Geophysical Research Abstracts
Vol. 17, EGU2015-457, 2015
EGU General Assembly 2015
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High resolution X-Band radar rainfall estimates for a Mediterranean to hyper-arid transition area

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Weather radars provide rainfall estimates with high spatial and temporal resolutions over wide areas. X-Band weather radars are of relatively low-cost and easy to be handled and maintained, moreover they offer extremely high spatial and temporal resolutions and are therefore object of particular interest. Main drawback of these instruments lies on the quantitative accuracy, that can be significantly affected by atmospheric attenuation. Distributed rainfall information is a key issue when hydrological applications are needed for small space-time scale phenomena such as flash floods and debris flows. Moreover, such detailed measurements represent a great benefit for agricultural management of areas characterized by substantial rainfall variability.

Two single polarization, single elevation, non-Doppler X-Band weather radars are operational since Oct-2012 in the northern Negev (Israel). Mean annual precipitation over the area drops dramatically from 500 mm/yr at the Mediterranean coast to less than 50 mm/yr at the hyper-arid region near the Dead Sea in less than a 100 km distance. The dryer region close to the Dead Sea is prone to flash floods that often cause casualties and severe damage while the western Mediterranean region is extensively used for agricultural purposes. Measures from a C-Band weather radar located 40-120 km away and from a sparse raingauge network (density $\sim$1gauge/450km2) are also available. C-Band rainfall estimates are corrected using combined physically-based and empirical adjustment of data.

The aim of this study is to assess the quantitative accuracy of X-Band rainfall estimates with respect to the combined use of in situ measurements and C-Band observations. Results from a set of storms occurred during the first years of measurements are discussed paying particular attention to: (i) wet radome attenuation, (ii) range dependent degradation including attenuation along the path and (iii) systematic effects related to the Mediterranean to hyper-arid climatic transition.