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Global Flood and Landslide Detection and Prediction Using Satellite Observations

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A global flood and landslide detection/prediction system is now running in real-time using satellite multi-satellite rainfall analysis in combination with hydrological models and algorithms to estimate key flood and landslide parameters (http://trmm.gsfc.nasa.gov/publications_dir/potential_flood_hydro.html). The system also uses satellite-based land surface information such as digital elevation information from the NASA SRTM (Shuttle Radar Terrain Mission) and vegetation information from MODIS in he model and algorithm calculations. Progress in using the TRMM Multi-satellite Precipitation Analysis (TMPA) as input to these flood and landslide forecasts is outlined, with case studies as well as validation in terms of flood/landslide events. Examples shown include the major flood in Burma in spring of 2008 and examples of floods and landslide events associated with tropical cyclones.

The flood determination algorithm consists of three major components: 1) multi-satellite precipitation estimation; 2) characterization of land surface including digital elevation information and other surface information, topography-derived hydrologic parameters such as flow direction, flow accumulation, basin, and river network etc.; 3) a hydrological model to infiltrate rainfall and route overland runoff. Results of calculated water depth over a threshold are then displayed about six hours after real-time. Time-history of inundations are also calculated and displayed. Validation analysis indicates good results for flood detection and evolution, but with limitations in the current routing calculations. Global numerical weather prediction rainfall forecasts are being used experimentally to extend the period of utility of the flood information.

In terms of landslides, the satellite rainfall information is combined with a global landslide susceptibility map, derived from a combination of global surface characteristics (digital elevation topography, slope, soil types, soil texture, and land cover classification etc.) using a weighted linear combination approach. In those areas identified as “susceptible” (based on the surface characteristics), landslides are forecast where and when a rainfall intensity/duration threshold is exceeded. Results are described indicating general agreement with landslide occurrences, but with regions of over- and under-estimation.