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Evaluating GPM DPR precipitation estimates for use in Alpine regions

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The Global Precipitation Measurement (GPM) Dual-frequency Precipitation Radar (DPR) data have the potential to provide fill-in data for parts of the world where little or no ground data exists, as well as augmenting or validating existing data sources elsewhere. It may be particularly tempting to apply such measurements in more mountainous regions, where instrumentation and ground radar coverage can be made difficult by the terrain. However, complex terrain has a strong effect on the reliability of precipitation measurements from the DPR, and so care must be taken when using the data.

We take advantage of Switzerland's mixed mountainous and flatter terrain to highlight the variation in performance with terrain. We make comparisons between the DPR measured rainfall rate and the simultaneous measurements of the MeteoSwiss ground-based radar and gauge networks over the first two years of GPM's operation. From aggregated data sliced by terrain, season, precipitation type and precipitation rate we compare detection and estimation performance metrics. We also consider the spatial distribution of errors. We show that, compared to both ground-based gauge and radar measurements, the performance of the GPM DPR level 2 instantaneous precipitation products are notably poorer in mountainous terrain than in flat terrain. Performance is also shown to be poorer in winter than in summer (i.e. in predominantly solid rather than predominantly liquid precipitation), and in stratiform rain than in convective rain.

However, by consideration of the dominant type of precipitation expected and by careful selection of the rainfall rate threshold of interest it is possible to get meaningful information, even in complex terrain. We show the effects found over Switzerland, and therefore the likely effects elsewhere in the world.