Rainfall mapping in complex orography from C-band radar at Mt. Midia in Central Italy: data synergy and adaptive algorithms

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A new radar installation

During 2005 a new project for installing a C-band weather radar in Central Italy has been successfully accomplished. The goal was to replace an existing single-polarized radar, located in a valley near L’Aquila (Italy), into a new site at M. Midia at the border between the Abruzzo and Lazio regions in Central Italy. Mt. Midia top height is at 1760 m and covering most Central Italy, including the Abruzzo inland and the urban area of Rome.

The project, sponsored by the Italian Civil Protection Dept. (DPC), has been a synergic work, coordinated by the Research Center CETEMPS and including both regional authorities Functional Center of the Abruzzo Region and Italian companies: Telespazio, Icarus, ELDES and HIMET.

Rain path attenuation correction techniques

In a complex orographic environment, like Italian peninsula, a study on the path attenuation correction techniques has been carried out and discussed. The basic idea has been to exploit the mountain radar returns to estimate the path integrated attenuation (PIA) along suitable rays at the lowest elevation angles.

Path attenuation factor $L_{ab}$ can be evaluated from PIA by:

$$L_{ab} = \frac{Z_{ab}(r_f)}{Z_{ab}(r_o)} = e^{-\alpha_{ab}(r_f-r_o)}$$

Where $Z_{ab}$ is the measured co-polar reflectivity, $Z_{ab}$ is the corrected reflectivity, $\alpha_{ab}$ the specific attenuation and $r_o$ and $r_f$ are the nearest and farthest range bin respectively along the selected rain path direction.

Two methods are adopted to find the equation solution: the attenuation-adjustment (AA) and the final-value (FV)

A case studies has been investigated: results confirm that the correction algorithms can be successfully used to correct path attenuation, especially during heavy rain when better scores in rain estimations are reach.