RICCAR

Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region

Extreme climate indices in selected basins (Wadi Diqah, Nahr Al Kabir, Medjerda)

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The Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD)

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objective

- The objective of this study is to provide insights to extreme events over the coming decades due to climate change in three hydrological basins in the Arab region.

Changes in Precipitation Indices

- Consecutive dry days : Maximum number of consecutive days with precipitation<1mm
- Consecutive wet days : Maximum number of consecutive days with precipitation >=1mm
- Heavy precipitation days : Annual count of days when precipitation>=10mm
- Very Heavy precipitation days : Annual count of days when precipitation>=20mm
- Simple daily intensity index : Annual total precipitation divided by the number of wet days (defined as PRCP>=1.0mm) in the year

Changes in Temperature Indices

- Warm spell duration indicator : Annual count of days with at least 6 consecutive days when maximum temperature>90th percentile
- Cold spell duration indicator : Annual count of days with at least 6 consecutive days when minimum temperature <10th percentile
- Tropical nights : Annual count when daily minimum temperature>20ºC
- Number of hot days> Annual number of days when Tmax >35ºC
- Number of very hot days> Annual number of days when Tmax >40ºC

Study Area


Mejerda basin
Tunisia-Algeria
Nahr el Kabir
Al-Junoubi-
Syria-Lebanon
WADI DAYQAH
SULTANATE OF OMAN
Algeria
Libya
Egypt
Niger
Chad
Sudan
Eritrea
Yemen
Saudi Arabia
Kuwait
Iran
Iraq
Turkey
Syria
Greece
Malta
Rabat
Niamey
Khartoum
Asmara
Sana'a
Tehran
Baghdad
Kuwait City
Riyadh
Doha
Abu Dhabi
Manama
Bahrain
Qatar
United Arab Emirates
Persian Gulf
Gulf of Oman
Gulf of Aden
Red Sea
Ionian Sea
Athens
Ashgabat
Afghanistan
Lake Chad
N'Djamena
Abuja
Nigeria
Porto Novo
Benin
Togo
Djibouti

Medjerda River

Basin Area =22070 km^2

Shared between Tunisia and Algeria

Wadi Dayqah basin, Oman

located 60 km southeast of Muscat

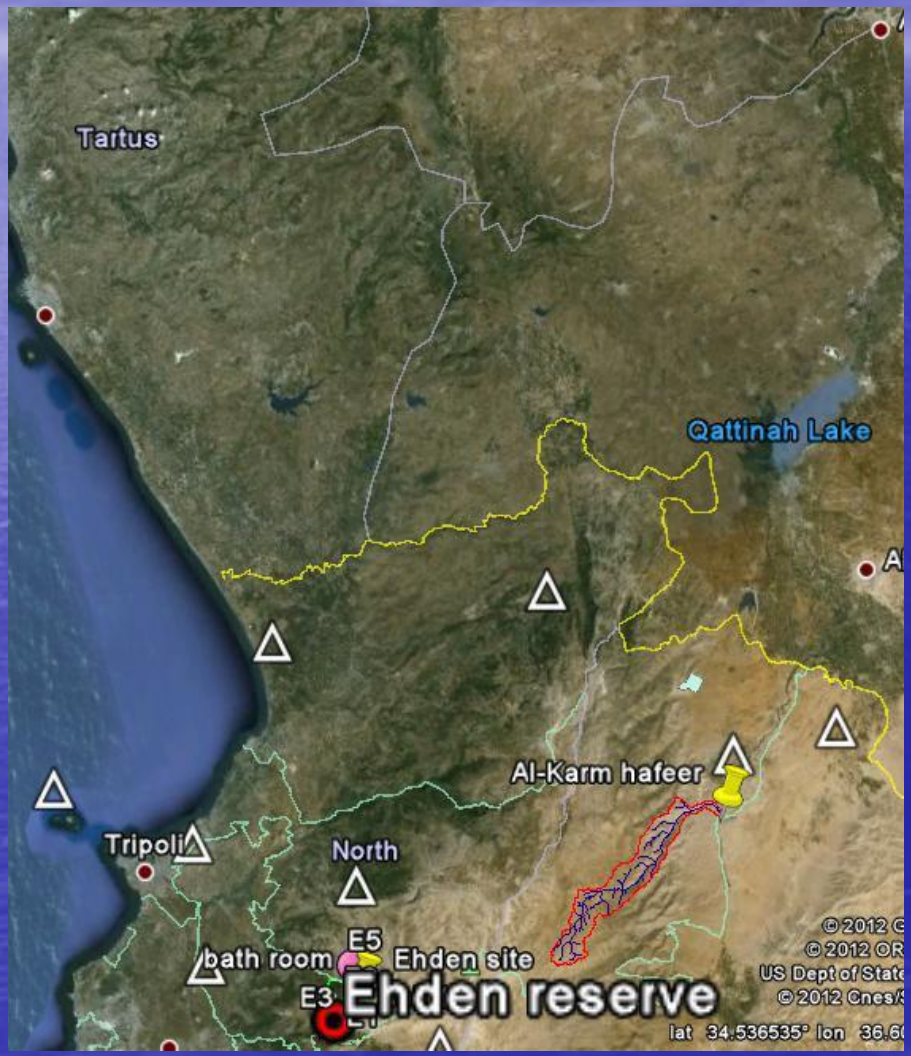
Basin area =1870 km^2

Nahr el Kabir Al-Junoubi

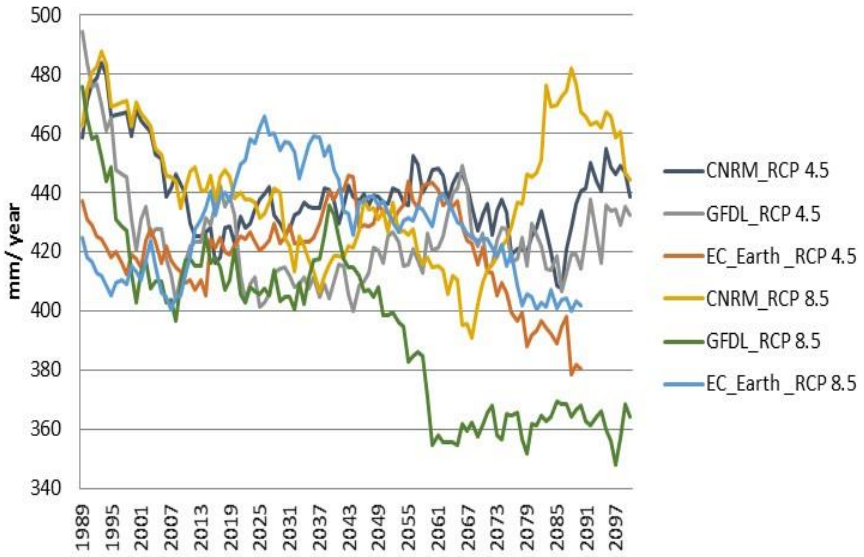
- The Nahr el Kabir Al-Junoubi constitutes the Lebanese Syrian borders
- The total water shed area (within Lebanon and Syria) is about 990 km^2 of which 295 km^2 lies in Lebanon

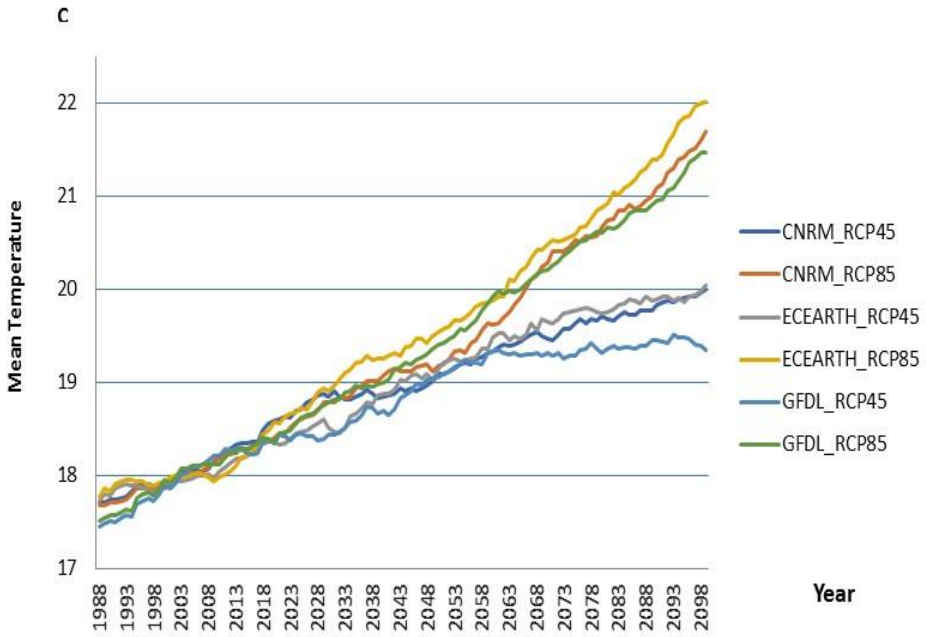
results

Nahr el Kabir Al-Junoubi



projected precipitation and temperature at Nahr el Kabir Al-Junoubi



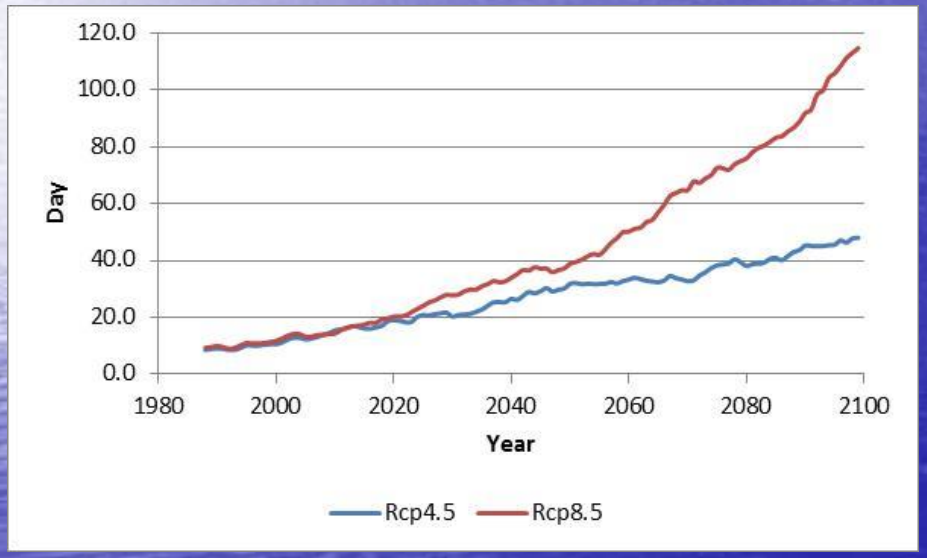


Changes in Temperature Indices

Nahr el Kabir Al-Junoubi basin

Warm spell duration indicator

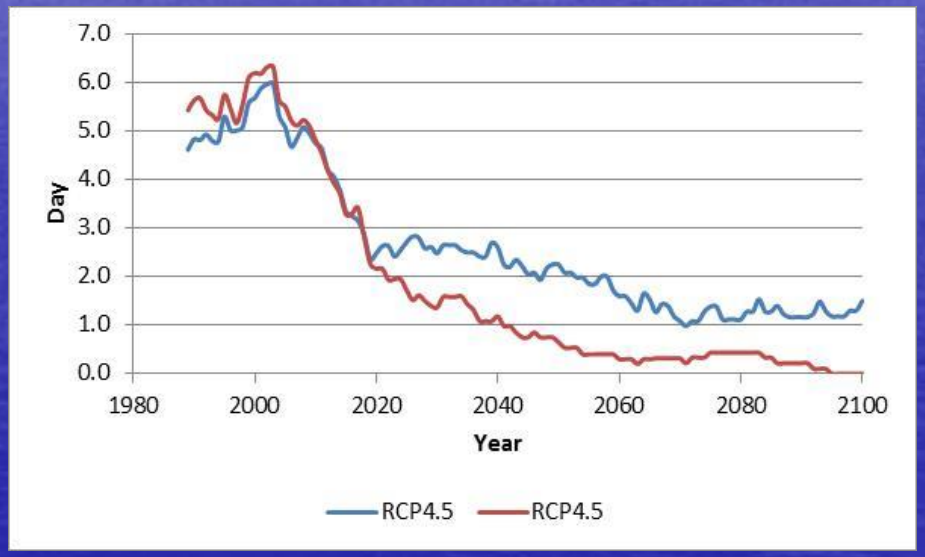
Annual count of days with at least 6 consecutive days when maximum temperature>90th percentile



	1986-2005	2046-2065	2081-2100
RCP4.5	10	32	44
RCP8.5	11	44	94

Cold spell duration indicator

Annual count of days with at least 6 consecutive days when minimum temperature <10th percentile

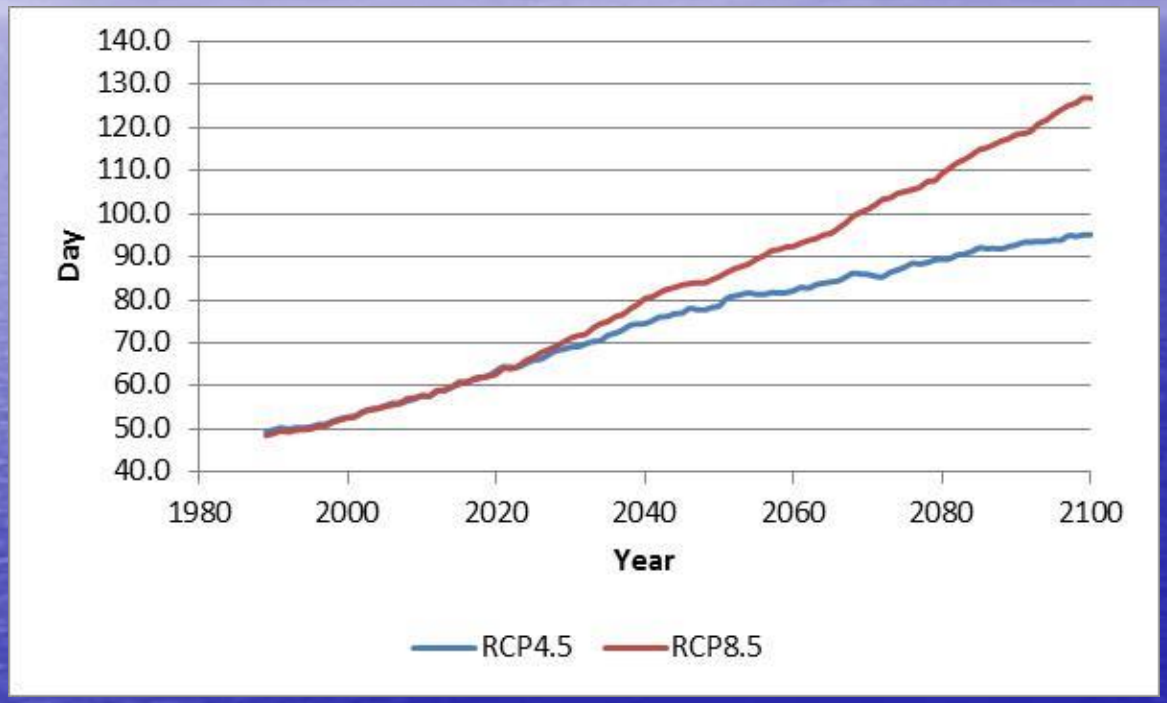


	1986-2005	2046-2065	2081-2100
RCP4.5	5.2	1.9	1.3
RCP8.5	5.7	0.5	0.2

Nahr el Kabir Al-Junoubi basin

Tropical nights

Annual count when daily minimum temperature>20ºC

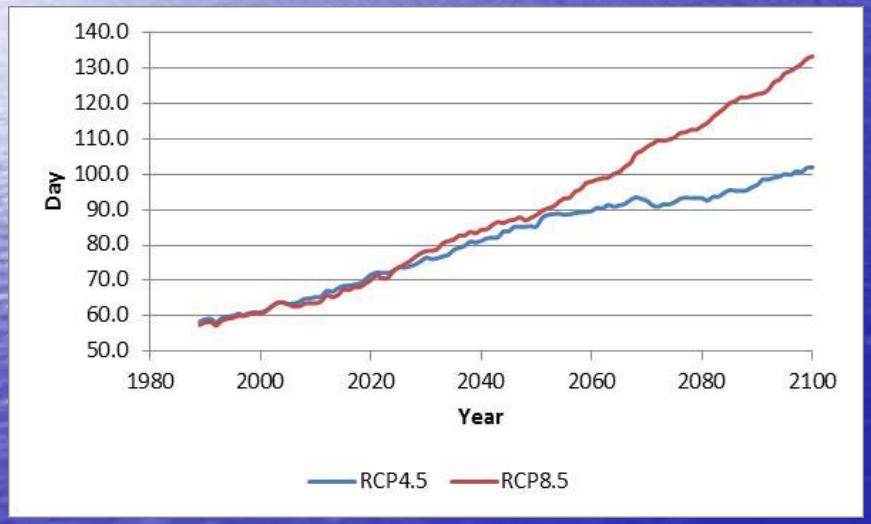


	1986-2005	2046-2065	2081-2100
RCP4.5	52	81	93
RCP8.5	52	89	119

Nahr el Kabir Al-Junoubi basin

Number of hot days

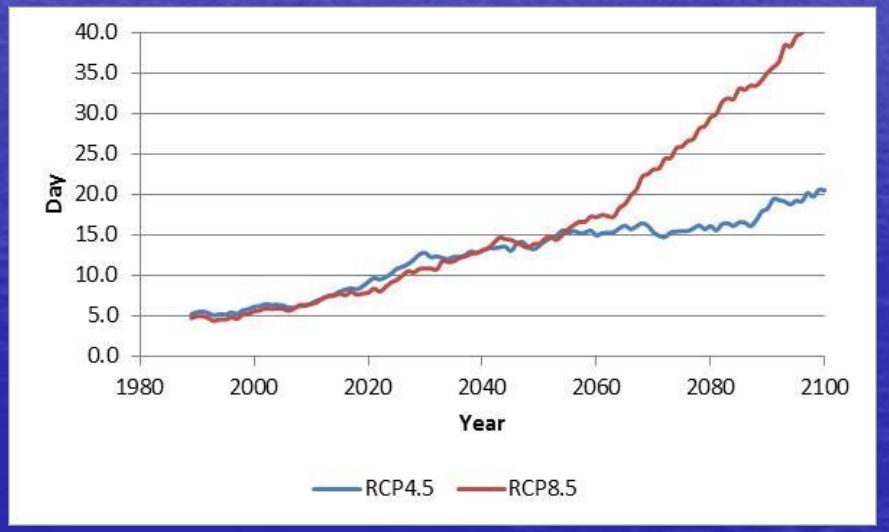
Annual count when daily maximum temperature >35ºC



	1986-2005	2046-2065	2081-2100
RCP4.5	60	88	98
RCP8.5	60	93	124

Number of very hot days

Annual count when daily maximum temperature >40ºC



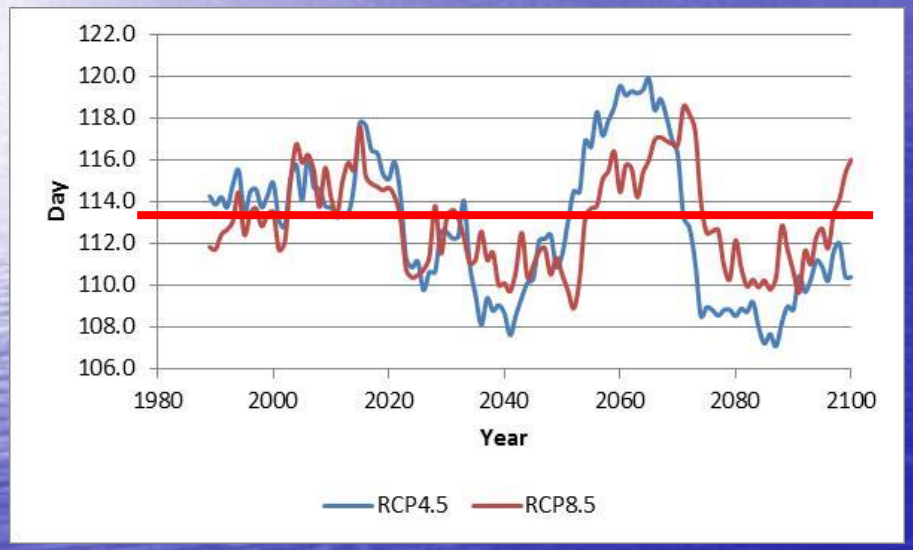
	1986-2005	2046-2065	2081-2100
RCP4.5	5	15	18
RCP8.5	5	16	36

Changes in Precipitation Indices

Nahr el Kabir Al-Junoubi basin

Consecutive dry days

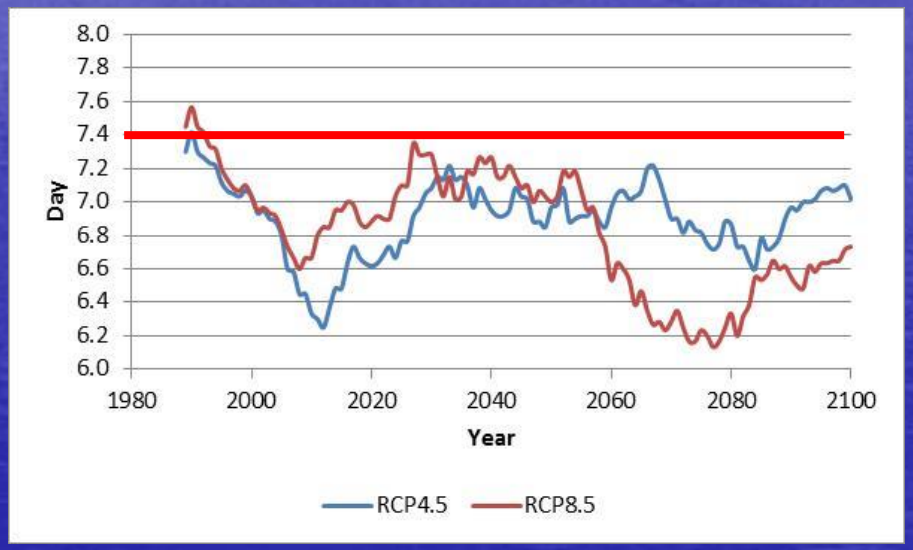
Maximum number of consecutive days with precipitation<1mm



	1986-2005	2046-2065	2081-2100
RCP4.5	114	116	110
RCP8.5	113	113	112

Consecutive wet days

Maximum number of consecutive days with precipitation >=1mm

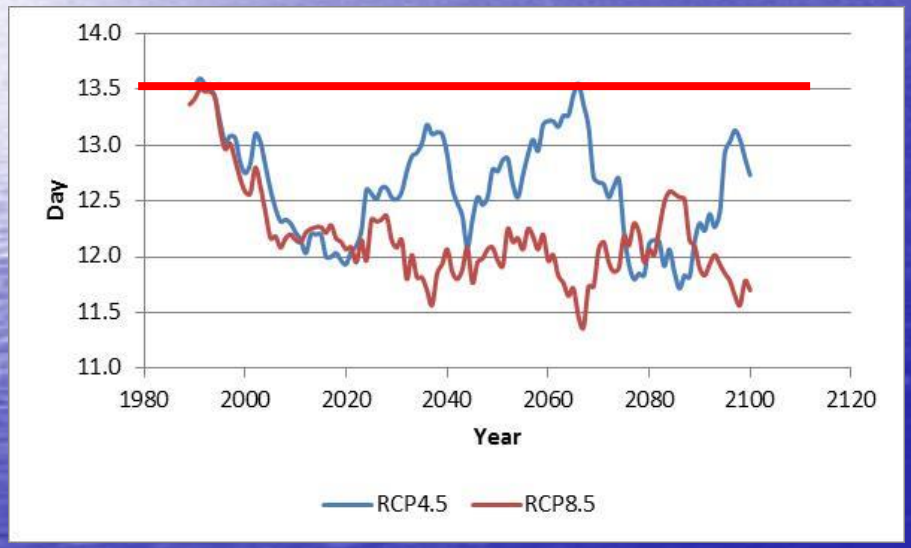


	1986-2005	2046-2065	2081-2100
RCP4.5	7.1	7.0	6.9
RCP8.5	7.2	6.9	6.6

Nahr el Kabir Al-Junoubi basin

Heavy precipitation days

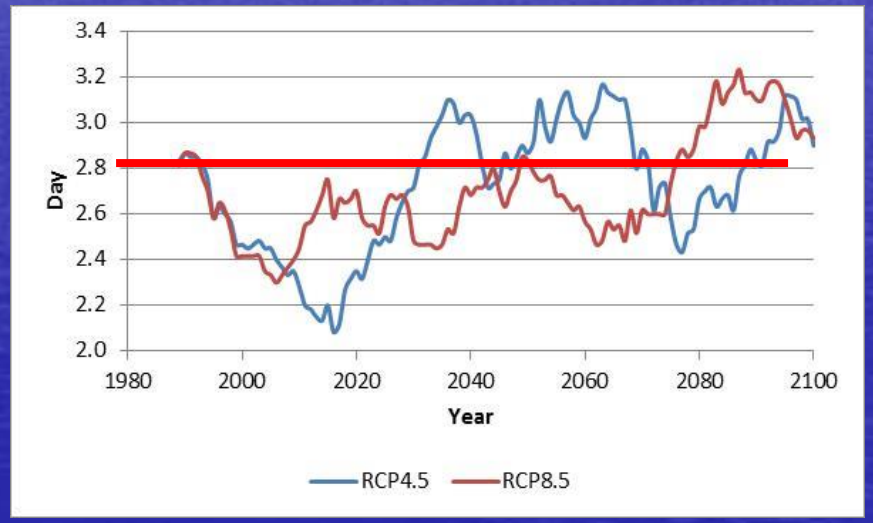
Annual count of days when precipitation>=10mm



	1986-2005	2046-2065	2081-2100
RCP4.5	13.1	12.9	12.3
RCP8.5	13.0	12.0	12.1

Very Heavy precipitation days

Annual count of days when precipitation>=20mm

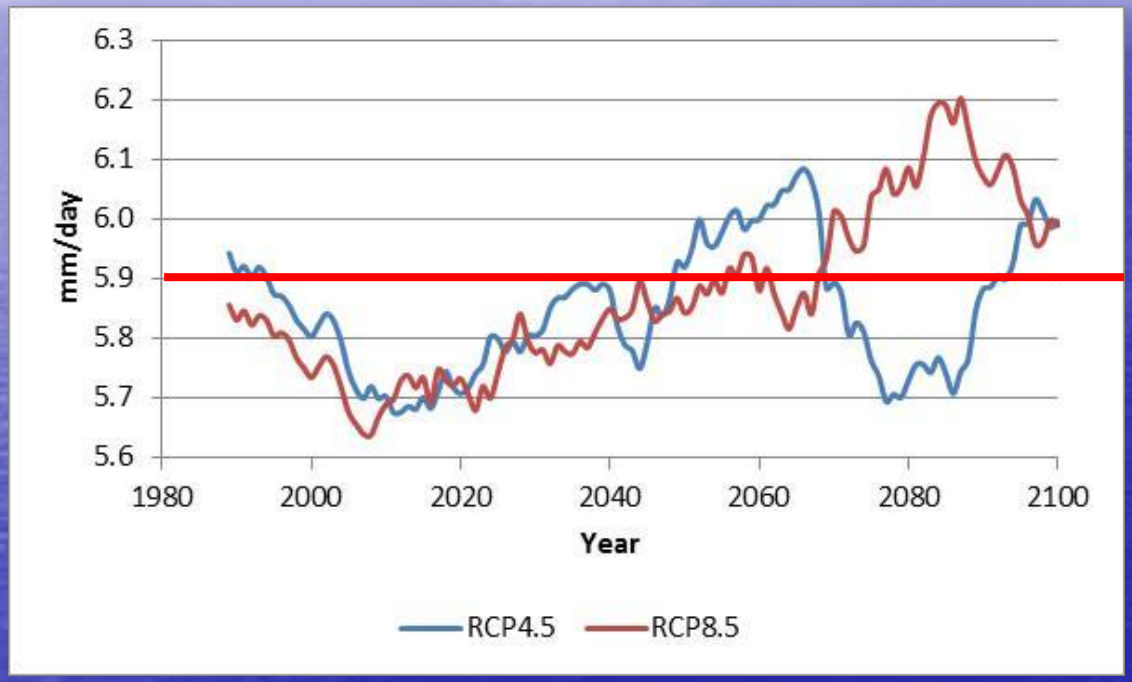


	1986-2005	2046-2065	2081-2100
RCP4.5	2.6	3.0	2.9
RCP8.5	2.6	2.7	3.1

Nahr el Kabir Al-Junoubi basin

Simple daily intensity index

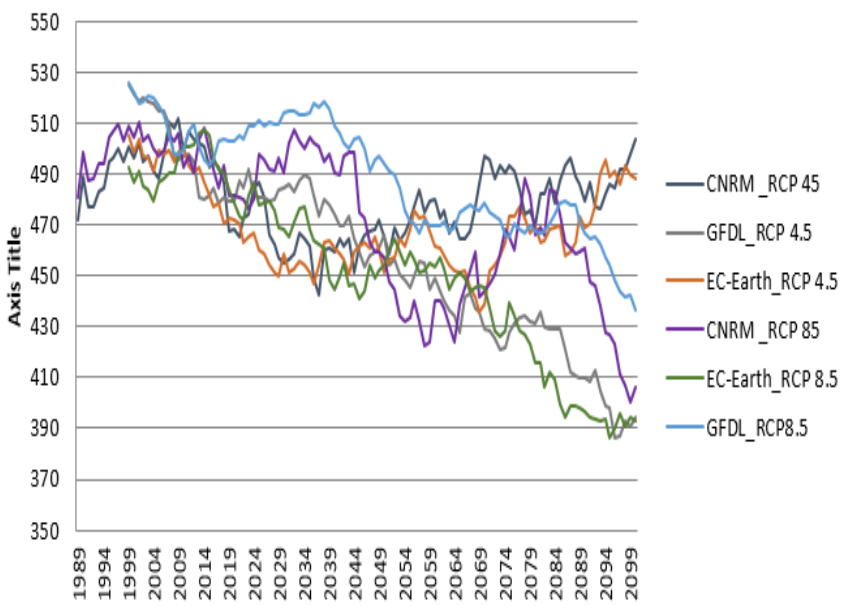
Annual total precipitation divided by the number of wet days (defined as PRCP>=1.0mm) in the year

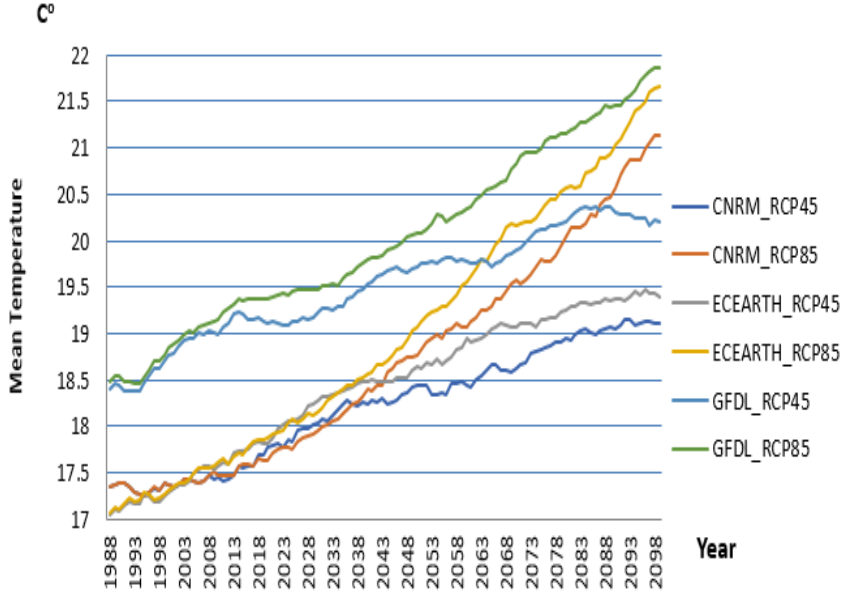


	1986-2005	2046-2065	2081-2100
RCP4.5	5.9	6.0	5.9
RCP8.5	5.8	5.9	6.1

Medjerda River Basin

Projected precipitation and temperature at Mejerda Basin



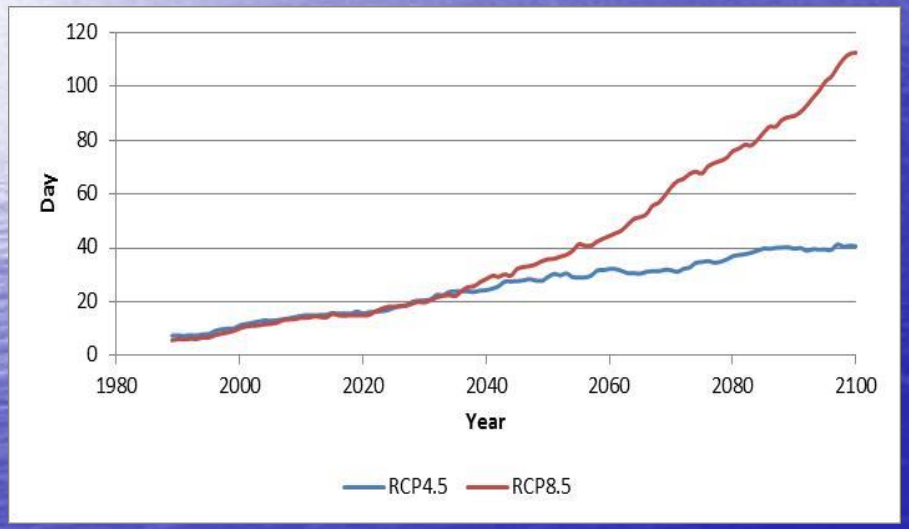


Changes in Temperature Indices

Medjerda River Basin

Warm spell duration indicator

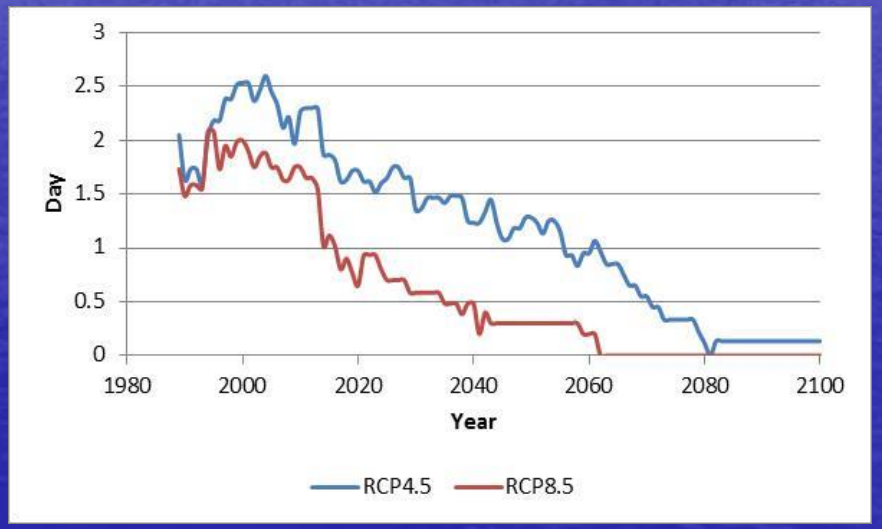
Annual count of days with at least 6 consecutive days when maximum temperature>90th percentile



	1986-2005	2046-2065	2081-2100
RCP4.5	10	30	40
RCP8.5	8	40	93

Cold spell duration indicator

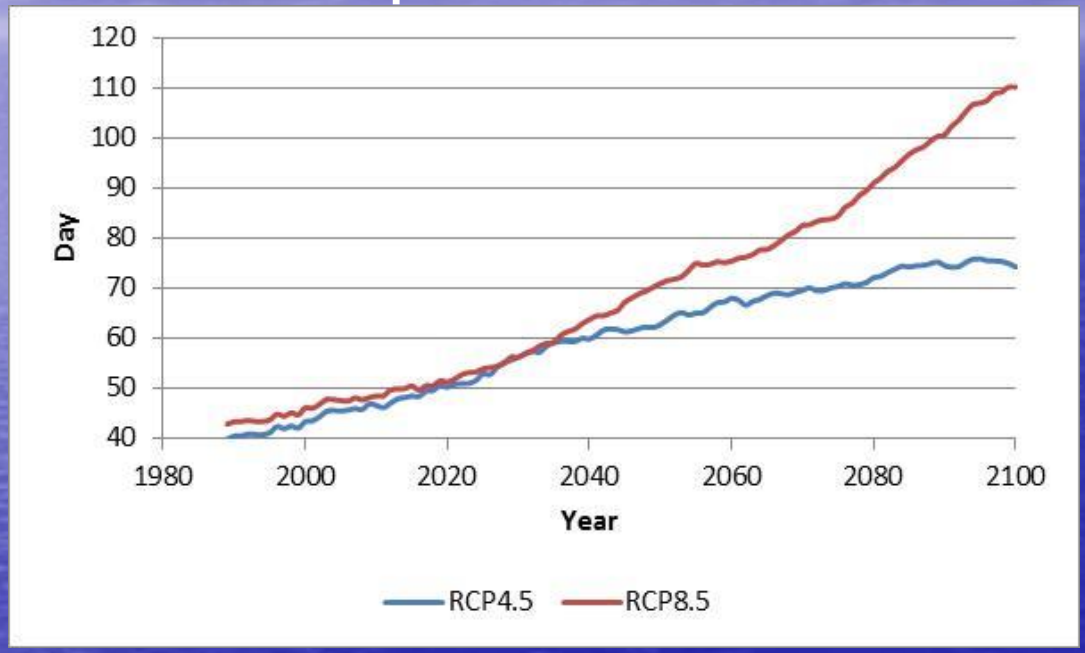
Annual count of days with at least 6 consecutive days when minimum temperature <10th percentile



	1986-2005	2046-2065	2081-2100
RCP4.5	2.2	1.1	0.1
RCP8.5	1.8	0.2	0.0

Tropical nights

Annual count when daily minimum temperature>20ºC

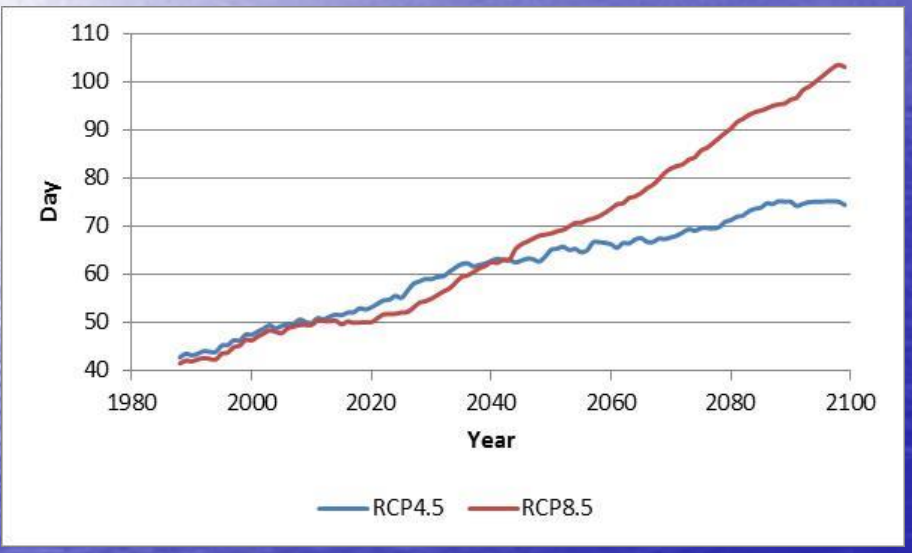


	1986-2005	2046-2065	2081-2100
RCP4.5	42	65	75
RCP8.5	45	73	102

Medjerda River Basin

Number of hot days

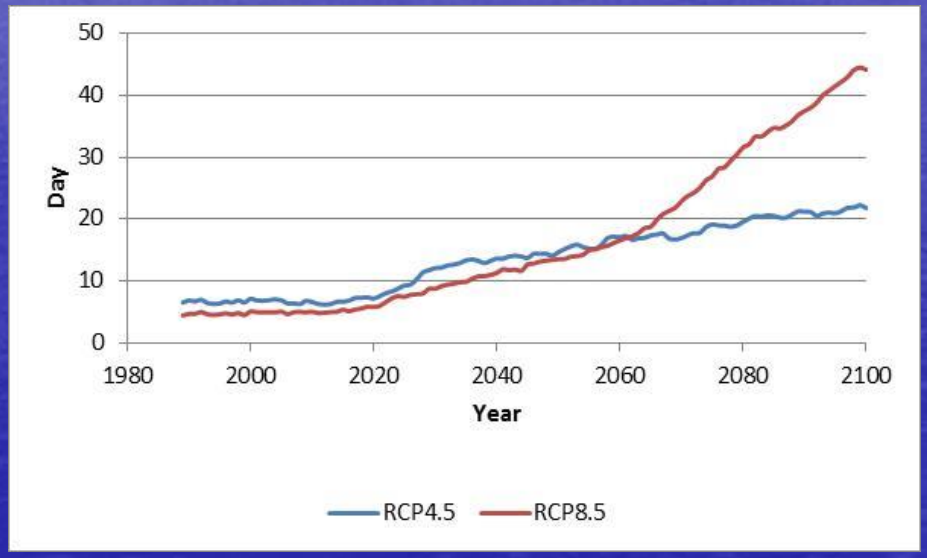
Annual count when daily maximum temperature >35ºC



	1986-2005	2046-2065	2081-2100
RCP4.5	46	65	74
RCP8.5	45	71	97

Number of very hot days

Annual count when daily maximum temperature >40ºC

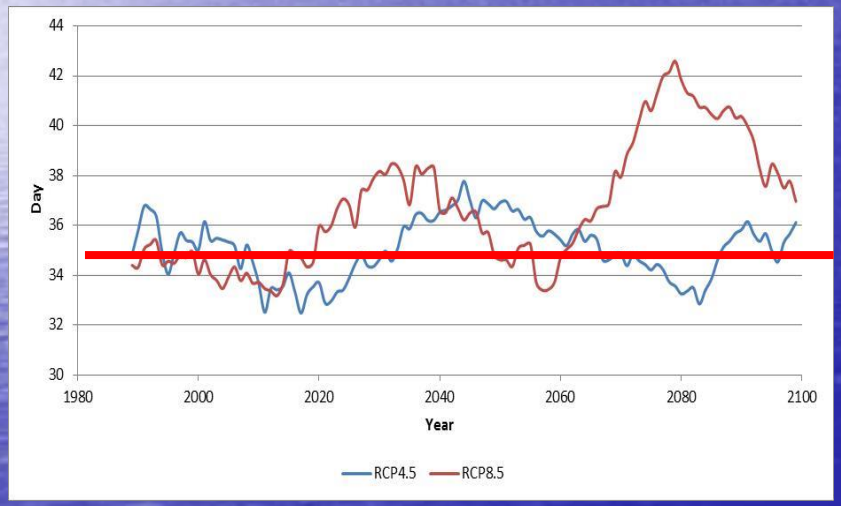


	1986-2005	2046-2065	2081-2100
RCP4.5	7	16	21
RCP8.5	5	15	38

Changes in Precipitation Indices

Consecutive dry days

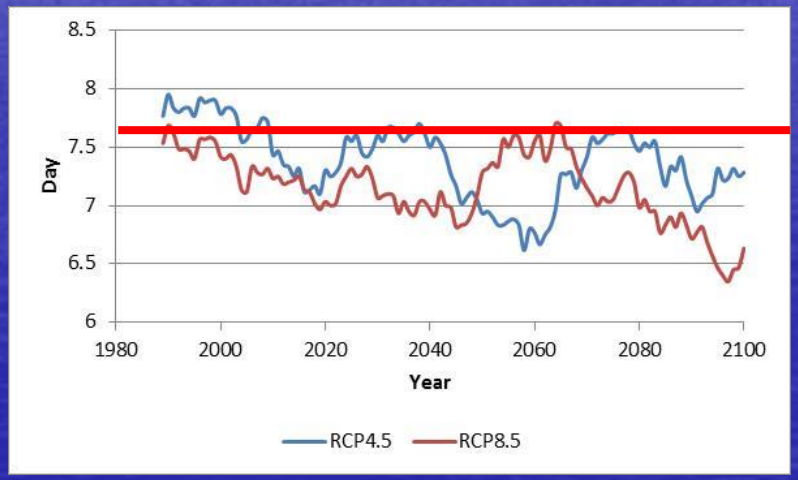
Maximum number of consecutive days with precipitation<1mm



	1986-2005	2046-2065	2081-2100
RCP4.5	36	36	35
RCP8.5	34	35	40

Consecutive wet days

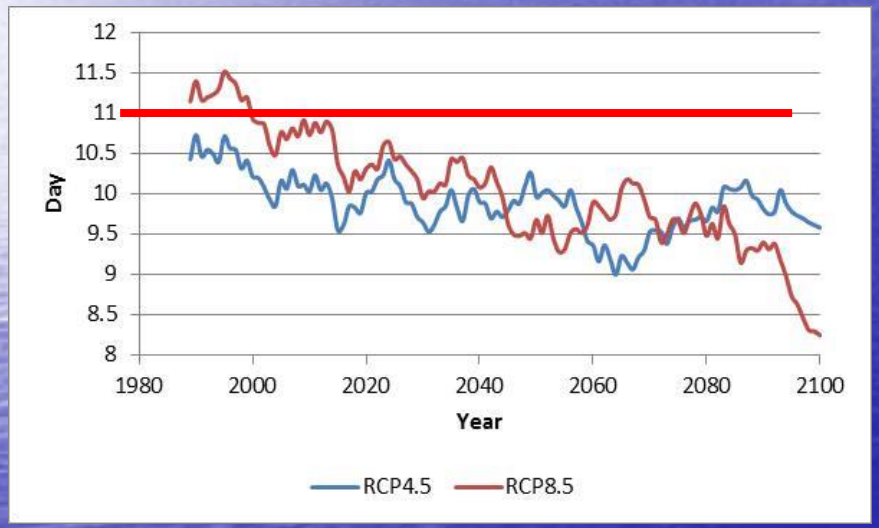
Maximum number of consecutive days with precipitation >=1mm



	1986-2005	2046-2065	2081-2100
RCP4.5	7.8	6.9	7.3
RCP8.5	7.5	7.3	6.7

Heavy precipitation days

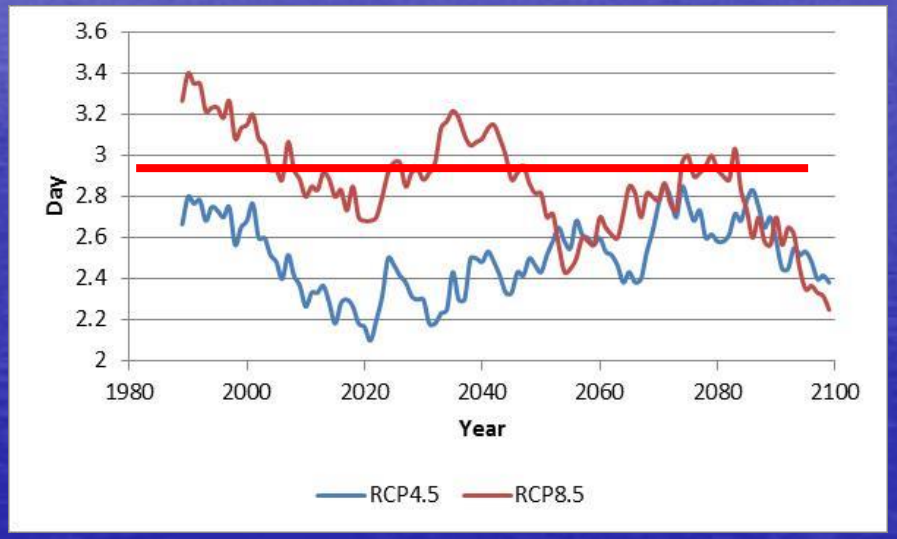
Annual count of days when precipitation>=10mm



	1986-2005	2046-2065	2081-2100
RCP4.5	10.4	9.7	9.9
RCP8.5	11.1	9.6	9.1

Heavy precipitation days

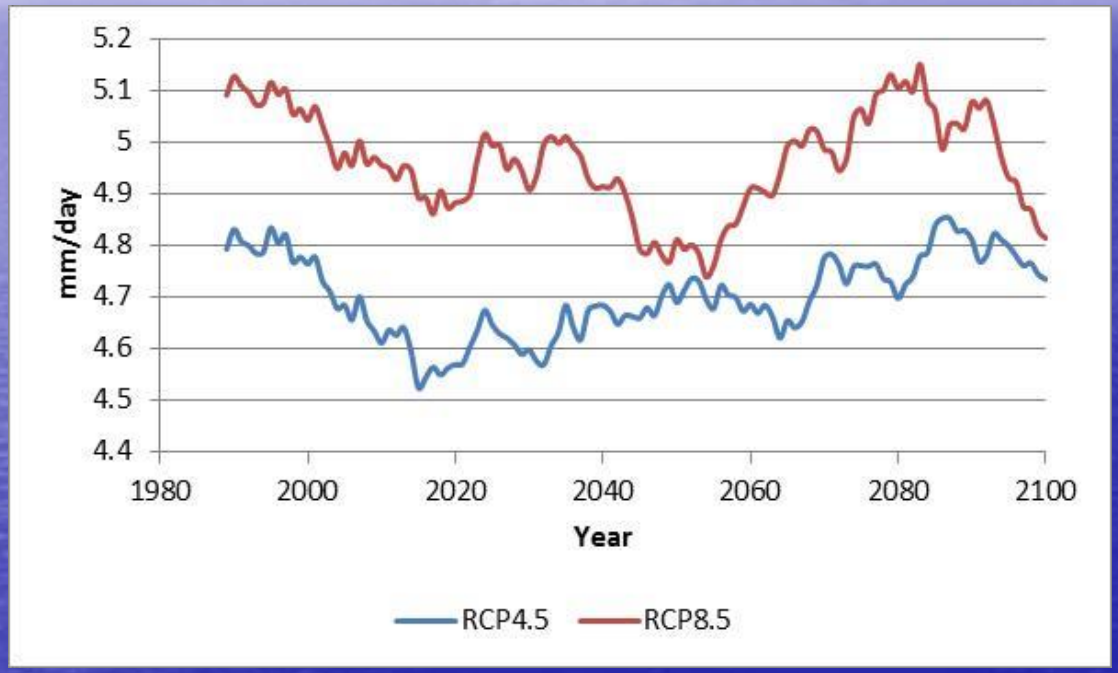
Annual count of days when precipitation>=20mm



	1986-2005	2046-2065	2081-2100
RCP4.5	2.7	2.5	2.6
RCP8.5	3.2	2.7	2.6

Simple daily intensity index

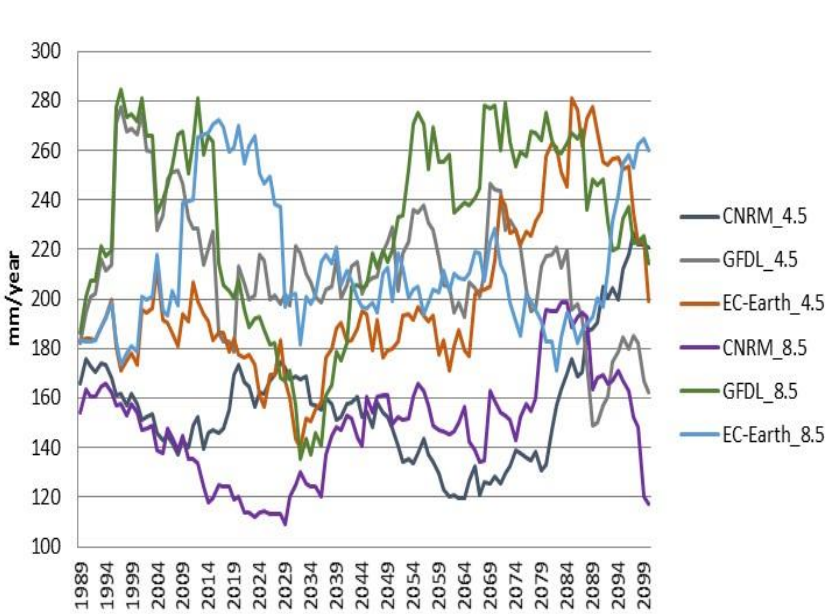
Annual total precipitation divided by the number of wet days (defined as PRCP>=1.0mm) in the year

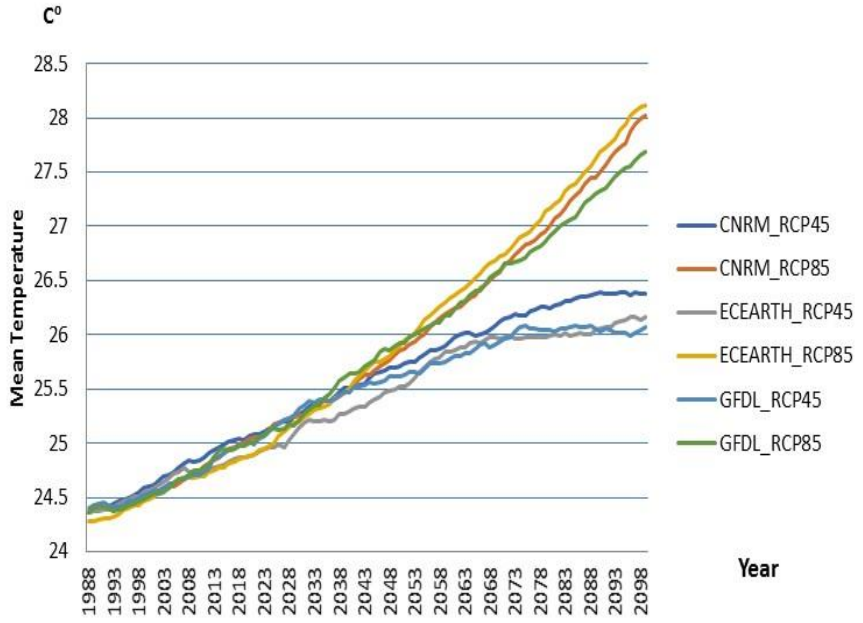


	1986-2005	2046-2065	2081-2100
RCP4.5	4.8	4.7	4.8
RCP8.5	5.1	4.8	5.0

Wadi Dayqah Basin

projected precipitation and temperature at Wadi Dayqah Basin



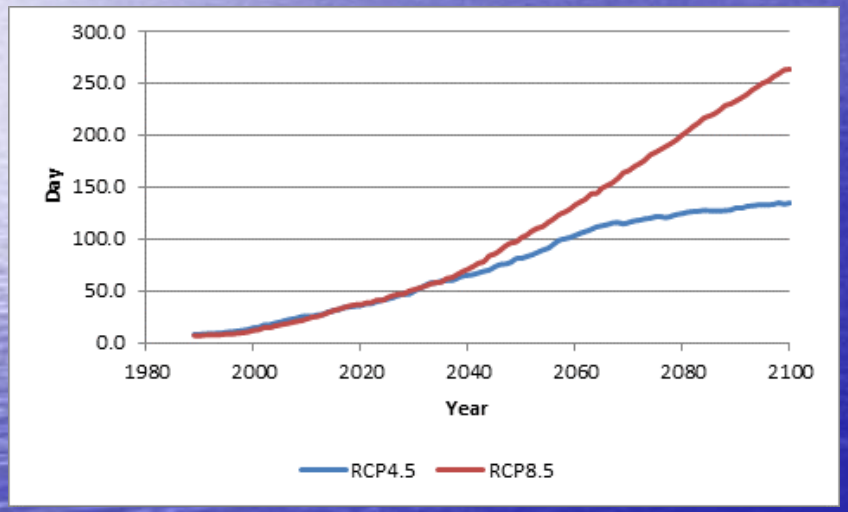


Changes in Temperature Indices

Wadi Dayqah Basin

Warm spell duration indicator

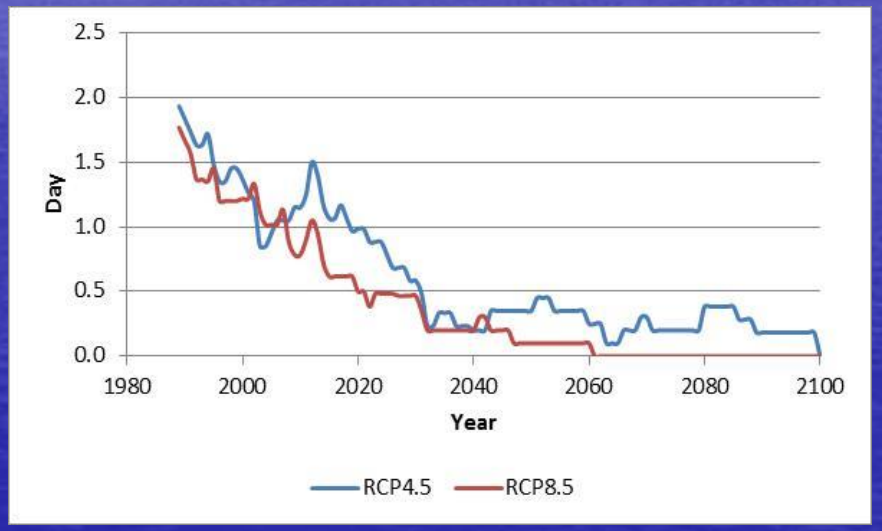
Annual count of days with at least 6 consecutive days when maximum temperature>90th percentile



	1986-2005	2046-2065	2081-2100
RCP4.5	13	93	130
RCP8.5	11	117	236

Cold spell duration indicator

Annual count of days with at least 6 consecutive days when minimum temperature <10th percentile

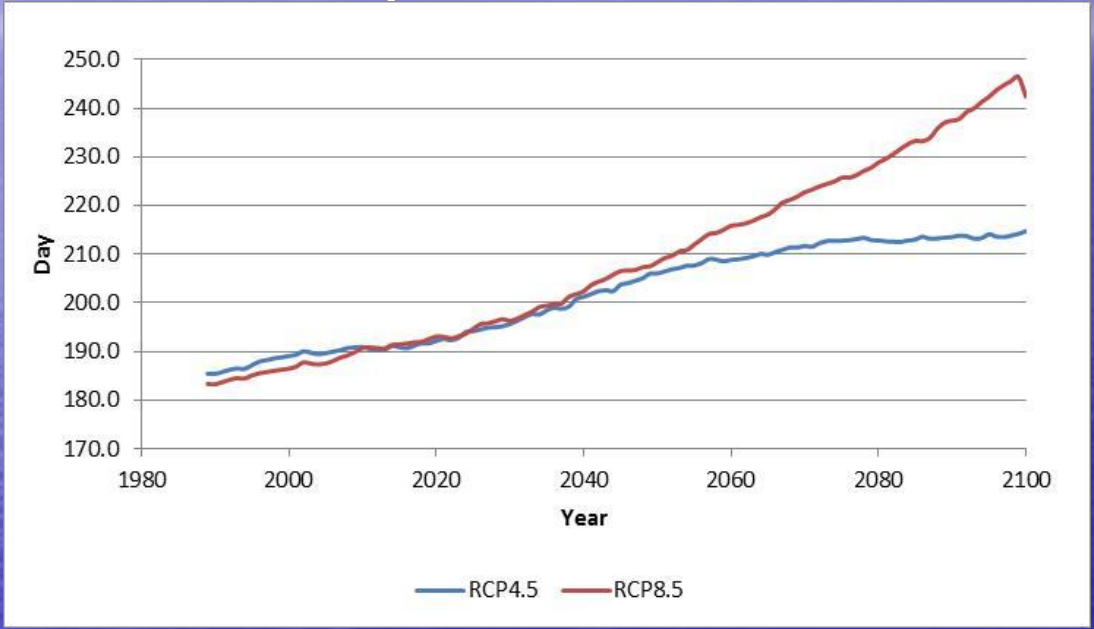


	1986-2005	2046-2065	2081-2100
RCP4.5	1.4	0.3	0.2
RCP8.5	1.3	0.1	0.0

Wadi Dayqah Basin

Tropical nights

Annual count when daily minimum temperature>20ºC

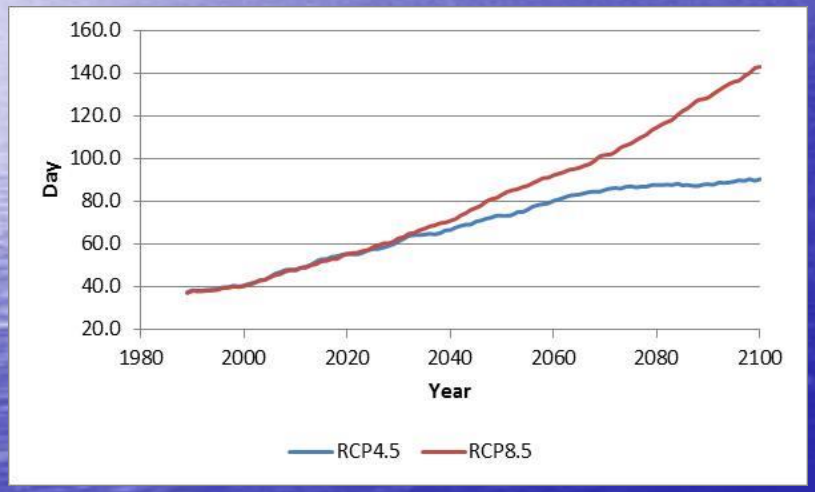


	1986-2005	2046-2065	2081-2100
RCP4.5	188	207	213
RCP8.5	186	212	238

Wadi Dayqah Basin

Number of hot days

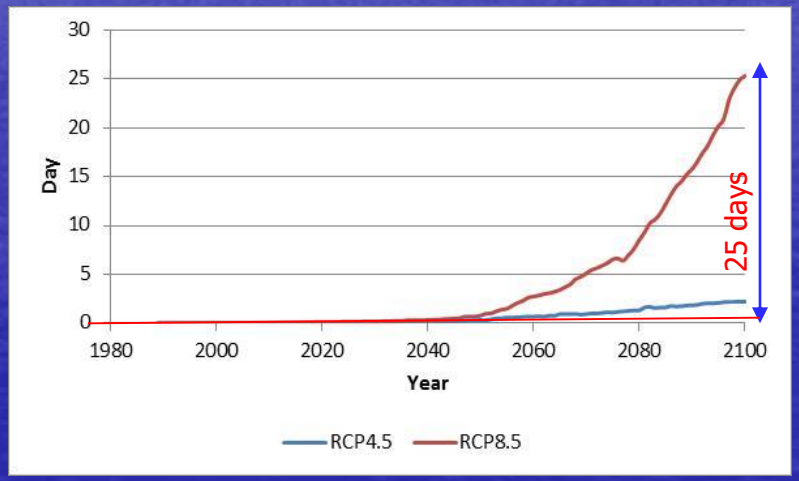
Annual count when daily maximum temperature >35ºC



	1986-2005	2046-2065	2081-2100
RCP4.5	40.4	76.9	88.7
RCP8.5	40.1	87.6	129.9

Number of very hot days

Annual count when daily maximum temperature >40ºC



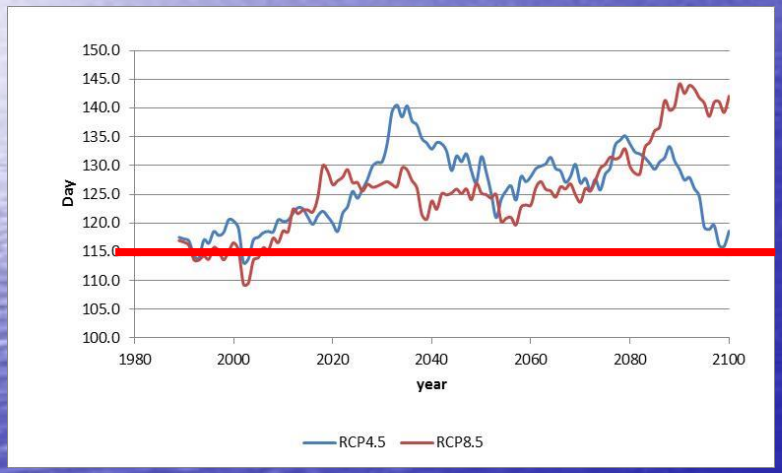
	1986-2005	2046-2065	2081-2100
RCP4.5	0.0	0.5	1.9
RCP8.5	0.0	1.8	16.8

Changes in Precipitation Indices

Wadi Dayqah Basin

Consecutive dry days

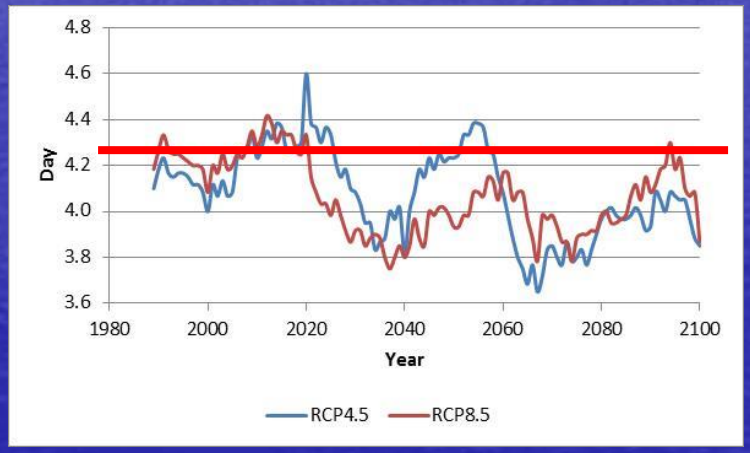
Maximum number of consecutive days with precipitation<1mm



	1986-2005	2046-2065	2081-2100
RCP4.5	117.0	128	126
RCP8.5	114	124	139

Consecutive wet days

Maximum number of consecutive days with precipitation >=1mm

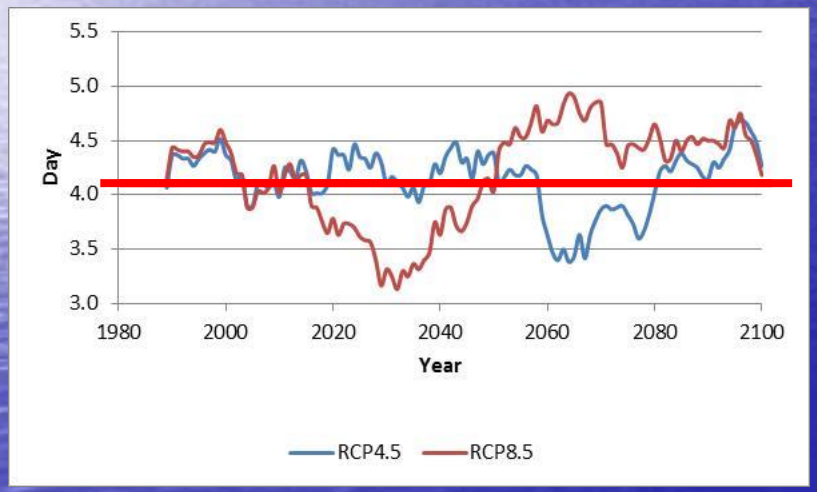


	1986-2005	2046-2065	2081-2100
RCP4.5	4.1	4.2	4.0
RCP8.5	4.2	4.0	4.1

Wadi Dayqah Basin

Heavy precipitation days

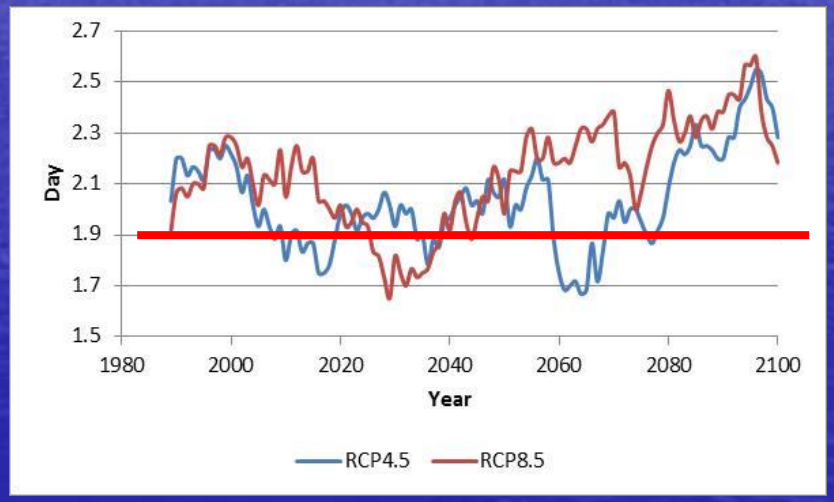
Annual count of days when precipitation>=10mm



	1986-2005	2046-2065	2081-2100
RCP4.5	4.3	4.0	4.4
RCP8.5	4.3	4.5	4.5

Very Heavy precipitation days

Annual count of days when precipitation>=20mm

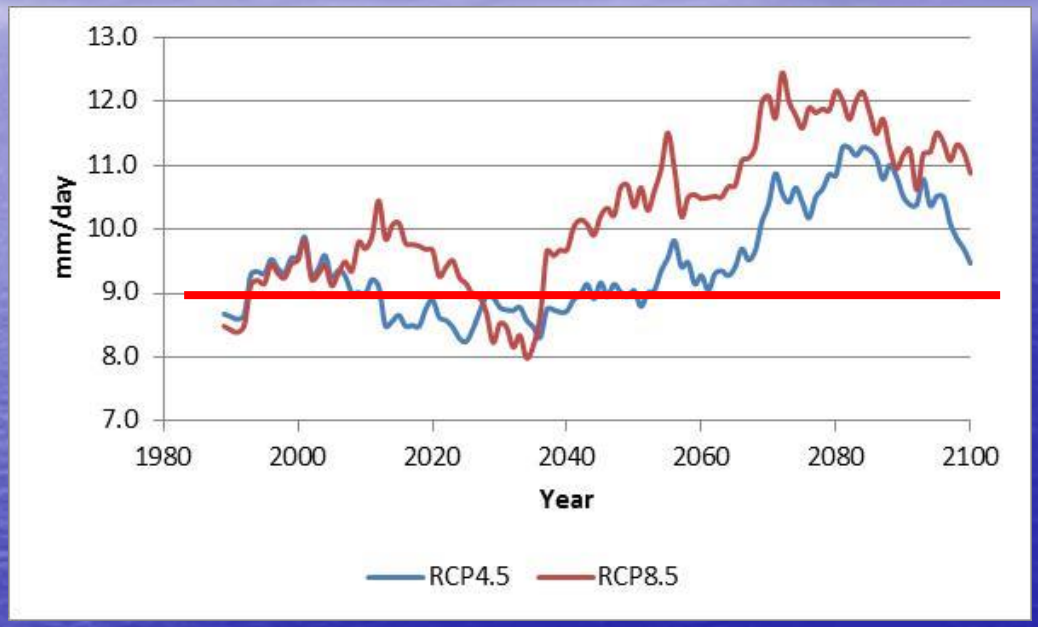


	1986-2005	2046-2065	2081-2100
RCP4.5	2.1	2.0	2.3
RCP8.5	2.1	2.2	2.4

Wadi Dayqah Basin

Simple daily intensity index

Annual total precipitation divided by the number of wet days (defined as PRCP>=1.0mm) in the year



	1986-2005	2046-2065	2081-2100
RCP4.5	9.2	9.2	10.6
RCP8.5	9.1	10.6	11.4

summary

summary

At Nahr el Kabir Al-Junoubi basin :

- There is a tendency towards dryer conditions
- There is an increase in heat extremes such as warm spell duration, number of hot days, number of very hot days, and tropical nights over the time period,
- There is an increase of precipitation intensity and heavy precipitation together with increasing consecutive dry days.

summary

At Mejerda Basin:

- There is a tendency towards dryer conditions
- There is an increase in heat extremes such as warm spell duration, number of hot days, number of very hot days, and tropical nights over the time period,
- There is an increase of precipitation intensity and heavy precipitation together with increasing consecutive dry days.

summary

- At Wadi Dayqah Basin :
  - There is a tendency towards wetter conditions,
  - There is an increase in heat extremes such as warm spell duration, number of hot days, number of very hot days, and tropical nights over the time period,
  - There is an increase of precipitation intensity and heavy precipitation together with increasing consecutive dry days, and

Thanks