

Supplementary Material: Precipitation type classification of Micro Rain Radar data using an improved Doppler spectral processing methodology

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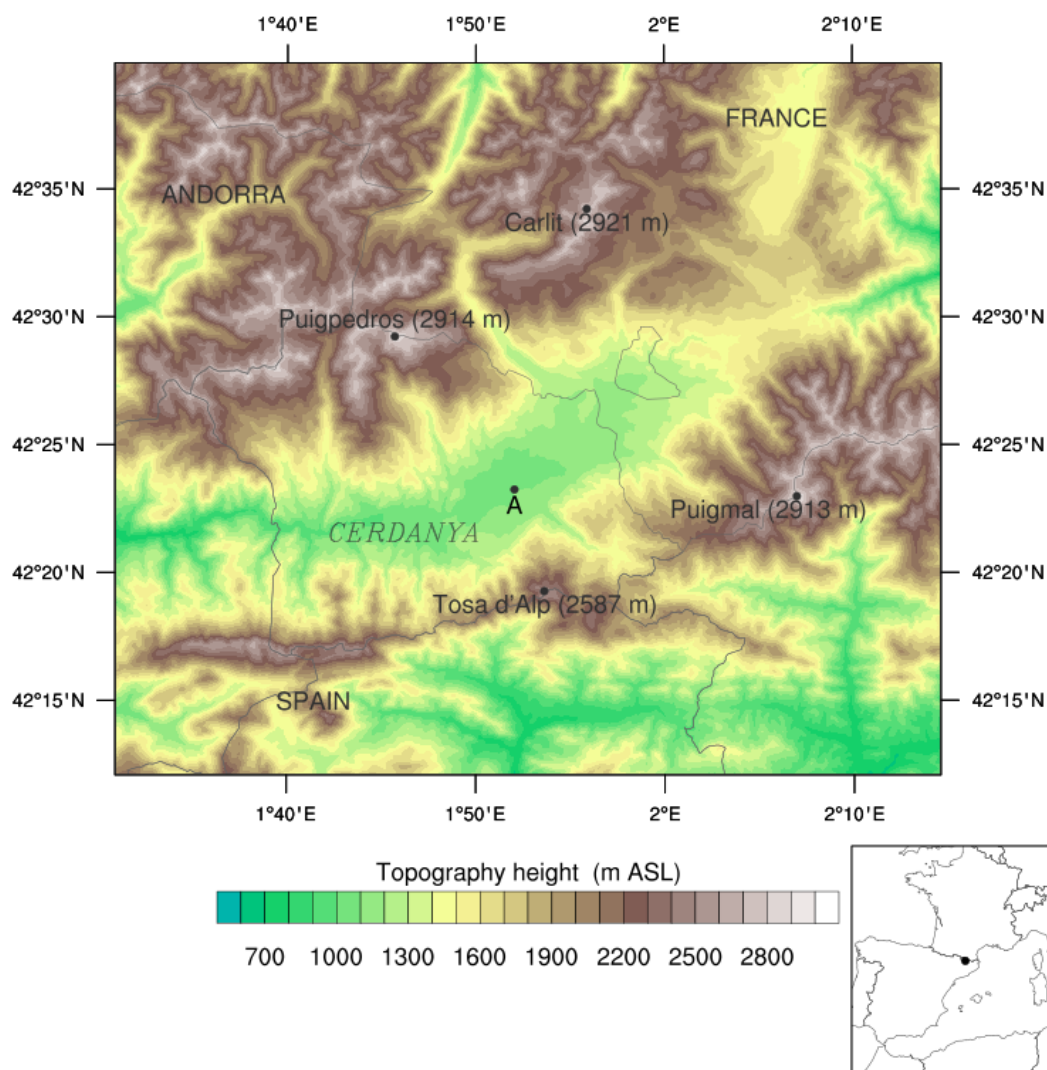


Figure S1. Location of the study area in NE Spain showing the Aerodrome (labelled "A") where the MRR, the Parsivel disdrometer and the microwave radiometer were located as other instruments of the Cerdanya-2017 field campaign..

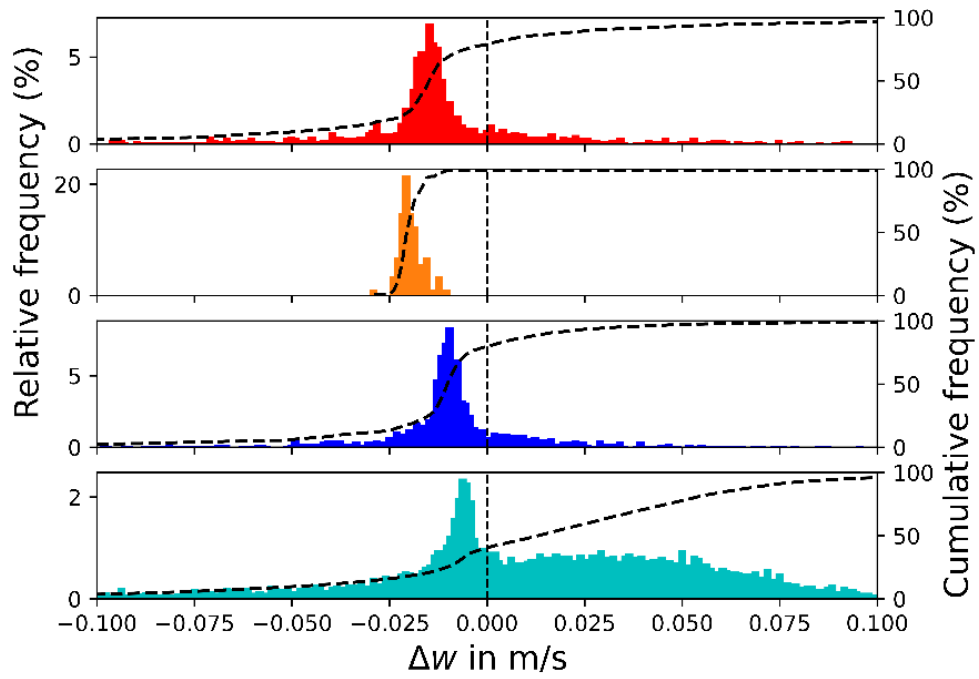


Figure S2. Histograms of differences in fall speed between Method3 and Method2 for different hydrometeor types: rain (red), drizzle (orange), mixed (blue), and snow (cyan). The black dashed line is the accumulated frequency. Note that y-axis are different for each hydrometeor type

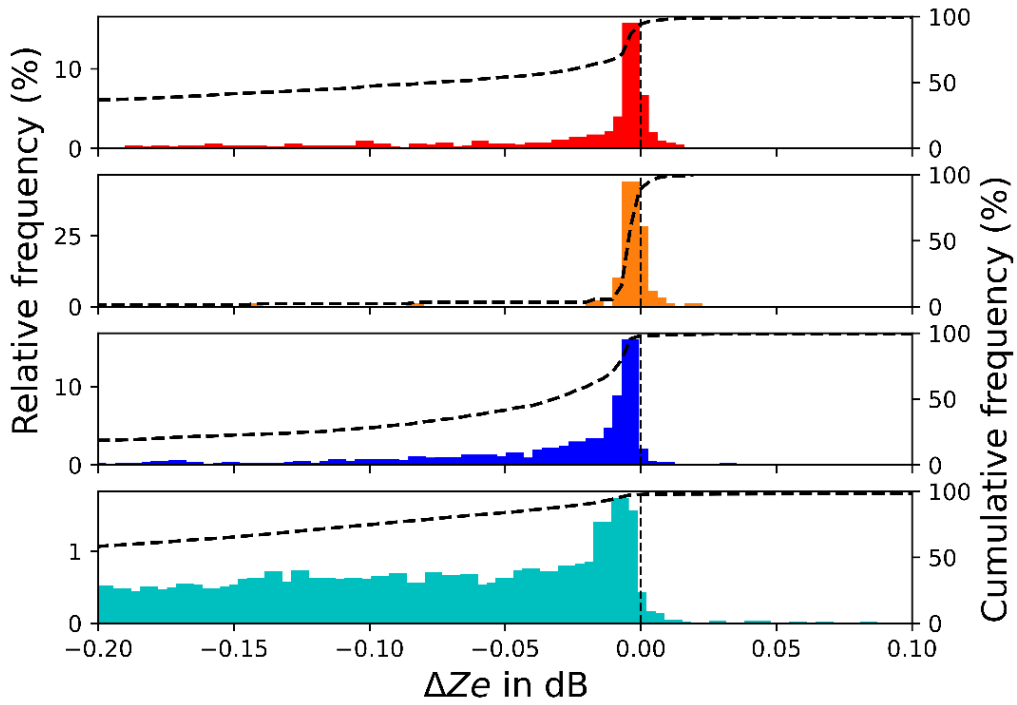


Figure S3. As Fig. 9 but for equivalent reflectivity.

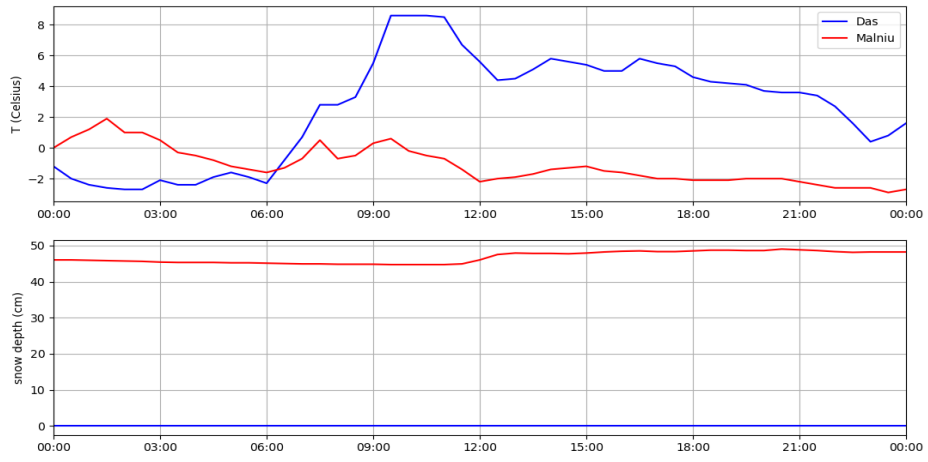


Figure S4. Air temperature at 2 m (top) and snow depth (bottom) on 27 March 2017 from AWS Malniu (red) and Das (blue).

Table S1 Main details of instruments used

Instrument	Manufacturer/Model (owner)	Parameters used in the study	Temporal resolution (s)	Latitude (°N)	Longitude (°E)	Height MSL (m)
Micro-rain radar	Metek/MRR2 (Univ. of Barcelona)	Spectral reflectivity Equivalent reflectivity (dBZ) Hydrometeor or fall speed (m/s) Hydrometeor type Equivalent reflectivity (dBZ)	60	42.38643	1.86650	1099
Disdrometer	OTT/Parsivel2 (Univ. of Barcelona)	Velocity hydrometeor (m/s) Hydrometeor type	60	42.38643	1.86655	1101
Microwave Radiometer	RPG/HATPRO (Univ. Toulouse/CNRM)	Temperature profile (°C, m)	120-180	42.38661	1.86666	1100
AWS Das	(Meteorological Service of Catalonia)	Air Temperature (°C) Precipitation (mm) Snow depth (cm)	1800	42.38605	1.86664	1097
AWS Malniu	(Meteorological Service of Catalonia)	Air Temperature (°C) Precipitation (mm) Snow depth (cm)	1800	42.46605	1.7785	2230

Table S2 Precipitation type according to WMO present weather code 4677 from disdrometer to hydrometeor type.

Precipitation type	Rain rate (mm/h)	Parameter 4677	Type in this work
Drizzle light	<0.1	51	Drizzle
Drizzle moderate	≥0.1 ... <0.5	53	
Drizzle heavy	≥0.5	55	
Drizzle with rain light	<2.5	58	
Drizzle with rain moderate	≥2.5 ... <10.0	59	
Drizzle with rain heavy	≥10.0	59	
Rain light	<2.5	61	Rain
Rain moderate	≥2.5 ... <10.0	63	
Rain heavy	≥10.0	65	
Snow light	<1.5	71	Snow
Snow moderate	≥1.9 ... <4.0	73	
Snow heavy	≥4.0	75	
Rain, drizzle with snow light	<2.5	68	Mixed
Rain, drizzle with snow moderate	≥2.5 ... <10.0	69	
Rain, drizzle with snow heavy	≥10.0	69	
Snow grains	>0	77	
Soft hail light	<1.0	87	
Soft hail mod./heavy	≥1.0	88	Hail
Hail light	<2.5	89	
Hail mod./heavy	≥2.5	90	
No data			No Data