Geophysical Research Abstracts
Vol. 15, EGU2013-8489, 2013
EGU General Assembly 2013


# Using Satellite Rainfall for Simulation of Flash Floods in Mountainous Basins

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Effective flash flood warning procedures are usually hampered by observational limitations of precipitation over mountainous basins where flash floods occur. Satellite rainfall estimates are available over complex terrain regions offering a potentially viable solution to the observational coverage problem. However, satellite estimates of heavy rainfall rates are associated with significant biases and random errors that non-linearly propagate in hydrologic modeling imposing severe limitations on the use of these products in flood forecasting. In this study we investigate the use of three quasi-global and near-real-time high-resolution satellite-rainfall products (3B42, PERSIANN, CMORPH) for simulating flash floods over complex terrain basins. The study uses major flash flood events on medium size mountainous basins (600-1500 km2) in Northern Italian Alps. Comparison of satellite-rainfall with rainfall derived from gauge-calibrated weather radar estimates showed that although satellite products suffer from large biases they could represent the temporal variability of basin-averaged precipitation. Propagation of satellite-rainfall through a hydrologic model revealed that systematic error in rainfall was severely magnified when transformed to error in runoff (especially under dry initial soil conditions). Simulation hydrographs became meaningful after adjusting the satellite rainfall for underestimation due to retrieval bias and resolution effects determined based on high-resolution cloud-resolving storm simulations. Overall, this study highlights the use of high-resolution NWP analysis for improving satellite-rainfall retrieval to allow a more appropriate use of satellite-rainfall products in flash-flood applications of complex terrain basins.