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Analyzing satellite QPE underestimation over mountainous terrain: A NWP-based microphysical investigation

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Satellite precipitation estimates are an invaluable source of information. Especially over remote mountainous regions with complex terrain characteristics, where nonexistence or scant availability of in-situ measurements is evident. The benefit of the accurate spatiotemporal estimation from the satellite sensors is often counterbalanced from the severe underestimation of precipitation quantities. Remediation techniques involve a number of adjustment processes that primarily rely to rain gauge and radar observations, where/when the latter are available. Upon their absence, high-resolution NWP simulations have become a viable substitute in order to drive the correction.

In addition to the benefit of magnitude correction, the NWP simulations allow for an important insight upon the microphysical commodities amongst the cases of poor satellite detection. This becomes feasible through the effective combination of numerical schemes that resolve explicitly the cloud microphysical processes and cloud-resolving scales in model resolution (1km). An analysis of the storm characteristics, vertical structure, as well as ice and liquid water content of the cloud is discussed for a number of extreme heavy precipitation events over the Italian Alps. Cases with sufficient precipitation detection from the satellites were steadily associated with high ice mixing ratios and extensive cloud structures that stretched to the tropopause, whereas poor and no detection cases featured low ice and ice/liquid mixing ratio values and confined cloud structures in low altitudes, with cloud tops barely reaching 6000m in some cases.