

# The Drought Regime in Southern Africa: additional results of the long-term space-time distribution of main drought descriptors

Fernando Maliti Chivangulula <sup>1,2</sup>, Malik Amraoui <sup>1</sup> and Mário Gonzalez Pereira <sup>1,3</sup>,

<sup>1</sup> Centre for Research and Technology of Agro-Environmental and Biological Sciences (CITAB), Inov4Agro, University of Trás-os-Montes and Alto Douro (UTAD), Quinta de Prados, 5000-801 Vila Real, Portugal; al75113@alunos.utad.pt, malik@utad.pt, gpereira@utad.pt

<sup>2</sup> Instituto Politécnico da Huíla (IPH), Universidade Mandume Ya Ndemufayo (UMN), Estrada Principal da Arimba, C.P. 776 Lubango, Angola; fmaliti@isph.umn.ed.ao

<sup>3</sup> Instituto Dom Luiz (IDL), FCUL, Campo Grande Edifício C1, Piso 1 1749-016 Lisboa, Portugal; gpereira@utad.pt

\* Correspondence: gpereira@utad.pt; Tel.: +351 259 350 728

## 1. Summary

This supplementary material aims to present part of the results obtained in this study to assess the drought regime in Southern Africa through the long-term spatiotemporal distribution of the main drought descriptors. These results are presented exclusively in the form of figures. The first figures aim to characterise the climate of the study region in terms of precipitation and trends in precipitation. Then, we mostly present figures to illustrate the spatial and temporal distribution of several drought descriptors evaluated based on the Standardised Precipitation and Evapotranspiration Index (SPEI) and only three figures based on the Standardised Precipitation Index (SPI).

2. Results

26

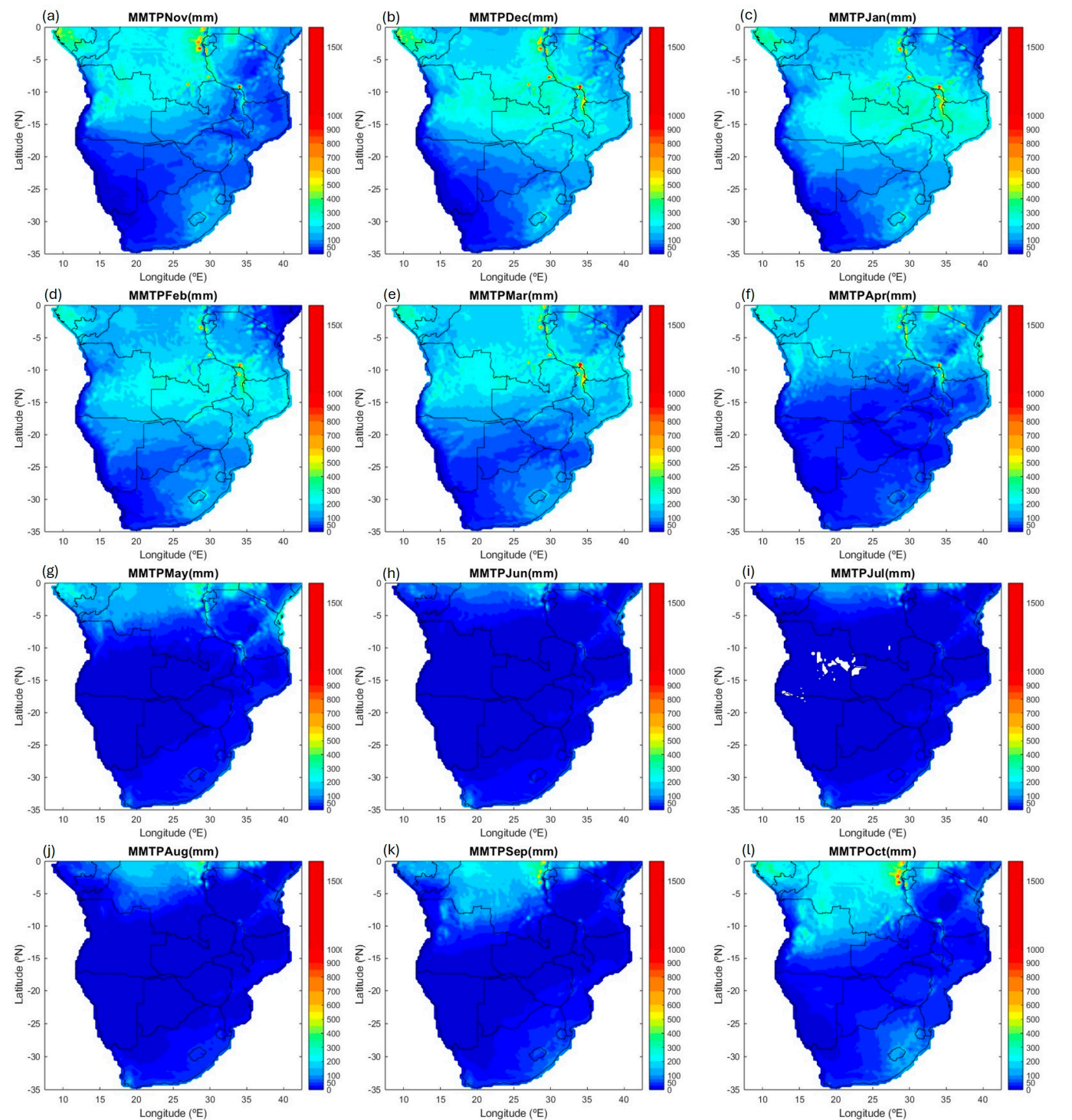
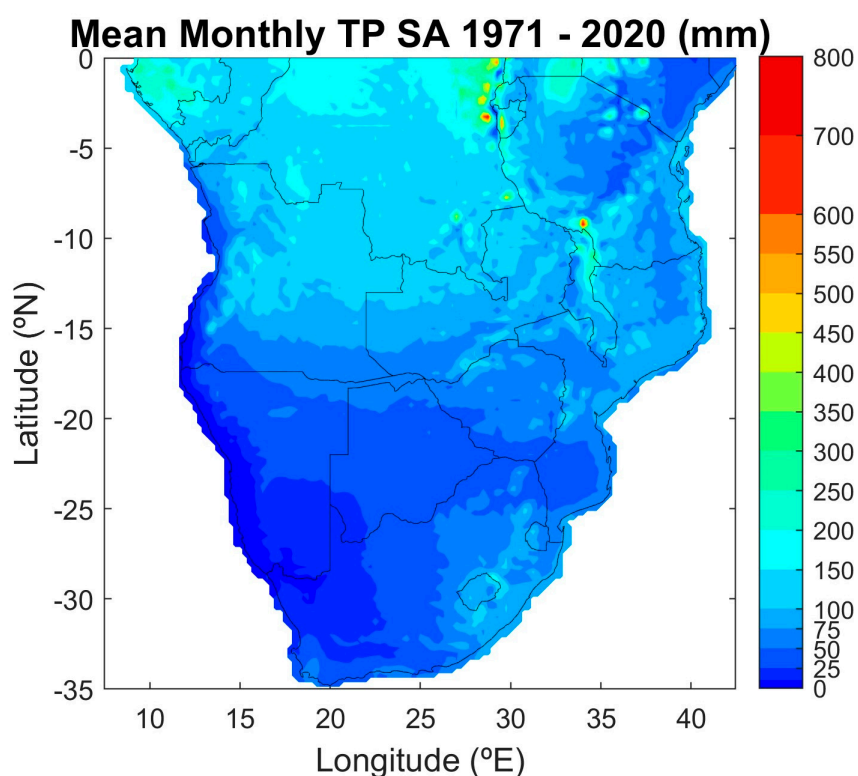
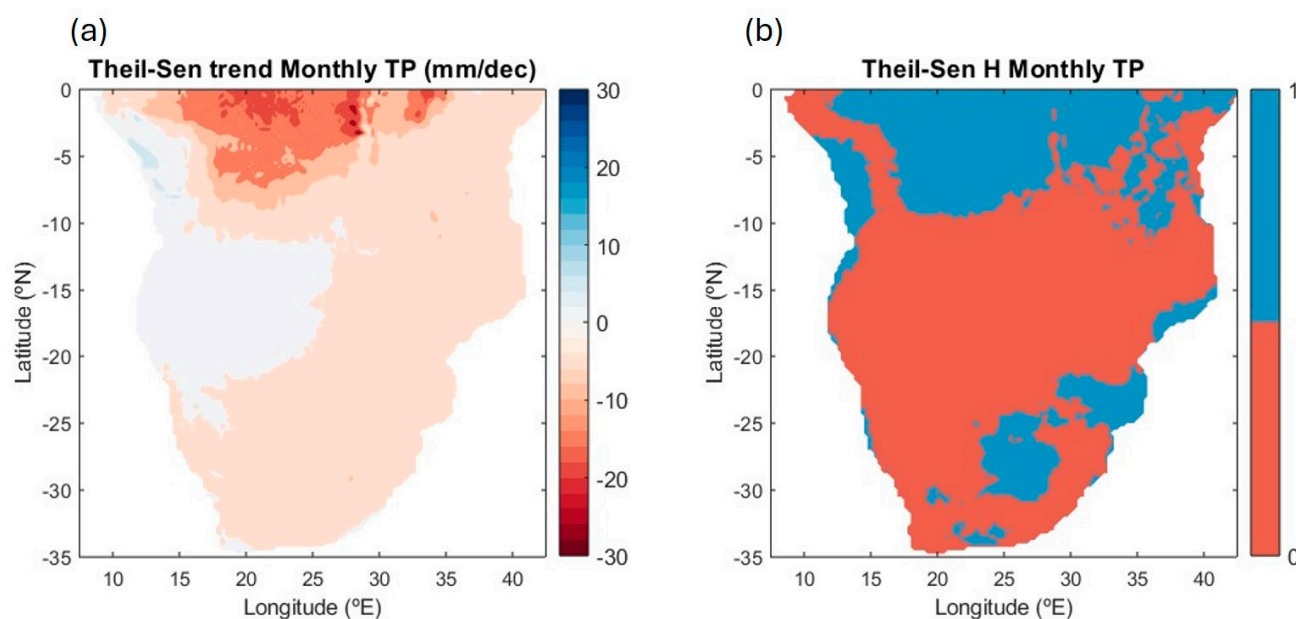


Figure S1. Average monthly precipitation in Southern Africa in the 1971–2020 period.

27  
28  
29  
30  
31  
32  
33  
34



**Figure S2.** Mean annual precipitation in Southern Africa in the 1971–2020 period.



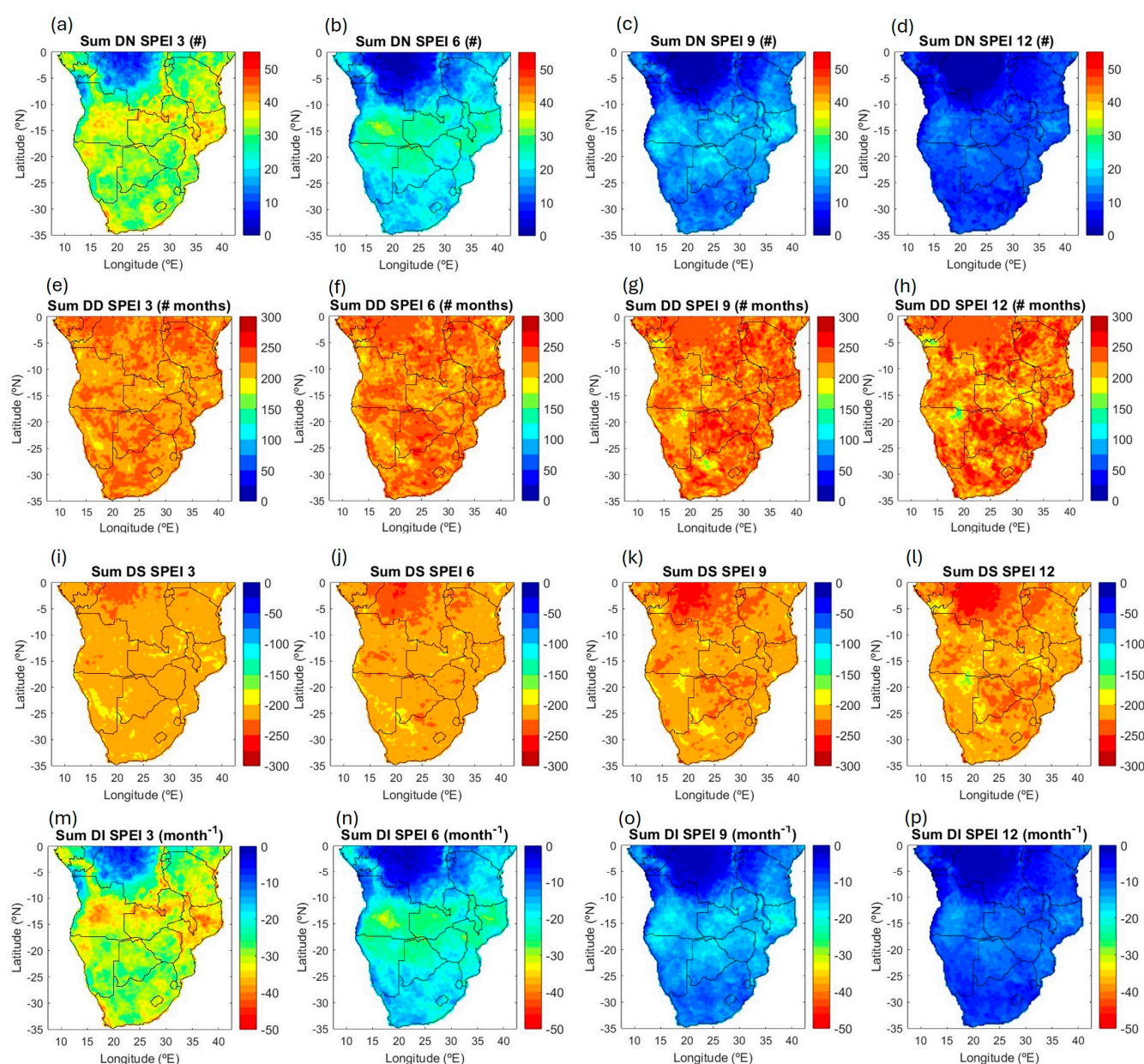
**Figure S3.** Results of the trend analysis carried out for monthly precipitation in SA during the 1971–2020 period, using the method of Theil–Sen, including (a) the Theil–Sen slope estimator and (b) the statistical significance, assessed with the Theil–Sen H hypothesis test. Regions with statistically significant trends are represented in blue ( $H = 1$ ).

35  
36

37  
38  
39  
40

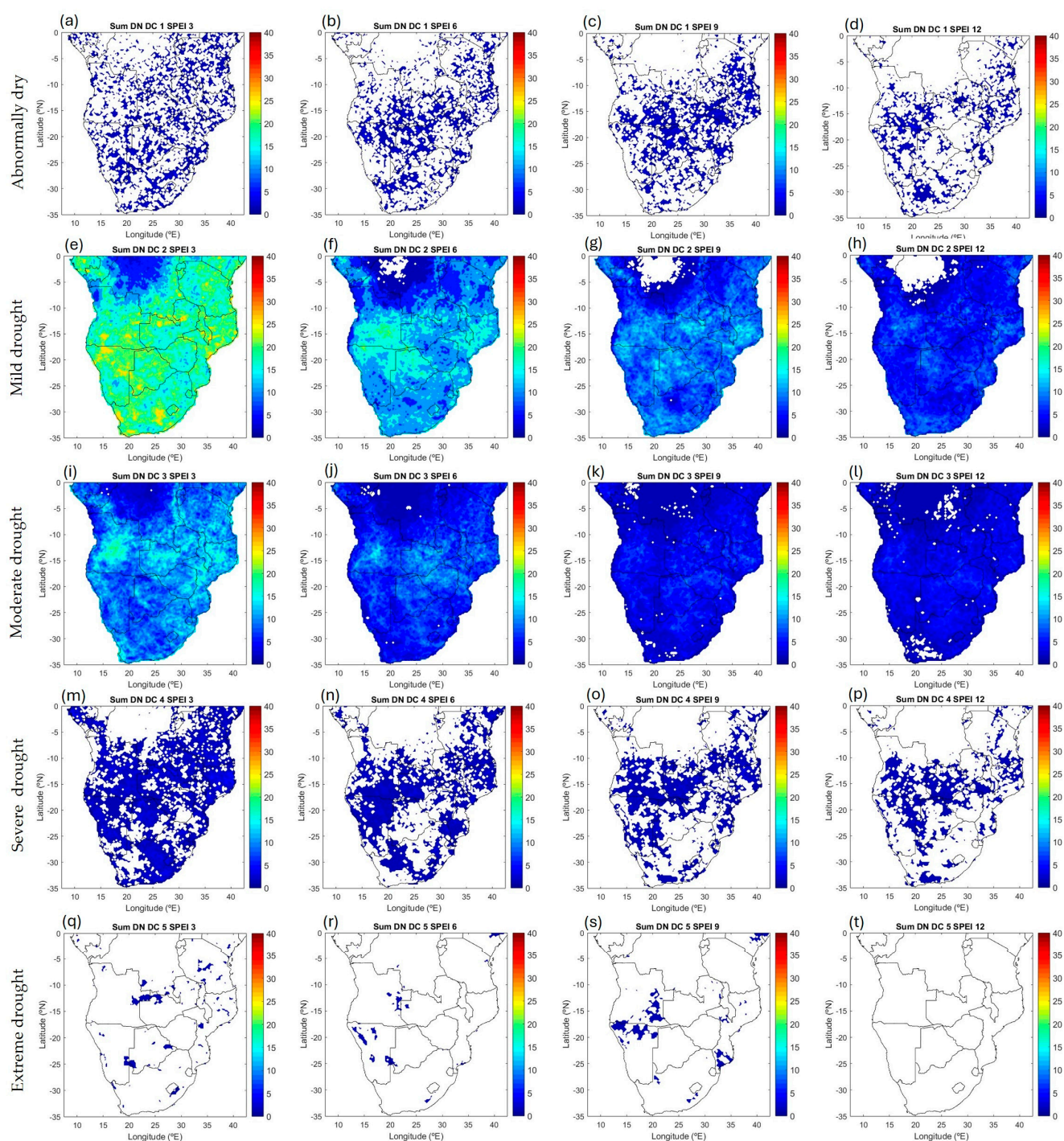
41



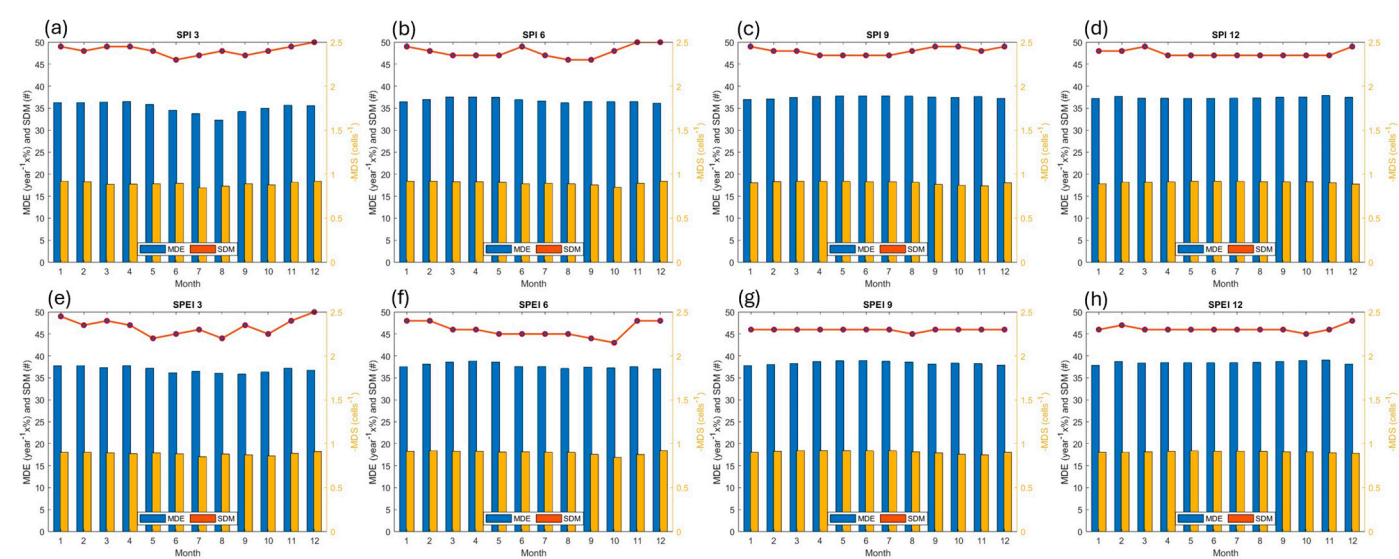


**Figure S4.** The Sum of the Drought Number (Sum DN, panels *a* to *d*), Drought Duration (Sum DD, panels *e* to *h*), Drought Severity (Sum DS, panels *i* to *l*) and Drought Index (Sum DI, panels *m* to *p*), assessed with the Standardised Precipitation Evapotranspiration Index (SPEI) at the 3-, 6-, 9- and 12-month timescales (from left to right), during the 1971–2020 period.





**Figure S5.** The Sum of the Drought Number (Sum DN) assessed with the Standardised Precipitation Evapotranspiration Index (SPEI) at the 3-, 6-, 9- and 12-month timescales (panels left to right), during the 1971–2020 period for each Drought Class (DC), namely, abnormally dry (DC 1, panels a to d), mild drought (DC 2, panels e to h), moderate drought (DC 3, panels i to l), severe drought (DC 4, panels m to p) and extreme drought (DC 5, panels q to t).



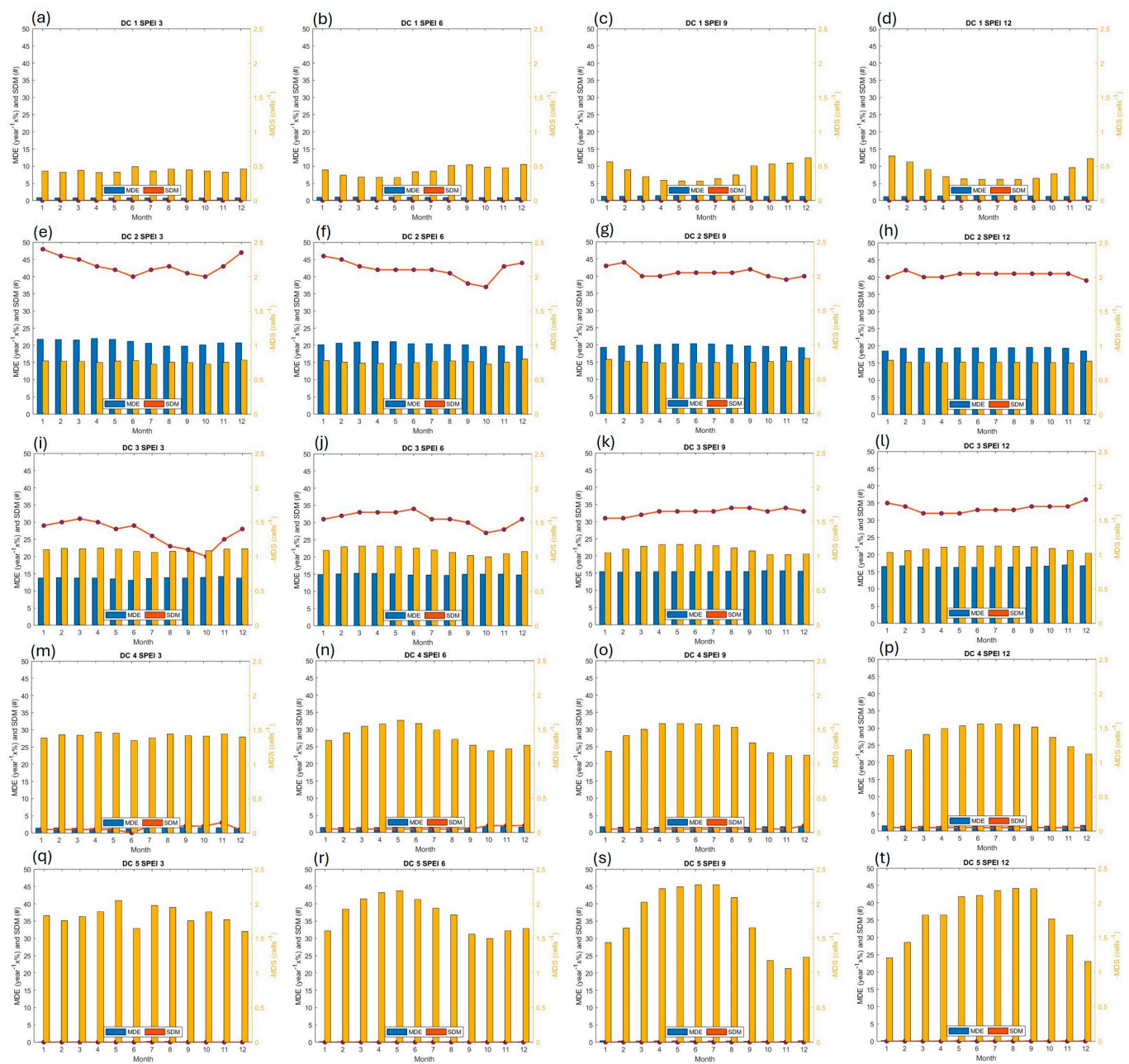
**Figure S6.** Intra-annual distribution of the Sum of Drought Months (SDM), Mean Drought Severity (MDS) and Mean Drought Extension (MDE) assessed with the Standardized Precipitation Index (SPI) (panels *a* to *d*) and the Standardised Precipitation Evapotranspiration Index (SPEI) (panels *e* to *h*) at timescales of 3, 6, 9 and 12 months (panels *a* to *d*), for the 1971–2020 period.

55  
56  
57  
58  
59  
60



**Figure S7.** Intra-annual distribution of Sum of Drought Months (SDM), Mean Drought Severity (MDS) and Mean Drought Extension (MDE) assessed with the SPI at the 3-, 6-, 9- and 12- month timescales (from left to right), for the 1971–2020 period and each Drought Class (DC), namely, abnormally dry (DC 1, panels a to d), mild drought (DC 2, panels e to h), moderate drought (DC 3, panels i to l), severe drought (DC 4, panels m to p) and extreme drought (DC 5, panels q to t).





**Figure S8.** Intra-annual distribution of Sum of Drought Months (SDM), Mean Drought Severity (MDS) and Mean Drought Extension (MDE) assessed with the Standardised Precipitation Evapotranspiration Index (SPEI) at the 3-, 6-, 9- and 12-month timescales (from left to right), for the 1971–2020 period and each Drought Class (DC), namely, abnormally dry (DC 1, panels *a* to *d*), mild drought (DC 2, panels *e* to *h*), moderate drought (DC 3, panels *i* to *l*), severe drought (DC 4, panels *m* to *p*) and extreme drought (DC 5, panels *q* to *t*).

68

69

70

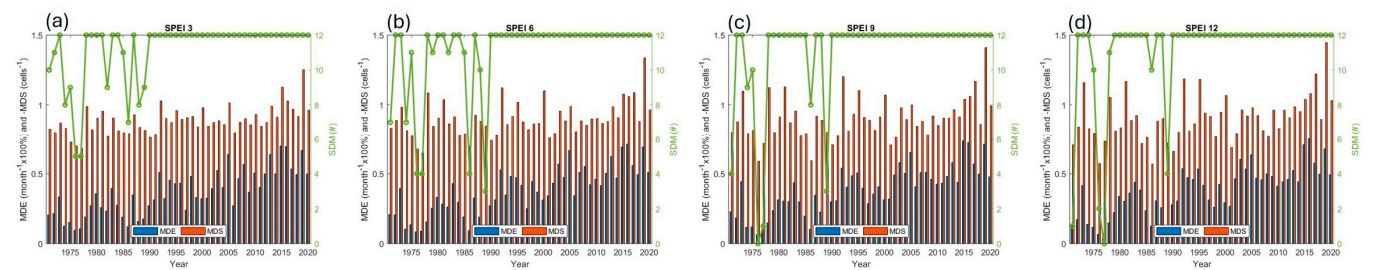
71

72

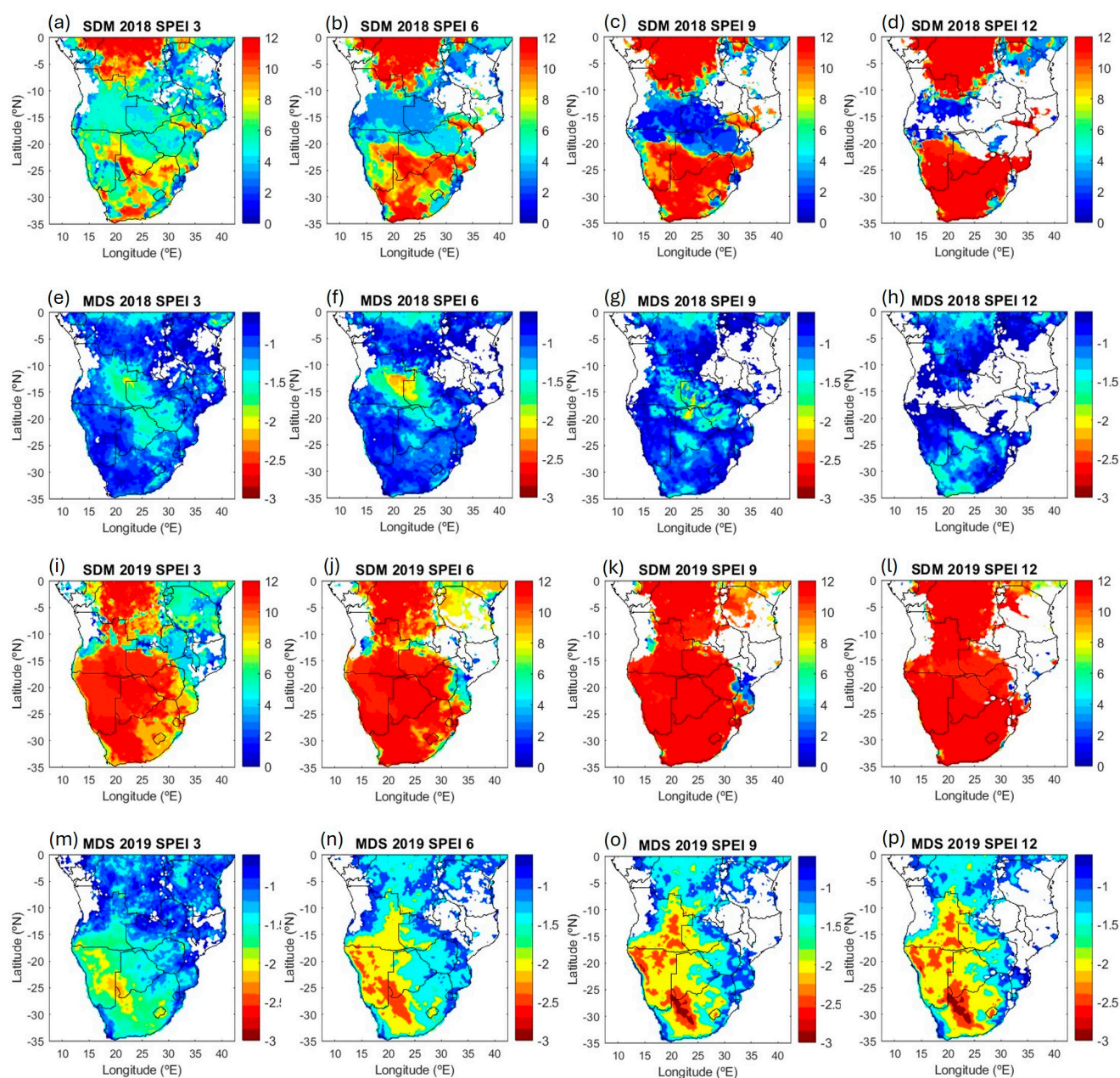
73

74

75



**Figure S9.** Interannual distribution of the Sum of Drought Months (SDM), Mean Drought Severity (MDS) and Mean Drought Extension (MDE) assessed with the Standardised Precipitation Evapo-transpiration Index (SPEI) at the 3-, 6-, 9- and 12-month timescale (panels *a* to *d*), for the 1971–2020 period.



**Figure S10.** Spatial distribution of the annual Sum of Drought Months (SDM) for 2018 (panels *a* to *d*) and 2019 (panels *e* to *h*) and the Mean Drought Severity (MDS) also for 2018 (panels *i* to *l*) and 2019 (panels *m* to *p*), computed with the Standardised Precipitation Evapotranspiration Index (SPEI) at timescales of 3, 6, 9 and 12 months (from left to right).

83

84

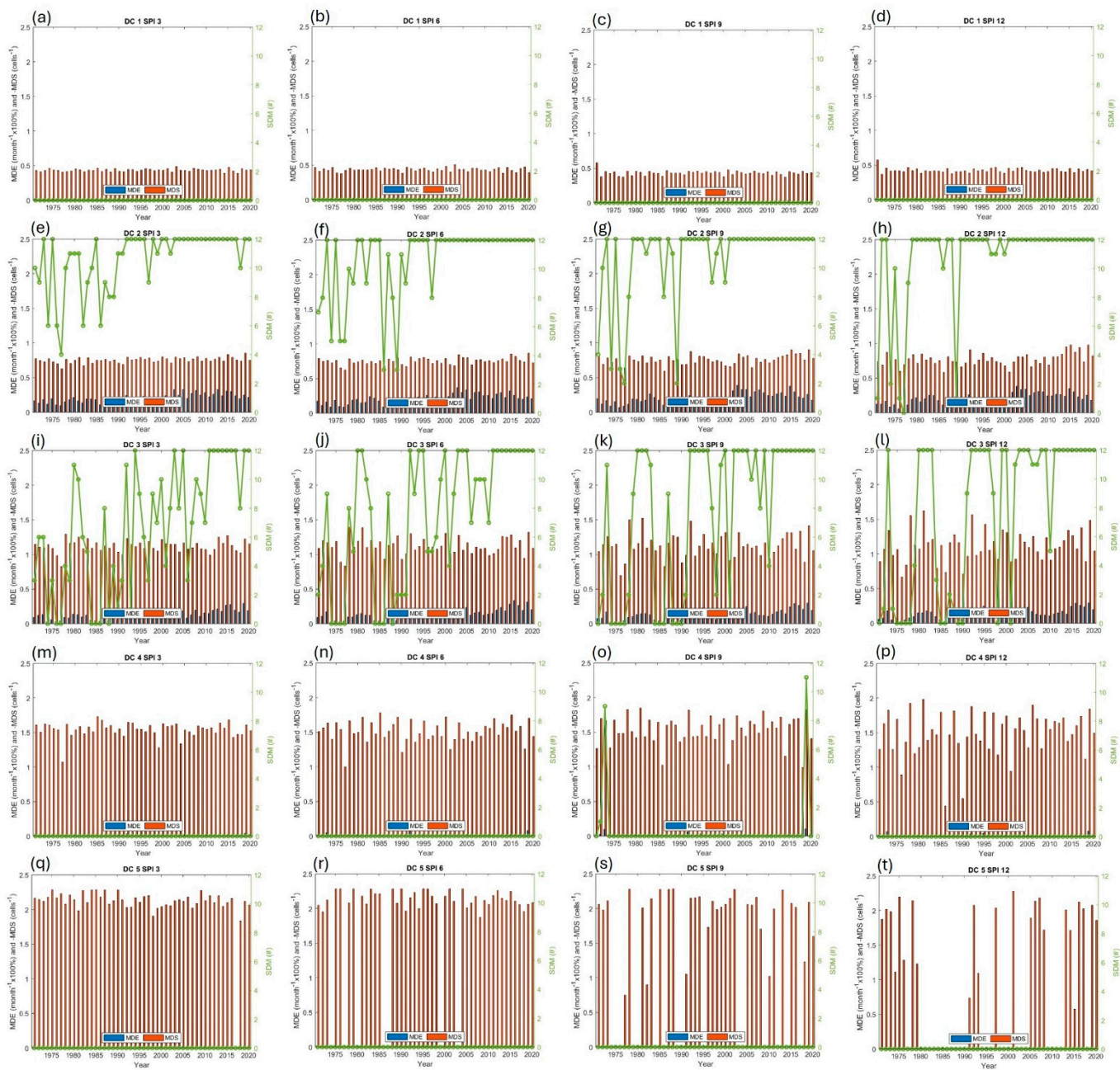
85

86

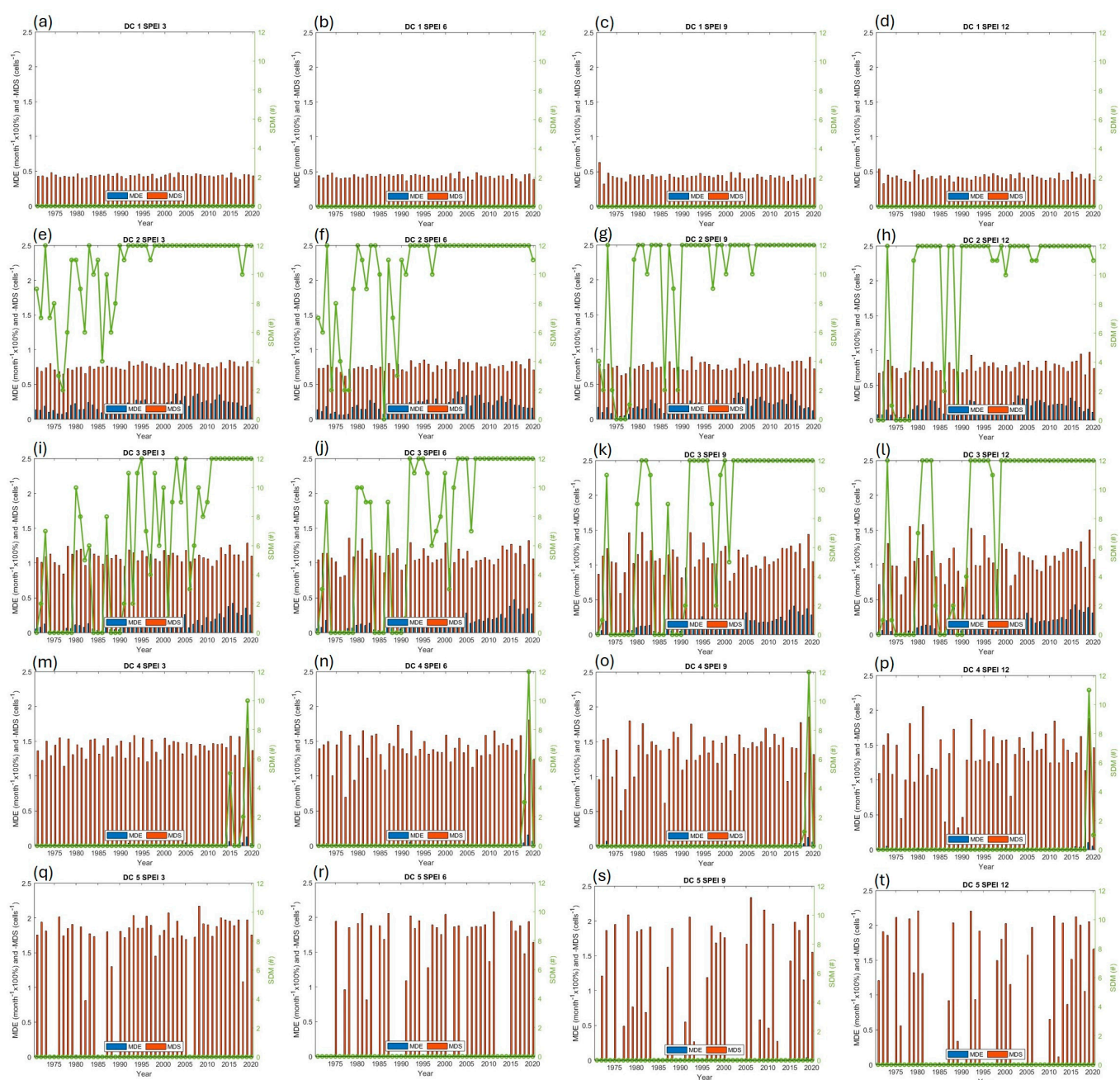
87

88



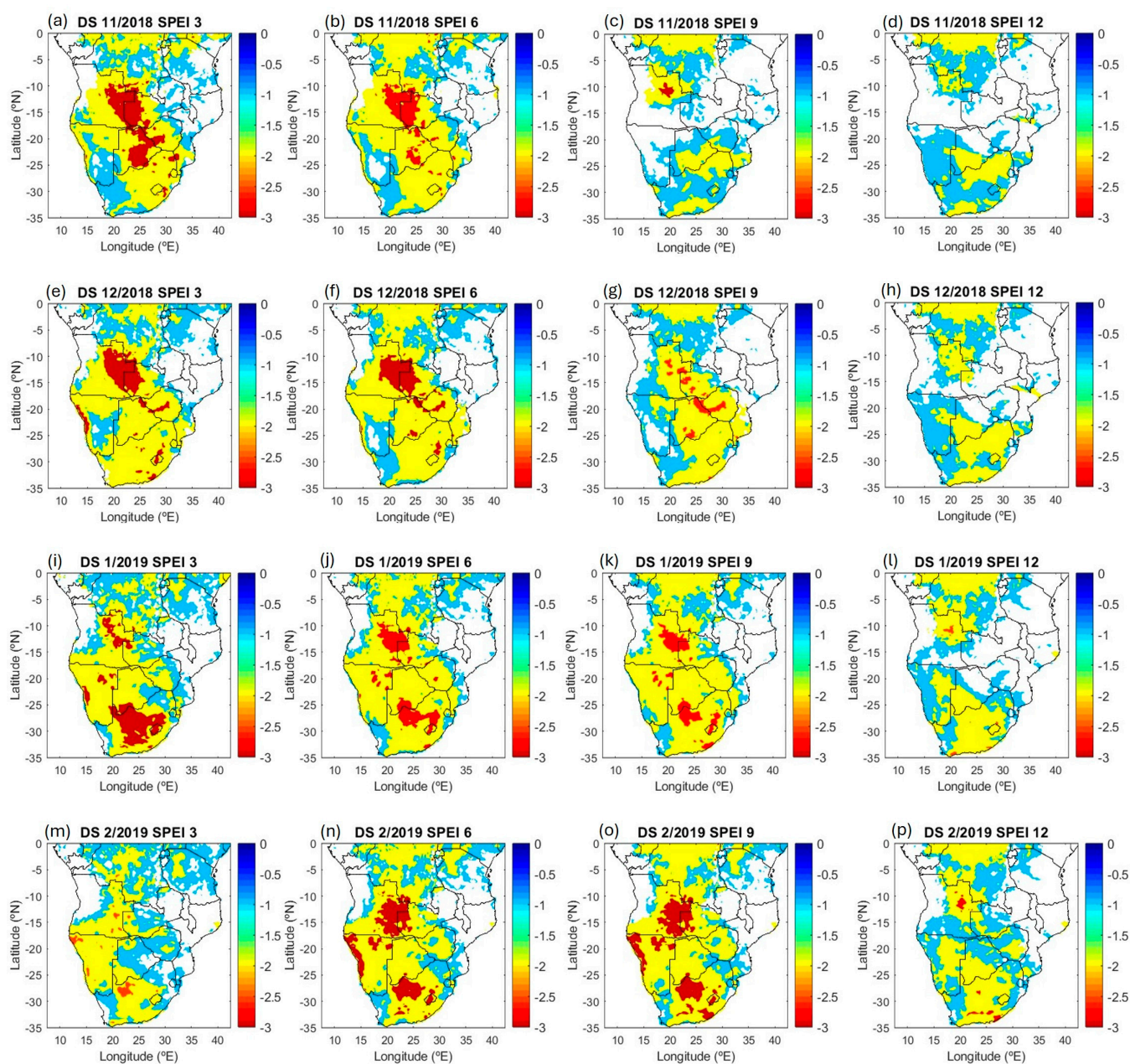


**Figure S11.** Interannual distribution of Sum of Drought Months (SDM), Mean Drought Severity (MDS) and Mean Drought Extension (MDE) assessed with the SPI at 3-, 6-, 9- and 12-month scales (from left to right), during the 1971–2020 period, for each Drought Class (DC), namely, abnormally dry (DC 1, panels a to d), mild drought (DC 2, panels e to h), moderate drought (DC 3, panels i to l), severe drought (DC 4, panels m to p) and extreme drought (DC 5, panels q to t).



**Figure S12.** Interannual distribution of Sum of Drought Months (SDM), Mean Drought Severity (MDS) and Mean Drought Extension (MDE) assessed with the Standardised Precipitation Evapotranspiration Index (SPEI), at 3, 6, 9 and 12-month timescales (from left to right), during the 1971–2020 period, for each Drought Class (DC), namely, abnormally dry (DC 1, panels *a* to *d*), mild drought (DC 2, panels *e* to *h*), moderate drought (DC 3, panels *i* to *l*), severe drought (DC 4, panels *m* to *p*) and extreme drought (DC 5, panels *q* to *t*).





**Figure S13.** Drought Severity (DS) for November (panels *a* to *d*) and December (panels *e* to *h*) 2018, January (panels *i* to *l*) and February (panels *m* to *p*) 2019, computed with the Standardised Precipitation Evapotranspiration Index (SPEI), at the 3-, 6-, 9- and 12-month timescales (from left to right).

104

105

106

107