Comparison of rainfall microphysics estimates from a dual-polarization X-band radar with a 2D video disdrometer, a Parsivel disdrometer and a K-band Micro Rain Radar

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Objectives

- Understand differences in microphysical rainfall estimates from different synergistic observations (2DVD and Parsivel disdrometers, surface polarimetric radars XPOL and vertical pointing radar MRR)
- XPOL attenuation correction and rainfall microphysical retrieval algorithm present in NETWORK 10.5
- MRR algorithm present in poster session QPE.40
- Validate the using this synergistic measurements newly develop polarimetric algorithm for attenuated frequency radar

HydReX Experimental SetUp

Data

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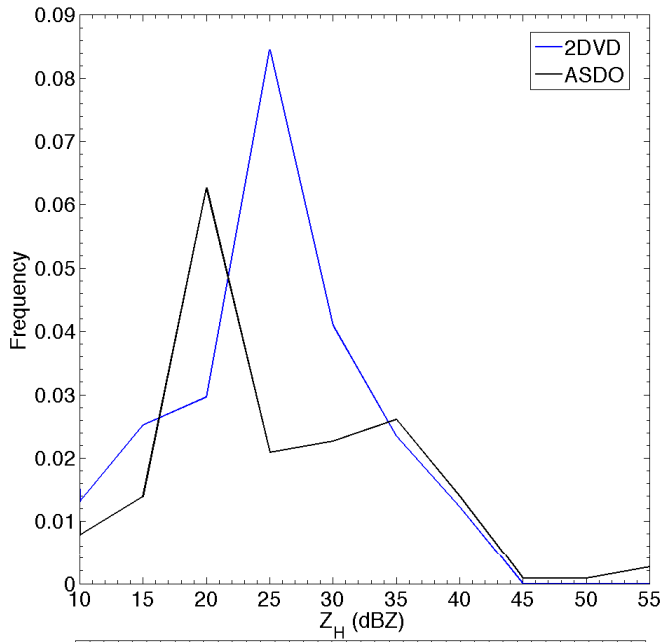
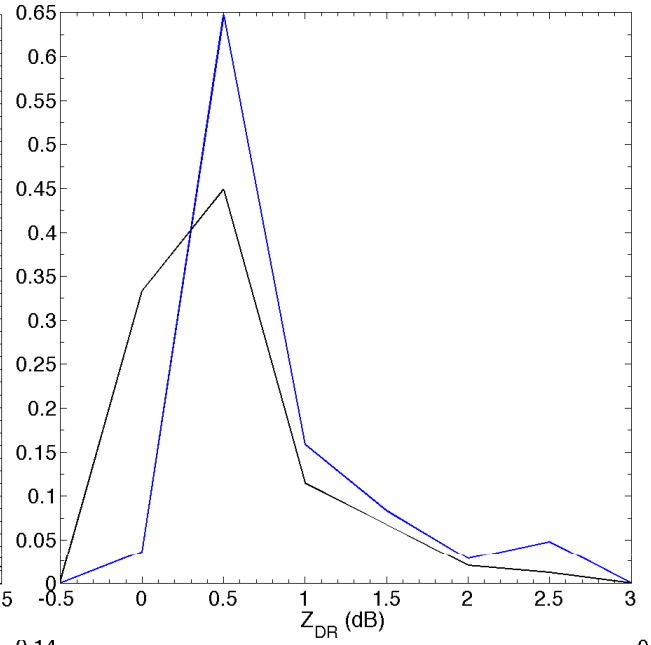




Dates: 16, 28-29/01/2011 and 02/03/2011

Mean Reflectivity Z_H (dBZ)

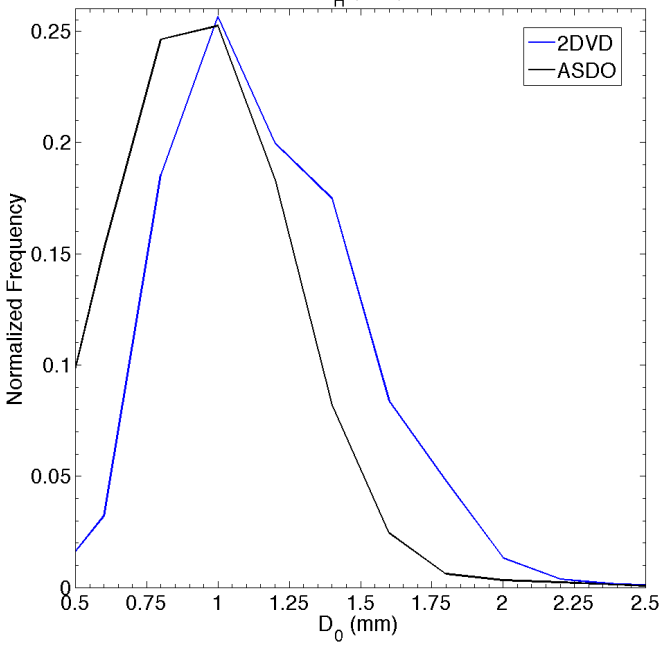
2DVD: 25.80

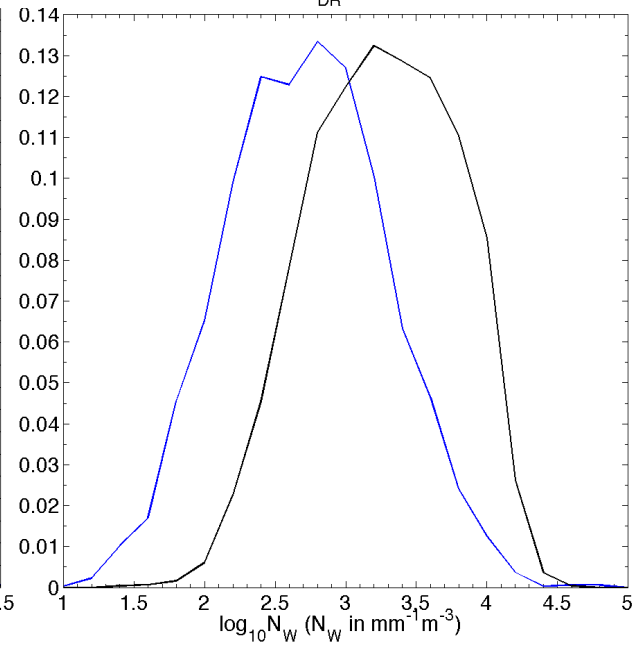
ASDO: 15.30

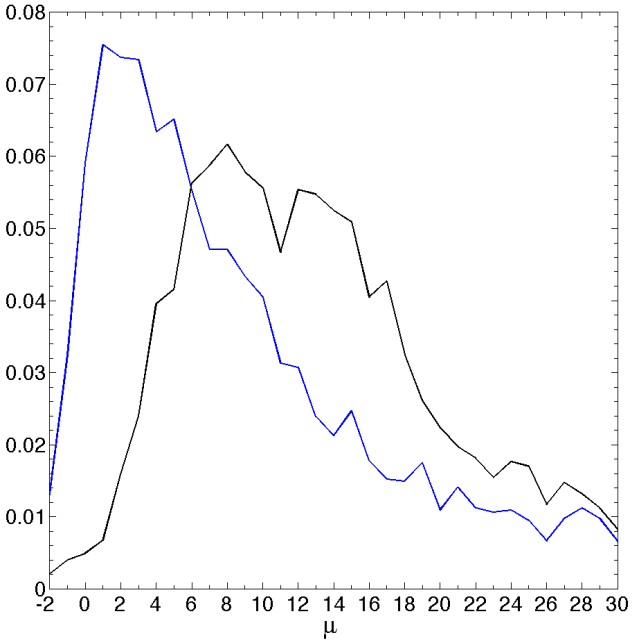
Mean Differential Reflectivity Z_{DR} (dB)

2DVD: 0.80

ASDO: 0.50







MRR Vertical Reflectivity Profiles

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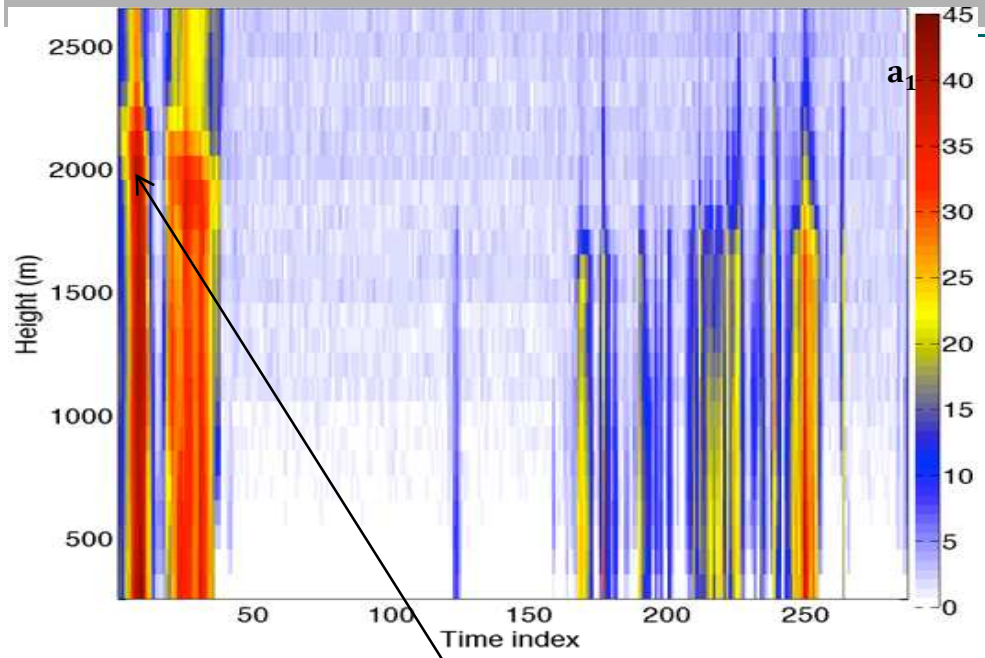

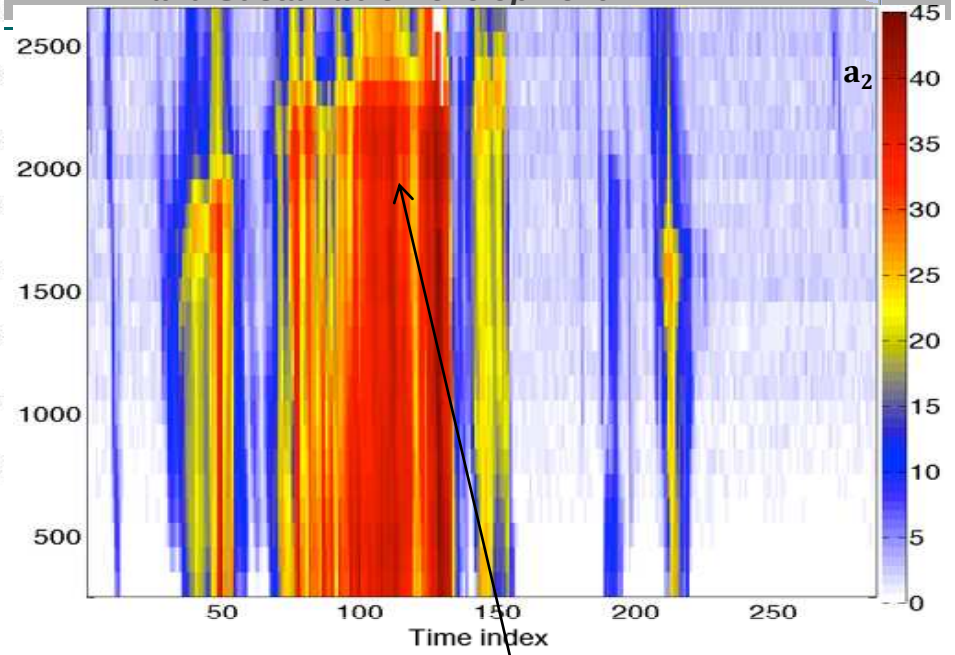

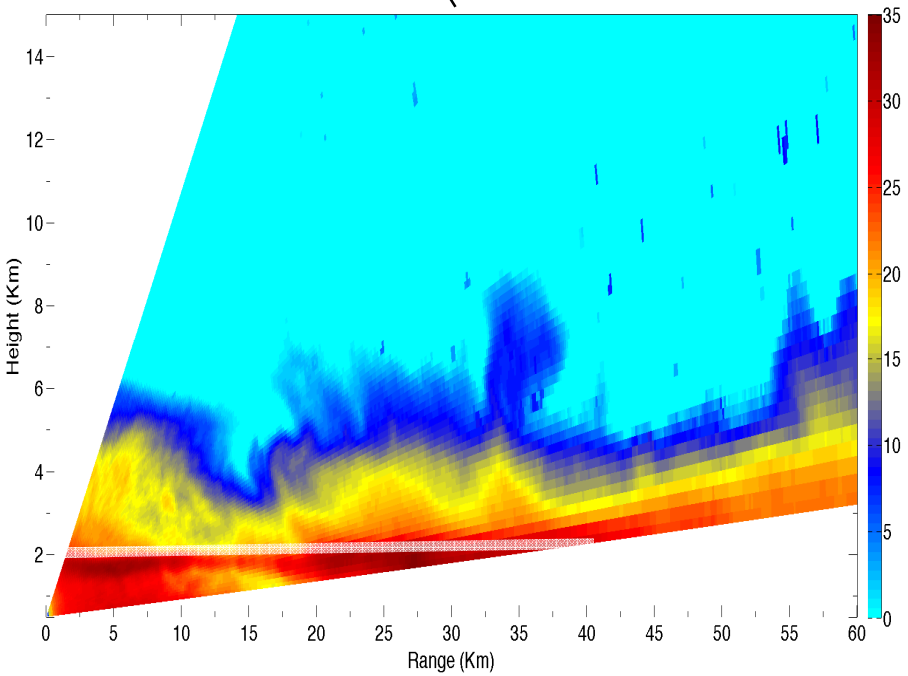

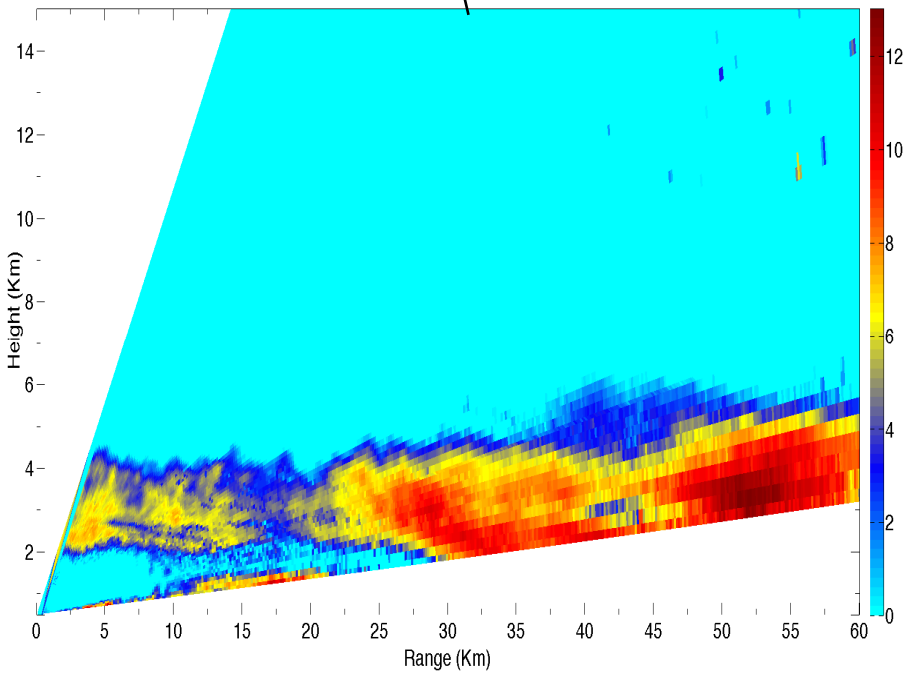

XPOL Rainfall Accumulation Maps (in mm)

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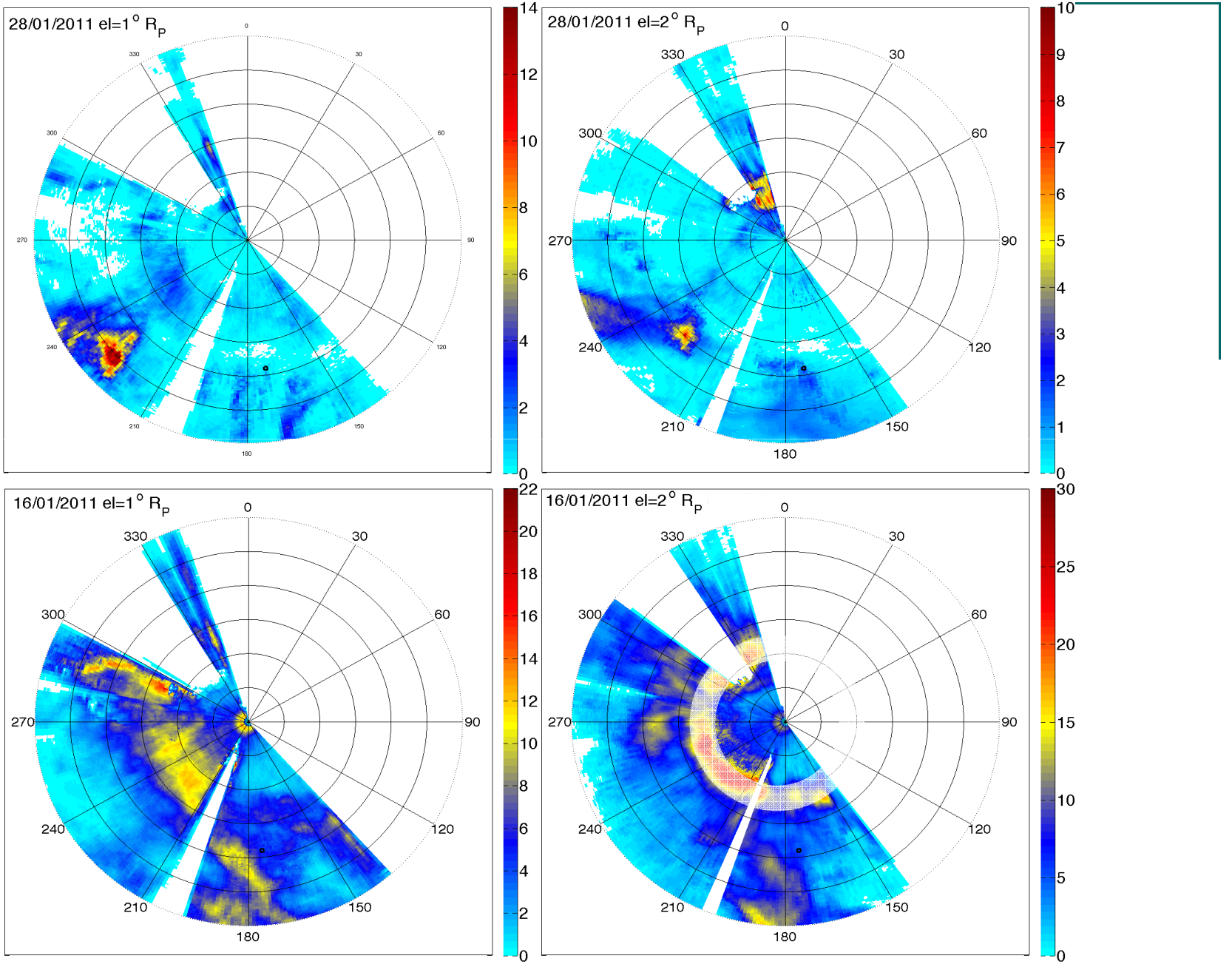

Z_H and Z_{DR} Time-series plots

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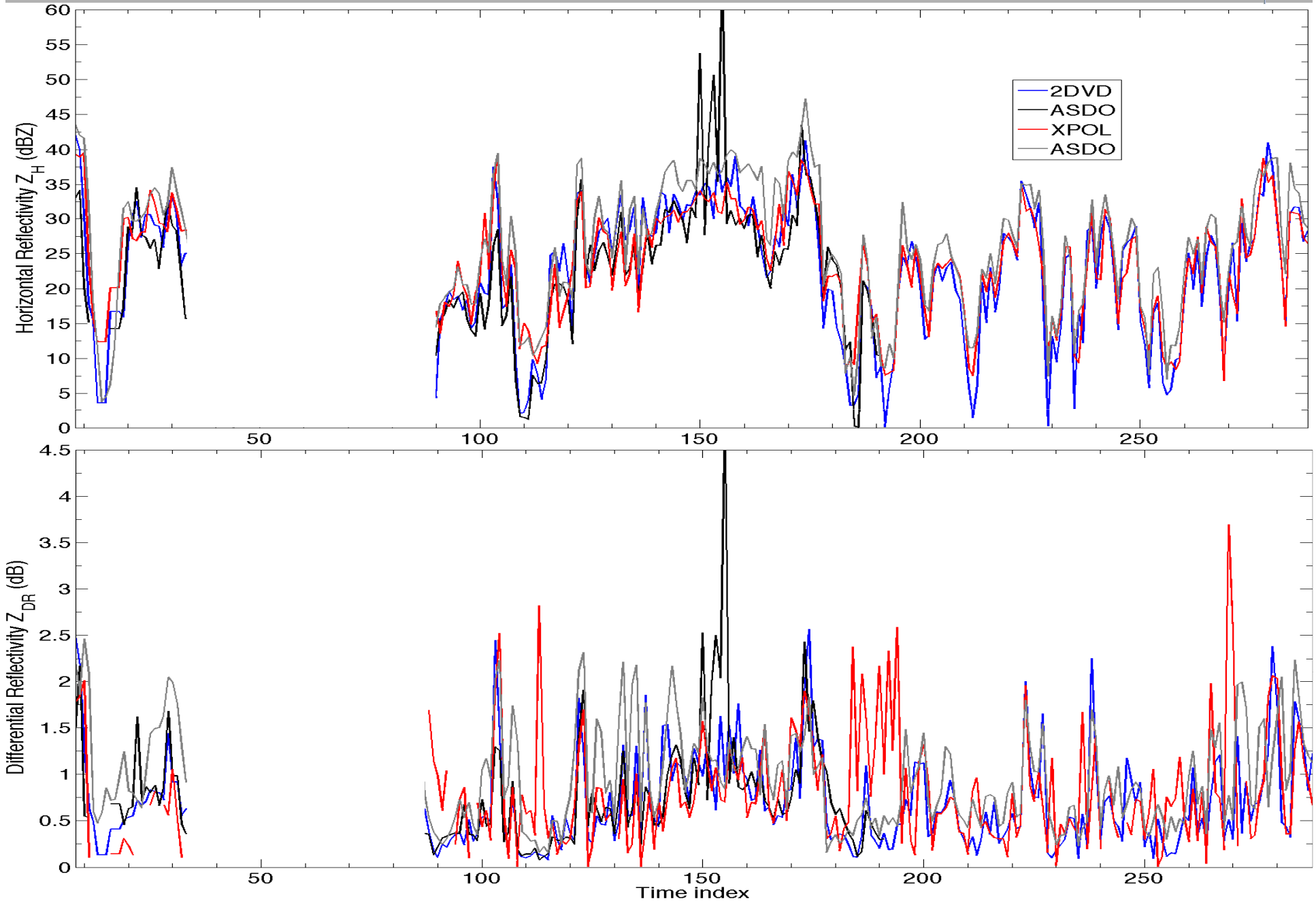

Statistical comparisons

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Z_H (dBZ)/Z_{DR} (dB)

	corr.	rME	rRMSE
ASDO vs. XPOL	0.57/0.57	-0.23/0.28	0.39/0.82
ASDO vs. MRR	0.68/0.41	-0.17/-0.24	0.33/0.82
2DVD vs. XPOL	0.85/0.66	-0.03/0.31	0.14/0.67
2DVD vs. MRR	0.73/0.57	-0.10/-0.25	0.23/0.67
MRR vs. XPOL	0.84/0.40	-0.08/-0.24	0.20/0.71
2DVD vs. ASDO	0.70/0.57	0.15/0.12	0.27/0.64

Scatter Plots of Rainfall (mm)

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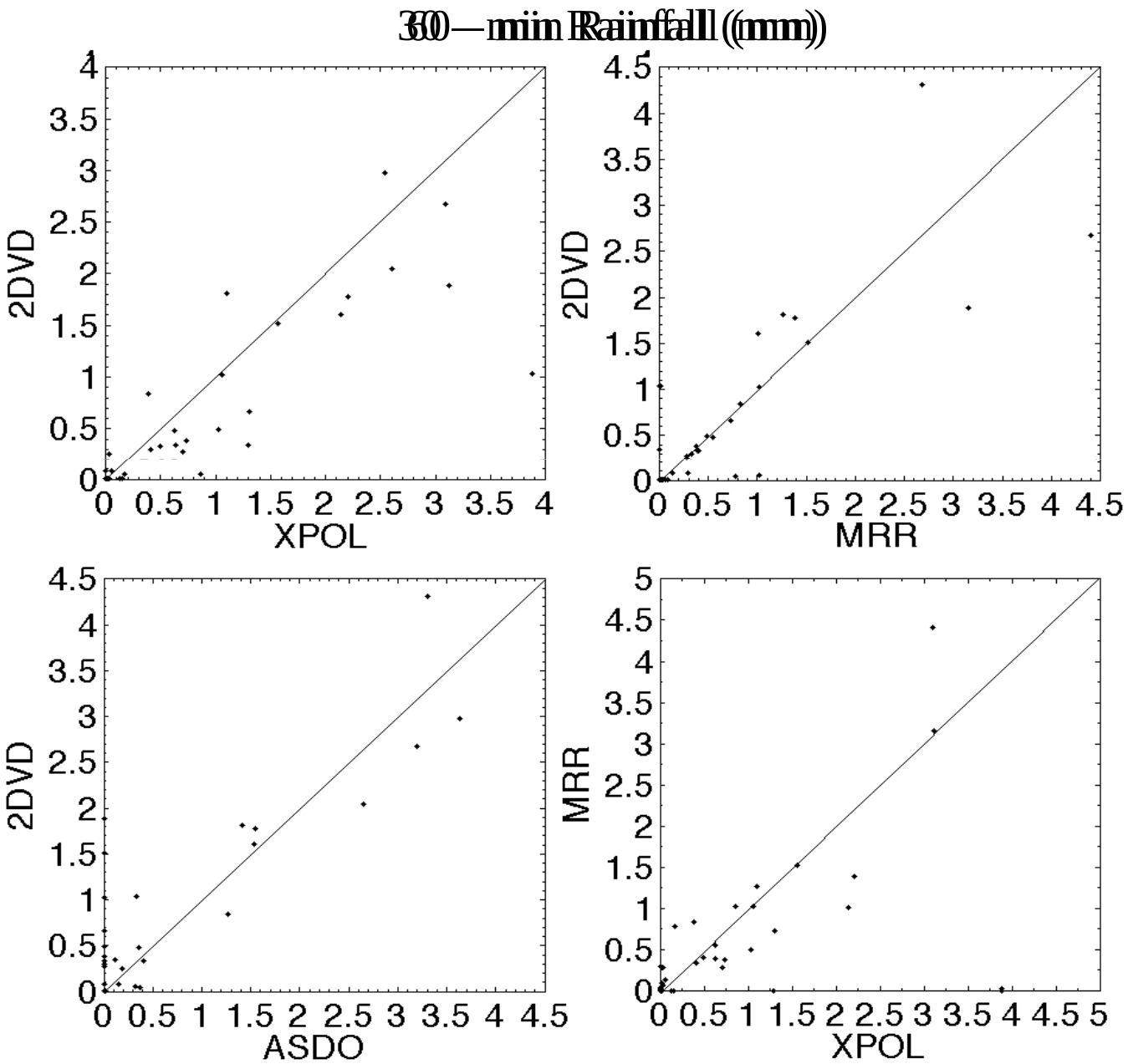

Rainfall Rate (mm hr^{-1})

30-min/60-min	corr.	rME	rRMSE
ASDO vs. XPOL	0.60/0.65	-0.84/0.84	2.26/2.32
ASDO vs. MRR	0.77/0.82	-0.52/-0.52	2.72/2.55
2DVD vs. XPOL	0.80/0.85	-0.64/0.29	1.60/1.57
2DVD vs. MRR	0.63/0.68	-0.33/-0.35	2.63/2.43

D_0-$\log_{10}N_W$ 2D-Frequency Plot

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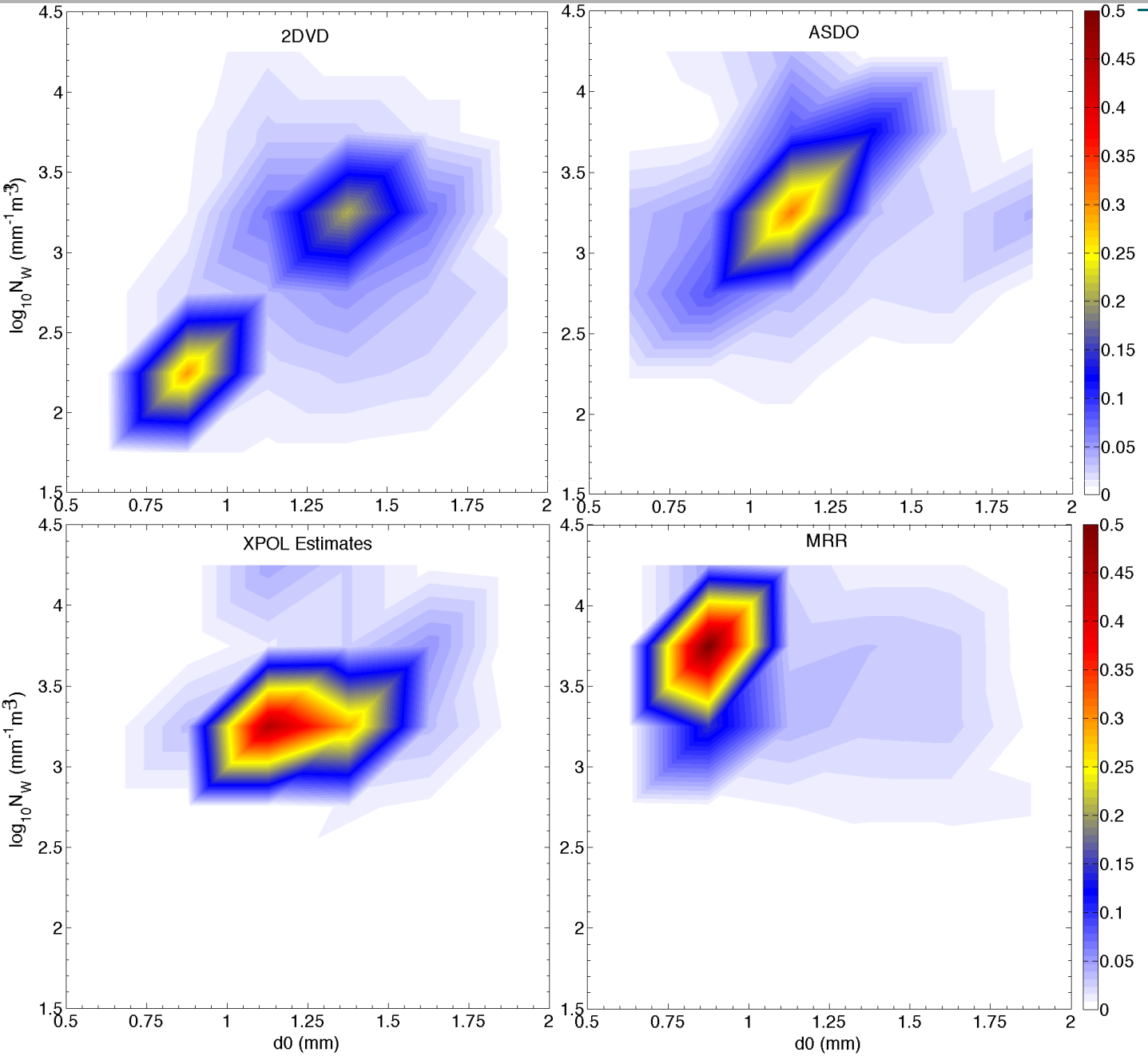

Conclusion

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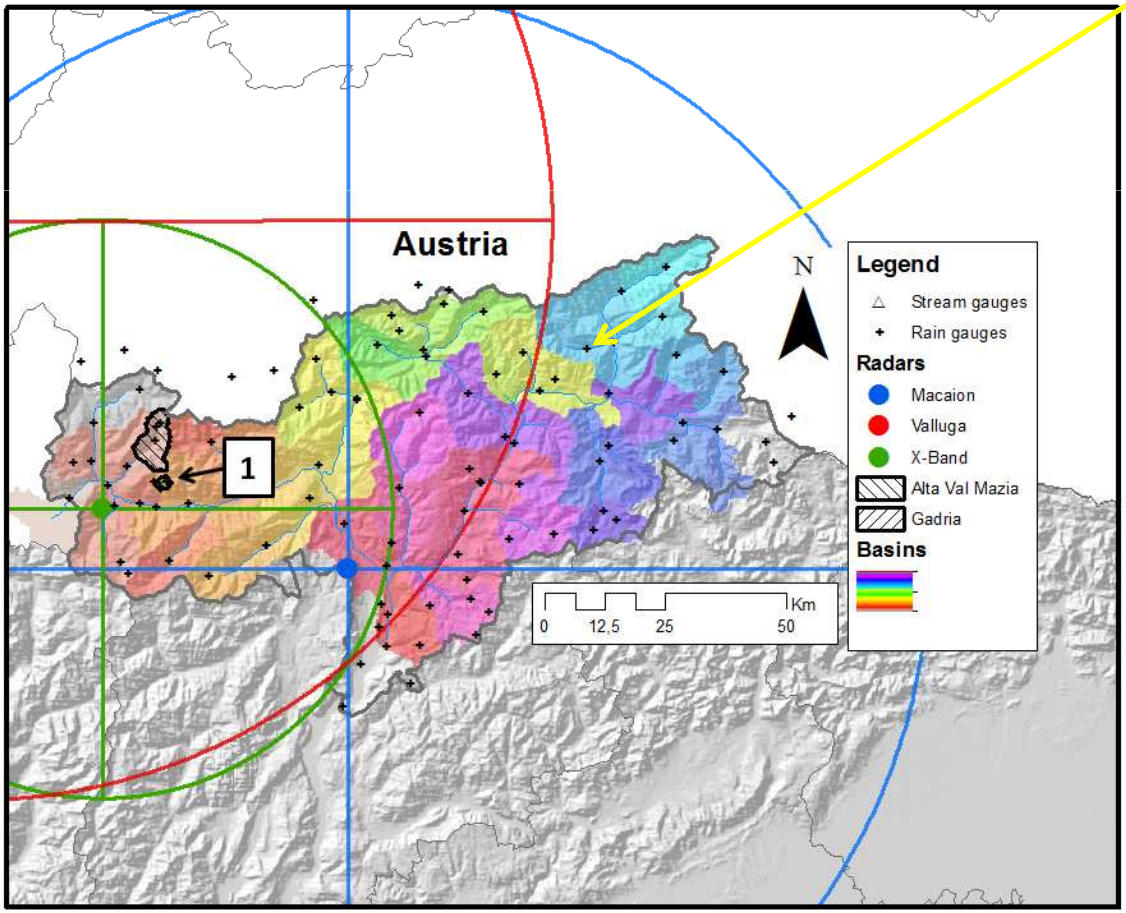
- XPOL overall algorithm gave in general high correlations and low rRMSE
- 2DVD and ASDO gave statistical differences between the two remote sensing instruments
- The comparison between XPOL and MRR indicated that XPOL gave similar error statistics against the in situ observations
- In rainfall we notice again that the 2DVD/XPOL estimates comparison gives better statistics compare to the ASDO/XPOL and similar we notice for the MRR comparison with the disdrometers
- The DSD comparison indicates differences that are significant among the two disdrometers and compare to the XPOL radar and the MRR
- This multi-instrument synergistic experiment will be repeated in the framework of Hymex…

Acknowledgments. This work is part of the HYDRORAD project (Research for SMEs category – Grand Agreement number FP7-SME-2008-1-232156) funded by EC 7th Framework Program from 2009 until 2011. *Marios N. Anagnostou* thanks the support of the Marie Curie Fellowship under the Grant Agreement Number 236871 HYDREX, coordinated by the *Prof. Frank S. Marzano*, Sapienza University

Proposed site for X band and 6 Parsivels deployment

Existing instrumentation:

+ two experimental catchments (Mazia, Gadria)
+ two C-band radar coverage (Macaion I and Valluga A)
+ raingauges (see map)
+ streamgauges (see map)



Three Parsivels will be deployed on Site 1 (Gadria) to form a cluster, sampling precipitation characteristics along an orographic transect.

Further three Parsivels will be deployed in a larger area around Site 1, to ensure a more complete sampling of precipitation characteristics and relationships with topography.

X band proposed radar site
Position of the two experimental catchments (Mazia, Gadria) and radar coverage (numerical simulation of beam occlusion)

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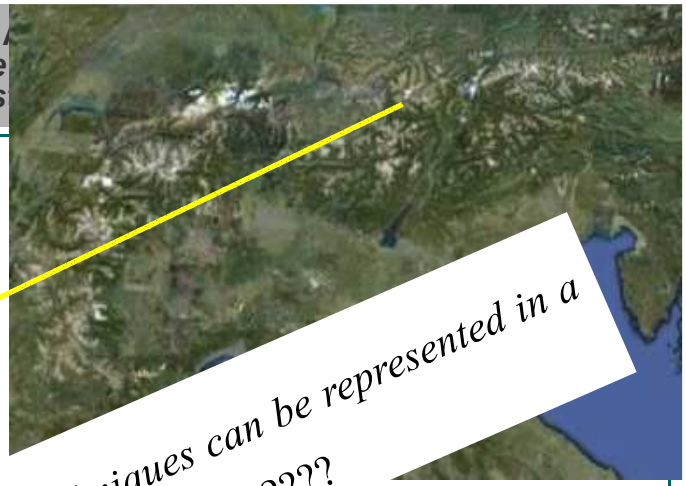
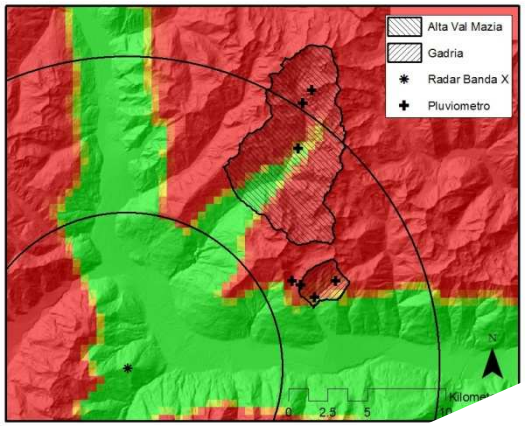
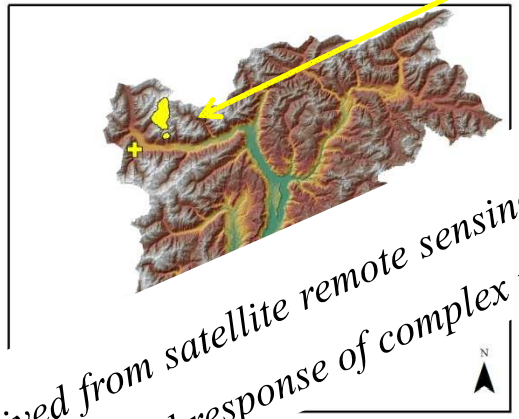


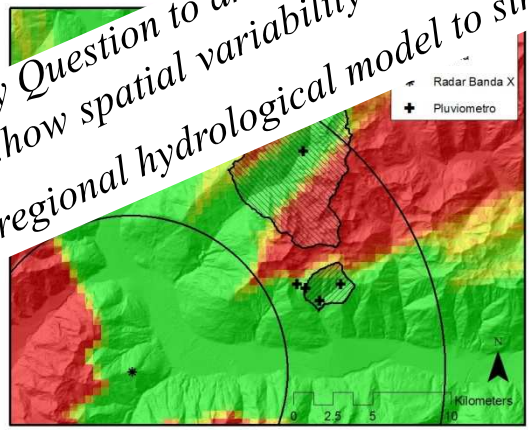
Key Question to answer:
...how spatial variability of rainfall derived from satellite remote sensing techniques can be represented in a regional hydrological model to simulate the flood response of complex terrain basins….????



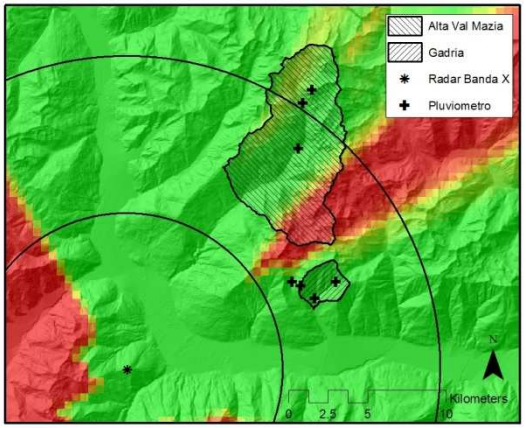
Elevation 1.0°



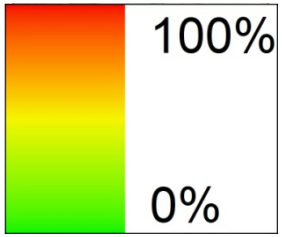
Proposed position for the radar and the two basins



Elevation 3.0°



Elevation 4.0°



% Beam Occlusion