Impact of climate change on weather-related fire risk factors in the TWWHA
Part II Report

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Summary

This report furthers the main findings of the weather-related fire risk factors for the Tasmanian Wilderness World Heritage Area Part I report. Estimates of future change are based on a high emissions scenario. Projected changes to quantitative measures of fire danger and associated climate parameters have the following characteristics:

- The number of days per fire season on which MSDI exceeds 50, averaged over the TWWHA, increases by 16% in the near future, 58% by mid-century and 218% by end-of-century.
- The area of the TWWHA over which MSDI exceeds 50 on a given day is projected to increase by similar percentages.
- The number of days per fire season on which 30-day antecedent rainfall is less than 50 mm increases by 8% in the near future, 22% by mid-century and 91% by end-of-century.
- The tendency of dryness indicators is towards longer more intense summers with more rapid transitions between summer and winter conditions.

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- The areal extent of the TWWHA subject to dry lightning potential environment decreases across all seasons.
- The most extreme dry lightning potential environment events do not decrease in extent beyond the near future and peak in summer, coinciding with peak increases in dryness indicators.
- The frequency of occurrence of synoptic weather conditions within an operational classification scheme do not change significantly on an annual basis.

Contents

List of Acronyms

CCAM	Conformal Cubic Atmospheric Model
CFT	Climate Futures for Tasmania
DLPE	Dry Lightning Potential Environment
FFDI	Forest Fire Danger Index
MFDI	Moorland Fire Danger Index
MSDI	Mount Soil Dryness Index
TWWHA	Tasmanian Wilderness World Heritage Area

1 Projected Changes to Fire Danger Indices

1.1 Summary Statistics

1.1.1 Analysis Methods

The projected changes to quantitative measures of fire danger across the Climate Futures for Tasmania (CFT) downscaled model outputs have been summarised for the Tasmanian Wilderness World Heritage Area (TWWHA) within four periods, baseline (1980–2000), near-future (2010–2030), mid-century (2040–2060) and end-of-century (2080–2100). Full tables of statistics can be found in Appendix A, with important results summarised in this section. All statistics are presented as the multi model mean of the six models in the CFT ensemble.

Table 1 summarises the changes in fire danger as measured by the McArthur Forest Fire Danger Index (FFDI). The mean values in these tables are determined by first calculating the mean FFDI at each grid point within the TWWHA over the period in question. The mean values at each grid point are then averaged over the entire TWWHA region. Similarly the percentile statistics are calculated over the period in question at each grid point and then averaged over the TWWHA. Values in parentheses are the percentage increase over the value for the baseline period. Tables 2 and 3 have been compiled in the same way for MFDI and MSDI.

1.1.2 TWWHA Averaged Fire Danger Indices

The findings of the Part I report showed modest increases in FFDI in the near future, with the increase accelerating towards end of century for both general conditions and high danger days. The analysis of the four periods (baseline, near-future, mid-century and end-of-century) have been extended here to include more extreme events at 99.5th and 99.9th percentiles (Table 1). Similar trends are found here with the increase in the FFDI on the most extreme days at 11% by mid-century and 21% by end-of-century. These increase steadily towards the lower percentiles to around 14% and 40% for the 85th percentile at the mid- and end-of-century periods respectively.

Mean and lower percentile Buttongrass Moorland Fire Danger Index (MFDI) were previously seen to increase towards the end of the century. High percentile fire season MFDI appears to decrease slightly although the confidence in these small percentage changes is low. As with the FFDI, the 99.5th and 99.9th percentiles are consistent with the pattern observed in the Part I report, with these highest percentiles showing no increase from the baseline period (Table 1). The two factors contributing to the MFDI are wind speed and Moisture Factor, the latter largely dependent on rainfall during the preceding two days. Wind is projected to decrease in general during fire season, although the intensity of the windiest days is not projected to change significantly. Decreasing wind would drive a decrease in MFDI but is offset by large decreases in the moisture factor. Full-year moisture factor statistics exhibit similar decreases but winter winds strengthening towards the end of the century play a larger role in the full-year MFDI statistics, noting of course that the MFDI captures the coincidence of these two parameters and not just the general conditions.

Very large increases in Mount Soil Dryness Index (MSDI) are projected across all statistics (Table 3). Significant increases of around 10% in broad indicators are evident in the near future and large increases across all statistics are present by mid-century. By the end-of-century increases range from close to 50% for the 99.9th percentile to greater than 80% in the mean.

1.1.3 Dryness Thresholds

Changes in the occurrence of days on which MSDI exceeds 50 have been analysed by two methods. First, the total number of days on which this criterion is met was calculated for each grid cell within the TWWHA during each period. These totals were then averaged over the TWWHA, and are given in the "Count" column of Table 4 as the number of days per fire season or per full year. Second, the total number of grid cells in which this criterion was met was determined for each day during each period. The mean and various percentiles were then calculated from the time-series of these daily totals. These mean and percentile statistics are given in Table 4 as the areal extent as a percentage of the total area of the TWWHA where MSDI is greater than 50.

All of the statistics for the MSDI threshold are projected to increase very dramatically, although the increase in the highest percentiles is not seen until mid-century. The number of days on which MSDI exceeds 50, averaged over the TWWHA, increases by 16% in the near future, 58% by mid-century and 218% by end-of-century, more than triple the baseline period. The area of the TWWHA, as a percentage, over which MSDI exceeds 50 on a given day is projected to increase equally dramatically. The 95th percentile increases from 22% of the TWWHA to 72% of the TWWHA by end-of-century. Similarly large absolute increases in the areal extent of MSDI greater than 50 are seen for the other percentiles, and similar percentage increases are seen in the mean area. The percentage increase in the higher percentiles is lower as the areal extents above the threshold approach 100% of the TWWHA towards the end of the century.

The occurrence of days on which the 30-day antecedent rainfall is less than 50 mm has been analysed by the same methods as for the MSDI threshold, and is also projected to increase dramatically by the end-of-century period (Table 5). As with the other parameters considered, the increase accelerates towards the end of the century. The number of days this criterion is met is projected to increase incrementally during the near and mid-century periods and nearly double during fire season by the end of the century. Similar or larger percentage increases are projected for the statistics of the areal extent of this criterion, except at larger percentiles where coverage of the TWWHA during the baseline period is already close to 100%.

1.1.4 Dry Lightning Potential Environment

The same statistics are presented for calculations of the Dry Lightning Potential Environment (DLPE). The time-series decrease in the mean and 99th percentile areal extent of DLPE seen in the Part I report is reflected in the statistics given in Table 6. Note that the very low values in the 85th, 90th and 99th percentiles indicate a large disparity in the distribution of DLPE event sizes. That is to say, the majority of the time the TWWHA experiences no regions of DLPE while on a small number of days it experiences wide spread DLPE. This disparity is projected to increase, but while the areal extent of the most extreme events decreases by around 10% in the near-future period it does not decrease further. These DLPE results consider only the 1200 UTC model time. Further analysis of DLPE time-series and discussion of the diurnal variations in DLPE is given in Section 2.

1.2 TWWHA Subregional Variations

Inspection of the geographic distribution of parameters relating to rainfall and moisture (MSDI (and consequently FFDI), 30-day antecedent rainfall, moisture factor used to calculate MFDI) all reveal that the strip of land running along the eastern boundary of the TWWHA is consistently much dryer than the rest of the TWWHA as seen for example in figure 1. This largely explains the systematically lower values of FFDI and MFDI calculated for the influential adjacent reserves and vegetation westward of the TWWHA (hereafter Adjacent Areas) compared to the TWWHA, as noted in the Part I report.

A quantitative subregional analysis has not yet been carried out, but initial investigation suggests that the statistics for the majority of the western TWWHA are similar to those for the Adjacent Areas. Note that while the absolute values of the fire danger indices in the Adjacent Areas are consis-

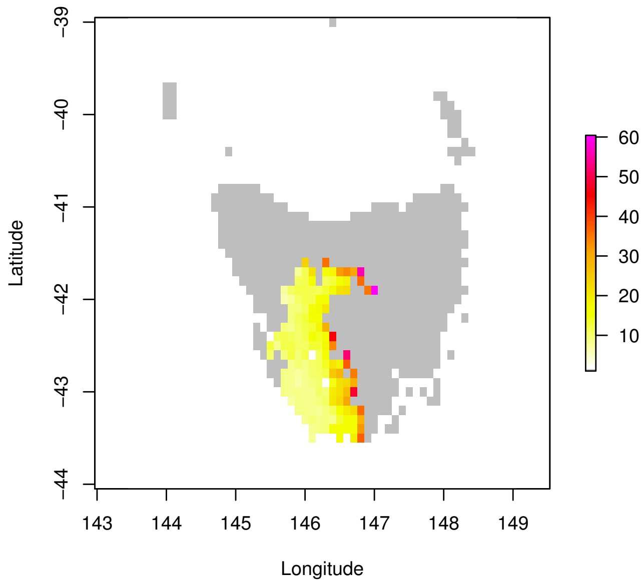

Figure 1: Mean Mount Soil Dryness Index during baseline period.

tently slightly lower than the corresponding values for the (entire) TWWHA, the percentage increases in the fire danger indices are larger for the Adjacent Areas.

1.3 Seasonality of Fire Danger Index Projections

1.3.1 Analysis Methods

Seasonal variations in the projections of the fire danger indices have been investigated by calculating the percentile statistics for each month of each year of the CFT period. Thus, for each calendar month a time-series was obtained spanning the 140 years of the CFT period. Each of the resulting 12 time-series was smoothed with a 30-year running mean. The complete set of results is given in Appendix B where the statistics have been plotted as a function of year of CFT period (horizontal axis) and calendar month (vertical axis) for each of the six percentiles. As in Section 1.1, all results presented are multi model means. In general the 99.5th and 99.9th percentile plots are very similar to the 99th percentile as a result of the relatively small number of data points contributing to each value, but are included for completeness.The exception is DLPE (Figure 8) where the disparity in the distribution of event size leads to changes being noticable only in the highest percentiles.

1.3.2 Projected Seasonal Changes

The tendency in the seasonality of FFDI is towards a somewhat shorter duration of typical winter conditions, with a slightly longer but much more intense summer peaking in February and more rapid transitions between summer and winter conditions (Figure 3).

MFDI differs significantly in seasonality from FFDI. The annual variation in MFDI is much smaller, peaking in February for the lower percentiles (Figure 4). The higher percentile plots show that the most extreme events occur during two peak periods of February and October. Throughout the CFT period the February peak weakens while the October peak strengthens to become dominant.

The tendency in MSDI is similar to that of FFDI but more pronounced (Figure 5). The shortening of winter conditions is more obvious and the increase in the intensity of extreme events during summer significantly higher. The occurrence of MSDI greater than 50 shows similar tendency again (Figure 6). During summer the extreme events will cover a much larger area of the TWWHA while there will be a shortening of the duration of winter conditions when only very small areas experience the theshold value.

The occurence of low 30-day antecendent rainfall also shows the strong increase in areal extent of the largest events during summer, peaking in March (Figure 7). Only a very subtle increase in the duration of summer is seen, leading again to more rapid transitions between summer and winter conditions.

Strong seasonality in the occurence of DLPE varies significantly between lower and higher percentiles (Figure 8). More frequent events covering mostly very small areas of the TWWHA occur during winter and are projected to steadily decrease in areal extent throughout the CFT period. The largest, less frequent events covering 10-15% or more of the TWWHA occur during summer and decrease in extent only slightly during the CFT period. The timing of the summer peak steadily shifts to earlier in the season through the CFT period

2 CFT Projections of Dry Lightning Potential Environments in the TWWHA

2.1 Analysis Methods

As flagged in Part I of the report on future fire danger potential in the TWWHA, dry lightning potential environments have been investigated to reveal any diurnal or seasonal variation in the general trend of slow decline in DLPE through the period of the CFT projections.

A comprehensive series of plots of the annual and seasonal changes in DLPE are given in Appendix C. Each plot consists of a 30 year running mean of values, to reduce the influence of interannual variability, which will be a feature of the free-running models and not reflective of the trend resulting from climate change. Each of the six CFT downscaled general circulation model values of DLPE are plotted in colour, together with a multi-model mean value in bold black. Year is plotted on the x-axis, noting that the first thirty years of the CFT time period is not available due to the requirement to compute the 30 year running mean. The count of annual average and 99th percentile values of the number of grid cells within the TWWHA which meet the criteria for DLPE are displayed on the y-axis.

2.2 DLPE Projections

In general, the plots of annual DLPE reflect the changes that are projected on a seasonal basis. There is a decline across the seasons in the projected occurrence of suitable environments. Autumn levels of DLPE are lowest in both the average and 99th percentile values, likely a reflection of generally more stable conditions in Tasmania during that season.

Average values of DLPE are more consistent between models than are 99th percentile values. Within individual models, there is very substantial interannual and interdecadal variability in 99th percentile values, despite the plotted values being 30 year running means. It is, however, overwhelmingly the case that there is a decline in 99th percentile DLPE from the start to end of the series for each model.

While there are some diurnal variations both annually and seasonally, for no available time of day (0600, 1200, 1800 and 2400) and no season is there a projected increase in the DLPE, in either the average or 99th percentile values. The minima in the diurnal cycles of both mean and 99th percentile DLPE occur consistently at 0600 UTC across all seasons except for summer. This time corresponds to mid-afternoon local time which is typically when the strongest convective activity and therefore highest DLPE would be anticipated. So, it may be that summer is the only season in which there is a sufficiently deep boundary layer to reflect diurnal surface heating at 850 hPa in CCAM.

3 CFT Projections of Changes in Synoptic Patterns Over Tasmania During the 21st Century

Synoptic patterns provide a summary of likely weather conditions across a range of environments. For fire managers in Tasmania, they provide an indication of which areas might be suitable, at different times of the year, for fuel reduction burning, or that will require supplementation of fire suppression resources. There is a clear interest in knowing whether there will be a change in future in the frequency of particular synoptic patterns. For example, the northwest Tasmanian fires that occurred during the 2015-16 summer were characterised by persistent easterly and northeasterly winds that were offshore and therefore drier than usual over most of the firegrounds. The prospect of such conditions becoming more common is of considerable interest to fire and land managers tasked with the protection of the Tasmanian Wilderness World Heritage Area.

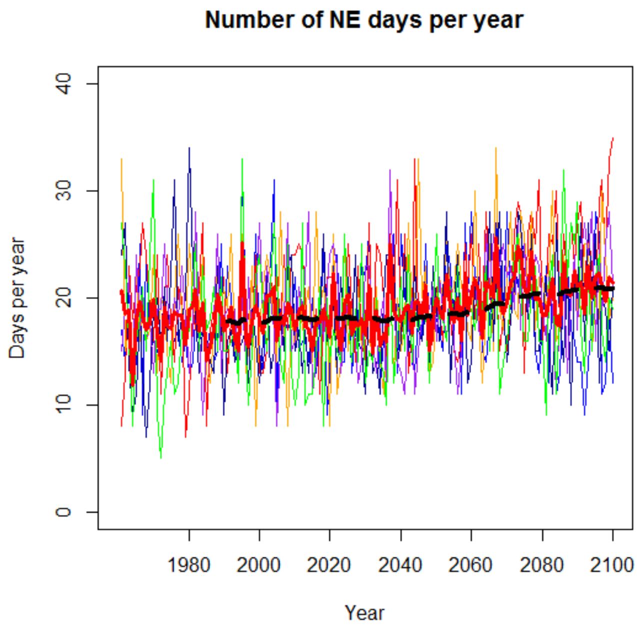

Figure 2: Frequency of occurence of northeasterly synoptic patterns

To gauge the likelihood of changes in the frequency of typical synoptic patterns over Tasmania, pressure gradient information was derived from the daily surface pressure fields available from the CFT high resolution models. Pressure gradients were classified into compass direction, and further classified according to the strength of the pressure gradient (and, therefore of the winds over Tasmania). In addition, two other classifications were used. One corresponded to anticyclonic conditions, when the pressure was higher over Tasmania than over surrounding points. The other corresponded to cyclonic conditions, with lower pressure over Tasmania than its surroundings. For each synoptic type, plots were generated of the change in the annual number of occurrences of that type through time, for each CFT model. A multimodel mean of the annual count was calculated for each type, together with a 30 year running mean of the annual count of occurrences of that type. In Figure 2, annual counts of each model are displayed as thin lines, the multimodel mean of annual count is the bold red line, and the 30 year running mean of the multimodel mean is the black dashed line. The figure shows clearly a considerable interannual variation, and variation between models, of the count of northeasterly conditions over Tasmania (thus, with lower pressure to the northwest of the state and higher pressure to the southeast). There is a suggestion of a slight increase in the number of days of such northeasterly flow during the current century, but it is not a strong trend.

Overall, initial analysis suggests that there are no strong trends within any of the synoptic types on an annual basis. It would be useful to confirm these results, and to examine whether there might be seasonal changes that are not evident when the counts of synoptic types are binned annually.

Appendix A: Statistics of changes to fire danger indices

Period	Mean	85th Perc.	90th Perc.	95th Perc.	99th Perc.	99.5th Perc.	99.9th Perc.
October–March							
1980–2000	2.64	5.13	6.68	9.72	18.13	21.83	29.80
2010–2030	2.79 (5.9)	5.47 (6.5)	7.12 (6.4)	10.31 (6.0)	19.03 (5.0)	22.66 (3.8)	30.23 (1.4)
2040–2060	3.00 (14.0)	5.86 (14.2)	7.56 (13.1)	10.84 (11.5)	20.08 (10.7)	24.35 (11.6)	33.26 (11.6)
2080–2100	3.62 (37.5)	7.22 (40.7)	9.18 (37.3)	12.78 (31.4)	22.39 (23.5)	26.74 (22.5)	36.05 (20.9)
July–June							
1980–2000	1.61	3.07	4.29	6.77	14.37	18.13	26.81
2010–2030	1.70 (5.3)	3.23 (5.3)	4.54 (6.0)	7.18 (6.1)	15.19 (5.7)	19.03 (5.0)	27.52 (2.7)
2040–2060	1.82 (12.7)	3.49 (13.8)	4.88 (13.7)	7.62 (12.6)	15.86 (10.4)	20.08 (10.8)	29.99 (11.8)
2080–2100	2.15 (33.4)	4.29 (39.9)	5.99 (39.7)	9.21 (36.1)	18.00 (25.3)	22.39 (23.5)	32.57 (21.5)

Table 1: McArthur Forest Fire Danger Index (FFDI). Statistics are calculated over the 20 year periods at each grid cell and averaged over the TWWHA. Quantities in parentheses are percentage change over baseline period. All statistics are multi model means. (Smaller percentage changes in FFDI than reported in Part I are due to correction of a small data alignment error.)

Period	Mean	85th Perc.	90th Perc.	95th Perc.	99th Perc.	99.5th Perc.	99.9th Perc.
October–March							
1980–2000	3.68	6.79	8.05	10.21	15.02	16.82	20.16
2010–2030	3.68 (0.0)	6.79 (-0.1)	8.05 (-0.1)	10.15 (-0.6)	14.78 (-1.6)	16.47 (-2.1)	19.63 (-2.6)
2040–2060	3.73 (1.4)	6.87 (1.1)	8.08 (0.4)	10.15 (-0.6)	14.87 (-1.0)	16.60 (-1.4)	19.85 (-1.6)
2080–2100	3.89 (5.7)	7.15 (5.2)	8.31 (3.2)	10.25 (0.3)	14.66 (-2.4)	16.40 (-2.5)	19.54 (-3.1)
July–June							
1980–2000	3.33	6.00	7.40	9.59	14.09	15.90	19.51
2010–2030	3.36 (0.8)	6.03 (0.4)	7.42 (0.3)	9.59 (0.0)	13.98 (-0.7)	15.71 (-1.2)	19.25 (-1.3)
2040–2060	3.42 (2.8)	6.17 (2.7)	7.52 (1.6)	9.66 (0.8)	14.16 (0.5)	15.92 (0.1)	19.50 (-0.0)
2080–2100	3.56 (7.0)	6.43 (7.0)	7.75 (4.7)	9.83 (2.5)	14.27 (1.3)	16.03 (0.8)	19.58 (0.4)

Table 2: Buttongrass Moorland Fire Danger Index (MFDI). Statistics are calculated over the 20 year periods at each grid cell and averaged over the TWWHA. Quantities in parentheses are percentage change over baseline period. All statistics are multi model means.

Period	Mean	85th Perc.	90th Perc.	95th Perc.	99th Perc.	99.5th Perc.	99.9th Perc.
October–March							
1980–2000	14.84	30.27	35.74	44.16	62.12	68.02	73.84
2010–2030	16.39 (10.4)	33.81 (11.7)	39.76 (11.2)	48.36 (9.5)	63.04 (1.5)	67.25 (-1.1)	72.23 (-2.2)
2040–2060	18.76 (26.4)	37.78 (24.8)	44.21 (23.7)	54.26 (22.9)	73.39 (18.1)	79.02 (16.2)	86.81 (17.6)
2080–2100	26.93 (81.5)	54.25 (79.2)	62.78 (75.7)	74.78 (69.4)	95.48 (53.7)	101.13 (48.7)	107.70 (45.8)
July–June							
1980–2000	9.69	22.14	28.22	37.53	56.12	63.15	72.69
2010–2030	10.77 (11.2)	24.68 (11.5)	31.61 (12.0)	41.71 (11.2)	58.83 (4.8)	63.96 (1.3)	71.24 (-2.0)
2040–2060	12.37 (27.7)	28.12 (27.0)	35.60 (26.1)	46.53 (24.0)	67.39 (20.1)	74.66 (18.2)	85.50 (17.6)
2080–2100	17.85 (84.3)	41.78 (88.7)	51.57 (82.7)	65.60 (74.8)	89.19 (58.9)	96.90 (53.4)	106.43 (46.4)

Table 3: Mount Soil Dryness Index (MSDI). Statistics are calculated over the 20 year periods at each grid cell and averaged over the TWWHA. Quantities in parentheses are percentage change over baseline period. All statistics are multi model means.

Period	Count	Mean	85th Perc.	90th Perc.	95th Perc.	99th Perc.	99.5th Perc.	99.9th Perc.
Oct–Mar								
1980–2000	10.26	5.22	11.27	15.06	22.44	51.80	60.61	70.93
2010–2030	11.87 (15.7)	6.04 (15.7)	13.35 (18.5)	17.90 (18.9)	27.08 (20.7)	49.24 (-4.9)	57.10 (-5.8)	65.25 (-8.0)
2040–2060	16.18 (57.8)	8.23 (57.8)	17.80 (58.0)	24.43 (62.3)	37.41 (66.7)	66.48 (28.3)	75.47(24.5)	85.23(20.2)
2080–2100	32.57(217.6)	16.57(217.6)	39.30(248.7)	53.50(255.3)	71.78(219.8)	89.20 (72.2)	90.81(49.8)	91.86(29.5)
Jul–Jun								
1980–2000	13.44	3.41	7.20	10.32	16.48	37.50	52.08	68.47
2010–2030	15.80 (17.6)	4.01 (17.6)	8.81 (22.4)	12.31 (19.3)	19.89 (20.7)	40.06 (6.8)	49.34 (-5.3)	62.50 (-8.7)
2040–2060	21.26 (58.2)	5.39 (58.2)	11.08 (53.9)	16.29 (57.8)	26.61 (61.5)	55.78 (48.7)	66.86(28.4)	82.58(20.6)
2080–2100	42.16(213.7)	10.70(213.7)	23.86(231.6)	33.90(228.4)	54.92(233.3)	85.13(127.0)	89.20(71.3)	91.57(33.7)

Table 4: Occurence of Mount Soil Dryness Index (MSDI) greater than 50. Count is the number of days per fire season (Oct-Mar) or per full year (Jul-Jun) on which MSDI exceeded 50, averaged over the TWWHA. Mean and percentile statistics are for the areal extent as a percentage of the TWWHA where daily MSDI exceeded 50. Quantities in parentheses are percentage change over baseline period. All statistics are multi model means.

Period	Count	Mean	85th Perc.	90th Perc.	95th Perc.	99th Perc.	99.5th Perc.	99.9th Perc.
Oct–Mar								
1980–2000	9.31	5.12	8.33	13.54	27.37	69.60	85.32	96.40
2010–2030	10.04 (7.8)	5.52 (7.8)	9.56 (14.8)	15.44 (14.0)	29.92 (9.3)	71.78 (3.1)	85.61 (0.3)	95.45(-1.0)
2040–2060	11.36(22.0)	6.24(22.0)	11.46 (37.5)	18.84 (39.2)	33.24 (21.5)	76.70(10.2)	90.62 (6.2)	99.62 (3.3)
2080–2100	17.81(91.3)	9.78(91.3)	19.98(139.8)	31.82(135.0)	57.20(109.0)	96.78(39.0)	98.96(16.0)	100.00 (3.7)
Jul–Jun								
1980–2000	11.83	3.24	4.45	7.77	16.95	54.64	73.30	95.64
2010–2030	12.82 (8.4)	3.51 (8.4)	5.02 (12.8)	9.19 (18.3)	19.03 (12.3)	57.58 (5.4)	72.92 (-0.5)	93.37(-2.4)
2040–2060	14.32(21.1)	3.92(21.1)	5.97 (34.0)	10.32 (32.9)	22.54 (33.0)	60.98(11.6)	77.37 (5.6)	98.20 (2.7)
2080–2100	21.15(78.8)	5.79(78.8)	8.71 (95.7)	16.29(109.8)	35.32(108.4)	87.69(60.5)	96.78(32.0)	99.91 (4.5)

Table 5: Occurence of 30-day dry periods (less than 50mm rain). Count is the number of days per fire season (Oct-Mar) or per full year (Jul-Jun) for which the 30-day antecedent rainfall was less than 50 mm, averaged over the TWWHA. Mean and percentile statistics are for the areal extent as a percentage of the TWWHA where the 30-day antecedent rainfall was less than 50 mm. Quantities in parentheses are percentage change over baseline period. All statistics are multi model means.

Period	Count	Mean	85th Perc.	90th Perc.	95th Perc.	99th Perc.	99.5th Perc.	99.9th Perc.
Oct–Mar								
1980–2000	1.02	0.57	0.00	0.00	1.61	18.75	26.14	41.57
2010–2030	0.89 (-13.2)	0.49 (-13.2)	0.00 (0)	0.00 (0)	1.23 (-23.5)	15.81 (-15.7)	23.67 (-9.4)	37.50 (-9.8)
2040–2060	0.84 (-18.0)	0.46 (-18.0)	0.00 (0)	0.00 (0)	0.85 (-47.1)	16.29 (-13.1)	24.53 (-6.2)	38.35 (-7.7)
2080–2100	0.66 (-35.2)	0.37 (-35.2)	0.00 (0)	0.00 (0)	0.28 (-82.4)	12.78 (-31.8)	22.16 (-15.2)	37.88 (-8.9)
Jul–Jun								
1980–2000	2.15	0.59	0.00	0.28	2.46	16.29	24.15	39.30
2010–2030	1.88 (-12.6)	0.52 (-12.6)	0.00 (0)	0.19 (-33.3)	2.08 (-15.4)	14.58 (-10.5)	21.50 (-11.0)	35.61 (-9.4)
2040–2060	1.71 (-20.6)	0.47 (-20.6)	0.00 (0)	0.00 (-100.0)	1.70 (-30.8)	13.64 (-16.3)	21.69 (-10.2)	36.65 (-6.7)
2080–2100	1.21 (-43.8)	0.33 (-43.8)	0.00 (0)	0.00 (-100.0)	0.47 (-80.8)	9.56 (-41.3)	17.71 (-26.7)	35.13 (-10.6)

Table 6: Occurence of lightning potential environment for model time 1200 UTC. Count is the number of days per fire season (Oct-Mar) or per full year (Jul-Jun) for which lightning potential environment was favourable, averaged over the TWWHA. Mean and percentile statistics are for the areal extent as a percentage of the TWWHA where lightning potential environment is favourable. Quantities in parentheses are percentage change over baseline period. All statistics are multi model means.

Appendix B: Seasonality of changes to fire danger indices

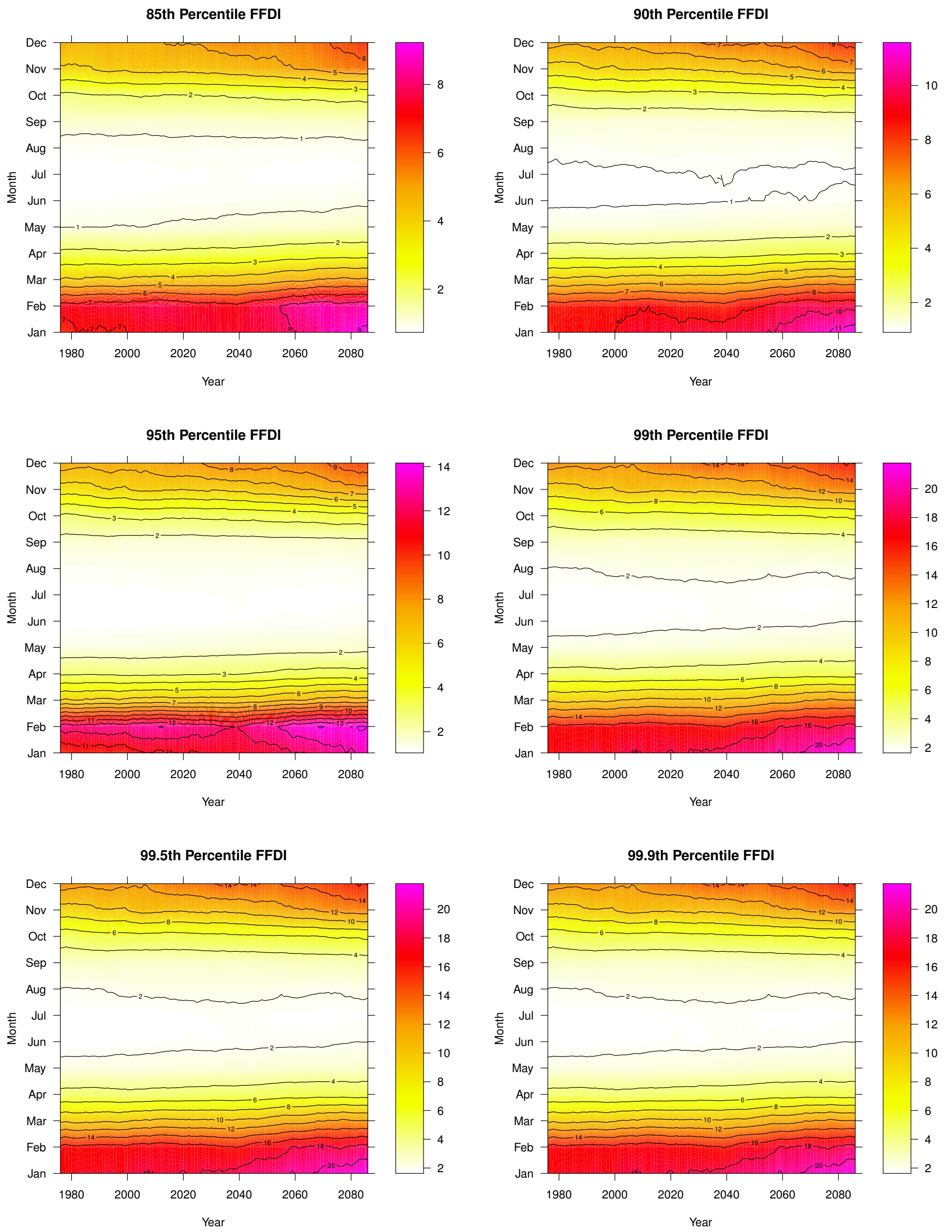

Figure 3: Projected 85th, 90th, 95th, 99th, 99.5th and 99.9th percentile McArthur Forest Fire Danger Index averaged over the TWWHA as a function of month-of-year and year-of-period. A 30-year running mean has been applied across the year-of-period. All statistics are multi model means.

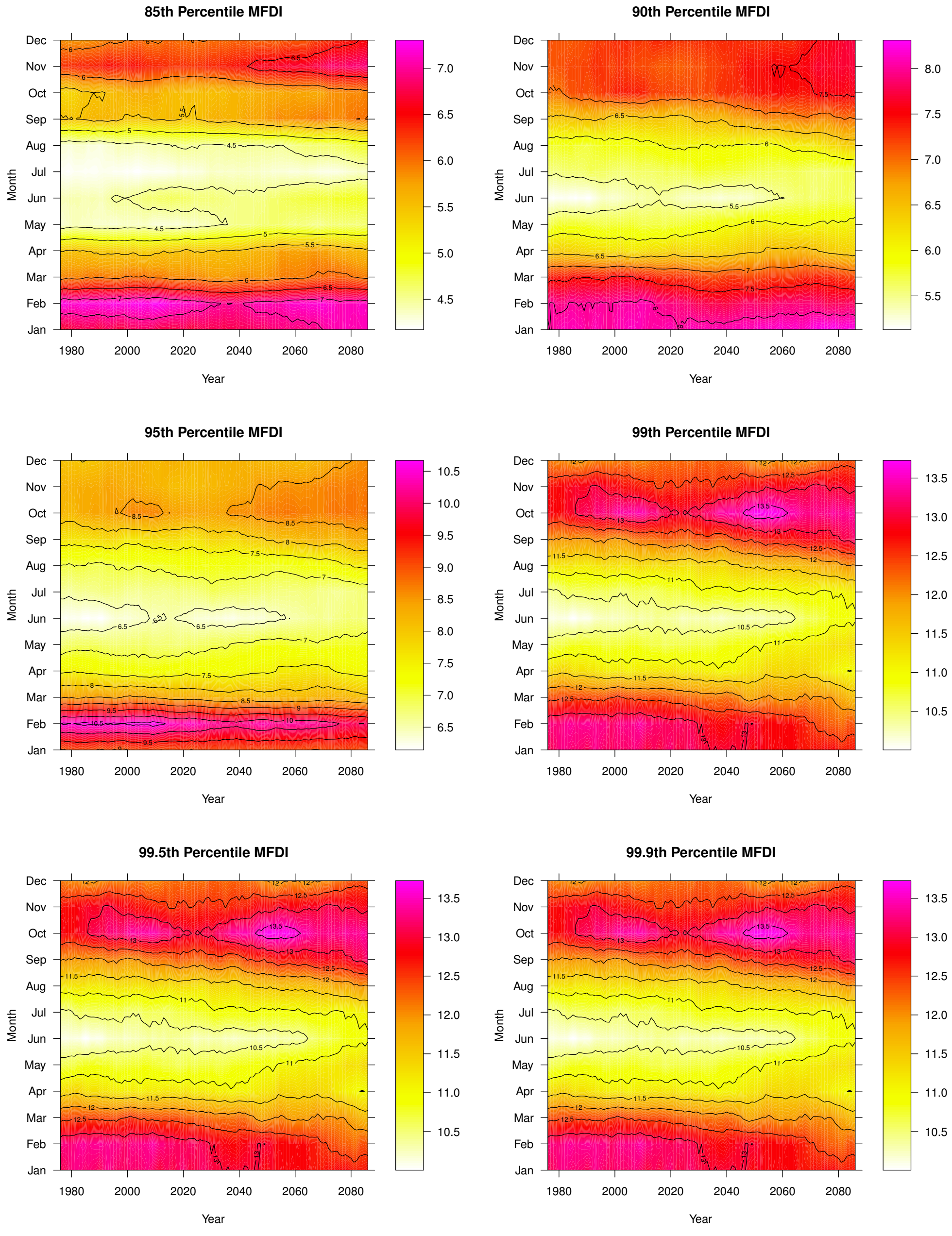

Figure 4: Projected 85th, 90th, 95th, 99th, 99.5th and 99.9th percentile Buttongrass Moorland Fire Danger Index averaged over the TWWHA as a function of month-of-year and year-of-period. A 30-year running mean has been applied across the year-of-period. All statistics are multi model means.

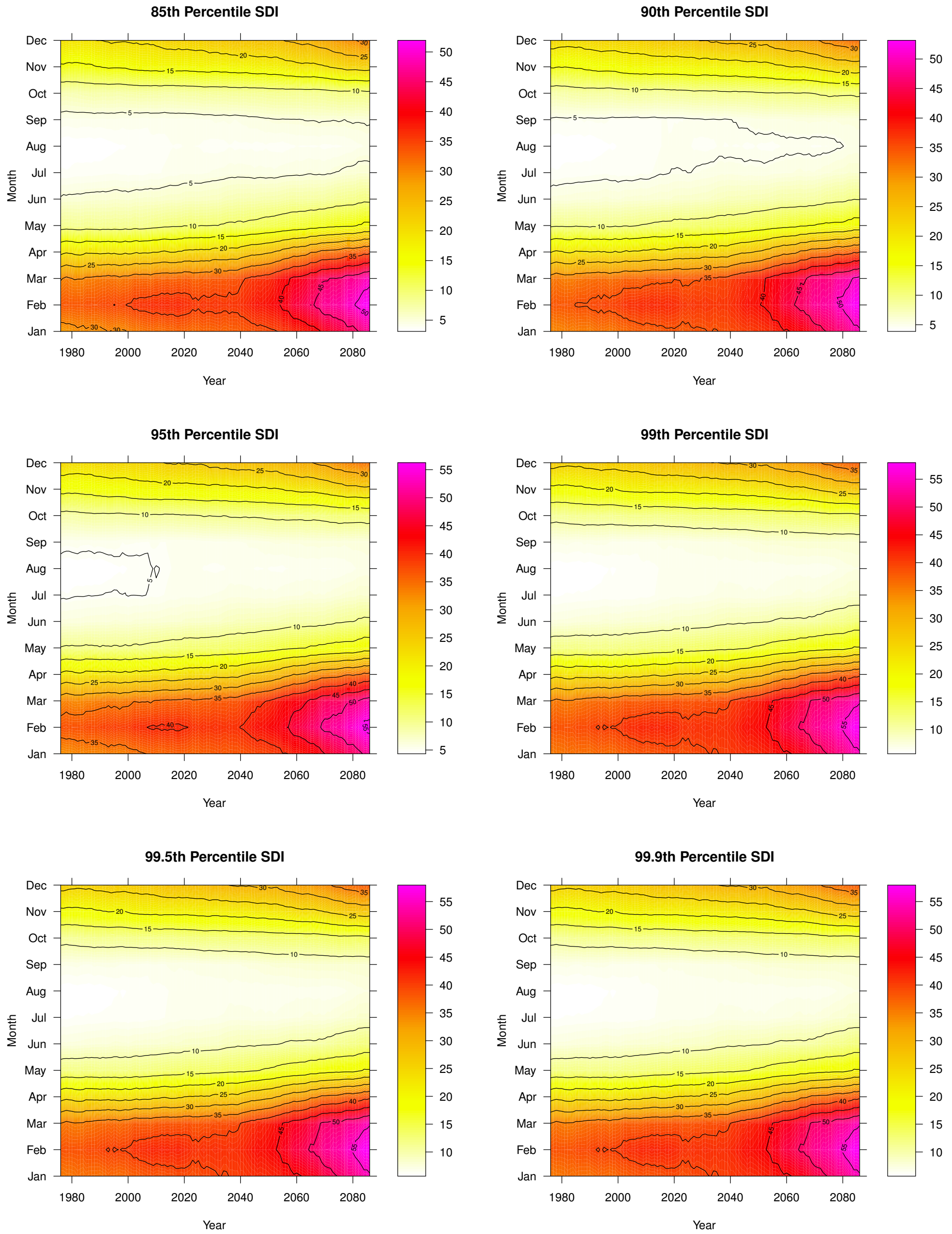

Figure 5: Projected 85th, 90th, 95th, 99th, 99.5th and 99.9th percentile Mount Soil Dryness Index averaged over the TWWHA as a function of month-of-year and year-of-period. A 30-year running mean has been applied across the year-of-period. All statistics are multi model means.

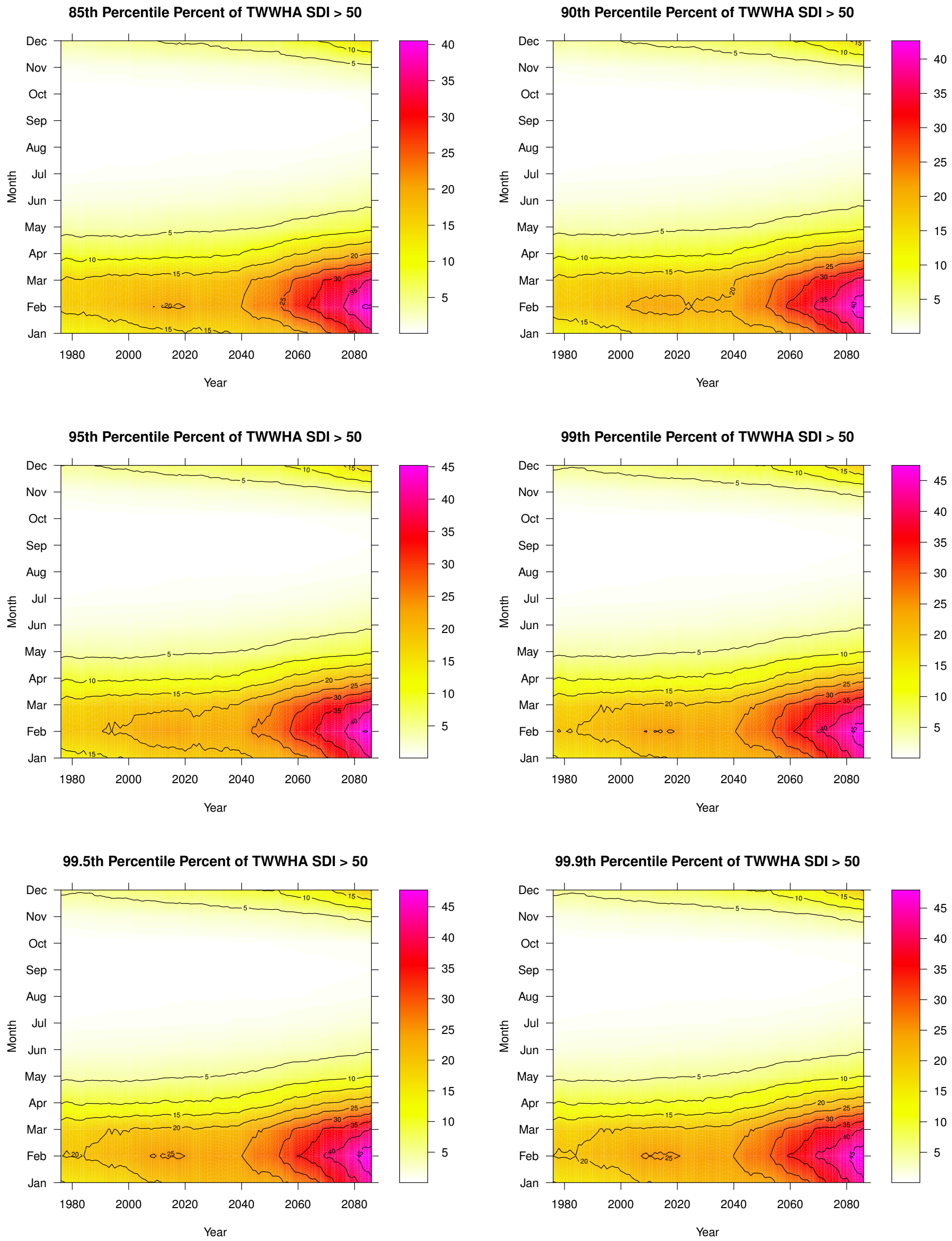

Figure 6: Projected 85th, 90th, 95th, 99th, 99.5th and 99.9th percentile areal extent as a percentage of the TWWHA where Mount Soil Dryness Index is greater than 50, as a function of month-of-year and year-of-period. A 30-year running mean has been applied across the year-of-period. All statistics are multi model means.

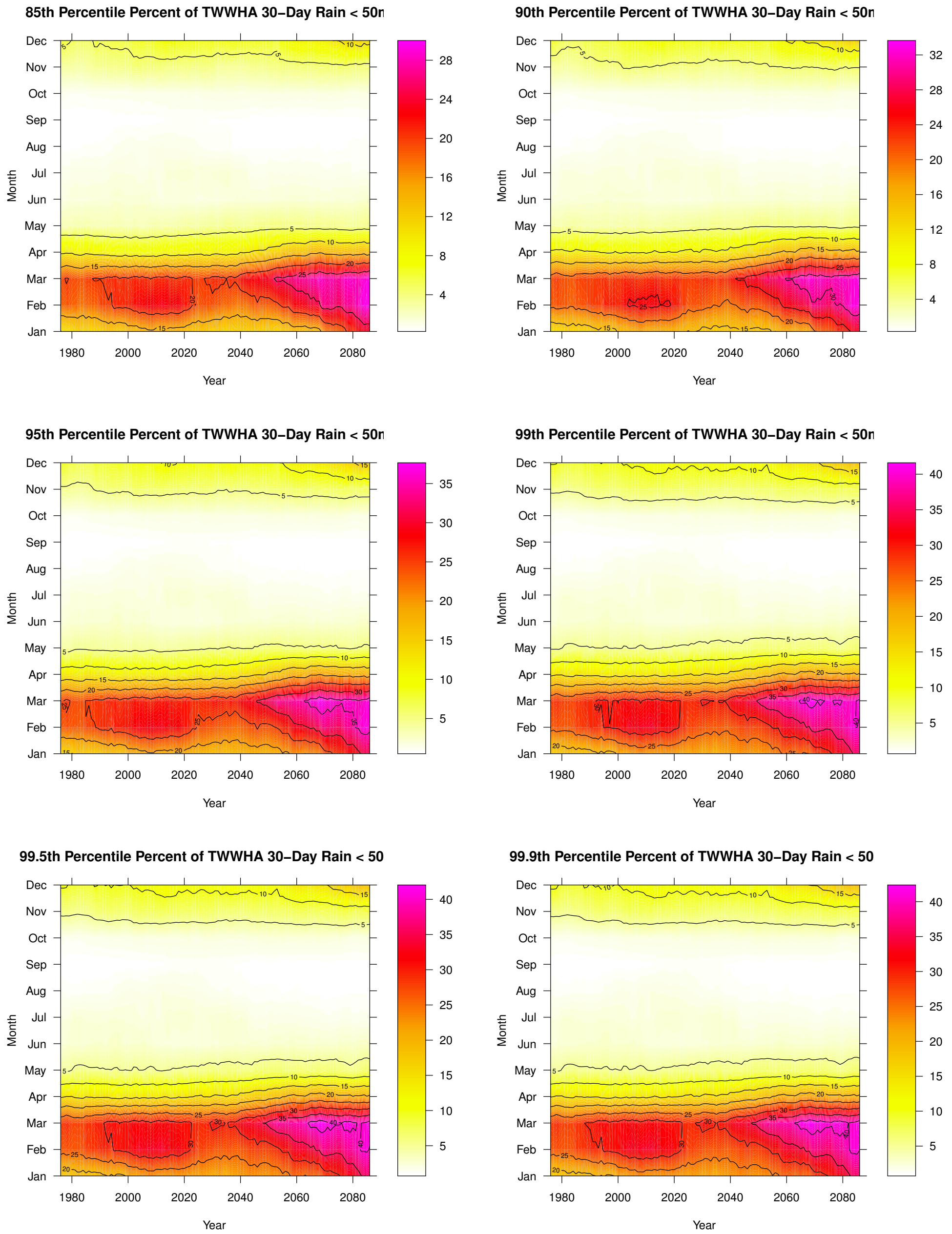

Figure 7: Projected 85th, 90th, 95th, 99th, 99.5th and 99.9th percentile areal extent as a percentage of the TWWHA where 30-day antecedent rainfall is less than 50 mm, as a function of month-of-year and year-of-period. A 30-year running mean has been applied across the year-of-period. All statistics are multi model means.

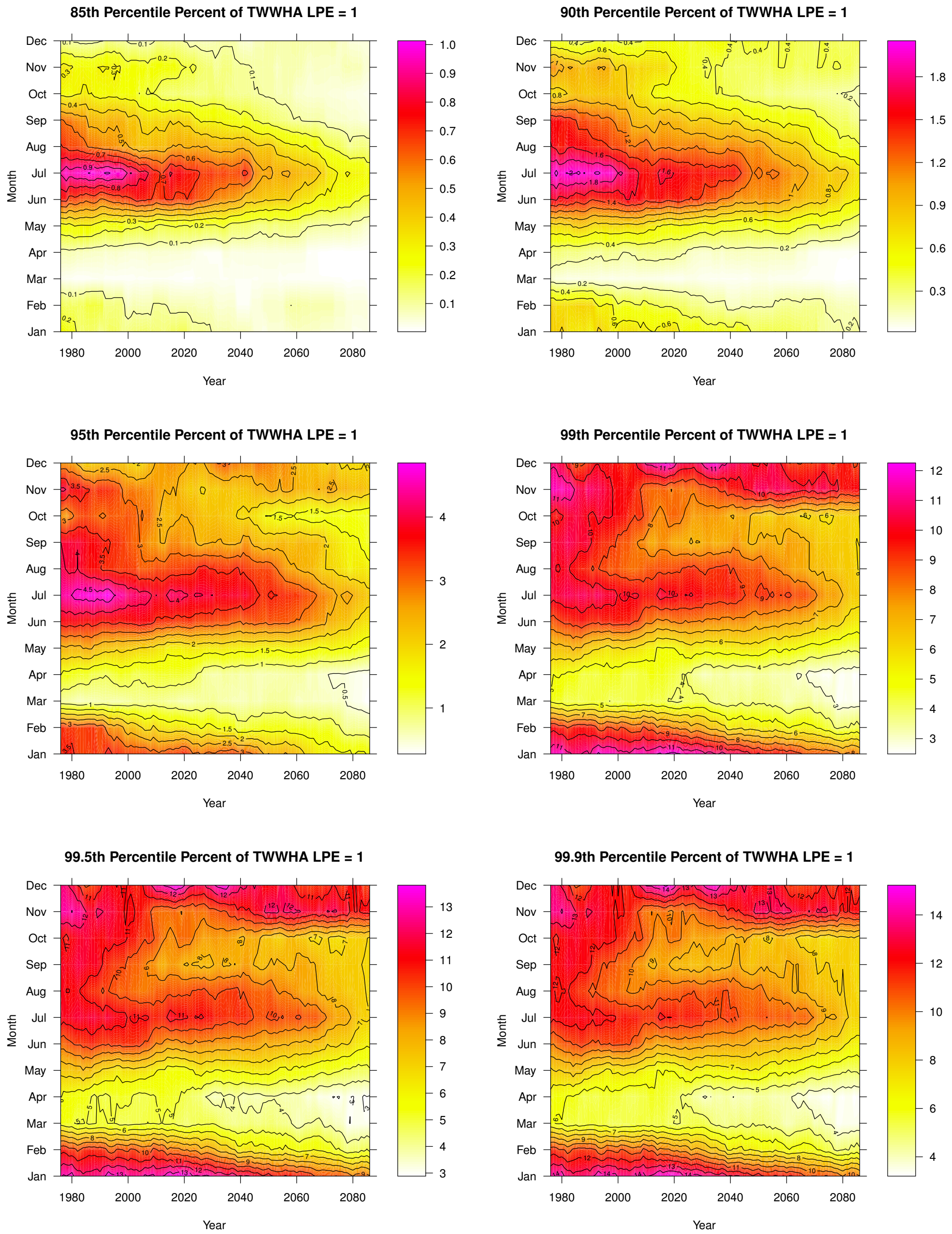

Figure 8: Projected 85th, 90th, 95th, 99th, 99.5th and 99.9th percentile areal extent as a percentage of the TWWHA where dry lightning potential environment is favourable, as a function of month-of-year and year-of-period. A 30-year running mean has been applied across the year-of-period. DLPE was calculated for 1200 UTC model time. All statistics are multi model means.

Appendix C: Dry Lightning Potential Environment Projections

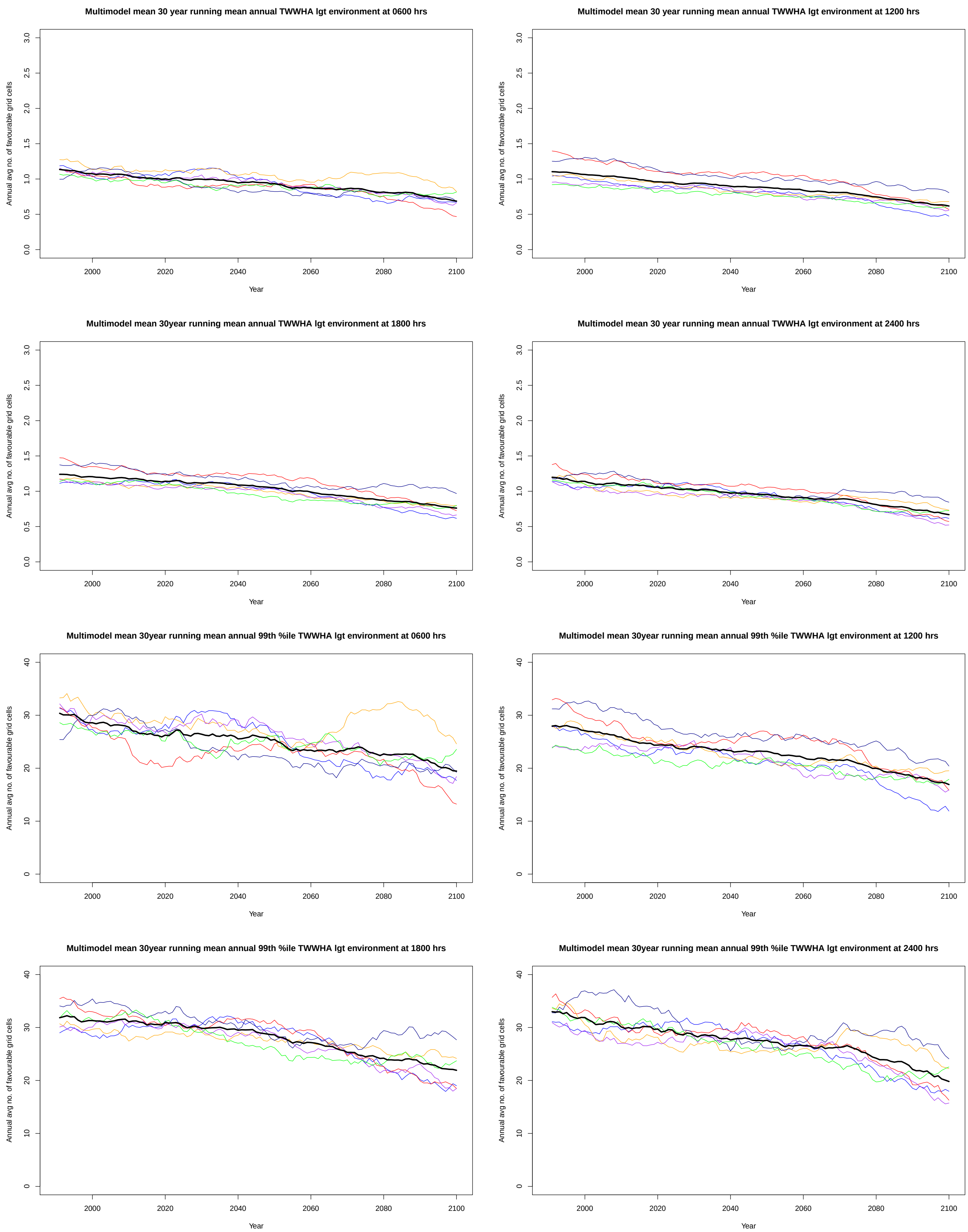

Figure 9: Annual Dry Lightning Potential Environment mean and 99th percentile. Coloured lines are individual models, black line is the multi model mean. Individual models and multi model mean have been smoothed with 30-year running mean.

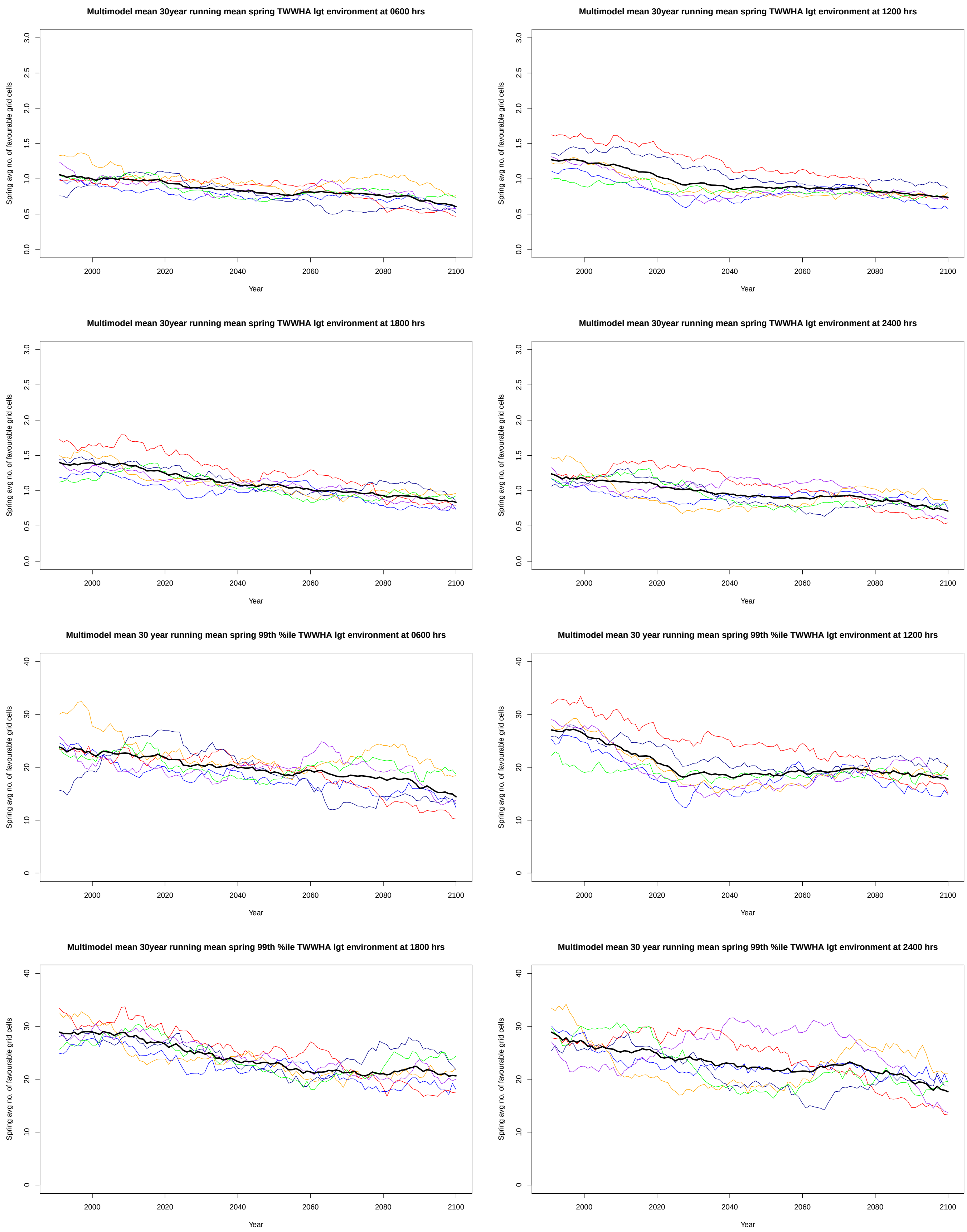

Figure 10: Spring Dry Lightning Potential Environment mean and 99th percentile, as for Figure 9

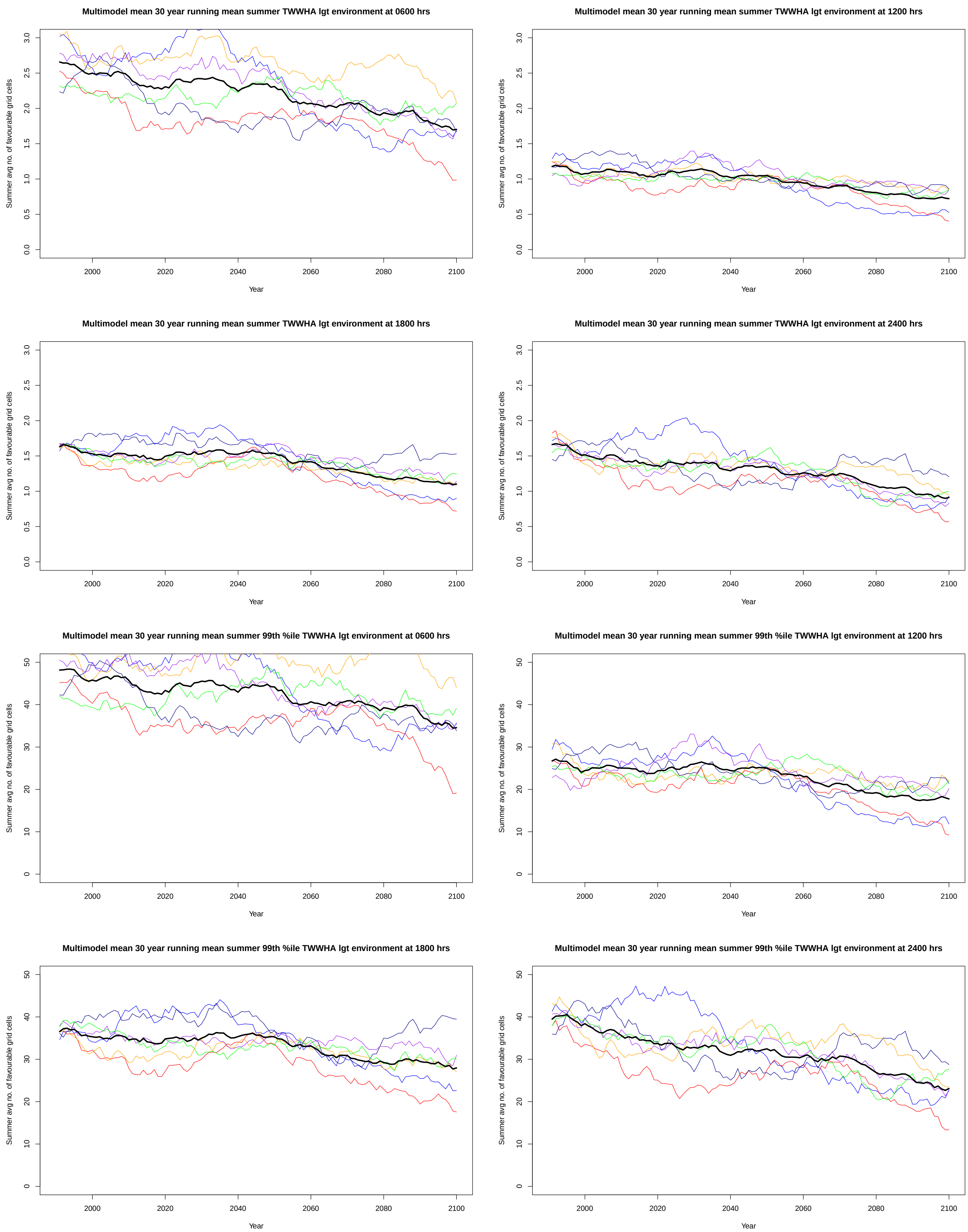

Figure 11: Summer Dry Lightning Potential Environment mean and 99th percentile, as for Figure 9

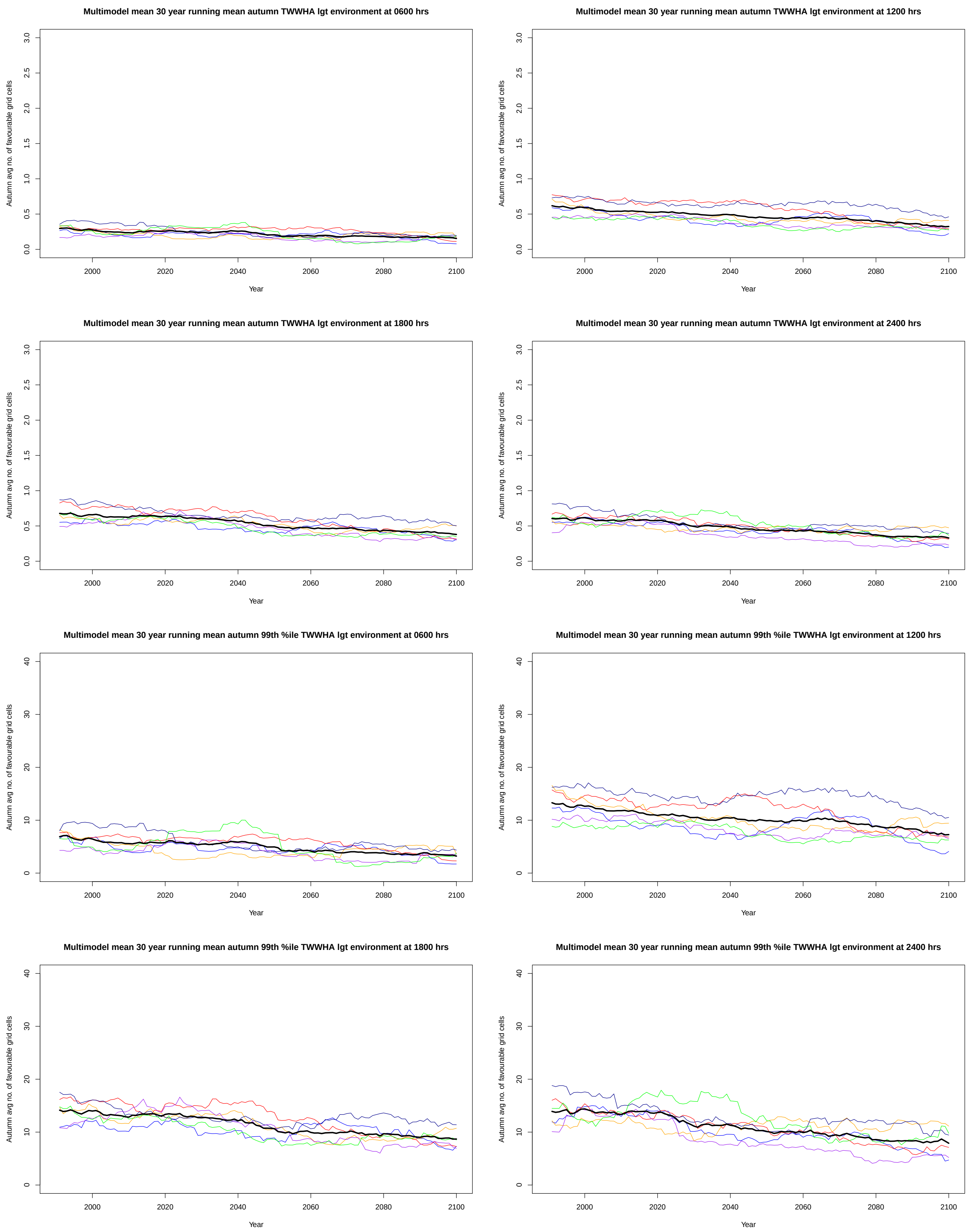

Figure 12: Autumn Dry Lightning Potential Environment mean and 99th percentile, as for Figure 9

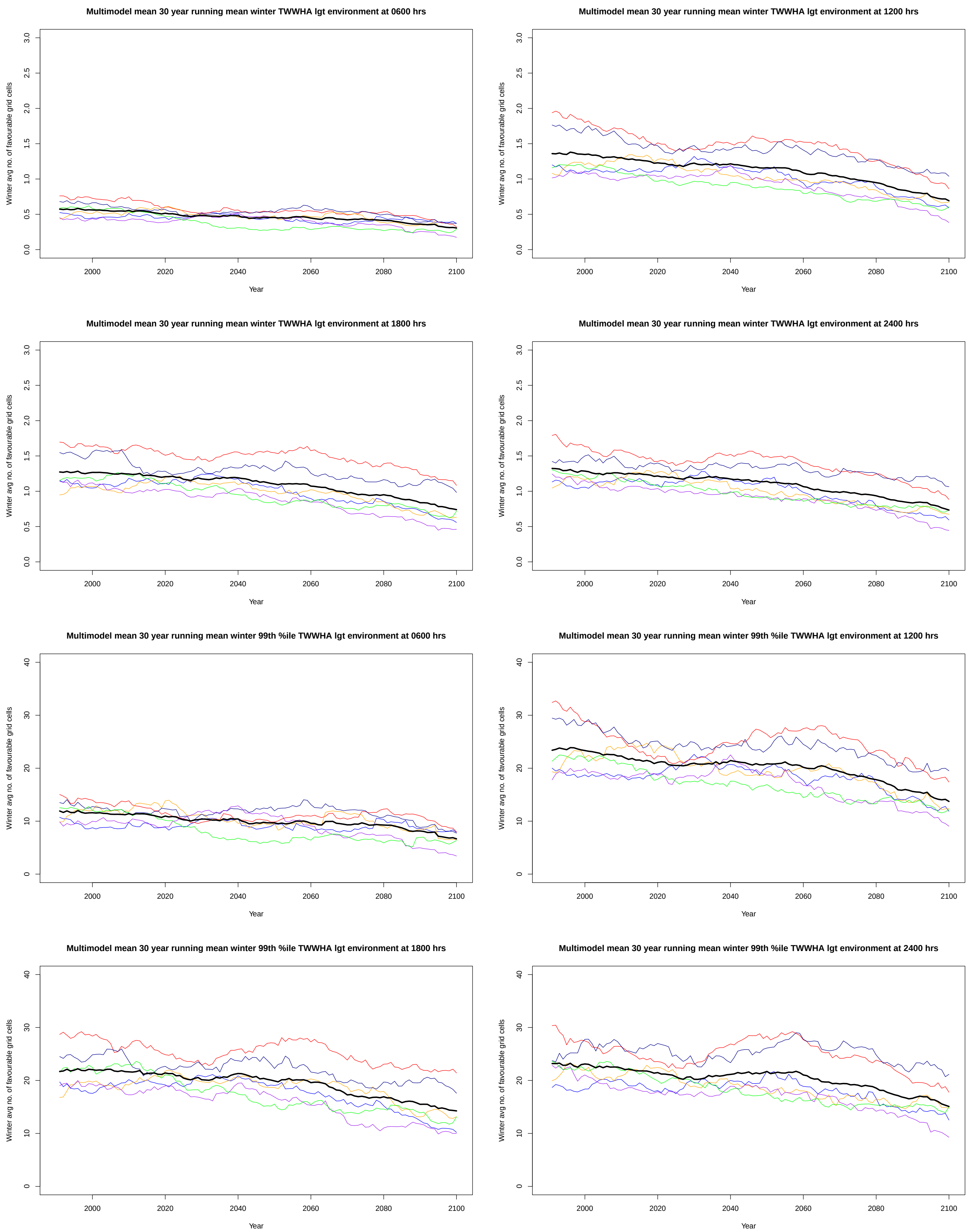

Figure 13: Winter Dry Lightning Potential Environment mean and 99th percentile, as for Figure 9