ABSTRACT

Land subsidence, the gradual sinking or downward movement of the Earth's surface, is a significant geological phenomenon that poses serious environmental and societal challenges. This study aims to access land subsidence in Joshimath region of Uttarakhand, utilizing Synthetic Aperture Radar (SAR) data and the Persistent Scatterer (PS) module of ENVI Sarscape. The objective of this research is to assess and monitor ground movements in the region, providing valuable insights into the velocity, locations, and temporal evolution of land subsidence in Joshimath. By analyzing a dataset of SAR images acquired over a specific time period, the PS technique is employed to process and interpret the data, extracting precise measurements of land surface deformation. The results reveal notable ground movement within Joshimath, with varying displacement rates observed across different areas. The annual displacement rate ranges approximately from -25 mm to +25 mm/year, indicating both positive and negative subsidence, signifying both uplifting and sinking of the ground. Middle area of Joshimath having densely placed buildings experiences most significant degree of subsidence. Also, the time-series analysis demonstrates an increasing trend in the subsidence rate from January 2021 to April 2023. This trend is of great concern to the local community and authorities, highlighting the urgency of further investigation and potential mitigation measures. The findings of this research may contribute to a better understanding of the land subsidence phenomenon in Joshimath. The accurate mapping and monitoring of subsidence using SAR data and the PS module enable the identification of vulnerable areas and support decision-making processes regarding infrastructure management and sustainable land use planning. The outcomes of this study have implications for similar mountainous regions facing land subsidence challenges, providing insights into geohazard assessment and management strategies.

Ultimately, this research emphasizes the importance of utilizing advanced remote sensing techniques, such as SAR data analysis and the PS module, for studying land subsidence. The results underscore the need for ongoing monitoring and proactive measures to mitigate the potential risks associated with ground movements in Joshimath and other susceptible regions.

Keywords: Land subsidence, Synthetic Aperture Radar (SAR), Persistent Scatterer (PS) technique, Joshimath, Uttarakhand, Remote sensing, Geohazard assessment, Infrastructure management.