Changes in temperature and pressure probability distributions from sub-daily data

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Supplementary Information

Band	N-stations	Mean (°C decade^{-1})	St. Dev. (°C decade^{-1})	Skew (decade^{-1})	Kurtosis (decade^{-1})
			Day		
$70 \rightarrow 60$	138	**0.43 (0.34 → 0.50)**	−0.15 (−0.20 → −0.12)	0.02 (−0.00 → 0.04)	**0.07 (0.05 → 0.10)**
$60 \rightarrow 50$	386	**0.28 (0.24 → 0.34)**	−0.04 (−0.09 → −0.02)	**0.03 (0.01 → 0.06)**	−0.09 (−0.16 → −0.02)
$50 \rightarrow 40$	347	**0.21 (0.17 → 0.27)**	−0.06 (−0.07 → −0.05)	**0.03 (0.02 → 0.05)**	−0.08 (−0.10 → −0.04)
$40 \rightarrow 30$	193	**0.10 (0.06 → 0.21)**	−0.05 (−0.10 → −0.02)	0.00 (−0.00 → 0.02)	**0.07 (0.04 → 0.12)**
$30 \rightarrow 20$	90	**0.18 (0.01 → 0.21)**	0.05 (−0.01 → 0.07)	0.00 (−0.01 → 0.04)	**0.04 (0.01 → 0.08)**
$20 \rightarrow 10$	55	**0.21 (0.17 → 0.24)**	−0.02 (−0.03 → 0.02)	**0.10 (0.06 → 0.12)**	−0.17 (−0.25 → −0.09)
$10 \rightarrow 0$	20	**0.16 (0.14 → 0.17)**	**0.02 (0.00 → 0.05)**	−0.06 (−0.09 → −0.01)	**0.24 (0.16 → 0.54)**
$0 \rightarrow -10$	18	**0.04 (0.00 → 0.10)**	0.01 (−0.00 → 0.04)	−0.09 (−0.15 → −0.02)	−0.09 (−0.21 → 0.09)
$-10 \rightarrow -20$	21	**0.04 (0.01 → 0.06)**	**0.02 (0.00 → 0.04)**	−0.05 (−0.11 → −0.01)	−0.04 (−0.20 → 0.18)
$-20 \rightarrow -30$	20	0.04 (−0.03 → 0.12)	−0.07 (−0.08 → −0.05)	−0.07 (−0.08 → −0.04)	**0.26 (0.20 → 0.37)**
$-30 \rightarrow -40$	22	**−0.12 (−0.17 → −0.04)**	0.01 (−0.04 → 0.07)	−0.02 (−0.03 → −0.01)	**0.07 (0.05 → 0.12)**
$-40 \rightarrow -50$	5	−0.02 (−0.05 → 0.06)	**0.03 (0.02 → 0.07)**	0.00 (−0.01 → 0.03)	**0.04 (0.01 → 0.08)**
			Night		
$70 \rightarrow 60$	111	**0.44 (0.36 → 0.58)**	−0.15 (−0.17 → −0.11)	−0.01 (−0.03 → 0.04)	**0.07 (0.04 → 0.12)**
$60 \rightarrow 50$	344	**0.30 (0.25 → 0.36)**	−0.04 (−0.08 → −0.02)	**0.03 (0.02 → 0.05)**	−0.11 (−0.17 → 0.04)
$50 \rightarrow 40$	302	**0.29 (0.25 → 0.34)**	−0.11 (−0.12 → −0.08)	**0.04 (0.02 → 0.06)**	−0.07 (−0.11 → −0.03)
$40 \rightarrow 30$	144	**0.18 (0.17 → 0.31)**	−0.10 (−0.16 → −0.06)	**0.03 (0.01 → 0.06)**	**0.06 (0.02 → 0.11)**
$30 \rightarrow 20$	44	**0.20 (0.10 → 0.25)**	**0.03 (0.00 → 0.06)**	0.01 (−0.00 → 0.03)	0.11 (−0.04 → 0.16)
$20 \rightarrow 10$	29	**0.21 (0.18 → 0.25)**	−0.02 (−0.04 → −0.00)	**0.15 (0.13 → 0.20)**	−0.36 (−0.44 → −0.22)
$10 \rightarrow 0$	7	**0.23 (0.21 → 0.26)**	−0.01 (−0.02 → 0.01)	**0.11 (0.08 → 0.22)**	−0.49 (−1.10 → −0.32)
$0 \rightarrow -10$	8	**0.08 (0.08 → 0.12)**	−0.04 (−0.06 → −0.02)	0.02 (−0.10 → 0.08)	−0.12 (−0.38 → 0.43)
$-10 \rightarrow -20$	5	**0.08 (0.06 → 0.15)**	−0.01 (−0.05 → 0.04)	0.08 (−0.03 → 0.15)	−0.20 (−0.43 → −0.05)
$-20 \rightarrow -30$	12	**0.16 (0.06 → 0.19)**	−0.00 (−0.03 → 0.02)	−0.03 (−0.04 → −0.01)	**0.13 (0.09 → 0.20)**
$-30 \rightarrow -40$	13	0.00 (−0.03 → 0.06)	−0.05 (−0.07 → 0.01)	−0.04 (−0.05 → −0.01)	**0.08 (0.05 → 0.12)**
$-40 \rightarrow -50$	3	**0.09 (0.05 → 0.16)**	**0.03 (0.01 → 0.07)**	**0.02 (0.01 → 0.03)**	−0.12 (−0.18 → −0.05)

Table 1. Fits to parameters in zonal analysis for TOP day-, and BOTTOM night-time dewpoint temperature observations. Values in bold show parameters and bands where the 1σ range of the fitted trend does not include zero.
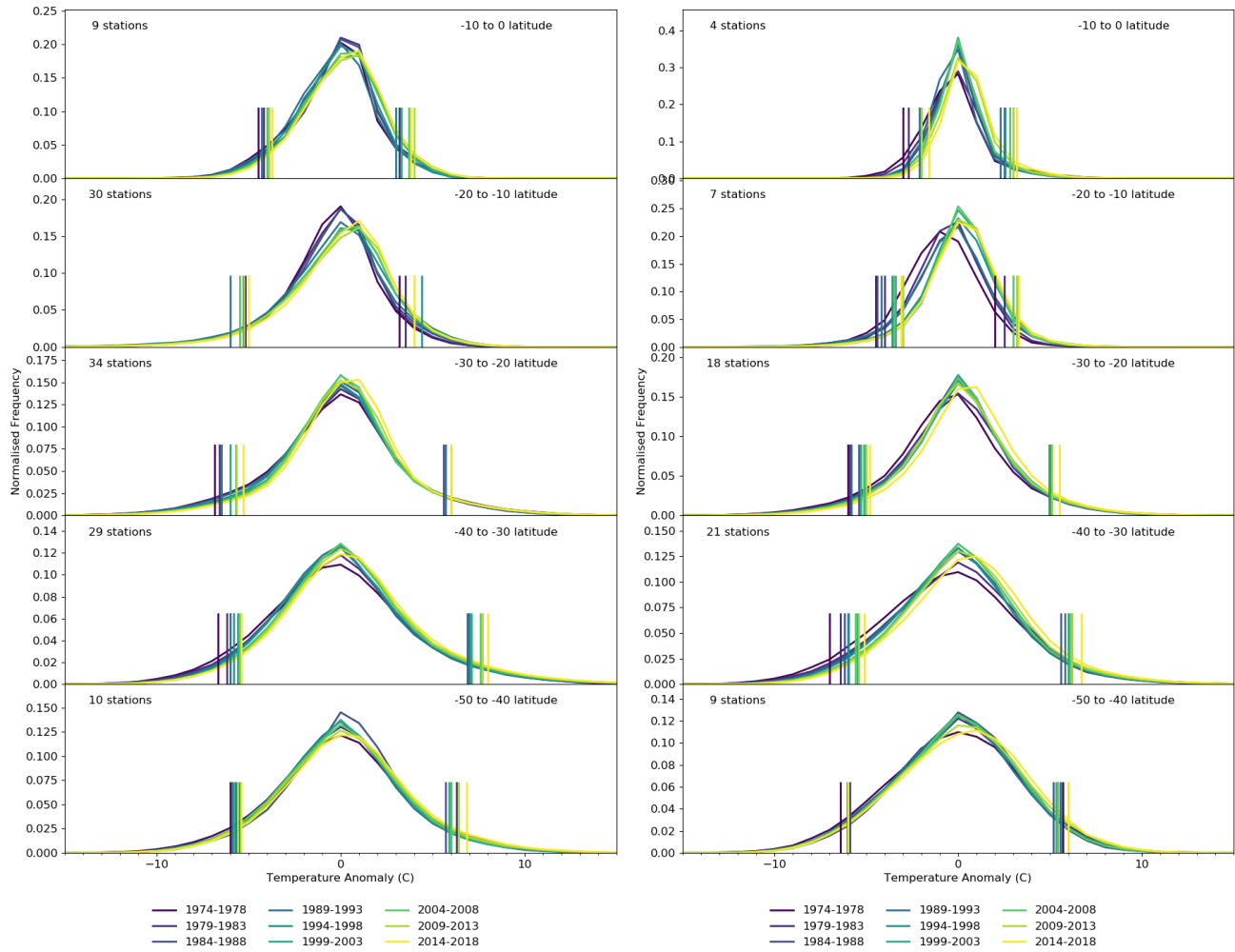
Figure 1. Temperature distributions in latitudinal bands for LEFT day and RIGHT night time observations for the southern hemisphere.
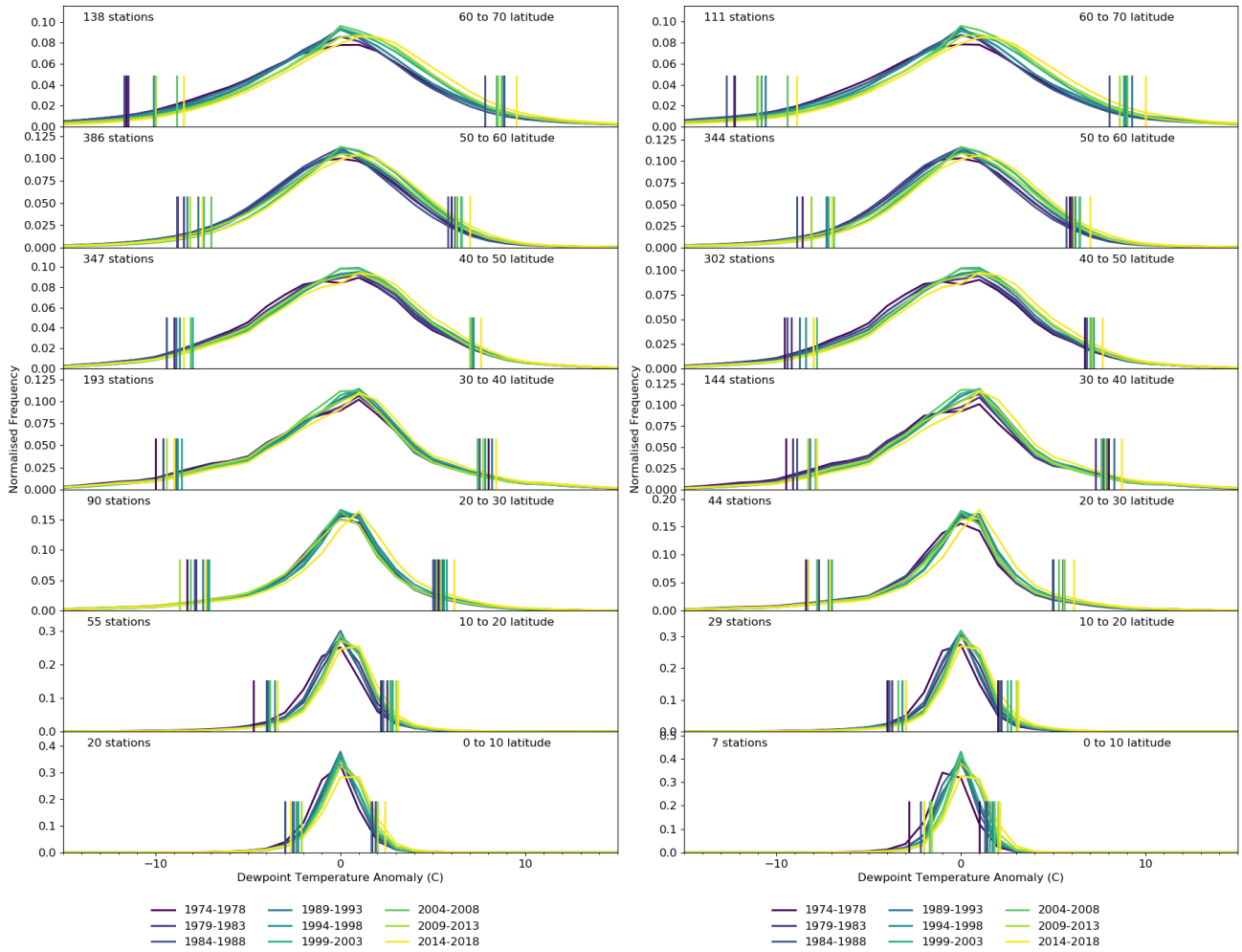
Figure 2. Dewpoint temperature distributions in latitudinal bands for LEFT day and RIGHT night time observations for the northern hemisphere.
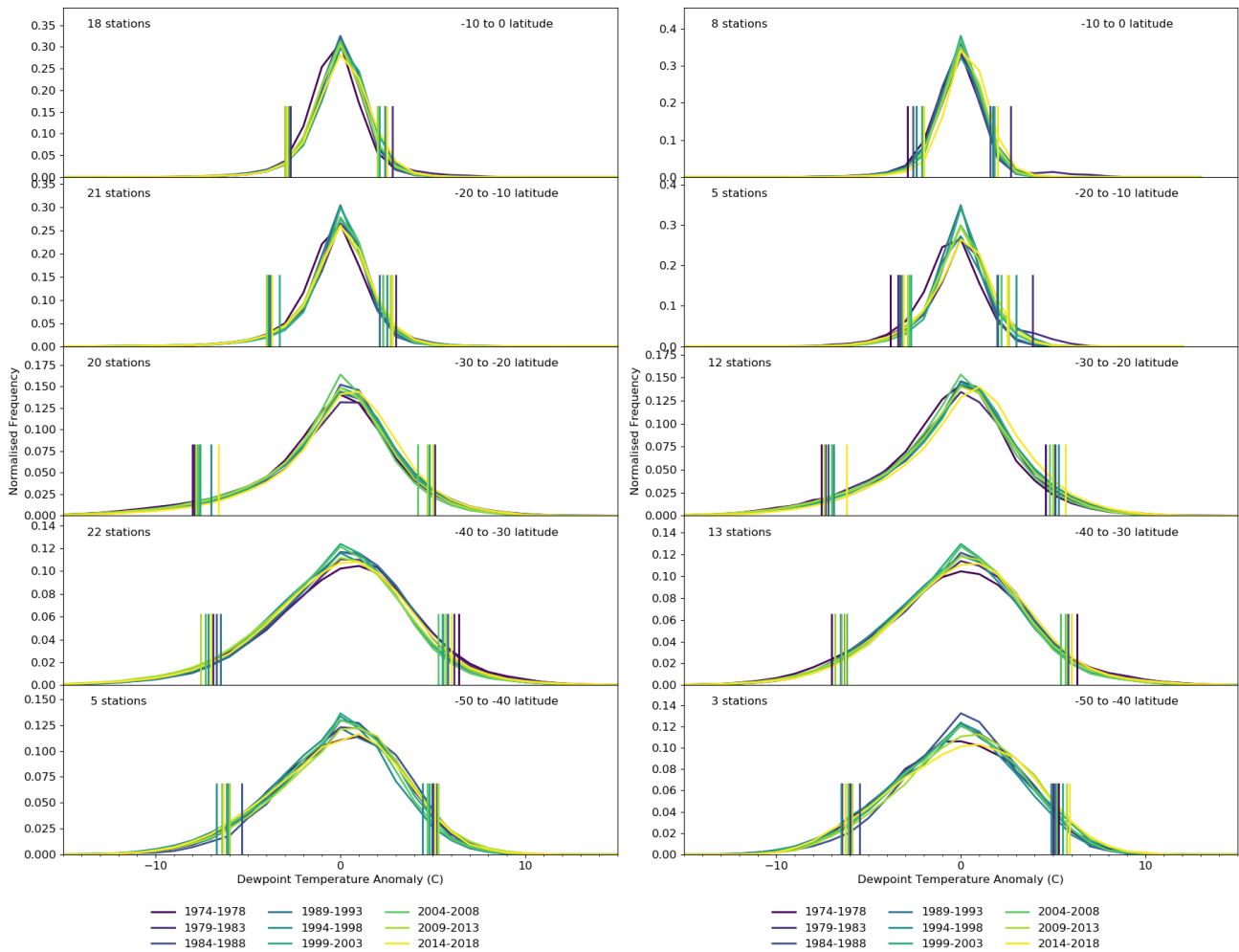
Figure 3. Dewpoint temperature distributions in latitudinal bands for LEFT day and RIGHT night time observations for the southern hemisphere.

Band	N-stations	Mean (m s^{-1} decade^{-1})	St. Dev. (m s^{-1} decade^{-1})	Skew (decade^{-1})	Kurtosis (decade^{-1})
			Day		
70 → 60	81	−0.03 (−0.04 → 0.01)	**−0.03 (−0.05 → −0.00)**	−0.01 (−0.09 → 0.04)	−0.25 (−1.14 → 0.12)
60 → 50	179	**−0.12 (−0.12 → −0.08)**	**−0.08 (−0.08 → −0.05)**	**0.02 (0.02 → 0.04)**	**0.16 (0.06 → 0.40)**
50 → 40	273	**−0.07 (−0.08 → −0.07)**	**−0.04 (−0.04 → −0.03)**	0.00 (−0.01 → 0.02)	0.02 (−0.09 → 0.38)
40 → 30	134	**−0.04 (−0.05 → −0.03)**	**−0.01 (−0.02 → −0.00)**	0.01 (−0.00 → 0.04)	**−0.22 (−0.26 → −0.02)**
30 → 20	57	**−0.03 (−0.04 → −0.01)**	**−0.01 (−0.01 → −0.00)**	−0.03 (−0.09 → 0.03)	**−0.54 (−1.22 → −0.03)**
20 → 10	23	**−0.10 (−0.11 → −0.07)**	−0.03 (−0.05 → 0.00)	**−0.18 (−0.31 → −0.12)**	**−3.65 (−4.56 → −1.56)**
10 → 0	13	−0.01 (−0.04 → 0.02)	**−0.10 (−0.11 → −0.08)**	**−0.28 (−0.30 → −0.20)**	**−4.09 (−4.35 → −1.99)**
			Night		
70 → 60	64	−0.01 (−0.03 → 0.03)	**−0.03 (−0.04 → −0.00)**	−0.02 (−0.05 → 0.06)	−0.26 (−0.96 → 0.44)
60 → 50	156	**−0.10 (−0.11 → −0.06)**	**−0.08 (−0.09 → −0.06)**	**0.02 (0.01 → 0.03)**	**0.21 (0.08 → 0.43)**
50 → 40	229	**−0.05 (−0.05 → −0.05)**	**−0.04 (−0.05 → −0.03)**	−0.01 (−0.02 → 0.05)	0.02 (−0.04 → 0.29)
40 → 30	97	**−0.01 (−0.02 → −0.00)**	−0.01 (−0.02 → 0.01)	0.01 (−0.03 → 0.05)	−0.12 (−0.21 → 0.19)
30 → 20	34	0.01 (−0.01 → 0.04)	**0.02 (0.00 → 0.04)**	**0.04 (0.02 → 0.10)**	**0.69 (0.13 → 1.20)**
20 → 10	11	**−0.07 (−0.07 → −0.03)**	0.00 (−0.02 → 0.04)	**−0.20 (−0.40 → −0.05)**	**−3.18 (−4.41 → −1.90)**
10 → 0	6	**0.06 (0.03 → 0.08)**	**−0.05 (−0.07 → −0.02)**	**−0.67 (−0.96 → −0.55)**	**−12.39 (−14.00 → −4.79)**

Table 2. Fits to parameters in zonal analysis for TOP day-, and BOTTOM night-time windspeed observations. Values in bold show parameters and bands where the 1σ range of the fitted trend does not include zero.
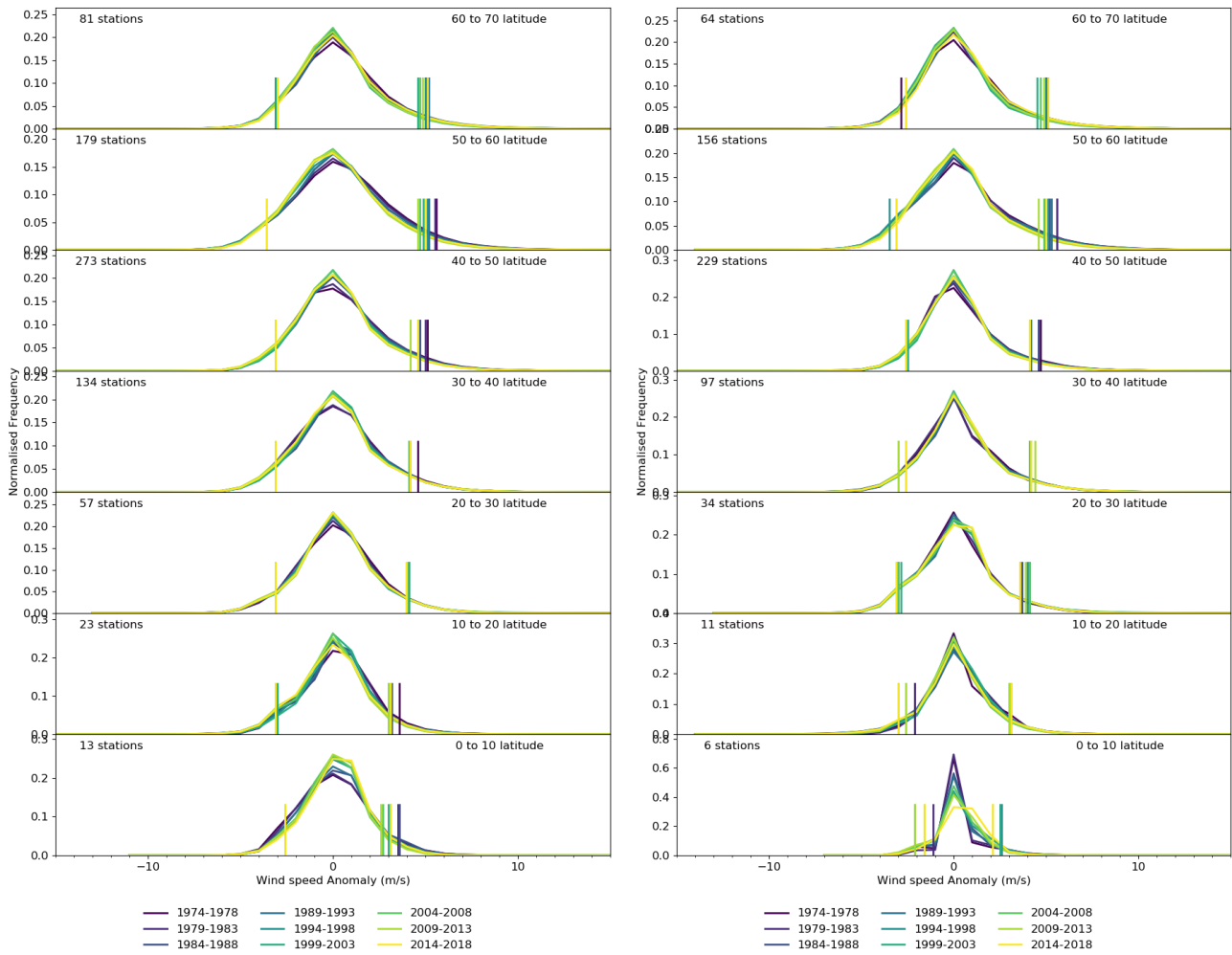
Figure 4. Wind speed distributions in latitudinal bands for LEFT day and RIGHT night time observations for the northern hemisphere.
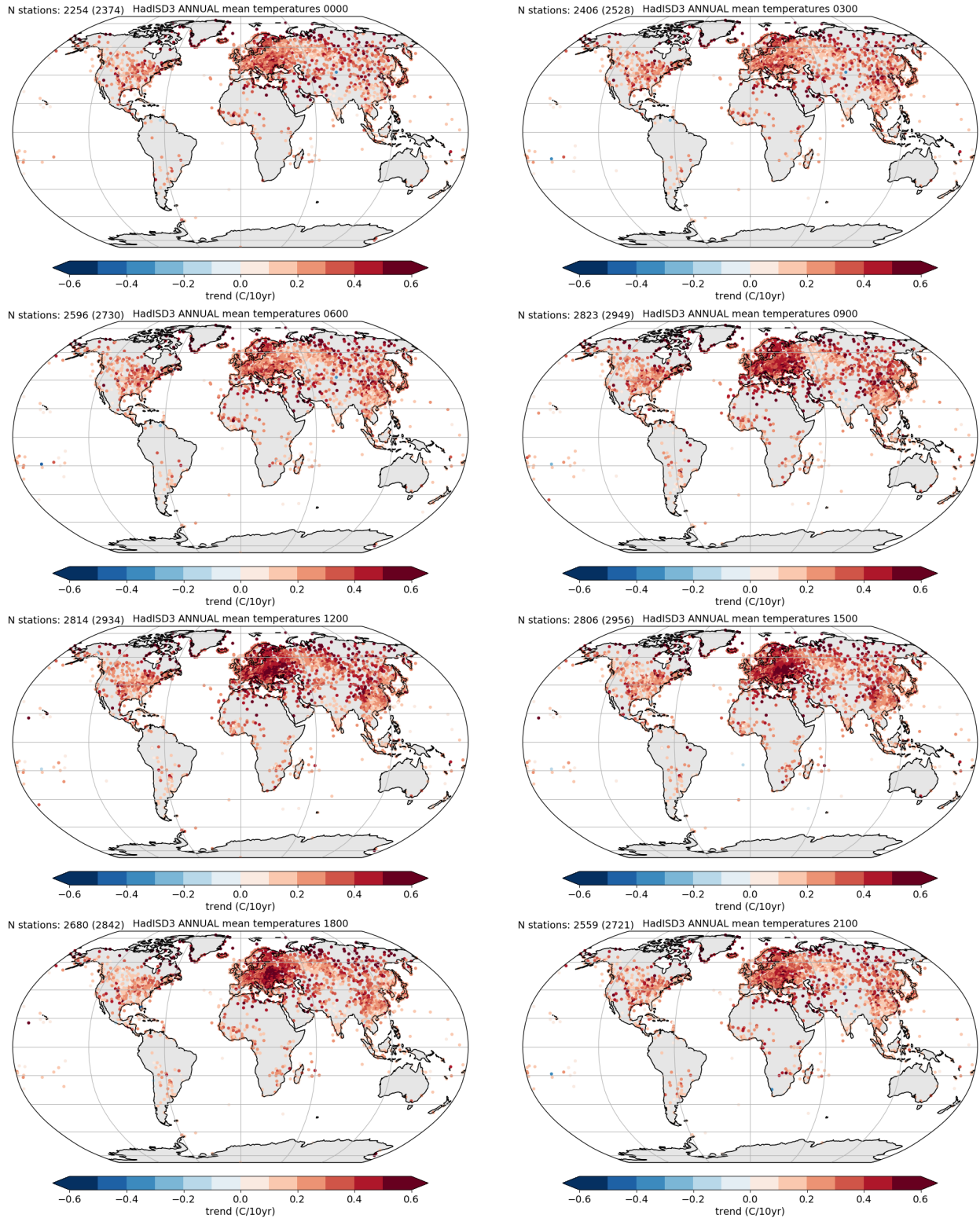
Figure 5. Trend over 1974-2018 in distribution mean for temperature at each three hourly interval. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
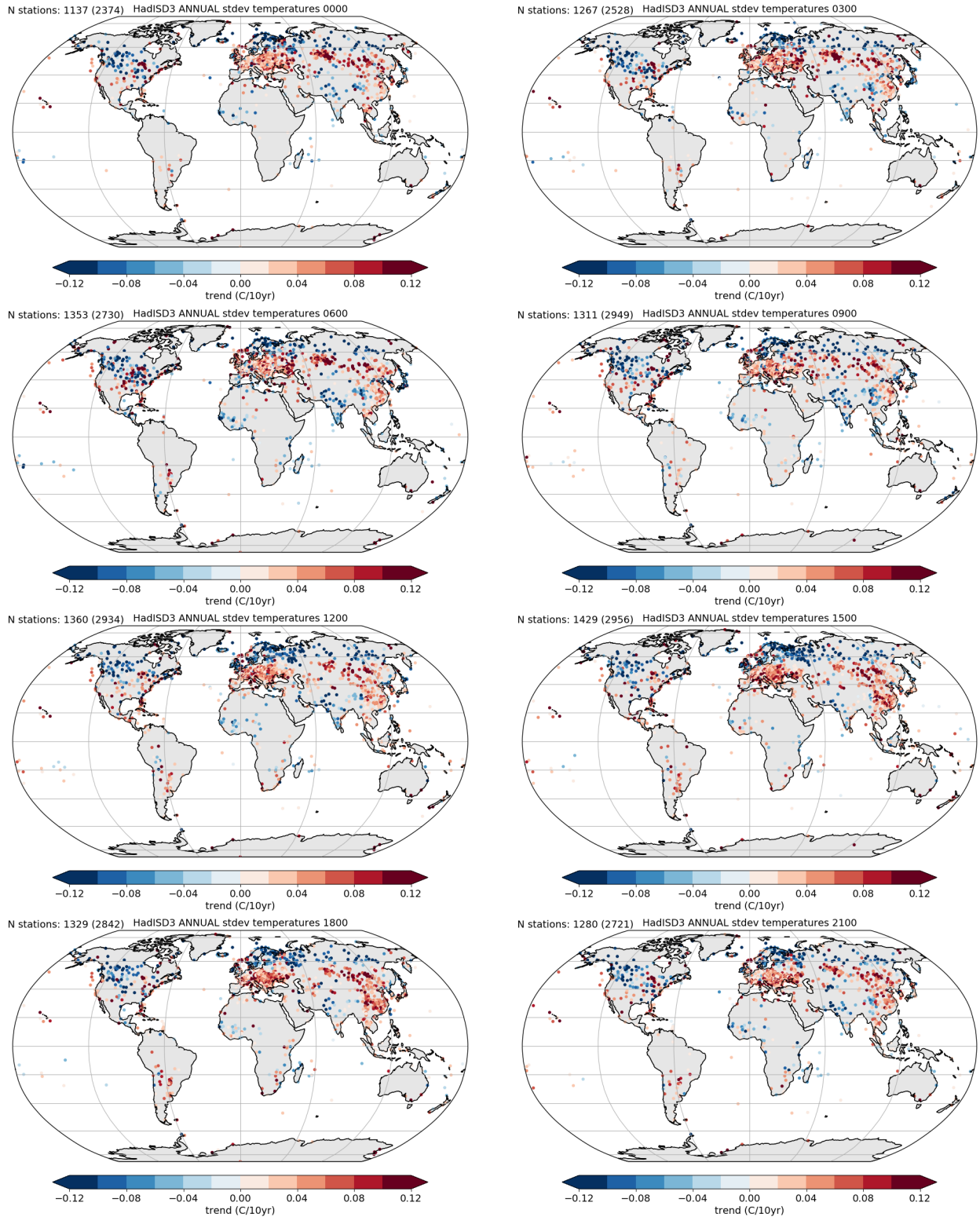
Figure 6. Trend over 1974-2018 in distribution standard deviation for temperature at each three hourly interval. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
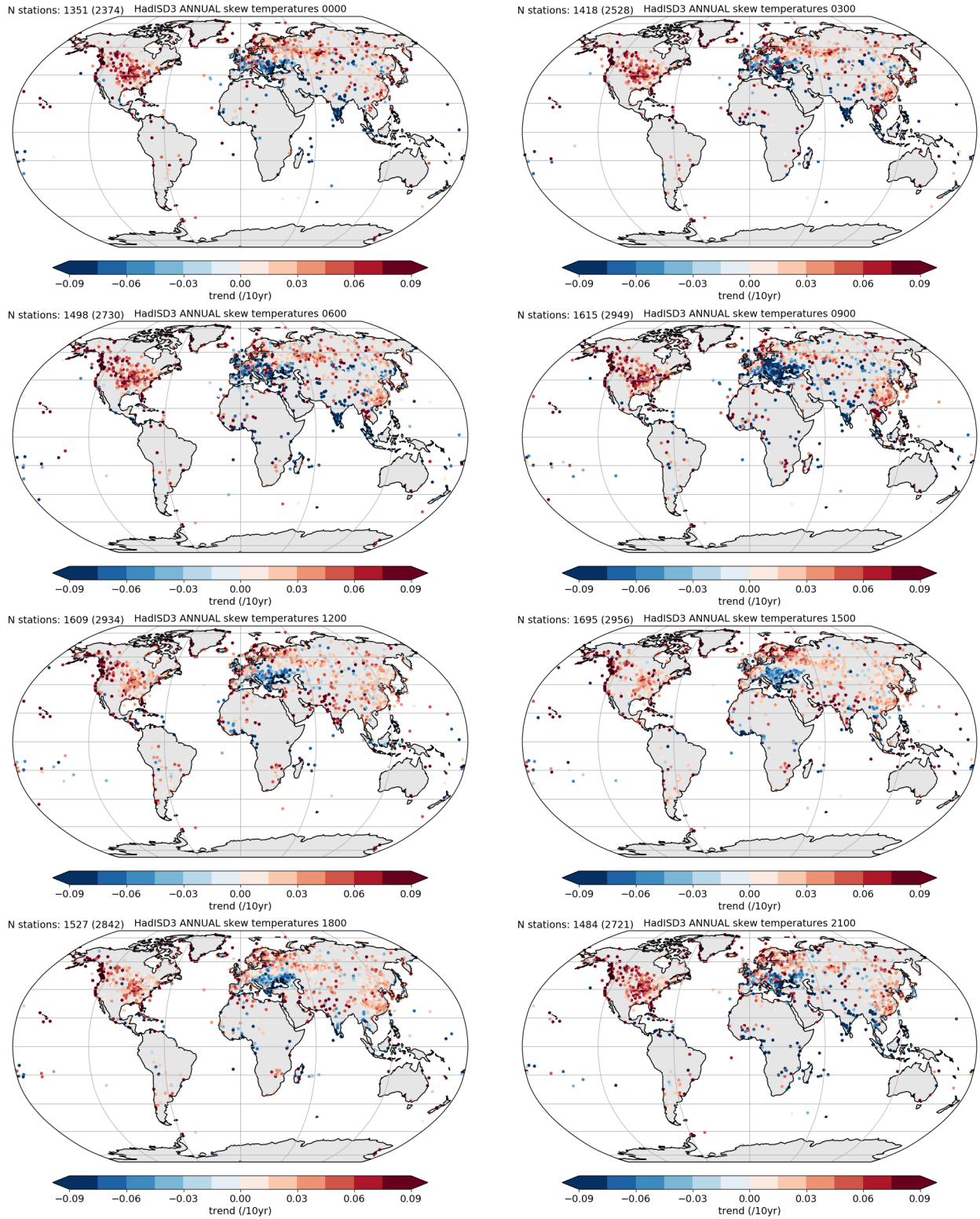
Figure 7. Trend over 1974-2018 in distribution skewness for temperature at each three hourly interval. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
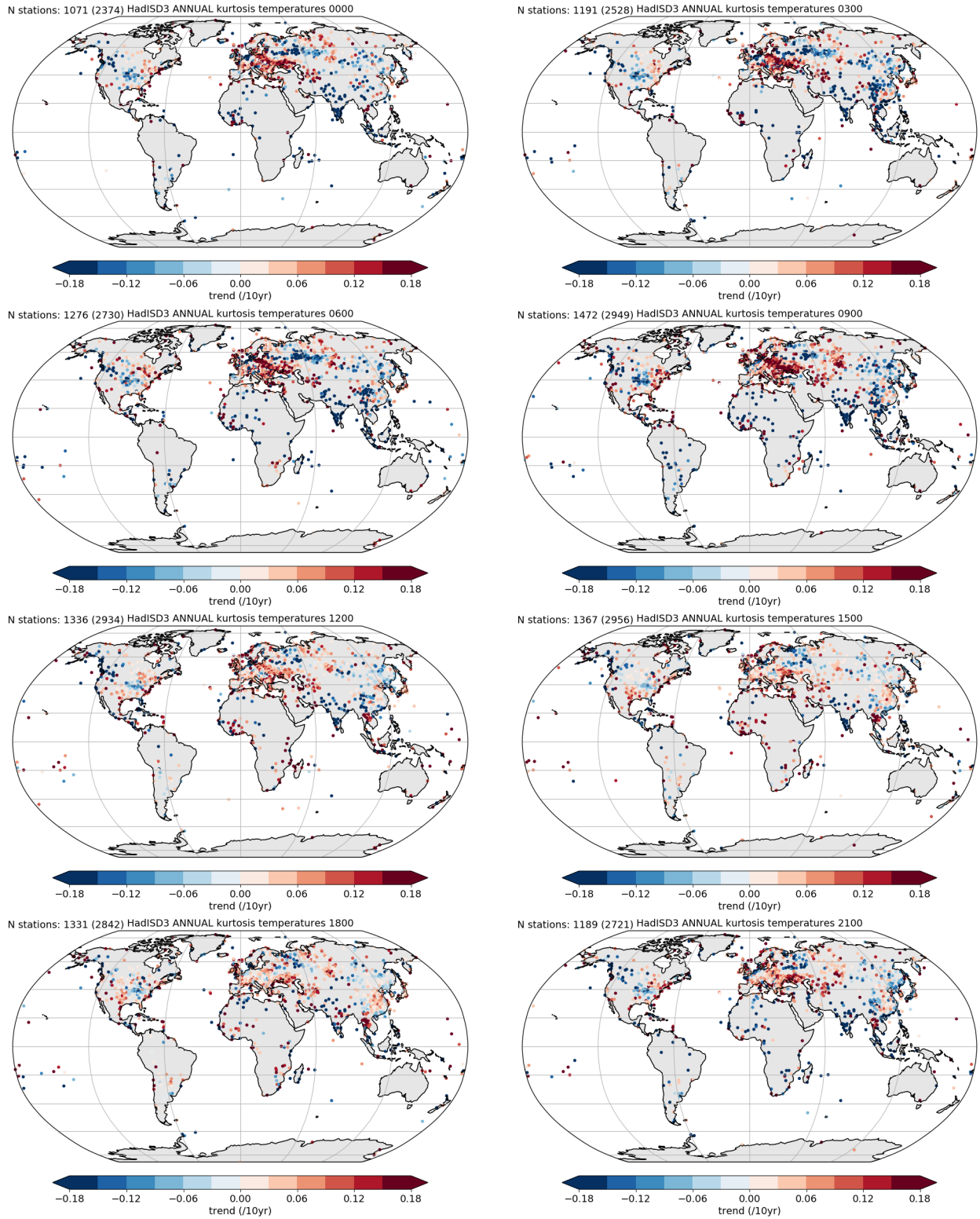
Figure 8. Trend over 1974-2018 in distribution kurtosis for temperature at each three hourly interval. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
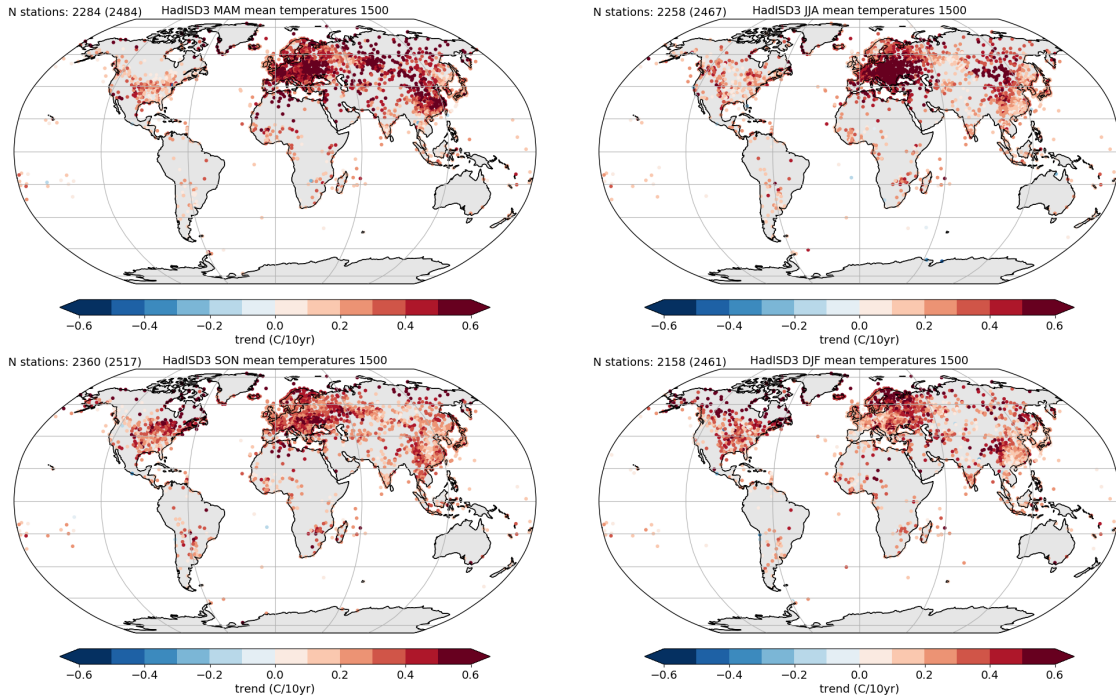
Figure 9. Trend over 1974-2018 in distribution mean for temperature at 1500 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
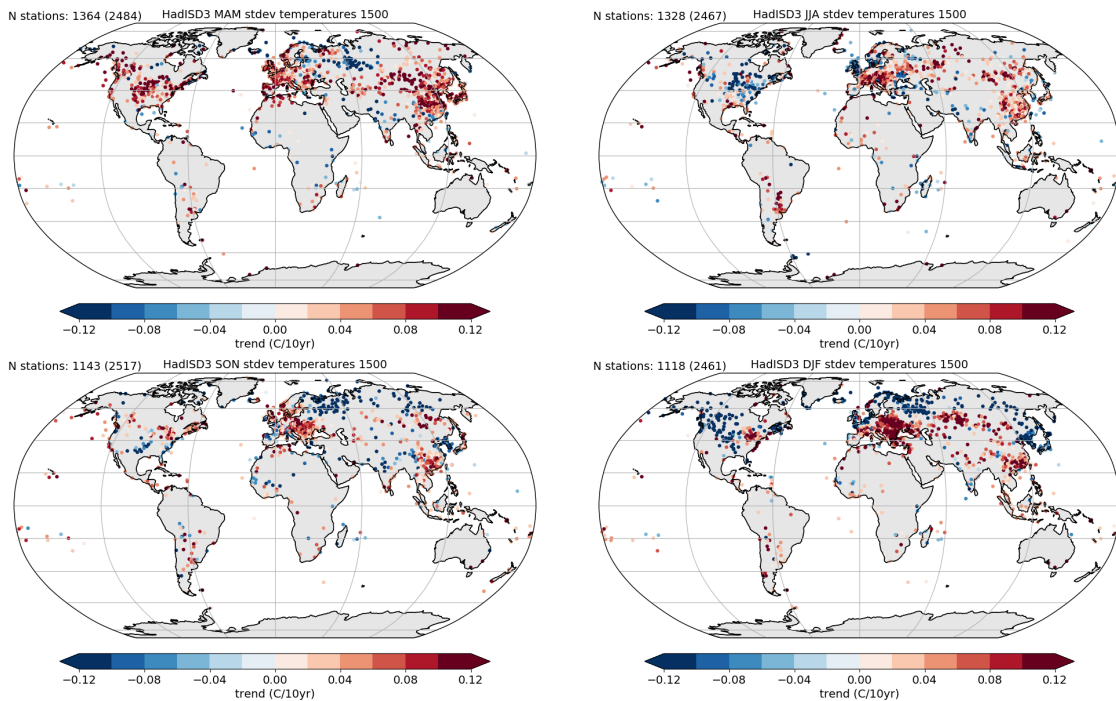
Figure 10. Trend over 1974-2018 in distribution standard deviation for temperature at 1500 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
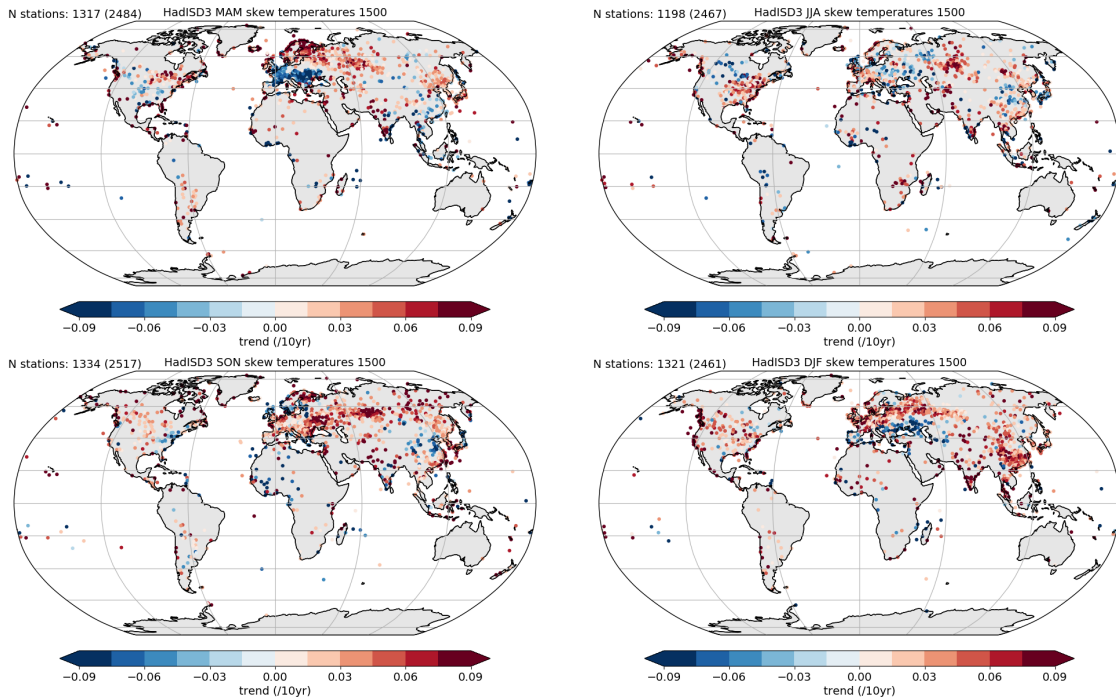
Figure 11. Trend over 1974-2018 in distribution skew for temperature at 1500 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
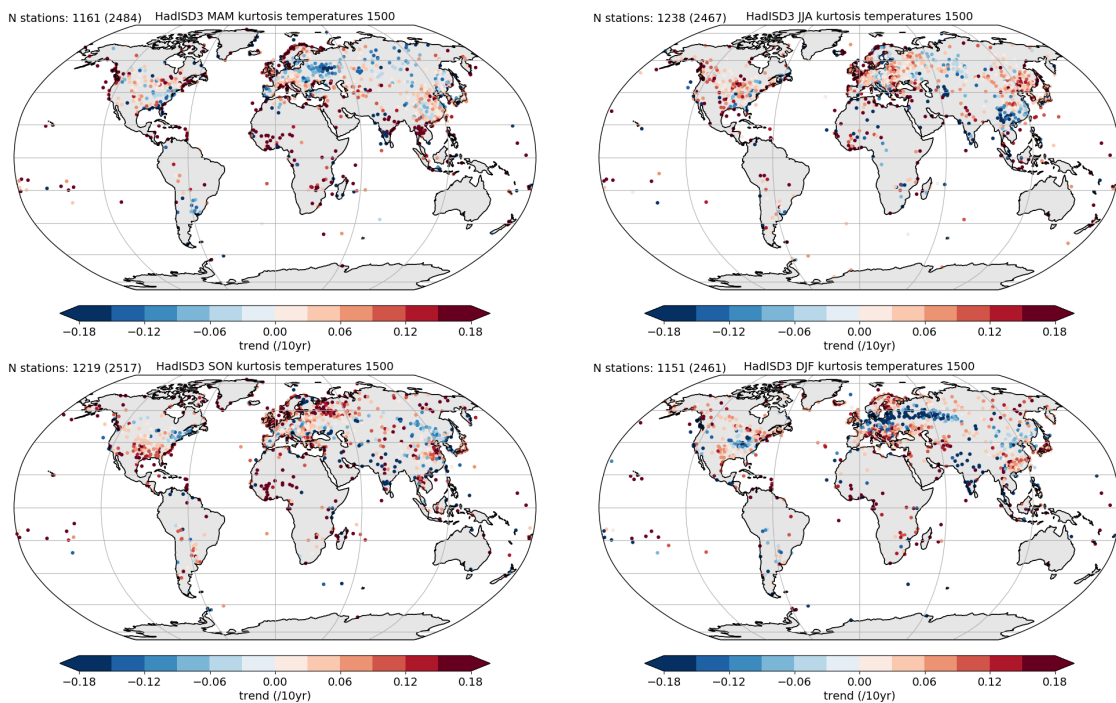
Figure 12. Trend over 1974-2018 in distribution kurtosis for temperature at 1500 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
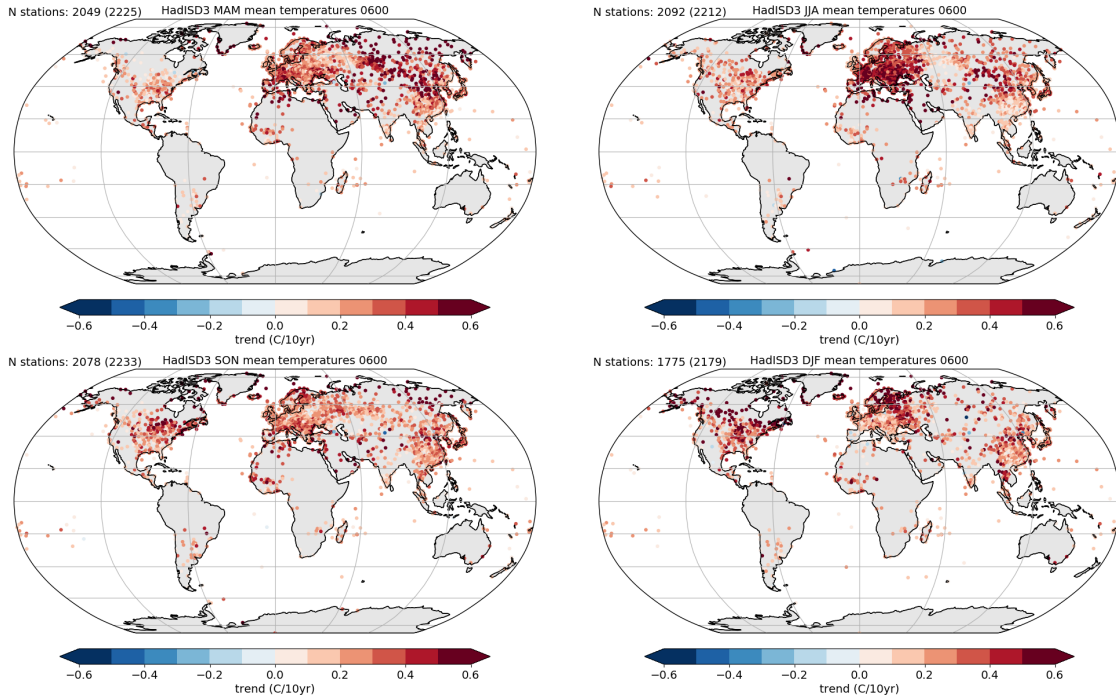
Figure 13. Trend over 1974-2018 in distribution mean for temperature at 0600 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
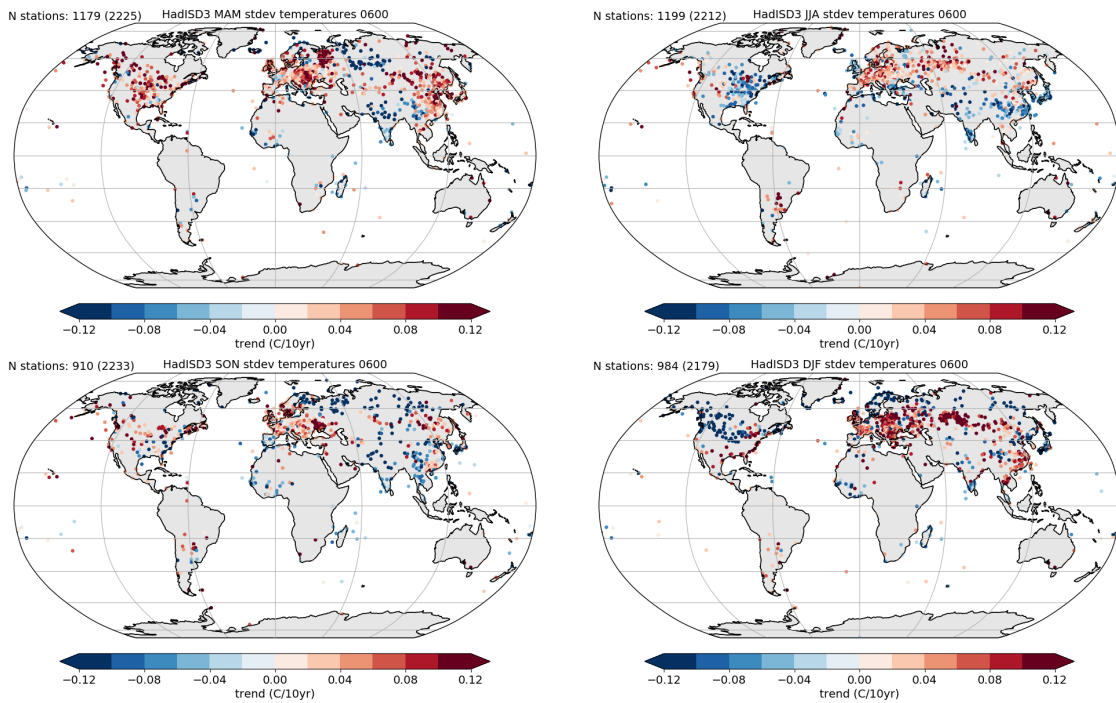
Figure 14. Trend over 1974-2018 in distribution standard deviation for temperature at 0600 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
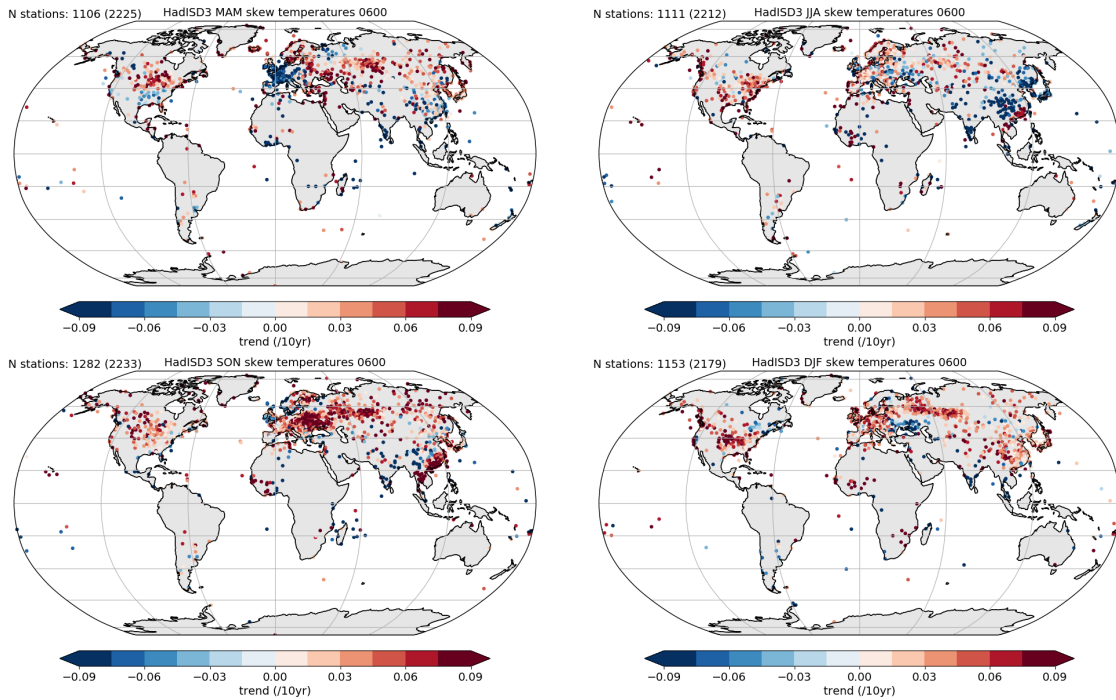
Figure 15. Trend over 1974-2018 in distribution skew for temperature at 0600 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
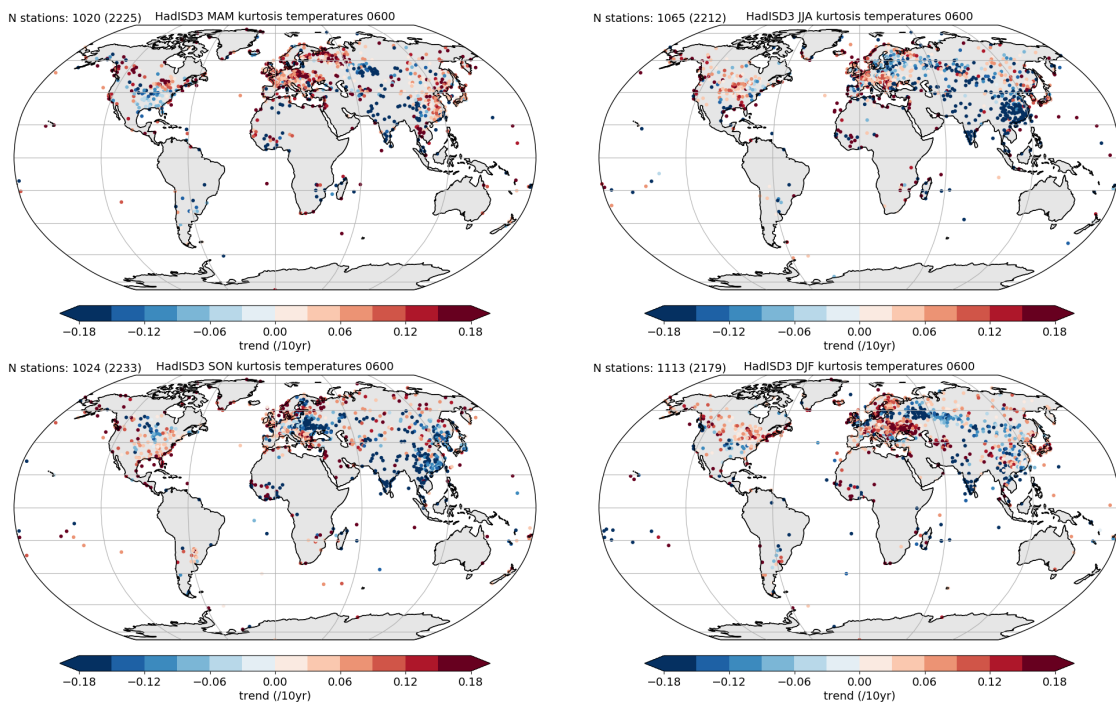
Figure 16. Trend over 1974-2018 in distribution kurtosis for temperature at 0600 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
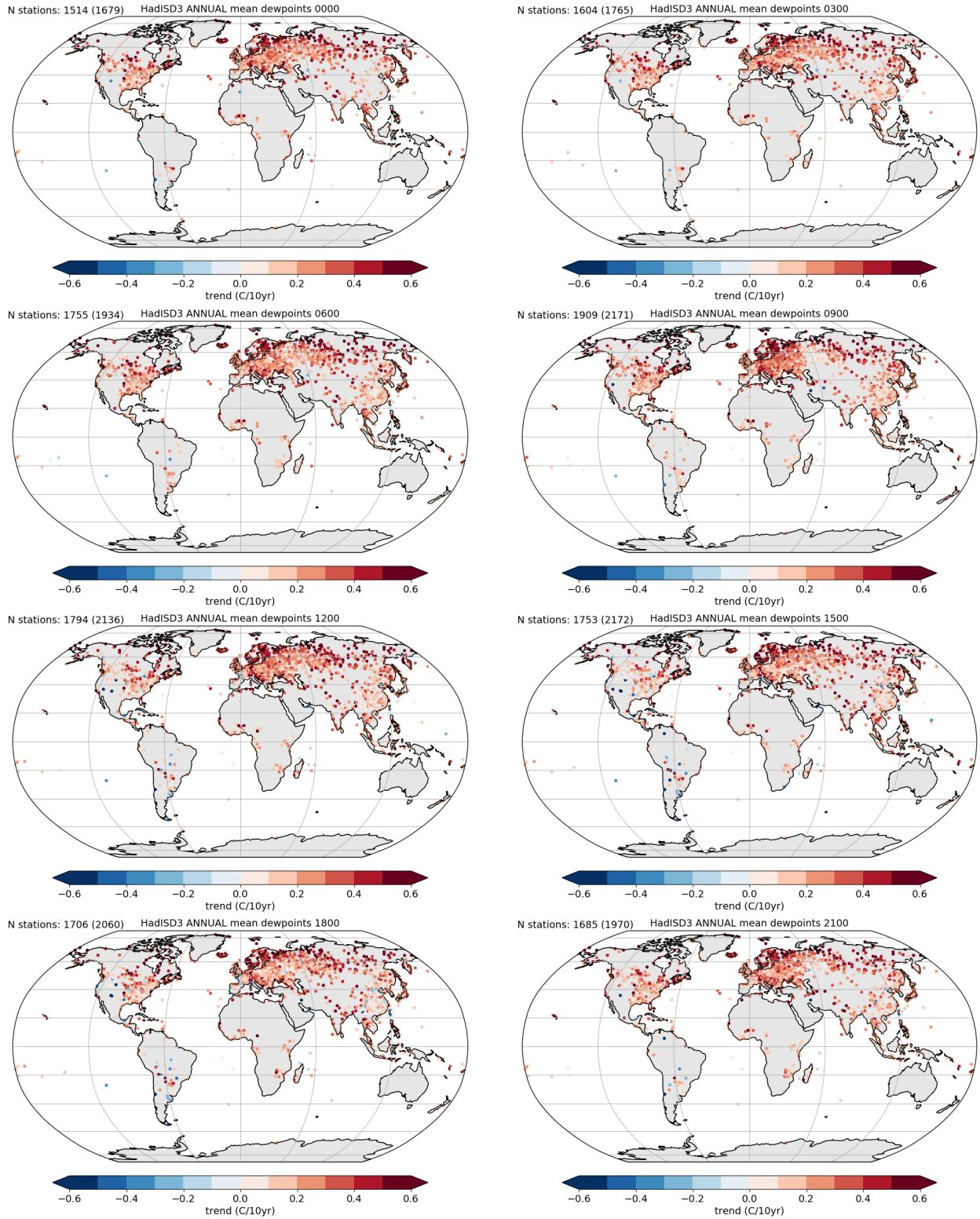
Figure 17. Trend over 1974-2018 in distribution mean for dewpoint temperature at each three hourly interval. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
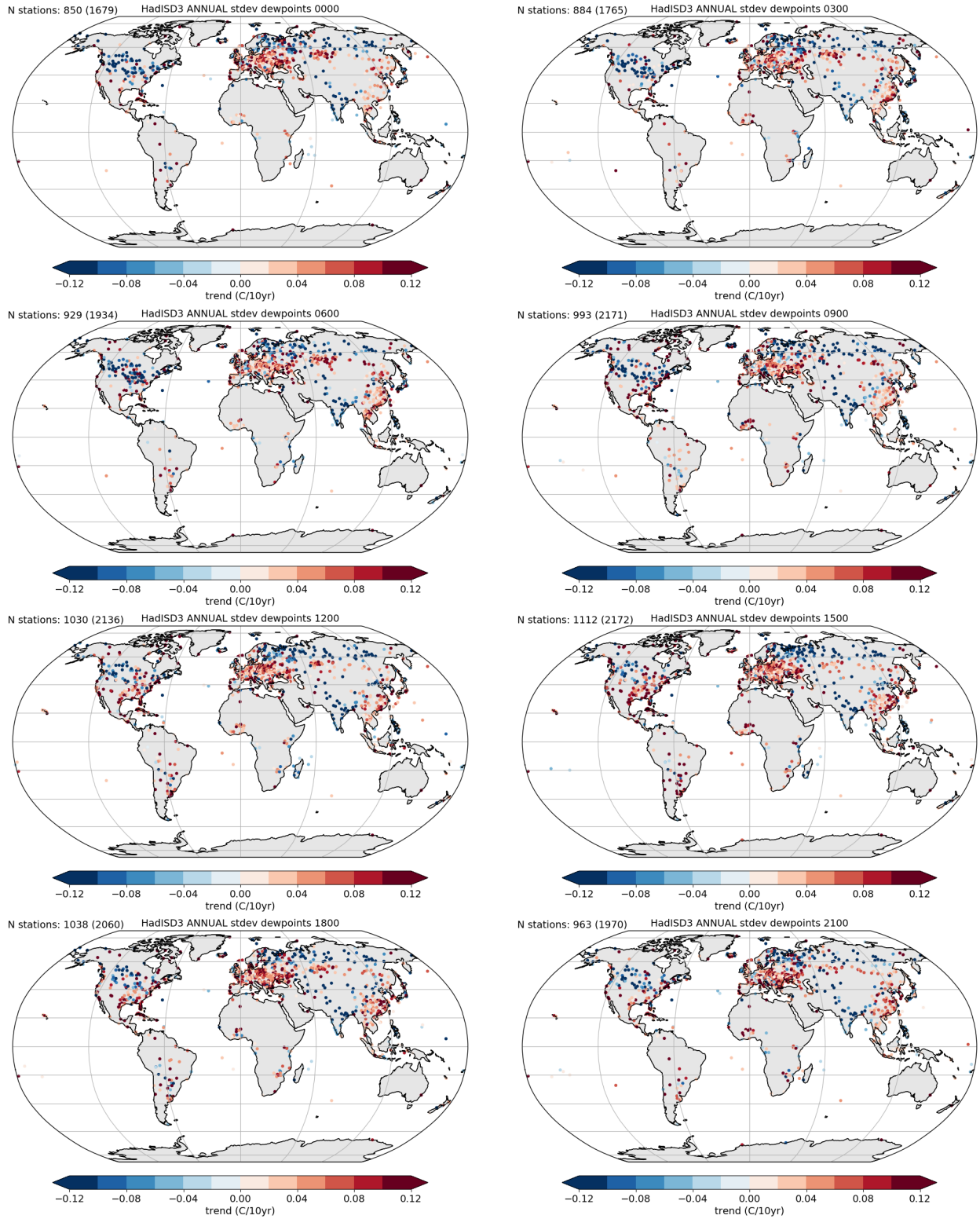
Figure 18. Trend over 1974-2018 in distribution standard deviation for dewpoint temperature at each three hourly interval. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
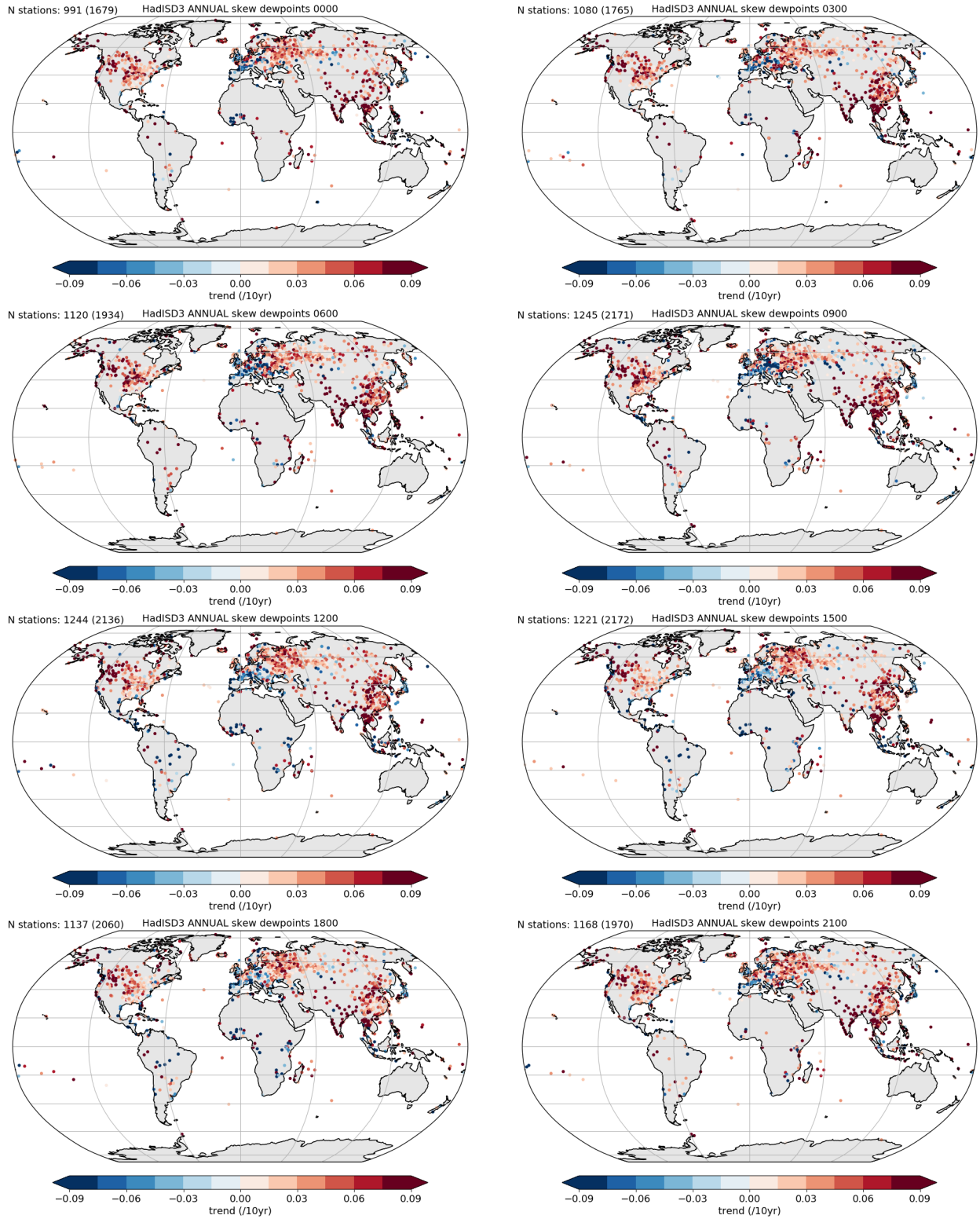
Figure 19. Trend over 1974-2018 in distribution skewness for dewpoint temperature at each three hourly interval. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
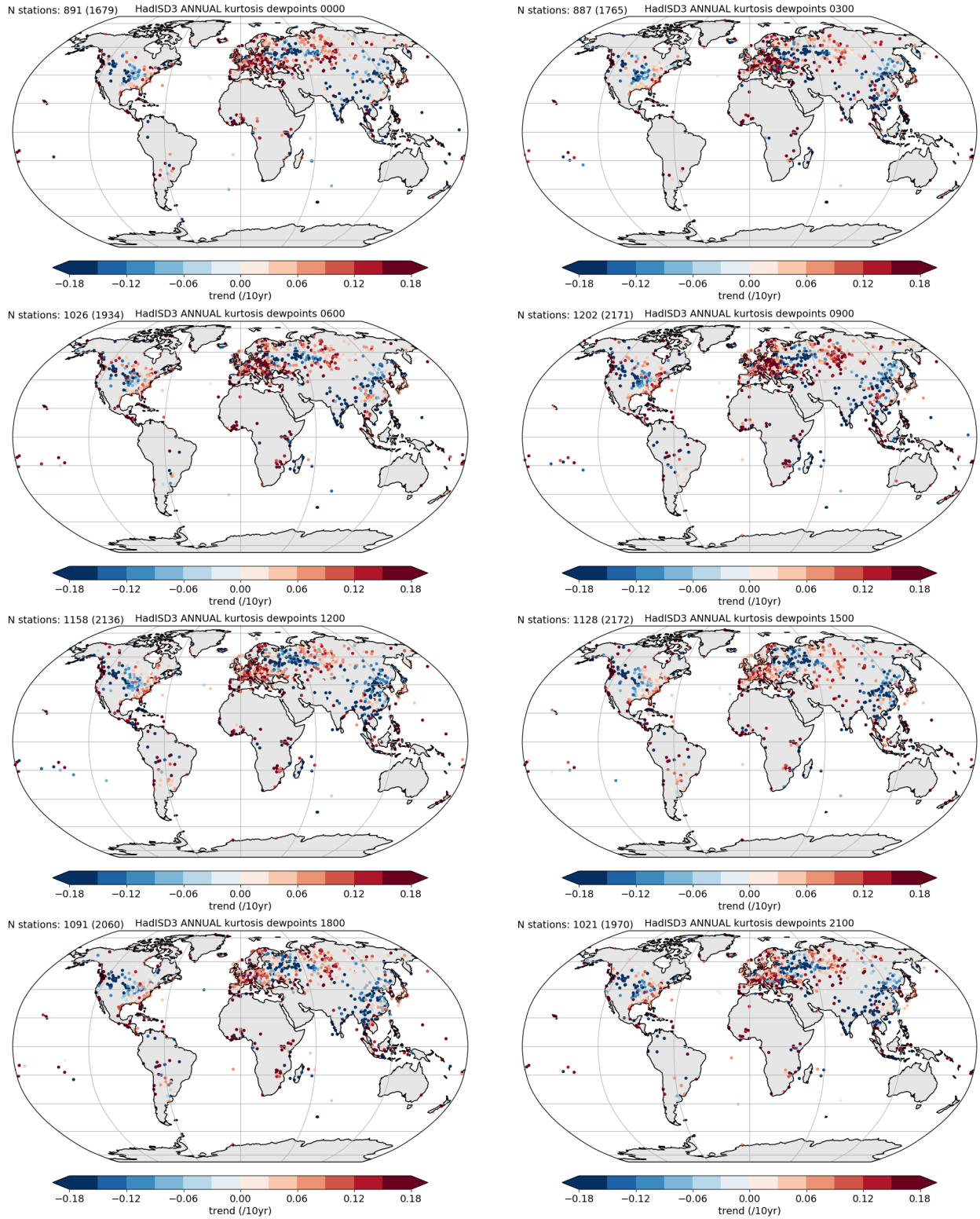
Figure 20. Trend over 1974-2018 in distribution kurtosis for dewpoint temperature at each three hourly interval. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
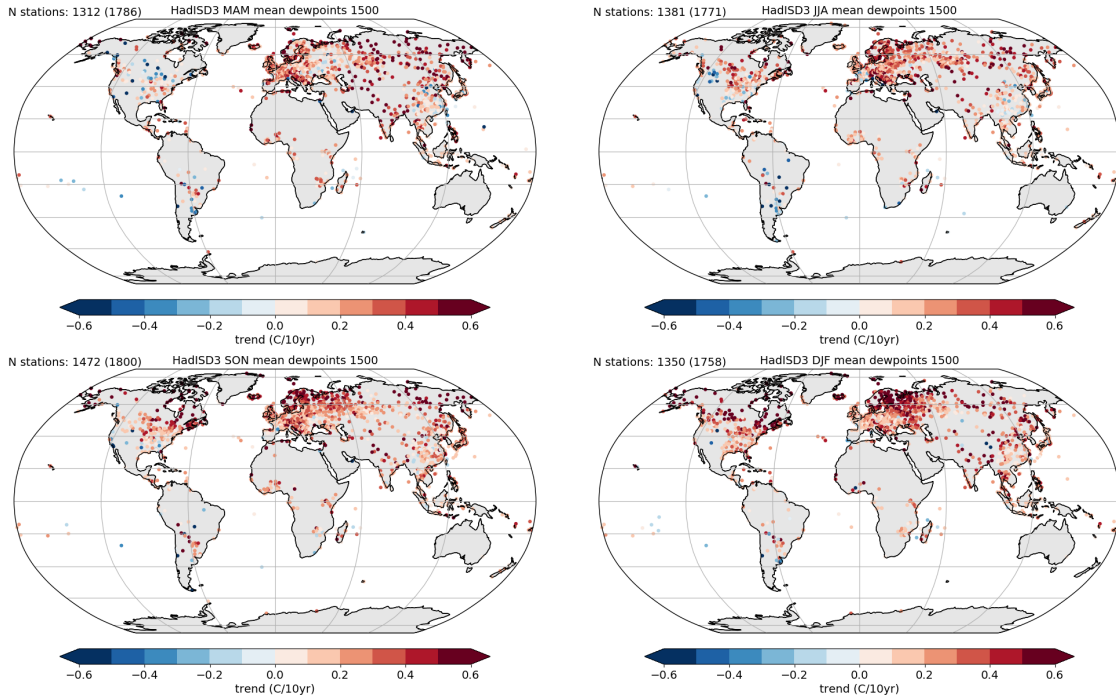
Figure 21. Trend over 1974-2018 in distribution mean for dewpoint temperature at 1500 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
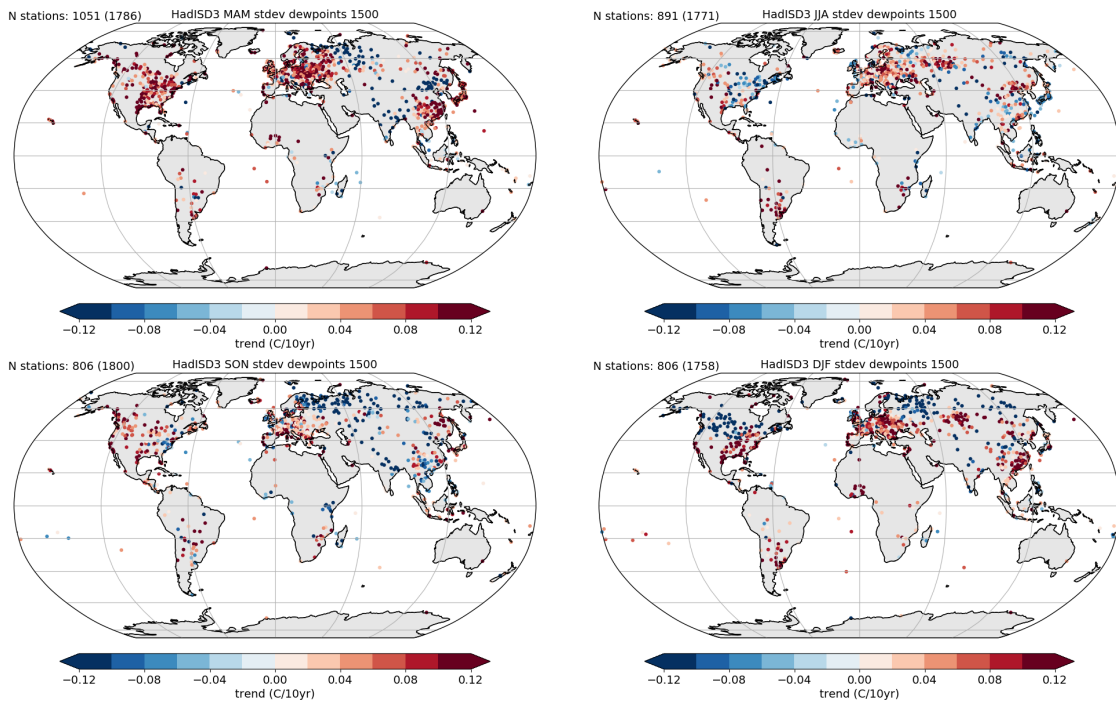
Figure 22. Trend over 1974-2018 in distribution standard deviation for dewpoint temperature at 1500 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
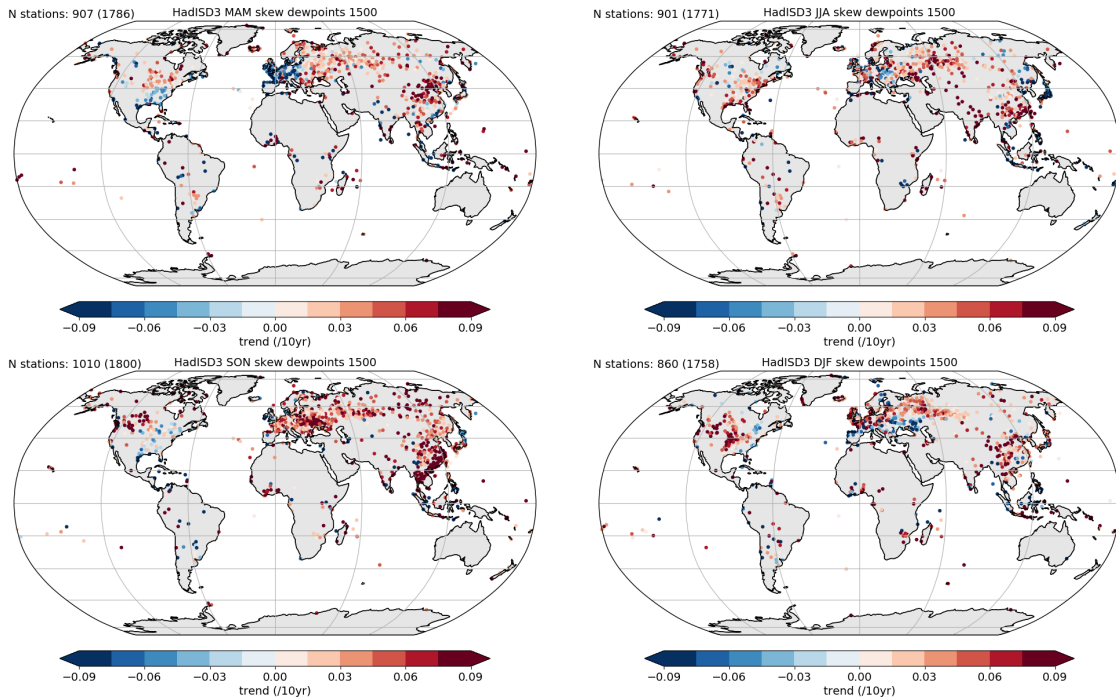
Figure 23. Trend over 1974-2018 in distribution skew for dewpoint temperature at 1500 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
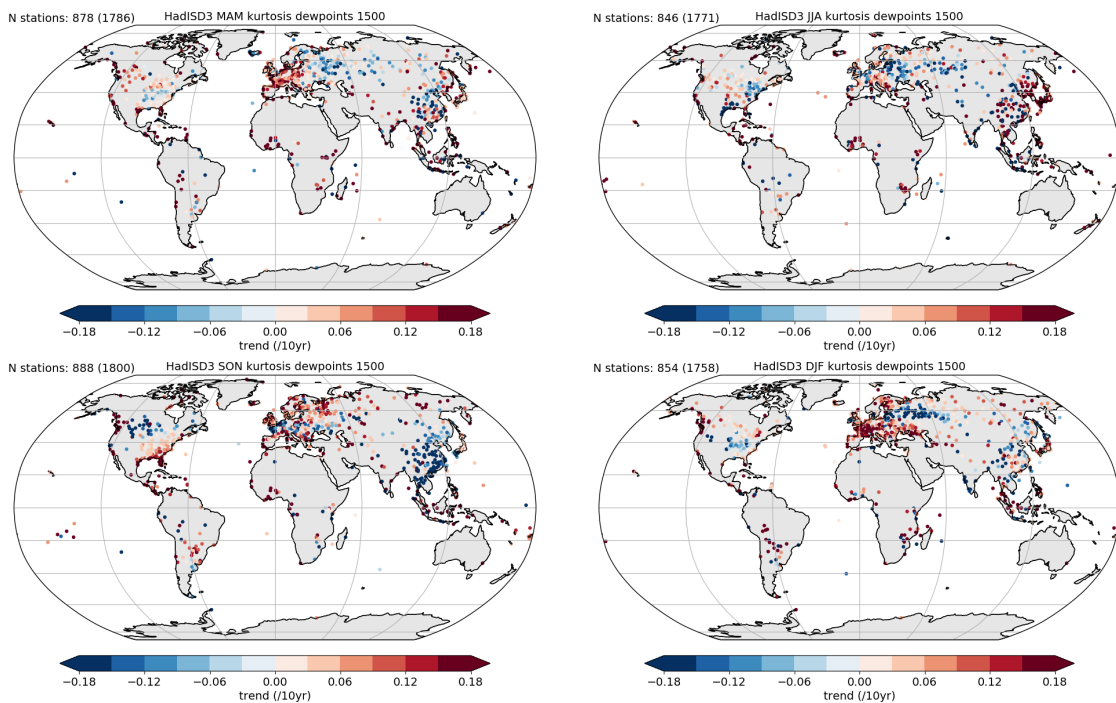
Figure 24. Trend over 1974-2018 in distribution kurtosis for dewpoint temperature at 1500 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
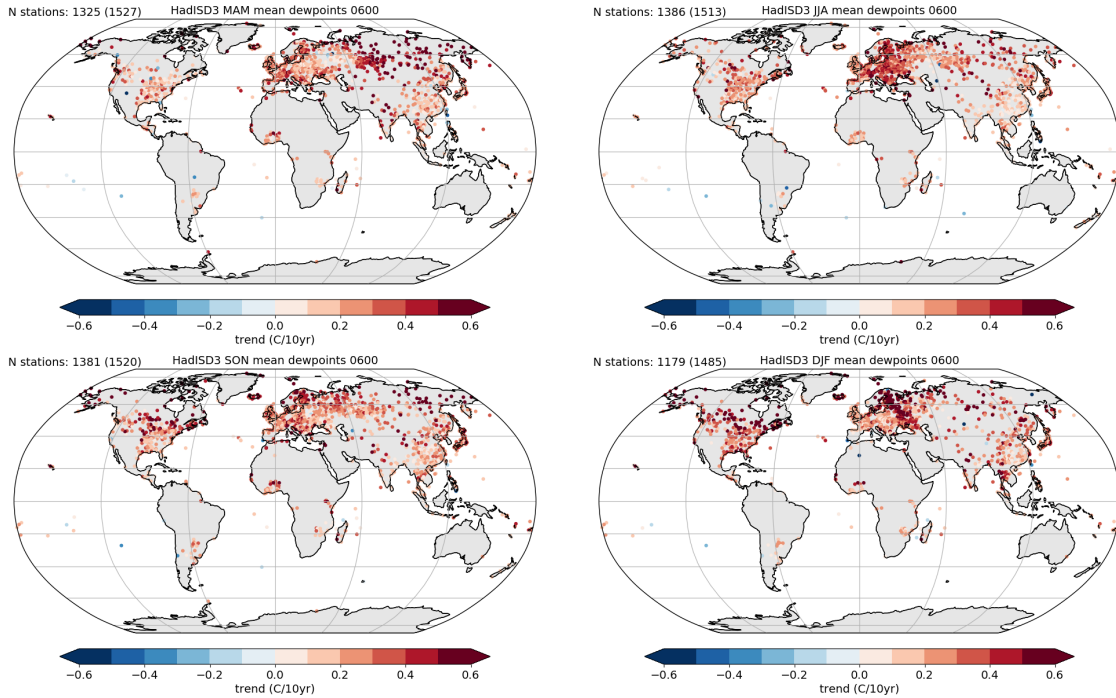
Figure 25. Trend over 1974-2018 in distribution mean for dewpoint temperature at 0600 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
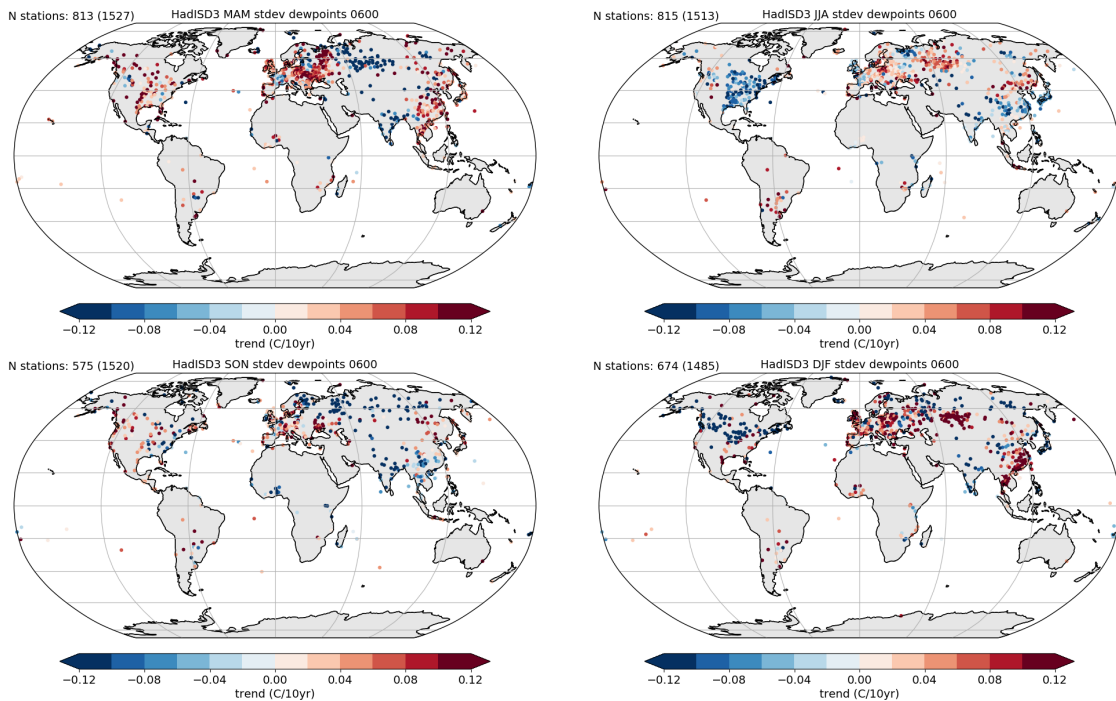
Figure 26. Trend over 1974-2018 in distribution standard deviation for dewpoint temperature at 0600 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
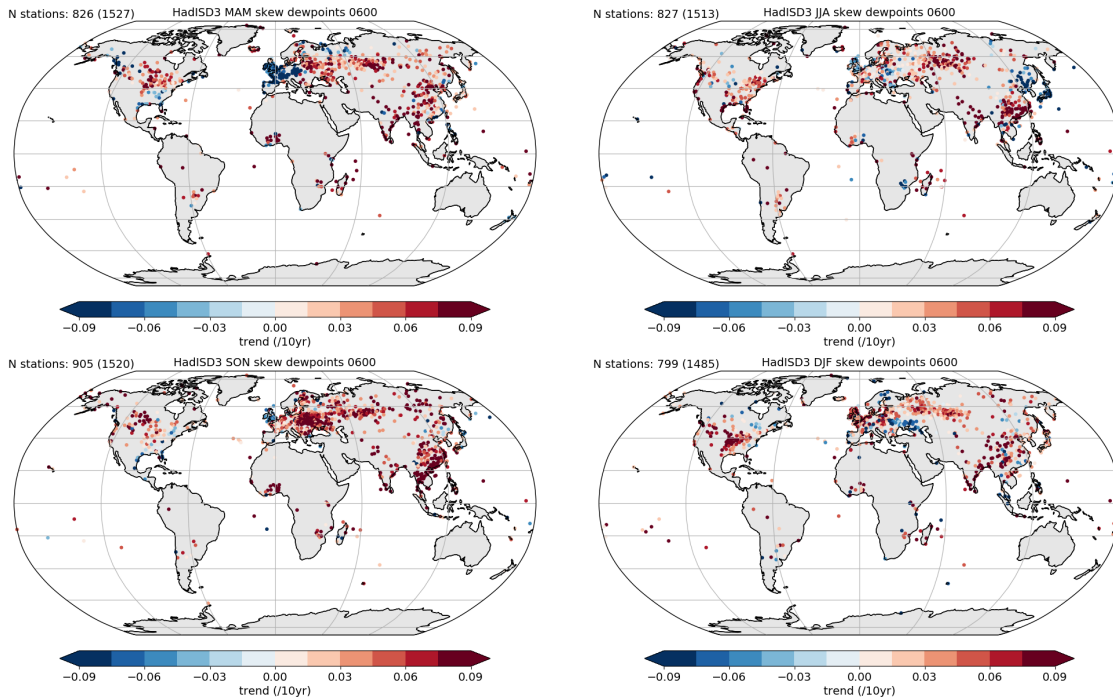
Figure 27. Trend over 1974-2018 in distribution skew for dewpoint temperature at 0600 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
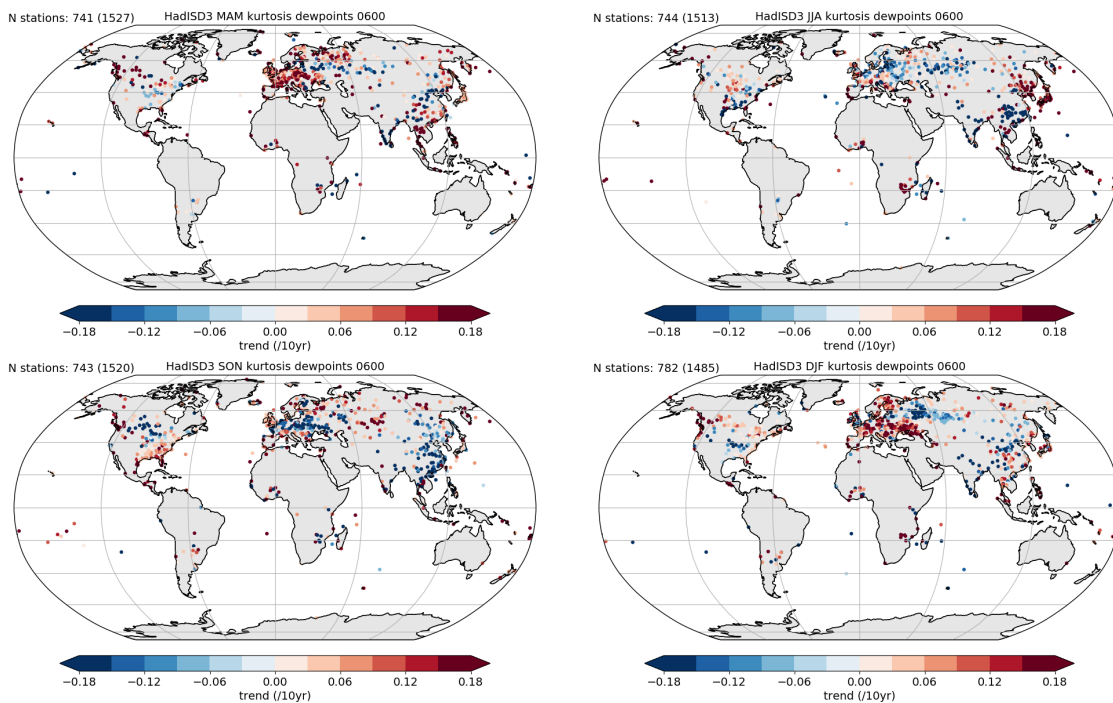
Figure 28. Trend over 1974-2018 in distribution kurtosis for dewpoint temperature at 0600 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
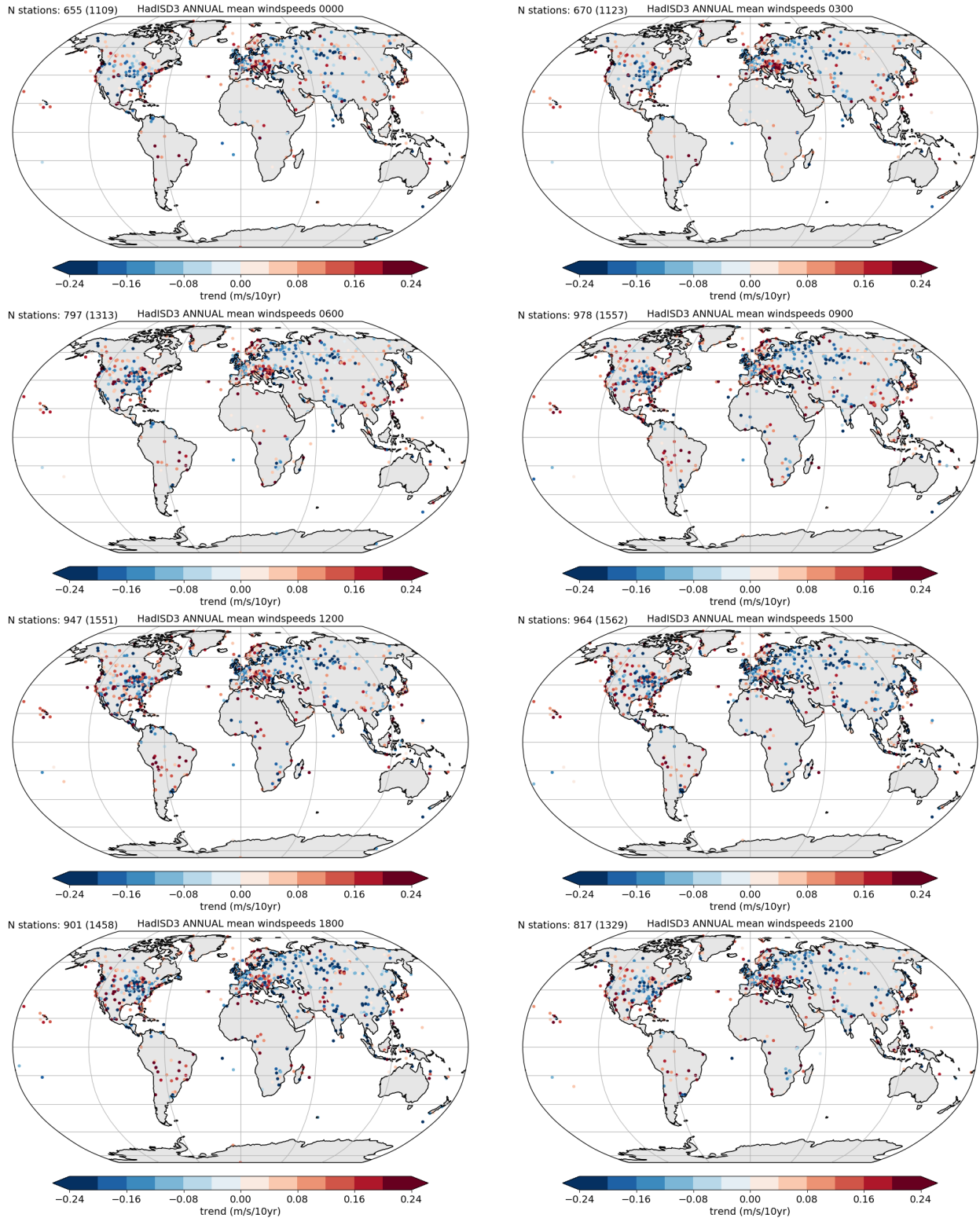
Figure 29. Trend over 1974-2018 in distribution mean for wind speeds at each three hourly interval. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
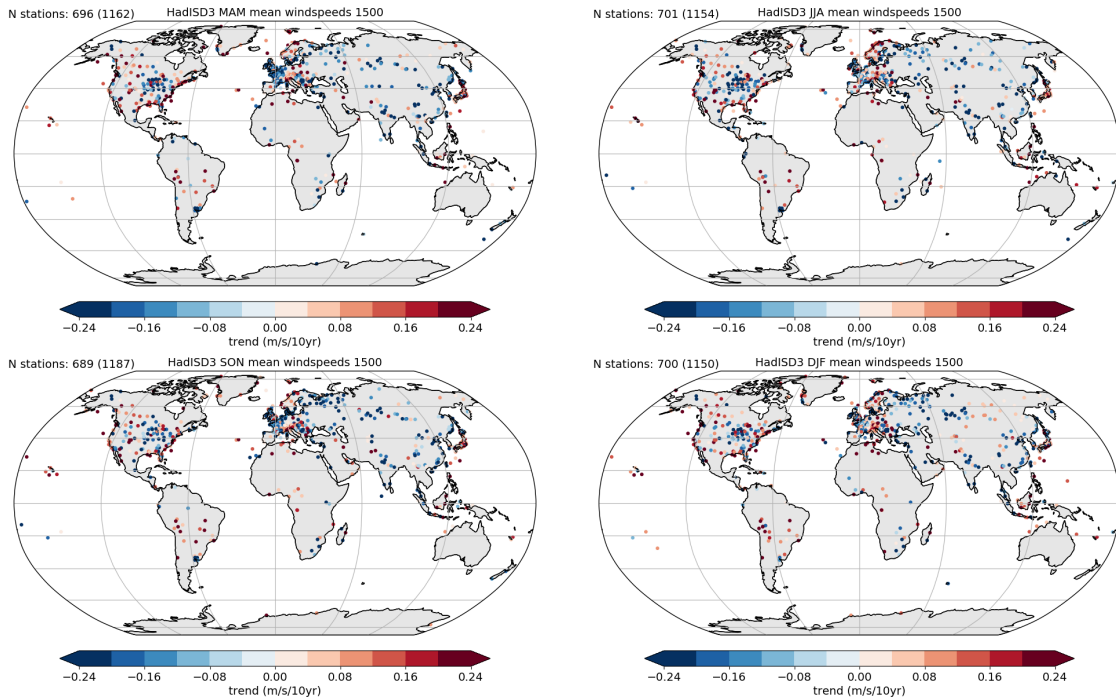
Figure 30. Trend over 1974-2018 in distribution mean for wind speeds at 1500 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
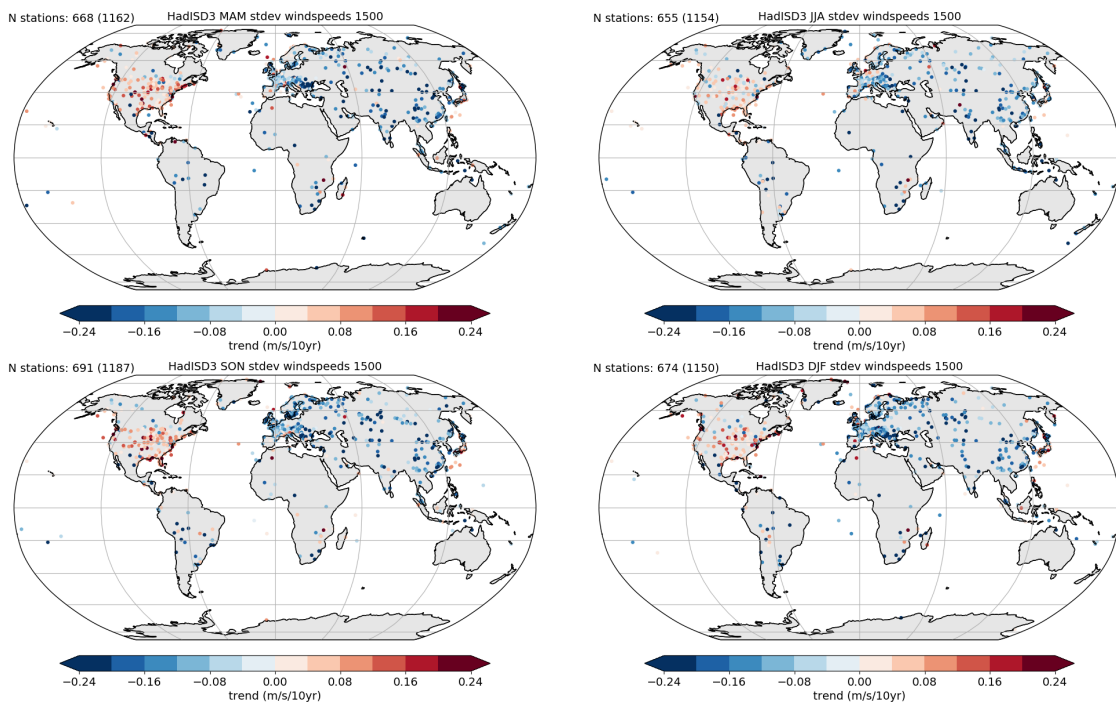
Figure 31. Trend over 1974-2018 in distribution standard deviation for wind speeds at 1500 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
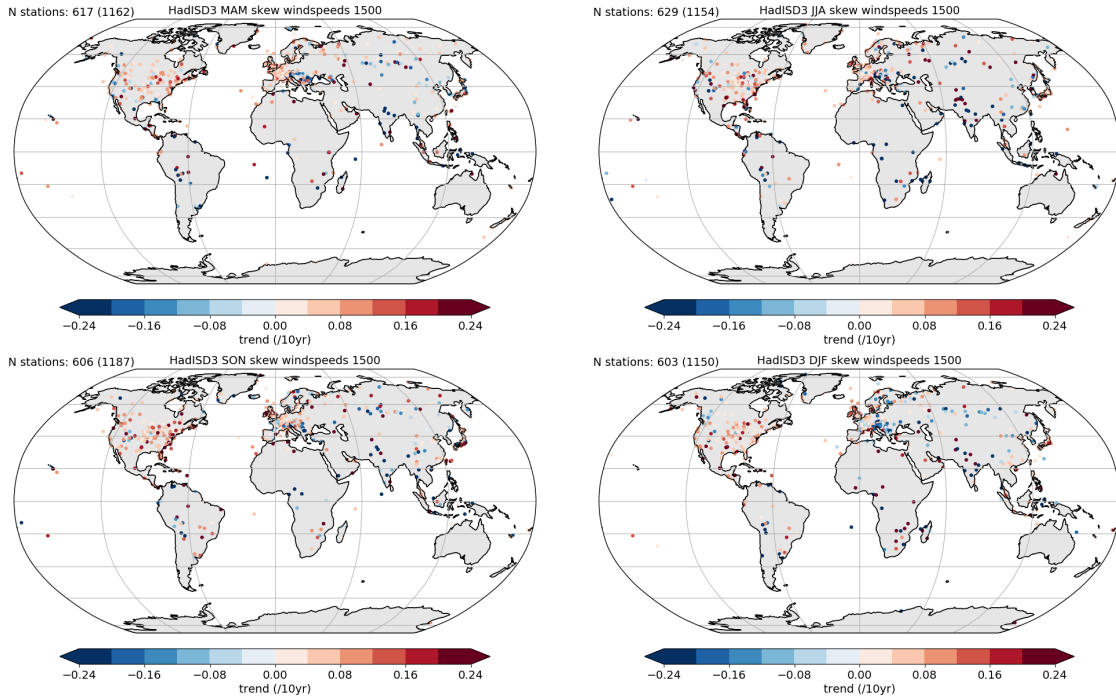
Figure 32. Trend over 1974-2018 in distribution skew for wind speeds at 1500 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
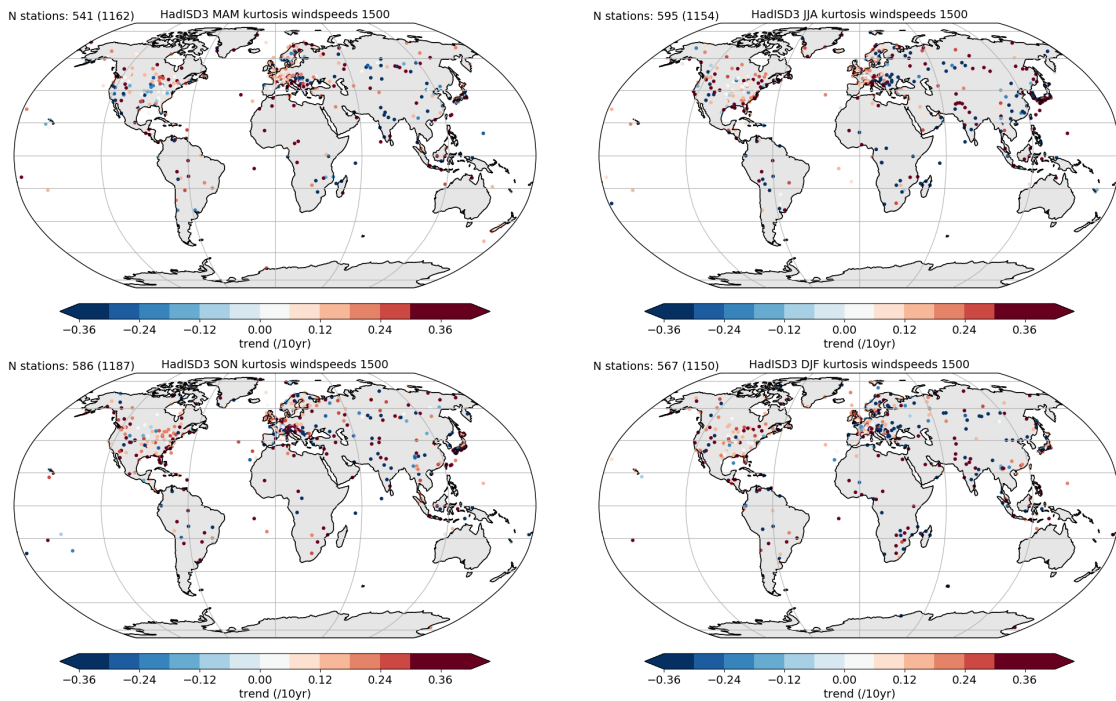
Figure 33. Trend over 1974-2018 in distribution kurtosis for wind speeds at 1500 local time across the four seasons. Only the stations where the 1σ range of the fitted trend does not include zero are plotted (the number of these is shown in the top left hand corner of each plot). The total number of stations available is shown in parentheses.
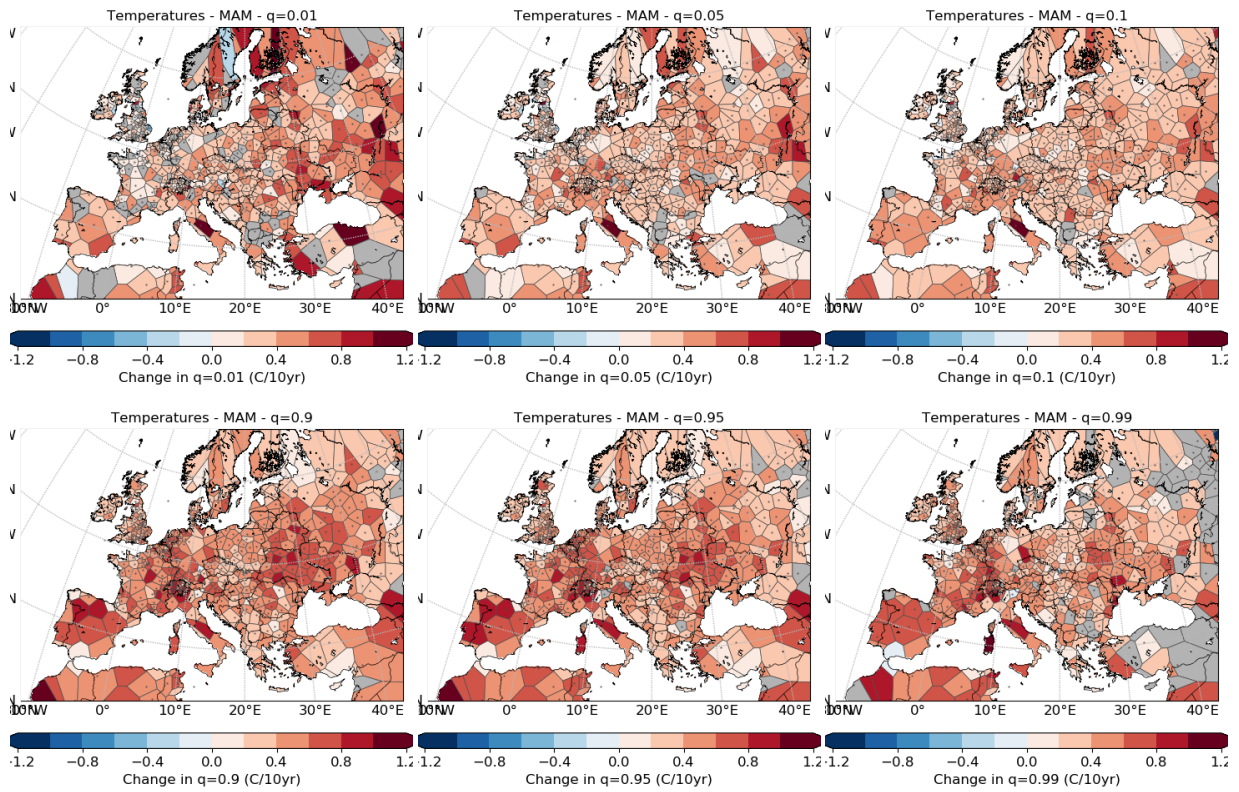
Figure 34. Trend over 1973-2017 in quantiles of temperature ($^{\circ}$C decade^{-1}) at TOP 0.01, 0.05 and 0.10; and BOTTOM 0.90, 0.95, 0.99 over Europe (MAM).
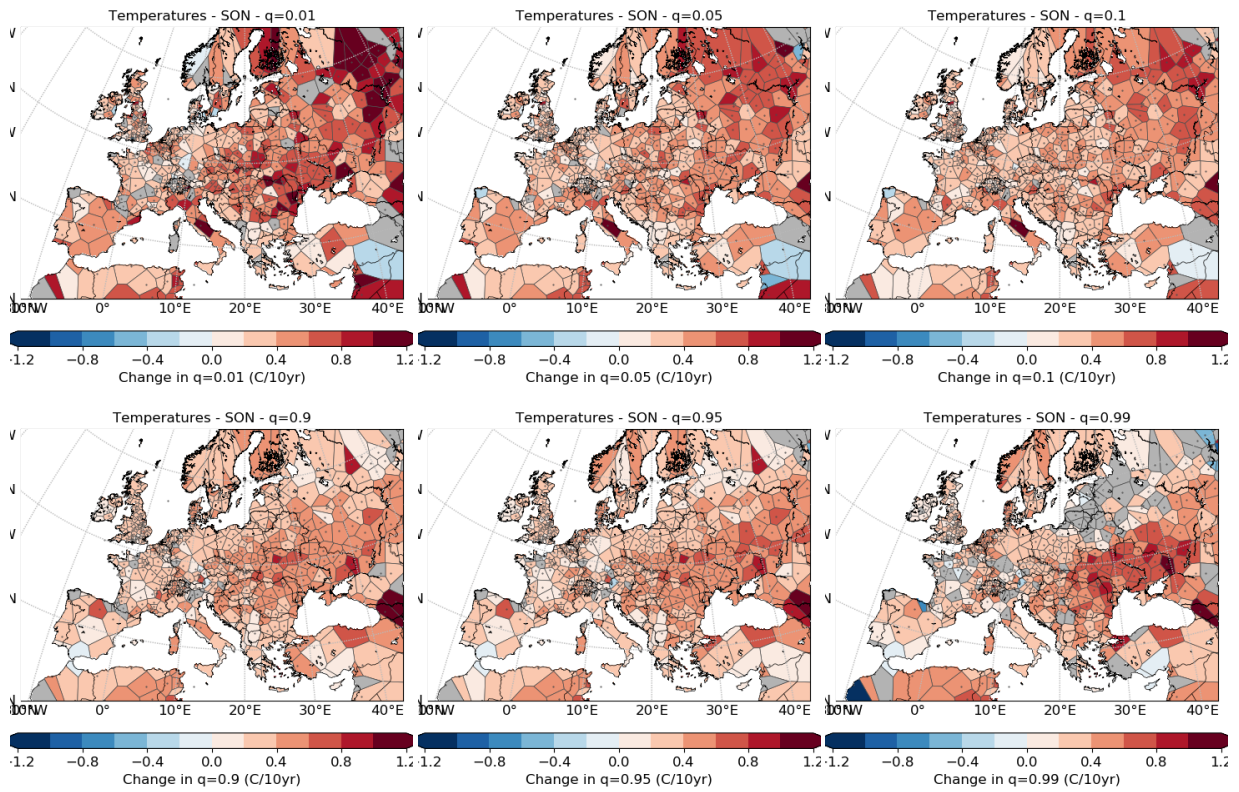
Figure 35. Trend over 1973-2017 in quantiles of temperature ($^\circ$C decade^{-1}) at TOP 0.01, 0.05 and 0.10; and BOTTOM 0.90, 0.95, 0.99 over Europe (SON).
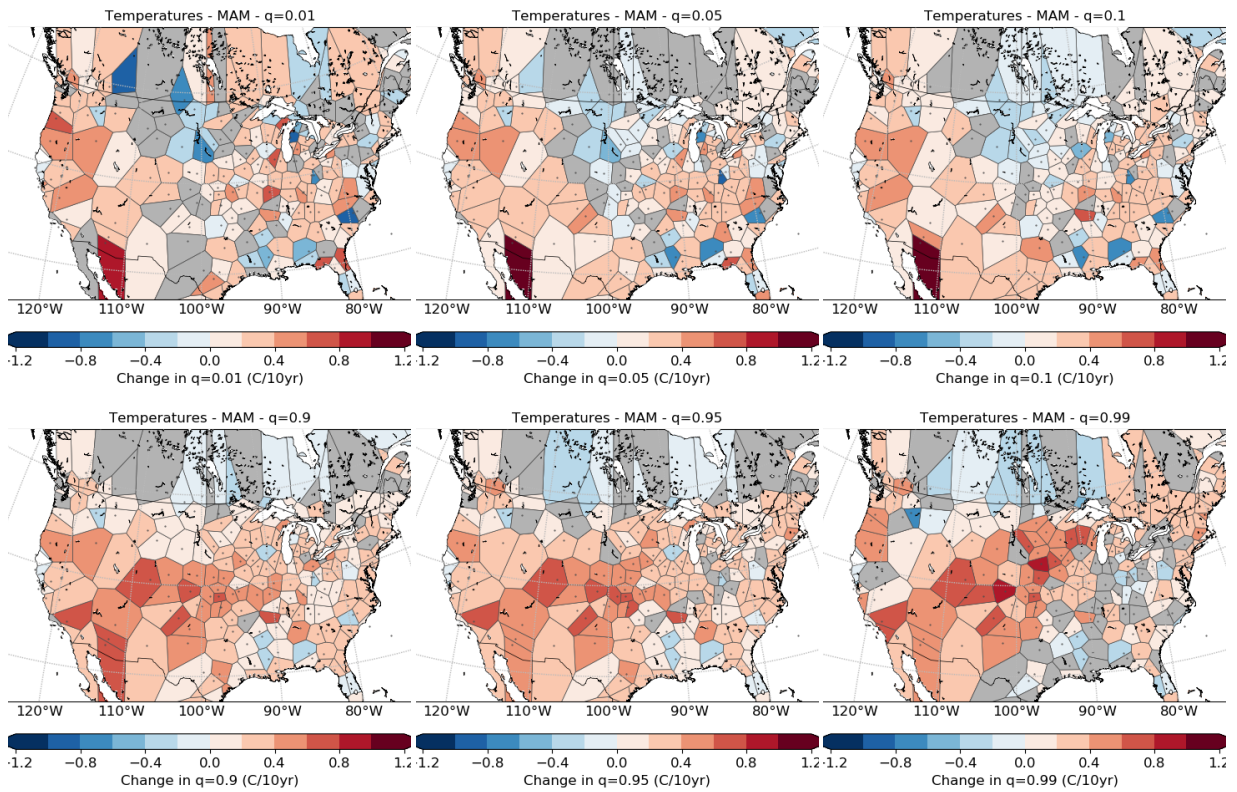
Figure 36. Trend over 1973-2017 in quantiles of temperature (°C decade^{-1}) at TOP 0.01, 0.05 and 0.10; and BOTTOM 0.90, 0.95, 0.99 over North America (MAM).
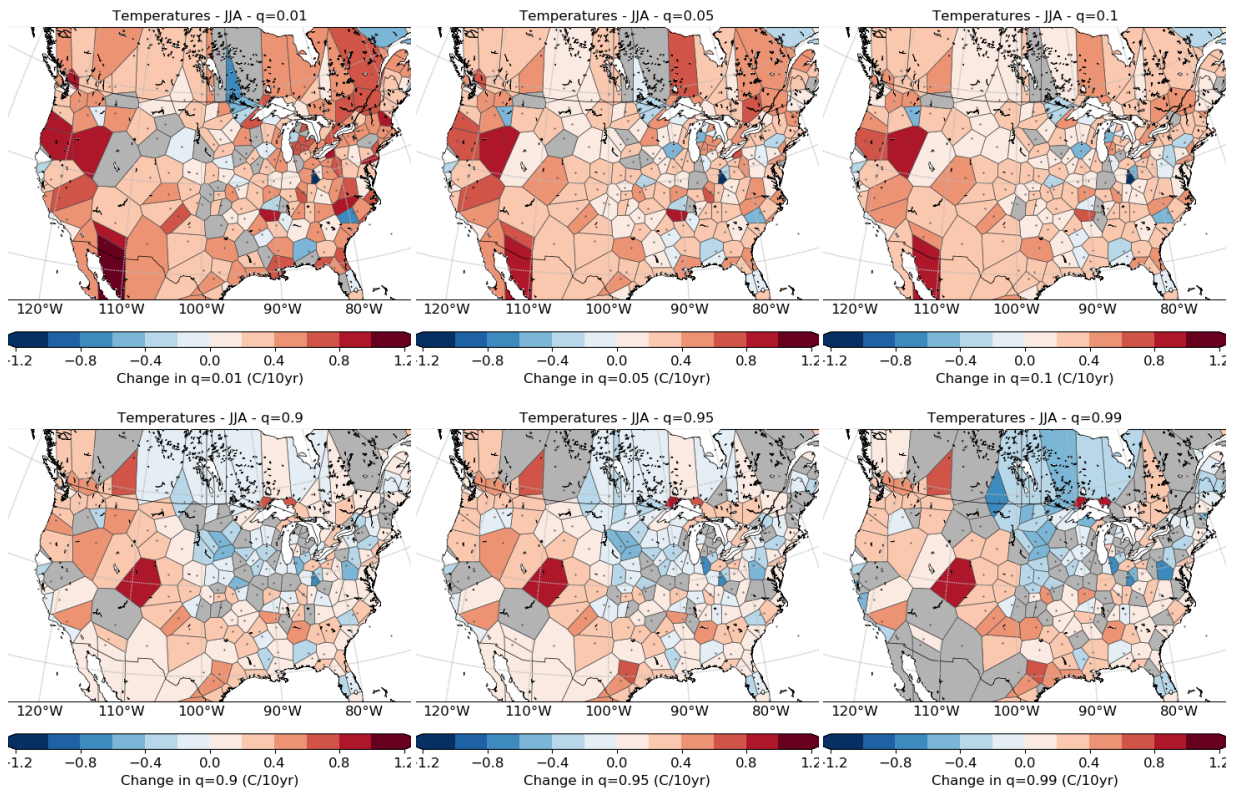
Figure 37. Trend over 1973-2017 in quantiles of temperature ($^{\circ}$C decade^{-1}) at TOP 0.01, 0.05 and 0.10; and BOTTOM 0.90, 0.95, 0.99 over North America (JJA).
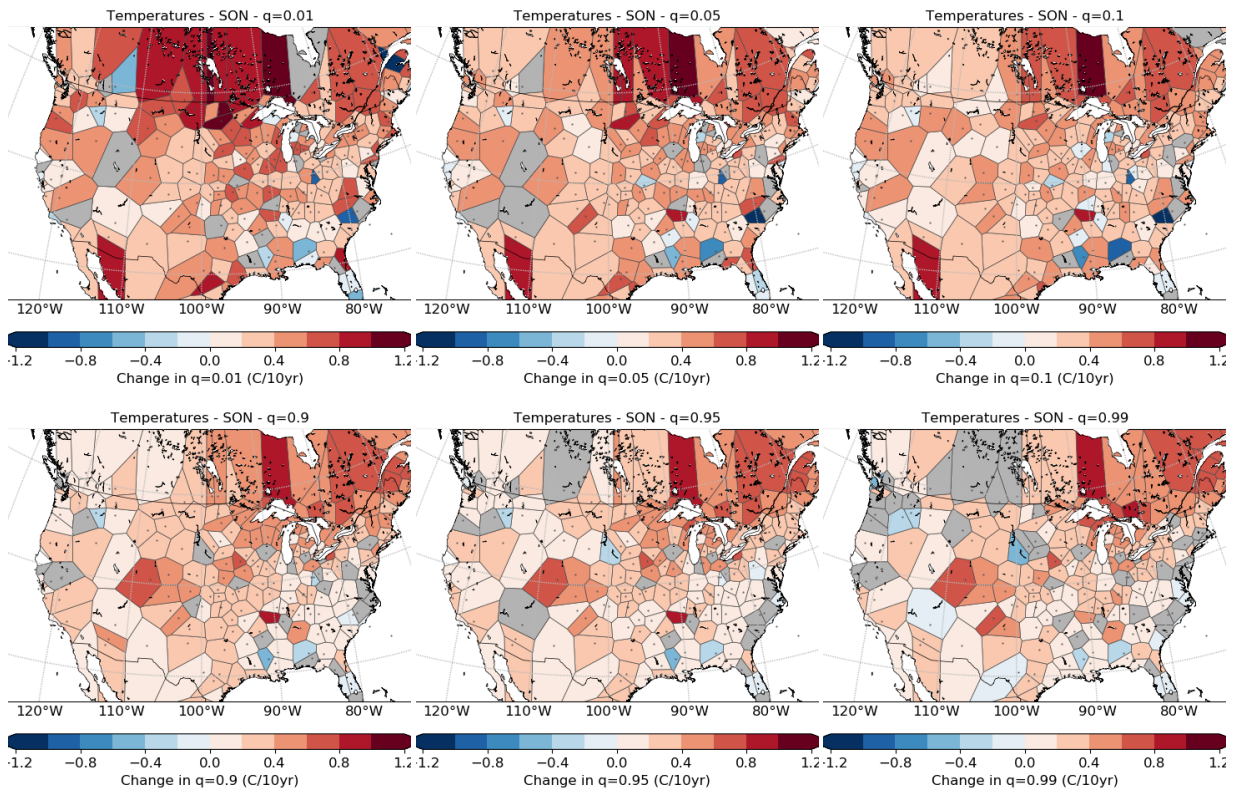
Figure 38. Trend over 1973-2017 in quantiles of temperature ($^{\circ}$C decade^{-1}) at TOP 0.01, 0.05 and 0.10; and BOTTOM 0.90, 0.95, 0.99 over North America (SON).
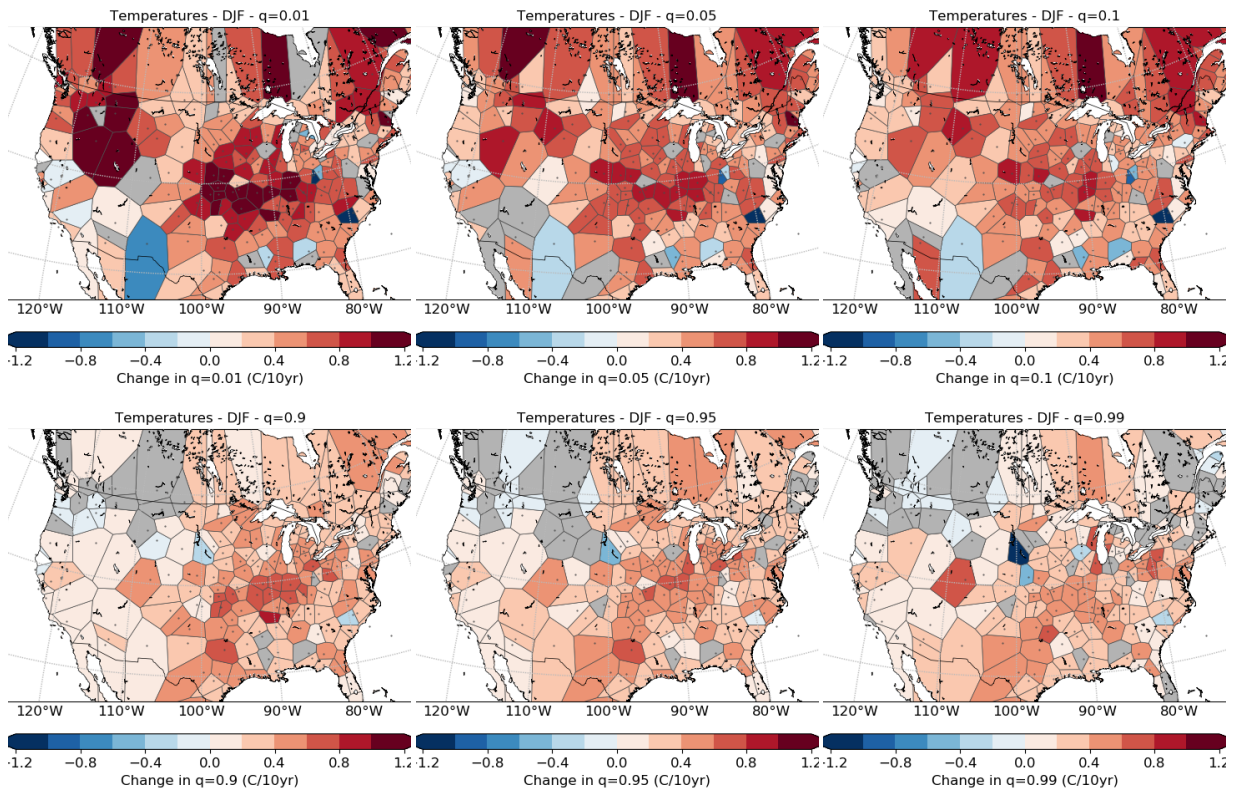
Figure 39. Trend over 1973-2017 in quantiles of temperature ($^{\circ}$C decade^{-1}) at TOP 0.01, 0.05 and 0.10; and BOTTOM 0.90, 0.95, 0.99 over North America (DJF.
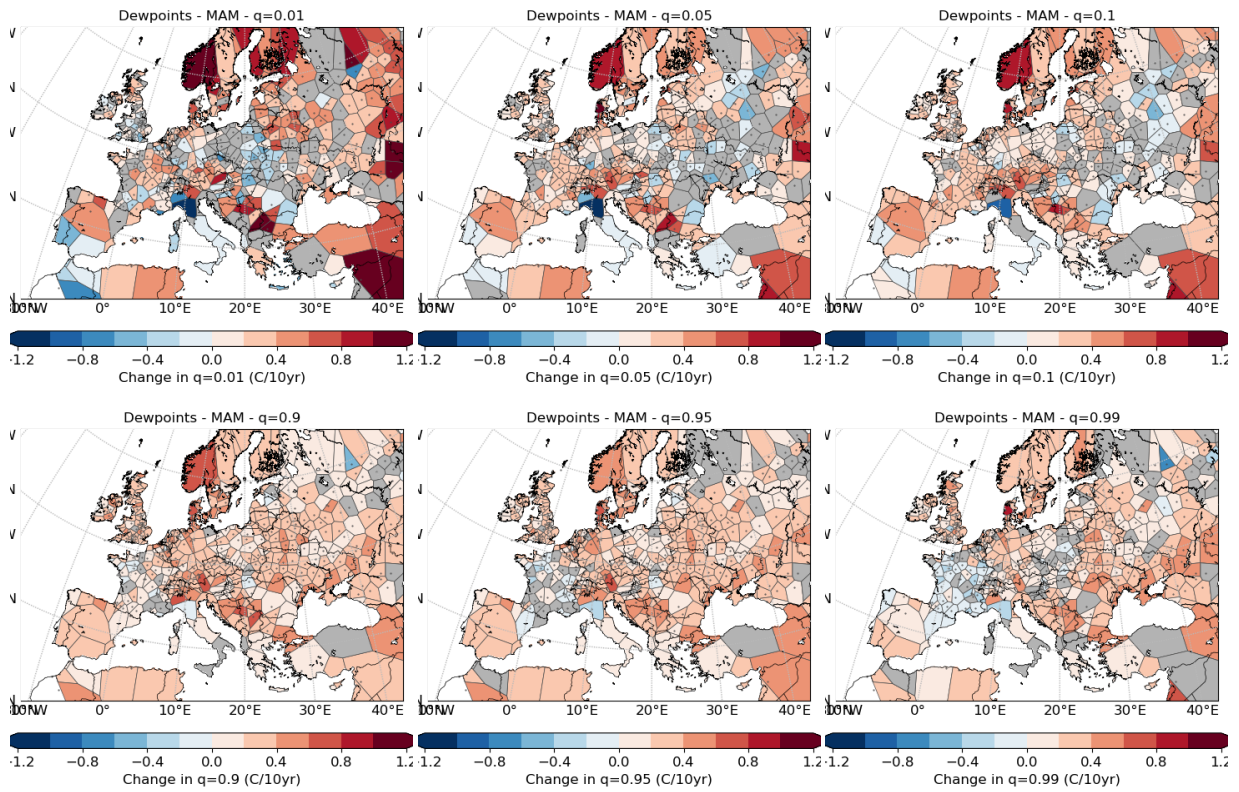
Figure 40. Trend over 1973-2017 in quantiles of dewpoint temperature ($^{\circ}$C decade^{-1}) at TOP 0.01, 0.05 and 0.10; and BOTTOM 0.90, 0.95, 0.99 over Europe (MAM).
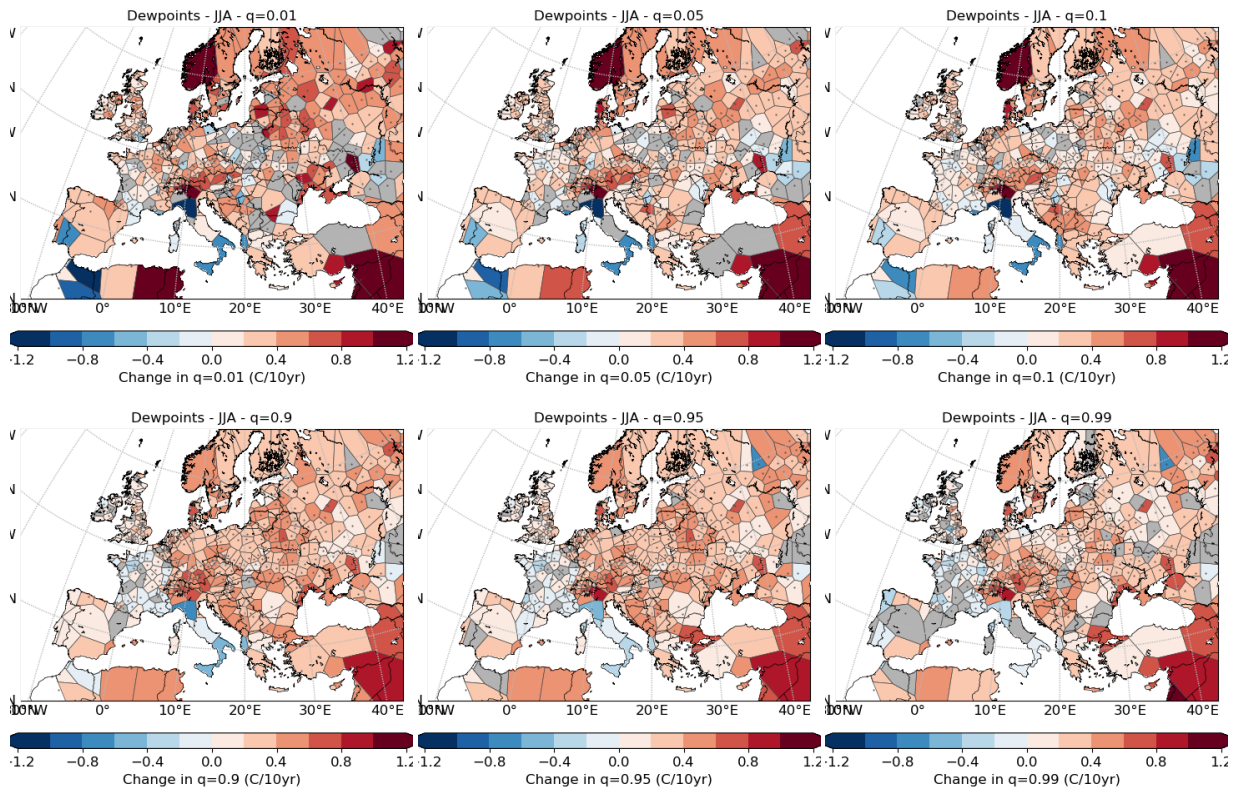
Figure 41. Trend over 1973-2017 in quantiles of dewpoint temperature (°C decade^{-1}) at TOP 0.01, 0.05 and 0.10; and BOTTOM 0.90, 0.95, 0.99 over Europe (JJA).
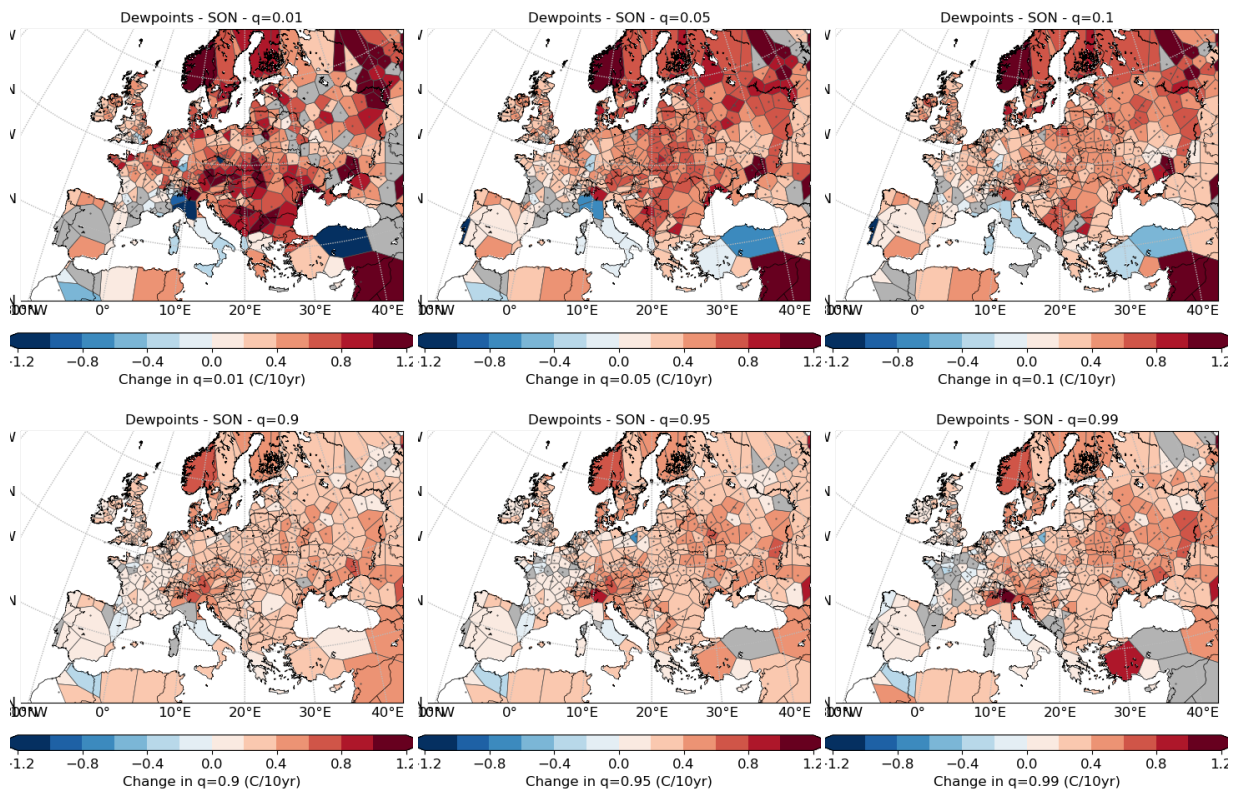
Figure 42. Trend over 1973-2017 in quantiles of dewpoint temperature ($^{\circ}$C decade^{-1}) at TOP 0.01, 0.05 and 0.10; and BOTTOM 0.90, 0.95, 0.99 over Europe (SON).
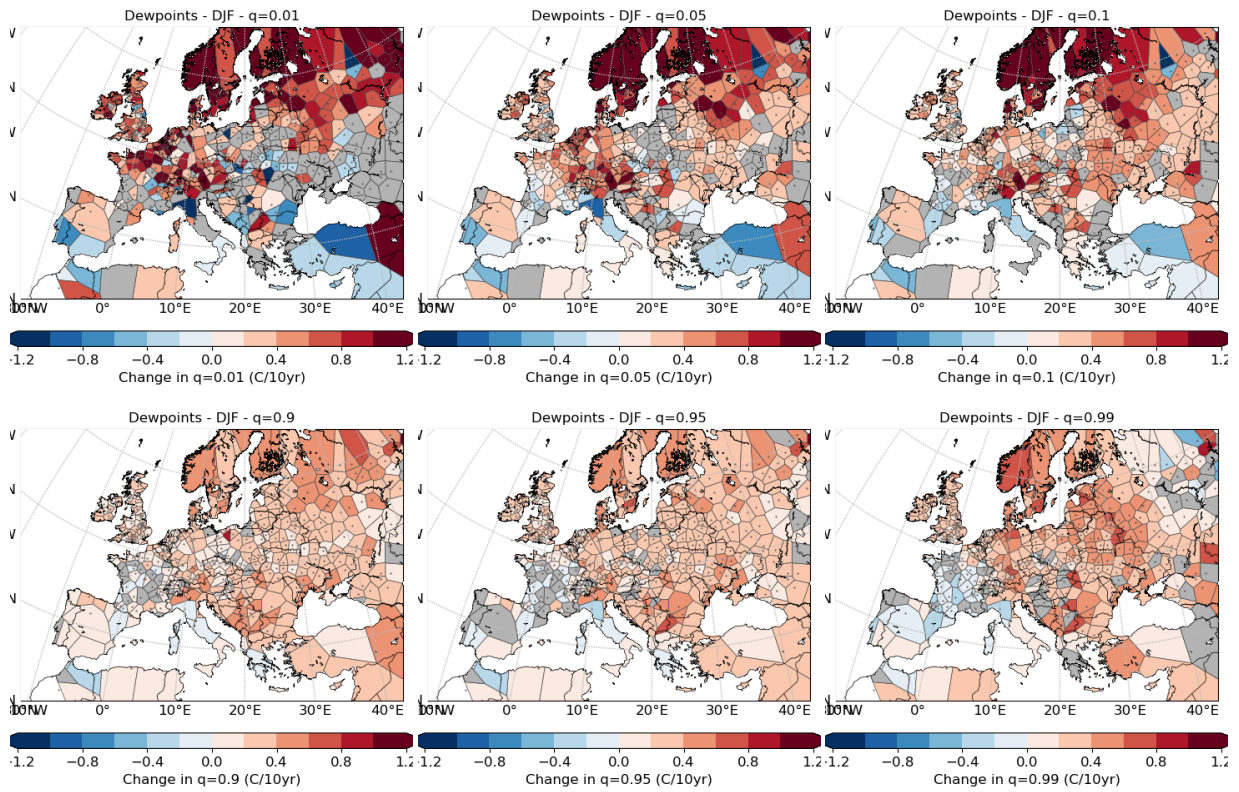
Figure 43. Trend over 1973-2017 in quantiles of dewpoint temperature ($^{\circ}$C decade^{-1}) at TOP 0.01, 0.05 and 0.10; and BOTTOM 0.90, 0.95, 0.99 over Europe (DJF).
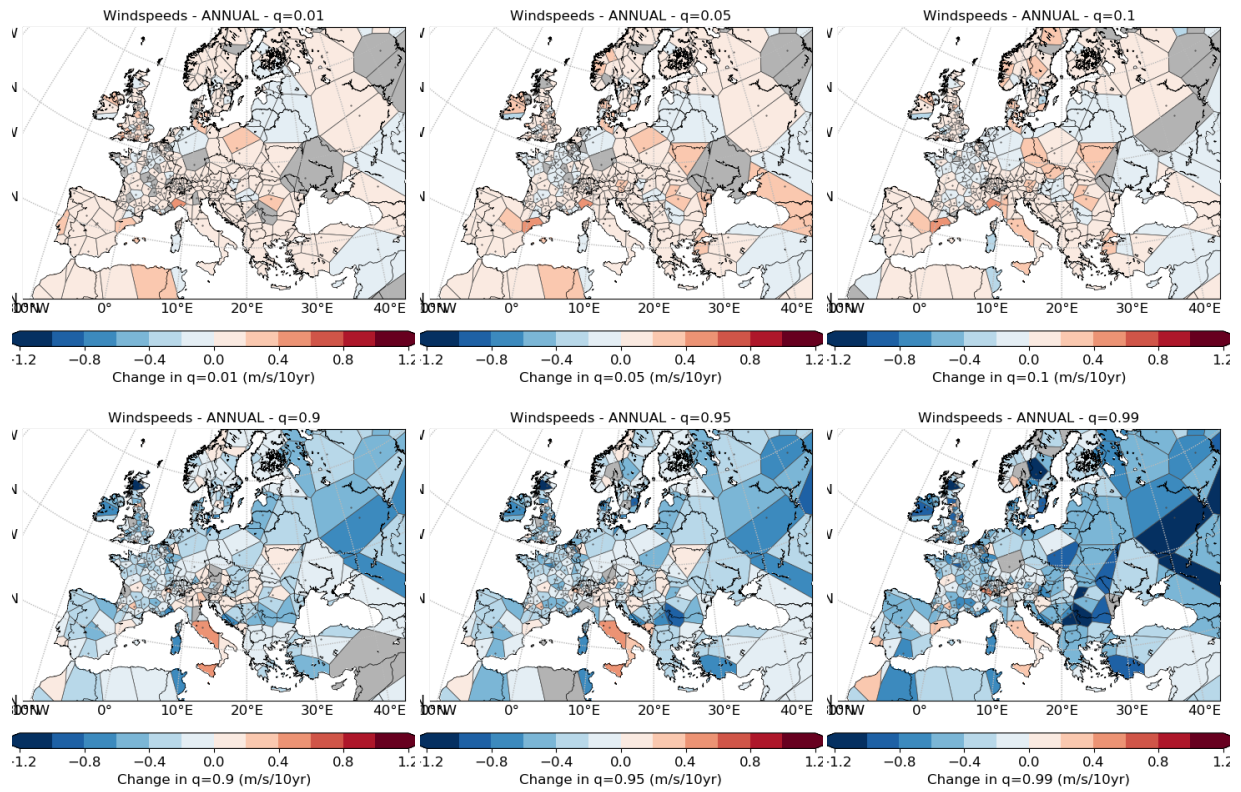
Figure 44. Trend over 1973-2017 in quantiles of wind speed (m s^{-1} decade^{-1}) at TOP 0.01, 0.05 and 0.10; and BOTTOM 0.90, 0.95, 0.99 over Europe (annual).