# Assessment of Global Precipitation Forecast for use in Landslide Prediction Model

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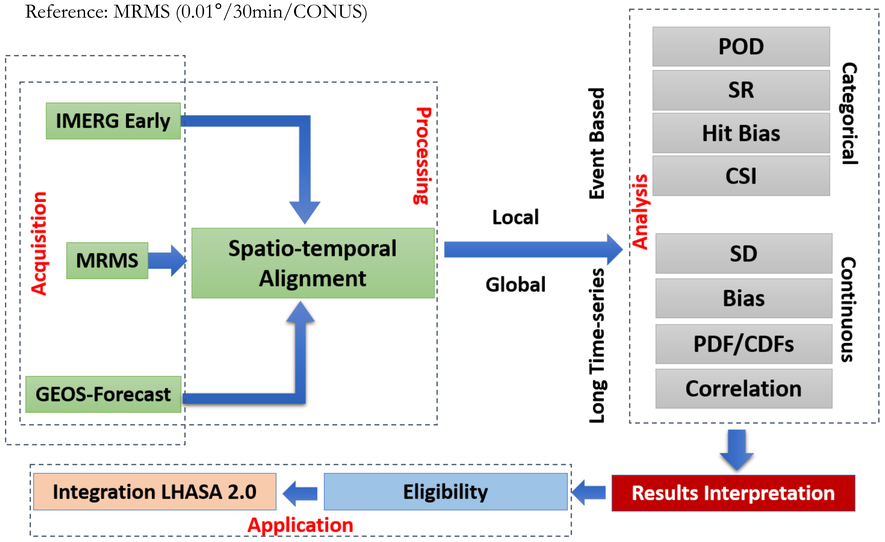
## Methodology

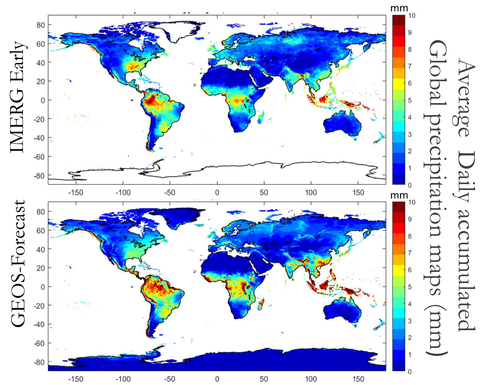
**Dataset:**
Evaluation products:
GPM-IMERG Early V06 Level-3 (0.1°/30min/Global)
GEOS-Forecast (H00) (0.25°×0.31°/1hr /Global)
Reference: MRMS (0.01°/30min/CONUS)

**Study Period:** July 2018 – February 2020

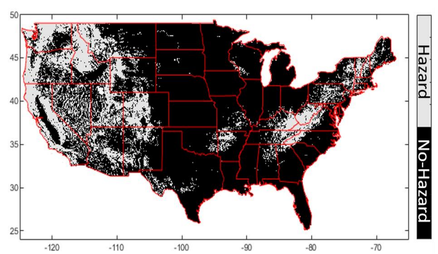
**Study area:** CONUS, Globe




**Landslide Hazard Assessment for Situational Awareness (LHASA 2.0) Model:**
The LHASA 2.0 Model uses XGBoost machine learning techniques to incorporate dynamic variable such as rainfall as well as static variable to better represent the landslide globally.

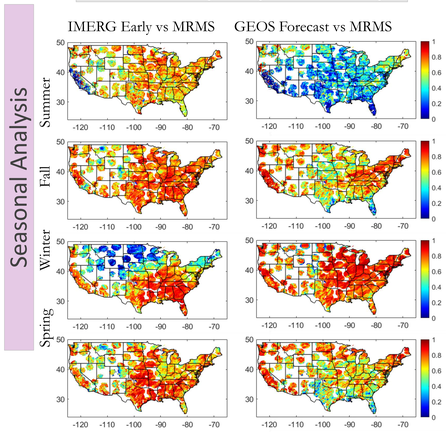


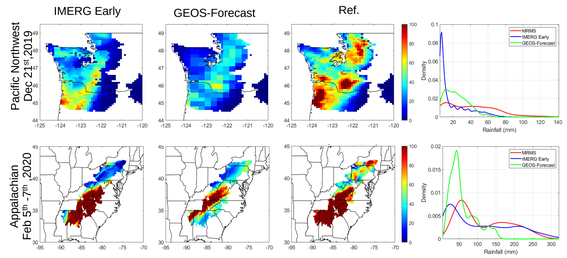

CONUS Landslide Susceptibility Map




## Results

Correlation precipitation maps

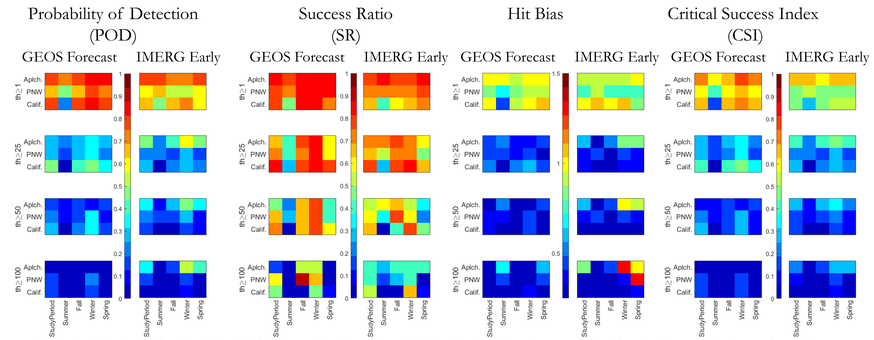



Accumulated precipitation maps (in mm) over the event durations and PDFs (extreme right panels) for Pacific Northwest (top panel) and Appalachian (bottom panel) region respectively. Ref. corresponds to MRMS-derived reference.

Event-based Analysis

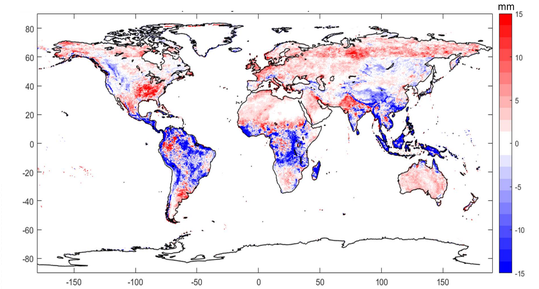
Analysis Resolution: 0.1°/Daily. The white spaces indicate MRMS Radar Quality Index (RQI) < 65



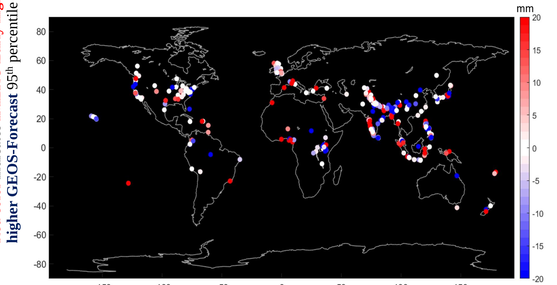

Categorical Statistics for High Landslide Hazard Regions: Appalachian, Pacific Northwest and California. The panels (top to bottom) exhibit the performance of GEOS Forecast and IMERG early against MRMS in three regions at four rainfall thresholds i.e. 1mm, 25mm, 50mm and 100mm for entire study period as well as across the four seasons (summer, fall, winter and spring).

Global-scale Analysis

95th Percentile difference between IMERG Early and GEOS-Forecast precipitation map (mm/day)




Additive bias between IMERG Early and GEOS-Forecast precipitation(mm/day) for the landslide points




Red color indicates **IMERG Early higher** than GEOS-Forecast and blue color correspond to **higher GEOS-Forecast** 95th percentile precipitation accumulation

## Conclusions

- The correlation between IMERG Early and MRMS is overall high except for west coast and northeast where GEOS Forecast show relatively better correlation
- GEOS-Forecast showed comparable performance to satellite estimates in many parts of United States, however, validation over landslide points reveal GEOS-Forecast precipitation for tropical cyclones correspond well with near-real time satellite estimates (IMERG Early) compared to other types of storms
- GEOS Forecast is promising in forecasting rare downpours (triggering landslides), showing temporal coherence with the ground truth, albeit with seasonal and regional variation

## References


- Kirschbaum, D., Stanley, T., Emberson, R., Amatya, P., Khan, S. and Tanyas, H., 2020, May. Global Landslide Hazard Assessment for Situational Awareness (LHASA) Version 2: New Activities and Future Plans. In *EGU General Assembly Conference Abstracts* (p. 11012).
- Zhang, J., Howard, K., Langston, C., Kaney, B., Qi, Y., Tang, L., Grams, H., Wang, Y., Cocks, S., Martinaitis, S. and Arthur, A., 2016. Multi-Radar Multi-Sensor (MRMS) quantitative precipitation estimation: Initial operating capabilities. Bulletin of the American Meteorological Society, 97(4), pp.621-638.
- https://gpm.nasa.gov/applications/global-landslide-model
- https://gmao.gsfc.nasa.gov/weather_prediction/