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Assessing the viability of using GEOS-Forecast Product for Landslides Forecasting–A step toward Early Warning Systems

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Landslides across the globe are mostly triggered by extreme rainfall events affecting infrastructure, transportation and livelihoods. The risks are rarely quantified due to lack of data, analytical skills and limited modeling techniques. Knowledge of local to global scale landslide risks provides communities and national agencies the ability to adapt disaster management practices to mitigate and recover from these hazards. In order to minimize the risks and improve characterization of community resilience to landslides, it is vital to have reliable information about the factors triggering landslides such as rainfall, well ahead in time.

Forecasting potential landslide activity and impacts can be achieved through reliable precipitation forecast models. However, it is challenging because of the temporal and spatial variability of precipitation, an important factor in triggering landslides. Evaluation of the precipitation field, associated errors, and sampling uncertainties is integral for development of efficient and reliable landslide forecasting and early warning system.

This study develops a methodology to assess the viability of using a precipitation field provided by a global model and its potential integration in the landslide forecasting system. The study focuses on the comparison between the IMERG (Integrated Multi-satellitE Retrievals for Global Precipitation Mission) and GEOS (NASA Goddard Earth Observing System)-Forecast product over contiguous United States (CONUS). GEOS model assimilates new observations every 6 hours, at 00, 06, 12, and 18 UTC. The framework is tested on the GEOS-Forecast Model initialized at 00 UTC using daily IMERG early product as reference using both categorical and continuous statistics. The categorical statistics includes the probability of detection (POD), success ratio (SR), critical success index (CSI), and the hit bias. Continuous statistics such as correlation, normalized standard deviation, and root-mean-square error are also evaluated. Overall, GEOS-Forecast precipitation field over the analysis period (~1 year) show underestimation with respect to IMERG early for the daily accumulated rainfall. However, the probability distribution function and cumulative distribution function of both show similar patterns. In terms of correlations, POD, SR, CSI, hit bias, the performance varies with respect to the rainfall threshold used.

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