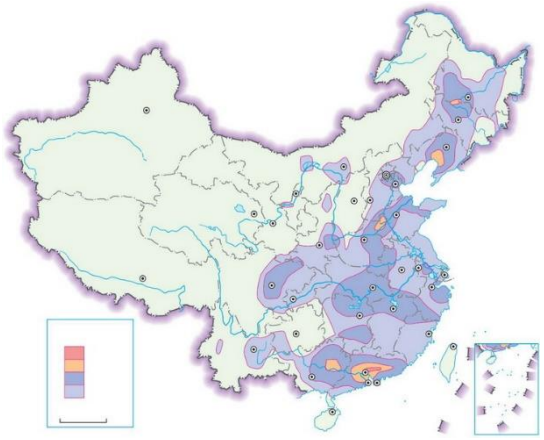


Proposal of CEOS Flood Pilot in Chinese Region

Chuanrong Li crli@aoe.ac.cn
Lingli Tang lltang@aoe.ac.cn
Ziyang Li zyli@aoe.ac.cn
Weiyuan Yao yaowy@aircas.ac.cn

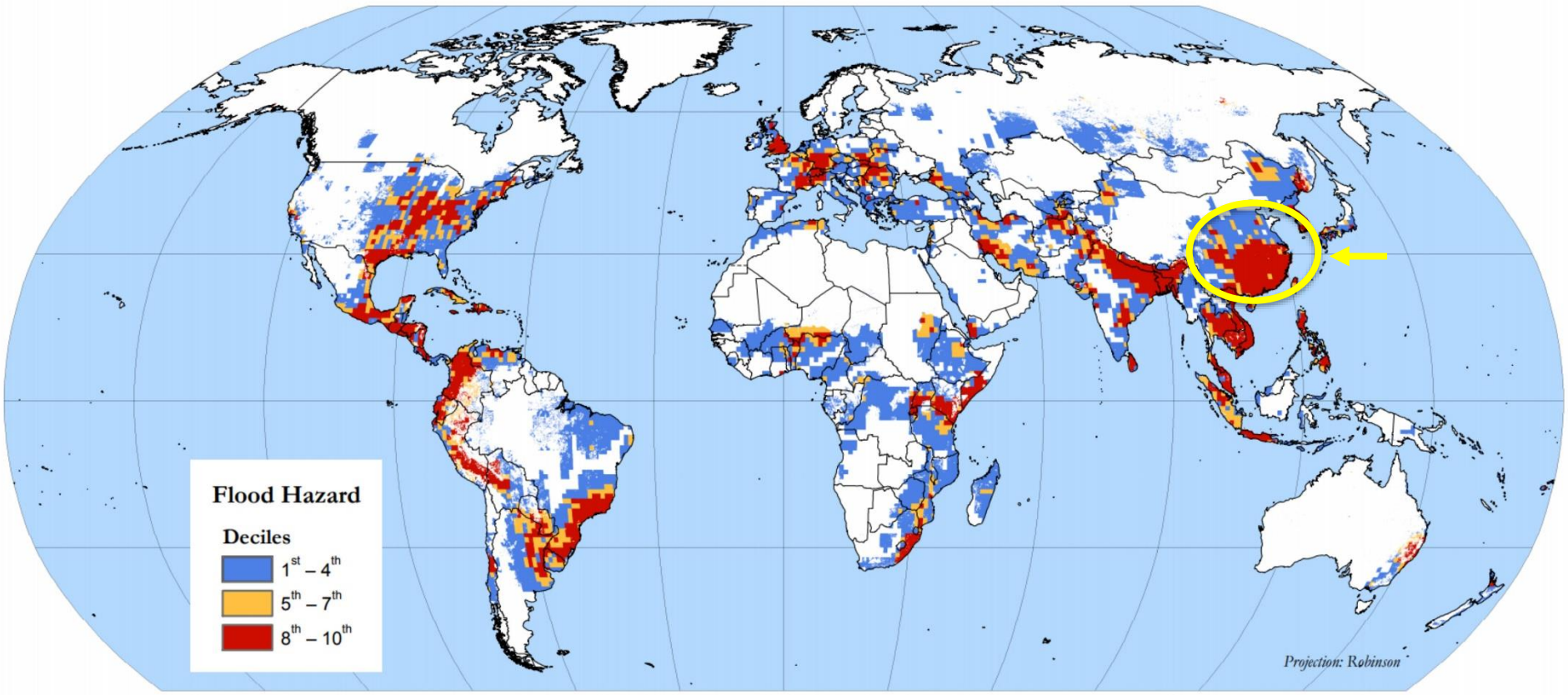
Key Laboratory of Quantitative Remote Sensing Information Technology, Academy of Opto-Electronics (AOE), Chinese Academy of Sciences (CAS)

09-11 March, 2020

Overview

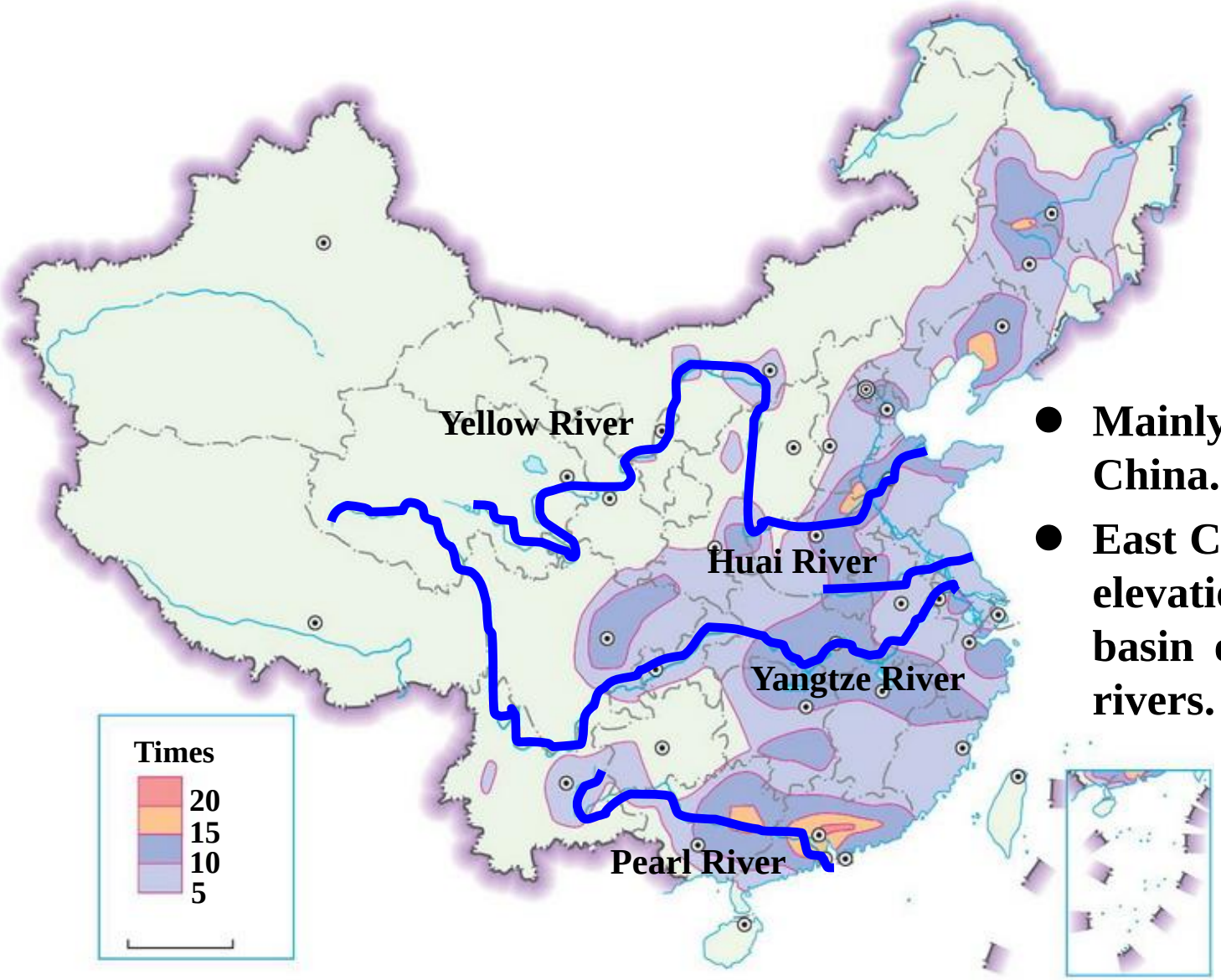
- **Floods in China**
- Methods and Chinese satellite data
- Objectives

Global Flood Map (2003-2016)



- **China is one of the regions that floods occurs frequently.**

Flood map of China (1949 to 1989)



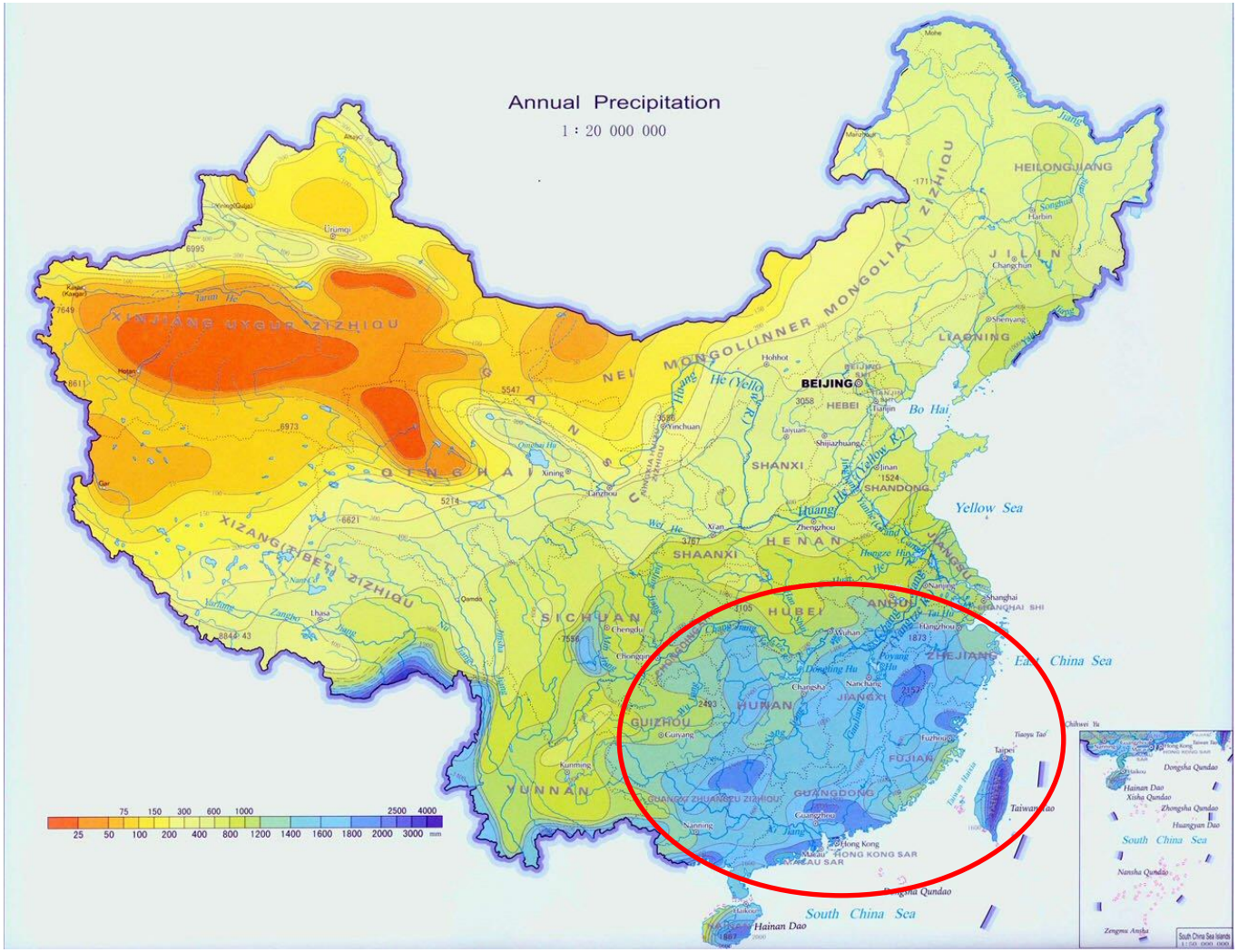
- Mainly occur in East China.
- East China is with flat elevation, and is the basin of several main rivers.

Flood Type

Flood Type	Causes	Affected Region	Affected Period
Rainstorm Flood	• Heavy rainfall • Flat elevation • Human activity	East China (Monsoon area)	April to September
Snowmelt Flood	• Temperature	Mountainous area of Northeast and Northwest China	April to May (Snow melt) July to August (Glacier melt)
Ice Flood	• Direction of river flow • Geographical location	Rivers flow from low latitude to high latitude	November and March

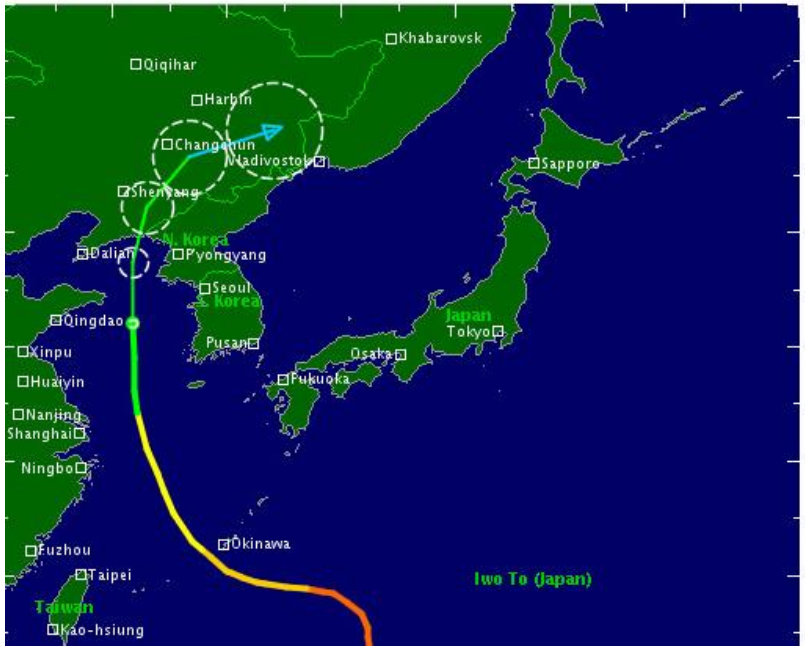
- **Rainstorm Flood is the most harmful flood type in China, which affects the widest region and for longest period.**

Rainstorm Flood Cause 1: Precipitation



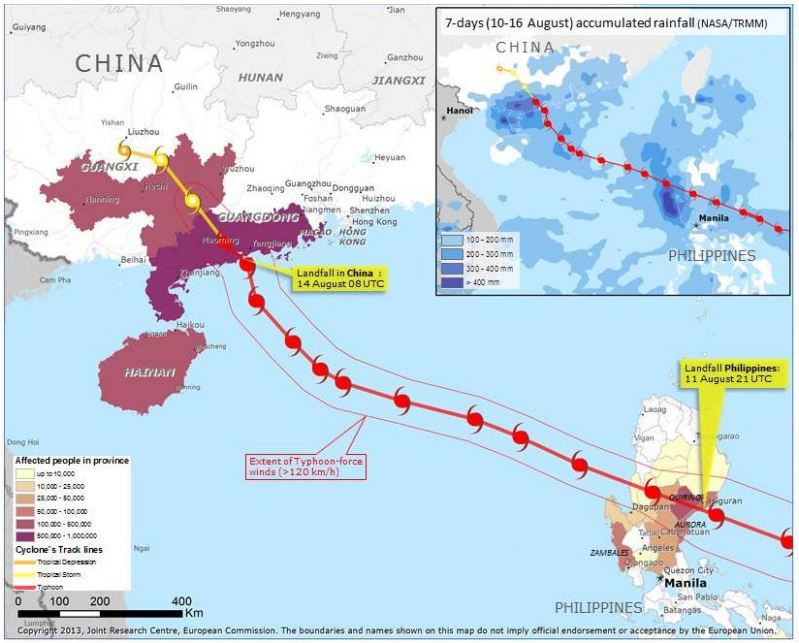
- **The high average rainfall in Southeast China increases the flood risk;**
- **Main reason of the high flood incidence in the basin of Yangtze River and Pearl River.**

Rainstorm Flood Cause 1: Precipitation



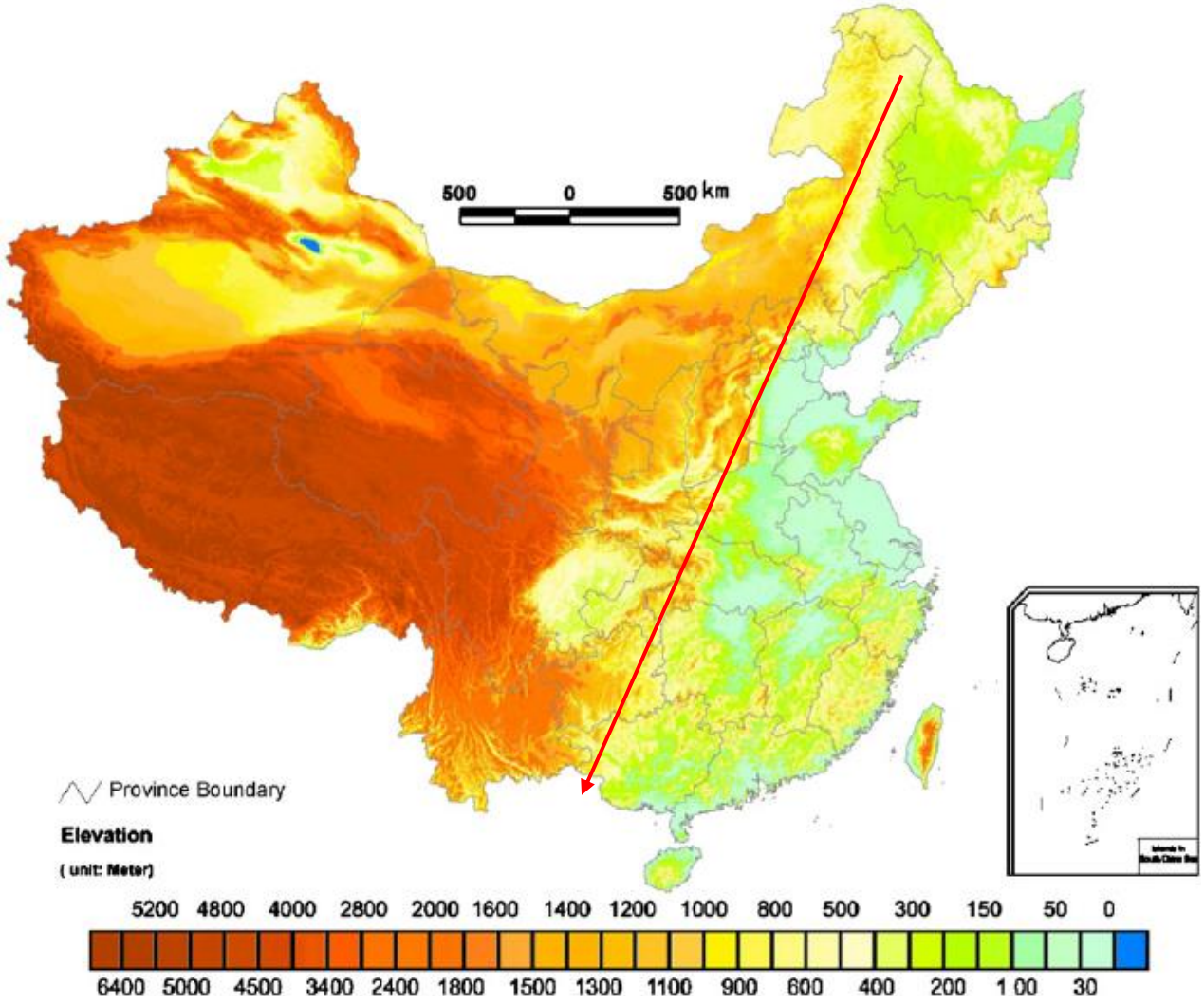
- **Typhoon brings heavy rainfalls, causing floods along the east coastline of China.**

– **Typhoon Muifa**
– Liaoning, Northeast China
– 08-2011



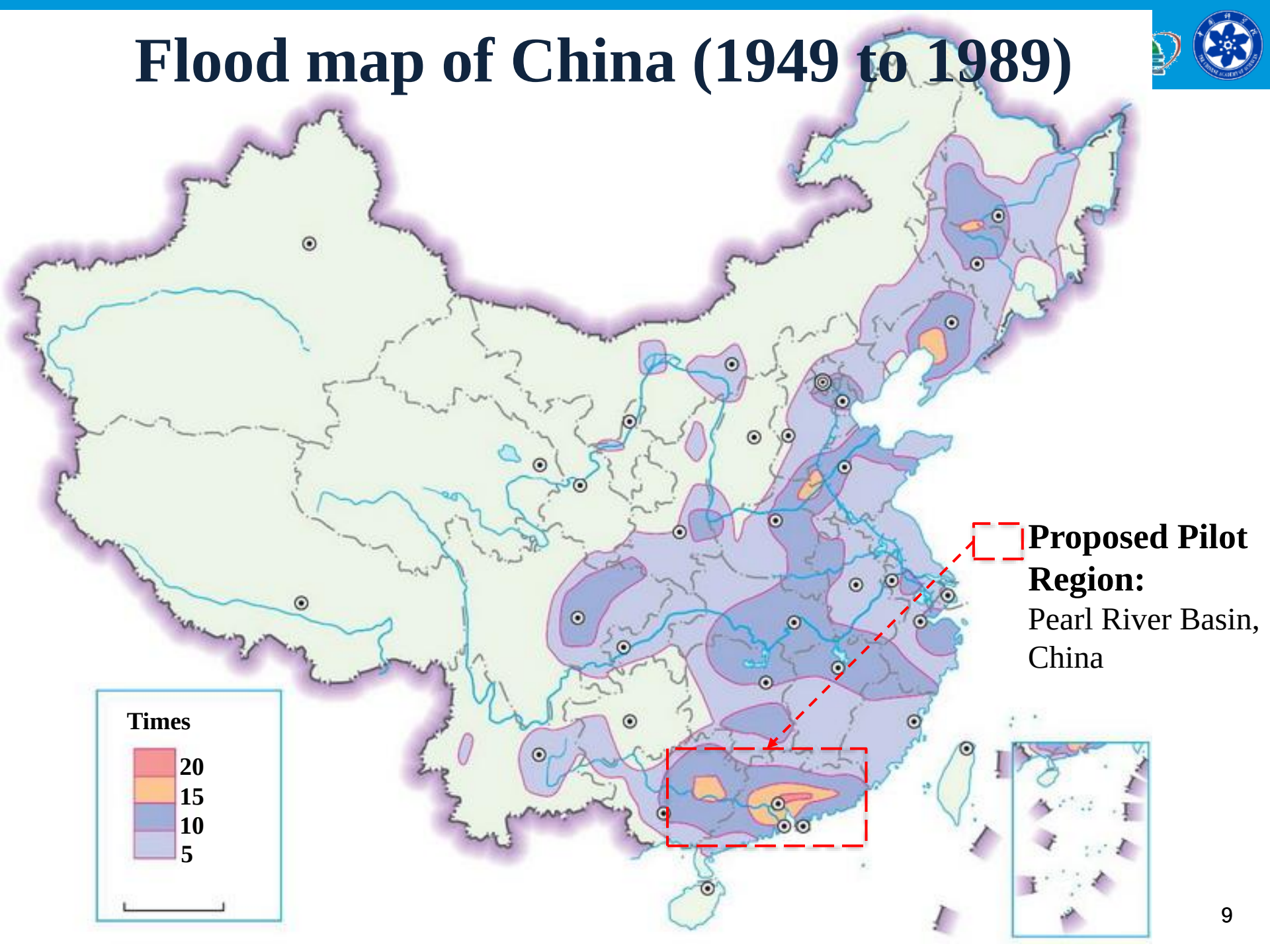
– **Typhoon Utor**
– Guangdong and Guangxi, Southeast China
– 08-2013

Rainstorm Flood Cause 2: Topography



- East China is quite flat and with low elevation;
- Flat terrain cause poor drainage.

Flood map of China (1949 to 1989)



Flood in Pearl River Basin, Guangdong

- Date: 08-2013
- Triggers: Typhoon “Utor” and Heavy Rain
- Death toll is 43, 9 missing
- Affected Population is 8.05 million

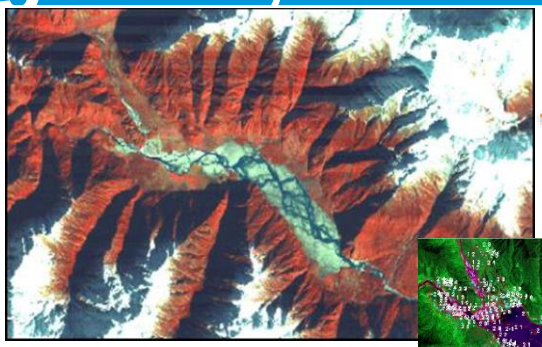
Pearl River Basin, Guangdong

Overview

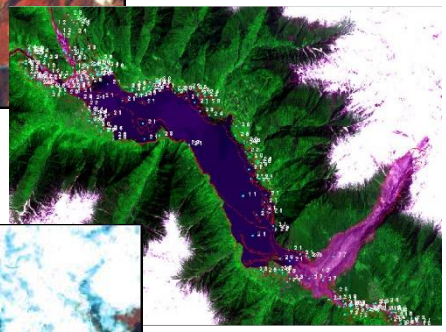
- Floods in China
- **Methods and Chinese satellite data**
- Objectives

Case Study of Yigong Lake, Tibet

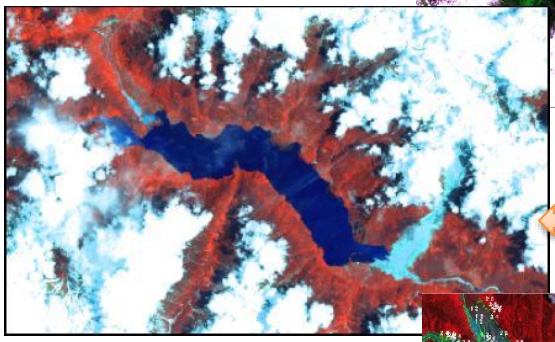
- The lake was barriered by a landslide at the downstream on 09-04-2000. The dam is of 60 meter high;
- A flood discharge is happened on 08-06-2020;
- Satellite data were used for the risk assessment of dam-breaching flood:
  - 20-12-1999 (before the landslide)
  - 20-05-2000 (after landslide)
  - 15-06-2000 (Flood discharge begins)
  - 28-06-2000 (Flood discharge ends)



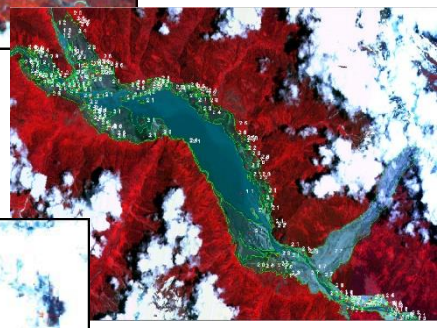
Landsat-7
Date: 20-12-1999



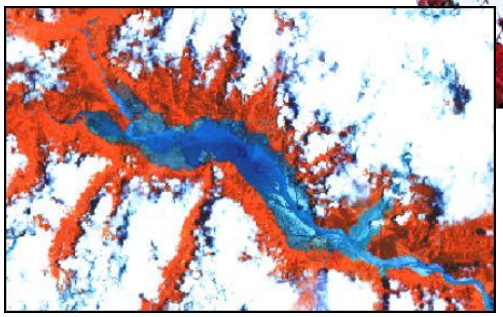
SPOT-1
Date: 20-05-2000



Landsat-7
Date: 20-05-2000



SPOT-1
Date: 15-06-2000



SPOT-1
Date: 28-06-2000

Chinese Optical and SAR Satellites Overview

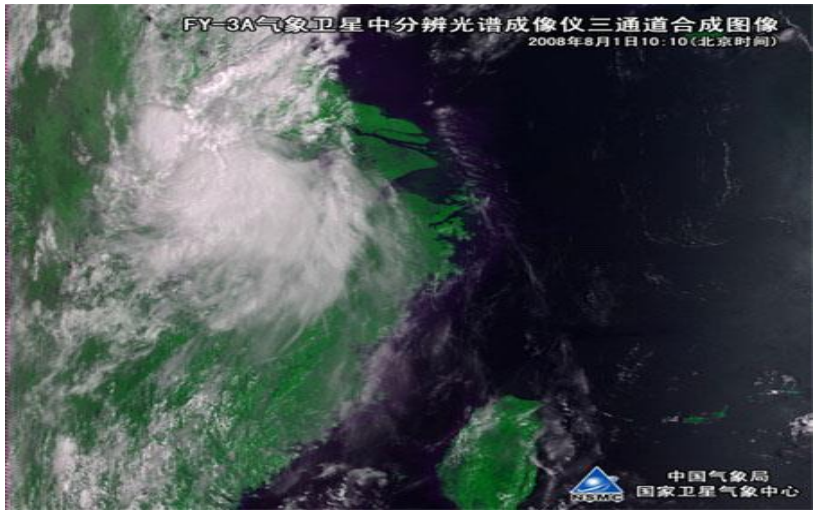
Satellite	Sensors
HJ-1A/B	HJ-1A: CCD Camera, Hyper Spectral Imager (HSI); HJ-1B: CCD Camera, Infrared Scanner (IRS)
HJ-1C	S-wave Band Synthetic Aperture Radar(SAR)
ZY-1 02C	Panchromatic & Multispectral Camera(PAN), HR Camera
ZY-3 01/02	Three-line Array Camera (TAC), Multi-Spectral Camera (MSC)
SJ-9 A/B	SJ-9A: Panchromatic & Multispectral Camera SJ-9B: Infrared Camera
CBERS 03/04	Panchromatic & Multispectral Camera, Multispectral Camera, Infrared Multispectral Camera, Wide Field Camera
GF-1/2/3/4/5/6/7	GF-1: Panchromatic & Multispectral Camera, Multispectral Camera; GF-2: Panchromatic & Multispectral Camera; GF-3: Multi-polarized C-band SAR Sensor; GF-4: Visible Light Near Infrared(VNIR), Medium Wave Infrared(MWIR); GF-5: Environment Monitoring Instrument (EMI), Greenhouse Gases Monitoring Instrument (GMI) , Directional Polarization Camera (DPC); GF-6: Panchromatic/Hyperspectral Camera, Wide Angle Camera; GF-7: Panchromatic and Multi-spectral CCD Camera

Chinese Optical and SAR Satellites Overview

Satellite	Sensors
GJ 01A/B/C/D	Panchromatic Camera(0.5 m), Multispectral Camera(2m)
FY-3 A/B/C	Visible and Infrared Radiometer (VIRR), Infrared Atmospheric Sounder (IRAS), Microwave Temperature Sounder (MWTS), Microwave Humidity Sounder (MWHS), Medium Resolution Spectral Imager (MERSI) Solar Backscattering UV Sounder(SBUS), Total Ozone Unit (TOU), Microwave Radiation Imager (MWRI), Atmospheric Sounding Interferometer(ASI), Earth Radiation Measurement (ERM), Space Environment Monitor(SEM), Solar Irradiation Monitor (SIM)

Optical Sensors on the Satellites

- Pan spectrum range is 0.45μm-0.89μm.
- Multispectral spectrum range is visible, near-infrared, middle-infrared and thermal infrared bands.
- Hyperspectral range is 0.4μm-2.5μm, and the highest spectral resolution is 0.5μm.



FY-3A MERSI Image

GF-1 Pan-MUX Fusion Image

SAR Sensors on the Satellites

Sensor	Observing mode	Resolution (m)	Swath width (km)
HJ-1C: S-wave Band SAR Sensor	Single-Look, Scan Mode	5	100
	Four Directional-Look, Strip Mode	10	40

Sensor	Observing mode	Incidence angle (º)	resolution (m)	swath width (km)	Polarization
GF-3: Multi-polarized C-band SAR Sensor	Spotlight (p)	20~50	1	10 x 10	single
	Ultra-fine stripmap (UF)	20~50	3	30	single
	Fine stripmap (F)	19~50	5	50	dual
	Wide fine stripmap (WF)	19~50	10	100	dual
	Standard stripmap (S)	17~50	25	130	dual
	Narrow ScanSAR (NS)	17~50	50	300	dual
	Wide ScanSAT (WS)	17~50	100	500	dual
	Global observation (G)	17~53	500	650	dual
	Quad-pol stripmap (Q)	20~41	8	30	quad
	Wide quad-pol stripmap (WQ)	20~38	25	40	quad
	Wave (WV)	20~41	10	5 x 5	quad
	Expanded incidence angle(E)	10~20	25	130	dual

GF-3: Multi-polarized C-band SAR Sensor

GF-3
Product: Fine Strip 1
Polarization: HH
Space Resolution: 5m
Date: 15-08-2016

Overview

- Floods in China
- Methods and Chinese satellite data
- **Objectives**

Pilot Objectives

- **Objective A:**
- Identify and inventory Chinese satellite data sources that contribute to flood mapping.

- **Objective B:**
- Explore the feasibility of integrating optical with SAR flood observations and do studies on the flood cases in Pearl River Basin.

Thank you!

Academy of Opto-Electronics (AOE)
Chinese Academy of Sciences (CAS)
www.aircas.ac.cn