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Assessing impacts of future potential climate change scenarios on snow cover area by using cellular automata models and Montecarlo simulations

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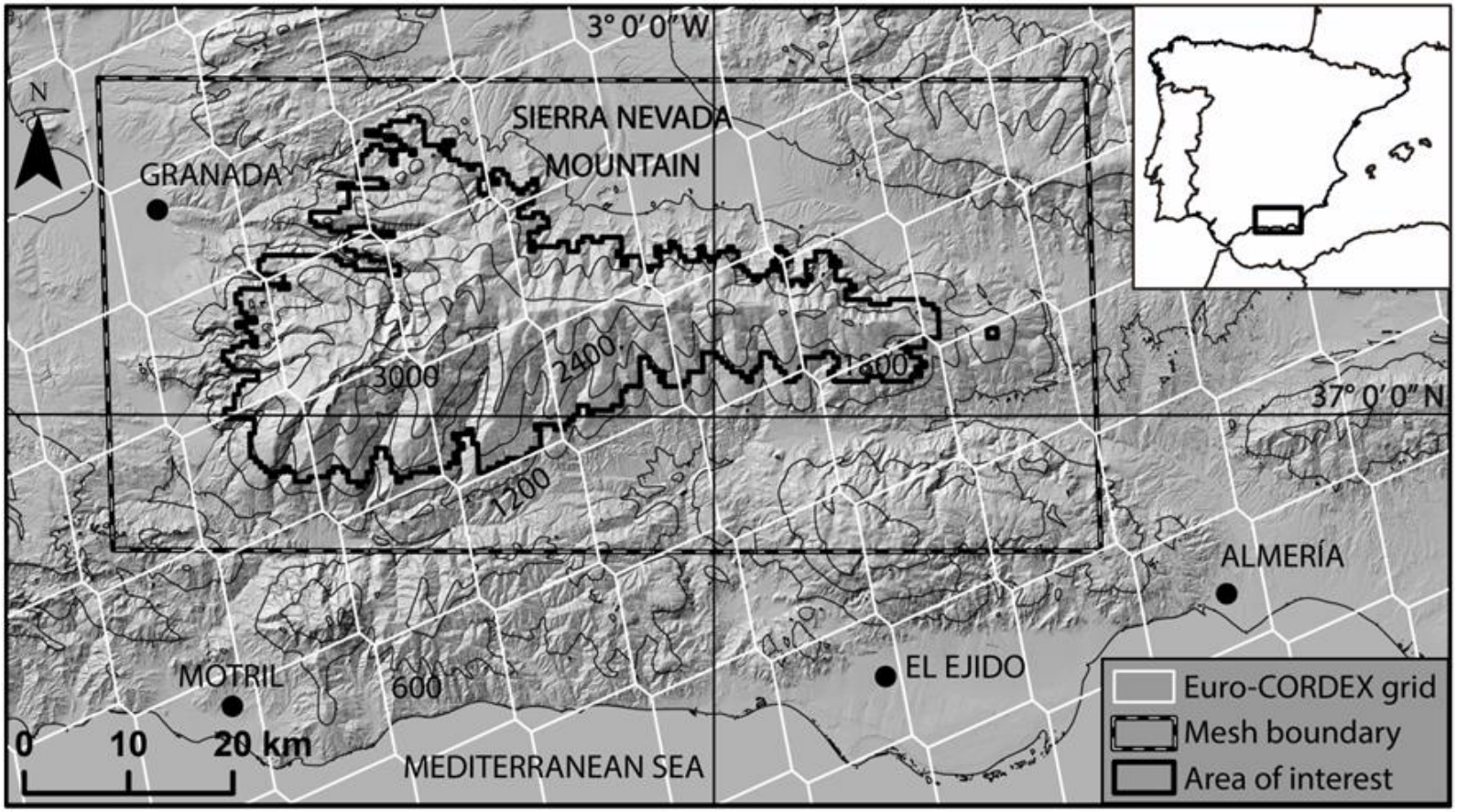
Case study

Sierra Nevada Mountain Range (Spain)



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

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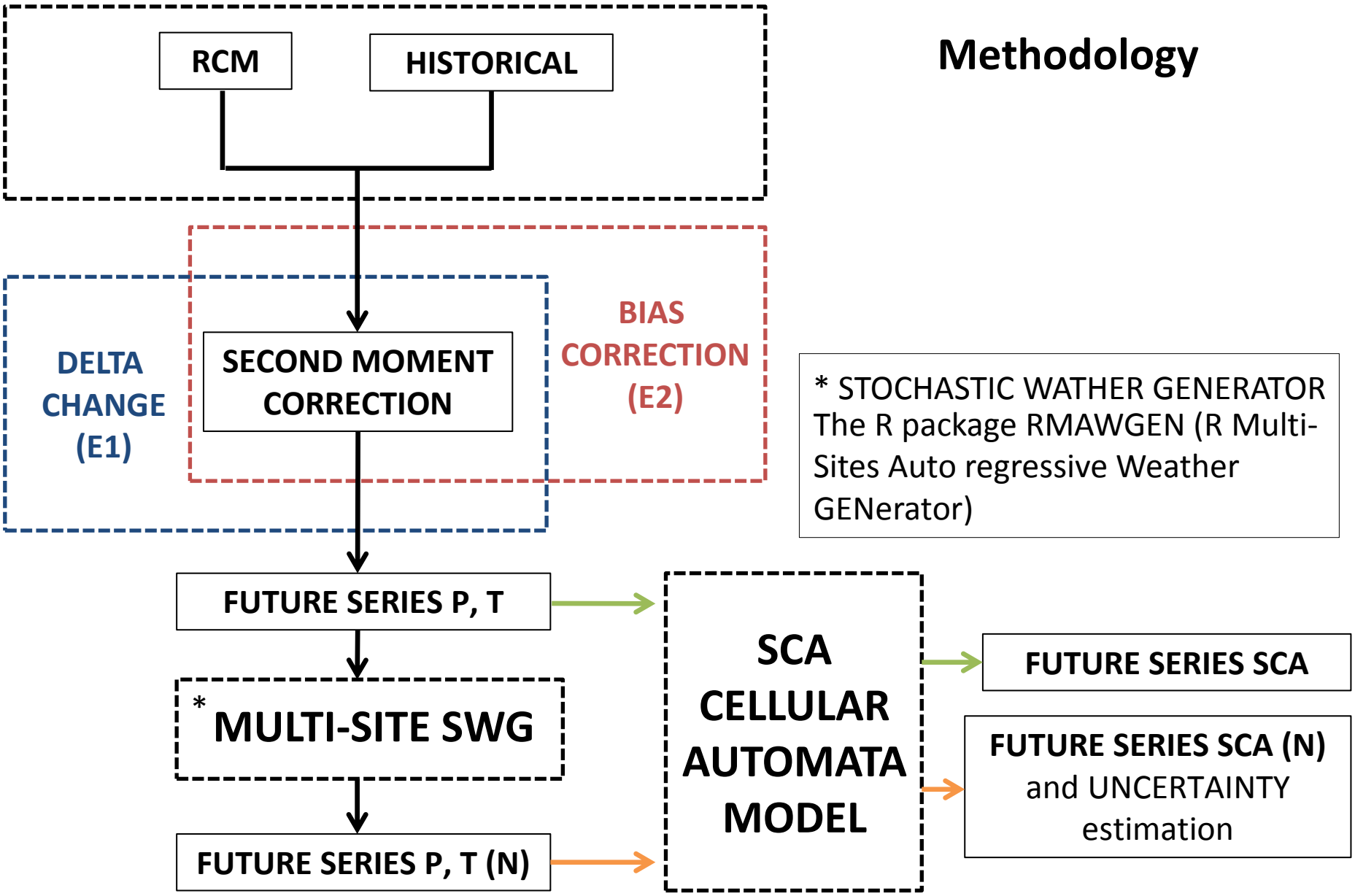
Methodology



* STOCHASTIC WATHER GENERATOR
The R package RMAWGEN (R Multi-Sites Auto regressive Weather GENerator)

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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)

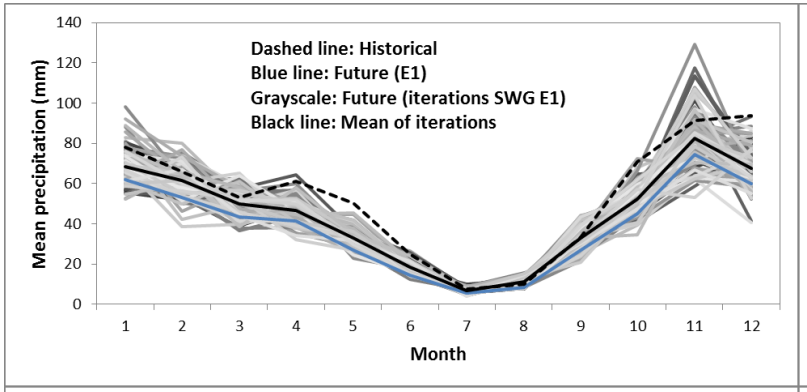
Future period: 2071-2100 (30 years)

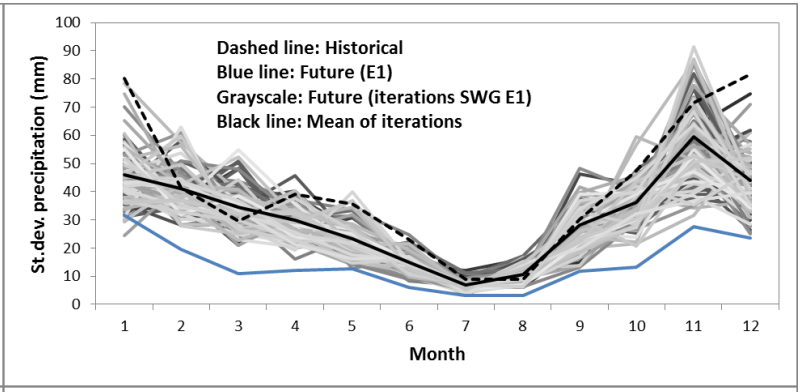
Scenario: RCP 8.5

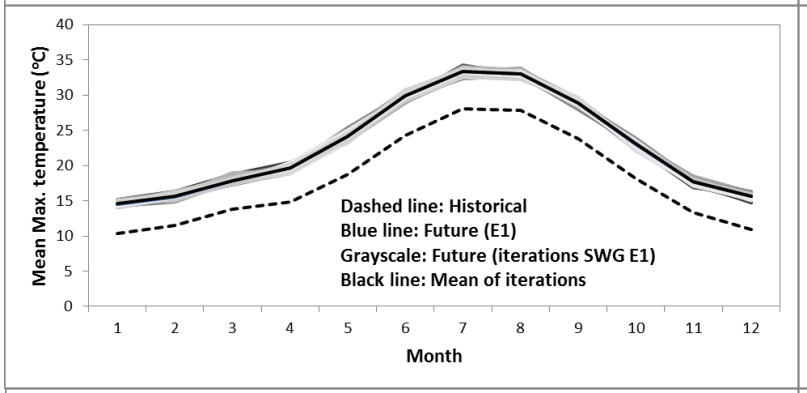
RCM \ GCM	CNRM-CM5	EC-EARTH	MPI-ESM-LR	IPSL-CM5A-MR
CCLM4-8-17	X	X	X	
RCA4	X	X	X	
HIRHAM5		X		
RACMO22E		X		
WRF331F				X

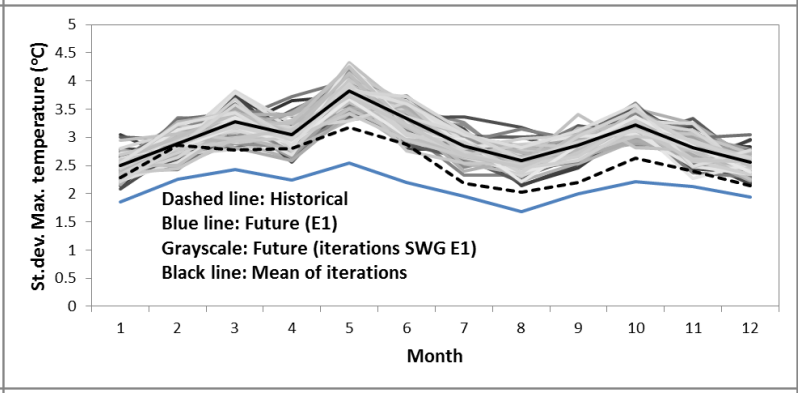
Results: Future series P, T delta change

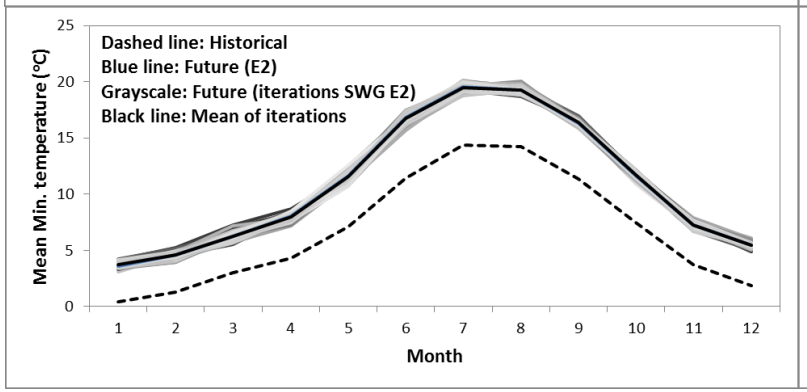
The SWG overestimate standard deviation

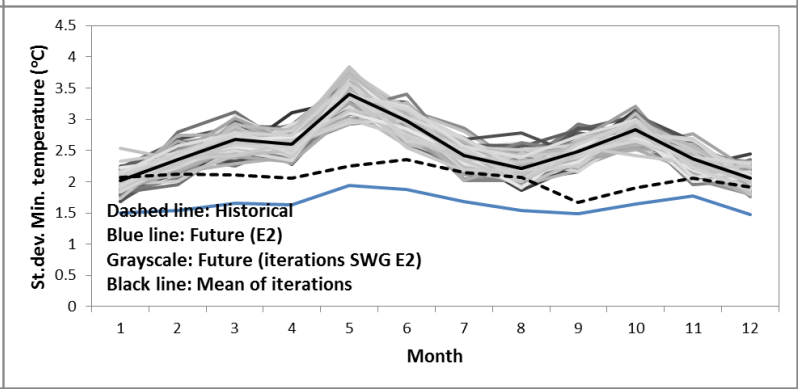






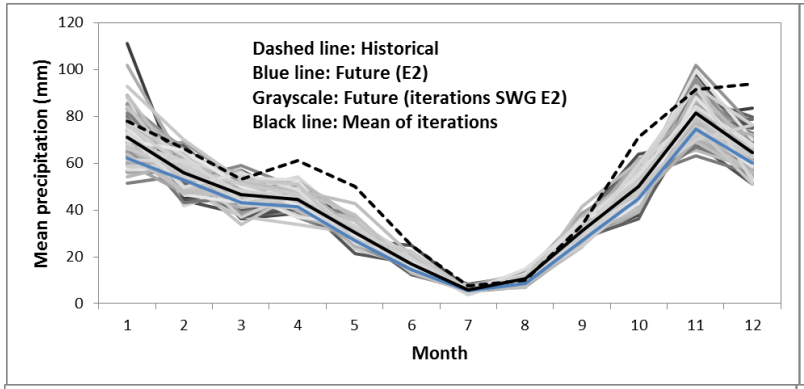


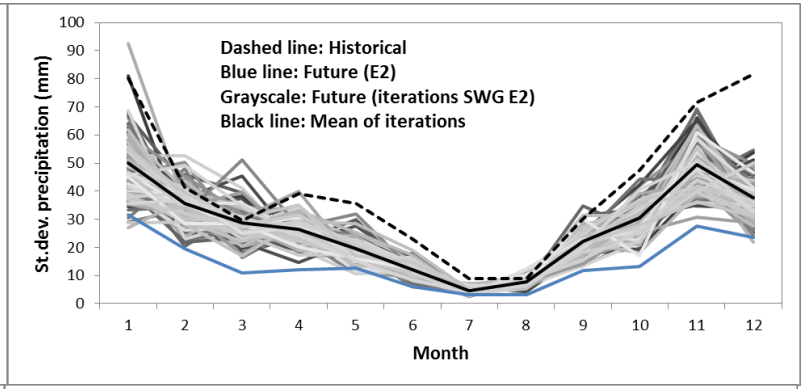


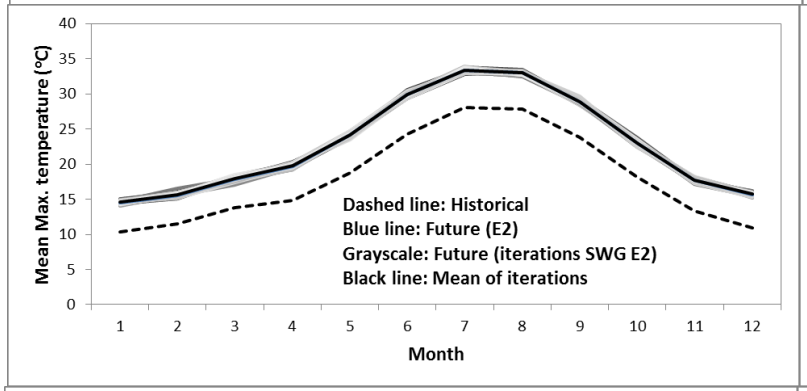


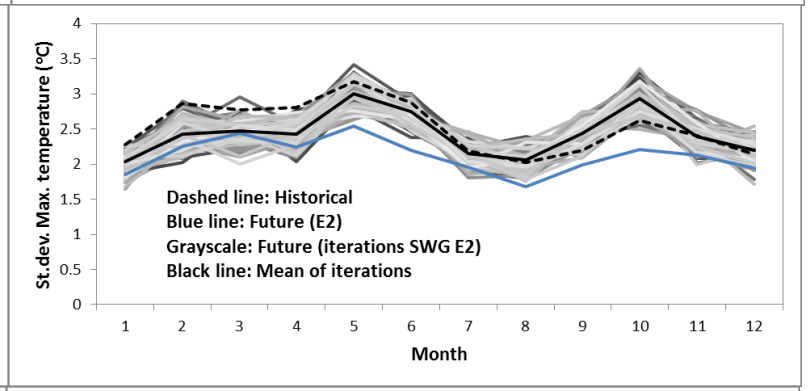
Results: Future series P, T bias correction

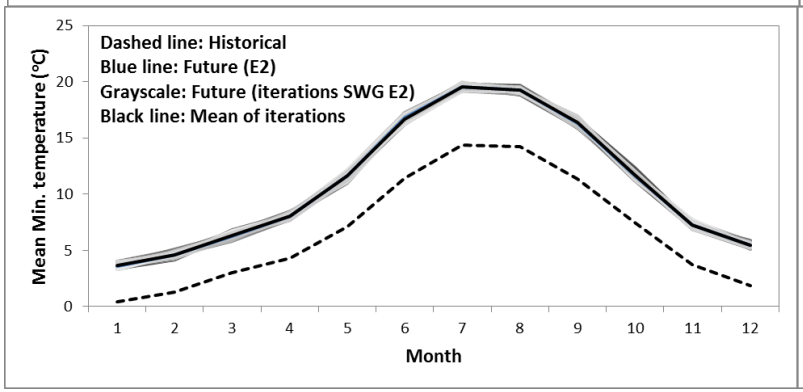
The SWG overestimate standard deviation

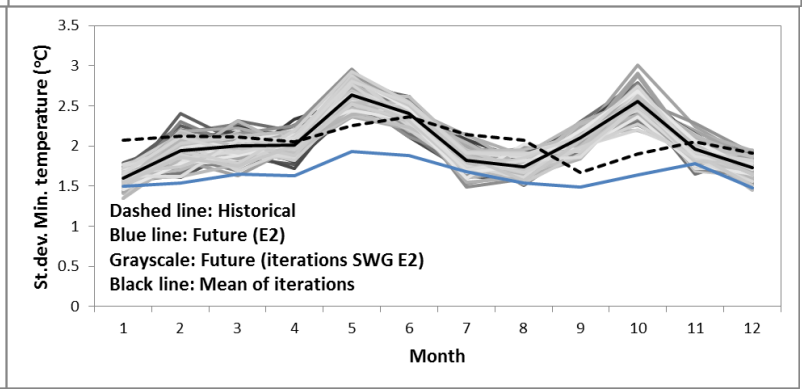






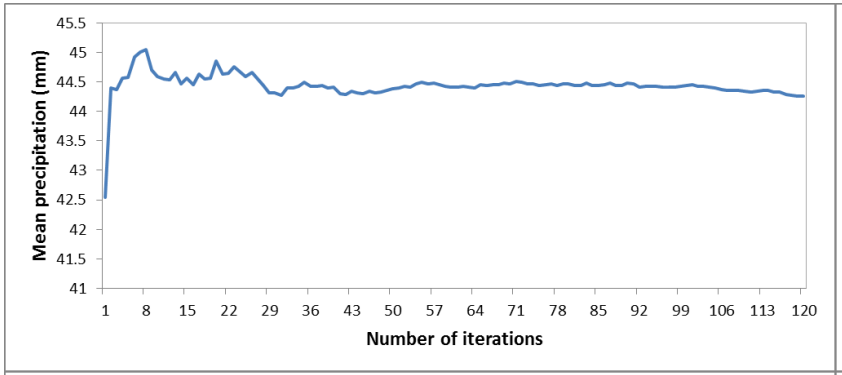


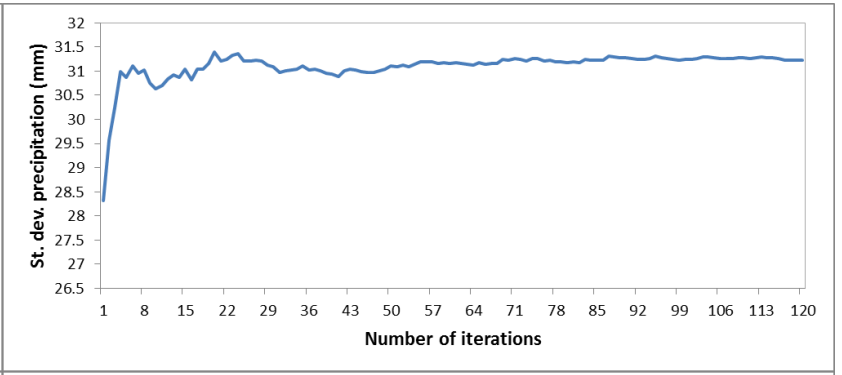


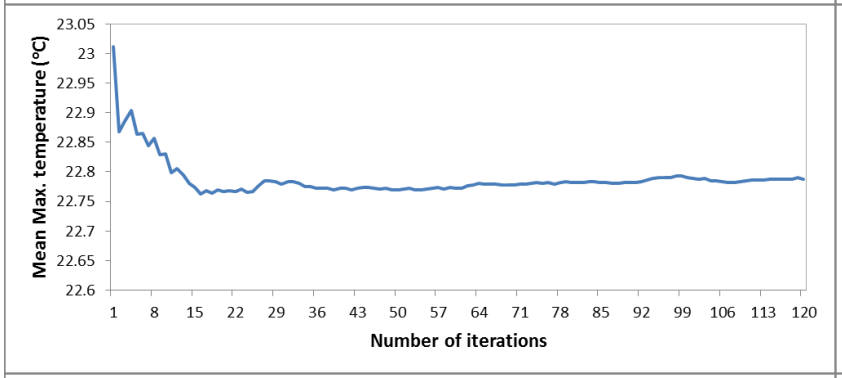


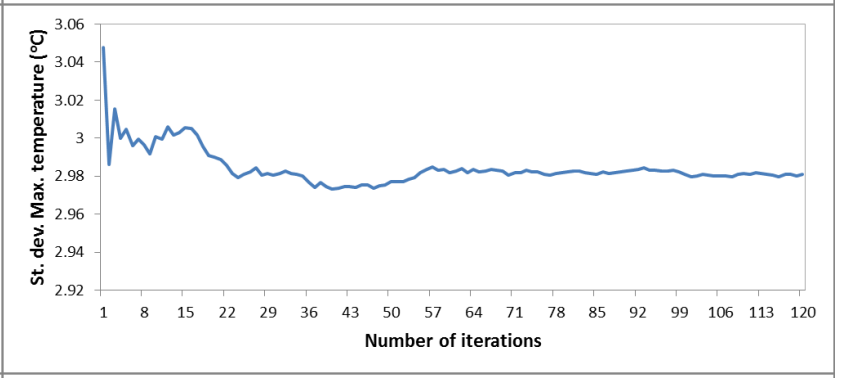
Results: SWG, How many series? Delta change

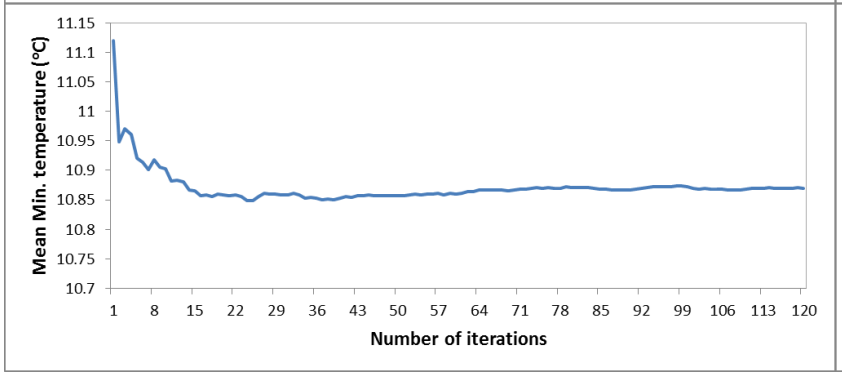
From 50 statistics are stable

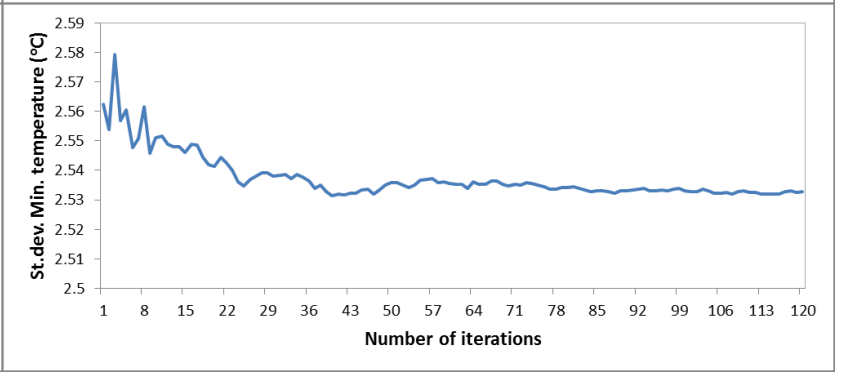






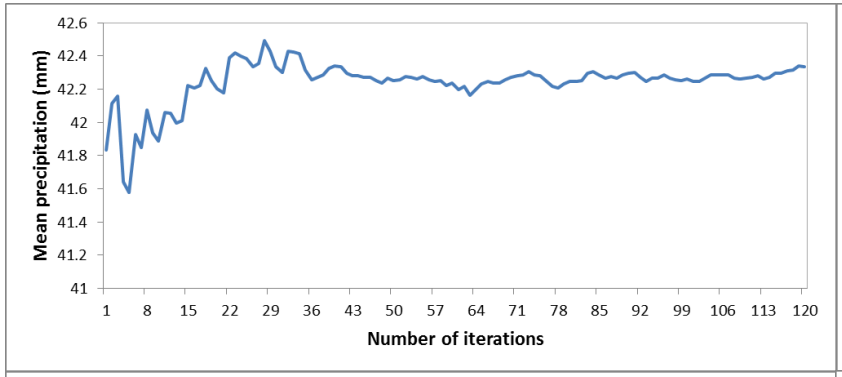


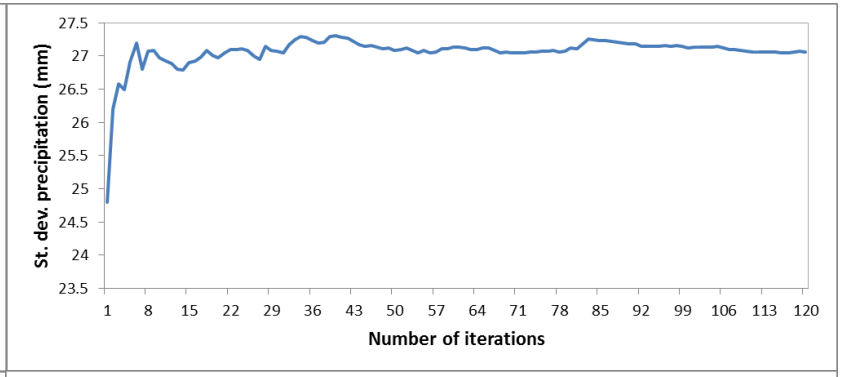


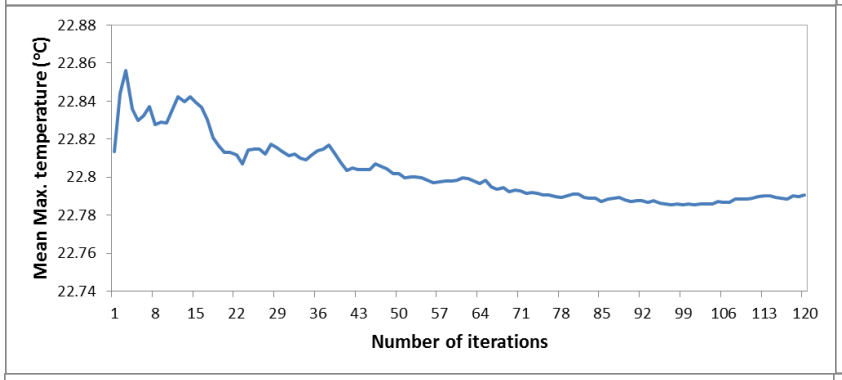


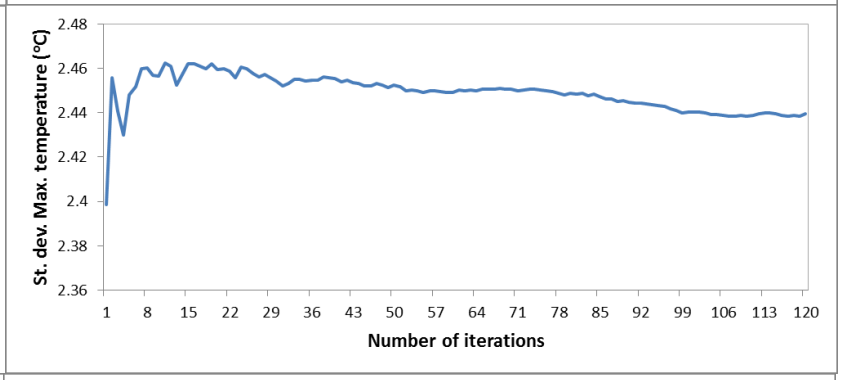
Results: SWG, How many series? Bias correction

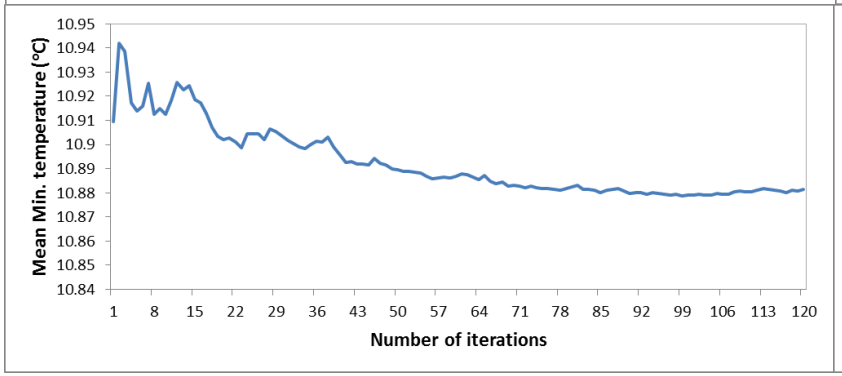
From 50 statistics are stable

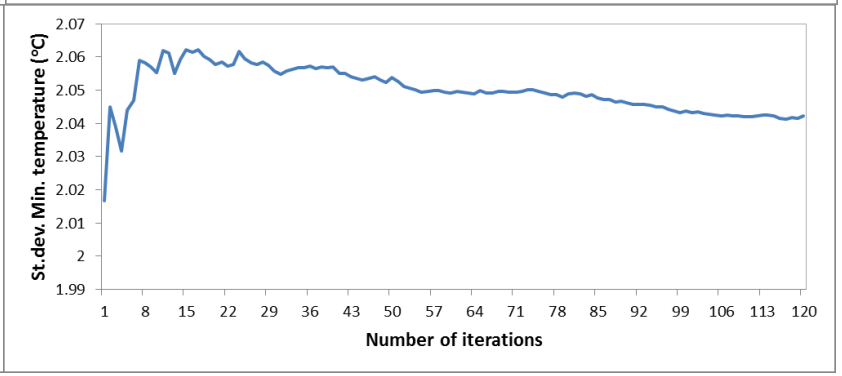












Methodology: Correction of the series generated by the SWG

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

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

2) Normalization of the generated series

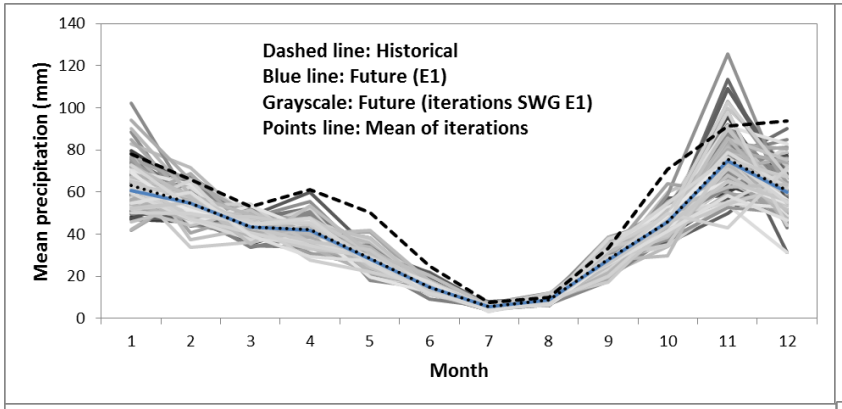
$$Gn_i = \frac{G_i - \mu G}{\sigma G}$$

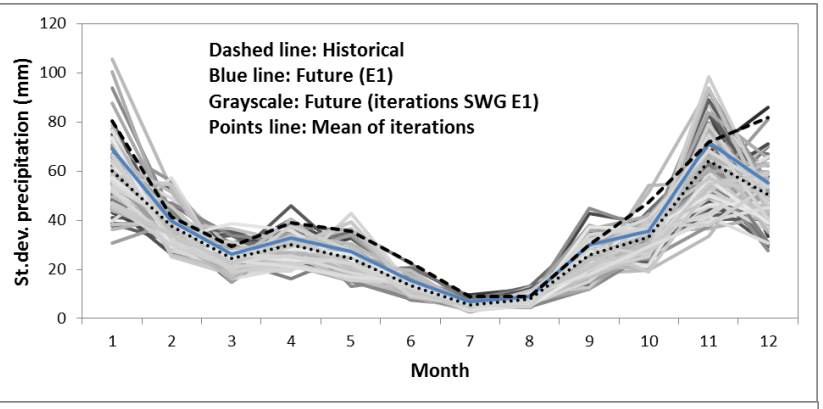
3) Generation of the corrected series

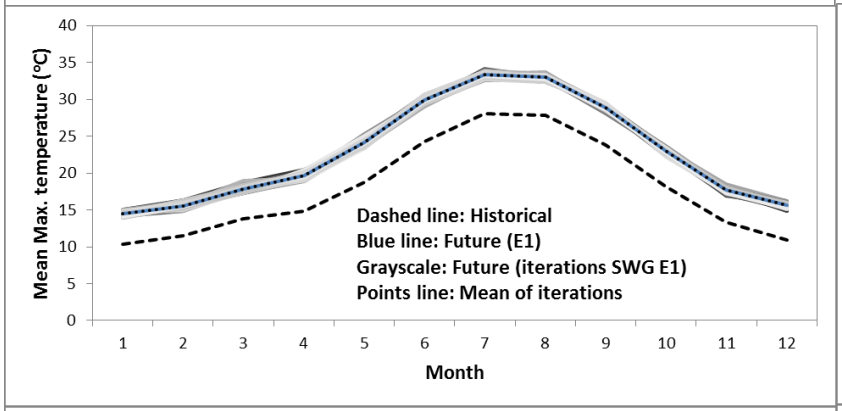
$$GC_i = \sigma_c \cdot Gn_i + \mu_c$$

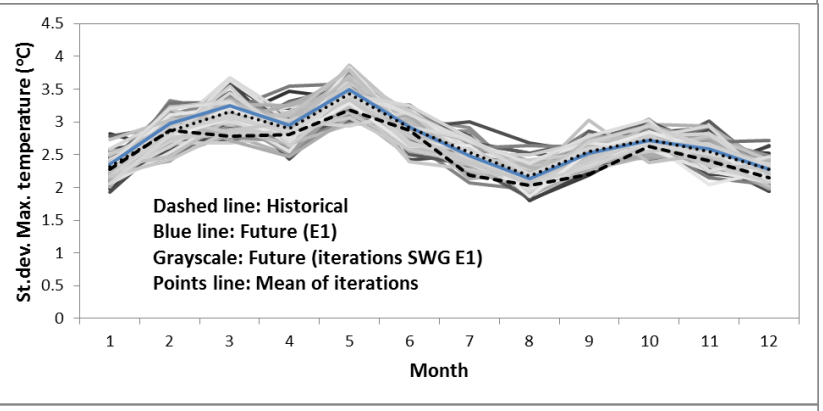
where $\mu_c = \mu B \cdot (1 + \Delta\mu)$ and $\sigma_c = \sigma B \cdot (1 + \Delta\sigma)$

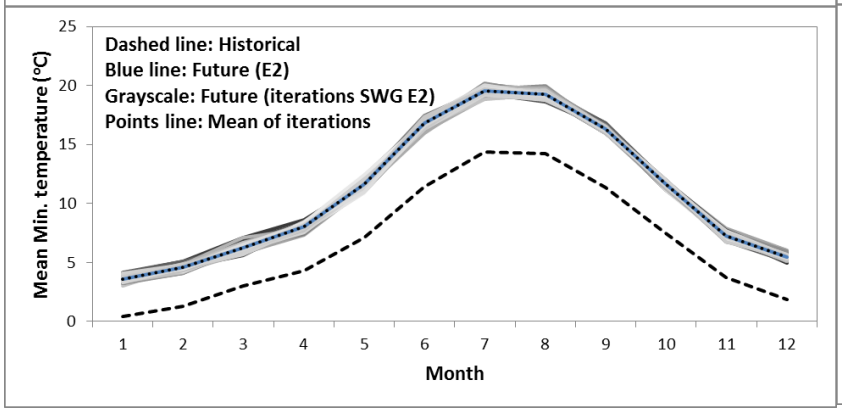
Results: Future series P, T delta change

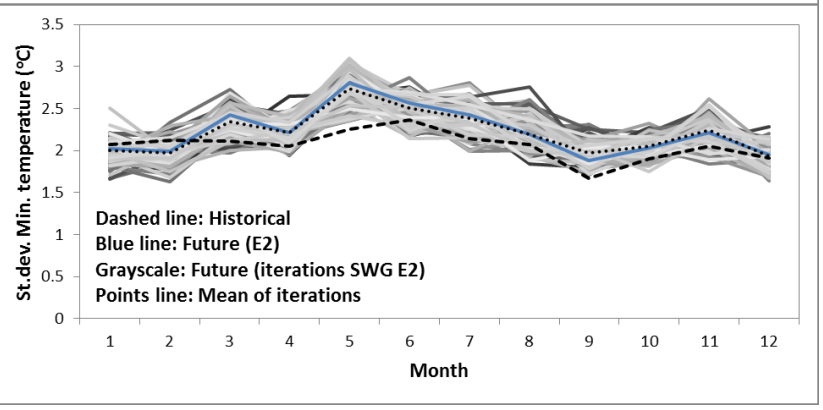




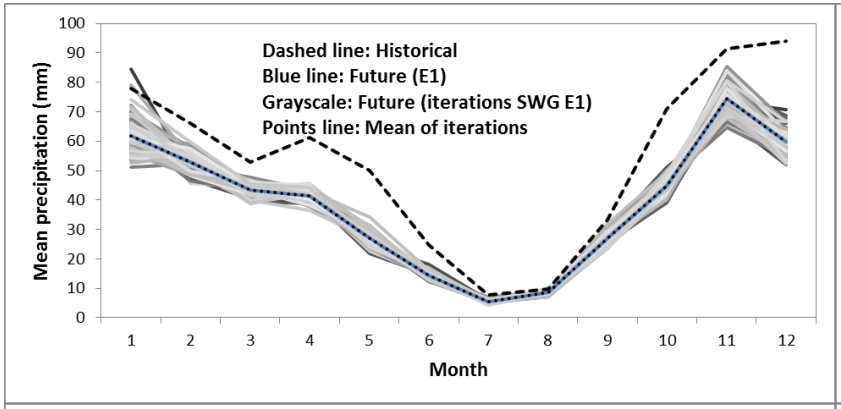


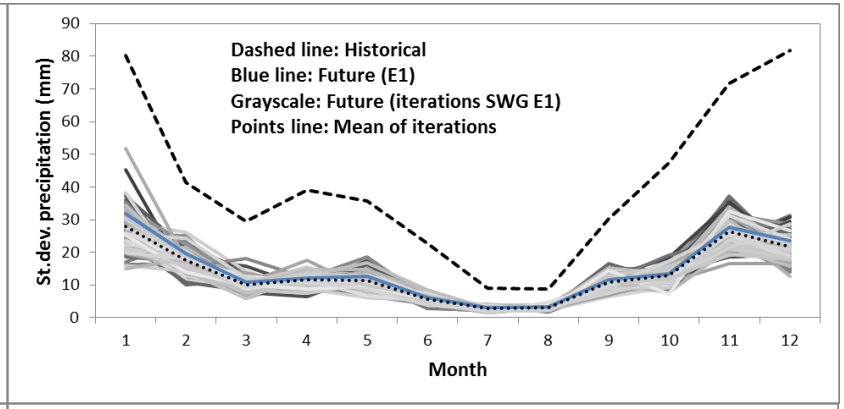


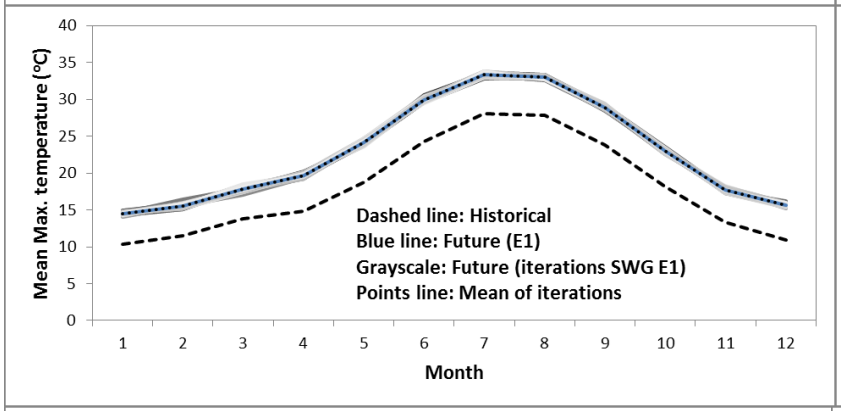


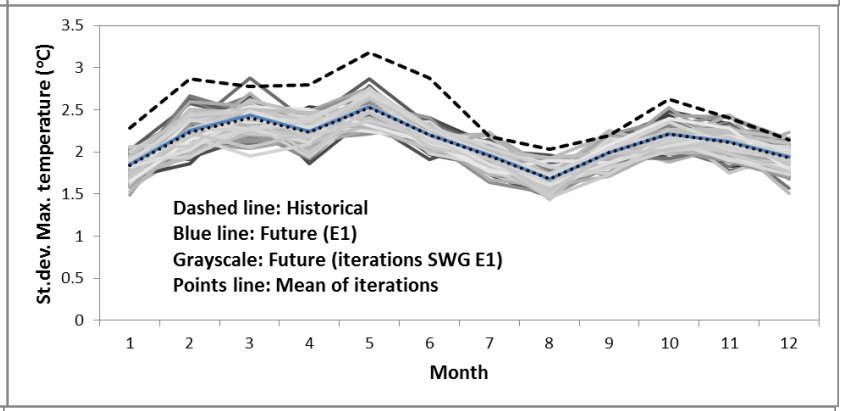


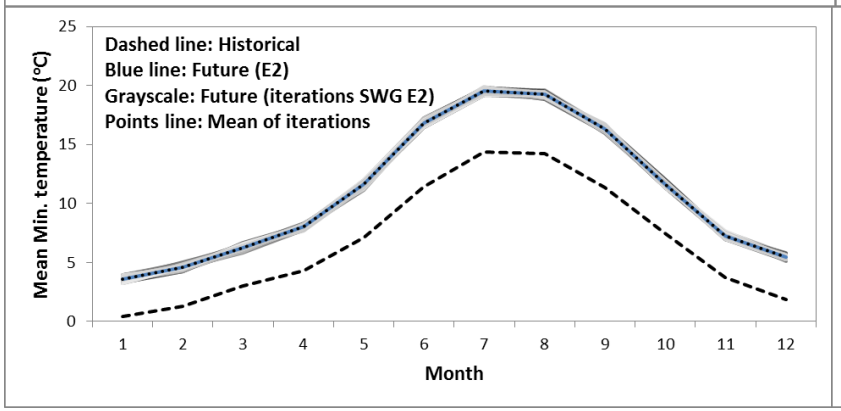
Results: Future series P, T bias correction

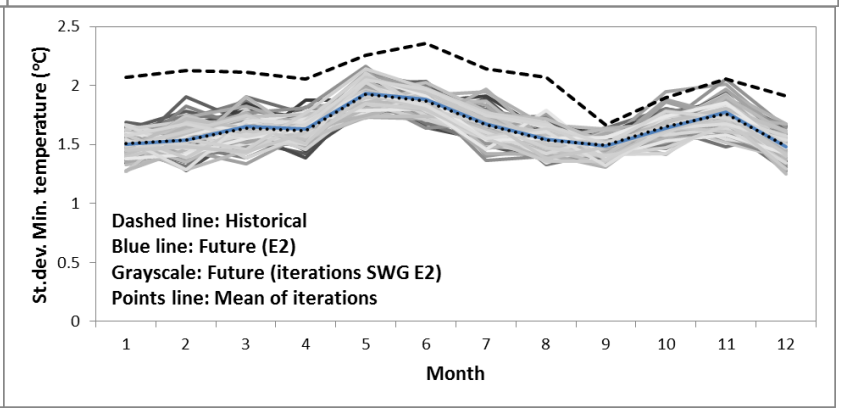












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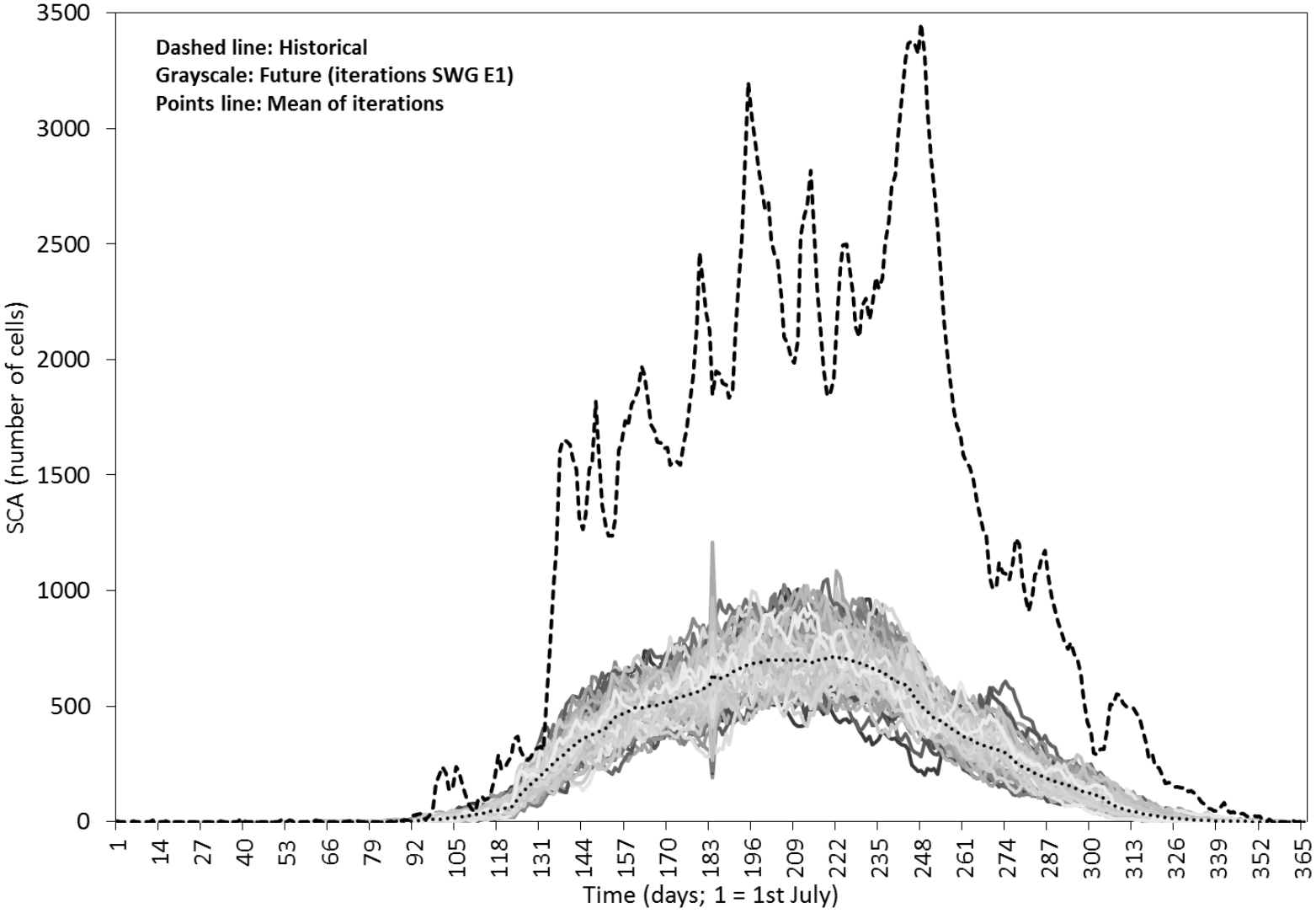
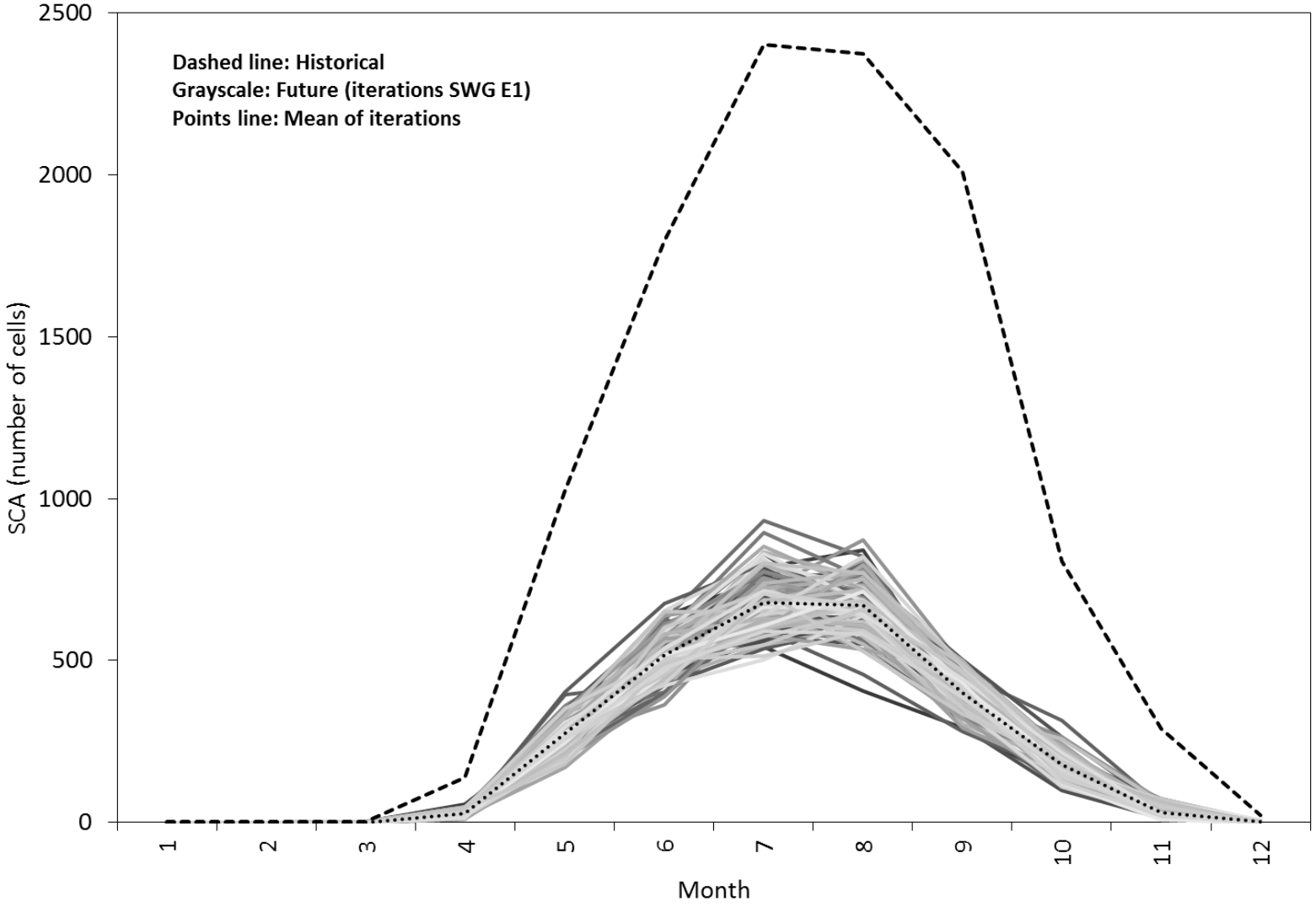
Results: Future series SCA delta change



Results: Future series SCA delta change



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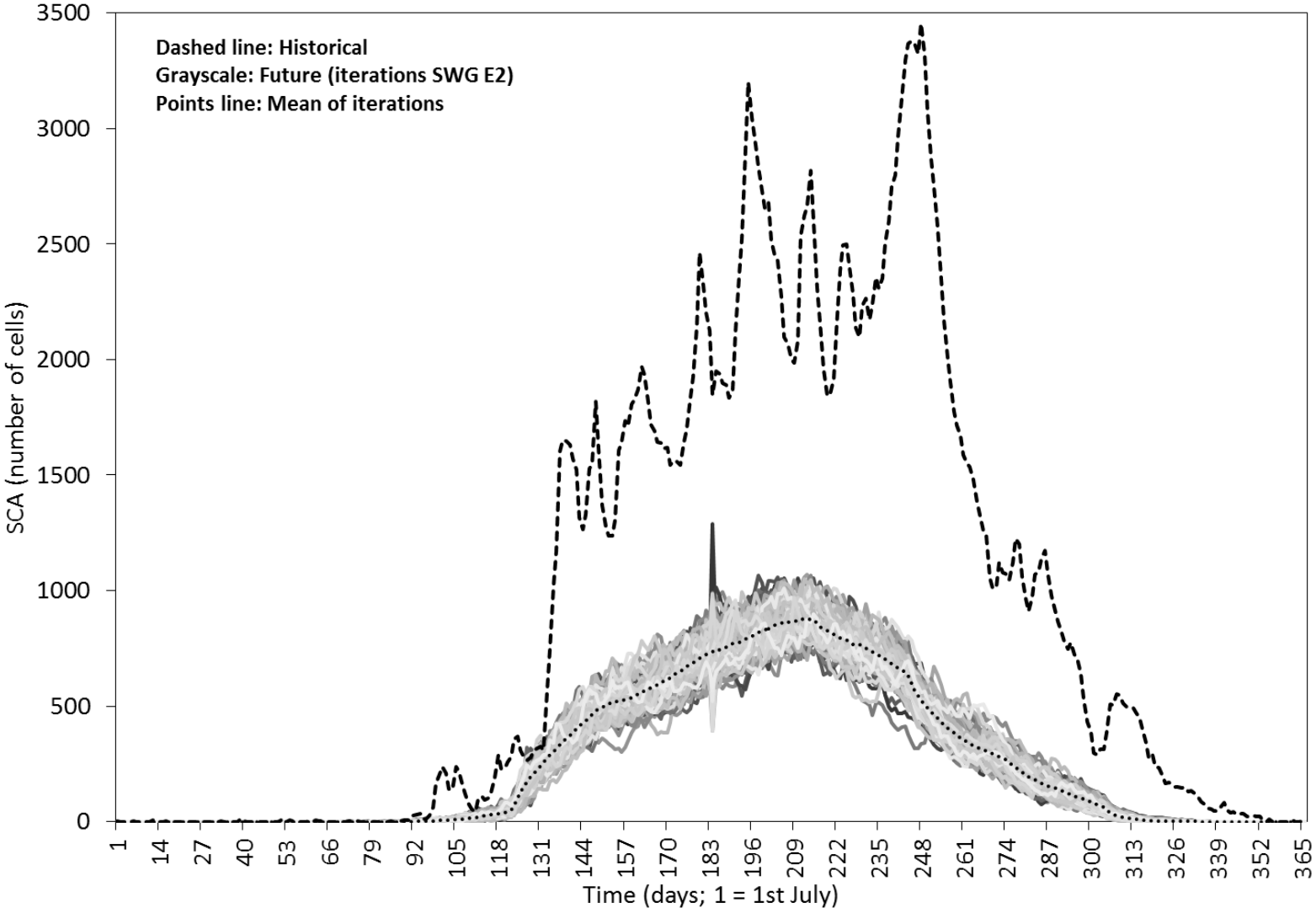
Results: Future series SCA bias correction



Results: Future series SCA bias correction