



Application of Remote Sensing and GIS on Flood Monitoring and Assessment in China

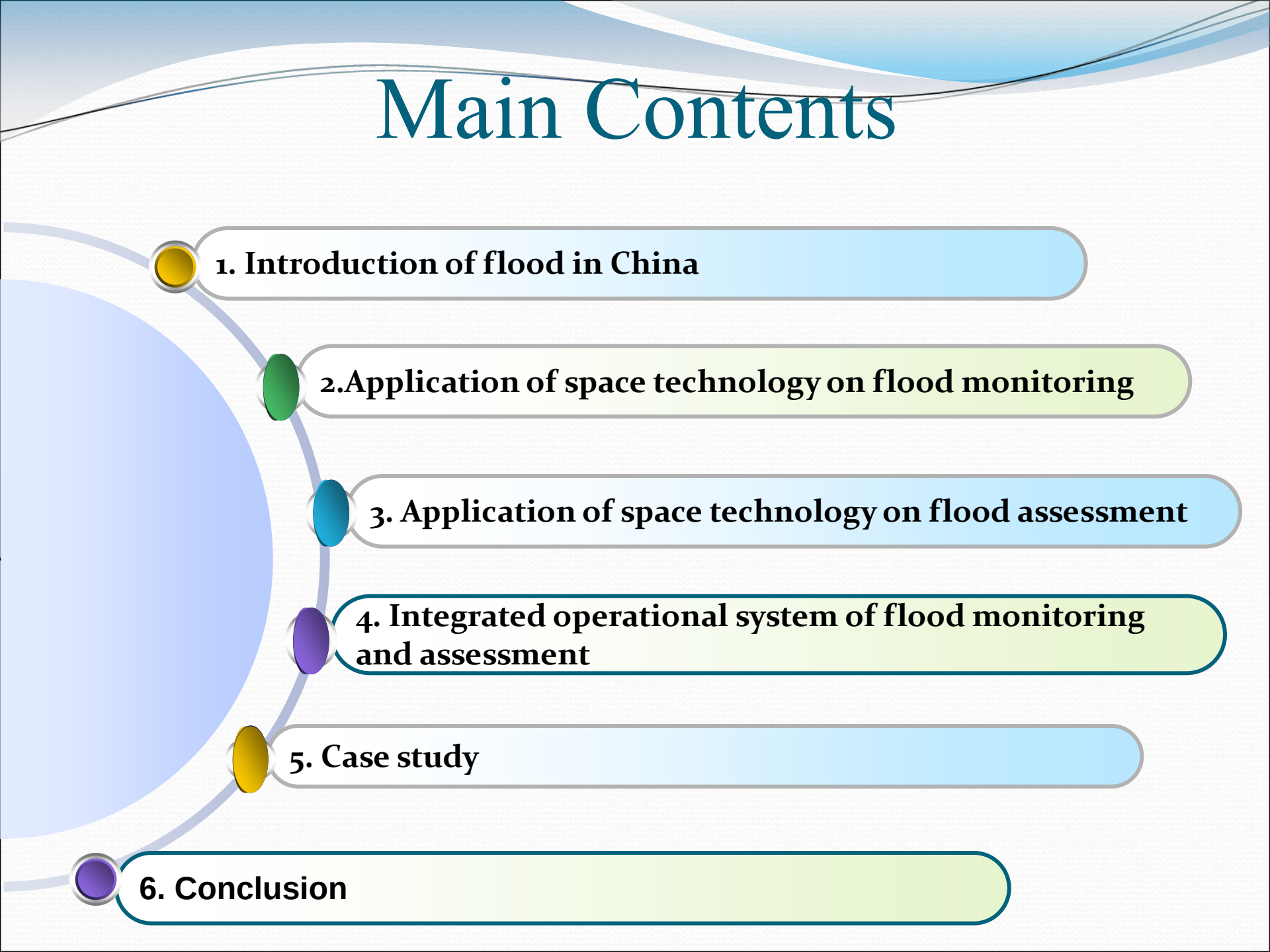
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Main Contents



1. Introduction of flood in China

2. Application of space technology on flood monitoring

3. Application of space technology on flood assessment

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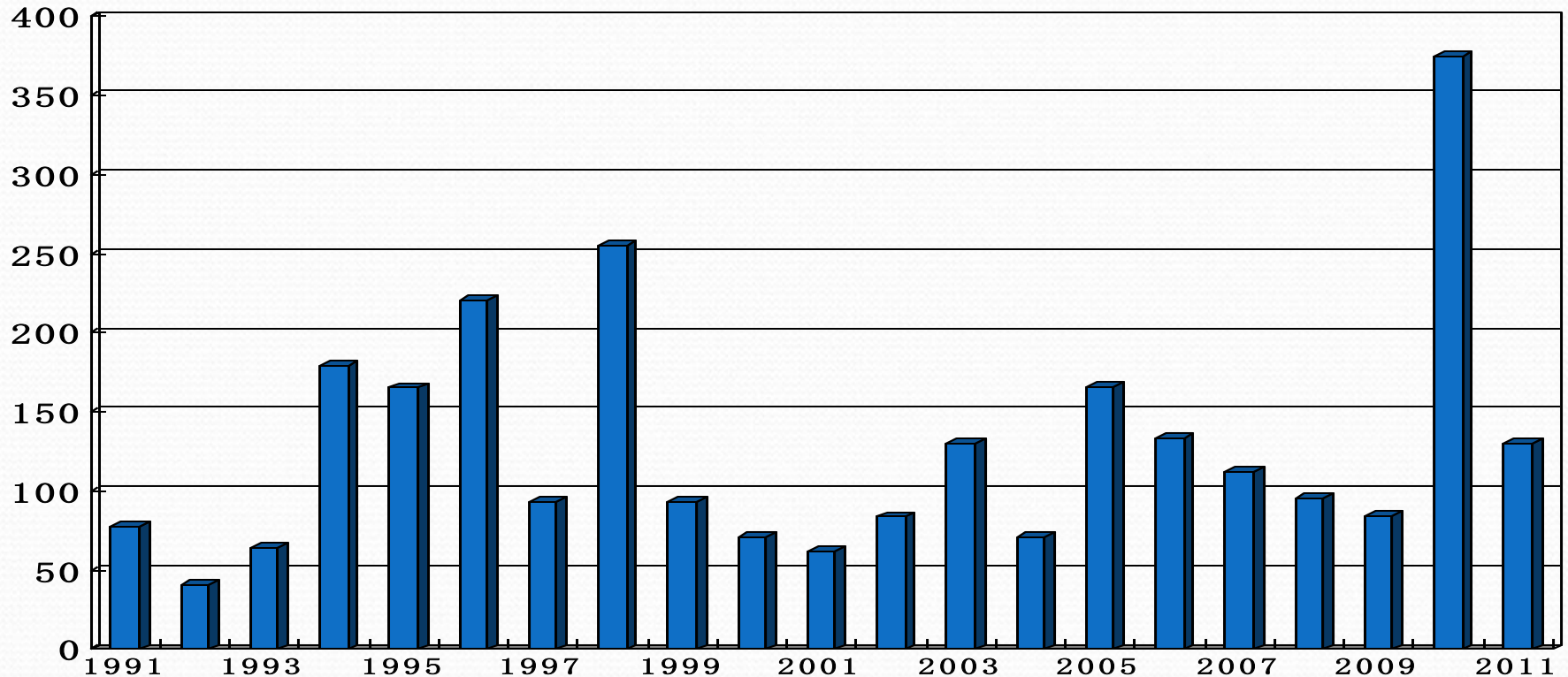
6. Conclusion



1. Introduction of flood in China

1. Economic loss caused by flood & waterlogging is very higher

Billion RMB



Flood disaster is one of constraint factors for development of society and economy

Yangtze river in 1998



river flood

The flood situation of Duchang County taken from helicopter

Place: Zhouqu county,
Gansu province

Time: Aug.7, 2010

deaths: more than 1700



flash flood

“7·21”暴雨降雨时间：21日午后至22日凌晨

中央气象台从20



urban flood

Beijing (July 21, 2012)



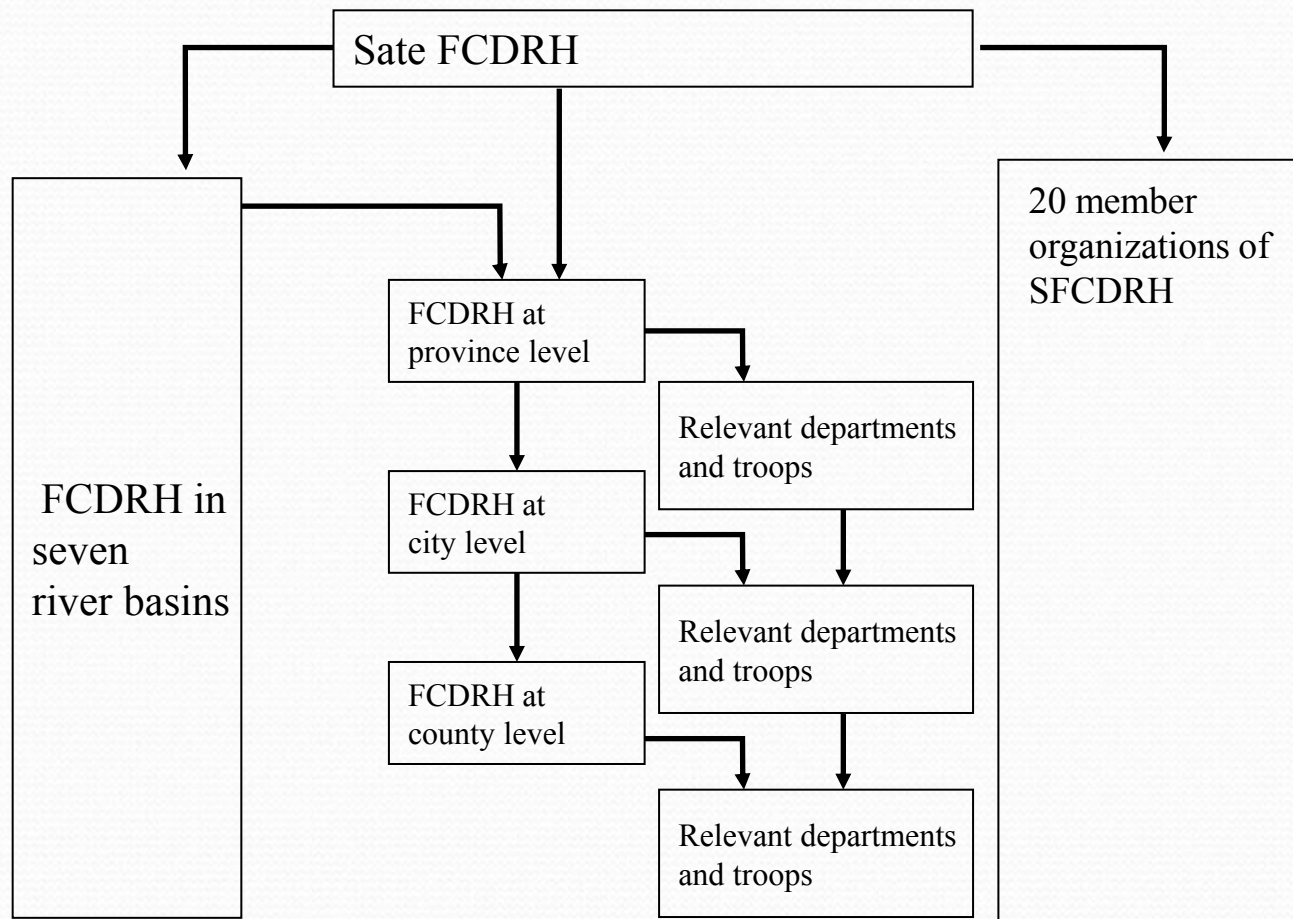
- Place: Fuhe river,
Jiangxi province
- Time: June 21, 2010



dam -break flood

2. Chinese government pays a lot of attention to flood control and disaster mitigation.

•In China, flood control and disaster mitigation is charged by the State Headquarter of Flood Control and Drought Relief. It is composed by 20 member organizations. Its office is in the Ministry of Water Resources.



Engineering System for flood control



Ching River

Embankment



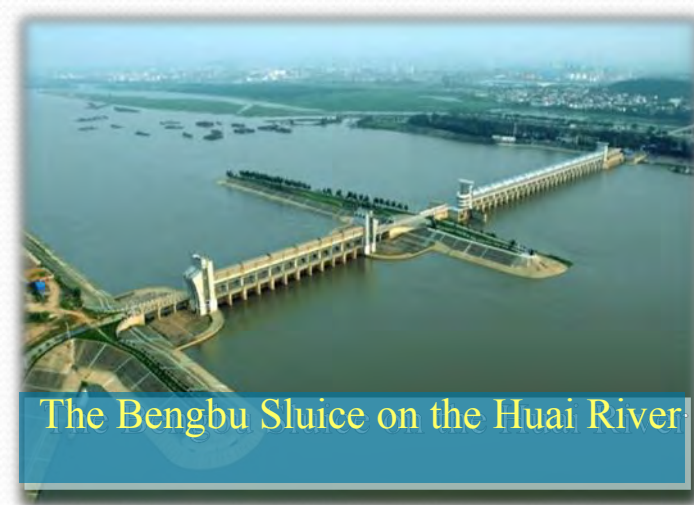
Flood intake gate in the Dongping Lake
flood retention area of the Yellow River

flood storage and retention areas



Three Gorges Project

Reservoir



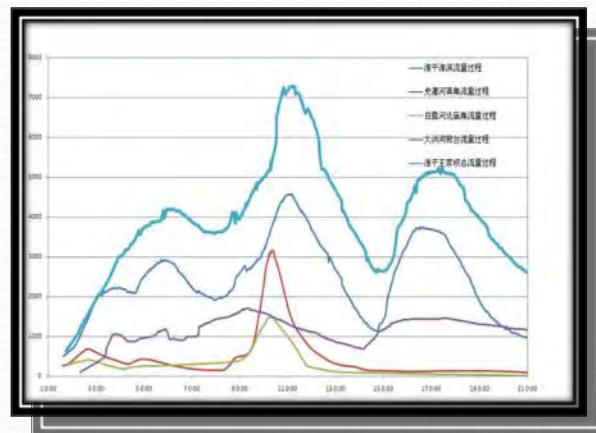
The Bengbu Sluice on the Huai River

Sluice

- After greatly strengthening structural and non-structural measures, including application of space technology, loss due to flood disaster is significantly reduced in recent years.



Remote sensing



Flood forecast



Regulation

3. Application of RS and GIS in flood control

Flood disaster monitoring

Remote sensing ,GPS current water body
difference between baseline is inundated area

Disaster assessment

Overlaying of inundated extent on GIS-based
background database (land use, social and
economic database)



2. Flood monitoring based on space technology



Platform of Flood Monitoring

1.Space-borne sensors:

- 1) Low resolution: NOAA(AVHRR)、FY-1、FY-2
- 2) Moderate resolution: EOS/MODIS
- 3) High resolution: Landsat (TM, ETM⁺), SPOT, CBERS-1, Radarsat, ERS, ALOS ,TerraSAR, Cosmo-Skymed

2.Airborne sensors:

- 1)SAR (10,000~13,000m, all-weathered)
- 2) Helicopter (900m, weather condition limitation)
- 3) Unmanned Aerial Vehicle

SATELLITE

1. Landsat (TM, ETM⁺), SPOT, CBERS-1, HJ-1

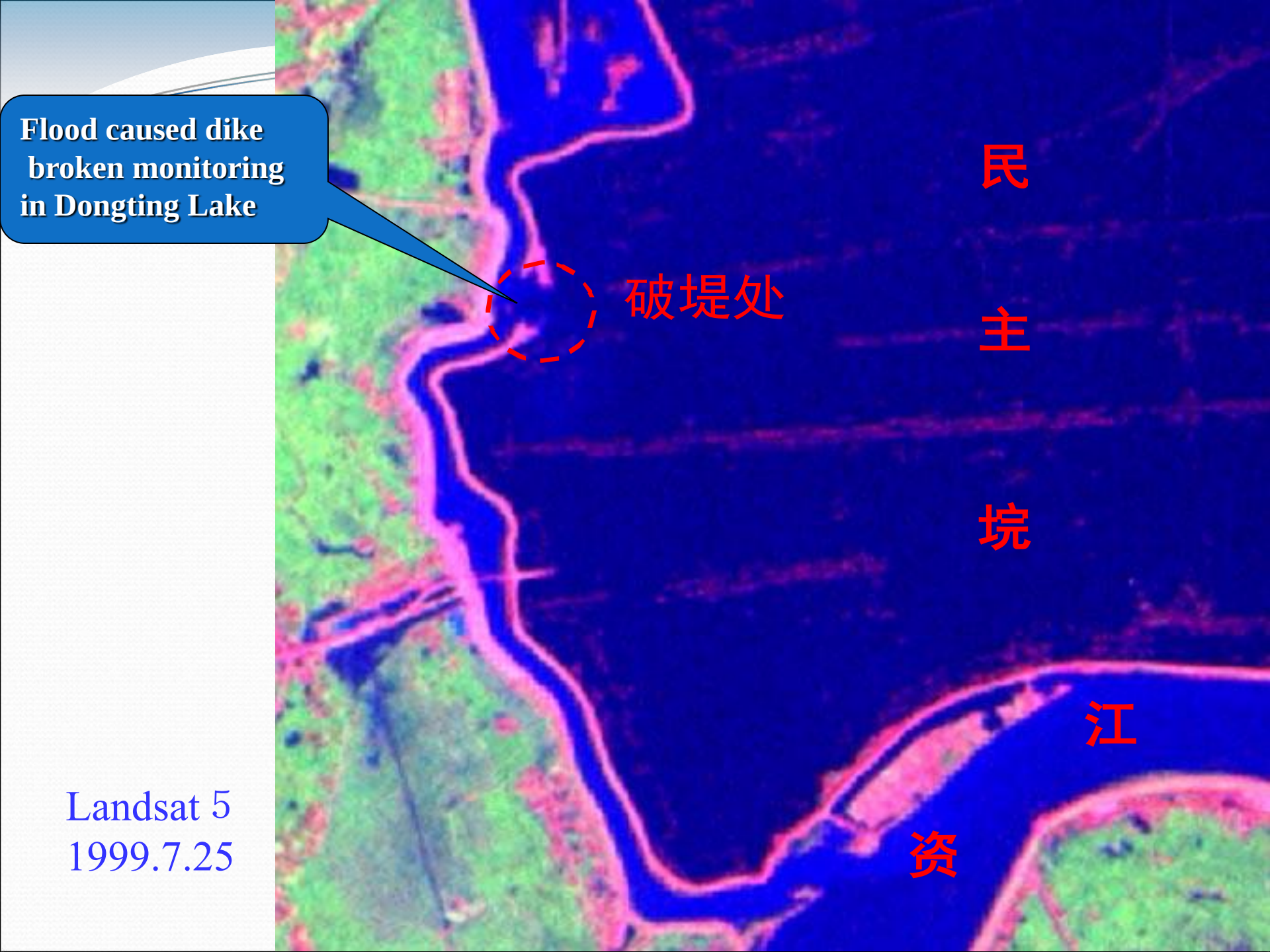
Background data extraction, baseline of water body
land use classification, monitoring

2. Radarsat, ERS-1/2, Envisat, ALOS, TerraSAR, Cosmo-Skymed

Extraction of water body during flood

3. MODIS, NOAA(AVHRR), FY-1, FY-2, FY-3

Macro and dynamic monitoring



Flood caused dike broken monitoring in Dongting Lake

破堤处

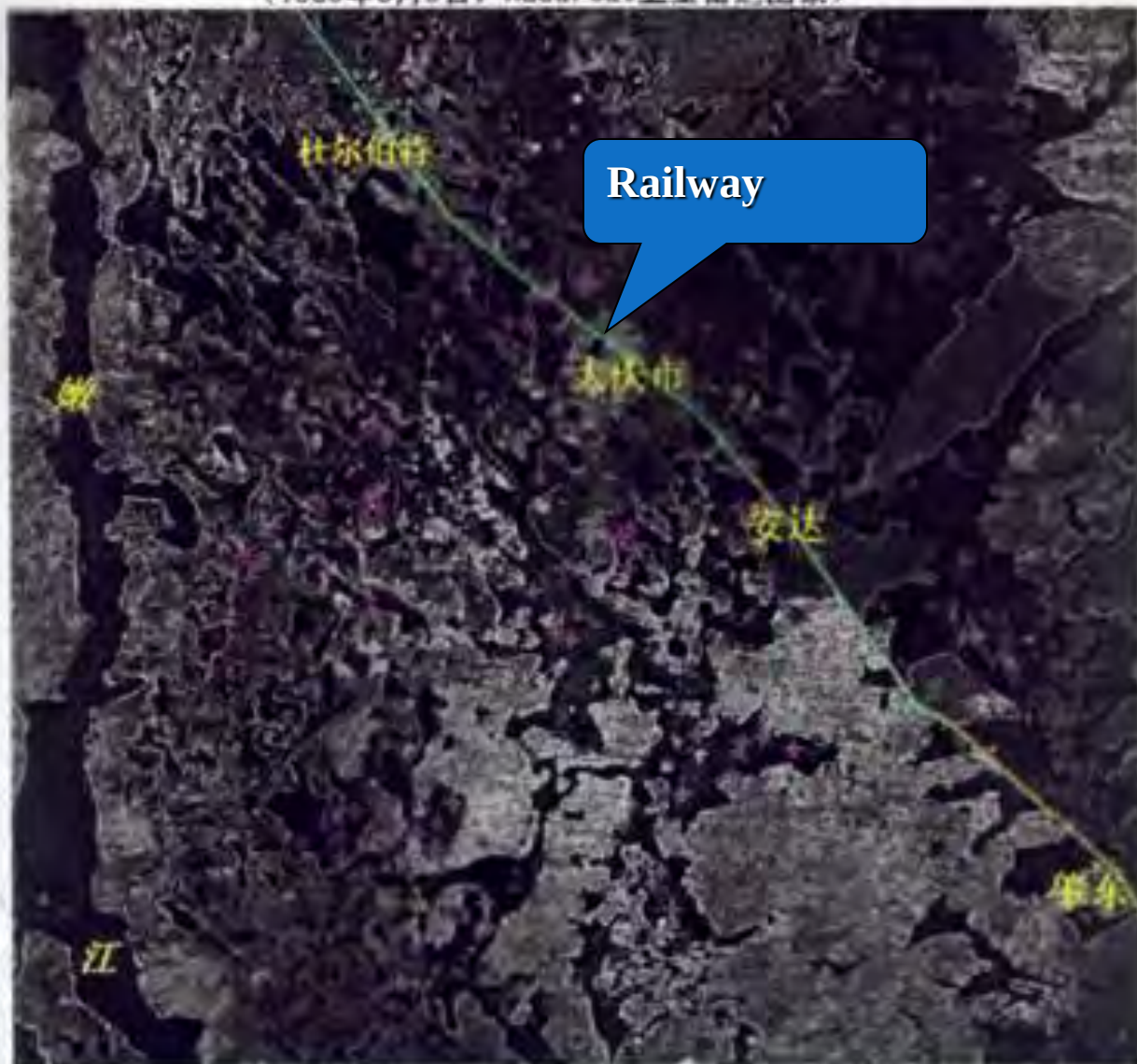
民主江

Landsat 5
1999.7.25

RadarSat
1998.8.9

大庆油田地区铁路、油井洪涝淹没分布图

(1989年8月9日, RadarSat卫星雷达图像)



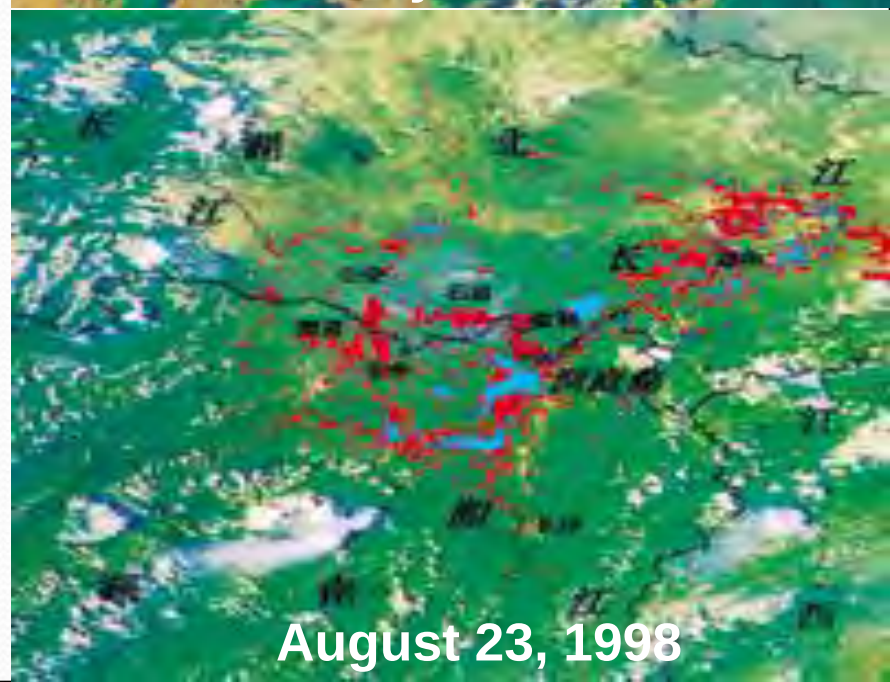
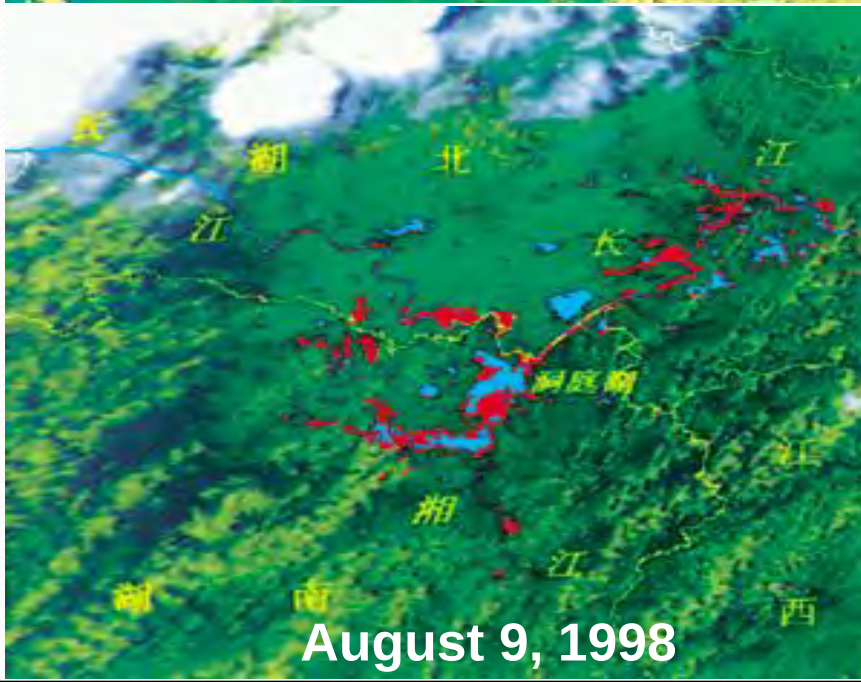
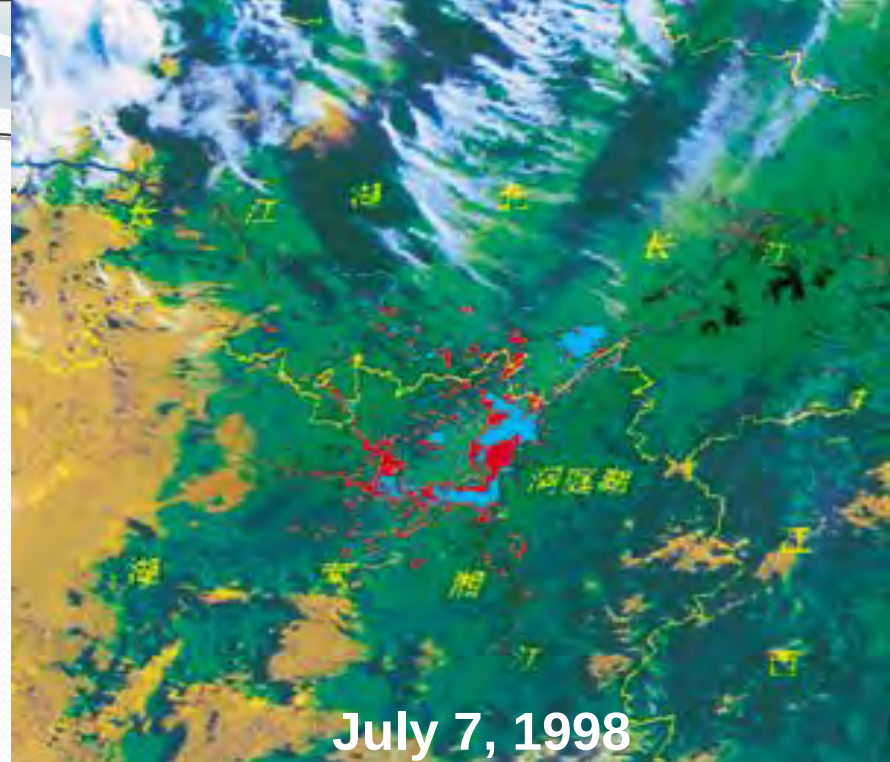
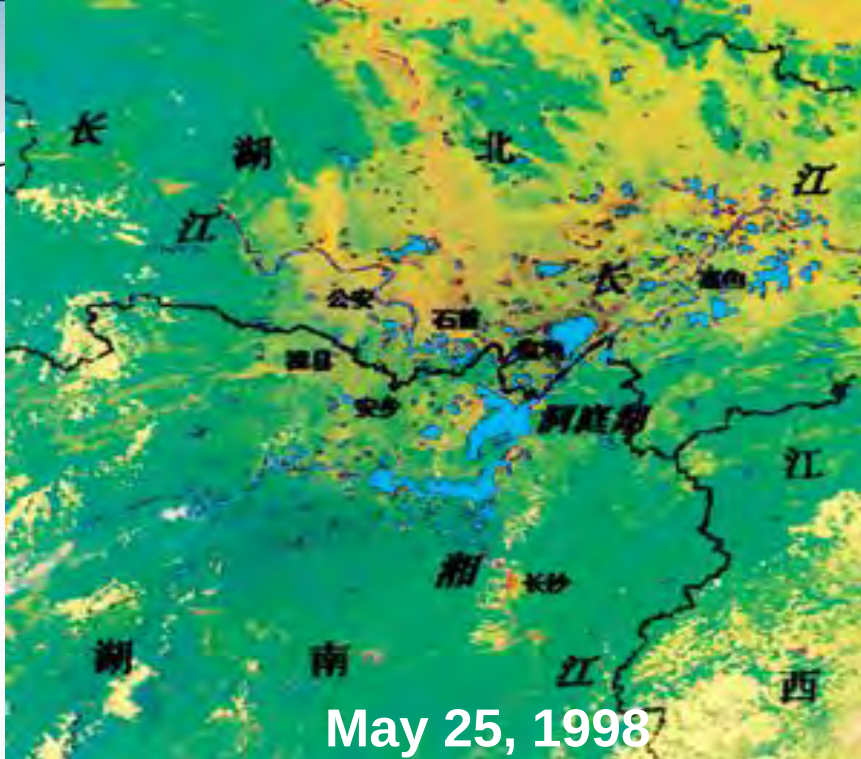
淹没区界线



被淹油井

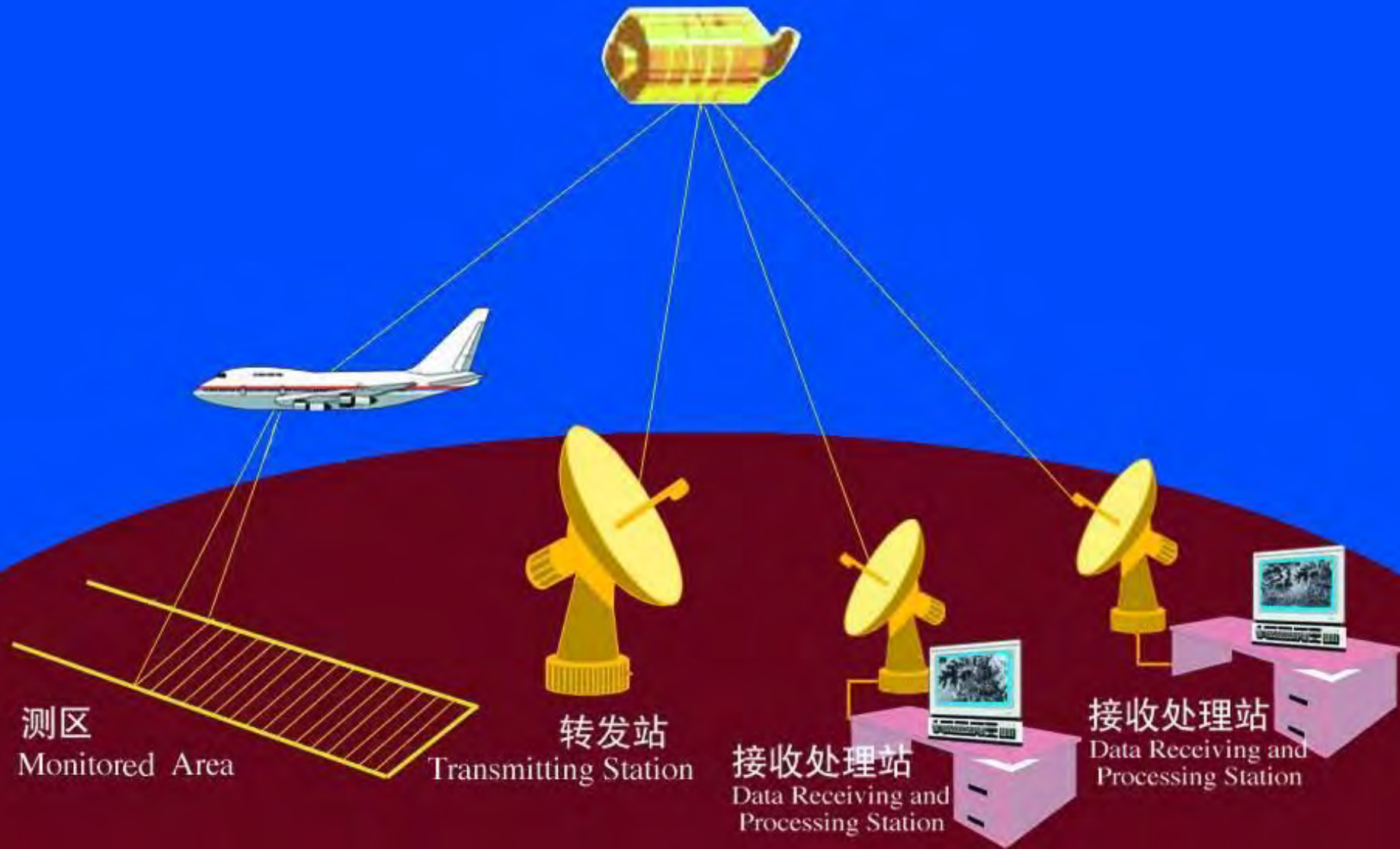


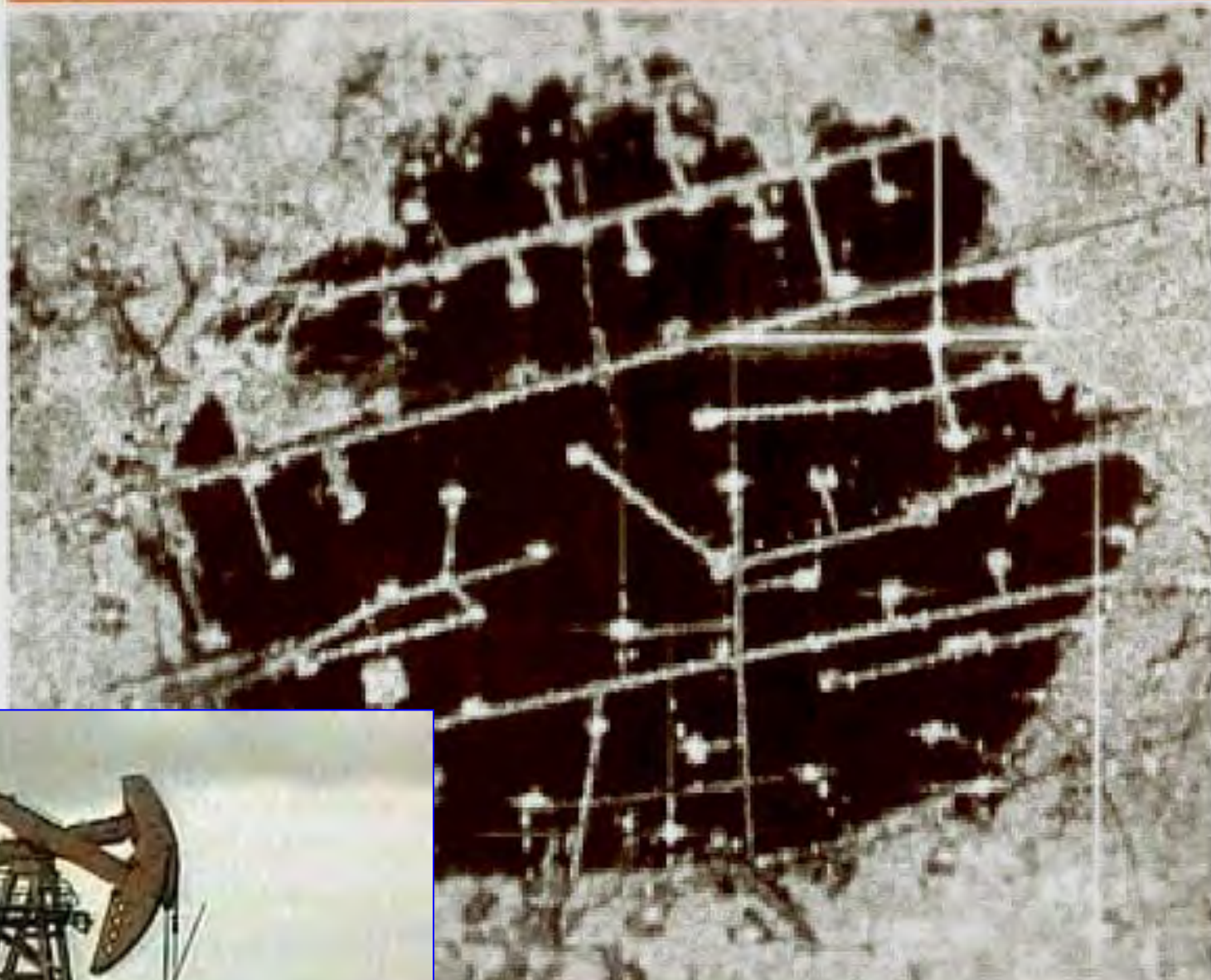
被淹铁路



Airborne SAR and real-time transmission system

Sketch Map of Aeroplane-Satellite-Ground System





大的航空田采油区洪水淹没情况

Aug. 30, 1998



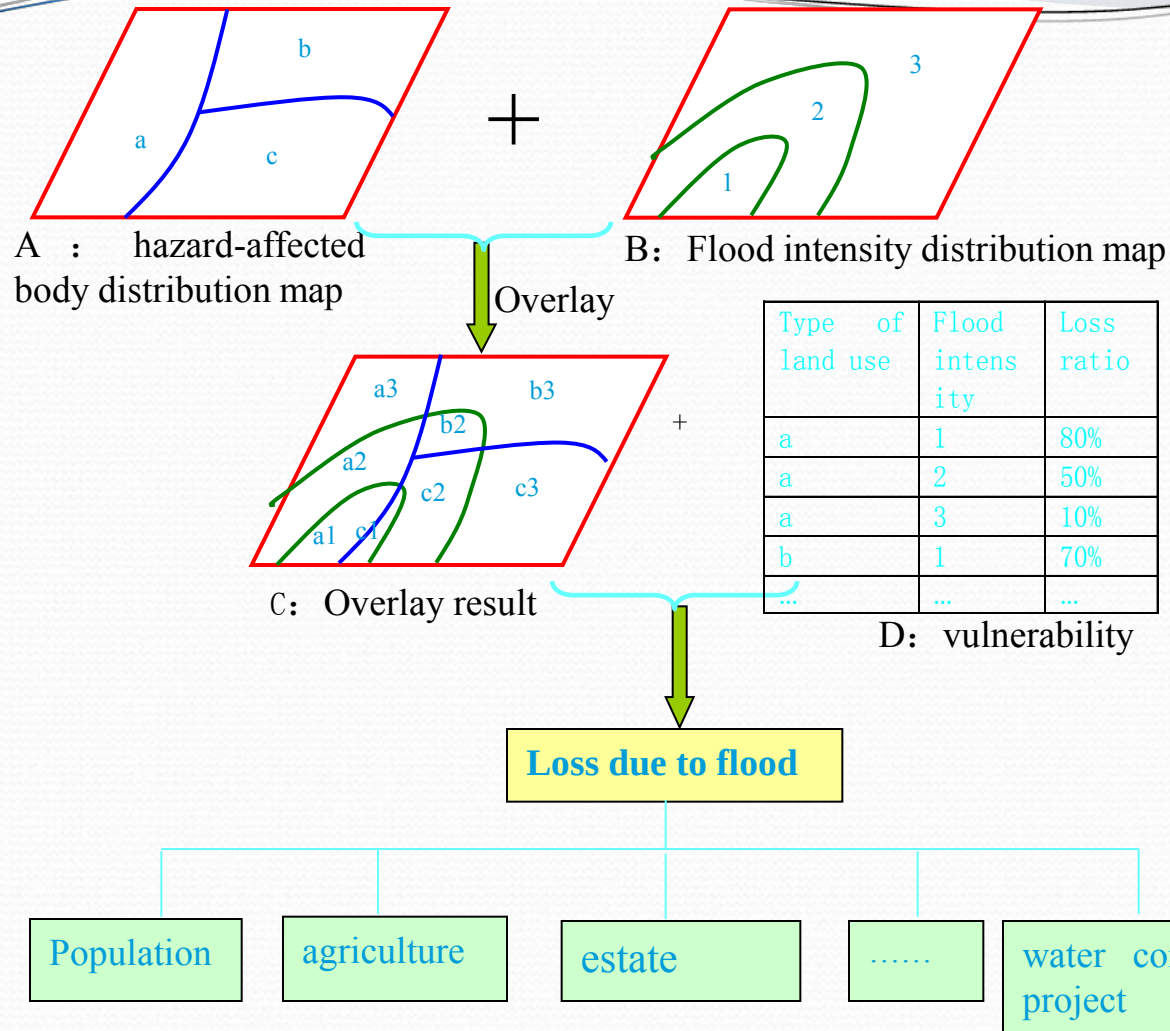


Unmanned Aerial Vehicle Remote Sensing



3. Flood disaster assessment based on space technology



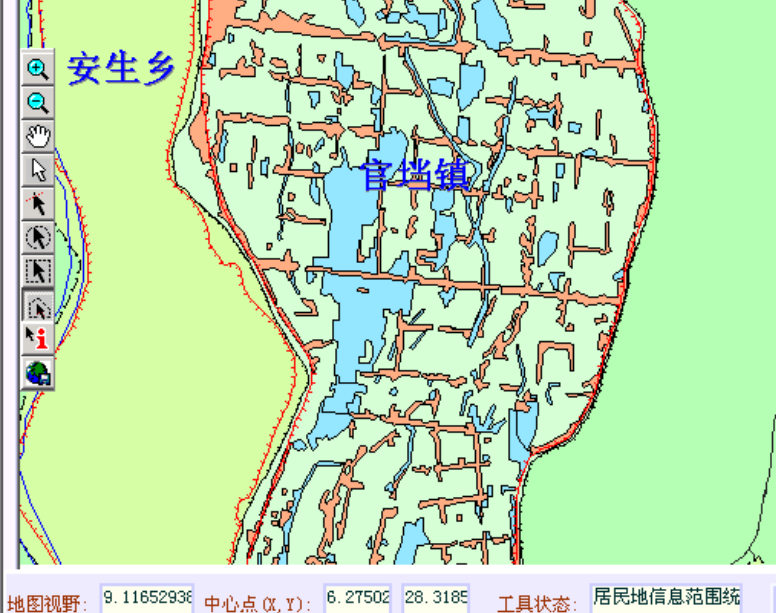
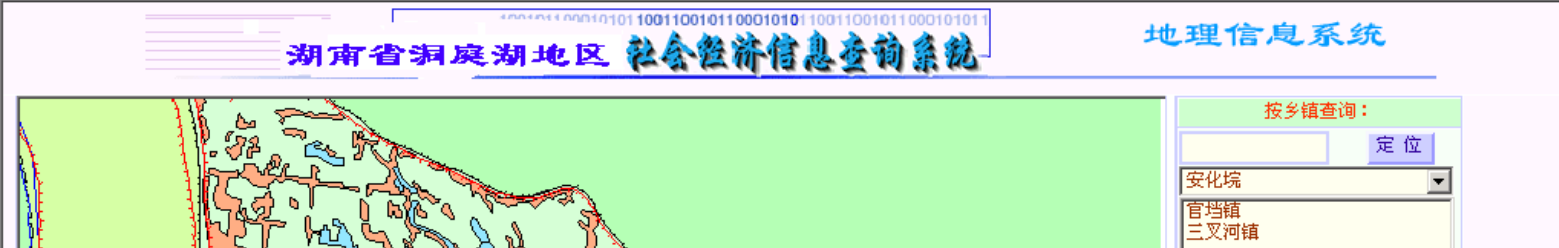
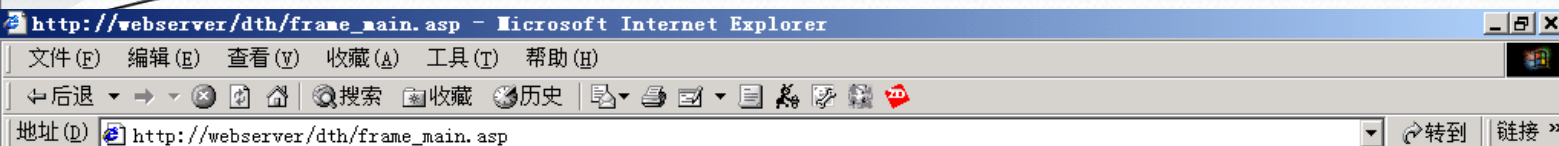


Sketch map of flood disaster assessment based on GIS platform

Data source for assessment

- monitoring results
- baseline of water body
- land use
- administrative boundary
- social and economic data
- elevation (DEM).

Spatial database of society and economy of Dongting lake area



地图视野: 9.11652936 中心点(X,Y): 6.27502 28.318E 工具状态: 居民地信息范围统



http://webserver/Dth/report1.asp?lyr=eleanhua - Microsoft Internet Explorer

居民地社会经济数据信息表

总共23条记录

区块代码	类型	面积(平方米)	高程范围	所属县市	所属乡镇	所属坳	人口(人)	房屋(间)	生猪(头)	耕牛(头)	耕地面积(亩)
1055	11	349688.75	31.5~32	安乡县	官垱镇	安化坳	0	0	0	0	524.51
1089	11	61833.16	32~32.5	安乡县	官垱镇	安化坳	0	0	0	0	92.75
1117	12	5612.04	31~31.5	安乡县	官垱镇	安化坳	0	0	0	0	0
1120	12	386.109	31.5~32	安乡县	官垱镇	安化坳	0	0	0	0	0
1123	22	6697.68	30.5~31	安乡县	官垱镇	安化坳	21	33	17	0	0
1124	22	10231	31.5~32	安乡县	官垱镇	安化坳	32	51	26	0	0
1126	22	2976.73	31~31.5	安乡县	官垱镇	安化坳	9	15	8	0	0
1133	22	12588.76	32~32.5	安乡县	官垱镇	安化坳	39	62	32	0	0
1135	22	2750.96	32~32.5	安乡县	官垱镇	安化坳	9	14	7	0	0
1137	22	11433.69	31.5~32	安乡县	官垱镇	安化坳	36	57	29	0	0
1138	22	14.3203	32~32.5	安乡县	官垱镇	安化坳	0	0	0	0	0
1140	12	1000.18	30.5~31	安乡县	官垱镇	安化坳	0	0	0	0	0
1141	12	1656.78	31~31.5	安乡县	官垱镇	安化坳	0	0	0	0	0
1142	12	1601.08	31.5~32	安乡县	官垱镇	安化坳	0	0	0	0	0
1144	11	353.617	31.5~32	安乡县	官垱镇	安化坳	0	0	0	0	0.53
1152	11	2184.91	30~30.5	安乡县	官垱镇	安化坳	0	0	0	0	3.28
1162	22	104.25	31.5~32	安乡县	官垱镇	安化坳	0	1	0	0	0
1163	11	31.3516	32~32.5	安乡县	官垱镇	安化坳	0	0	0	0	0.05
1170	11	1206.47	31~31.5	安乡县	官垱镇	安化坳	0	0	0	0	1.01

Distributed social and economic database of Harbin city



SQL Server Enterprise Manager - [2表"harbin_city"中的数据, 位置是"HLJZQPG"中、"WEBSEVER"上]									
VILLAGE	VILLAGE	AREA	FIXASSE_AE	FIXASSE_BE	FIXASSE_CE	FIXASSE_DE	FIXASSE_EE	FIXASSE_FE	FIXASSE_GE
230102001001	省报社区居委会	200687.328	0	01882	00182	01882	23893	1828	58055
230102001002	索非亚社区居委会	149997.594	0	04537	3453	01153	36205	1.4592	00006
230102001003	柳林社区居委会	189054.609	0	00683	00011	01153	44743	00233	0
230102001004	森林社区居委会	120457.929	0	01342	00525	01153	00233	1.52452	0
230102001005	天美社区居委会	89898.469	0	01095	00212	01153	00331	00233	0
230102002001	群都社区居委会	97344.141	0	21089	00638	01153	14028	00731	0
230102002002	新阳社区居委会	81386.484	0	003835	01153	01153	00731	009	0
230102002003	地德里社区居委会	113787.328	0	11557	00212	01153	00731	009	0
230102002004	安图社区居委会	69698.234	0	00297	00578	01153	31737	17573	001
230102002005	安化社区居委会	37007.422	0	00297	00578	01153	00513	001	0
230102003001	安祥社区居委会	122239.766	0	03119	00525	01153	00621	01578	0
230102003002	兴安社区居委会	198773.828	0	09304	00523	01153	03552	03723	0405
230102003003	抗联社区居委会	96933.484	0	10241	62963	01153	00344	0	0
230102003004	安吉社区居委会	62459.75	0	07571	01153	01153	00176	05972	00019
230102003005	地德里社区居委会	98733.219	0	00115	02914	01153	01084	00942	0
230102004001	福乐湾社区居委会	117254.563	0	04979	05728	01153	01504	00224	00017
230102004002	大民屯社区居委会	99458.859	0	20312	39698	01153	0002	0	0
230102004003	大民屯南社区居委会	36228.234	0	10431	01153	01153	00254	0	0
230102004004	大民屯南社区居委会	93411.516	0	00021	13593	01153	01402	04372	02038
230102004005	民安社区居委会	248846.766	0	09842	07798	01153	02974	00684	0
230102004006	福同社区居委会	99735.531	0	02004	00324	01153	10532	01841	00067
230102004007	民安社区居委会	208642.219	0	97032	01153	01153	00348	00014	0
230102004008	光华社区居委会	111021.5	0	04133	05047	01153	00395	32768	0289
230102004009	民安社区居委会	208832.031	0	10895	00073	01153	00266	0	0
230102004010	民安社区居委会	71960.734	0	01255	39417	01153	00612	00895	0
230102005001	民安社区居委会	94902.063	0	2088	00156	00051	24992	13703	02197
230102005002	利民社区居委会	68791.625	0	00363	01153	01153	00337	00014	0
230102005003	爱民社区居委会	85201.625	0	00354	02207	01153	01904	0027	00031
230102005004	新阳社区居委会	159722.703	0	40798	01153	01153	02115	00385	0
230102005005	民政社区居委会	54797.578	0	00766	04398	01153	05741	03385	02701
230102005006	安化社区居委会	35573.578	0	0195	06393	01153	00065	02157	02069
230102005007	理工大学社区居委会	94851.5	0	16046	01153	01153	00245	00258	00006
230102005008	建群社区居委会	67288.016	0	01486	01153	01153	01486	0	0
230102005009	天合社区居委会	523705.25	0	04151	01153	01153	11034	01254	00006
230102005010	大民社区居委会	550073.5	0	92285	01153	01153	03291	114827	00069
230102005011	工安社区居委会	149901.939	0	00015	01153	01153	00015	0	0
230102005012	安化社区居委会	87302.969	0	01153	01153	01153	3.9361	01153	0
230102006001	民安社区居委会	520582.094	0	12226	01153	01153	1973	01669	0
230102006002	安化社区居委会	40189.625	0	06118	01153	01153	01153	0	0
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Results of Flood Disaster Assessment

Inundated area of each county

Inundated resident area of each county

Inundated cultivated land area of each county

Affected population

Inundated length of railway

Width of broken embankment

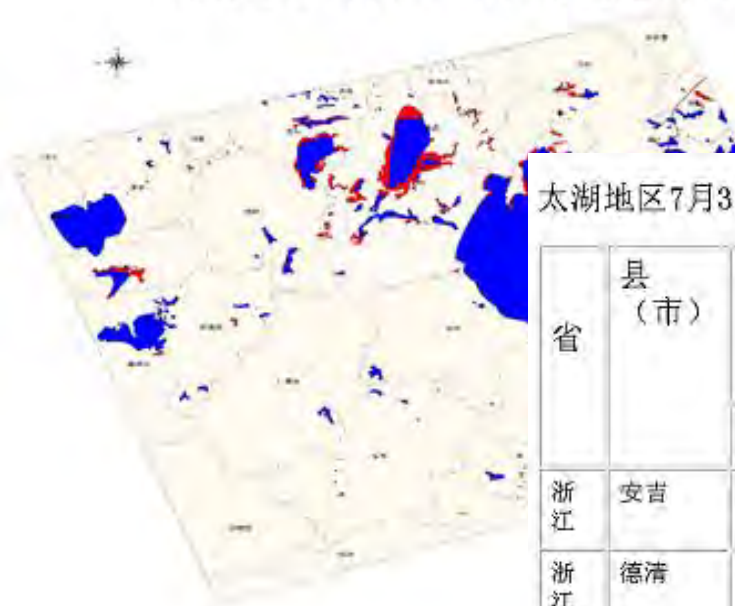
Treated Image with notation of place, thematic map (inundated area and land use classification), statistic table, analysis report

監製人：張紀元 總製導演：陳學明

来源: 中国天气网; 中国天气网; 中国天气网; 中国天气网; 中国天气网; 中国天气网; 中国天气网; 中国天气网; 中国天气网; 中国天气网

廣州通訊社訊：珠江及西江三區專署分刊《日
報》，廣州有以廣東日報為名，其發行時間及
版、內容均與廣東日報無涉之報章，此報章中

太湖地区7月3日洪水淹没范围图



圖說地圖全付、事類、戶口圖、錢糧圖、鹽課圖、

联系人: 孙平 电话: 0431-85263111

Analysis Report

Thematic Map

太湖地区7月3日洪涝灾情遥感监测统计

省	县 (市)	受淹地面积 (万亩)					监测范围
		居民地	水田	旱田	其它	合计	
浙江	安吉	0.0000	0.000	0.0000	0.7963	0.7963	全部
浙江	德清	0.0000	0.29	0.0000	0.0000	0.29	全部
浙江	长兴	0.0000	0.00	0.0000	0.0000	0.0000	全部
浙江	湖州市	0.0000	0.00	0.0000	0.0000	0.0000	全部
浙江	嘉善	0.0000	0.00	0.0000	0.0000	0.0000	局部

statistics

Statistics table

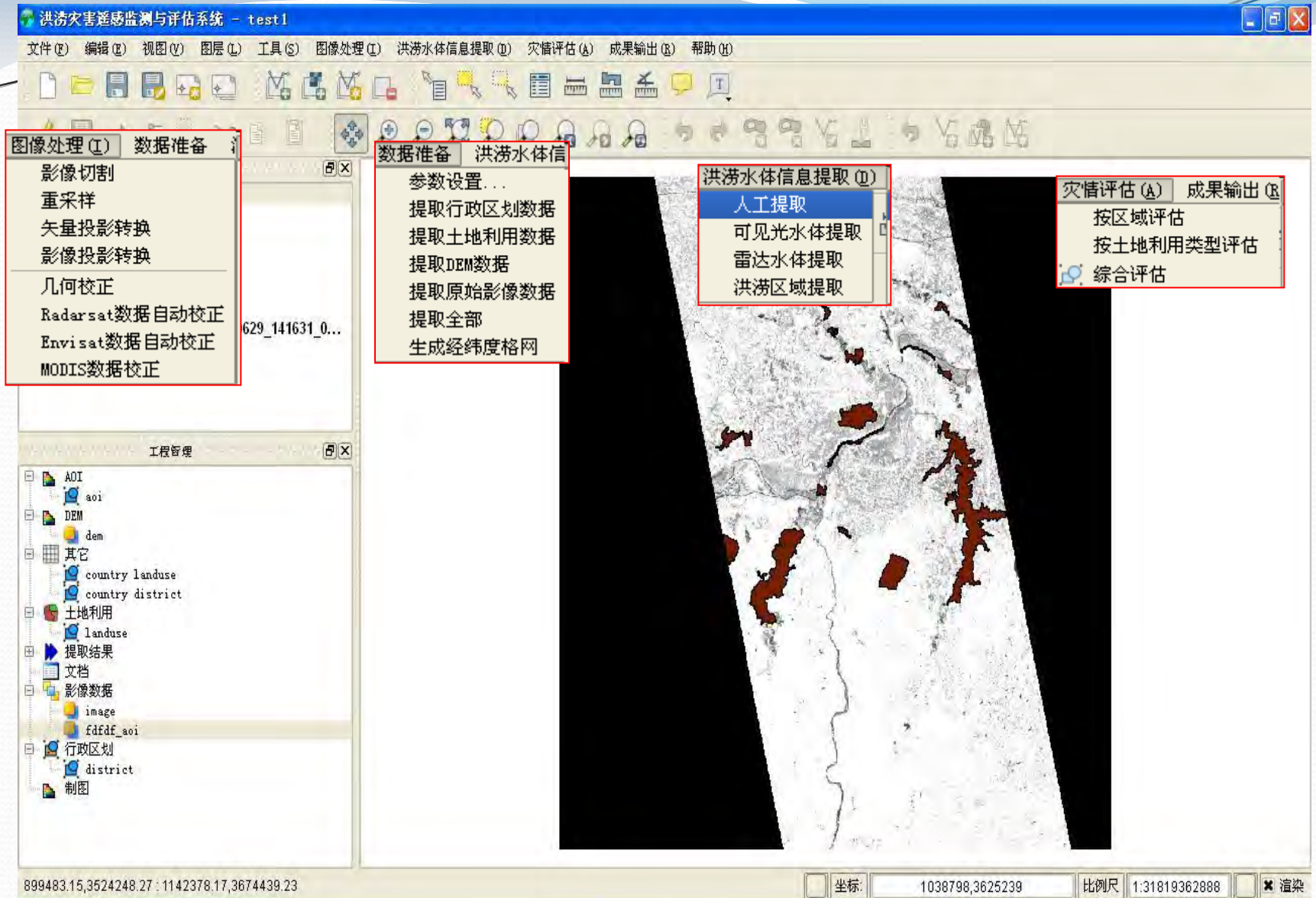


4. Integrated operational system of flood monitoring and assessment

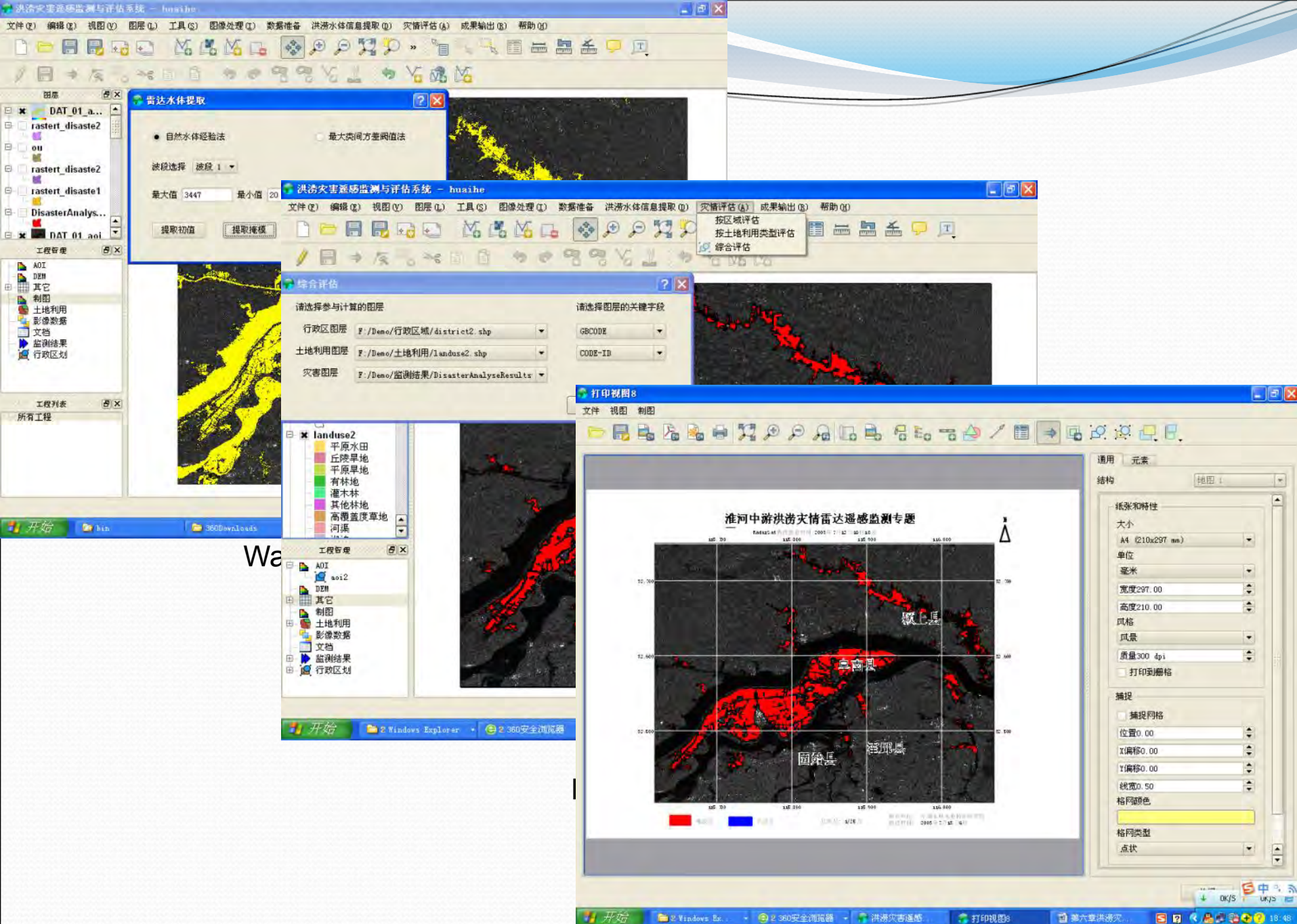




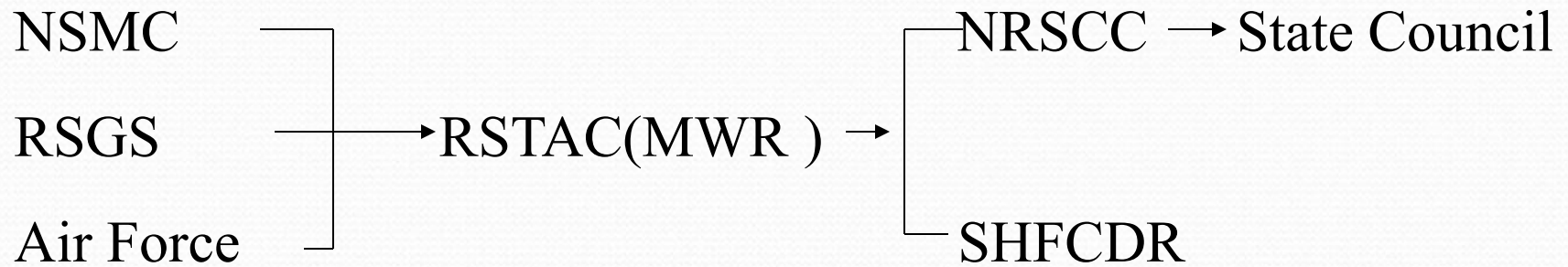
Operational system for flood monitoring and assessment is very important for the state. It is totally different with research. It uses mainly space technology for flood management in a routine way.



Interface of integrated operational system of flood monitoring and assessment



Flood mapping



NSMC: National Satellite Meteorology Center

RSGS: China Remote Sensing Satellite Ground Station

RSTAC: Remote Sensing Technology Application Center, MWR

NRSCC: National Remote Sensing Center of China

SHFCDR: State Headquarter of Flood Control & Drought Relief



In general, the result of disaster assessment is transmitted to State Council and State Headquarter of Flood Control and Drought Relief by communication satellite within 4 hours after getting remote sensing image.



5. Case Study



1. Flood monitoring and assessment in the middle of
Huaihe river in 2003

2. dam -break flood monitoring in Heilongjiang
river in 2013

Case 1:

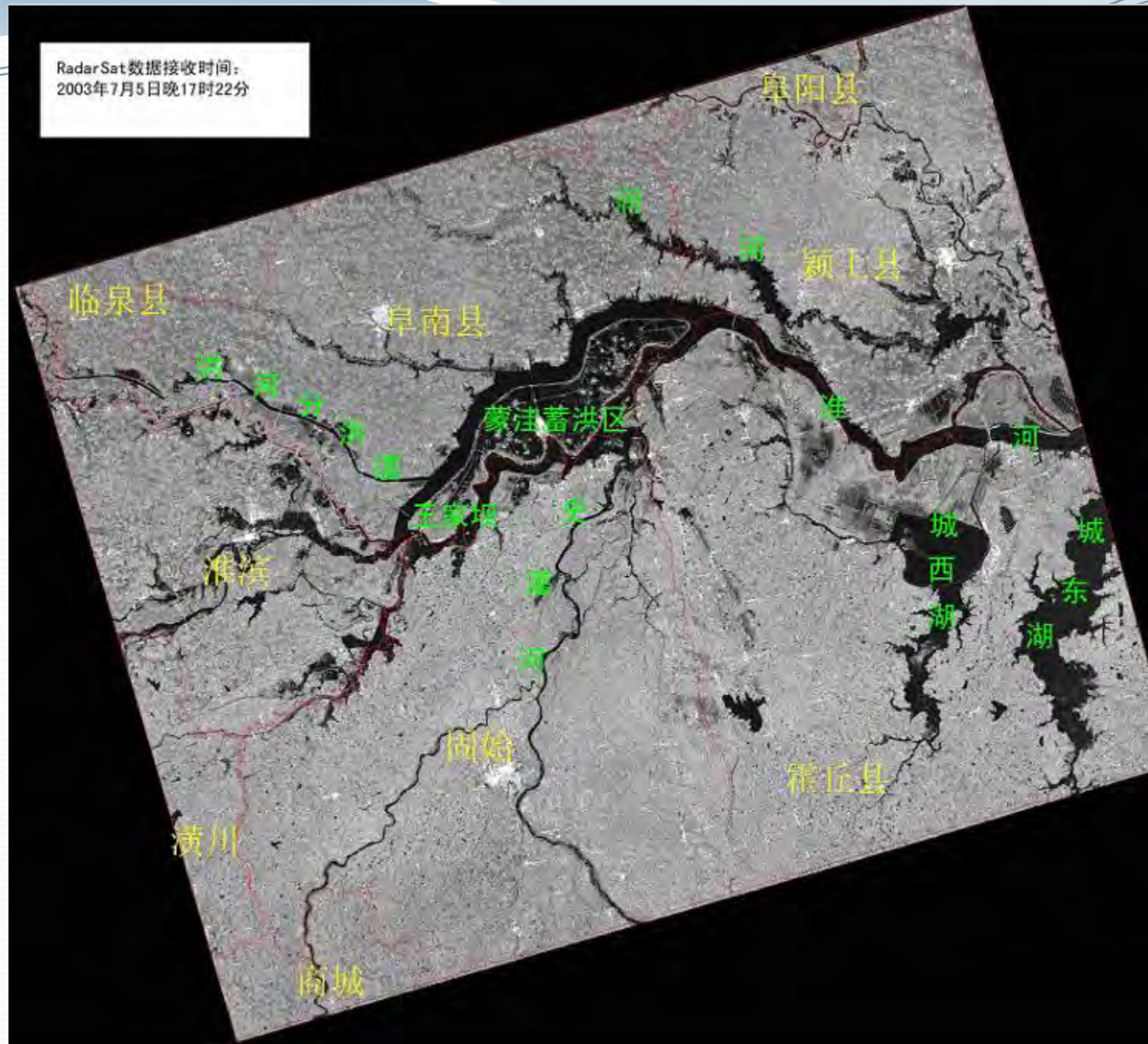
Flood monitoring and assessment in the middle of Huaihe river in 2003.



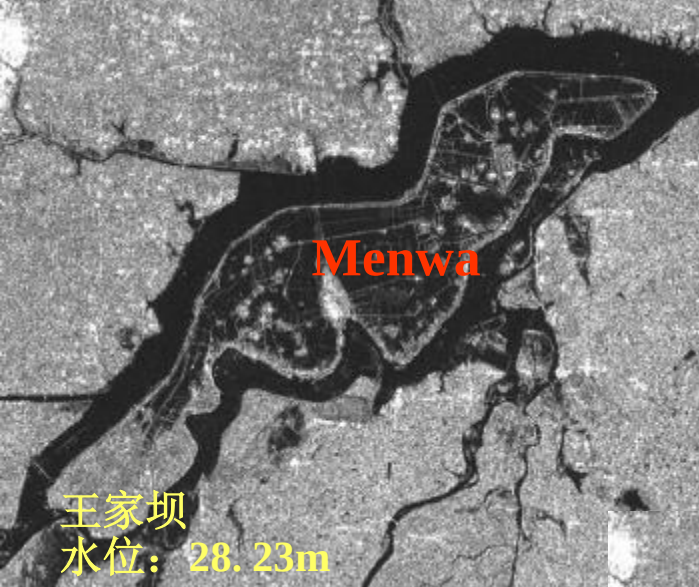
- 
- Five times continuous monitoring had been carried out:
 - 2003.7.5
 - 2003.7.7
 - 2003.7.9
 - 2003.7.12
 - 2003.7.14

RadarSat数据接收时间:
2003年7月5日晚17时22分

2003.7.5

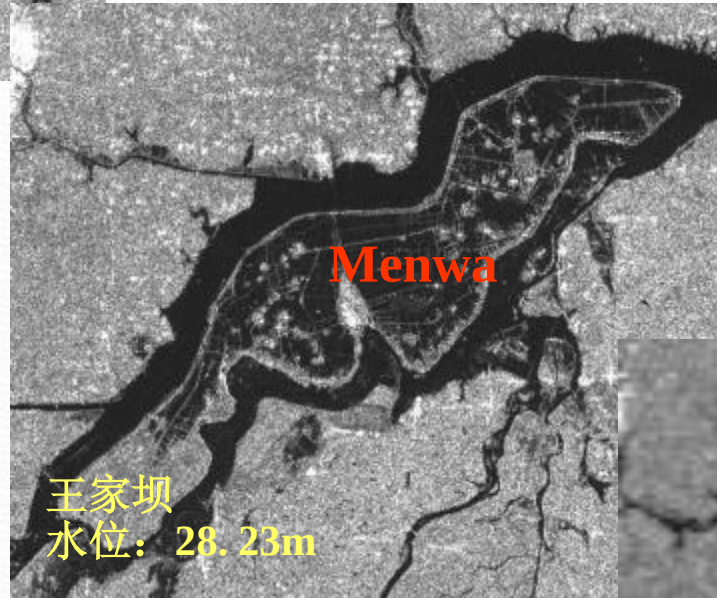


Menwa flood retention had been put in service twice



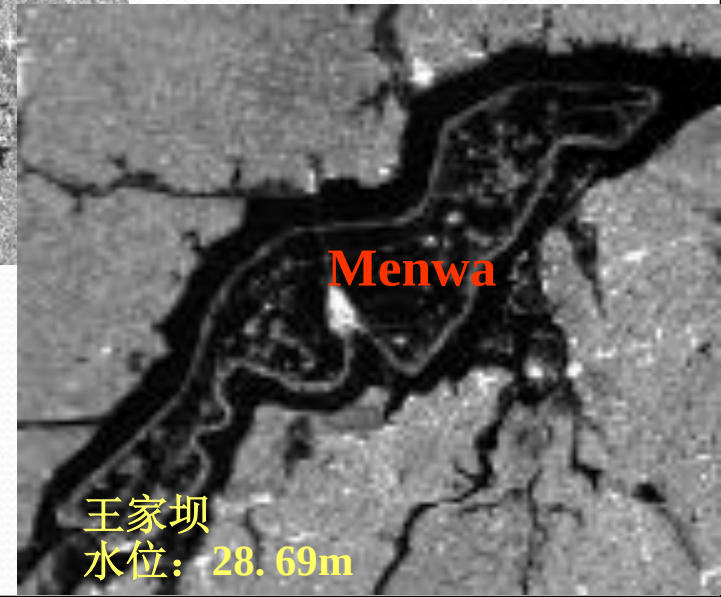
王家坝
水位: 28.23m

2003.7.5(17:22)



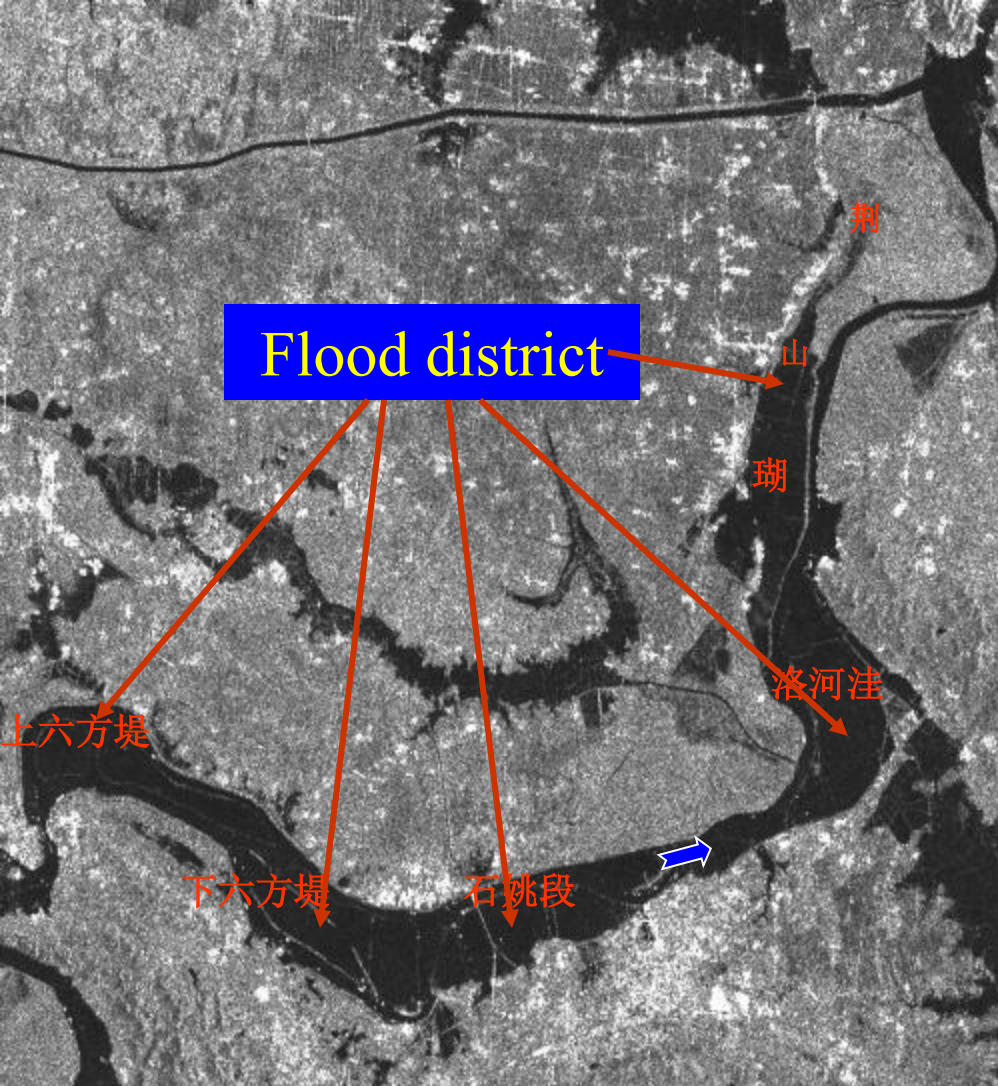
王家坝
水位: 28.23m

2003.7.7(6:11)



王家坝
水位: 28.69m

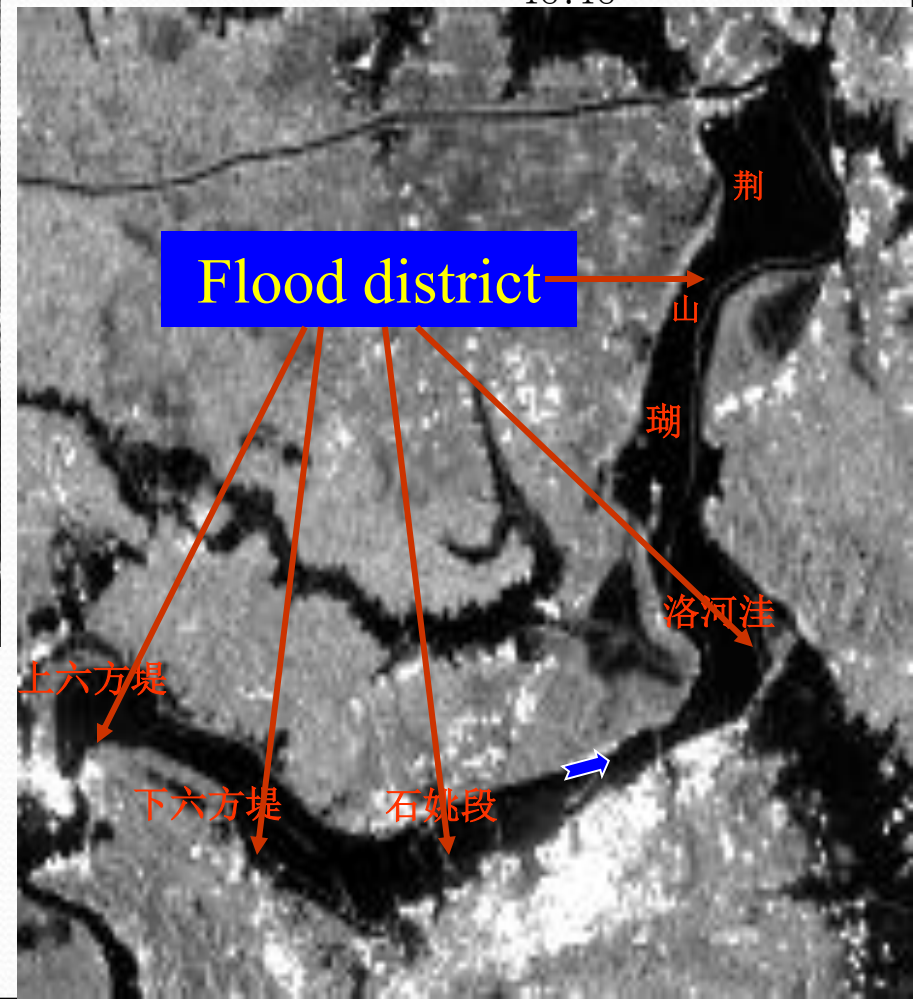
2003.7.12(18:18)



2003. 7. 7
6:11

Several flood district had been
put in service twice

2003. 7. 12
18:18



Case 2:

dam -break flood monitoring in Heilongjiang river in 2013



Inundated Village in Tongjiang (2013.8.30)

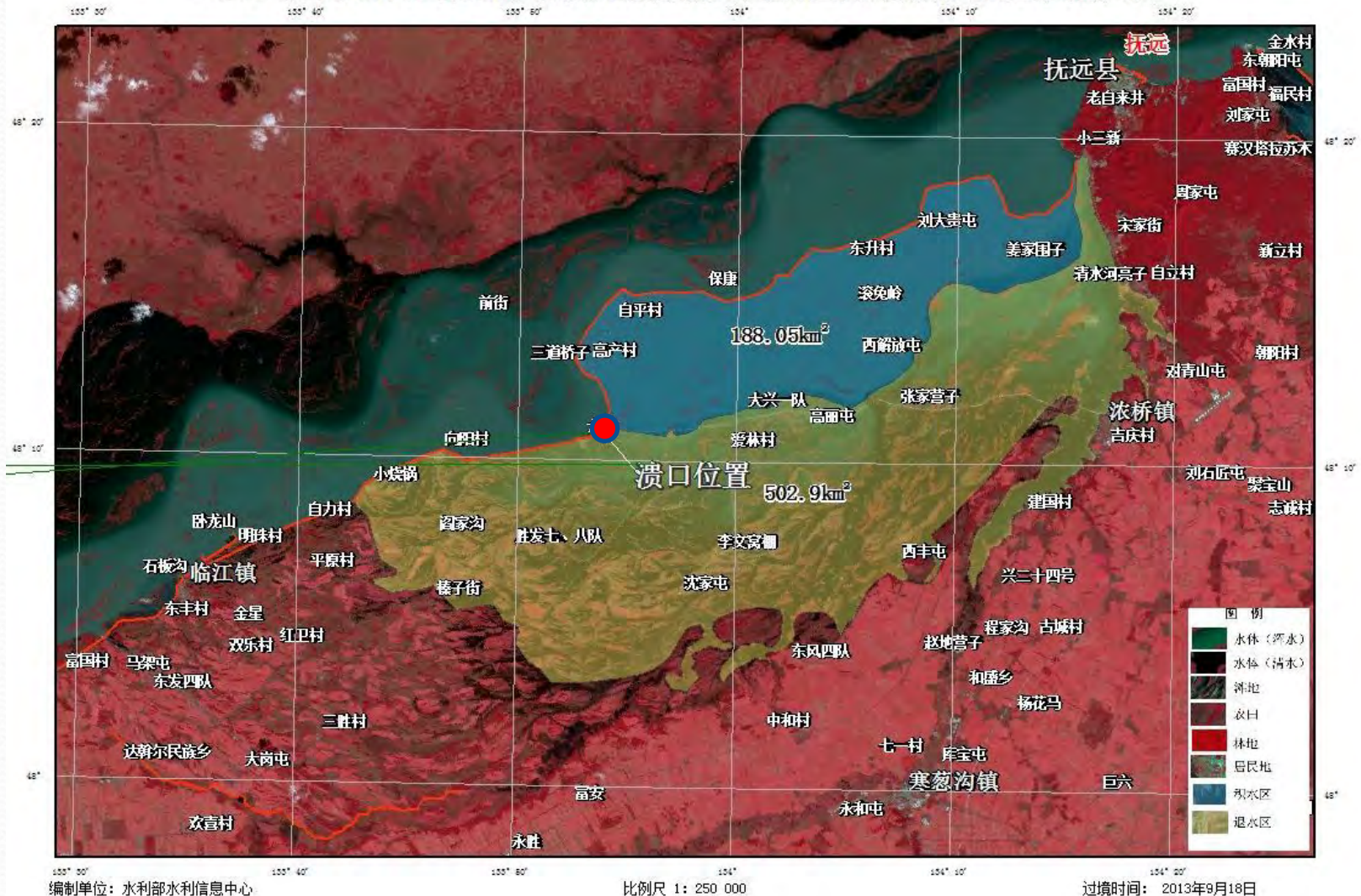
Three dam-break site in the main stream of Heilongjiang river



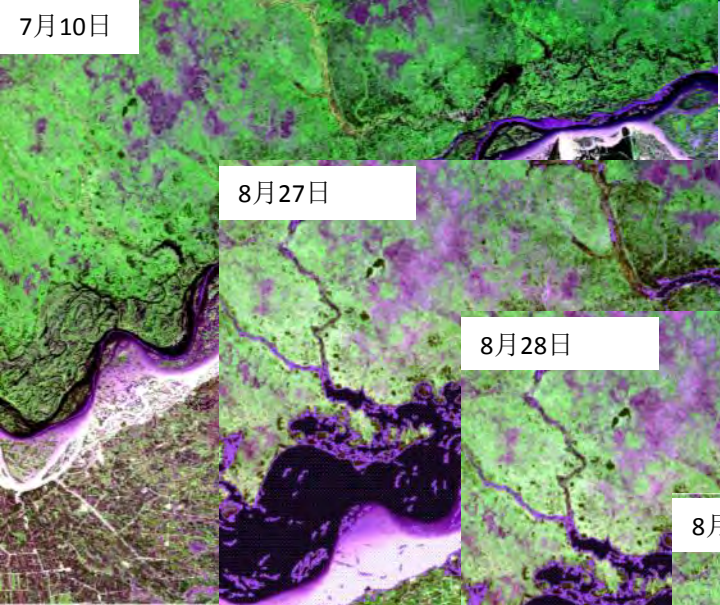
Satellite image used in flood monitoring in Heilongjiang river			
Date	Satellite	Data statistics	
		(Scene)	(G)
2013/7/10	GF-1	4	3.97
2013/8/15		1	1.19
2013/8/20		3	2.62
2013/8/27		3	3.78
2013/8/28		9	11.3
2013/8/29		4	5.05
2013/9/1		6	7.53
2013/9/6		3	8.63
2013/9/7		1	0.789
2013/9/9		5	6.49
2013/9/13		3	3.59
2013/9/18		5	6.49
subtotal		52	61.43
2013/8/25	HJ-A/B	1	0.73
2013/8/26		1	0.65
2013/8/27		1	0.90
2013/8/29		1	0.95
subtotal		4	3.24
2013/8/26	RS-1 (SAR)	1	0.55
2013/8/27		1	0.75
2013/8/29		3	0.47
2013/8/30		1	0.22
2013/8/31		1	0.20
2013/9/1		3	1.28
2013/9/2		4	0.29
2013/9/3		1	0.42
2013/9/4		2	0.62
2013/9/5		3	1.33
2013/9/6		1	0.44
2013/9/9		1	1.05
2013/9/11		3	1.68
subtotal		25	9.3
2013/8/18	Other satellites	2	2.31
2013/8/24		2	3.21
subtotal		4	5.52
total		80	79.49

dam –break flood monitoring in Tongjiang county

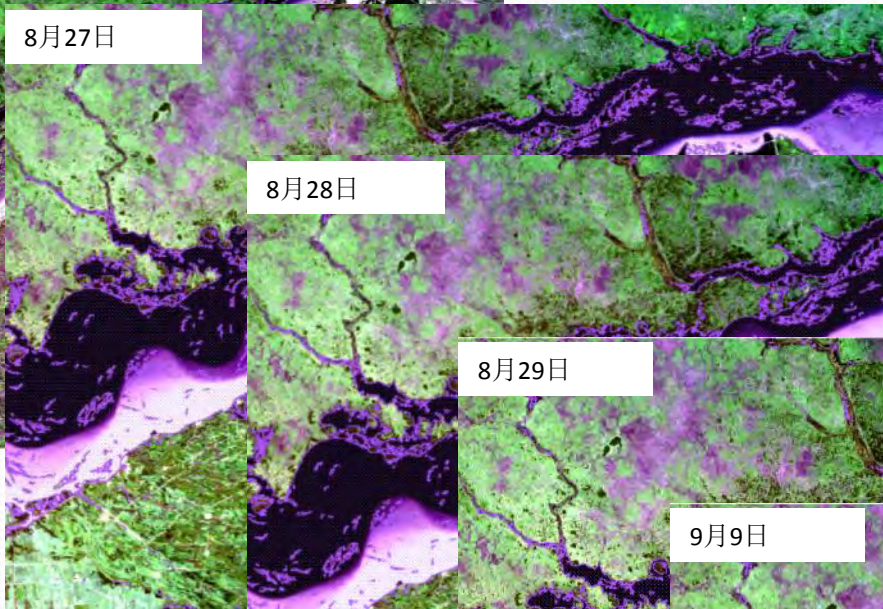
2013年9月18日同江市八岔乡堤防溃口淹没区持续积水和退水范围图



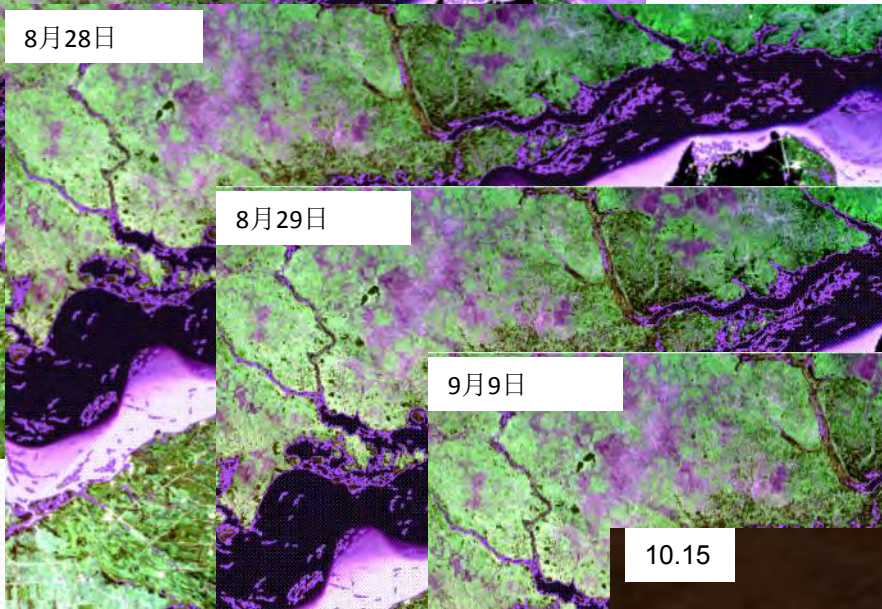
7月10日



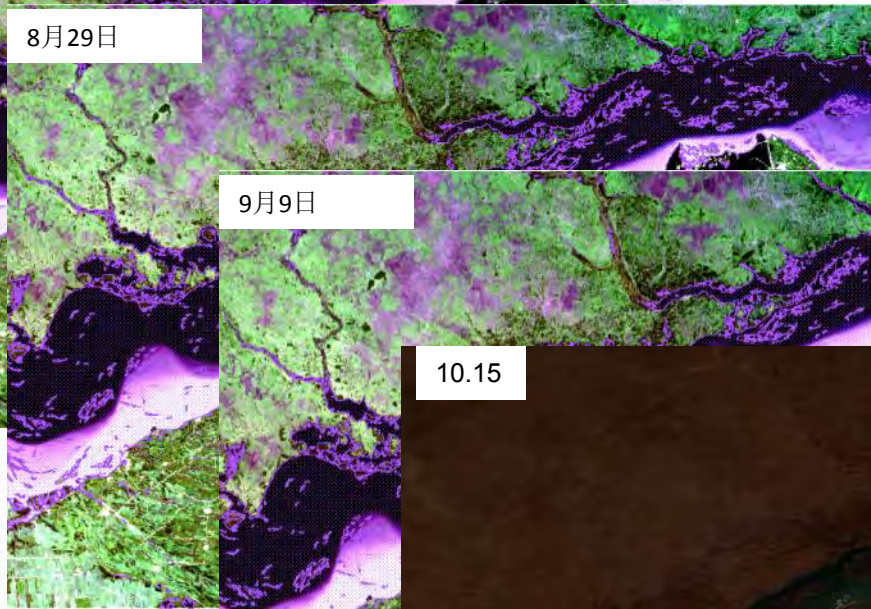
8月27日



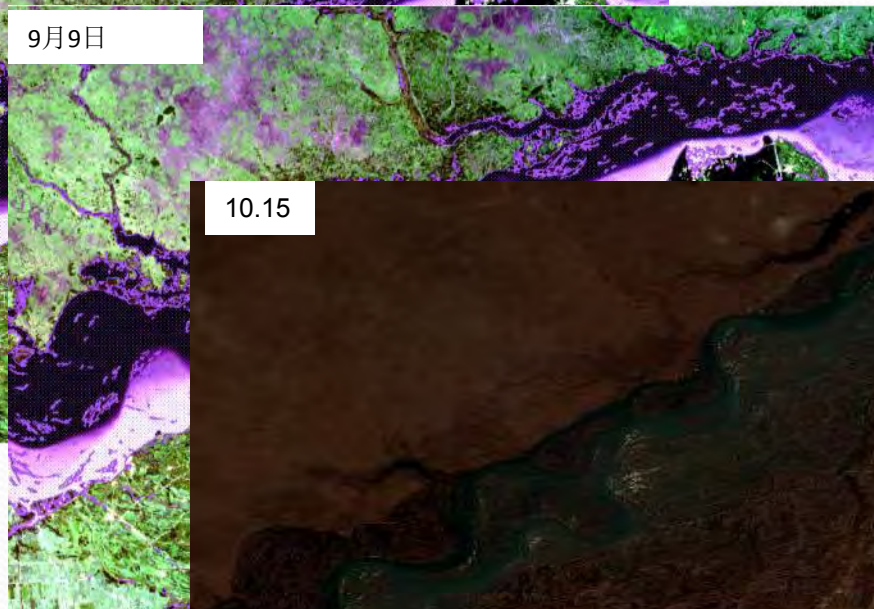
8月28日



8月29日



9月9日



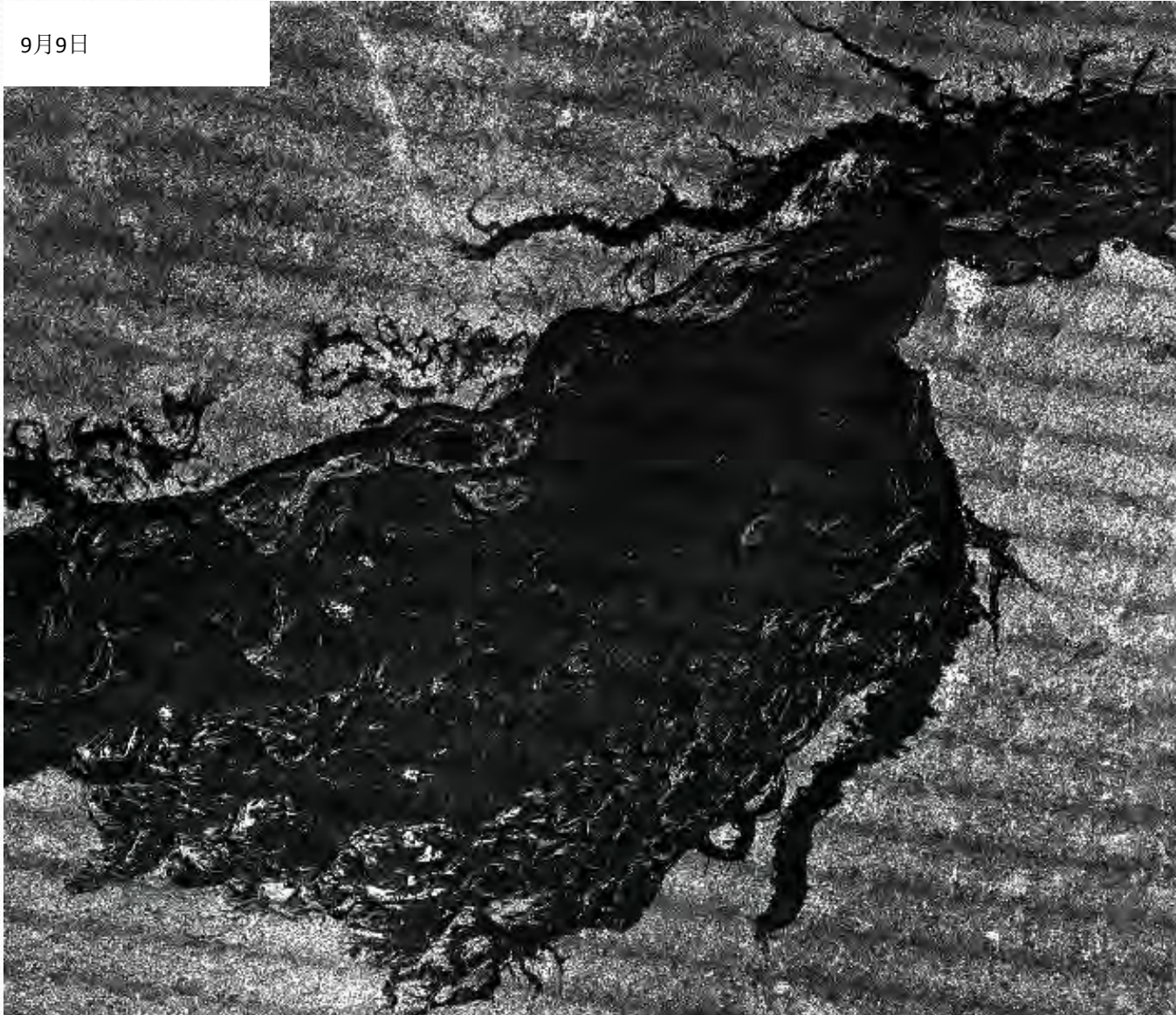
10.15



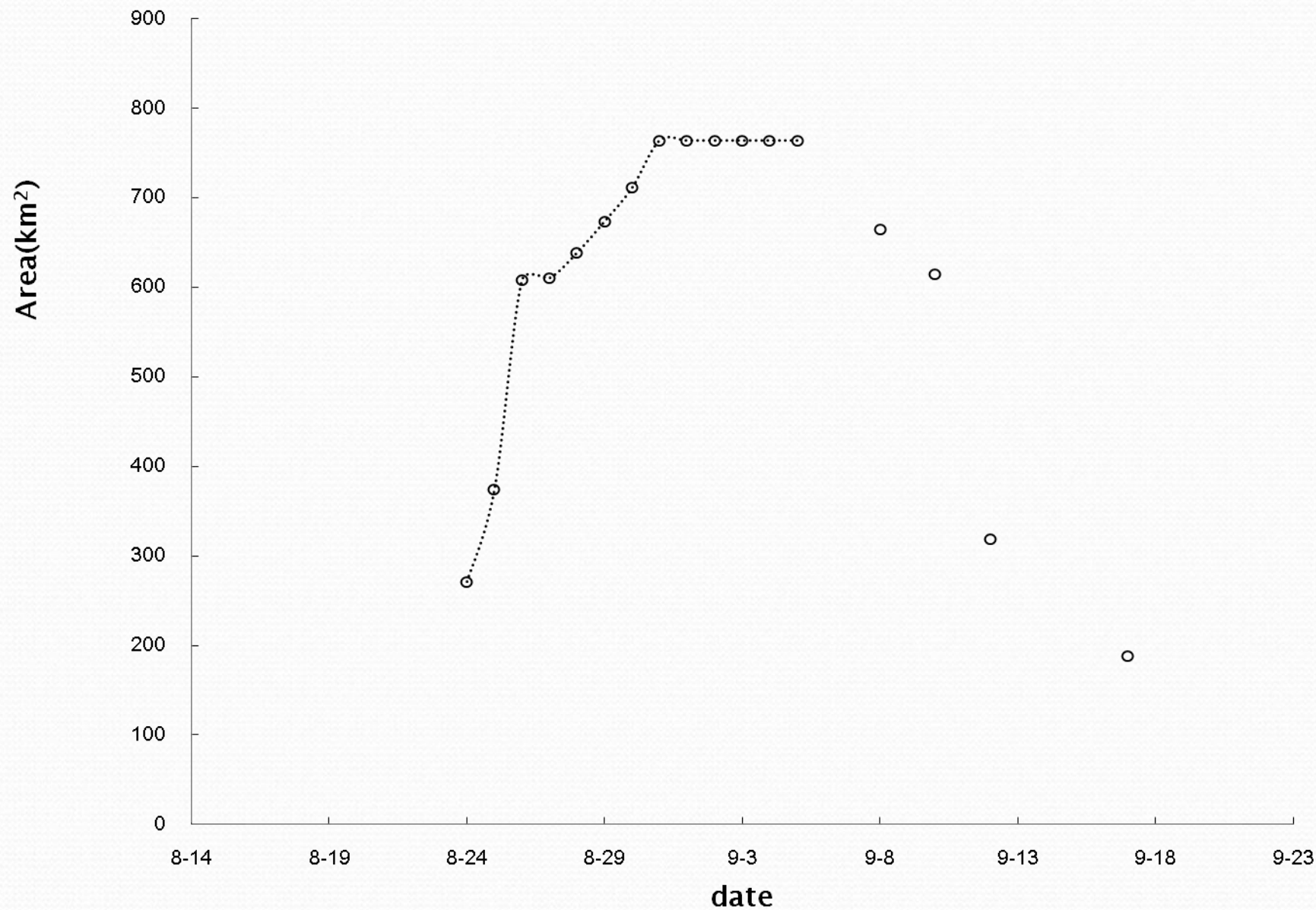
GF-1 image

SAR Image

9月9日

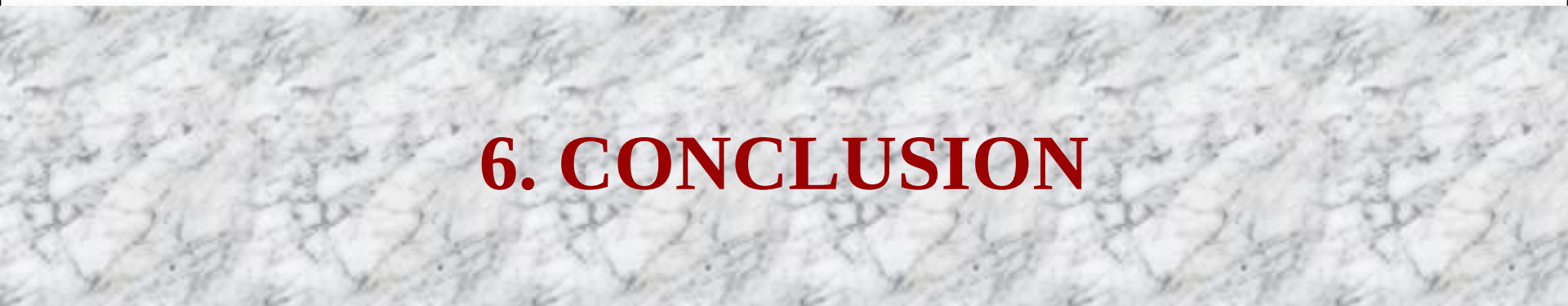


Inundated area variation in Tongjiang county due to dam-broken

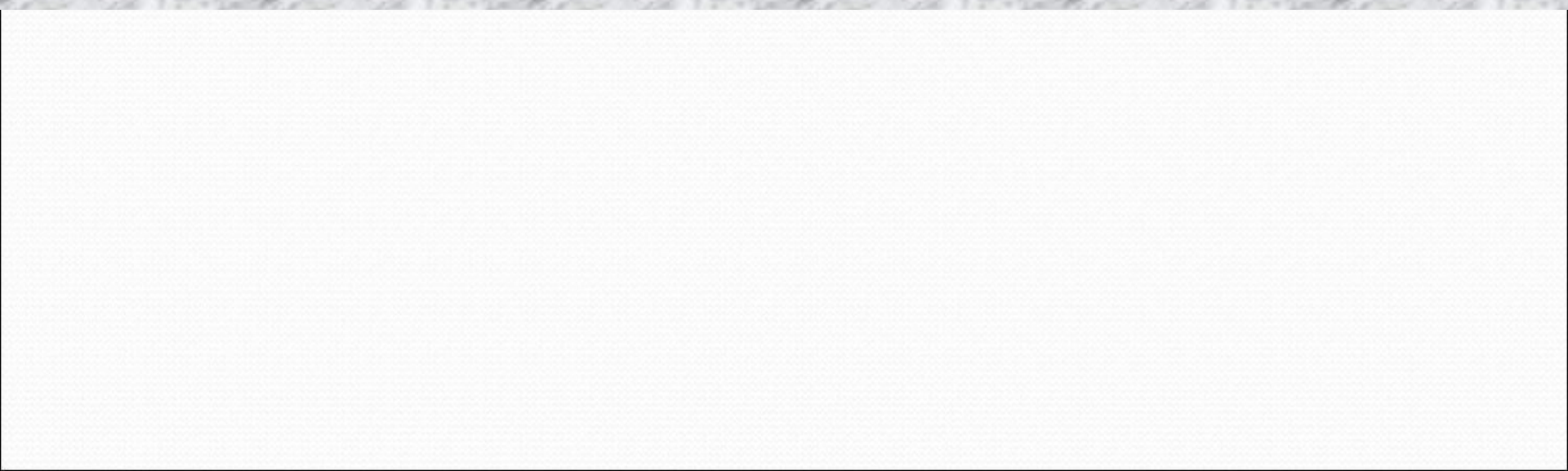




The examples mentioned above show that such kind of operational system is really necessary and important for the state. One system can support flood management for the whole country from the aspect of space technology.



6. CONCLUSION

The slide features a decorative header with blue and white wavy lines. The main content area has a marbled background pattern. The title "6. CONCLUSION" is centered in a bold, dark red font. The footer area is white.

CONCLUSION

- 1. Space technology can play important rule to flood management.**
- 2. Preparedness and assessment before the occurrence of flood disaster is more important for disaster mitigation, space technology is still very useful for that.**
- 3. Integrated system (software, data) is extremely necessary for operational system.**

CONCLUSION (continue)

- 4. Flash floods occur frequently and result in serious losses recently year, we should pay more attention to monitoring of flash floods.**
- 5. It is important to exchange and jointly enjoy data and technology through international cooperation.**

Thank you !

