HyMeX ST-Lightning

An Overview on the HyMeX ST-Lightning Activities: From SOP1 to LOP

MISTRALS

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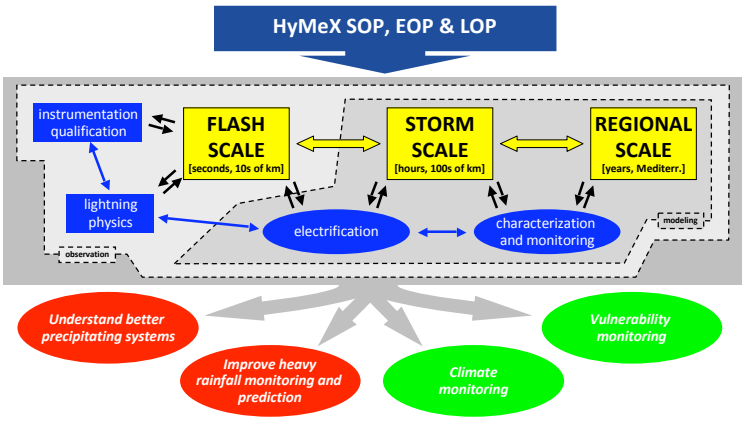
➲ ST-LIGHTNING OBJECTIVES

1. Provide and analyze long-term records of the lightning activity as reported by research and operational lightning locating systems (LLSs)
2. Perform multi-scale observational- and modeling-based studies in the frame of HyMeX WG3 activities with emphasis on
   - Links between kinematics, microphysics, electrification, aerosols and lightning occurrence and characteristics
   - Electrification processes and charge structures inside clouds over sea and land, and during sea-to-land and land-to-sea transitions
   - Climatology of the lightning activity over the Mediterranean Basin
   - Comparison of lightning observations from different LLSs
   - Use of lightning detection in assimilation and nowcasting

Bringing an additional insight on heavy precipitation systems by means of electrical observations synergistically or not with other types of weather observations

➲ A MULTIPLE SCALE APPROACH



➲ AN INTERNATIONAL PARTNERSHIP

Austria	ALDIS, TU Graz
Croatia	Meteorological and Hydrological Service
France	CEA, CNRM, LA, LERMA, LMD, LTHE, Météorage, Université de la Polynésie française
Germany	nowcast GmbH
Greece	National Observatory of Athens
Italy	CNR-ISAC
Spain	Meteorological Service of Catalonia, Universidad del País Vasco/EHU, Universitat de Barcelona
UK	Met Office
USA	NMT

➲ DISSEMINATION

12 scientific papers

55 contributions to international conferences and workshops (including the ECSS 2013 *Heino Tooming* award)

Student education : 3 PhD Thesis, 2 Masters Thesis

➲ ST-LIGHTNING INSTRUMENTATION

Instrument	SOP1 :	HyLMA, SLA, MBA/MPA, EFM, INR, VFRS, TLE cameras, *ATDnet*, *EUCLID*, *LINET*, *ZEUS*
	EOP :	SAETTA, *ATDnet*, *EUCLID*, *ZEUS*
	LOP :	*ATDnet*, *EUCLID*, *ZEUS*
Model	xOPn :	MesoNH, WRF, Arome

Learning from the SOP1 observations, applying to EOP and LOP records

Interactions with the other HyMeX Science Teams in on-going case investigations

➲ SOP1, A COMPREHENSIVE AND UNIQUE DATASET: EXAMPLE OF THE IOP-06 CASE

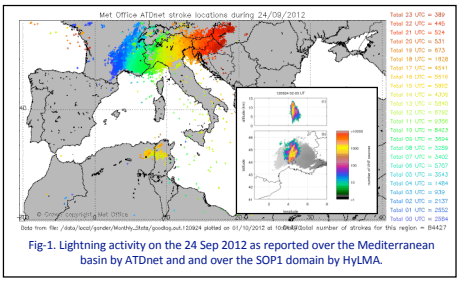


Fig-1. Lightning activity on the 24 Sep 2012 as reported over the Mediterranean basin by ATDnet and and over the SOP1 domain by HyLMA.

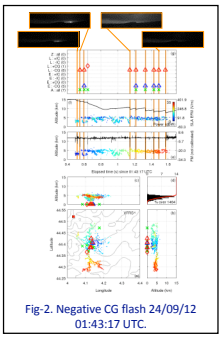


Fig-2. Negative CG flash 24/09/12 01:43:17 UTC.

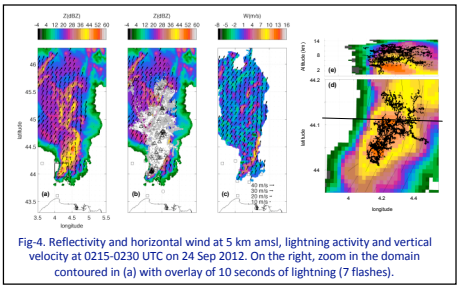


Fig-4. Reflectivity and horizontal wind at 5 km amsl, lightning activity and vertical velocity at 0215-0230 UTC on 24 Sep 2012. On the right, zoom in the domain contoured in (a) with overlay of 10 seconds of lightning (7 flashes).

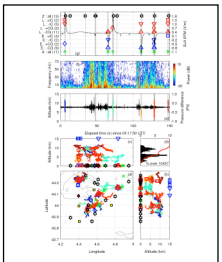


Fig-3. 2.5-min of lightning activity starting at 24/09/12 05:17:50 UTC.

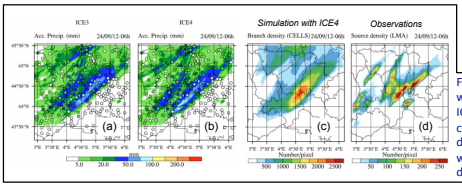


Fig-5. 6-hour accumulated rain simulated with (a) ICE3 *[3 ice-particle types]* and (b) ICE4 *[4 ice-particle types]* MesoNH scheme compared to raingauge records (colored dots), (c) density of branches simulated with ICE4 and (d) HyLMA VHF source density detected during the same period.

➲ OBSERVATIONS AND PRODUCTS OF INTEREST FOR HyMeX COMMUNITY

Type	Δt	Δx	Parameter	S	E	L	Applications
3D & 4D maps	sec. to days	100's of m to 100's of km	Flash and storm locations and density maps	X	X	X	real time display, storm tracking/monitoring, assimilation, climate
	sec. to few hours	few 10's of km	Charge layer structures in parent clouds	X	X	-	storm monitoring and analysis
Time series	sec. to days	100's of m to 1000's of km	Flash rate, IC/CG ratio, flash duration, maximum of flash density…	X	X	X	real time display, storm monitoring and analysis
	sec. to few hours	few 10's of km	Charge layer structures in parent clouds	X	X	-	storm monitoring and analysis

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References

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Ducrocq, V., *et al.*: HyMeX-SOP1: The Field Campaign Dedicated to Heavy Precipitation and Flash Flooding in the Northwestern Mediterranean, Bull. Amer. Meteor. Soc., 95, 1083–1100, 2014.

HyMeX sponsors in France