

# Multi-scale interactions between **moist-air flow** and **deep convection**

During HyMeX **IOP 15a** heavy precipitation event



**Lee KO<sup>1</sup>, Flamant C<sup>1</sup>, Durocq V<sup>2</sup>, Delanoe J<sup>1</sup>, Raut JC<sup>1</sup>, Chazette P<sup>3</sup>,  
rié N<sup>2</sup>, Labatut L<sup>2</sup>, Bock O<sup>4</sup>**

**Four-**

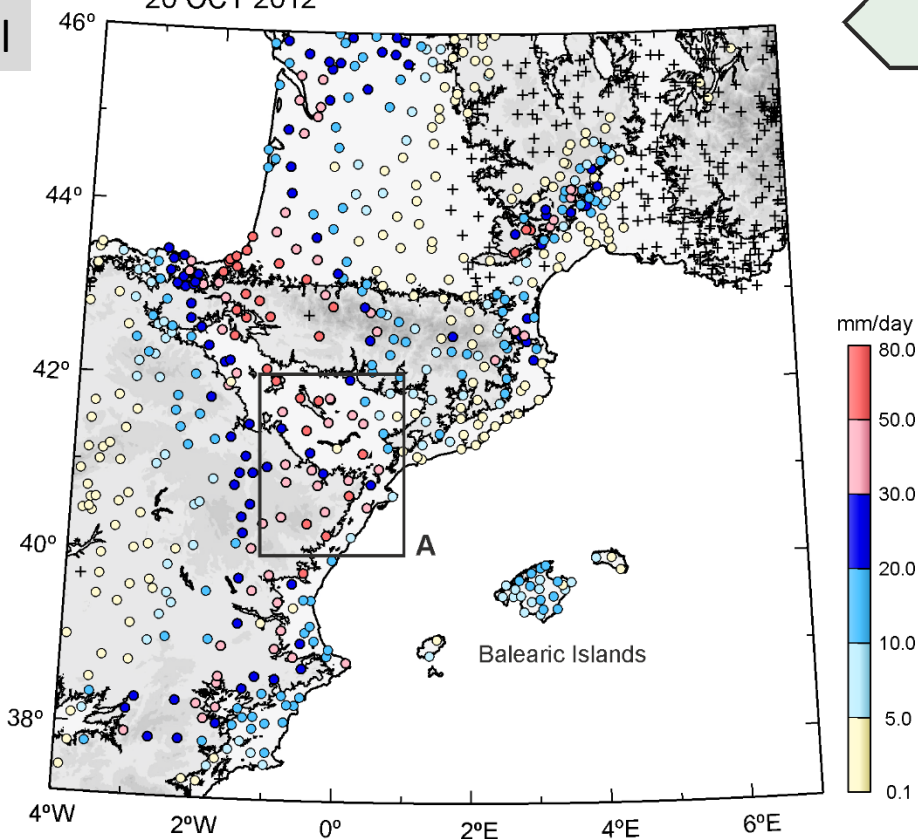
<sup>1</sup>LATMOS, Université Paris 6, CNRS & UVSQ, France

<sup>2</sup>CNRM-GAME, Météo-France & CNRS, France    <sup>3</sup>LSCE, France

<sup>4</sup>LAREG-IGN, Université Paris Diderot, France

# Daily rainfall

20 OCT 2012



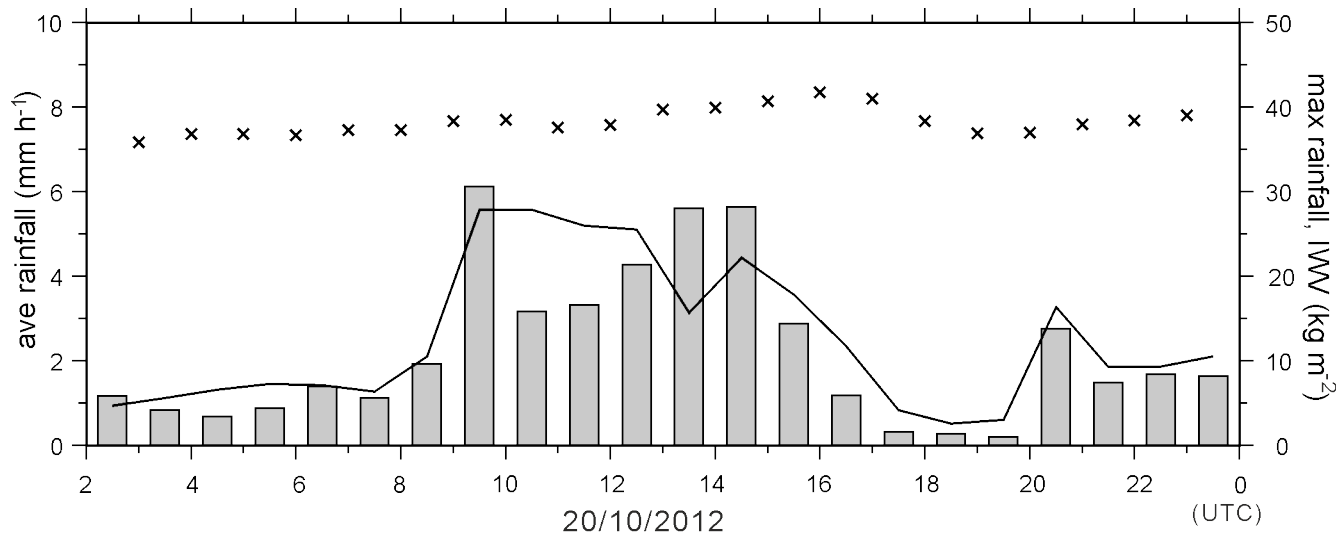
# IOP15a (20/10/2012): CA

- max. rainfall amount  
: **136.4 mm** (-1.3 °E, 42.89 °N)

- max. IWV  
: **42 kg m<sup>-2</sup>** (0.3 °E, 40.9 °N)

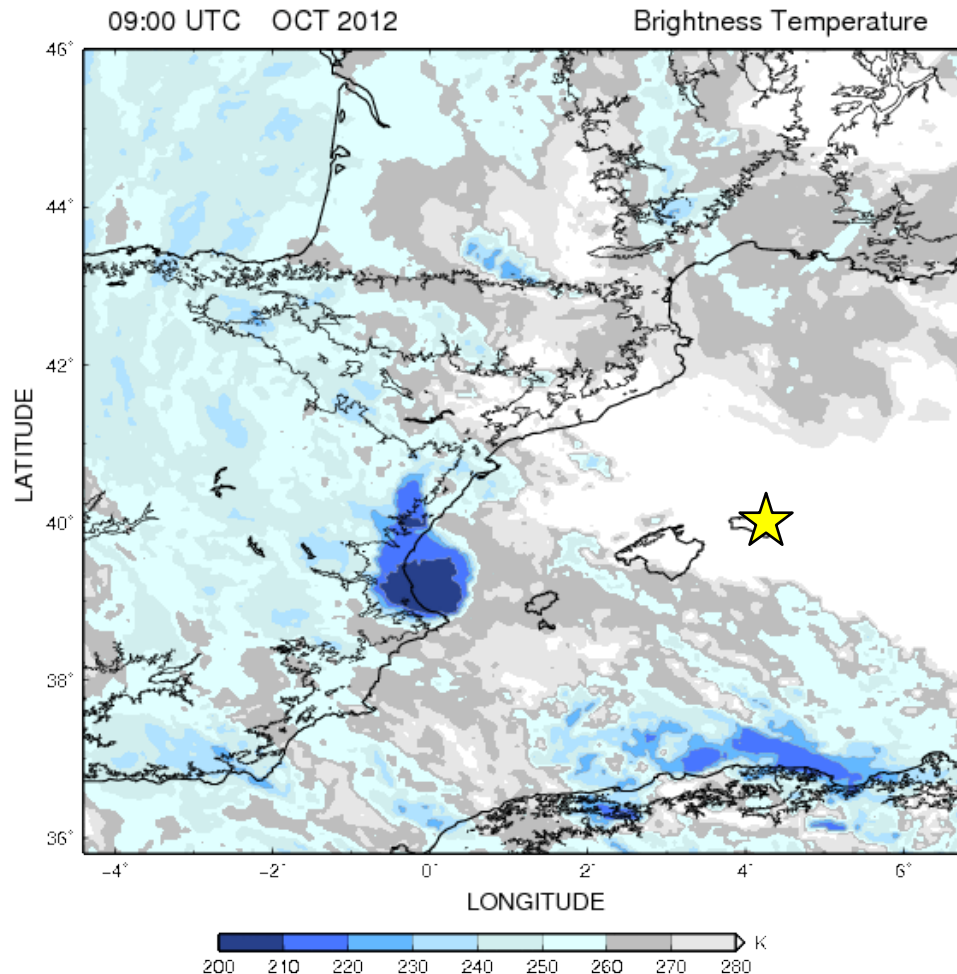
# Hourly rainfall

cross: IWV (GPS: 0.3 °E, 40.9 °N)  
solid line: ave. rain-gauge  
bar: max. rain-gauge



## Target MCS

- Period: **from 1300 UTC to 1800 UTC** on 20 OCT
- Location: **CA**, South of Pyrenees



## Dataset

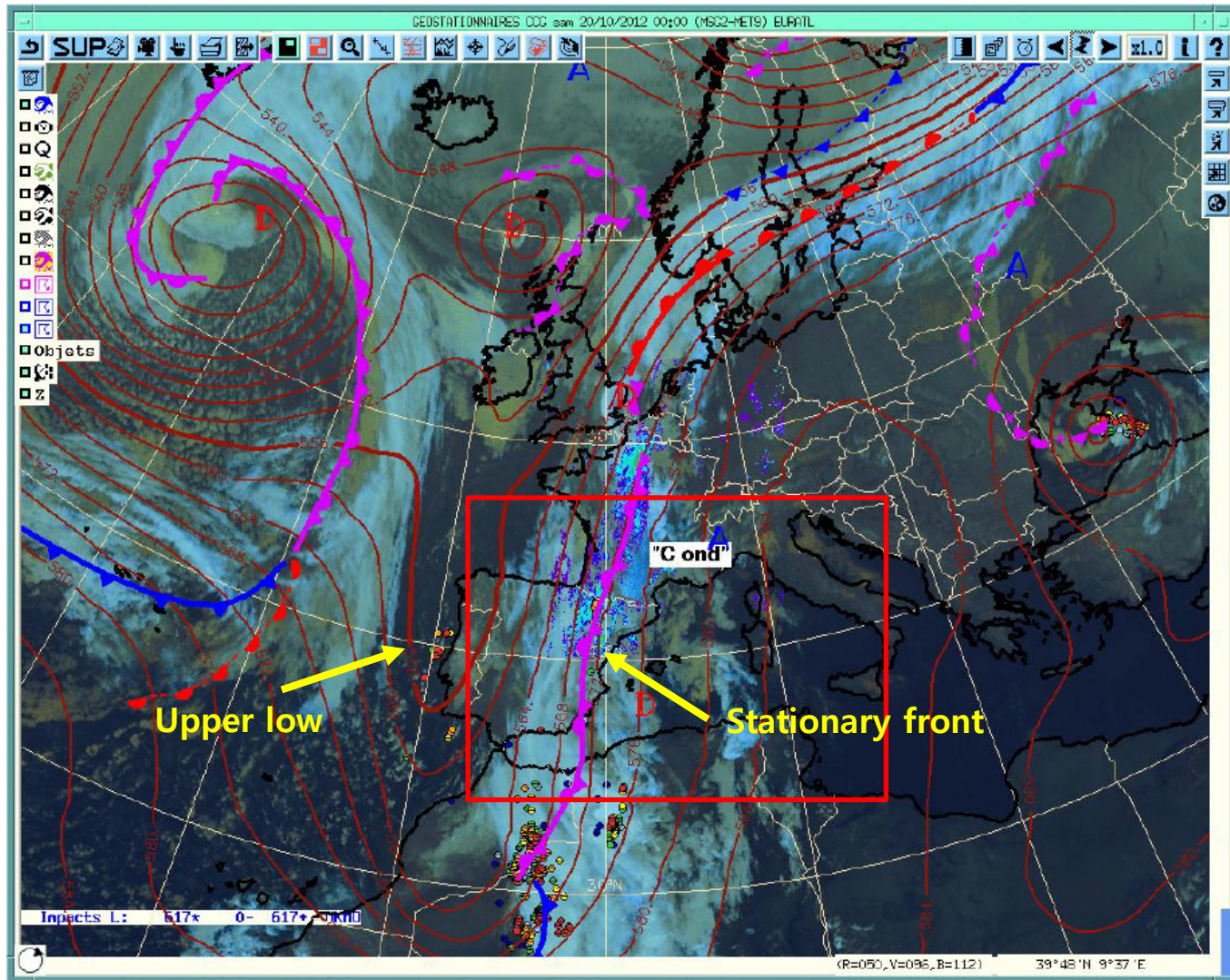
### ○ HyMeX SOP 1 observational data

- LEANDRE 2 lidar onboard ATR42 ☆
- RASTA radar onboard F20 ○
- MSG-SEVIRI
- Ground-based radar network
- Ground-based GPS network
- WALI lidar ☆

### ○ Modelling data

- AROME-WMED analyses  
:  $\Delta x, \Delta y = 2.5$  km
- WRF model  
:  $\Delta x, \Delta y = 10$  km

# Mean sea level, geopotential at 500 hPa, satellite image at 00 UTC on 20 October 2012



— 500 hPa geopotential

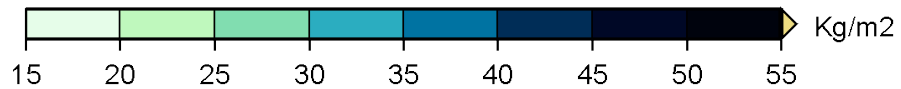
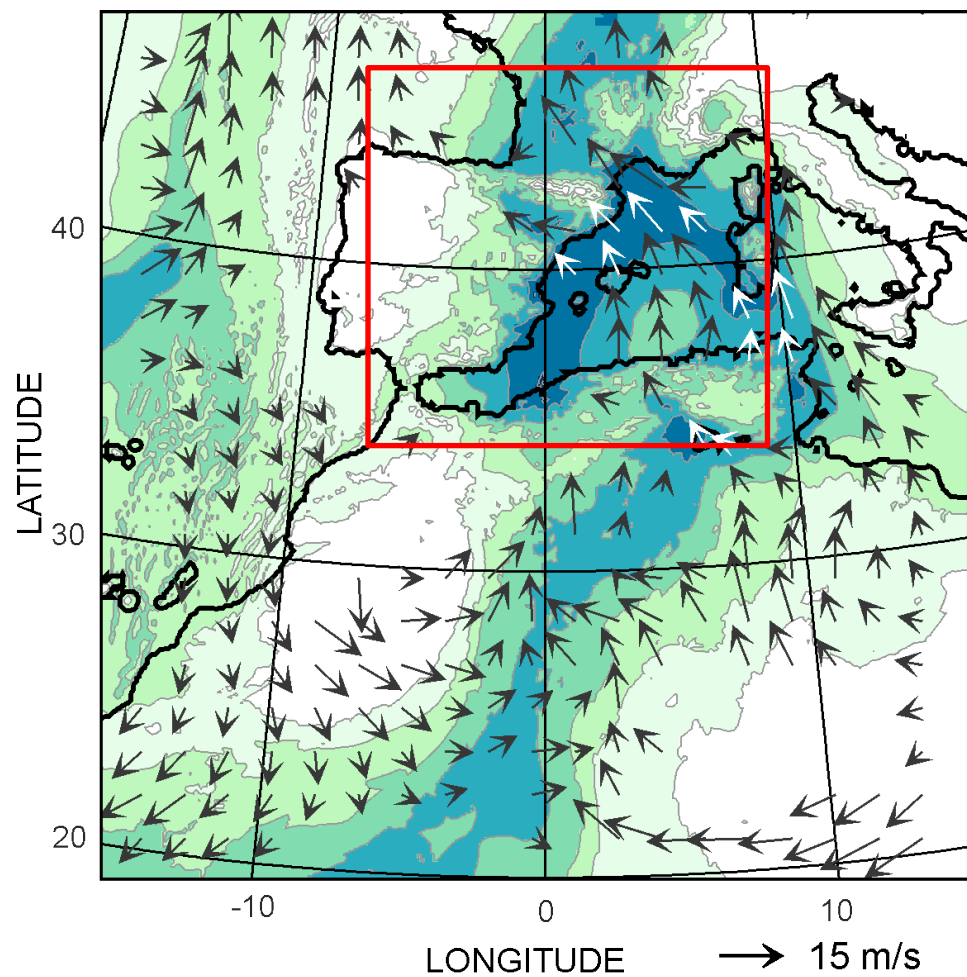
(From HyMeX SOP 1 daily report)

# WRF IWV results

## Total columns

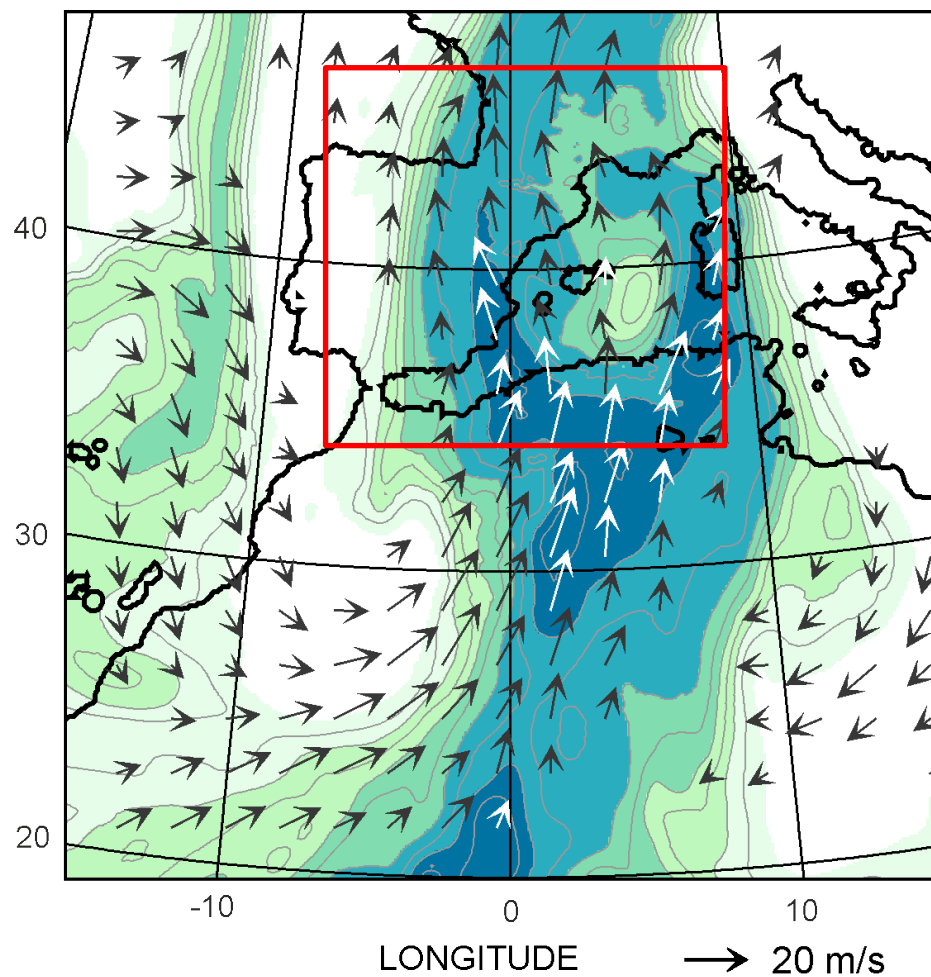
06 UTC 20 OCT 2012

(a) PW (shade), wind 925 hPa



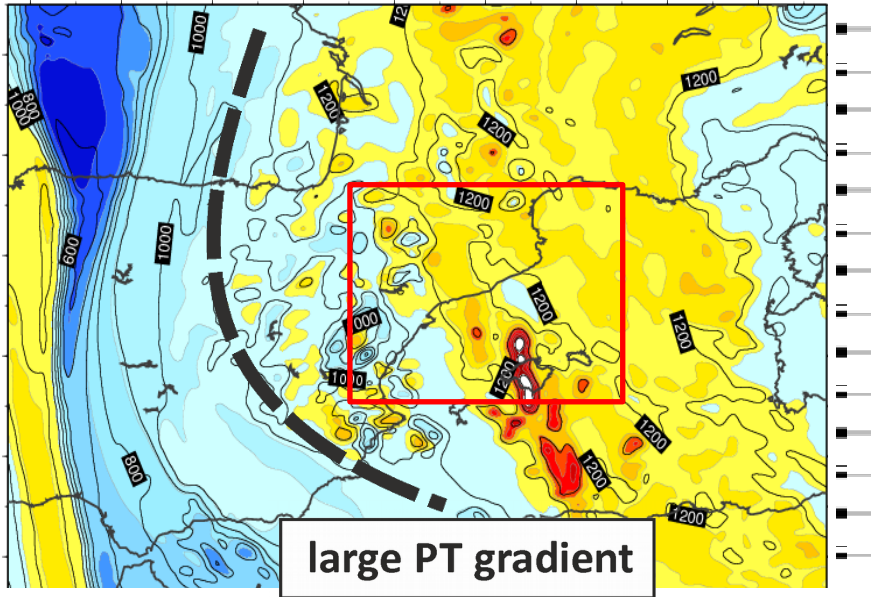
## Middle levels (700-300 hPa)

(b) IWV 700-300 hPa (shade), wind 700 hPa

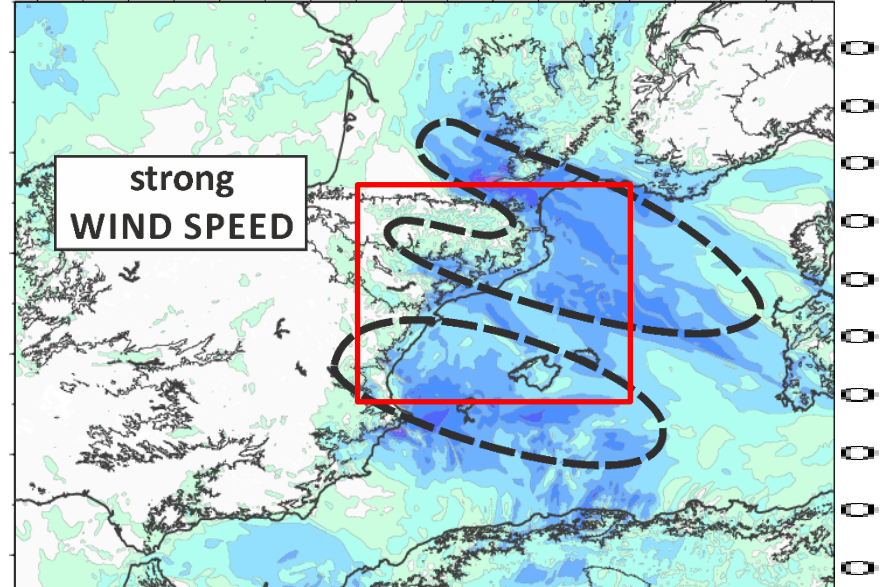


AROME-WMED analyses results at **1200 UTC** on 20 OCT 2012

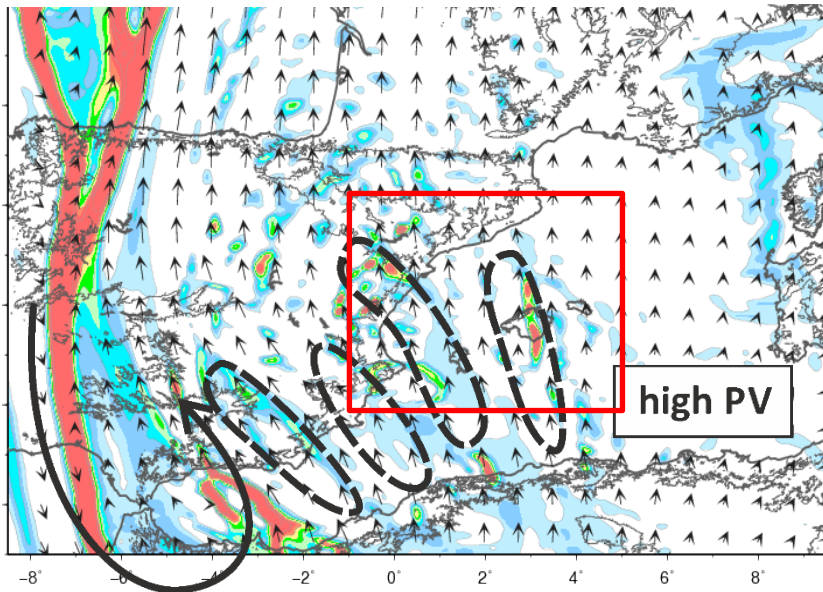
(a) PT (shading) and geopotential (contours) at PVU 1.5



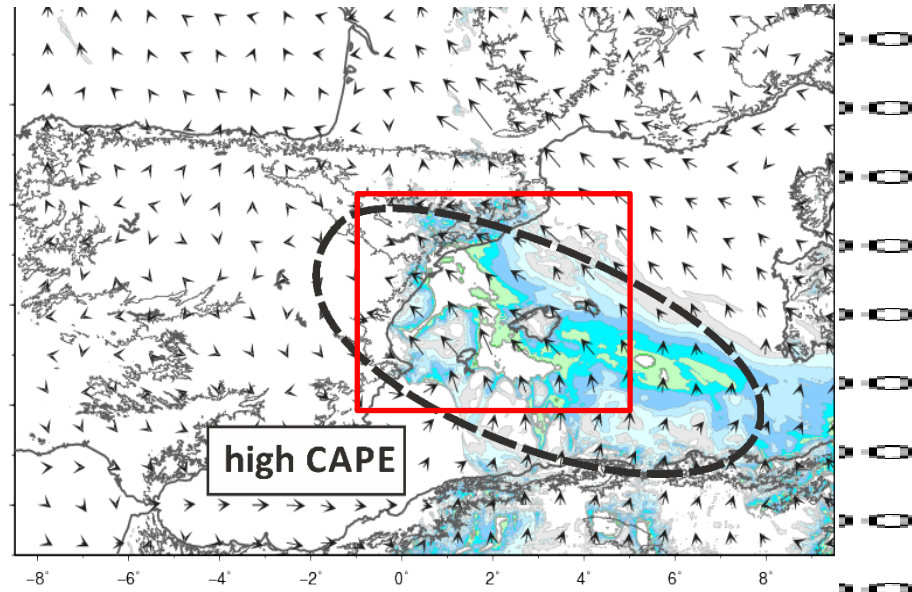
(c) Wind speed (shading) at 925 hPa



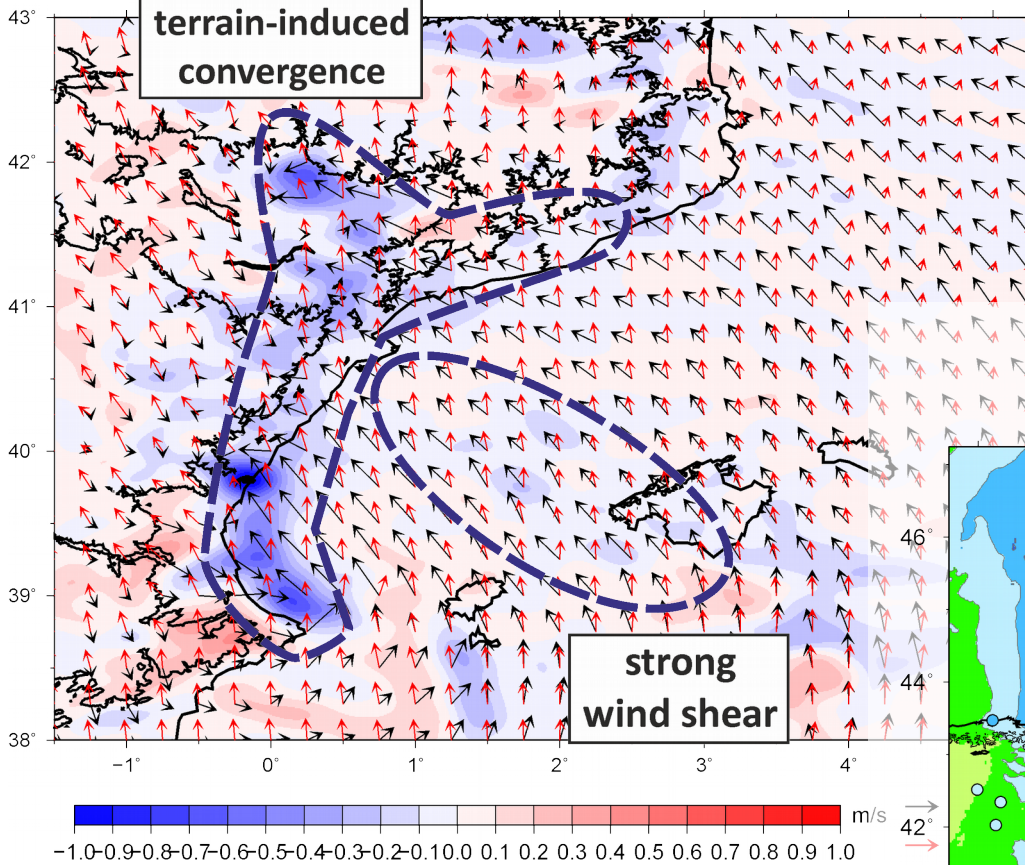
(b) PV (shading) and wind (vector) at PVU 1.5



(d) CAPE (shading) and wind at 925 hPa (vector)



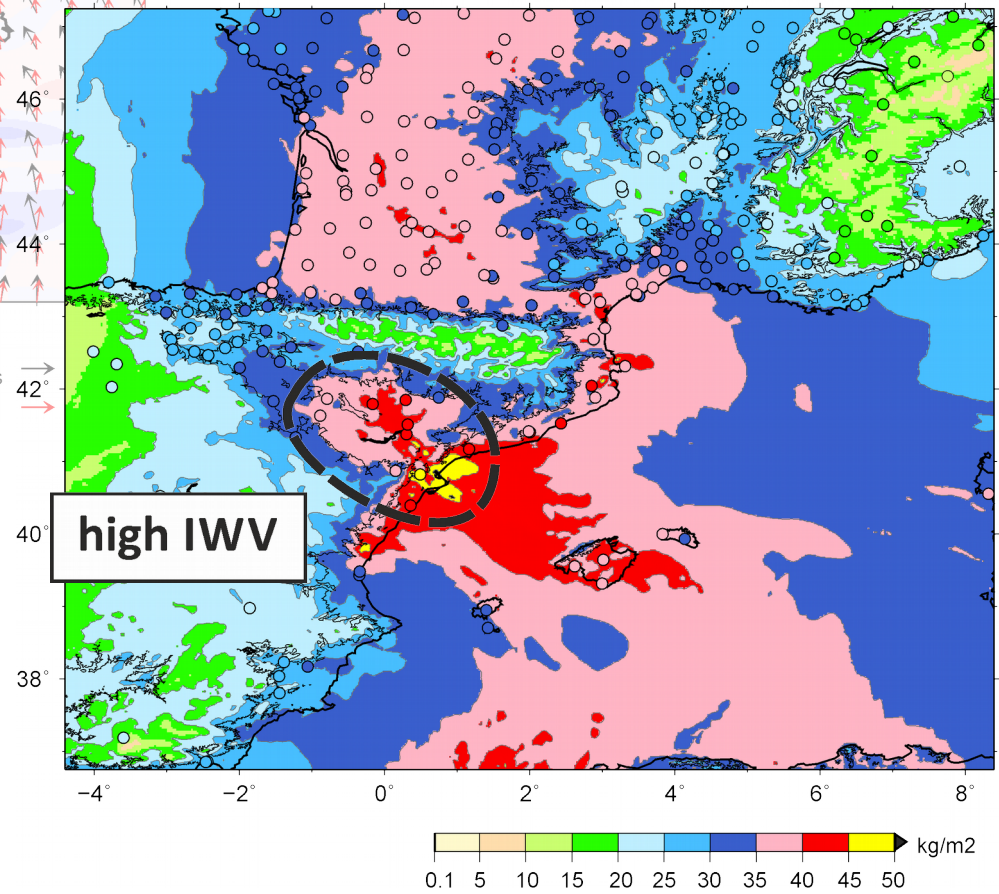
Divergence at 950 hPa (shading) and wind shear



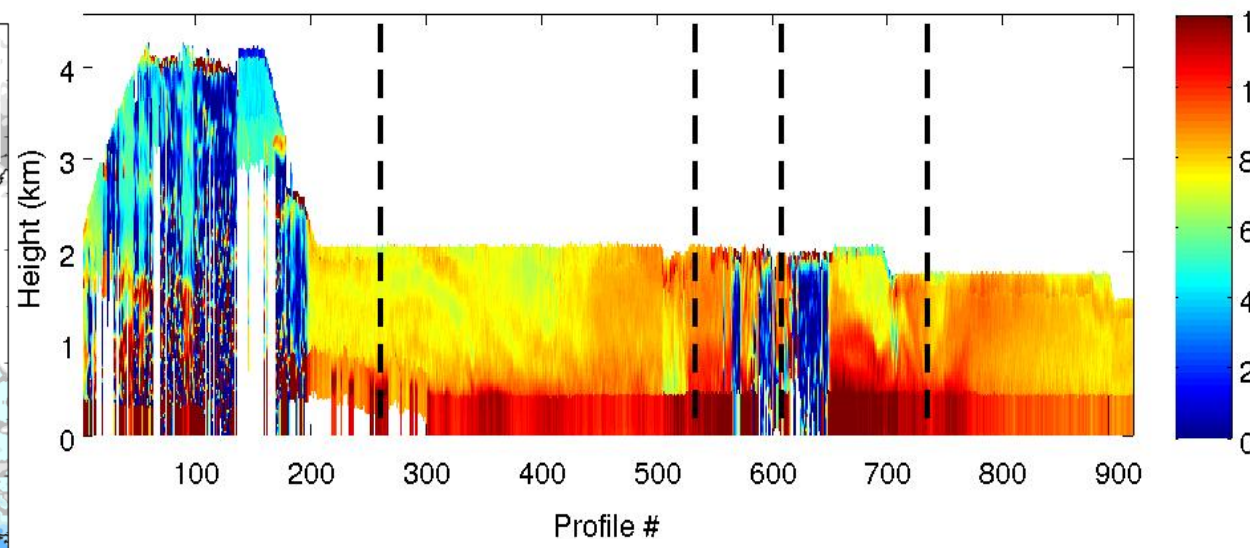
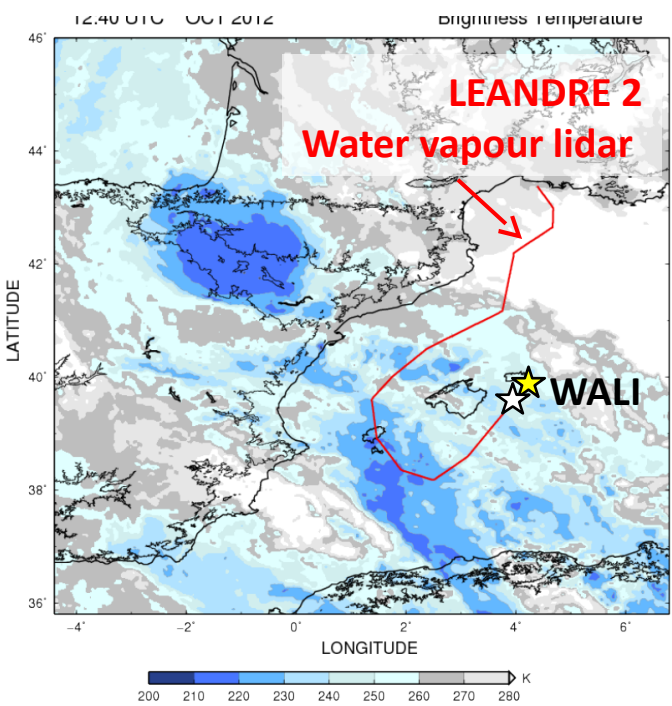
IWV (AROME and surface GPS)

1500 UTC OCT 2012

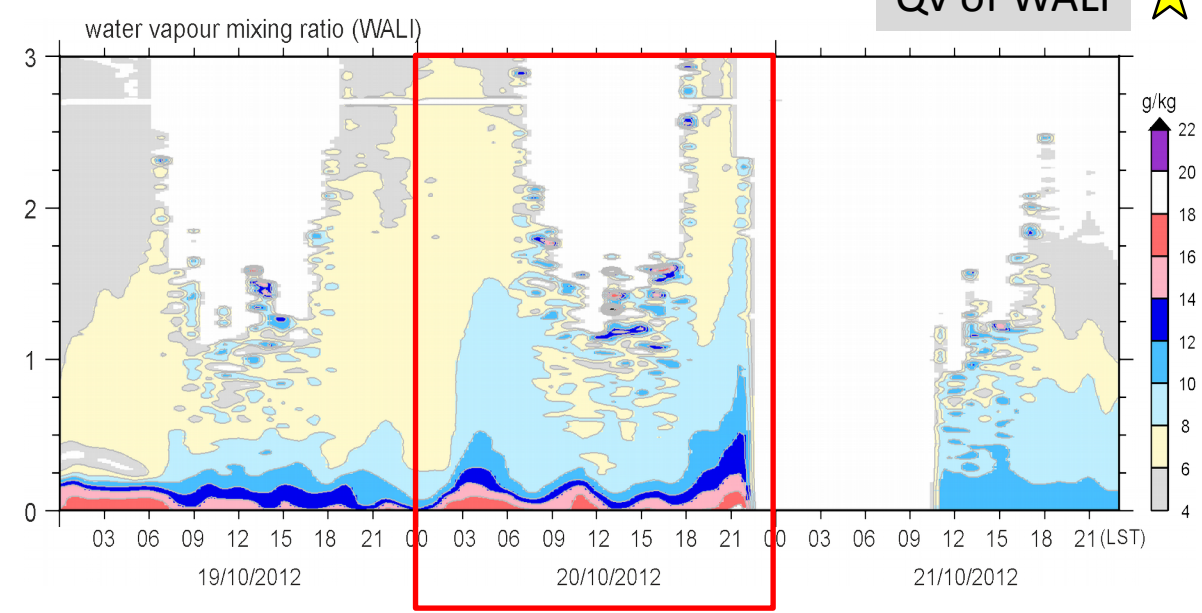
IWV (AROME, shade), IWV (GPS, symbol)



# Qv of LEANDRE 2

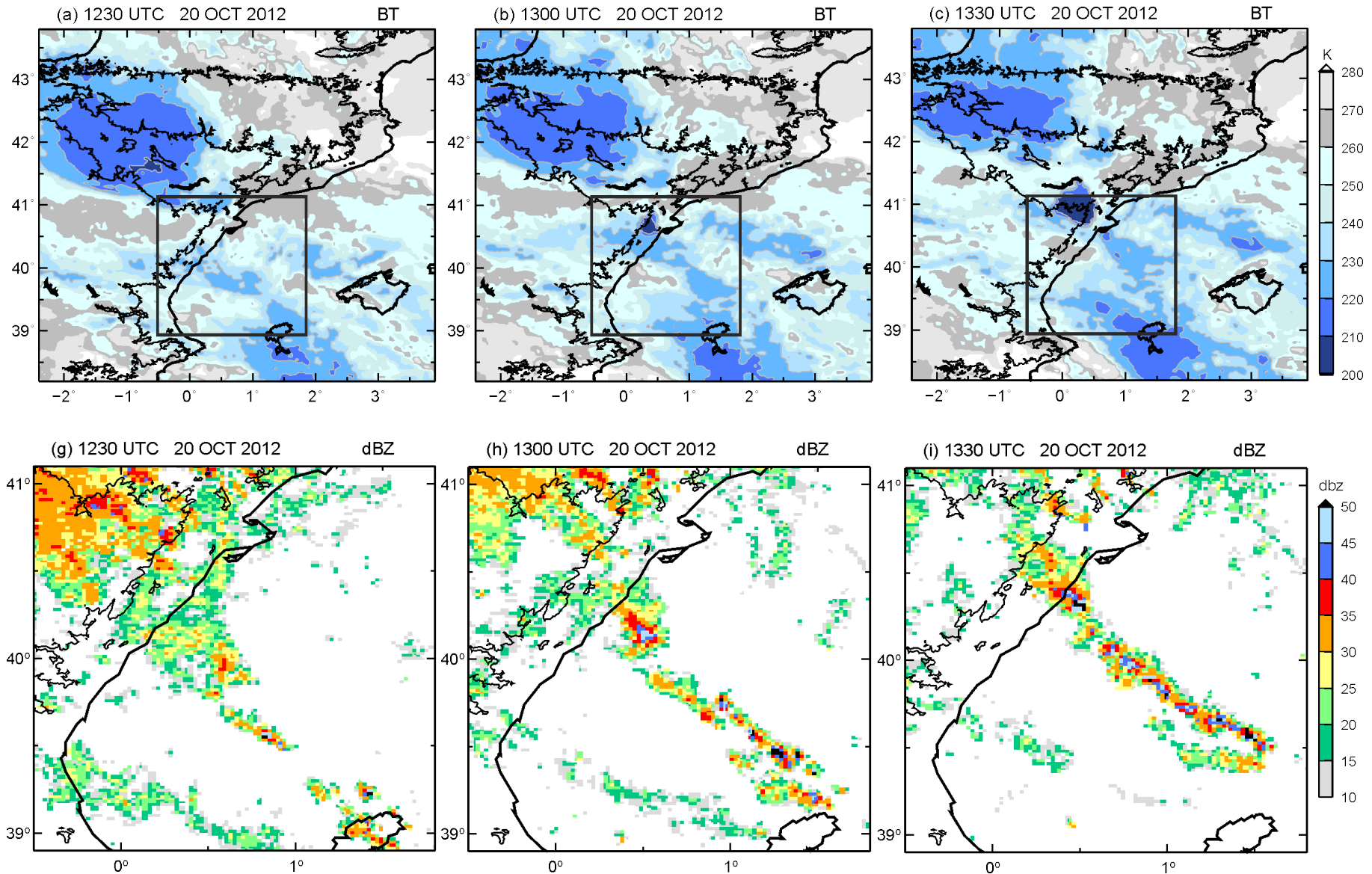


# Qv of WALI

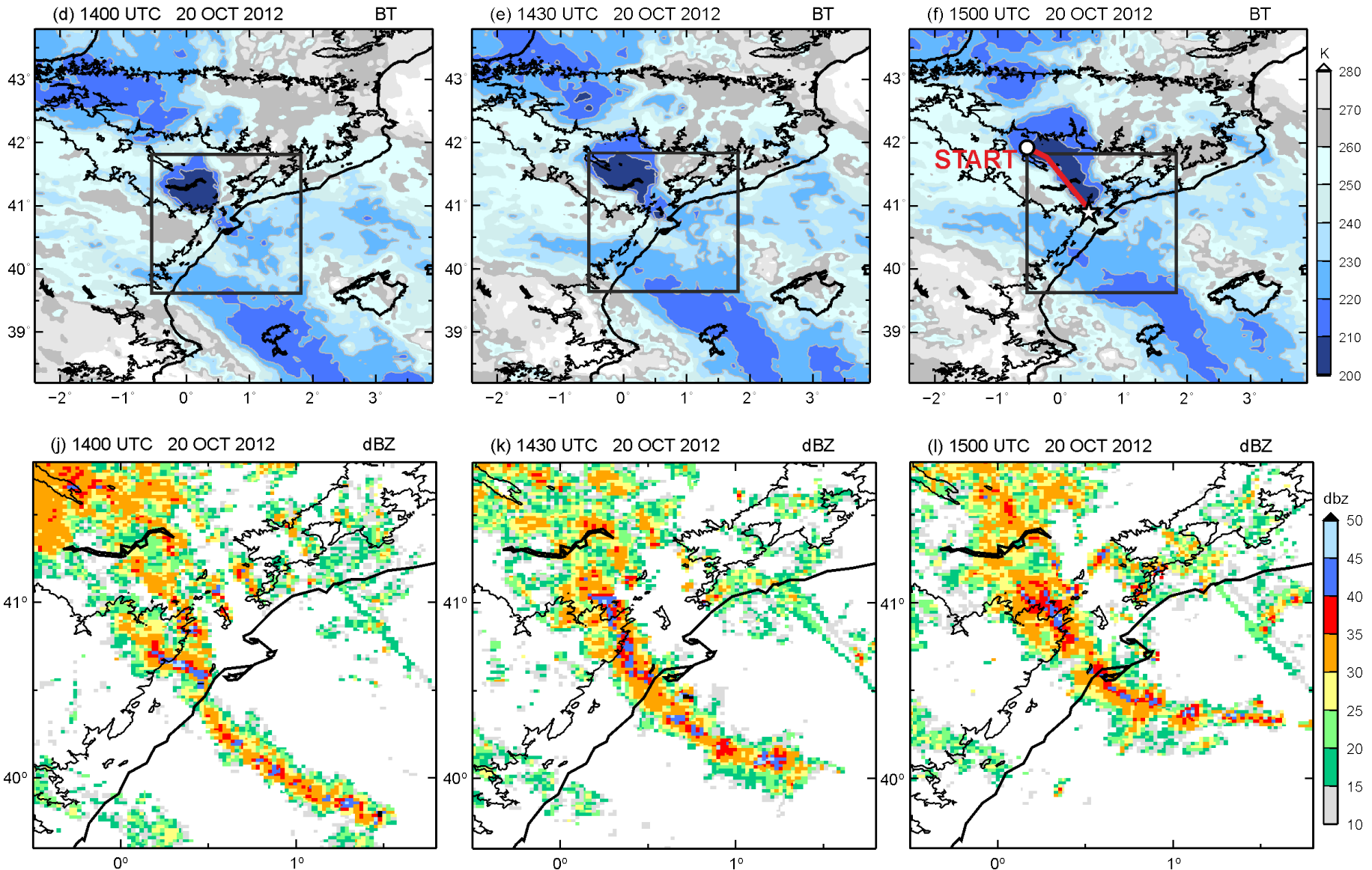


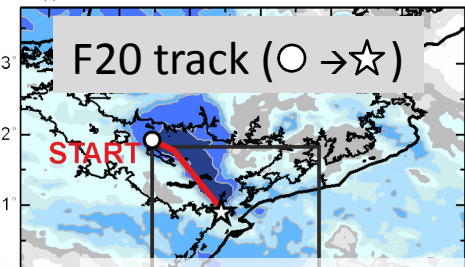


# SEVIRI BT and ground-based radar network Reflectivity ①

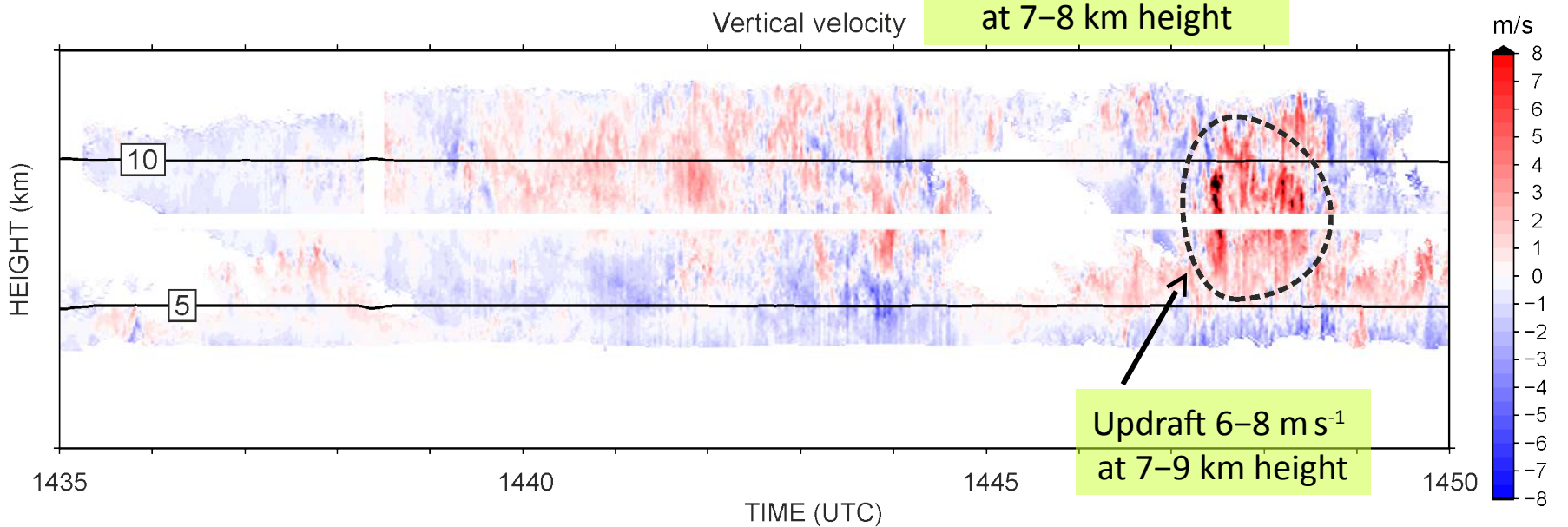
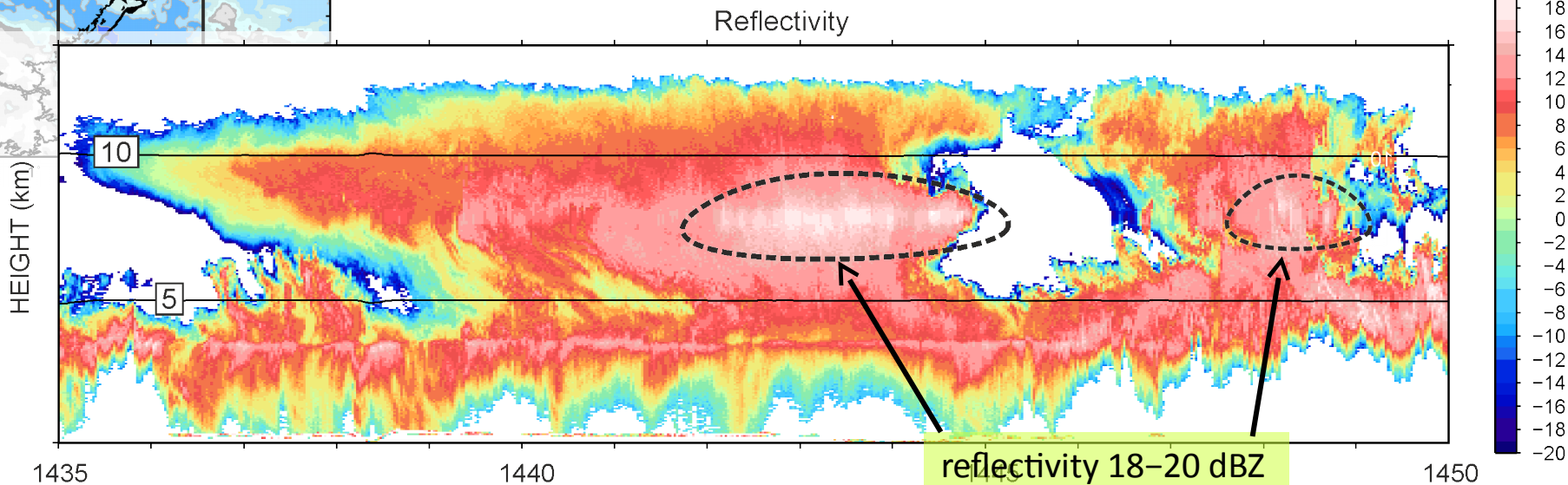


# SEVIRI BT and ground-based radar network Reflectivity ②

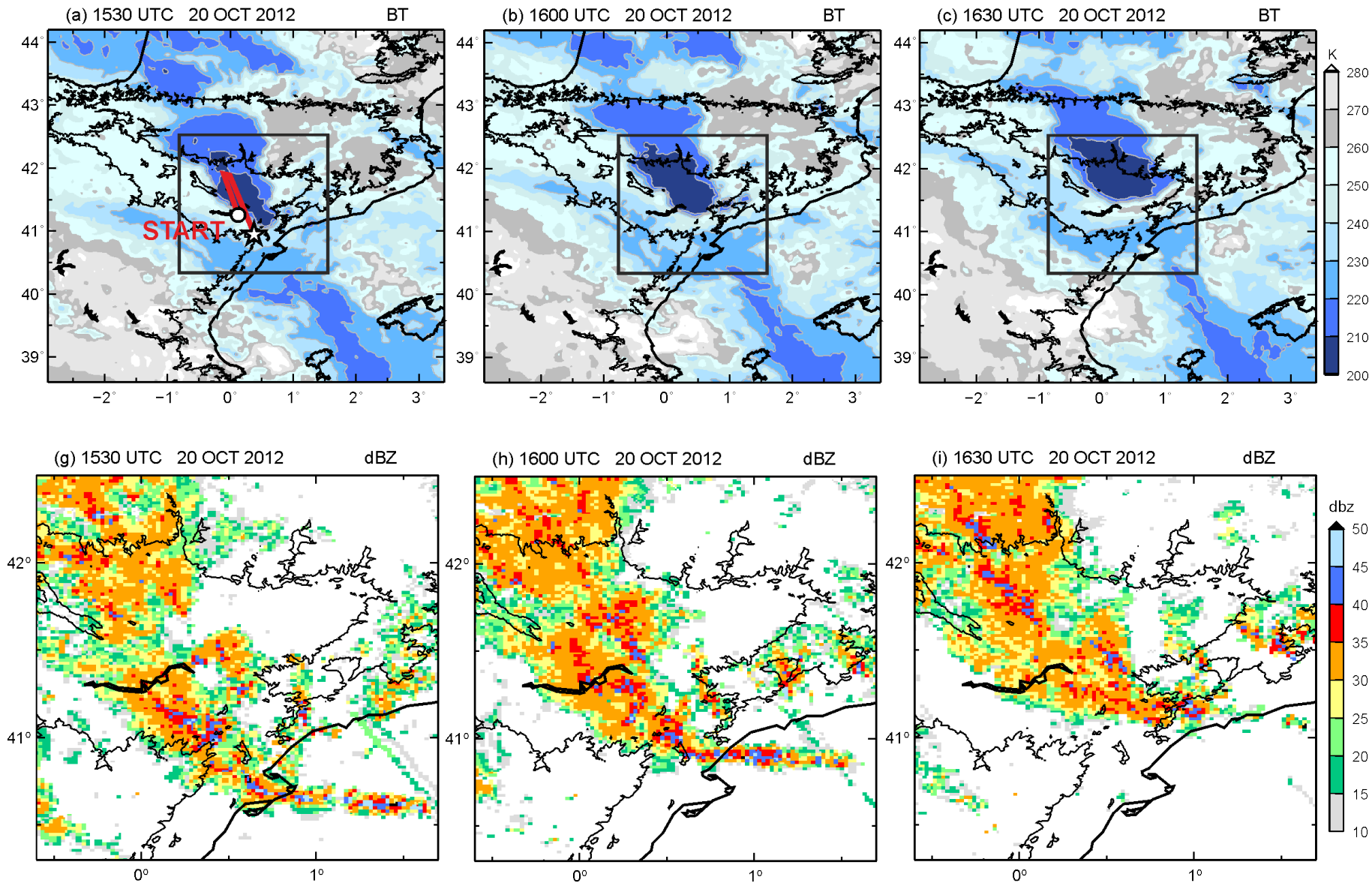




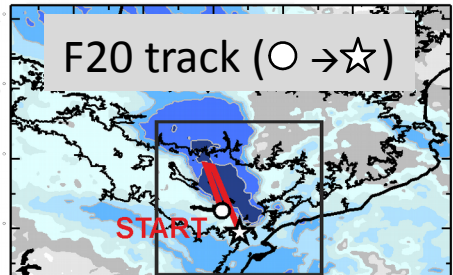
### Height-Time reflectivity and vertical wind of Rasta Radar ①



# SEVIRI BT and ground-based radar network Reflectivity ③

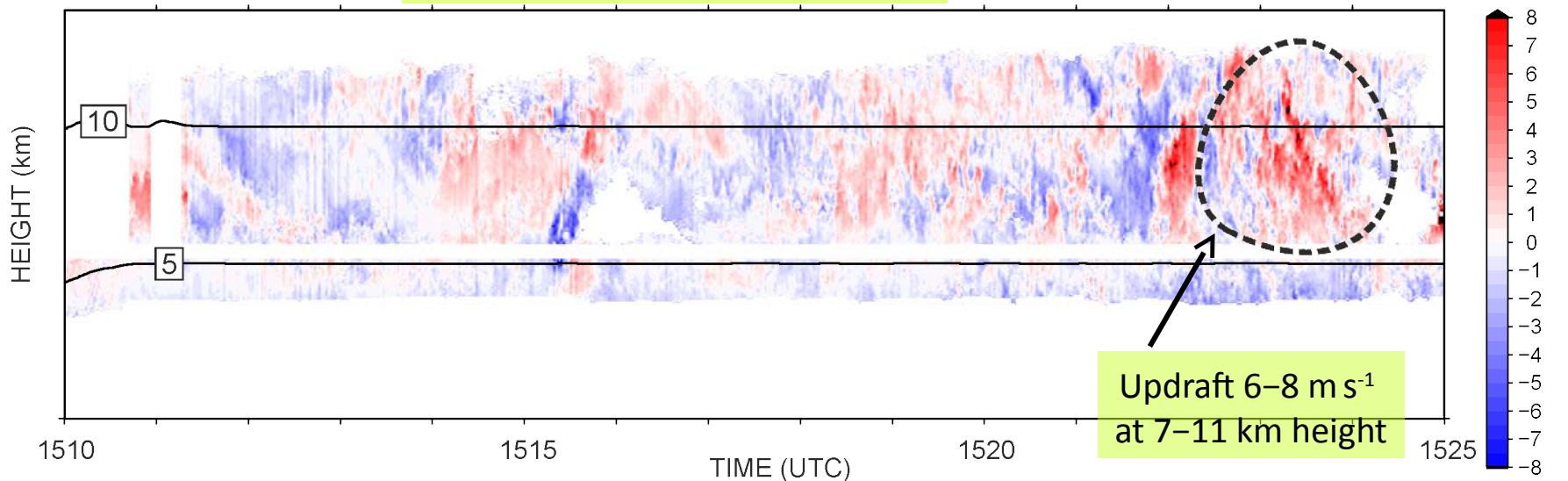
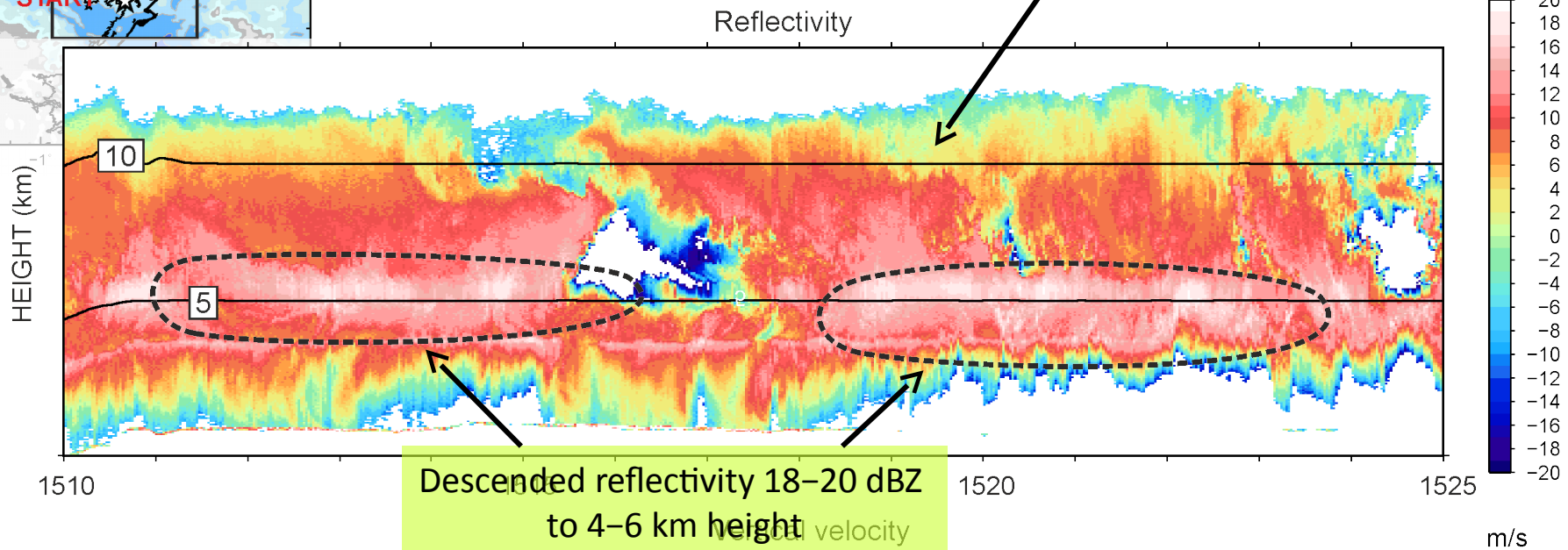


(a) 1530 UTC 20 OCT 2012 BT

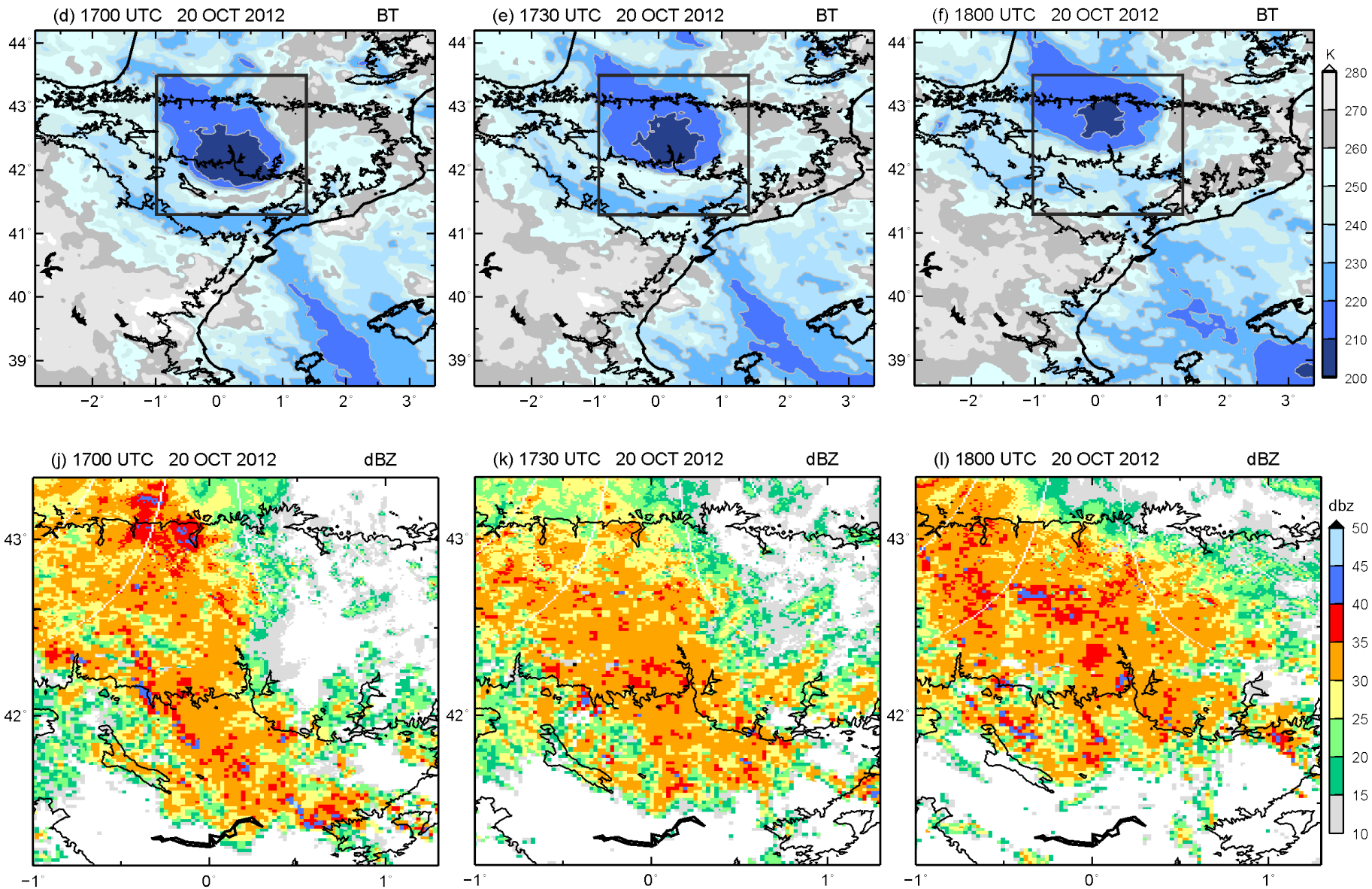


### Height-Time reflectivity and vertical wind of Rasta Radar ②

Descended 10 dBZ Echo-top height to around 10 km

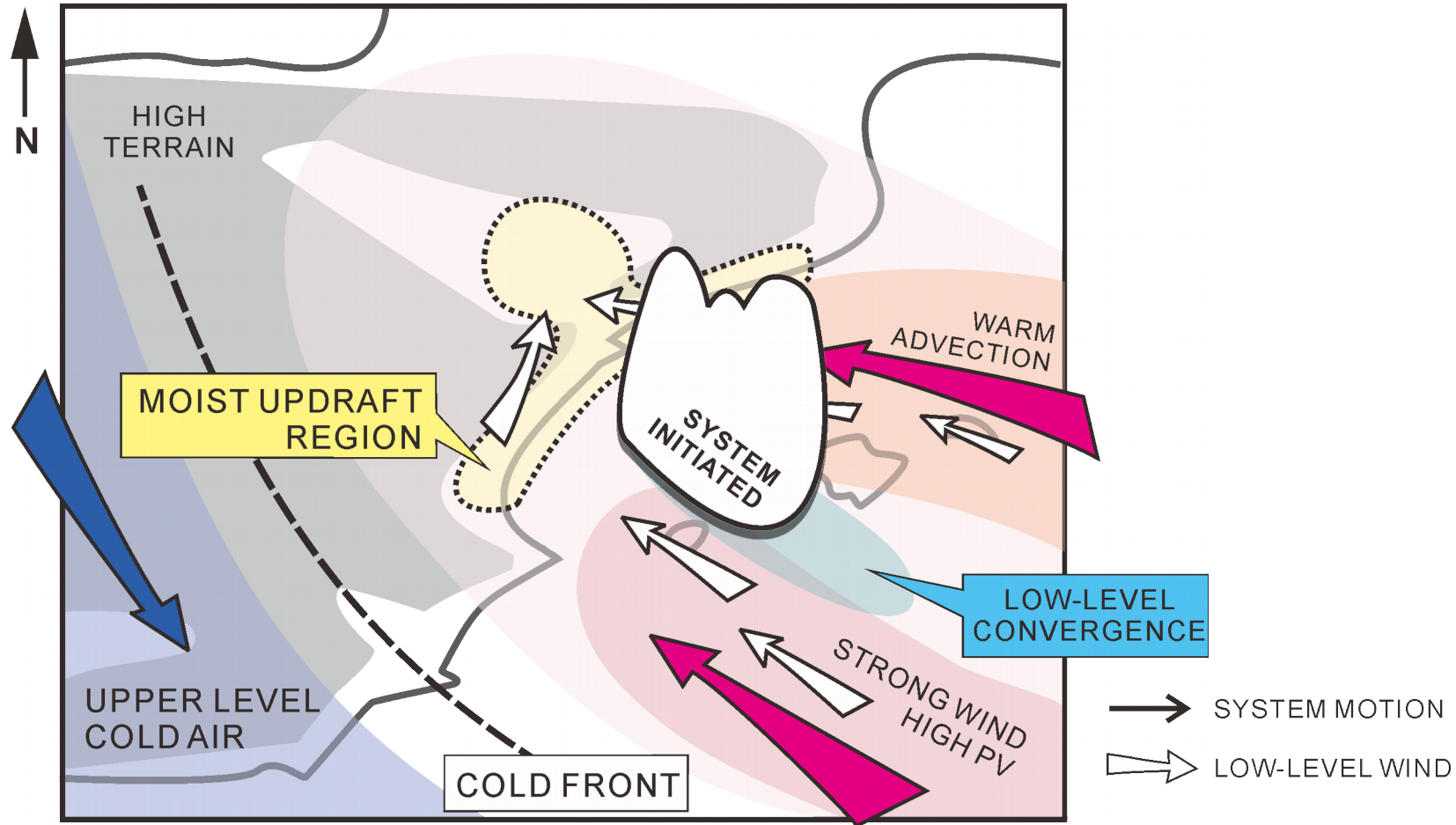


# SEVIRI BT and ground-based radar network Reflectivity ④



## Concluding remarks

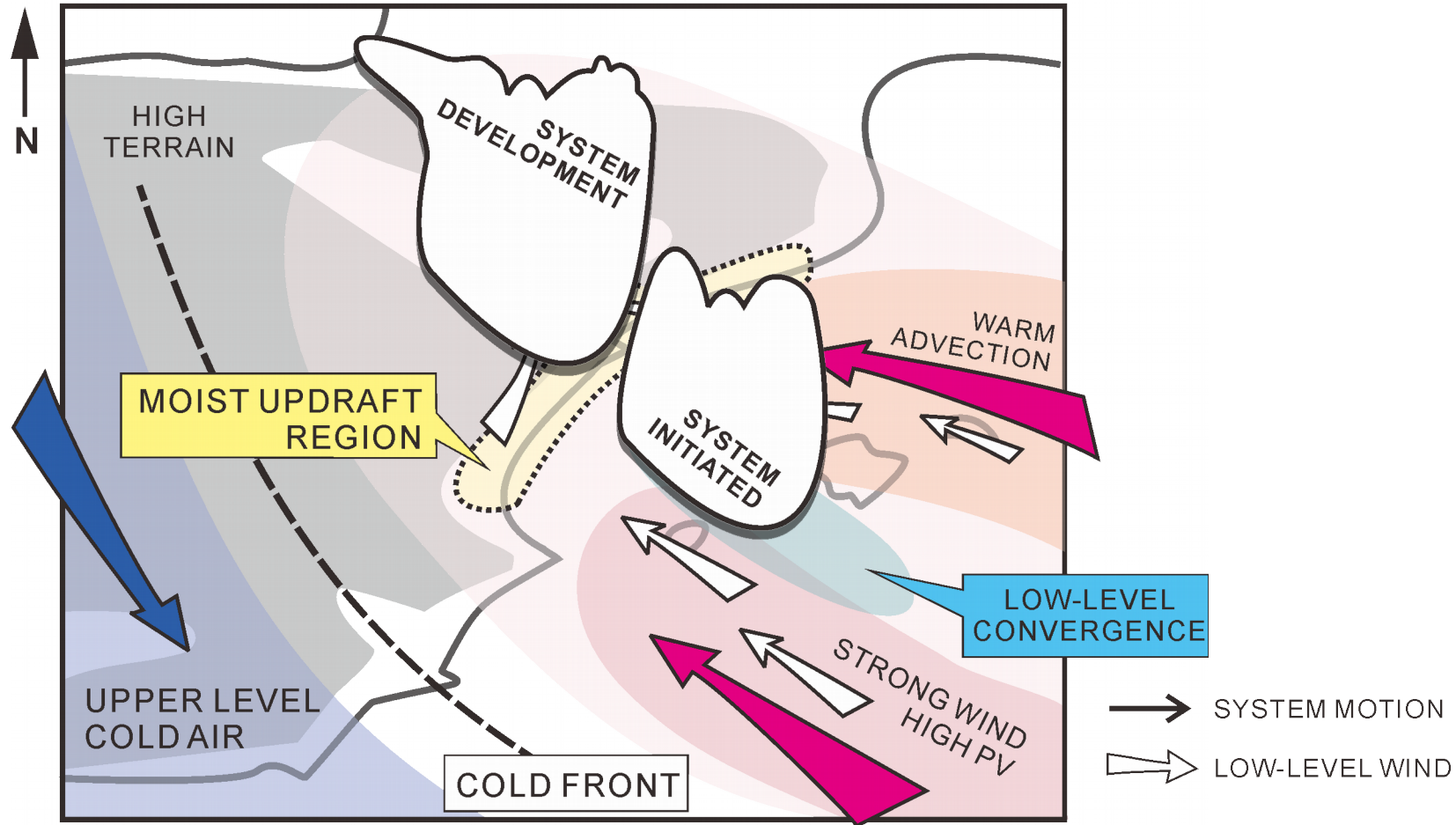
- Low-level **wind convergence** ahead of a cold front and **local moist updraft** induced by terrain played an important role to **develop MCS**, resulting heavy rainfall over the **southern Pyrenees** for IOP 15a.



Schematic illustration of MCS development (IOP 15a)

## Concluding remarks

- Low-level **wind convergence** ahead of a cold front and **local moist updraft** induced by terrain played an important role to **develop MCS**, resulting heavy rainfall over the **southern Pyrenees** for IOP 15a.



Schematic illustration of MCS development (IOP 15a)