高分辨率对地观测系统在灾害监测与评估信息服务中的应用

Application of High Resolution Earth Observation System on the Disaster Monitoring and Assessment

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14 September 2015

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   Introduction of High Resolution Earth Observation System (HREOS)
2. 高分灾害监测与评估信息服务技术与系统
   Technology and system of Disaster Monitoring and Assessment by HREOS
3. 高分辨率对地观测系统减灾应用实践
   Application of HREOS on Disaster Reduction

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1. 高分辨率对地观测系统简介
INTRODUCTION OF HIGH RESOLUTION EARTH OBSERVATION SYSTEM (HREOS)

1. 高分辨率对地观测系统简介
Introduction of HREOS

高分辨率对地观测系统是16个国家重大科技专项之一，计划2020年建成，将形成全天候、全天时、全球覆盖的对地观测能力，为现代农业、防灾减灾、资源环境、公共安全等提供信息服务和决策支持。

HREOS, one of 16 major national S&T projects, will form the all-weather condition and global coverage EO for agriculture, disaster reduction, resources and environment.

Satellite	Payload	Feature	Launch time	Application
Gaofen-1	Multi-spectral camera	Spatial Resolution：8m/16m（V-NIR），2m（PAN）；Swath Width：800km（16m），60km（2m/8m）	26 April 2013	Land Resource, Agriculture, Environment, etc.
Gaofen-2	Multi-spectral camera	Spatial Resolution：1m（V-NIR），1m（PAN）；Swath Width：45km	19 August 2014	Land Resource, Transportation, Forest, etc.
Gaofen--3	SAR	Spatial Resolution: 1m，C Band，Multi-polarity SAR	2016-2020 (Planned)	Ocean, Disaster Reduction, Meteorology, etc.
Gaofen--4	Fixed continued observation	Geosynchronous orbit；Spatial Resolution: 50m.	2015 (Planned)	Disaster Reduction, Meteorology, Earthquake, Forest, etc.
Gaofen--5	Hyperspectral	High Spectral Resolution	2016-2020 (Planned)	Environment, Land Resources, etc.
Gaofen--6	Multi-spectral camera	Spatial Resolution：8m/16m（V-NIR），2m（PAN）；Swath Width：800km（16m），60km（2m/8m）	2016-2020 (Planned)	Agriculture, Forest, Disaster Reduction, etc.
Gaofen--7	Multi-spectral and PAN camera	High Resolution 3D Mapping	2016-2020 (Planned)	Mapping

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1. 高分辨率对地观测系统简介
Introduction of HREOS

高分一号卫星（Gaofen-1）

高分天基系统首发星

每天成像8轨，800km大范围观测能力为国际同类卫星最高水平

First Satellite of HREOS

Wide observation capabilities

Orbit	Sun-synchronous orbit
Altitude	645km
Inclination	98.0506°
Descending node (Local time)	10:30AM
Spatial Resolution	8m/16m（MSS），2m（PAN）
MSS	Blue/Green/Red/NIR
Swath Width	60km（2m/8m Camera ×2），800km（16 Camera ×4）
On-board capacity	1Tb
Repetition cycle	4 days（Side looking）
Covering Cycle	41 days
Design Life	5-8 years
Launch	16 April 2013

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1. 高分辨率对地观测系统简介
Introduction of HREOS

高分二号卫星（Gaofen-2）

我国首颗民用亚米级卫星

具有高辐射精度、高定位精度和快速姿态机动能力等特点。

High precision radiation, High positioning accuracy, rapid attitude maneuver ability.

Orbit	Sun-synchronous orbit
Altitude	631km
Inclination	97.9080°
Descending node (Local time)	10:30AM
Side-looking ability	±35°
Spatial Resolution	4m（MSS），1m（PAN）
MSS	Blue/Green/Red/NIR
Swath Width	45km（2 Camera）
On-board Capacity	1Tb
Repetition cycle	5 days（Side looking）
Covering Cycle	69 days
Design Life	5-8 years
Launch	19 August 2014

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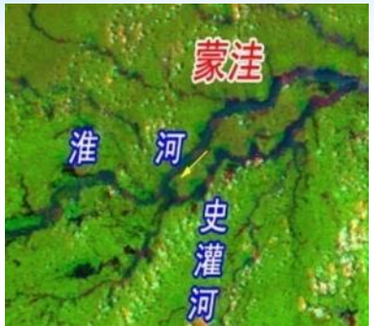
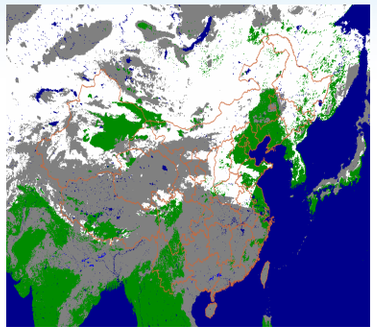
1. 高分辨率对地观测系统简介
Introduction of HREOS

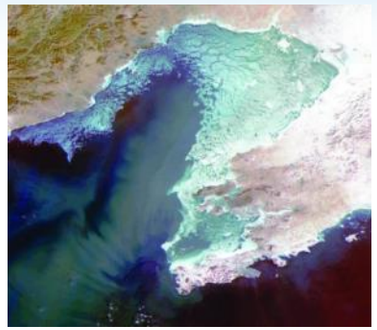
高分四号卫星（Gaofen-4）

我国第一颗民用静止轨道对地观测高分辨率光学遥感卫星，将在灾害风险普查、灾害范围快速监测、生态资源毁损和恢复等方面发挥重要作用。

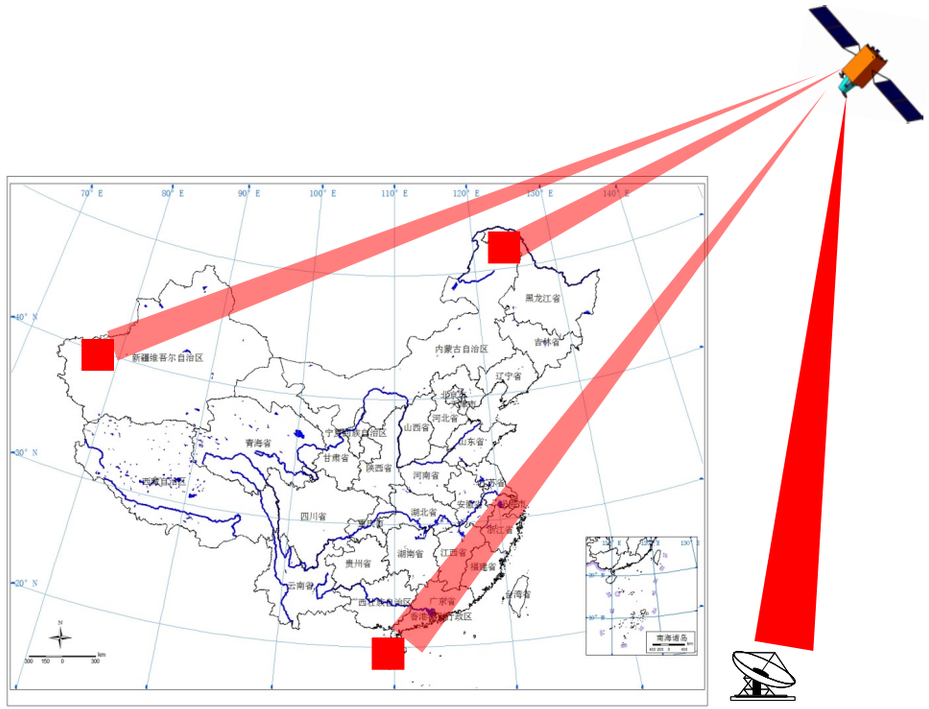
First Civilian geostationary orbit satellite with high resolution earth observation capacity, will play an important role in disaster risk analysis and rapid monitoring.







- 正圆形地球同步轨道 Geosynchronous orbit
- 覆盖面积大Wide Coverage
- 快速机动Rapid mobility
- 宏观同步动态观测Macro synchronous dynamic monitoring



卫星计划于2015年底发射，最高50m地面分辨率，可达到分钟级的快速重复观测，能够对固定区域进行持续凝视成像观测。

GF-4 is scheduled for launch by the end of 2015, which has spatial resolution of 50m and can achieve rapid repeated observations in minutes. It has the capacity for fixed continued observation.

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2. 高分灾害监测与评估信息服务技术与系统

TECHNOLOGY AND SYSTEM OF DISASTER MONITORING AND ASSESSMENT BY HREOS

高分灾害监测与评估信息服务技术总体架构
Structure of the Disaster monitoring and Assessment by HREOS

产品检验与评价子系统Products validation and evaluation

灾害监测与预评估
Disaster Monitoring and Predictive Assessment

灾情评估
Disaster Loss Assessment

产品标准

协同研判 Collaborative Judgment

多维可视化子系统 Multi-D Visible System

数据库管理子系统 Database Management

信息共享与服务子系统 Information Sharing and Service

高分运行管理平台（含关键技术）Operation Management

软硬件集成平台

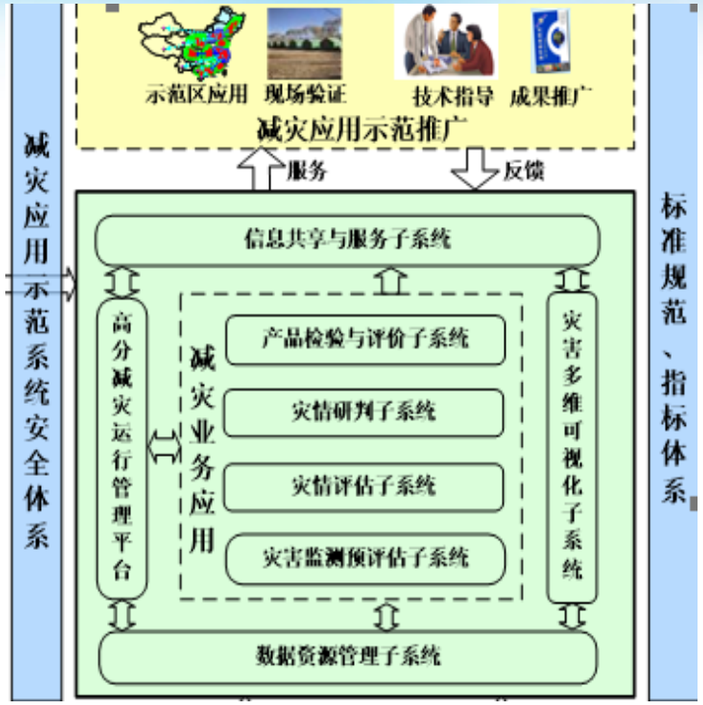
StorNEXT、VMWare、PlatForm etc.

存储资源 | 计算资源 | 网络资源 | 软件资源

系统集成标准规范

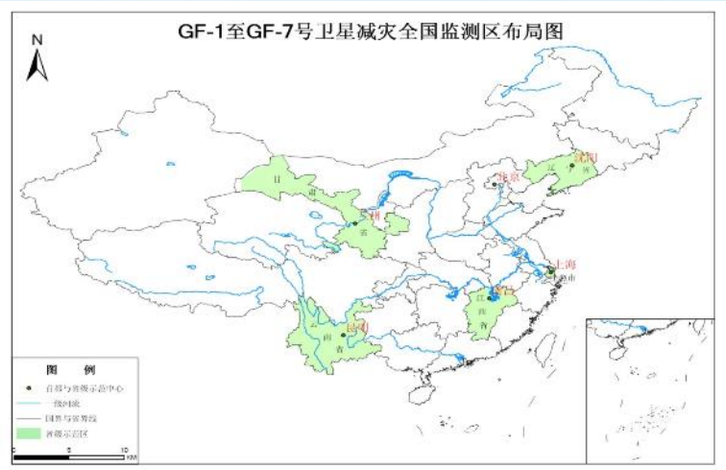
课题一 课题二 课题三

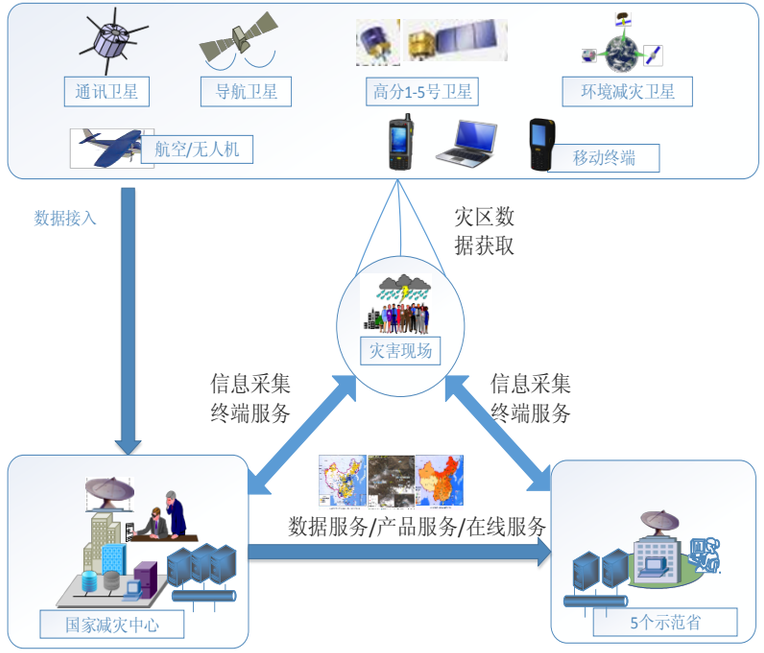
课题四 课题五 课题六



高分项目
Research on HREOS

产业化示范工程
Industrialization Demonstration Projects





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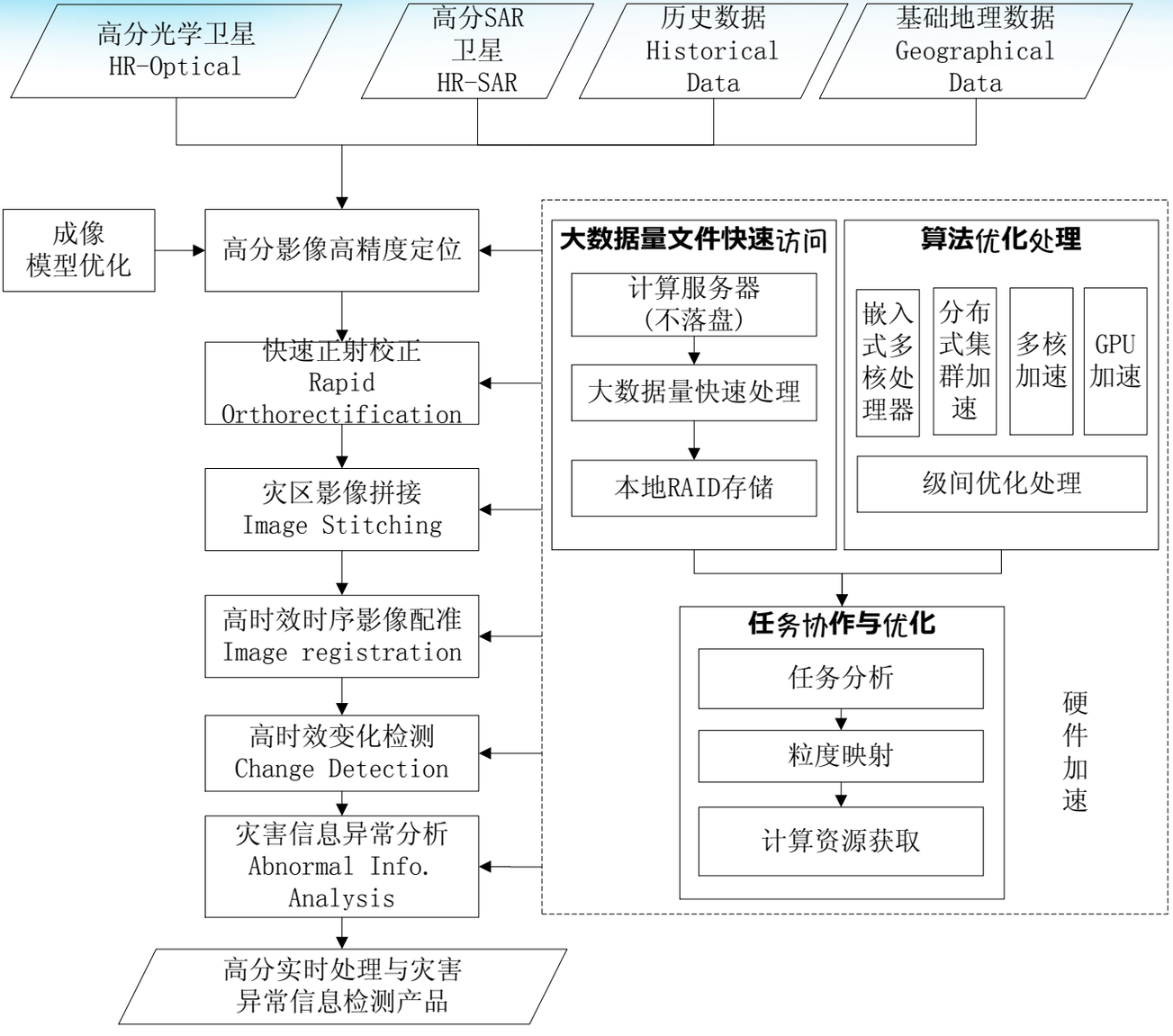
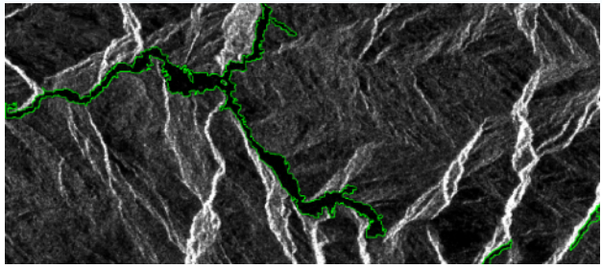
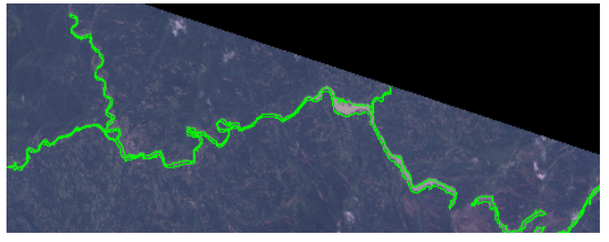
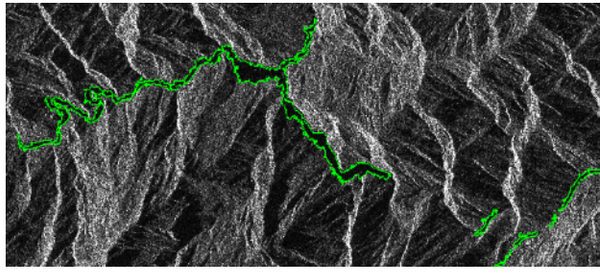
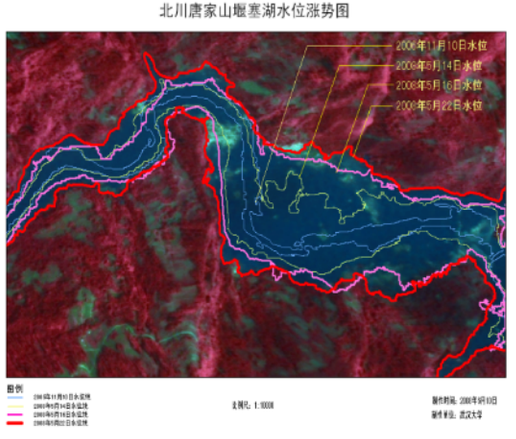
基于高时效遥感数据的灾害异常信息检测技术
Disaster Abnormal information detection based on RS images











多源数据实时接入的灾害过程模拟仿真技术
Disaster simulation based on Multi-information

多源异构动态观测数据 Multi-Resource Dynamic Data

统一语义描述模型 Unified Describe Model

领域无关的数据清洗 Data Clean

数据特征约束的模型语义匹配 Model semantic matching

模型语义感知的动态数据发现 Data extration

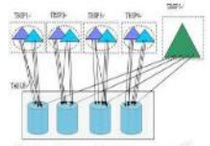
事件驱动的实时观测数据动态接入
Dynamic Access of Event-driven real-time observation

动态数据与模拟模型的耦合

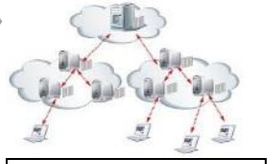
模拟参数动态率定 Para. Calibration

可控灾害过程模拟

动态数据驱动的灾害模拟
Disaster simulation



语义感知的数据组织

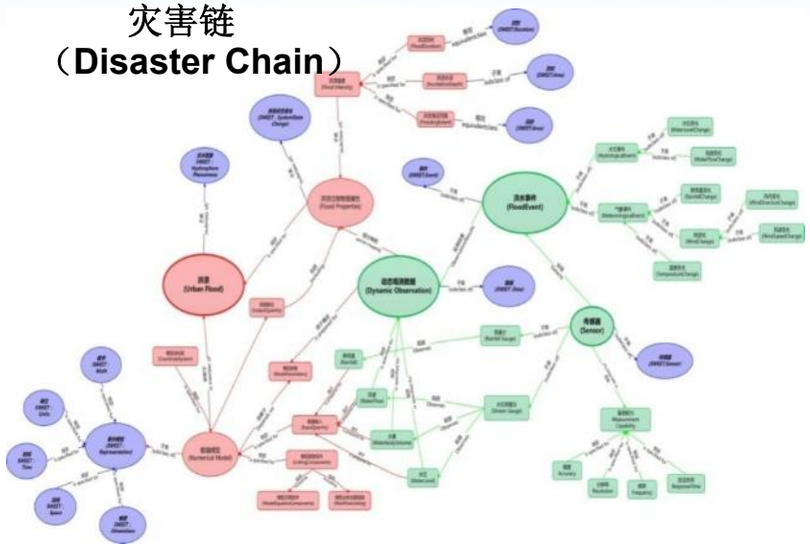


分布式数据存储与管理

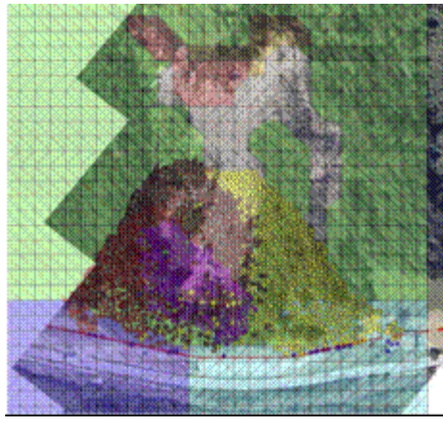
智能数据检索

语义感知的数据管理

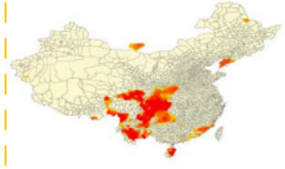
灾害链
（Disaster Chain）



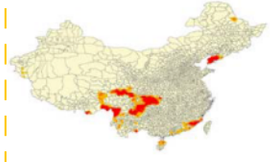
次生地质灾害
Secondary Disaster



旱灾Drought



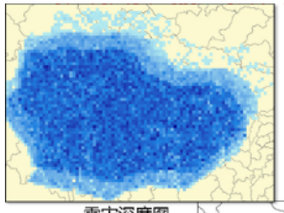
旱灾历时图



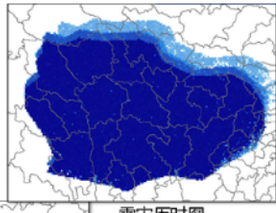
旱灾强度图

旱灾范围图

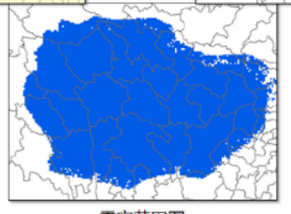
雪灾Snow



雪灾深度图

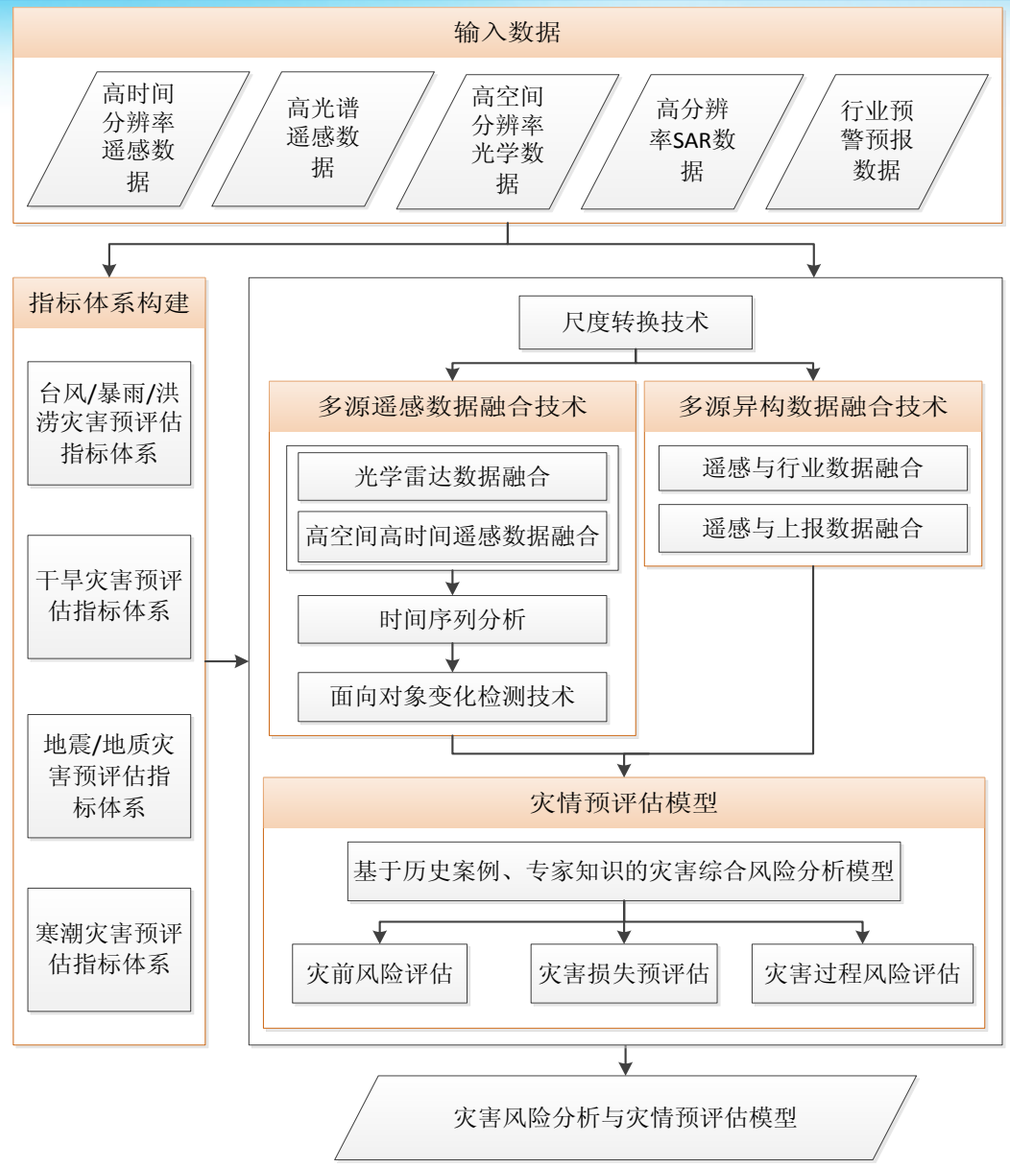


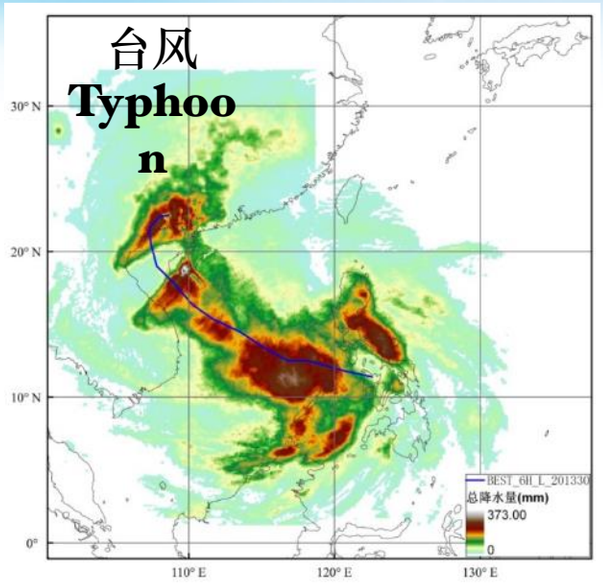
雪灾历时图

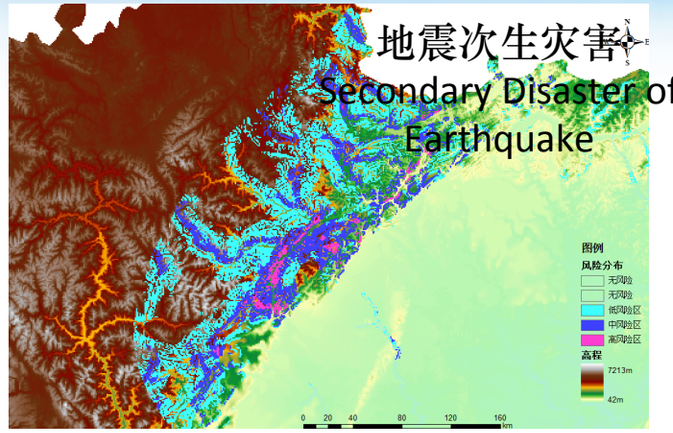


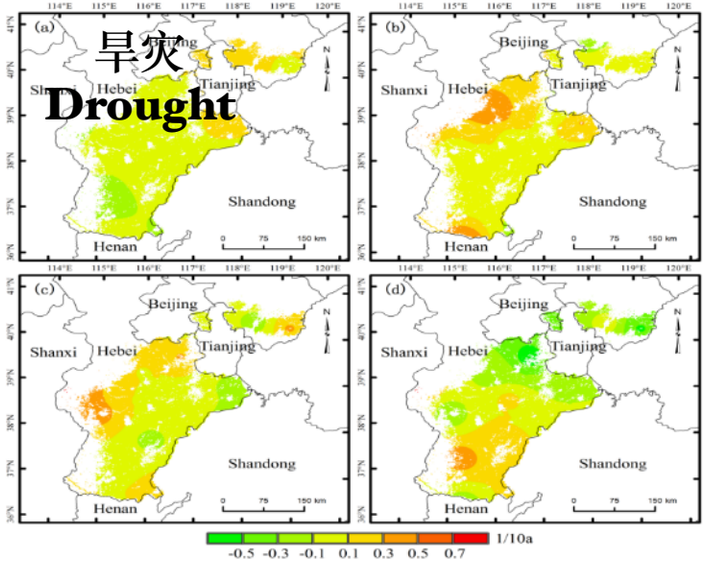
雪灾范围图

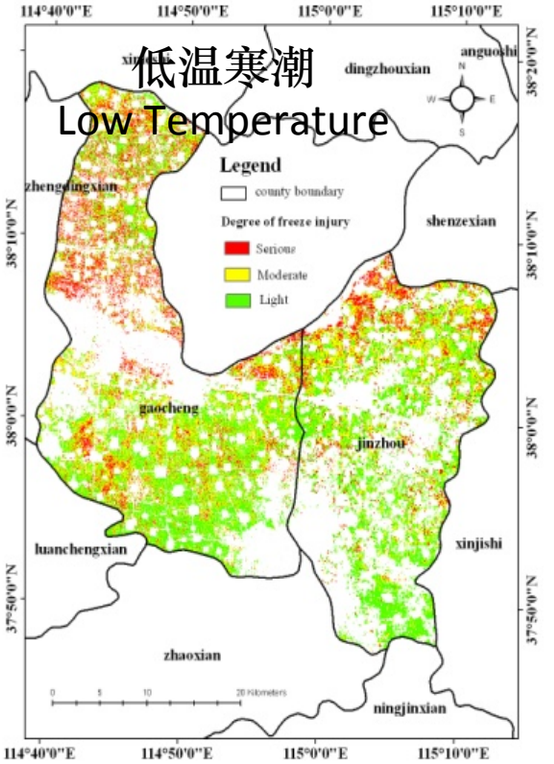
多源多尺度高分数据灾情预评估技术
Predictive loss assessment





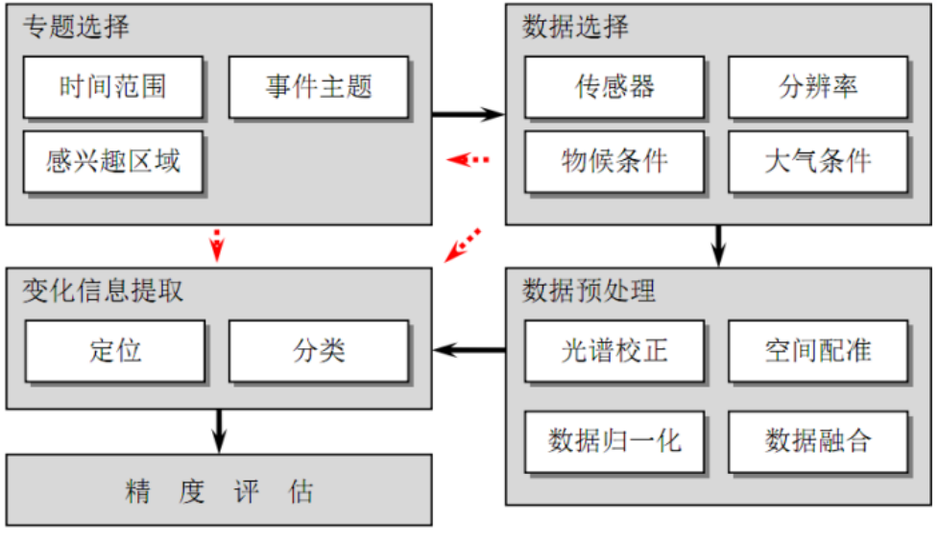






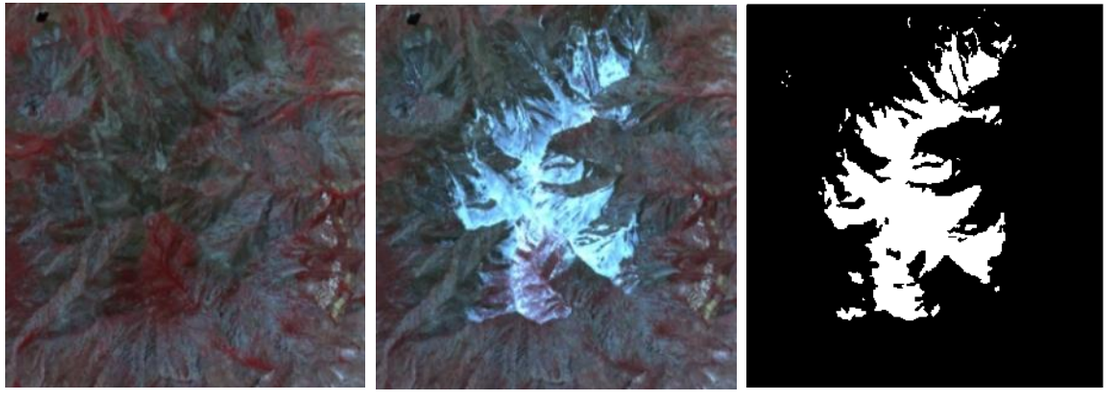
高分灾害目标智能识别与变化检测信息提取技术
Identification of disaster objects and change detection based on HREOS

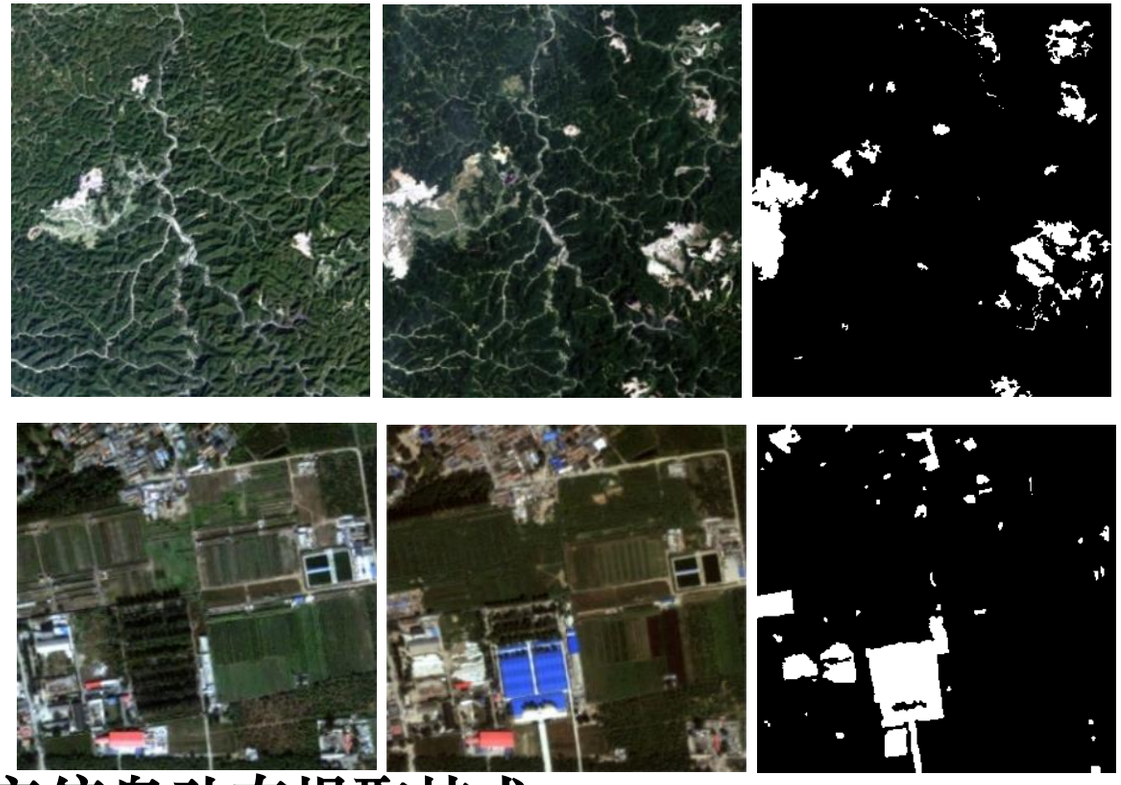
变化检测的一般步骤
Routine process



- 变化检测是灾变信息提取的基础，同时也是基于遥感的实物量评估的关键技术。

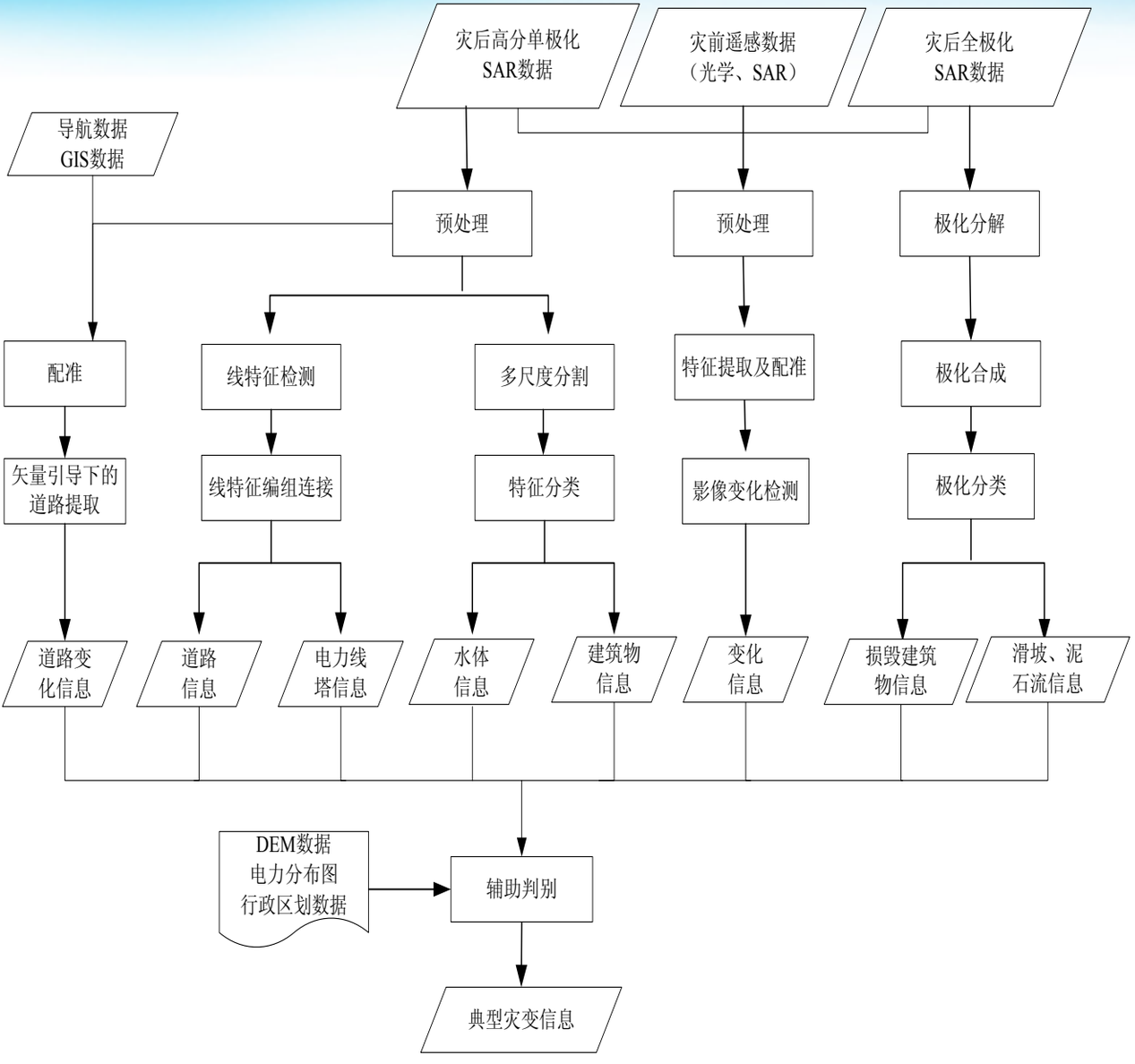
Change detection is basic for disaster information extraction, which is also the key technique for physical loss assessment by RS.



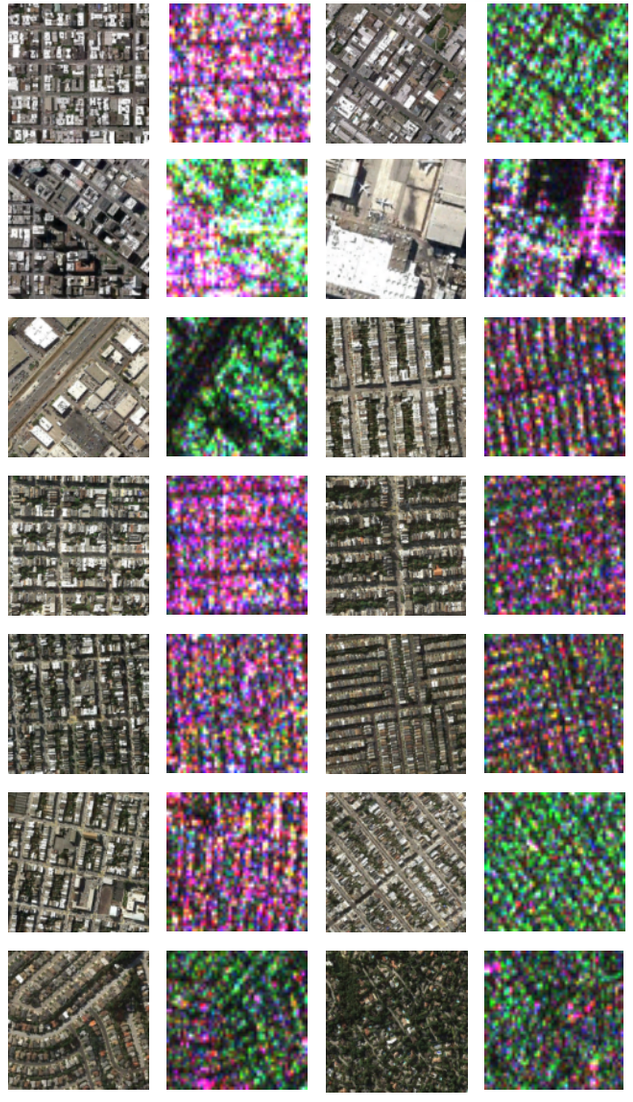


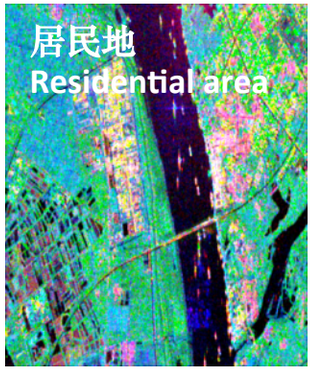
灾变信息动态提取技术 **Disaster dynamic extraction**

基于全极化SAR数据的灾害目标损毁信息提取技术
Damage Information Extraction from Full-polarization SAR



全极化SAR监测建筑物
Building in Full-polarization SAR





基于专家知识库的灾情综合研判技术
Comprehensive judgement based on export knowledge

灾情综合研判基础数据
Database

基础地理信息 Basic Geo-Info

历史灾情信息 Historical Data

多源遥感信息 Multi-RS

现场信息 Local Info

灾情信息现场动态加载与融合
Dynamic Upload and Integrated of Disaster Information

灾情综合研判核心技术体系 Key Technology in Comprehensive Judgment of Disaster Info.

致灾因子危险性分析及动态监测 Dynamic Hazard Monitoring

基于历史灾害信息的快速评估 Rapid assessment based on Historical Record

承灾体易损性及灾情评估 Vulnerability and Disaster assessment

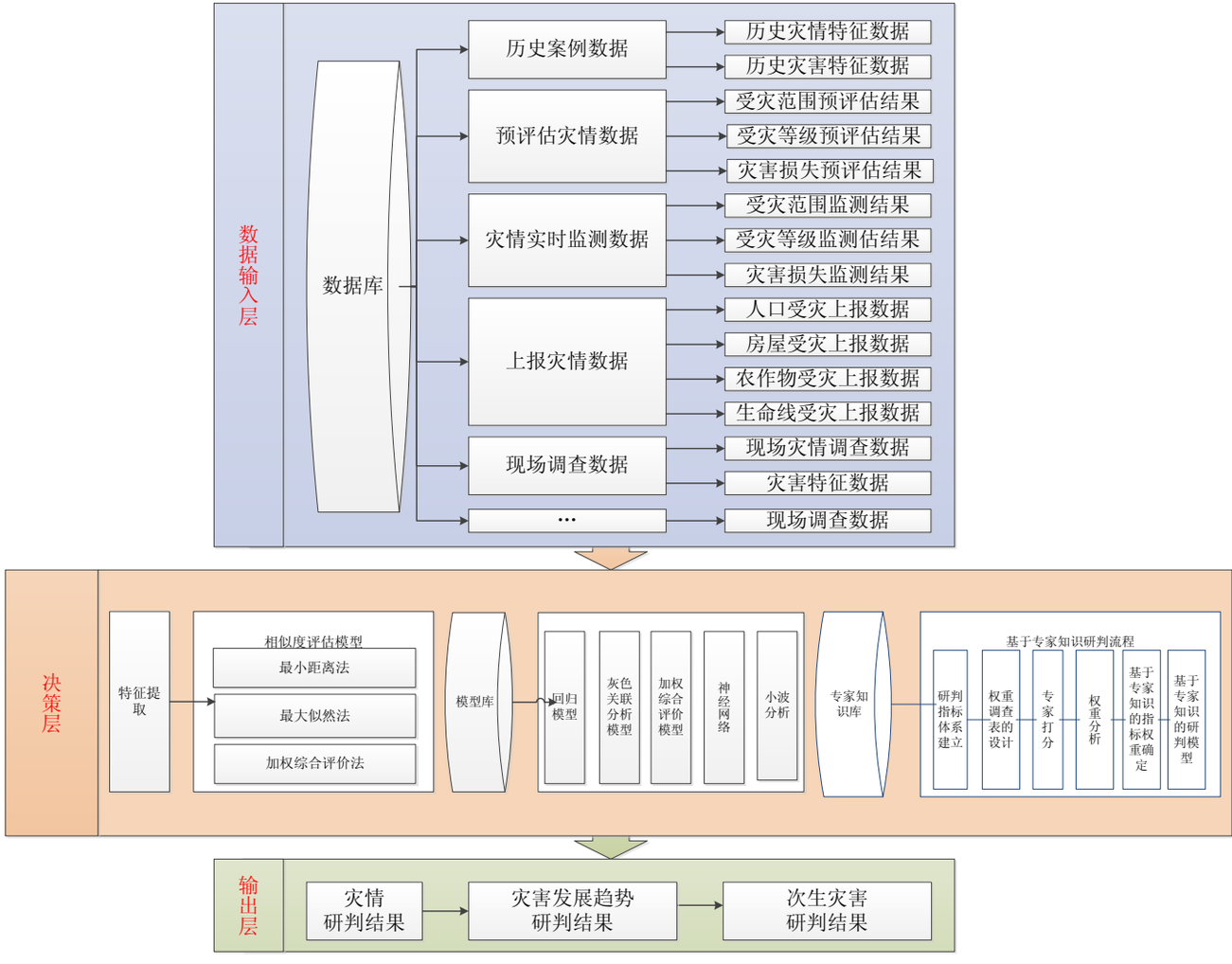
承灾体易损性及灾情评估

次生灾害风险分析 Secondary Disaster Risk Analysis

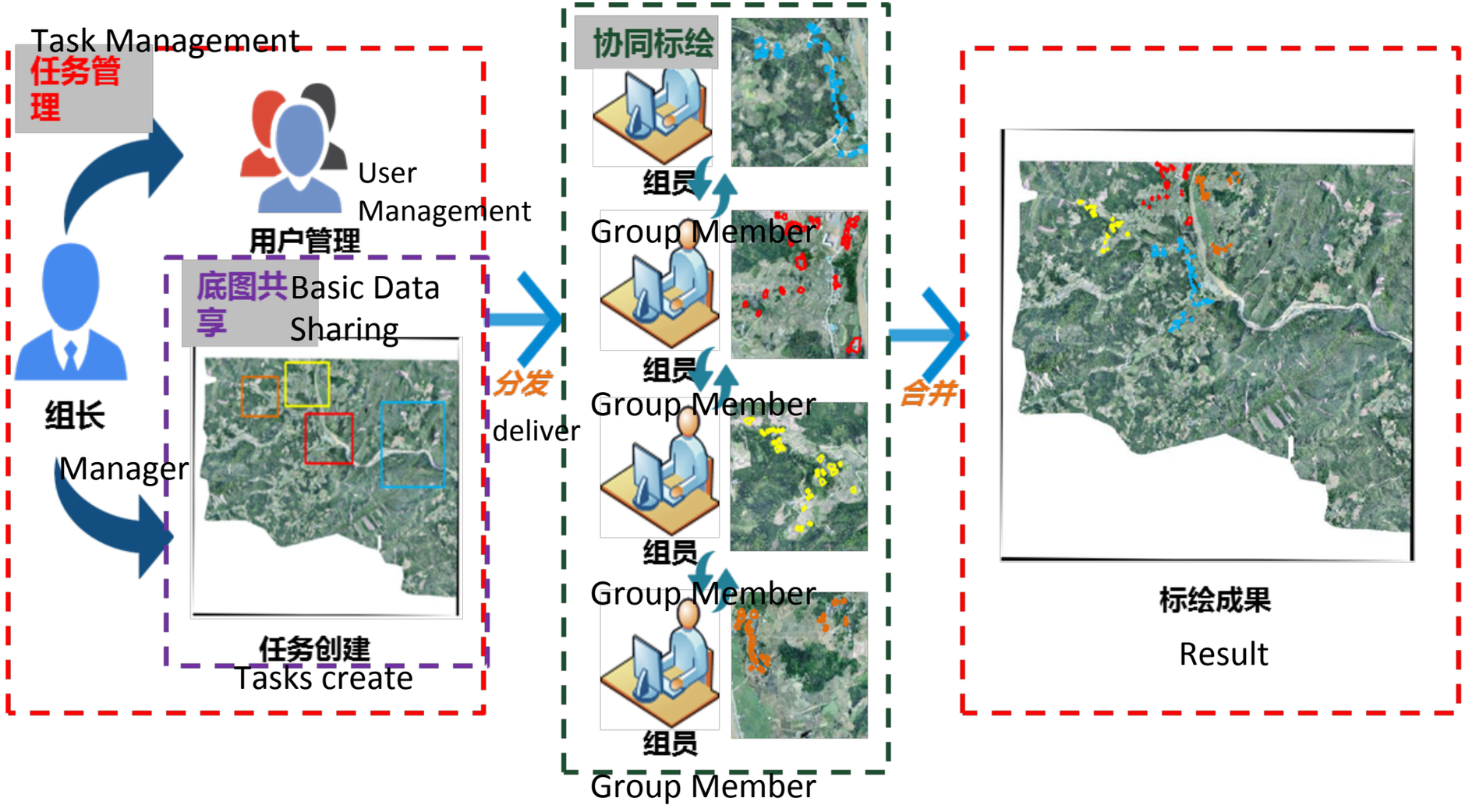
次生灾害灾情评估

灾情协同标绘与专家决策

承灾体易损性及灾情评估



协同标绘数据共享与一致性控制技术
Data sharing and consistency control technology for collaborated plotting



- **几何冲突** Geometry conflict
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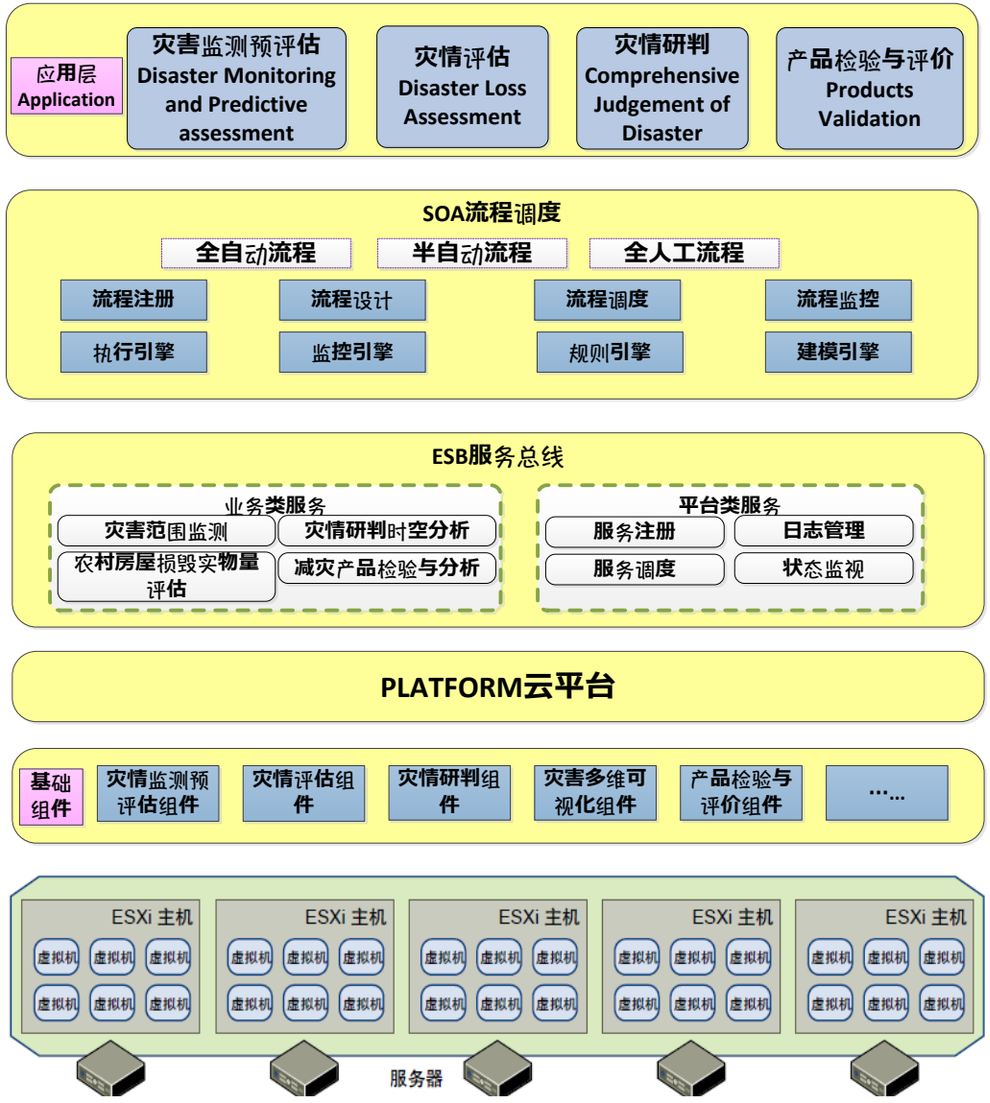
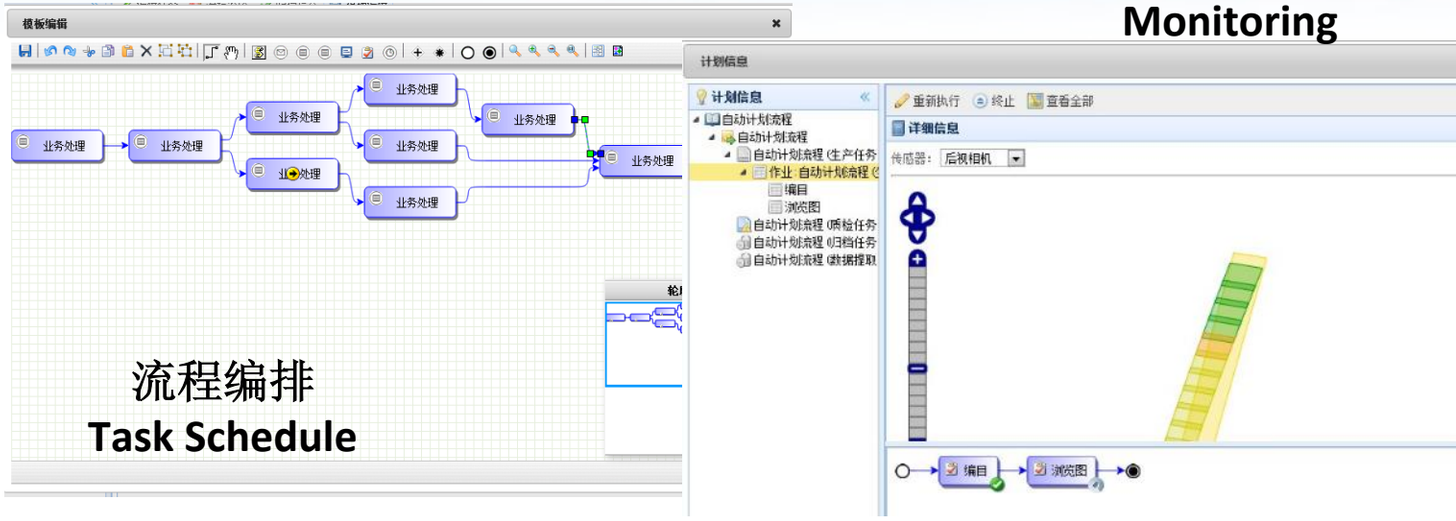
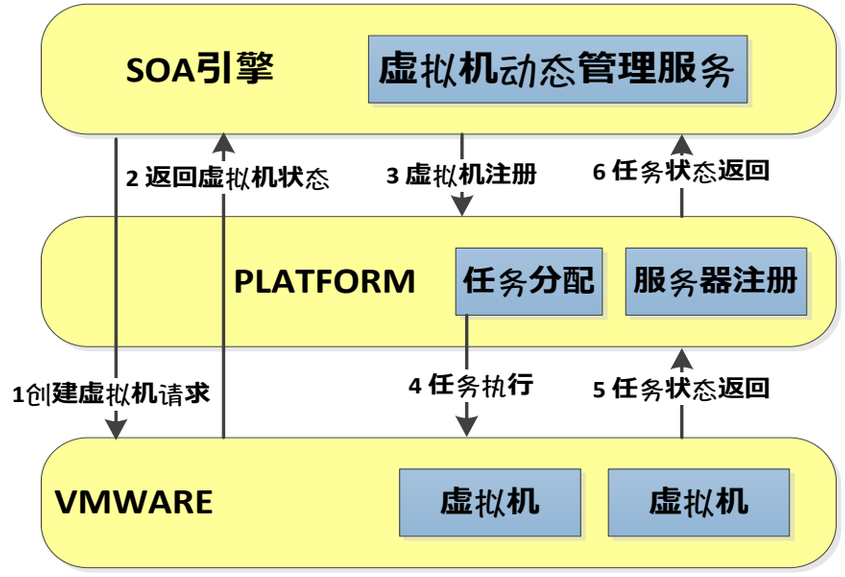
  - ✓ 算法不一致
  - ✓ 作业员不一致
- **属性冲突** Property conflict
  - ✓ 标准不一致
  - ✓ 算法不一致
  - ✓ 作业员不一致

减灾业务集成调度协同服务技术
Dispatch and collaboration of disaster management tasks



实时监控Real-time Monitoring





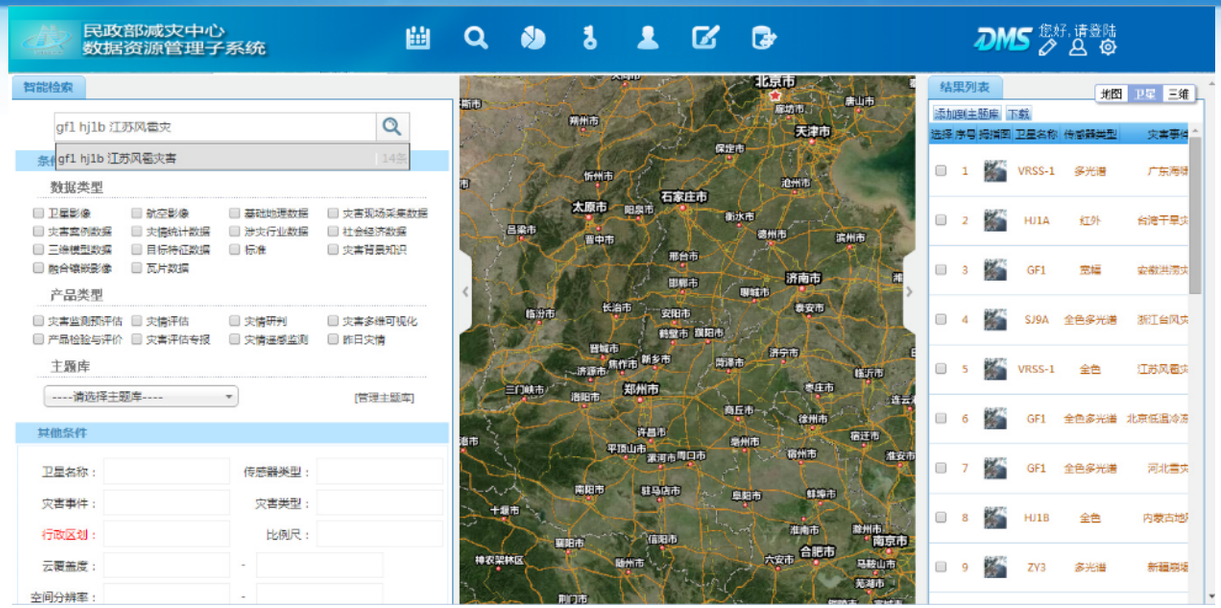
虚拟机动态加载技术
VM Dynamic Loading Technique

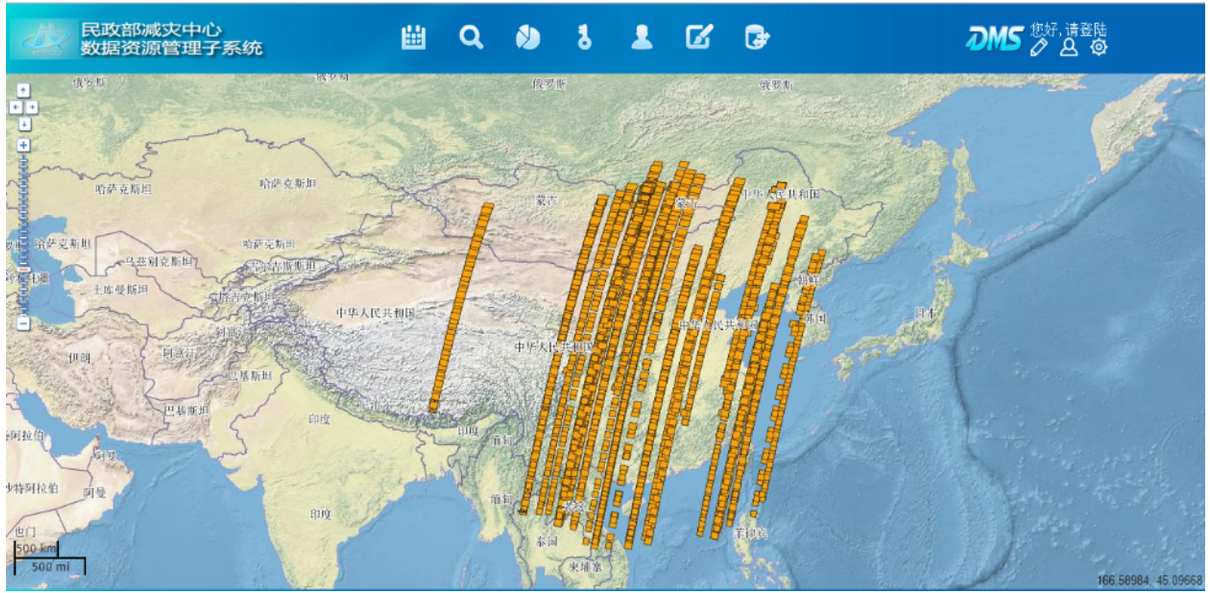
高分灾害监测与评估信息服务软件系统
Disaster monitoring and assessment service system

高分灾害监测与评估信息服务集成系统
Disaster monitoring and assessment Service integration System by HEROS

高分灾害监测与评估信息服务软件系统
Disaster monitoring and assessment service system

数据管理与信息共享服务平台
Data Management and Information Sharing Service Platform

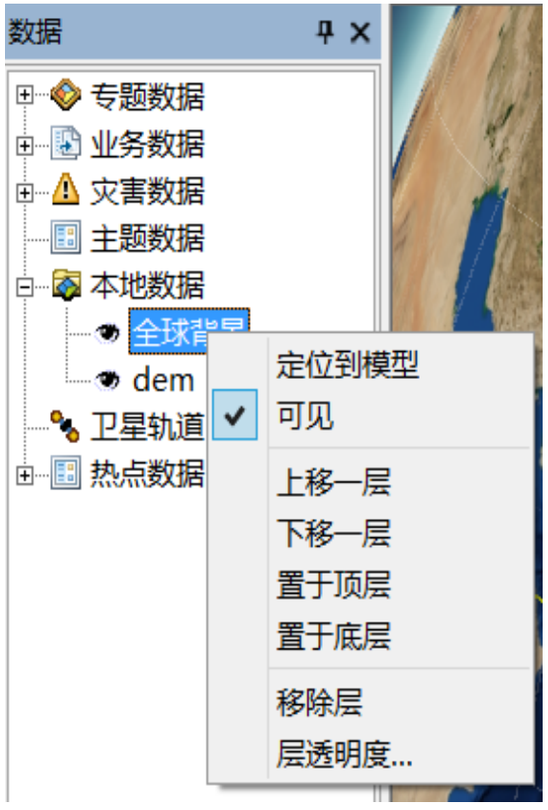




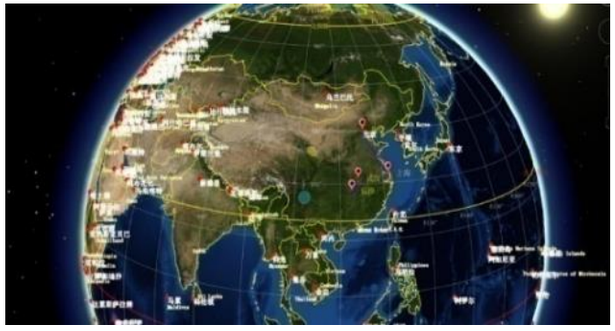
高分灾害监测与评估信息服务软件系统
Disaster monitoring and assessment service system

二三维可视化环境/3D Visualization Environment

图层管理树
Layers Manager Tree



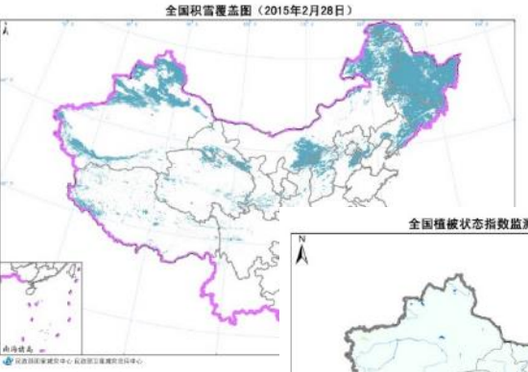
图形渲染
Graphic Rendering



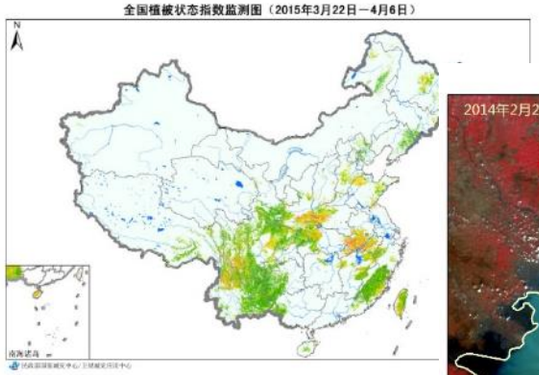
3. 高分辨率对地观测系统减灾应用实践

APPLICATION OF HREOS ON DISASTER REDUCTION

日常监测模式 Routine Monitoring



积雪 Snow

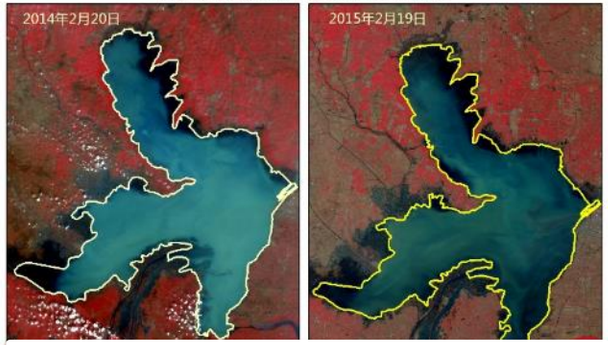


植被 Vegetation

定期目标监测
Periodical Disaster Monitoring

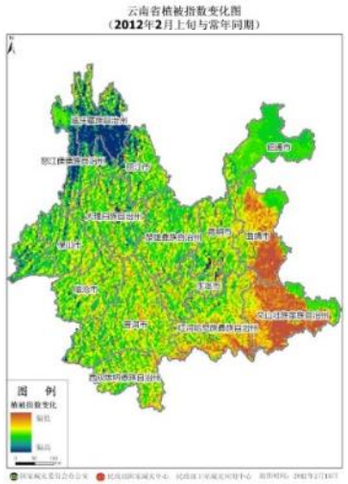
水体 Water Body

洪泽湖水体面积变化遥感监测图

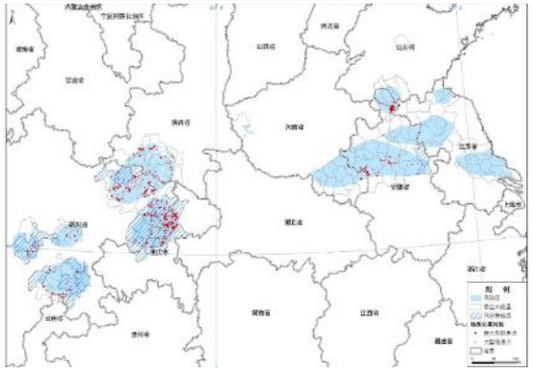


高分一号监测水体变化
Water Area Change Detection by Gaofen-1

特征参数反演
Characteristic Parameter Extraction

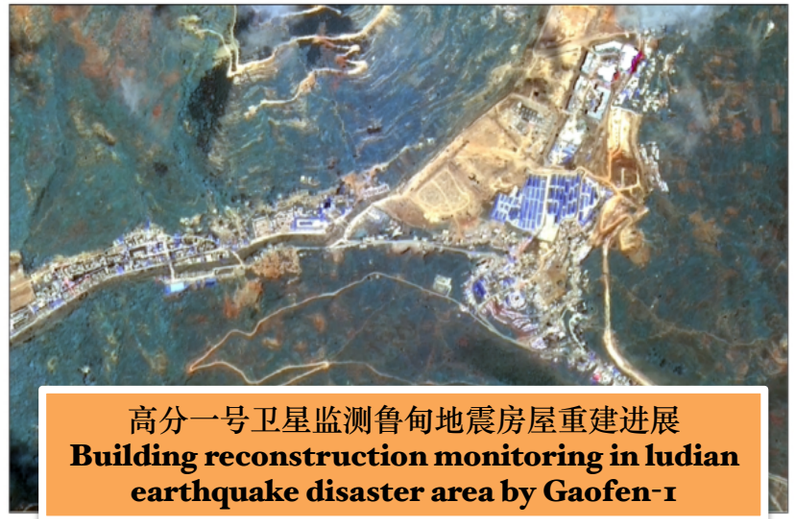


灾害风险评估
Risk Assessment

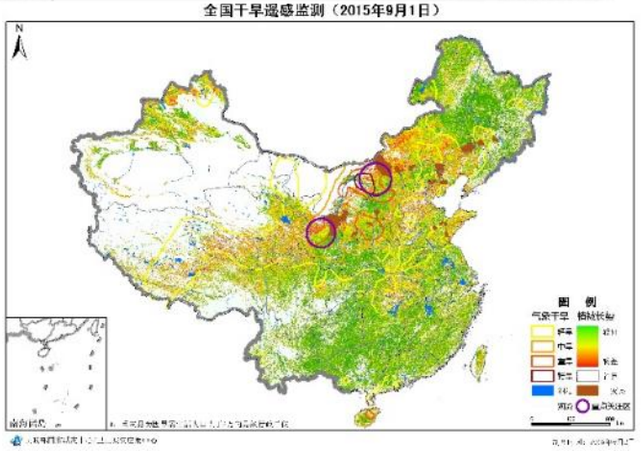


恢复重建监测 Recovery & Reconstruction Monitoring

2014年云南鲁甸6.5级地震灾后恢复重建遥感监测图

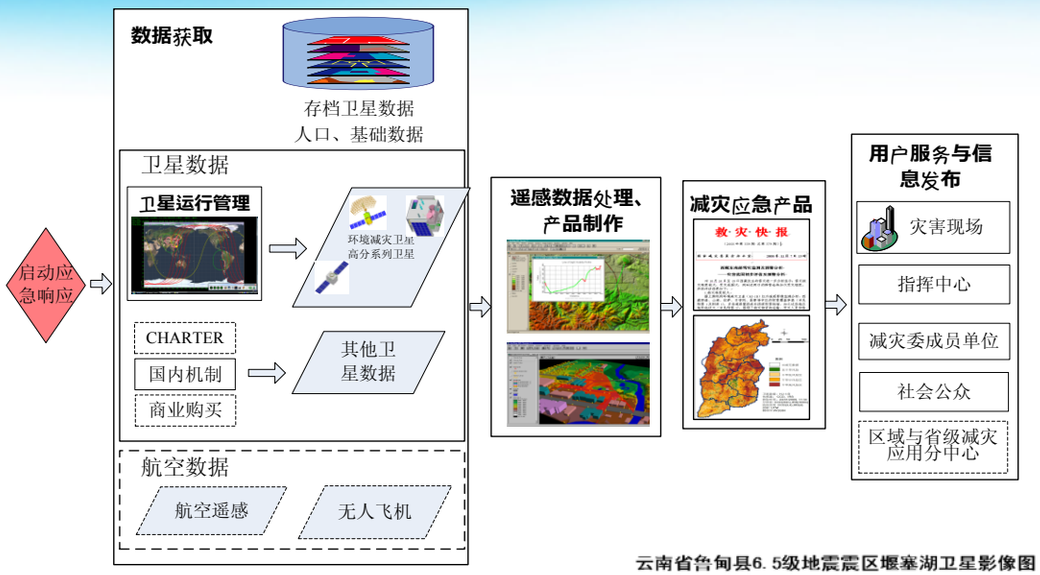


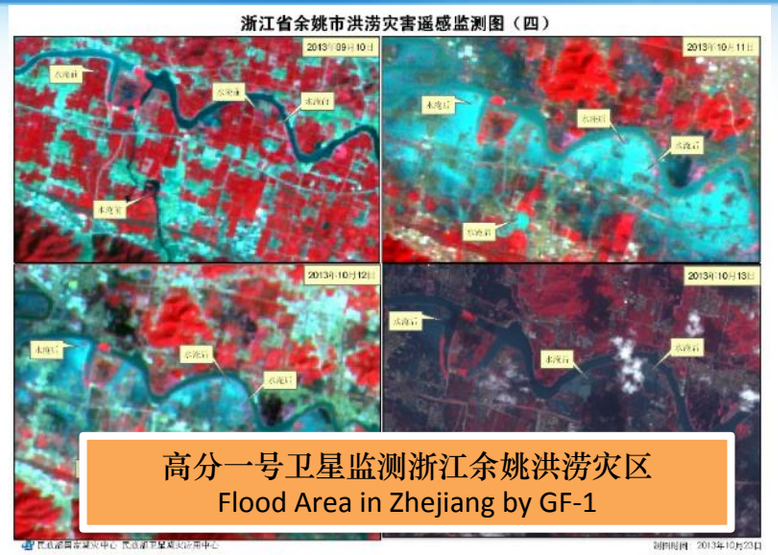
高分一号卫星监测鲁甸地震房屋重建进展
Building reconstruction monitoring in ludian earthquake disaster area by Gaofen-1



fanyida@ndrcc.gov.cn

应急监测模式 Emergency Monitoring





高分一号卫星监测浙江余姚洪涝灾区
Flood Area in Zhejiang by GF-1

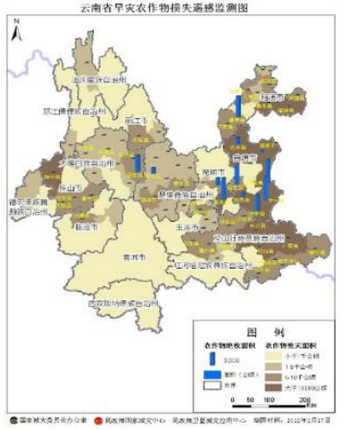
灾害范围监测 Disaster Area Monitoring

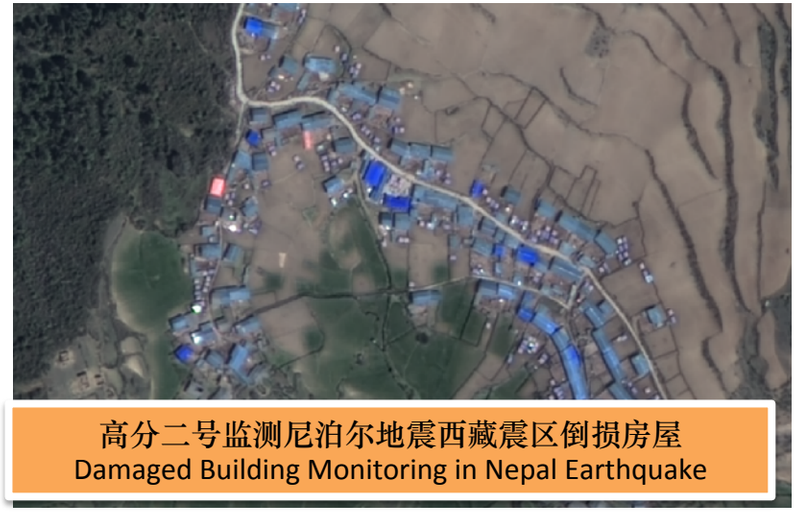
高分二号卫星监测陕西山阳滑坡
Landslide monitoring in Shaanxi by GF-2

次生灾害监测 Secondary Disaster Monitoring

高分一号卫星监测鲁甸地震灾害堰塞湖
Quake Lake Monitoring by Gaofen-1 in Ludian Earthquake

实物量毁损评估 Physical damage assessment





高分二号监测尼泊尔地震西藏震区倒损房屋
Damaged Building Monitoring in Nepal Earthquake

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谢谢!

Thanks for your attention!