1 Supplementary Figures

Table 1: Initial conditions and spin up

Model name	initial ocean temperature	Run length years	net TOA radiation W/m^2
CCSM4-1deg	warm start with blended PRISM3D and CCSM4 PlioMIP1	1000	0.04
CCSM4-2deg	horizontally homogeneous 15°C top - 4°C bottom (tanh function) (globally averaged 3°C above preindustrial)	2000	-0.07
CCSM4-UoT	Levitus	2820	0.1
CESM1.2	warm start blended PRISM3D and CCSM4 PlioMIP1	1200	0.17
COSMOS	Levitus	2000	1.89 (diff from PI = +0.16)
EC-Earth3.1	PRISM3D deep ocean temperature	500	0.67
GISS2.1G	Levitus	1250	038
HadCM3	zonally-averaged 3D temperatures from a preindustrial simulation	2500	0.05
IPSLCM6A-LR	preindustrial	1450	0.91
IPSLCM5A2.1	End of PlioMIP1 expt 2	1500	0.43
IPSLCM5A	End of PlioMIP1 expt 2	800	0.69
MIROC4m	preindustrial	4000	0.84
MRI-CGCM2.3	present day	1000	2.69 (diff from PI = -0.17)
NorESM1-F	end of 2000 year 400ppmv CO_2 simulation	500	-0.01
NorESM-L	end of PlioMIP1	1200	0.10

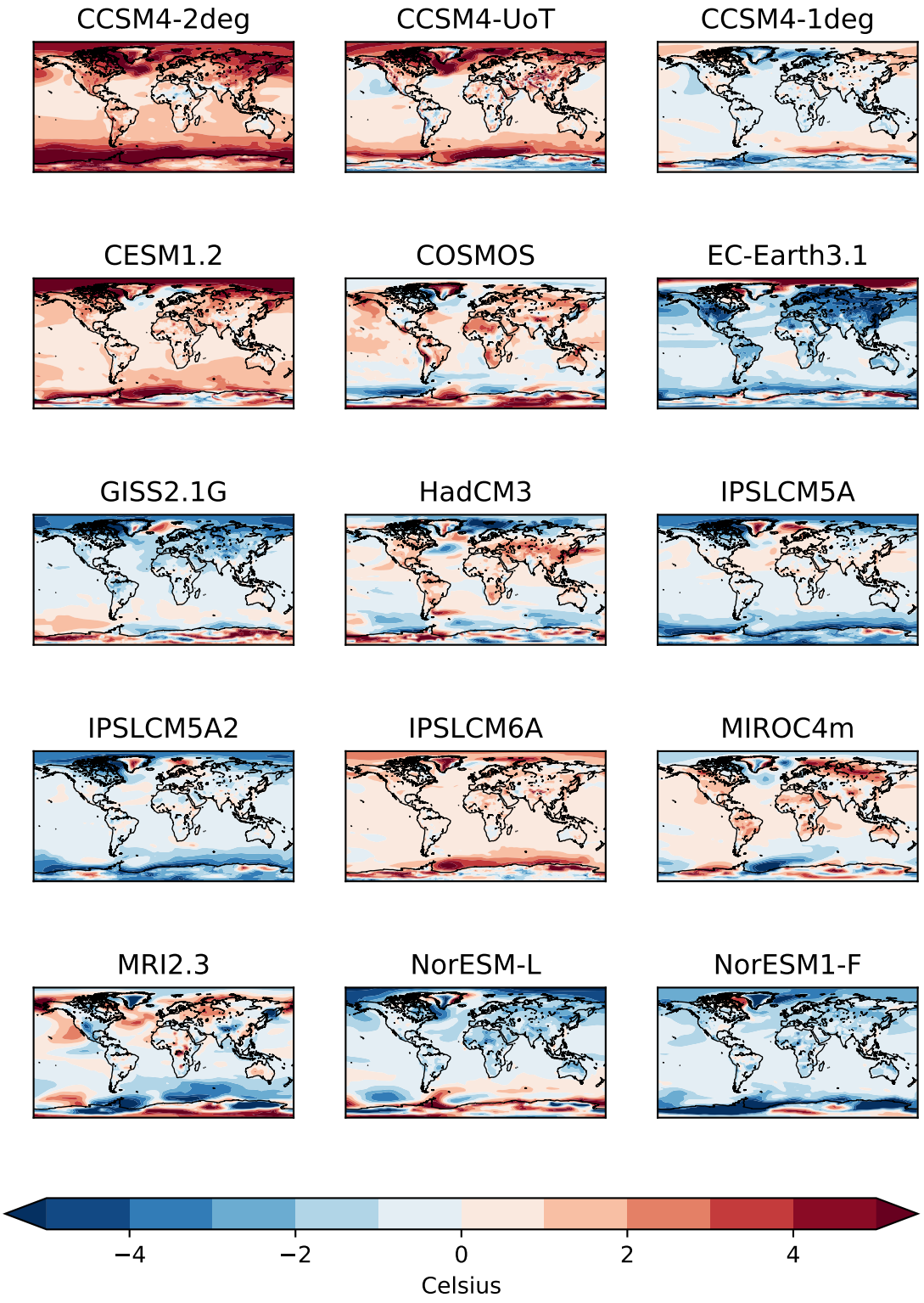

Figure 1: Near Surface Air Temperature anomaly *(Plio$_{Core}$ - PI$_{Ctrl}$)* from each model minus the multimodel mean Near Surface Air Temperature anomaly

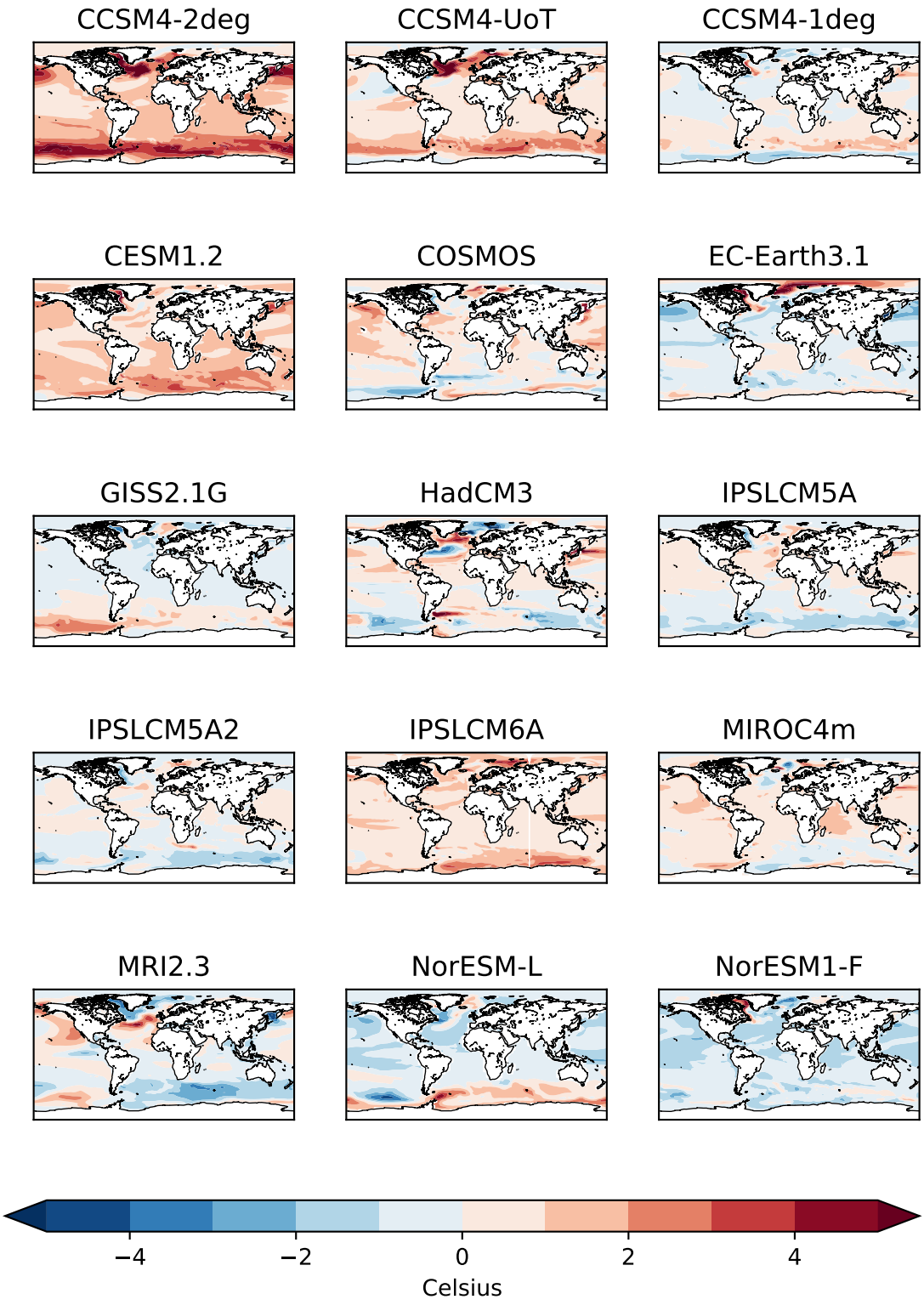

Figure 2: SST anomaly $(Plio_{Core}$ - $PI_{Ctrl})$ from each model minus the multimodel mean SST anomaly

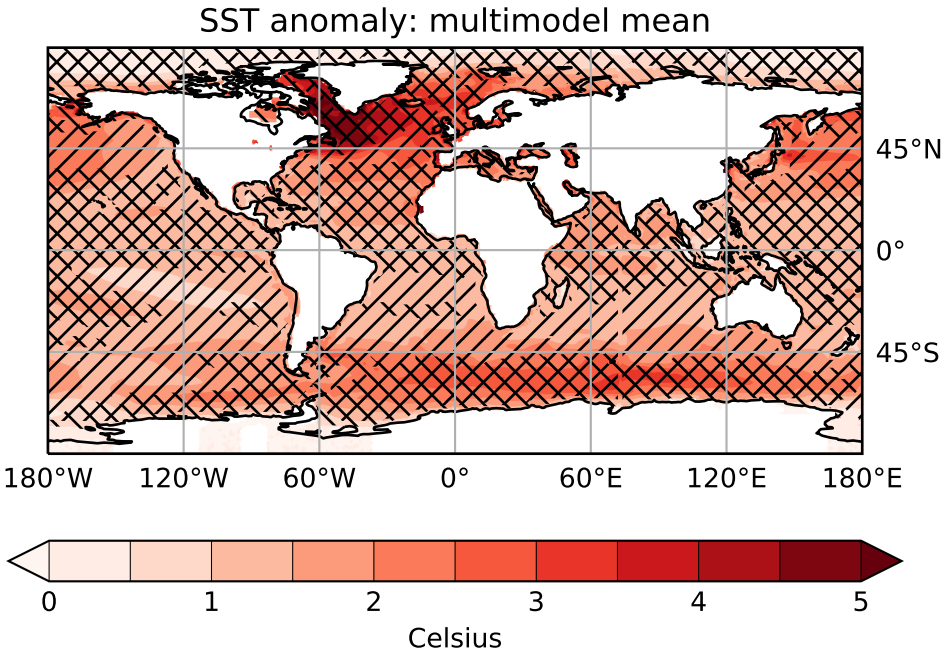

Figure 3: Multimodel mean *(Plio$_{Core}$ - PI$_{Ctrl}$)* SST anomalies (colors). Regions which have at least 12 of the 15 models agreeing on the sign of the change are marked '/'. Regions which have the ratio of the multimodel mean SST change to the PI_{Ctrl} intermodel standard deviation greater than 1 are marked '\'. Regions which fulfil both these conditions are said to be robust across the ensemble.

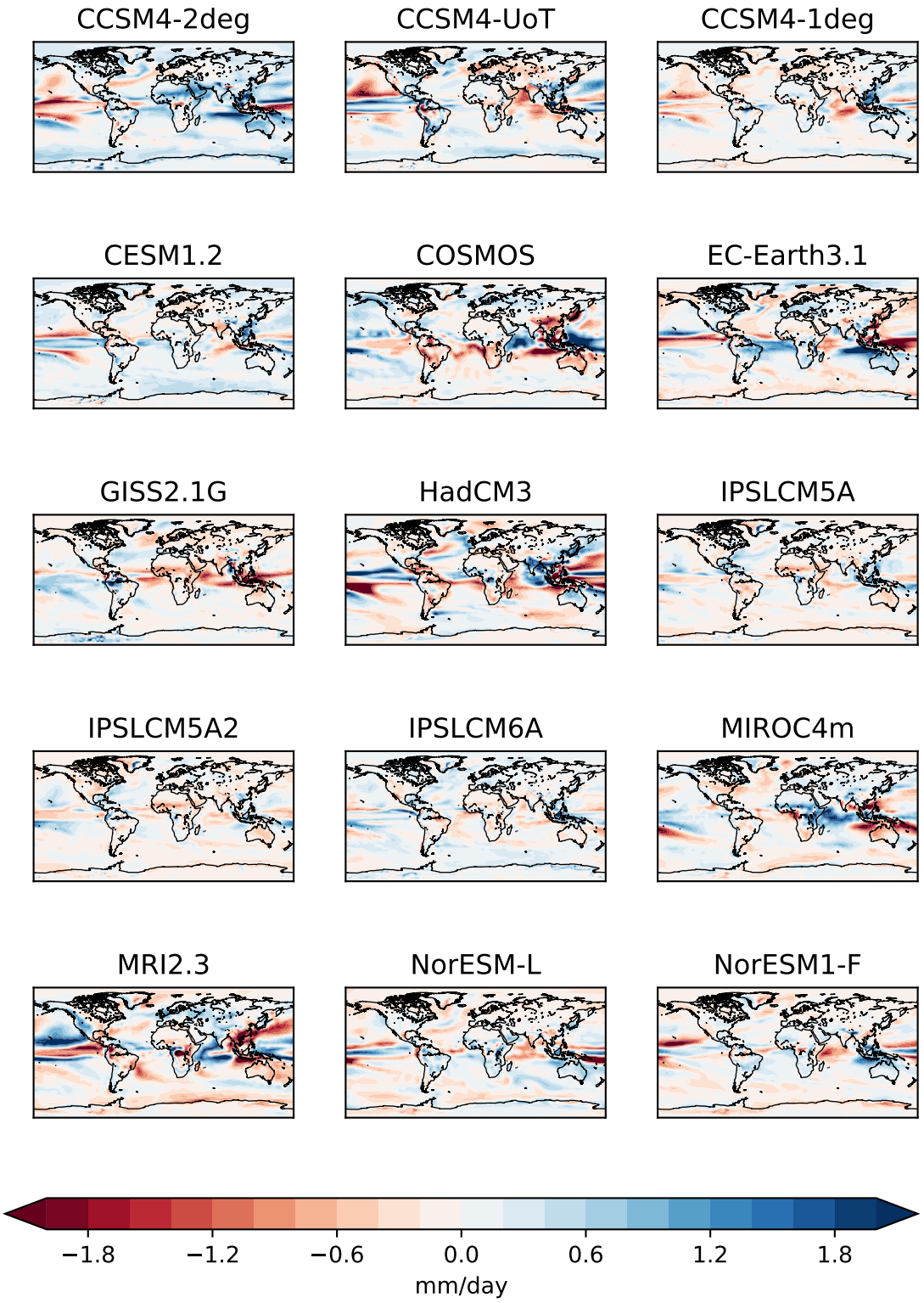

Figure 4: Precipitation anomaly $(Plio_{Core}$ - $PI_{Ctrl})$ from each model minus the multimodel mean Precipitation anomaly

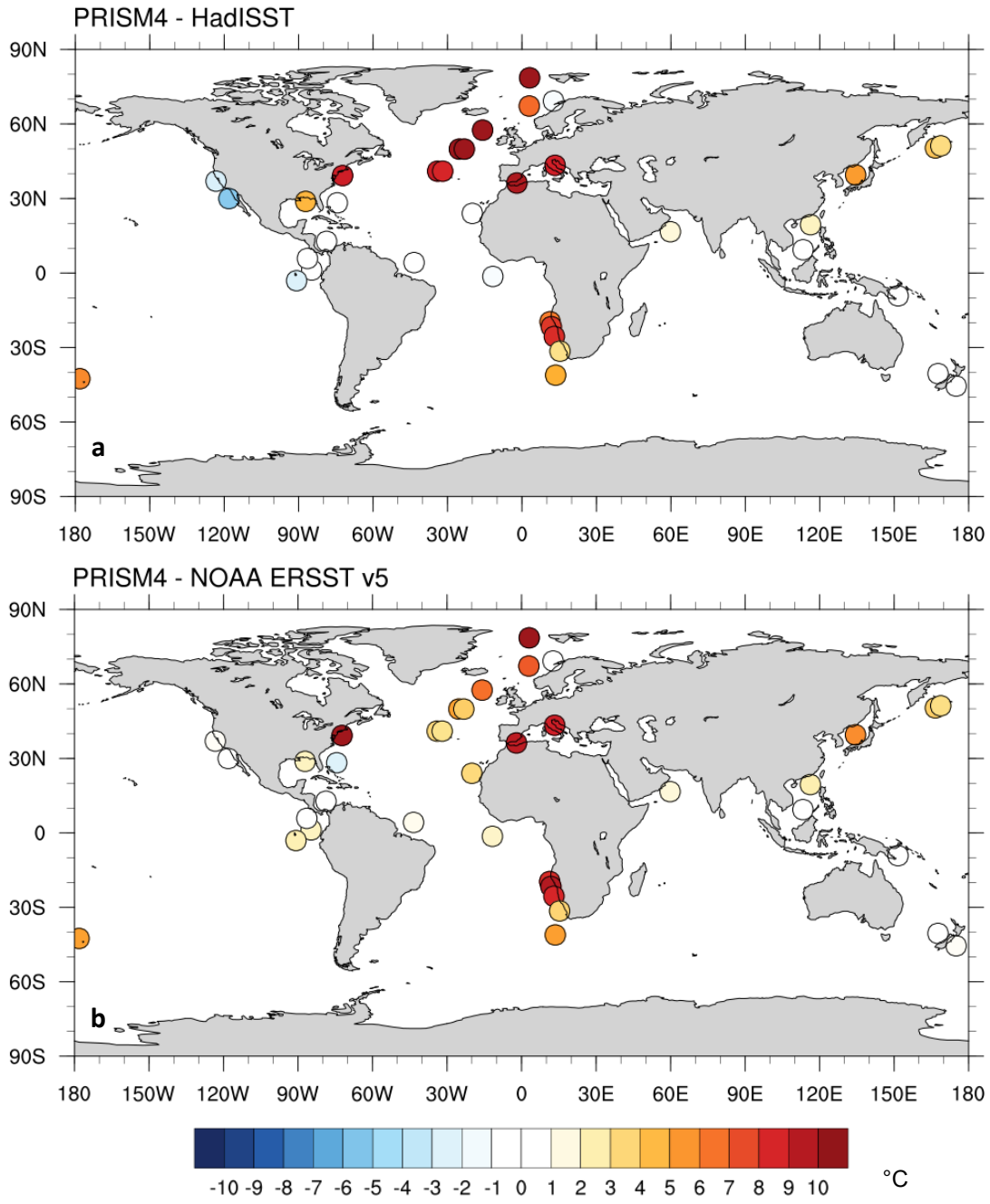

Figure 5: SST anomaly from the data using preindustrial SST from different sources. a) PRISM4 SST - HadISST, b) PRISM4 SST - NOAA ERSSTv5

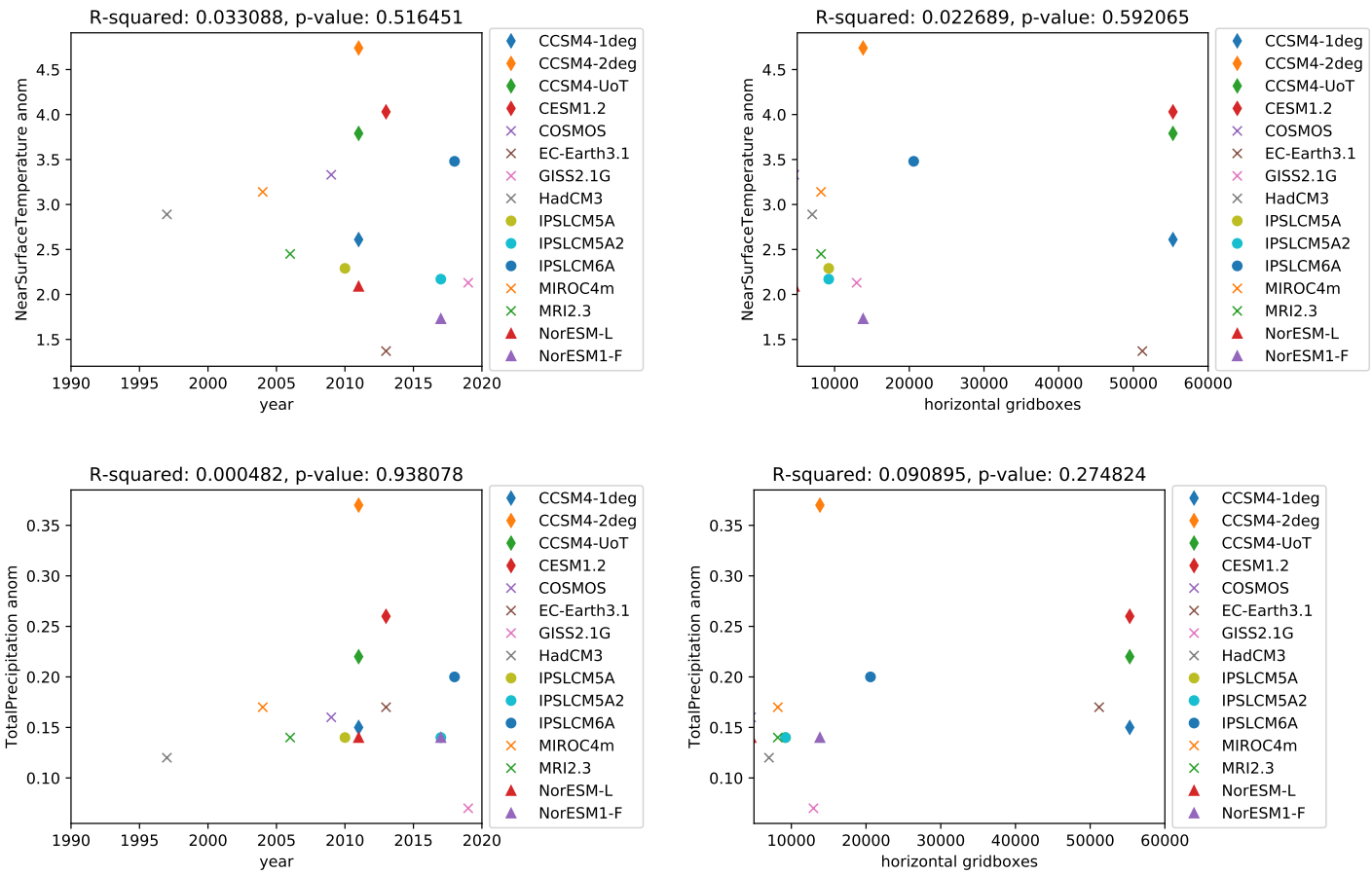

Figure 6: a) the correlation between the $Plio_{Core}$ - PI_{Ctrl} SAT anomaly and year of model release. b) the correlation between the $Plio_{Core}$ - PI_{Ctrl} SAT anomaly and the number of atmopsheric gridboxes. (c) and (d) are as (a) and (b) but for precipitation