Modification of the albedo et fraction de sol nu..

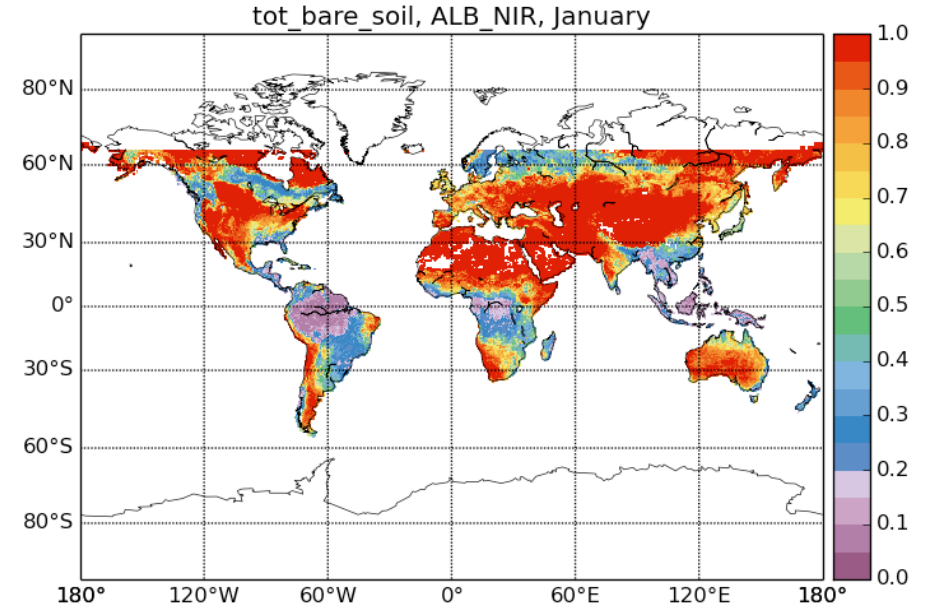
Philippe Peylin, Vladislav Bastrikov,
Catherine Ottle, Nicolas Vuichard,
Fabienne Maignan, Josefine Ghattas,…

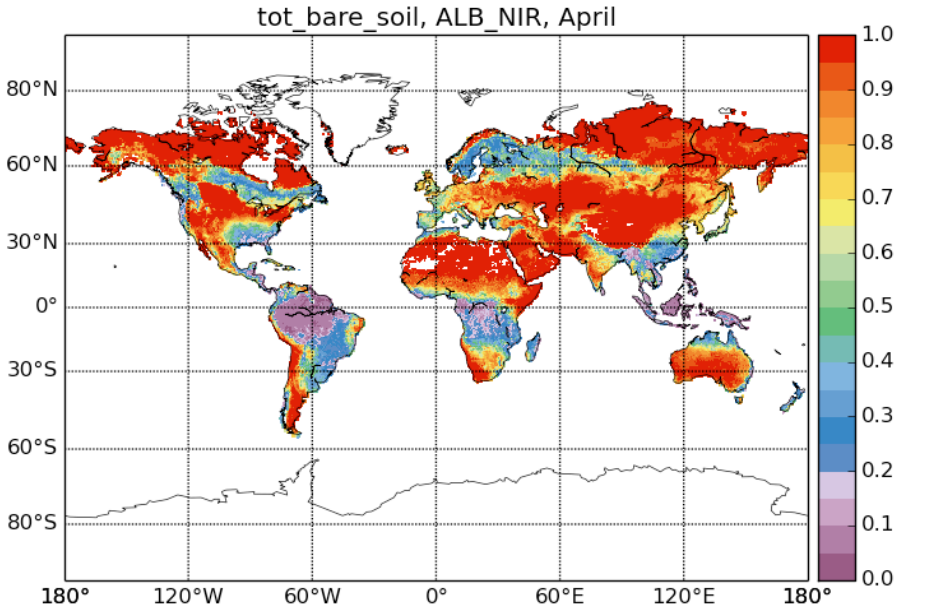
Bare soil fraction in ORCHIDEE

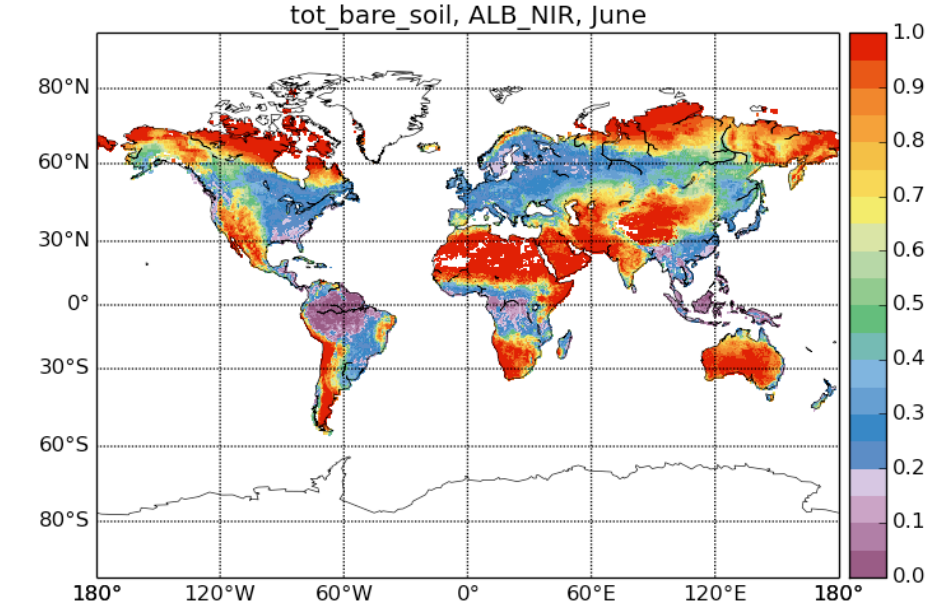
- Bare soil corresponding to deserts (PFT-1):BS_PFT1

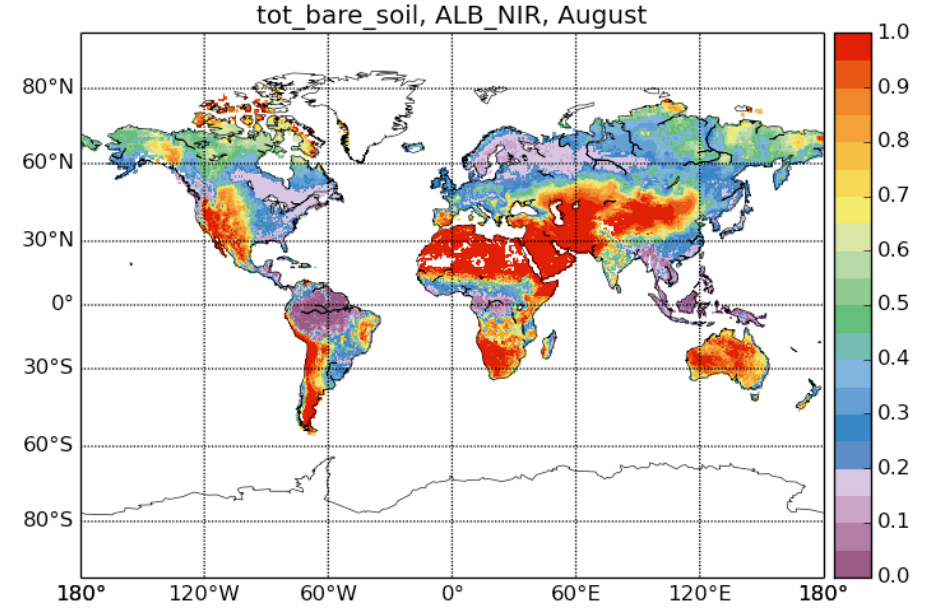
- Plus a fraction of vegetated PFT depending on the Leaf Area Index
  - $BS\_PFT_j = Exp\ (-\ LAI_j\ /\ 2.)$

➔ $BS\_total = BS\_PFT1 + Sum\_{j}\ (BS\_PFT_j)$


tot_bare_soil, ALB_NIR, January
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0


tot_bare_soil, ALB_NIR, April
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0


tot_bare_soil, ALB_NIR, June
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0


tot_bare_soil, ALB_NIR, August
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0

How to improve..

- Changing the coef in the formular exp [-LAI / x] with x = 1. or ?
- A more “physically based approach” - see Goudrian (1977)

$$\rho_{eff} = \frac{(\rho_s \rho_h - 1)\exp(K.LAI) + (1 - \rho_s/\rho_h)\exp(-K.LAI)}{\left(\rho_s - \frac{1}{\rho_h}\right)\exp(K.LAI) + (\rho_h - \rho_s)\exp(-K.LAI)} \quad (2.26)$$

➔ Nearly no Bare Soil for LAI > 2...

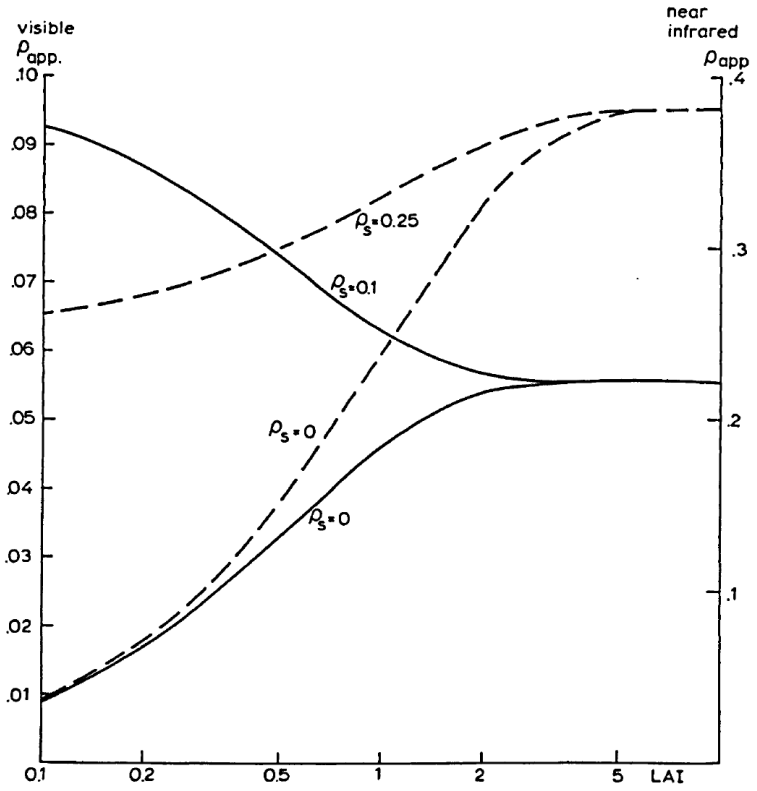
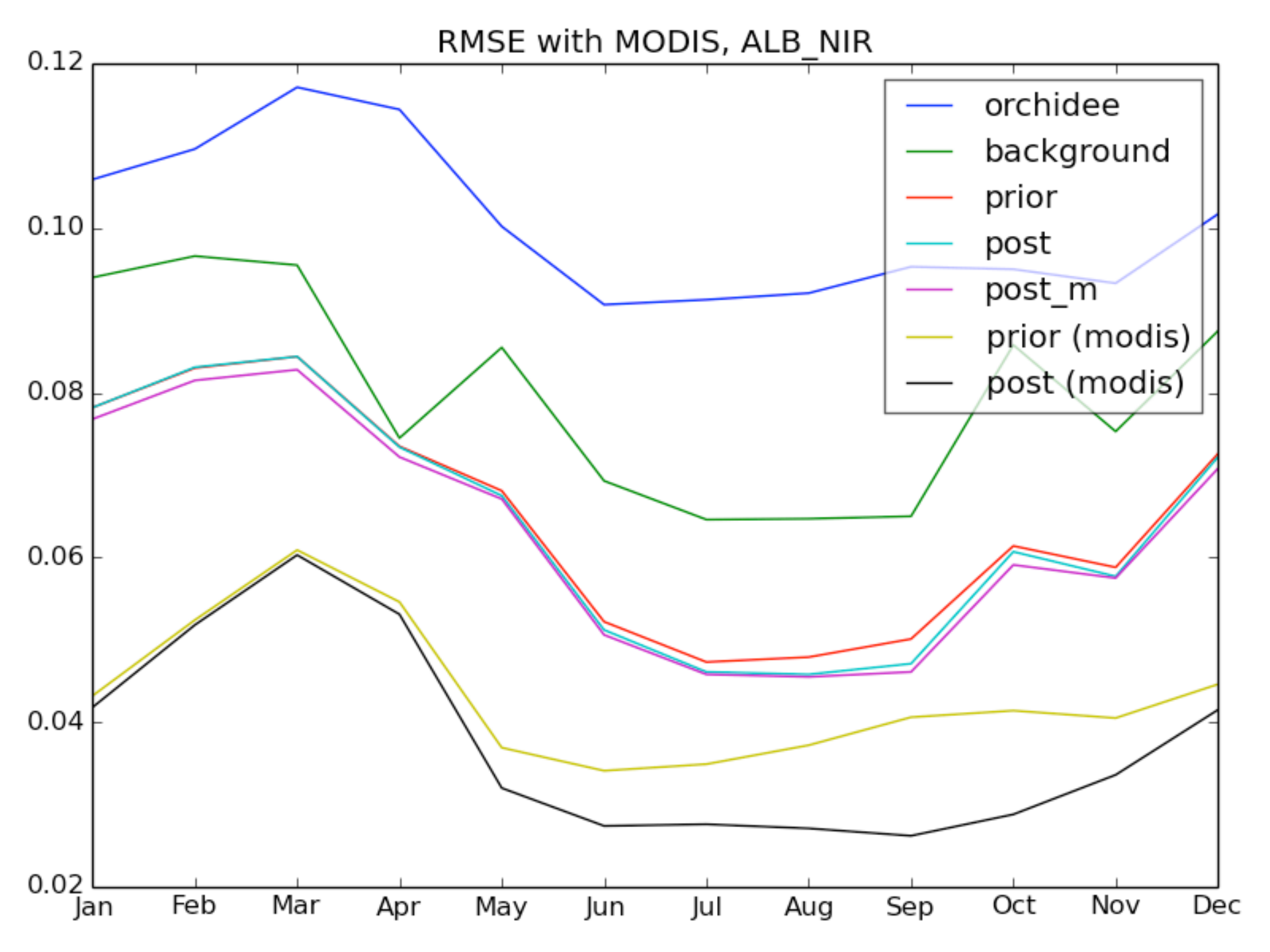


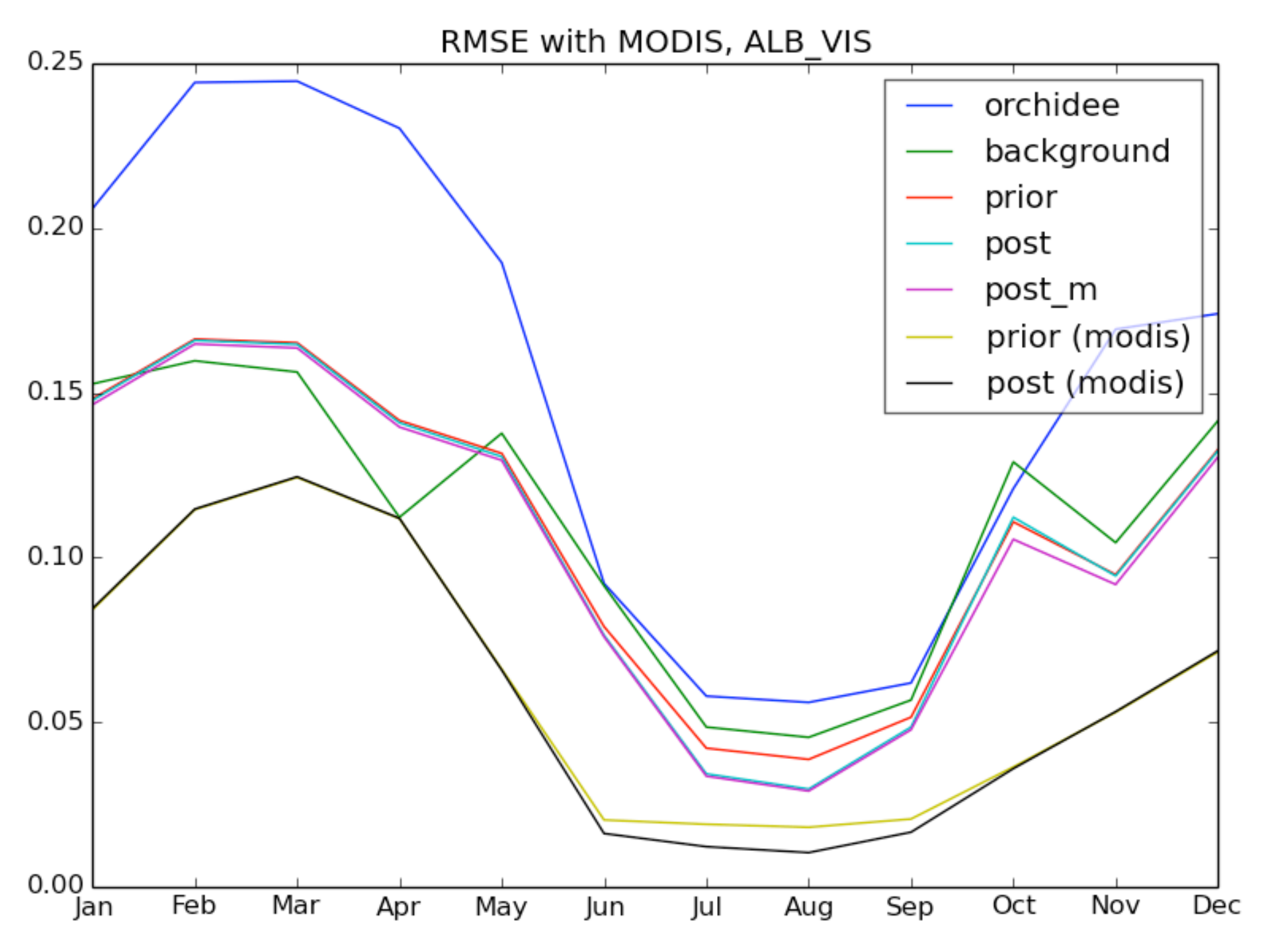
Fig. 3 | Apparent reflection coefficient of the canopy-soil system as function of the leaf area index for two values of the soil reflectance ρ_s. For the visible region (solid lines) the values are indicated on the left ordinate and for the near-infrared region (broken lines) on the right ordinate.

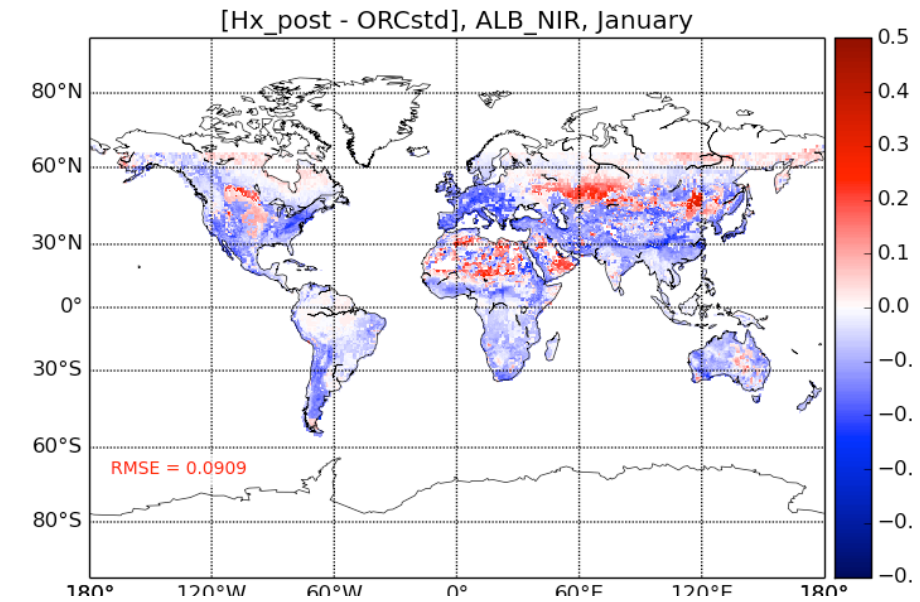
Change of the albedo…

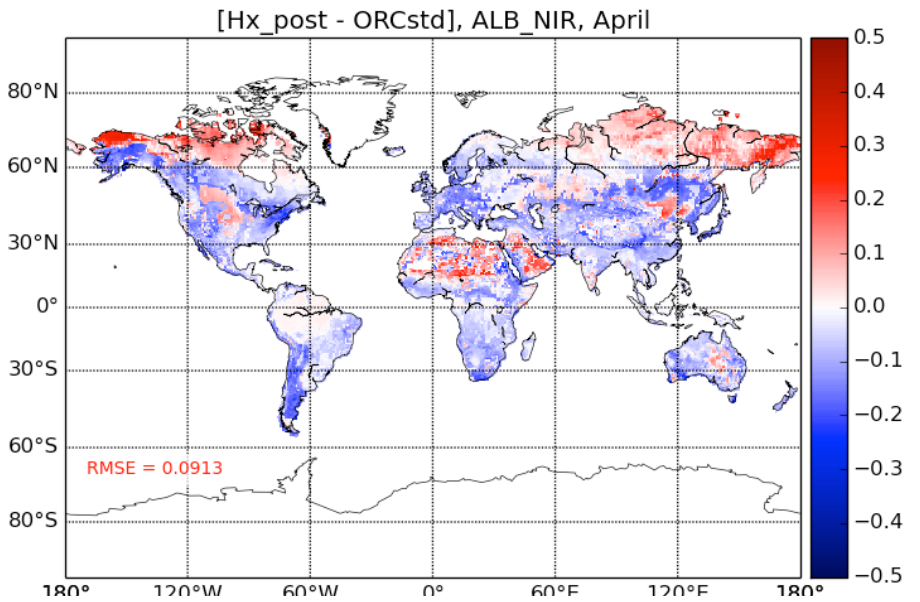
- 1st step:
  - Bare soil albedo (old) = f (soil color map)
  - New implementation = Background from JRC-TIP using MODIS data
  - BS_new = f(MODIS, monthly)

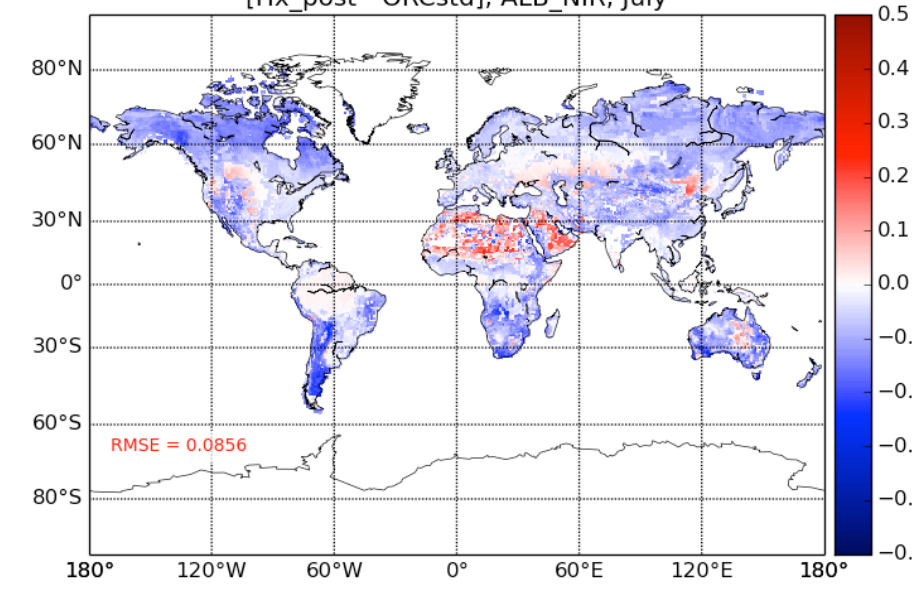
- 2nd Step:
  - Optimisation of all vegetation albedo (parameters) to fit MODIS overall albedo..
  - Set of coefficient for VIS and NIR

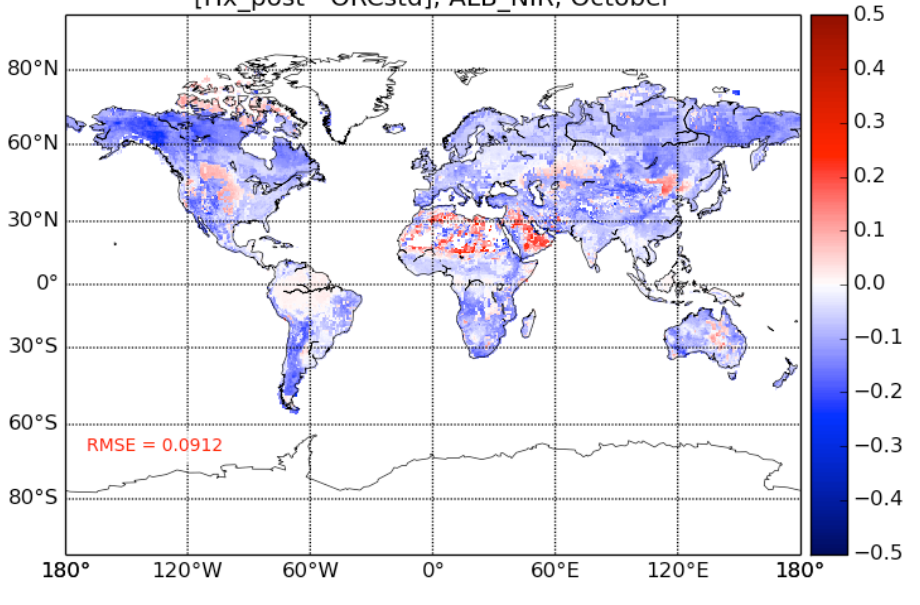

RMSE with MODIS, ALB_NIR
0.12
0.10
0.08
0.06
0.04
0.02
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
orchidee
background
prior
post
post_m
prior (modis)
post (modis)

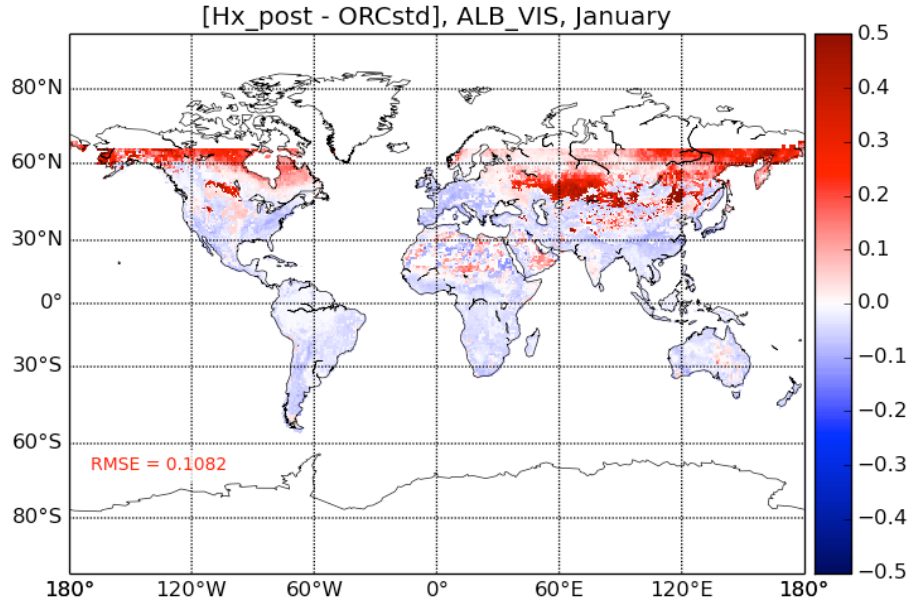

RMSE with MODIS, ALB_VIS
0.25
0.20
0.15
0.10
0.05
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
orchidee
background
prior
post
post_m
prior (modis)
post (modis)

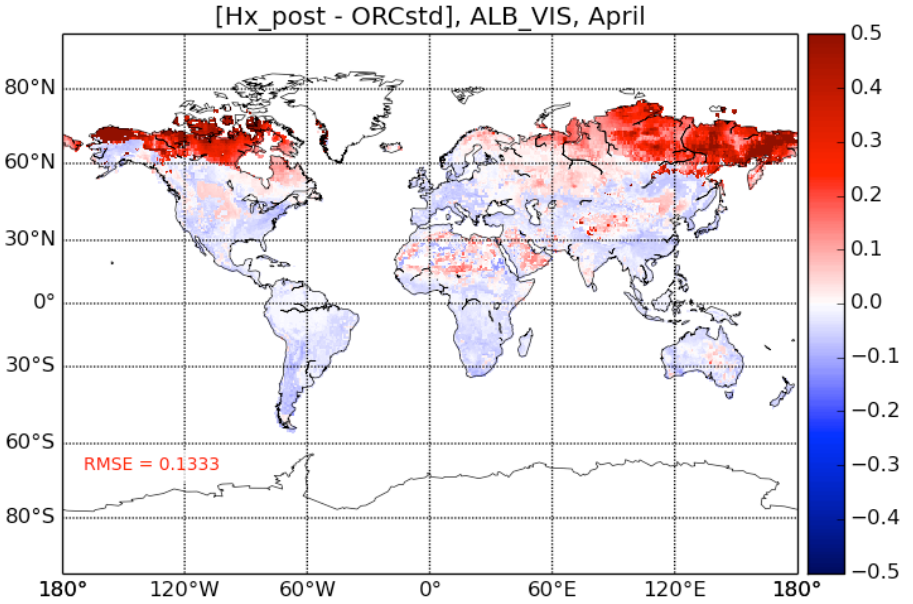

[Hx_post - ORCstd], ALB_NIR, January
RMSE = 0.0909
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
0.5
0.4
0.3
0.2
0.1
0.0
−0.
−0.
−0.
−0.
−0.

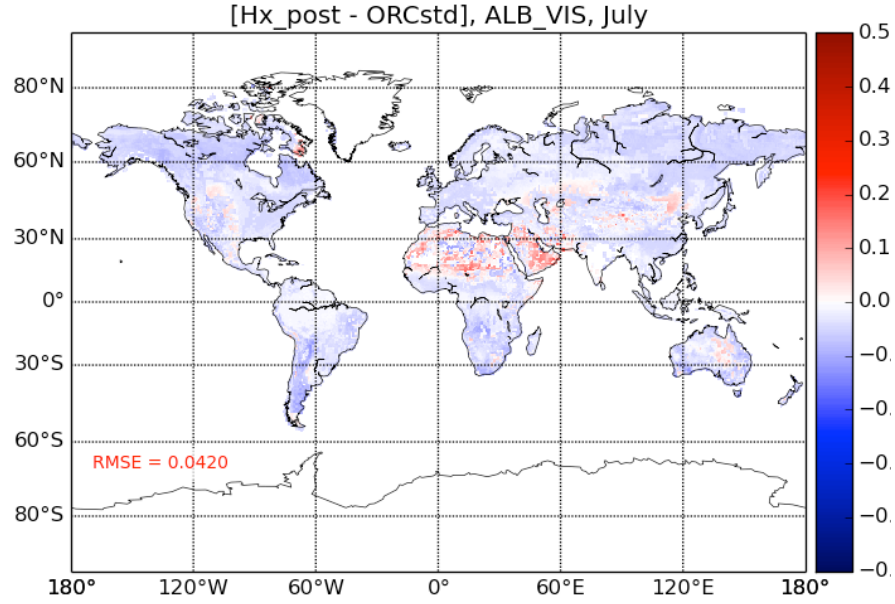

[Hx_post - ORCstd], ALB_NIR, April
RMSE = 0.0913
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
−0.4
−0.5

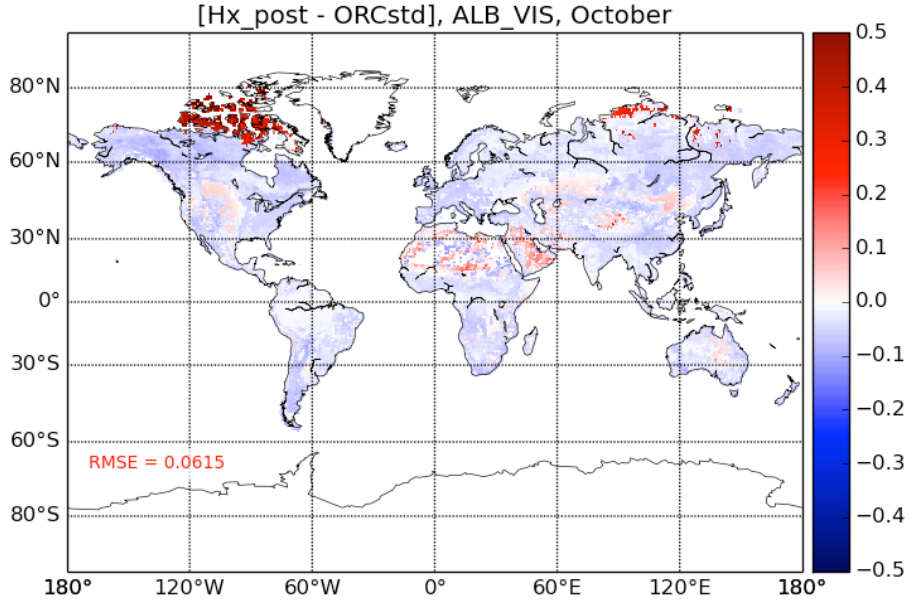

[Hx_post - ORCstd], ALB_NIR, July
RMSE = 0.0856
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
0.5
0.4
0.3
0.2
0.1
0.0
−0.
−0.
−0.
−0.
−0.


[Hx_post - ORCstd], ALB_NIR, October
RMSE = 0.0912
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
−0.4
−0.5

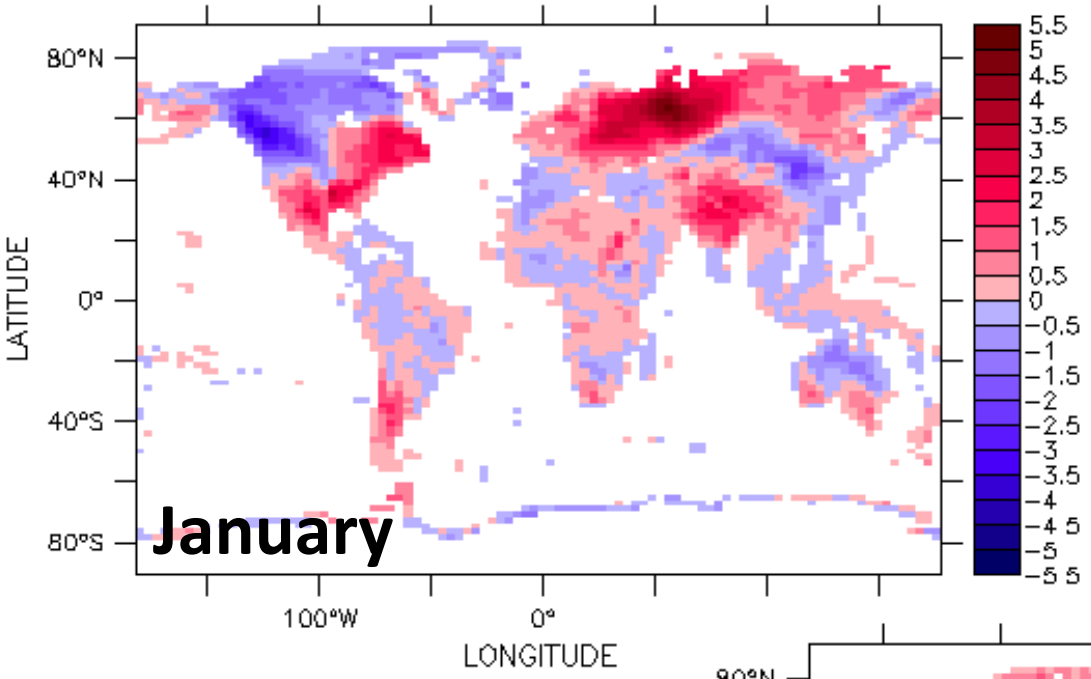

[Hx_post - ORCstd], ALB_VIS, January
RMSE = 0.1082
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
−0.4
−0.5

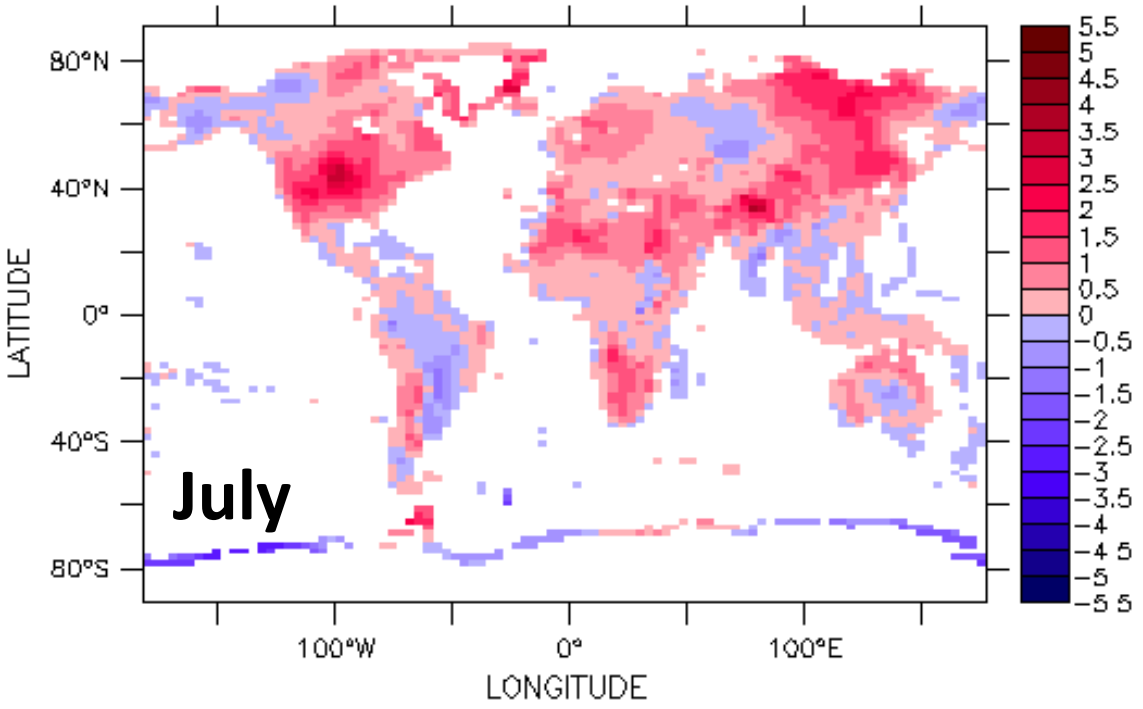

[Hx_post - ORCstd], ALB_VIS, April
RMSE = 0.1333
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
−0.4
−0.5


[Hx_post - ORCstd], ALB_VIS, July
RMSE = 0.0420
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
0.5
0.4
0.3
0.2
0.1
0.0

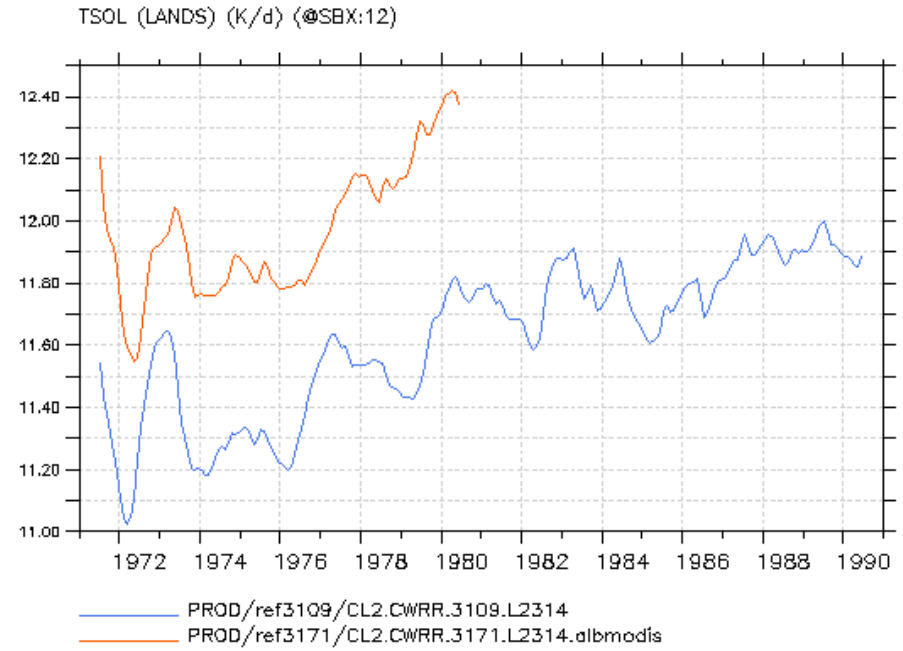

[Hx_post - ORCstd], ALB_VIS, October
RMSE = 0.0615
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
−0.4
−0.5

Tair
Alb_modis - Ref

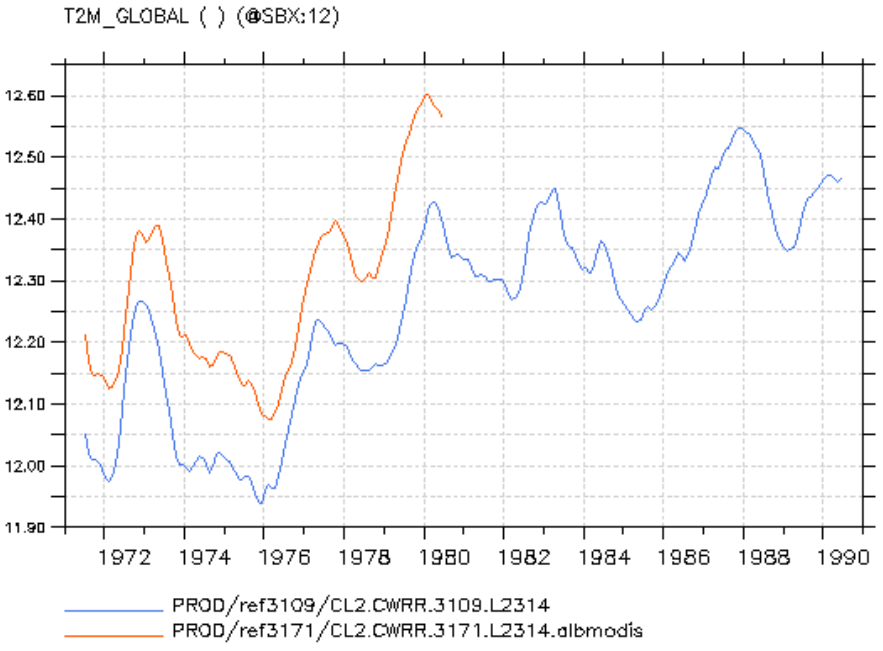




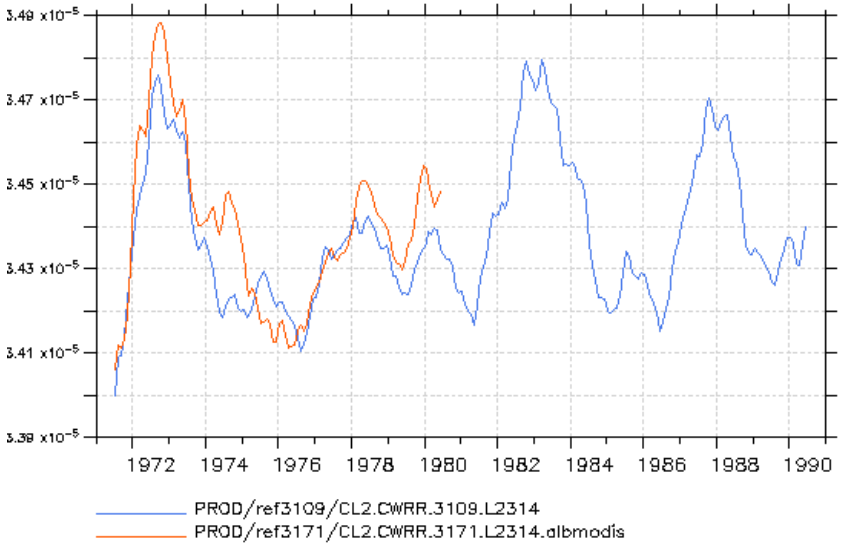
SRF_temp_sol_lands_ave.nc



ATM_t2m_global_ave.nc



ATM_evap_global_ave.nc

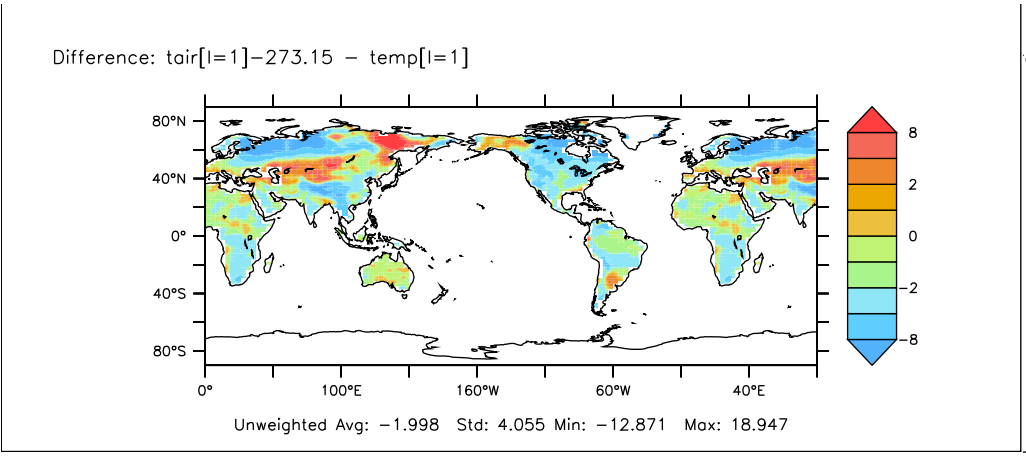


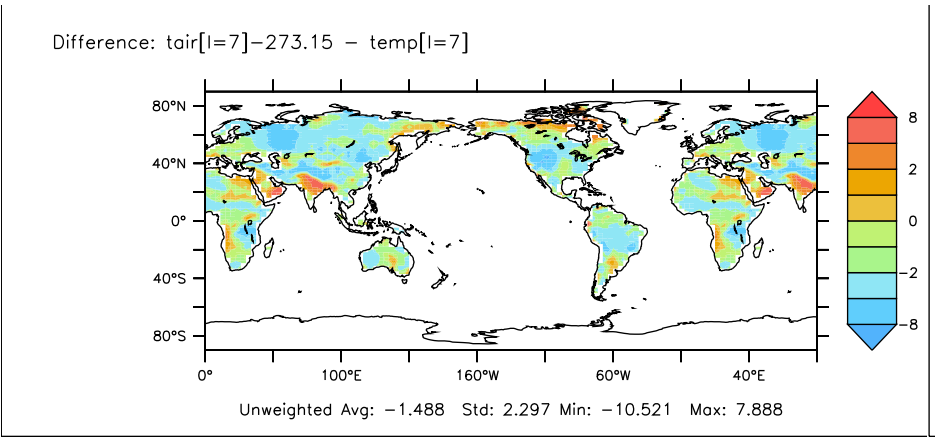
Reference (3109)

BS albedo from MODIS

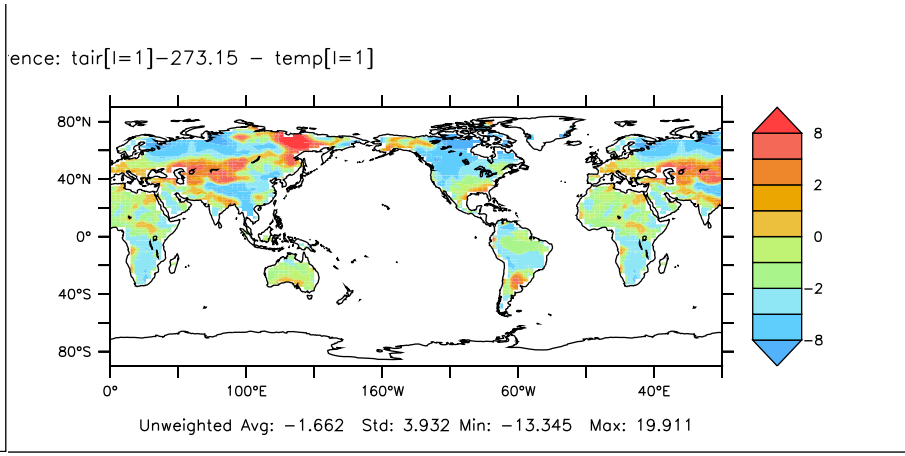
Difference Tair – CRU observations

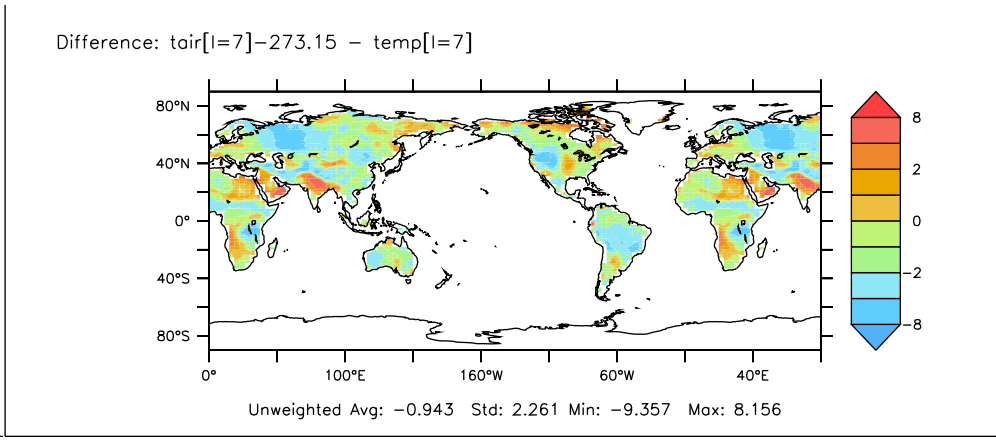
REF





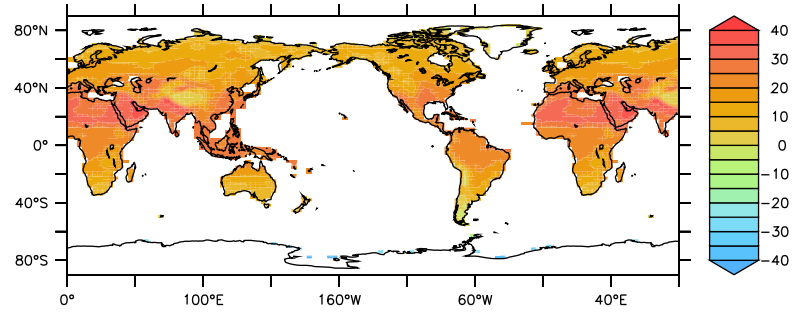
New ALbedo





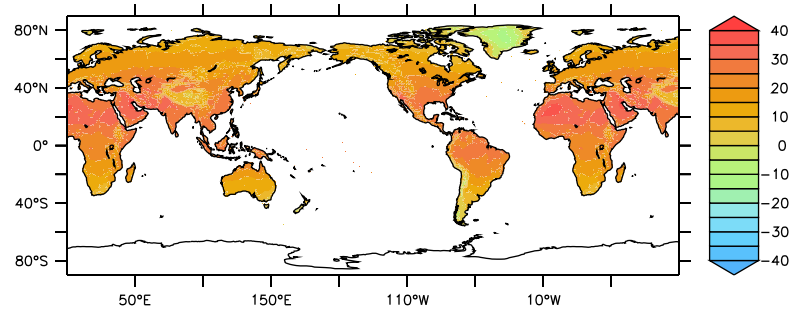
Temperature (C)

CL2.CWRR.3109.L2314_SE_1981_1990_1M_sechiba_history.nc: tair[l=7]−273.15



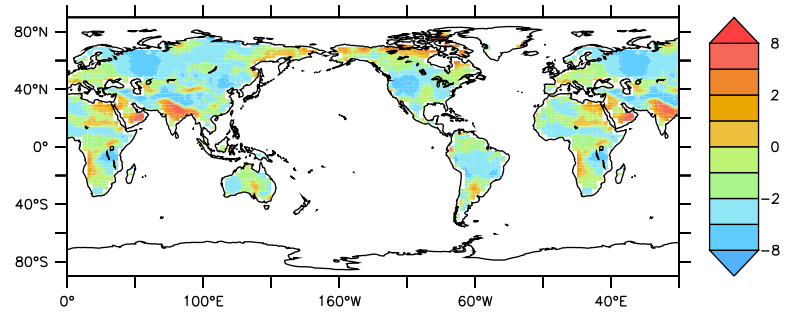
Unweighted Avg: 15.116 Std: 12.46 Min: −46.434 Max: 37.646

CRU_temperature.nc: temp[l=7]



Unweighted Avg: 17.778 Std: 8.916 Min: −11.5 Max: 37

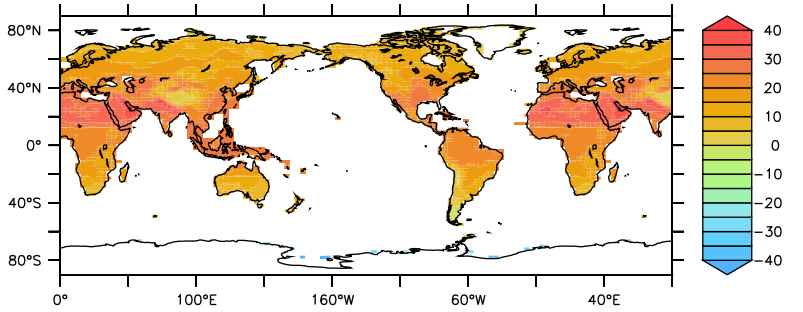
Difference: tair[l=7]−273.15 − temp[l=7]



Unweighted Avg: −1.488 Std: 2.297 Min: −10.521 Max: 7.888

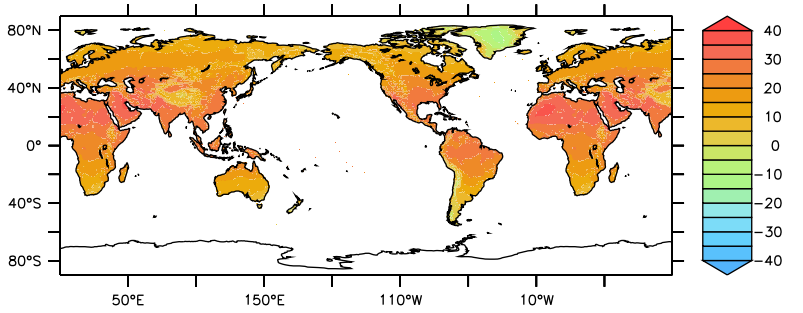
Temperature (C)

CL2.CWRR.3171.L2314.albmodis_SE_1981_1990_1M_sechiba_history.nc: tair[l=7]−273.15



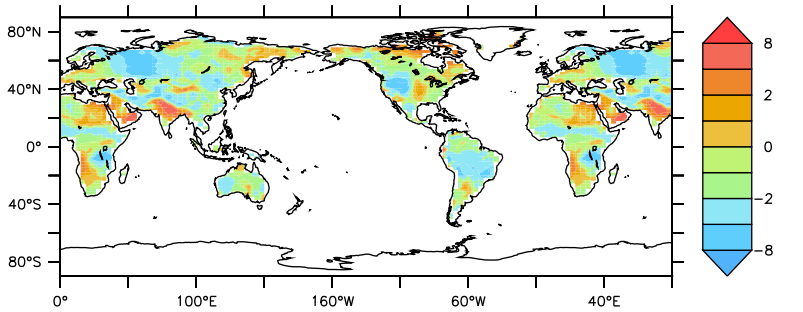
Unweighted Avg: 15.504 Std: 12.624 Min: −48.47 Max: 38.3

CRU_temperature.nc: temp[l=7]



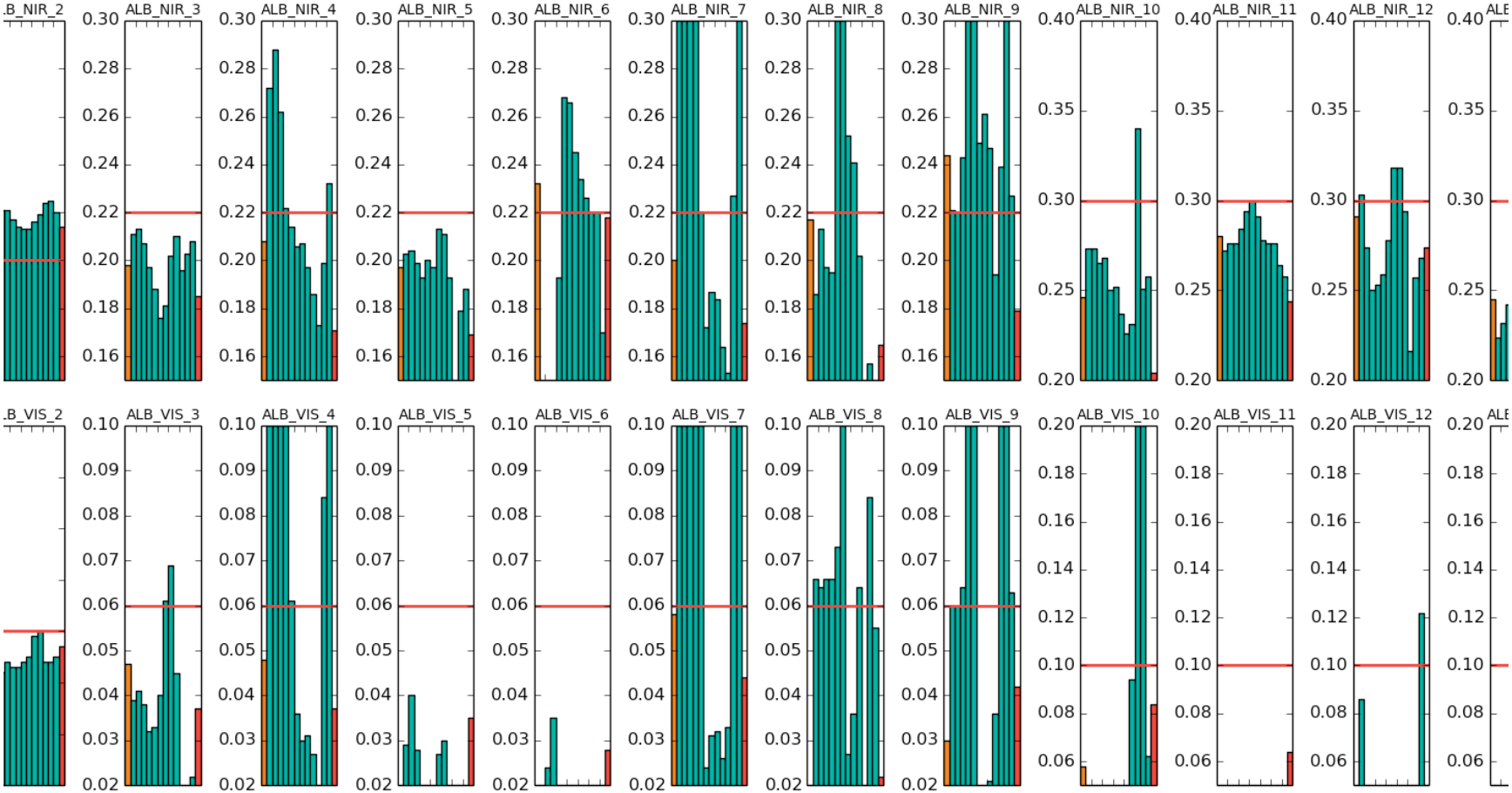
Unweighted Avg: 17.778 Std: 8.916 Min: −11.5 Max: 37

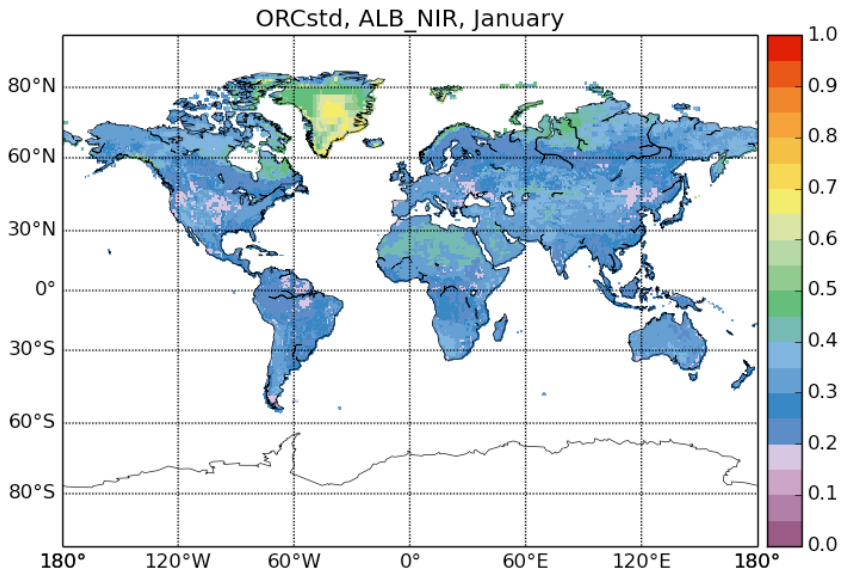
Difference: tair[l=7]−273.15 − temp[l=7]

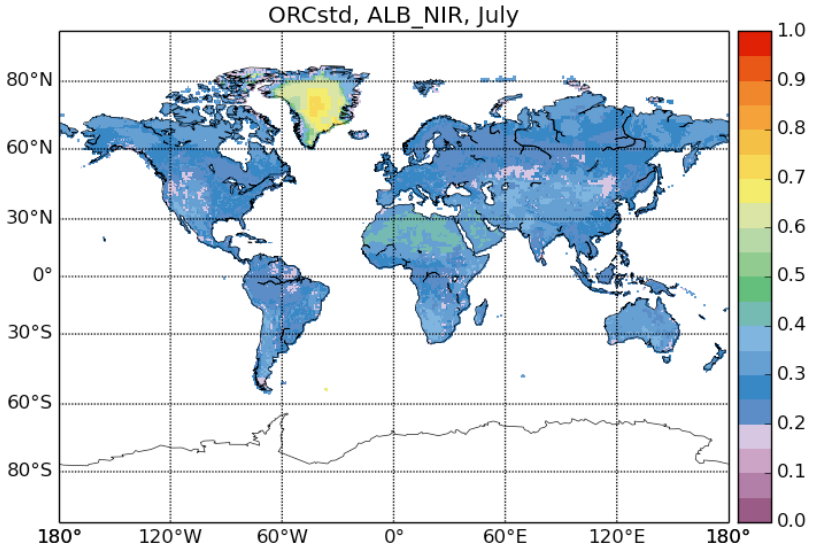


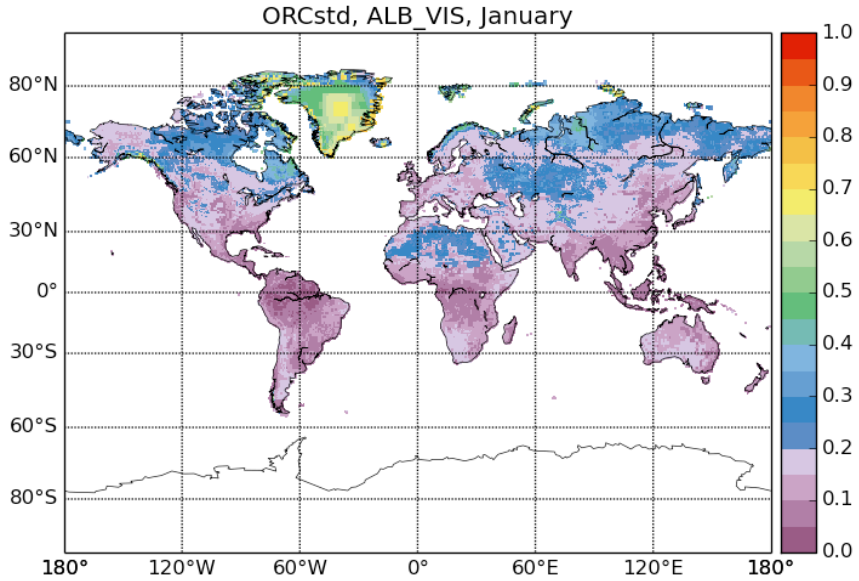
Unweighted Avg: −0.943 Std: 2.261 Min: −9.357 Max: 8.156

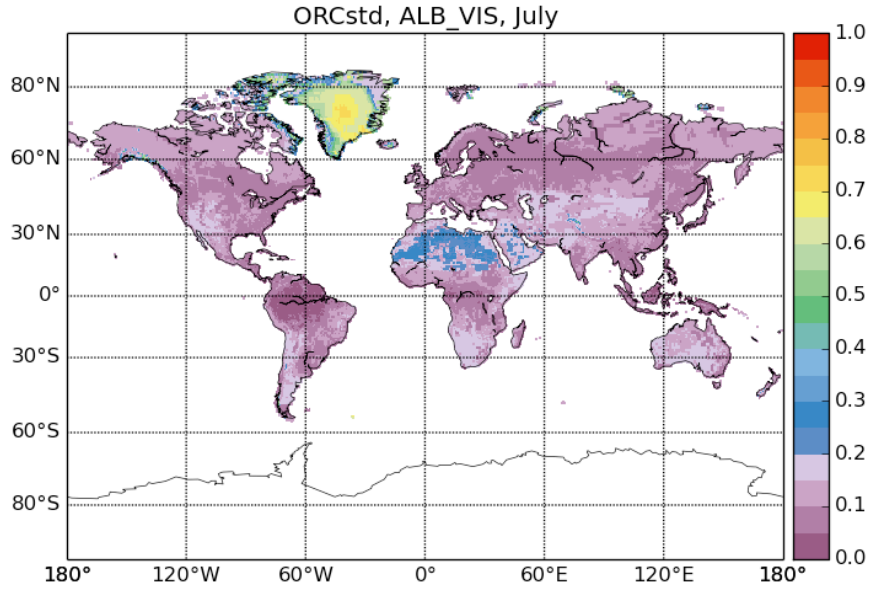
Optimised vegetation parameters




ORCstd, ALB_NIR, January
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0


ORCstd, ALB_NIR, July
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0


ORCstd, ALB_VIS, January
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0


ORCstd, ALB_VIS, July
80°N
60°N
30°N
0°
30°S
60°S
80°S
180°
120°W
60°W
0°
60°E
120°E
180°
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0