National Remote Sensing Centre
Indian Space Research Organisation, Government of India, Hyderabad.

Science Story
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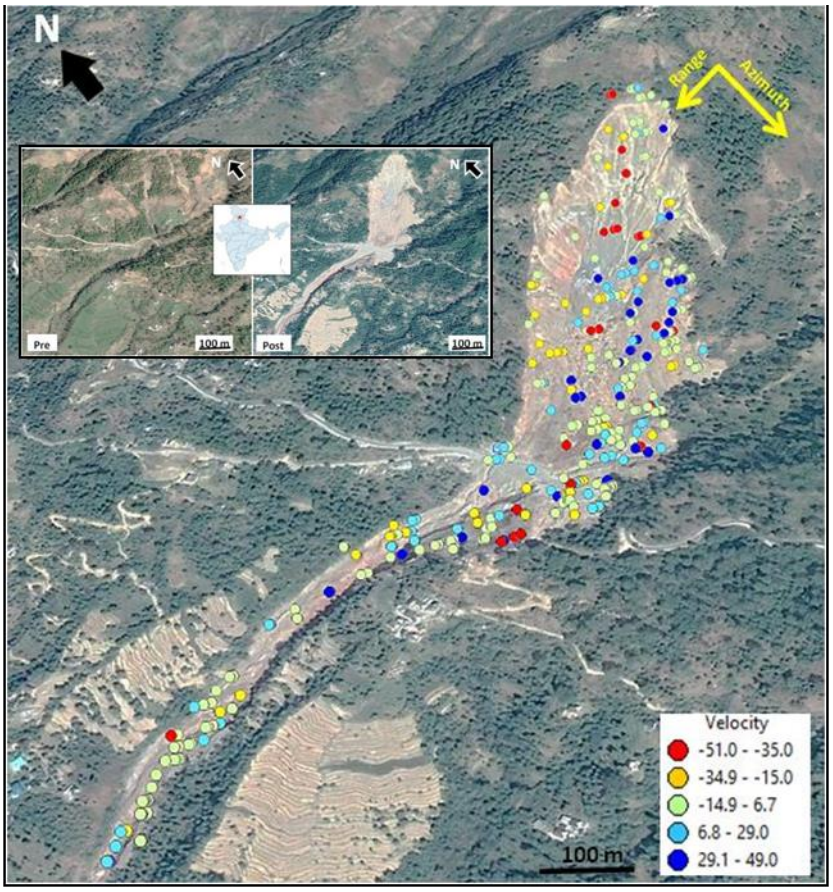
Landslide – Time and path prediction

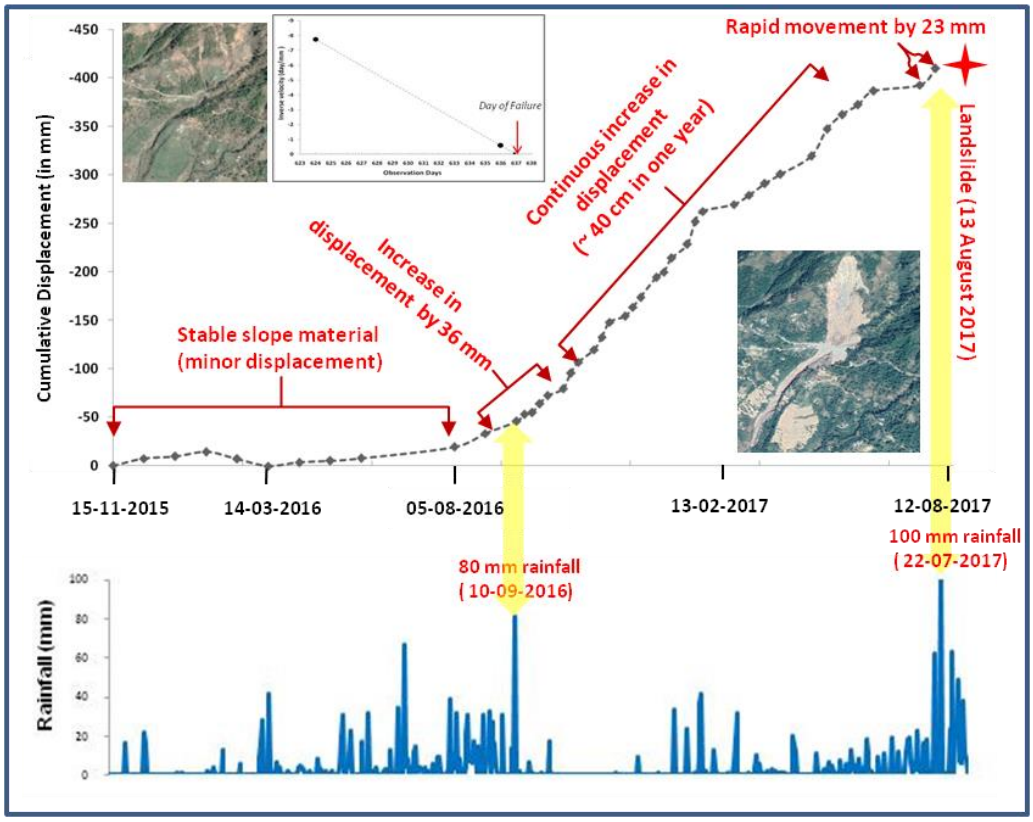


Kotropi Landslide, Himachal Pradesh, India

Scientists in National Remote Sensing Centre (NRSC), developed a new method to Predict time and path of anticipated Landslide using microwave satellite data and the InSAR technique, which potentially can detect displacement at millimetre level.

Landslides originating from remote steep slopes render people living downhill vulnerable, unaware of the impending danger. Identifications of slow-moving mountain slopes are possible now due to time series measurement from space using microwave satellite data. Availability of open-source Sentinel-1 data has revolutionised the study involving landslide kinematics and predicting the time of failure. However, identification of

accelerating trend, demarcation of release area and prediction of flow path after failure initiation are still challenging.



Analysis of deformation time series curves from MTInSAR

Highlights

- A novel method to map landslide release area from InSAR derived slope acceleration.
- PSI and SBAS are used to detect the deformation trend leading to slope failures.
- Velocity (Inverse and Modified Inverse) are used for failure time prediction.
- Flow path simulated using the Voellmy friction model.

A novel method for time and path prediction of landslides using two large landslides (Kikruma and Kotropi) located in the Himalayas in India. Sentinel-1 data stack was processed using the Persistent Scatterer and Small BAselineSubset interferometric techniques to analyse the trend of ground deformation leading to slope failures. The displacement time series of the measurement points, analysed using inverse velocity and

modified inverse velocity methods, show that the instability had commenced almost a year or more with the final onset of acceleration triggered by heavy rainfall, couple of weeks prior to the actual failure. The acceleration image created from displacement time series data was clustered using image segmentation techniques to demarcate the release area of landslides. The flow simulation was done using the Voellmy friction model with a high-resolution DEM to predict the flow path. The analysis done for Kikruma and Kotropi landslide case studies with this method provided a safe prediction of the time of landslide with ~90% accuracy of the flow path prediction.

In Future

This method has evolved as an effective tool for landslide early warning in hilly areas and will be implemented in the SILAAS project under ISRO-DMSP.