FFGS Landslide Products

FFGS includes a landslide assessment component for alerting forecasters on the imminent likelihood of landslide occurrence in highly susceptible mountainous slope. In the context of this work, only landslides that occur because of effects of rainfall on unstable slopes are considered. Thus, landslide events caused by seismic activity or construction activities (e.g. associated with road construction) are excluded from this analysis.

Photo credits: BMKG, Rangga Firmansyah

Methodology

(A) The methodology for landslide diagnosis to follow each country and region is the same as followed for the prototype FFGS implementation in Central America for the Central America Flash Flood Guidance System (CAFFGS).

The main analysis steps are two: (a) development of a high or very high susceptibility for landsliding caused by rainfall; and (b) the development of the boundary line that separates rain caused landslide occurrence from non-occurrence on the two-dimensional space of a measure of mean areal precipitation versus a measure of basin-average soil moisture.

The data for such analysis include: the spatial coordinates of past landslides, the time and date of landslide occurrence for the past events, information regarding terrain and land-surface features for the locations of the past landslides (e.g. slope, aspect, elevation, land cover, soils, etc.), a designation as to whether events other than weather events triggered the landslides in the record, and historical basin average precipitation and soil water for basins of the FFGS.

The current FFGS implementation includes an activation parameter for the landslide assessment component and of the ingest of the parametric files associated with the high- and very-high susceptibility mapping on slope scale, and the parameters of the boundary line for real time diagnosis of potential landslides from precipitation and soil-water information. At the present, there is only diagnostic/nowcast products made available by the FFGS on the basis of the most current observations and system variables.

(B) In addition to technical development and implementation of the FFGS Landslide Assessment Component, the project includes the training for meteorological and hydrologic service personnel, representatives of the Disaster Management Agencies (DMA) and other relevant agencies for to be able to use its products effectively in daily operations and effective flash flood and landslide warning and response. The standardization of databases pertinent to landslide occurrence assessment/prediction for countries that do not currently have them, and the formulation of validation and adjustment strategies on a regular basis will also be subjects of discussion and hands-on exercises. Training will also aim to produce guidelines for landslide forecast operations suitable for use in countries, and guidelines for assessment accuracy and forecasting reliability validation using existing databases.

Main Objectives

The main objectives of the development and implementation of the FFGS Landslide Assessment Component (module) are to:

1) Enhance country's capacity to issue timely and accurate landslide warnings and alerts;

2) Mitigate adverse impacts of landslide occurrences;

3) Enhance collaborations between NMHS, DMA and other relevant agencies;

4) Provide extensive training to the hydrometeorological forecasters, disaster managers and representatives of other relevant national agencies;

5) Foster national and regional developments and collaborations.

Landslide Threat Index

The gridded index on each Global HydroEstimator Satellite-based Precipitation Estimates (GHE) pixel of interest in the landslide hazard assessment module indicating likelihood of landslide occurrence.

The index is computed by identifying the locations with 4-day average lower-zone soil water saturation fraction and 24-hour maximum merged nearest neighbor precipitation greater than given threshold values. Pixels identified as exceeding the given threshold are considered as high likelihood of landslide occurrence.

These high likelihood pixels are assigned an index value of 1.0 in the text export and colored red in the image exports. Pixels that do not exceed the given threshold are assigned an index value of 0.0 in the text exports and colored white in the image exports. Gray-colored pixels indicate regions where landslide computations are not applicable due to either relatively low climatological risk for landslide occurrence or lack of data.

This product is updated every 6 hours.
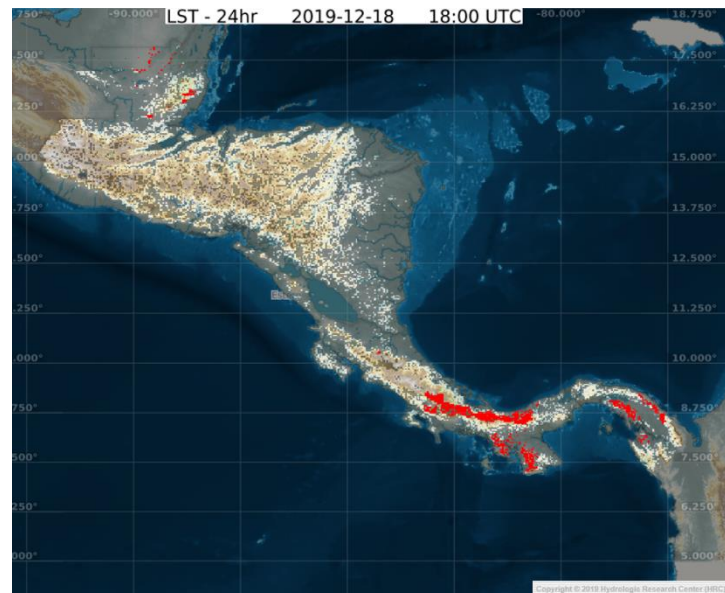
Landslide Threat Index for Central America

Merged Maximum Neighbour Precipitation

The total 24 hour accumulation, ending at the current hour, of the maximum bias-adjusted precipitation estimate selected hourly from the nearest 9 grid points for each GHE pixel of interest in the landslide hazard assessment module.

The gridded maximum neighbor precipitation value reflects a merging of the best-available input product selected from the bias-adjusted Microwave-adjusted Global HydroEstimator Satellite-based Precipitation Estimates (MWGHE) precipitation and the bias-adjusted GHE precipitation input products analogous to that of the Merged MAP selection processing.

Gray-colored pixels indicate regions where landslide computations are not applicable due to either relatively low climatological risk for landslide occurrence or lack of data.

This product is updated every 6 hours.
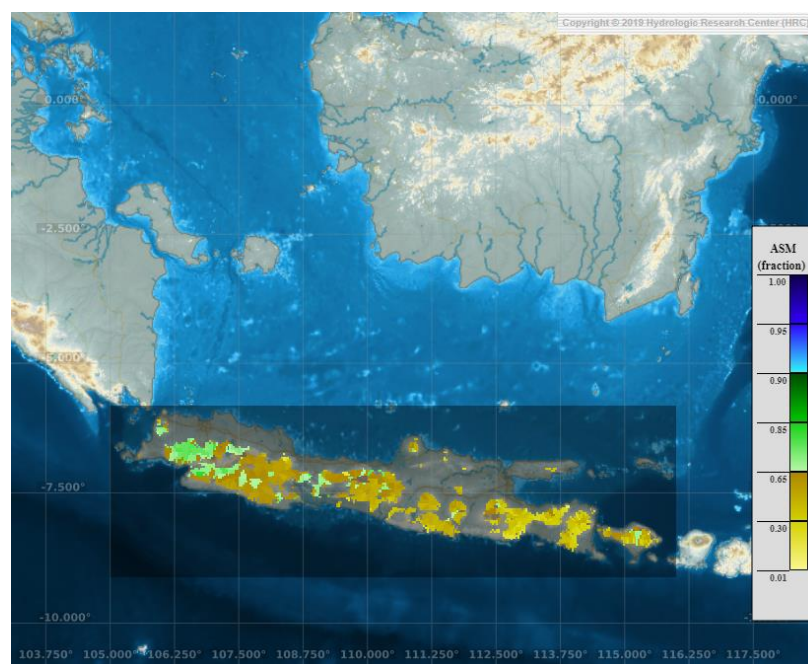
Merged Maximum Neighbour Precipitation for Java Island, Indonesia

4-Day Average Lower Soil Moisture (ASML)

The average lower-zone soil-water saturation fraction over a 4-day period ending at present time, mapped onto the Global Hydroestimator satellite pixels. The 6-hourly mean areal estimates of the lower-zone soil-water saturation fraction is used to produce the averages over each delineated small basin on the domain of the flash flood guidance system prior to their mapping onto the GHE grid scale.

Gray-colored pixels indicate regions where landslide computations are not applicable due to either relatively low climatological risk for landslide occurrence or lack of data.

This product is updated every 6 hours.
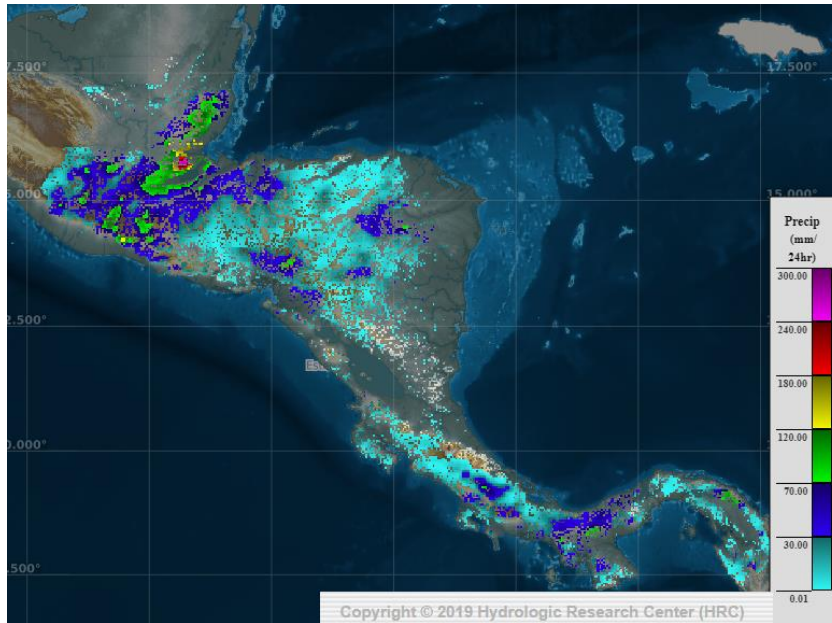
4-Day Average Lower Soil Moisture for Central America

ASML Lower-zone soil-water saturation in the lower zone (fraction of soil capacity) as estimated by the SACMA model averaged over a 4-day period ending at the current model processing hour and mapped to applicable GHE pixels. Lower-zone soil-water saturation in the lower zone (fraction of soil capacity) as estimated by the SACMA model averaged over a 4-day period ending at the current model processing hour and mapped to applicable GHE pixels.

This document was prepared by WMO-FFGS team using South East Europe Flash Flood Guidance System Forecaster Guide[1] and FFGS Operational Output Product Descriptions available in the FFGS Real-Time Product Console developed by Hydrologic Research Center.

[1] https://www.wmo.int/pages/prog/hwrp/flood/ffgs/documents/SEEFFGS_Forecaster_Guide-Final_ES_TM-AS-PM.pdf