Climate effects of a general increase of LAI

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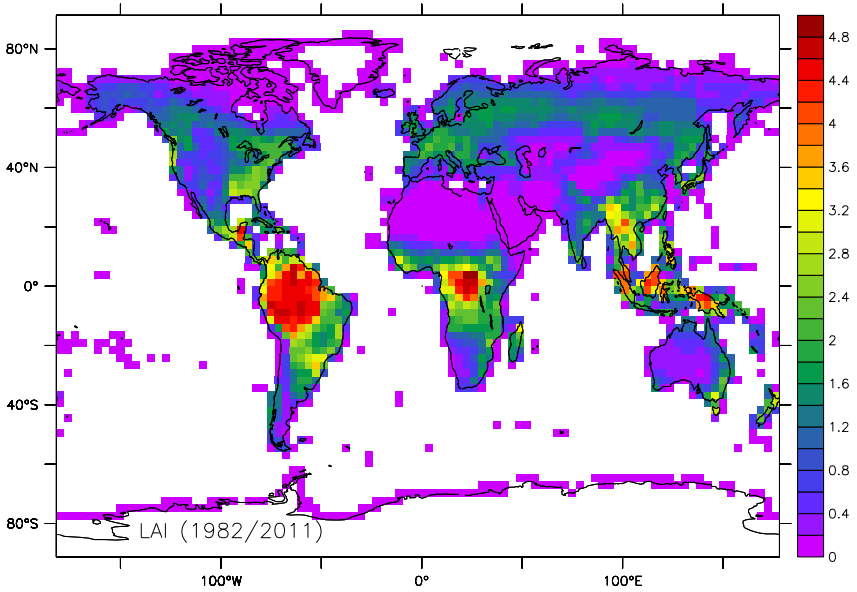
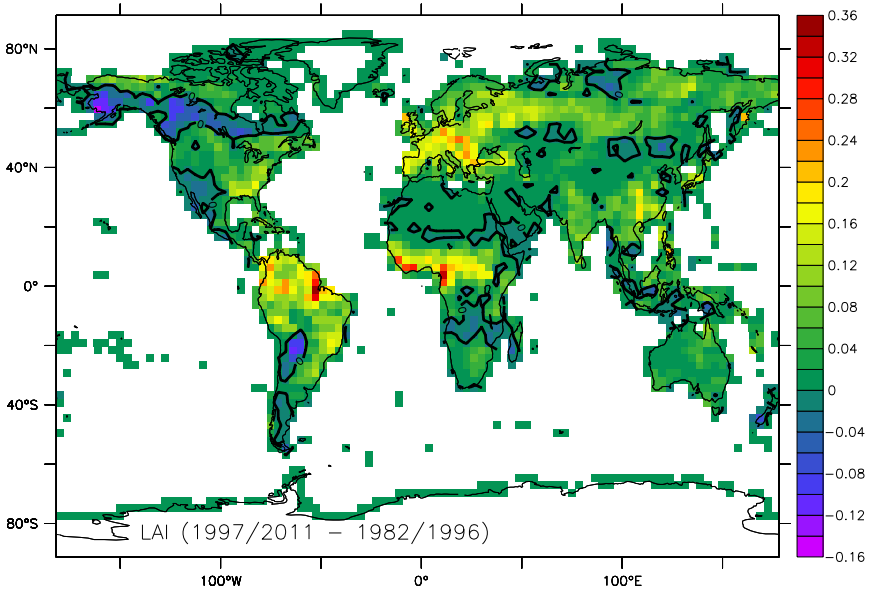
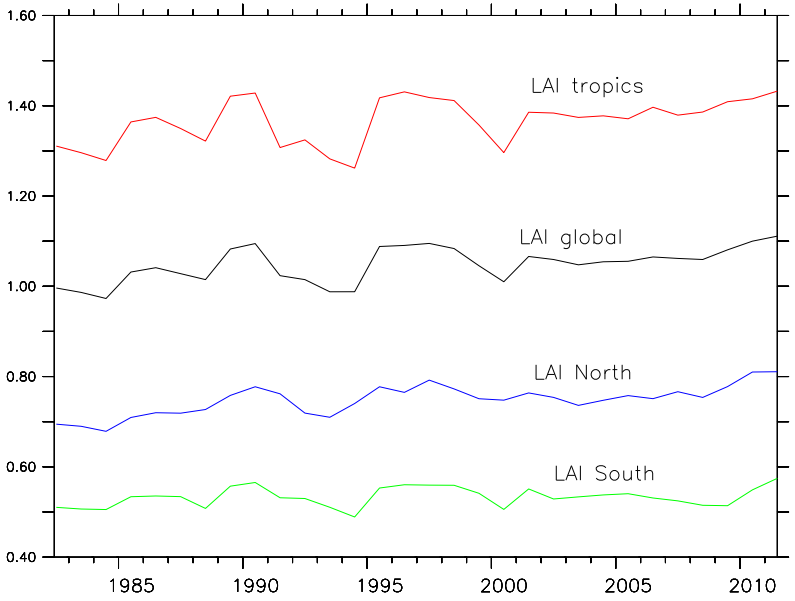
Annual-mean LAI

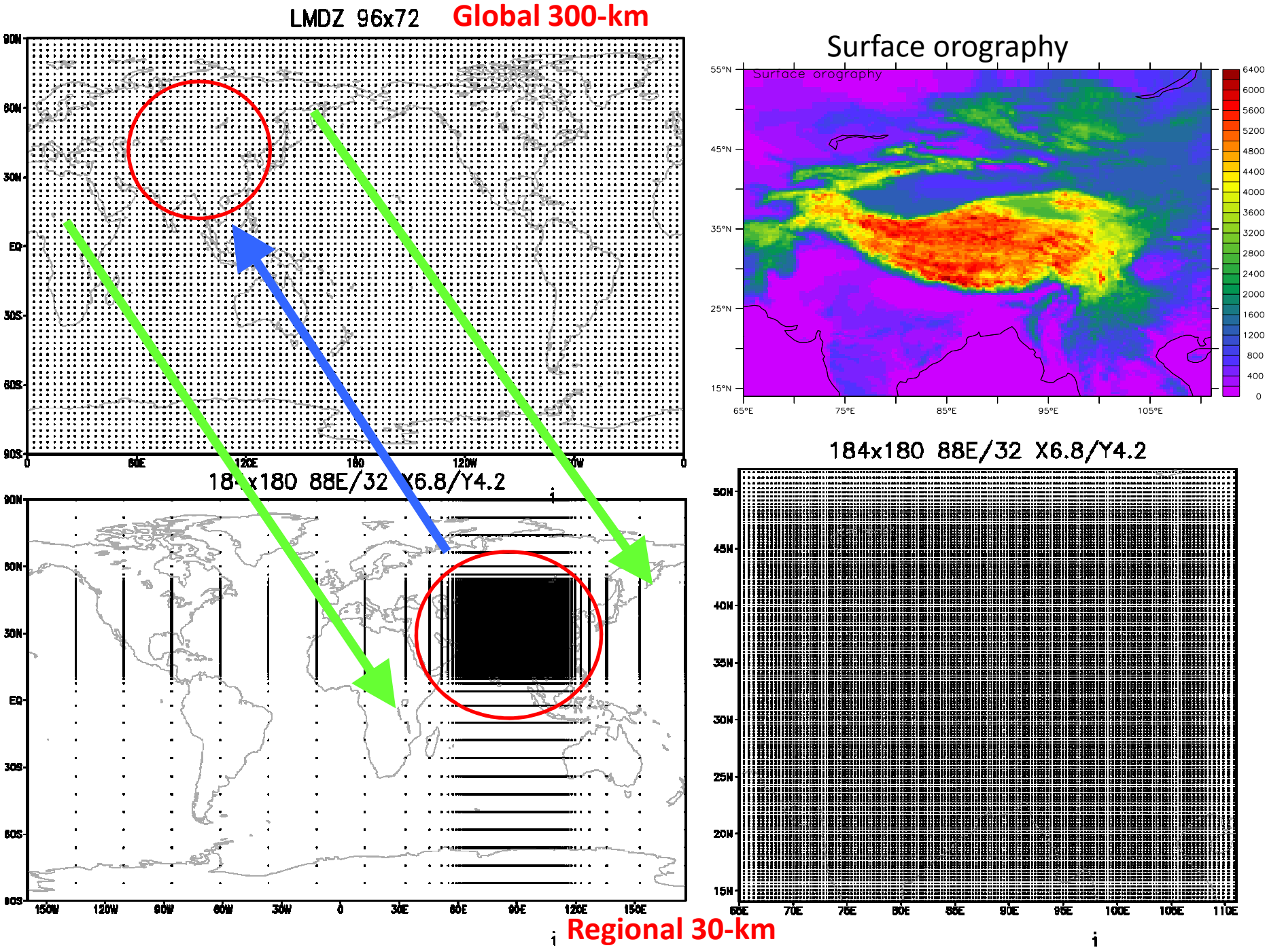


Annual-mean LAI changes



Motivation: Global vegetation cover goes well during the last 30 years, due to global warming, CO2 fertilization, etc. Are there any physical feedbacks to climate ?

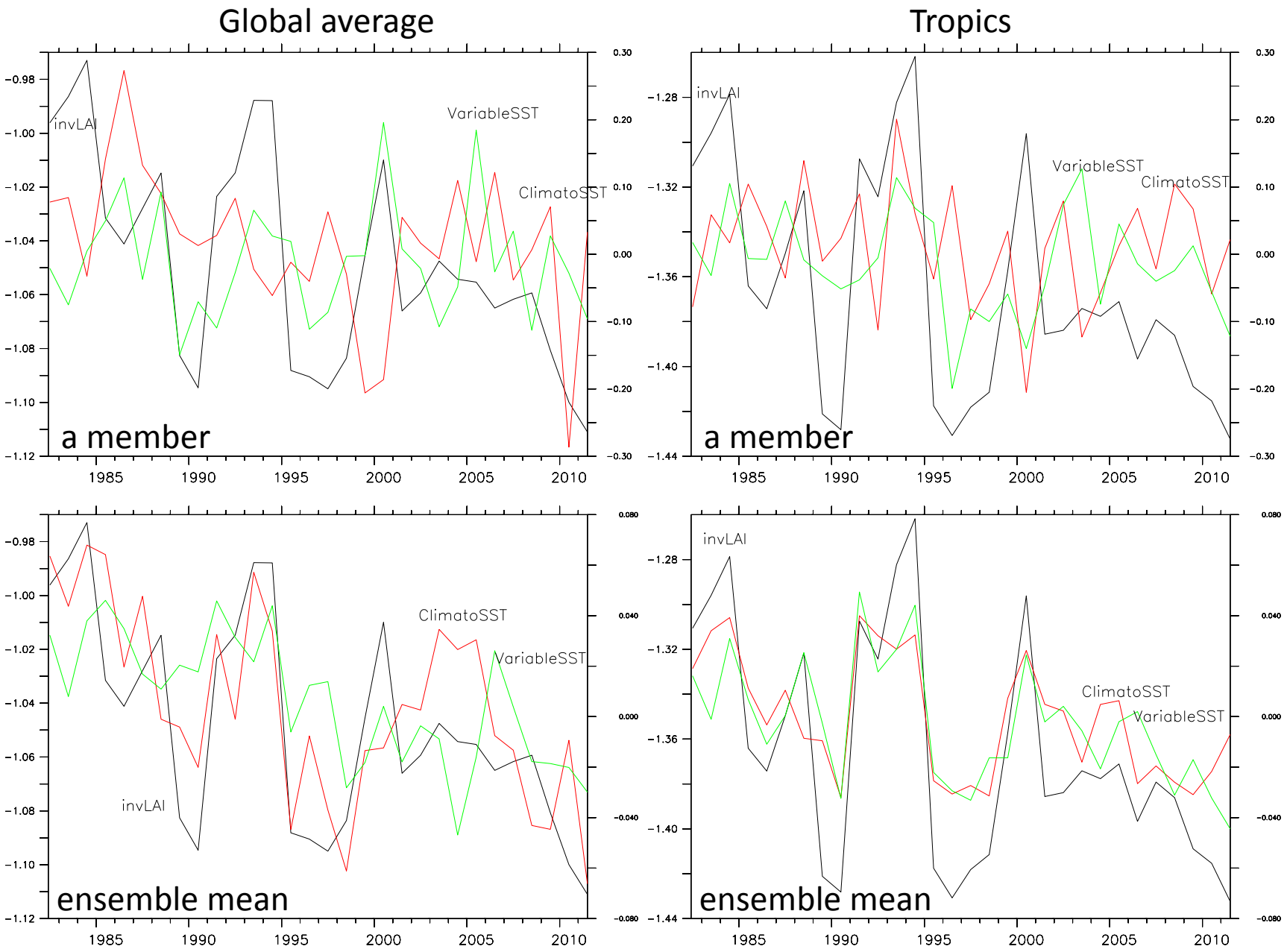



LMDZ 96x72
Global 300-km
Surface orography
Surface orography
184x180 88E/32 X6.8/Y4.2
184x180 88E/32 X6.8/Y4.2
Regional 30-km

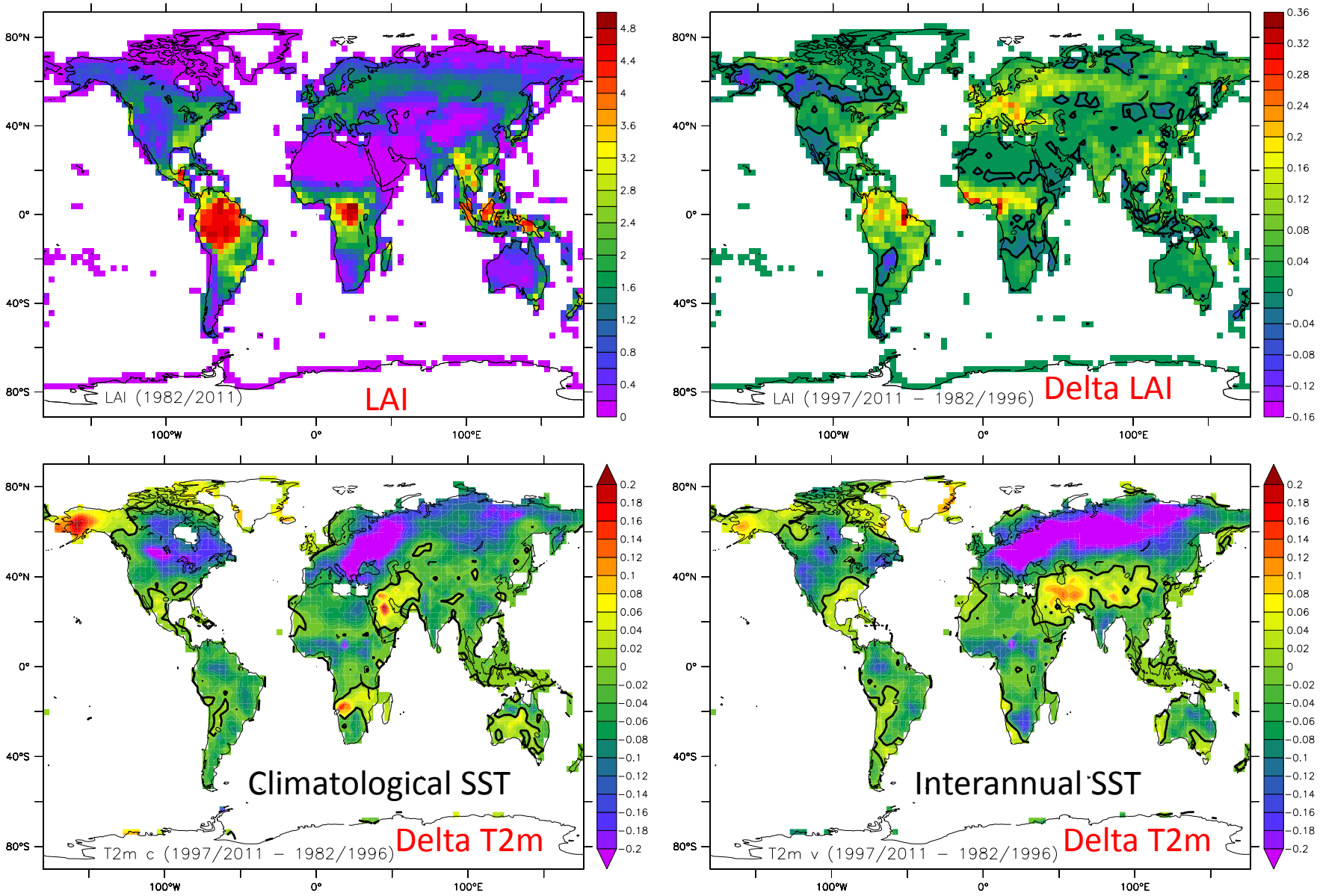
Simulations performed (global model):

	Climato_LAI	Variable_LAI
Climato_SST	30 members	30 members
Variable_SST	30 members	30 members

Climato: climatological values 1982/2011
Variable: observed, with interannual variation from 1982 to 2011



LAI (-1x, black) on left axis; temperatures (red and green) on right axis

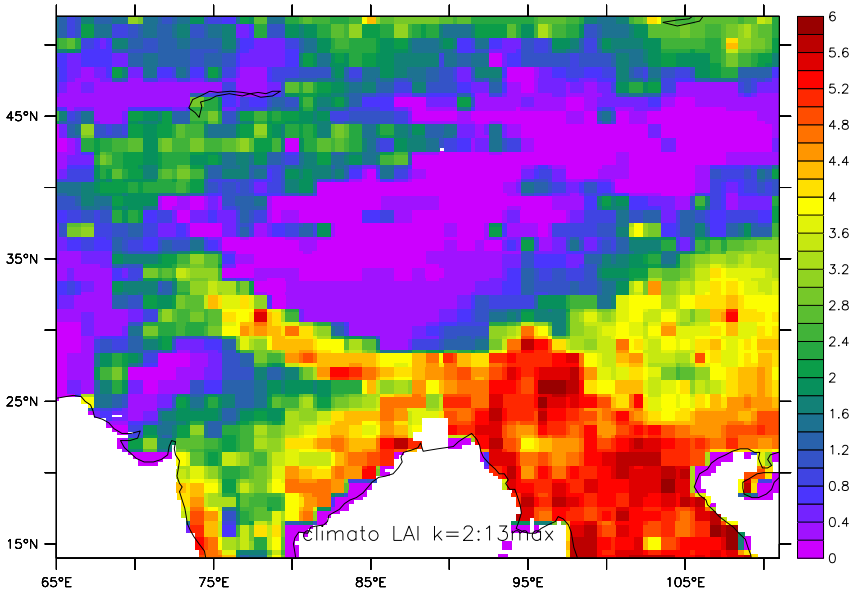

80°N
40°N
0°
40°S
80°S
100°W
0°
100°E
LAI (1982/2011)
LAI
4.8
4.4
4
3.6
3.2
2.8
2.4
2
1.6
1.2
0.8
0.4
0
LAI (1997/2011 – 1982/1996)
Delta LAI
0.36
0.32
0.28
0.24
0.2
0.16
0.12
0.08
0.04
0
−0.04
−0.08
−0.12
−0.16
Climatological SST
T2m c (1997/2011 – 1982/1996)
Delta T2m
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
−0.1
−0.12
−0.14
−0.16
−0.18
−0.2
Interannual SST
T2m v (1997/2011 – 1982/1996)
Delta T2m

Simulations performed (regional model):

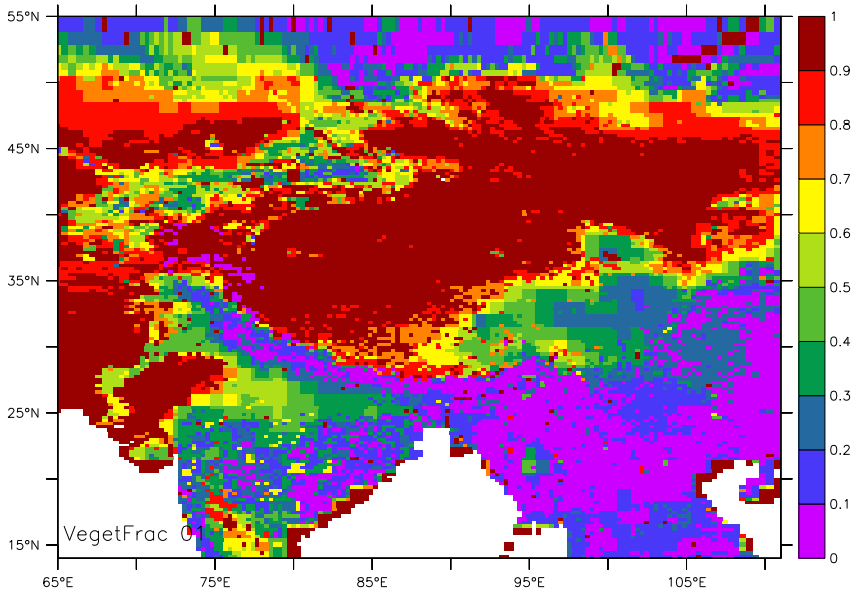
- Two-way nesting climatological run: 30 years
- ERA-driven runs: 1982/2011, variable LAI and fixed LAI

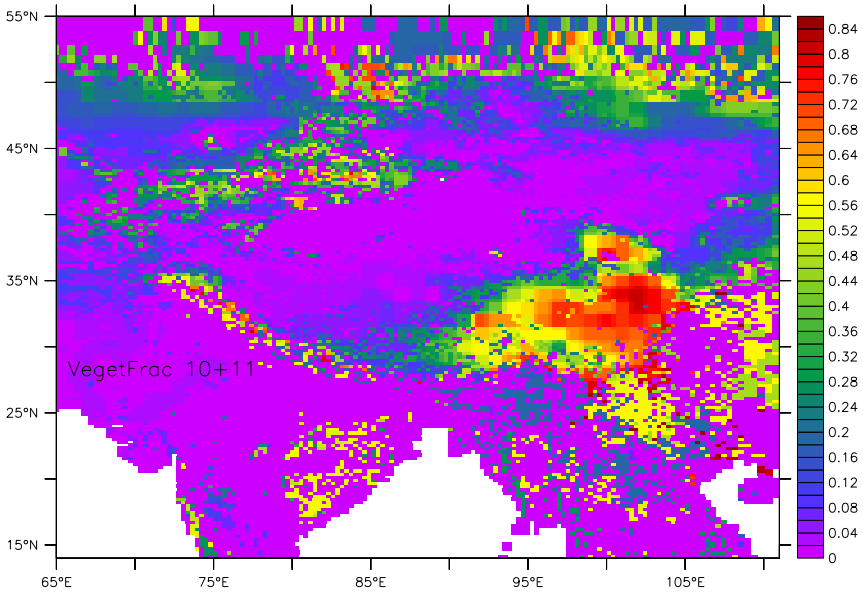
- IPCC-AR5 scenarios: historical, RCP45, RCP85 (to be planned)
- Other sensitivity runs targeting the role of the Tibetan Plateau

LAI (annual and all-veget mean)

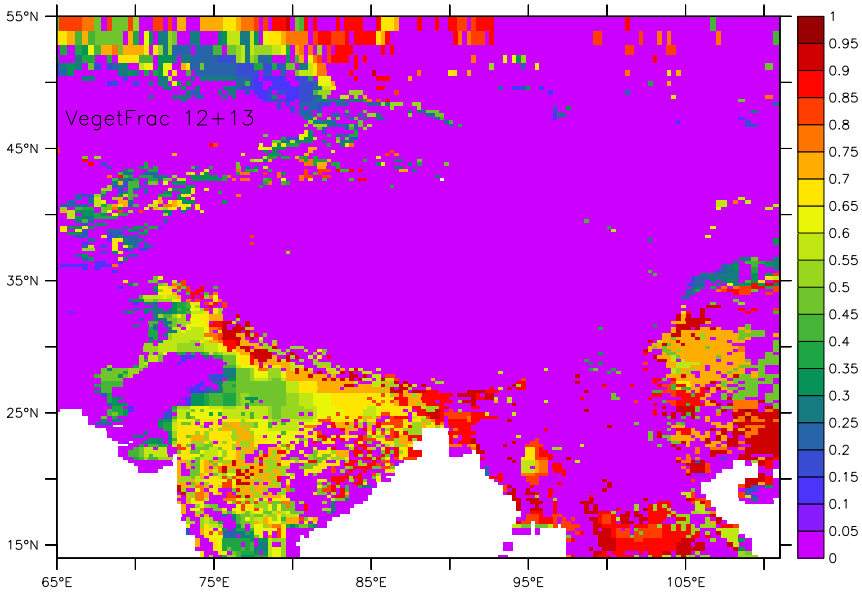


Orchidee: veget fraction 1 (bare soil)





Orchidee: veget fraction 10+11 (grass)



Orchidee: veget fraction 12+13 (crop)

Summary

- LAI at global scale has interannual variability, and increases significantly during the last 30 years
- Increase of LAI cools the global climate, mainly through a mechanism of evapotranspiration enhancement
- Signal-to-noisy ratio being low, large size of ensemble simulations is necessary to reach robustness of results.
- If the non-linearity of land-atmosphere interaction is important, higher-resolution simulations are recommended.