Orographic rainfall studies at LTHE

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1 Study area: Cévennes-Vivarais (CV) region

Mediterranean mountainous region intense rainfall

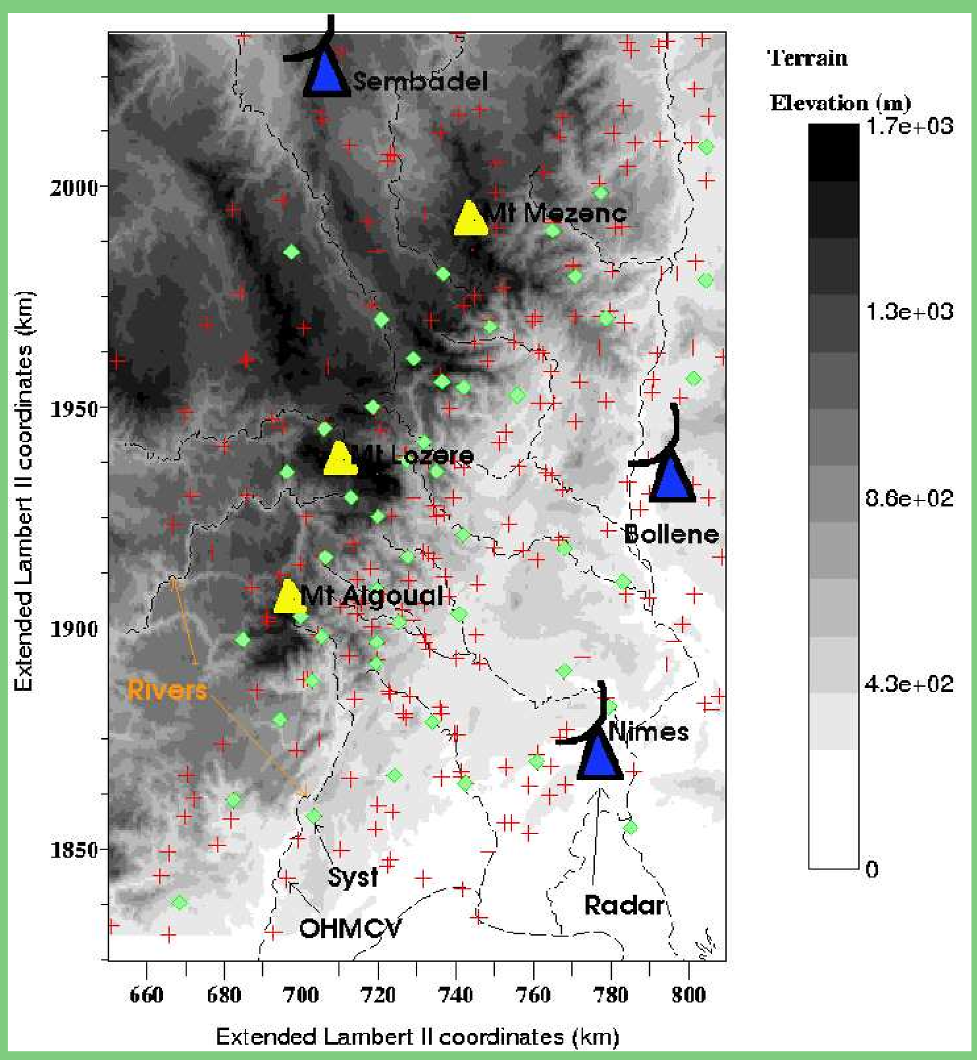

FIGURE 1: Hourly raingauge (Syst. ≡ 1958-2000 and OHMCV ≡ 2000-04) locations superimposed to terrain elevation.

Investigating **rainfall features** using :

- Data analysis
  - ▷ statistics
  - ▷ geostatistics
- Non-hydrostatic mesoscale simulations of atmospheric flows (MesoNH).

2 Rainfall climatology

★ **Mean rainfall rates** computed from 16 fall-seasons hourly-rainfall rates (spreading between 1970 and 2004).

Highest mean rainfall rates over the main south-east slope of CV.

★ **Extreme rainfall rates**

- weekly rainfall maxima during fall seasons between 1958 and 1983 (Bois et al., 1997).
- 100-year return value (100YRV) modelized using double exponential laws.

1h and 24h 100YRV → different patterns

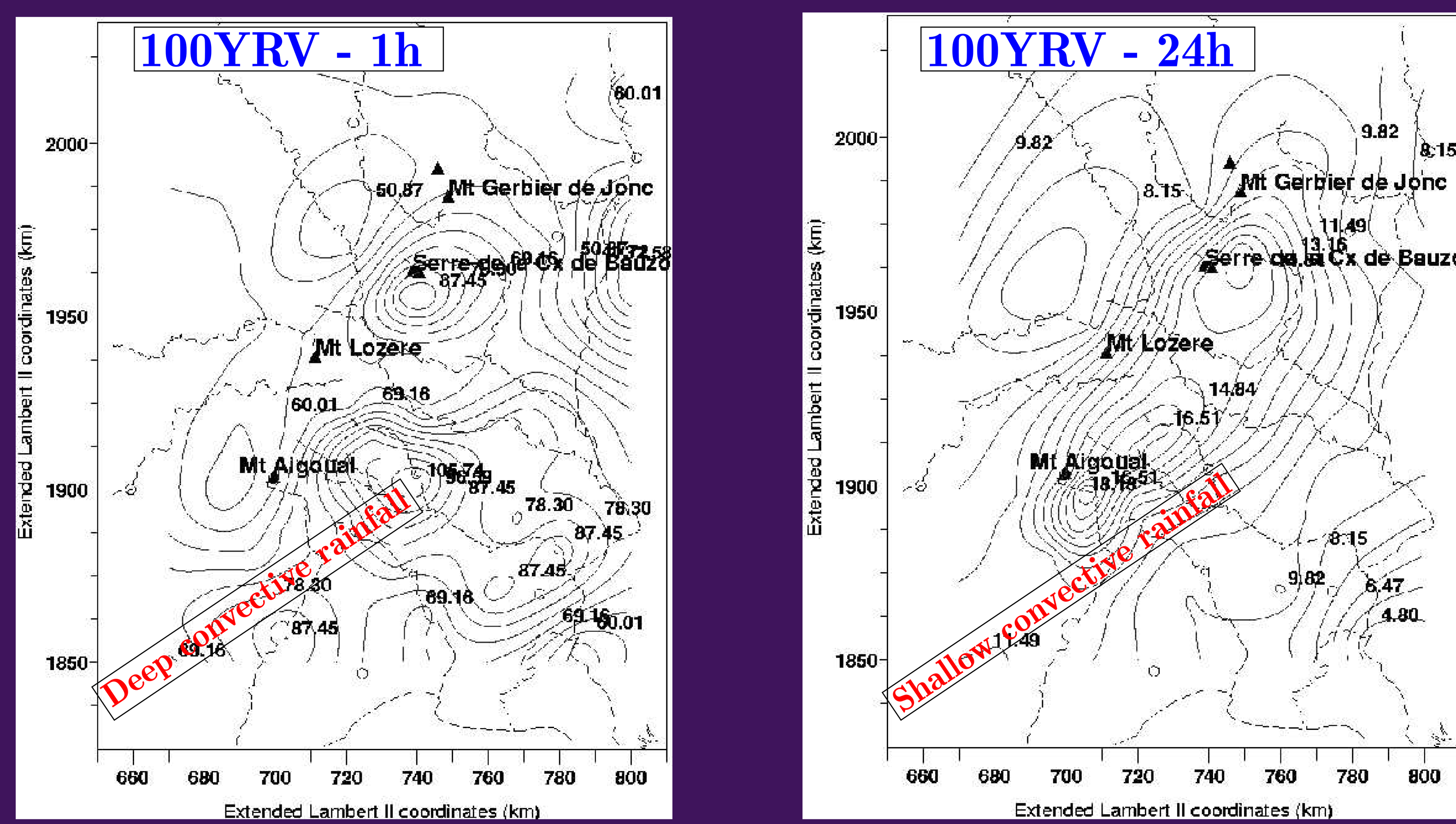

FIGURE 2: Rainfall rate (mm/h) maps (Molinié et al. (xxxx))

¿ Shallow and Deep convective rainfall physical processes

3 Shallow convective rainfall

Featuring **orographic rainbands** (Minisclox et al., 2001)
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1. Long-duration (day)
2. Stationary ⇒ up to 100 mm day^{-1};

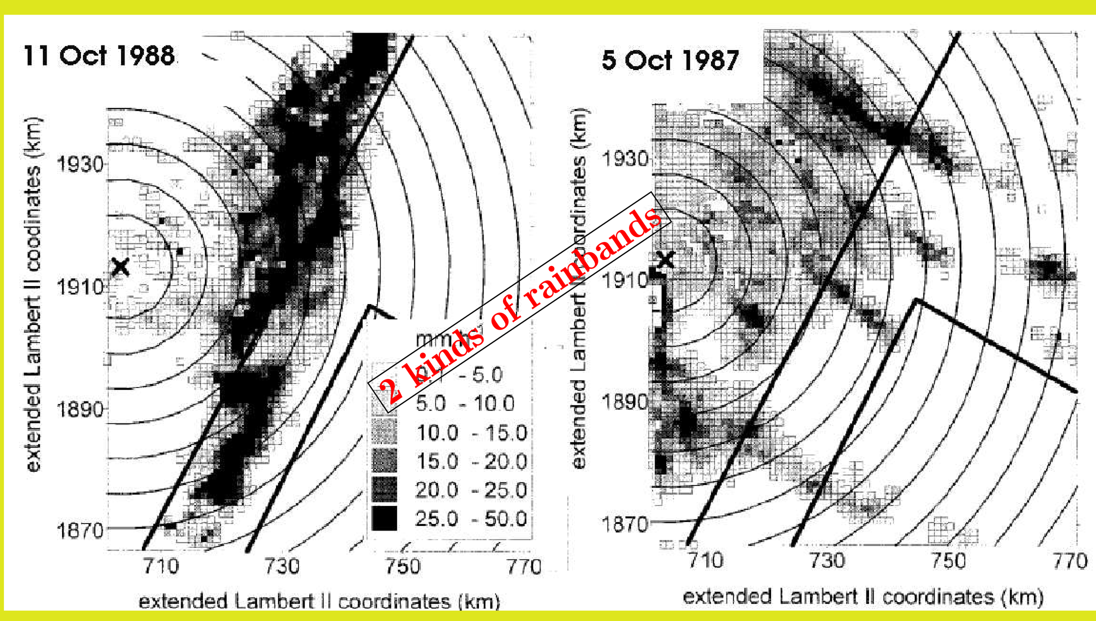

FIGURE 3: Radar echo maps (Miniscloux et al., 2001)

Generic initial conditions (Godart (2006))

Statistics on radio-soundings of shallow convective events featuring:

1. High rain accumulation;
2. Mean rainfall increases and intermittence decrease with altitude;
3. Northward blowing wind, low vertical shear, velocity > 7 m s^{-1}.

⇒

79 events extracted from the period 1976-2005.

- Low layer ▷ moist; ▷ conditionally unstable;
- Wind velocity > 10 m.s^{-1}.

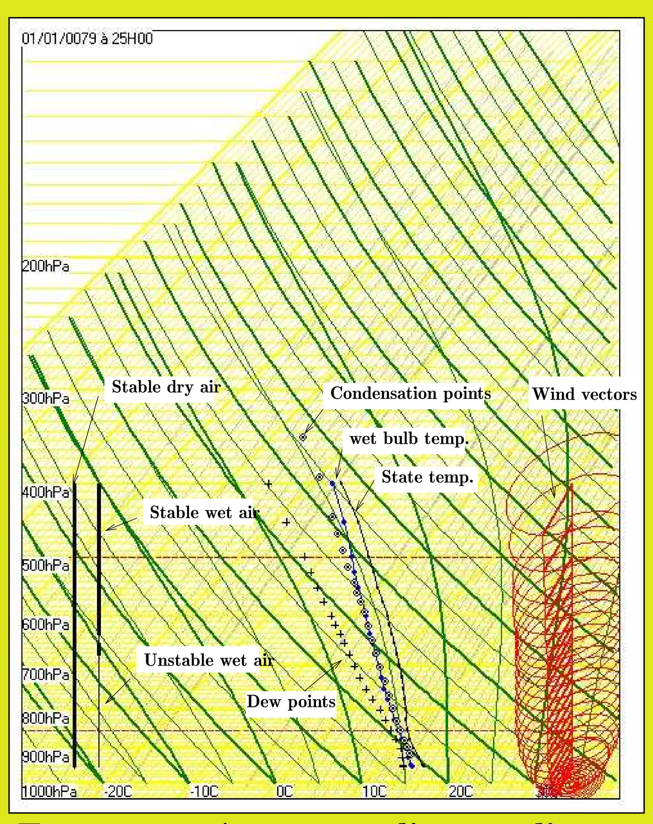

FIGURE 4: Average radio-sounding associated with shallow convective events

Initial conditions for numerical simulations ⇒

¿ Mechanisms structuring rainbands?

Academic mesoscale non-hydrostatic simulation of atmospheric flows (MesoNH) ⇒

1. **Relief Forcing** Convections result from relief involved convergences (Cosma et al. (2002), Anquetin et al. (2003)).
2. **Synoptic flow forcing (Fig. 5)** (Yates (2006))
   Incident wind orientation relatively to the relief
   Atmosphere stability relatively to the relief height ⇒ **convergence area locations and geometries**

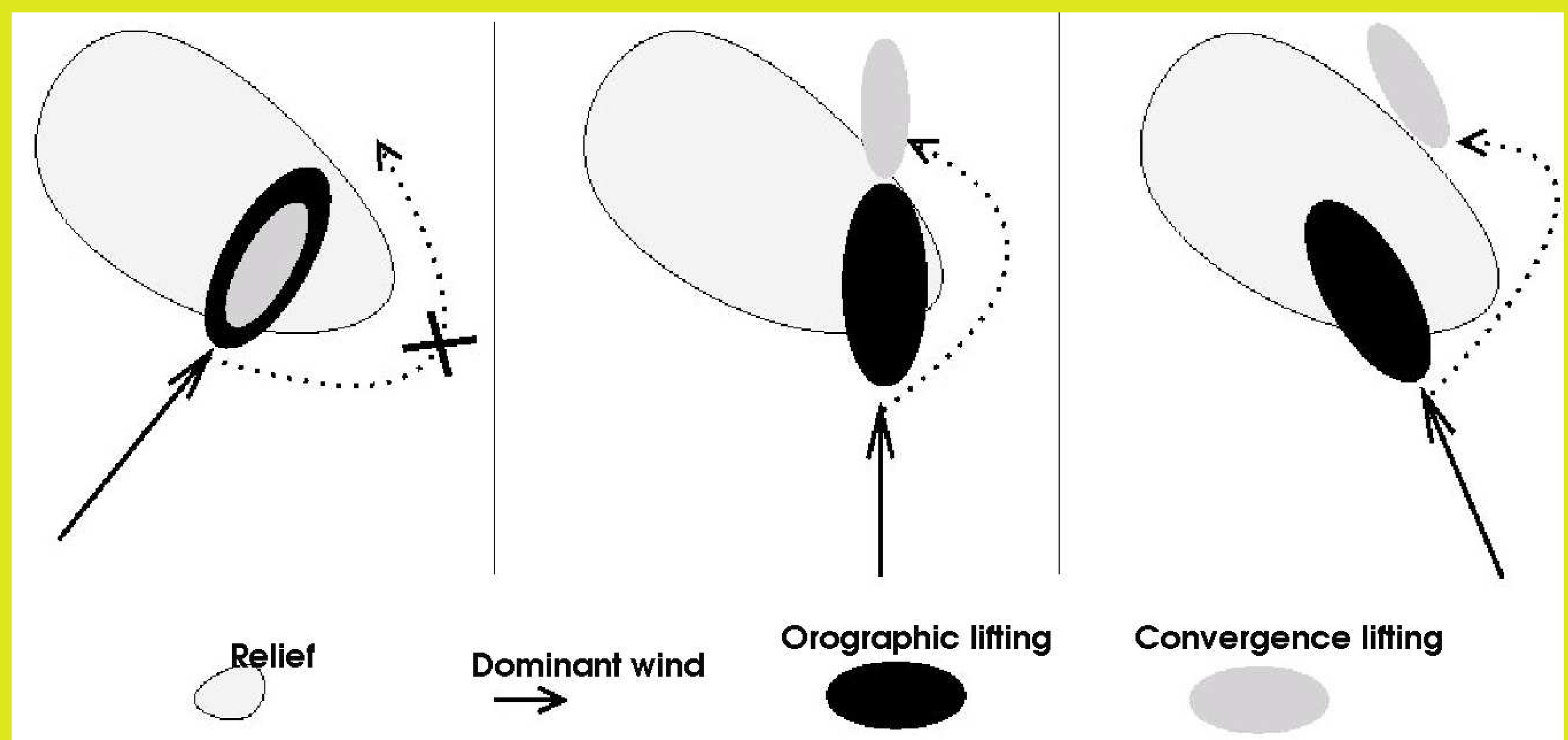

FIGURE 5: Wind flow orientation-relief interactions (Yates, 2006)

3. **Vertical wind shear-relief interactions** (Yates (2006))[5mm]
   3D shears of the horizontal wind ⟶ the greatest rainfall rates because in some configurations, air masses can be lifted both on the up and down side of the relief.

4 Perspectives

1. Investigate **deep convective rainfall** using both **geostatistics on extreme rainfalls** and **academic numerical simulations**;
2. Toward identifying **weather regimes**.

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