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Impact of topography on snowfall: a view from polarimetric radar

Nikola Besic (1), Daniele Nerini (2), Loris Foresti (2), Marco Gabella (2), Urs Germann (2), and Alexis Berne (1)
(1) EPFL, LTE, Lausanne, Switzerland (nikola.besic@epfl.ch), (2) MeteoSwiss, MDR, Locarno-Monti, Switzerland

In this contribution we analyze the topographic influence on snow precipitation, in terms of variability and microphysics, by interpreting polarimetric radar data. The former is related to the dynamics i.e. growth and decay analysis of the snowfall field, obtained by re-sampling high resolution radar observations (83m in range). The latter is related to the 3D hydrometeor classification of precipitation, supplemented by the hydrometeor de-mixing approach. The analysis focuses on three different events observed in the region around the Weissfluhgipfel (WFG) radar, in the vicinity of Davos, in the Eastern Swiss Alps.
The growth and decay analysis is based on the advection (semi-Lagrangian scheme) of the snowfall field and the comparison with the following actual measurement. Basically, we shift the precipitation field without incorporating the impact of the local topography and then compare it with the measurement which obviously accounts for the micro-scale influence. The growth and decay maps are obtained by averaging the instantaneous estimates over several different time periods (to smooth out the noise), allowing us to conduct analysis at various temporal resolutions.
The applied hydrometeor classification is a semi-supervised approach, adapted to the technical specificities of a radar, capable of distinguishing between 9 different hydrometeor classes, among which rimed ice particles (RP), aggregates (AG), crystals (CR) and vertically aligned ice. An additional hydrometeor de-mixing step allows to estimate, beside the primary hydrometeor type, the proportions of secondary hydrometeor types present within radar sampling volumes, which proves to be very relevant for such a spatially concentrated study.
Links between both variability (snowfall growth) and microphysics (intense riming + AG/CR co-occurrence) observation to the local topography are assessed through multi-scale spatial wavelet analysis. In particular, the gradient of the local topography in the direction of the flow is considered. The analysis shows a correspondence between the zones of snowfall growth on one side and the zones of relatively more intense riming and AG/CR co-occurrence on other side, as well as the interesting influence of the local topography at smaller scales.