Melting layer attenuation as observed by polarimetric radar-radiometer synergetic approach

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Melting layer is the main mechanism responsible for the conversion of solid precipitating into liquid during stratiform rain. Its mixed phase nature makes difficult to estimate the related attenuation and therefore modelers need to assume a certain composition of water-ice electromagnetic properties in order to be assess radar related parameters.

The present contribution attempts to estimated from measurement the attenuation in the melting layer by combining observation of active and passive sensors. Dual polarimetric weather radar are optimal tools to estimate attenuation for the rain layer by taking advantage of the methods that the radar community has developed specially for Quantitative Precipitation Estimation (QPE) applications. On the other hand, recently the multi-frequency dual-pol radiometer ADMIRARI has shown its capabilities to simultaneously estimate water vapor, rain and cloud precipitating parameters during rain events, e.g. the slant path integrated water vapor, rain and cloud water content independently.

Since the radiometer gives an estimation of the path integrated attenuation (PIA) for the whole precipitating slant column, the rain component can be estimated independently from the radar and the cloud component from the radiometer. Therefore the attenuation due to the melting layer is obtained by subtracting the rain and cloud attenuation from the PIA, this at the three ADMIRARI frequencies bands (X, K and Ka-band).

This method however strongly depends on the feasibility of the polarimetric methods to estimate the rain layer. Previous work has shown that when the rain attenuation is not properly estimated it might lead to unphysical results, this specially true for light rain where polarization is negligible.

The methods is tested by using measurements during several field campaigns which have been taken place in the frame of the NASA Global Precipitation Measurement (GPM) Ground Validation project.