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Risk of Ground Movement in Faridabad, India – Investigated using Remote Sensing and In-Situ Data

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Land surface elevation changes can cause damage to infrastructure and other resources; thus, its monitoring is crucial for the safety and economics of the city. Long-term excessive extraction of underground water is one of the factors that causes ground to sink. Faridabad, the industrial hub of Haryana, a state in north India is staring a severe water crisis in the near future and has already been declared as a dark zone with regard to groundwater resources. At many places, the underground water table has dropped more than 150m. The plummeting groundwater levels and the geology of this region make it prone to subsidence.

Continuous monitoring of land surface elevations using traditional surveying techniques can be time-consuming and labor-intensive. Several studies have shown the potential of remote sensing techniques in monitoring the changes in topography to an mm level accuracy. In this study, we used the elevation change map (derived using 200+ sentinel -1 images), subsidence gradient, groundwater in-situ data, population, population density, land cover, and lithology. These information were then processed and analyzed in a geographical information system to perform a hazard vulnerability and risk assessment. The final risk map was classified into three different classes viz high, medium, and low risk pertaining to ground movement.

The results indicate that the high-risk zone covers an area of more than 2.5 square kilometers. New Industrial Town (NIT) in Faridabad with an estimated population of more than 1.5 million, is found to be at high risk of ground movement. Groundwater levels in this area are currently depleting by more than 5m/year. Some other areas which are under high risk are the Dabua colony, Sanjay Gandhi Memorial Nagar, and Gandhi colony. All these regions have a high population density and demand urgent government attention.