

Combined Effect of Mining, Subsidence and Coal Fires in Jharkhand, India Investigated using Satellite Remote Sensing and Data Fusion

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Abstract

The coal fires that started over a century ago in Jharia Coal Fields constitute a significant threat to the coal reserves, infrastructure, and residents' lives. The fires burn underground coal leaving the surface with no support, leading to land subsidence and roof collapse. This will have a multiplier effect as it creates cracks and crevices that pump in more oxygen to aggravate the coal fires further. Despite the various measures taken by authorities, coal fires and land subsidence still have an increasing presence. In this study, we investigated the two hazards and their impact on the coal mines and surrounding settlements. We observed the subsidence and coal fires in the study area with the help of Persistent Scatterer Interferometry analysis of Sentinel-1 images and Temperature anomaly mapping of Thermal Infrared Imagery from Landsat-8, respectively. The subsidence velocity results and the coal fire zones are analysed, and a significant spatial overlap of both hazards is noticed. A few key locations severely affected by both the hazards are identified and examined to understand the mutual effect of coal fires and land subsidence. The subsidence of up to 20 cm/yr is observed in the study area. The results show that nearly 80% of the subsiding area is also affected by coal fires. Kusunda, Bararee and Keshalpur collieries are critically affected by both the hazards and need immediate intervention. Subsidence and coal fires extending towards the residential zones in several collieries is a matter of concern. In conclusion, the study presents an efficient methodology for multi-hazard monitoring, and the findings assist the authorities in enforcing appropriate disaster management strategies.

Location:

Jharia Coalfields, Jharkhand, India

Problem:

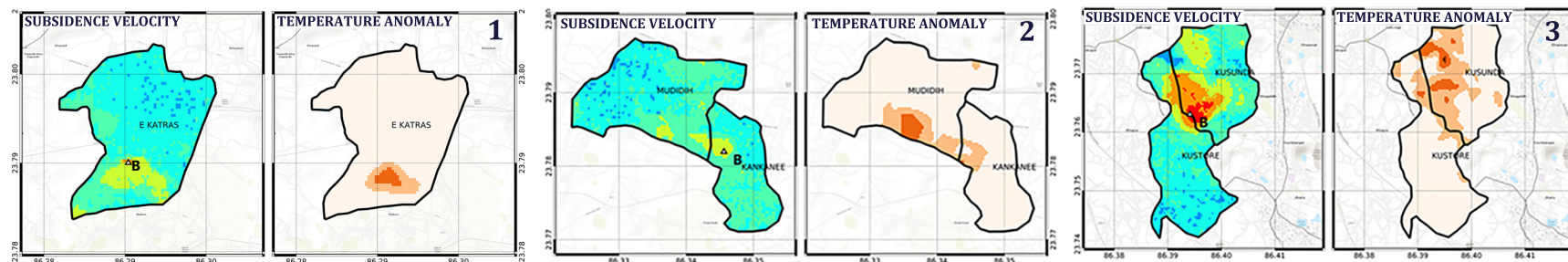
Coal fires resulting in land subsidence associated with roof collapse leading to loss of lives, coal reserves and infrastructure

Significance:

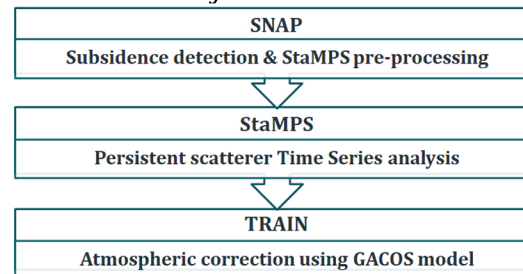
The largest and one of the oldest coal mines in India

One of the most densely populated coal-fields in the world

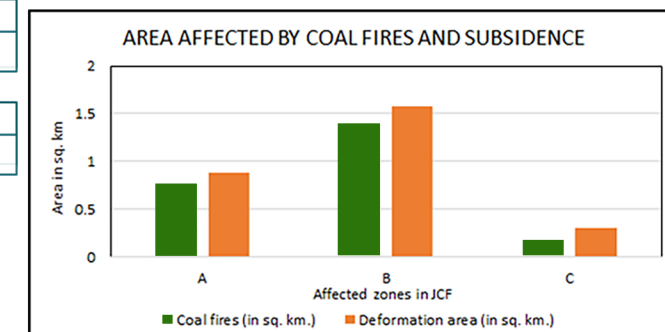
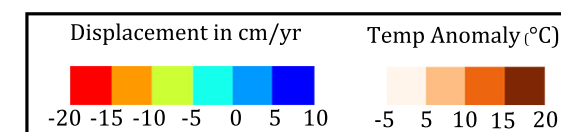
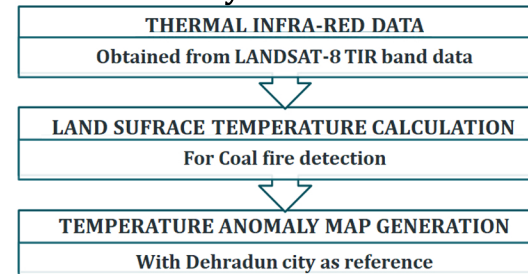
Storehouse of the precious coking coal in the country



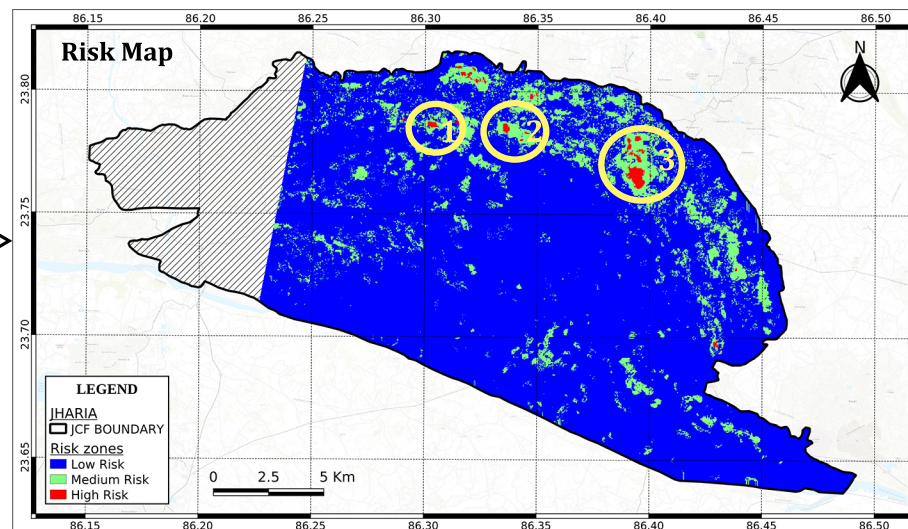
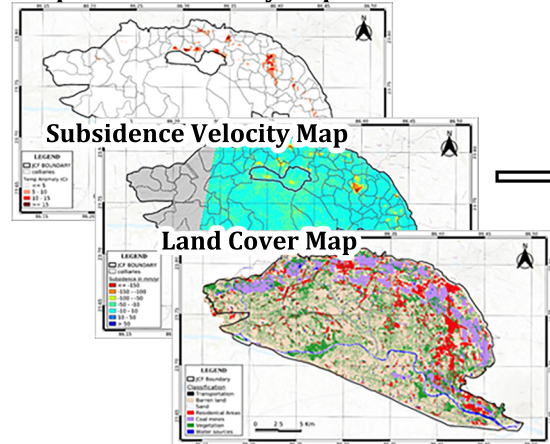
PSInSAR Analysis



Coalfire analysis



Temperature Anomaly Map



Conclusions:

- Kusunda, Mudidih, Katras and Keshalpur collieries are significantly affected by subsidence of up to 20 cm/yr.
- < 200m far from the residential and infrastructure zones.
- Efficiency of integration of Thermal data with the SAR data
- for the risk analysis of coal fire induced land subsidence

Reference:

Karanam, Vamshi, et al. "Multi-sensor remote sensing analysis of coal fire induced land subsidence in Jharia Coalfields, Jharkhand, India." International Journal of Applied Earth Observation and Geoinformation 102 (2021): 102439.
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