

Proposal for CEOS Landslide Pilot in Chinese Region

Chuanrong Li
Lingli Tang
Ziyang Li
Weiyuan Yao

crli@aoe.ac.cn
lltang@aoe.ac.cn
zyli@aoe.ac.cn
yaowy@aircas.ac.cn

Key Laboratory of Quantitative Remote Sensing Information Technology,
Chinese Academy of Sciences (CAS)



Virtual, 9-11 March, 2021

- ◆ Landslides along transportation corridors in Chinese pilot region
- ◆ Available data of the landslide-prone region in China
- ◆ Methods for the landslide disaster detection
- ◆ Equipment for validation
- ◆ What's next

Landslides along transportation corridors

in Chinese pilot region



Pilot Region:
SW China
Active earthquake
& Landslide-prone
region

Landslides triggers :
Earthquakes &
Heavy Rainfalls

Available data of the landslide-prone region in China



- 5808 Optical and 236 SAR Images in Group's Dataset in Total
 - Including Landsat, SPOT, GEOEYE, Quickbird, Radersat, TerraSAR-X, etc.

Chinese Optical and SAR Satellites Overview

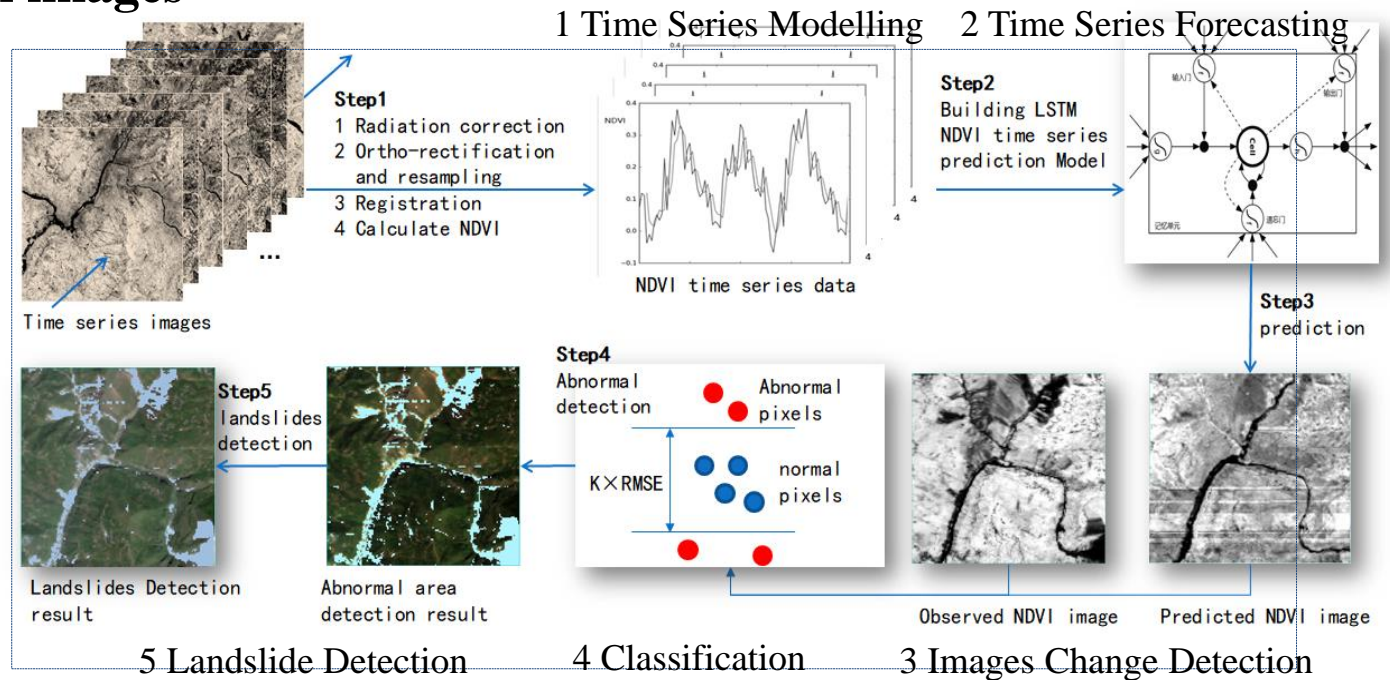
Satellite	Sensors
HJ-1A/B	HJ-1A: CCD Camera, Hyper Spectral Imager (HSI); HJ-1B: CCD Camera, Infrared Scanner (IRS)
ZY-1 02C	Panchromatic & Multispectral Camera(PAN), HR Camera
ZY-3 01/02	Three-line Array Camera (TAC), Multi-Spectral Camera (MSC)
SJ-9 A/B	SJ-9A: Panchromatic & Multispectral Camera, SJ-9B: 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
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 (MWS), 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)

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

Sensor	Observing mode	Incidence angle (°)	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	

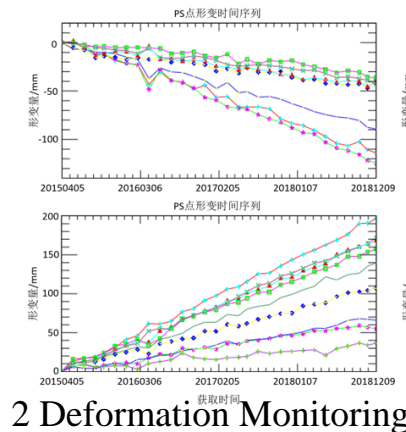
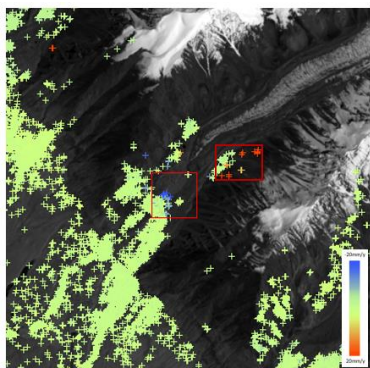


Method for optical images

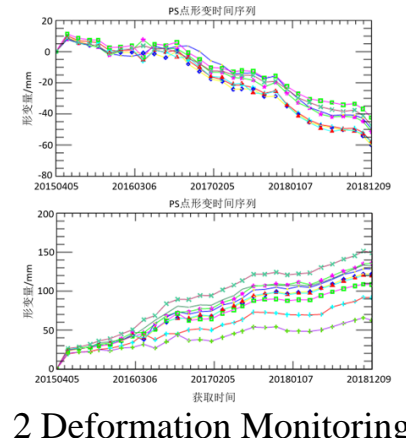
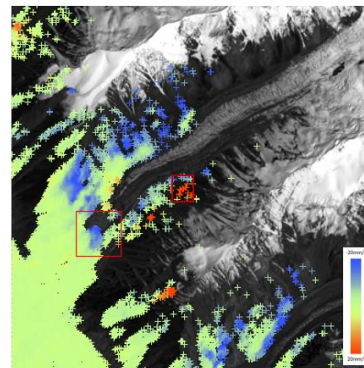


Method for SAR images

PS-InSAR



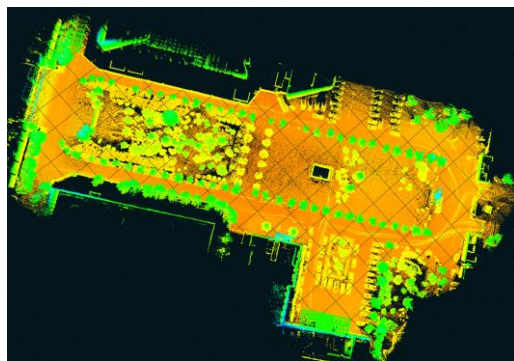
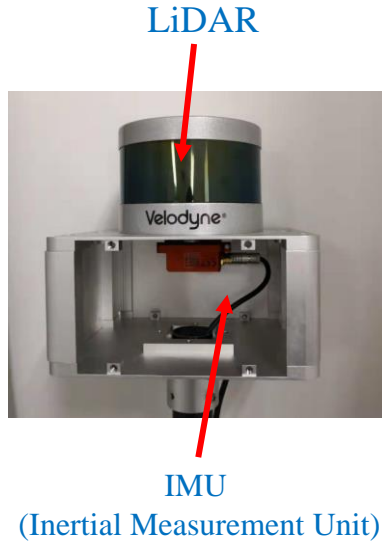
SBAS-InSAR



Equipment for validation



Simultaneous localization and Mapping (SLAM) technology

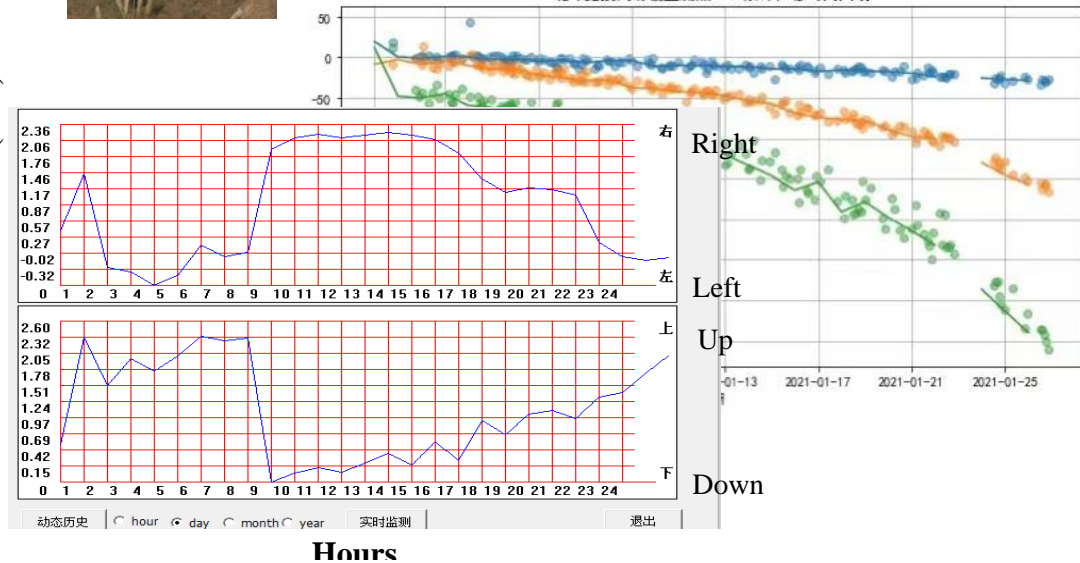


- Construct a map and keep track of the location

Topographic Deformation Monitor



The amount of deformation (mm)



- Capture deformation induced by landslide in real-time

The Beidou /GNSS Monitoring System





- **Site selection**

- Considering that the monitoring region of the validation methods is more limited than that of the satellite observation, the specific study site should be determined to utilize the method mentioned above comprehensively.

- **Landslide Detection algorithm**

- Develop an algorithm for synergetic use of optical, SAR, UAV derived information to obtain a complete picture of the landslide situation

- **Landslide detection system**

- Establish a landslide detection system for public use



Thank you!

Chinese Academy of Sciences (CAS)