Supplement of Hydrol. Earth Syst. Sci., 30, 2685–2701, 2026
https://doi.org/10.5194/hess-30-2685-2026-supplement

Hydrology and Earth System Sciences
Open Access
EGU

Supplement of

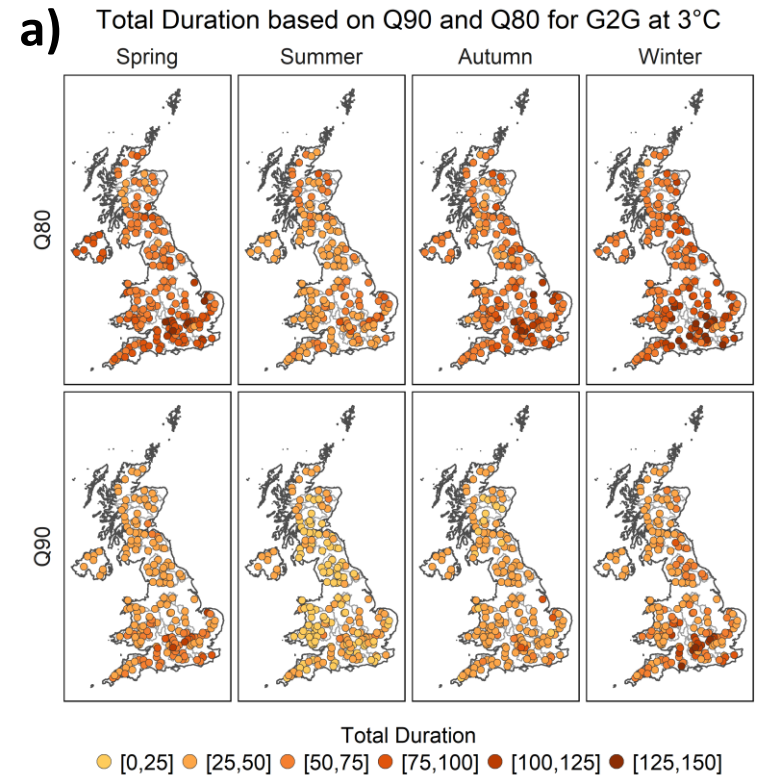
Evolution of nonstationary hydrological drought characteristics in the UK under warming

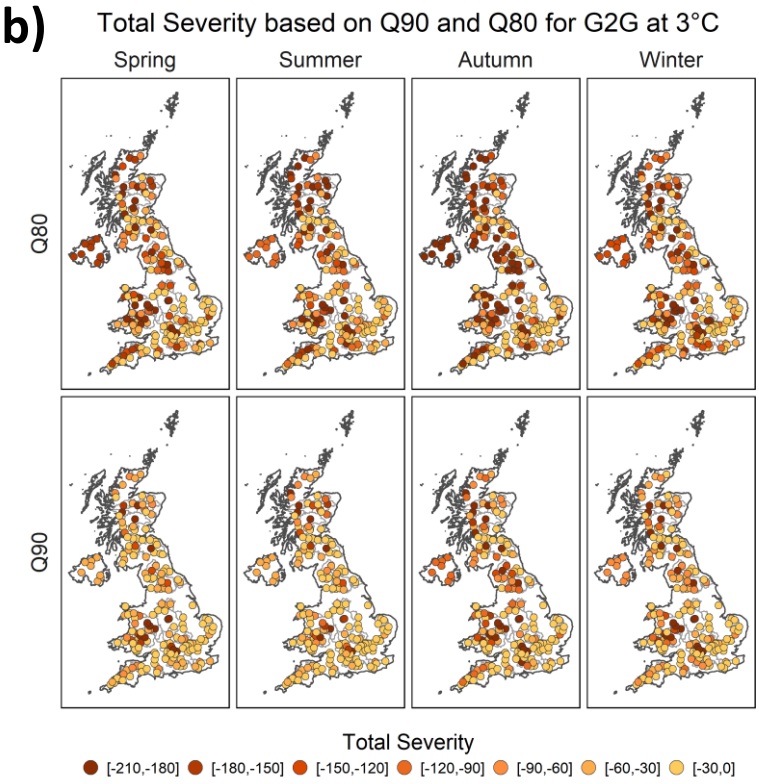
Srinidhi Jha et al.

Correspondence to: Srinidhi Jha (srijha@ceh.ac.uk)

List of figures:

List of Tables:


a)
Total Duration based on Q90 and Q80 for G2G at 3°C
Spring
Summer
Autumn
Winter
Q80
Q90
Total Duration
[0,25] [25,50] [50,75] [75,100] [100,125] [125,150]


b)
Total Severity based on Q90 and Q80 for G2G at 3°C
Spring
Summer
Autumn
Winter
Q80
Q90
Total Severity
[-210,-180] [-180,-150] [-150,-120] [-120,-90] [-90,-60] [-60,-30] [-30,0]

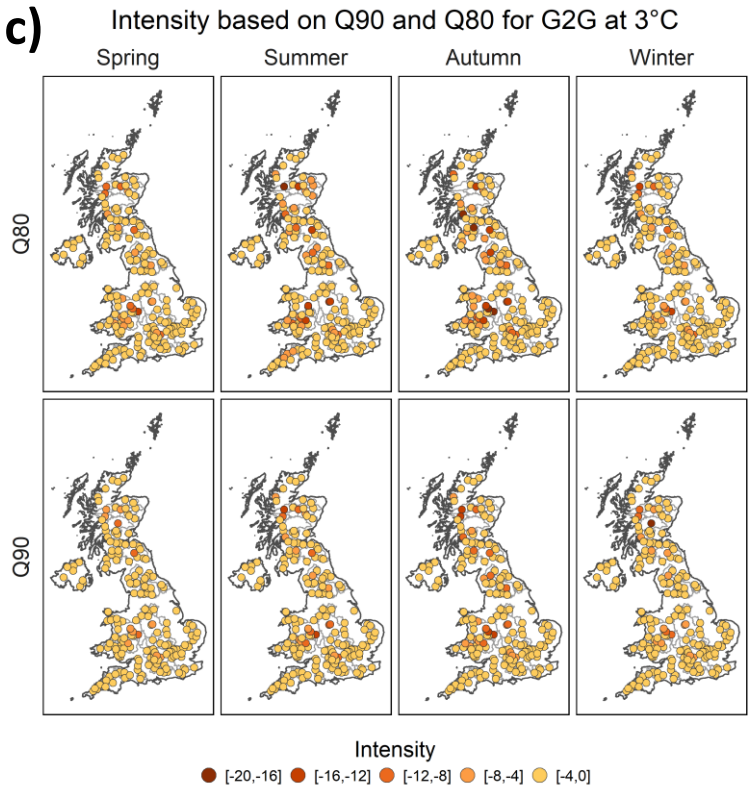
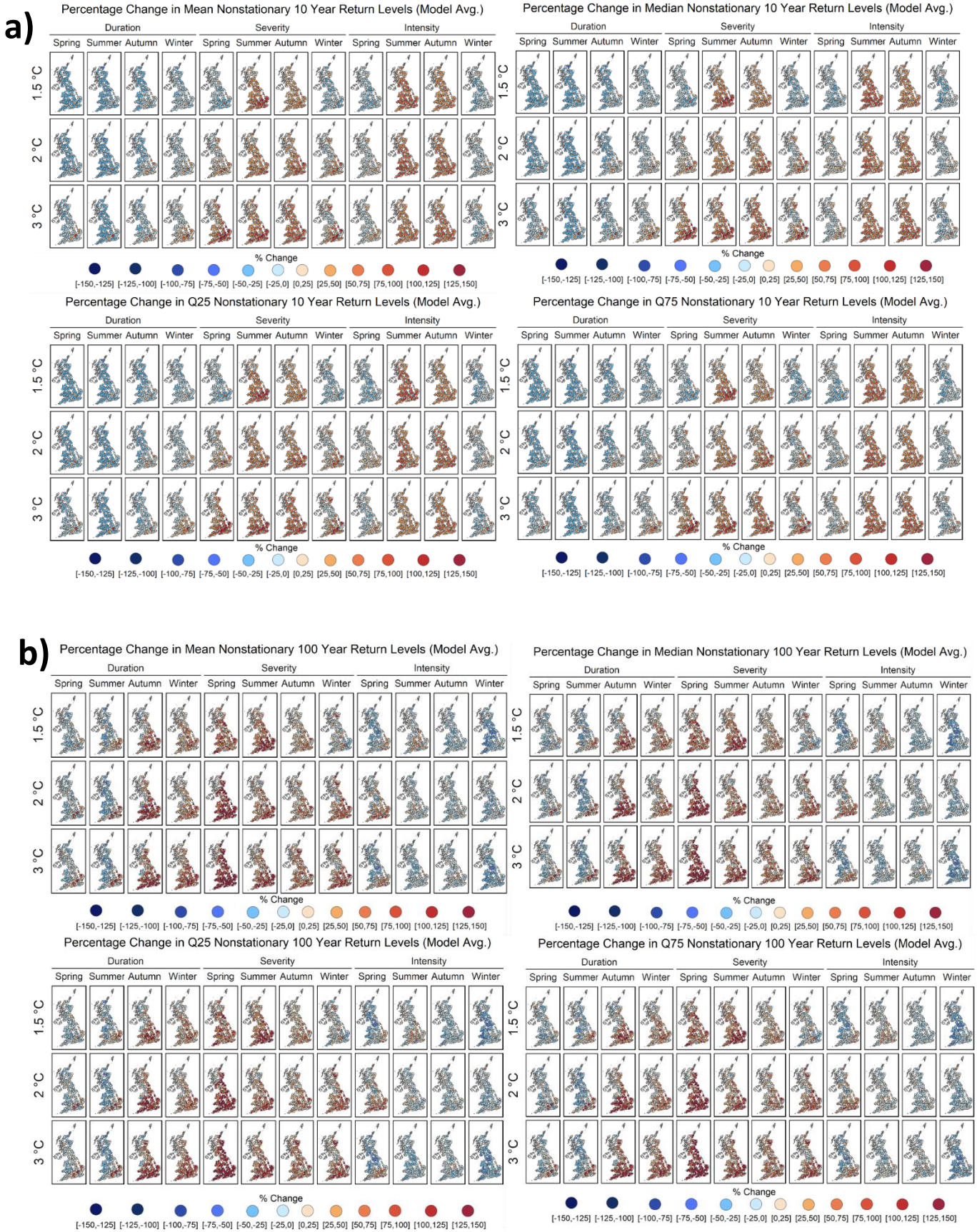


Figure S1. Spatial distribution of drought **a)** duration **b)** severity and **c)** intensity over UK for G2G model and 3°C warming across different seasons using Q80 and Q90 thresholds.


a)
Percentage Change in Mean Nonstationary 10 Year Return Levels (Model Avg.)
Percentage Change in Median Nonstationary 10 Year Return Levels (Model Avg.)
Percentage Change in Q25 Nonstationary 10 Year Return Levels (Model Avg.)
Percentage Change in Q75 Nonstationary 10 Year Return Levels (Model Avg.)
b)
Percentage Change in Mean Nonstationary 100 Year Return Levels (Model Avg.)
Percentage Change in Median Nonstationary 100 Year Return Levels (Model Avg.)
Percentage Change in Q25 Nonstationary 100 Year Return Levels (Model Avg.)
Percentage Change in Q75 Nonstationary 100 Year Return Levels (Model Avg.)
Duration
Severity
Intensity
Spring
Summer
Autumn
Winter
1.5 °C
2 °C
3 °C
% Change
[-150,-125]
[-125,-100]
[-100,-75]
[-75,-50]
[-50,-25]
[-25,0]
[0,25]
[25,50]
[50,75]
[75,100]
[100,125]
[125,150]

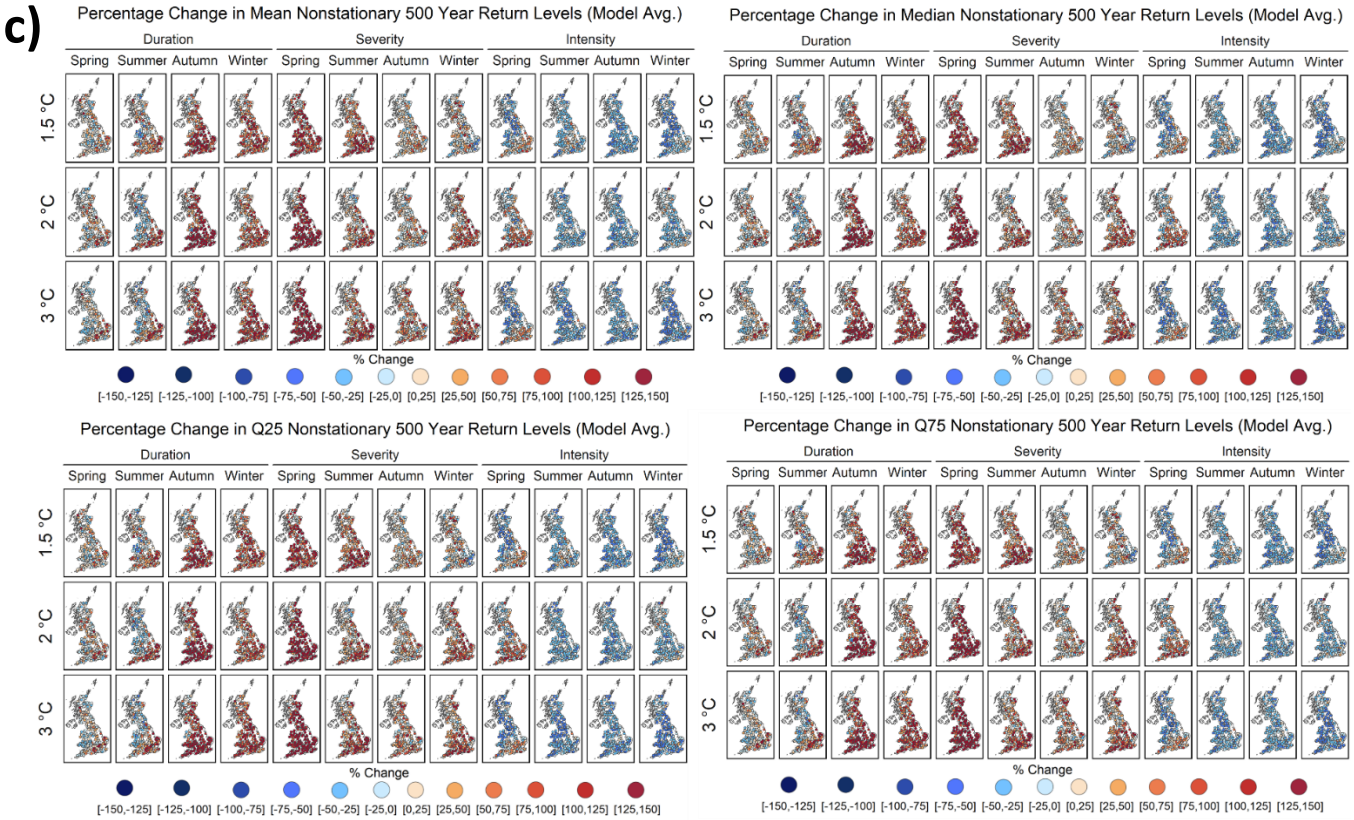
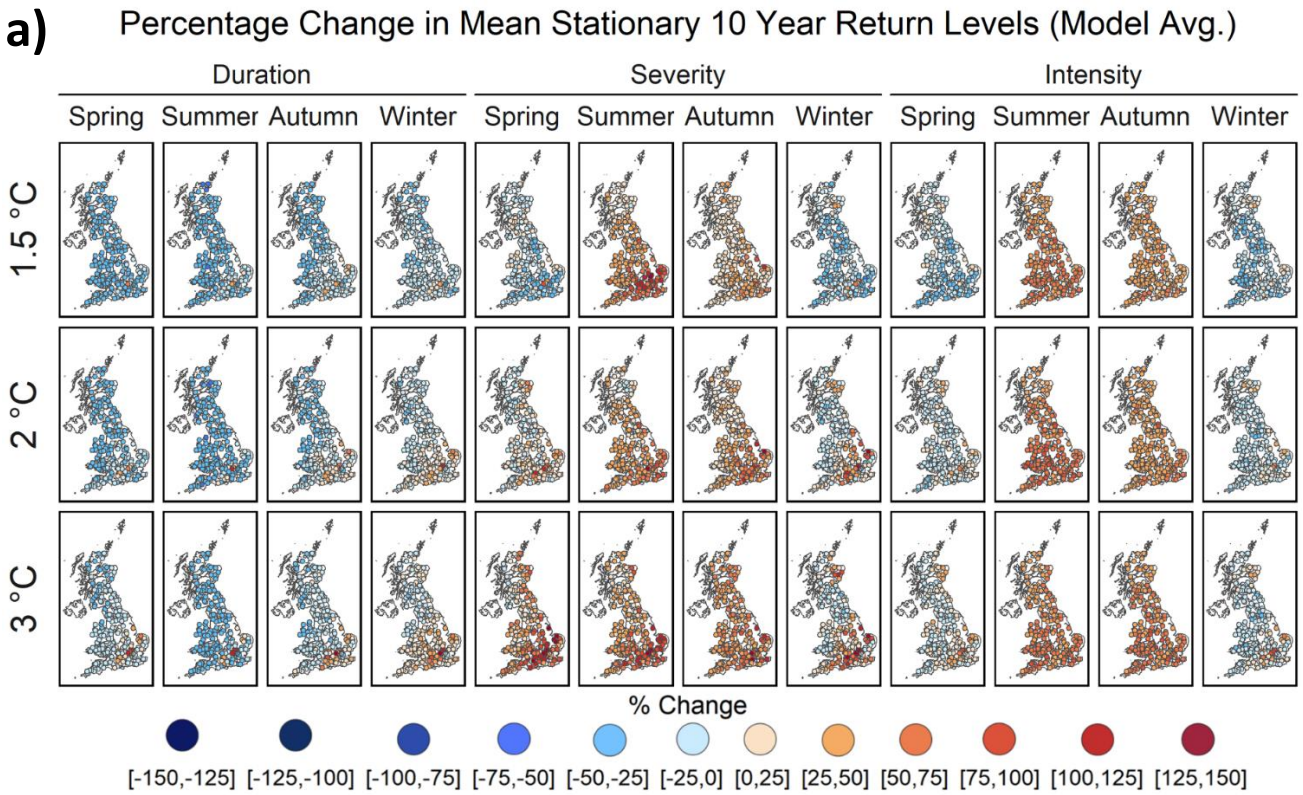
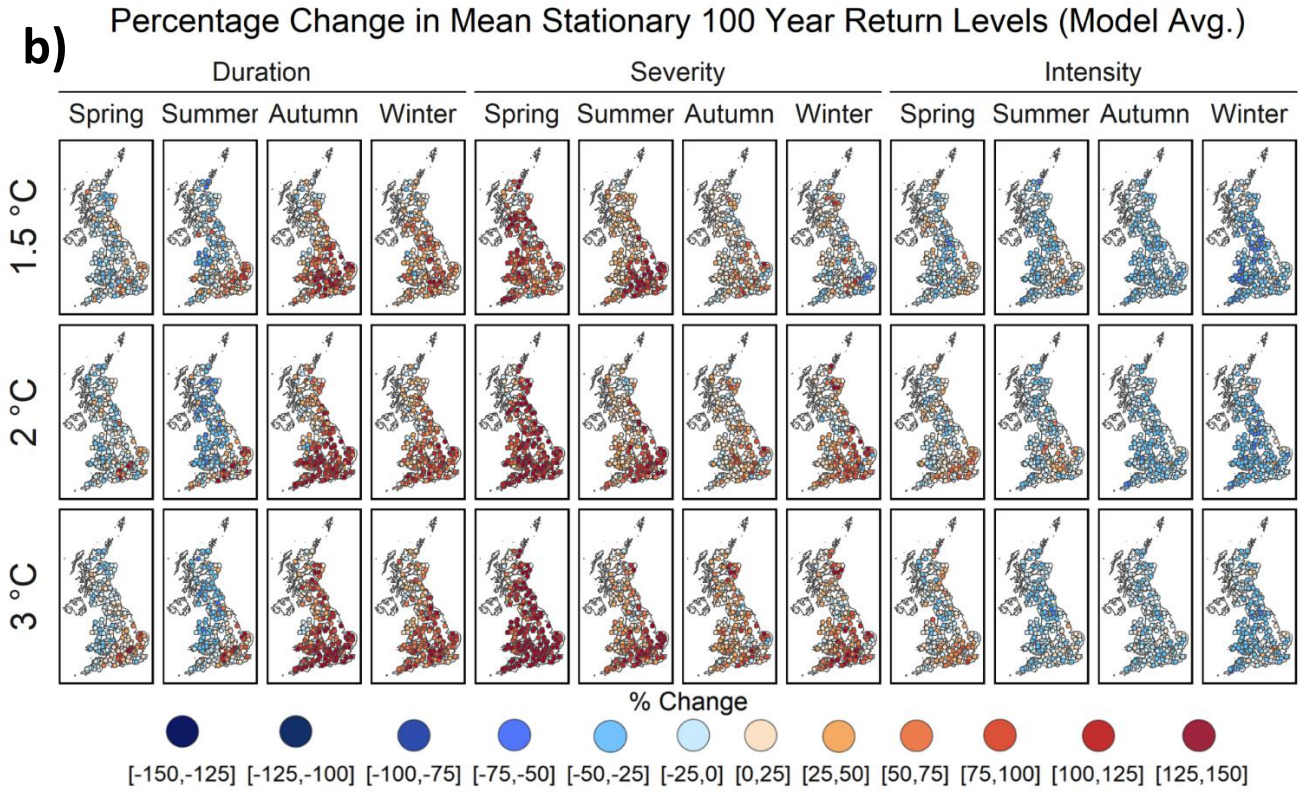


Figure S2 Percentage change in mean, median, Q25 and Q75 nonstationary return levels for **a)** 10-year **b)** 100-year, **c)** 500-year return period across different warming levels, seasons and


a)
Percentage Change in Mean Stationary 10 Year Return Levels (Model Avg.)
Duration
Severity
Intensity
Spring Summer Autumn Winter Spring Summer Autumn Winter Spring Summer Autumn Winter
1.5 °C
2 °C
3 °C
% Change
[-150,-125] [-125,-100] [-100,-75] [-75,-50] [-50,-25] [-25,0] [0,25] [25,50] [50,75] [75,100] [100,125] [125,150]


b)
Percentage Change in Mean Stationary 100 Year Return Levels (Model Avg.)
Duration
Severity
Intensity
Spring Summer Autumn Winter Spring Summer Autumn Winter Spring Summer Autumn Winter
1.5 °C
2 °C
3 °C
% Change
[-150,-125] [-125,-100] [-100,-75] [-75,-50] [-50,-25] [-25,0] [0,25] [25,50] [50,75] [75,100] [100,125] [125,150]

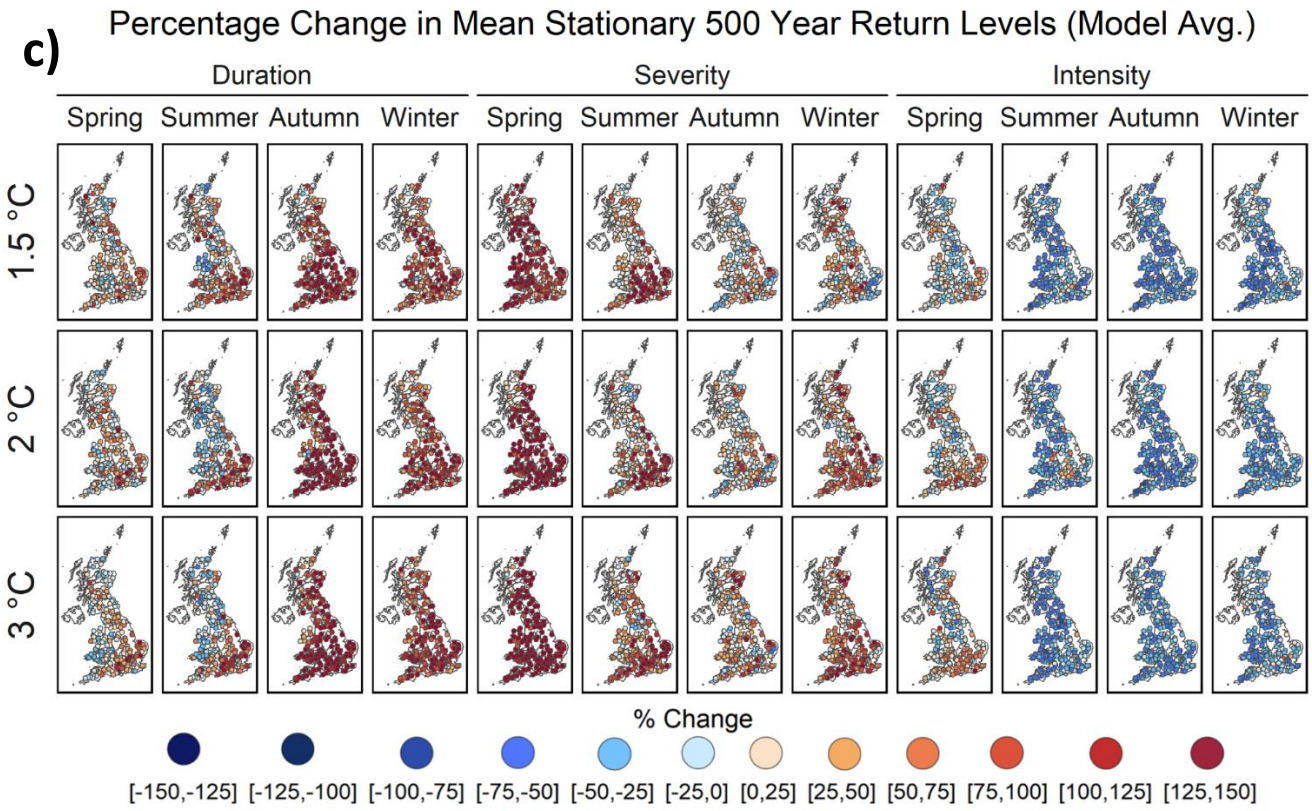
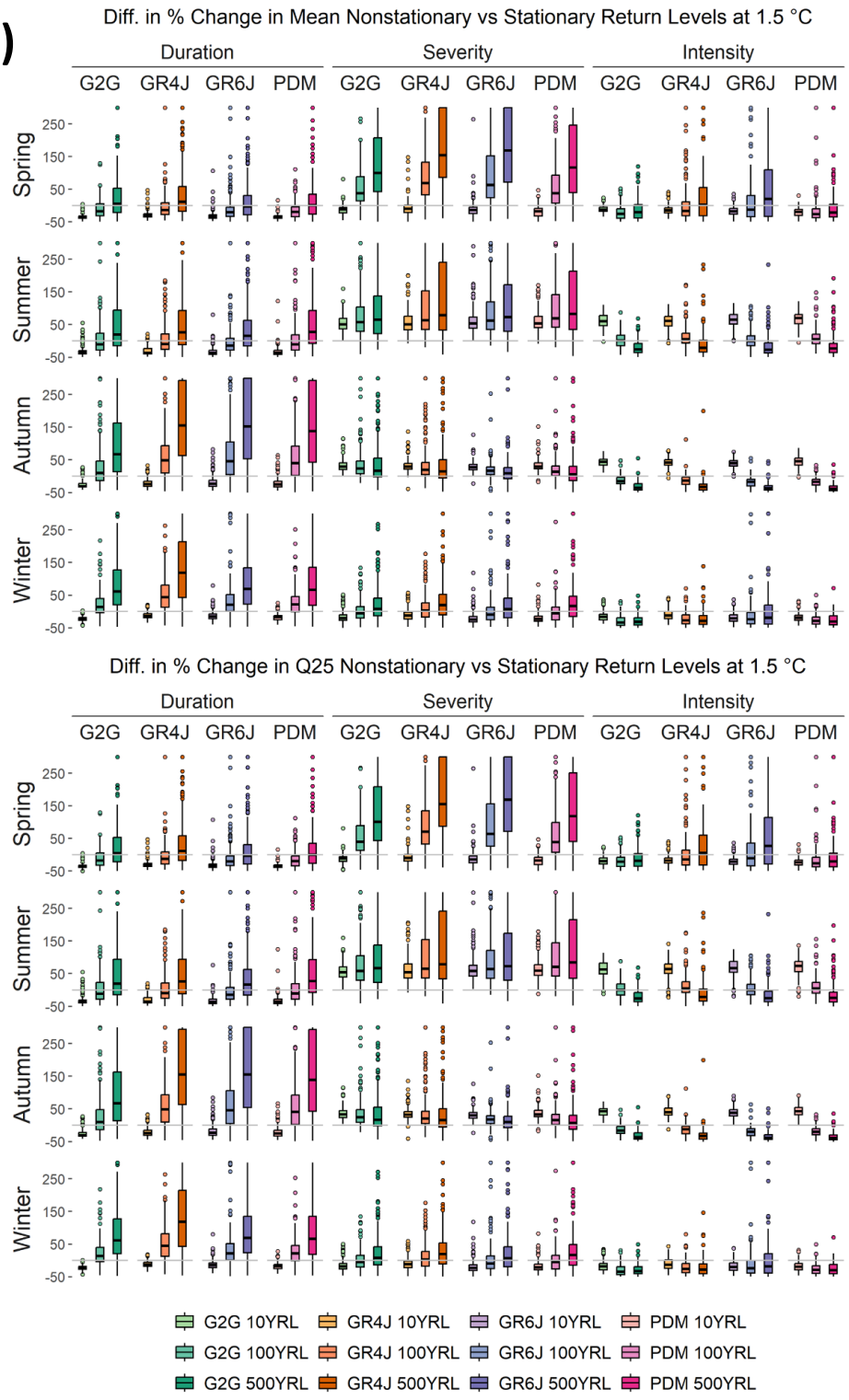
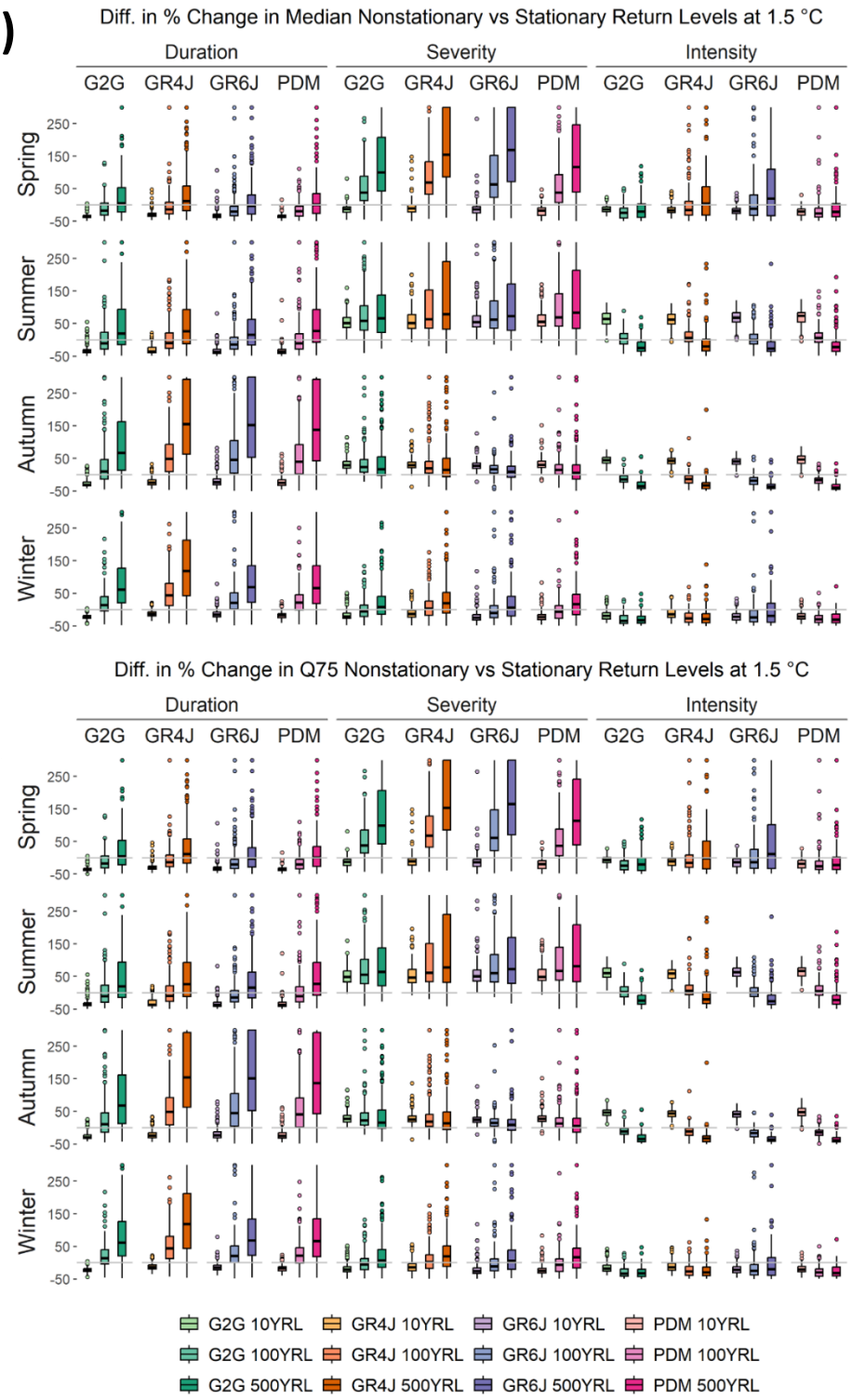


Figure S3. Percentage change in mean stationary return levels for **a)** 10-year, **b)** 100-year and **c) 500**-year return period across different warming levels, seasons and characteristics.

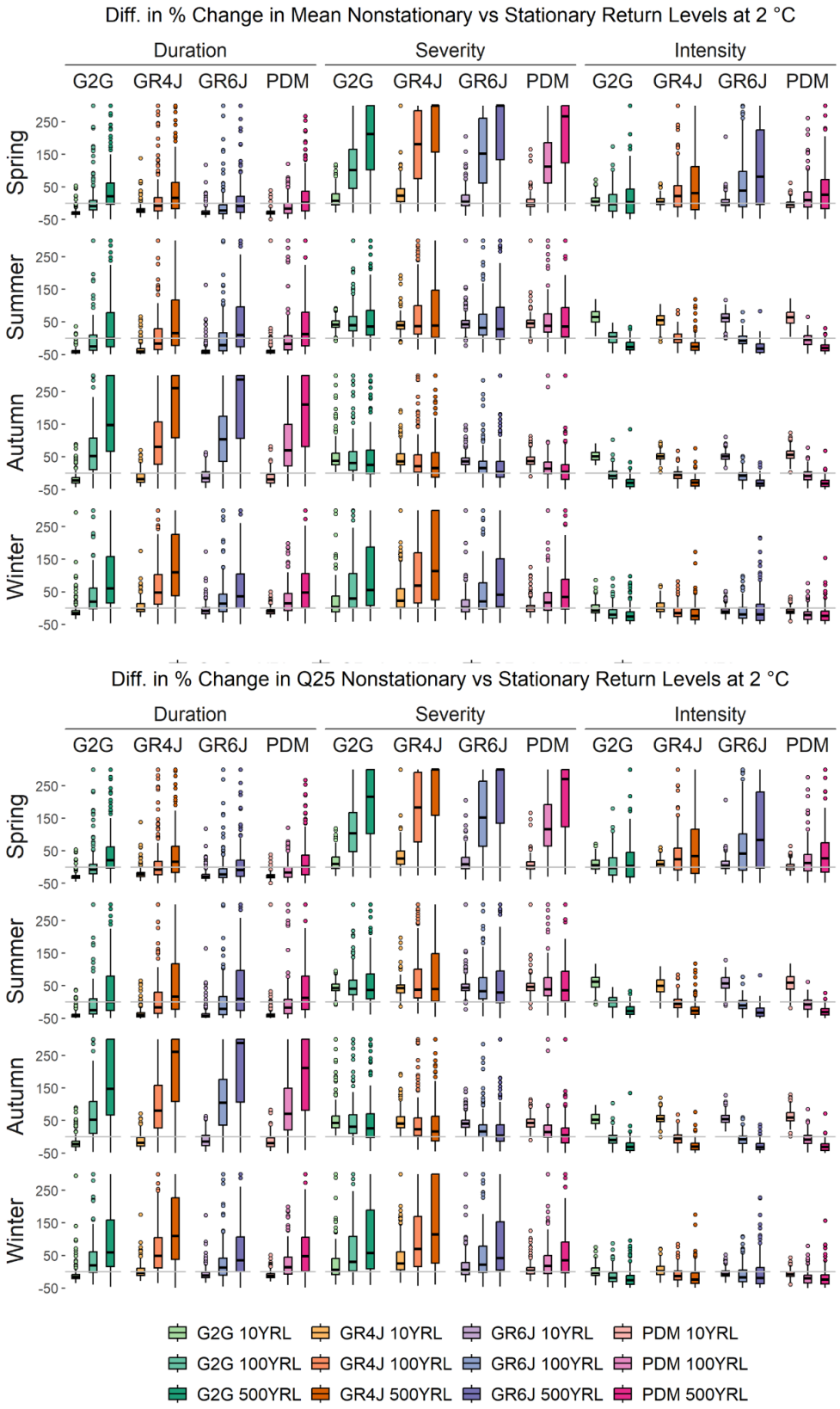
a)


Diff. in % Change in Mean Nonstationary vs Stationary Return Levels at 1.5 °C
Duration
Severity
Intensity
G2G
GR4J
GR6J
PDM
Spring
Summer
Autumn
Winter
250
150
50
-50
Diff. in % Change in Q25 Nonstationary vs Stationary Return Levels at 1.5 °C
G2G 10YRL
GR4J 10YRL
GR6J 10YRL
PDM 10YRL
G2G 100YRL
GR4J 100YRL
GR6J 100YRL
PDM 100YRL
G2G 500YRL
GR4J 500YRL
GR6J 500YRL
PDM 500YRL

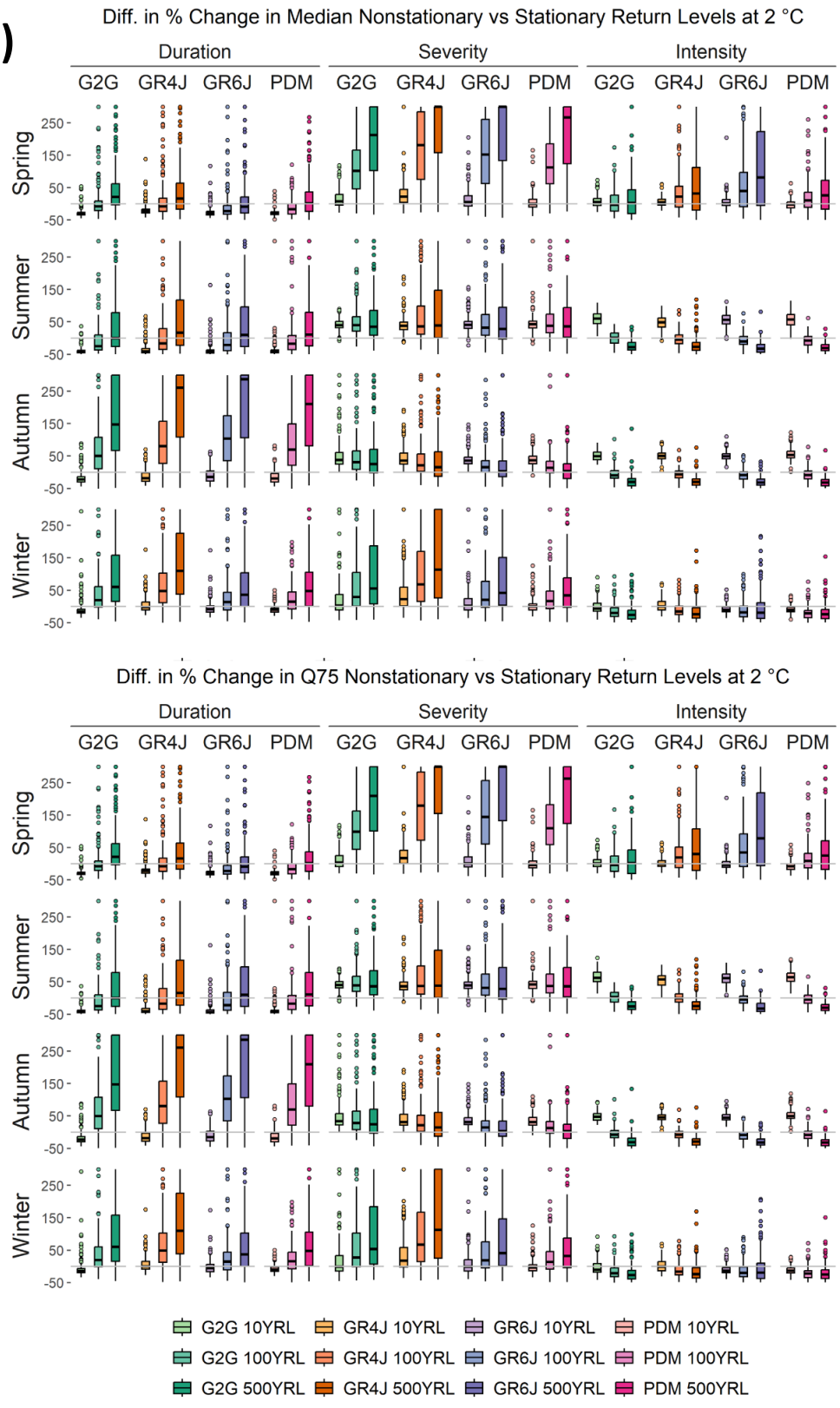
b)


Diff. in % Change in Median Nonstationary vs Stationary Return Levels at 1.5 °C
Duration
Severity
Intensity
G2G
GR4J
GR6J
PDM
Spring
Summer
Autumn
Winter
250
150
50
-50
Diff. in % Change in Q75 Nonstationary vs Stationary Return Levels at 1.5 °C
G2G 10YRL
GR4J 10YRL
GR6J 10YRL
PDM 10YRL
G2G 100YRL
GR4J 100YRL
GR6J 100YRL
PDM 100YRL
G2G 500YRL
GR4J 500YRL
GR6J 500YRL
PDM 500YRL

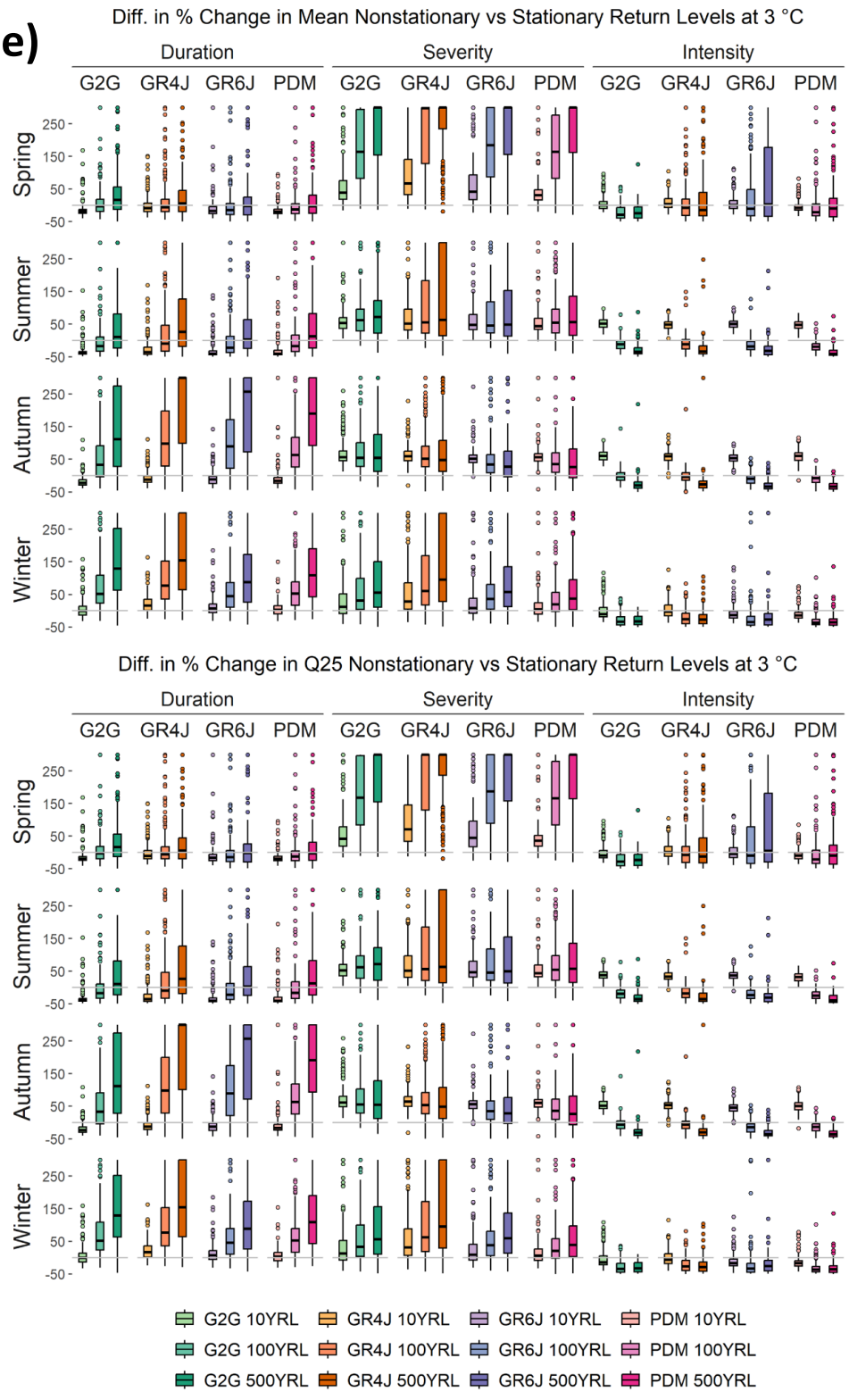
c)


Diff. in % Change in Mean Nonstationary vs Stationary Return Levels at 2 °C
Duration
Severity
Intensity
G2G
GR4J
GR6J
PDM
Spring
Summer
Autumn
Winter
250
150
50
-50
Diff. in % Change in Q25 Nonstationary vs Stationary Return Levels at 2 °C
G2G 10YRL
GR4J 10YRL
GR6J 10YRL
PDM 10YRL
G2G 100YRL
GR4J 100YRL
GR6J 100YRL
PDM 100YRL
G2G 500YRL
GR4J 500YRL
GR6J 500YRL
PDM 500YRL

d)


Diff. in % Change in Median Nonstationary vs Stationary Return Levels at 2 °C
Duration
Severity
Intensity
G2G
GR4J
GR6J
PDM
Spring
Summer
Autumn
Winter
250
150
50
-50
Diff. in % Change in Q75 Nonstationary vs Stationary Return Levels at 2 °C
G2G 10YRL
GR4J 10YRL
GR6J 10YRL
PDM 10YRL
G2G 100YRL
GR4J 100YRL
GR6J 100YRL
PDM 100YRL
G2G 500YRL
GR4J 500YRL
GR6J 500YRL
PDM 500YRL

e)


Diff. in % Change in Mean Nonstationary vs Stationary Return Levels at 3 °C
Duration
Severity
Intensity
G2G
GR4J
GR6J
PDM
Spring
Summer
Autumn
Winter
250
150
50
-50
Diff. in % Change in Q25 Nonstationary vs Stationary Return Levels at 3 °C
G2G 10YRL
GR4J 10YRL
GR6J 10YRL
PDM 10YRL
G2G 100YRL
GR4J 100YRL
GR6J 100YRL
PDM 100YRL
G2G 500YRL
GR4J 500YRL
GR6J 500YRL
PDM 500YRL

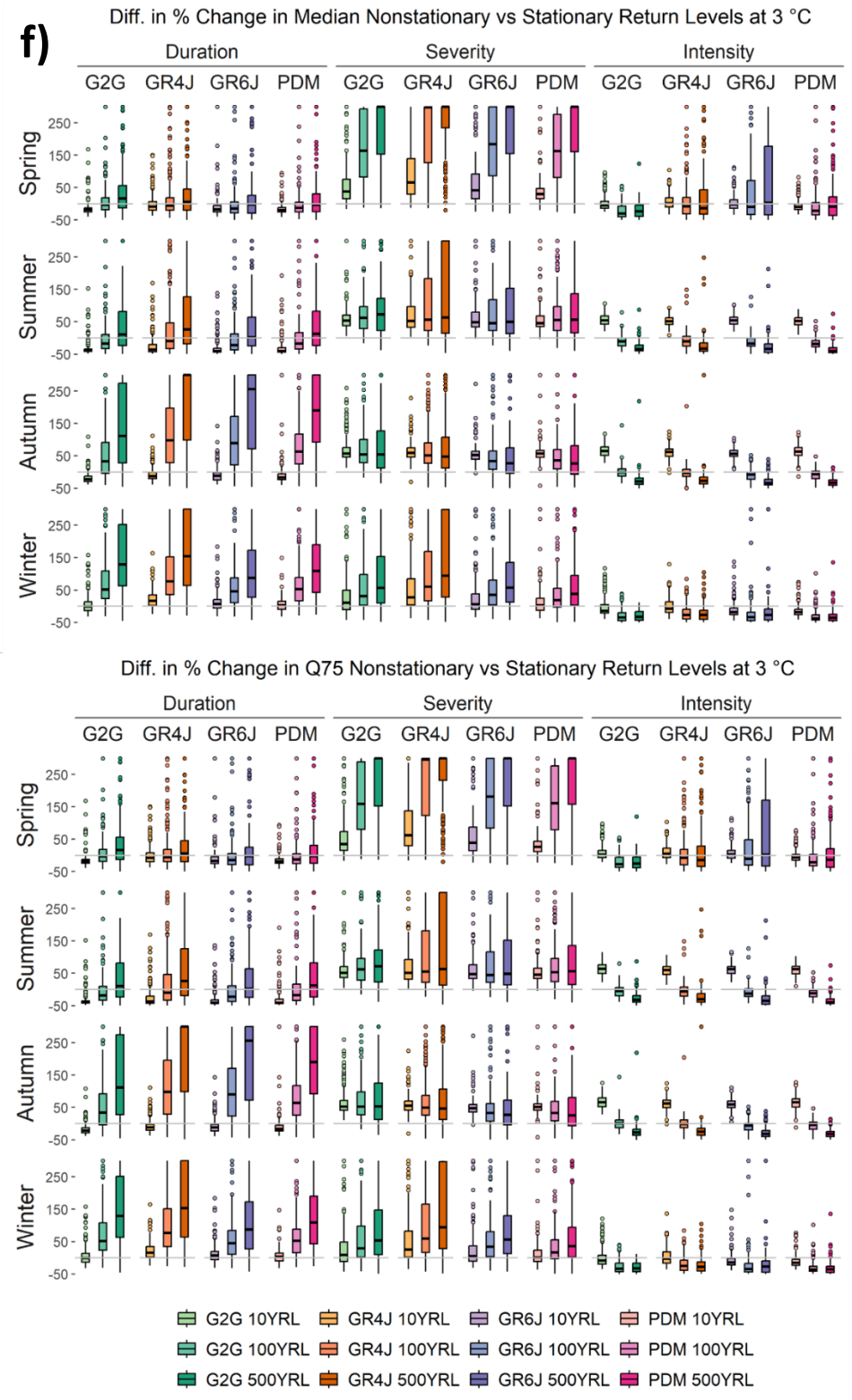


Figure S4. Difference in percentage change **a)** mean and Q25 nonstationary and stationary return levels at 1.5°C, **b)** median and Q75 nonstationary and stationary return levels at 1.5°C, **c)** mean and Q25 nonstationary and stationary return levels at 2°C , **d)** median and Q75 nonstationary and stationary return levels at 2°C, **e)** mean and Q25 nonstationary and stationary return levels at 3°C, **d)** median and Q75 nonstationary and stationary return levels at 2°C. **e)** mean and Q25 nonstationary and stationary return levels at 3°C, and **f)** median and Q75 nonstationary and stationary return levels at 3°C warming level.

Table S1. Number and percentage of nonstationary catchments obtained based on the likelihood ratio test.

Season	Metric	Model	Warming	No of NS catchments	% of NS catchments
Summer	Intensity	G2G	1.5	14	7
Summer	Intensity	GR4J	1.5	20	10
Summer	Intensity	GR6J	1.5	36	18
Summer	Intensity	PDM	1.5	22	11
Winter	Intensity	G2G	1.5	81	40.5
Winter	Intensity	GR4J	1.5	61	30.5
Winter	Intensity	GR6J	1.5	65	32.5
Winter	Intensity	PDM	1.5	62	31
Autumn	Intensity	G2G	1.5	52	26
Autumn	Intensity	GR4J	1.5	88	44
Autumn	Intensity	GR6J	1.5	55	27.5
Autumn	Intensity	PDM	1.5	57	28.5
Spring	Intensity	G2G	1.5	73	36.5
Spring	Intensity	GR4J	1.5	128	64
Spring	Intensity	GR6J	1.5	96	48
Spring	Intensity	PDM	1.5	117	58.5
Summer	Duration	G2G	1.5	191	95.5
Summer	Duration	GR4J	1.5	194	97
Summer	Duration	GR6J	1.5	194	97
Summer	Duration	PDM	1.5	192	96
Winter	Duration	G2G	1.5	122	61
Winter	Duration	GR4J	1.5	82	41
Winter	Duration	GR6J	1.5	58	29
Winter	Duration	PDM	1.5	92	46
Autumn	Duration	G2G	1.5	197	98.5
Autumn	Duration	GR4J	1.5	192	96
Autumn	Duration	GR6J	1.5	191	95.5
Autumn	Duration	PDM	1.5	186	93
Spring	Duration	G2G	1.5	194	97
Spring	Duration	GR4J	1.5	190	95
Spring	Duration	GR6J	1.5	193	96.5
Spring	Duration	PDM	1.5	195	97.5
Summer	Severity	G2G	1.5	39	19.5
Summer	Severity	GR4J	1.5	39	19.5
Summer	Severity	GR6J	1.5	33	16.5
Summer	Severity	PDM	1.5	29	14.5
Winter	Severity	G2G	1.5	180	90
Winter	Severity	GR4J	1.5	154	77
Winter	Severity	GR6J	1.5	157	78.5
Winter	Severity	PDM	1.5	162	81
Autumn	Severity	G2G	1.5	147	73.5
Autumn	Severity	GR4J	1.5	153	76.5
Autumn	Severity	GR6J	1.5	139	69.5
Autumn	Severity	PDM	1.5	138	69

Spring	Severity	G2G	1.5	99	49.5
Spring	Severity	GR4J	1.5	144	72
Spring	Severity	GR6J	1.5	120	60
Spring	Severity	PDM	1.5	133	66.5
Summer	Intensity	G2G	2	8	4
Summer	Intensity	GR4J	2	8	4
Summer	Intensity	GR6J	2	7	3.5
Summer	Intensity	PDM	2	7	3.5
Winter	Intensity	G2G	2	91	45.5
Winter	Intensity	GR4J	2	72	36
Winter	Intensity	GR6J	2	78	39
Winter	Intensity	PDM	2	81	40.5
Autumn	Intensity	G2G	2	25	12.5
Autumn	Intensity	GR4J	2	38	19
Autumn	Intensity	GR6J	2	24	12
Autumn	Intensity	PDM	2	21	10.5
Spring	Intensity	G2G	2	6	3
Spring	Intensity	GR4J	2	50	25
Spring	Intensity	GR6J	2	54	27
Spring	Intensity	PDM	2	31	15.5
Summer	Duration	G2G	2	193	96.5
Summer	Duration	GR4J	2	197	98.5
Summer	Duration	GR6J	2	199	99.5
Summer	Duration	PDM	2	193	96.5
Winter	Duration	G2G	2	186	93
Winter	Duration	GR4J	2	178	89
Winter	Duration	GR6J	2	174	87
Winter	Duration	PDM	2	177	88.5
Autumn	Duration	G2G	2	122	61
Autumn	Duration	GR4J	2	153	76.5
Autumn	Duration	GR6J	2	124	62
Autumn	Duration	PDM	2	136	68
Spring	Duration	G2G	2	171	85.5
Spring	Duration	GR4J	2	133	66.5
Spring	Duration	GR6J	2	168	84
Spring	Duration	PDM	2	165	82.5
Summer	Severity	G2G	2	18	9
Summer	Severity	GR4J	2	27	13.5
Summer	Severity	GR6J	2	20	10
Summer	Severity	PDM	2	18	9
Winter	Severity	G2G	2	150	75
Winter	Severity	GR4J	2	132	66
Winter	Severity	GR6J	2	165	82.5
Winter	Severity	PDM	2	189	94.5
Autumn	Severity	G2G	2	119	59.5
Autumn	Severity	GR4J	2	144	72
Autumn	Severity	GR6J	2	104	52

Autumn	Severity	PDM	2	107	53.5
Spring	Severity	G2G	2	40	20
Spring	Severity	GR4J	2	95	47.5
Spring	Severity	GR6J	2	87	43.5
Spring	Severity	PDM	2	70	35
Summer	Intensity	G2G	3	160	80
Summer	Intensity	GR4J	3	126	63
Summer	Intensity	GR6J	3	131	65.5
Summer	Intensity	PDM	3	142	71
Winter	Intensity	G2G	3	137	68.5
Winter	Intensity	GR4J	3	137	68.5
Winter	Intensity	GR6J	3	130	65
Winter	Intensity	PDM	3	125	62.5
Autumn	Intensity	G2G	3	26	13
Autumn	Intensity	GR4J	3	75	37.5
Autumn	Intensity	GR6J	3	63	31.5
Autumn	Intensity	PDM	3	83	41.5
Spring	Intensity	G2G	3	53	26.5
Spring	Intensity	GR4J	3	108	54
Spring	Intensity	GR6J	3	88	44
Spring	Intensity	PDM	3	95	47.5
Summer	Duration	G2G	3	195	97.5
Summer	Duration	GR4J	3	191	95.5
Summer	Duration	GR6J	3	188	94
Summer	Duration	PDM	3	197	98.5
Winter	Duration	G2G	3	198	99
Winter	Duration	GR4J	3	196	98
Winter	Duration	GR6J	3	199	99.5
Winter	Duration	PDM	3	197	98.5
Autumn	Duration	G2G	3	196	98
Autumn	Duration	GR4J	3	197	98.5
Autumn	Duration	GR6J	3	196	98
Autumn	Duration	PDM	3	197	98.5
Spring	Duration	G2G	3	191	95.5
Spring	Duration	GR4J	3	177	88.5
Spring	Duration	GR6J	3	193	96.5
Spring	Duration	PDM	3	188	94
Summer	Severity	G2G	3	191	95.5
Summer	Severity	GR4J	3	190	95
Summer	Severity	GR6J	3	185	92.5
Summer	Severity	PDM	3	188	94
Winter	Severity	G2G	3	162	81
Winter	Severity	GR4J	3	149	74.5
Winter	Severity	GR6J	3	169	84.5
Winter	Severity	PDM	3	168	84
Autumn	Severity	G2G	3	105	52.5
Autumn	Severity	GR4J	3	129	64.5

Autumn	Severity	GR6J	3	118	59
Autumn	Severity	PDM	3	120	60
Spring	Severity	G2G	3	96	48
Spring	Severity	GR4J	3	138	69
Spring	Severity	GR6J	3	117	58.5
Spring	Severity	PDM	3	124	62