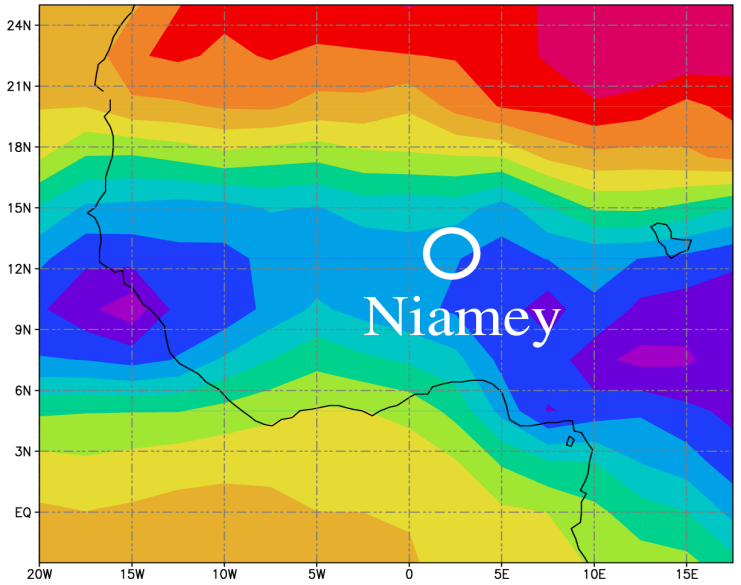
Analysis of the isotopic composition of rainwater samples collected in the Niamey area during the 2006 monsoon: from convective events to seasonal variations

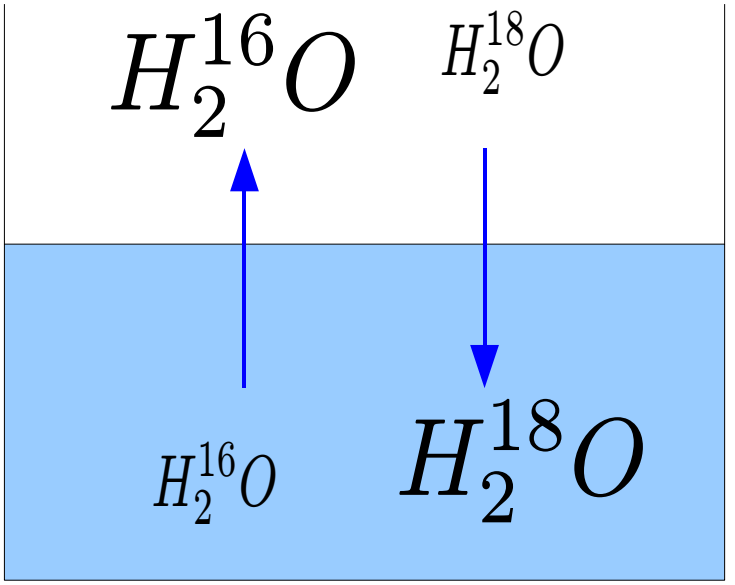


Camille Risi, Sandrine Bony (LMD),
Françoise Vimeux (LSCE/IRD),
Luc Descroix, Ibrahim Mamadou and Ibrahim Boubacar (IRD Niamey)

Goals for isotopic measurements during the AMMA campaign

isotopic forms of the water molecule:

$H_2{}^{16}O$, $H_2{}^{18}O$, $HD^{16}O$



Main question:

•Water isotopes can be used to better constrain water budgets, but what controls the isotopic composition in the Tropics is still not well understood...

What controls the isotopic composition of precipitation in the Niamey area?

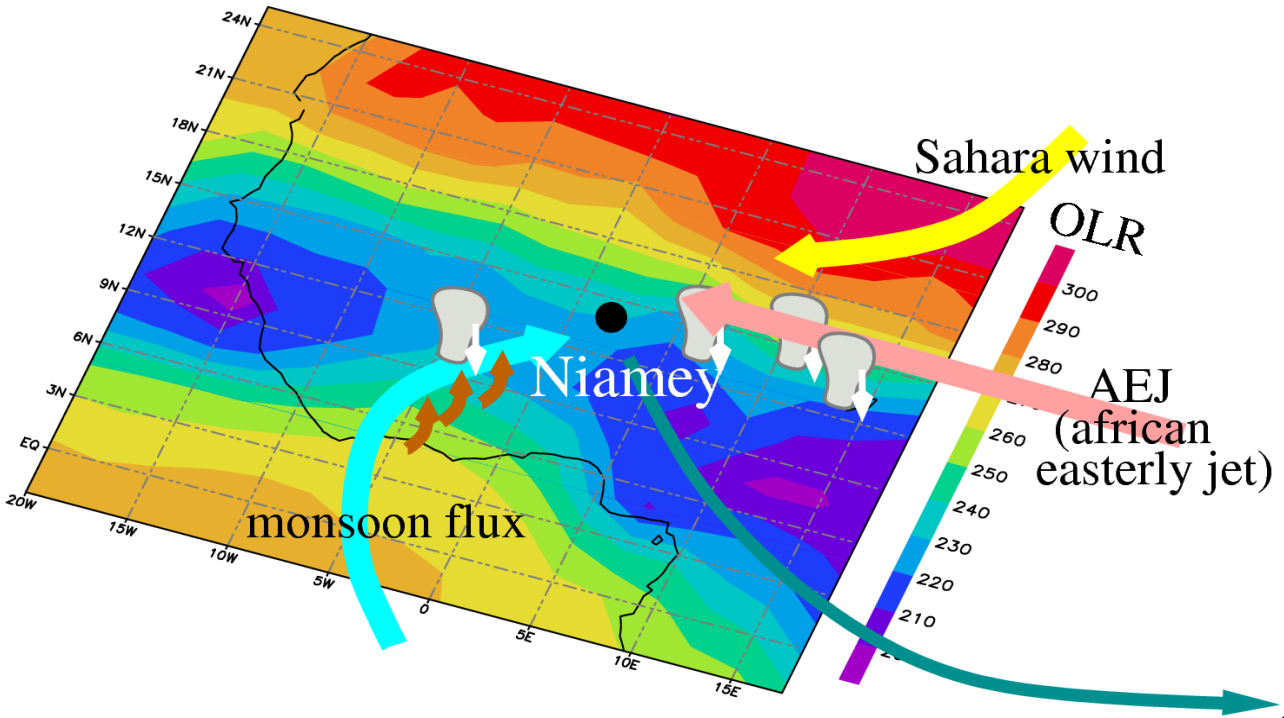
Why the Niamey area?

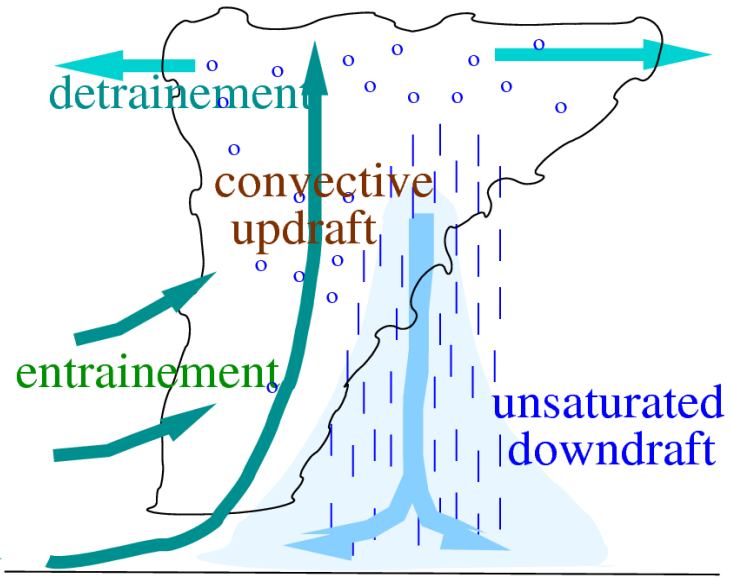
- high variability
- strong rain reevaporation
- lot of data available

What controls the isotopic composition in the Niamey area?

Large scale processes? (large scale convective activity, air mass origin, surface processes)

Convective processes?





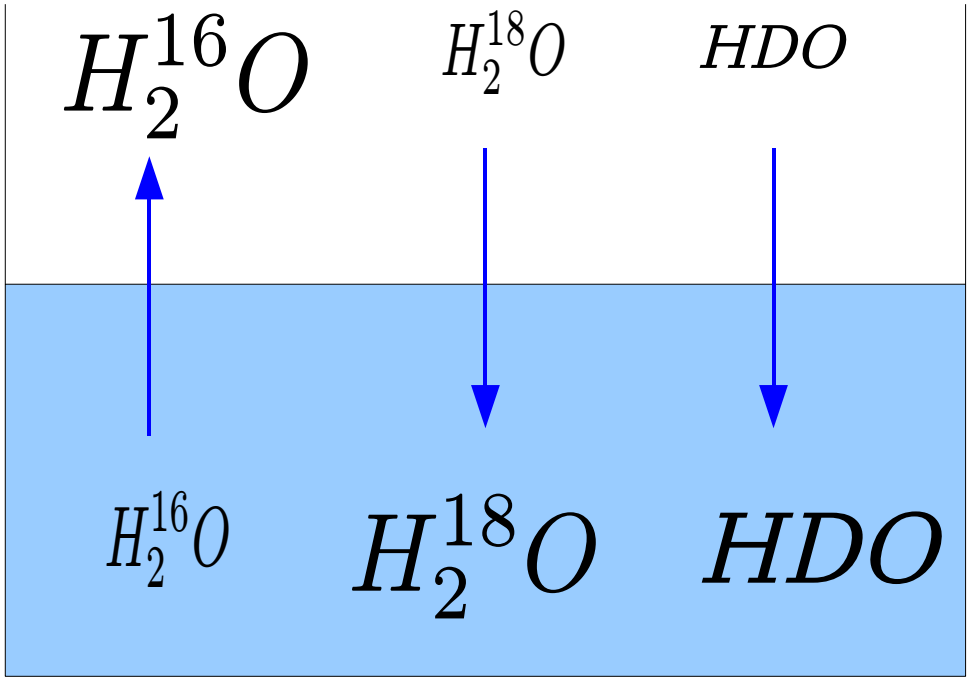
Collected isotopic data

2 kinds of data:

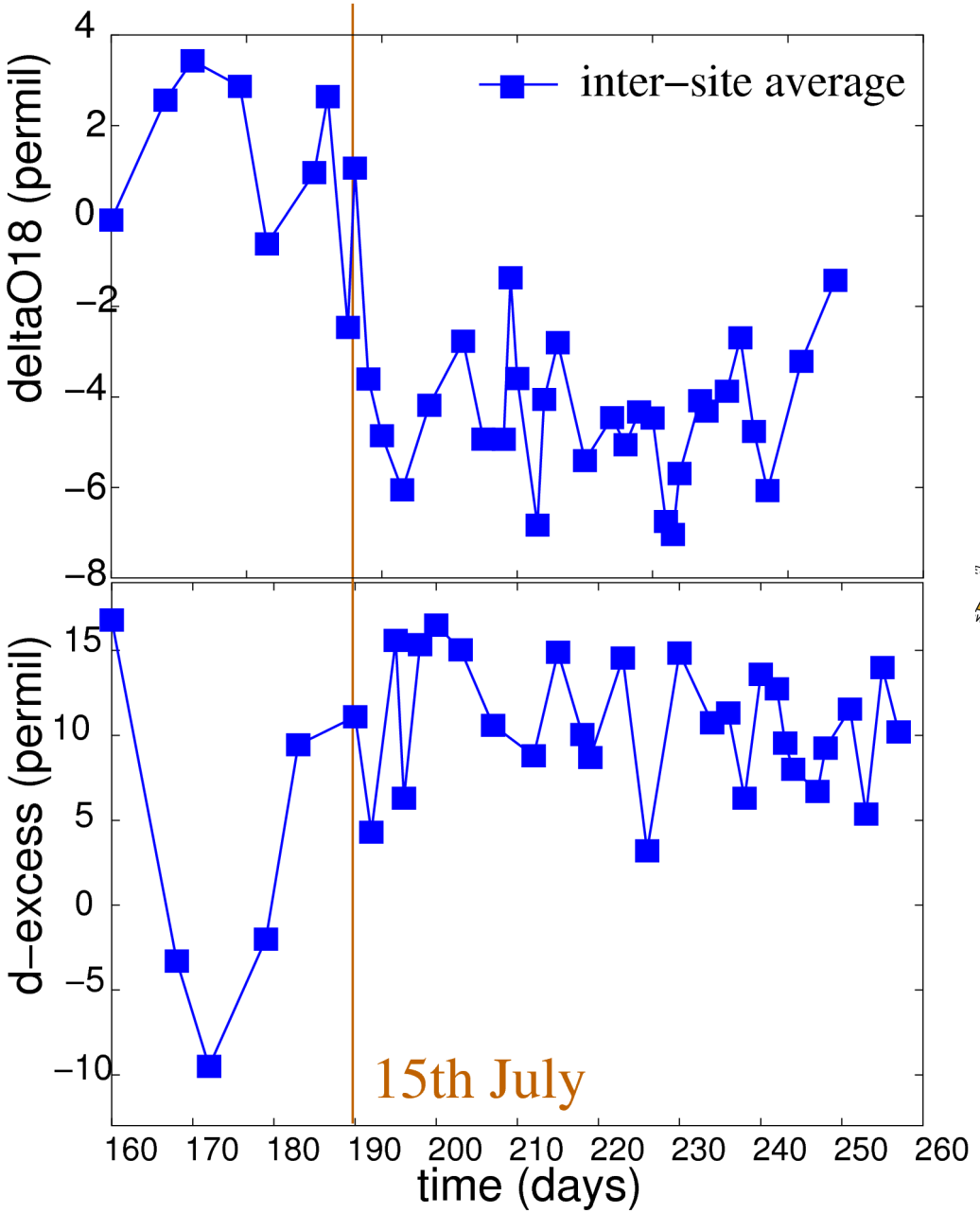
- at the event scale, collected all along the 2006 monsoon season on three sites (Niamey, Wankama, Banizoumbou)
- at infra-event scale, in Niamey, in August and September 2006

Isotopic analyses:

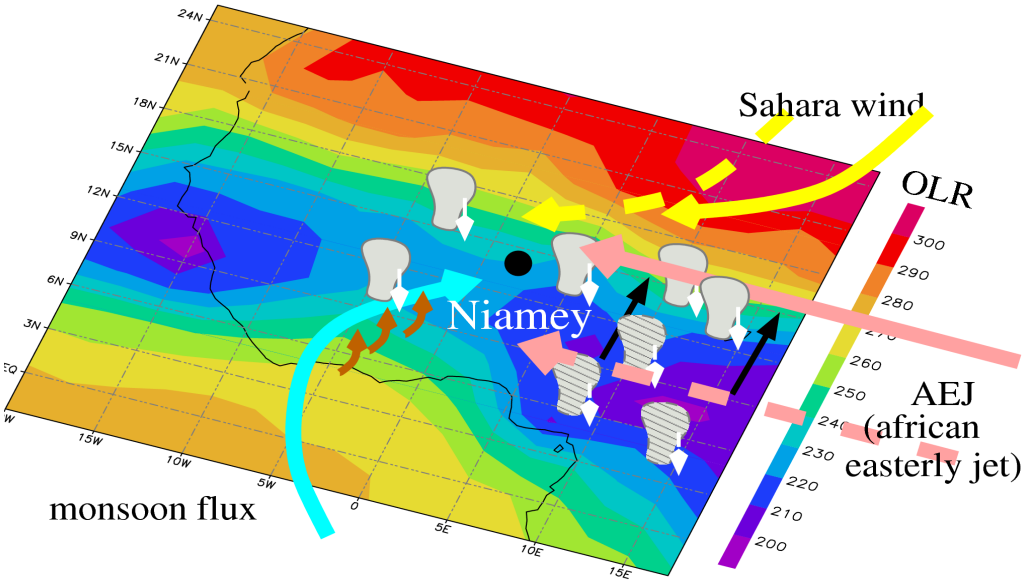
- deltaO18 (permil)
- d-excess=deltaD-8.deltaO18



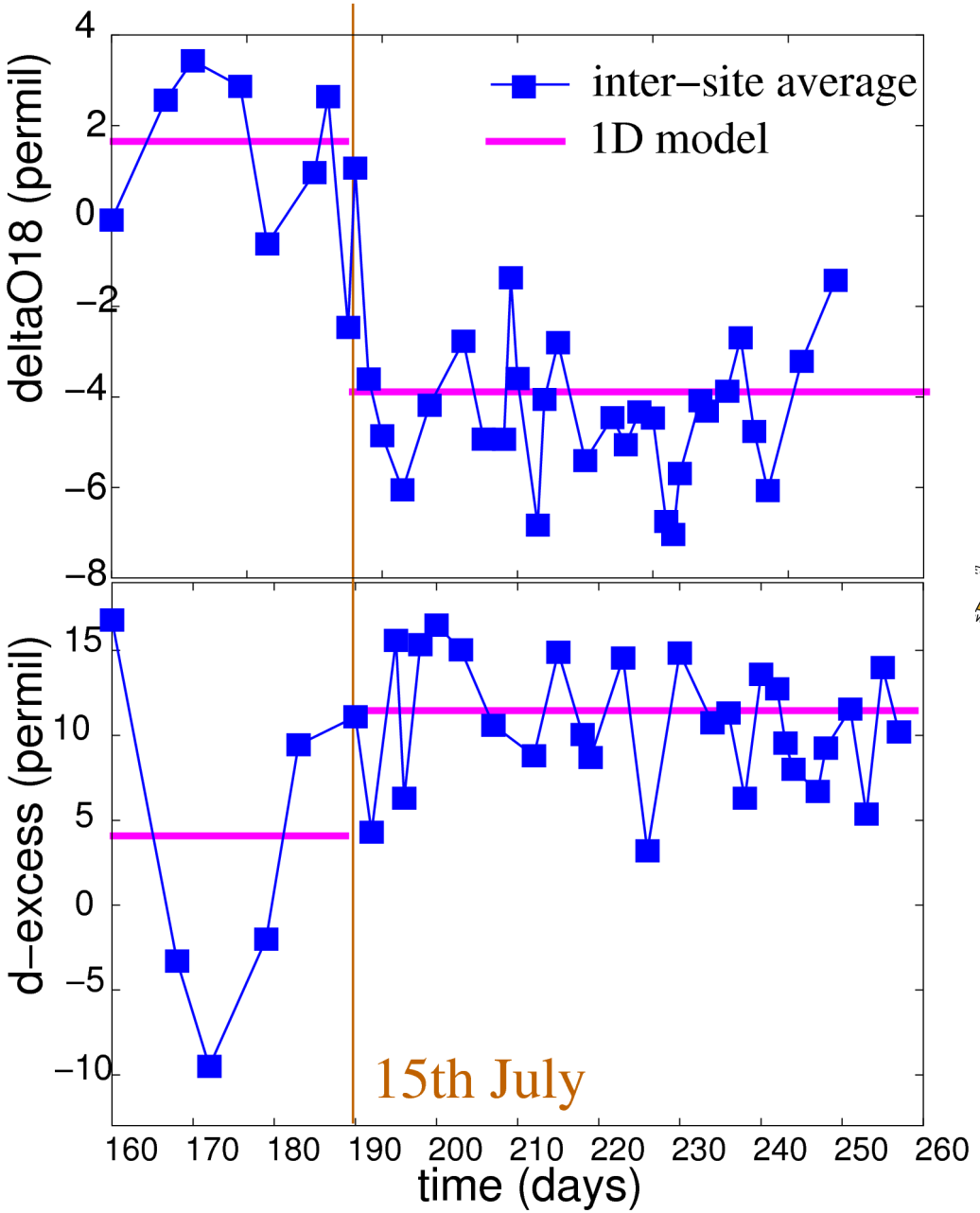
Evolution along the monsoon season



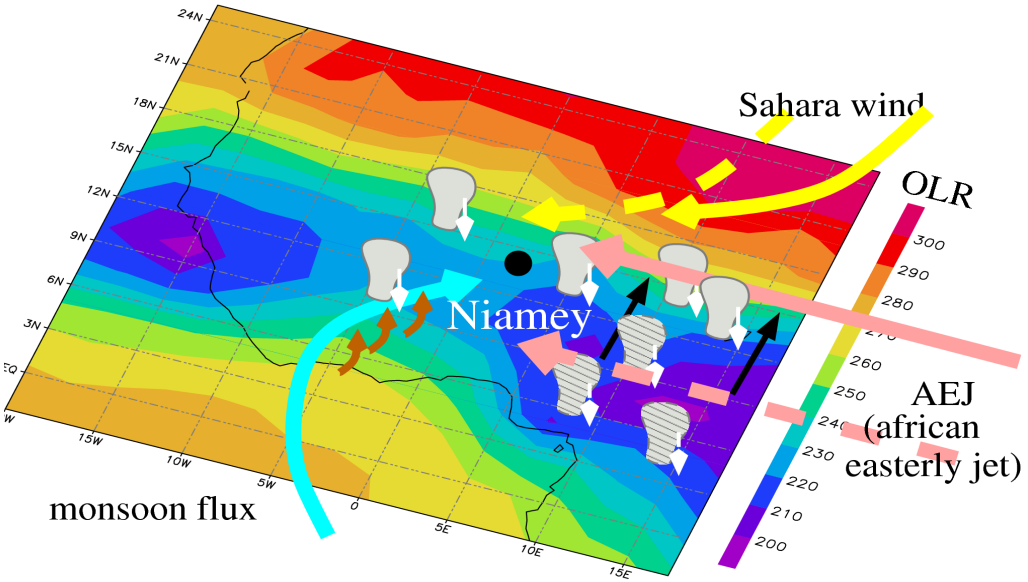
Signature of the monsoon onset



Evolution along the monsoon season

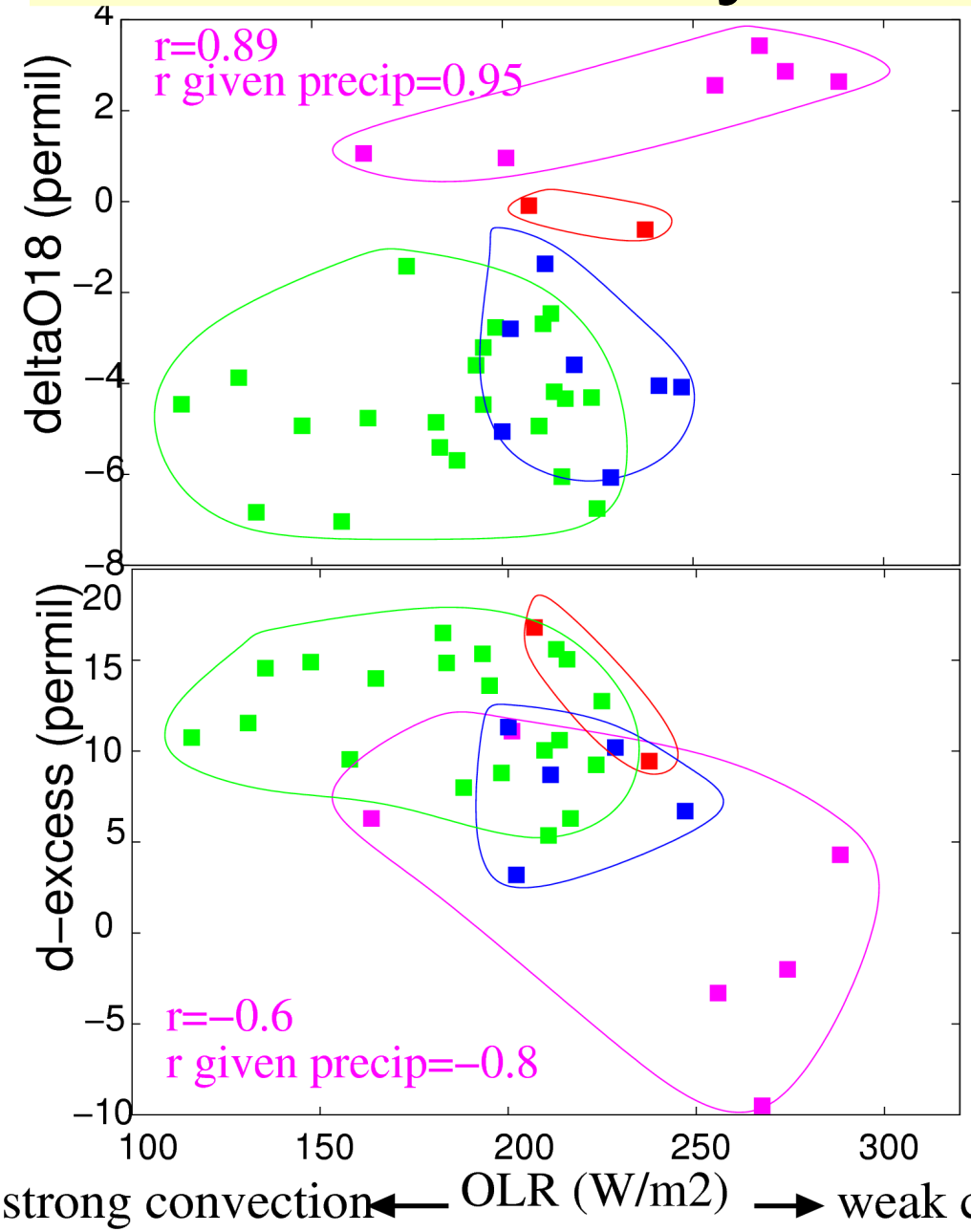


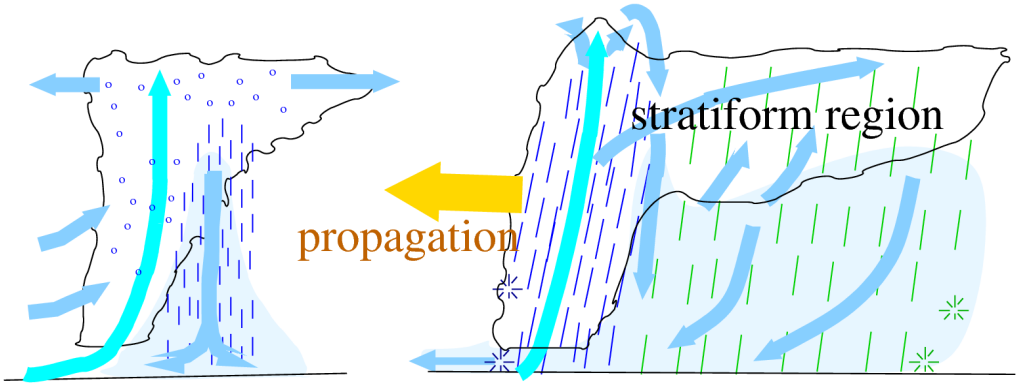
Signature of the monsoon onset



isotopic variations are related to large scale convective activity

Link between isotopes and convective intensity and organization



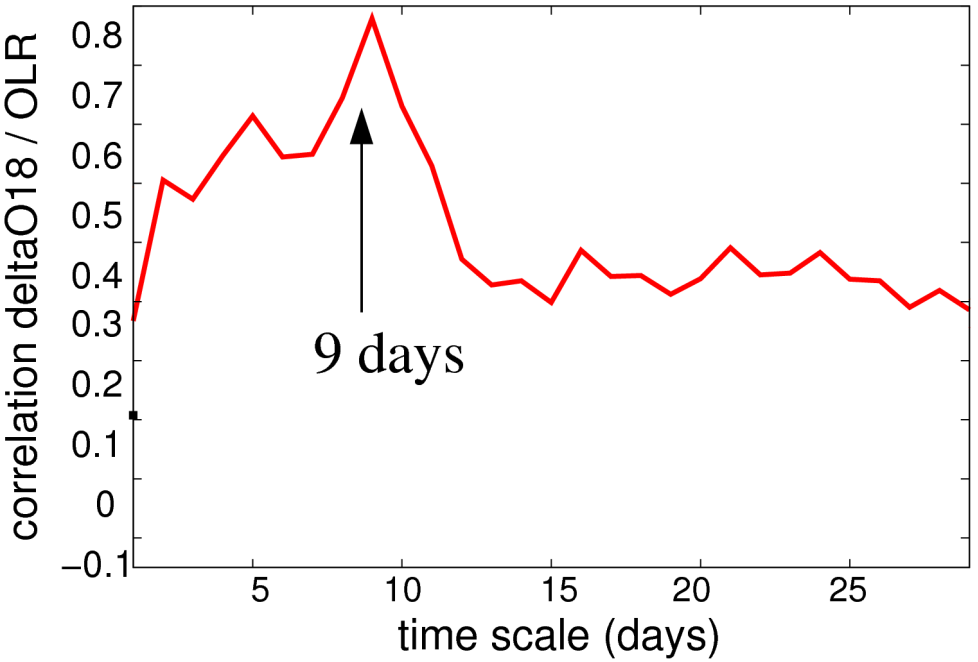


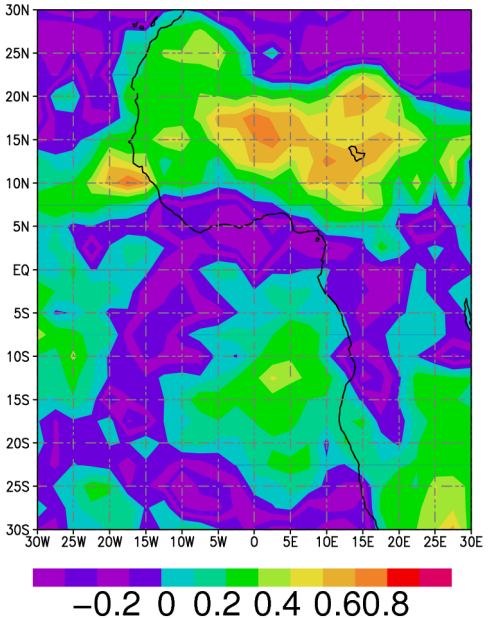
isolated systems
- before onset
- after onset

organized systems
- before onset
- after onset

- At event scale along the season, no link with local convective intensity
- Link with convective organization
- The isotopic composition for isolated events before onset is controled by local convective intensity

deltaO18 variability among organized systems after the onset





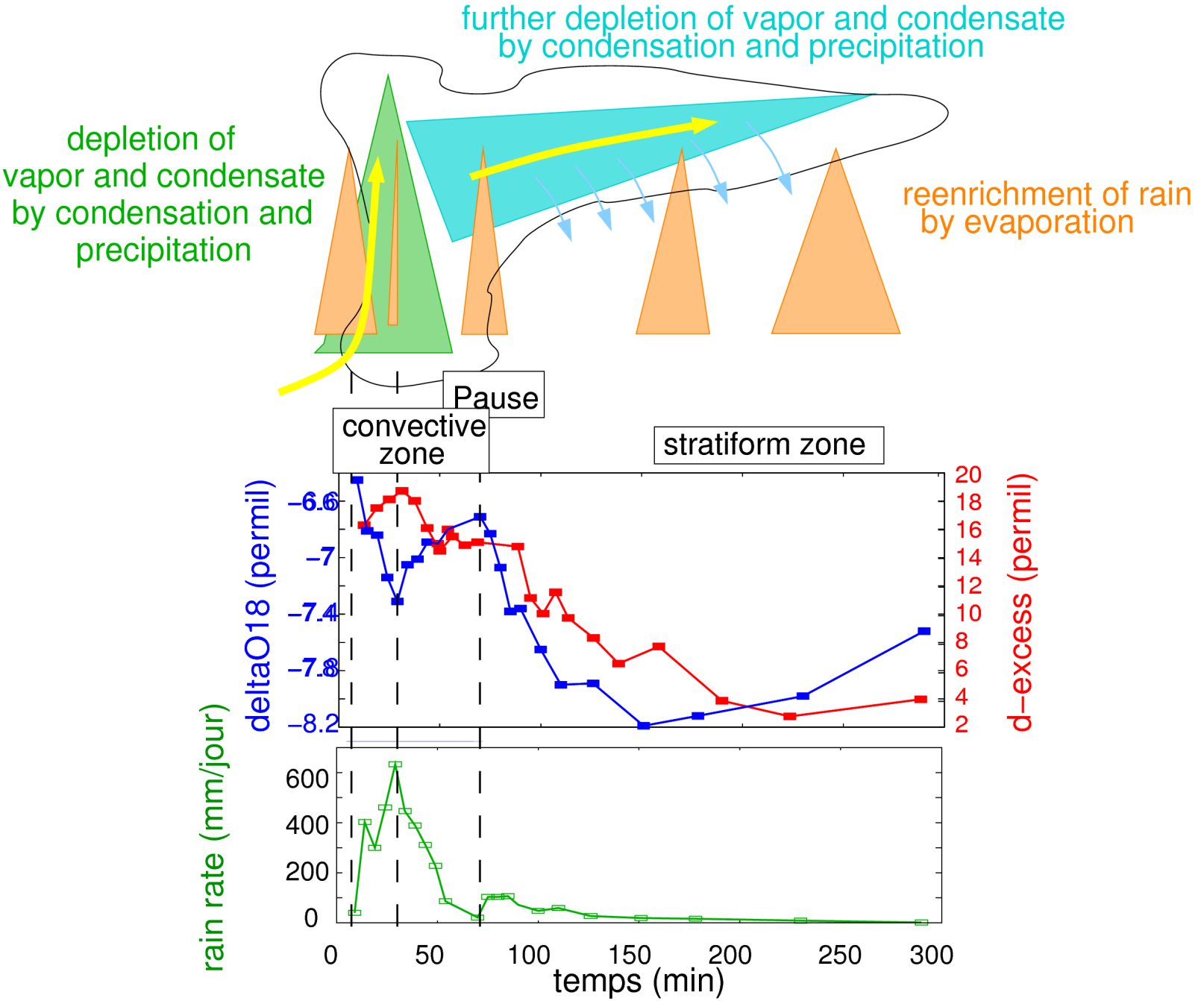
Correlation between deltaO18 of organized events and OLR averaged over the 9 previous days

→ deltaO18 = signature of intra-seasonnal variability (15-20 days variability documented by Sultan et Janicot 2003)?

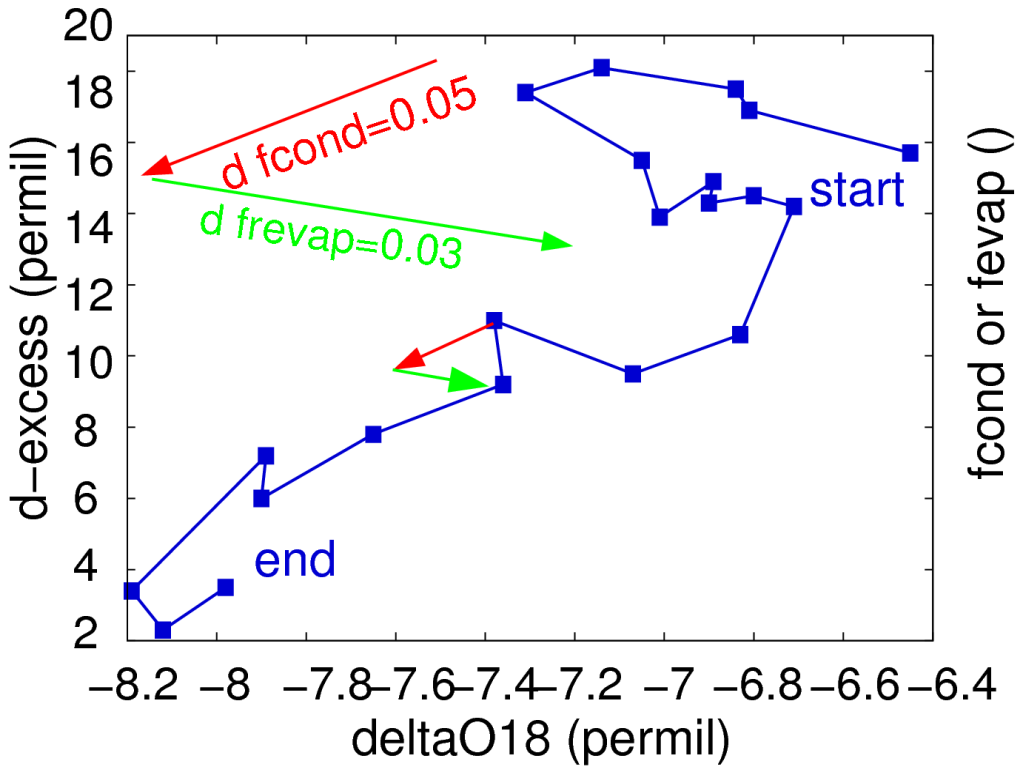
→ deltaO18 integrates temporally and spatially regional convection?

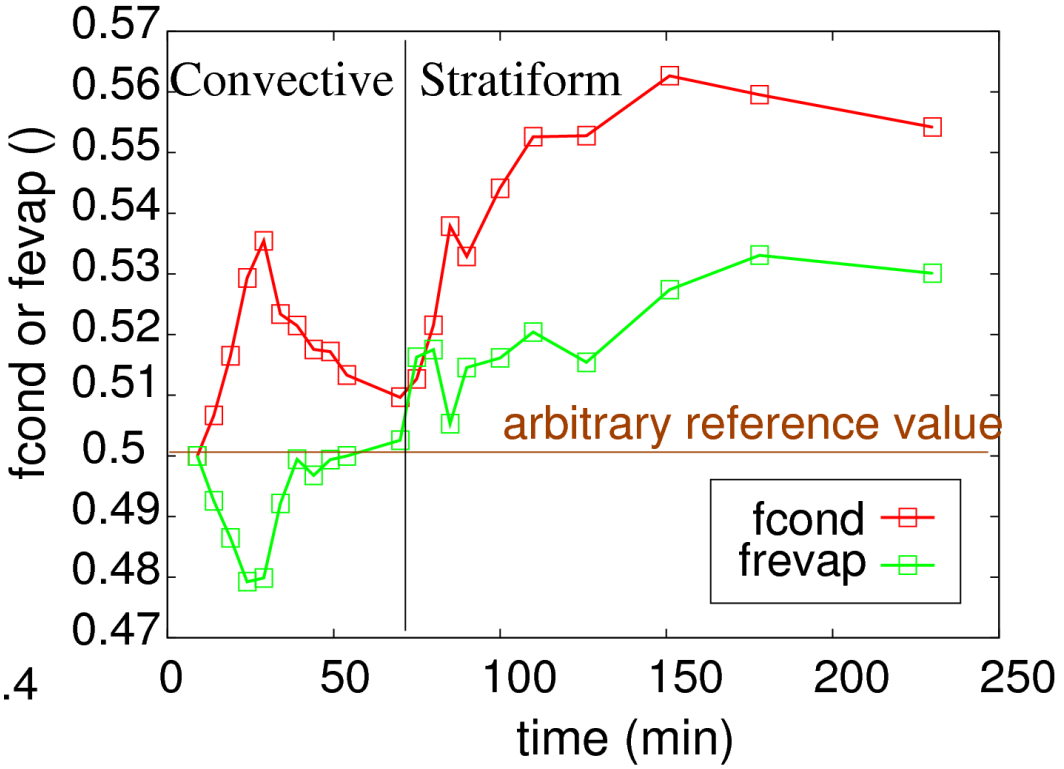
→ disentangle convective processes and regional processes?

Isotopic evolution along squall lines



Using water isotopes to constrain water budget in squall lines?





But many incertainties due to strong sensitivity to reevaporation and condensation processes

Perspectives

Infra-event data:

- development of a simple isotopic model of squall line

  ⇒ better understand the effect of convective processes and constrain water budget in squall lines

Event-scale data:

- isotopic simulations with LMDZ zoomed on the AMMA region

  ⇒ disentangle convective and regional processes

- coupling with the land surface scheme ORCHIDEE

  ⇒ influence of surface processes

- second year of data: 2007

  ⇒ more representative statistics