A close insight into precipitation microphysics and dynamics in Switzerland by means of two nearby X-band polarimetric radars, radar wind profilers and atmospheric modeling

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Since Spring 2014, MeteoSwiss together with EPFL operates two polarimetric X-band radars that are set up in close distance (5 km) to each other. The two radars acquire the power spectrum from synchronized RHI and vertically pointing scans, and the combination of these data allows to study precipitation dynamics and microphysical processes in great detail. Profiles of the drop size distribution of liquid precipitation are inferred from power spectrum measurements on vertical incidence and the obtained results are verified on the lowermost level with Parsivel laser disdrometers that are set up collocated to each radar. Outside of the liquid phase of the precipitation, the vertical power spectrum measurements allow the detailed microphysical study of snow formation and melting processes. The drawback of these measurements is the fact that polarimetric information is lost on vertical incidence. With the availability of two radars, this shortcoming can however be compensated: While one radar scans the atmosphere with a vertically pointing antenna, a high resolution vertical profile of polarimetric observables is extracted from an RHI scan that is made in the direction of the vertically scanning one. Combining the two sources of information leads to a comprehensive insight into the microphysical behavior of precipitation and a more unambiguous interpretation of precipitation formation becomes feasible. With the instrumental configuration we have at our disposal, precipitation and its underlying processes are sampled in two vertical columns above the two radars, which enables the study of the spatial heterogenity of microphysical processes and how it is influenced by atmospheric dynamics. In order to compensate the fact that even with two Doppler radars the horizontal motions of the hydrometeors cannot be completely resolved and hence the dynamical representation would remain incomplete, two radar wind profilers were set-up in the vicinity of the X-band radars. These instruments provide very detailed vertical profiles of 3 dimensional velocity vectors, and their data is hence used in the interpretation of the vertical profiles obtained with the X-band radars. Finally, a one dimensional microphysical model is run in the atmosphere above the radars with the goal that the relevant processes that are made visible with the radar data can be understood on the level of atmospheric physics.