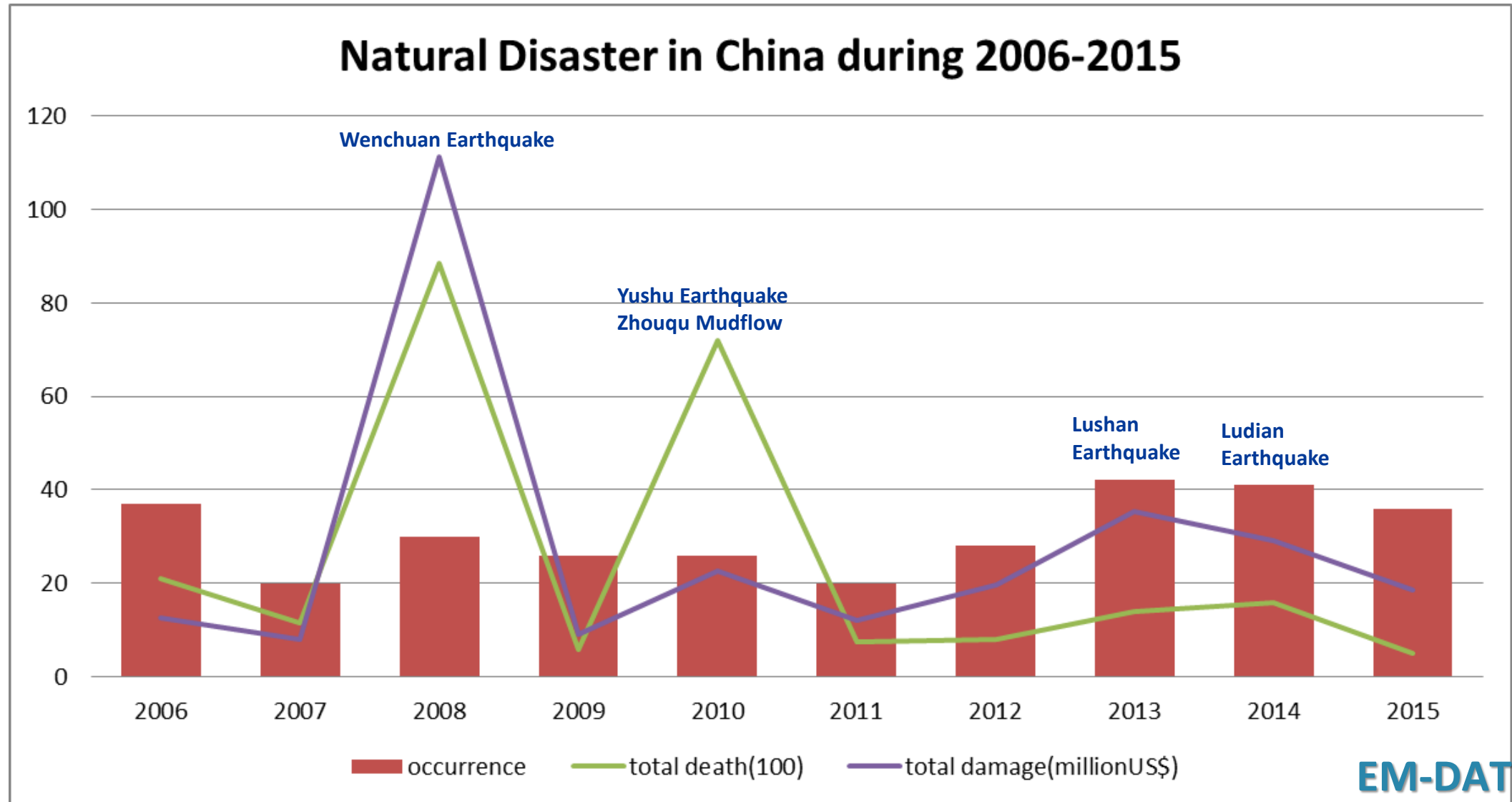
September 19 2016, Beijing



- ❖ **Natural Disaster and Emergency Response**
- ❖ **Satellite-base Emergency Mapping**
- ❖ **Conclusion and Perspectives**



# Natural Disasters



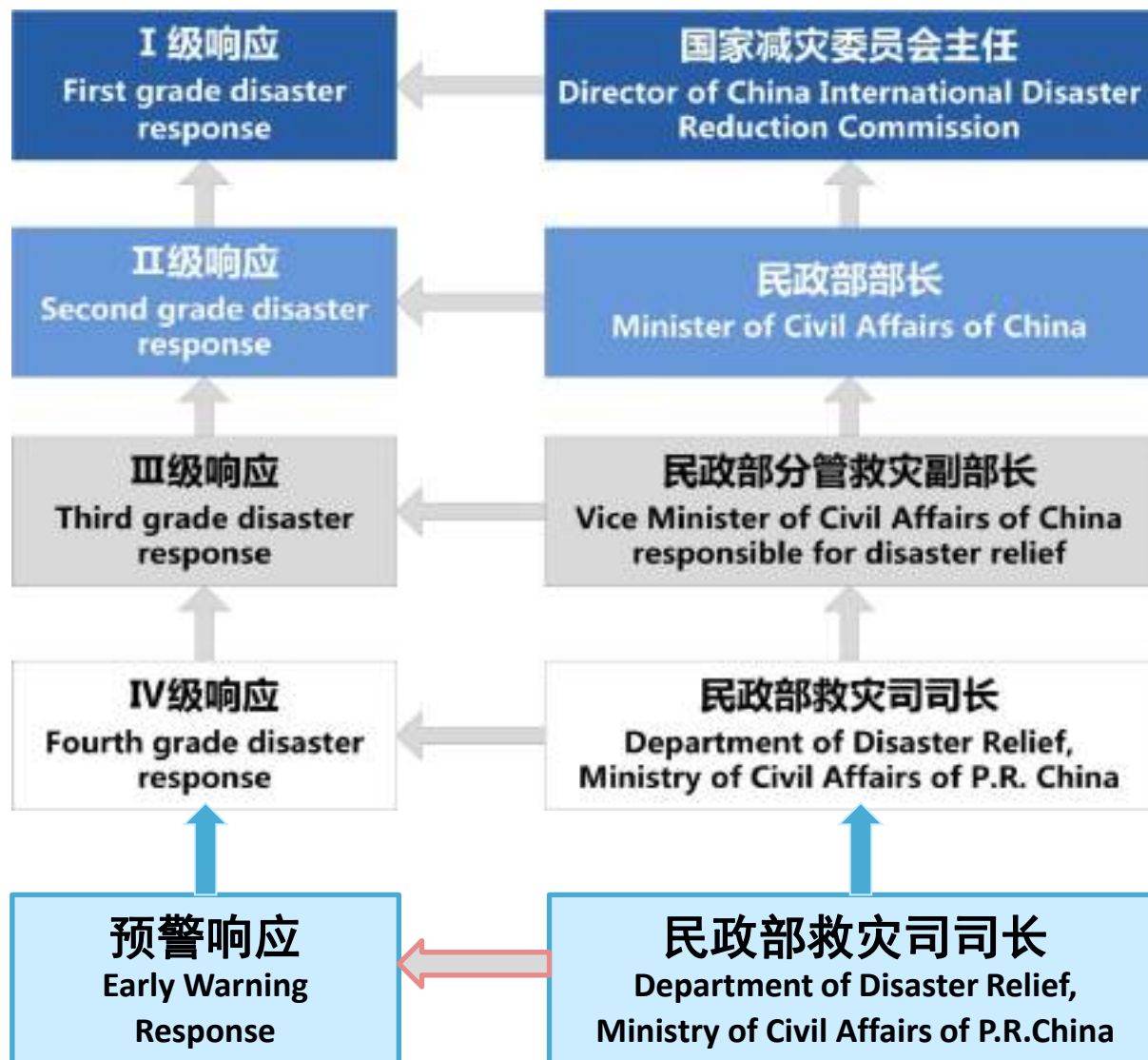


# Disaster Management in China



The *National Emergency Plan for Natural Disaster Relief* was first issued by State council in 2005 and revised in 2011 and 2016.

Response Level	Death Toll (×1 person)	Evacuated Population (×10000 persons)	Collapsed Houses (×10000 houses)	Drought	
				Hydroponic Population (%)	Relief Population (×10000 persons)
I - Level	> 200	> 200	> 30	30%	> 400
II -Level	100-200	100-200	20-30	25-30%	300-400
III -Level	50-100	50-100	10-20	20-25%	200-300
IV -Level	20-50	10-50	1-10	15-20%	100-200





# National Comprehensive Disaster Prevention and Reduction Plan



- ❖ The National Plan on Comprehensive Disaster Reduction(2006-2010): one of the 9 majors tasks is to strengthen capacity in the monitoring, early warning and forecasting of natural disasters. “...will lunch a satellite remote sensing monitoring system....”
- ❖ The National Plan on Comprehensive Disaster Prevention and Reduction (2011-2015): one of the 11 major tasks is to strengthen capacity building in monitoring and early warning of natural disasters. “...China will strengthen construction of its space-based information structure for disaster prevention and emergency response”

## 国务院办公厅文件

国办发〔2011〕65号

### 国务院办公厅关于印发国家综合防灾减灾规划（2011—2015年）的通知

各省、自治区、直辖市人民政府，国务院各部委、各直属机构：

《国家综合防灾减灾规划（2011—2015年）》（以下简称《规划》）已经国务院同意，现印发给你们，请认真贯彻执行。

编制和实施《规划》，是贯彻落实党中央、国务院关于加强防灾减灾工作决策部署的重要举措，是推进综合防灾减灾事业发展，构建综合防灾减灾体系，全面增强综合防灾减灾能力的迫切需要，对切实维护人民群众生命财产安全，保



# content



- ❖ **Disaster and Emergency Response**
- ❖ **Satellite-base emergency mapping**
- ❖ **Conclusion and Perspectives**





**Crisis or disaster**

**Mobilization**

Triggering process  
Situation briefing

**Data acquisition**

Satellite tasking  
Archive search  
Auxiliary data

**Pre-processing**

Geometric correction  
Image enhancement

**Analysis**

Data fusion  
Information generation

**Fusing with auxiliary data**

**Map production**

Quality control  
Maps (printed; online)  
GIS-ready geodata  
Information dossiers

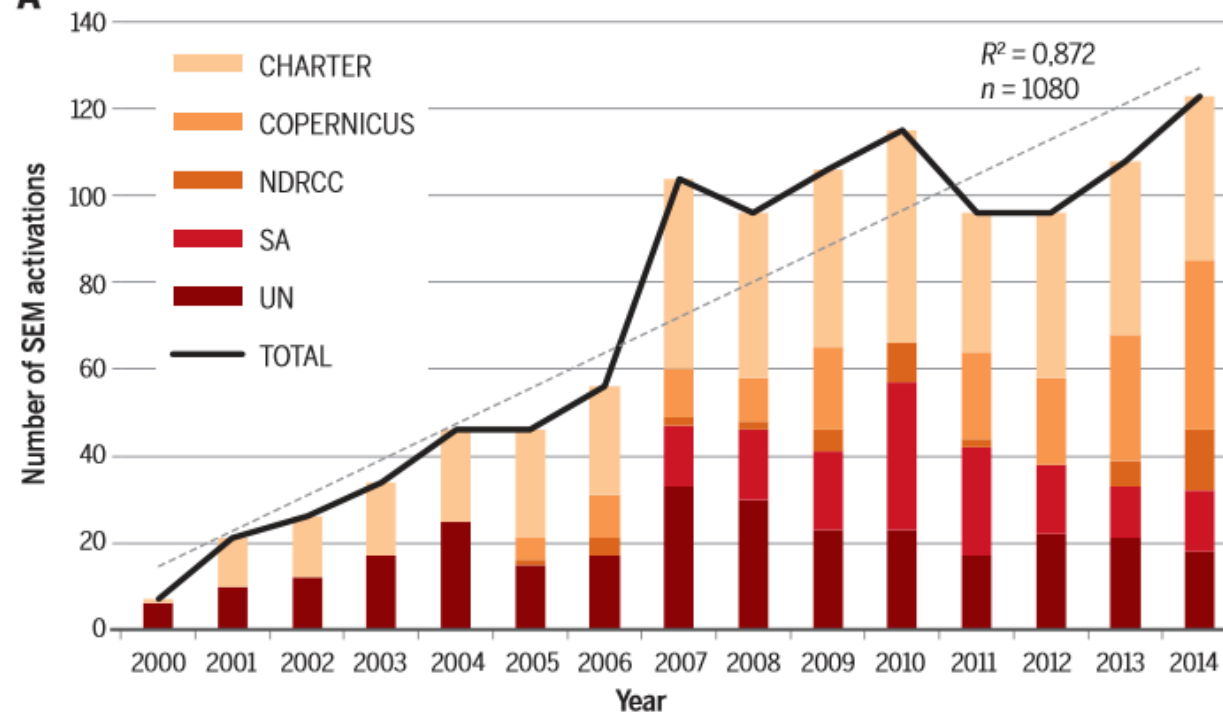
**Planning and decision support**

**Integration in collaborative platforms**

**Dissemination**

Cooperation with national/local authorities  
Relief organizations

**A**



Editor's Summary

**Global trends in satellite-based emergency mapping**

Stefan Voigt, Fabio Giulio-Tonolo, Josh Lyons, Jan Kucera, Brenda Jones, Tobias Schneiderhan, Gabriel Platzeck, Kazuya Kaku, Manzul Kumar Hazarika, Lorant Czarán, Suju Li, Wendi Pedersen, Godstime Kadiri James, Catherine Proy, Denis Macharia Muthike, Jerome Bequignon and Debarati Guha-Sapir (July 14, 2016)  
*Science* 353 (6296), 247-252. [doi: 10.1126/science.aad8728]



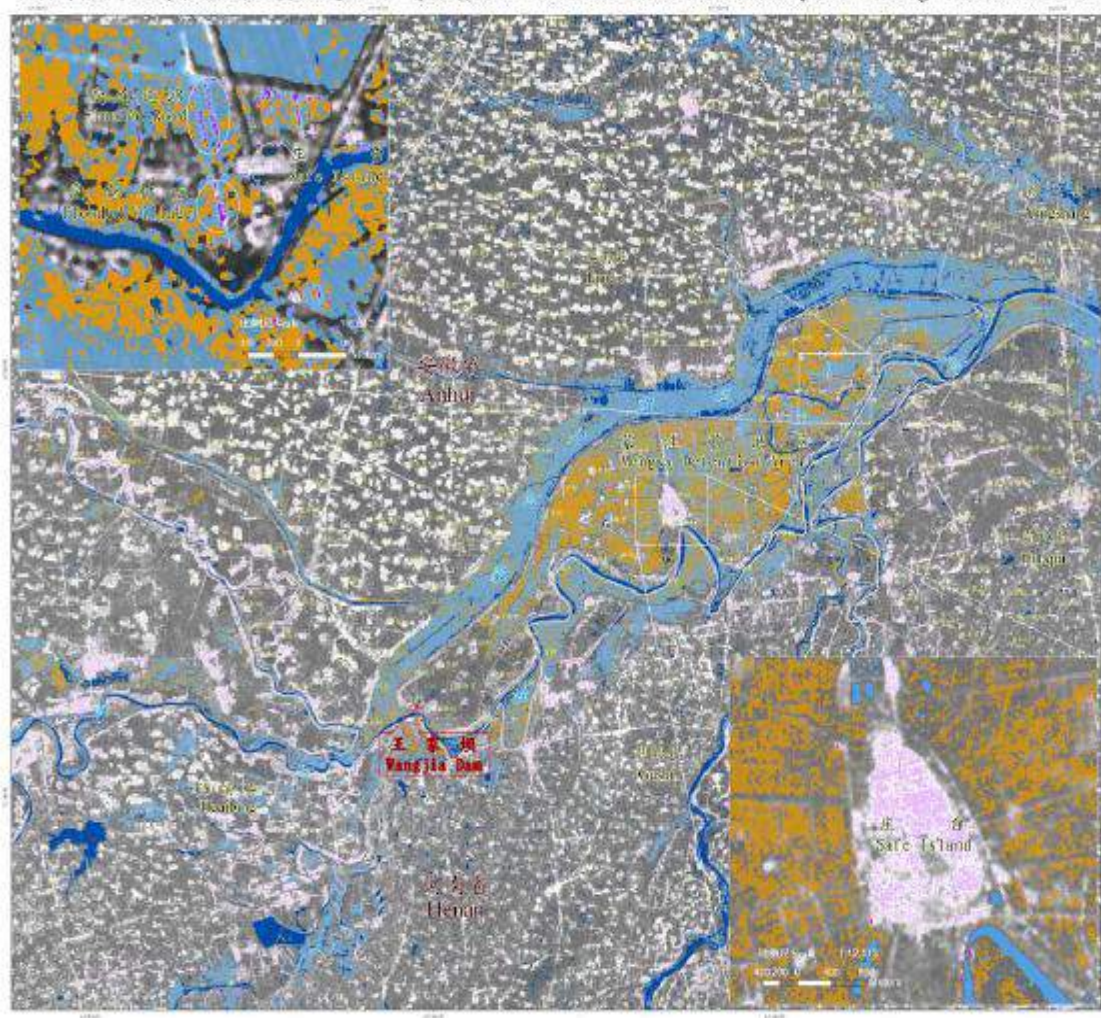
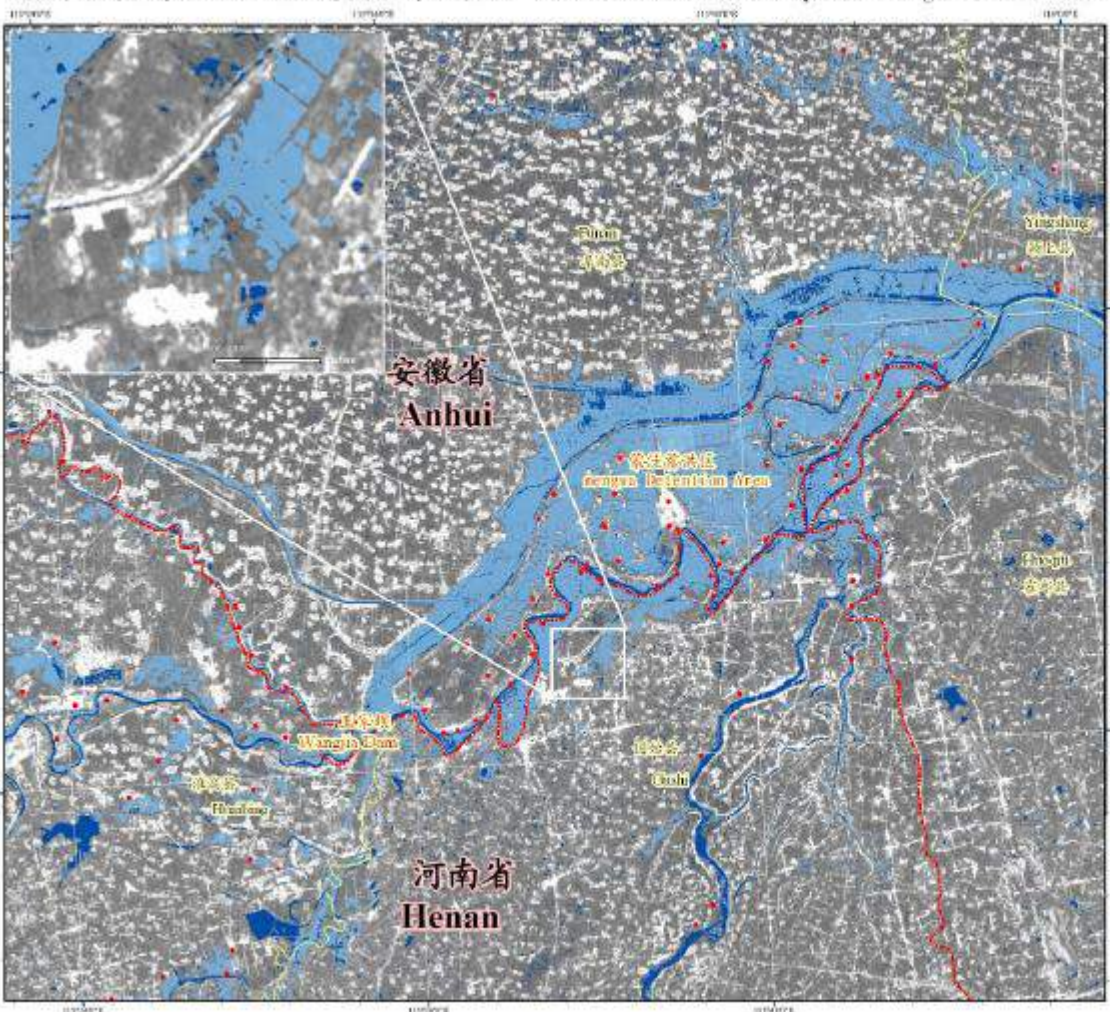


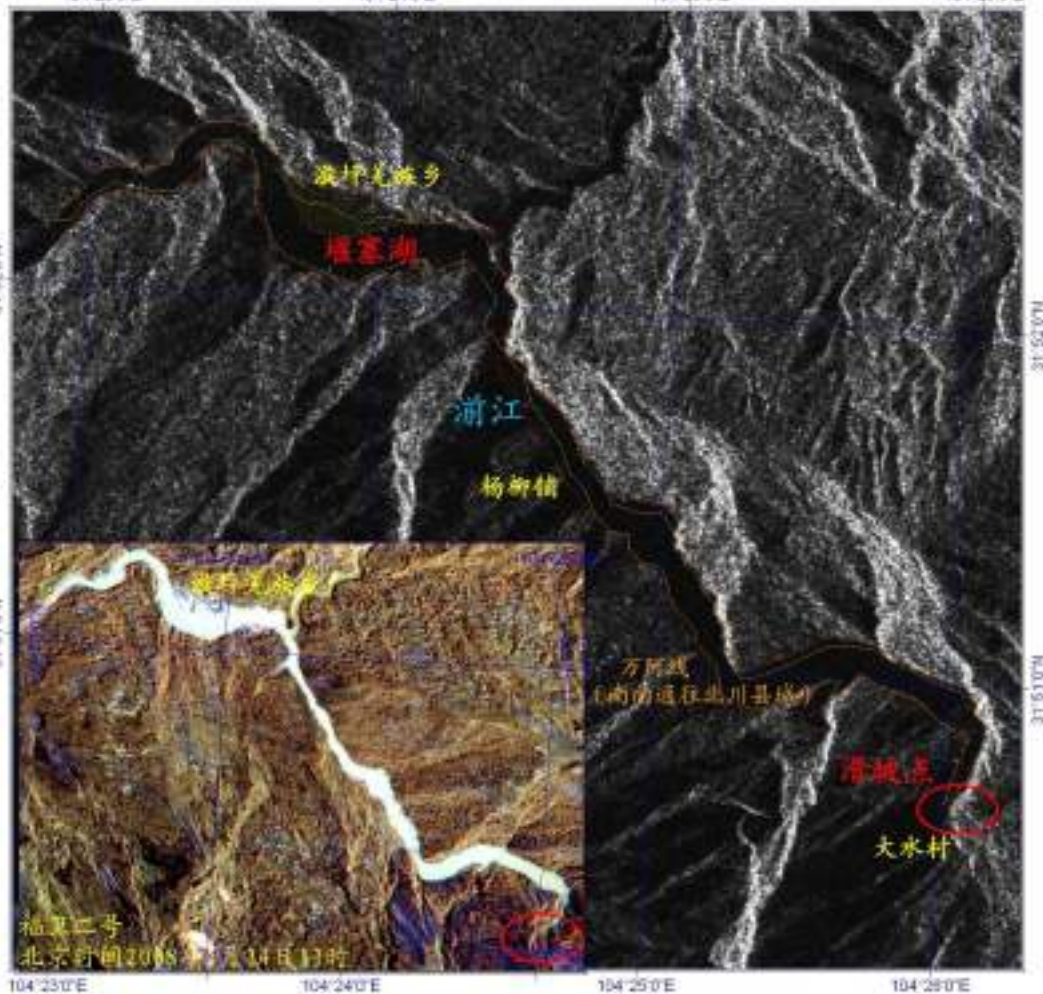
Figure 10. The map of the Yangtze River flood in 2007. The map shows the Yangtze River basin with various flood zones and administrative boundaries. The legend includes: 省界 (Province Boundary), 县界 (County Boundary), 村界 (Village Boundary), 经济作物区 (Economic Crop Area), 普通农作物区 (General Crop Area), 自然保护区 (Natural Reserve), 其他 (Other), 淹没区 (Flooded Area), 淹没深度 (Flood Depth), 淹没时间 (Flood Duration), 淹没面积 (Flooded Area), 淹没人口 (Flooded Population), 淹没财产 (Flooded Property), 淹没损失 (Flooded Loss), 淹没原因 (Flood Cause), 淹没后果 (Flood Consequence), 淹没对策 (Flood Countermeasure), 淹没责任 (Flood Responsibility), 淹没赔偿 (Flood Compensation), 淹没救济 (Flood Relief), 淹没安置 (Flood Relocation), 淹没重建 (Flood Reconstruction), 淹没恢复 (Flood Restoration), 淹没预防 (Flood Prevention), 淹没预警 (Flood Warning), 淹没监测 (Flood Monitoring), 淹没评估 (Flood Assessment), 淹没规划 (Flood Planning), 淹没管理 (Flood Management), 淹没立法 (Flood Legislation), 淹没执法 (Flood Enforcement), 淹没司法 (Flood Judiciary), 淹没行政 (Flood Administration), 淹没财政 (Flood Finance), 淹没金融 (Flood Finance), 淹没教育 (Flood Education), 淹没科技 (Flood Science and Technology), 淹没文化 (Flood Culture), 淹没体育 (Flood Sports), 淹没卫生 (Flood Hygiene), 淹没环保 (Flood Environment), 淹没安全 (Flood Safety), 淹没治安 (Flood Security), 淹没外交 (Flood Diplomacy), 淹没国防 (Flood National Defense), 淹没外交 (Flood Diplomacy), 淹没国防 (Flood National Defense).





# 2008

104°23'0"E      104°24'0"E      104°25'0"E      104°26'0"E



四川省汶川县地震北川县卫星遥感与无人机航拍对比监测图



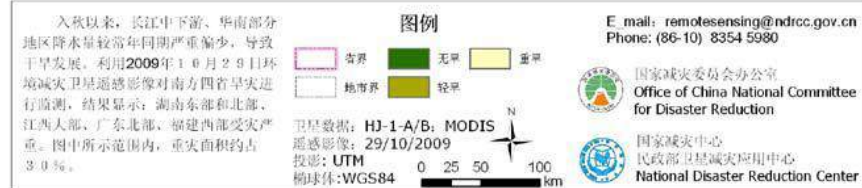
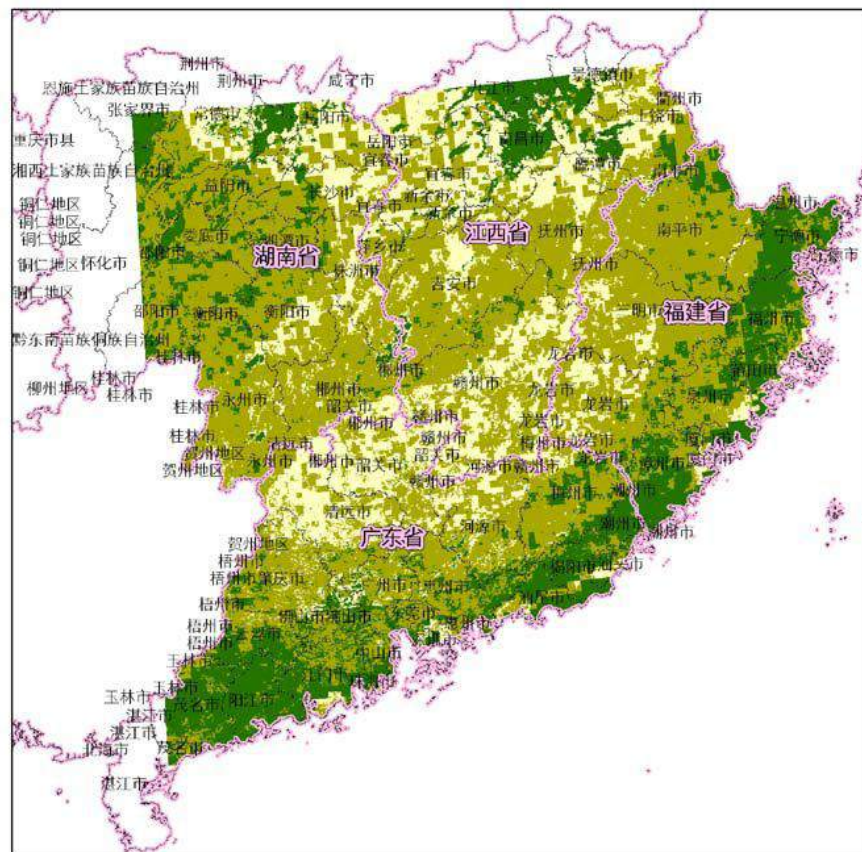
遥感数据  
Radarsat, 北京时间2008年5月17日19时  
哨卫二号, 北京时间2008年5月14日11时



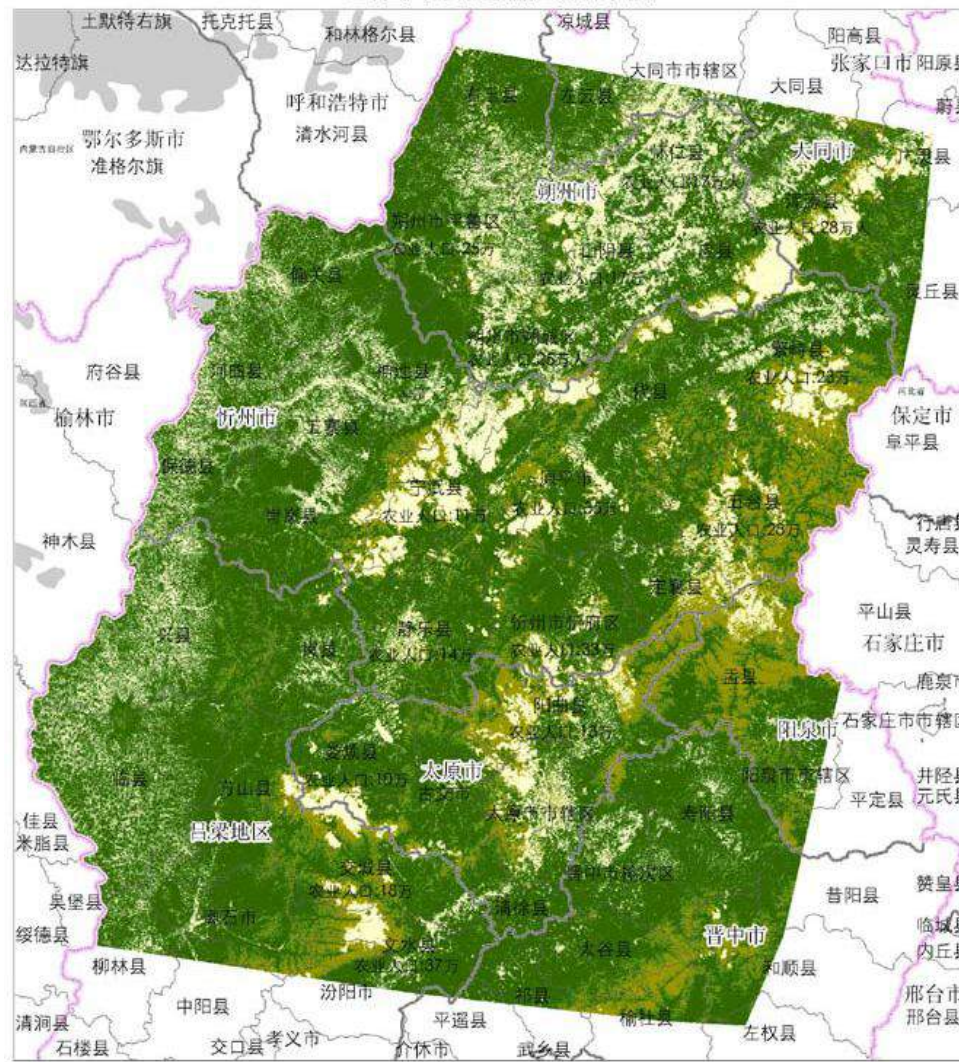




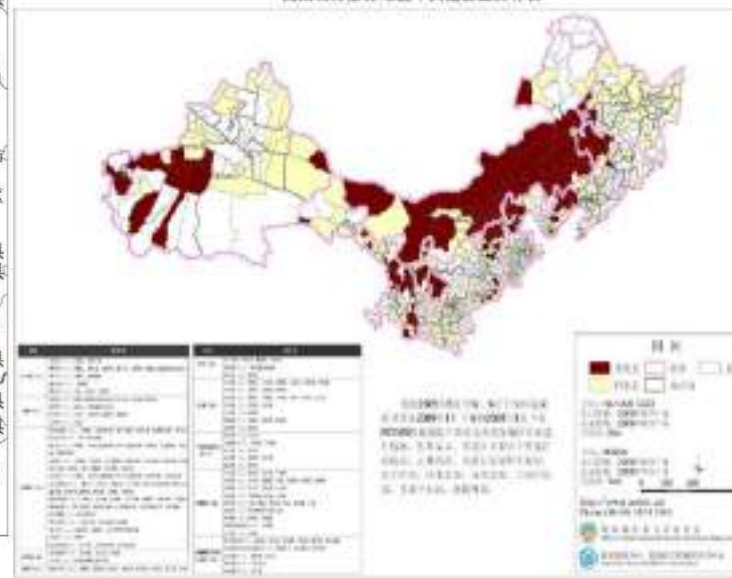
## 南方四省旱灾遥感监测 (10月下旬)



## 山西旱灾遥感监测评估



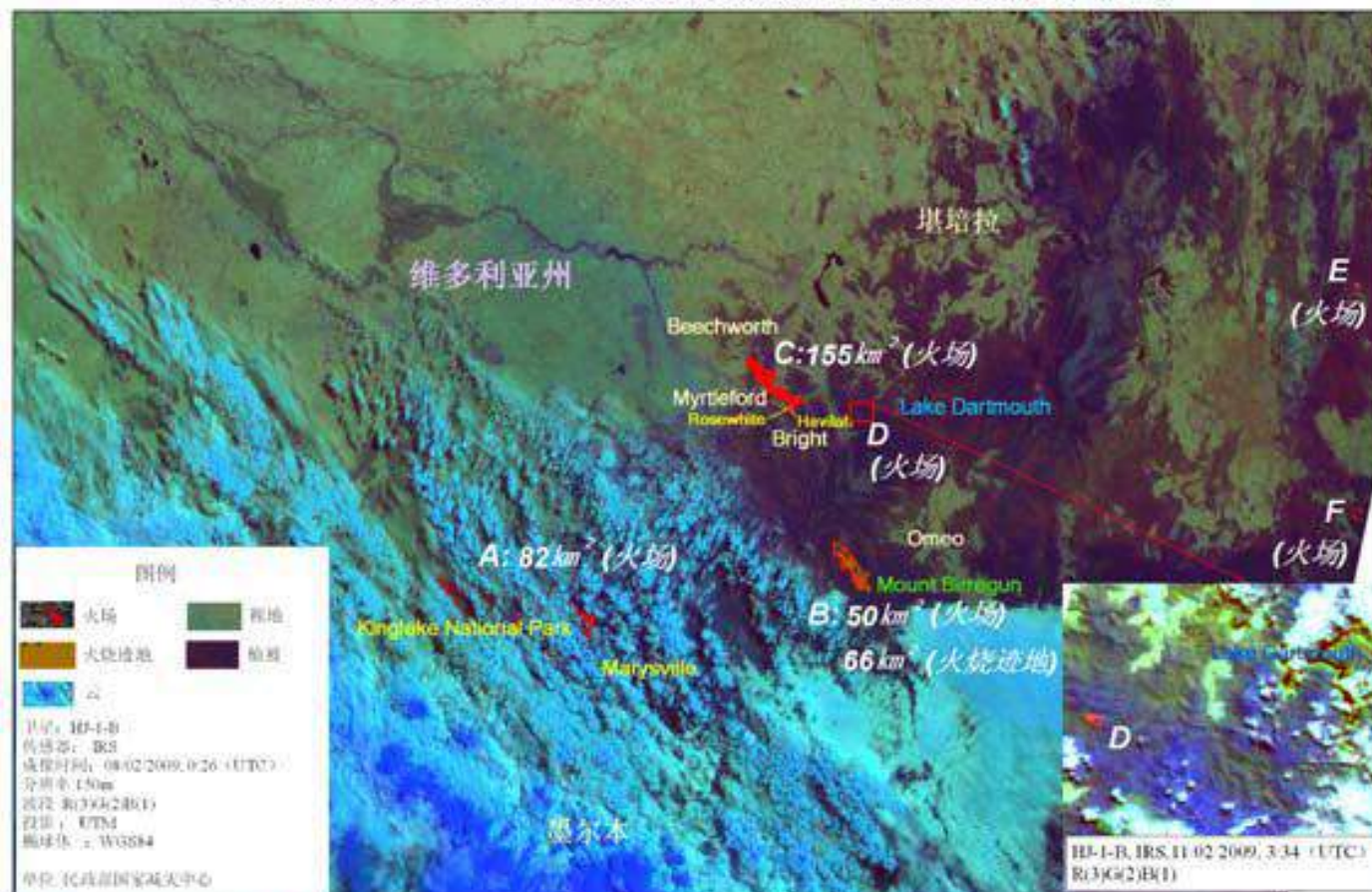
我国北方部分地区旱灾遥感监测评估



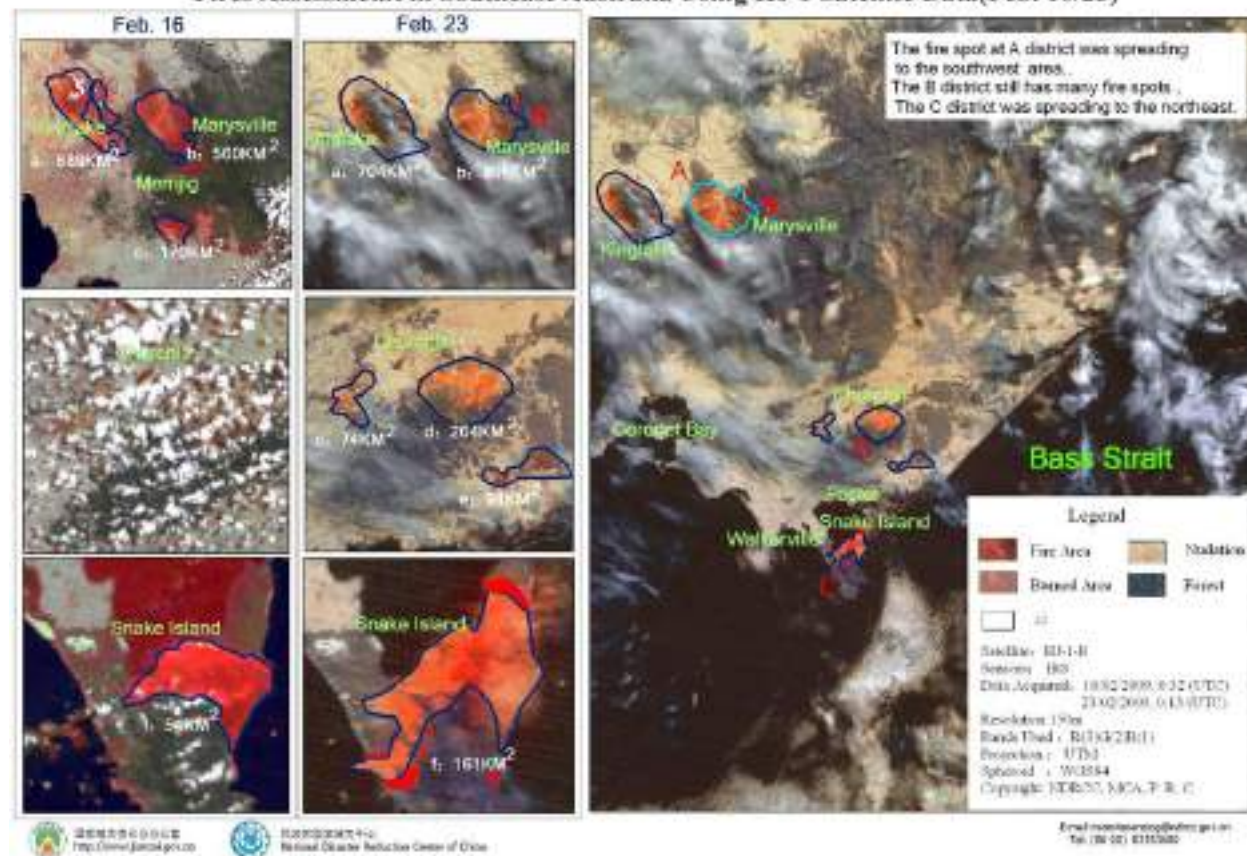




## 环境减灾星座澳大利亚森林草原火灾遥感监测评估（2009年2月8日、11日）



## Fires Assessment in Southeast Australia Using HJ-1 Satellite Data (Feb. 16/23)











巴基斯坦洪涝灾害遥感监测图

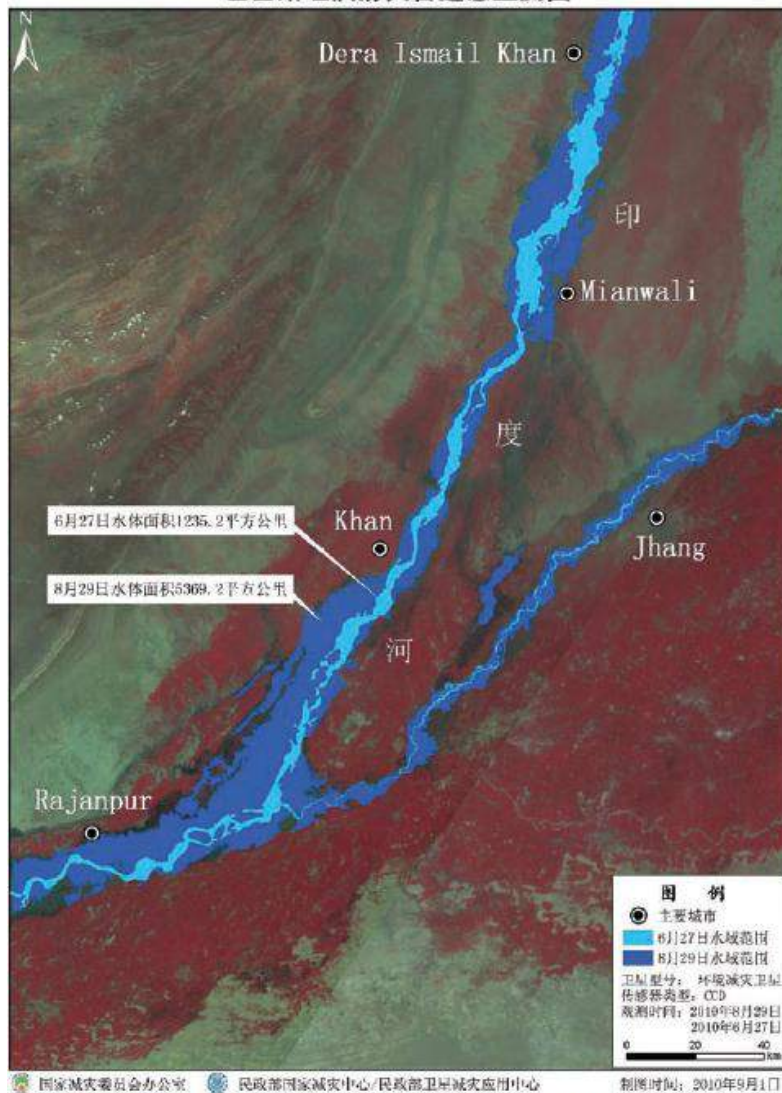


图1 巴基斯坦洪涝灾害遥感监测图

巴基斯坦洪涝灾害遥感监测图

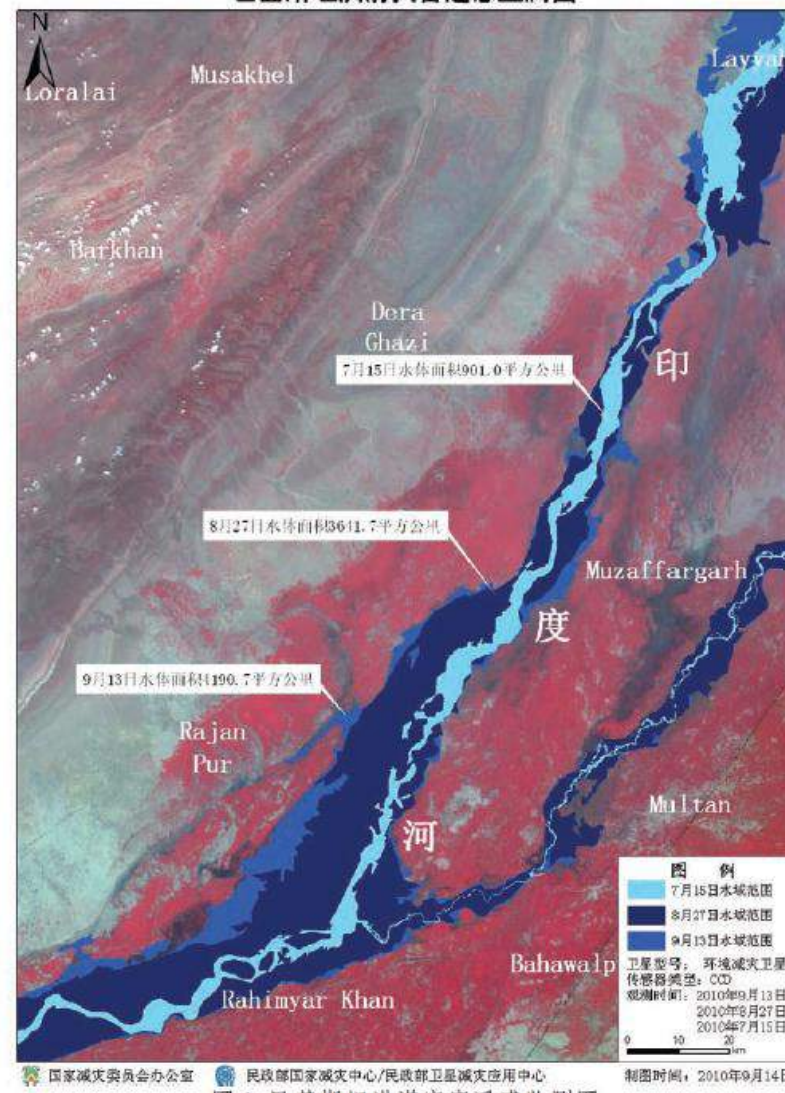


图1 巴基斯坦洪涝灾害遥感监测图

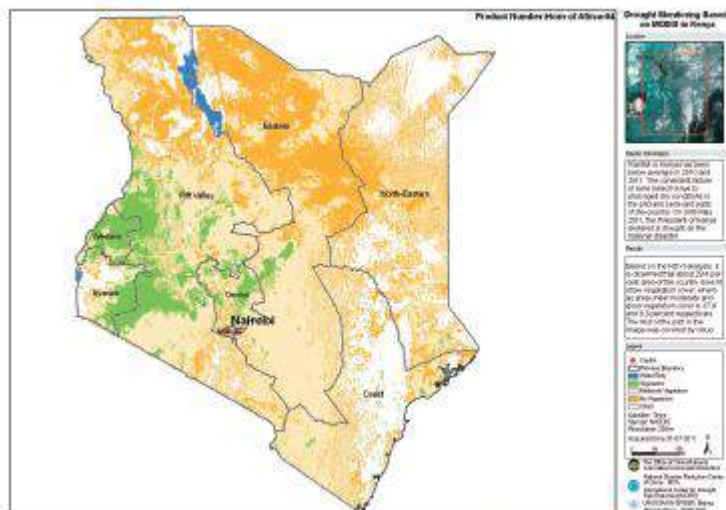




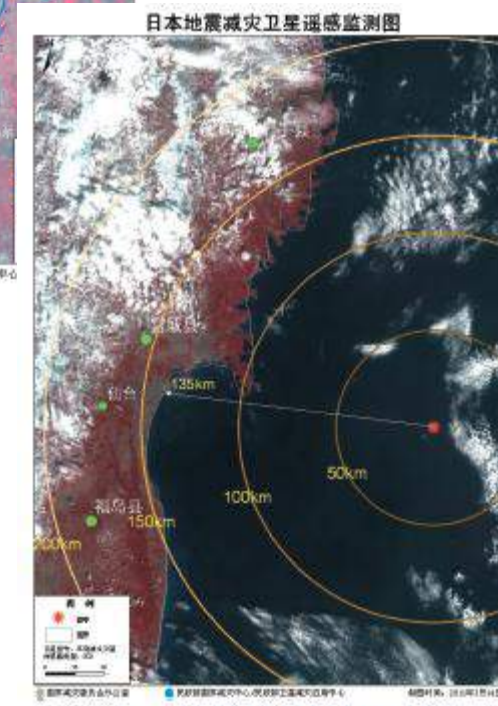
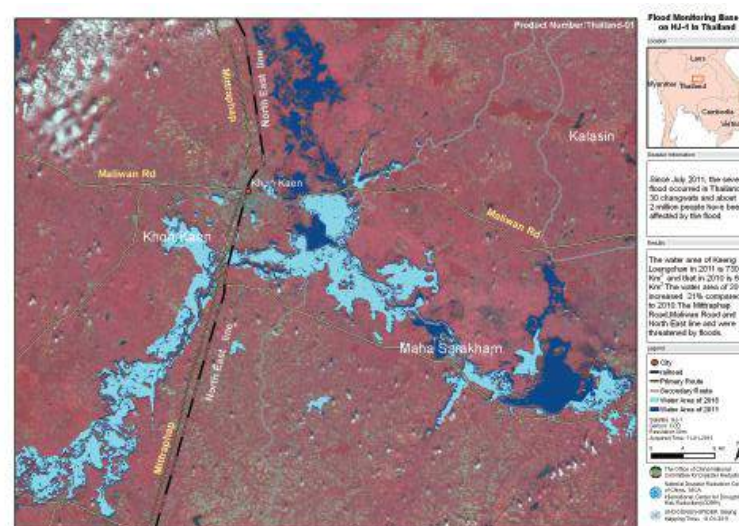
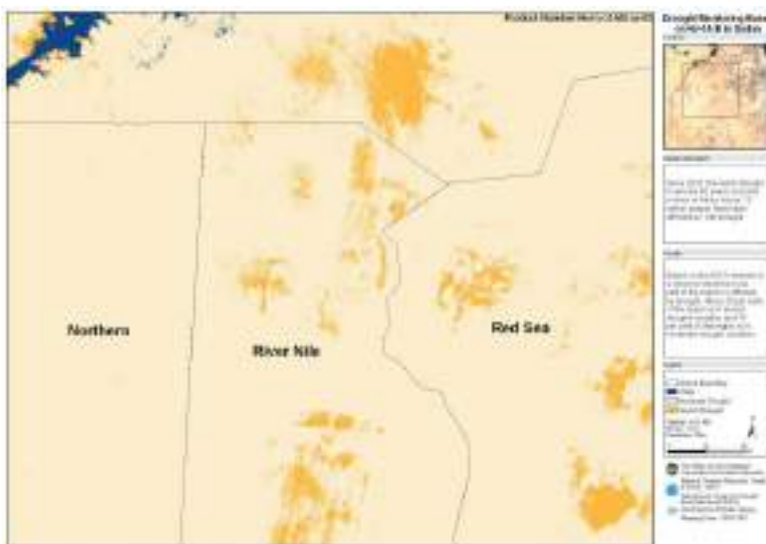
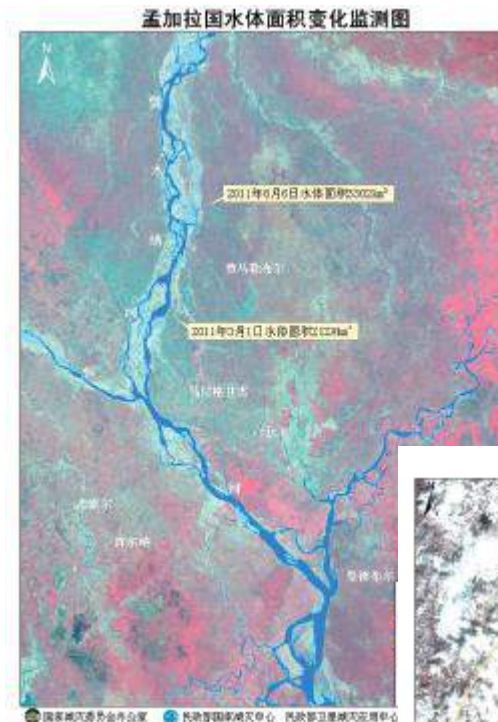
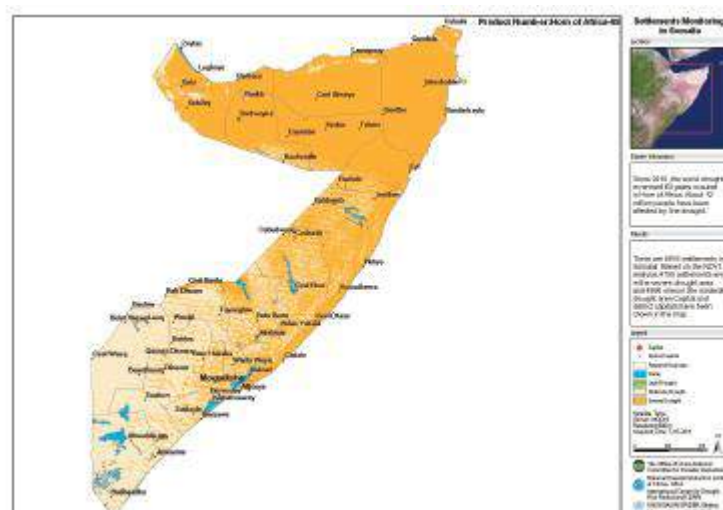




2011



肯尼亚干旱监测——遥感—无国界







云南彝良地震灾区帐篷安置监测图











**July 9, 2014 Pre-event**

Water area of Yuelong River basin is 3.62 km<sup>2</sup>

Water area of Yuelu River basin is 0.4 km<sup>2</sup>

**July 25, 2014 Post-event**

Water area of Yuelong River basin is 5.57 km<sup>2</sup>

Water area of Yuelu River basin is 21.3 km<sup>2</sup>

**Legend**

- Post-event water area
- Pre-event water area

**Description**

On July 18, the typhoon Rammasun made landfall on the China, triggering a severe storm surge, the typhoon caused of more than 20 deaths.

**Legend**

- Cloud/Shadow
- Debris/land
- Water

Local projection UTM Zone 48N/Datum WGS 1984

**Data Sources**

OLI, Landsat 8

Spatial resolution 30m

**Framework**

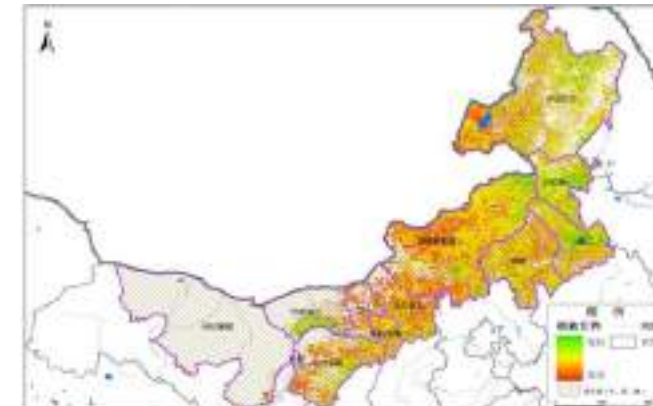
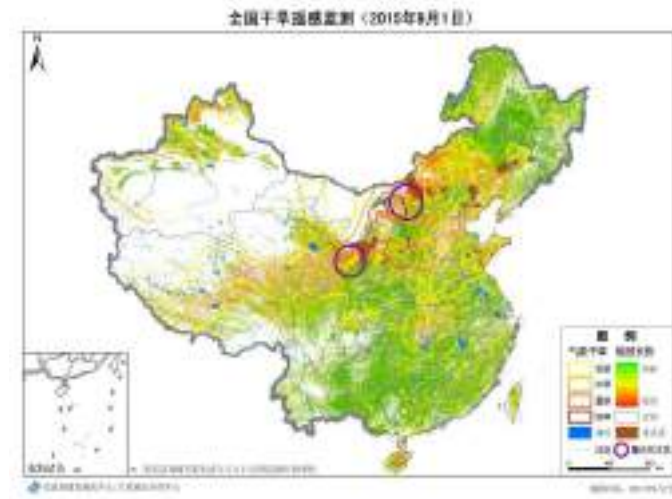
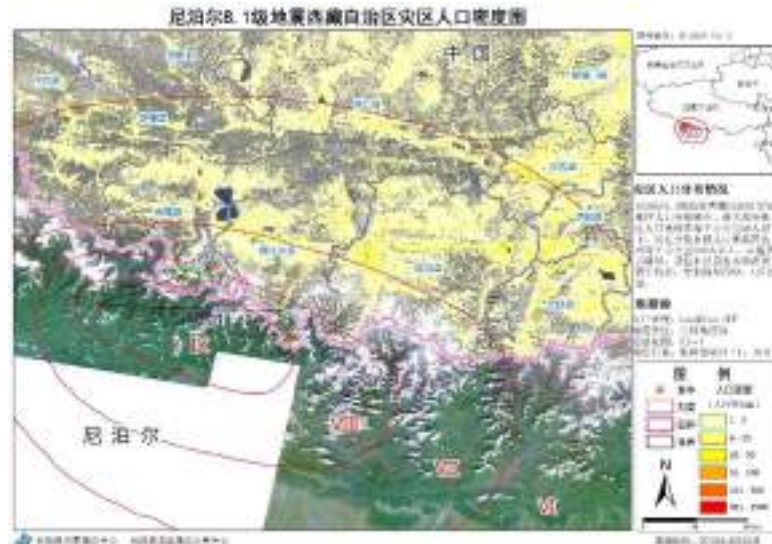
The products distributed for the rapid mapping activity are created in the best of our ability within a very short time frame optimizing the material available.

Map produced on July 23, 2014 by FEMA/OC

Office of the National Committee for Disaster Reduction

National Disaster Reduction Center of China





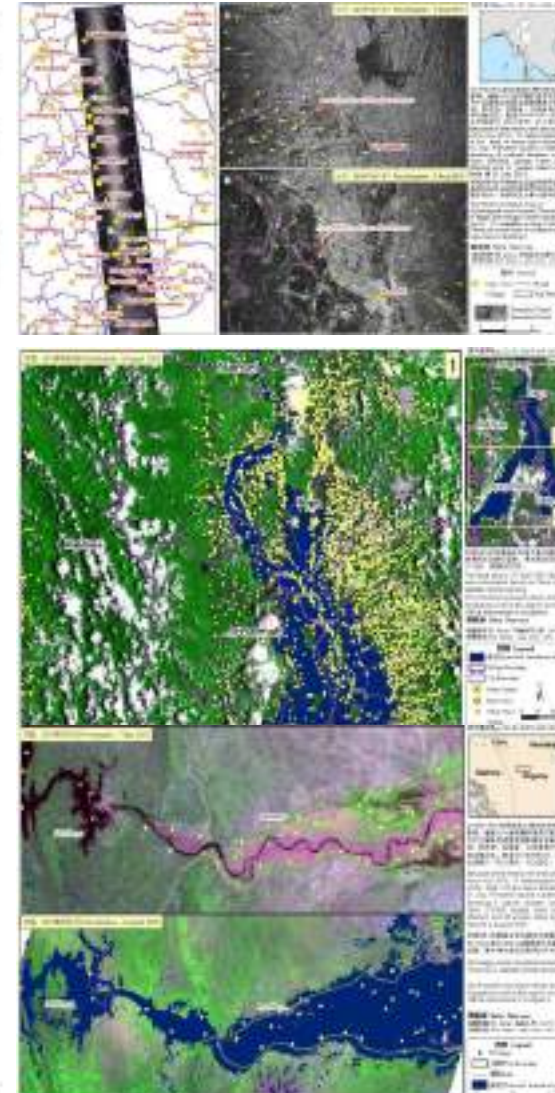
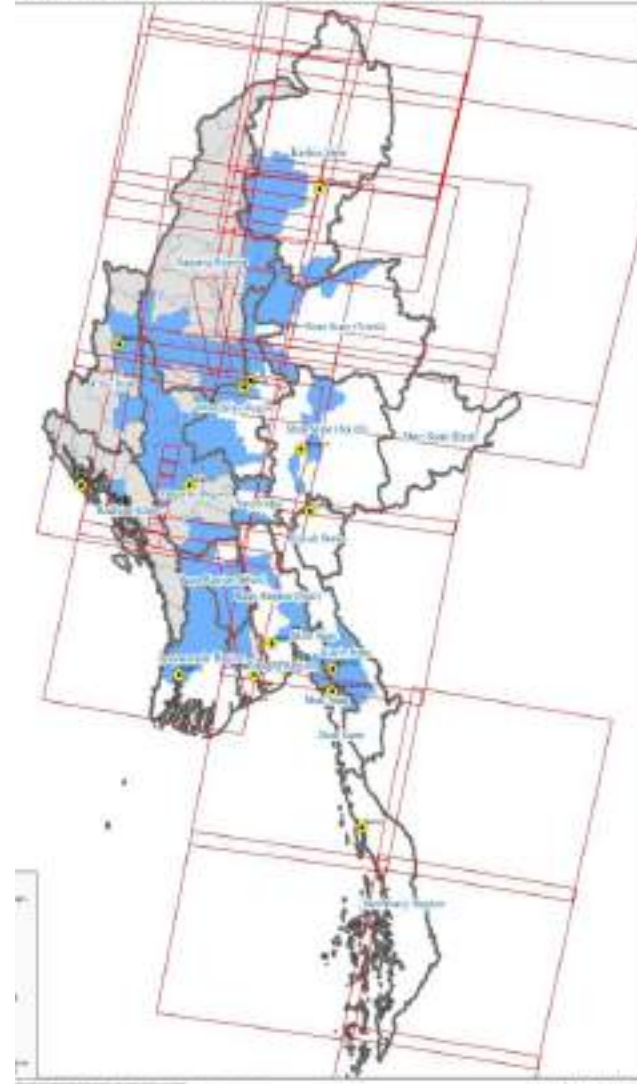




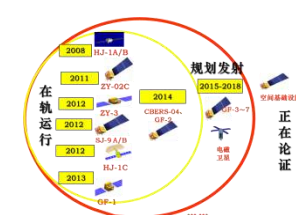
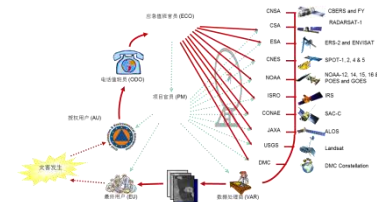
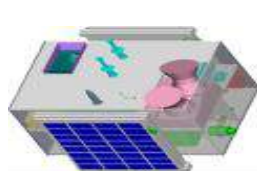
缅甸2015年洪涝灾区灾前影像图  
113-1 Satellite Remote Sensing Pre-Flood Image of Myanmar



缅甸洪涝灾区遥感影像覆盖范围图  
Coverage of Remote Sensing Images for the Flood Monitoring in Myanmar







## Space-based Resources (EO satellites, Airborne image, Geo-information and other data)

Hazard and exposure monitoring

Risk assessment

Dynamic Damage Assessment

Disaster Emergency Response

Recovery monitoring

Reconstruction Monitoring

Disaster prevention and preparation

Emergency Response

Reconstruction and recovery





## Space-based Information Products for Disaster Management

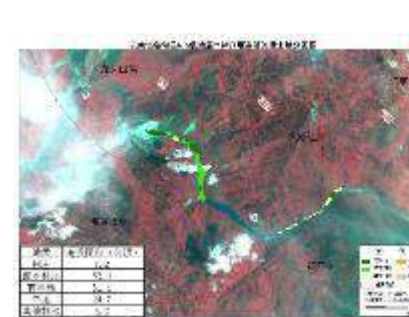
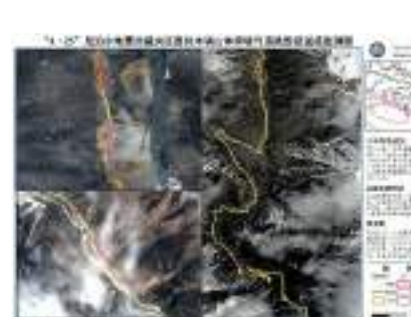
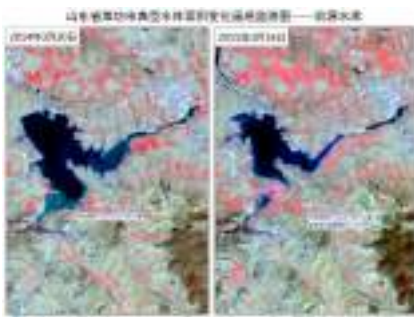
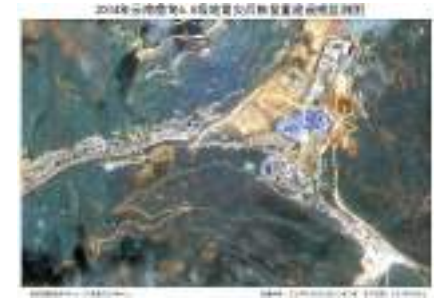
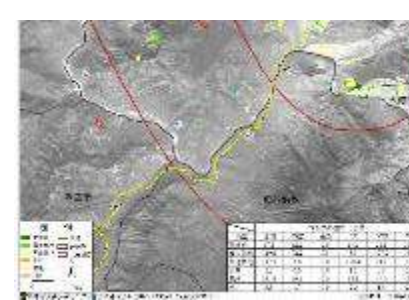
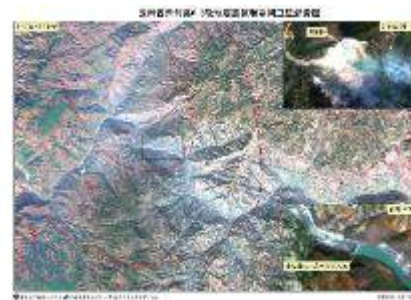
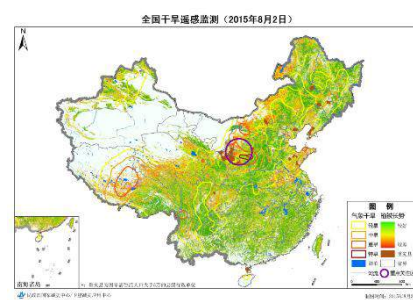
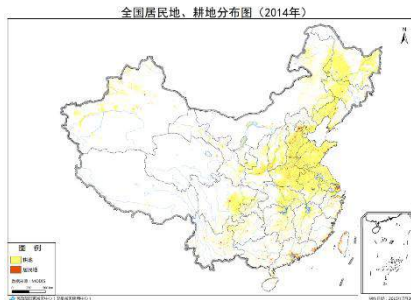
Risk Element  
Monitoring

Risk Assessment

Emergency  
Monitoring

Damage  
Assessment

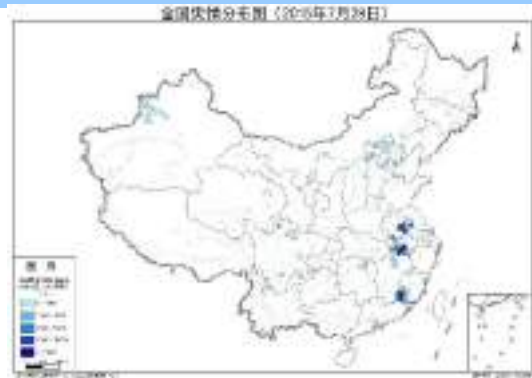
Recovery &  
Reconstruction  
Monitoring







# Daily Disaster Monitoring

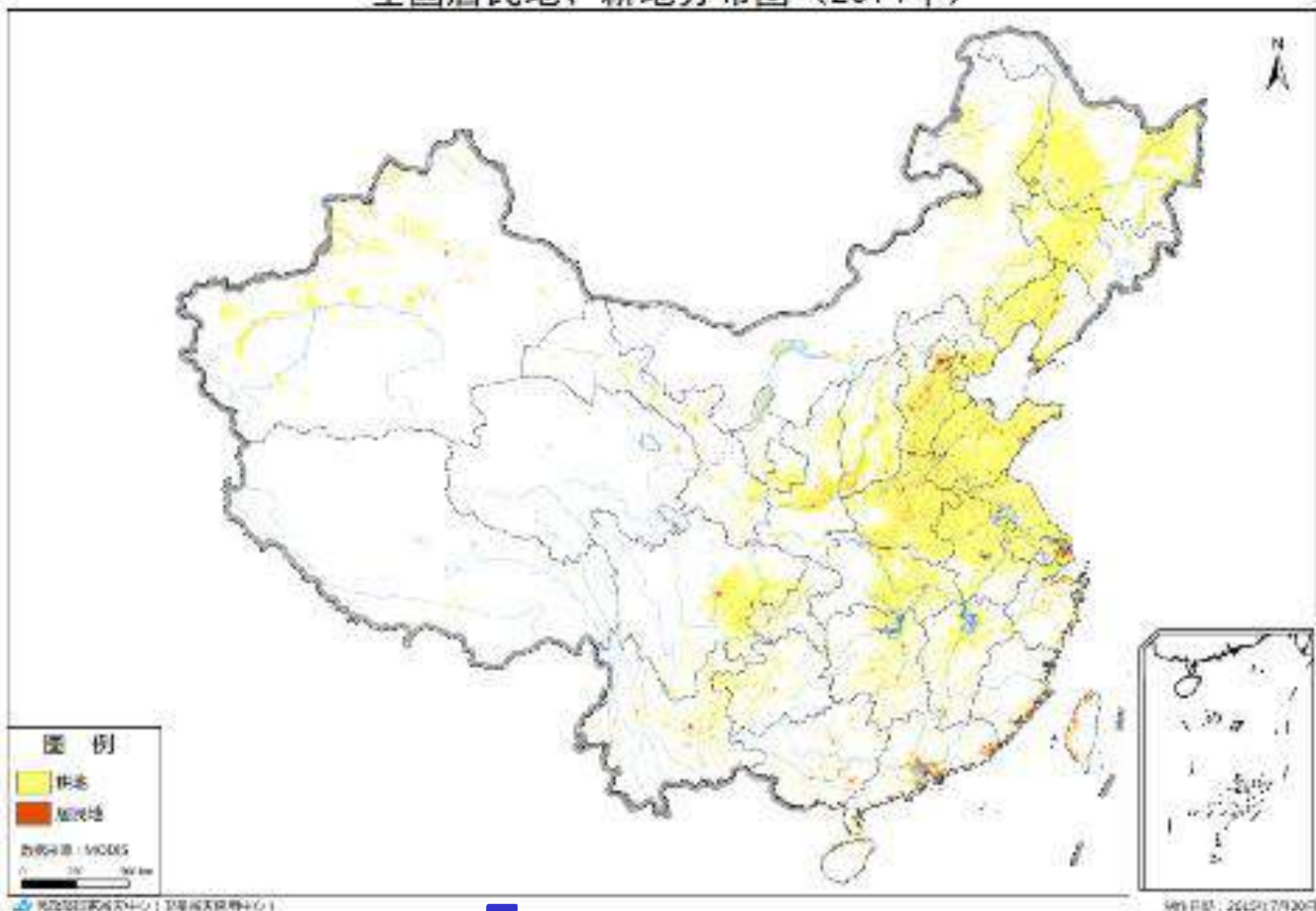




# Risk Element Monitoring

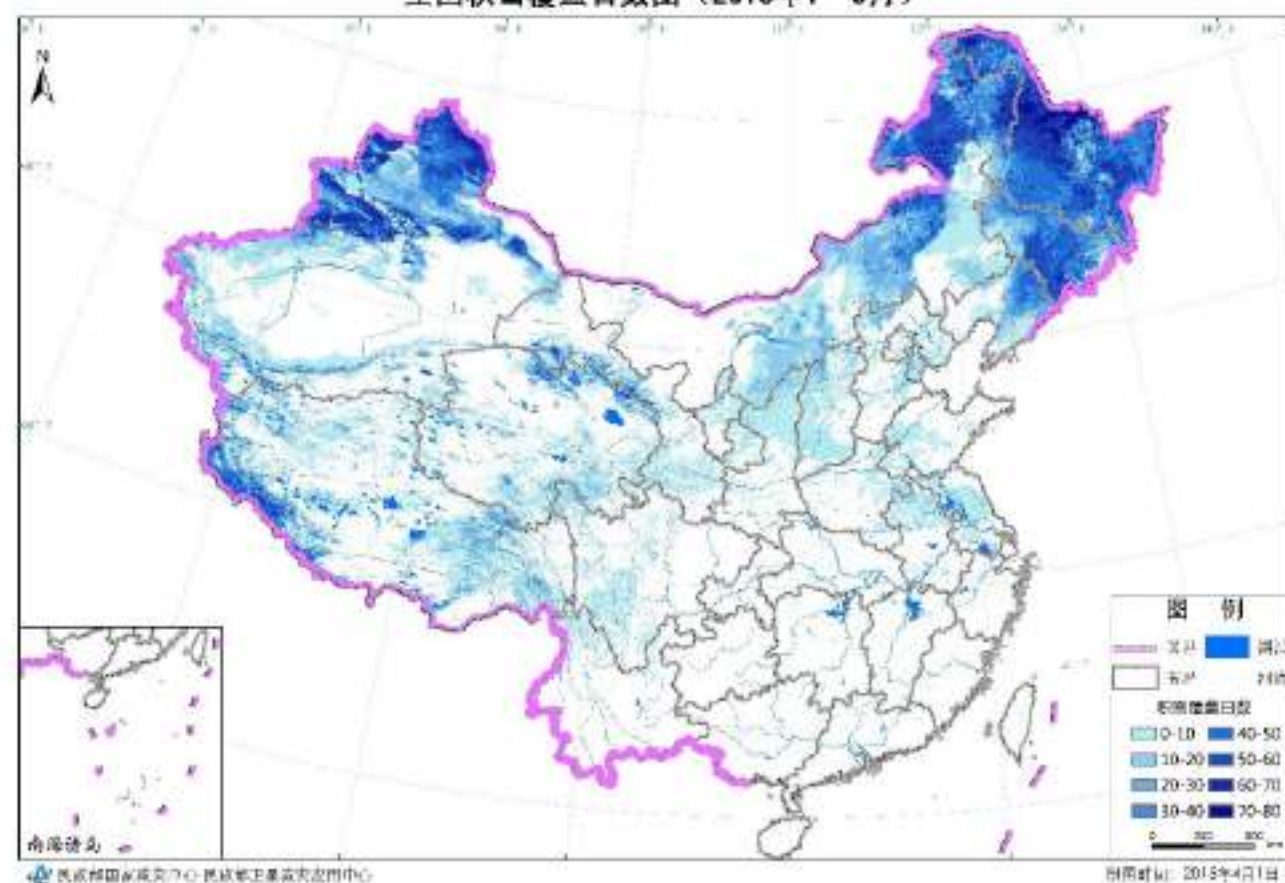


全国居民地、耕地分布图（2014年）



Exposure

全国积雪覆盖日数图（2015年1—3月）



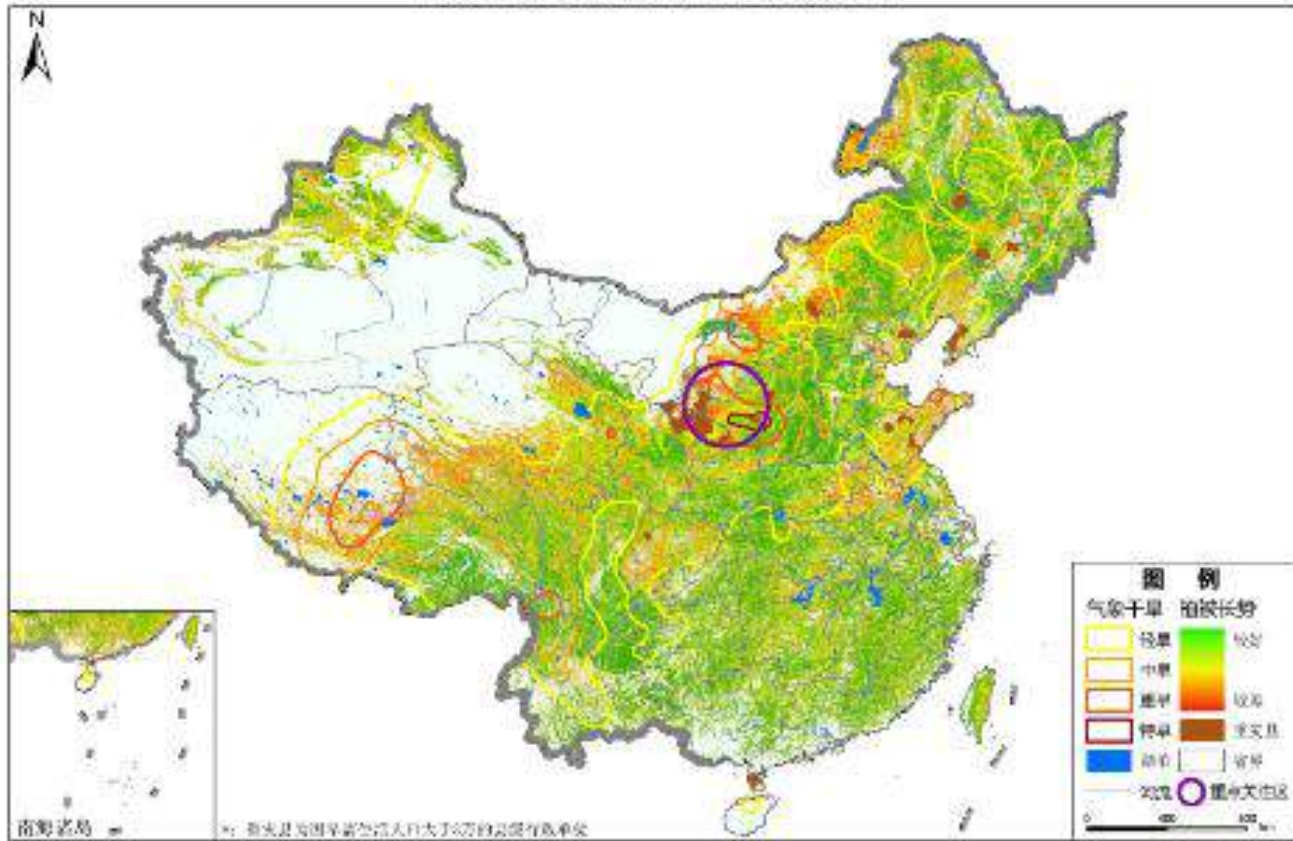
Hazard



# Risk Analysis and Assessment

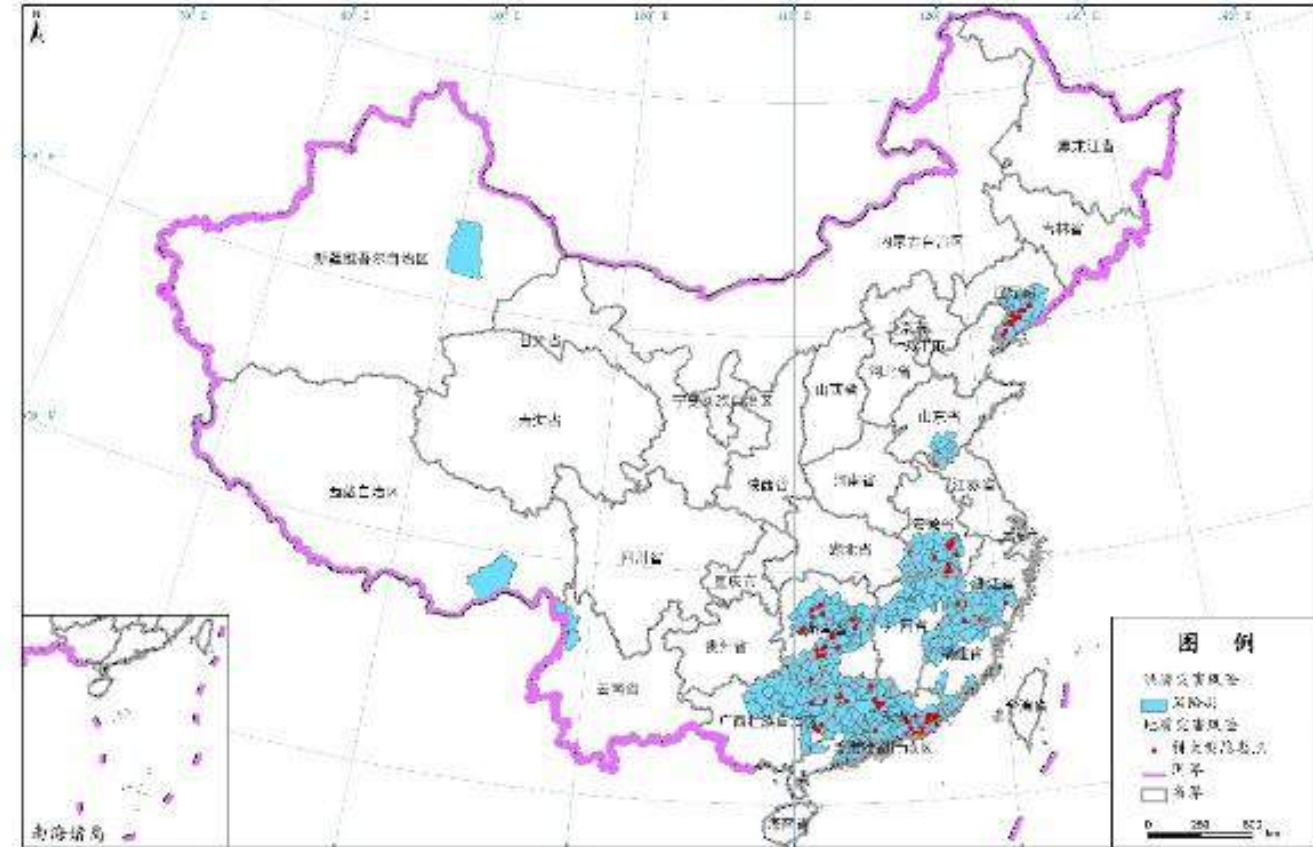


全国干旱遥感监测 (2015年8月2日)



Drought Risk Analysis

全国洪涝、地质灾害风险分布图 (2014年5月9日-11日)



Flood Risk Assessment



# Emergency Monitoring



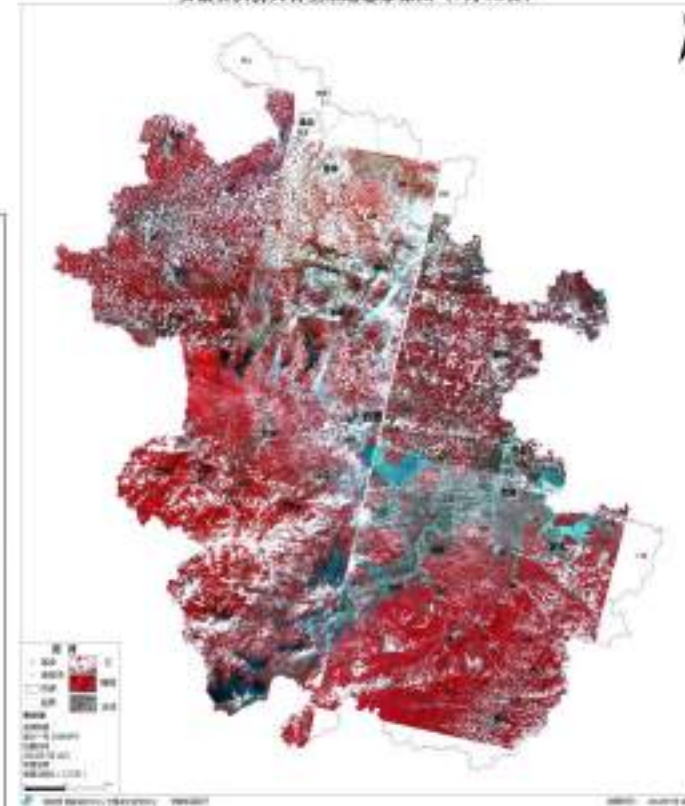
湖南省高分四号卫星遥感影像图(7月24日)



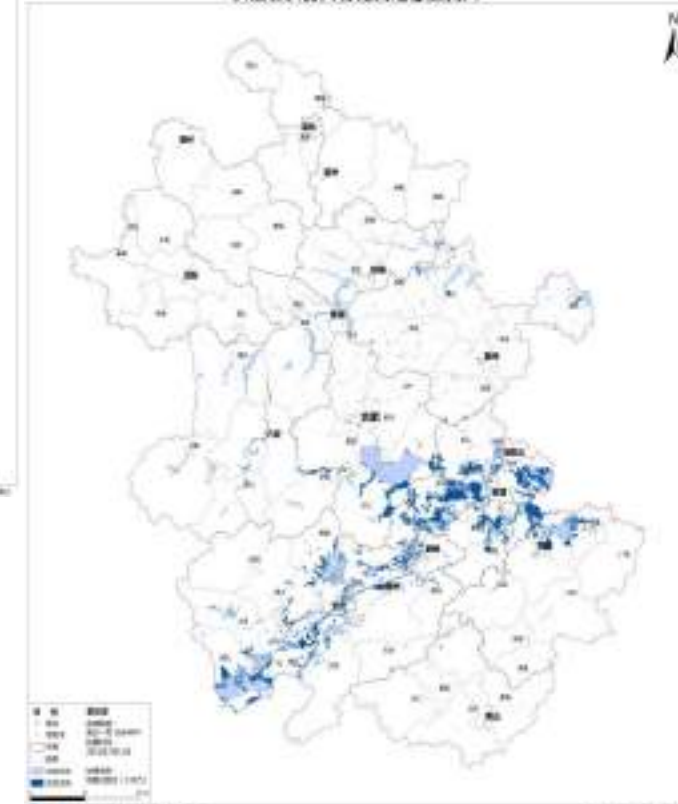
湖南省洪涝灾害范围遥感监测图(7月24日)



安徽省洪涝灾害卫星遥感影像图 (7月12日)



安徽省洪涝灾害范围遥感监测图



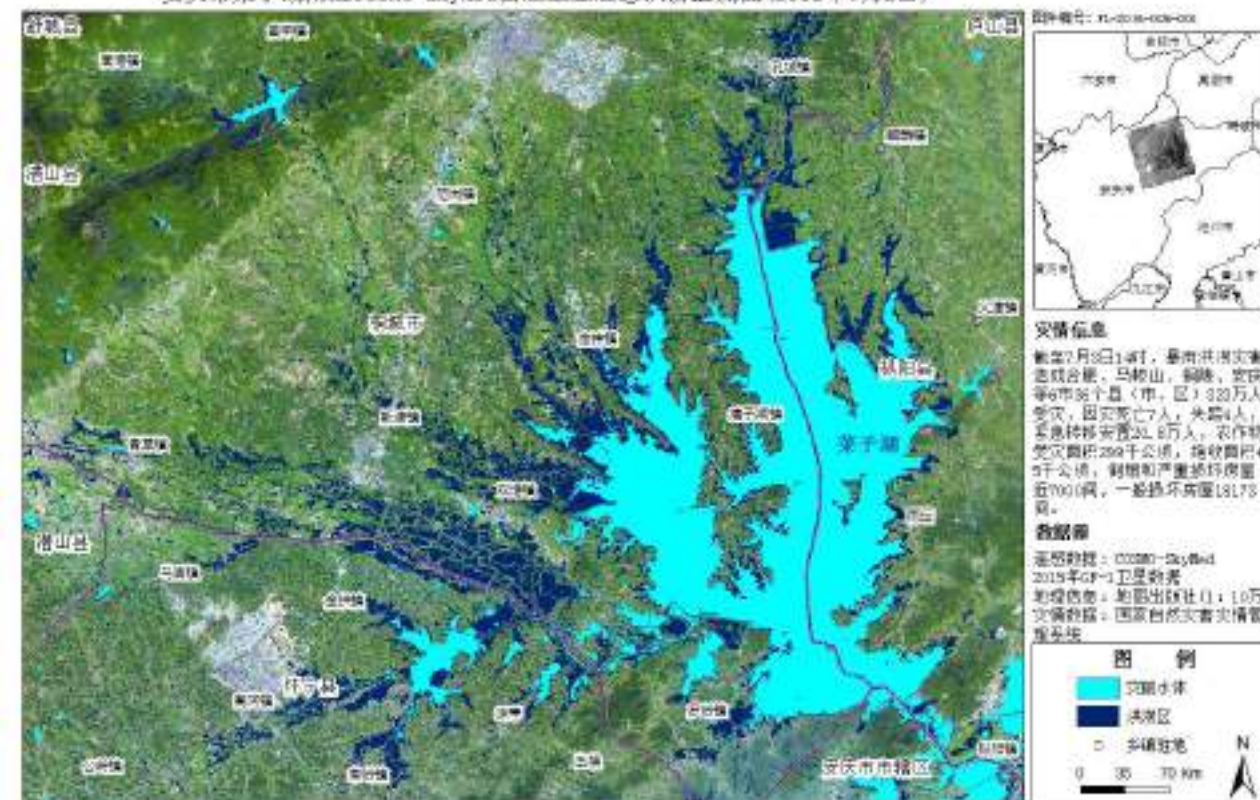




2016年6月16日江西洪涝国家Ⅳ级救灾应急响应遥感信息监测产品  
江西省鄱阳县洪涝灾区滨田水库溃坝北京二号遥感监测图

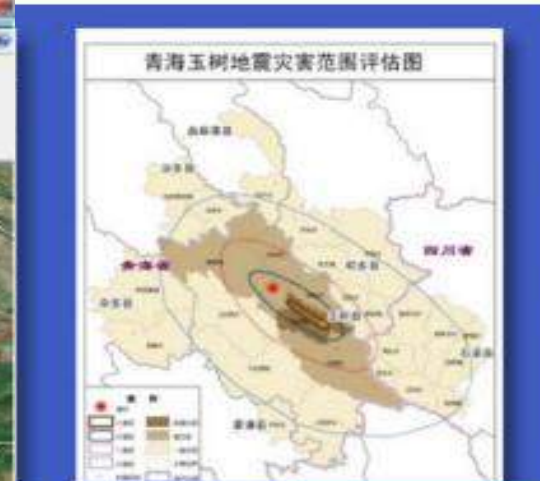
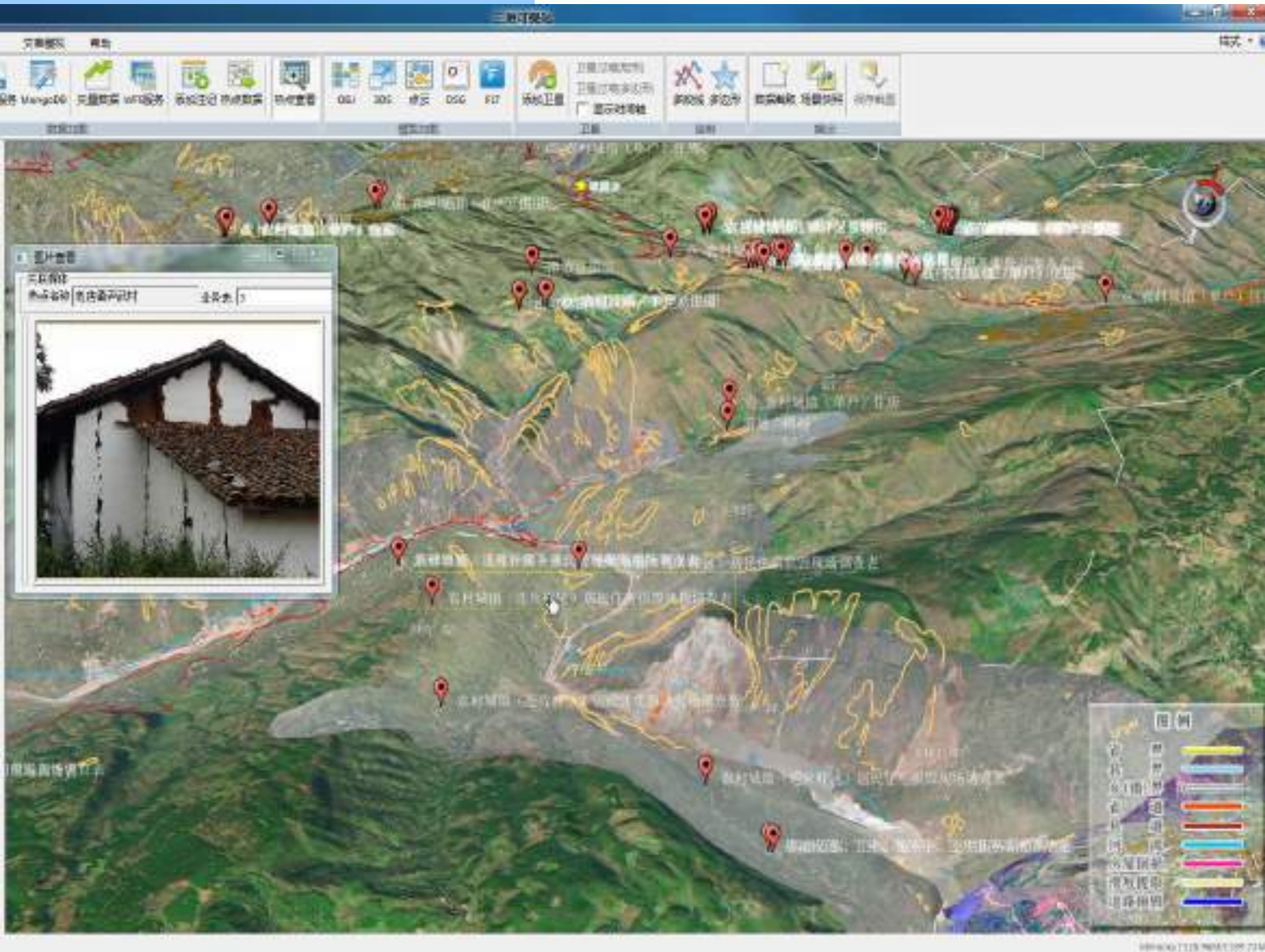


2016年7月3日安徽洪涝国家Ⅳ级救灾应急响应遥感信息监测产品  
安庆市菜子湖附近COSMO-SkyMed雷达卫星遥感洪涝监测图(2016年7月2日)





# Comprehensive Damage Assessment

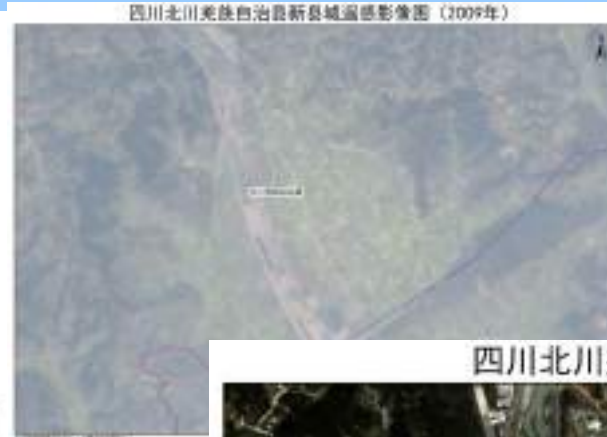




# Reconstruction and Recovery Monitoring



四川北川老县城地震遗址高分二号遥感影像图



四川北川羌族自治县新城遥感影像图 (2009年)

四川北川羌族自治县新城高分二号遥感影像图





唐山市区遥感影像图（1976年）



## Reconstruction and Recovery



# content



- ❖ **Disaster and Emergency Response**
- ❖ **Satellite-base emergency mapping**
- ❖ **Conclusion and Perspectives**





# Conclusion



- ❖ Increasing satellite resources: from data driven to user driven; From Charter satellites dominant to domestic satellites dominant.
- ❖ Expanding mapping dimension: from static to dynamic; from catastrophe to all response; from sample points/areas to whole disaster area coverage; from 2D to 3D;
- ❖ Strengthening supporting capability: from support post major disaster response to support whole disaster management cycle
- ❖ Standardizing mapping : SOP, product;
- ❖ Existing Challenges: mega data processing, automatic analyzing, multi-sourced data integrating, new innovative sensor interpreting, .....





# Perspectives



- ❖ Synergy and collaborative: dynamic observing, processing, analyzing and serving;
- ❖ Innovation: new sensor; tools; working modalities; methodologies;
- ❖ Inclusive and cooperation: open source at Global level;
- ❖ Crowdsourcing --- Breakout session 3: Crowdsourcing Mapping for risk assessment and emergency response Time: 20th September 2016, 14:00-17:00 Venue: Hibiscus room, 3rd floor



# 灾害遥感专题

DISASTER REMOTE SENSING



国家减灾中心

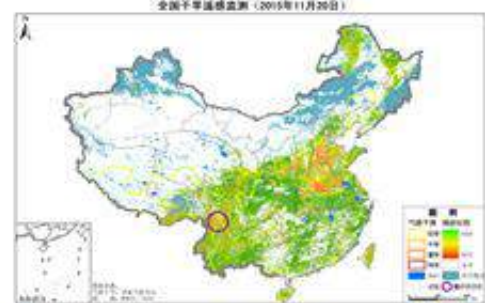
## 遥感平台

国家减灾中心遥感平台



## 灾害监测

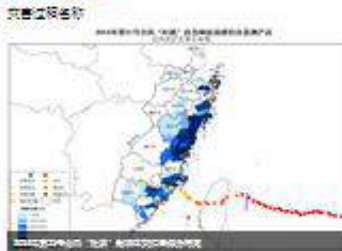
国家减灾中心灾害监测平台



国家减灾中心灾害监测平台

## 应急响应

国家减灾中心应急响应平台

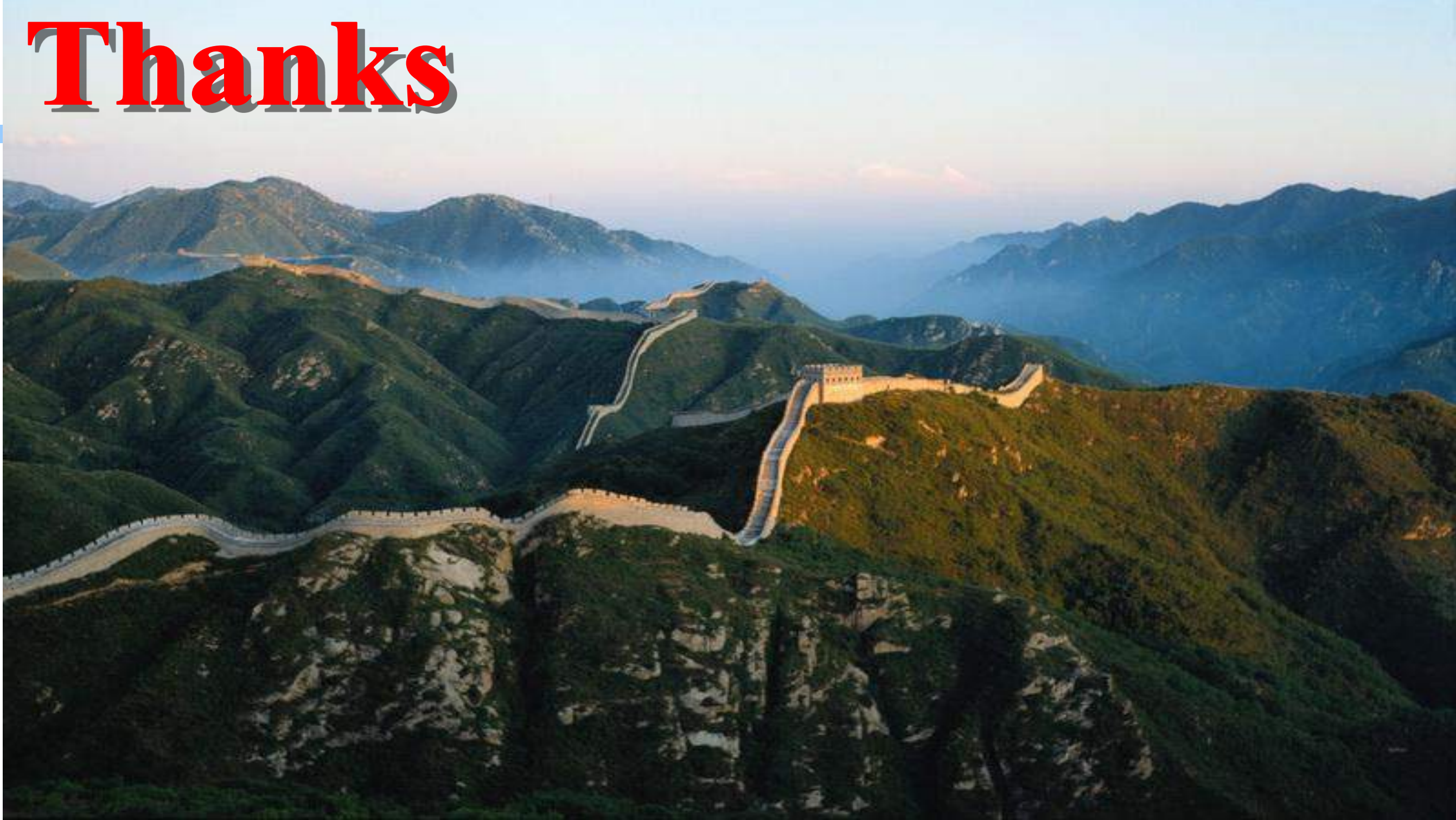


国家减灾中心（卫星减灾应用中心）

❖ <http://www.jianzai.gov.cn//DRpublish/ztz/000100060005-1.html>







**Thanks**