UNDP Climate Change Country Profiles

Cameroon

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http://country-profiles.geog.ox.ac.uk

General Climate

Cameroon is located western central Africa, on the coast of the Gulf of Guinea, at a latitude of 3-13˚N. The southern regions of Cameroon are generally humid and equatorial, but the climate becomes semi-arid in the northern regions. The geography of Cameroon is highly diverse and its topographic features superimpose climatic variations on this north-south gradient. The low-lying coastal plain rises rapidly to the inland regions of high plateaus and mountain ranges. The Cameroon mountain range stretches along the country's northern border with Nigeria, with peaks in excess of 3000m.

The semi-arid north of Cameroon (north of 6˚N) is the hottest and driest part of the country, experiencing average temperatures between 25-27˚C in the cooler seasons (SON, DJF), and 27-30˚C in the warmer seasons (MAM, JJA). Temperatures in the southern regions are largely dependent on altitude ranging 20-25˚C, and varying little with season.

Annual rainfall is highest in the coastal and mountainous regions of Cameroon. The main wet season lasts between May and November for most of the country, when the West African Monsoon winds blow from the south-west, bringing moist air from the ocean. The wettest regions receive more than 400mm per month of rainfall, but the semi-arid northern regions of Cameroon receive less than 100mm per month. The southern plateau region has two shorter rainy seasons, occurring in May to June and October to November.

Recent Climate Trends

Temperature

- Mean annual temperature has increased by 0.7˚C since 1960, an average rate of 0.15˚C per decade.
- The rate of increase over the whole country is most rapid in MAM, at 0.19˚C per decade, but in the north of Cameroon, the warming is most rapid in DJF and SON, occurring at rates of 0.2 to 0.4˚C per decade.

- There are few daily observations available from which to infer changes in daily temperature extremes. Available data indicate significantly increasing trends in the frequency of days, annually, that are classed as 'hot'[1] in annual data. The average number of 'hot' nights per year in Cameroon has increased by 79 (an additional 21.7% of nights[2]) between 1960 and 2003.

Precipitation

- Mean annual rainfall over Cameroon has decreased by around 2.9mm per month (2.2%) per decade since 1960. Cameroon experienced particularly low rainfalls in 2003 and 2005.
- There is not sufficient daily precipitation data available to determine trends in daily rainfall extremes.

GCM Projections of Future Climate

Temperature

- The mean annual temperature is projected to increase by 1.0 to 2.9˚C by the 2060s, and 1.5 to 4.7˚C by the 2090s. The range of projections by the 2090s under any one emissions scenario is 1.5- 2˚C.
- The projected rate of warming is faster in the continental interior regions of Cameroon (the north and east), and slower in the western coastal areas.

- Model projections all indicate increases in the frequency of days and nights that are considered 'hot' in current climate. The rate at which the frequency of hot days increases, however, varies considerably between models.
    - Annually, projections indicate that 'hot' days will occur on 20-51% of days by the 2060s, and 23-83% of days by the 2090s. Days considered 'hot' by current climate standards for their season are projected to increase most rapidly in JJA, occurring on 35-99% of days of the season by the 2090s.
    - Nights that are considered 'hot' for the annual climate of 1970-99 are projected to increase more quickly that hot days, projected to occur on 36-75% of nights by the 2060s and 49-87% of nights by the 2090s. Nights that are considered hot for each season by 1970-99 standards are projected to increase most rapidly in JJA, occurring on 62-99% of nights in every season by the 2090s.
- All projections indicate decreases in the frequency of days and nights that are considered 'cold'[3] in current climate. These events are expected to become exceedingly rare, and do not at all by the 2090s in under the highest emissions scenario (A2).

[1] 'Hot' day or 'hot' night is defined by the temperature exceeded on 10% of days or nights in current climate of that region and season.

[2] The increase in frequency over the 43-year period between 1960 and 2003 is estimated based on the decadal trend quoted in the summary table.

[3] 'Cold' days or 'cold' nights are defined as the temperature below which 10% of days or nights are recorded in current climate of that region or season.

Precipitation

- Projections of mean annual rainfall averaged over the country from different models in the ensemble indicate a wide range of changes in precipitation for Cameroon. Projected change range from -12 to +20mm per month (-8 to +17%) by the 2090s, with ensemble means +1 to -3 mm per month (0 to 2%).
- Models are broadly consistent in projecting increases in SON rainfall – projected changes range from -14mm to +39mm (-6% to +26%).

- Models are broadly consistent in indicating increases in the proportion of total rainfall that falls in heavy[4] events, even in seasons when mean rainfall does not increase. Annually, these changes range from -2% to +15%.
- Projections indicate that maximum 1- and 5-day rainfalls are also likely to increase in magnitude by as much as 27mm and 40mm respectively.

Other Regional Climate Change Information

- Cameroon's coastal lowlands may be vulnerable to sea-level rise. Sea-level in this region is projected by climate models to rise by the following levels[5] by the 2090s, relative to 1980-1999 sea-level:
    - 0.13 to 0.43m under SRES B1
    - 0.16 to 0.53m under SRES A1B
    - 0.18 to 0.56m under SRES A2

- For further information on climate projections for Africa, see the IPCC Working Group I Report: '*The Physical Science Basis'*, Chapter 11 *(Regional Climate projections*): Section 11.2 *(Africa*).

[4] A 'Heavy' event is defined as a daily rainfall total which exceeds the threshold that is exceeded on 5% of rainy days in current the climate of that region and season.

[5] Taken from the IPCC Working group I (*The Physical Science Basis*): Chapter 10 (Global Climate Projections) (Meehl *et al*., 2007). Regional sea-level projections are estimated by applying regional adjustments (Fig 10.32, p813) to projected global mean sea-level rise from 14 AR4 models.

Data Summary

	Observed Mean 1970-99	Observed Trend 1960-2006		Projected changes by the 2030s Min	Median	Max	Projected changes by the 2060s Min	Median	Max	Projected changes by the 2090s Min	Median	Max
Temperature												
	(˚C)	*(change in ˚C per decade)*		*Change in ˚C*			*Change in ˚C*			*Change in ˚C*		
			A2	0.9	**1.3**	1.5	1.8	**2.5**	2.9	3.0	**4.2**	4.7
Annual	24.1	0.15*	*A1B*	0.9	**1.4**	1.7	1.7	**2.4**	2.8	2.4	**3.4**	4.2
			B1	0.6	**1.1**	1.3	1.0	**1.8**	2.1	1.5	**2.2**	2.7
			A2	0.8	**1.3**	1.8	1.8	**2.5**	3.3	2.9	**4.2**	5.6
DJF	23.9	0.13*	*A1B*	0.8	**1.3**	1.8	1.6	**2.5**	3.1	2.5	**3.2**	4.1
			B1	0.4	**1.2**	1.4	0.9	**1.8**	2.3	1.4	**2.2**	2.9
			A2	0.9	**1.3**	1.6	1.7	**2.6**	2.9	2.9	**4.3**	5.0
MAM	25.7	0.19*	*A1B*	0.9	**1.5**	1.7	1.8	**2.5**	3.0	2.4	**3.4**	4.6
			B1	0.6	**1.0**	1.4	1.1	**1.8**	2.3	1.6	**2.2**	3.0
			A2	1.0	**1.2**	1.6	1.9	**2.6**	2.9	3.1	**3.9**	4.8
JJA	23.3	0.14*	*A1B*	0.7	**1.4**	1.7	1.8	**2.4**	3.1	2.4	**3.1**	4.4
			B1	0.6	**1.0**	1.5	0.8	**1.6**	2.1	1.6	**2.1**	2.8
			A2	0.7	**1.3**	1.5	1.8	**2.4**	2.8	3.0	**4.0**	4.4
SON	23.5	0.15*	*A1B*	0.8	**1.4**	1.7	1.5	**2.4**	2.8	2.2	**3.2**	3.9
			B1	0.6	**1.1**	1.3	0.8	**1.7**	2.2	1.3	**2.1**	2.6
Precipitation												
	(mm per month)	*(change in mm per decade)*		*Change in mm per month*			*Change in mm per month*			*Change in mm per month*		
			A2	-5	**0**	6	-6	**4**	11	-12	**1**	19
Annual	129.7	-2.9*	*A1B*	-3	**1**	4	-8	**-1**	10	-7	**3**	20
			B1	-4	**0**	5	-4	**0**	8	-8	**2**	14
			A2	-4	**0**	6	-6	**0**	15	-11	**-1**	26
DJF	22.0	-0.3	*A1B*	-5	**0**	7	-5	**0**	13	-8	**2**	18
			B1	-7	**0**	6	-7	**0**	10	-5	**0**	10
			A2	-14	**0**	6	-17	**4**	13	-29	**3**	16
MAM	125.2	-4.3*	*A1B*	-13	**0**	7	-16	**2**	13	-26	**1**	21
			B1	-9	**2**	17	-16	**1**	13	-11	**-3**	14
			A2	-14	**3**	11	-19	**3**	17	-24	**3**	22
JJA	196.1	-4.7*	*A1B*	-6	**1**	12	-15	**0**	13	-19	**7**	33
			B1	-23	**0**	11	-9	**2**	11	-15	**3**	15
			A2	-15	**6**	18	-8	**8**	26	-13	**10**	35
SON	175.6	-1.6	*A1B*	-9	**5**	13	-23	**4**	21	-14	**10**	39
			B1	-8	**2**	9	-7	**6**	15	-14	**7**	25
Precipitation (%)												
	(mm per month)	*(change in % per decade)*		*% Change*			*% Change*			*% Change*		
			A2	-3	**0**	4	-4	**3**	9	-8	**0**	17
Annual	129.7	-2.2*	*A1B*	-2	**0**	3	-6	**-1**	7	-5	**2**	14
			B1	-2	**0**	4	-3	**0**	6	-5	**2**	10
			A2	-9	**-2**	10	-18	**1**	29	-27	**-2**	49
DJF	22.0	-1.4	*A1B*	-11	**0**	18	-11	**0**	25	-22	**4**	35
			B1	-16	**0**	12	-17	**-1**	17	-17	**2**	17
			A2	-7	**0**	3	-12	**3**	9	-20	**2**	11
MAM	125.2	-3.4*	*A1B*	-10	**0**	4	-11	**1**	9	-13	**1**	14
			B1	-4	**1**	9	-8	**1**	9	-8	**-2**	9
			A2	-6	**1**	7	-10	**1**	12	-13	**2**	11
JJA	196.1	-2.4*	*A1B*	-5	**0**	7	-9	**0**	7	-9	**4**	16
			B1	-10	**0**	6	-7	**1**	6	-8	**1**	8
			A2	-7	**3**	9	-3	**4**	17	-6	**6**	26
SON	175.6	-0.9	*A1B*	-5	**3**	9	-10	**2**	13	-6	**5**	25
			B1	-3	**1**	7	-3	**4**	8	-6	**4**	16

	Observed Mean 1970-99	Observed Trend 1960-2006		Projected changes by the 2030s			Projected changes by the 2060s			Projected changes by the 2090s		
				Min	Median	Max	Min	Median	Max	Min	Median	Max
	% Frequency	Change in frequency per decade					Future % frequency			Future % frequency		
Frequency of Hot Days (TX90p)												
			A2	****	****	****	27	**33**	51	38	**49**	83
Annual	****	****	*A1B*	****	****	****	25	**32**	53	35	**41**	78
			B1	****	****	****	20	**26**	40	23	**31**	54
			A2	****	****	****	34	**45**	67	55	**70**	86
DJF	10.5	1.73	*A1B*	****	****	****	35	**44**	65	51	**60**	86
			B1	****	****	****	24	**34**	52	34	**41**	68
			A2	****	****	****	34	**50**	60	54	**70**	92
MAM	****	****	*A1B*	****	****	****	33	**50**	63	41	**62**	88
			B1	****	****	****	24	**41**	48	31	**45**	64
			A2	****	****	****	33	**55**	88	50	**77**	99
JJA	****	****	*A1B*	****	****	****	34	**52**	90	40	**69**	99
			B1	****	****	****	29	**40**	77	35	**50**	89
			A2	****	****	****	32	**46**	71	54	**68**	91
SON	****	****	*A1B*	****	****	****	33	**45**	73	51	**59**	88
			B1	****	****	****	28	**37**	57	36	**43**	75
Frequency of Hot Nights (TN90p)												
			A2	****	****	****	53	**59**	75	78	**83**	87
Annual	13.6	5.04*	*A1B*	****	****	****	49	**63**	73	68	**76**	86
			B1	****	****	****	36	**46**	64	49	**56**	75
			A2	****	****	****	37	**49**	68	58	**70**	81
DJF	****	****	*A1B*	****	****	****	34	**48**	62	46	**63**	79
			B1	****	****	****	27	**36**	56	31	**43**	67
			A2	****	****	****	61	**75**	87	88	**94**	97
MAM	****	****	*A1B*	****	****	****	61	**70**	86	81	**85**	96
			B1	****	****	****	46	**57**	77	53	**68**	86
			A2	****	****	****	67	**81**	96	95	**98**	99
JJA	****	****	*A1B*	****	****	****	64	**84**	97	85	**96**	99
			B1	****	****	****	50	**59**	85	62	**74**	94
			A2	****	****	****	47	**61**	74	66	**80**	90
SON	****	****	*A1B*	****	****	****	48	**60**	73	57	**74**	86
			B1	****	****	****	37	**43**	64	41	**50**	75
Frequency of Cold Days (TX10p)												
			A2	****	****	****	0	**1**	3	0	**0**	0
Annual	****	****	*A1B*	****	****	****	0	**2**	2	0	**0**	1
			B1	****	****	****	1	**3**	4	0	**2**	3
			A2	****	****	****	0	**1**	2	0	**0**	1
DJF	****	****	*A1B*	****	****	****	1	**2**	2	0	**0**	1
			B1	****	****	****	0	**3**	5	0	**2**	4
			A2	****	****	****	0	**1**	3	0	**0**	1
MAM	****	****	*A1B*	****	****	****	0	**1**	2	0	**0**	1
			B1	****	****	****	0	**2**	4	0	**1**	3
			A2	****	****	****	0	**1**	2	0	**0**	1
JJA	****	****	*A1B*	****	****	****	0	**1**	3	0	**0**	2
			B1	****	****	****	0	**2**	4	0	**1**	2
			A2	****	****	****	1	**2**	3	0	**0**	0
SON	****	****	*A1B*	****	****	****	0	**2**	3	0	**1**	2
			B1	****	****	****	1	**3**	5	0	**1**	3
Frequency of Cold Nights (TN10p)												
			A2	****	****	****	0	**1**	3	0	**0**	0
Annual	****	****	*A1B*	****	****	****	0	**1**	3	0	**0**	1
			B1	****	****	****	1	**3**	4	0	**1**	3
			A2	****	****	****	0	**0**	2	0	**0**	1
DJF	****	****	*A1B*	****	****	****	0	**1**	3	0	**0**	1
			B1	****	****	****	0	**2**	6	0	**1**	3
			A2	****	****	****	0	**0**	1	0	**0**	0
MAM	****	****	*A1B*	****	****	****	0	**0**	1	0	**0**	0
			B1	****	****	****	0	**1**	2	0	**1**	1
			A2	****	****	****	0	**0**	0	0	**0**	0
JJA	****	****	*A1B*	****	****	****	0	**0**	0	0	**0**	0
			B1	****	****	****	0	**0**	2	0	**0**	1
			A2	****	****	****	0	**1**	3	0	**0**	0
SON	7.4	-3.68*	*A1B*	****	****	****	0	**1**	3	0	**0**	2
			B1	****	****	****	1	**2**	4	0	**1**	2

	Observed Mean 1970-99	Observed Trend 1960-2006		Projected changes by the 2030s			Projected changes by the 2060s			Projected changes by the 2090s		
				Min	*Median*	*Max*	*Min*	*Median*	*Max*	*Min*	*Median*	*Max*
% total rainfall falling in Heavy Events (R95pct)												
	%	*Change in % per decade*					*Change in %*			*Change in %*		
			A2	****	****	****	0	**2**	8	-2	**2**	15
Annual	****	****	*A1B*	****	****	****	-1	**1**	8	0	**4**	15
			B1	****	****	****	0	**1**	5	-2	**2**	7
			A2	****	****	****	-15	**0**	8	-25	**4**	18
DJF	****	****	*A1B*	****	****	****	-16	**0**	13	-13	**1**	12
			B1	****	****	****	-10	**-2**	13	-7	**0**	13
			A2	****	****	****	-6	**3**	7	-9	**2**	13
MAM	****	****	*A1B*	****	****	****	-2	**2**	10	-1	**3**	18
			B1	****	****	****	-1	**1**	5	-3	**2**	8
			A2	****	****	****	-1	**2**	9	1	**3**	16
JJA	****	****	*A1B*	****	****	****	-2	**2**	8	0	**3**	15
			B1	****	****	****	0	**1**	5	0	**1**	8
			A2	****	****	****	0	**2**	10	-1	**3**	17
SON	****	****	*A1B*	****	****	****	-3	**1**	9	-1	**5**	13
			B1	****	****	****	-2	**2**	5	-3	**4**	9
Maximum 1-day rainfall (RX1day)												
	mm	*Change in mm per decade*					*Change in mm*			*Change in mm*		
			A2	****	****	****	-4	**1**	16	-3	**4**	27
Annual	****	****	*A1B*	****	****	****	-2	**1**	13	-3	**3**	23
			B1	****	****	****	-2	**1**	11	-3	**1**	16
			A2	****	****	****	-2	**0**	1	-2	**0**	8
DJF	****	****	*A1B*	****	****	****	-1	**0**	3	-2	**0**	2
			B1	****	****	****	-2	**0**	5	0	**0**	2
			A2	****	****	****	-8	**0**	6	-7	**1**	7
MAM	****	****	*A1B*	****	****	****	-3	**0**	10	-1	**1**	9
			B1	****	****	****	-1	**0**	4	-3	**0**	12
			A2	****	****	****	-1	**0**	10	0	**2**	12
JJA	****	****	*A1B*	****	****	****	-1	**0**	7	0	**2**	10
			B1	****	****	****	-3	**0**	5	-1	**0**	5
			A2	****	****	****	-2	**1**	13	-3	**3**	24
SON	****	****	*A1B*	****	****	****	-2	**0**	9	-3	**1**	20
			B1	****	****	****	-2	**1**	10	-7	**1**	14
Maximum 5-day Rainfall (RX5day)												
	mm	*Change in mm per decade*					*Change in mm*			*Change in mm*		
			A2	****	****	****	-6	**3**	25	-7	**8**	40
Annual	****	****	*A1B*	****	****	****	-6	**2**	16	-2	**5**	33
			B1	****	****	****	-5	**2**	13	-5	**2**	27
			A2	****	****	****	-3	**0**	5	-5	**0**	10
DJF	****	****	*A1B*	****	****	****	-2	**1**	4	-4	**2**	6
			B1	****	****	****	-3	**0**	9	-2	**1**	7
			A2	****	****	****	-11	**1**	11	-14	**3**	16
MAM	****	****	*A1B*	****	****	****	-4	**1**	14	-2	**3**	22
			B1	****	****	****	-3	**1**	6	-7	**2**	20
			A2	****	****	****	-9	**2**	14	-3	**2**	23
JJA	****	****	*A1B*	****	****	****	-8	**2**	10	-3	**3**	21
			B1	****	****	****	-4	**1**	7	-4	**3**	10
			A2	****	****	****	-3	**3**	21	-6	**4**	36
SON	****	****	*A1B*	****	****	****	-3	**1**	10	-3	**5**	26
			B1	****	****	****	-4	**3**	11	-11	**3**	21

* indicates trend is statistically significant at 95% confidence

**** indicates data are not available

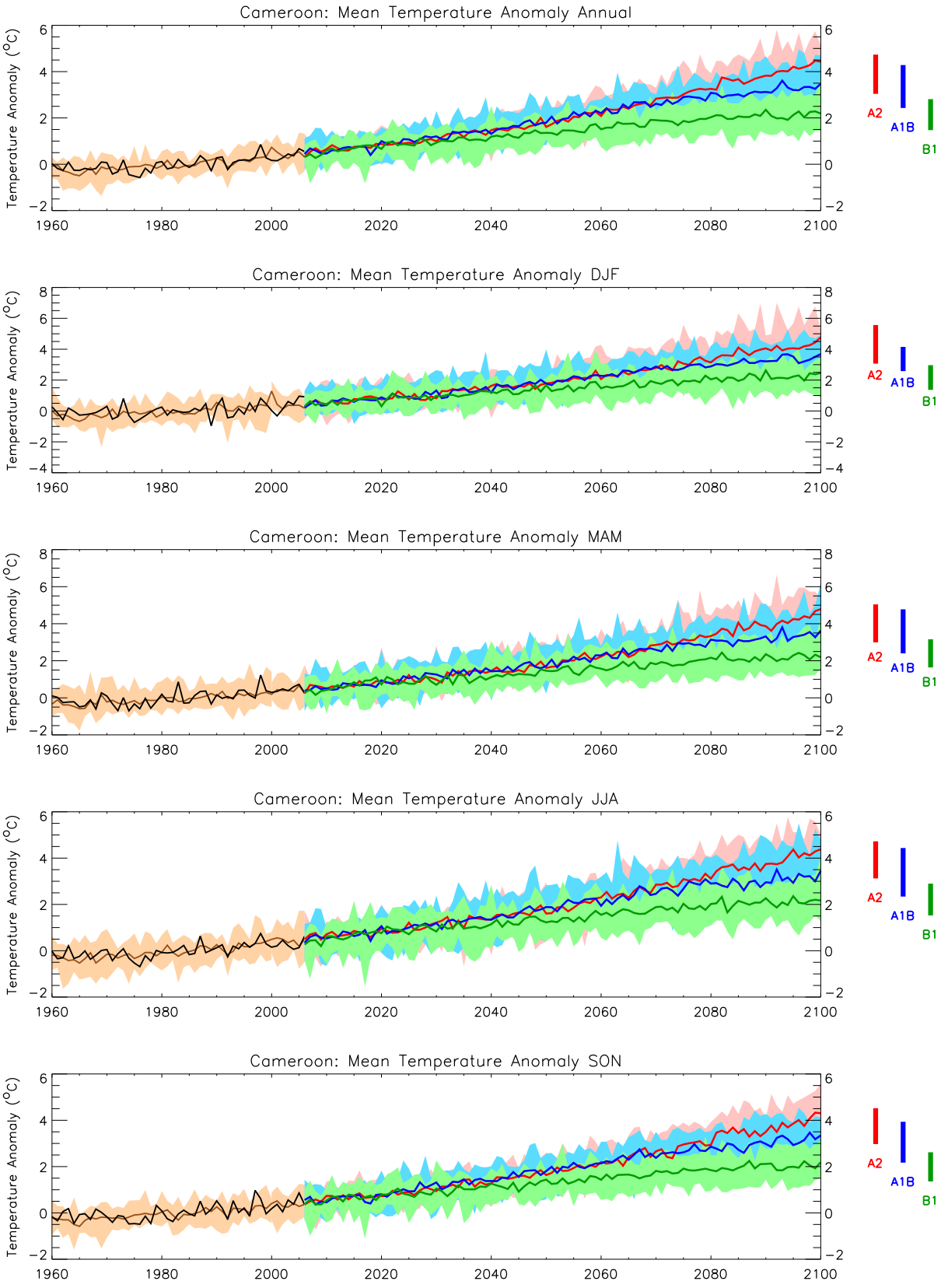

Figure 1: Trends in annual and seasonal mean temperature for the recent past and projected future. All values shown are anomalies, relative to the 1970-1999 mean climate. Black curves show the mean of observed data from 1960 to 2006, Brown curves show the median (solid line) and range (shading) of model simulations of recent climate across an ensemble of 15 models. Coloured lines from 2006 onwards show the median (solid line) and range (shading) of the ensemble projections of climate under three emissions scenarios. Coloured bars on the right-hand side of the projections summarise the range of mean 2090-2100 climates simulated by the 15 models for each emissions scenario.

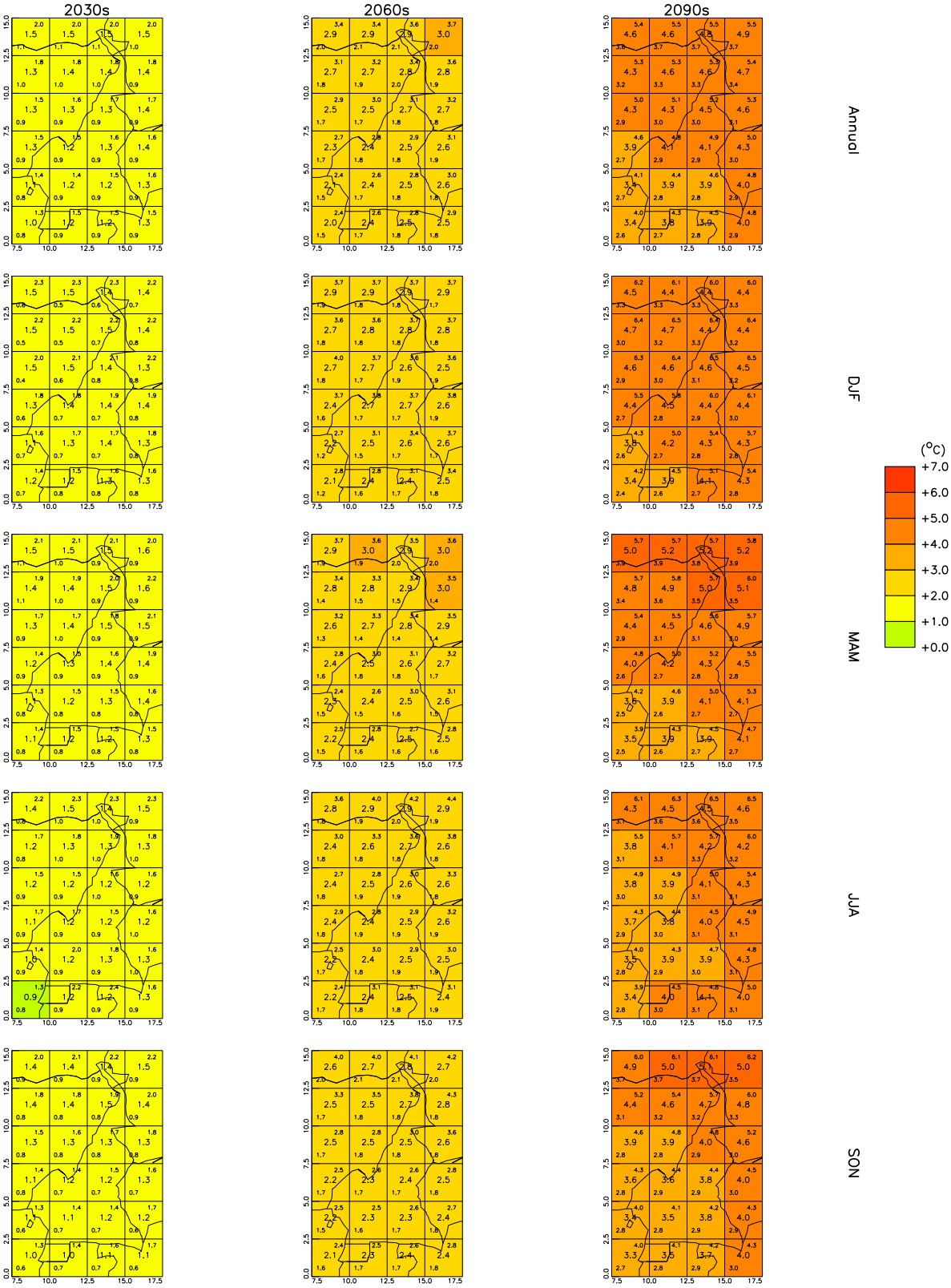

Figure 2: Spatial patterns of projected change in mean annual and seasonal temperature for 10-year periods in the future under the SRES A2 scenario. All values are anomalies relative to the mean climate of 1970-1999. In each grid box, the central value gives the ensemble median and the values in the upper and lower corners give the ensemble maximum and minimum.

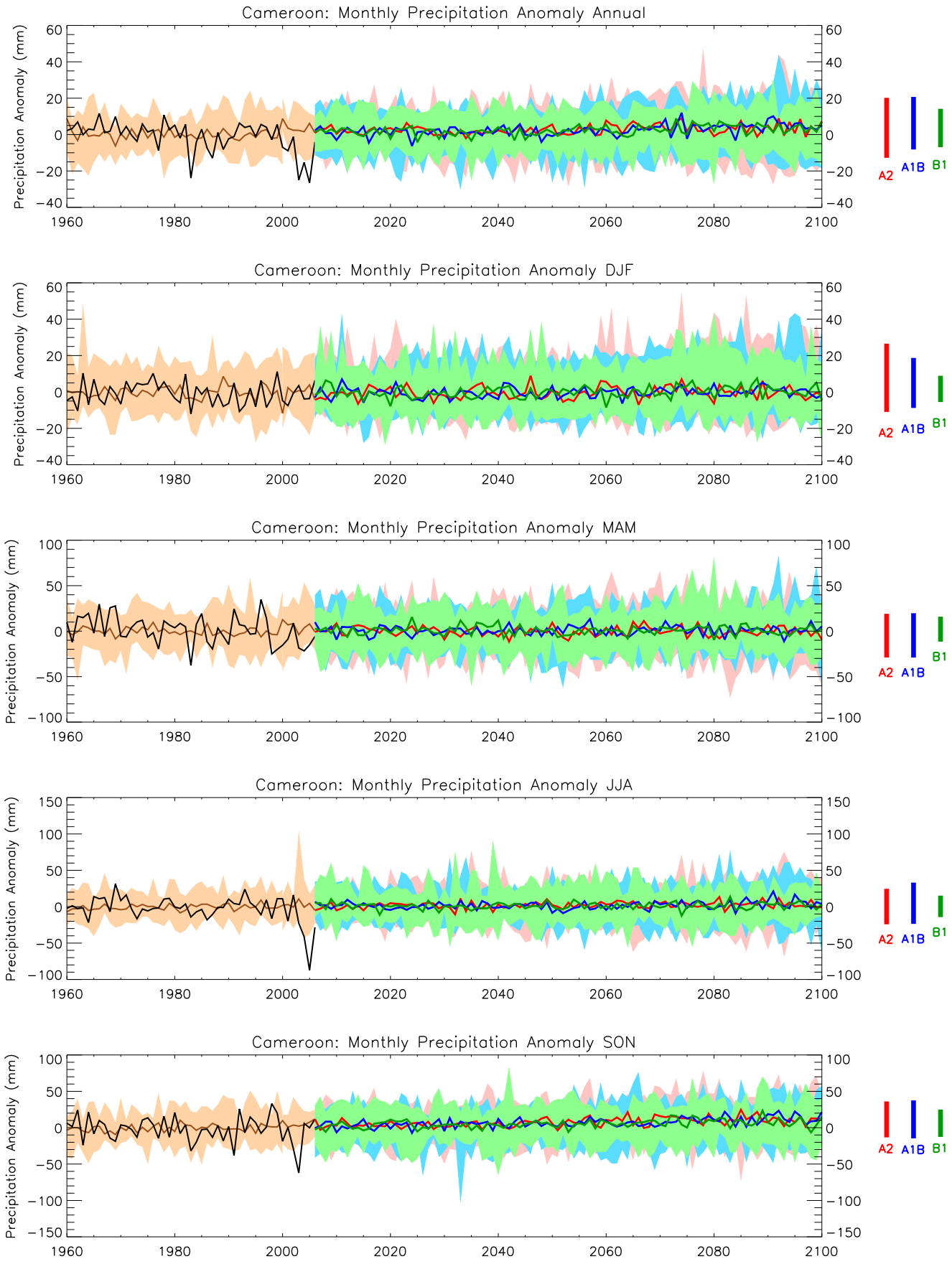

Figure 3: Trends in monthly precipitation for the recent past and projected future. All values shown are anomalies, relative to the 1970-1999 mean climate. See Figure 1 for details.

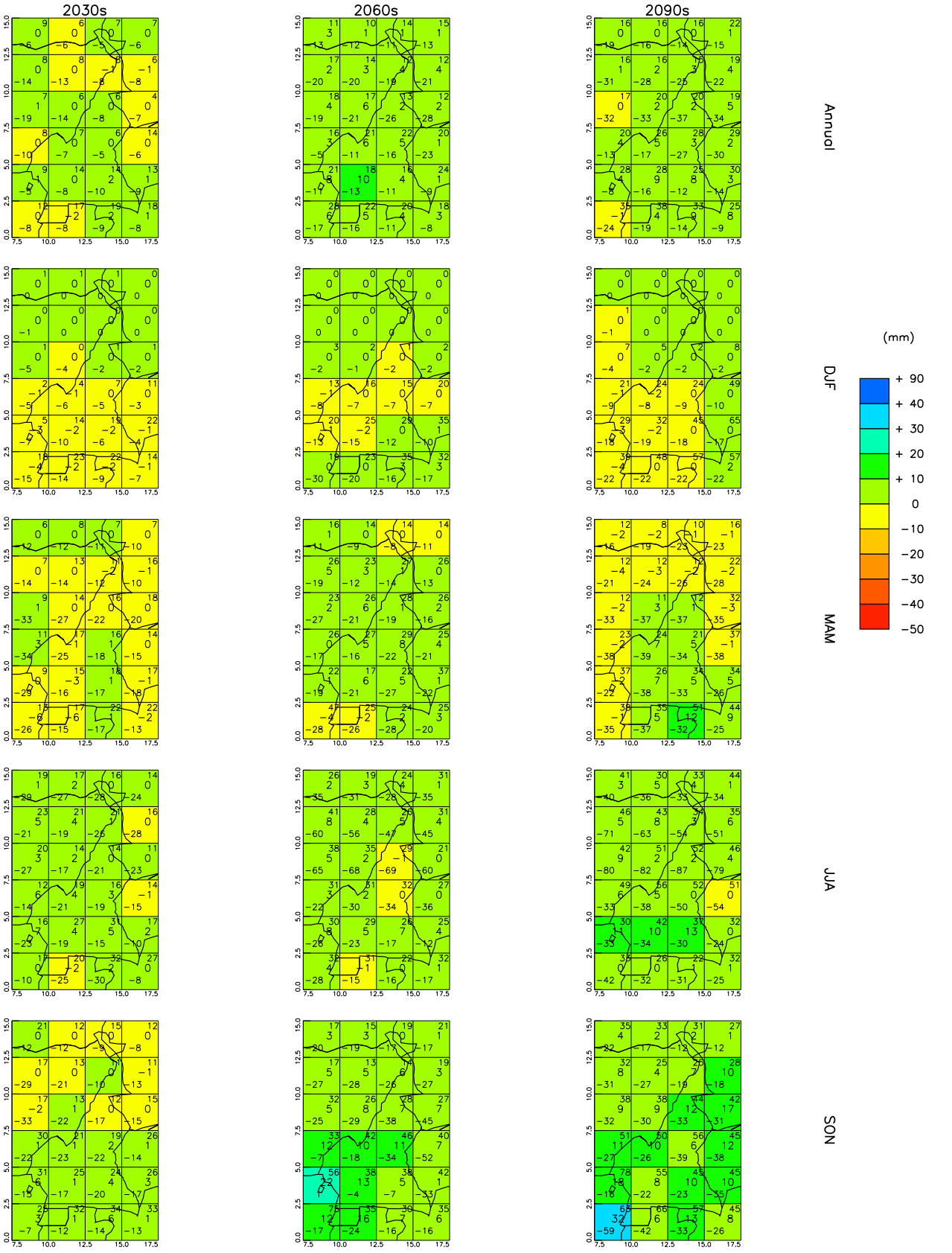

Figure 4: Spatial patterns of projected change in monthly precipitation for 10-year periods in the future under the SRES A2 scenario. All values are anomalies relative to the mean climate of 1970-1999.See Figure 2 for details.

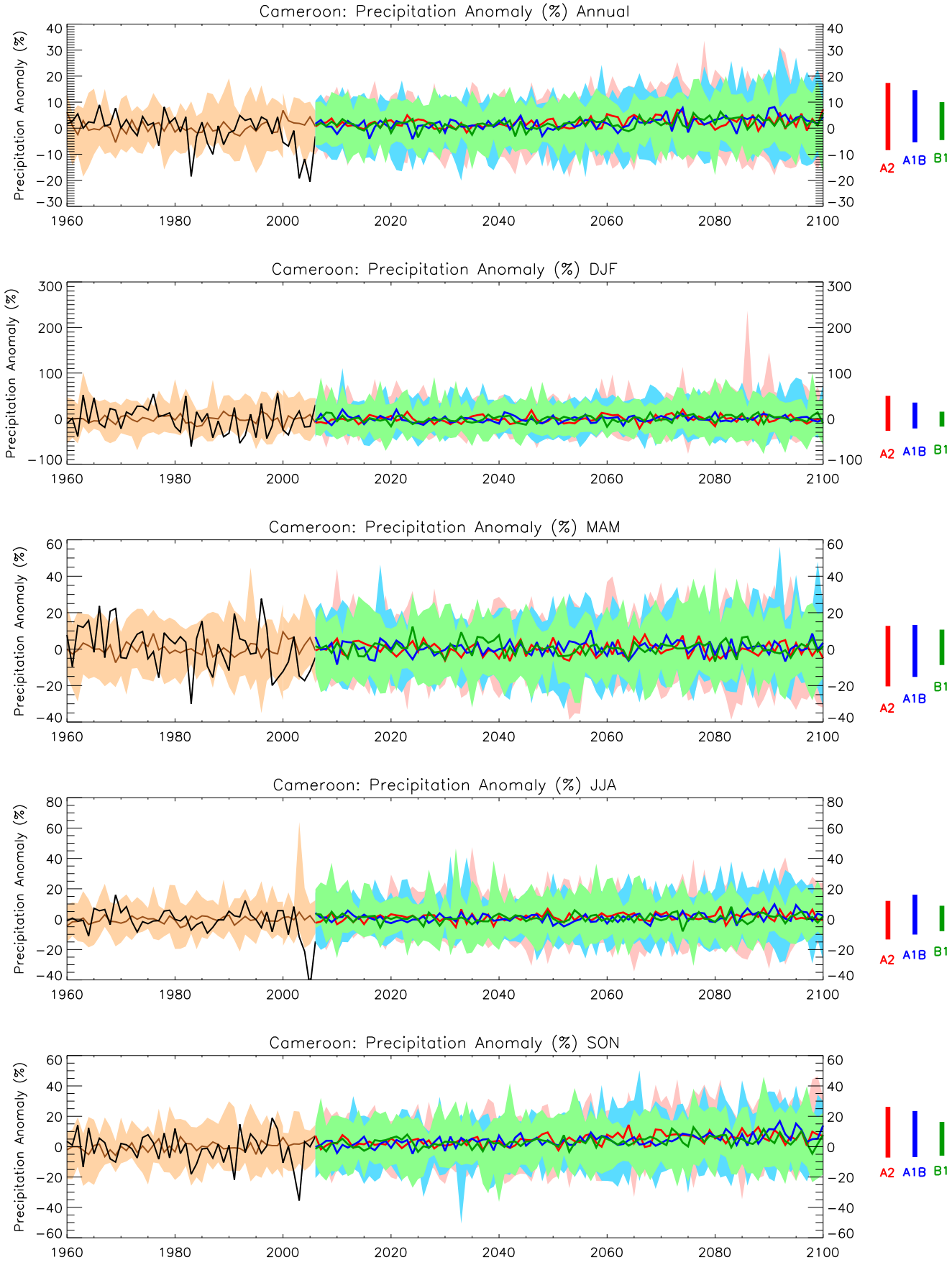

Figure 5: Trends in monthly precipitation for the recent past and projected future. All values shown are percentage anomalies, relative to the 1970-1999 mean climate. See Figure 1 for details.

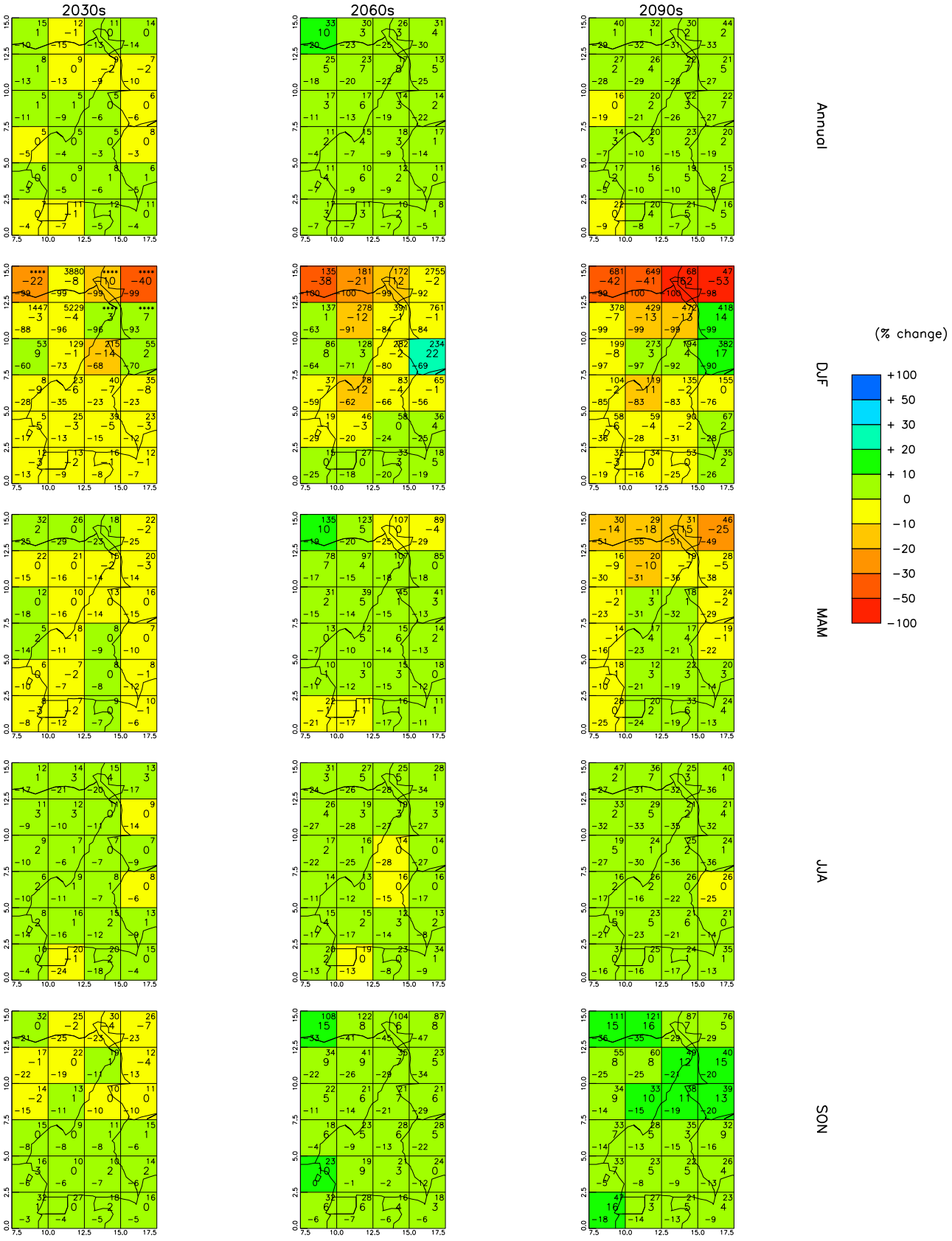

Figure 6: Spatial patterns of projected change in monthly precipitation for 10-year periods in the future under the SRES A2 scenario. All values are percentage anomalies relative to the mean climate of 1970-1999.See Figure 2 for details.

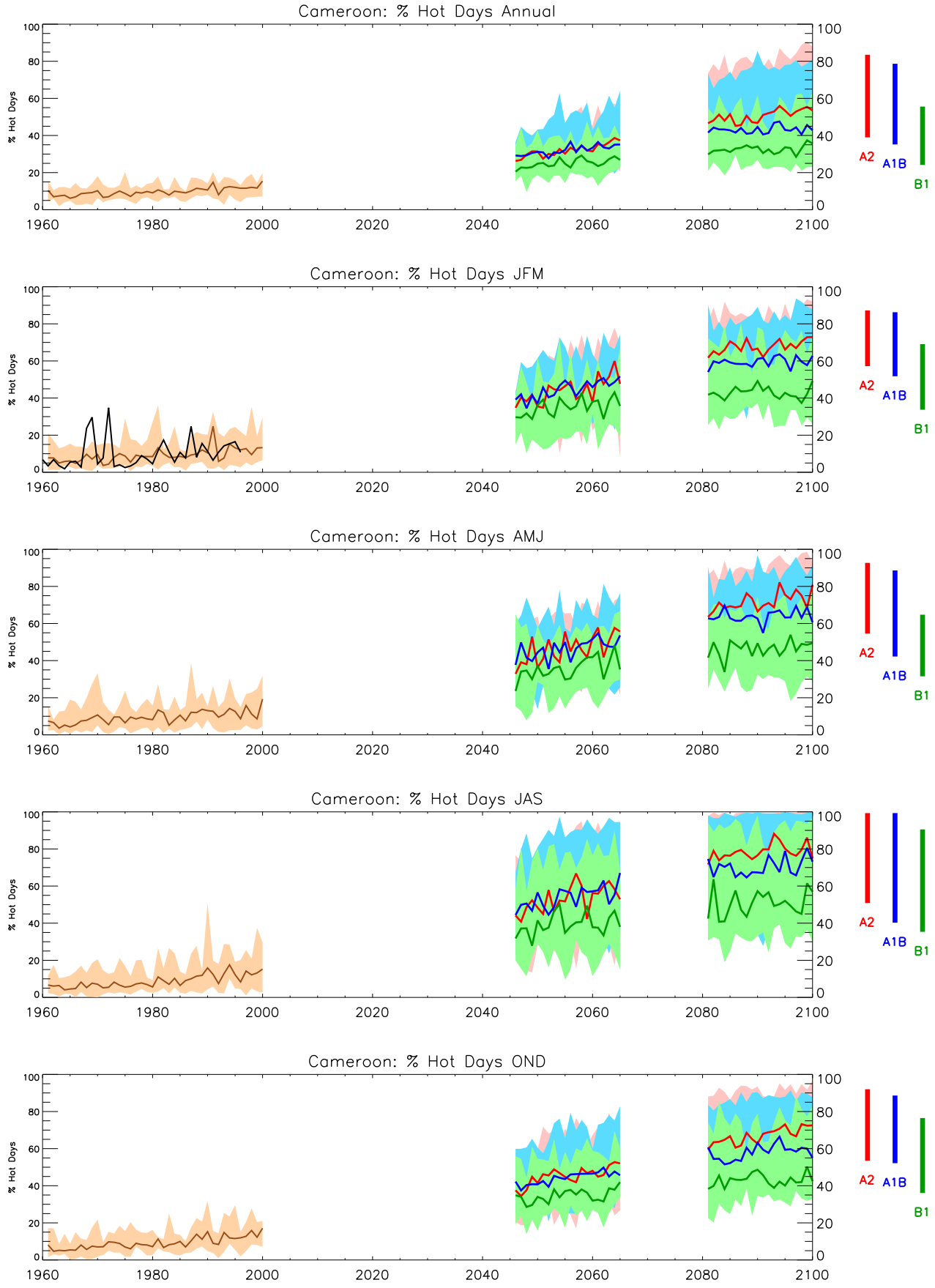

Figure 7: Trends in Hot-day frequency for the recent past and projected future. See Figure 1 for details.

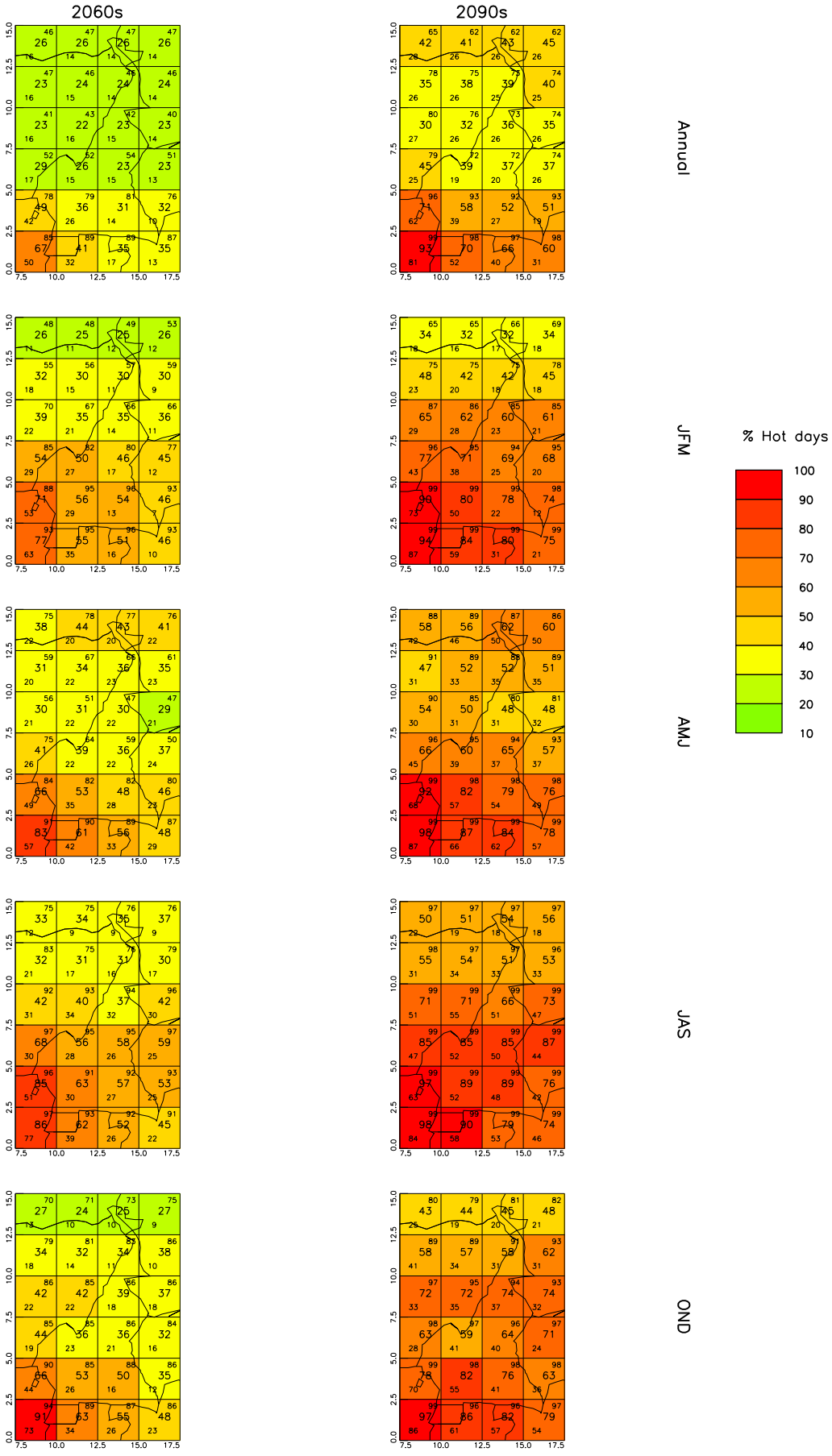

Figure 8: Spatial patterns of projected change in Hot-day frequency for 10-year periods in the future under the SRES A2 scenario. See Figure 2 for details.

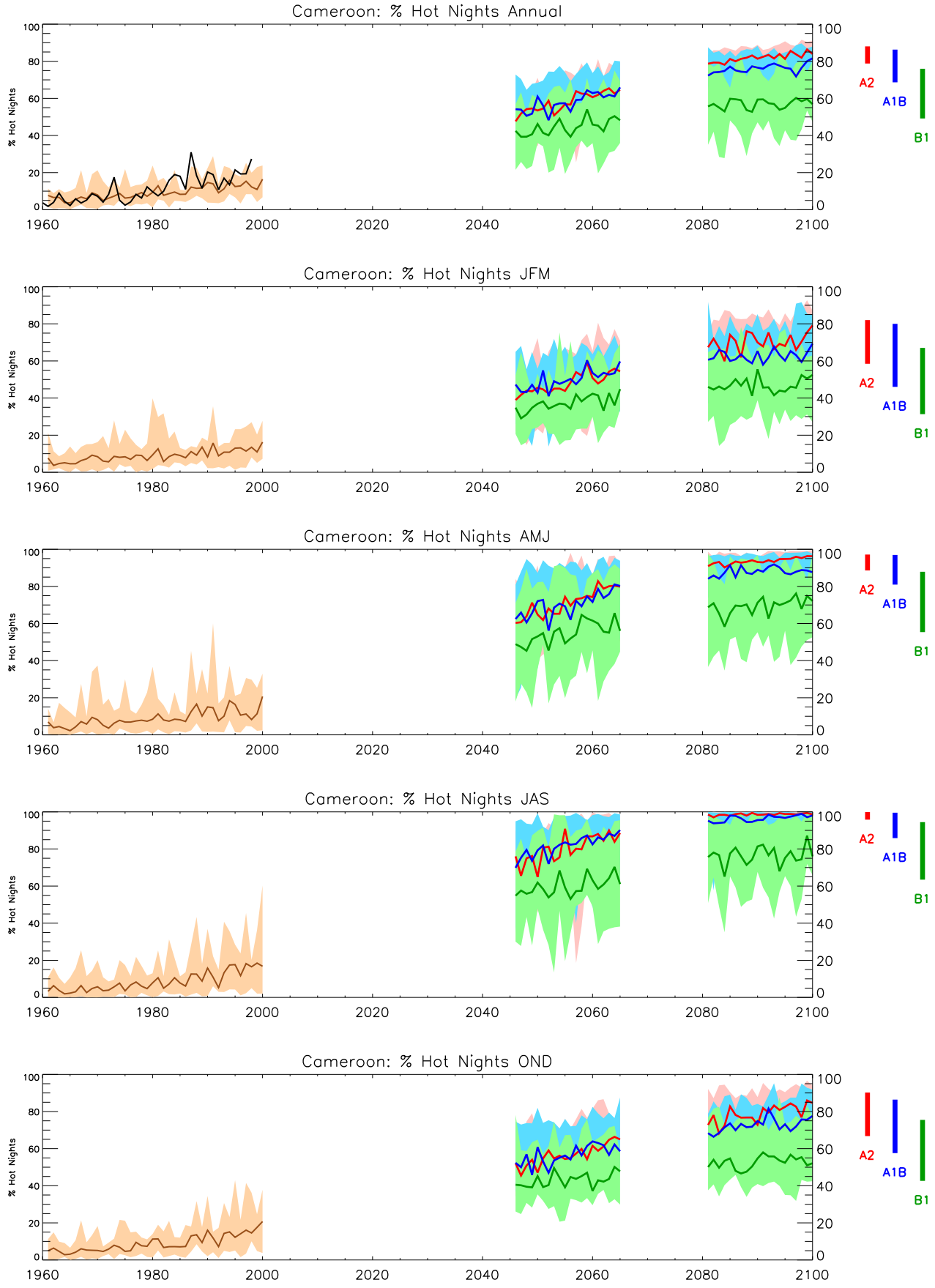

Figure 9: Trends in hot-night frequency for the recent past and projected future. See Figure 1 for details.

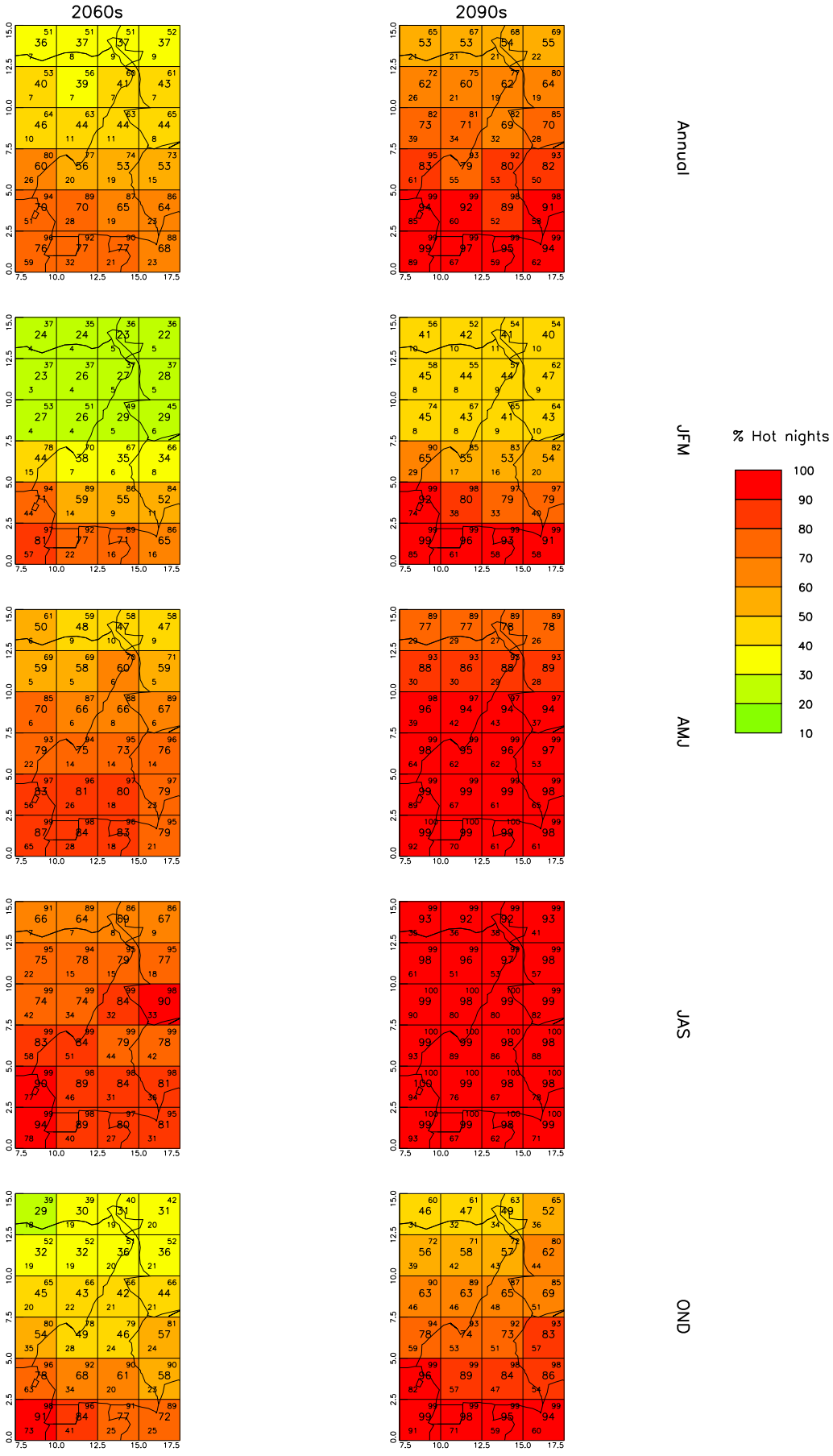

Figure 10: Spatial patterns of projected change in hot-night frequency for 10-year periods in the future under the SRES A2 scenario. See Figure 2 for details.

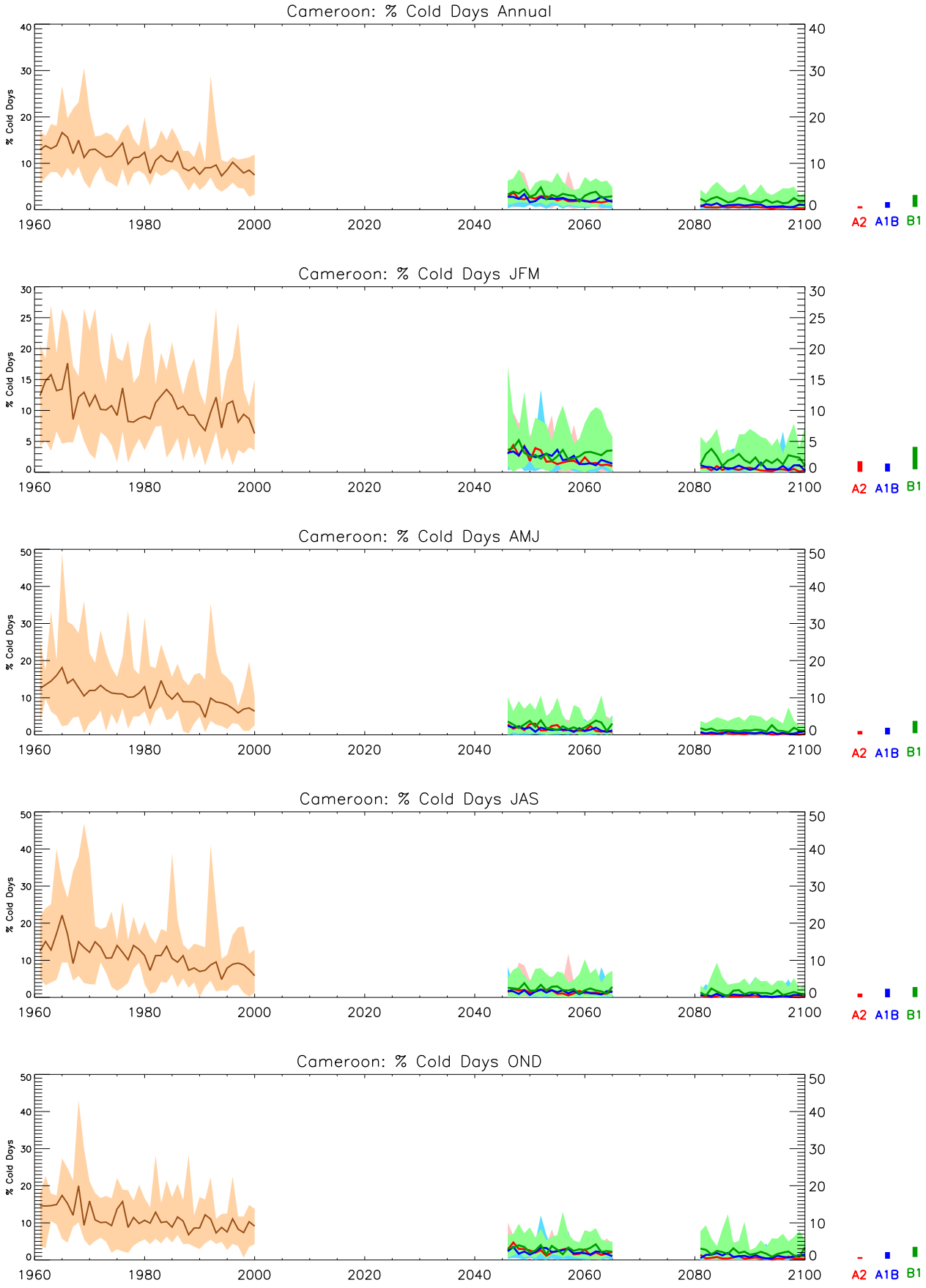

Figure 11: Trends in cold-day frequency for the recent past and projected future. See Figure 1 for details.

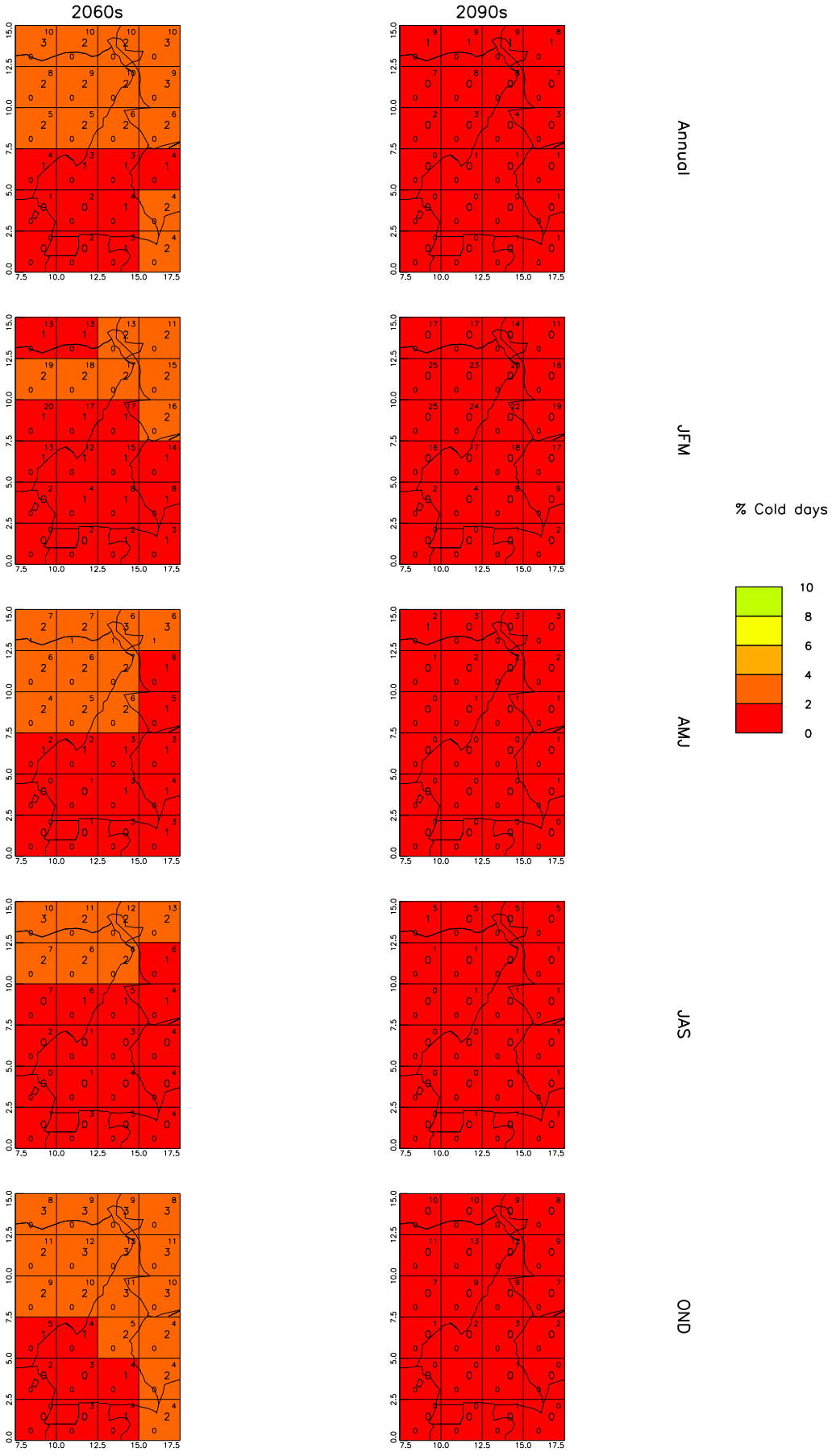

Figure 12: Spatial patterns of projected change in cold-day frequency for 10-year periods in the future under the SRES A2 scenario. See Figure 2 for details.

Figure 13: Trends in cold-night frequency for the recent past and projected future. See Figure 1 for details.

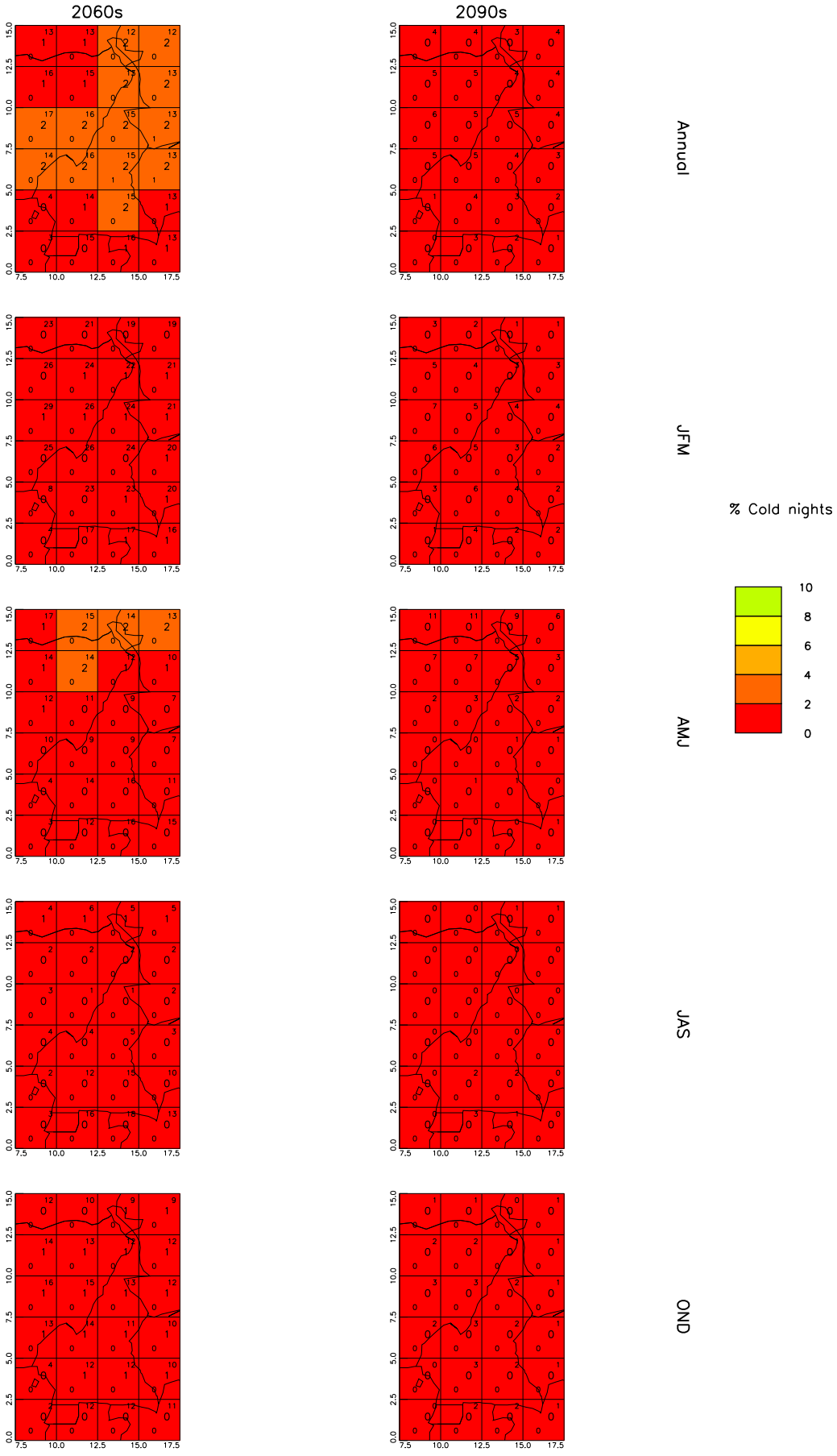

Figure 14: Spatial patterns of projected change in cold-night frequency for 10-year periods in the future under the SRES A2 scenario. See Figure 2 for details.

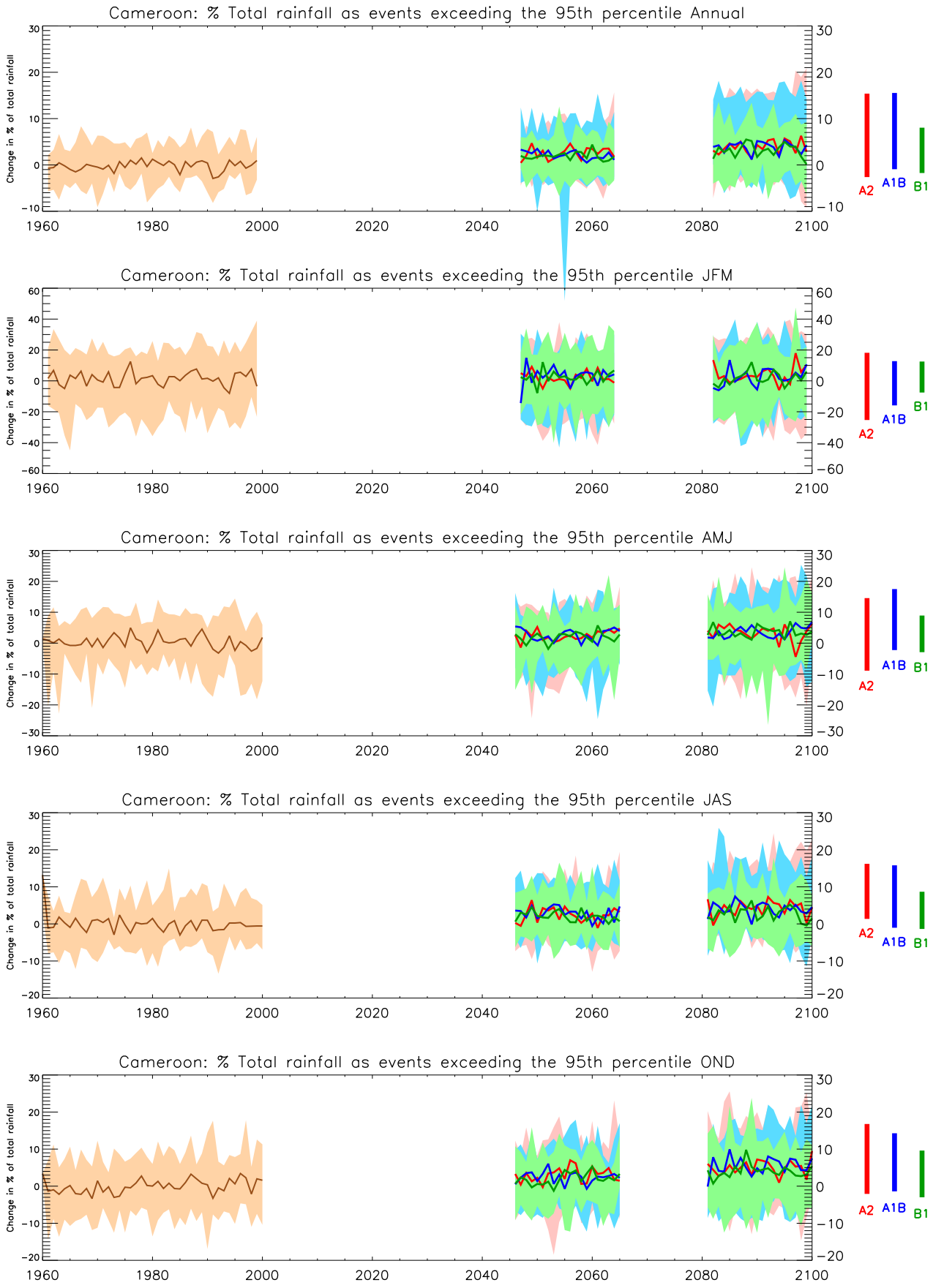

Figure 15: Trends in the proportion of precipitation falling in 'heavy' events for the recent past and projected future. All values shown are anomalies, relative to the 1970-1999 mean climate. See Figure 1 for details.

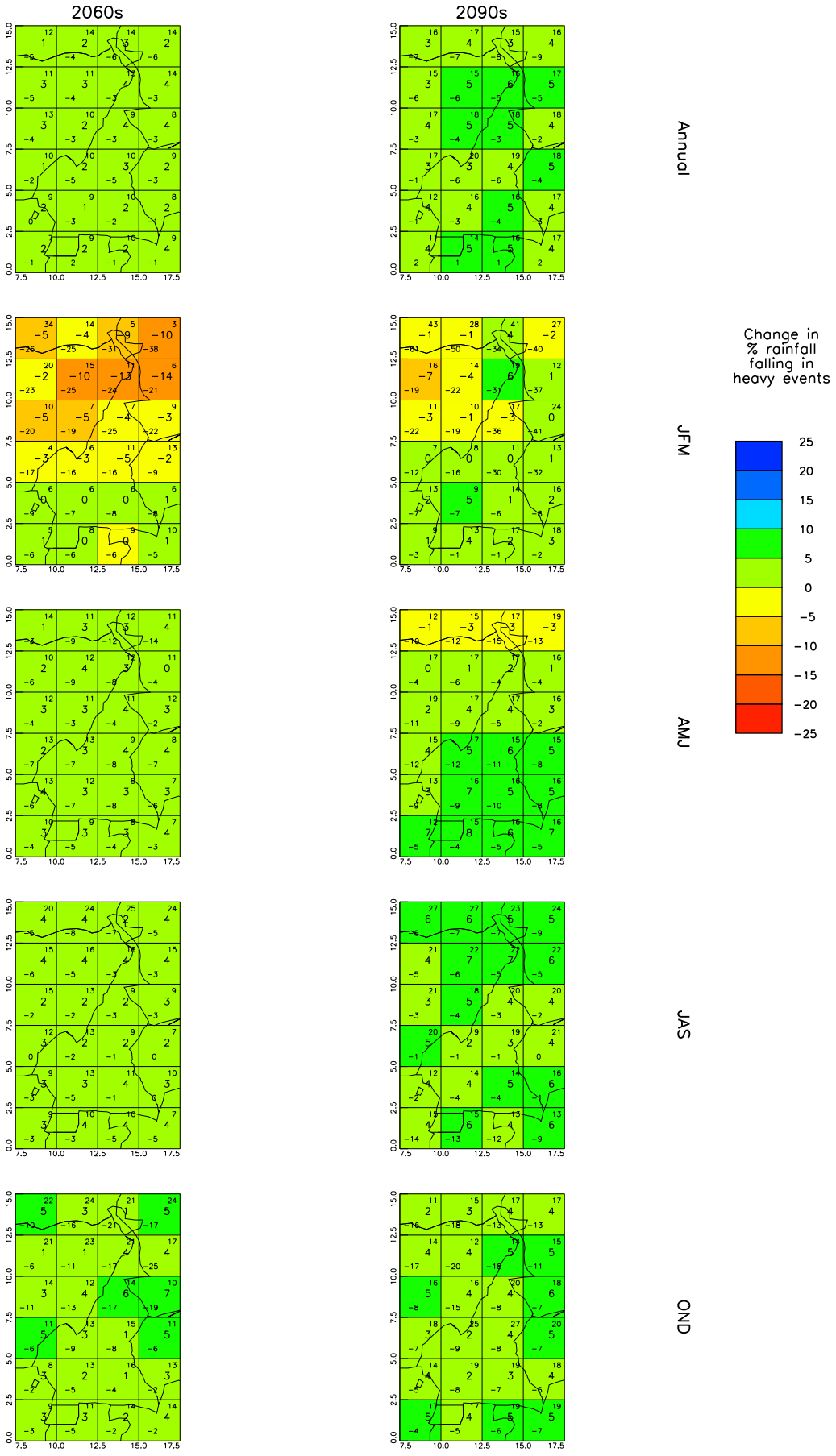

Figure 16: Spatial patterns of projected change in the proportion of precipitation falling in 'heavy' events for 10-year periods in the future under the SRES A2 scenario. All values are anomalies relative to the mean climate of 1970-1999. See Figure 2 for details.

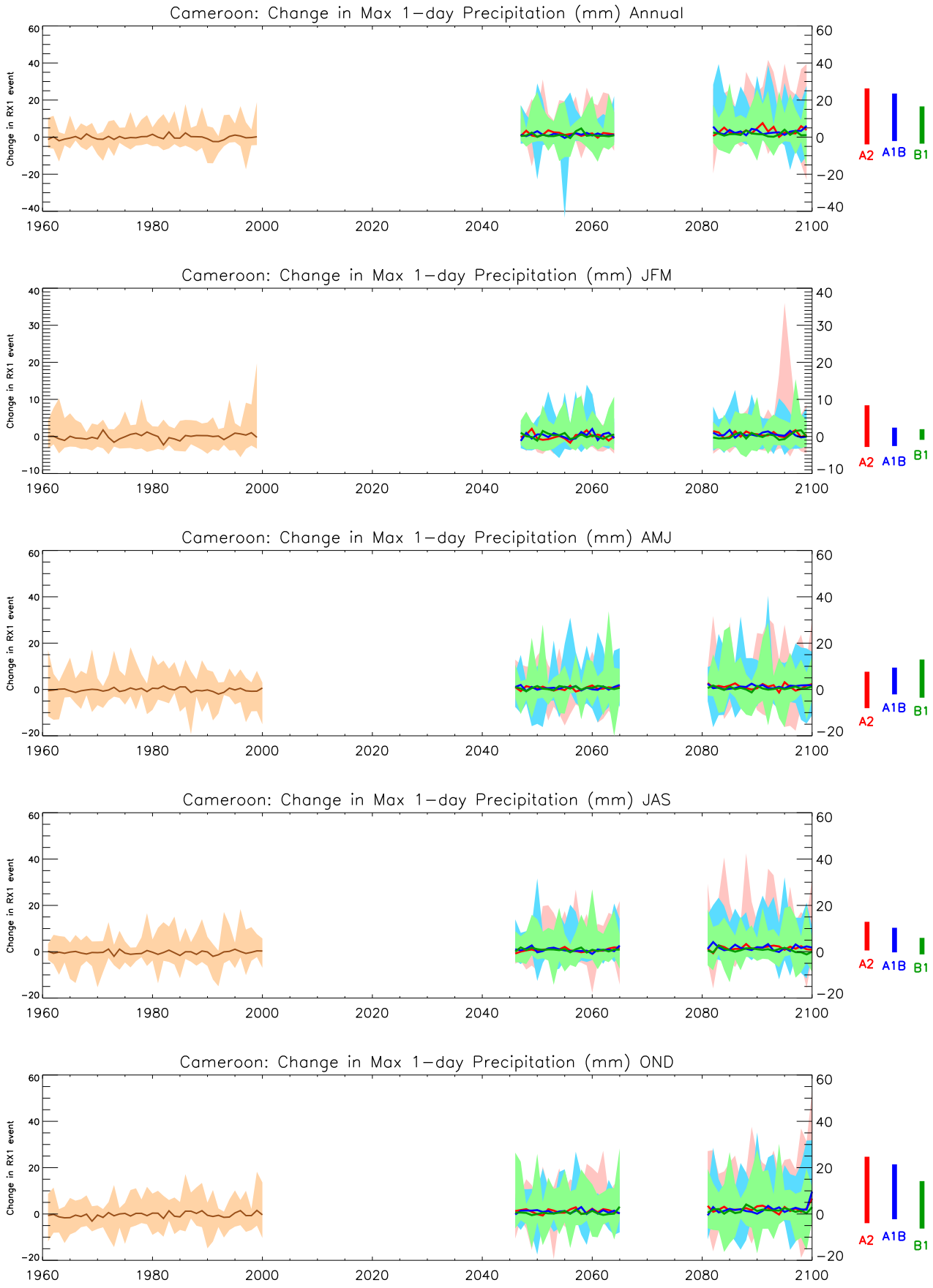

Figure 17: Trends in maximum 1-day rainfall for the recent past and projected future. All values shown are anomalies, relative to the 1970-1999 mean climate. See Figure 1 for details.

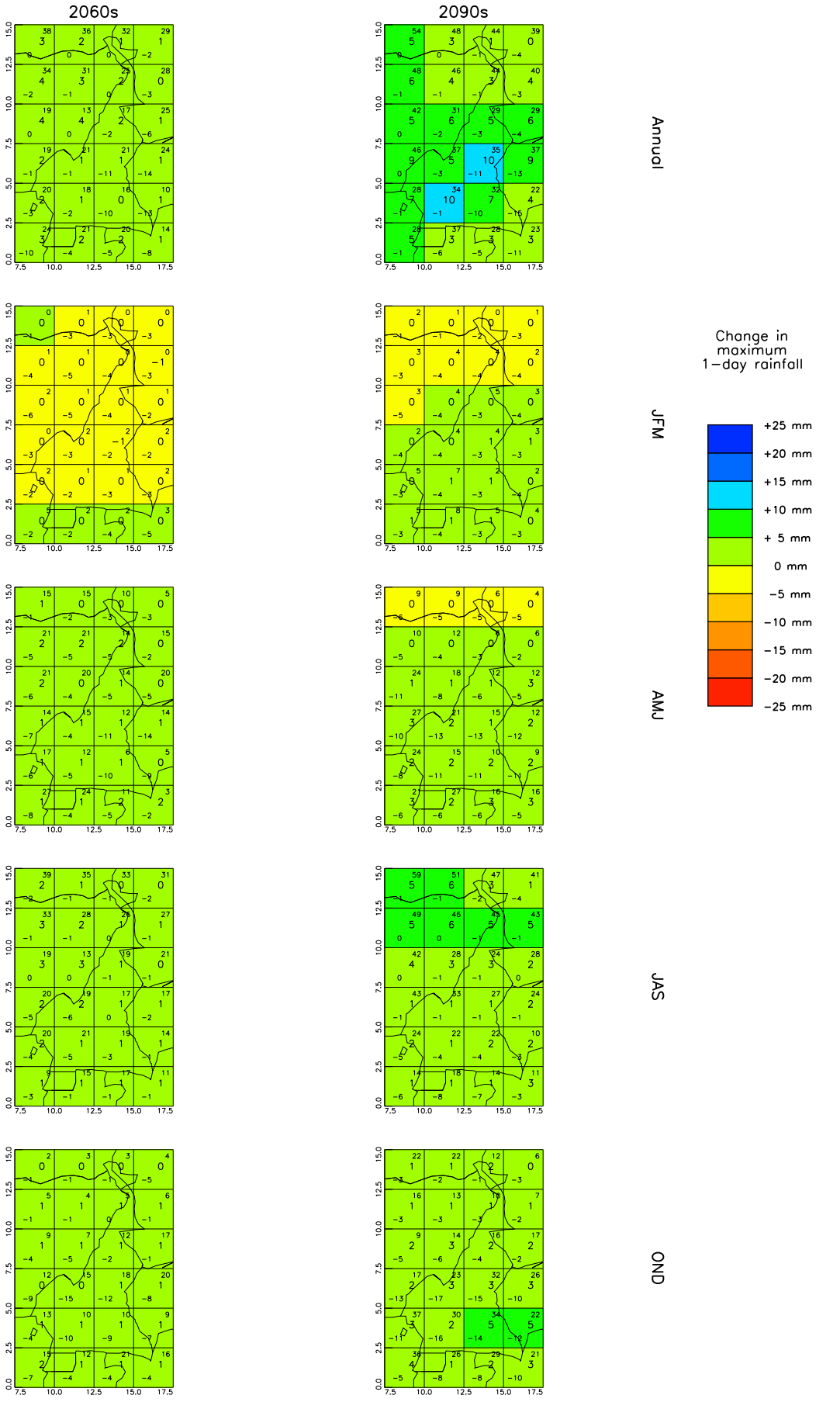

Figure 18: Spatial patterns of maximum 1-day rainfall for 10-year periods in the future under the SRES A2 scenario. All values are anomalies relative to the mean climate of 1970-1999. See Figure 2 for details.

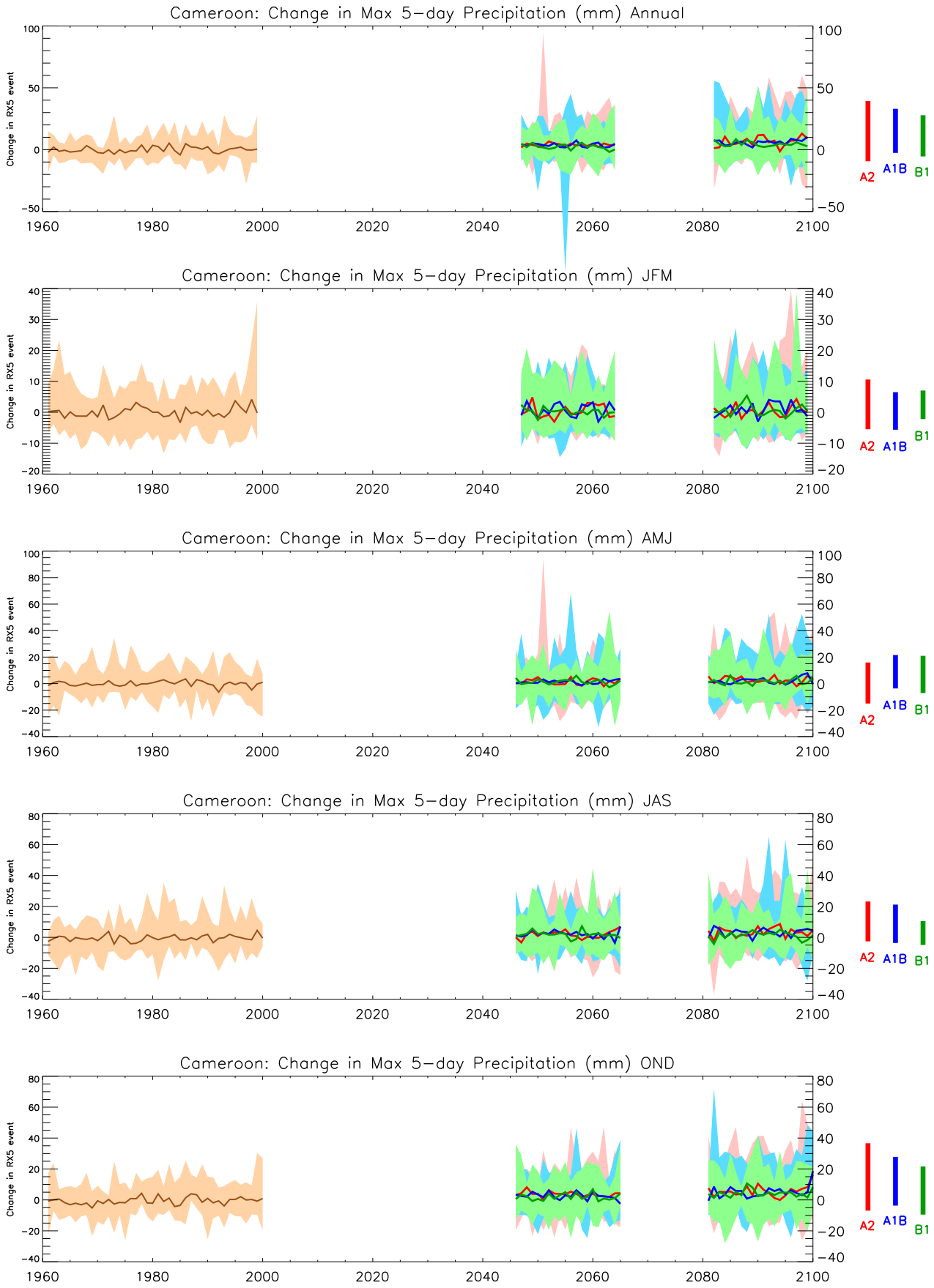

Figure 19: Trends in maximum 5-day rainfall for the recent past and projected future. All values shown are anomalies, relative to the 1970-1999 mean climate. See Figure 1 for details.

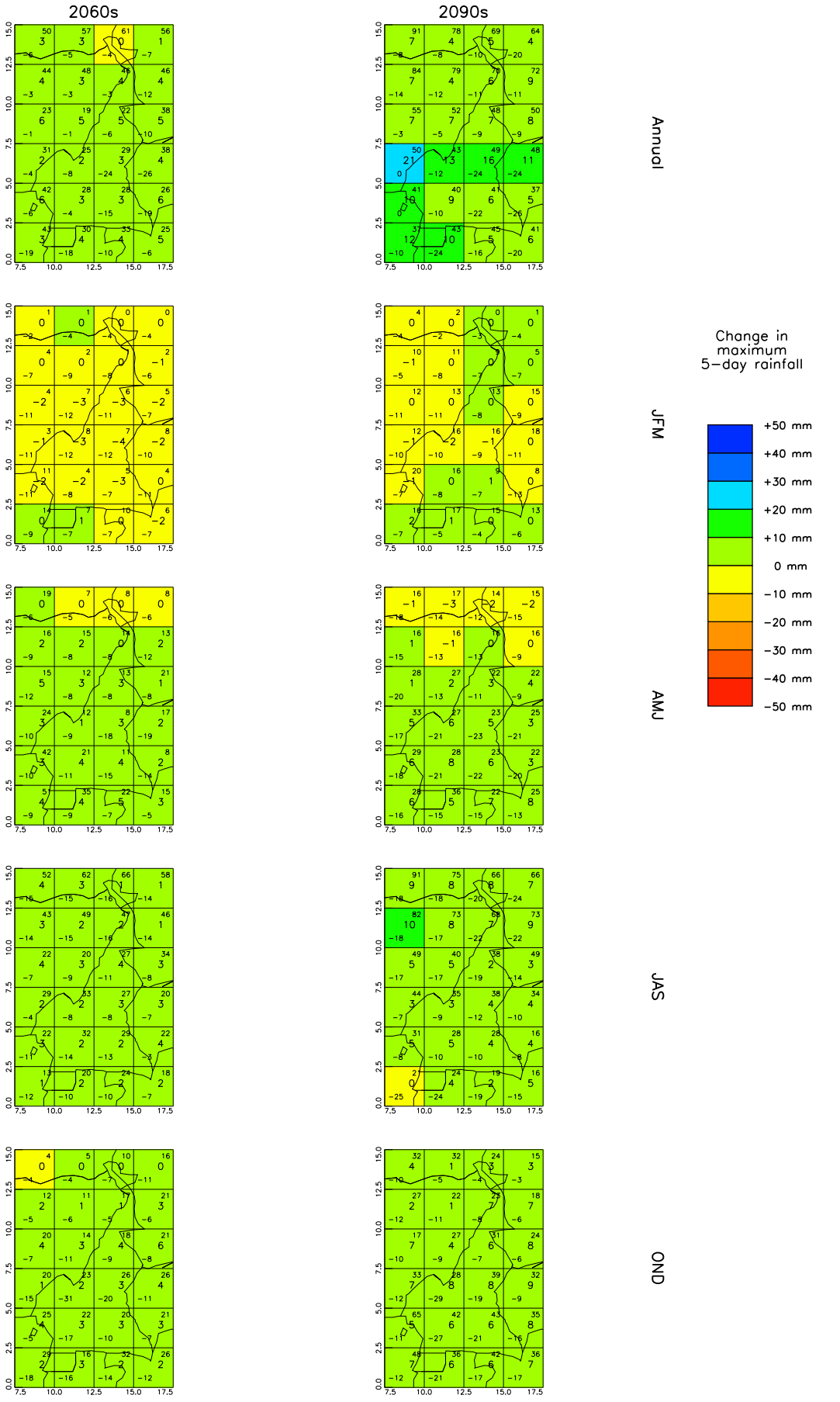

Figure 20: Spatial patterns of projected change in maximum 5-day rainfall for 10-year periods in the future under the SRES A2 scenario. All values are anomalies relative to the mean climate of 1970-1999. See Figure 2 for details.