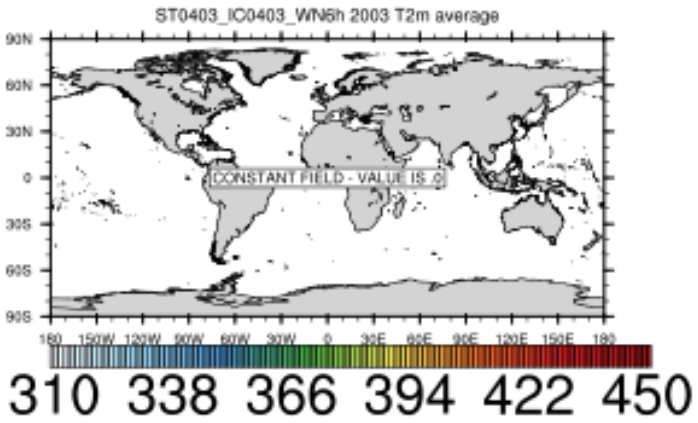
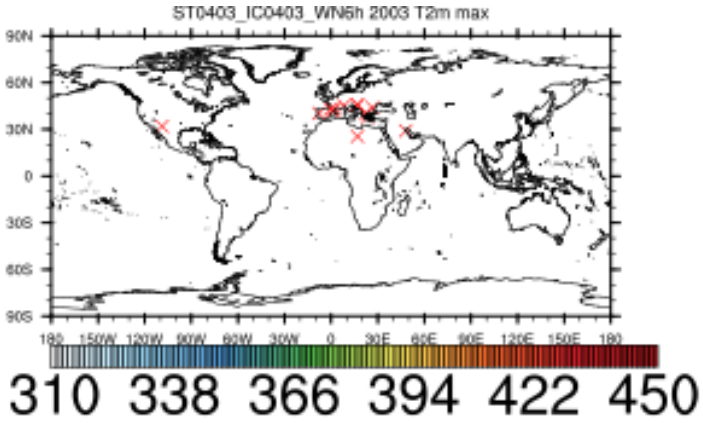
Température et humidité à 2m dans LMDZOR

F.Cheruy, I. Musat , F. Hourdin

Pourquoi cette question?



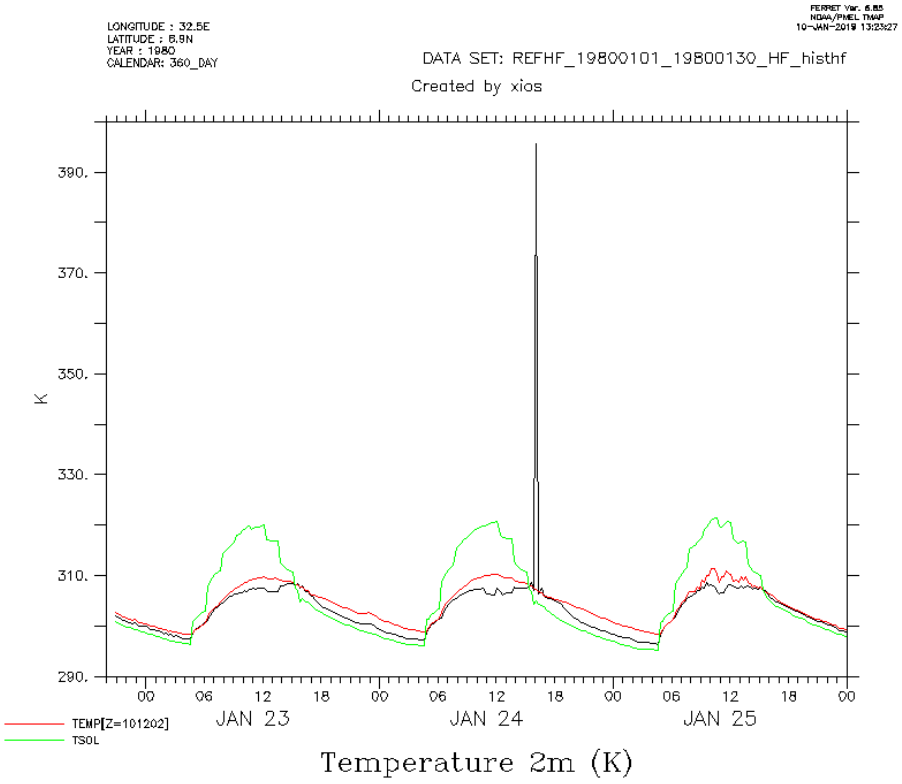
TAS (daily)



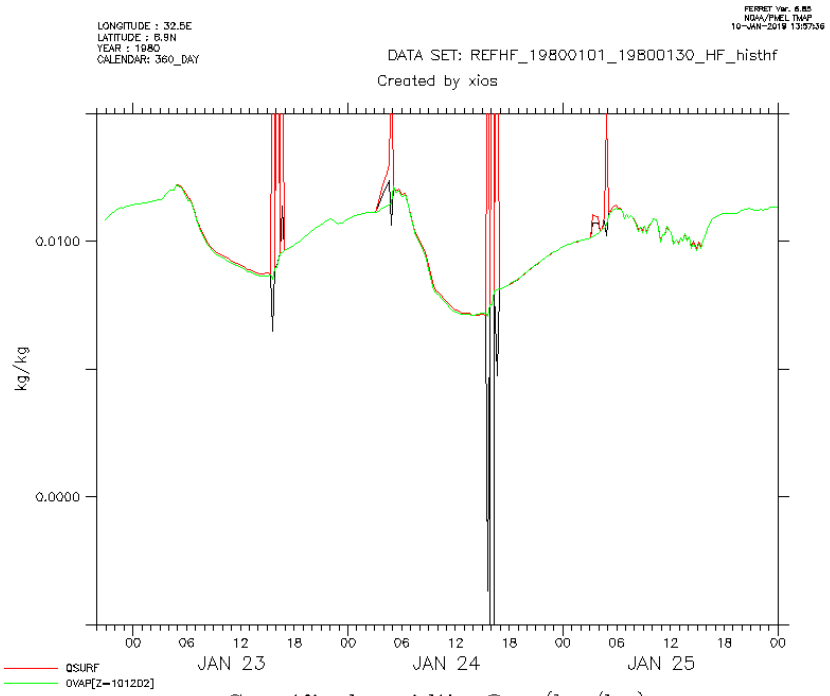
Tasmax
August 2003
nudged

Diagnostique d'évènements extremes (Vagues de chaleur)

Yanfeng Zhao



Temperature 2m (K)



Specific humidity 2m (kg/kg)

- Valeurs interpolées entre le premier niveau du modèle (Env. 10m) et la surface
- Schéma d'interpolation probablement dans d'autres modèles

(vient des premiers AMIP)

- Fondé sur variables star et flux constants dans la couche de surface

first guess- Dyer Businger, LMO- , variables star,

iteration fonction de stabilité Fonction de Ri (Louis)

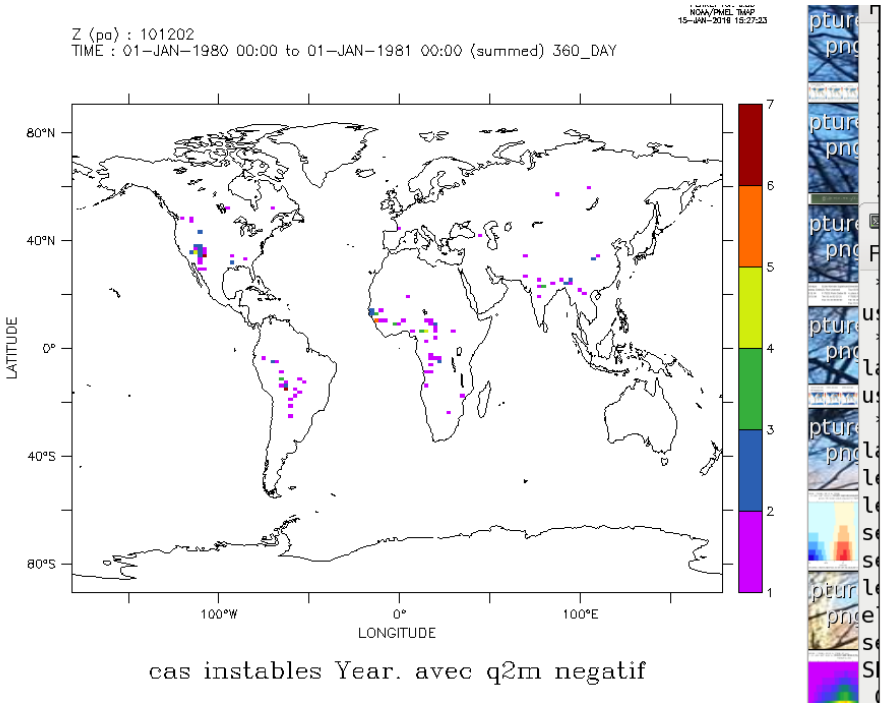
Problemes quand

Vent dans la première couche faible et

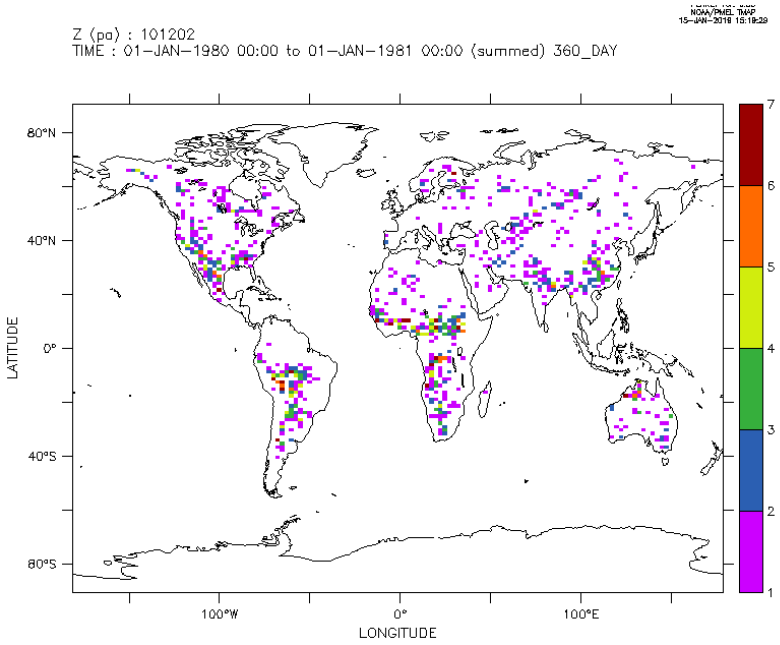
Changement de régime Turbulent (lever du jour, coucher du soleil), Tair > tsurf

atmosphere seche

la première couche de sol a au moins une texture humide



cas instables Year. avec q2m negatif



cas stables Year. avec q2m negatif

About the values interpolated at a reference level near the surface (e.g. 2m)

Principle: Constant flux in the surface layer and similarity laws: Non dimensional vertical gradient of horizontal wind, potential temperature, specific humidity are assumed to be universal function of a stability parameter z/L (L= Monin-Obukhov law) or of the Richardson Number.

$$\frac{kz}{u_*}\frac{\partial u}{\partial z} = \phi_m\left(\frac{z}{L}\right) \quad ; \quad \frac{kz}{\theta_*}\frac{\partial \theta}{\partial z} = \phi_H\left(\frac{z}{L}\right) \quad ; \quad \frac{kz}{q_*}\frac{\partial q}{\partial z} = \phi_\varphi\left(\frac{z}{L}\right)$$

integrating these equations gives

$$\frac{ka}{u_*} = \ln\left(\frac{z}{z_0}\right) - \Psi_M\left(\frac{z}{L}\right) + \Psi_M\left(\frac{z_0}{L}\right)$$

$$\frac{k(\theta-\theta_0)}{\theta_*} = \ln\left(\frac{z}{z_{0H}}\right) - \Psi_H\left(\frac{z}{L}\right) + \Psi_H\left(\frac{z_{0H}}{L}\right)$$

Louis shows that one can use the Richardson (bulk) number instead of the monin obukhov length

$$\frac{ka}{u_*} = \frac{\ln(z/z_0)}{F_M^{1/2}\left(R_i^b, \frac{z}{z_0}\right)}$$

$$\text{II} \quad \frac{k(\theta-\theta_0)}{\theta_*} = \frac{\ln\left(\frac{z}{z_0}\right)}{F_H\left(R_i^b, \frac{z}{z_0}\right)} F_M^{1/2}\left(R_i^b, \frac{z}{z_0}\right)$$

Simplification du schéma (supprime les variables star, sauf peut-etre firstguess)

Louis shows that one can use the Richardson (bulk) number instead of the monin obukhov length

$$\frac{k\,u}{u_*} = \frac{\ln(z/z_0)}{F_M^{1/2}\left(R_i^b, \frac{z}{z_0}\right)}$$

II
$$\frac{k(\theta-\theta_0)}{\theta_*} = \frac{\ln\left(\frac{z}{z_0}\right)}{F_H\left(R_i^b, \frac{z}{z_0}\right)} F_M^{1/2}\left(R_i^b, \frac{z}{z_0}\right)$$

if on writes II for 2 levels (first atm. level and reference level)

$$\frac{\theta_{ref}-\theta_0}{\theta_1+\theta_0} = \frac{\ln\left(\frac{z_{ref}}{z_0}\right)}{\ln\left(\frac{z_1}{z_0}\right)} \cdot \frac{F_M^{1/2}\left(R_i^{ref}, \frac{z_{ref}}{z_0}\right)}{F_M^{1/2}\left(R_i^1, \frac{z_1}{z_0}\right)} \cdot \frac{F_H\left(R_i^1, \frac{z_1}{z_0}\right)}{F_H\left(R_i^{ref}, \frac{z_{ref}}{z_0}\right)}$$

$\theta_0 = T_s$

→ evaluate $\theta_{ref} = f(\theta_0, \theta_1, \text{stability}, z_1, z_{ref}) R_i^1, R_i^{ref})$

$$\frac{q_{ref}+q_0}{q_1-q_0} = \frac{\ln\left(\frac{z_{ref}}{z_0}\right)}{\ln\left(\frac{z_1}{z_0}\right)} \cdot \frac{F_M^{1/2}\left(R_i^{ref}, \frac{z_{ref}}{z_0}\right)}{F_M^{1/2}\left(R_i^1, \frac{z_0}{z_0}\right)} \cdot \frac{F_H\left(R_i^1, \frac{z_1}{z_0}\right)}{F_H\left(R_i^{ref}, \frac{z_{ref}}{z_0}\right)}$$

$$u_* = u_1 \sqrt{C_{D1}} = u_{ref} \sqrt{C_{Dref}} \Rightarrow u_{ref} = u_1 \frac{\sqrt{C_{D1}}}{\sqrt{C_{Dref}}}$$

$$C_{H1} (\theta_1 - \theta_s) u_1 = C_{Href} (\theta_{ref} - \theta_s) u_{ref}$$

$$\theta_{ref} = \theta_1 + (1-\alpha) \theta_s$$

$$\alpha = \frac{C_{H1}}{C_{Href}} \cdot \frac{\sqrt{C_{Dref}}}{\sqrt{C_{D1}}}$$

$$C_D = f(z_0, R_i)$$

$$C_H = f(z_0, z_{0h}, R_i)$$

$$q_{ref} = q_1 + (1-\alpha) q_{surf}$$

$$q_{surf} = (1-\beta) q_1 + \beta q_{sat}(T_s) \quad \left[\beta = \frac{E}{E_{pot}} \right]$$

$$q_{ref} = q_1 + (1-\alpha)\, q_{surf}$$

$$q_{surf} = (1-\beta)\, q_1 + \beta\, q_{sat}(T_s)$$

$$\beta = \frac{E_{pot}}{E_{pot}}$$

$$\beta \propto \frac{h_{am\,rel}}{(1 + u_1 C_{H_1} (r_{reg} + r_{struct}))}$$

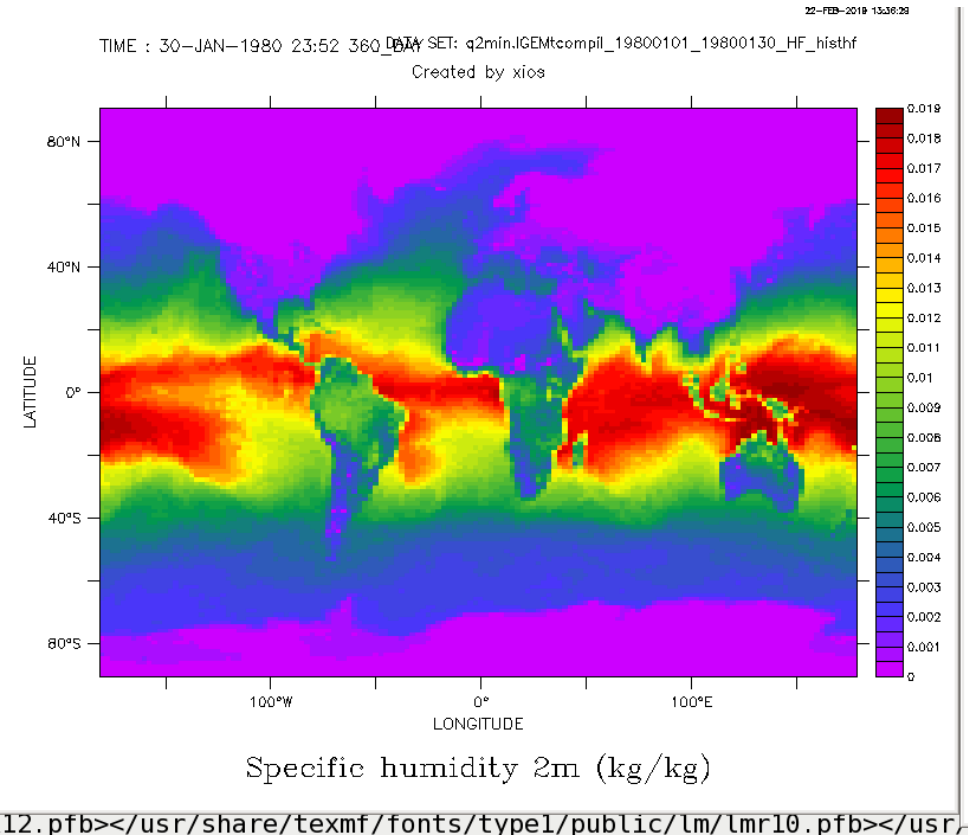
β_{max} car $u_1 C_{H_1} \longrightarrow 0$

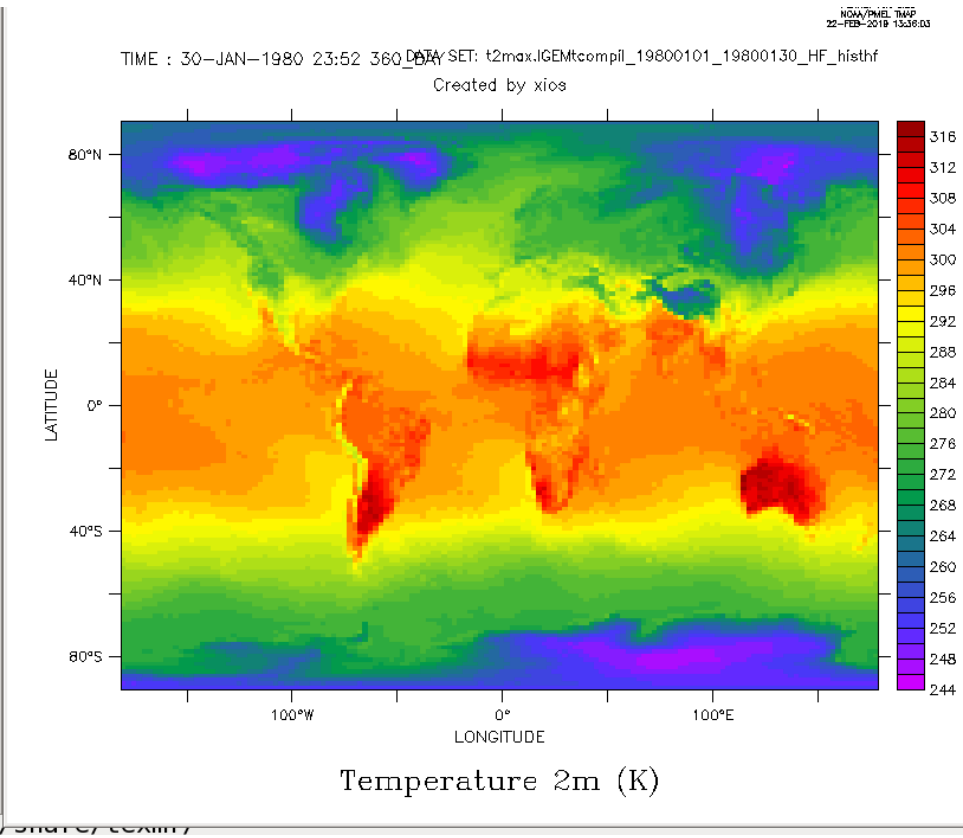
$(r_{aero}\ \alpha)$

mais $E_{pot} = E = 0$.

Une solution borner le vent pour le calcul du drag pour les diagnostiques

speed=max(speed,1)



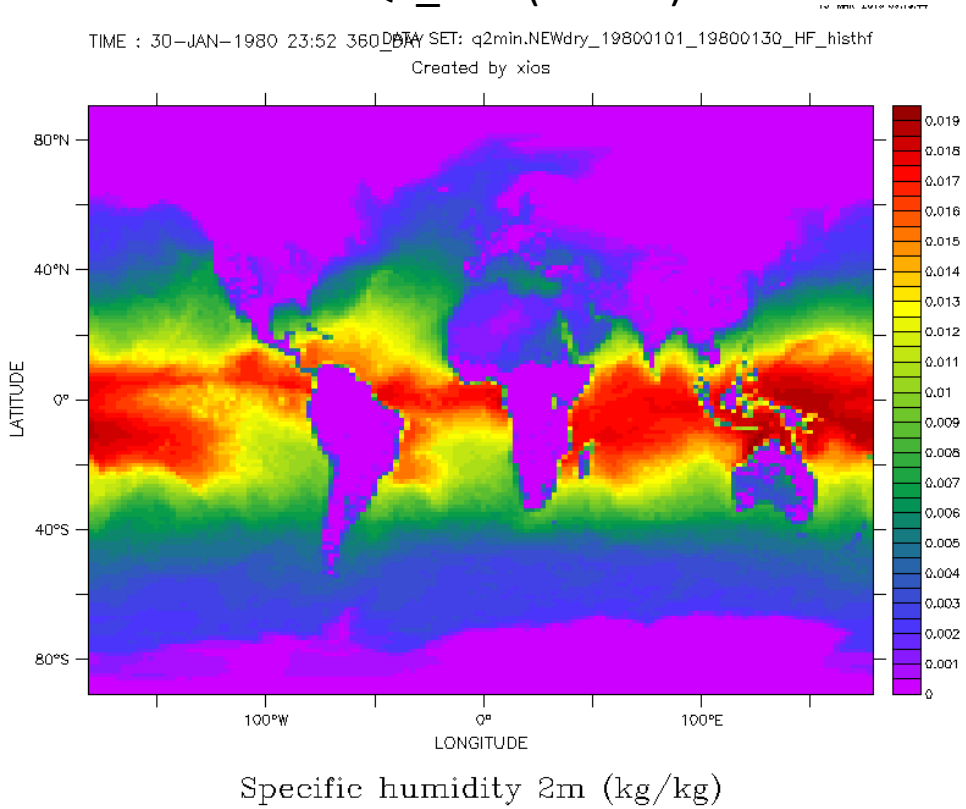


12.pfb></usr/share/texmf/fonts/type1/public/lm/lmr10.pfb></usr/share/texmf/

Q2m_min

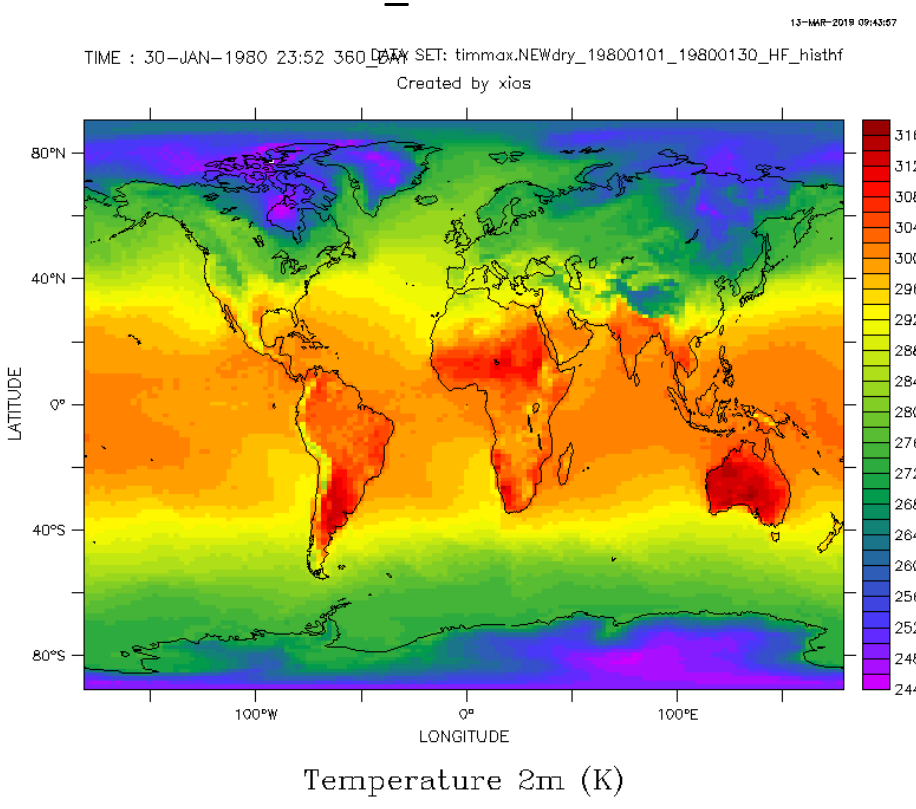
T2m_max

Q2_min (1 mois)



Specific humidity 2m (kg/kg)

T2m_max

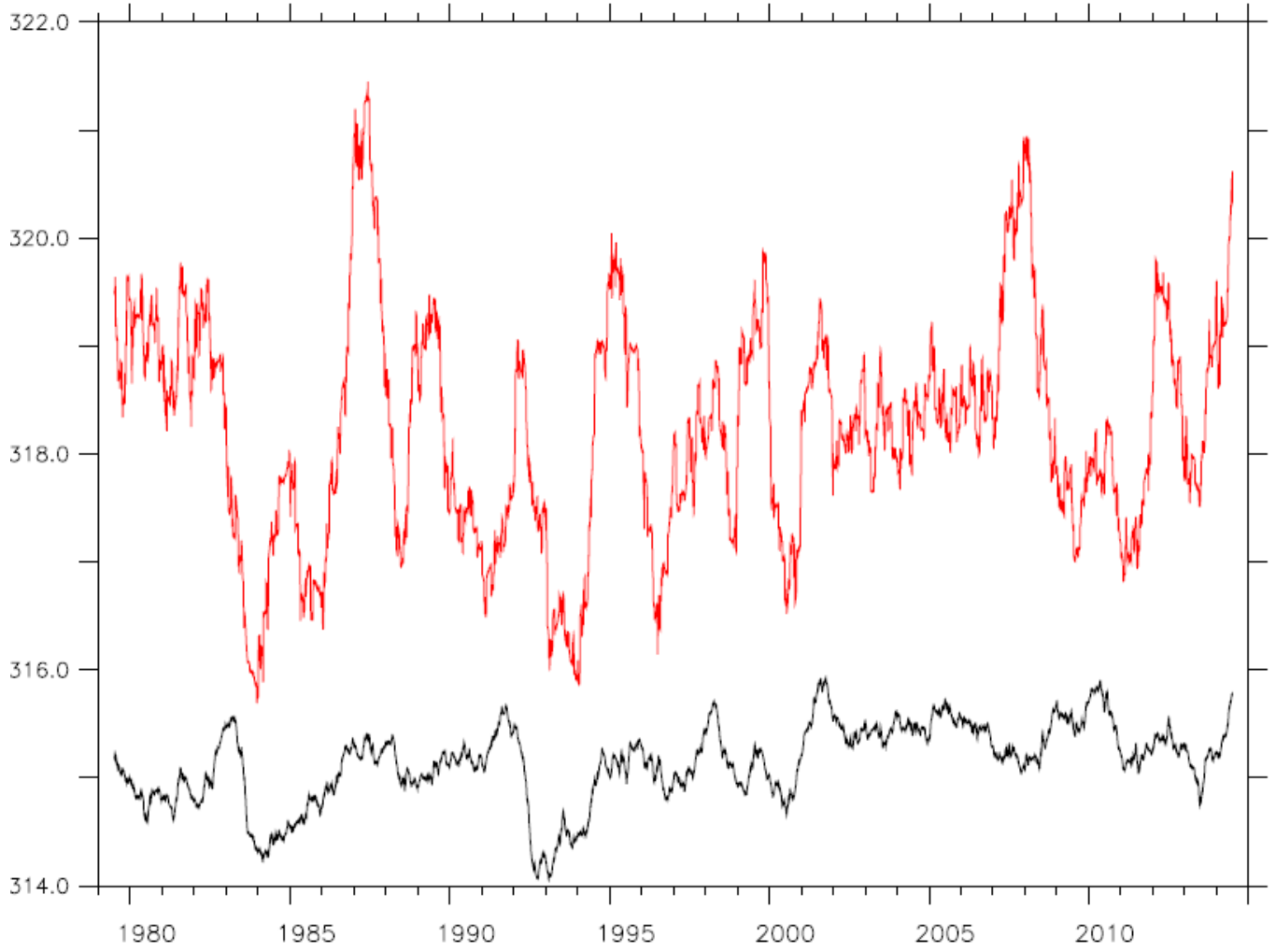


Temperature 2m (K)

R_i sec dans les fonctions de stabilité pour le diagnostique uniquement.

- Schéma d'interpolation probablement dans d'autres modèles (vient des premiers AMIP)
- Fondé sur variables star et flux constants dans la couche de surface
  first guess- Dyer Businger, LMO- , variables star,
  iteration fonction de stabilité Fonction de Ri (Louis)
- Simplifié (pas variables star, assure cohérence des Fonc. Stabilité)
- Deux tests: vent borné à 1m/s ou R_i sec pour le diagnostique
  Résultats différents pour q2min.
- Que vaut qsurf, lorsque la resistance aerodynamique devient tres grande et que le sol est humide ?

Correction à posteriori : Impact sur t2m_max (global)



I. Musat