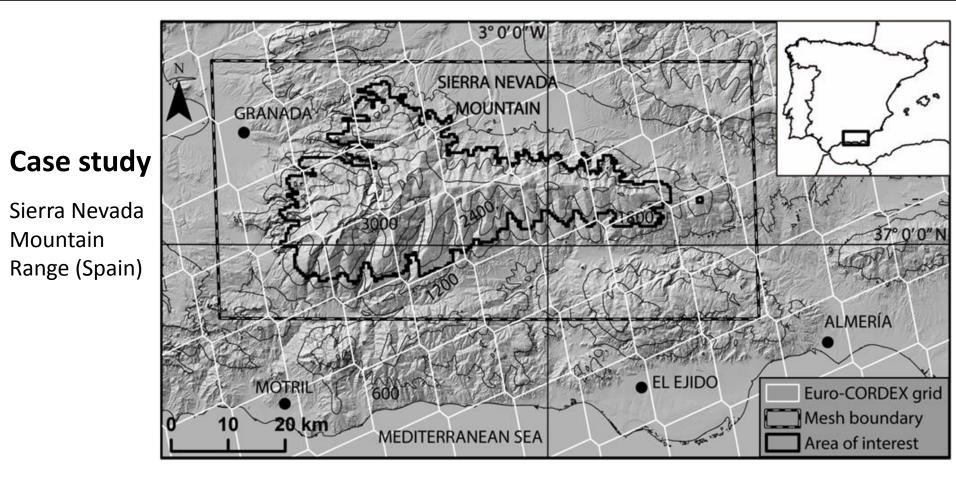


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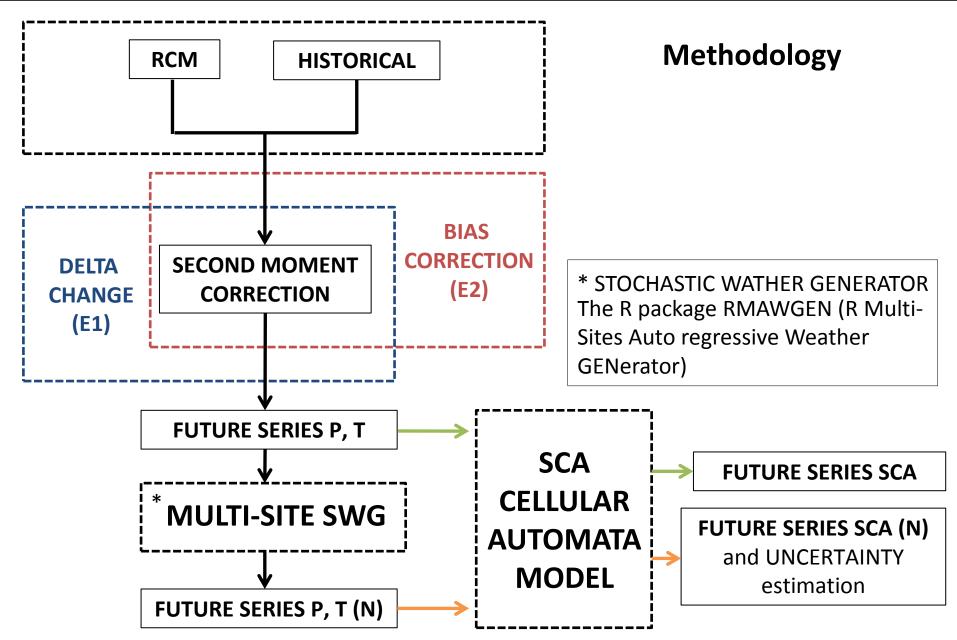




Objectives

Assessing impacts of future potential climate change scenarios on snow cover area by using cellular automata models, potential scenarios of CC and Stochastic Weather Generators







Data

Historical climatic data (Spain02 project)

Spatial resolution: 12.5 Km

Temporal resolution: 1 day

Period for CA: 2000-2006 (3 + 3 years)

Period for FE: 1971-2000 (30 years)

Historical SCA data (MODIS)

Spatial resolution: approx.. 460 m

Temporal resolution: 1 day

Period: 2000-2006 (3 + 3 years)

Regional climate models (Project CORDEX)

Spatial resolution: 12.5 Km

Temporal resolution: 1 day

Control period: 1971-2000 (30 years)

Future period: 2071-2100 (30 years)

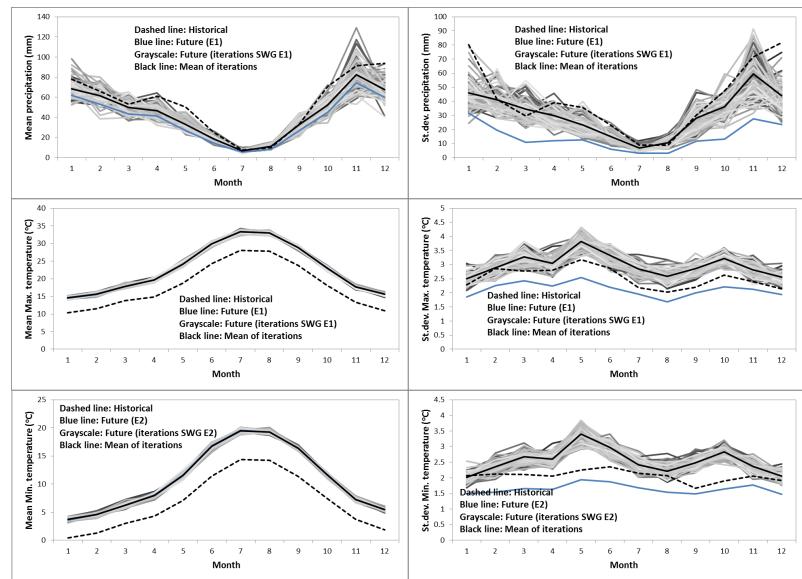
Scenario: RCP 8.5

GCM RCM	CNRM-CM5	EC-EARTH	MPI-ESM-LR	IPSL- CM5A-MR
CCLM4-8-17	Х	Х	Х	
RCA4	Х	Х	Х	
HIRHAM5		Х		
RACMO22E		Х		
WRF331F				Х



Results: Future series P, T delta change

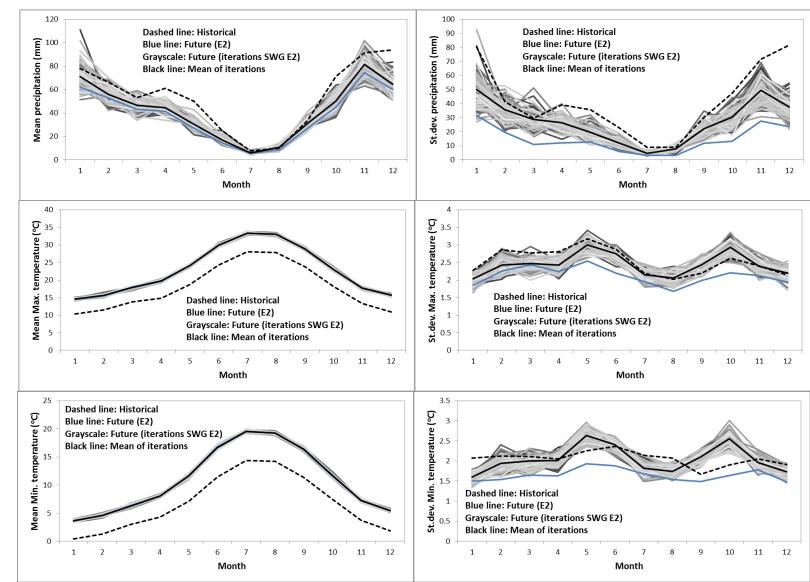
The SWG overestimate standard deviation





Results: Future series P, T bias correction

The SWG overestimate standard deviation





45.5 32 31.5 31 30.5 30 29.5 29 28.5 28.5 45 precipitation (mm) 44.5 44 43.5 43 42.5 dev. 42 41.5 28 From 50 27.5 St. 27 statistics 41 26.5 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 1 8 1 8 are stable Number of iterations Number of iterations 23.05 3.06 Mean Max. temperature (°C) 23 22.95 22.9 22.85 22.8 22.75 22.7 22.65 ŗ. 22.6 2.92 8 15 22 29 36 50 57 64 78 85 92 99 106 113 120 8 15 22 29 36 43 50 57 71 78 85 92 99 106 113 120 1 43 71 1 64 Number of iterations Number of iterations 11.15 2.59 2.59 2.58 2.57 2.56 2.55 2.54 temperature (°C) 11.1 11.05 11 10.95 10.9 2.53 2.52 2.51 2.51 Mean Min. 10.85 10.8 10.75 10.7 2.5 15 22 29 36 43 8 50 57 64 71 78 85 92 99 106 113 120 1 8 15 22 29 36 43 50 57 71 78 85 92 99 106 113 120 1 64 Number of iterations Number of iterations

Results: SWG, How many series? Delta change



42.6 27.5 27 26.5 26 25.5 25 24.5 42.4 42.2 42 41.8 41.6 41.4 41.4 41.2 From 50 s. 24 statistics 41 23.5 1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 are stable Number of iterations Number of iterations 22.88 2.48 dev. Max. temperature (°C) Mean Max. temperature (°C) 22.86 2.46 22.84 2.44 22.82 2.42 22.8 2.4 22.78 2.38 22.76 s. 22.74 2.36 78 15 22 29 36 50 99 106 113 120 8 15 22 29 36 43 50 57 64 71 85 92 99 106 113 120 1 8 43 57 64 71 78 85 92 1 Number of iterations Number of iterations 10.95 2.07 2.07 2.06 2.05 2.04 2.03 10.94 10.93 10.92 10.91 10.9 10.9 10.9 2.02 2.01 2.01 2 2 10.88 <u>.</u> Σ 10.87 10.84 1.99 8 15 22 29 36 43 50 57 85 92 99 106 113 120 1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 1 64 71 78 Number of iterations Number of iterations

Results: SWG, How many series? Bias correction



Methodology: Correction of the series generated by the SWG

1) Monthly relative change of the mean and standard deviation between the base series (B) and the generated series (G)

$$\Delta \mu = \frac{\mu B - \mu G}{\mu G}$$
 and $\Delta \sigma = \frac{\sigma B - \sigma G}{\sigma G}$

2) Normalization of the generated series

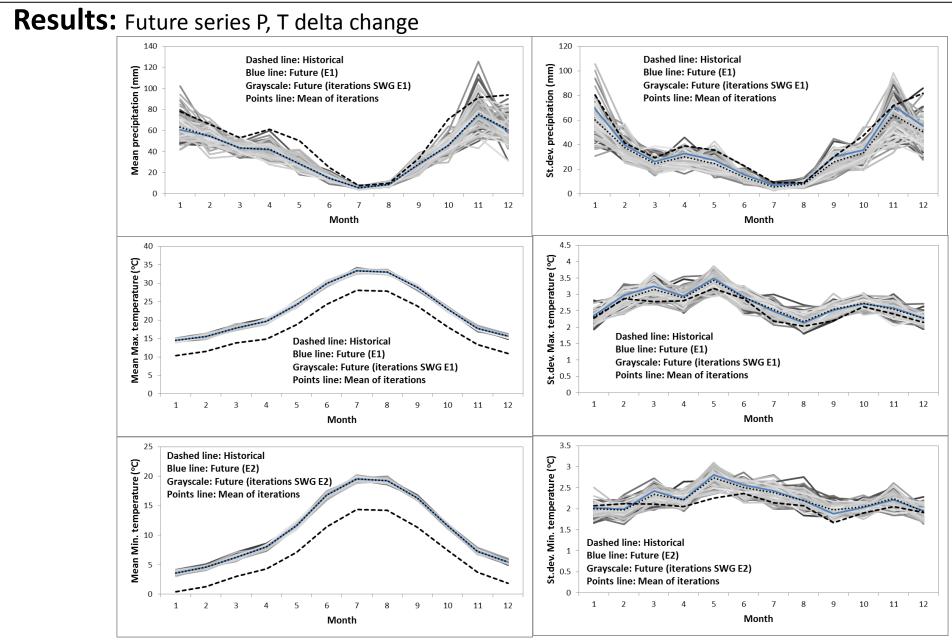
$$Gn_i = \frac{G_i - \mu G}{\sigma G}$$

3) Generation of the corrected series

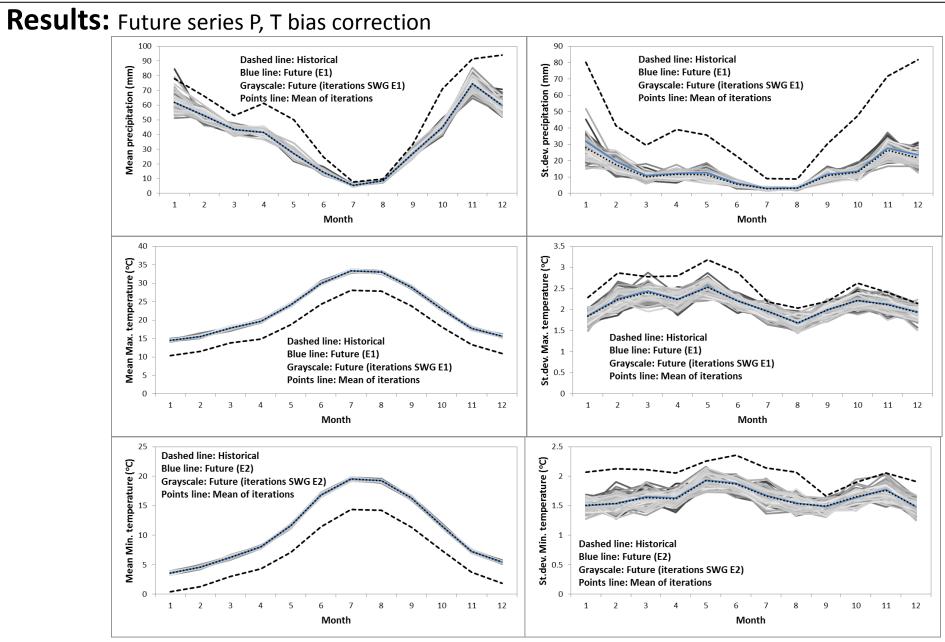
$$GC_i = \sigma_c \cdot Gn_i + \mu_c$$

where $\mu_c = \mu B \cdot (1 + \Delta \mu)$ and $\sigma_c = \sigma B \cdot (1 + \Delta \sigma)$



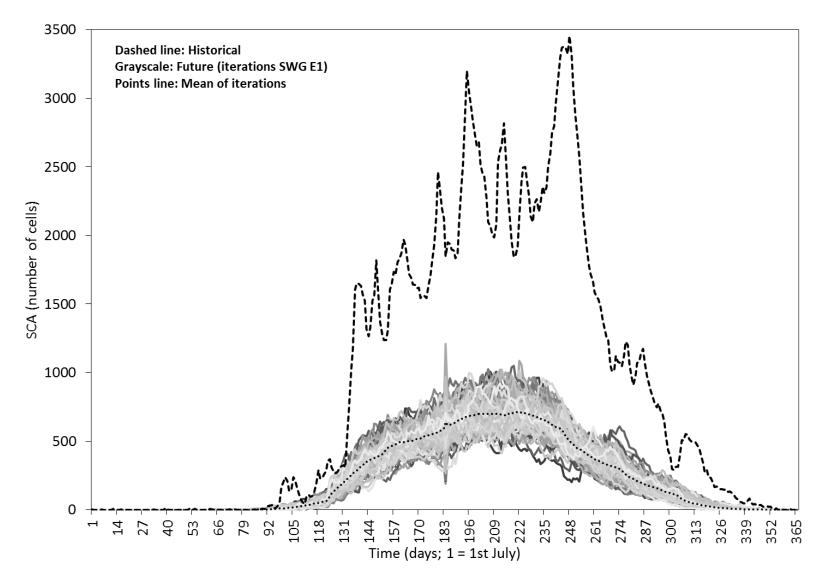






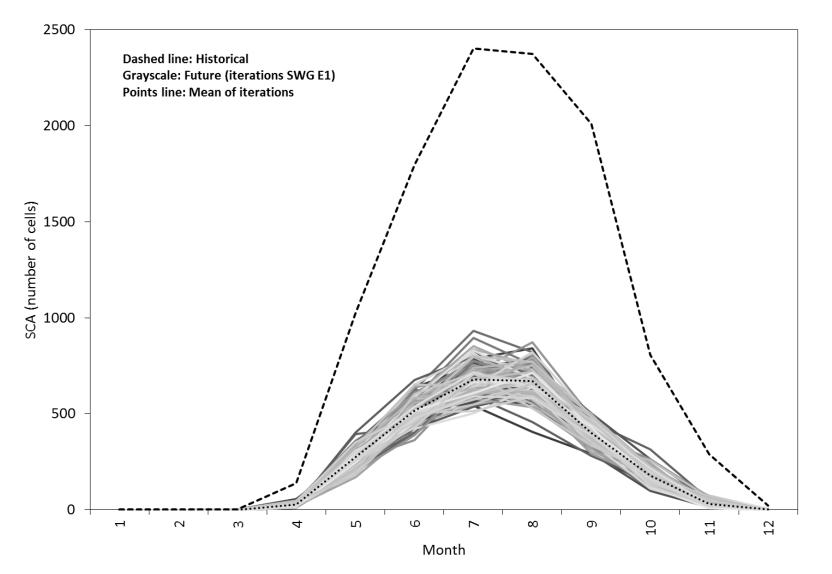


Results: Future series SCA delta change



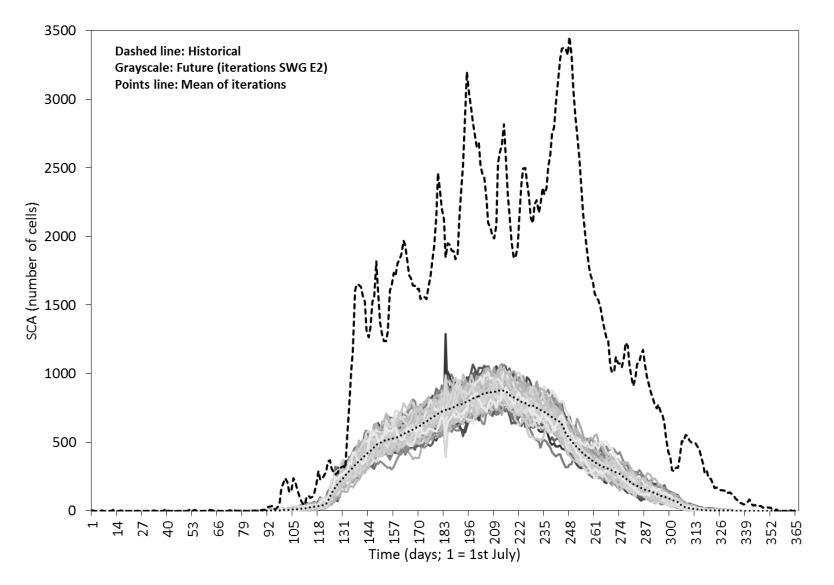


Results: Future series SCA delta change





Results: Future series SCA bias correction





Results: Future series SCA bias correction

