Geophysical Research Abstracts
Vol. 16, EGU2014-13031, 2014
EGU General Assembly 2014

Evaluating the potential use of a high-resolution X-band polarimetric radar observations in Urban Hydrology

Marios N. Anagnostou (1), John Kalogiros (1), Frank S. Marzano (2,3), Emmanouil N. Anagnostou (4), Luca Baldini (5), EfThymios Nikolopoulos (6), Mario Montopoli (7,3), Errico Picciotti (8,3)

(1) IERSD, National Observatory of Athens, Athens, Greece (managn@noa.gr, jkalog@noa.gr), (2) Sapienza University of Rome, DIET, Italy (marzano@die.uniroma1.it), (3) University of L'Aquila, CETEMPS, Italy (marzano@die.uniroma1.it), (4) Civil and Environmental Engineering, University of Connecticut, Storrs, Connecticut, USA (manos@engr.uconn.edu), (5) CNR, ISAC, Italy (l.baldini@isac.cnr.it), (6) Department of Land and Agroforest Environment, University of Padova, Padova, Italy (enikolop@engr.uconn.edu), (7) University of Cambridge, UK (mario.montopoli@gmail.com), (8) HIMET, Italy (errico.picciotti@aquila.infn.it)

The Mediterranean area concentrates the major natural risks related to the water cycle, including heavy precipitation and flash-flooding during the fall season. Every year in central and south Europe we witness several fatal and economical disasters from severe storm rainfall triggering Flash Floods, and its impacts are increasing worldwide, but remain very difficult to manage. The spatial scale of flash flood occurrence is such that its vulnerability is often focused on dispersed urbanization, transportation and tourism infrastructures (De Marchi and Scolobig 2012). Urbanized and industrialized areas shows peculiar hydrodynamic and meteo-oceanographic features and they concentrate the highest rates of flash floods and fatal disasters. The main causes of disturbance being littoral urban development and harbor activities, the building of littoral rail- and highways, and the presence of several polluted discharges. All the above mentioned characteristics limit our ability to issue timely flood warnings.
Precipitation estimates based on raingauge networks are usually associated with low coverage density, particularly at high altitudes. On the other hand, operational weather radar networks may provide valuable information of precipitation at these regimes but reliability of their estimates is often limited due to retrieval (e.g. variability in the reflectivity-to-rainfall relationship) and spatial extent constrains (e.g. blockage issues, overshooting effects). As a result, we currently lack accurate precipitation estimates over urban complex terrain areas, which essentially means that we lack accurate knowledge of the triggering factor for a number of hazards like flash floods and debris flows/landslides occurring in those areas. A potential solution to overcome sampling as well as retrieval uncertainty limitations of current observational networks might be the use of network of low-power dual-polarization X-band radars as complement to raingauges and gap-filling to operational, low-frequency (C-band or S-ban) and high-power weather radars.
The above hypothesis is examined using data collected during the HyMEX 2012 Special Observation Period (Nov-Feb) the urban and sub-urban complex terrain area in the Central Italy (CI). The area is densely populated and it includes the high-density populated urban and industrial area of Rome. The orography of CI is quite complex, going from sea level to nearly 3000 m in less than 150 km. The CI area involves many rivers, including two major basins: the Aniene-Tiber basin (1000 km long) and the Aterno-Pescara basin (300 km long), respectively on the west and on the east side of the Apennines ridge. Data include observations from i) the National Observatory of Athens' X-band polarimetric weather radar (XPOL), ii) two X-band miniradars (WR25X located in CNR, WR10X located in Rome Sapienza), iii) a dense network of raingauges and disdrometers (i.e. Parsivel type and 2D-video type). In addition, the experimental area is also covered from the nearby the National Research Council (CNR)'s C-band dual-polarization weather radar (Polar55C), which were involved also in the analysis. A number of storm events are selected and compared with the nearby C-band radar to investigate the potential of using high-resolution and microphysically-derived rainfall based on X-band polarimetric radar observations. Events have been discriminated on the basis of rainfall intensity and hydrological response. Results reveal that in contrast with the other two rainfall sources (in situ and C-band radar), X-band radar rainfall estimates offer an improved representation of the local precipitation variability, which turns to have a significant impact in simulating the peak flows associated with these events.