An Overview of The Electrical Activity Recorded During PEACH, the Atmospheric Electricity Component of HyMeX

[presented at ECSS 2013]

E. Defer¹, S. Coquillat², J.-P. Pinty², S. Soula², J.-F. Ribaud²,4, E. Richard², J.-M. Martin², S. Prieur², W. Rison³, P. Krehbiel³, R. Thomas³, D. Rodeheffer³, V. Ducrocq⁴, O. Bousquet⁴, L. Labatut⁴, O. Roussot⁴, F. Honoré⁴, S. Roos⁴, T. Farges⁵, L. Gallin⁵, C. Vergeiner⁶, F. Malaterre⁷, S. Pedebey⁷, W. Schulz⁸, P. Blanchet⁹, G. Anderson¹⁰, H.-D. Betz¹¹, B. Meneux¹¹, V. Kotroni¹², K. Lagouvardos¹², P. Ortéga¹³, G. Molinié¹⁴

Acknowledgements: MISTRALS, ANR IODA-MED, Toulouse University, LEFE-IDAO, NASA-MSFC, NOAA GOES-R Visitor Program, TTO1h Instrument Hosts
The PEACH Project in HyMeX

• **HyMeX**: Hydrological cycle in the Mediterranean Experiment
  A 10-year project with LOP, EOP and SOP for a better understanding and quantification of the hydrological cycle with emphasis on high-impact weather events

• **PEACH**: Projet en Electricité Atmosphérique pour la Campagne Hymex (Project in Atmospheric Electricity for HyMeX)
  Part of WG3 (Heavy Precipitation) HyMeX Activities
  Primary objective: multi-scale and multi-year lightning detection for observational- and modeling-based studies of the electrical activity in maritime and continental Mediterranean storms
  Second objective: characterization of the electrical nature of storms and lightning flashes

• **SOP1**: North-western Mediterranean, 6 Sept. to 6th Nov. 2012
34 elements deployed over the SOP1 domain

+ Operational LLSs (ATDnet, EUCLID, LINET, ZEUS)
Other SOP1 HyMeX Instruments

MétéoFrance Operational Radars

+ MRR
+ operational RGs
+ microphysics probes
+ Lidar
+...
+ TLE cameras
**Atmospheric Electricity**
- Stand-alone LMA network (real time through wireless connection)
- Other instruments recording continuously with post-event evaluation
- MLL on “storm chasing mode” with guidance from HOC and TTO1h members
- Operational LLSs in support inside and outside the SOP1 domain

### SOP1-IOP

<table>
<thead>
<tr>
<th>Month Week</th>
<th>J 22 23 24 25</th>
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<th>A 30 31 32 33 34</th>
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</table>
Examples of Lightning Flashes

**Regular Intra-Cloud - 2012/09/24 02:02:32 (800 ms)**

**“Bolt from the Blue” - 2012/09/05 17:51:20 (550 ms)**
HyMeX
PEACH / 7

Acoustics, LF and VHF Records
[2012/10/26 20:30 - 2012/10/26 20:40]

IOP-16

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(a)

(b)

(c)

(d)
Lightning Activity & Cloud Properties
[LMA, RASTA & microphysics - 2012/09/26 08:40-08:50]

(a)

(b)

(c)

(d) LMA (+/-15 s, dlat<0.1°, dlon<0.1° relative to a/c)

(e) (Courtesy J. Delanoë, LATMOS)

LMA Real time + EUCLID
Optical, EFM and VHF Records

[Negative Cloud-to-Ground flash, 2012/09/26 08:48:49]

200 frames per sec.

(a)

(b)

(c)

LMA real time + EUCLID

MLL

IOP-07
HyMeX

Tornado Case near Marseille
[LMA, EUCLID and Op. MF Radars - 2012/10/14 13:00-15:00]

© Nicolas Giusti

(a)

13:00 14:00 15:00
Time (UT)

(b)

CS1

CS2

14:21:06.906

beginning of CS2

14:31:05.286

end of CS2

(c)

12.5

0

10km

10km

Alt=1000m

Z(dZ)

(d)

(e)

Alt(km)

Elapsed Time (s)
Comprehensive and unique dataset to perform studies at flash and storm levels over continental and maritime North-Western Mediterranean Basin

- **Flash Level**
  - Description of the same flash by different instruments
  - Inter-comparison and cross-normalization of available LLSs

- **Storm Level**
  - Links between dynamics, rain/hail/microphysics, electrification and lightning occurrence
  - Interpretation with the use of electrified cloud models

- Regional and Mediterranean Basin levels
• Use of PEACH observations for verification and improvement of NWP simulations and cloud modeling (e.g. lightning data assimilation)
• Interact with local Weather Office based on lessons learned during SOP1

• Observations and products of interest for HyMeX Community:

<table>
<thead>
<tr>
<th>Type</th>
<th>Δt</th>
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<th>Parameter</th>
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<tbody>
<tr>
<td>3D &amp; 4D maps</td>
<td>sec. to days</td>
<td>100’s of m to 100’s of km</td>
<td>Flash and storm locations and density maps</td>
<td>X</td>
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<td>real time display, storm tracking/monitoring, assimilation, climate</td>
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<td>sec. to few hours</td>
<td>few 10’s of km</td>
<td>Charge layer structures in parent clouds</td>
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<td>storm monitoring and analysis</td>
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<tr>
<td>Time series</td>
<td>sec. to days</td>
<td>100’s of m to 1000’s of km</td>
<td>Flash rate, IC/CG ratio, flash duration, maximum of flash density…</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>real time display, storm monitoring and analysis</td>
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Thanks to PEACH SOP1 team!

Contact: hymex-TTO1h@cnrm.meteo.fr

Soon: ST-lightning@hymex.org
The 05 September 2012 Storm
[LMA, Euclid & Op. MF Radar Analysis Methodology]

See Pinty et al, tomorrow