

Identification of snow and rain at the surface using polarimetric radar

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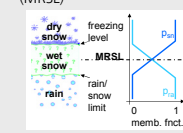
Motivation

- The transition from rain to snow at the surface is one of the challenging facts in aviation and road traffic during winter weather condition.
- Numerical weather forecast is able to provide reasonable good forecasts. Often timing and localization of precipitation is not correct.
- Nowcasting applications still suffer from the precise observation of the transition from rain to snow at the surface.
- Polarimetric weather radar allow detailed classification of hydrometeors. However, radar measurements are normally several hundred meters above ground and can therefore not represent the situation at the surface.

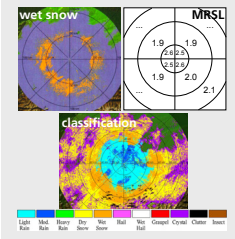


Freezing Level Estimation

- Modeled rain / dry snow limit (MRSL)

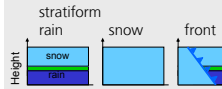


- Estimation of MRSL for volume scan sectors



Situation Classification

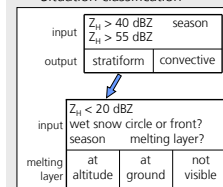
- Hydrometeor classification is used to identify convective and stratiform regions in the volume scan
- Fuzzy logic situation classification for each volume scan sector



	favored hydromet.	adverse hydromet.
convective	hail, graupel	snow
stratiform rain	snow rain	hail, graupel
stratiform snow	snow	hail, graupel
stratiform front	snow	hail, graupel

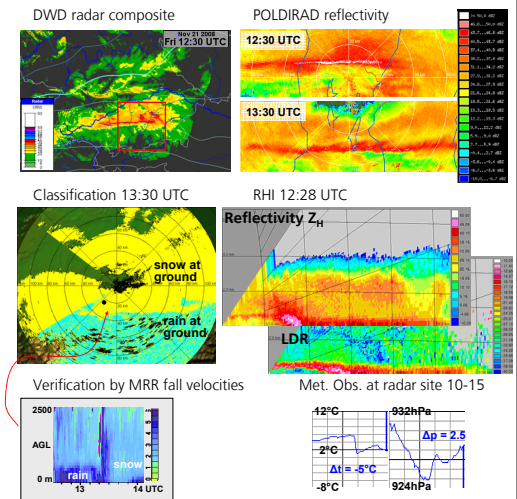
Classification at Ground

- Without further observations an extrapolation of radar hydrometeor classification towards the ground is limited.
- Situation classification



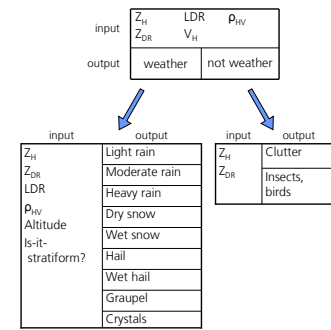
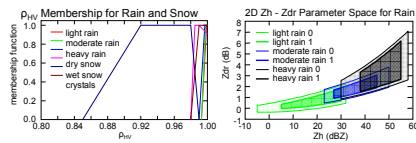
situation	con- vect.	stratiform	
		ML	no ML
hydro- met.	rain, hail, graupel	rain, snow	snow

Cold front Southern Germany 21 Nov. 2008



Fuzzy Logic Classification

- Fuzzy logic hydrometeor classification schemes are now standard for the application of polarimetric weather radar. They easily can be adapted to different operational requests and radar systems.
- POLDIRAD can use LDR and HV for the identification of melting hydrometeors
- The current classification is optimized for winter conditions.
- 1-D and 2-D membership functions are used:



Summary – Perspectives

Summary	Characteristics	Limits	Perspectives
<ul style="list-style-type: none"> Hydrometeor classification by polarimetric radar Melting layer detection by Z_H, Z_{DR}, LDR, and P_{HV} Snow fall estimation at ground is encouraging 	<ul style="list-style-type: none"> Globally robust method Rapid and easily adaptable Less sensitive to measurements errors Correct detection of the non-meteorological echoes Representation of the melting layer Detection of the snowfall 	<ul style="list-style-type: none"> Robustness of the detection of the snowfalls Detection of a front delineating an area of rain and of snow at the ground Limited precision in the hydrometeors classes Validity of the membership functions 	<ul style="list-style-type: none"> Add new input parameters like sounding or surface temperatures Determination of the contents of hydrometeors Comparison with the model data and others observations