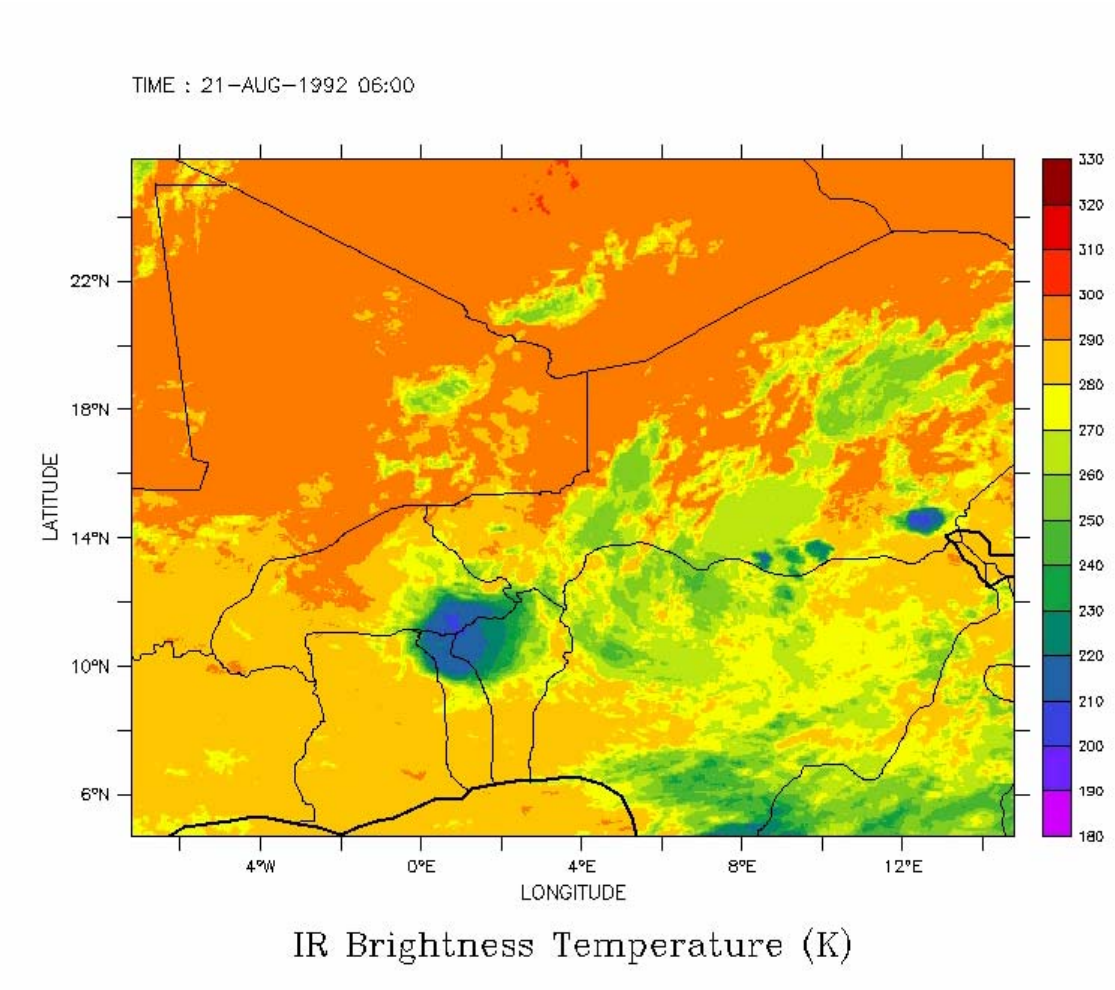
for WP1.2 evening meeting, 21 Sept 2005, Francoise Guichard

atmospheric **water cycle at mesoscale**

largely based on simulation at mesoscale of case-studies

squall line observed during HAPEX-Sahel 1992, animation 0600-2330 UTC



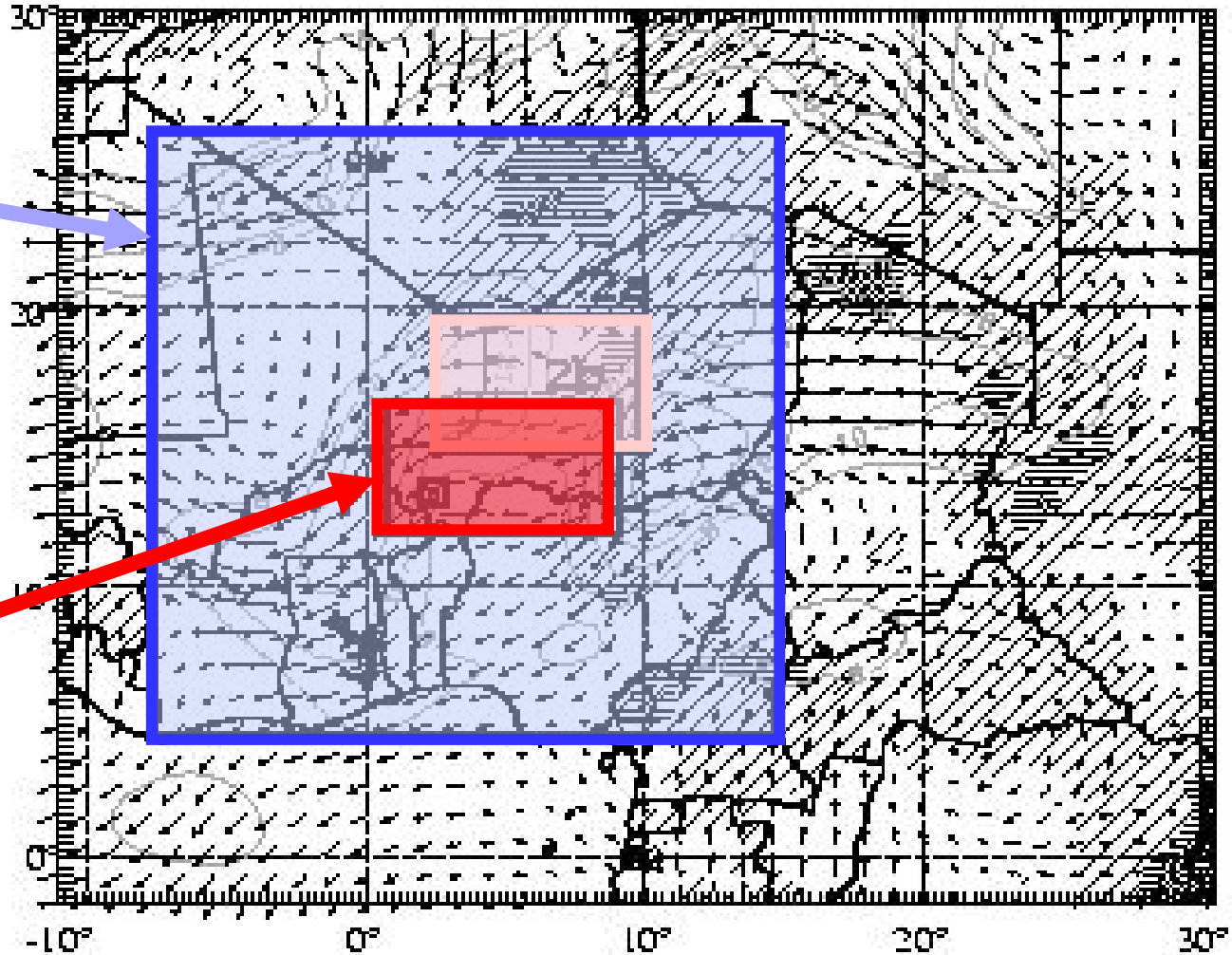
explicit simulation of squall line *(Diongue et al. 2002)*

MésoNH, grid nesting technics (interaction 2-way interaction)

- ✓ **initiation & boundary conditions : ERA-15**
- ✓ **27 h de simulation**

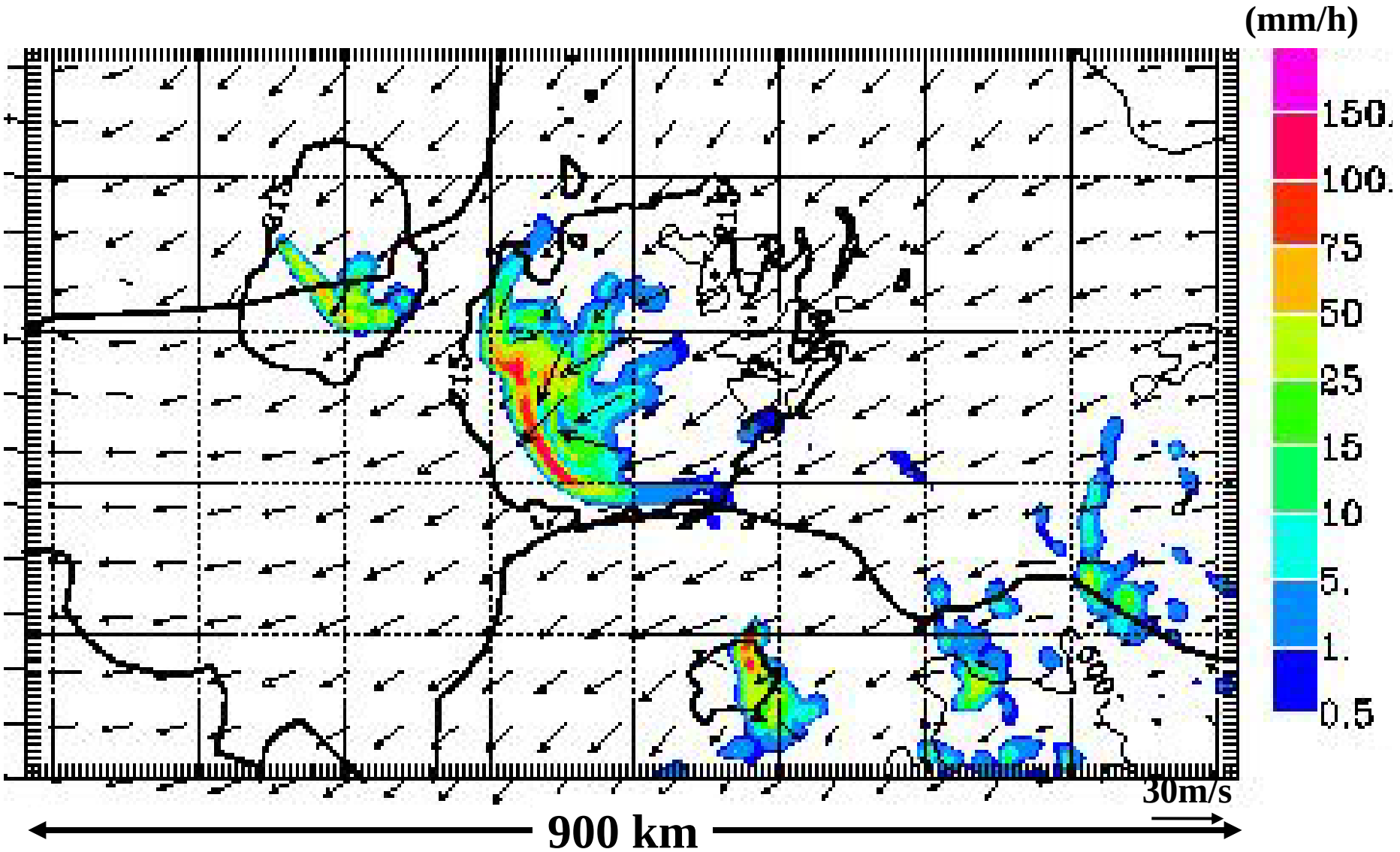
DOMAINE 1
2400 km x 2400 km
Δx = 30 km
convection paramétrée

DOMAINE 2
~ 900 km x 600 km
Δx = 5 km
convection explicite



wind à 650 hPa & précipitations

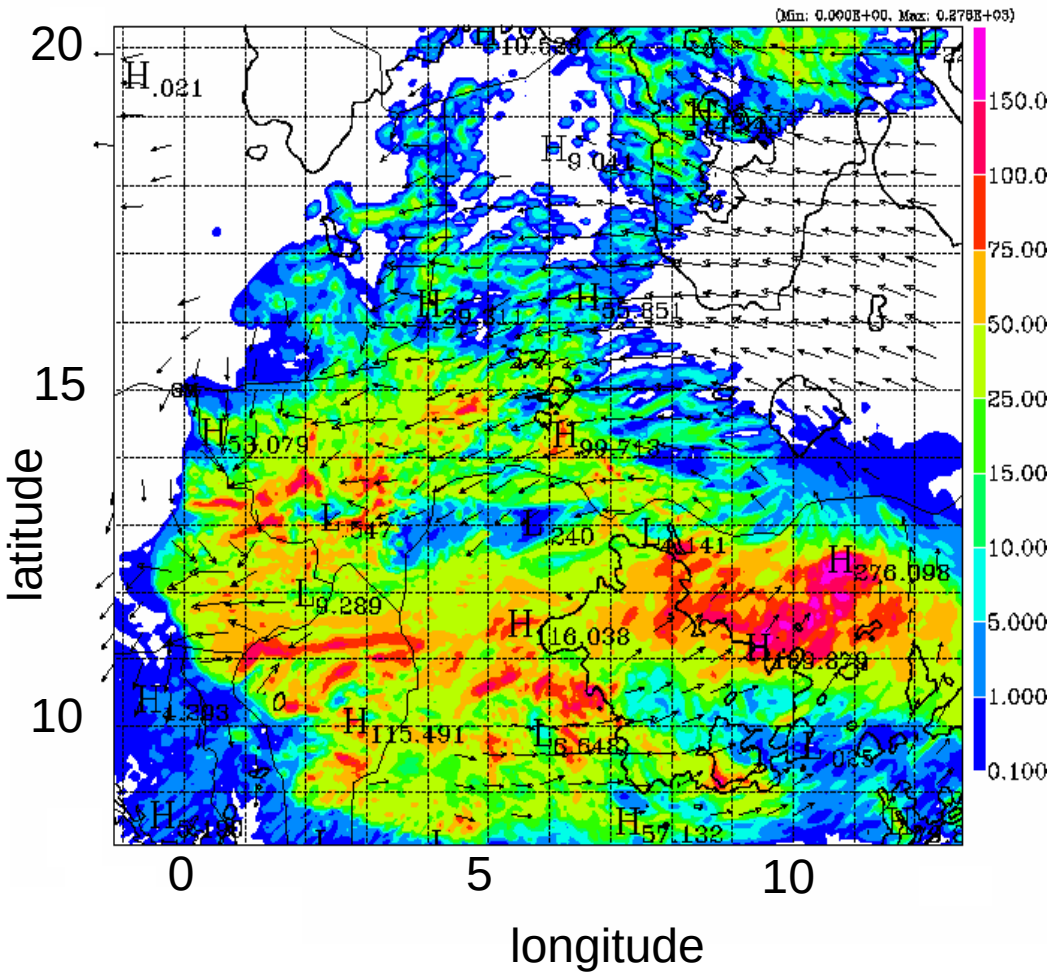
(domaine 2 à 22 h, at a time when the squall line is « mature »)



Diongue et al. (2002)

Diongue et al. (2002) case-study

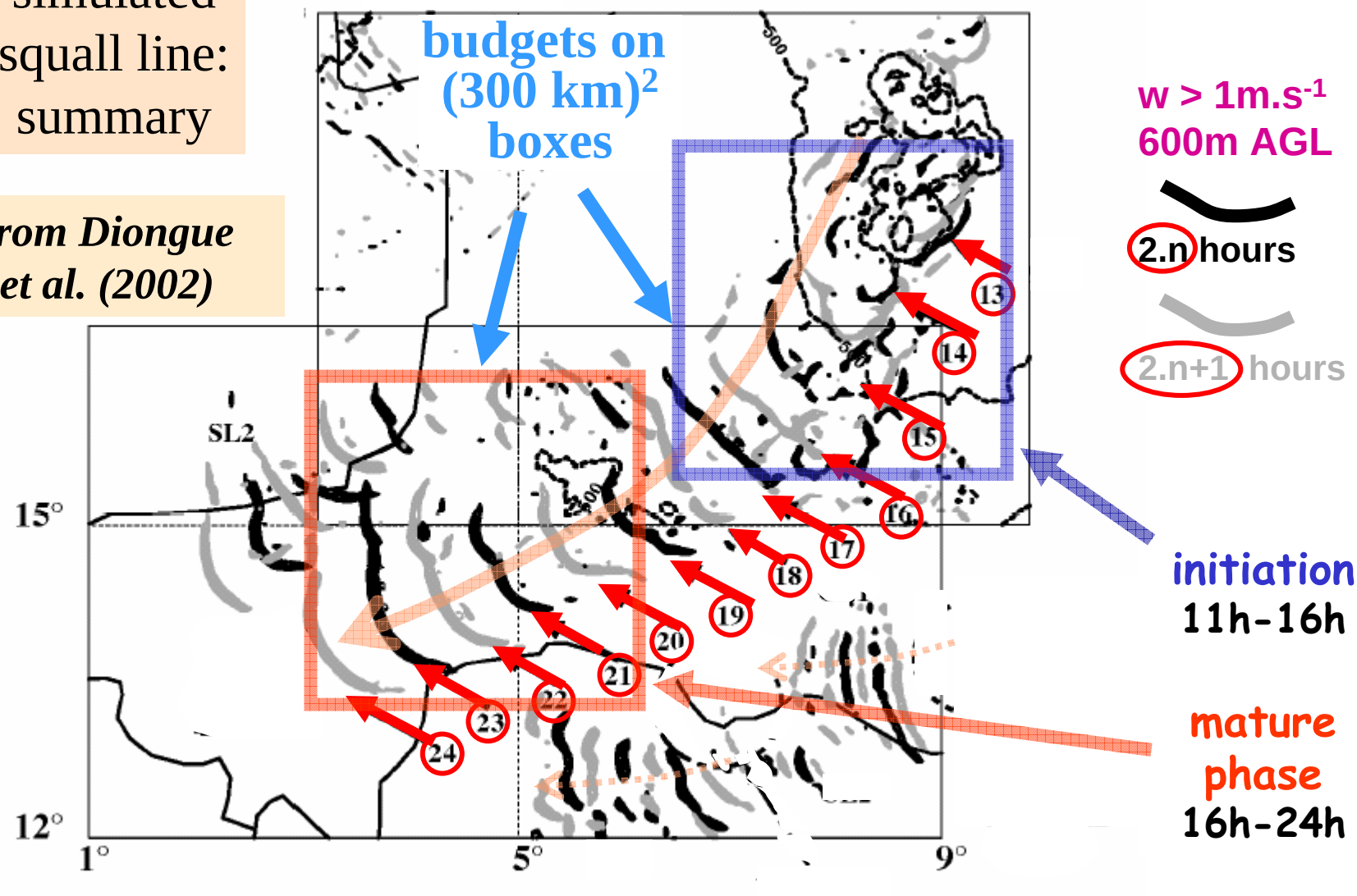
24-h cumulative precipitation



1992/08/22
0000 UTC

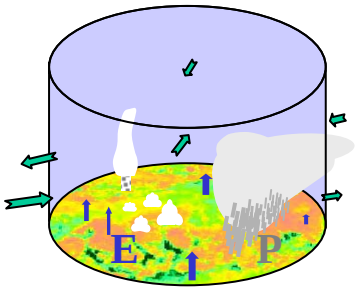
simulated squall line: summary

from Diongue et al. (2002)

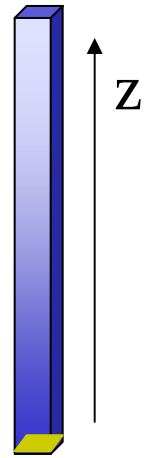


« quasi-stationary » behaviour during several hours

cover 1000 km in 15 hours, propagation speed of 17 m.s^{-1}



1D atmospheric water budget



about how water is redistributed on the vertical
involves in particular dry, moist & precipitating convection

$$\frac{\partial \overline{q_v}}{\partial t} = -\overline{u_i}\left(\frac{\partial \overline{q_v}}{\partial x_i}\right) - \frac{1}{\rho}\frac{\partial}{\partial z}\left(\rho \overline{q_v' w'}\right) + Q$$

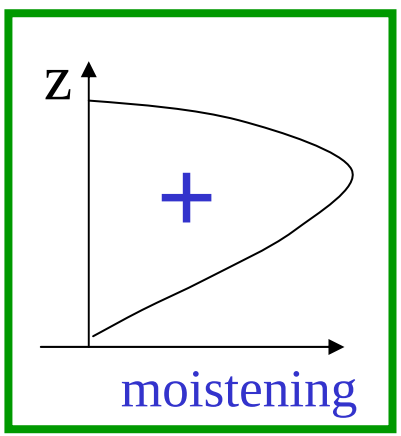
large-scale advection

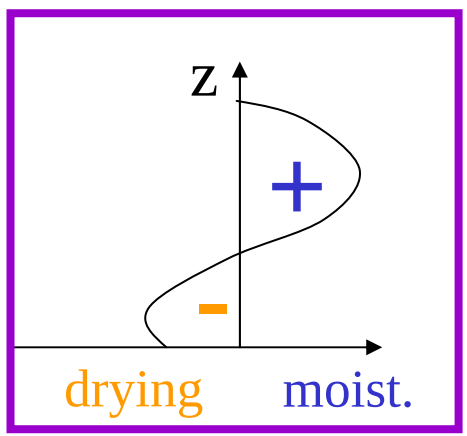
turbulent & convective vertical transport

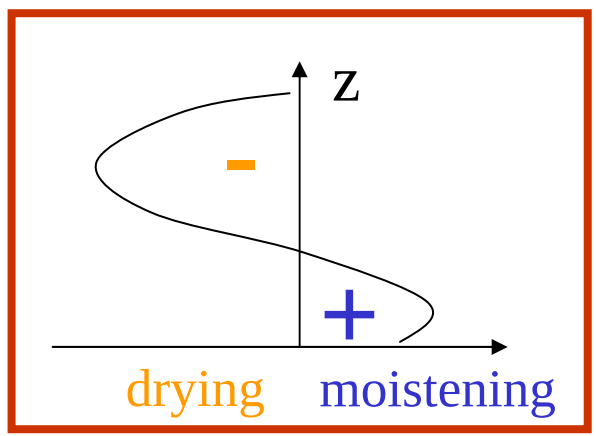
atmospheric sources/sink of q_v (thermodyn, microϕ) (condens, evap cloud & precip)

Q ≠ surface precip

highly schematic simplified view (rather for mature deep convective situation)



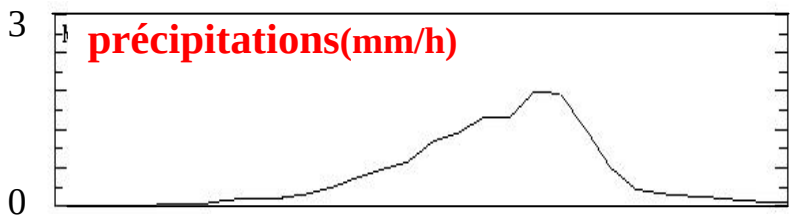


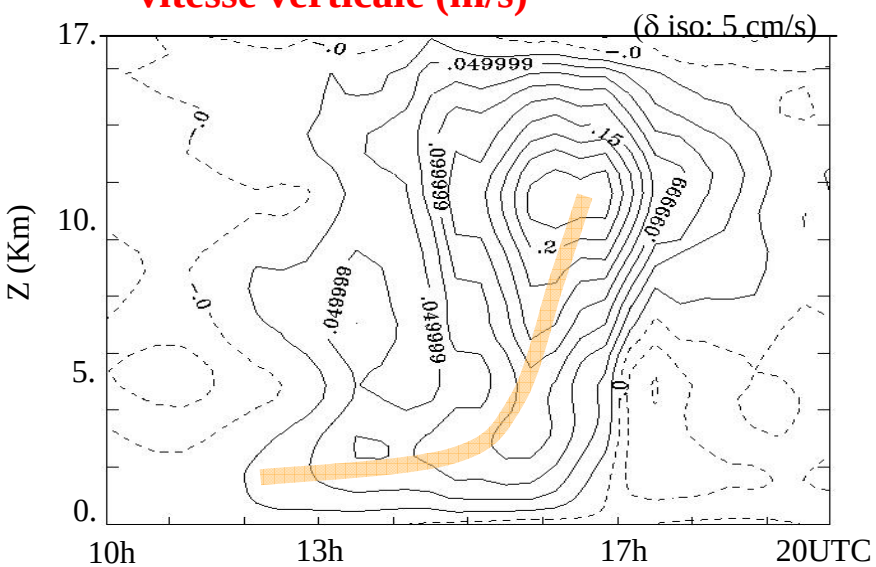


→ $\partial \overline{q_v} / \partial t$ ***results from a delicate balance of these processes***

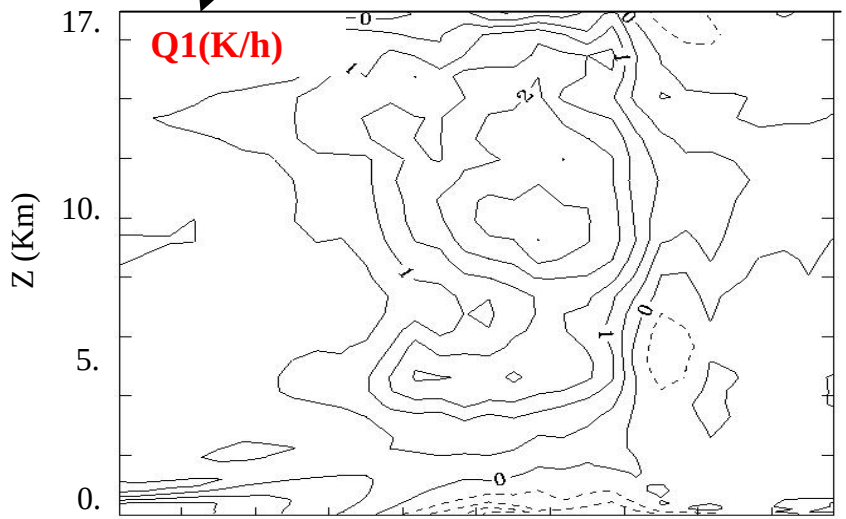
initiation phase

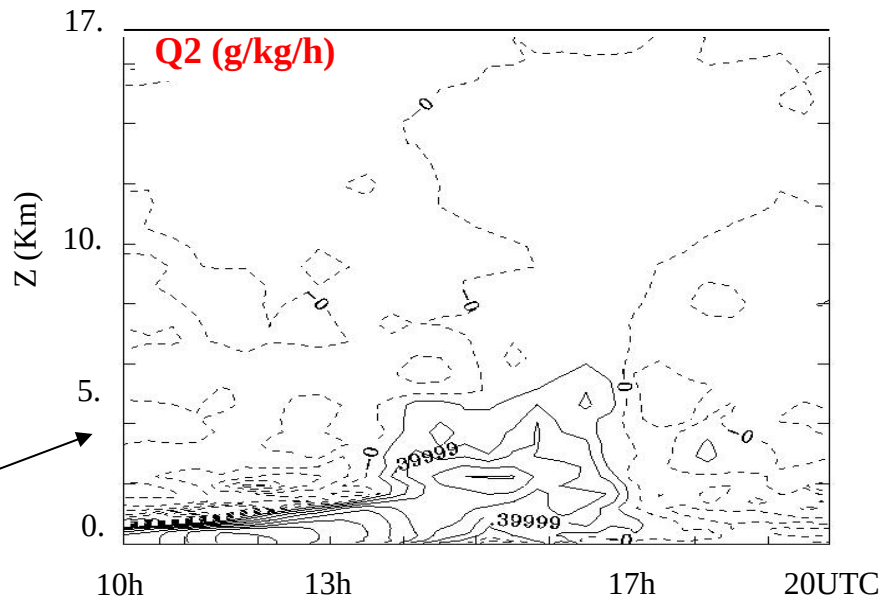
zone B1 (~ 300 km x 300 km)





convective + turbulent transport of heat + latent heat release



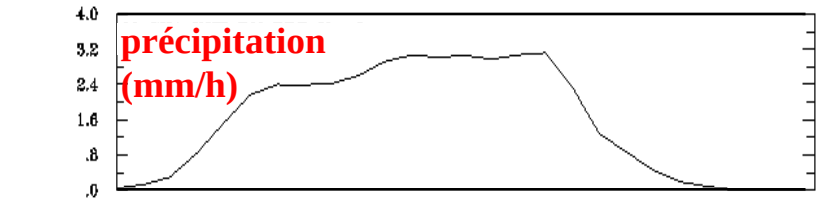


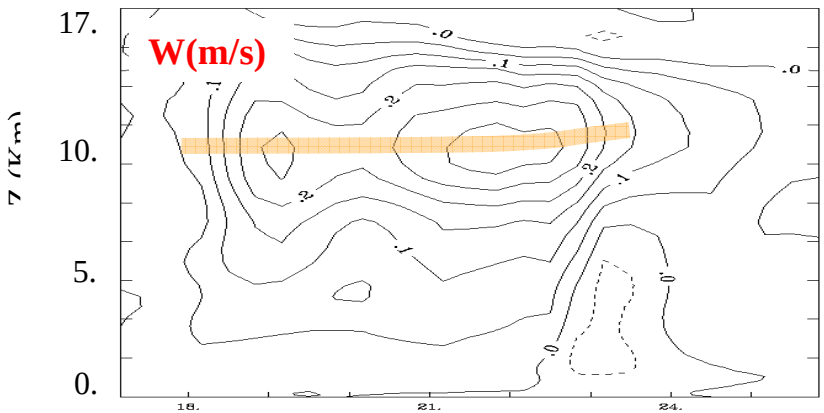
-convectif+turbulent transport of qv
+microphysical sink ofqv
drying: Q2 > 0, moistening: Q2 < 0

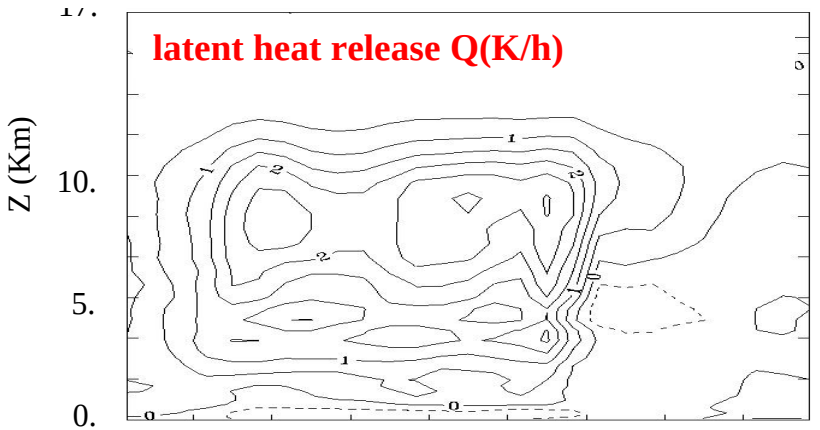
(Lafore)

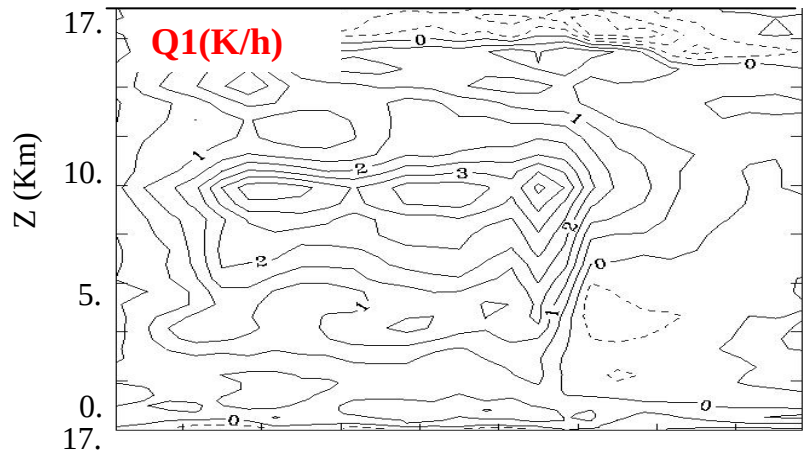
mature stage (zone B2)
17h – 2h

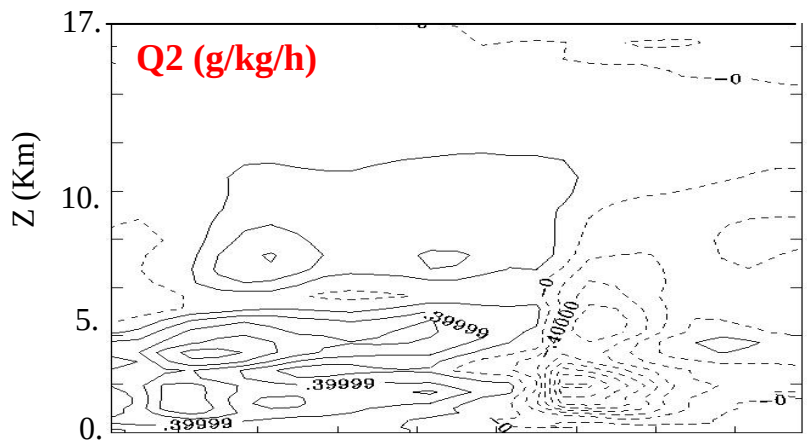
(Lafore)





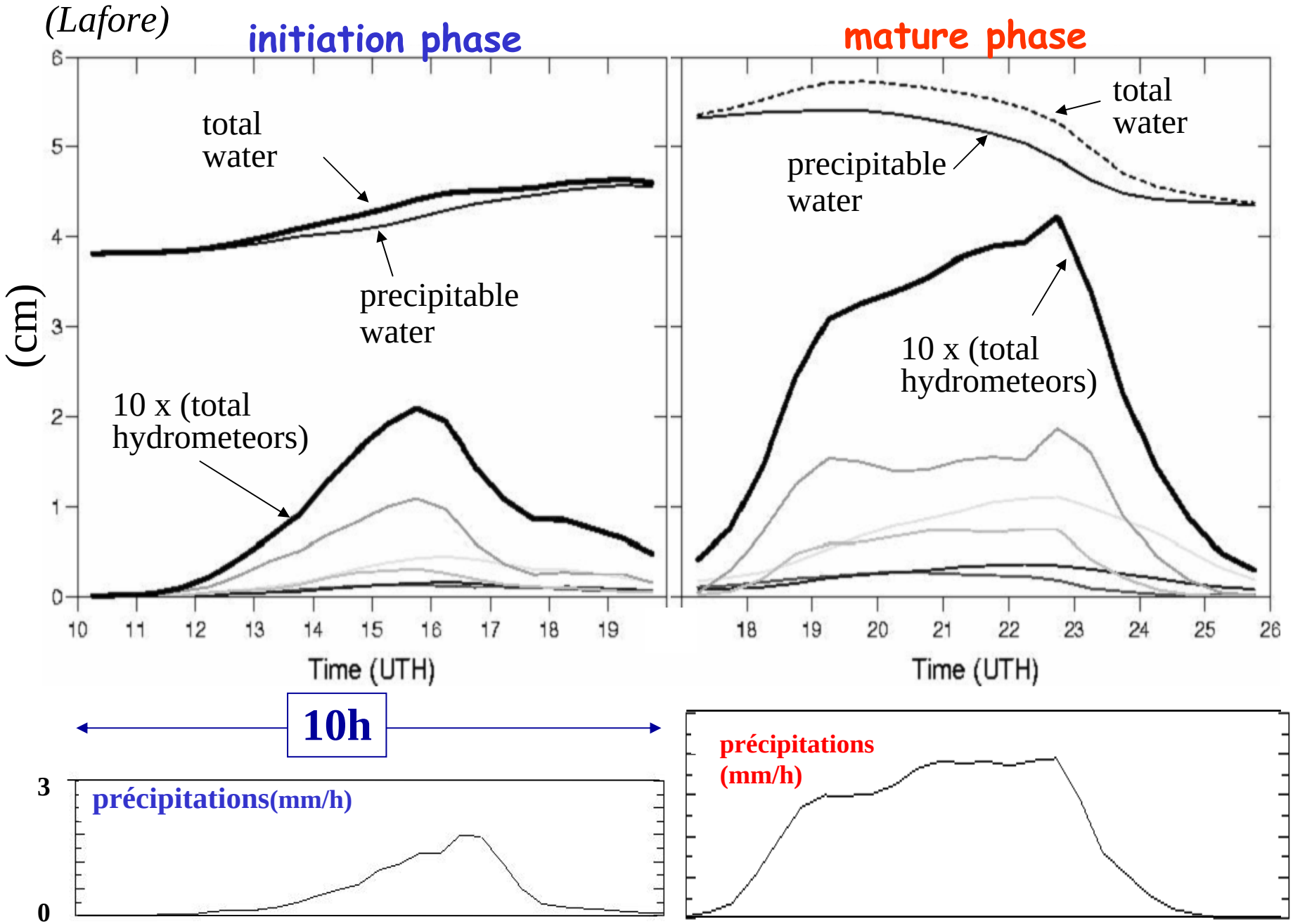


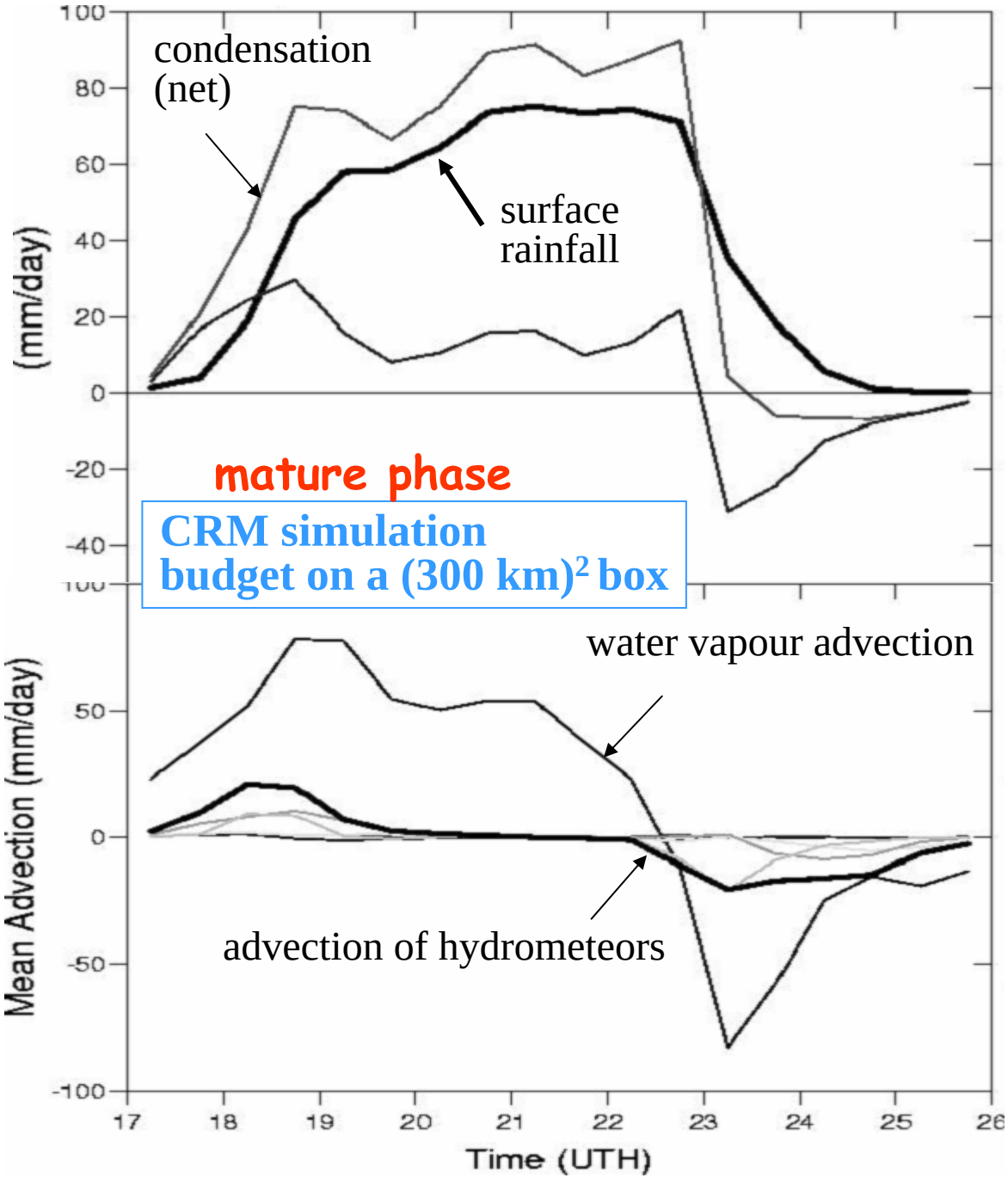




CRM simulation: average budgets on (300 km)^2 boxes

(Lafore)





usefullness of this type of analysis for larger scale, such as: estimation of the magnitude of hydrometeor-advection

(Lafore)

about the choice of other/additional case studies

simulation of a mesoscale system passing over Benin (?)

simulation of cases from the 2005 dry runs (?)

related questions:

which type of situation do we want to focus on?
well organized squall line (probably easier for models in a 1st stage...)
other types of mesoscale convective systems?
dry, shallow convection? diurnal convection...
recovery period following the passage of a system?
....
in response to which question?

+shedulde & work power