11.13 RADAR REMOTE SENSING FOR RAIN/SNOW ESTIMATION IN AN ALPINE CONTEXT: THE GRENOBLE EXPERIMENT

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The experiment aims at developing advanced methods for rain and snow estimation using weather radar remote sensing techniques in high mountain regions for improved water resource assessment and hydrological risk mitigation. Since 2016, a unique observation system composed of a Météo France operated X-band radar (volumetric, Doppler, polarimetric) on top of Mt. Moucherotte (1913m), a X-band XPORT radar (volumetric, Doppler, polarimetric), a K-band micro rain radar (MRR, Doppler, vertically pointing) and in situ sensors (rain gauges, disdrometers), latter three operated by IGE on Universit Grenoble Alpes campus (210 m asl), has been deployed in Grenoble (France) region. The first aim of the Grenoble experiment is to characterize the 3-dimensional structure of precipitation and its time variability within the Grenoble intermountain basin using the high-resolution, multi-angle, multi-frequency, multi-parameter measurements of the three weather radar systems available, as well as the in-situ sensors. As a critical aspect, the melting layer development below the 0°C isotherm altitude is receiving particular attention, since (i) it determines the rain/snow occurrence at ground level, (ii) it creates several radar artefacts (bright band, attenuation) affecting rain/snow radar estimation. An algorithm for the automatic detection of the melting layer characteristics is used to establish a climatology of the melting layer (top and bottom altitudes, peak values of the various polarimetric and Doppler parameters). In the next step, an inversion model will be developed to derive hydro-meteorological variables of interest (hydrometeor types, concentration and size distribution, falling speed distribution, intensity) from the radar and in-situ observables. Such a high-resolution information about the space-time structure of precipitation within a region of several hundreds of km^2, in rugged topography, is critical for the assessment / improvement of numerical weather prediction models (e.g. MesoNH, MAR) and satellite precipitation estimation techniques implemented within the Global Precipitation Measurement mission (GPM, NASA). The second aim is the development and quantitative assessment of the rain/snow estimation techniques using the ground-based radars. Several aspects are being studied, including (i) the capability of the Moucherotte radar to detect summer convective heavy rain events and to quantify heavy and more regular rainfall at the regional scale as a function of the 0°C isotherm altitude and other factors (topography, weather types), (ii) the added value of the XPORT radar for rain/snow estimation in the Grenoble intermount basin and more generally for improving high-elevation radars′performance.