



INTERNATIONAL RESEARCH CENTER OF BIG DATA
FOR SUSTAINABLE DEVELOPMENT GOALS
可持续发展大数据国际研究中心

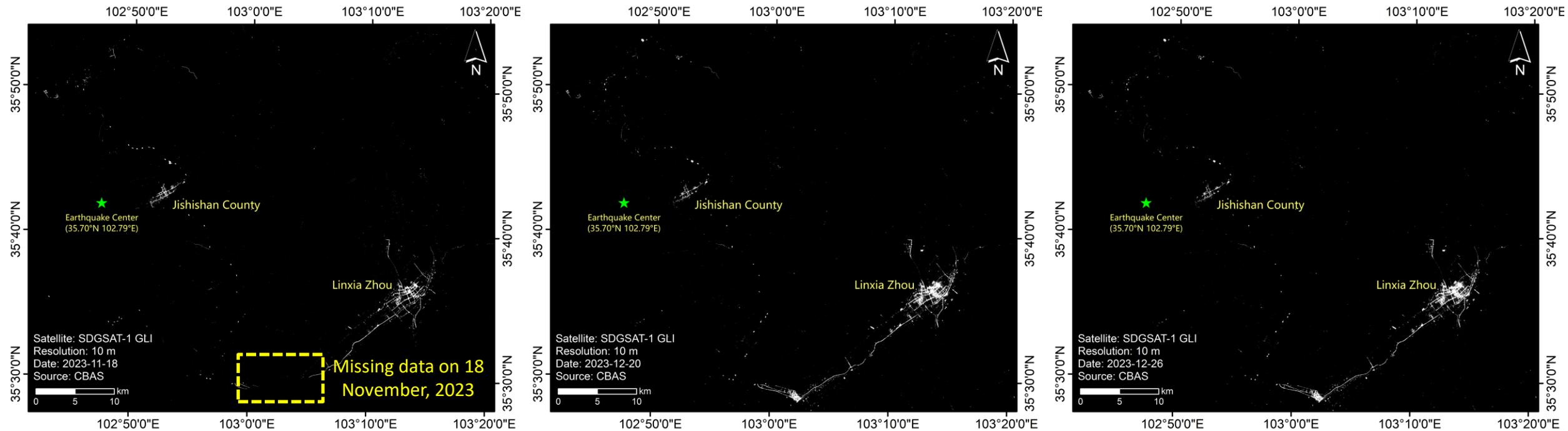


Analysis of Gansu Jishishan Earthquake Based on Nighttime Light

31 December 2023

Introduction

At 23:59 (BJT) on 18 December 2023, a 6.2-magnitude earthquake struck Jishishan County, Linxia Zhou, Gansu province, with a depth of 10 km. The earthquake resulted in the tragic loss of 113 lives, injuries to 536 individuals, and extensive damage to 155,393 houses, as reported as of 13:00 (BJT) on 22 December 2023. In response, the CBAS initiated emergency mapping activities in the affected areas, and planned the transit of SDGSAT-1 to obtain the nighttime light and synchronize thermal infrared spectrometer (TIS) data within one day after the earthquake.

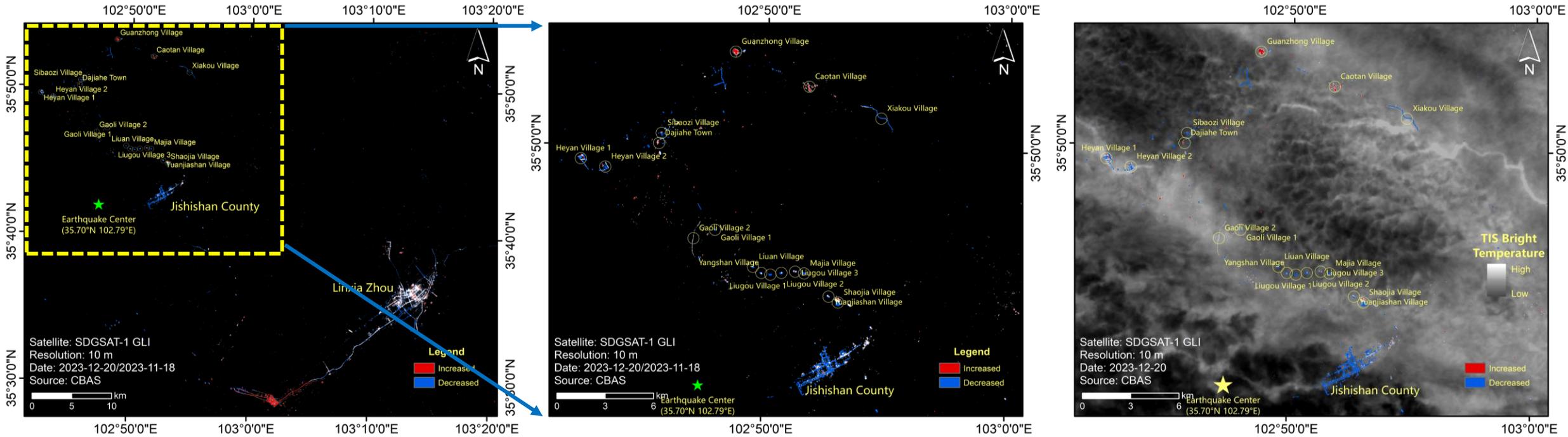


**Before earthquake
(18 November 2023)**

**After earthquake
(20 December 2023)**

**After earthquake
(26 December 2023)**

Impact of earthquakes on local lighting conditions (20 December 2023)



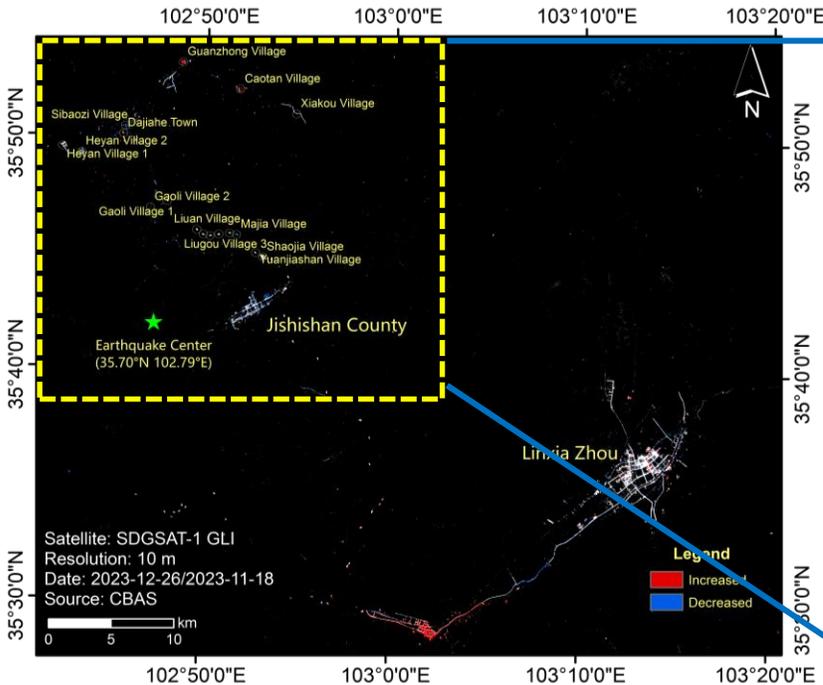
Variation before/after earthquake

Variation before/after earthquake

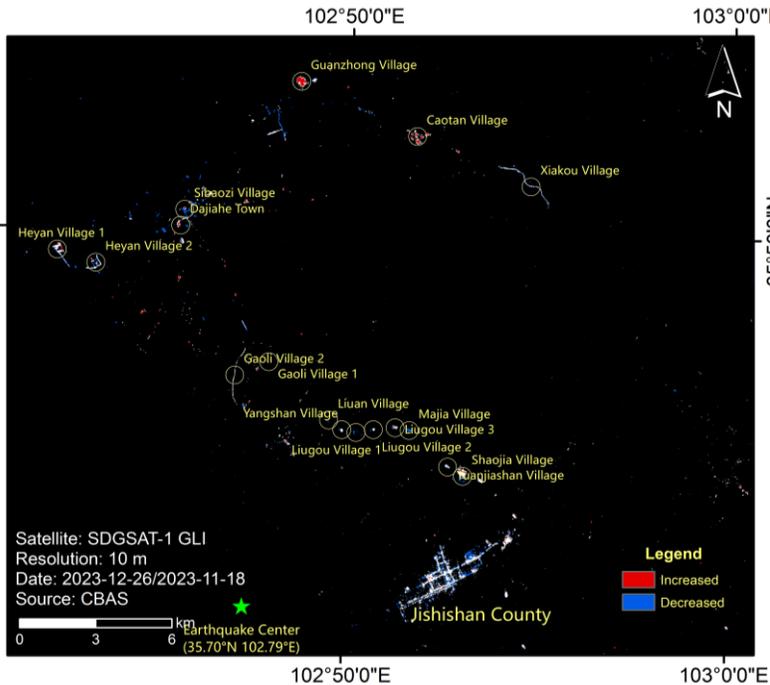
Variation maps with TIS image

On 20 December 2023, a discernible decrease in light intensity was observed in the earthquake-affected area, Villages in close proximity to the earthquake epicenter, such as Gaoli, Yangshan, Liugou, Shaojia, Yuanjiashan, and Majia, experienced a noticeable reduction in light. Conversely, some villages, including Caotan, Guanzhong, Dajiahe, and Sibaozi, witnessed a notable increase in light due to the ongoing rescue operations. However, it can be observed from the TIS image that the variation in lighting was influenced by cloud cover.

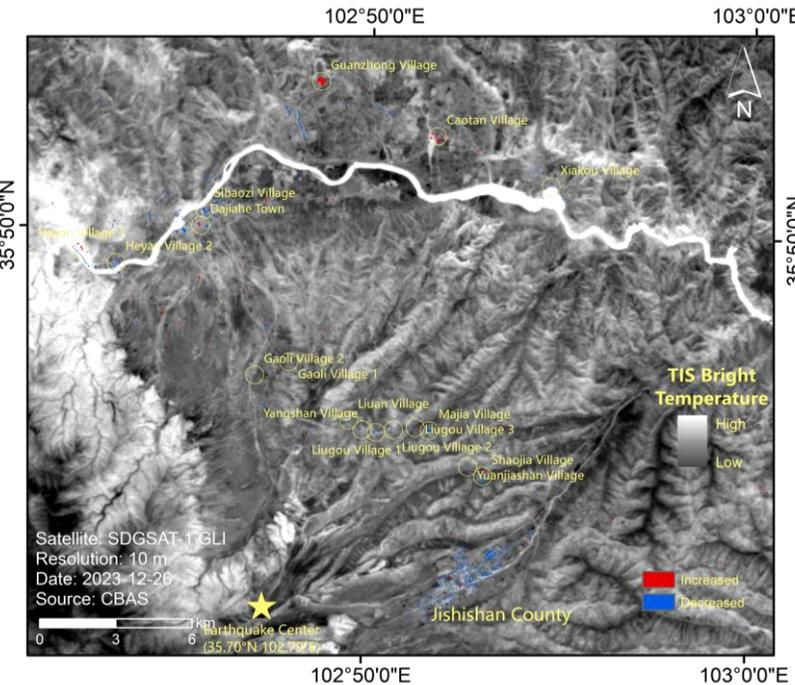
Impact of earthquakes on local lighting conditions (26 December 2023)



Variation before/after earthquake



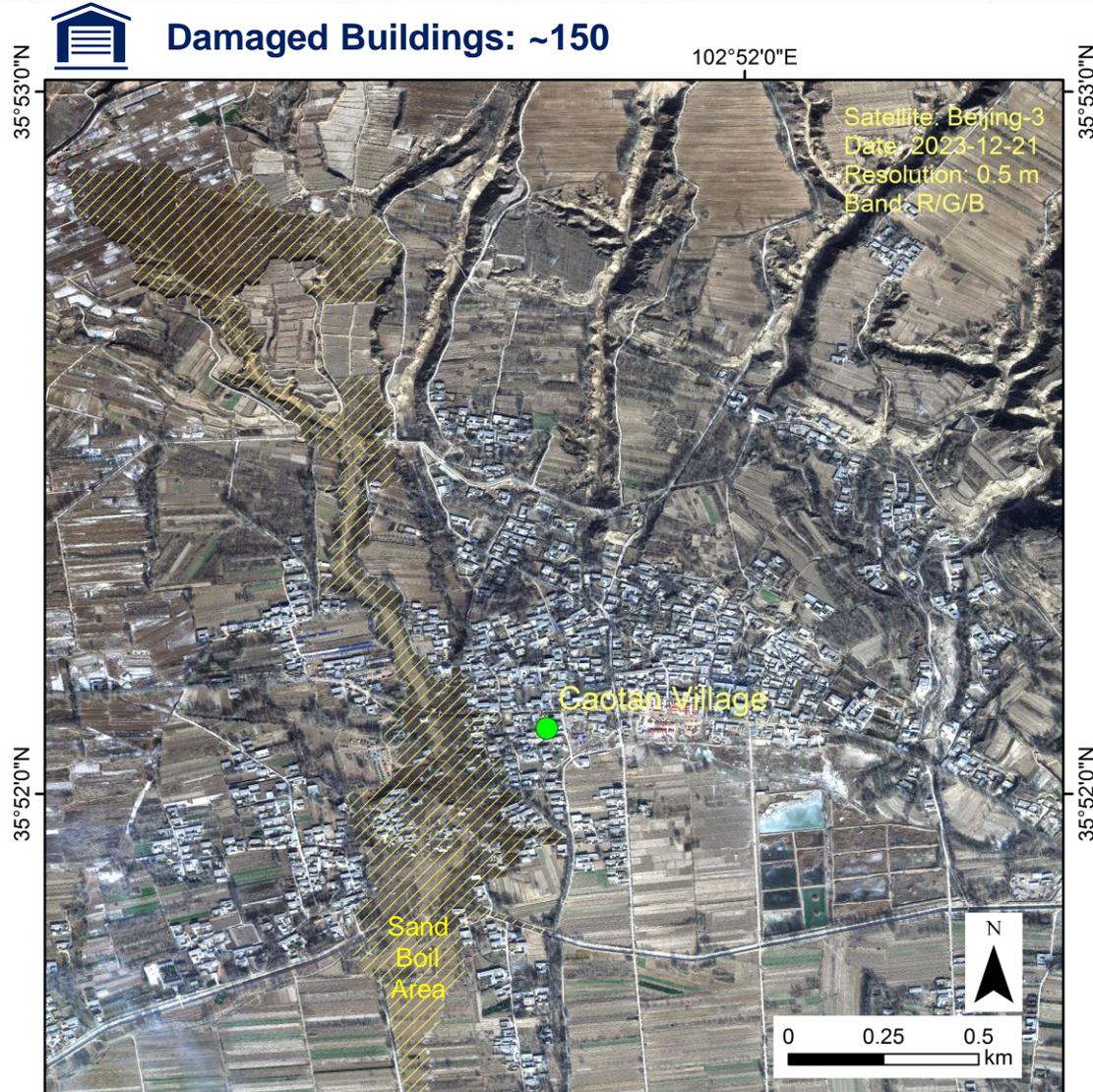
Variation before/after earthquake



Variation maps with TIS image

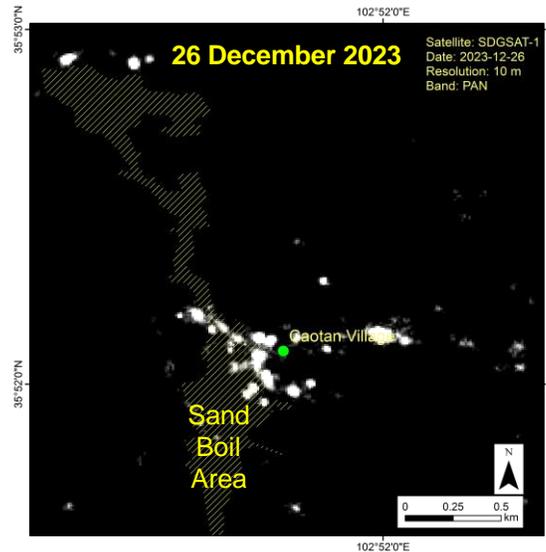
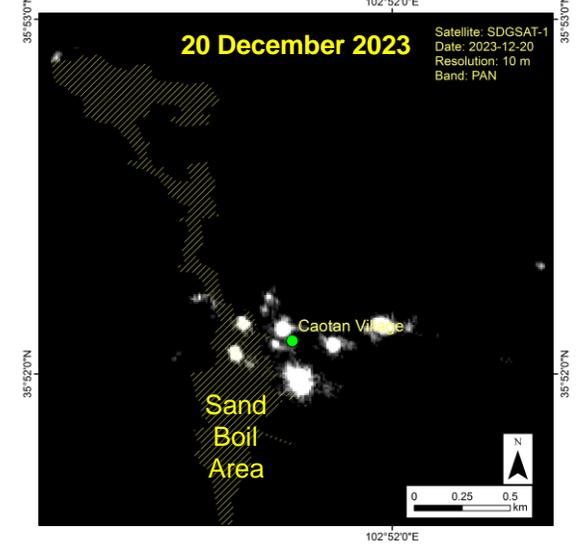
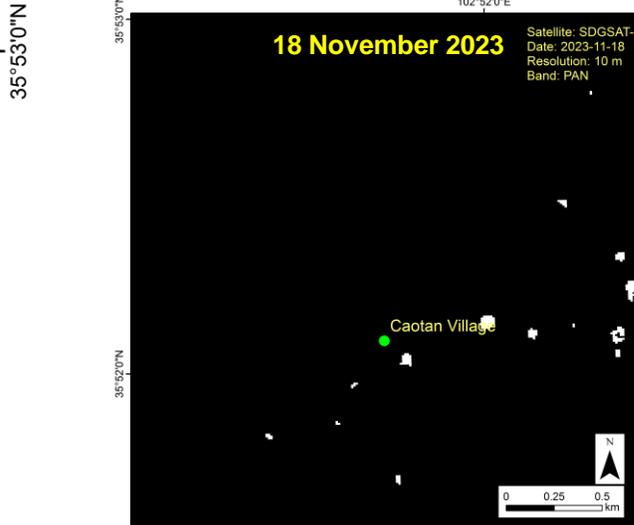
On 26 December 2023, the TIS image indicates that the weather conditions are relatively good. The light intensity in the Jishishan County and other earthquake-affected area has been largely restored, with the exception of Liugou Village. Illumination has returned to most places, notably in Guanzhong Village, Caotan Village and areas where emergency relief tents are situated.

Impact of earthquakes on local lighting conditions (Qinghai Caotan Village)



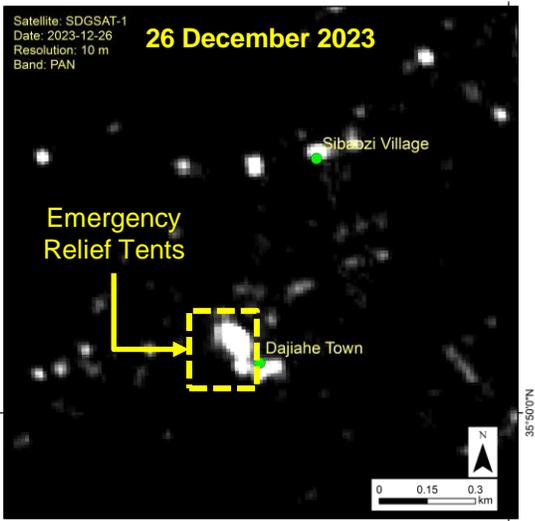
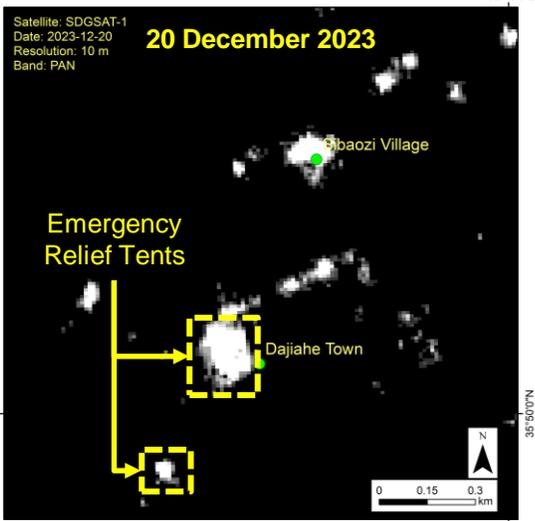
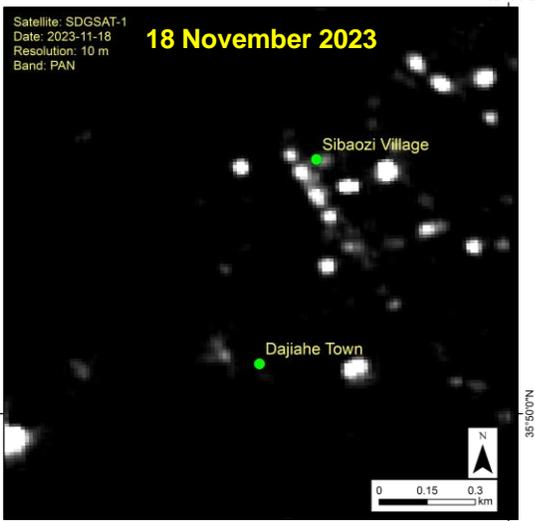
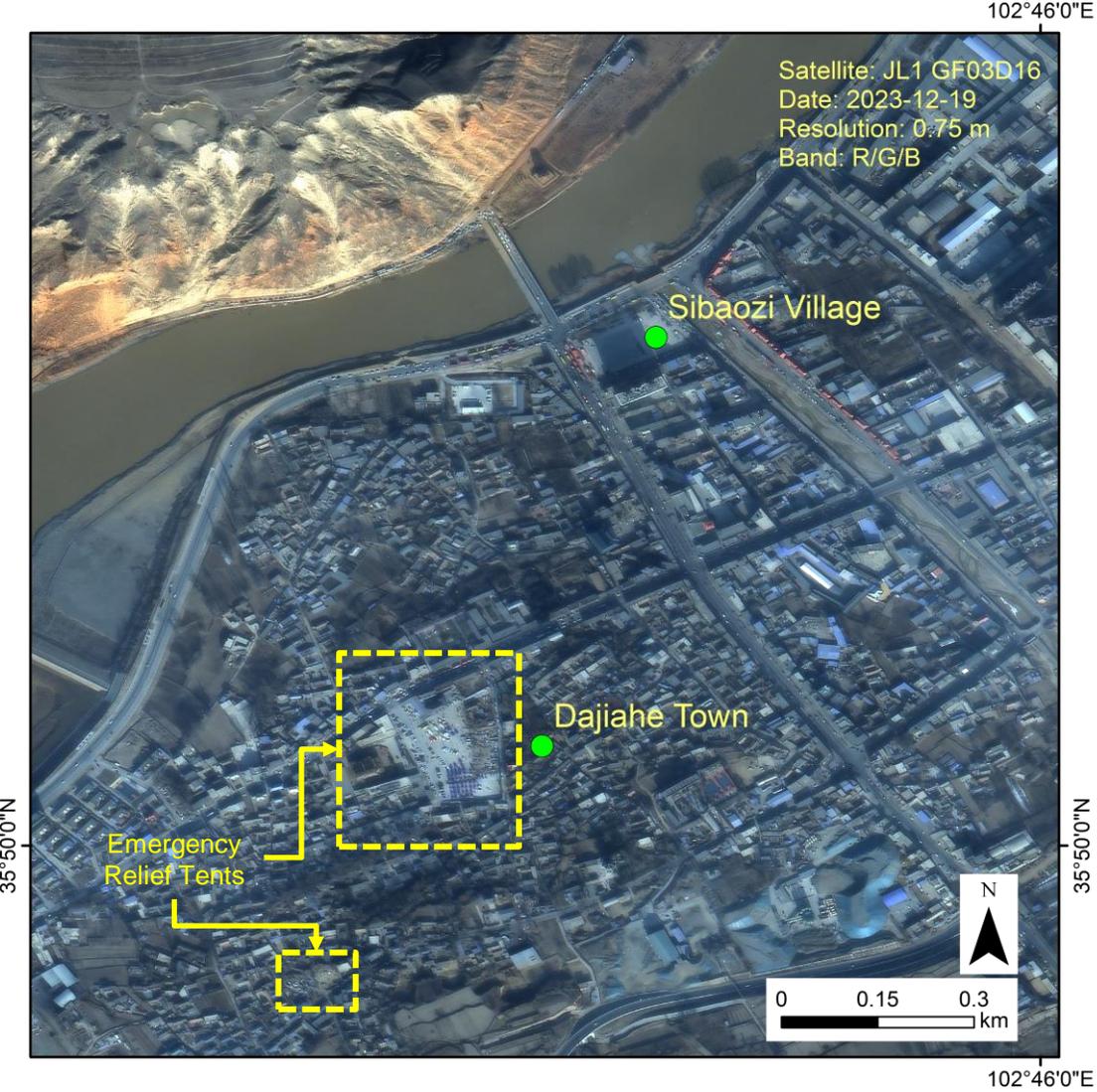
 **Damaged Roads: 4**

102°52'0"E



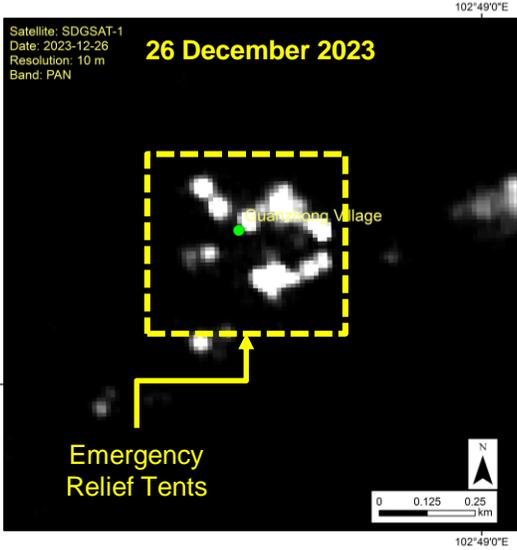
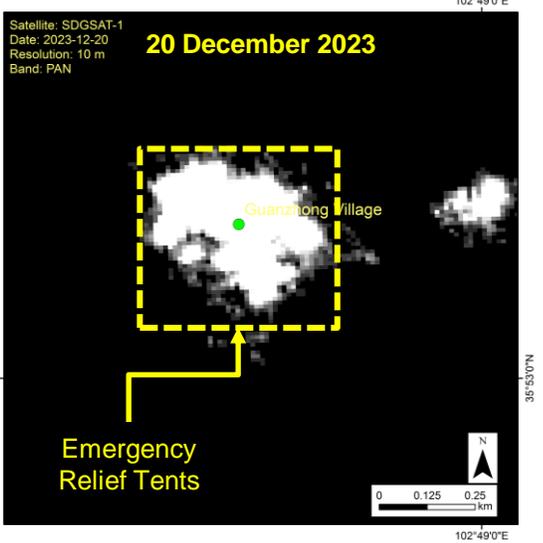
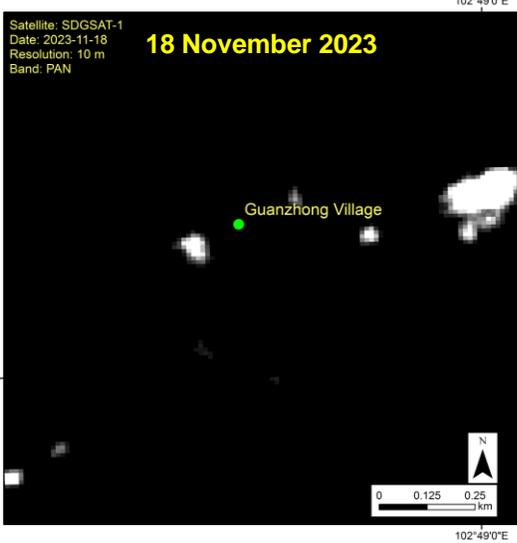
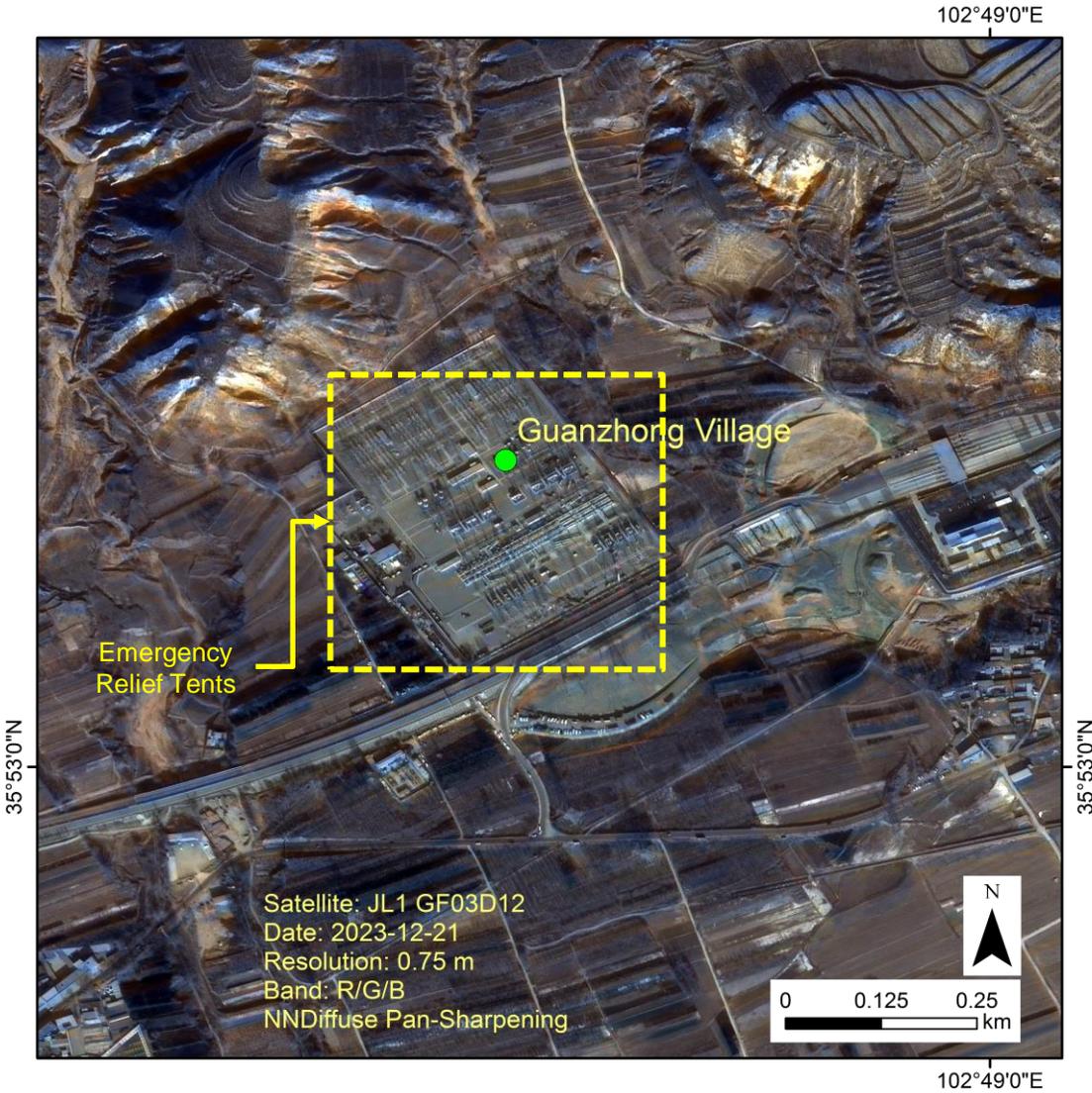
As a consequence of the earthquake, a sand boil occurred in Caotan Village, Qinghai Province, located 19.8 km away from the earthquake center, covering an approximate area of 0.5 km². The local government organized a rescue effort immediately, evident in the discernible trend of increased lighting in the affected area.

Impact of earthquakes on local lighting conditions (Gansu Dajiahe Town)



On 20 December 2023, the light intensity in Dajiahe Town increased significantly, primarily attributed to the setup of emergency relief tents (in the squares). By 26 December 2023, The light intensity began to gradually decrease, signifying significant progress and success in the ongoing relief efforts.

Impact of earthquakes on local lighting conditions (Qinghai Guanzhong Village)



On 20 December 2023, the light intensity in Guanzhong Village experienced a notable increase, mainly due to the installation of emergency relief tents in the village (in the square). By 26 December 2023, the light intensity began to gradually decrease, indicating the substantial success and positive outcomes of the relief efforts.

SUMMARY OF FINDINGS

- On 20 December 2023, there was a significant decrease in light intensity in the earthquake-affected area. Villages in proximity to the earthquake, such as Gaoli, Yangshan, Liugou, Shaojia, Yuanjiashan, and Majia, experienced a noticeable decline in light. Conversely, some villages, including Caotan, Guanzhong, Dajiahe, and Sibaozi, observed a notable increase in light due to the ongoing rescue operations.
- On 26 December 2023, the light intensity in the Jishishan County and other earthquake-affected area has been largely restored, with the exception of Liugou Village.
- As a consequence of the earthquake, a sand boil occurred in Caotan Village, Qinghai Province, located 19.8 km away from the earthquake center, covering an approximate area of 0.5 km². The sand boil resulted in nearly 150 buildings damaged, and ruined 4 roads. The local government organized a rescue effort immediately, evident in the discernible trend of increased lighting in the affected area.
- On 20 December 2023, there was a significant increase in light intensity in both Dajiahe Town and Guanzhong Village, primarily due to the installation of emergency relief tents in the town square. Subsequently, by 26 December 2023, the light intensity in the square began to gradually decrease, indicating the successful outcomes of the relief work.
- Ongoing monitoring and planning for continued efforts are in progress.

1. Data sources

(1) Satellite Images

SDGSAT-1 Glimmer Imager (GLI) / Thermal Infrared Spectrometer (TIS)

- Acquisition Date: 18 November 2023, 20 December 2023, 26 December 2023.
- Resolution: 10 m for GLI, 30 m for TIS
- Copyright: International Research Center of Big Data for Sustainable Development Goals (CBAS)
- Source: International Research Center of Big Data for Sustainable Development Goals (CBAS)

Jilin 1 (JL-1)

- Acquisition Date: 19 December 2023, 21 December 2023
- Resolution: 0.75 m
- Copyright: Chang Guang Satellite Technology Co., Ltd.
- Source: Gansu Data and Application Center for High-resolution Earth Observation System

Beijing 3 (BJ-3)

- Acquisition Date: 21 December 2023
- Resolution: 0.5 m
- Copyright: Twenty First Century Aerospace Technology Co., Ltd.
- Source: Gansu Data and Application Center for High-resolution Earth Observation System

Gaofen 2 (GF-2)

- Acquisition Date: 18 November 2023
- Resolution: 0.8 m / 3.2 m
- Copyright: Earth Observation System and Data Center, China National Space Administration
- Source: Gansu Data and Application Center for High-resolution Earth Observation System

(2) Ancillary data

Administrative boundaries, earth quake information, and other Geographic Information System data (i.e., POI) are kindly provided by the Gansu Data and Application Center for High-resolution Earth Observation System

2. Contribution

Analysis: International Research Center of Big Data for Sustainable Development Goals (CBAS)

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IRDR

Integrated Research on Disaster Risk

Thanks

No.9 Dengzhuang South Road, Haidian District, Beijing 100094, China

Tel: +86-10-82170000

Fax: +86-10-82178980