Geophysical Research Abstracts
Vol. 14, EGU2012-11734, 2012
EGU General Assembly 2012

Radar rainfall estimation as a support for the hydro-meteorological analysis of debris flow and flash flood events

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This work is dedicated to radar rainfall estimation for the post-event analysis of four debris flows/flash flood events which impacted the Upper Adige river system, in the Central Italian Alps with high rainfall amounts and causing damages to people and to the road system. The storm events were observed by means of a C-band weather radar system and a rain gauge network enabling the validation of radar rainfall amount estimates with fine time resolution. For these contrasted rainy system with convective and stratiform regions, the combination of the vertical (VPR) and radial (attenuation, screening) sources of heterogeneity yields a very challenging problem for radar quantitative precipitation estimation at C-band.
Results obtained by applying a number of corrections to radar reflectivity measures are described. Particular attention is paid on application of the mountain reference technique on signal attenuation, screening and vertical profile of radar reflectivity. Signal attenuation is corrected for by using the Mountain Reference Technique.
The worth of using the Mountain Reference Technique is demonstrated to quantify rain attenuation effects that affect C-band radar measurements in heavy rain. Screening effects were quantified using a geometrical calculation based on a digitized terrain model of the region. The vertical structure of the reflectivity was modelled with a normalized apparent vertical profile of reflectivity.
The spatial structure of the rainstorms is examined over various temporal aggregations. The rain estimates are used to assess the rain amount and intensities over the small catchments were debris flows were triggered.