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SHORT COMMUNICATION

Surface ruptures and land deformation from the 21 June 2022 Afghanistan earthquake

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The 2022 Afghanistan earthquake occurred at the border between Afghanistan and Pakistan at 20:54:36 (UTC) on June 21, 2022. According to the USGS, the earthquake caused vibrations with a magnitude of 5.9, a hypocenter located at a depth of 10 km, and an epicenter at 33,092°N, 69,514°E. According to European Civil Protection and Humanitarian Aid Operations, this event resulted in disaster for human beings 1039 people died, 2949 people were injured, and damaged to homes and infrastructures of 4500 houses were partially or fully destroyed across Paktika and Khost provinces. It is necessary to improve the knowledge of this phenomenon. On the one hand, it is essential to quickly determine the extent of the affected area to provide timely relief services.

On the other hand, it is necessary to determine the deformation characteristics of the fractured zone caused by earthquakes to minimize future damages. Conventional DInSAR technique applied to two images captured on June 18, 2022, and June 30, 2022, respectively, before and after the earthquake event shows the fractured zone with a maximum displacement of 78.4 cm, which locates on the west side of the previously identified northeast-southwest fault. The location of this zone is 15 km in the southward direction of the earthquake epicenter. The interferometric fringes show that a large area to the East of the study area is displaced in comparison to the original position. However, its Northwest region, which corresponds to the Paleogene formations, is much less affected by earthquakes. The earthquake occurred along a left lateral strike-slip fault in the plate boundary between India and Eurasia plates at the Northwestern margin of the collision.

Keywords: Afghanistan earthquake, DInSAR, Sentinel-1A, strike-slip fault, plate boundary.

Data used

Sensor	Beam mode	Acquisiton date	Orbit direction	Path	Frame
Sentinel 1A	IW	18 June 2022	Ascending	71	104
Sentinel 1A	IW	30 June 2022	Ascending	71	104

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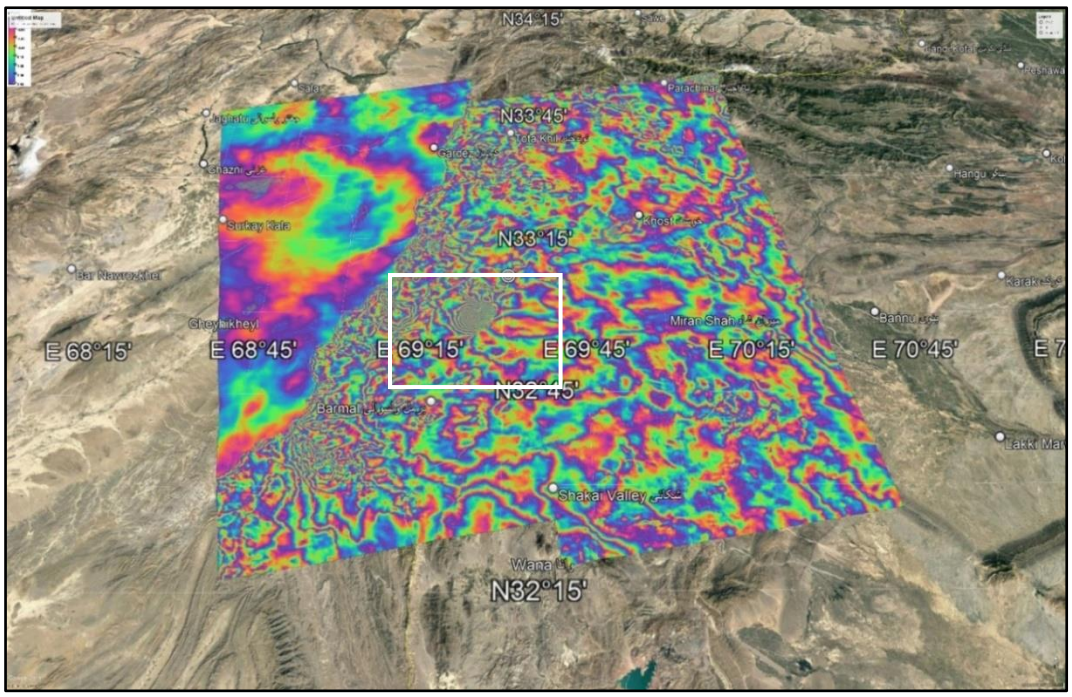

Figure 1. Interferogram from two Sentinel-1 images captured on 18 June 2022 and 30 June 2022. The white box is the location of Figure 2-3. The white dot is the location of earthquake's epicenter provided by USGS (33.092°N, 69.514°E)

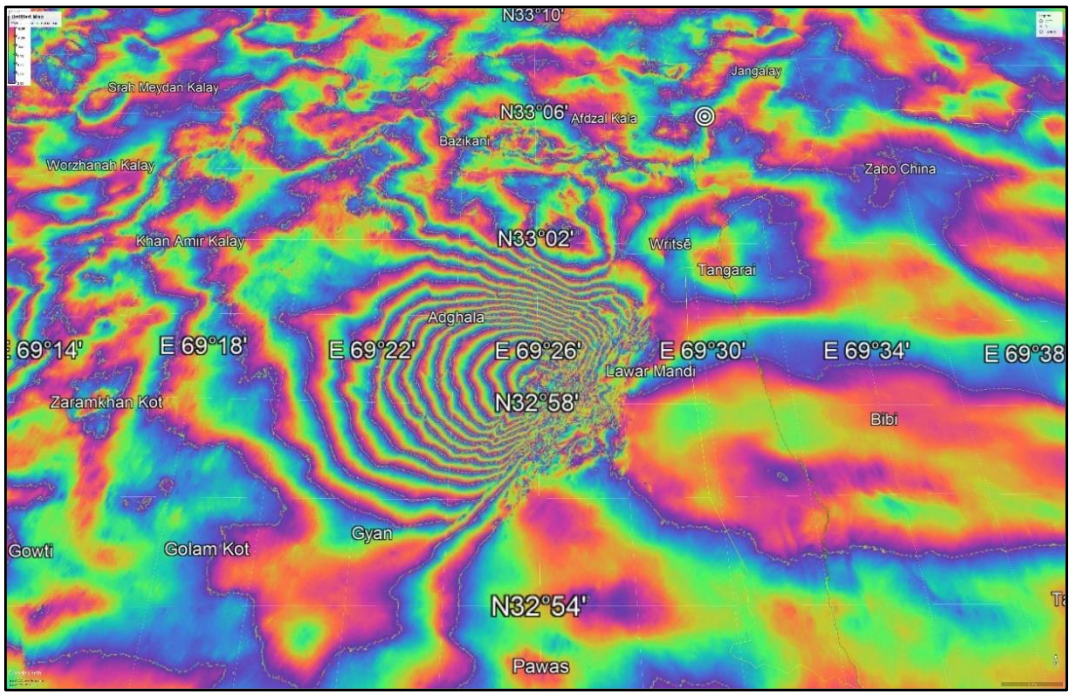

Figure 2. Close-up map at the epicenter of earthquake

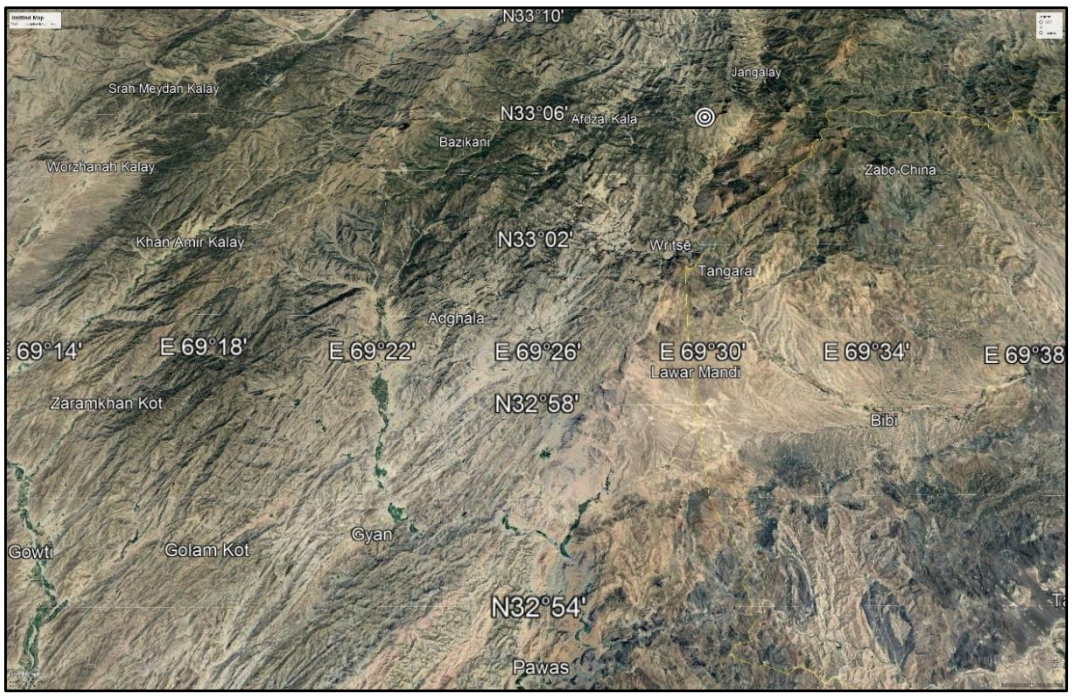

Figure 3. Spectral image from google database (6/2021)

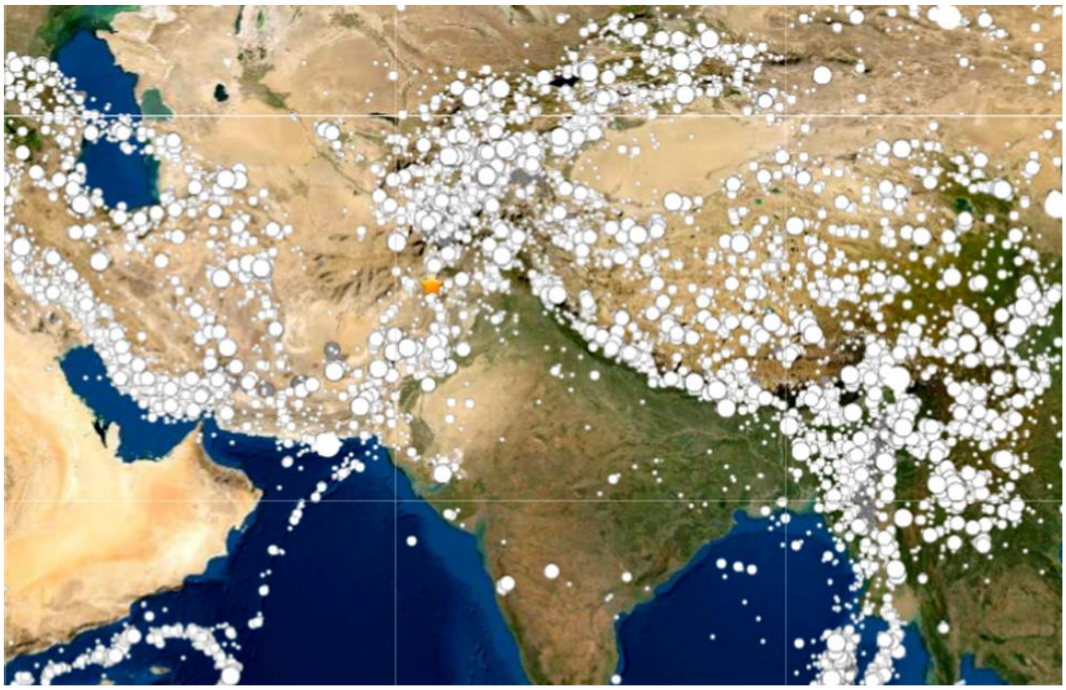

Figure 4. The earthquake occurred along a left lateral strike-slip fault in the plate boundary between India and Eurasia plates at the Northwestern margin of the collision. The yellow star is the location of earthquake's epicenter (Data: USGS)

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