

Small-scale variability of Mediterranean rainfall: set-up and preliminary analyses for HyMeX SOP1 in Ardèche

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Annapolis - March 20th, 2013

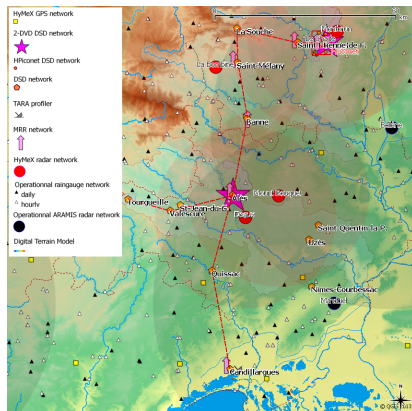
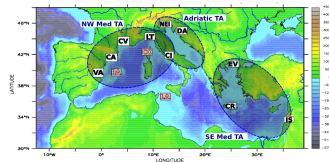


HyMeX

- HyMeX = Hydrological Cycle in the Mediterranean Experiment (<http://www.hymex.org/>).
- Working Group 3: heavy rainfalls, flash-floods and floods.
- Special Observation Period 1 (SOP1) in Fall 2012.

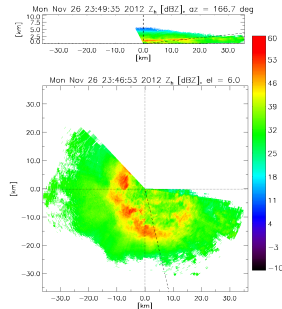
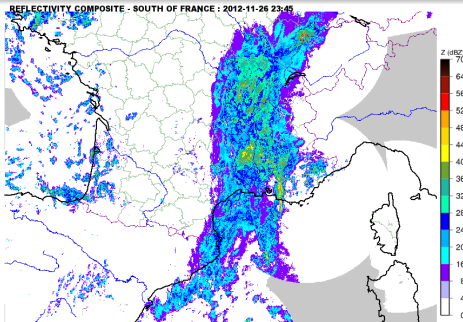
HPiconet

- Ardèche region, orographic rain.
- Dense networks of rain gauges, disdrometers, radars,...



Scientific objectives

- Characterization of orographic Mediterranean precipitation.
- Links between variability, microphysics and dynamics across scales.



Outline

- ➊ Overview of instruments deployed in Hpiconet during HyMeX SOP1.
- ➋ Quality control and preliminary analyses.
- ➌ Futures activities and perspectives.

Disdrometers - Rain gauges

Disdrometers

- 8 Parsivel1 (EPFL+LaMP).
- 3 Parsivel2 (LTHE).
- 8 sampling locations.

2DVD (EPFL)

- Size and shape of falling particles.

Rain gauges

- 9 tipping-bucket gauges (LTHE).
- 7 sampling locations.



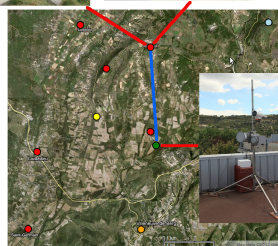
Optical+microwave links

Satellite links (LATMOS)

- 4 links (towards South).
- Around 12 GHz, 30° elevation.

Ground-based links (WUR)

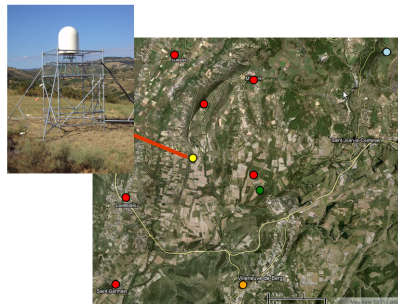
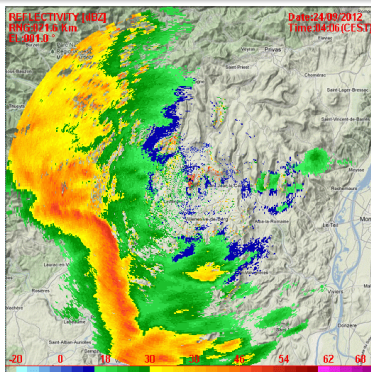
- Optical + 26 - 38 GHz.
- Length: 3.13 km,
Beam height / ground: 5-221 m.



Conventional X-band radar

RadarX (LaMP)

- Resolution: $\Delta r = 60\text{m}$, $\theta_{3\text{dB}} = 2^\circ$.
- Scan (3 min): 3 PPIs ($1, 2, 4^\circ$).



Polarimetric X-band radar

MXPol (EPFL)

- Resolution: $\Delta r = 75\text{m}$, $\theta_{3\text{dB}} = 1.5^\circ$.
- Scan (5 min):
 - 4 PPIs (2, 3.5, 4, 6°) in DPP.
 - 2-3 RHIs in FFT (64 points).
 - " Z_{dr} calibration" (PPI 90° , FFT).

Data collected

- 8 significant events over 3 months.
- ≈ 250 h of precipitation.
- No HPE recorded.
- Different precipitation types.



Example 1: 24 Sep. 2012 - convective line

 Z_h K_{dp} Z_{dr} V_h

Example 2: 27 Oct. 2012 - Stratiform rain

PPI+RHI scans - Z_h

Vertical Doppler Profile: power and Z_h

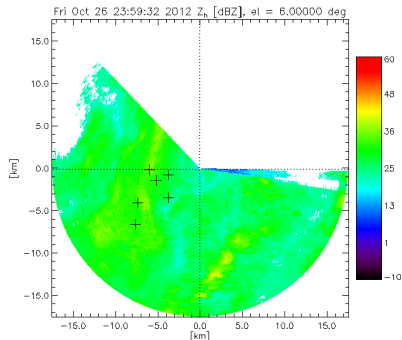
MXPol calibration (1)

Approach

- Use the network of 7 disdrometers.
- DSD $\rightarrow Z_h$ and Z_{dr} time series.
- Steady stratiform events.

Assumptions

- Limited vertical variability.
(alt. radar = alt disdros + 400m)
- Limited data scale effects.

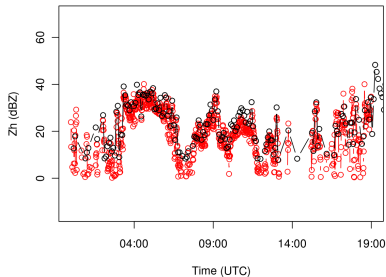


MXPol calibration (2)

 Z_h

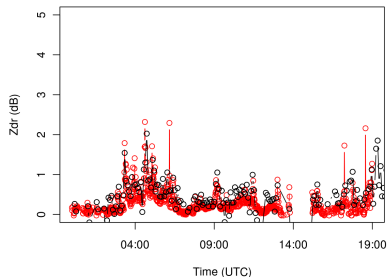
- Stable offset of 1.7 dBZ.
- Parsivel uncertainty ~ 2 dBZ.

Compare Pars 10-Radar. Time res 60

 Z_{dr}

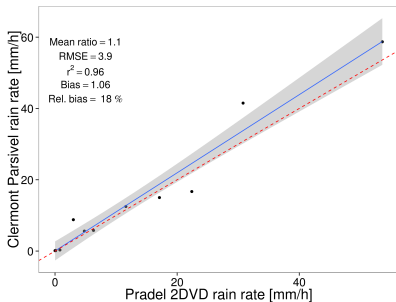
- Every 5 min \rightarrow average / event.
- $1.6 < \text{Offset} < 2.6$ dB ($\sigma < 0.1$ dB).

Compare Pars 10-Radar. Time res 60

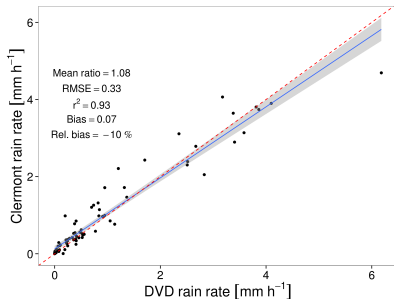


Comparison Parsivel / 2DVD (R)

24 Sep. 2012 (convective line)

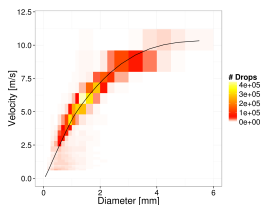


25-26 Oct. 2012 (stratiform)

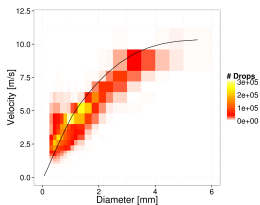


Comparison Parsivel / 2DVD (DSD)

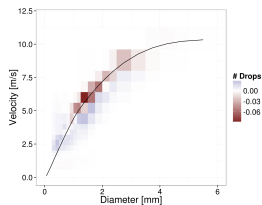
24 Sep. 2012 , 2DVD



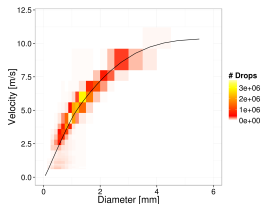
Parsivel



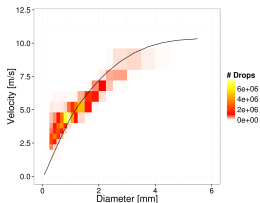
Parsivel - 2DVD



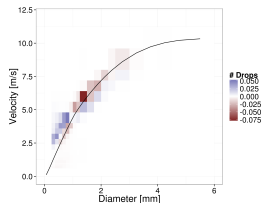
25-26 Oct. 2012 , 2DVD



Parsivel

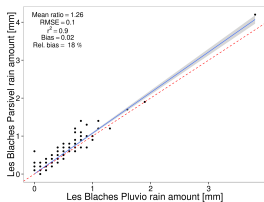


Parsivel - 2DVD

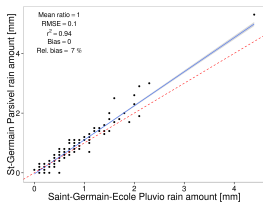


Comparison Parsivel / rain gauges (all events)

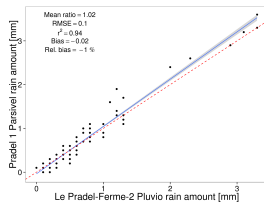
Les Blaches



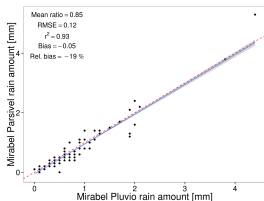
Saint Germain



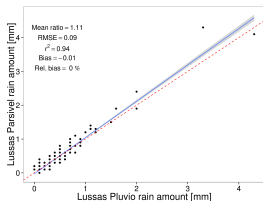
Le Pradel 1



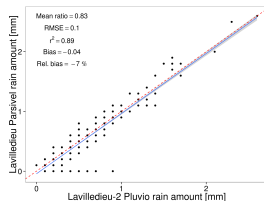
Mirabel



Lussas



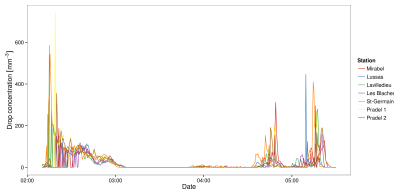
La Villedieu



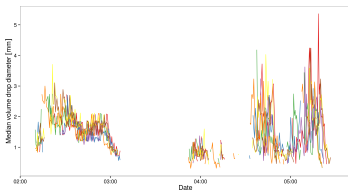
DSD variability

24 Sep. 2012 (convective line)

N_t

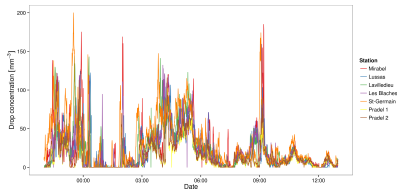


D_0

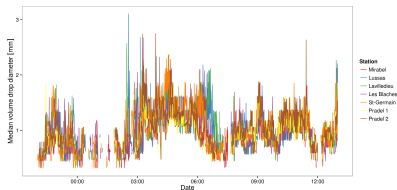


25-26 Oct. 2012 (stratiform)

N_t



D_0



Summary and perspectives

HyMeX SOP1 - Hpiconet

- Unique combination of instruments to characterize Mediterranean rainfall.
- Disdrometers and radars: microstructure + small-scale variability.
- Relevant for GPM GV (sub-grid variability, vertical profiles)!

Future work

- Hydrometeor classification (polarimetric radars at S-, C- and X-band).
- DSD retrieval (→ vertical variability).
- Links with microphysics and large-scale conditions.
- Improved QPE + hydrological responses.
- Much more!

Thank you for your attention!

