Nouvelles d'LMDZ-iso

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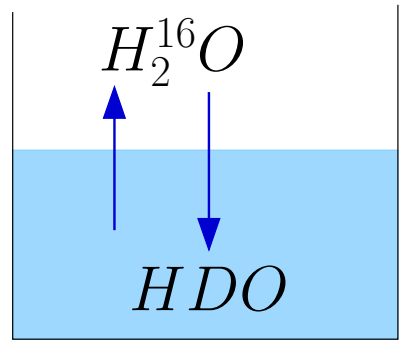
LMD/IPSL/CNRS

Avec: Alexandre Cauquoin, Amaelle Landais, You He, Obbe Tuinenburg, John Worden, Jean-Lionel Lacour, Sandrine Bony, Françoise Vimeux...

Jussieu, 30 Juin 2014

Pourquoi les isotopes de l'eau dans LMDZ?

- $H_2^{16}O$, HDO, $H_2^{18}O$ ...
- fractionnement pendant les changements de phase



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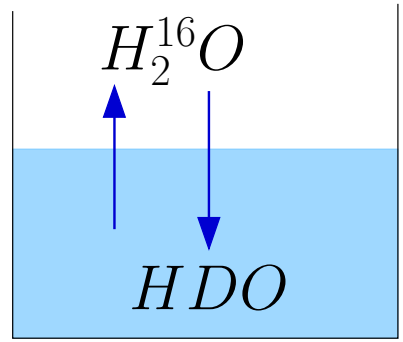

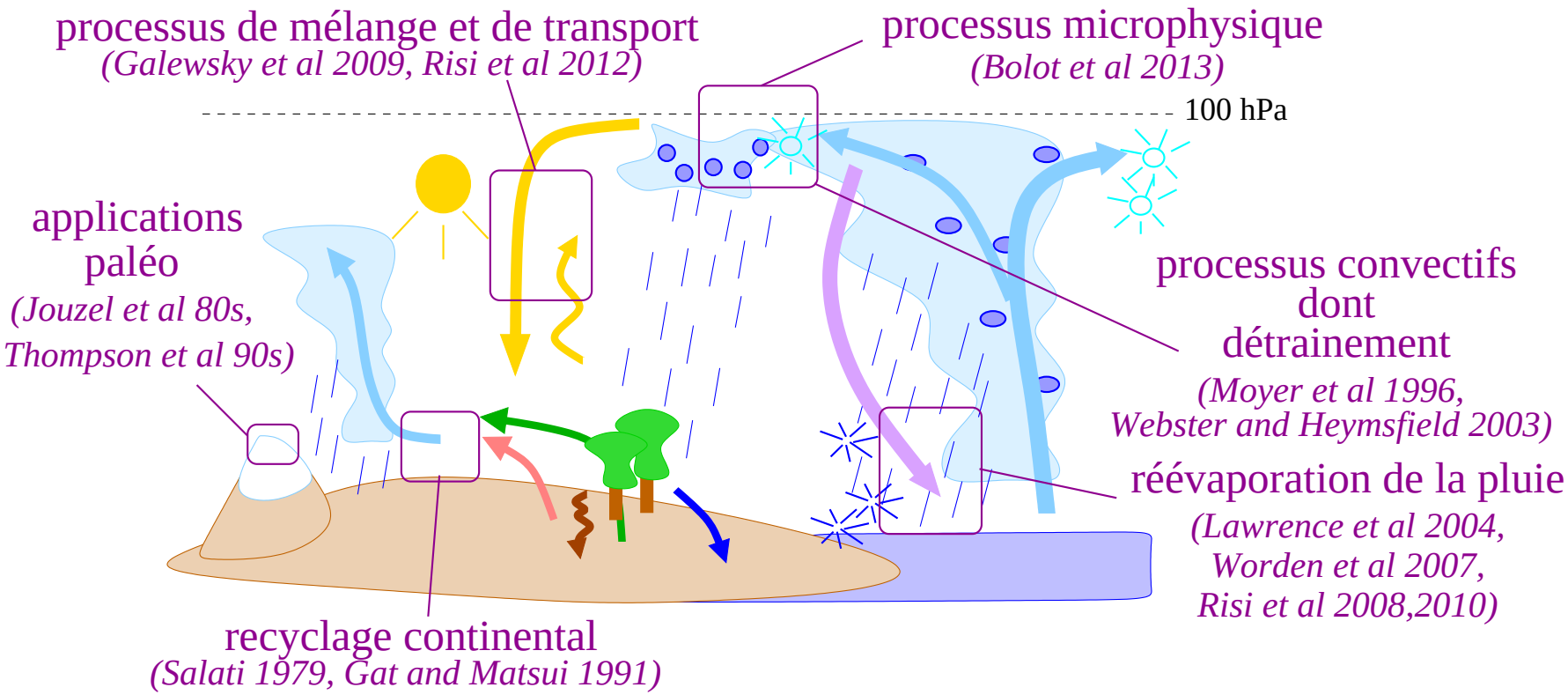

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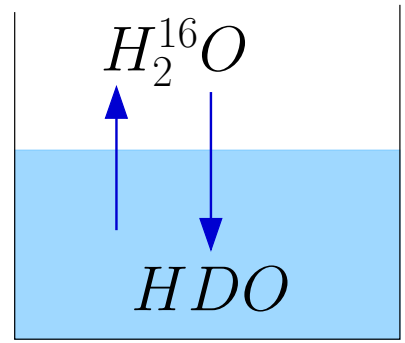
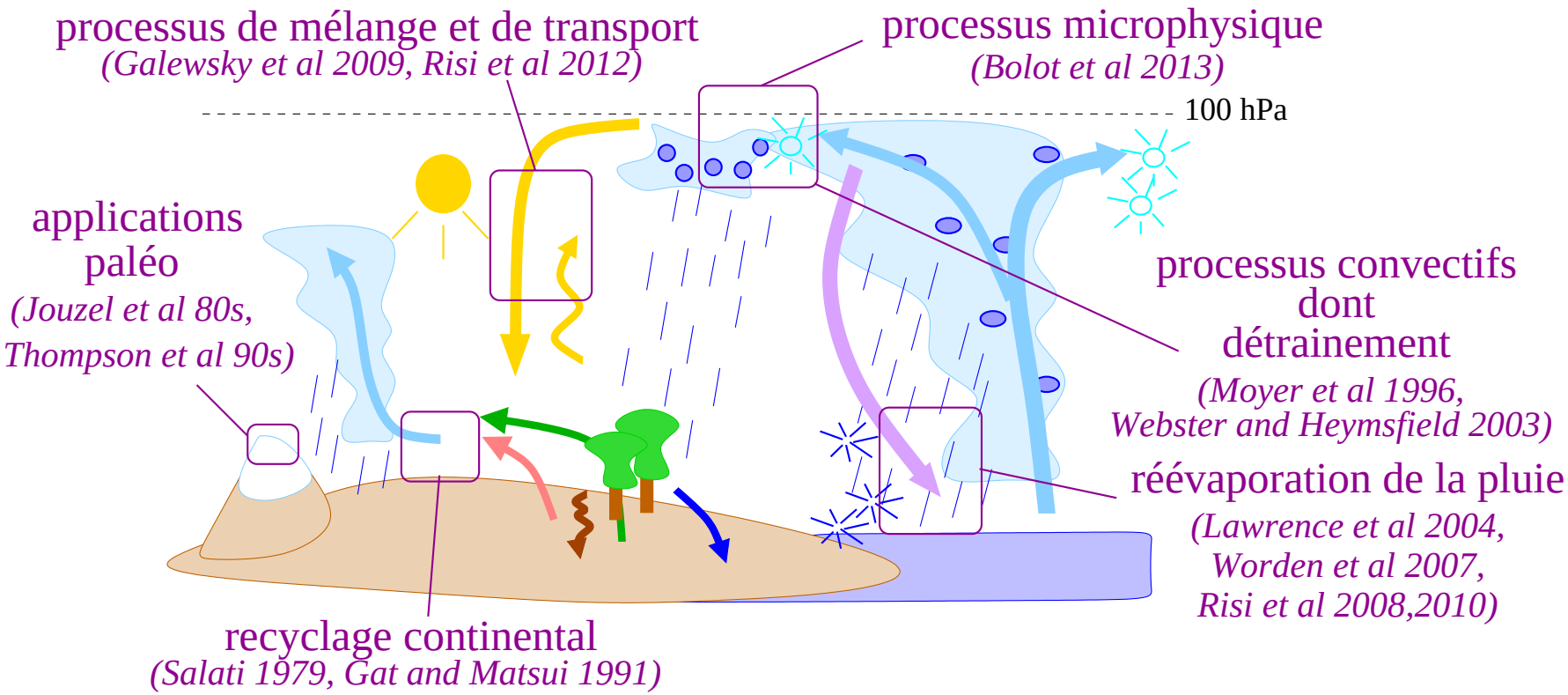


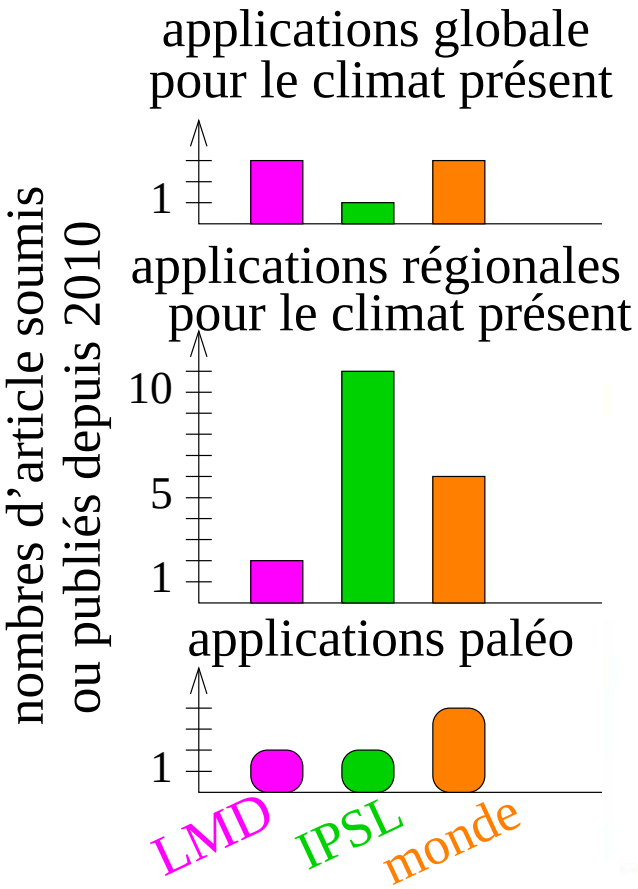


- isotopes dans LMDZ depuis 2009

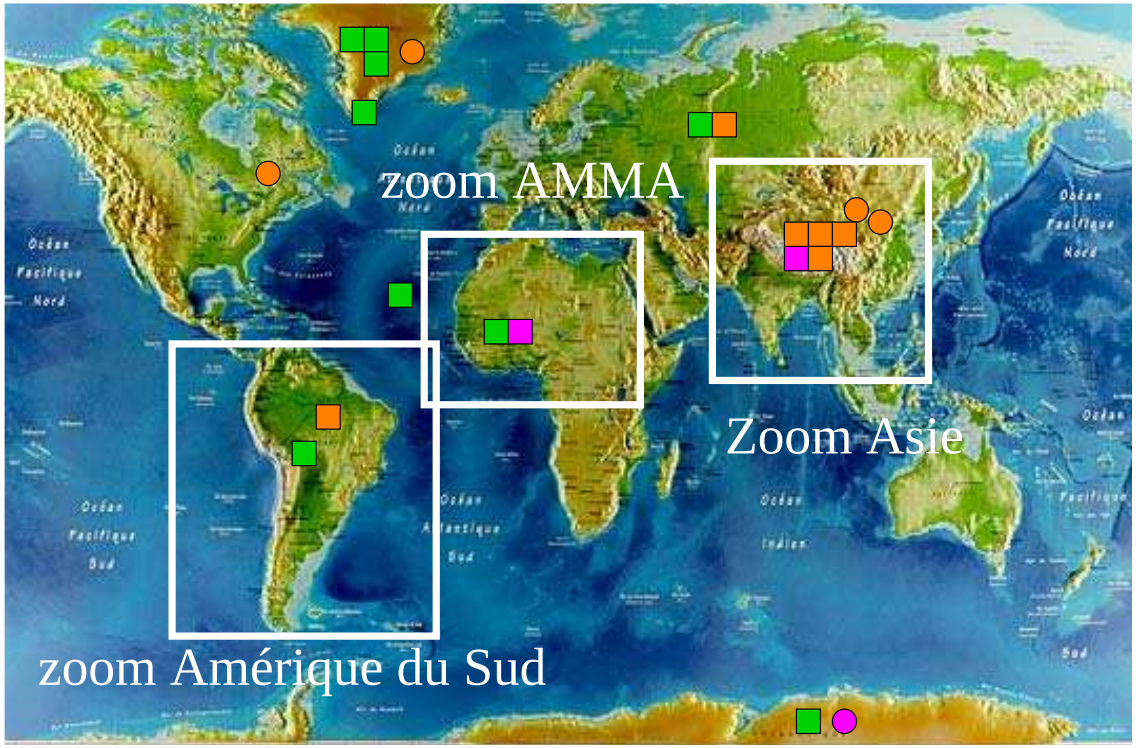
Où en est-on?

- dans LMDZ:
  - dans version de sept 2013: phylmd, phy1d, dyn3d, dyn3dpar
  - à faire:
    - mettre isos proprement dans dyn3dpar (ou dyn3dmem?) en vue d'inclure dans trunk
    - mettre à jour dans pysique récente
- couplage à ORCHIDEE
  - iso dans ORCHIDEE en 2009, couplable mais non paralléle
  - post-doc Francesca: isos dans trunk de 2012, parallèle mais pas bien couplable
  - à faire: inclure dans nouveau trunk fin 2014, parallèle+couplable
- couplage à NEMO
  - post-doc d'Anne Mouchet: marche en offline
  - LMDZ-NEMO couplé: bloqué par ORCHIDEE

Qui sont les utilisateurs d'LMDZ-iso?



Quelles régions étudient−ils?



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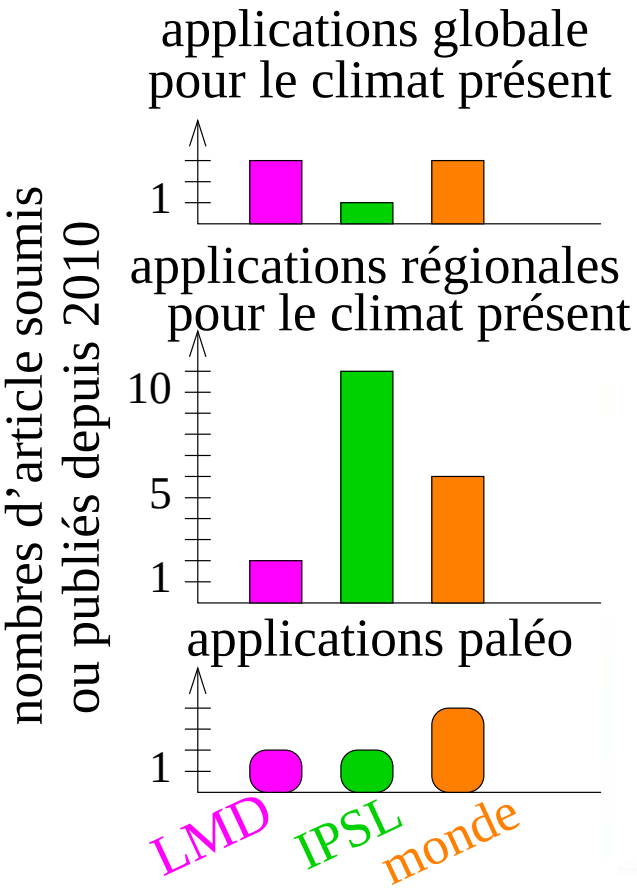

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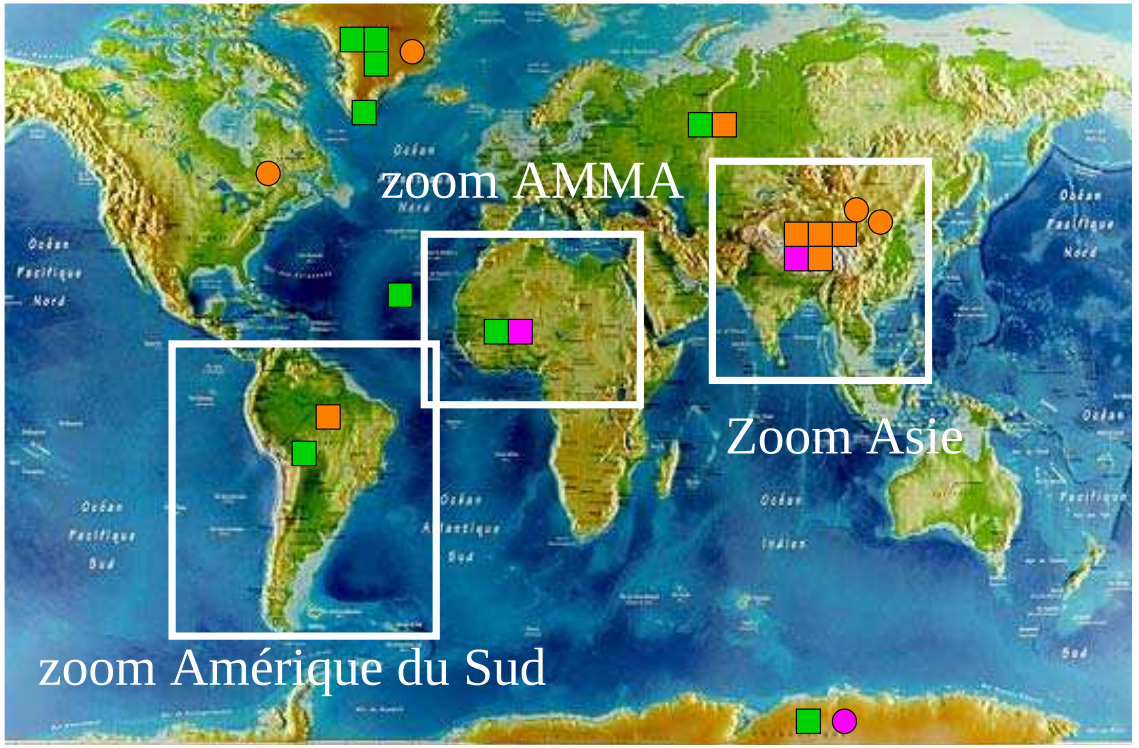
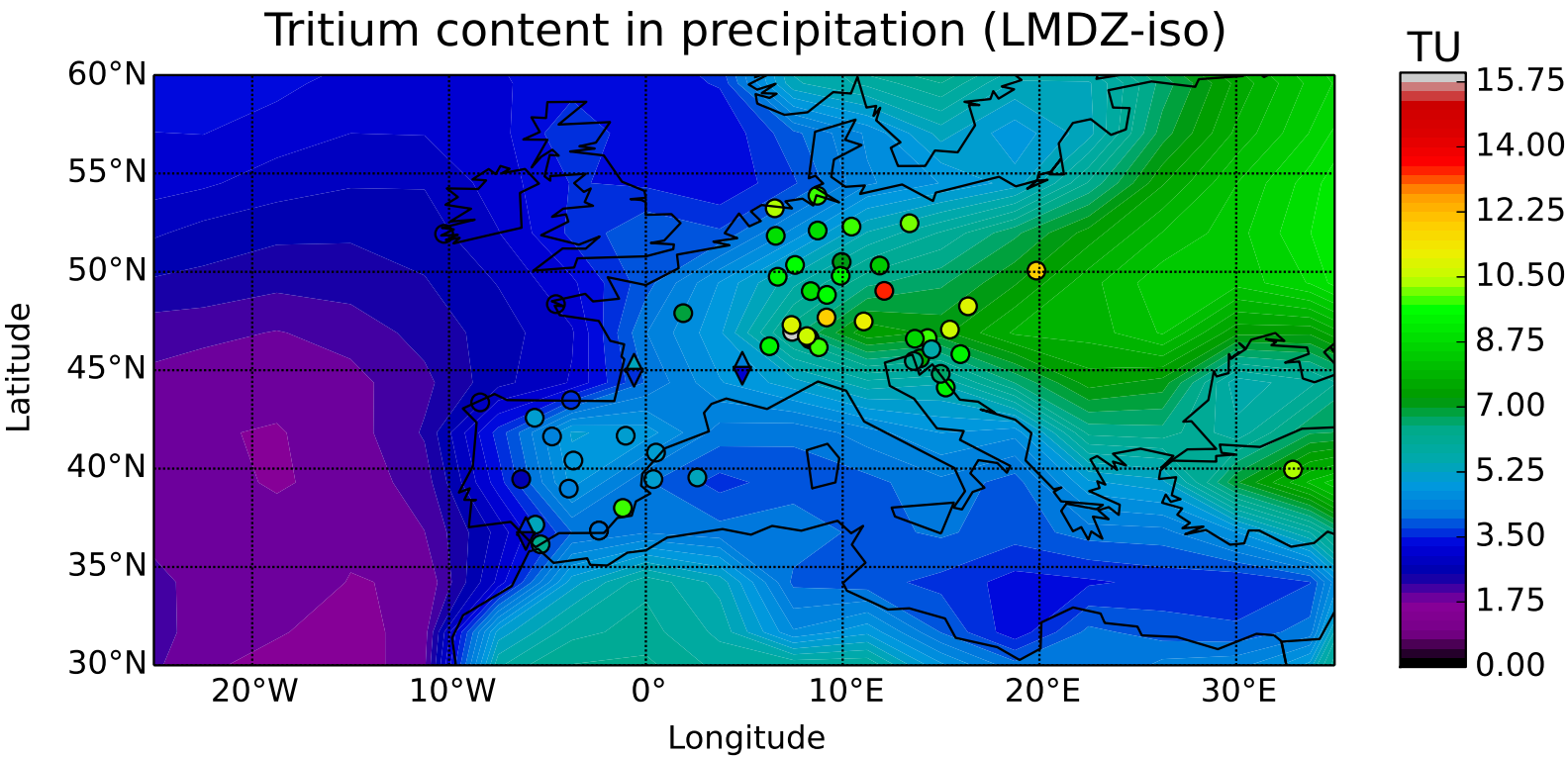


- atouts: grand diversité de configs: zoomé, guidé, paléo...
- mais manque le slab.

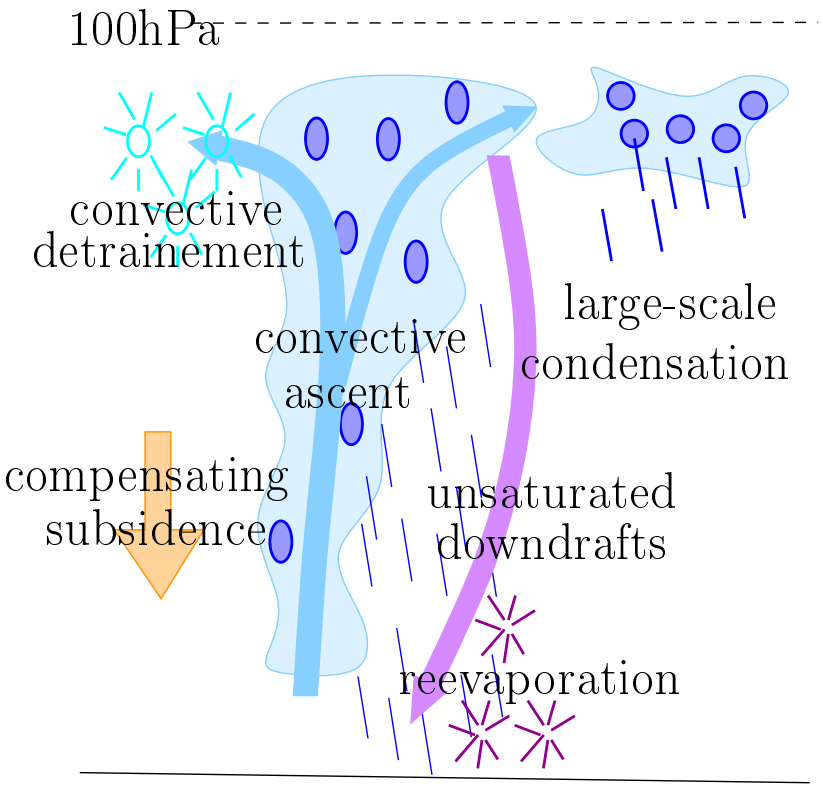
Un petit nouveau: *HTO* (Tritium)

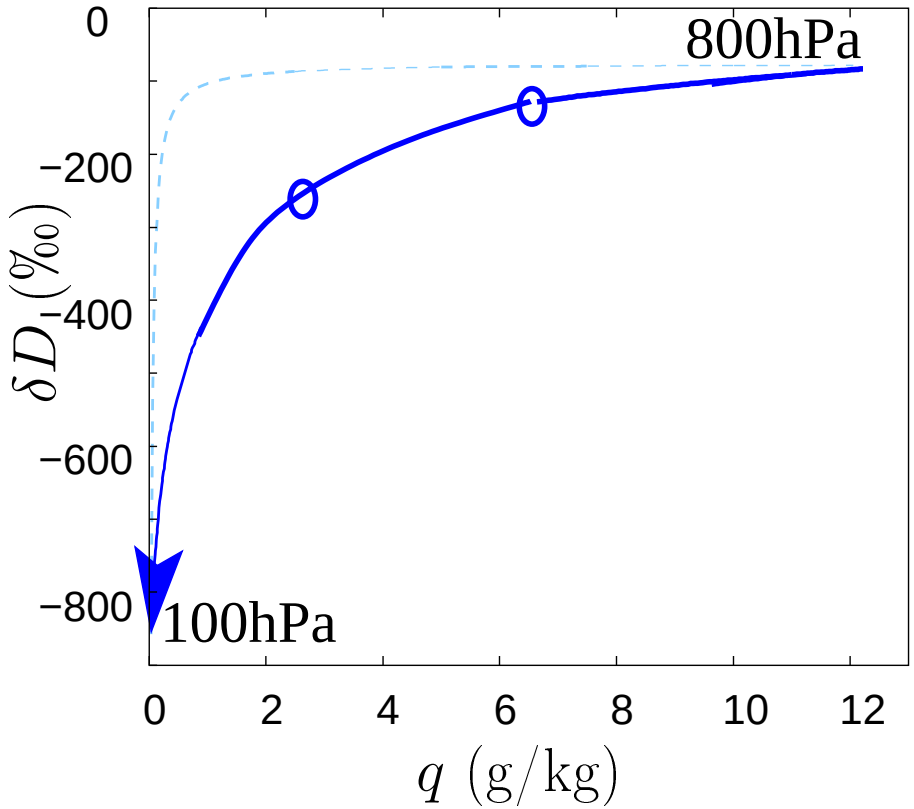
- post-doc d'Alexandre Cauquoin
- radioactif, produit par rayons cosmiques ou essais nucleaires



- But: intrusions stratosphériques en Antarctique avec *HTO*, ^{10}Be, $H_2^{17}O$

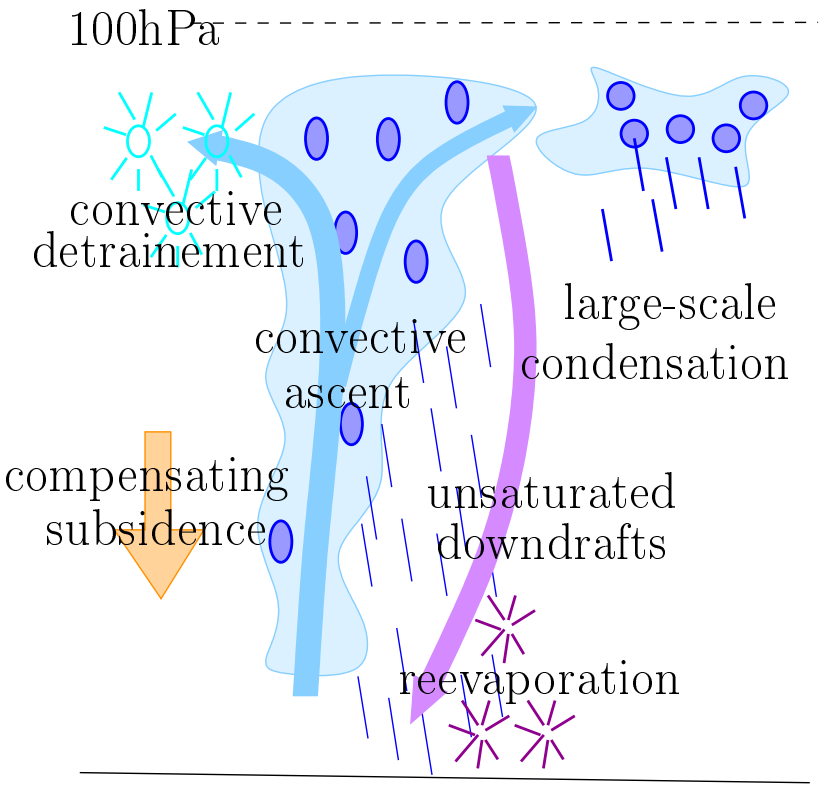
q-δD: processus humidifiants/deshydratants

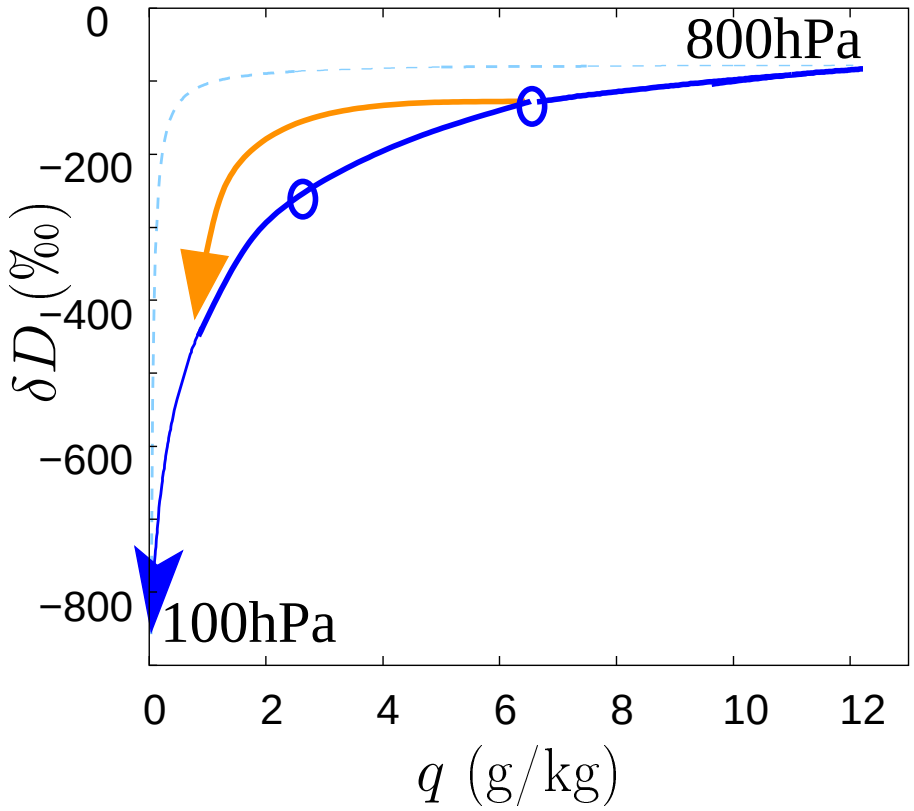




large−scale
condensation

q-δD: processus humidifiants/deshydratants

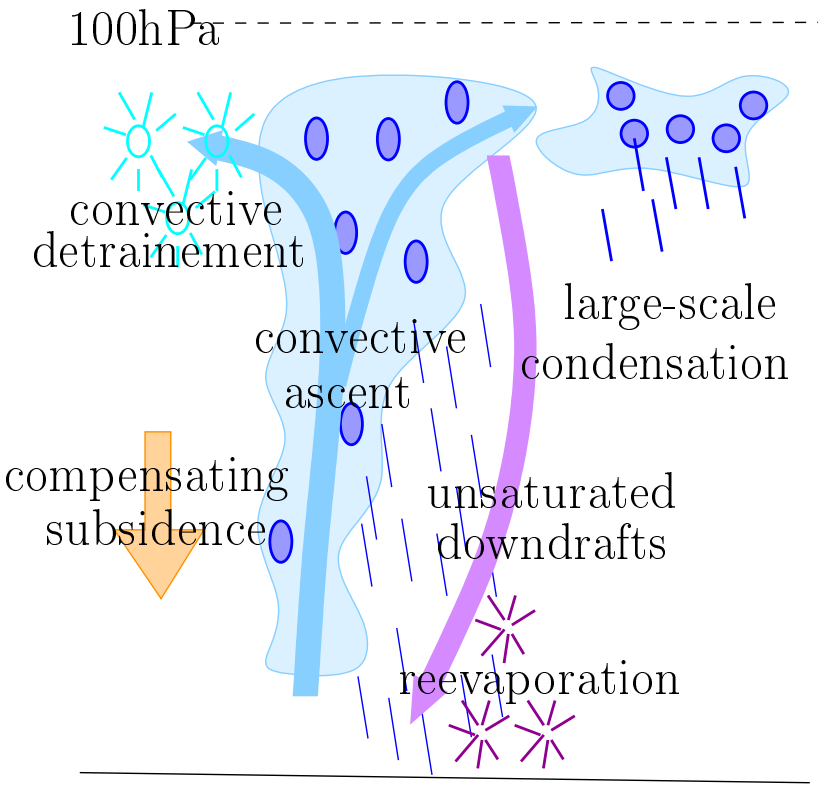


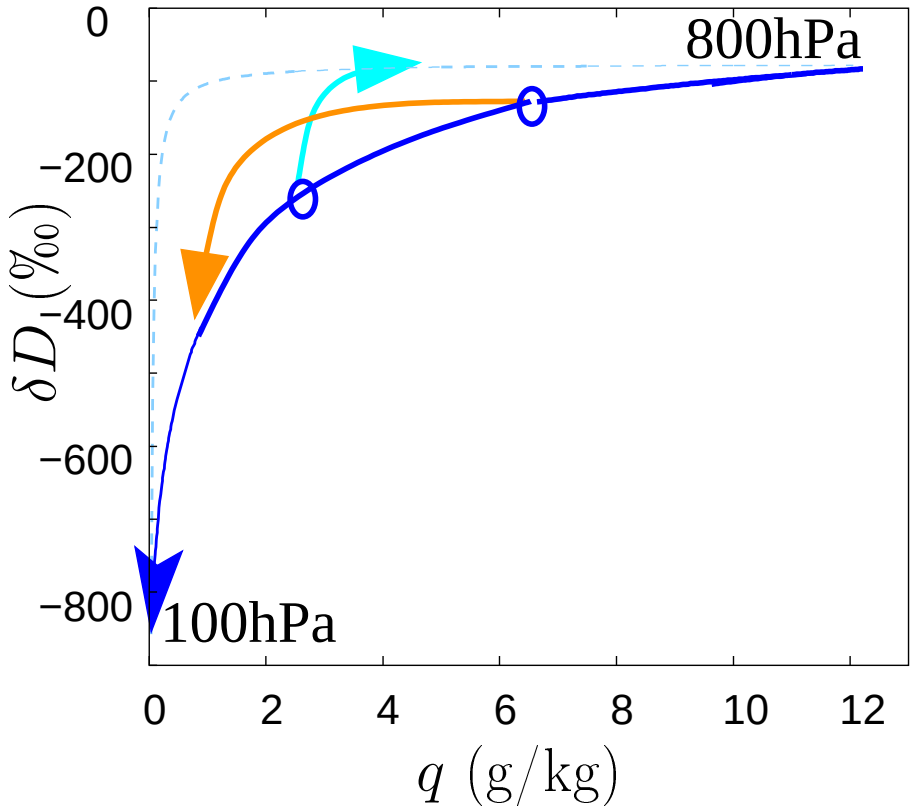


large−scale condensation

subsidence

q-δD: processus humidifiants/deshydratants





large−scale condensation

detrainment

subsidence

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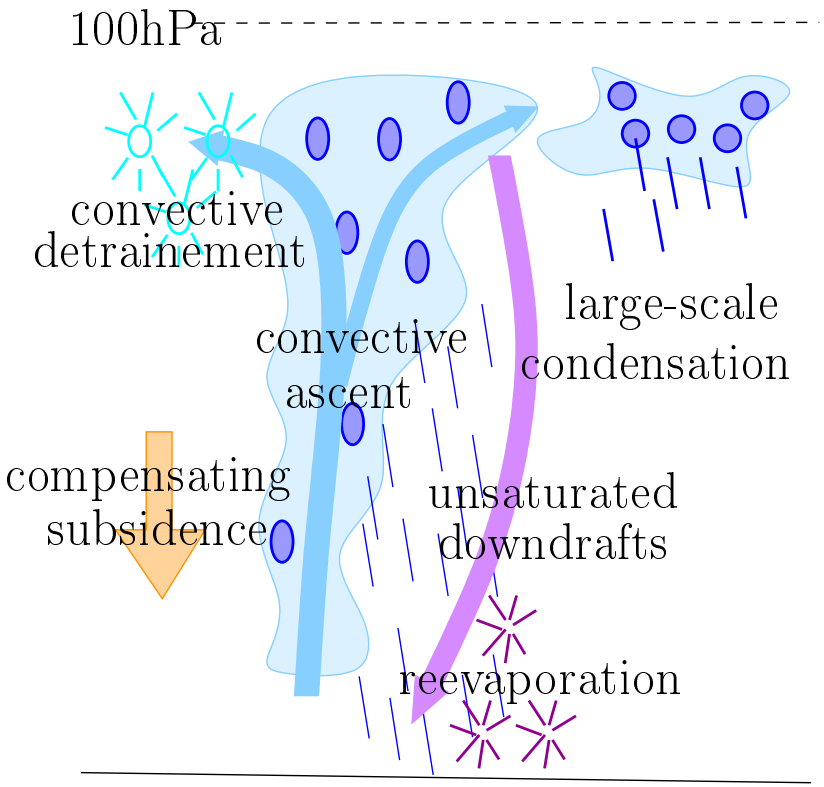
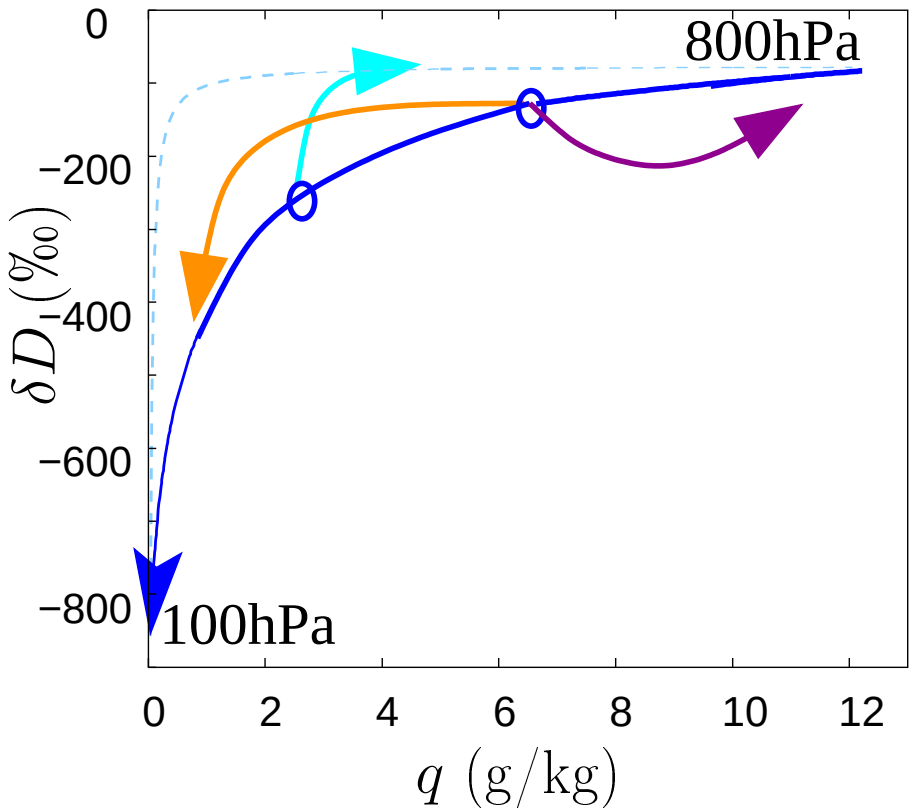




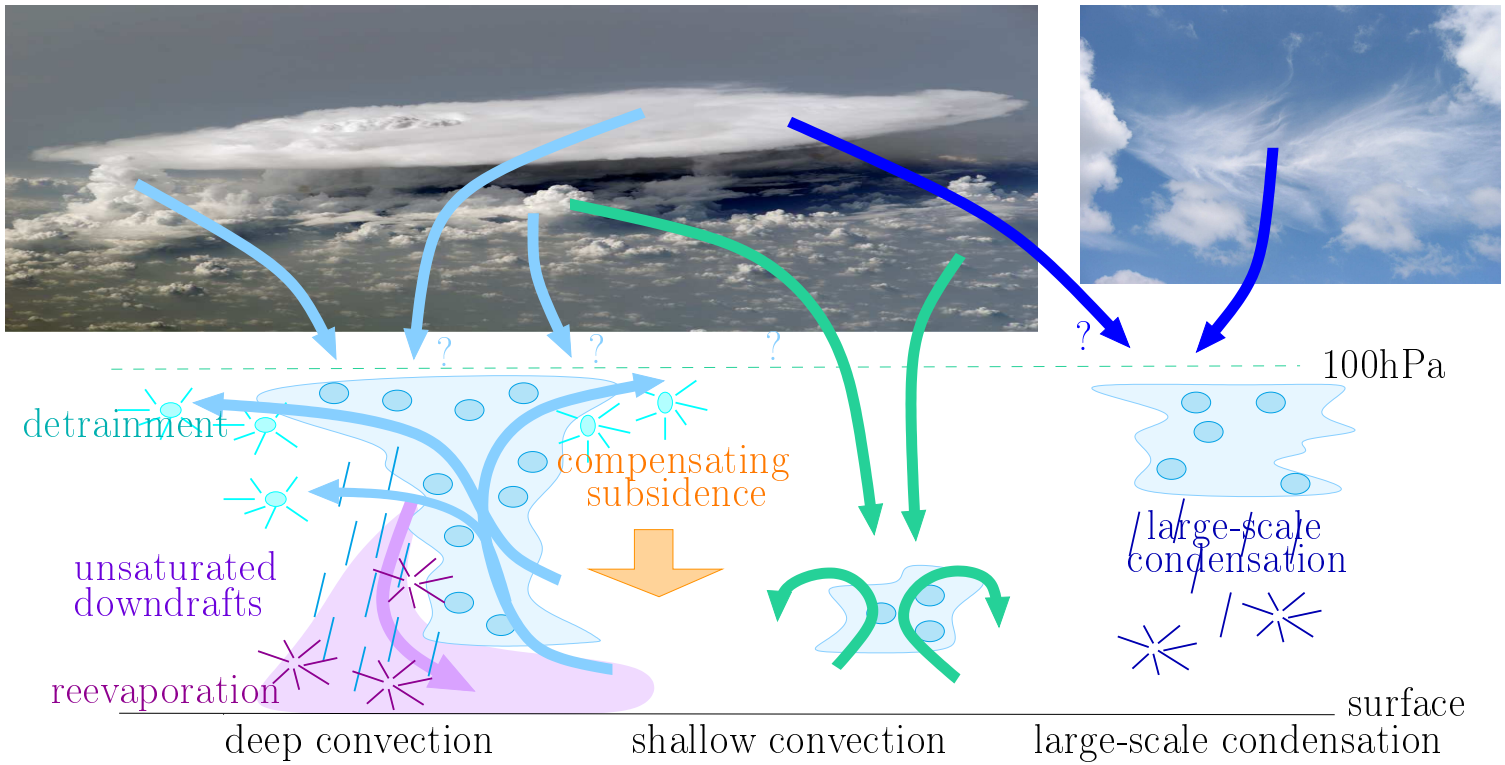
large−scale condensation

detrainment

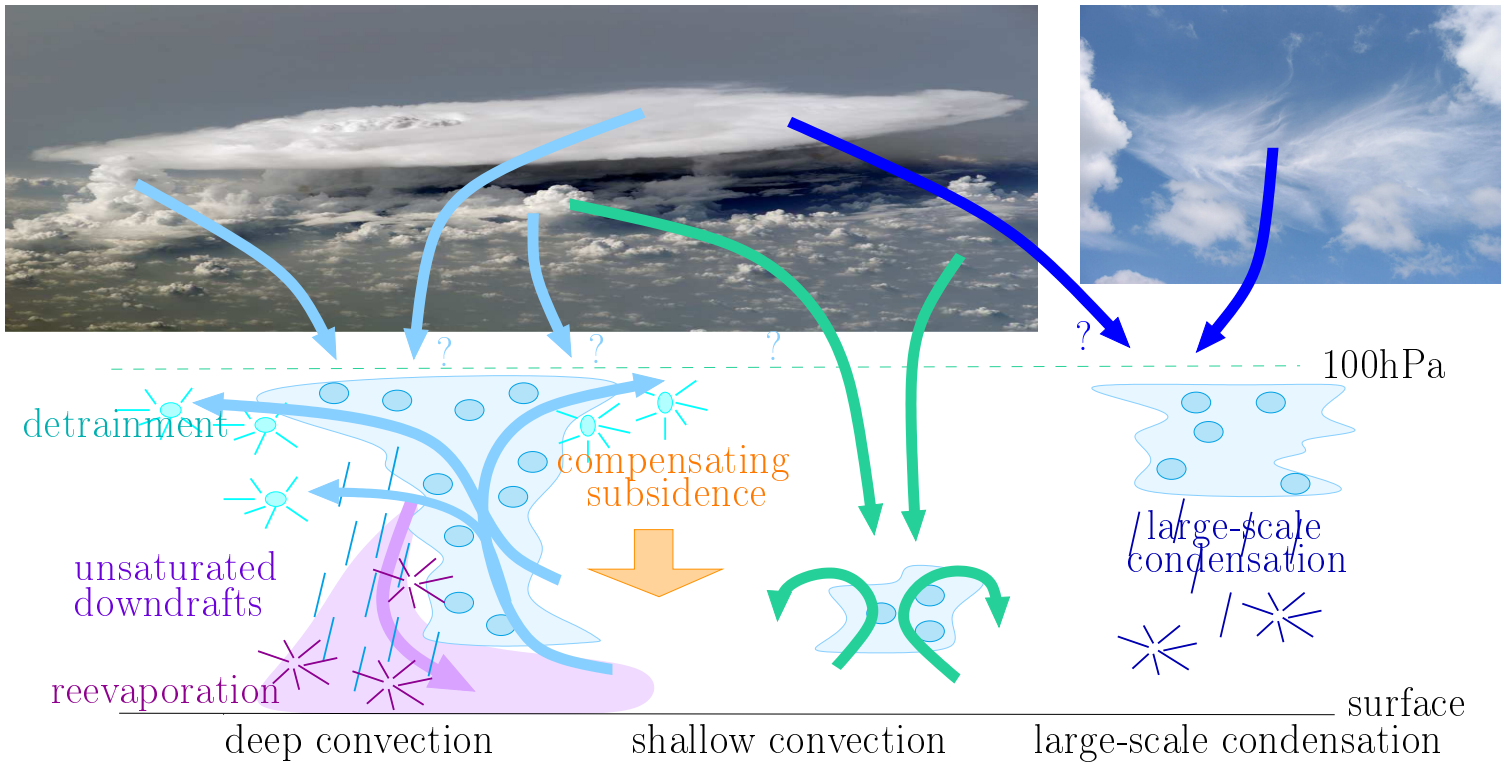
subsidence

rain reevaporation

Convection profonde/condensation LS

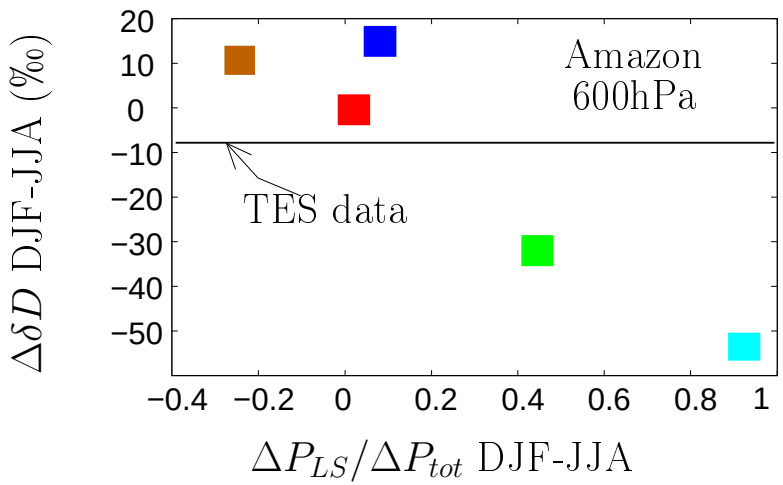


Convection profonde/condensation LS

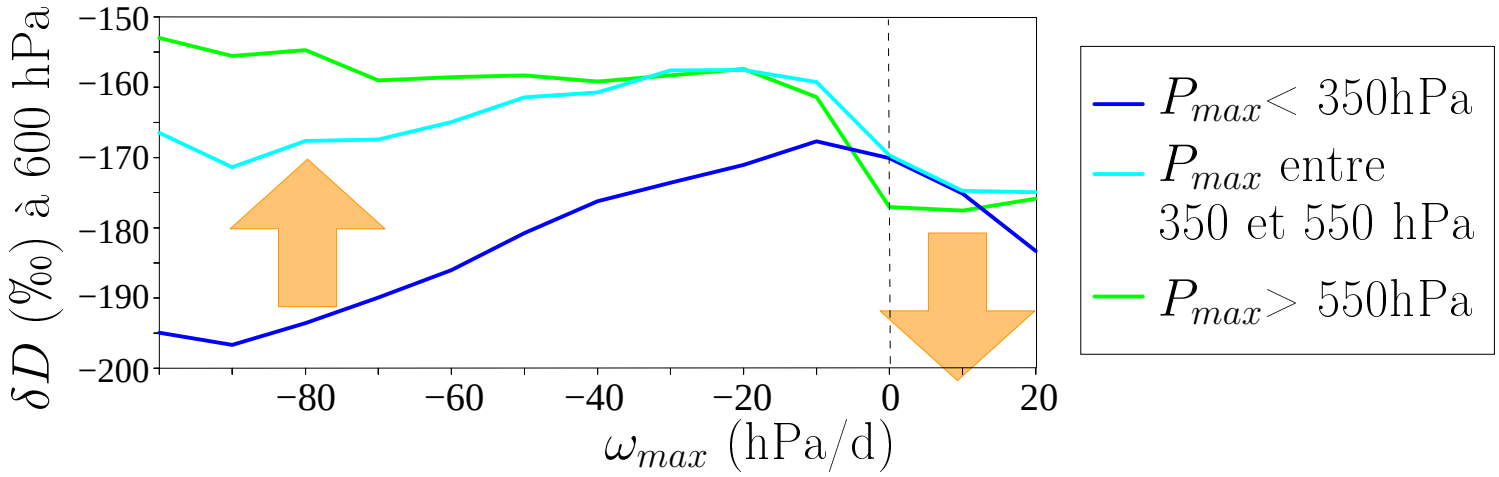


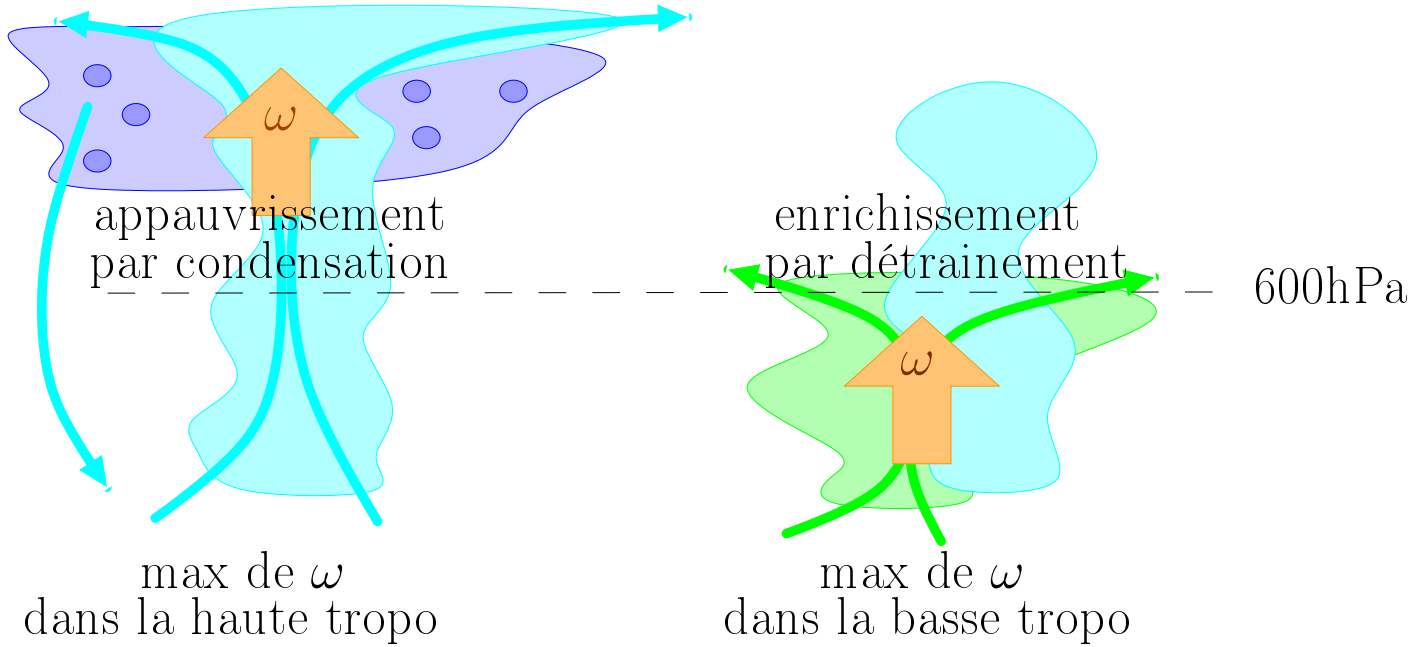
LMDZ sensitivity tests

- control
- vertical advection more diffusive
- stronger condensate detrainment
- less in-situ condensation
- less in-situ precipitation



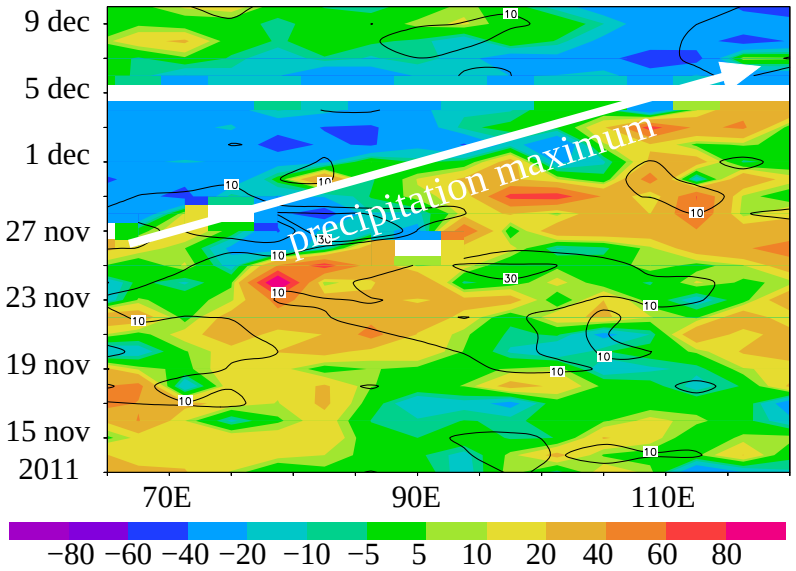
Convection profonde/peu profonde



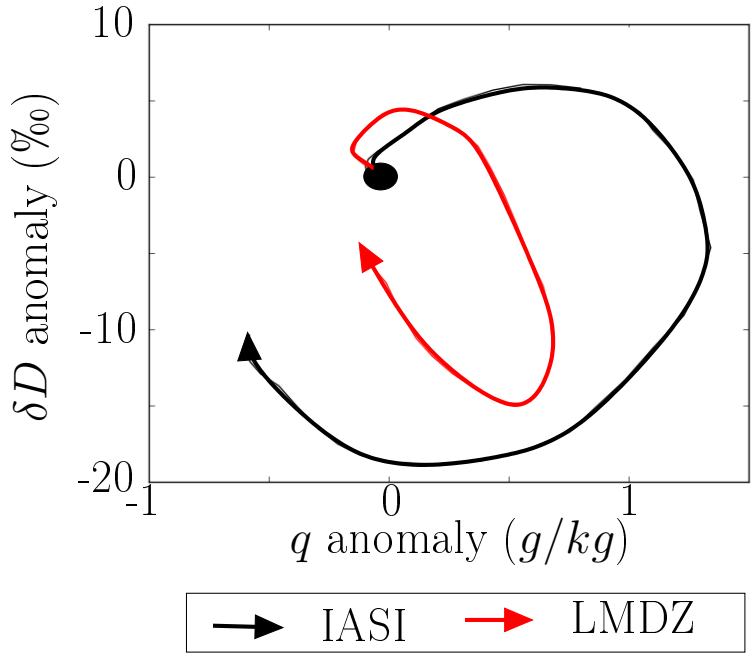


Les isotopes au cours de la MJO

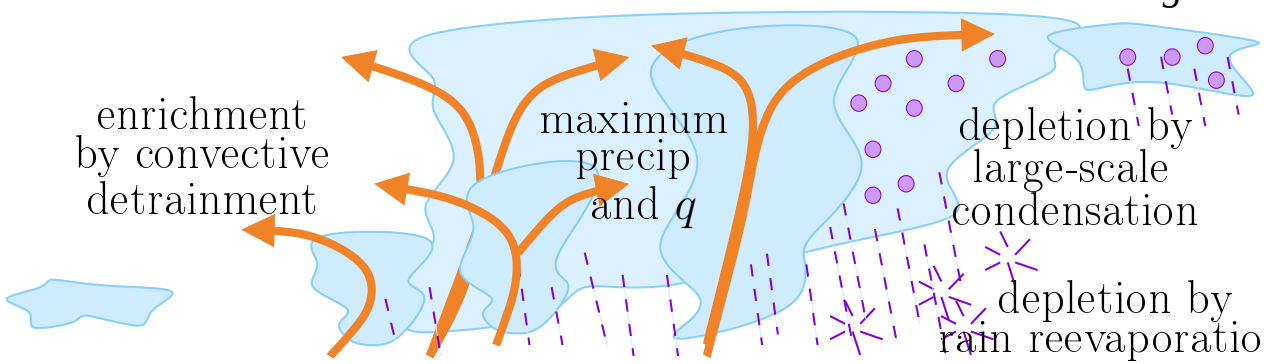
Hoevmuller diagram at 500hPa
during Cindy-Dynamo, observed by IASI



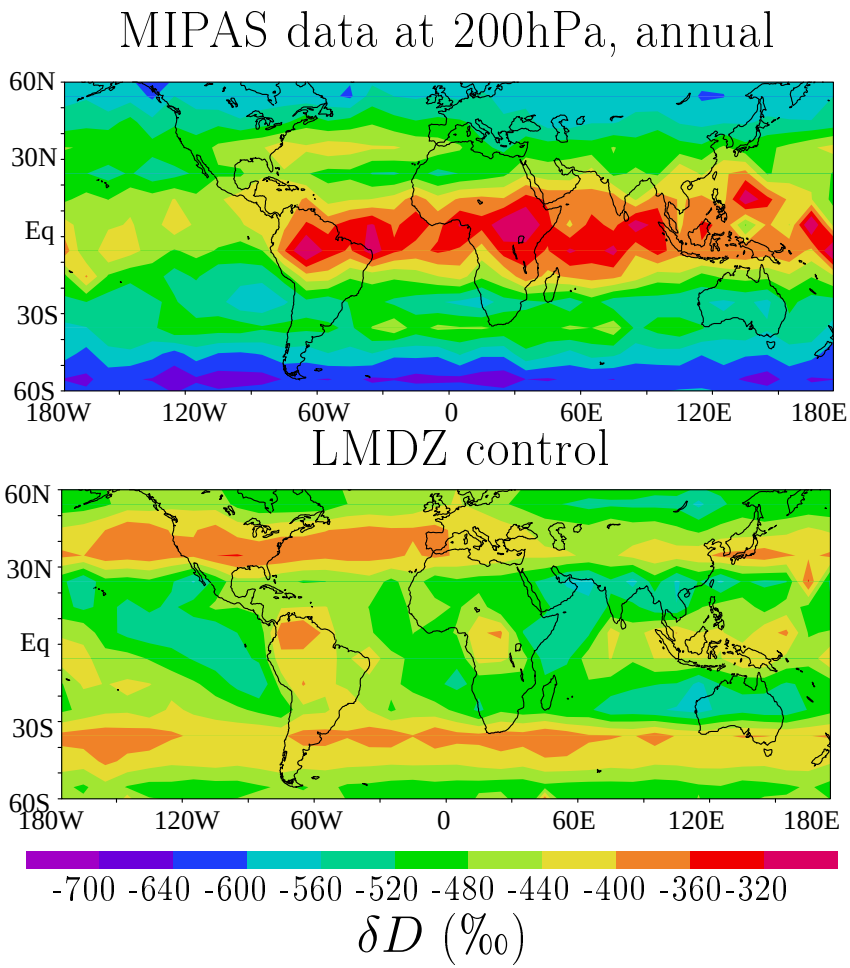
mean $q - \delta D$ cycles at 500hPa
in the Indian Ocean



Tuinenburg et al in prep

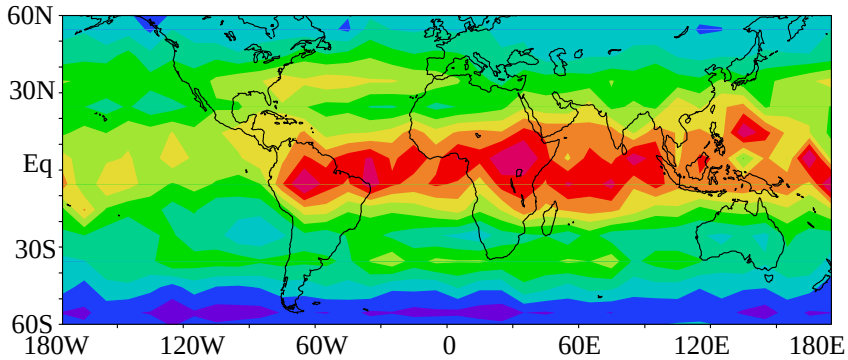


Le détrainement dans le haute troposphère

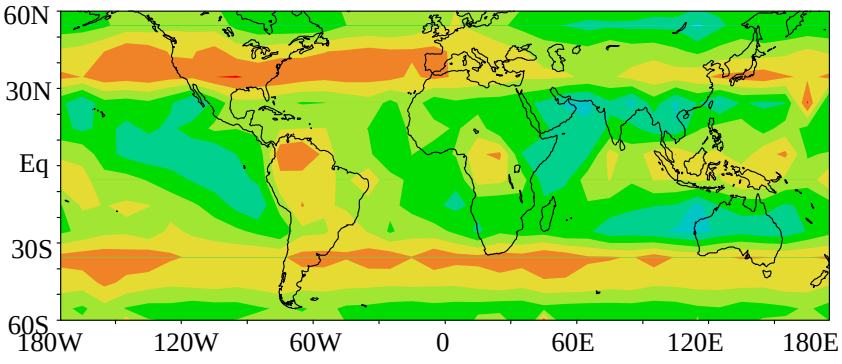


Le détrainement dans le haute troposphère

MIPAS data at 200hPa, annual



LMDZ control



δD (‰)

- control
- vertical advection more diffusive
- stronger condensate detrainment
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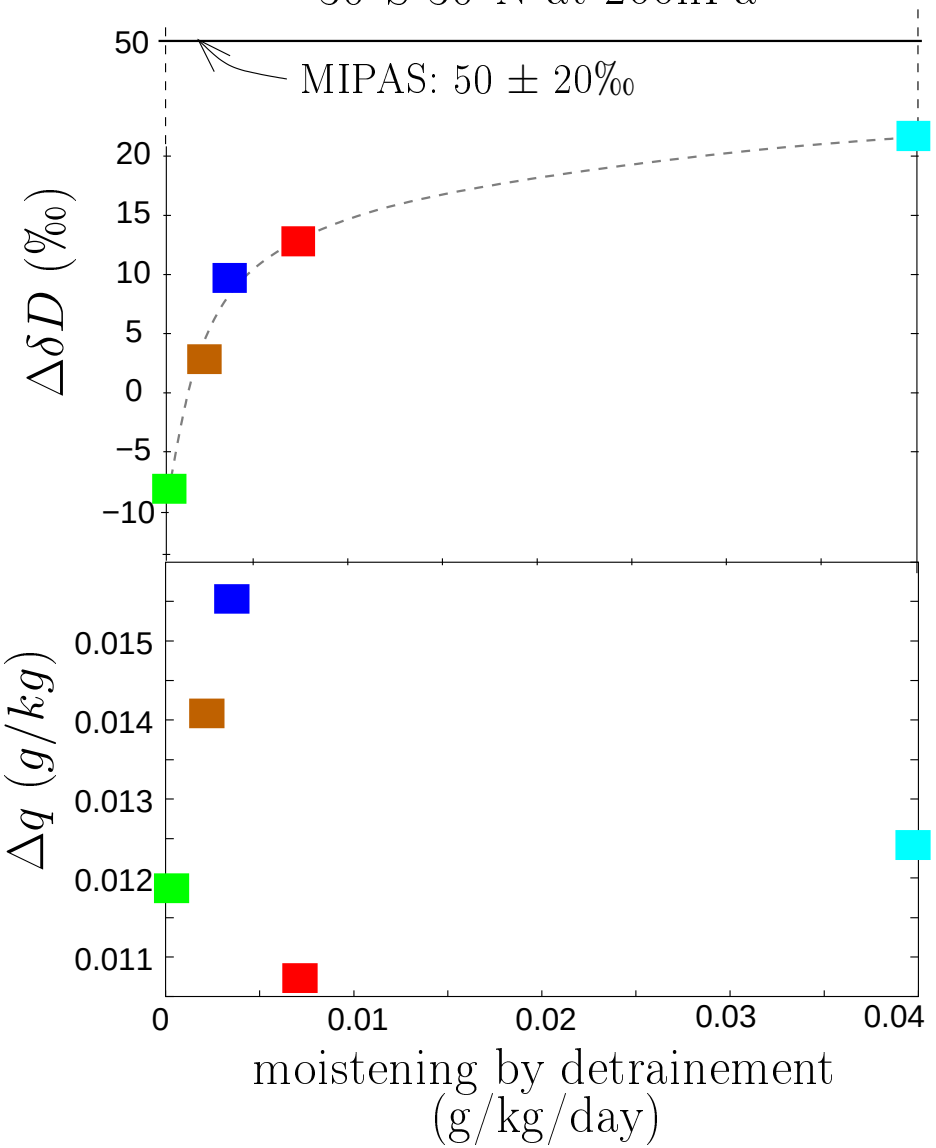
- less in-situ precipitation

Difference 15°S-15°N minus 30°S-30°N at 200hPa



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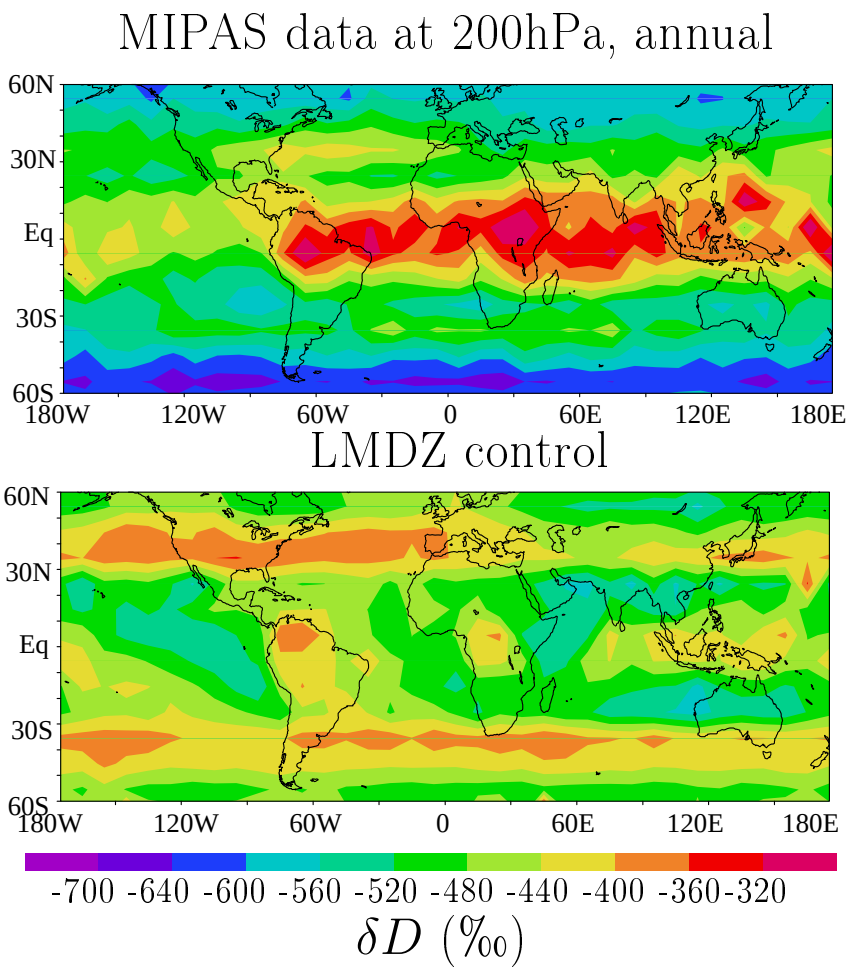
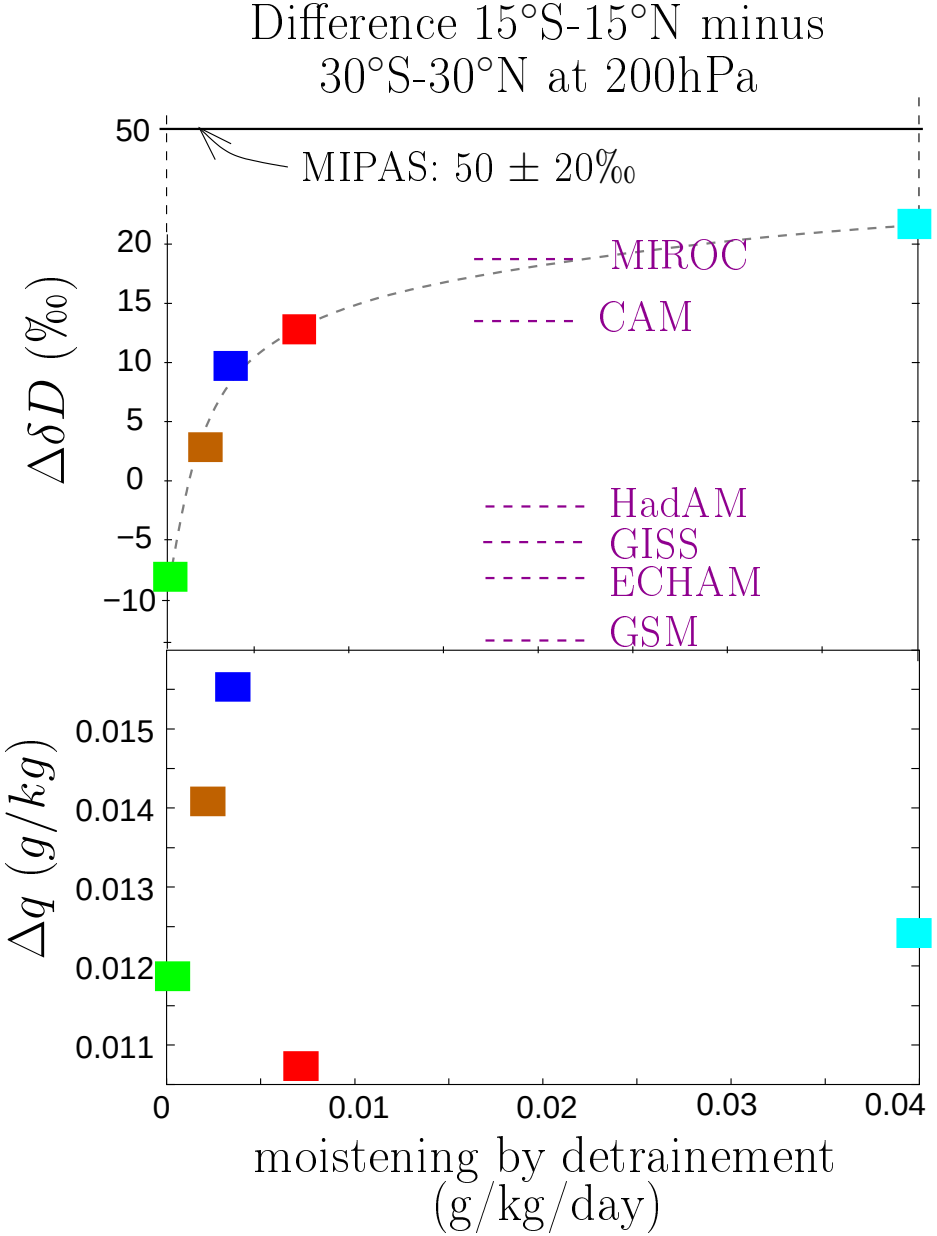




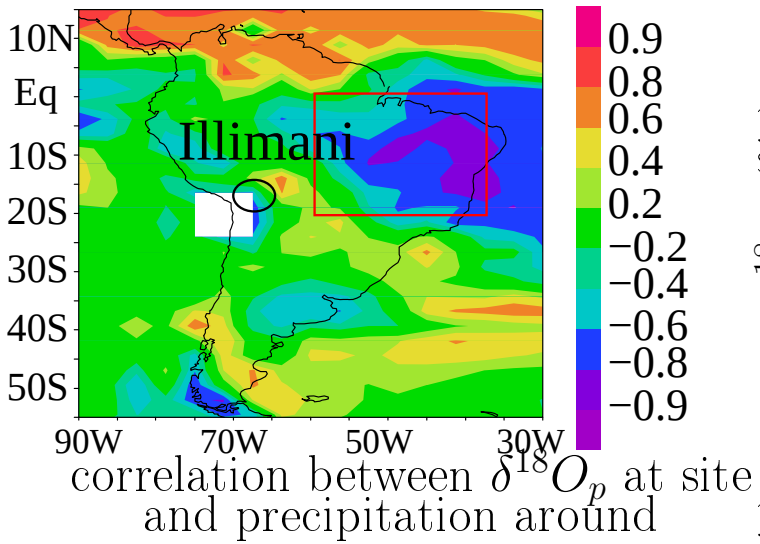
Quelle contribution au développement des prochaines versions d'LMDZ?

- isotopes complexes, encore travail pour comprendre ce que représentent
  $\Longrightarrow$ pas complètement murs pour être utilisés comme contrainte observationnelle en mode "opérationel"
- pistes les plus crédibles pour l'avenir:
  - mesures dans la haute tropo et ϵ_p^{max}, mais ϵ_p^{max} ne résoudra pas tout.
  - partitionnement convection profonde/peu profonde/condensation grande échelle, mais dépend de beaucoup de paramètres.

Annexes

Qu'enregistrent les archives isotopiques?

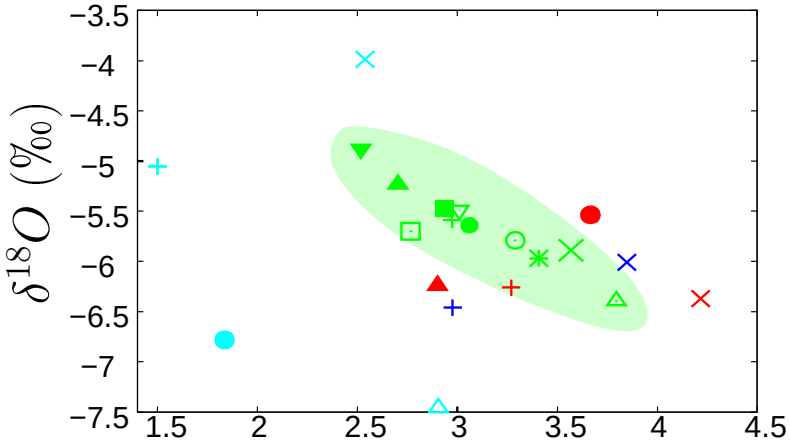
$\delta^{18}O$ enregistre plutôt température ou precip?

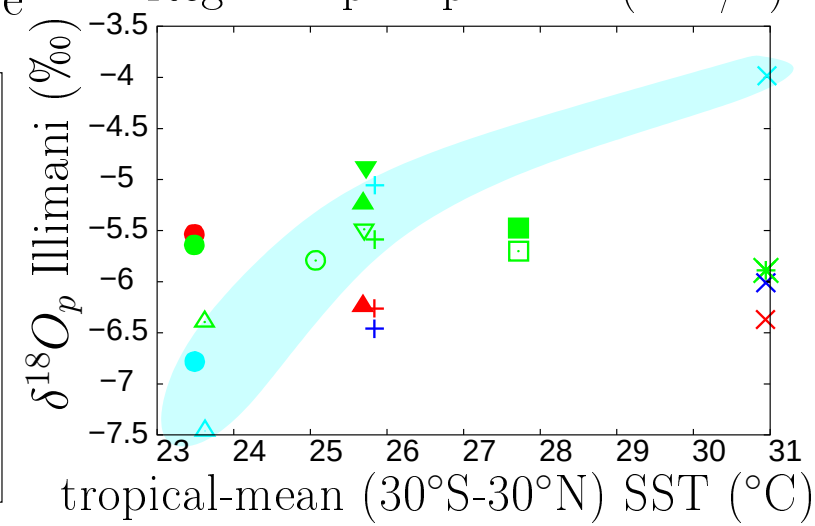


correlation between $\delta^{18}O_p$ at site and precipitation around

Climates:
- present−day
- 4xCO2 IPSL
- 2xCO2 IPSL
- 2xCO2 ECHAM
- 2xCO2 MIROChi
- LGM climap
- LGM IPSL
- LGM IPSL THCoff
- MH IPSL
- Eemien IPSL
- Eemien IPS THC+

Model versions:
- control
- less diffusion
- more detrainment
- less condensation
- 50 km resolution





$\Longrightarrow$ ça dépend de la physique du modèle, à creuser