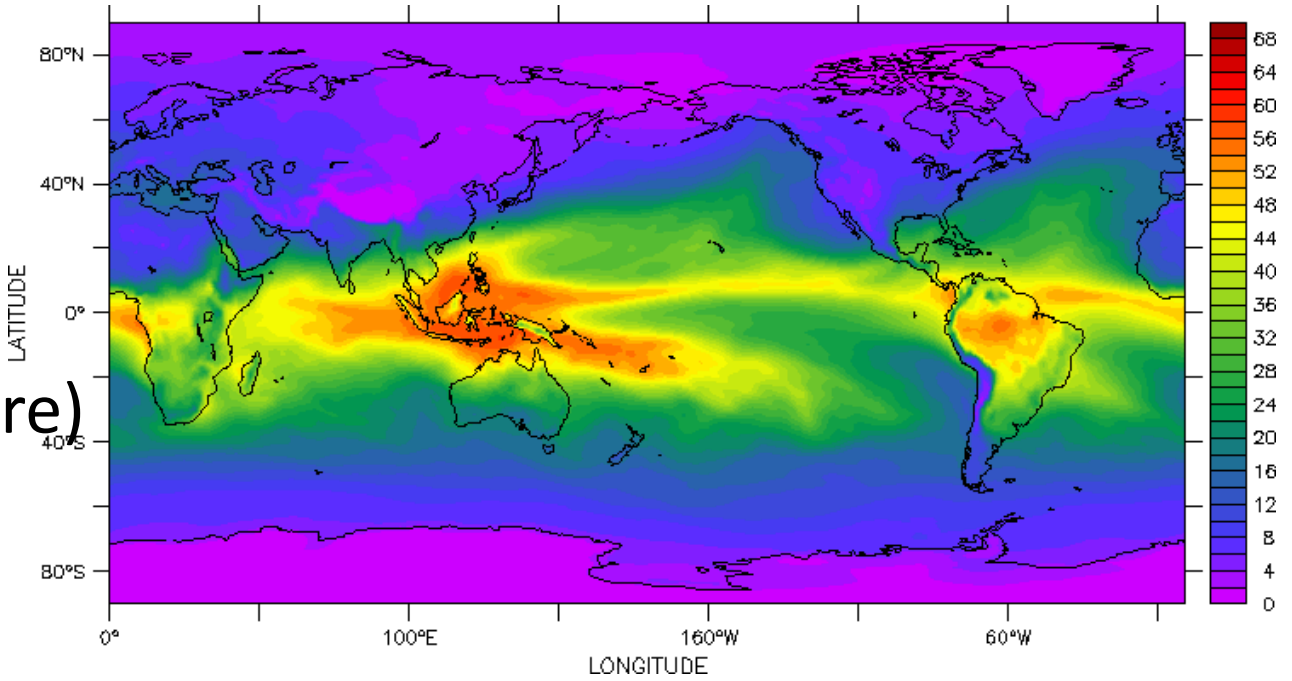
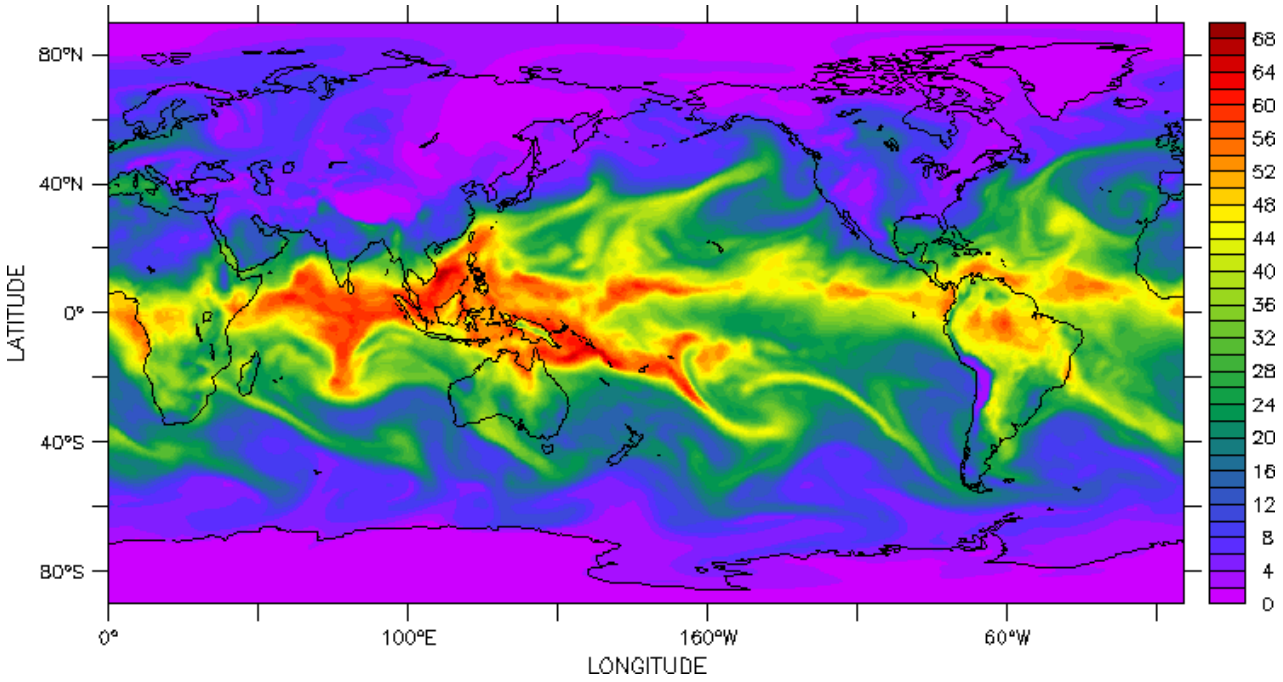
Vapeur d'eau intégrée

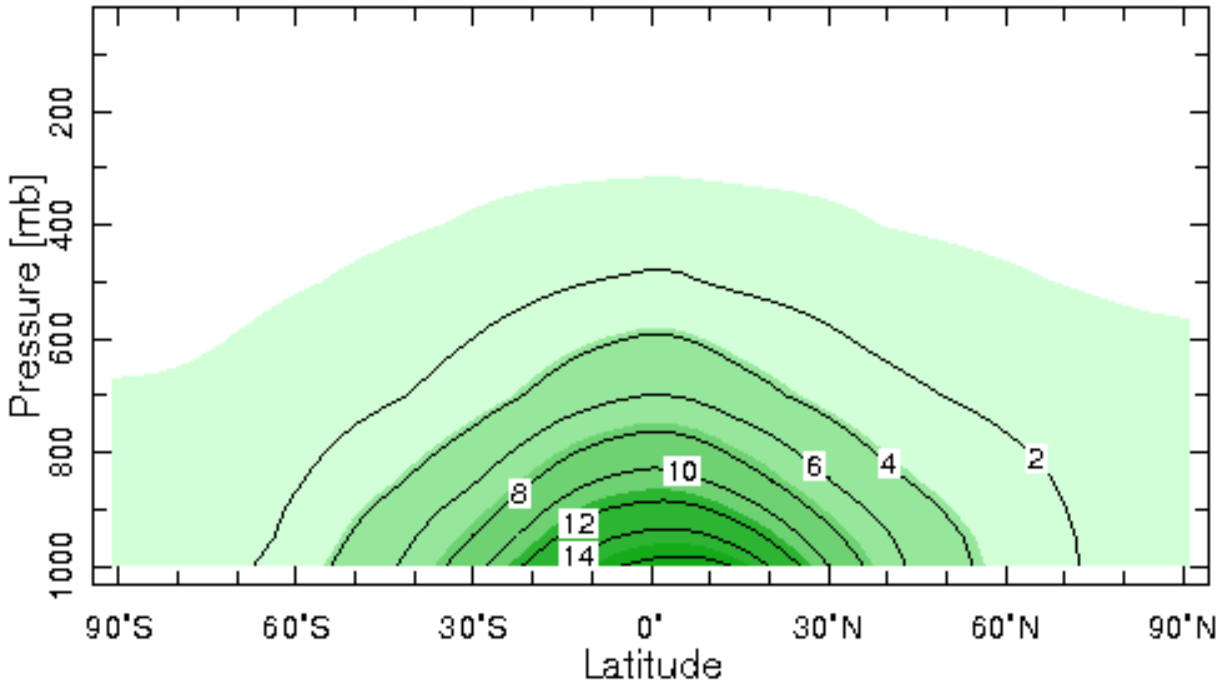
(moyenne décembre)



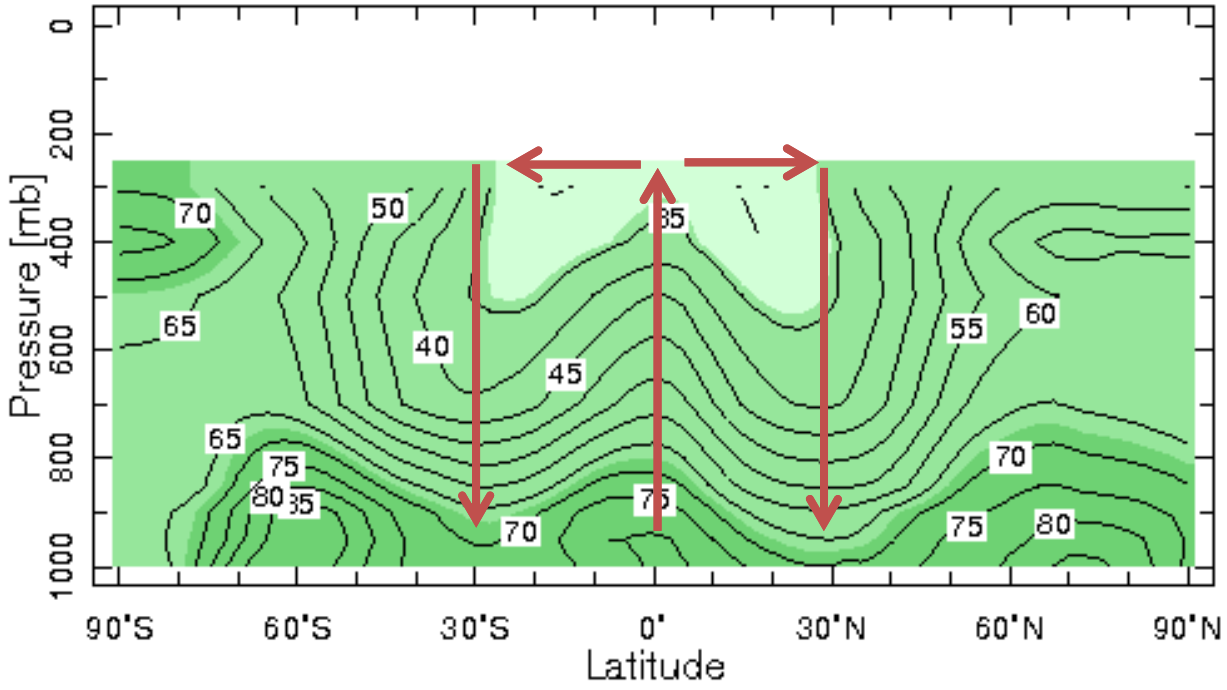
(instantanée)



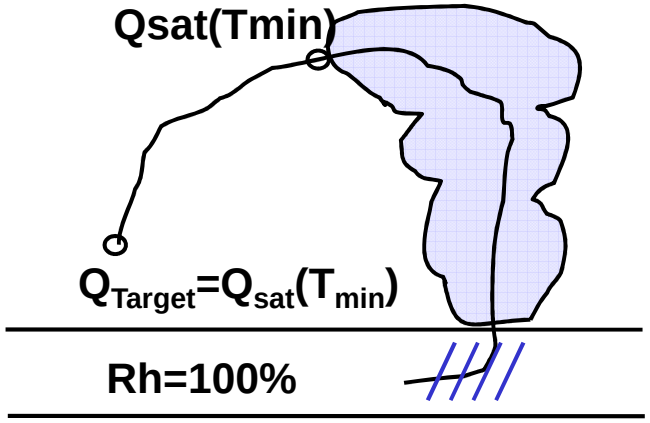
Rapport de mélange
(g / kg)



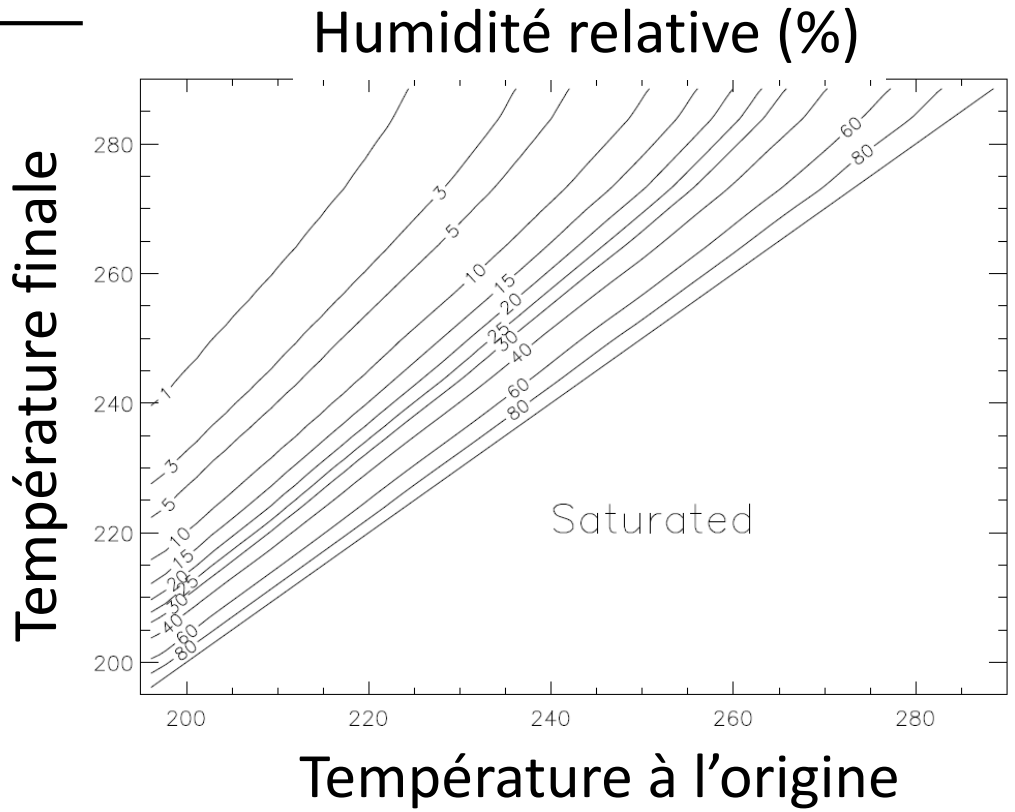
Humidité relative
(%)



Paradigme Advection - Condensation

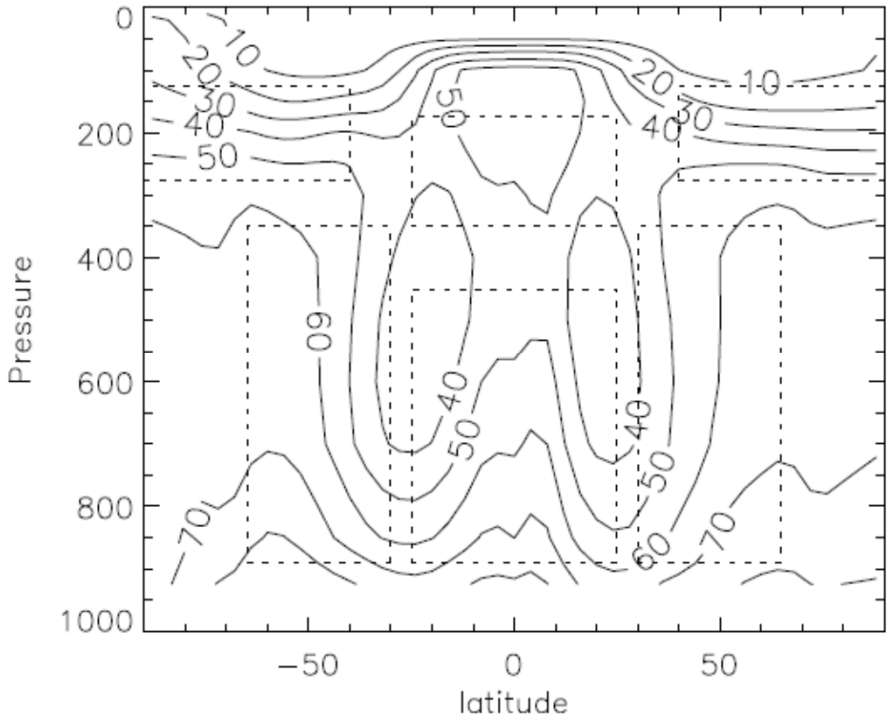


- Source: couche limite de surface
- Puit: sur-saturation précipite
- Rapport de mélange conservé si $T>T_{min}$

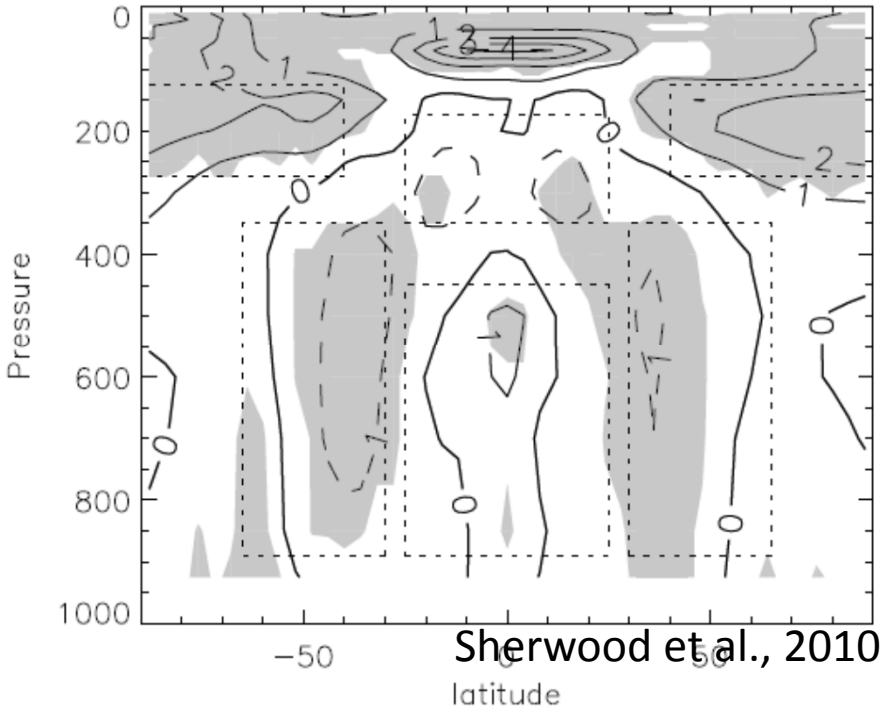


Changement climatique

Climat actuel
Moyenne Rel. Hum
18 modèles AR4



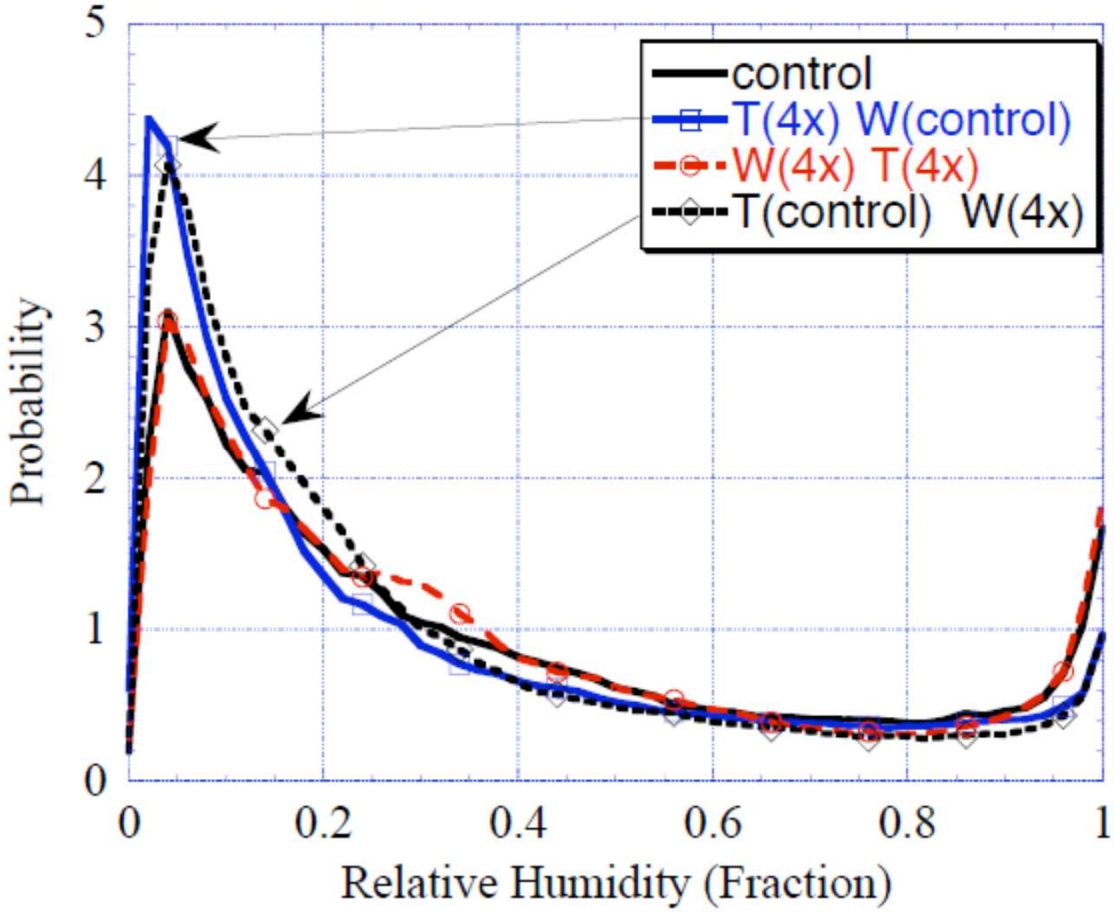
2xCO2
Moyenne Rel Hum
18 modèles AR4



Sherwood et al., 2010b

- Tropopause plus élevée
- Déplacement vers le Nord du minimum zonal
- Assèchement de ce minimum (en RH)

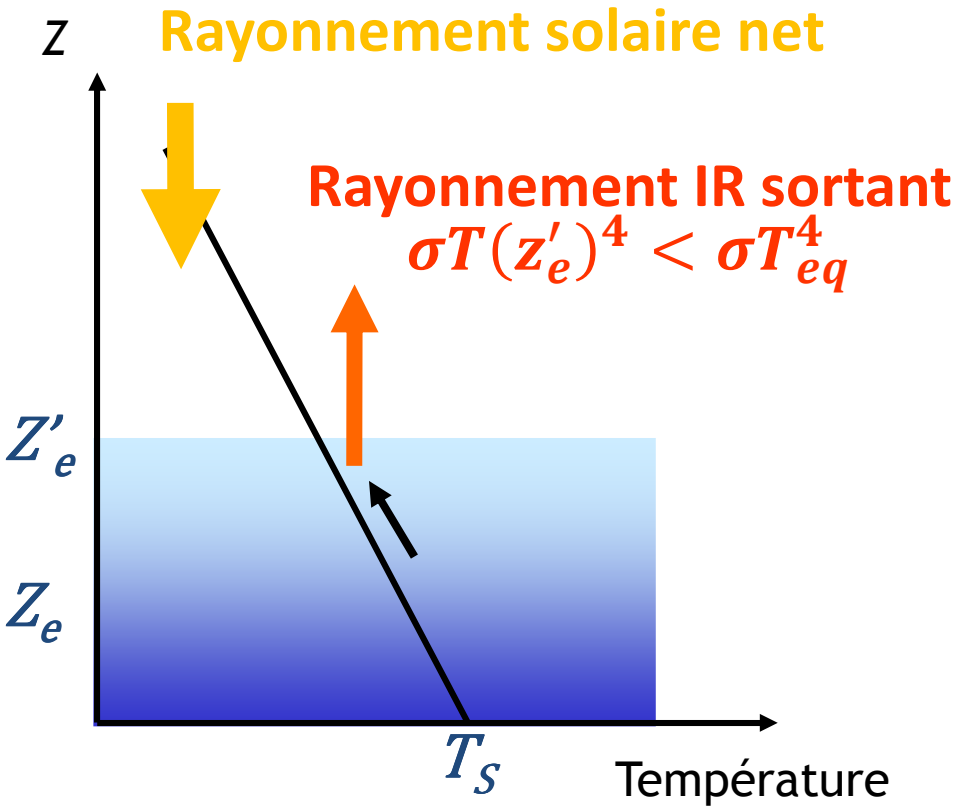
Distribution de l'humidité relative



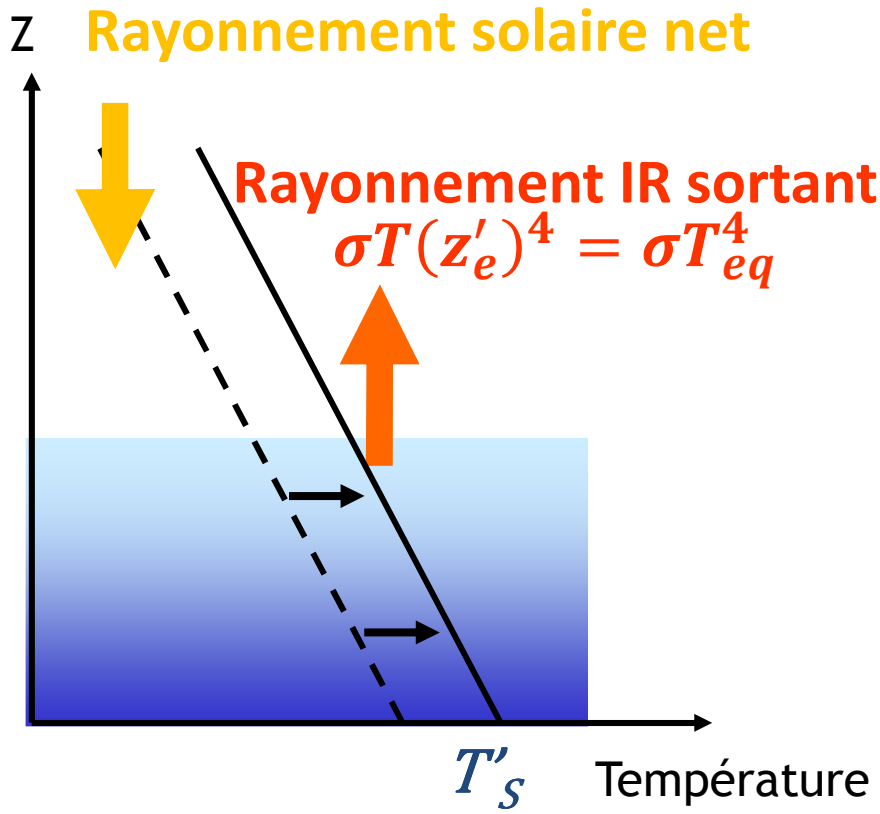
- **Not much change in PDF of RH**
- **Compensating effects : not understood**

Pierrehumbert et al., 2007

Réponse à augmentation de gaz à effet de serre avec humidité ***spécifique*** constante: Altitude d'émission indépendante de T.

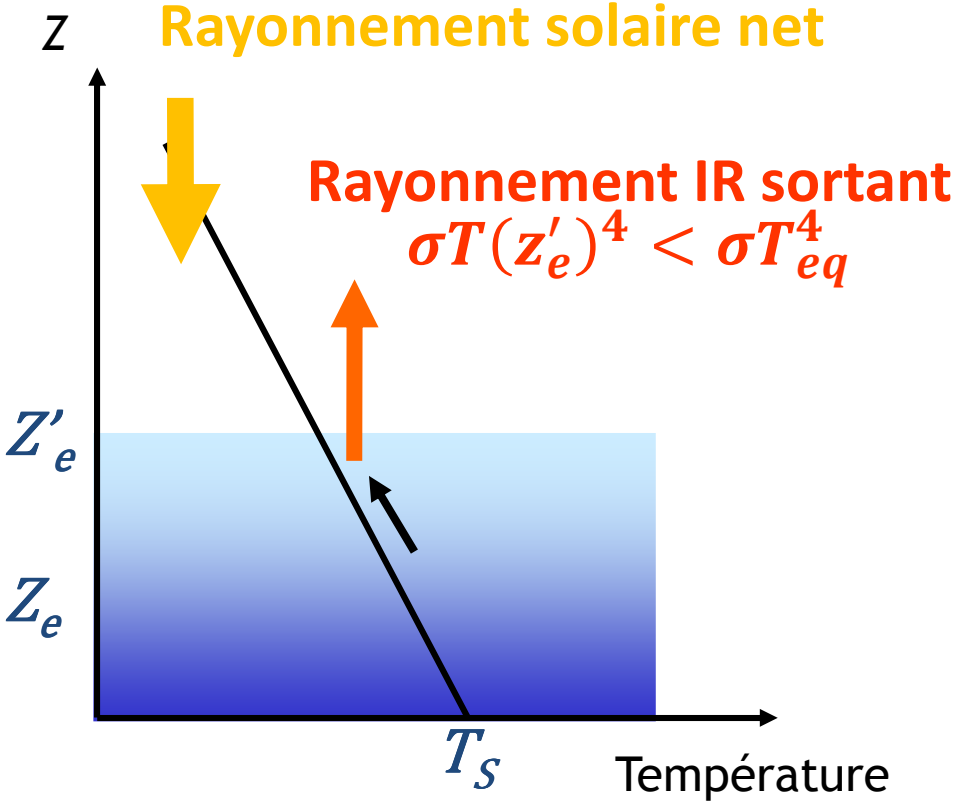


1. $T_{\text{émission}}$ diminue (z_e plus élevée): Rayonnement sortant plus faible.

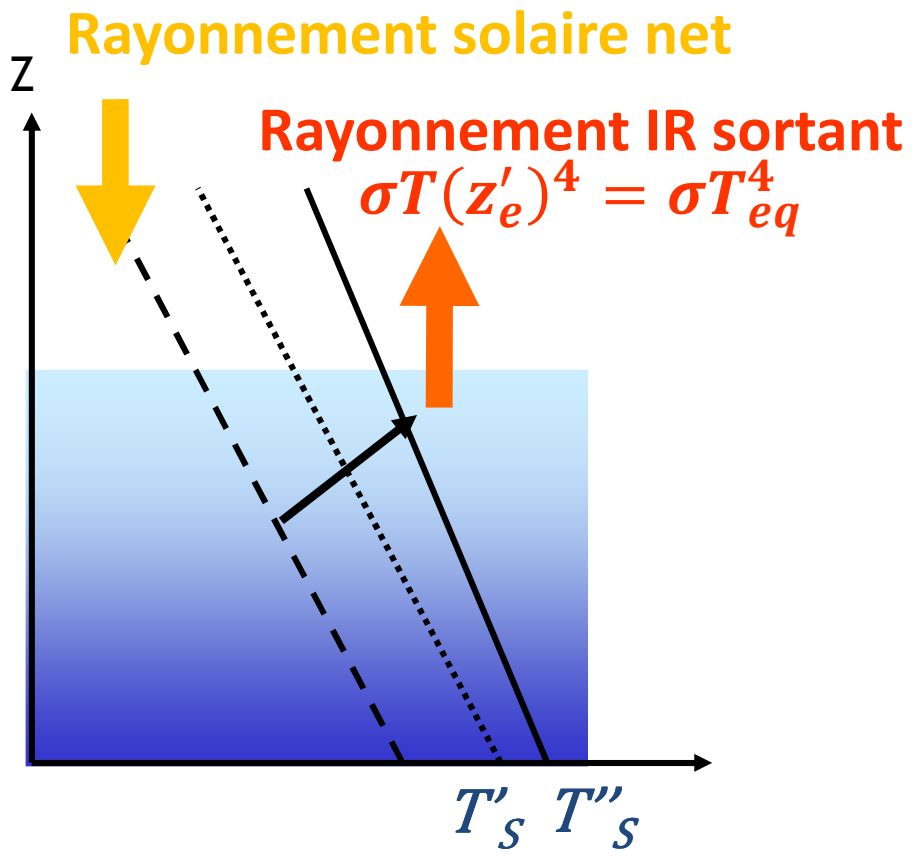


2. $T(z)$ augmente: Retour à l'équilibre

Réponse à augmentation de gaz à effet de serre avec humidité ***relative*** constante: Altitude d'émission augmente avec T+dT/dz augmente.

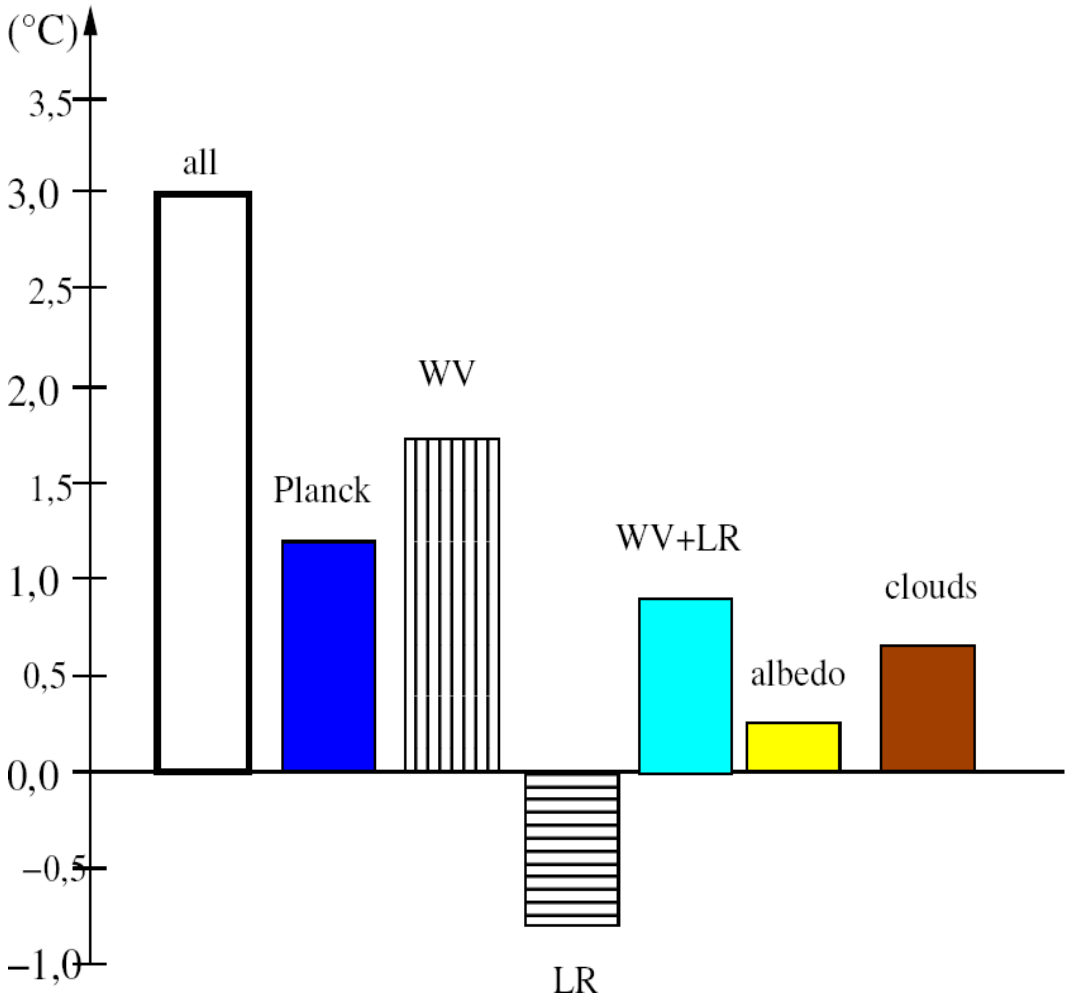


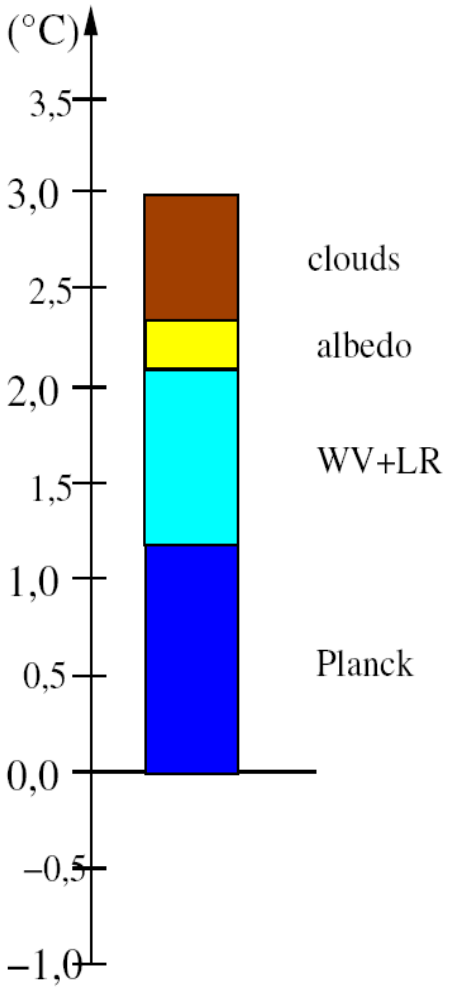
1. $T_{\text{émission}}$ diminue (z_e plus élevée): Rayonnement sortant plus faible.



2. $T(z)$ augmente: Retour à l'équilibre

Equilibrium temperature change decomposition, for 2xCO2

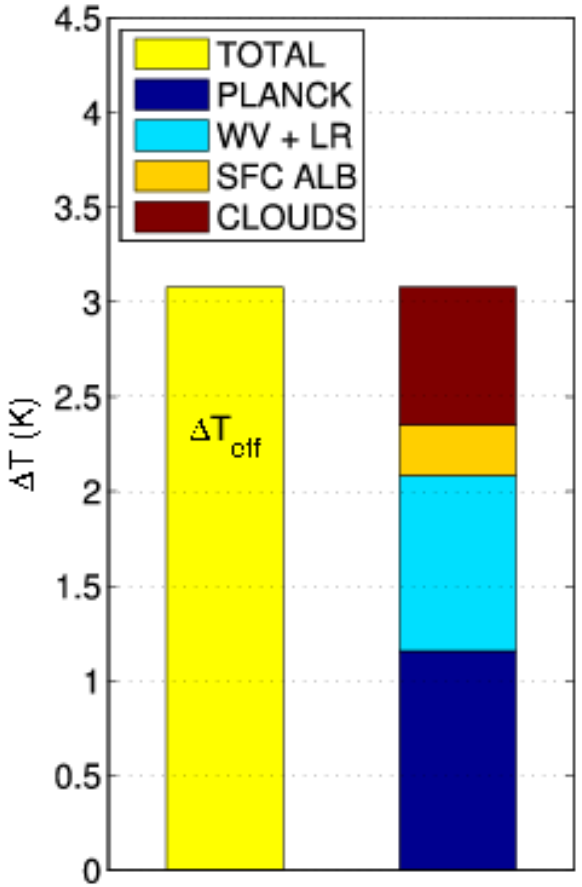




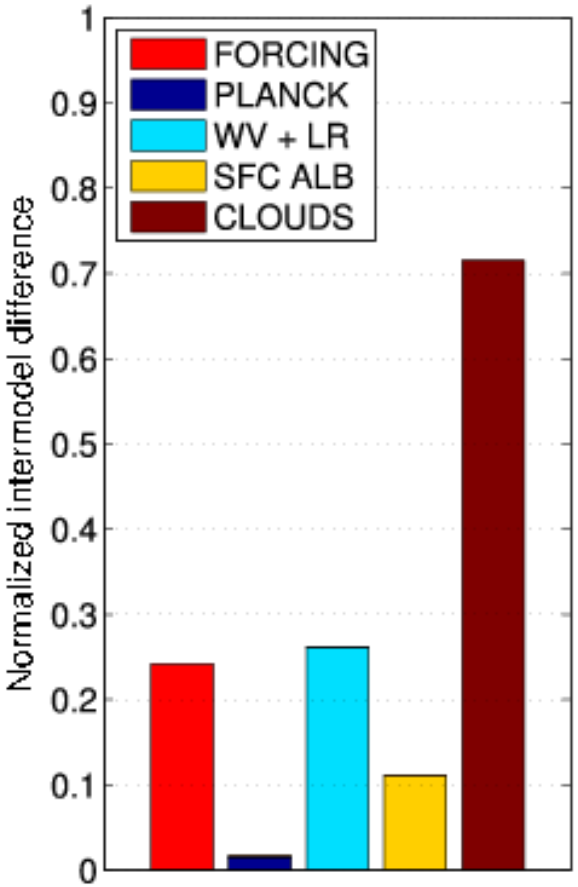
With feedback parameters from (Soden and Held, 2006)

[Dufresne and Bony, 2007]

Decomposition of the effective climate sensitivity simulated by CMIP3/AR4 OAGCMs :



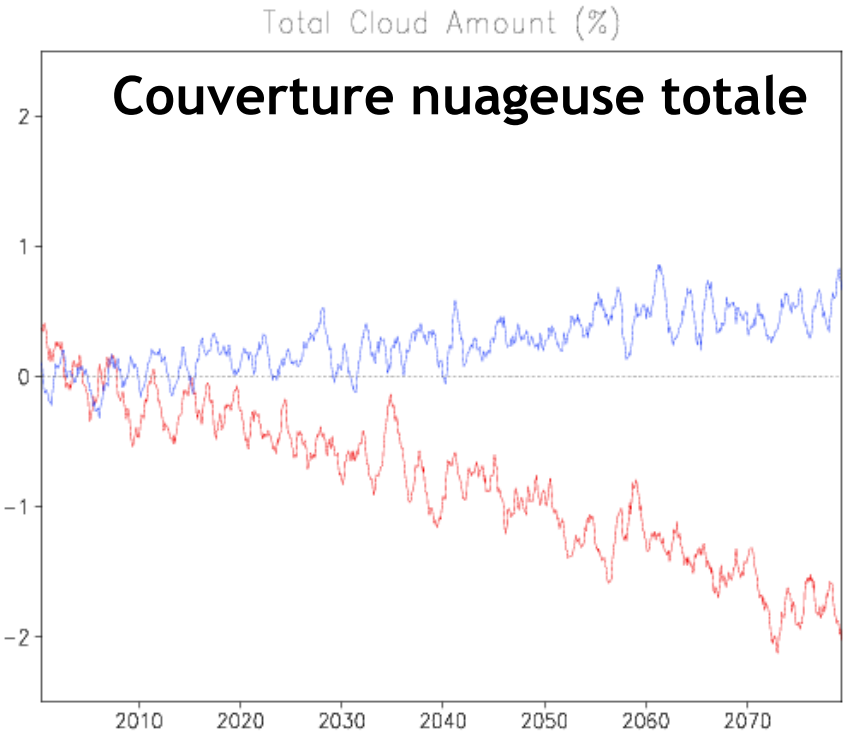
multi-model mean

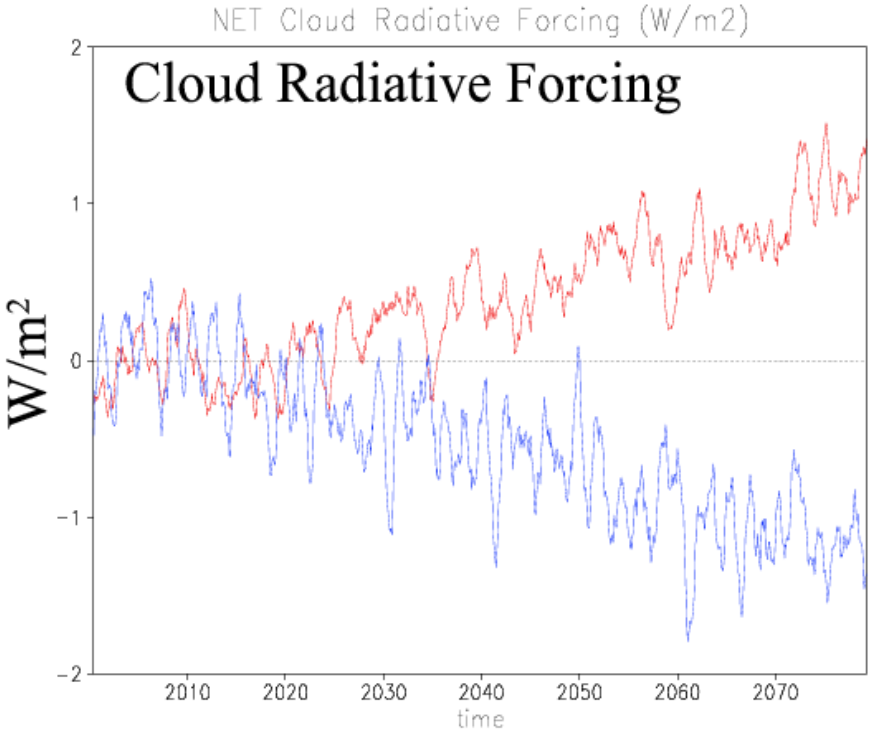


inter-model differences

(standard deviation)

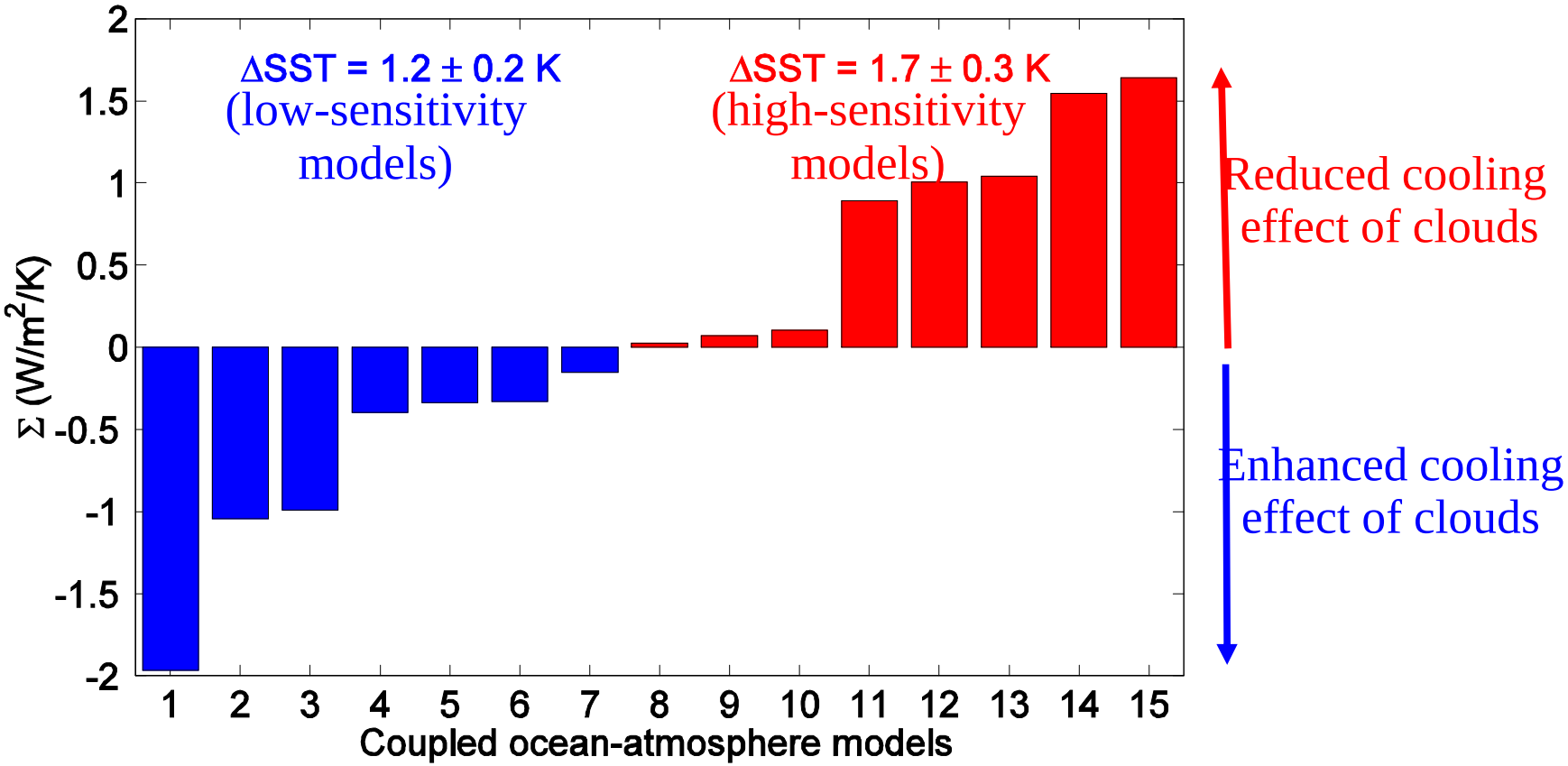
Changements des nuages pour deux modèles de climat…





15 CMIP3/AR4 Coupled Ocean-Atmosphere GCMs
(+1% CO2/year experiments)

Sensitivity of the tropical NET CRF
to surface temperature change ($W/m^2/K$)



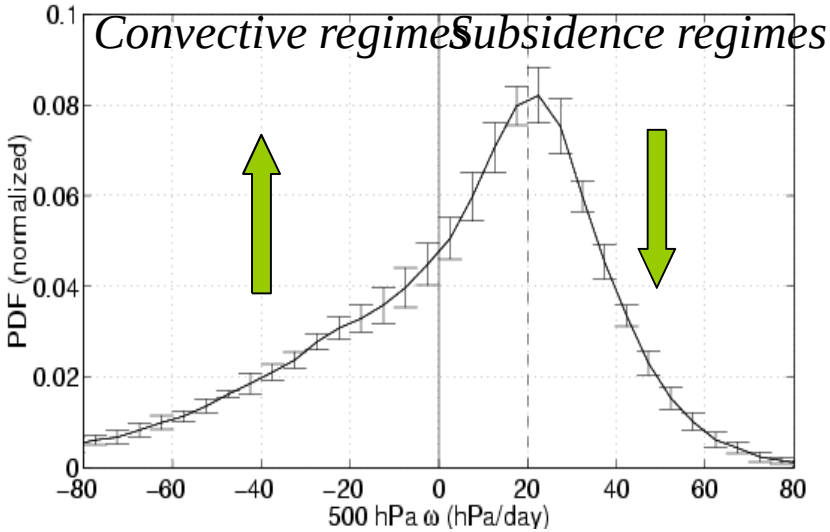
(Bony and Dufresne, GRL, 2005)

Analysis Method

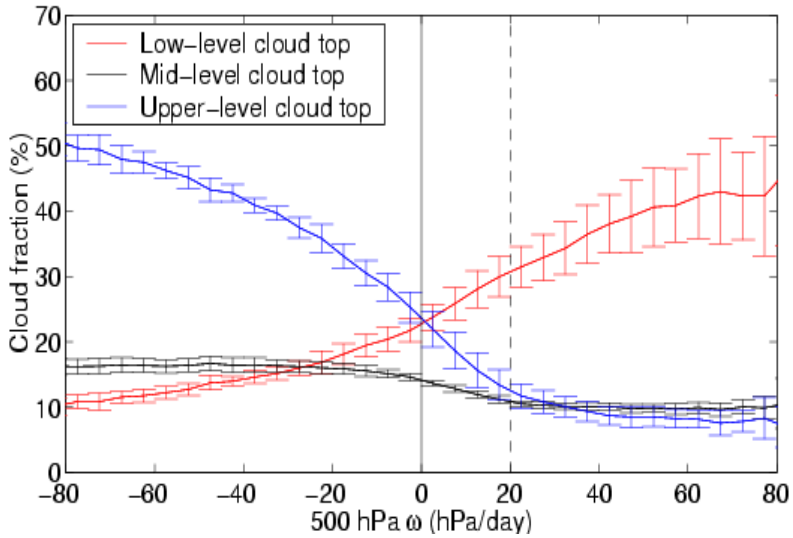
- Proxy ω for large-scale motions: ω_{500hPa}.
- Decomposition of the tropical circulation into dynamical regimes: $\int_{-\infty}^{+\infty} P_\omega \, d\omega = 1$
- Composite of cloud or radiative variables in each dynamical regime: C_ω
- Tropical average: $\overline{C} = \int_{-\infty}^{+\infty} P_\omega \, C_\omega \, d\omega$

(Bony et al., 2004, Bony and Dufresne, 2005)

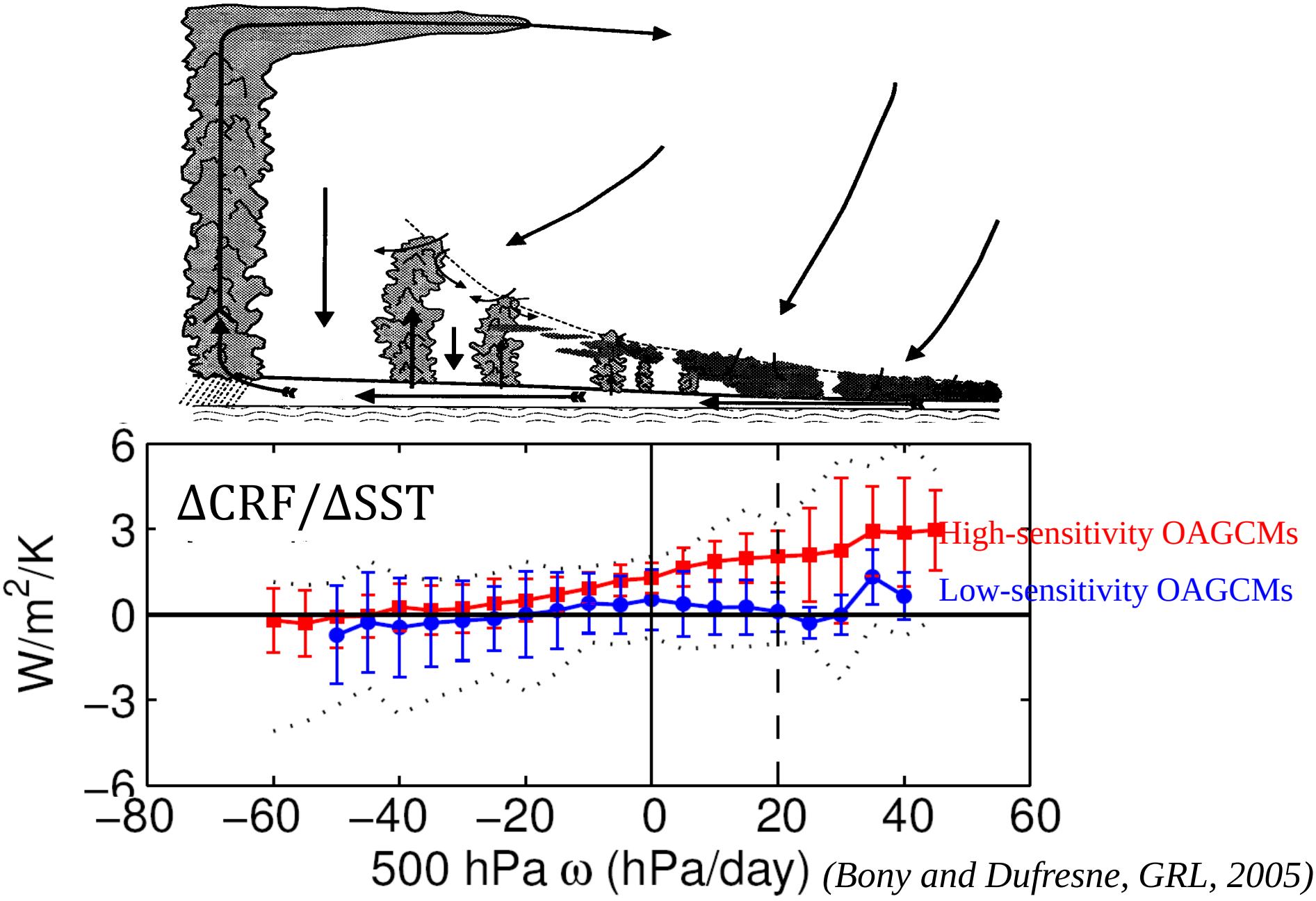
Hadley-Walker circulation as a PDF of 500 hPa ω :



ISCCP Cloud Types sorted by dynamical regimes



Sensitivity of the Tropical Cloud Radiative Forcing to Global Warming



(Bony and Dufresne, GRL, 2005)