**UNDP Climate Change Country Profiles**

Afghanistan

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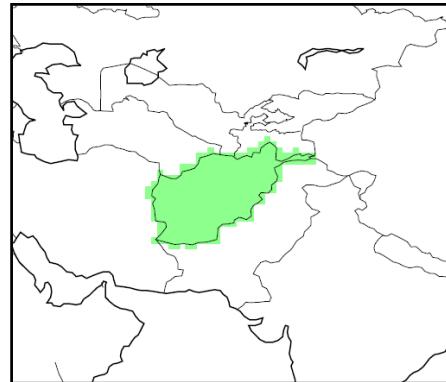
General Climate

Afghanistan is a mountainous and very dry country located in the arid sub-tropics at 29-37˚ north of the equator. The lowland plains in the south of Afghanistan experience extreme seasonal variations in temperature, with average summer (JJA) temperatures exceeding 33˚C and mean winter (DJF) temperatures of around 10˚C. The much of the country is at very high altitude and experiences much lower temperatures all year round, with average summer temperatures not exceeding 15˚C, and winter temperatures below zero in the highest regions.

Rainfall in Afghanistan is very scarce, and mainly only affects the northern highlands, arriving in March and April. Rainfall in the more arid lowlands is rare, and can be very unpredictable.

Recent Climate Trends

Temperature

- Mean annual temperature has increased by 0.6˚C since 1960, at an average rate of around 0.13˚C per decade. The rate of increase is most rapid in SON, with increases at an average rate of 0.29˚C per decade, and slower in DJF at a rate 0.11˚C per decade.

- The frequency of hot days[1] and hot nights has increased since 1960 in every season.
    - The average number of 'hot' days per year has increased by 25 (an additional 6.8% of days[2]) between 1960 and 2003. The rate of increases is greatest in SON, when the number of hot SON days has increased by 3 days per month (an additional 10.3% of SON days) over this period.
    - The average number of 'hot' nights per year has increased by 26 (an additional 6.7% of days) between 1960 and 2003.

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[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.

- The frequency of cold days[3] and nights, annually, has decreased since 1960.
  - The average number of 'cold' days per year has decreased by 12 (3.2% of days) between 1960 and 2003. The rate of decrease is greatest in winter (DJF) when the average number of cold winter days has decreased by 1.6 days per month (5.2% of winter days) over this period.
  - The number of cold nights has decreased at a similar rate to cold days.

Precipitation

- Mean rainfall over Afghanistan has decreased slightly (at an average rate of 0.5mm per month (or 2%) per decade,) since 1960. This is mainly due to decreases of around 2.7mm per month (6.6%) per decade in MAM rainfall, but is offset by small increases in JJA and SON rainfall.
- The proportion of rainfall that occurs in heavy[4] events has not changed with any consistent trend since 1960.
- The observed maximum 1- and 5-day rainfalls generally show small decreases in MAM, but increase slightly in other seasons.

GCM Projections of Future Climate
Temperature

- The mean annual temperature is projected to increase by 1.4 to 4.0˚C by the 2060s, and 2.0 to 6.2 degrees by the 2090s. The range of projections by the 2090s under any one emissions scenario is around 1.5 to 2.5˚C.
- The projected rate of warming is most rapid in spring and summer, and relatively uniform across the regions of the country.

- All projections indicate substantial increases in the frequency of days and nights that are considered 'hot' in current climate.
  - Annually, projections indicate that 'hot' days are projected to occur on 14-25% of days by the 2060s, and 16-32% of days by the 2090s. Days considered 'hot' by current climate standards for their season are projected increase most rapidly in Summer (JJA), occurring on 27-86% of days of the season by the 2090s.
  - Nights that are considered 'hot' for the annual climate of 1970-99 are projected to occur on 16-26% of nights by the 2060s and 19-36% of nights by the 2090s. Nights that are considered hot for each season by 1970-99 standards are projected to increase in frequency most rapidly in summer (JJA), occurring on 29-86% of nights in every season by the 2090s.

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[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.
[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.

- All projections indicate decreases in the frequency of days and nights that are considered 'cold' in current climate. These events are expected to become exceedingly rare, occurring on 0-6% of days in the year by the 2090s.

Precipitation

- Projections of mean annual rainfall from different models in the ensemble are broadly consistent in indicating decreases in rainfall for Afghanistan. The decreases arise largely due to reductions in MAM (the wettest season) rainfalls.
- Projections vary between -31% to +28% by the 2090s with ensemble median values of -5 to -8% in annual rainfall, and -51 to +9% with median values -7 to-19%.

- The proportion of total rainfall that falls in heavy events does not show a consistent direction of change, but tends towards positive changes, despite overall decreasing trends in total rainfall.
- Maximum 1- and 5-day rainfalls tend towards small increases in all seasons except MAM.

Other Regional Climate Change Information

- Complex topography in this part of the world means that local variations in response to global warming, particularly precipitation, are likely to be large and many areas may vary from the regional trends (Christensen *et al*., 2007).

- For further information on Climate Change projections for Asia, see Christensen *et al*. (2007) IPCC Working Group I Report: '*The Physical Science Basis'*, Chapter 11 *(Regional Climate projections*): Section 11.4 *(Asia)*.

Data Summary

	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
Temperature												
	(˚C)	(change in ˚C per decade)			Change in ˚C			Change in ˚C			Change in ˚C	
Annual	13.5	0.13*	A2	1.1	**1.5**	2.1	2.3	**3.3**	4.0	4.0	**5.1**	6.2
			A1B	1.1	**1.9**	2.4	2.0	**3.3**	3.9	3.2	**4.1**	5.4
			B1	0.9	**1.5**	2.0	1.4	**2.3**	3.2	2.0	**2.8**	3.7
DJF	5.6	0.11	A2	0.8	**1.7**	2.2	1.7	**3.0**	3.8	3.3	**4.8**	6.3
			A1B	1.2	**1.7**	2.8	2.0	**3.0**	3.9	2.8	**3.6**	5.1
			B1	0.4	**1.6**	1.8	0.9	**2.0**	2.9	1.9	**2.8**	3.8
MAM	13.8	0.17	A2	0.8	**1.4**	2.9	2.5	**3.1**	4.9	3.6	**5.4**	7.3
			A1B	1.2	**2.0**	3.0	1.6	**3.4**	3.9	2.8	**4.4**	5.5
			B1	0.5	**1.3**	2.3	1.5	**2.1**	3.7	1.8	**2.8**	3.7
JJA	23.6	0.15*	A2	0.9	**1.8**	2.4	2.2	**3.5**	4.0	4.3	**5.7**	7.0
			A1B	1.1	**1.8**	2.9	2.1	**3.5**	4.2	3.4	**4.2**	5.9
			B1	0.6	**1.5**	2.4	1.4	**2.5**	3.5	1.9	**3.1**	3.9
SON	13.5	0.29*	A2	0.8	**1.5**	2.3	2.2	**3.2**	3.8	3.6	**5.3**	6.3
			A1B	0.6	**1.8**	2.6	2.1	**3.1**	4.1	2.7	**4.2**	5.6
			B1	0.7	**1.4**	2.2	1.2	**2.2**	2.8	1.8	**2.7**	3.7
Precipitation												
	(mm per month)	(change in mm per decade)			Change in mm per month			Change in mm per month			Change in mm per month	
Annual	24.4	-0.5	A2	-6	**0**	6	-7	**0**	5	-11	**-2**	8
			A1B	-5	**0**	3	-6	**-2**	3	-6	**-2**	3
			B1	-4	**0**	5	-4	**-1**	4	-5	**-1**	3
DJF	38.4	0.0	A2	-3	**1**	6	-7	**-1**	10	-12	**0**	11
			A1B	-7	**0**	5	-10	**-1**	9	-4	**-1**	13
			B1	-6	**0**	8	-6	**0**	10	-13	**0**	6
MAM	40.7	-2.7*	A2	-13	**-5**	13	-24	**-4**	9	-29	**-9**	0
			A1B	-20	**-4**	3	-14	**-5**	3	-14	**-8**	1
			B1	-13	**-3**	14	-18	**-4**	7	-13	**-3**	2
JJA	8.5	0.2	A2	-2	**0**	12	-3	**0**	21	-6	**0**	21
			A1B	-3	**0**	10	-4	**0**	8	-4	**-1**	9
			B1	-2	**0**	6	-2	**-1**	5	-2	**0**	7
SON	10.1	0.8*	A2	-6	**0**	7	-8	**-1**	9	-7	**1**	15
			A1B	-3	**0**	5	-11	**-1**	6	-8	**0**	6
			B1	-6	**0**	2	-6	**0**	7	-8	**0**	4
Precipitation (%)												
	(mm per month)	(change in % per decade)			% Change			% Change			% Change	
Annual	24.4	-2.0	A2	-17	**0**	12	-21	**-2**	17	-31	**-8**	28
			A1B	-20	**-2**	10	-20	**-7**	11	-20	**-8**	13
			B1	-17	**-1**	20	-17	**-3**	9	-21	**-5**	10
DJF	38.4	0.0	A2	-12	**3**	39	-22	**-3**	29	-38	**-4**	29
			A1B	-26	**-1**	24	-31	**-4**	19	-14	**-5**	29
			B1	-20	**1**	20	-21	**0**	24	-41	**0**	41
MAM	40.7	-6.6*	A2	-26	**-11**	26	-42	**-9**	23	-51	**-19**	0
			A1B	-39	**-7**	7	-27	**-11**	6	-32	**-18**	4
			B1	-24	**-7**	29	-33	**-8**	9	-23	**-7**	9
JJA	8.5	2.3	A2	-20	**2**	30	-32	**-6**	64	-61	**-5**	63
			A1B	-33	**3**	31	-48	**-3**	25	-46	**-6**	43
			B1	-14	**-3**	20	-23	**-11**	17	-31	**0**	25
SON	10.1	7.4*	A2	-21	**-2**	42	-34	**-8**	25	-25	**5**	76
			A1B	-18	**2**	28	-39	**-8**	30	-27	**0**	31
			B1	-33	**-1**	11	-22	**-3**	33	-27	**-3**	22

	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)												
Annual	11.0	1.59*	A2	****	****	****	16	**20**	23	24	**27**	32
			A1B	****	****	****	16	**21**	25	20	**25**	31
			B1	****	****	****	14	**18**	19	16	**19**	23
DJF	10.7	1.36	A2	****	****	****	19	**28**	44	33	**47**	71
			A1B	****	****	****	22	**30**	43	29	**41**	66
			B1	****	****	****	11	**21**	32	22	**29**	35
MAM	9.9	1.5	A2	****	****	****	15	**22**	27	27	**36**	43
			A1B	****	****	****	17	**22**	32	24	**29**	40
			B1	****	****	****	13	**17**	22	13	**20**	25
JJA	11.6	1.33*	A2	****	****	****	26	**34**	56	46	**60**	86
			A1B	****	****	****	26	**36**	61	44	**51**	79
			B1	****	****	****	20	**27**	34	27	**32**	47
SON	12.0	2.39*	A2	****	****	****	19	**21**	27	25	**29**	39
			A1B	****	****	****	17	**22**	27	21	**26**	37
			B1	****	****	****	14	**18**	21	18	**20**	24
Frequency of Hot Nights (TN90p)												
Annual	10.8	1.57*	A2	****	****	****	20	**22**	25	27	**33**	36
			A1B	****	****	****	19	**23**	26	24	**28**	34
			B1	****	****	****	16	**19**	23	19	**20**	26
DJF	10.8	1.44*	A2	****	****	****	17	**25**	36	28	**42**	58
			A1B	****	****	****	18	**26**	36	23	**33**	53
			B1	****	****	****	16	**19**	22	17	**26**	33
MAM	9.9	1.26*	A2	****	****	****	19	**24**	28	33	**38**	46
			A1B	****	****	****	21	**24**	30	27	**31**	44
			B1	****	****	****	16	**18**	23	18	**22**	27
JJA	11.2	1.43*	A2	****	****	****	30	**45**	54	56	**77**	86
			A1B	****	****	****	35	**43**	59	44	**62**	84
			B1	****	****	****	23	**32**	45	29	**38**	57
SON	10.8	1.44*	A2	****	****	****	22	**25**	31	31	**39**	47
			A1B	****	****	****	20	**24**	30	25	**33**	43
			B1	****	****	****	15	**22**	26	19	**24**	29
Frequency of Cold Days (TX10p)												
Annual	9.9	-0.75*	A2	****	****	****	1	**4**	6	0	**2**	4
			A1B	****	****	****	2	**4**	5	0	**3**	5
			B1	****	****	****	4	**6**	8	3	**4**	6
DJF	9.8	-1.22	A2	****	****	****	0	**4**	6	0	**2**	4
			A1B	****	****	****	1	**4**	6	0	**2**	4
			B1	****	****	****	4	**6**	9	2	**4**	6
MAM	10.1	-0.88	A2	****	****	****	1	**4**	6	0	**2**	4
			A1B	****	****	****	1	**4**	7	1	**2**	5
			B1	****	****	****	4	**6**	8	3	**4**	6
JJA	9.7	-0.64	A2	****	****	****	1	**2**	4	0	**1**	2
			A1B	****	****	****	0	**2**	4	0	**1**	4
			B1	****	****	****	2	**4**	5	1	**3**	5
SON	9.9	-0.46	A2	****	****	****	1	**4**	6	0	**2**	4
			A1B	****	****	****	0	**3**	5	1	**3**	5
			B1	****	****	****	4	**6**	7	3	**4**	6
Frequency of Cold Nights (TN10p)												
Annual	9.3	-0.77	A2	****	****	****	2	**4**	6	0	**1**	5
			A1B	****	****	****	3	**4**	6	1	**3**	4
			B1	****	****	****	4	**6**	7	3	**5**	6
DJF	9.3	-1.31	A2	****	****	****	1	**2**	5	0	**0**	4
			A1B	****	****	****	1	**3**	5	0	**1**	4
			B1	****	****	****	3	**5**	7	1	**3**	5
MAM	10.3	-0.24	A2	****	****	****	2	**3**	6	0	**1**	4
			A1B	****	****	****	2	**4**	7	1	**3**	5
			B1	****	****	****	5	**6**	7	2	**4**	6
JJA	9.7	-0.24	A2	****	****	****	0	**1**	2	0	**0**	0
			A1B	****	****	****	0	**1**	2	0	**0**	1
			B1	****	****	****	1	**2**	3	0	**1**	3
SON	8.8	-1.25*	A2	****	****	****	1	**4**	6	0	**1**	2
			A1B	****	****	****	1	**3**	5	1	**2**	4
			B1	****	****	****	3	**5**	6	2	**4**	5

	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 %	
Annual	23.6	-0.45	A2	****	****	****	-1	**2**	6	-3	**3**	9
			A1B	****	****	****	-1	**2**	5	-2	**2**	8
			B1	****	****	****	-3	**2**	6	-5	**2**	6
DJF	****	****	A2	****	****	****	-6	**0**	8	-11	**1**	14
			A1B	****	****	****	-7	**1**	8	-4	**0**	16
			B1	****	****	****	-3	**1**	10	-8	**2**	9
MAM	****	****	A2	****	****	****	-11	**0**	10	-17	**-3**	10
			A1B	****	****	****	-9	**0**	7	-15	**-4**	11
			B1	****	****	****	-8	**2**	7	-7	**-1**	6
JJA	****	****	A2	****	****	****	-12	**0**	7	-20	**-1**	10
			A1B	****	****	****	-21	**-4**	6	-20	**-3**	9
			B1	****	****	****	-8	**-1**	2	-14	**-2**	6
SON	****	****	A2	****	****	****	-7	**0**	10	-13	**1**	8
			A1B	****	****	****	-19	**1**	8	-12	**1**	5
			B1	****	****	****	-5	**1**	6	-15	**0**	11
Maximum 1-day rainfall (RX1day)												
	mm	Change in mm per decade						Change in mm			Change in mm	
Annual	25.2	-0.85	A2	****	****	****	-1	**1**	5	-2	**2**	14
			A1B	****	****	****	-1	**1**	5	0	**2**	6
			B1	****	****	****	-1	**1**	4	-3	**1**	7
DJF	12.5	0.05	A2	****	****	****	-2	**0**	2	-3	**0**	8
			A1B	****	****	****	-2	**0**	3	-2	**0**	8
			B1	****	****	****	-2	**0**	3	-3	**0**	3
MAM	14.4	-0.46	A2	****	****	****	-4	**0**	2	-6	**0**	4
			A1B	****	****	****	-3	**0**	3	-5	**0**	4
			B1	****	****	****	-3	**0**	3	-3	**0**	4
JJA	8.5	0.81*	A2	****	****	****	-1	**0**	5	-2	**0**	10
			A1B	****	****	****	-2	**0**	3	-2	**0**	5
			B1	****	****	****	-1	**0**	1	-1	**0**	2
SON	6.1	0.28	A2	****	****	****	-1	**0**	5	-1	**1**	8
			A1B	****	****	****	-3	**0**	3	-2	**0**	4
			B1	****	****	****	-2	**0**	2	-2	**0**	3
Maximum 5-day Rainfall (RX5day)												
	mm	Change in mm per decade						Change in mm			Change in mm	
Annual	54.8	1.37	A2	****	****	****	-4	**3**	12	-6	**1**	26
			A1B	****	****	****	-1	**1**	10	-2	**2**	14
			B1	****	****	****	-2	**2**	9	-7	**2**	11
DJF	19.2	0.16	A2	****	****	****	-5	**0**	5	-9	**1**	12
			A1B	****	****	****	-4	**2**	7	-2	**0**	14
			B1	****	****	****	-5	**0**	5	-6	**1**	6
MAM	23.8	-0.52	A2	****	****	****	-10	**0**	4	-12	**-2**	7
			A1B	****	****	****	-6	**0**	7	-9	**-1**	10
			B1	****	****	****	-6	**0**	8	-8	**1**	9
JJA	11.5	0.77	A2	****	****	****	-3	**1**	12	-6	**0**	16
			A1B	****	****	****	-5	**0**	8	-5	**1**	10
			B1	****	****	****	-2	**0**	7	-3	**1**	7
SON	8.5	0.51	A2	****	****	****	-2	**1**	11	-4	**3**	17
			A1B	****	****	****	-6	**1**	4	-4	**0**	7
			B1	****	****	****	-4	**0**	6	-6	**0**	7

* indicates trend is statistically significant at 95% confidence

**** indicates data are not available
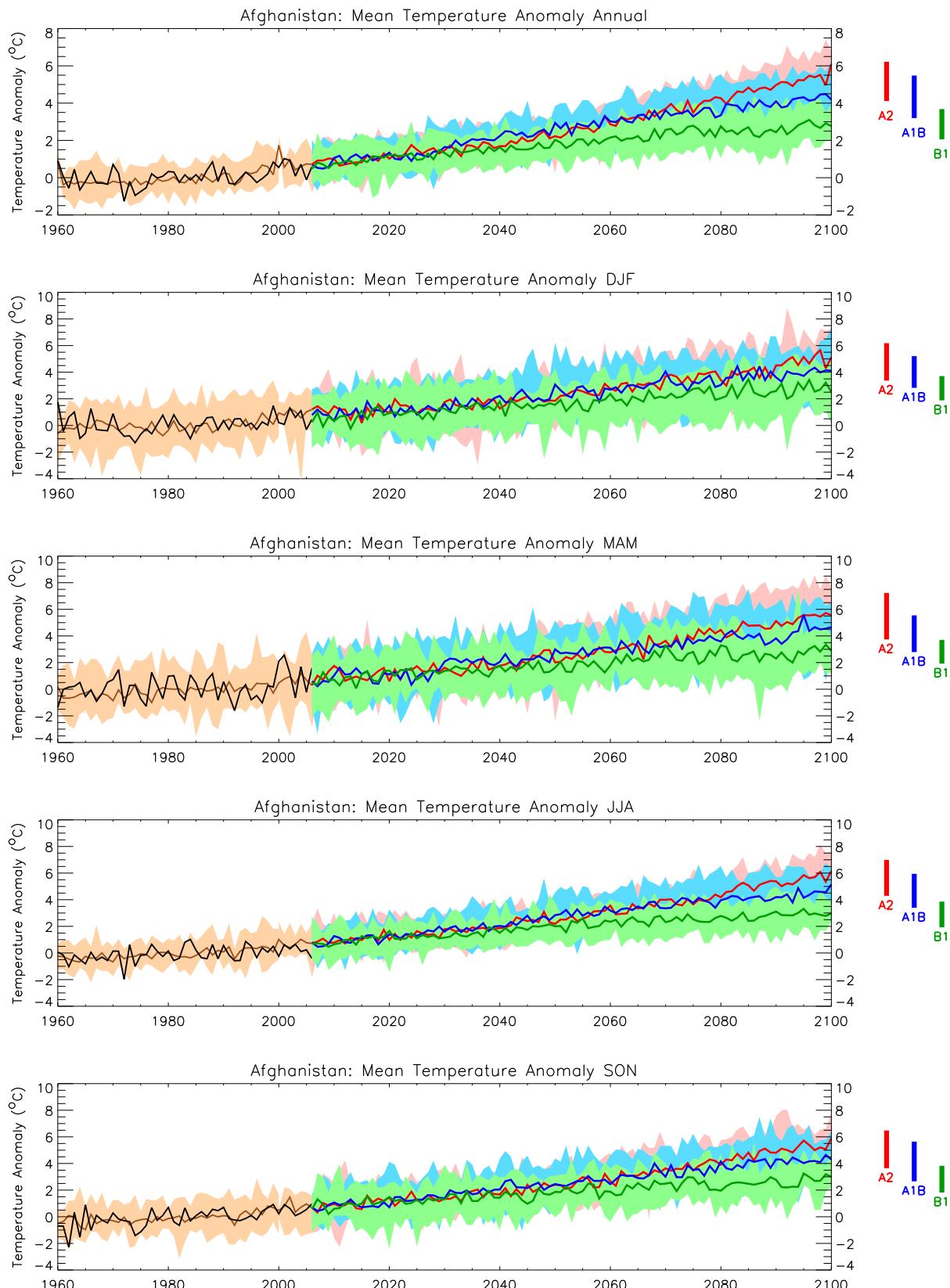
Figure 1: Trends in annual and seasonal mean temperature for the recent past and projected future. All values shown are anomalies, relative to the 1970-1999 mean climate. Black curves show the mean of observed data from 1960 to 2006, Brown curves show the median (solid line) and range (shading) of model 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.
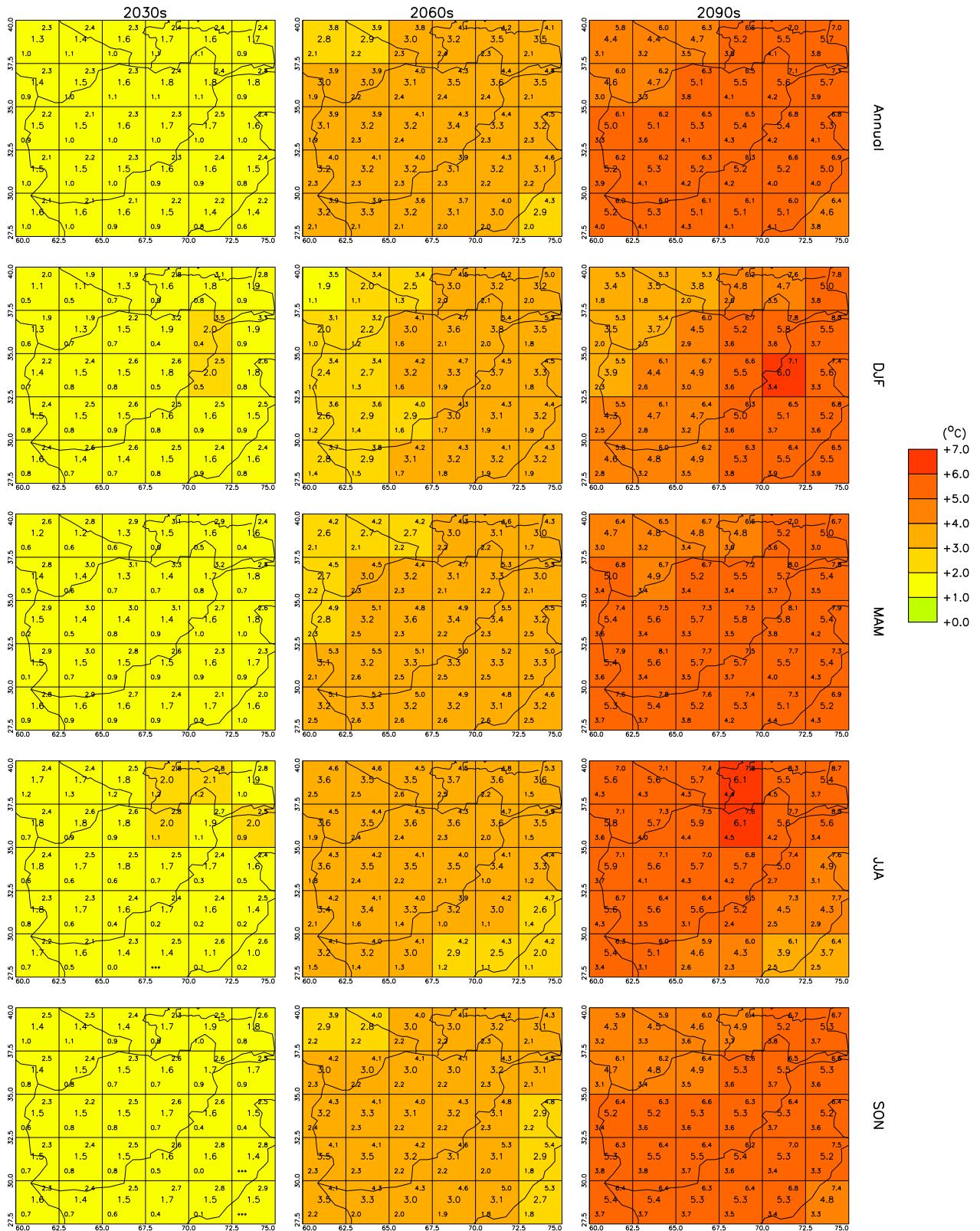
Figure 2: Spatial patterns of projected change in mean annual and seasonal temperature for 10-year periods in the future under the SRES A2 scenario. All values are anomalies relative to the mean climate of 1970-1999. In each grid box, the central value gives the ensemble median and the values in the upper and lower corners give the ensemble maximum and minimum.
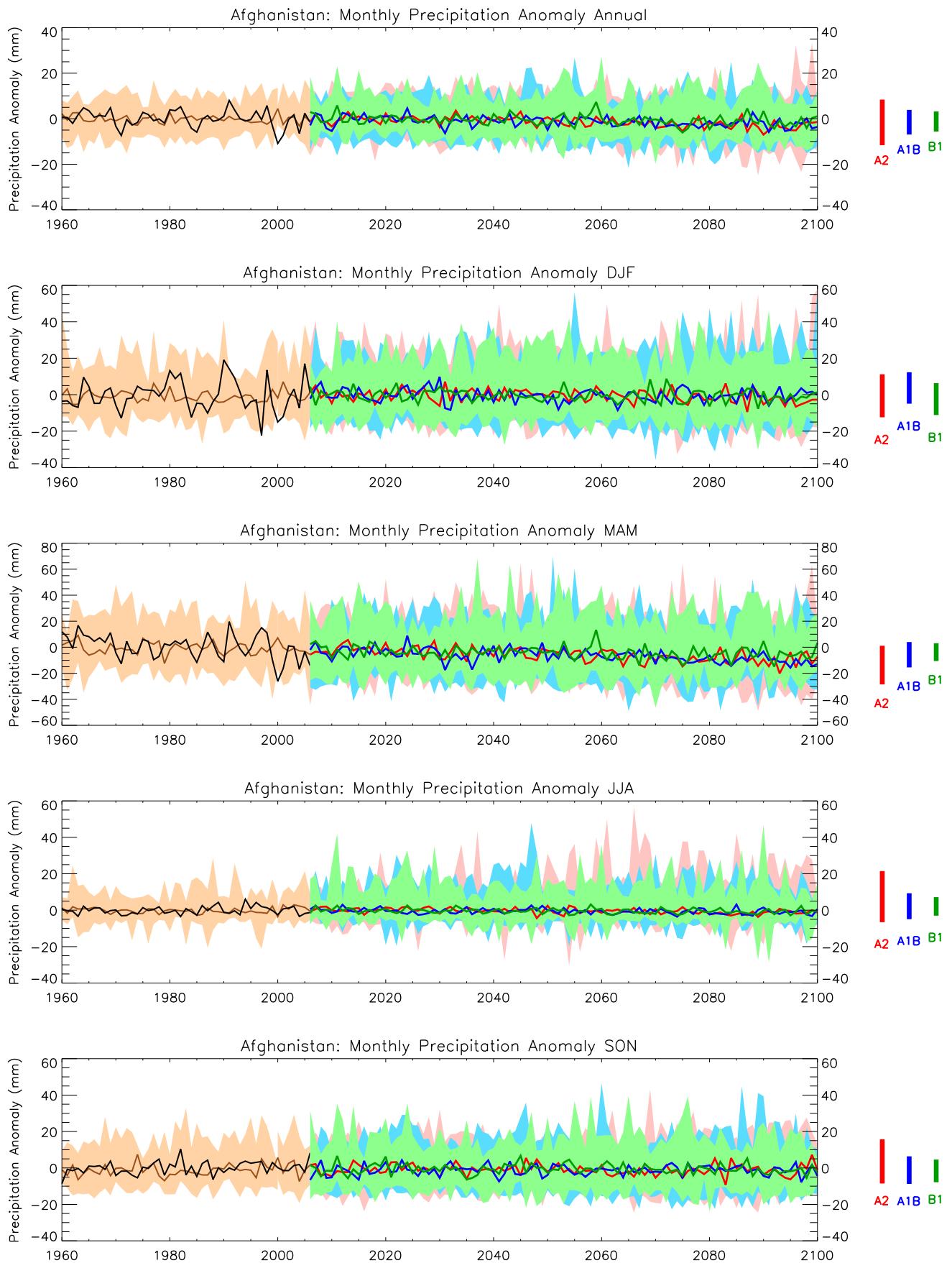
Figure 3: Trends in monthly precipitation for the recent past and projected future. All values shown are anomalies, relative to the 1970-1999 mean climate. See Figure 1 for details.
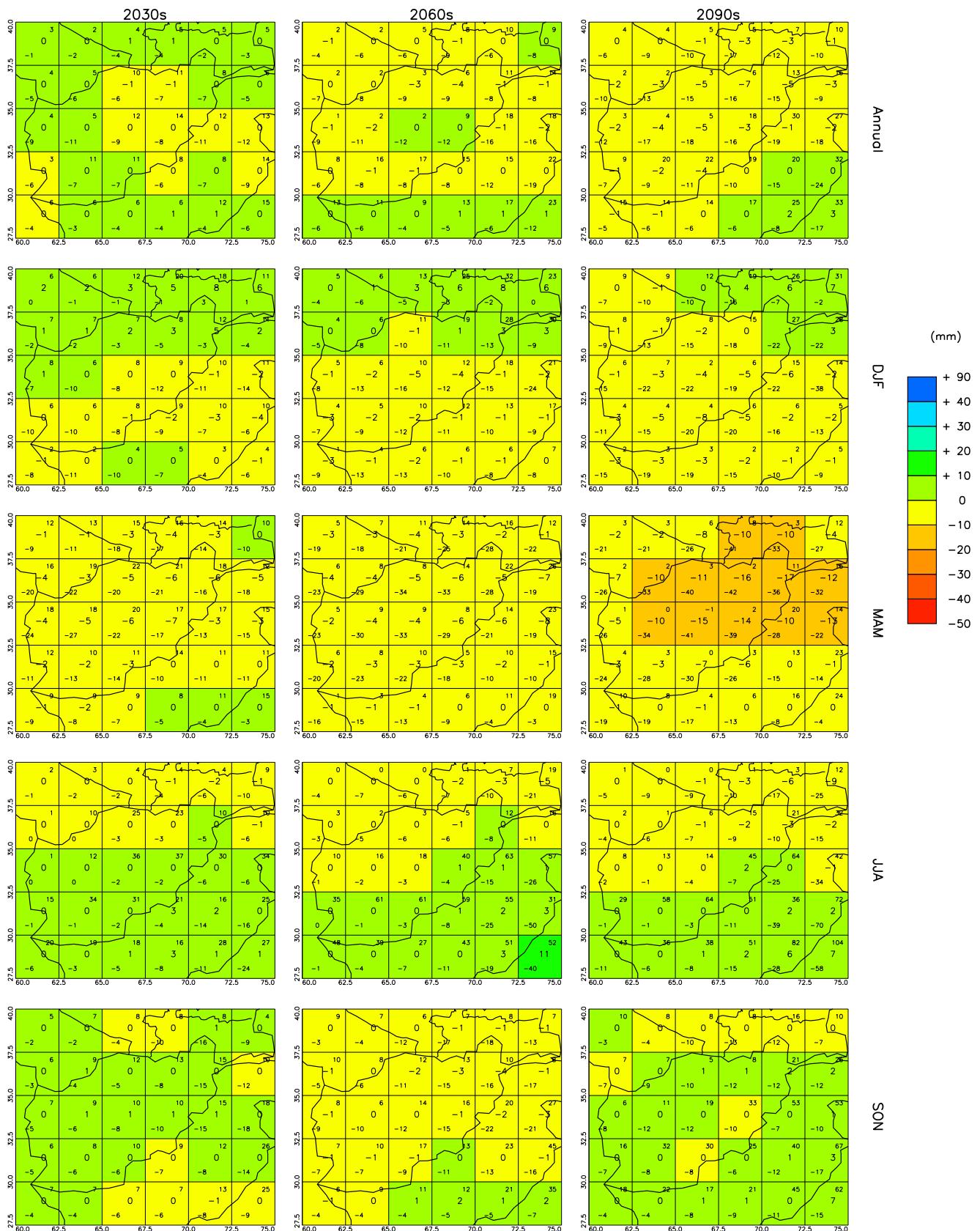
Figure 4: Spatial patterns of projected change in monthly precipitation for 10-year periods in the future under the SRES A2 scenario. All values are anomalies relative to the mean climate of 1970-1999.See Figure 2 for details.
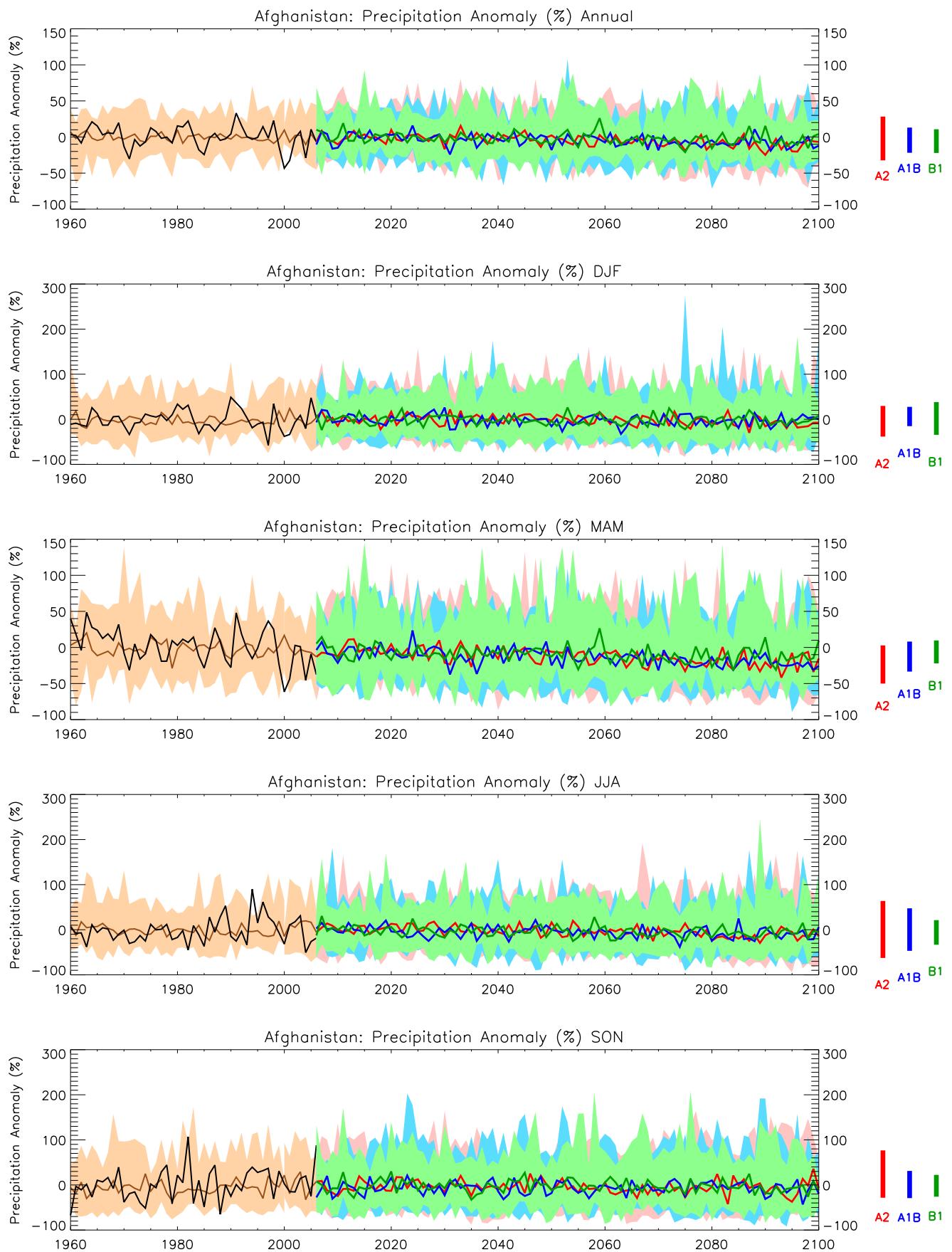
Figure 5: Trends in monthly precipitation for the recent past and projected future. All values shown are percentage anomalies, relative to the 1970-1999 mean climate. See Figure 1 for details.
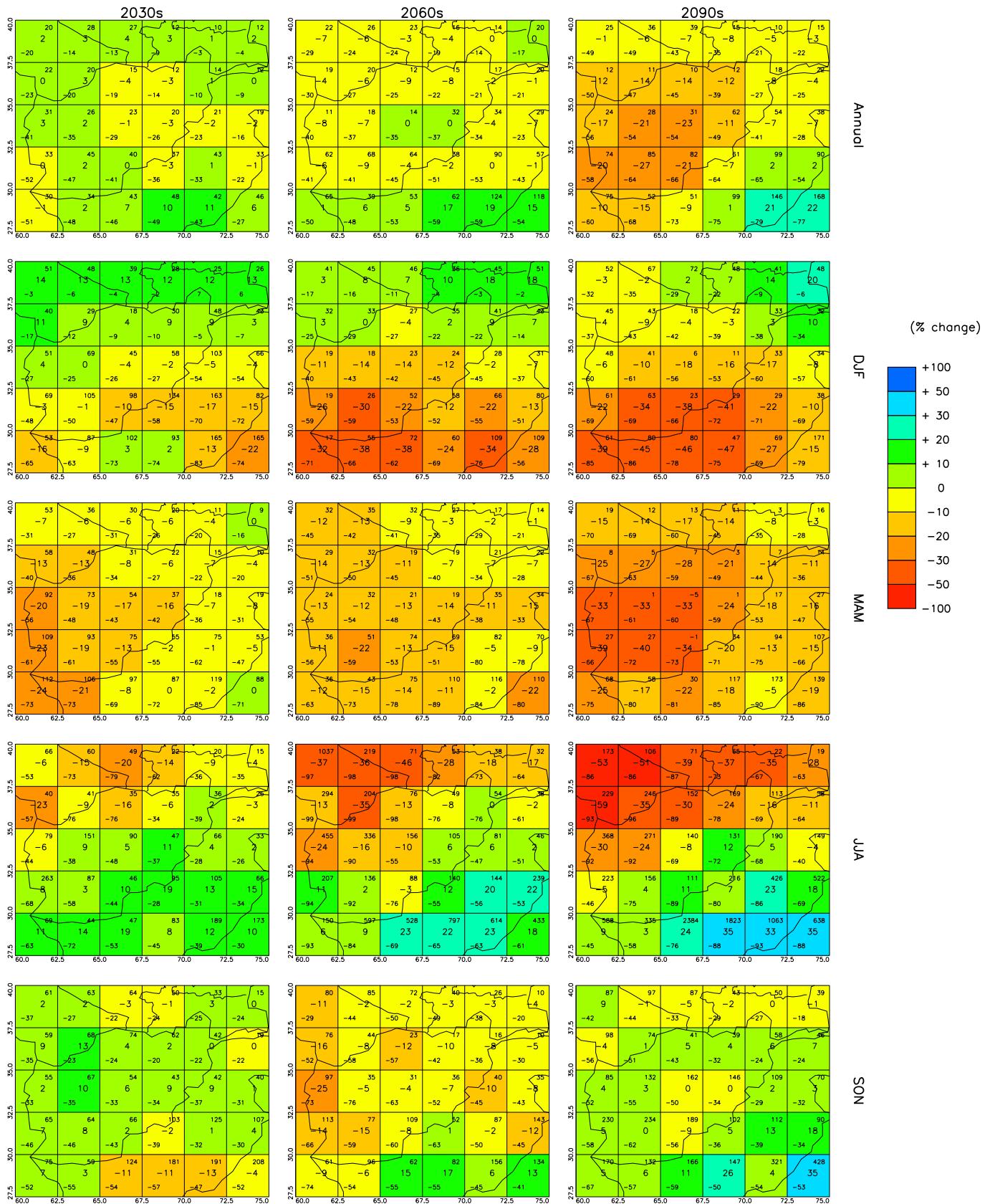
Figure 6: Spatial patterns of projected change in monthly precipitation for 10-year periods in the future under the SRES A2 scenario. All values are percentage anomalies relative to the mean climate of 1970-1999.See Figure 2 for details.
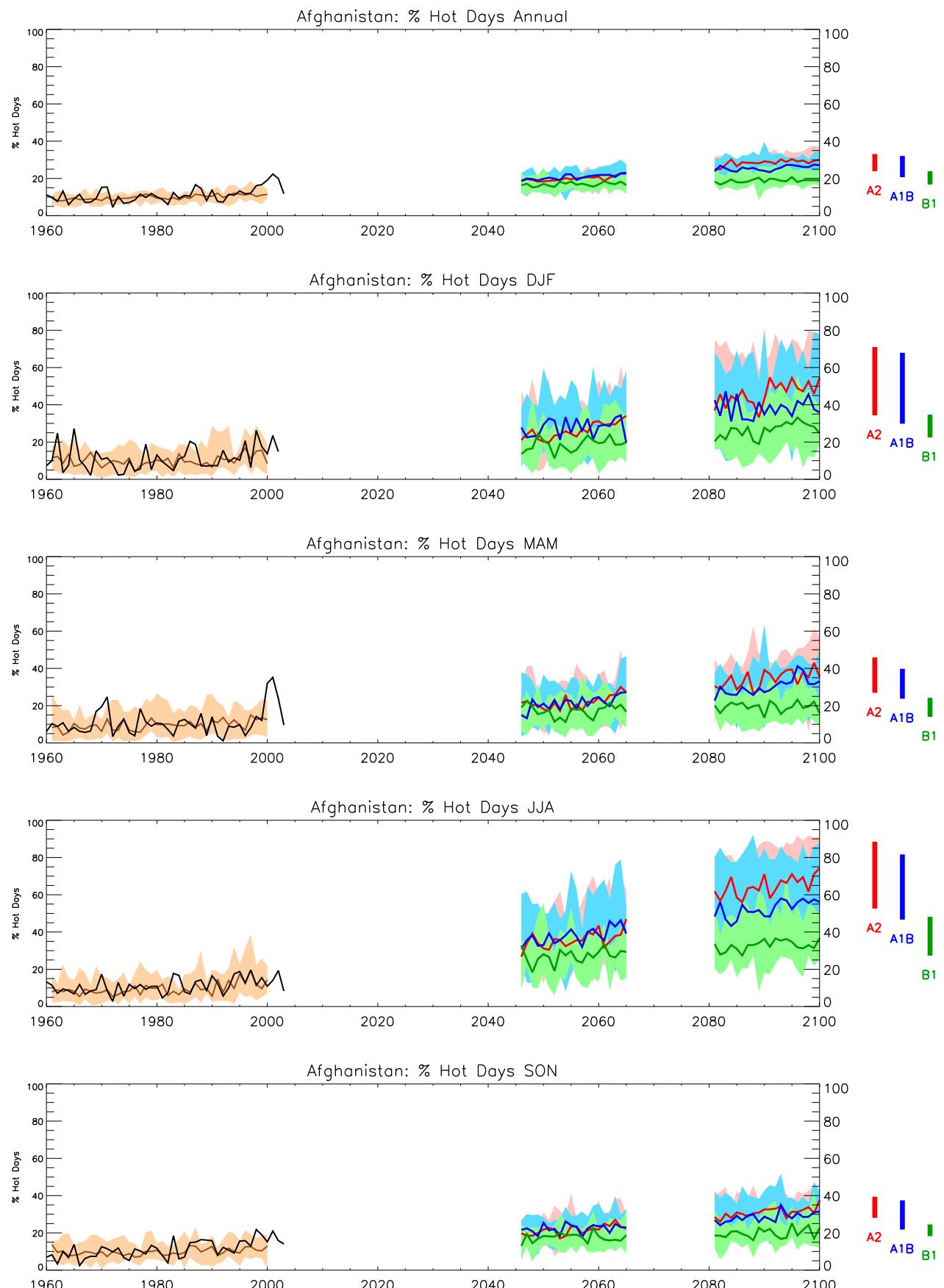
Figure 7: Trends in Hot-day frequency for the recent past and projected future. See Figure 1 for details.
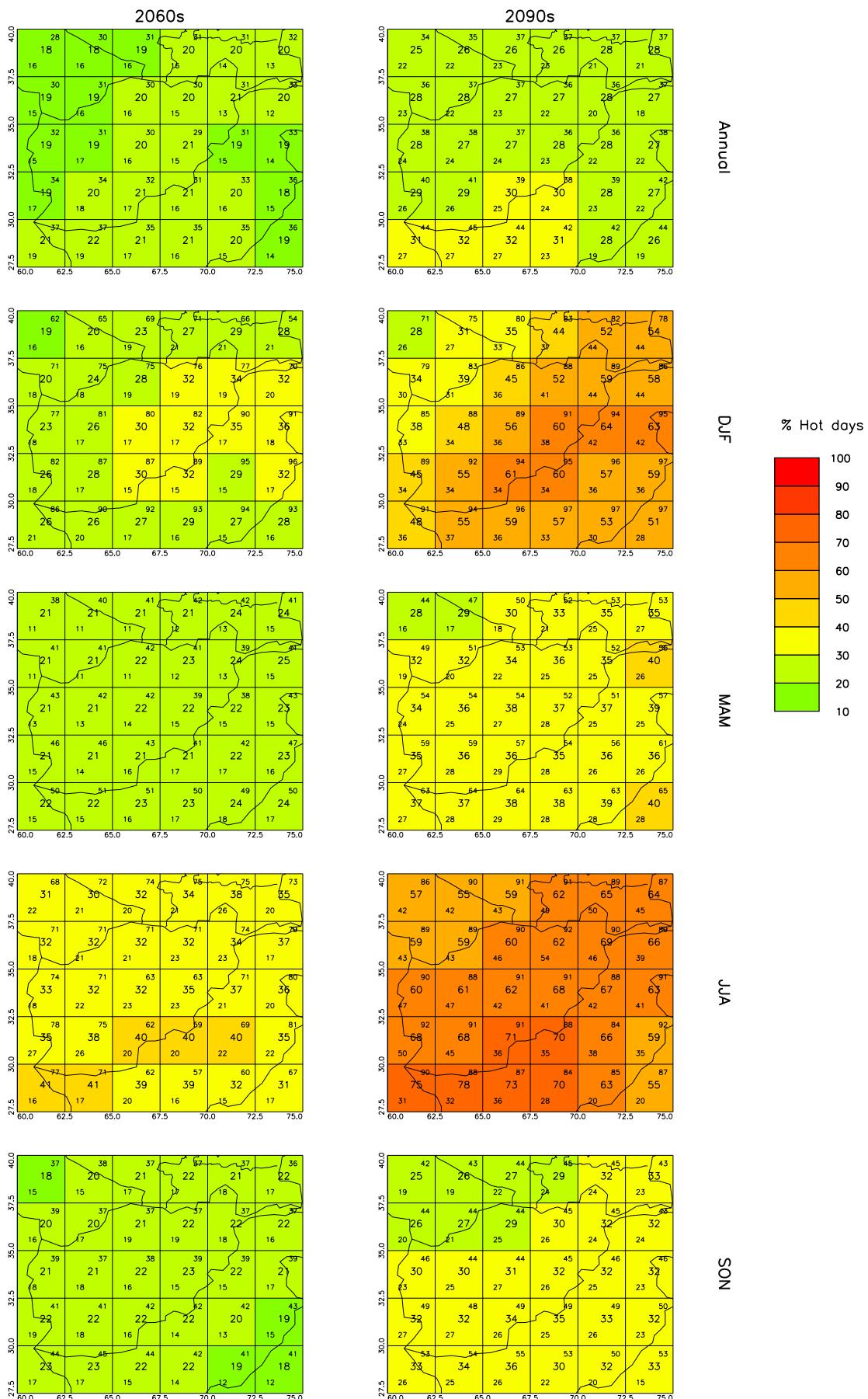
Figure 8: Spatial patterns of projected change in Hot-day frequency for 10-year periods in the future under the SRES A2 scenario. See Figure 2 for details.
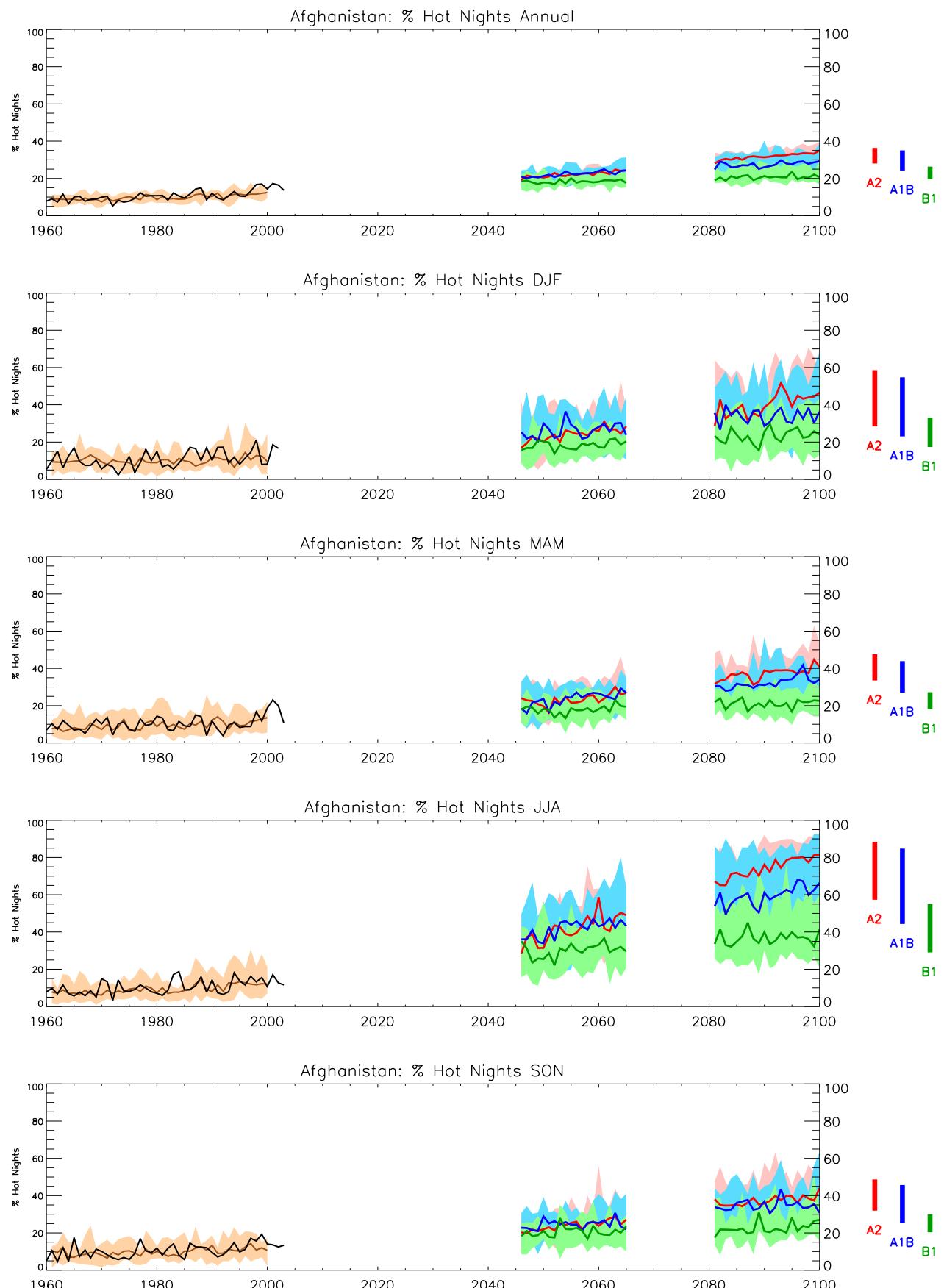
Figure 9: Trends in hot-night frequency for the recent past and projected future. See Figure 1 for details.
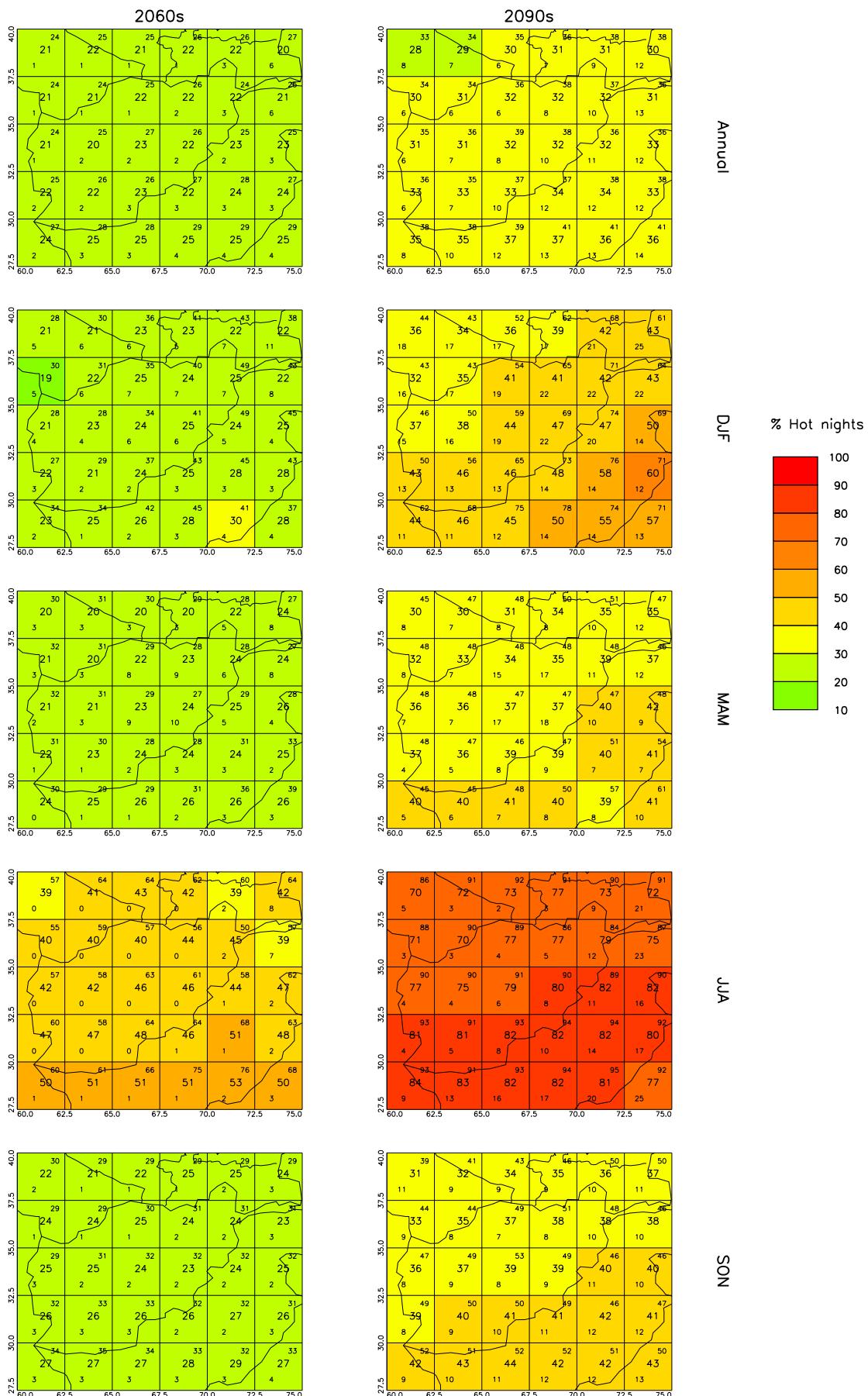
Figure 10: Spatial patterns of projected change in hot-night frequency for 10-year periods in the future under the SRES A2 scenario. See Figure 2 for details.
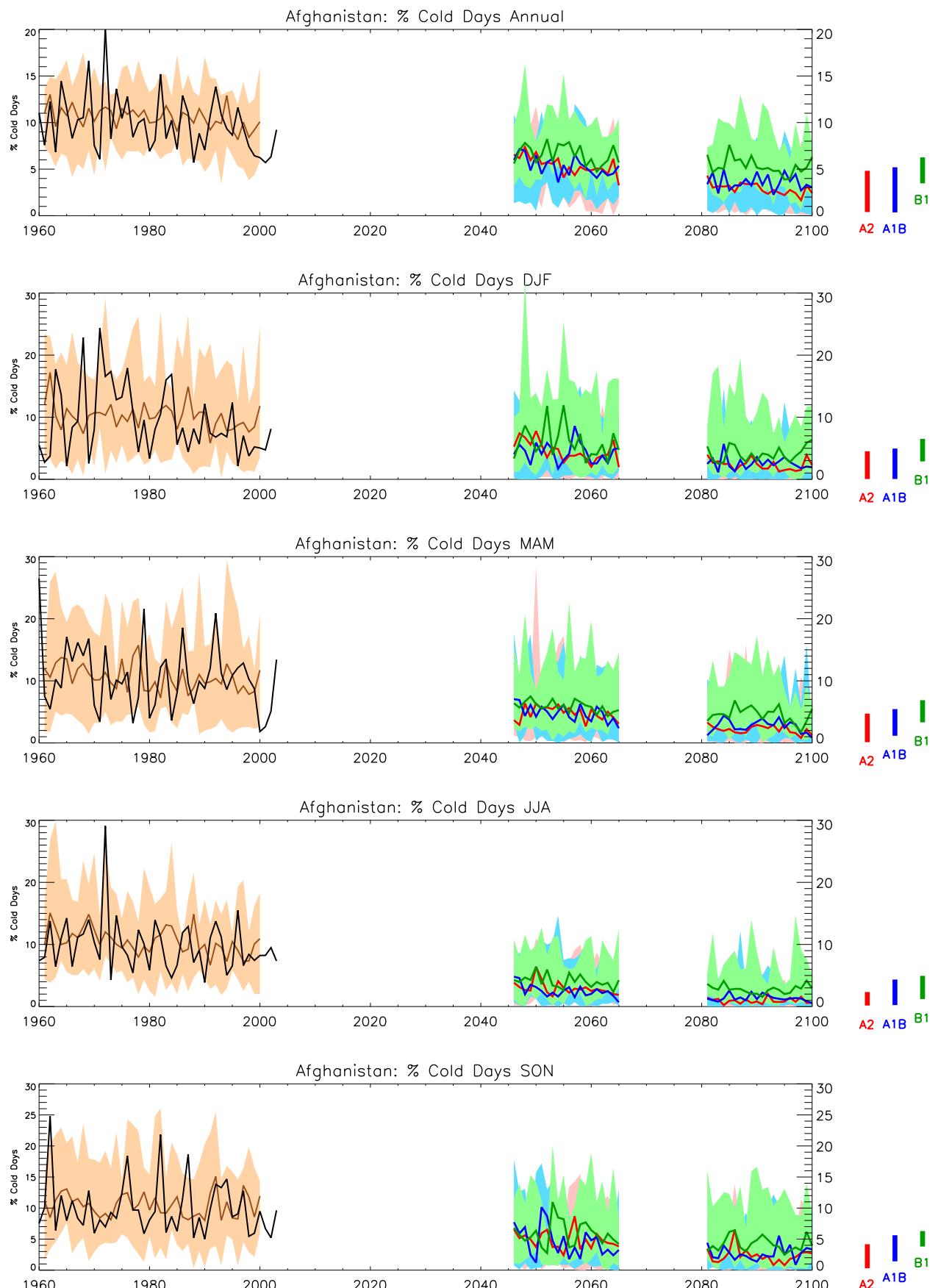
Figure 11: Trends in cold-day frequency for the recent past and projected future. See Figure 1 for details.
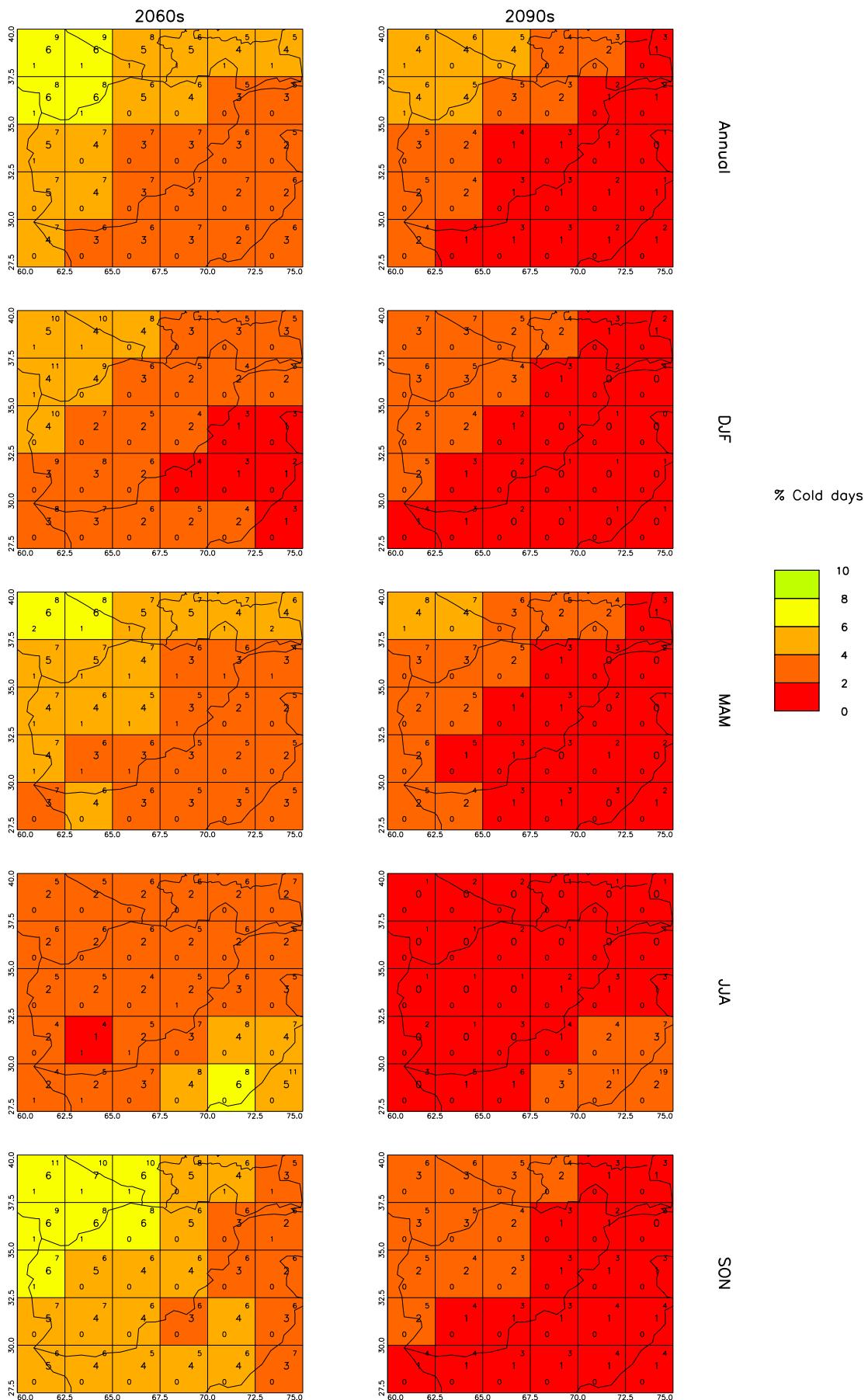
Figure 12: Spatial patterns of projected change in cold-day frequency for 10-year periods in the future under the SRES A2 scenario. See Figure 2 for details.
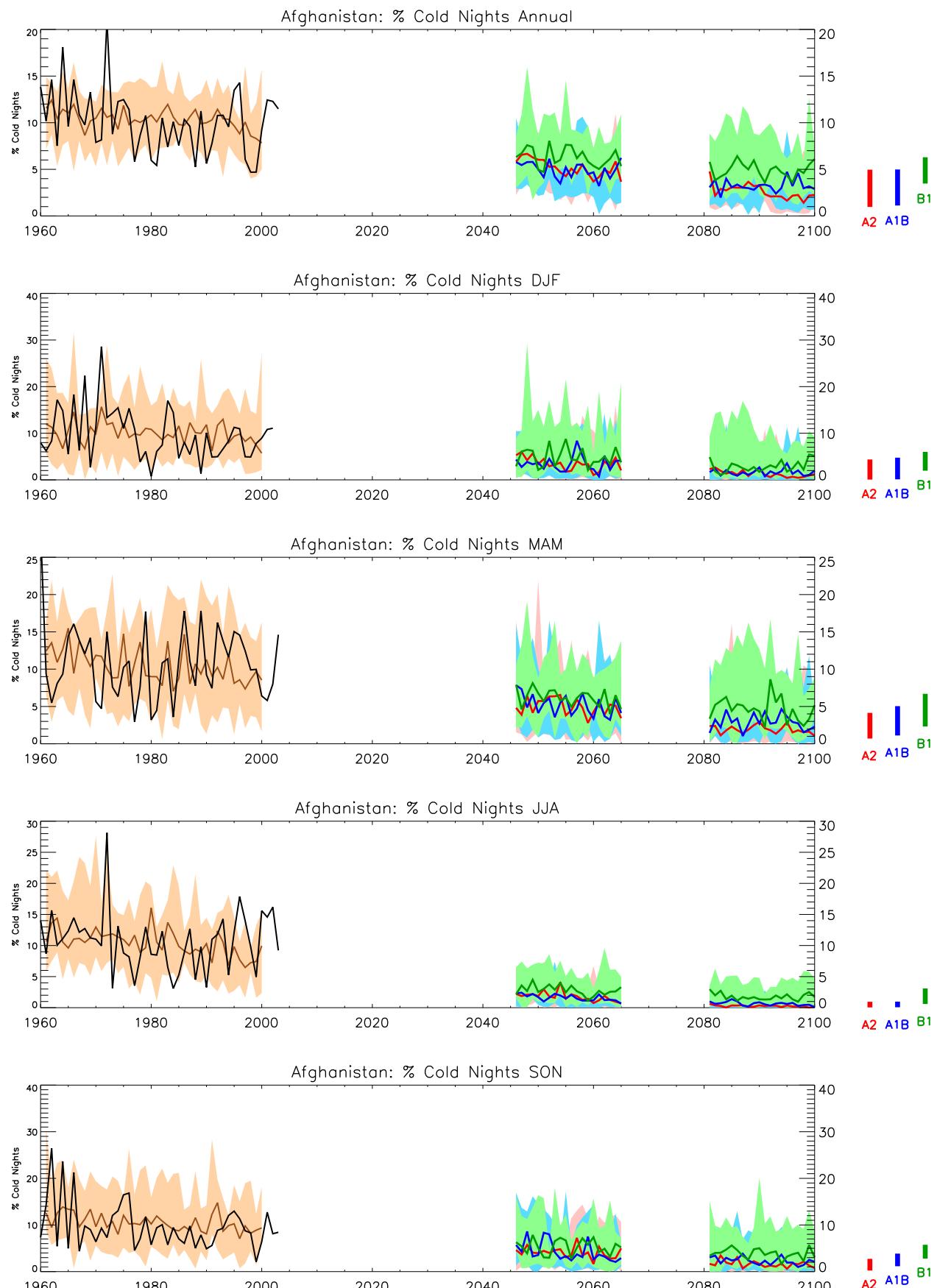
Figure 13: Trends in cold-night frequency for the recent past and projected future. See Figure 1 for details.
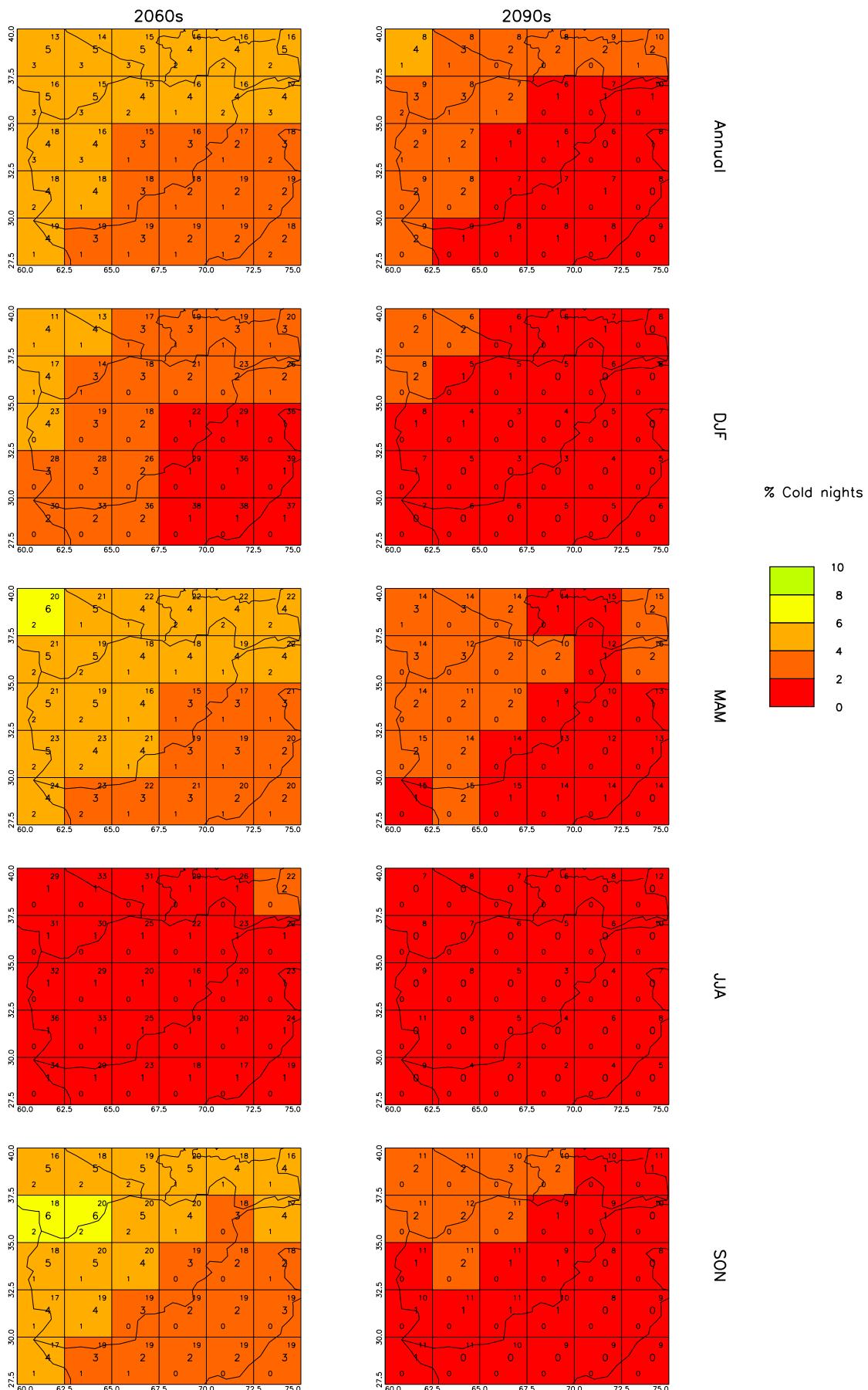
Figure 14: Spatial patterns of projected change in cold-night frequency for 10-year periods in the future under the SRES A2 scenario. See Figure 2 for details.
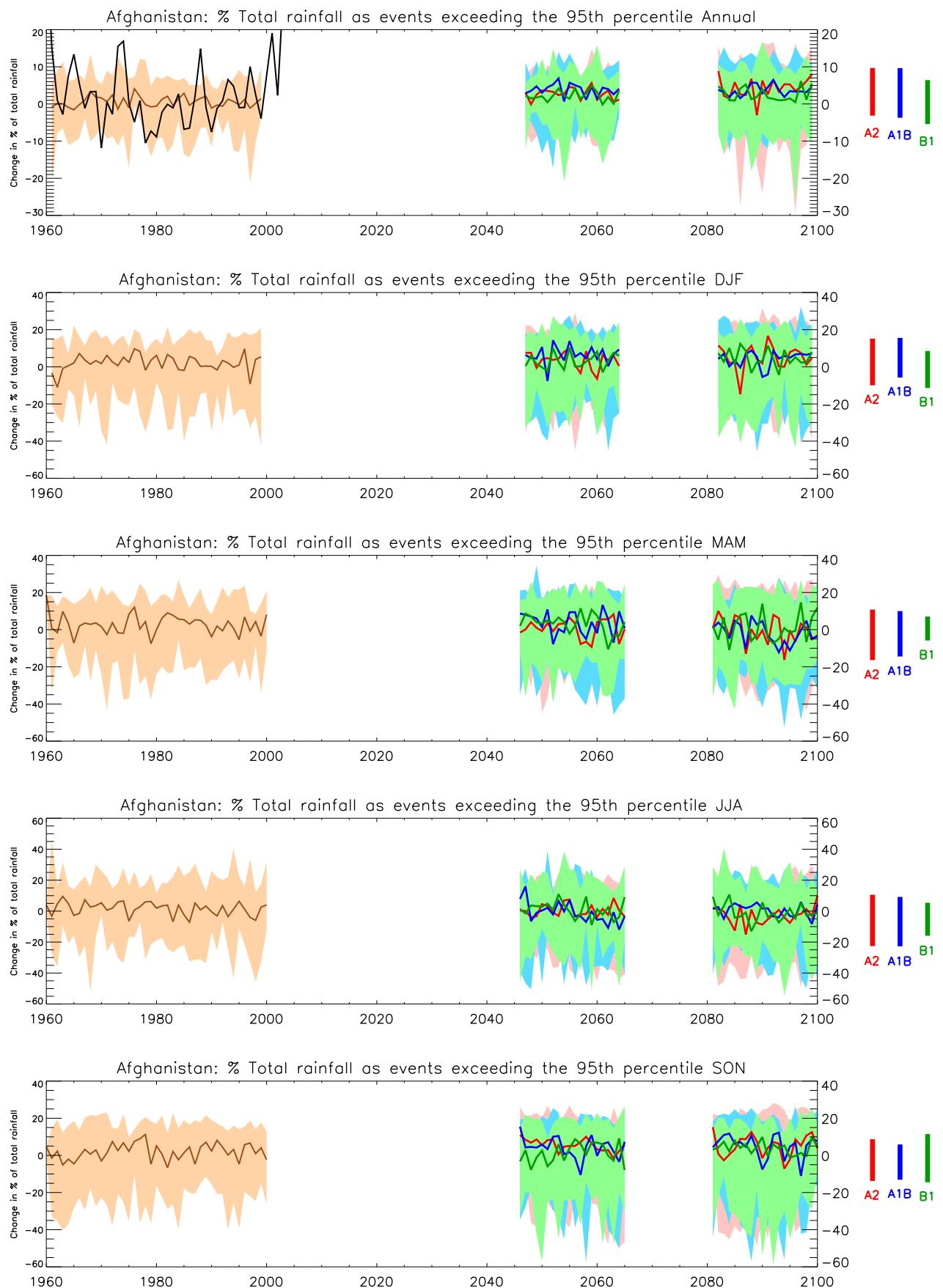
Figure 15: Trends in the proportion of precipitation falling in 'heavy' events for the recent past and projected future. All values shown are anomalies, relative to the 1970-1999 mean climate. See Figure 1 for details.
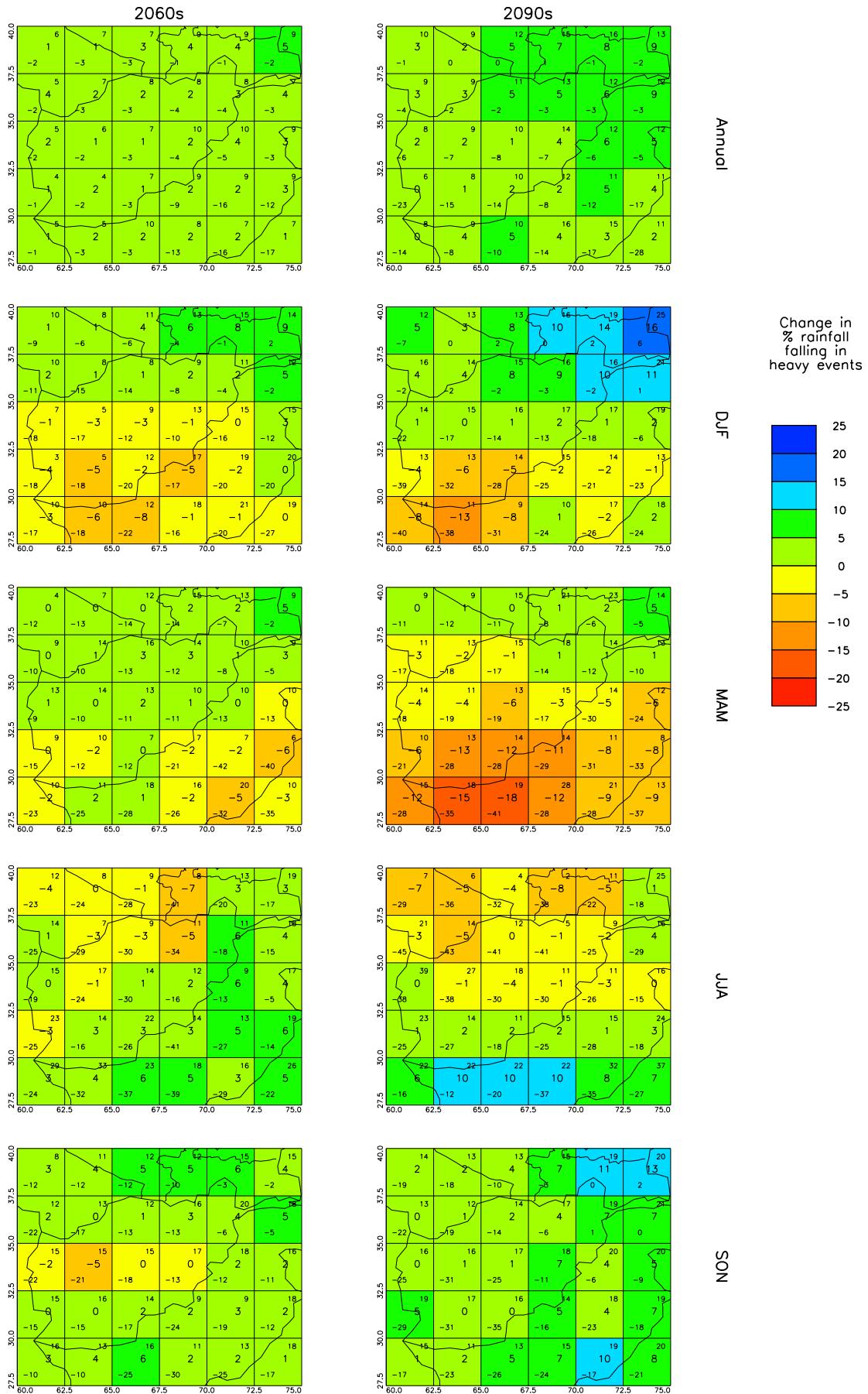
Figure 16: Spatial patterns of projected change in the proportion of precipitation falling in 'heavy' events for 10-year periods in the future under the SRES A2 scenario. All values are anomalies relative to the mean climate of 1970-1999. See Figure 2 for details.
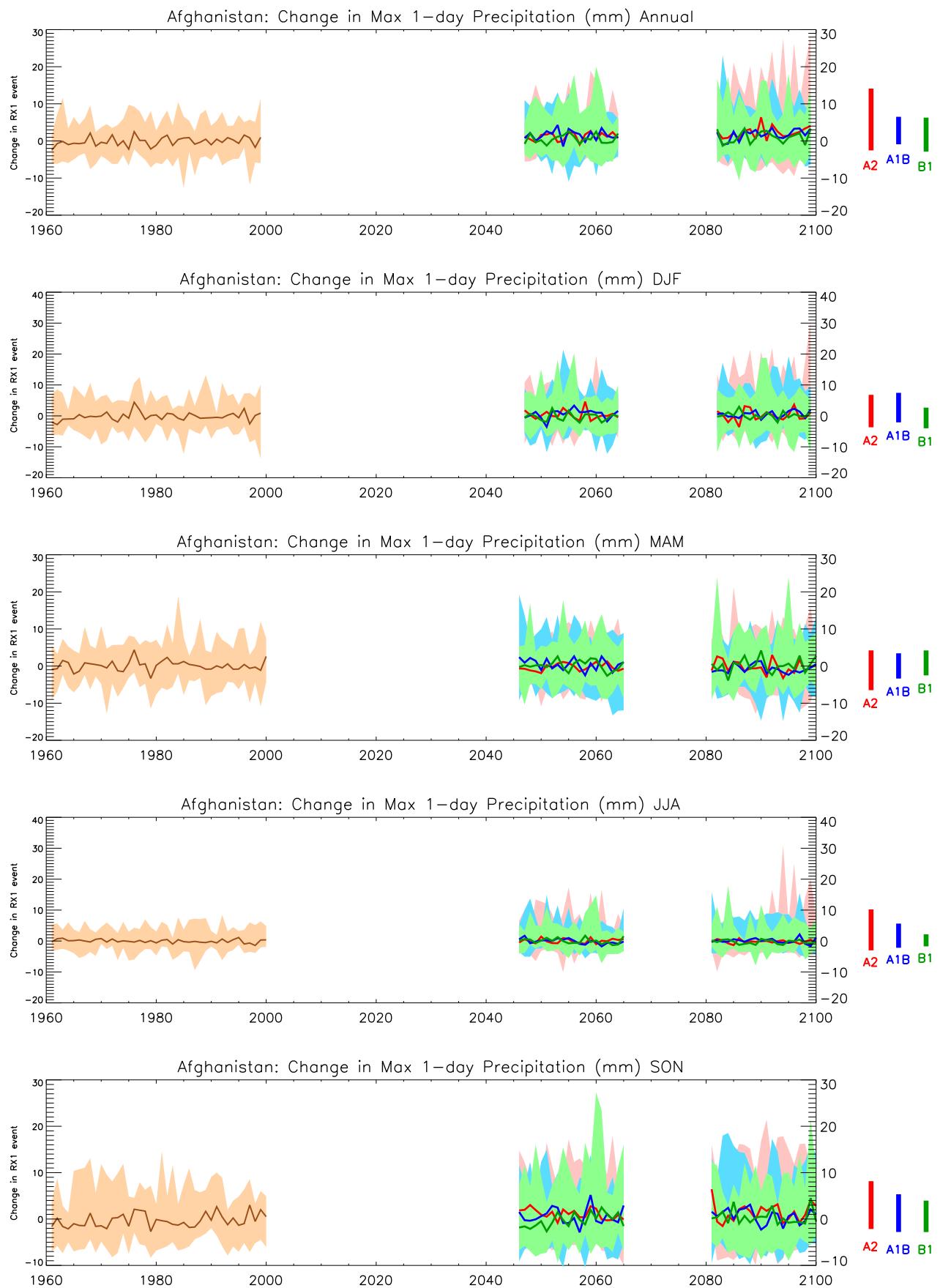
Figure 17: Trends in maximum 1-day rainfall for the recent past and projected future. All values shown are anomalies, relative to the 1970-1999 mean climate. See Figure 1 for details.
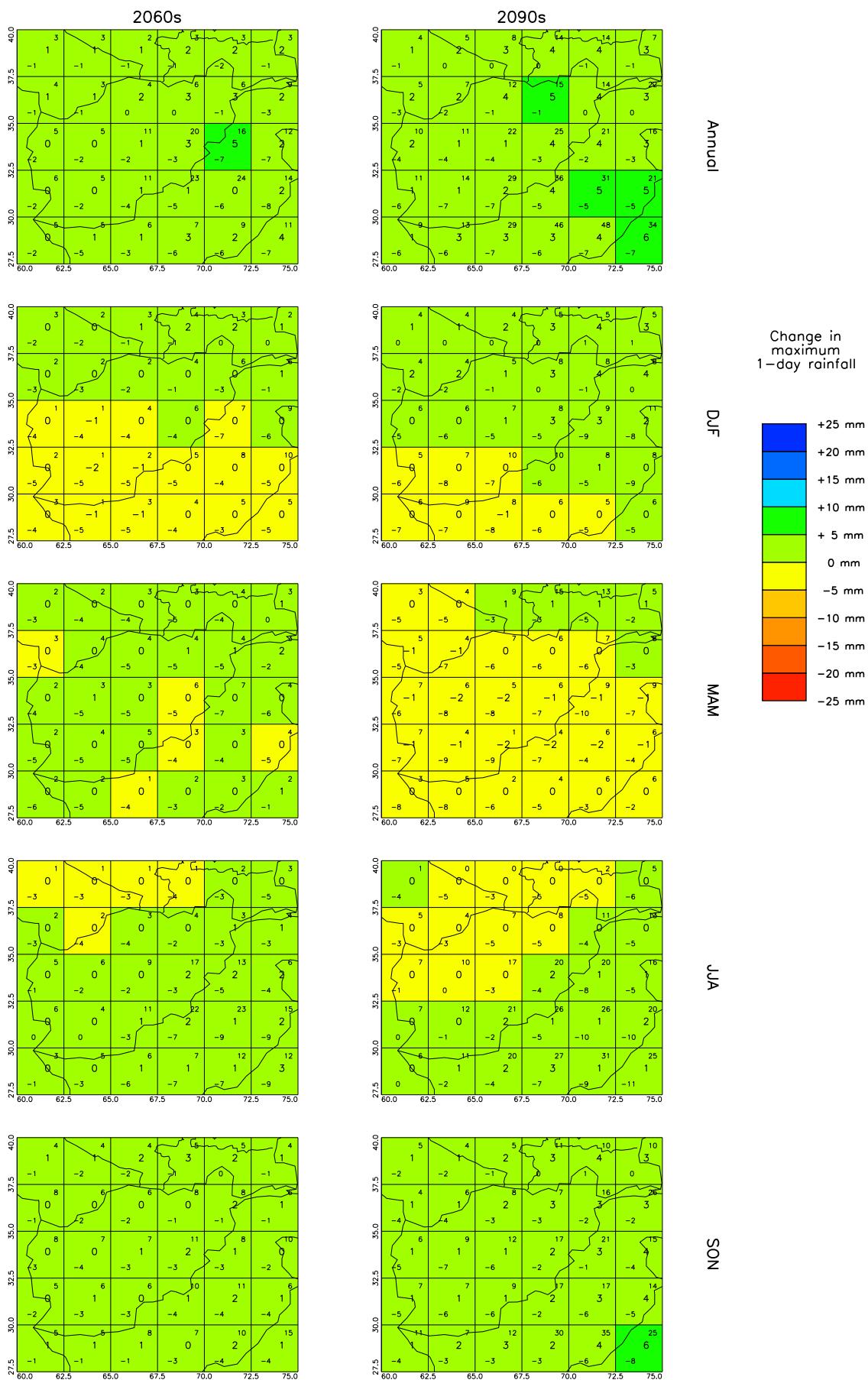
Figure 18: Spatial patterns of maximum 1-day rainfall for 10-year periods in the future under the SRES A2 scenario. All values are anomalies relative to the mean climate of 1970-1999. See Figure 2 for details.
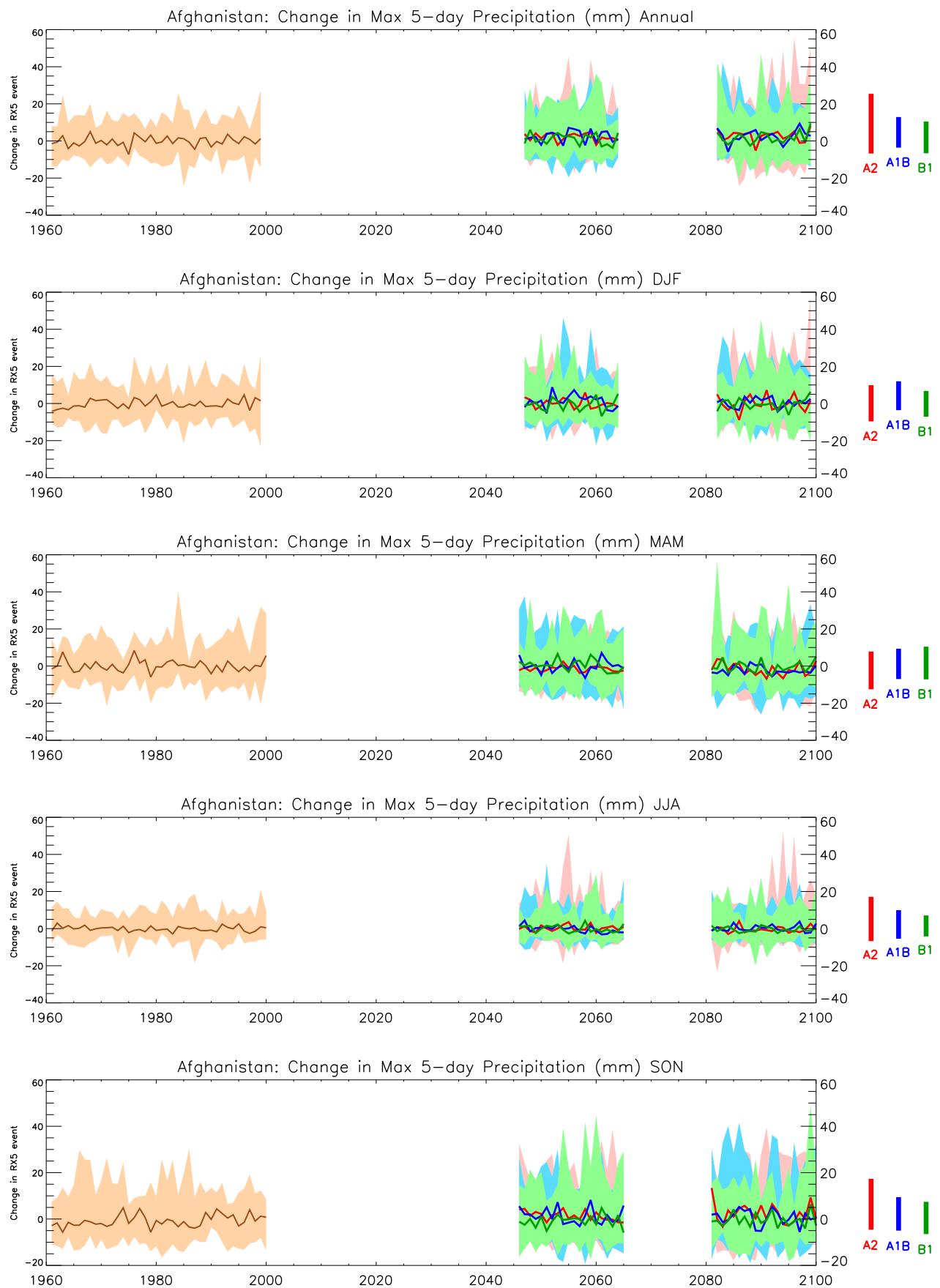
Figure 19: Trends in maximum 5-day rainfall for the recent past and projected future. All values shown are anomalies, relative to the 1970-1999 mean climate. See Figure 1 for details.
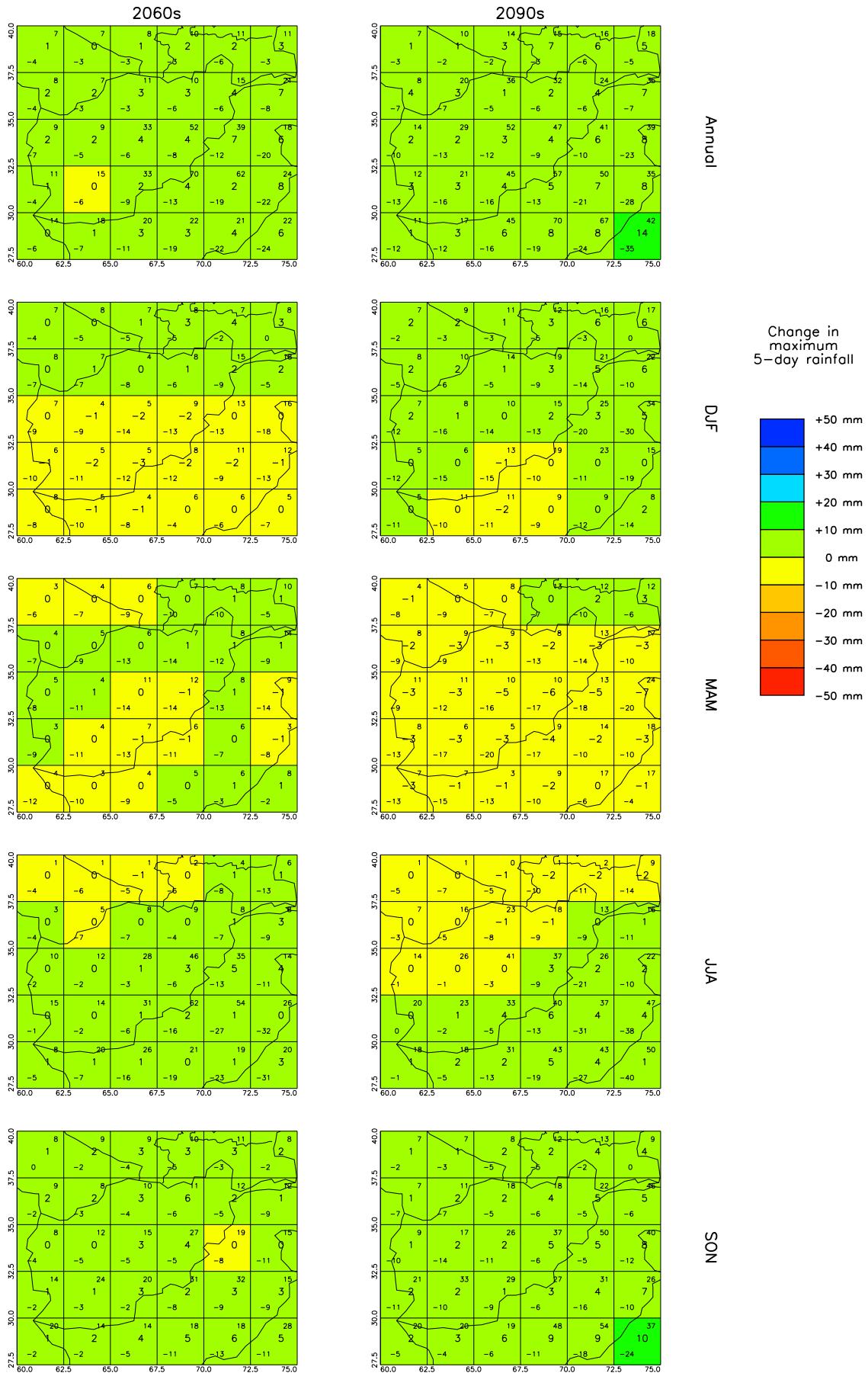
Figure 20: Spatial patterns of projected change in maximum 5-day rainfall for 10-year periods in the future under the SRES A2 scenario. All values are anomalies relative to the mean climate of 1970-1999. See Figure 2 for details.