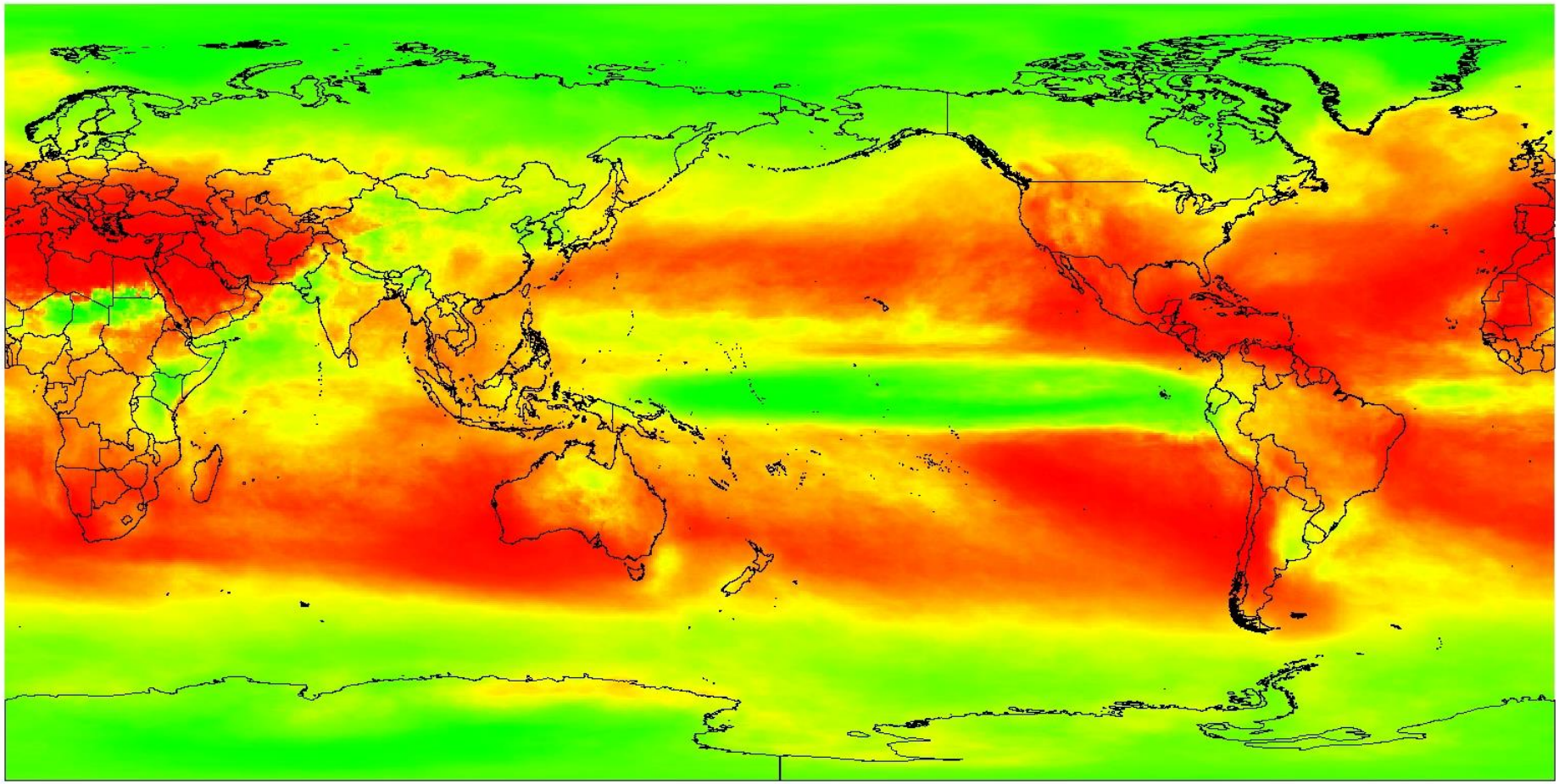
Dr Peter Kouwenhoven

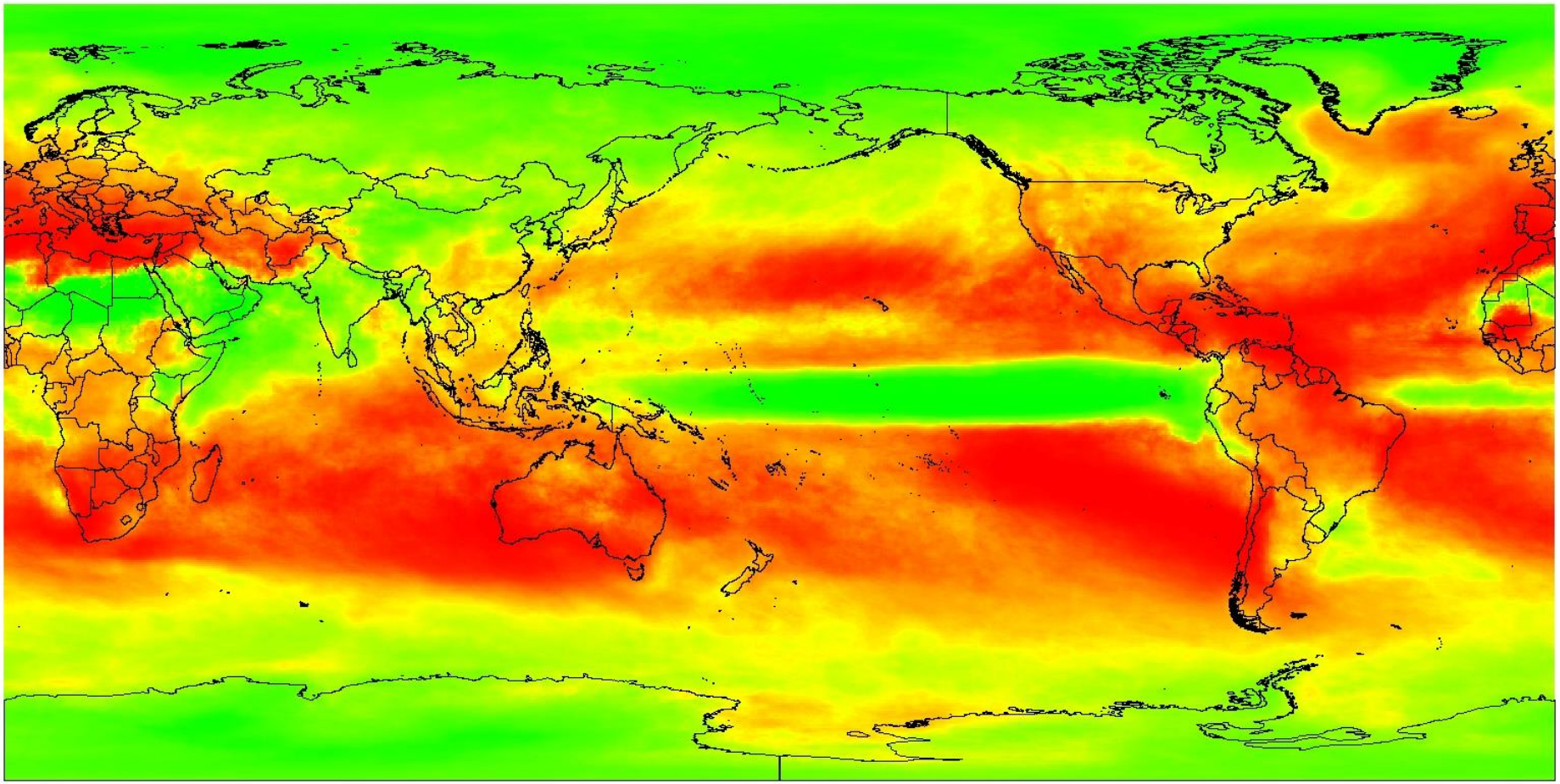
Precipitation

- AR4 (21 models) vs. AR5 (38 models)
- annual precipitation (mm/yr)
- relative change (%mm/Δ°C)

AR4 %/Δ˚C

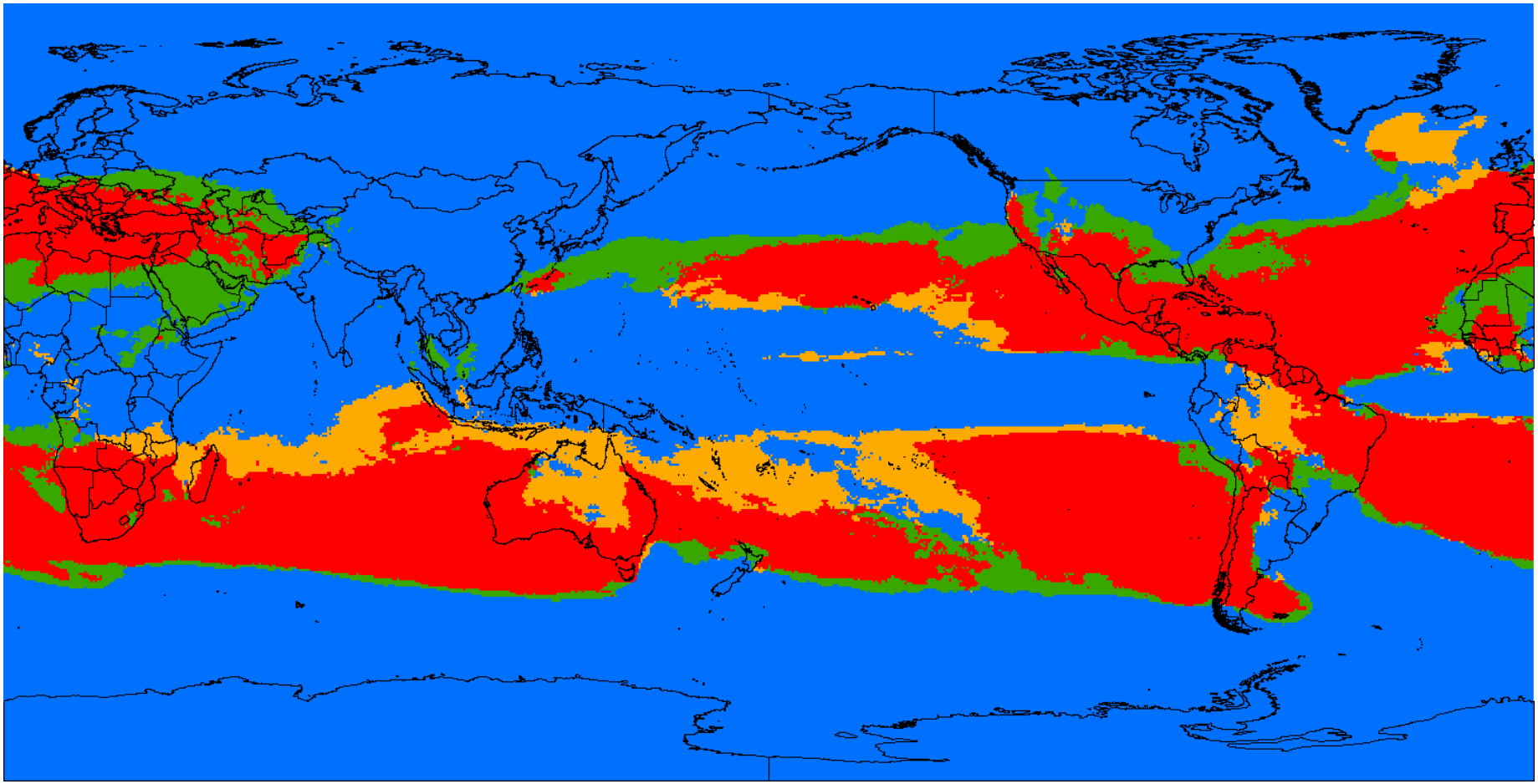


AR5 %/Δ˚C



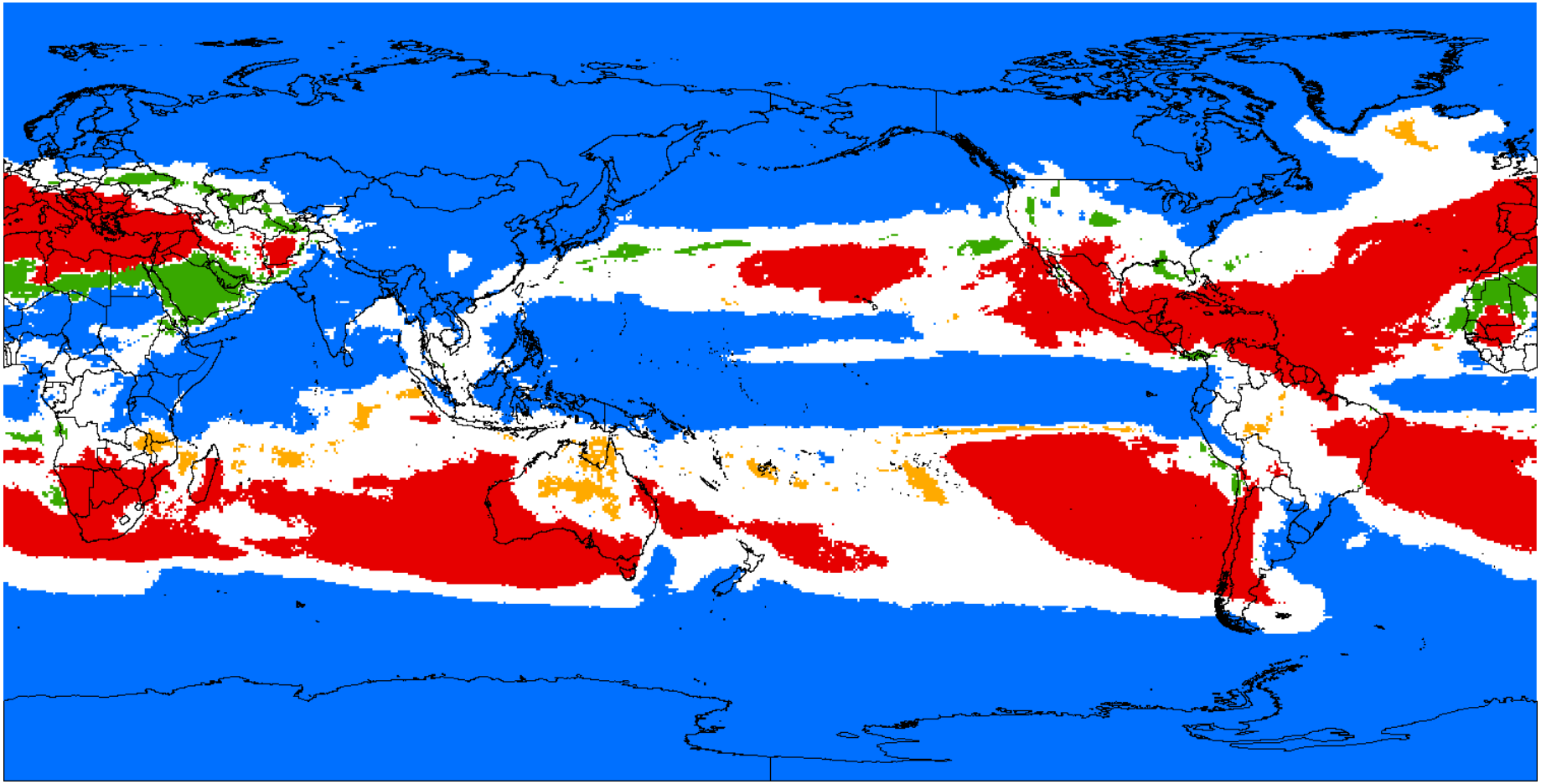
CLIMsystems

	AR4<0 (drier)	AR4>0 (wetter)
AR5<0 (drier)	RED	ORANGE
AR5>0 (wetter)	GREEN	BLUE



|Δ| >1%/Δ°C

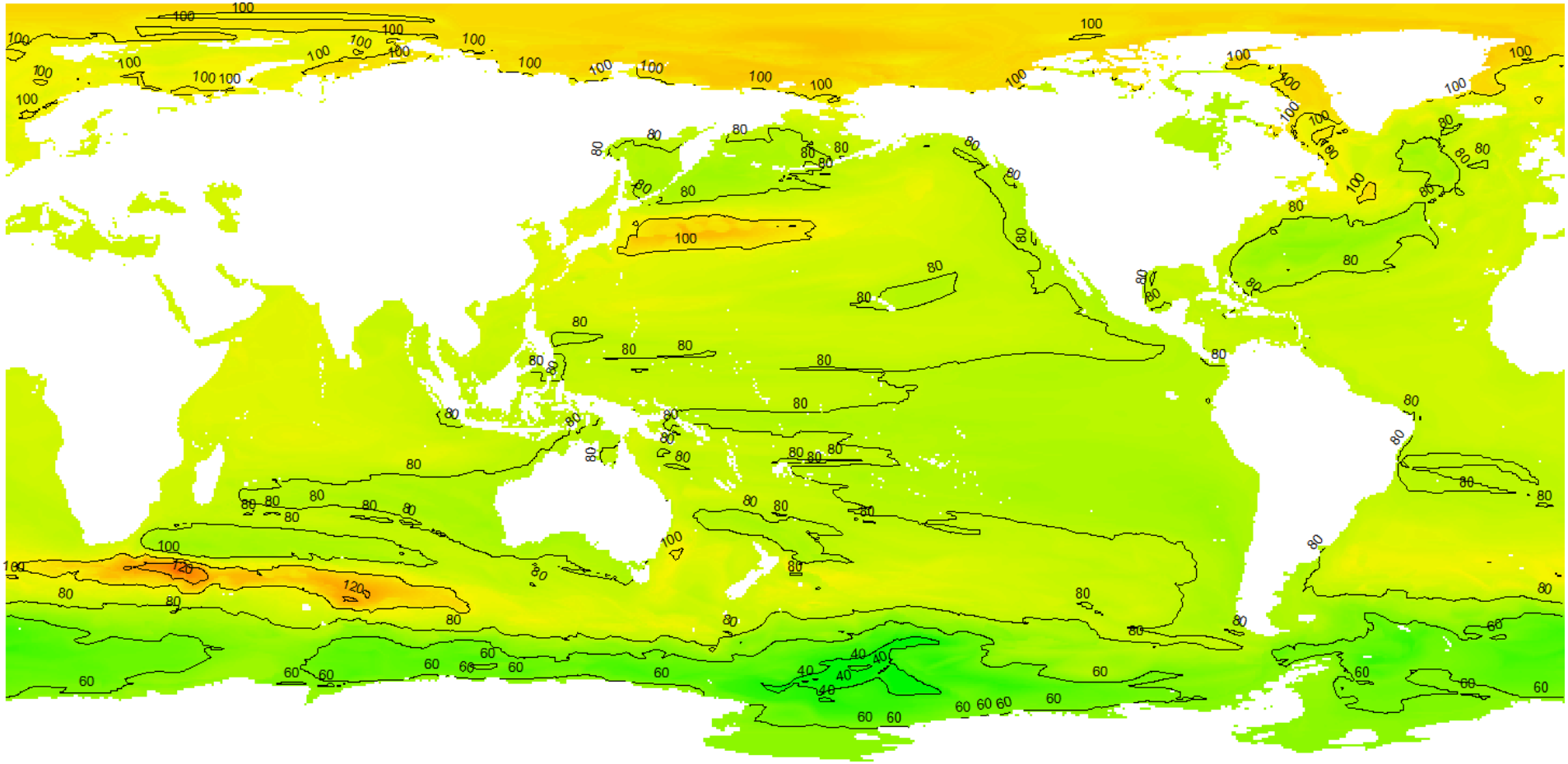
	AR4<0 (drier)	AR4>0 (wetter)
AR5<0 (drier)	RED	ORANGE
AR5>0 (wetter)	GREEN	BLUE



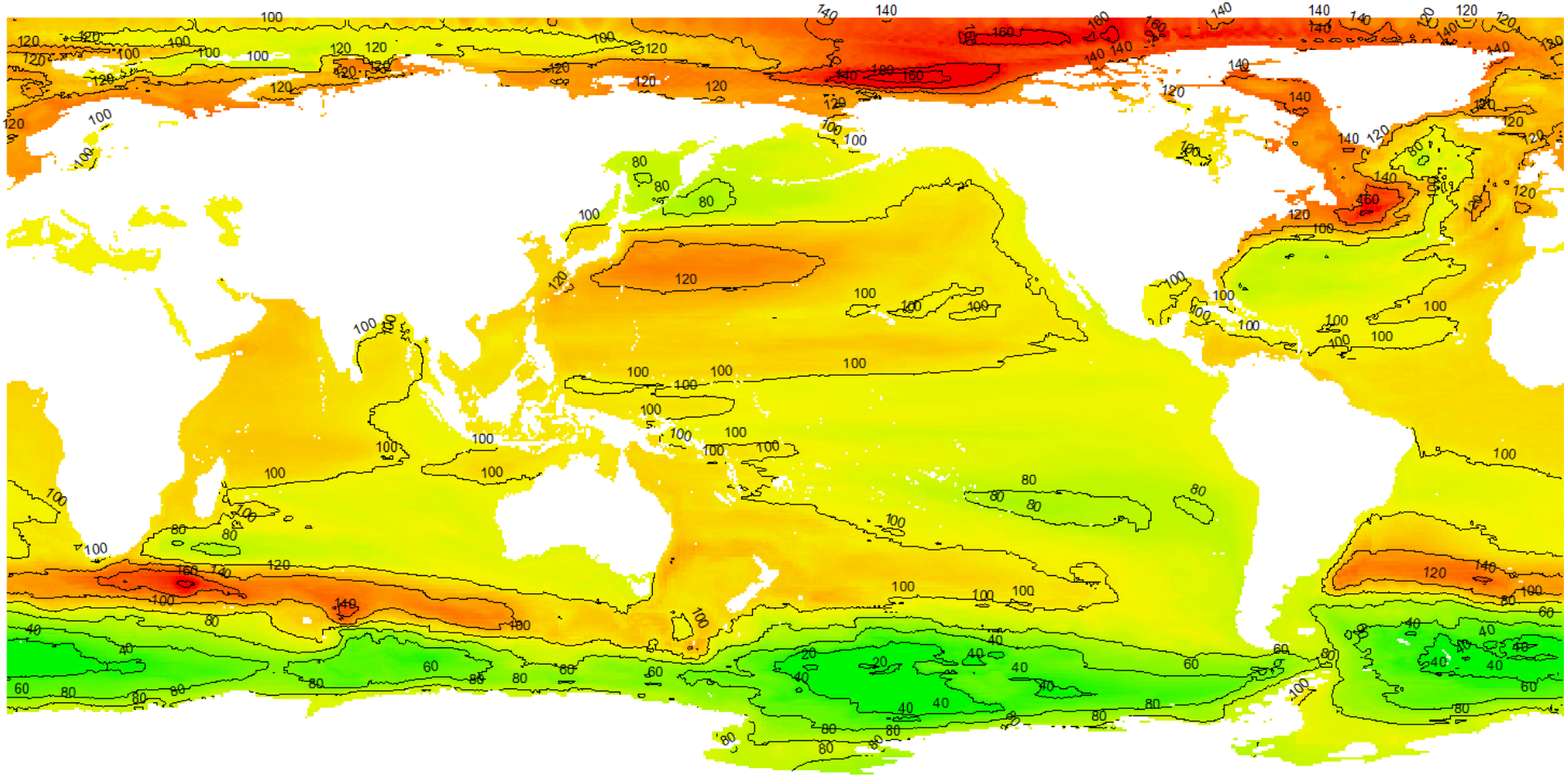
SEA LEVEL RISE

- AR4 (13 models) vs. AR5 (24 models)
- sea level rise over 1990-2100 (cm)
- most extreme scenario (AR4: A1FI-high, AR5: RCP8.5-high)

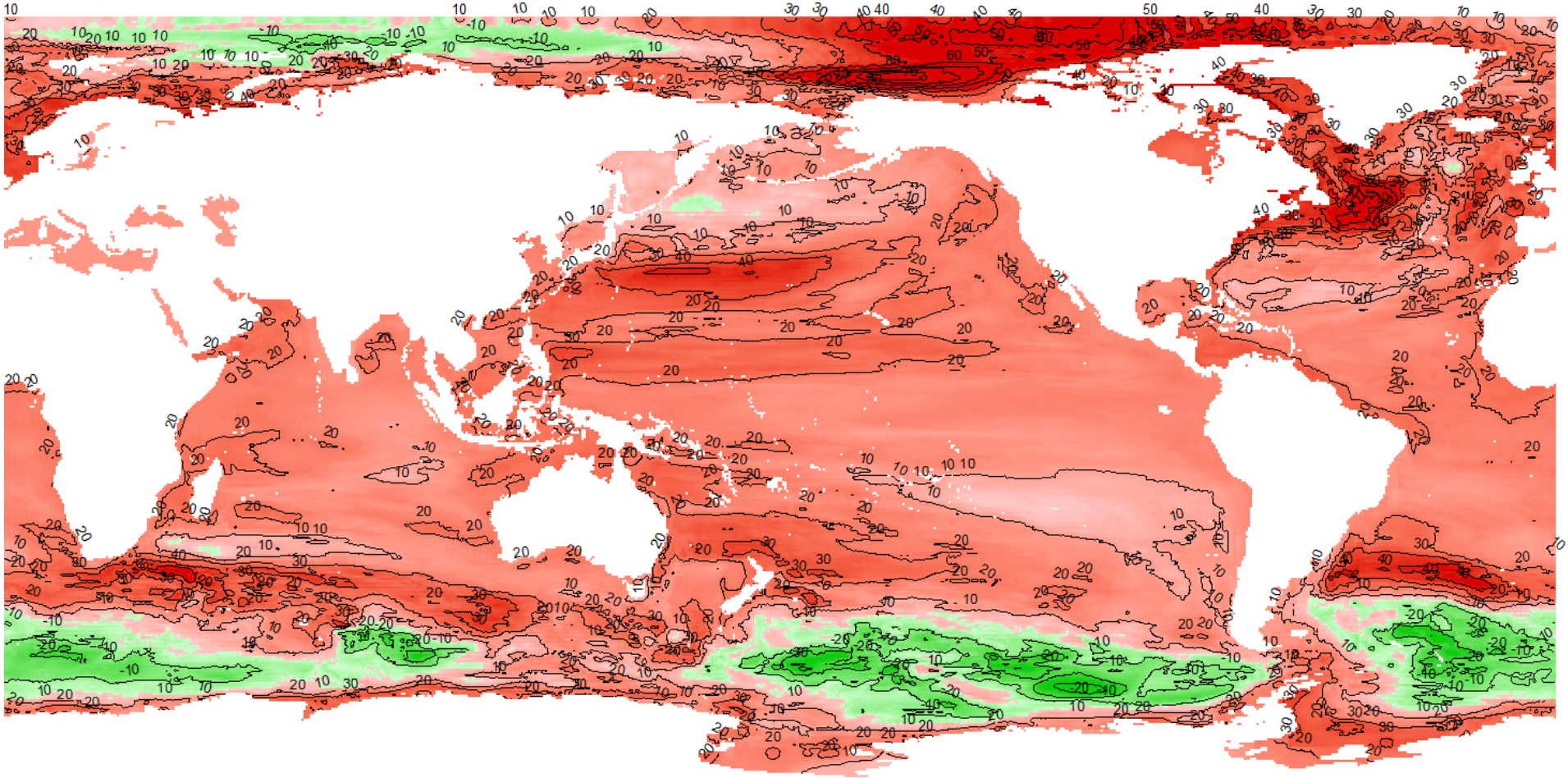
AR4 SLR 2100 (A1FI-high)



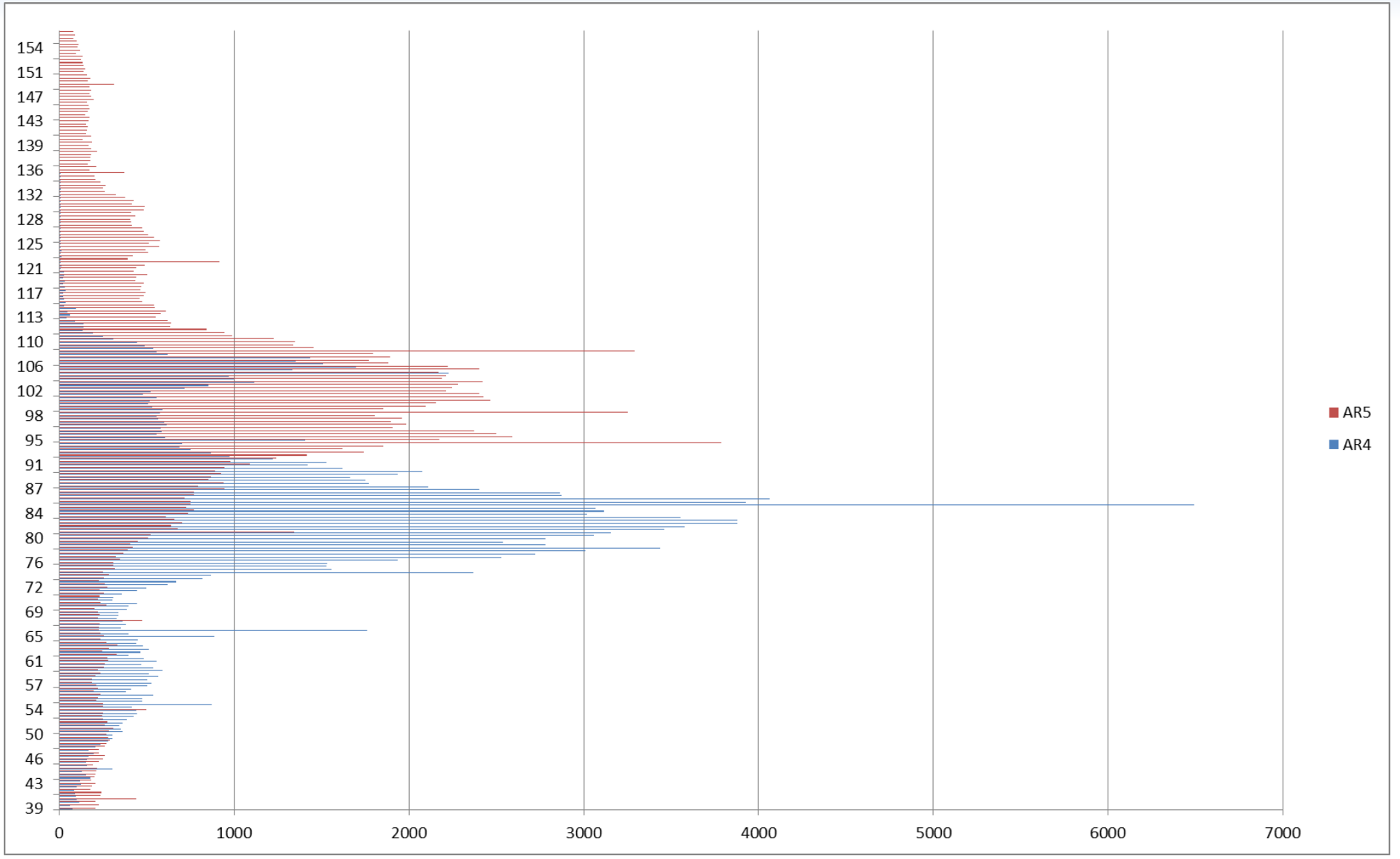
AR5 SLR 2100 (RCP8.5-high)



SLR 2100: AR4 vs AR5



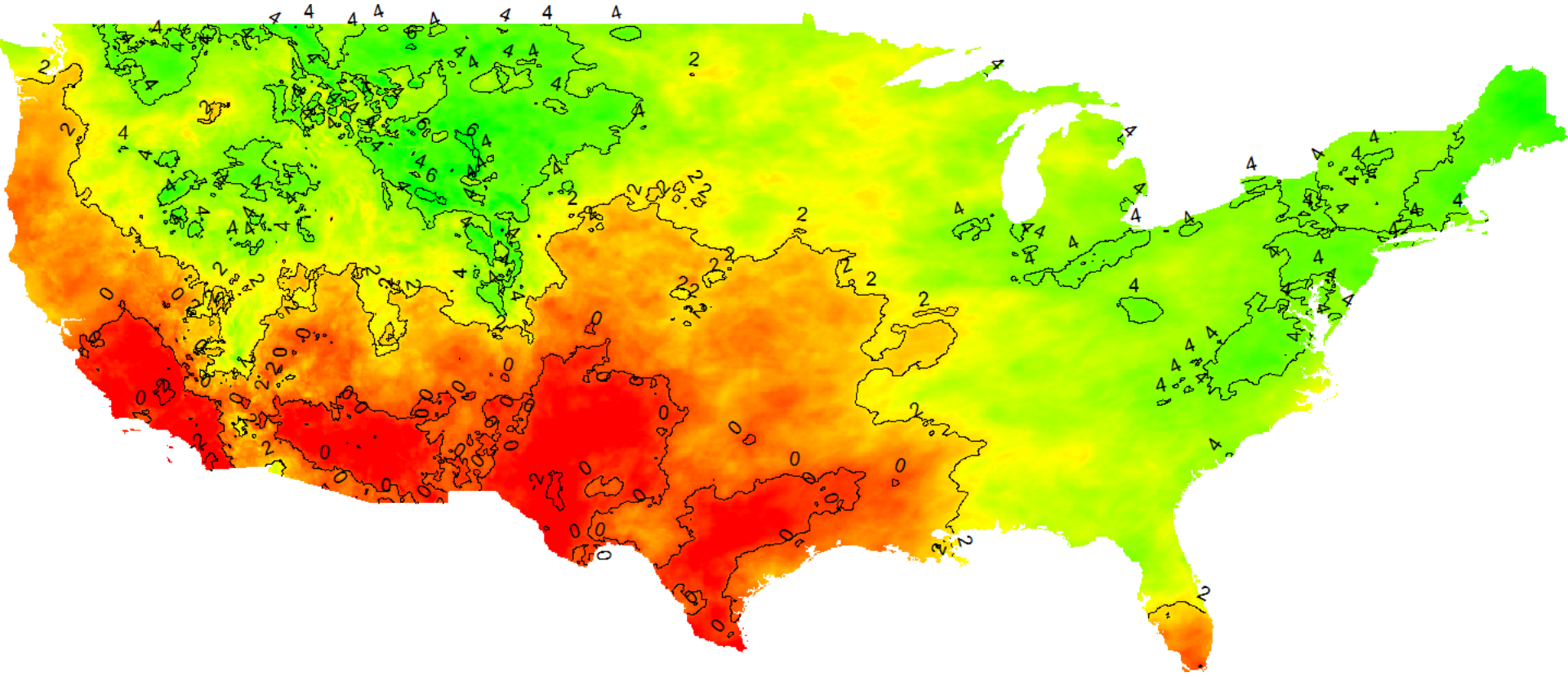
SLR distribution (2100)



USA comparison AR4 - AR5

- 39 models for the USA (AR5, 5km resolution, precipitation)
- calculate change in annual precipitation for each model separately (2100, RCP8.5 high)
- also as an ensemble (median value)
- thus 40 images

%Δprecip/Δ˚C



Caveats 1

- the ensemble calculation in SimCLIM determines the median for each month (with potentially having different models being the median value for different months) and then computes the annual change (using the monthly precipitation values, so weighing according to that precipitation)

Caveats 2

- thus there is unlikely to be 1 single model that corresponds with the median annual change (unless that model is the “best” every single month)
- the values are not area-weighted, ignoring the fact that the grid-cells have increasing areas from North to South

Range of model outputs

Normalized GCM values

Climate variable: Precipitation Longitude -99.2161 Latitude 38.4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
HADCM3	32.3100	15.5900	2.0100	-13.7000	-8.7000	-25.6500	-24.8600	-6.2000	-24.9200	31.4000	-4.8000	44.4300	-7.5966
ACCESS1-0	40.3700	0.8200	-13.0900	16.3800	-10.5800	-10.6200	-16.1300	-15.6900	-5.9500	2.8400	21.9700	-11.4800	-5.4400
MIROC5	5.1000	-19.0000	7.4800	-21.2900	-9.4100	-11.1200	3.1900	-6.0700	9.9300	-3.0100	-13.7000	4.0800	-4.8492
BCC-CSM1-1	-8.3600	-7.6700	-9.7500	16.1800	1.1200	3.5500	-6.7900	-20.8000	-13.2300	-6.8200	-10.7000	-4.2000	-4.7003
MIROC4H	18.4800	-7.1600	27.9400	-7.5500	3.1000	2.9500	-10.0700	-11.2400	0.1600	-21.7200	-47.9100	-7.1800	-3.7952
NORESM1-ME	21.8600	-3.1300	10.8700	1.3100	11.9300	-11.8900	-31.7100	-26.9100	1.1200	36.8800	-0.8000	6.2100	-3.3854
BCC-CSM1-1-M	22.2200	18.7800	-8.9000	6.0500	-0.0100	13.5700	-20.4700	-17.5700	-10.5600	-5.5100	-9.5900	19.0400	-3.3474
BNU-ESM	3.9000	-3.2300	-11.7400	20.3500	1.7400	-11.0900	-6.5700	-12.8100	-10.0000	1.4100	23.6400	-7.1100	-2.6382
HADGEM2-AO	29.2500	17.2800	10.5700	-0.9900	-8.2800	-2.4700	-4.8900	-8.6600	-0.2900	-11.5900	3.3700	-9.2300	-2.1001
IPSL-CM5A-LR	2.7800	-9.5000	0.3300	3.9400	-1.4400	-1.2900	-4.2500	-3.3900	1.9500	6.9500	-4.1900	-15.0800	-1.3150
GFDL-ESM2G	11.1700	58.0600	-29.1800	-11.4300	-1.7400	7.3600	-5.0400	13.5300	1.6800	-8.1200	14.7100	-51.0600	-1.1539
CMCC-CM	10.4300	13.4800	13.9200	17.8100	3.0400	9.3200	-13.7100	-10.1300	-14.1000	-7.9700	-10.5500	-13.1700	-0.4684
CESM1-CAM5	-6.2700	16.6400	9.9900	-1.2300	4.1200	-5.9700	-6.9500	-11.9000	-5.7100	5.2900	22.1800	13.1900	-0.0709
CESM1-BGC	-4.4300	-7.3700	26.6800	2.8700	4.1700	-14.5400	-20.0400	2.1900	3.2000	-7.5000	39.2900	16.9900	0.4155
MPI-ESM-MR	-3.5100	32.4800	6.4900	3.2400	-3.1200	-10.6300	-7.6900	-11.5300	-6.6000	-5.2300	57.1100	40.1600	0.5410
IPSL-CM5A-MR	-4.5300	-4.5600	10.6800	4.6100	2.1500	-11.6500	-3.8200	3.5100	-3.6400	27.8800	2.4500	-4.3900	1.2271
FIO-ESM	4.5200	-3.4600	-5.0800	-12.2400	40.4300	12.8300	-35.9400	-5.9600	5.1700	9.8900	1.6600	-7.3900	1.2586

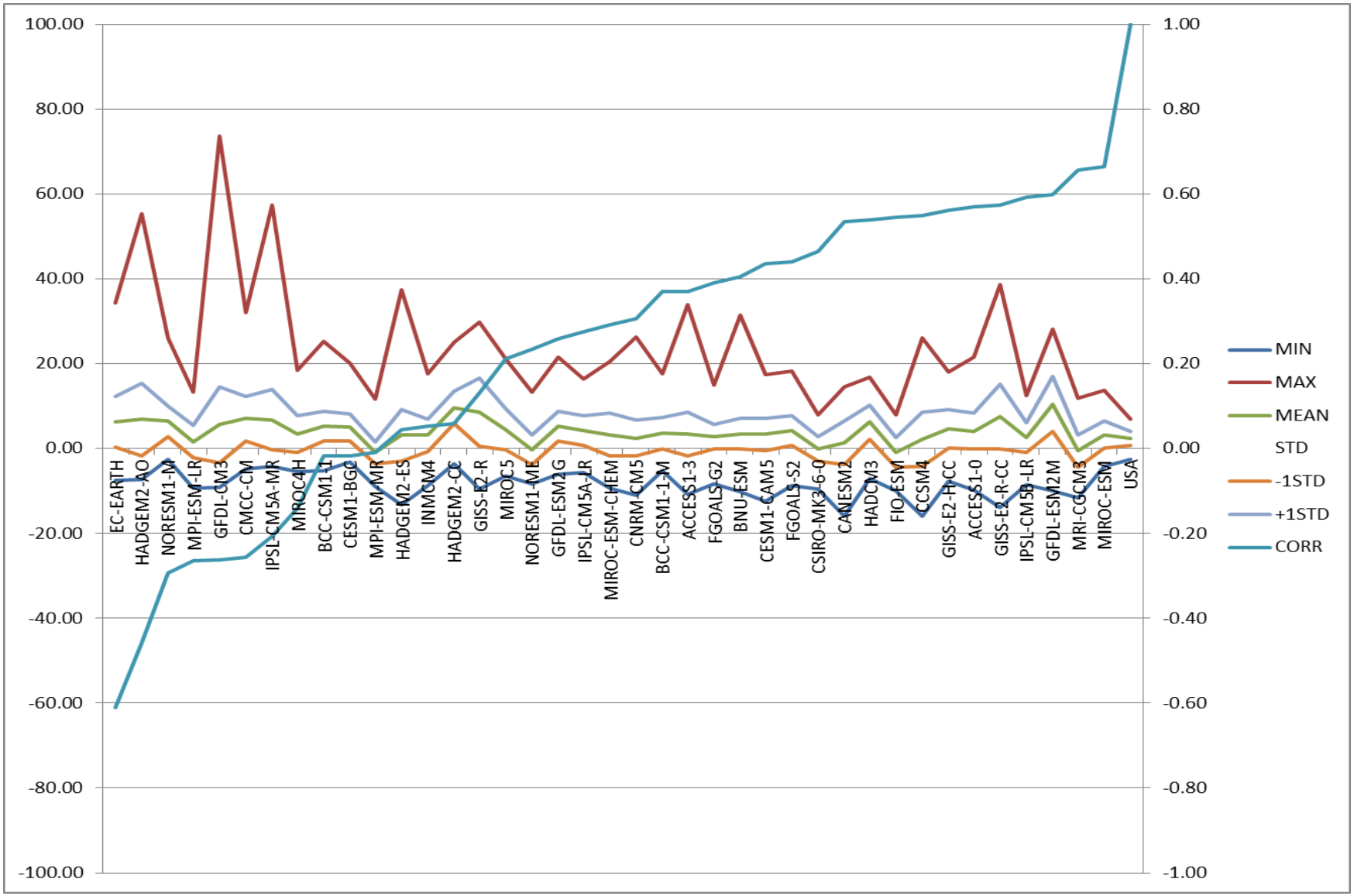
Low percentile 10.0 High percentile 90.0

Average	10.4123	9.8987	7.3087	2.7115	2.7615	2.9121	-5.9708	-1.9574	-1.8536	3.9423	10.6944	8.9874	2.0523
Median	**5.1000**	**7.7300**	**9.9900**	**3.2400**	**1.8300**	**4.3000**	**-4.8900**	**-4.2600**	**-0.2900**	**2.9600**	**6.9600**	**6.2100**	**1.8645**
Low Percent	-8.5000	-8.0360	-12.5460	-12.1520	-10.8100	-11.2260	-21.4100	-16.0660	-14.8240	-11.5900	-15.3480	-11.8180	-13.7501
High Percent	31.6140	34.3120	29.0800	18.3180	18.5740	17.5880	7.6500	12.9060	13.1240	23.5600	41.9180	35.9440	19.4401

Statistics calculated

- MIN: the lowest value in the image
- MAX: the highest value in the image
- MEAN: the average value over the image
- -1SD: mean minus one standard deviation
- +1SD: mean plus one standard deviation
- CORR: correlation between image and the USA (using the change values in each grid cell as X/Y values for which the correlation is determined)

USA GCM characteristics



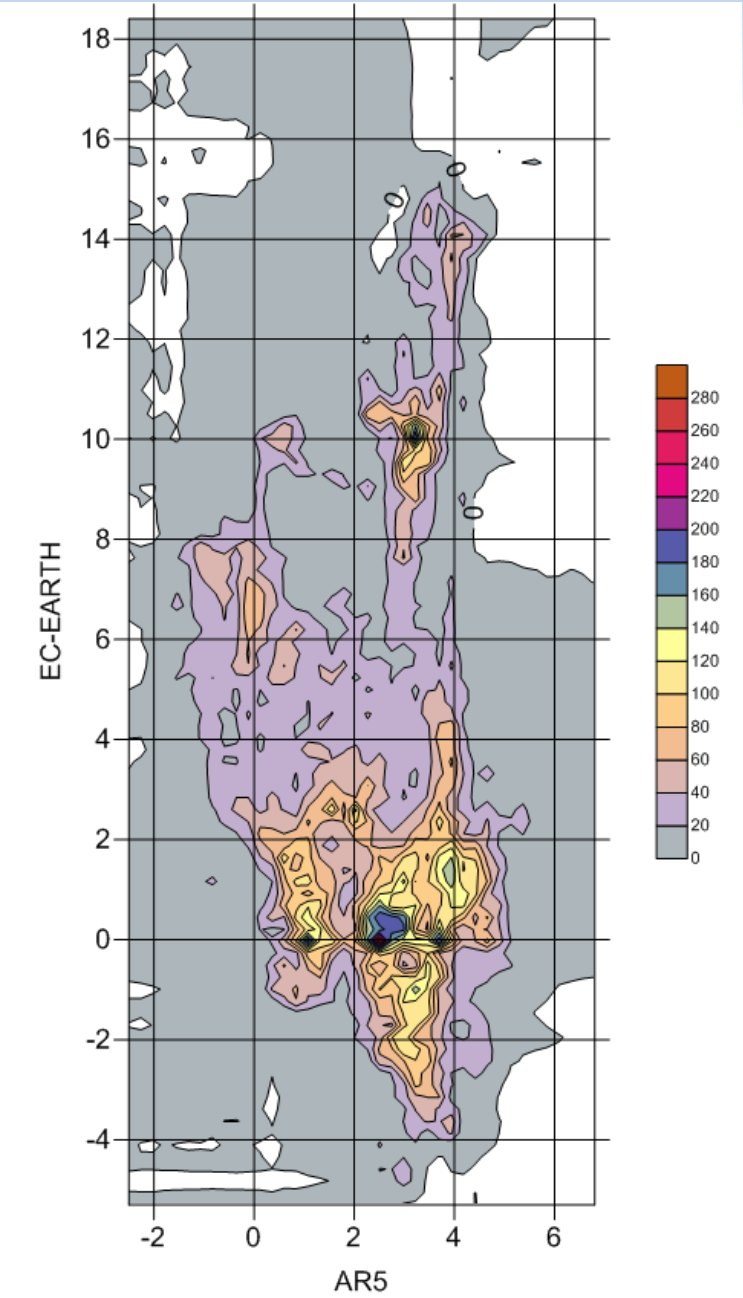
Observations 1

- the highest correlation value is 0.67
- in comparison, the correlation between the AR4 and AR5 ensembles for change in annual precipitation is 0.82
- there are 326,621 grid cells in the images (this means that even a correlation of ±0.01 is highly significant (<0.0001))

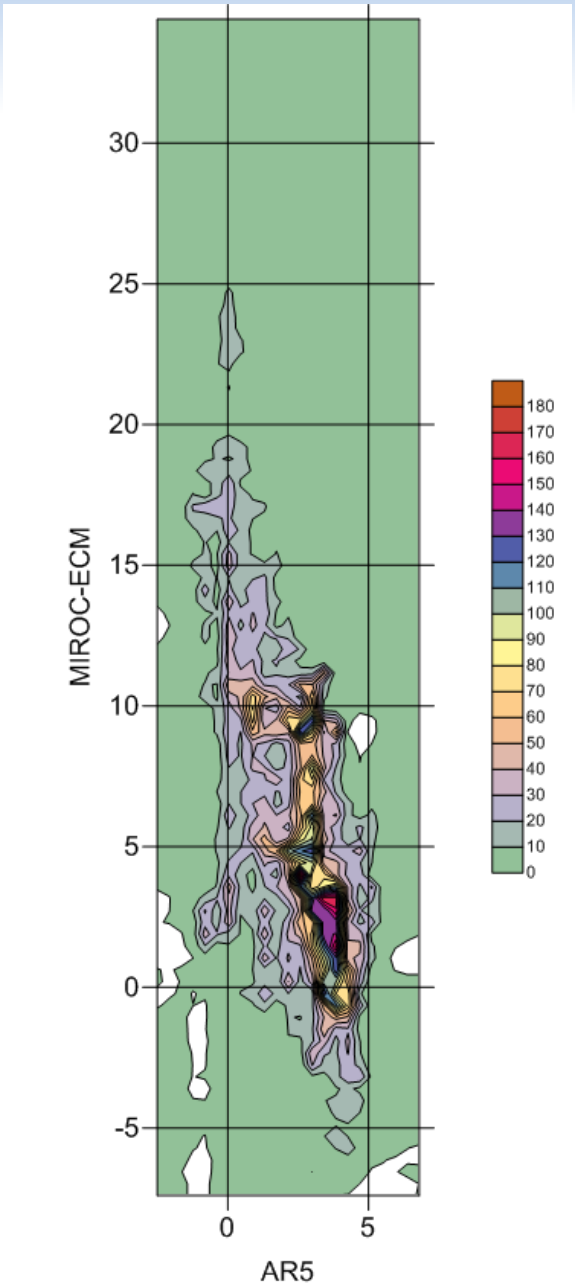
Observations 2

- the EC-EARTH correlation is so strongly negative, that it would perform way better if the opposite values were taken (change all the signs)
- 11 (out of 39) models have negative correlations with the ensemble result

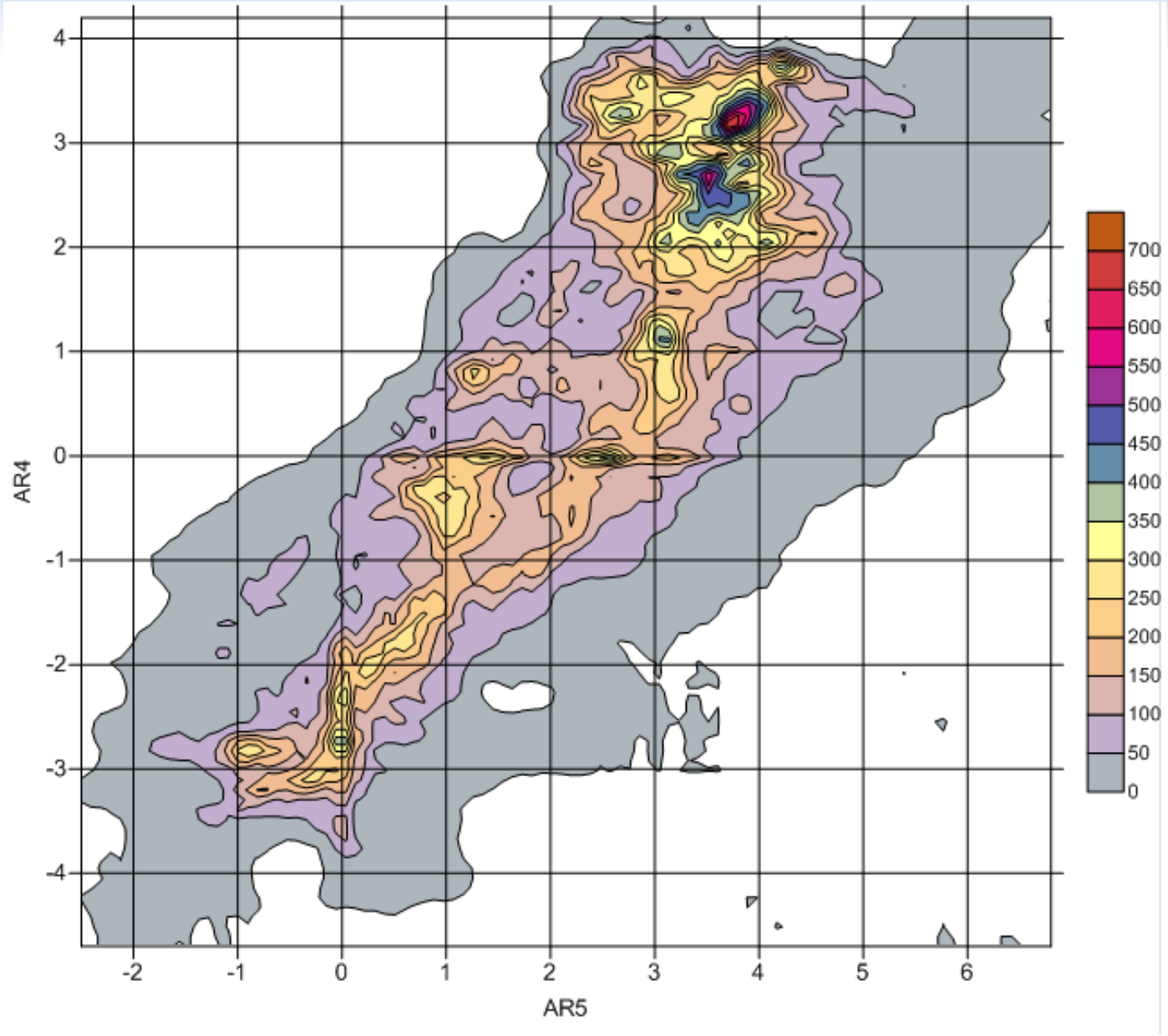
EC-EARTH (worst fit)



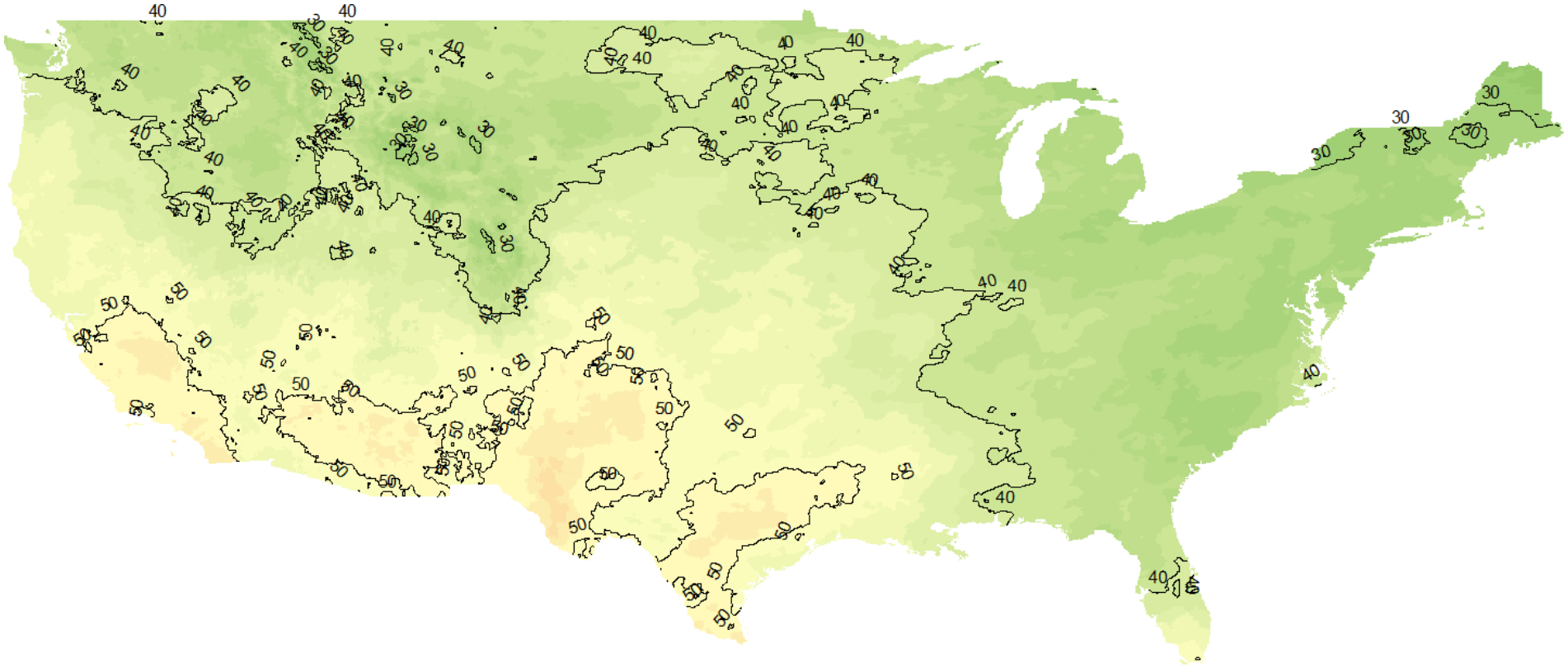
MIROC-ESM (best fit)



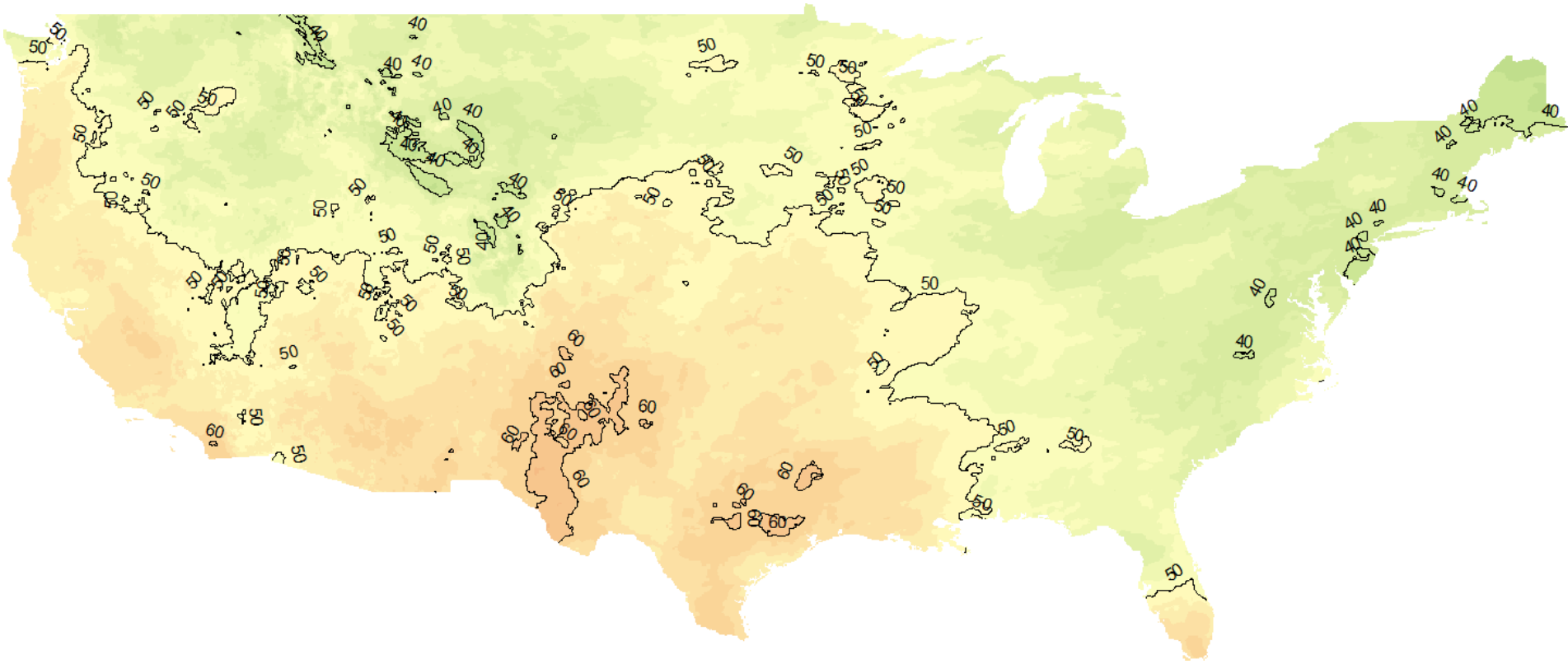
Correlation plot AR4 vs AR5



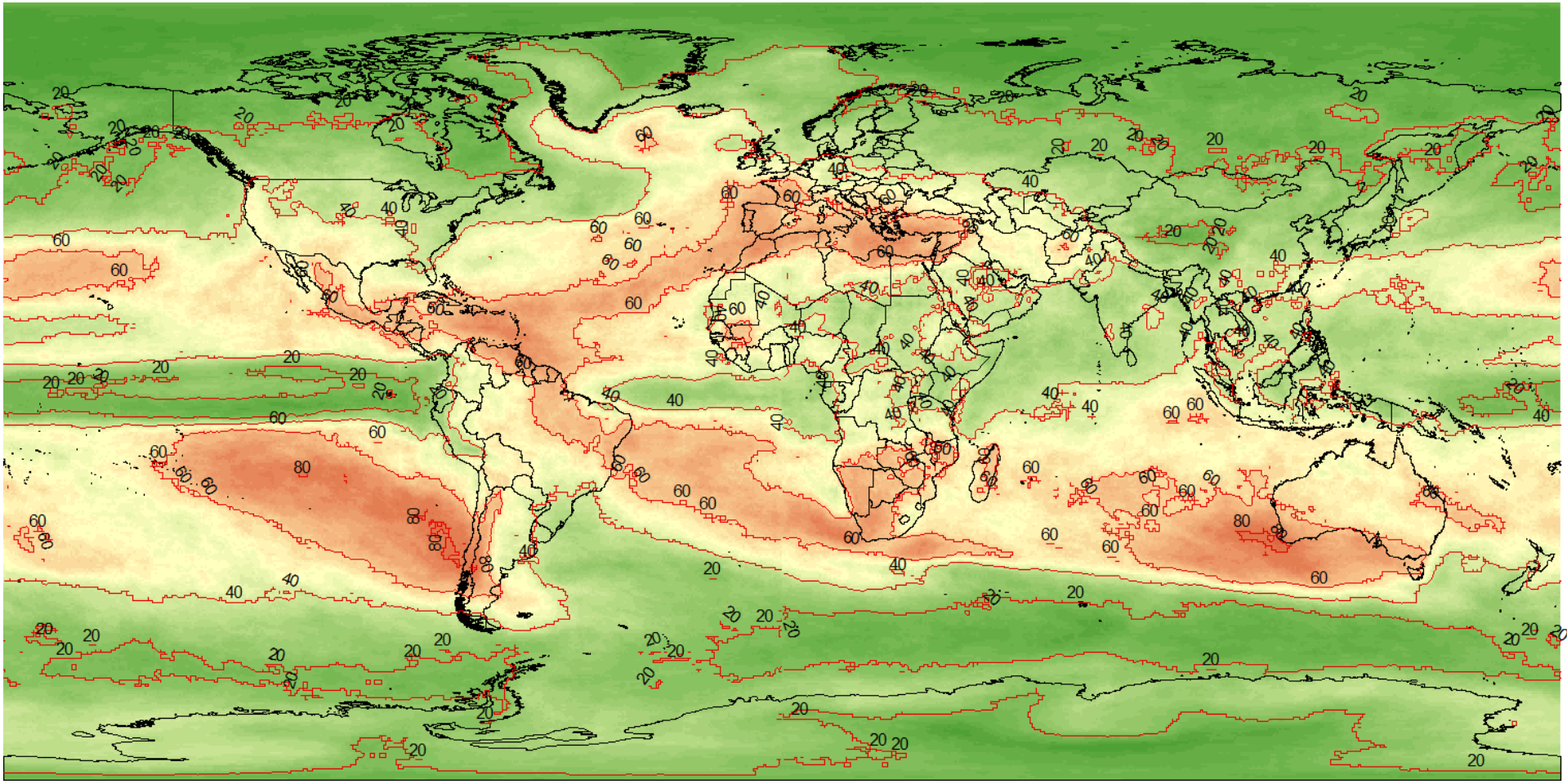
Model agreement USA %Δprecip<0%



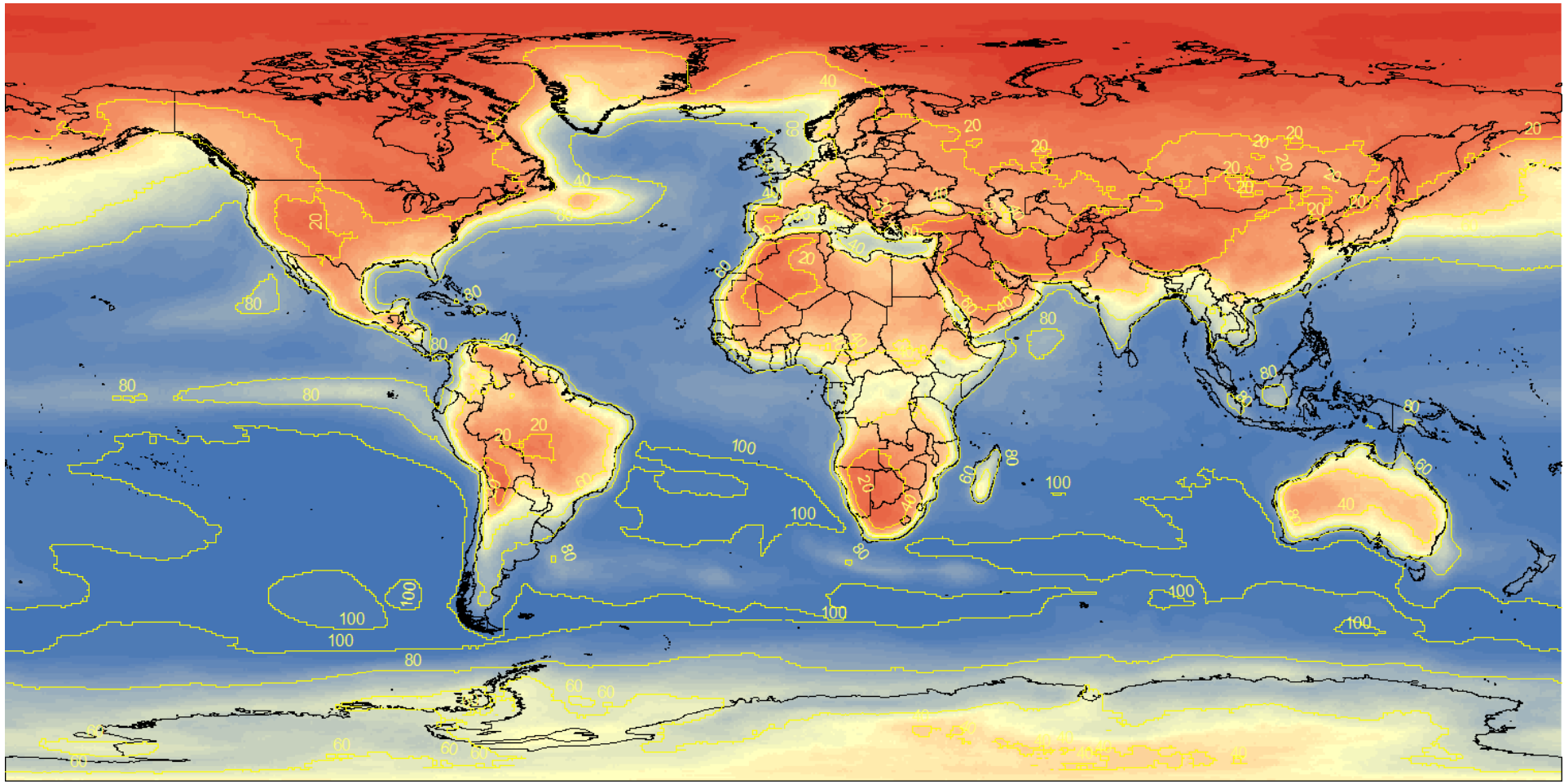
Model agreement USA %Δprecip<2.33%



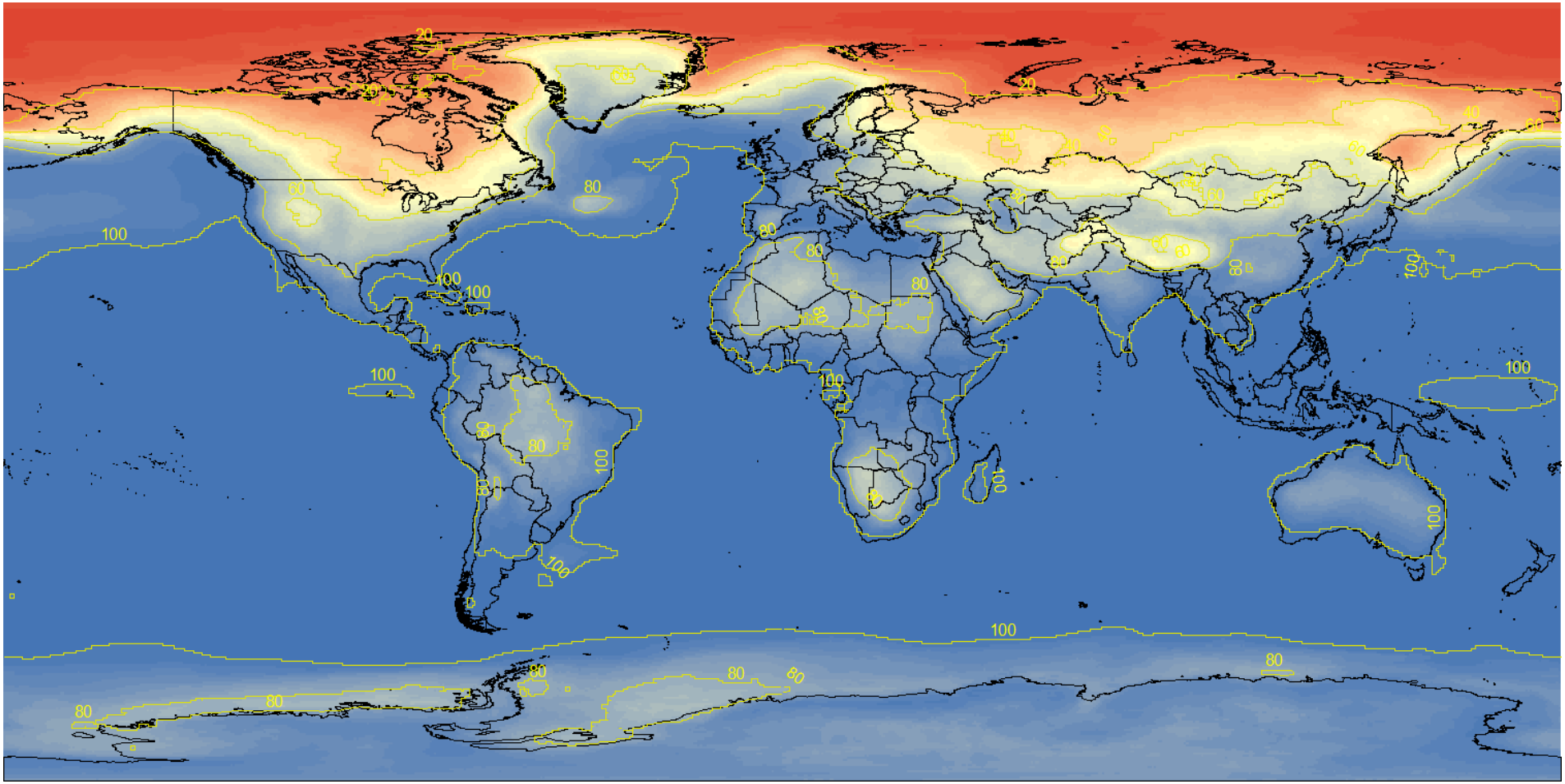
Global %Δprecip<0%



Global Δ°C<1°C/°C



Global Δ°C<1.5°C/°C



Thank you!

Questions?