Evaluation of the Sensitivity of the Updated RegCM4 Model to Physics Parameterizations over the Mediterranean Region: Precipitation and Temperature Simulations

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INTRODUCTION

GCMs

- Past climate changes
- Characteristics of the future climate changes in continental scale
- Coarse resolution

Simulation of important higher scale processes not feasible

Dynamical Downscaling of GCMs

INTRODUCTION

RCMs

- Finer spatial resolution
- Describe and reproduce the main climatic features
- Local scale (complex terrain, important mesoscale forcing)

INTRODUCTION

Regional Climate Models

+

Physics Parameterization Schemes

Sensitivity 

RESULTS SENSITIVE TO THE SCHEME SELECTION ?

INTRODUCTION

✓ Study the sensitivity of RegCM4 to different physics parameterization schemes

✓ Examine the modifications that occur in precipitation and temperature

REGIONAL CLIMATE MODEL

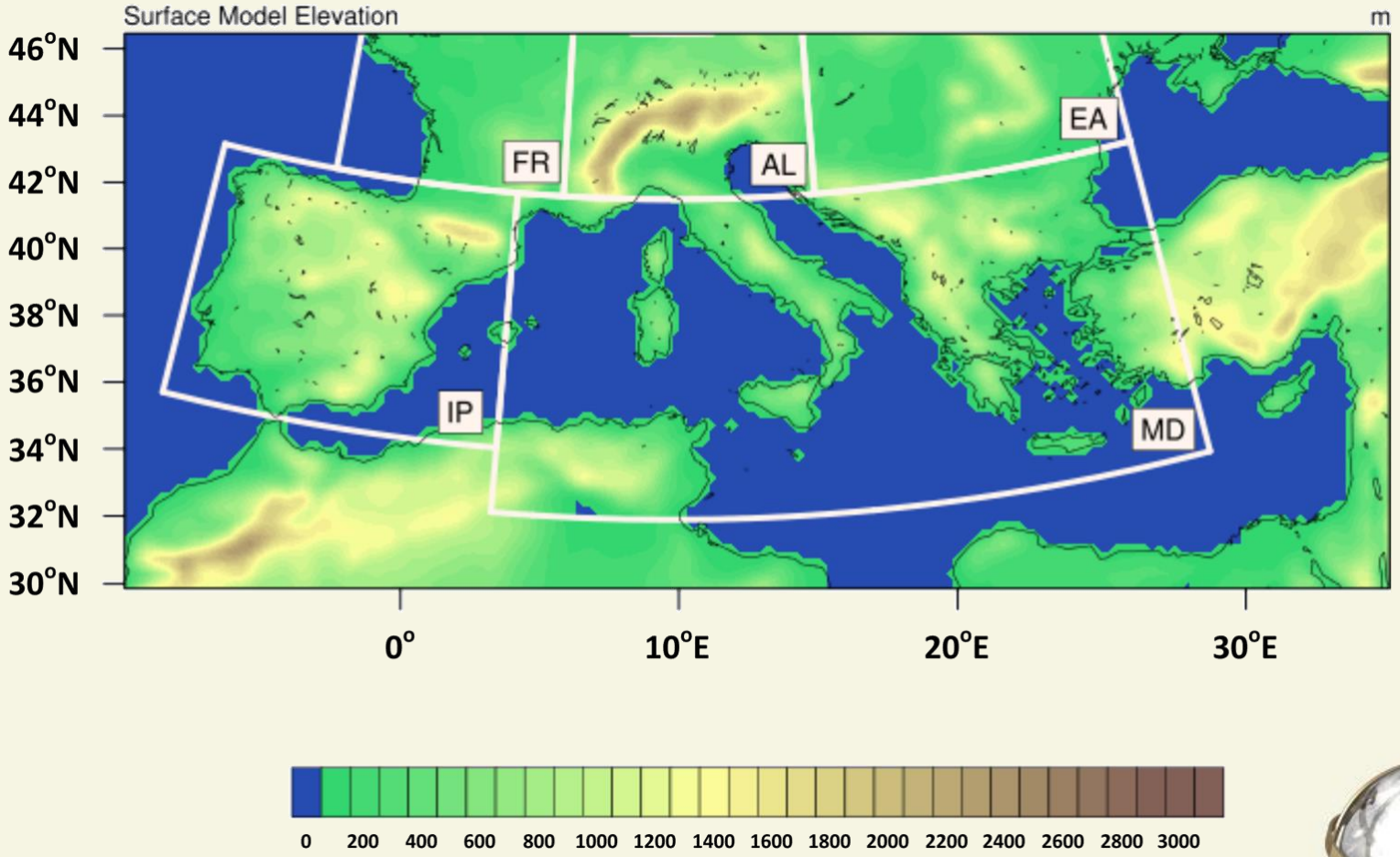
- RegCM4.4.5.1
  - Hydrostatic
  - Compressible
  - Sigma-p vertical coordinate model
  - Dynamical core → Hydrostatic version of MM5
- 25x25km

DOMAIN

- Mediterranean region
- More detailed study → Division of the area into 5 sub-regions (EURO-CORDEX analysis domain)

Abbreviation	Area
AL	The Alps and the surrounding area
EA	The part of Eastern Europe
FR	The wider France region
IP	The Iberian Peninsula
MD	The greatest part of the Mediterranean Sea, Italy, Greece, the Balkans and southwestern Turkey

DOMAIN


Surface Model Elevation
m
46°N
44°N
42°N
40°N
38°N
36°N
34°N
32°N
30°N
0°
10°E
20°E
30°E
FR
AL
EA
IP
MD
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000

SIMULATIONS

- 7 different simulations

Abbreviation	Driving Field	Cumulus Scheme	Convective Closure Scheme	Planetary Boundary Layer Scheme	Ocean Flux Scheme	Land Surface Model
Default	ERAINT	MIT-Emanuel	-	Holtslag PBL	Zeng et al.	BATS
GAS	ERAINT	Grell	Arakawa-Schubert	Holtslag PBL	Zeng et al.	BATS
GFC	ERAINT	Grell	Fritsch-Chappell	Holtslag PBL	Zeng et al.	BATS
Mixed	ERAINT	Grell (over land) MIT-Emanuel (over ocean)	Fritsch-Chappell	Holtslag PBL	Zeng et al.	BATS
UW-PBL	ERAINT	MIT-Emanuel	-	UW PBL	Zeng et al.	BATS
BATS1e	ERAINT	MIT-Emanuel	-	Holtslag PBL	BATS1e Monin-Obukhov	BATS
Corine	ERAINT	MIT-Emanuel	-	Holtslag PBL	Zeng et al.	BATS (with CORINE 2000 land cover data)

- 1981-1990

METHODOLOGY

- Precipitation and temperature
- Seasonal
- Differences

2^{nd} "RUN"$_{GFC}$ - 1^{st} "RUN"$_{MIT\text{-}Emanuel}$

3^{rd} "RUN"$_{GAS}$ - 1^{st} "RUN"$_{MIT\text{-}Emanuel}$

4^{th} "RUN"$_{Mixed}$ - 1^{st} "RUN"$_{MIT\text{-}Emanuel}$

5^{th} "RUN"$_{UW\text{-}PBL}$ - 1^{st} "RUN"$_{MIT\text{-}Emanuel}$

6^{th} "RUN"$_{BATS1e}$ - 1^{st} "RUN"$_{MIT\text{-}Emanuel}$

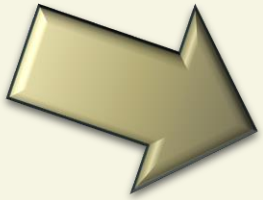
7^{th} "RUN"$_{CORINE}$ - 1^{st} "RUN"$_{MIT\text{-}Emanuel}$

Calculated
Mapped
Compared

- Student's t-test

METHODOLOGY

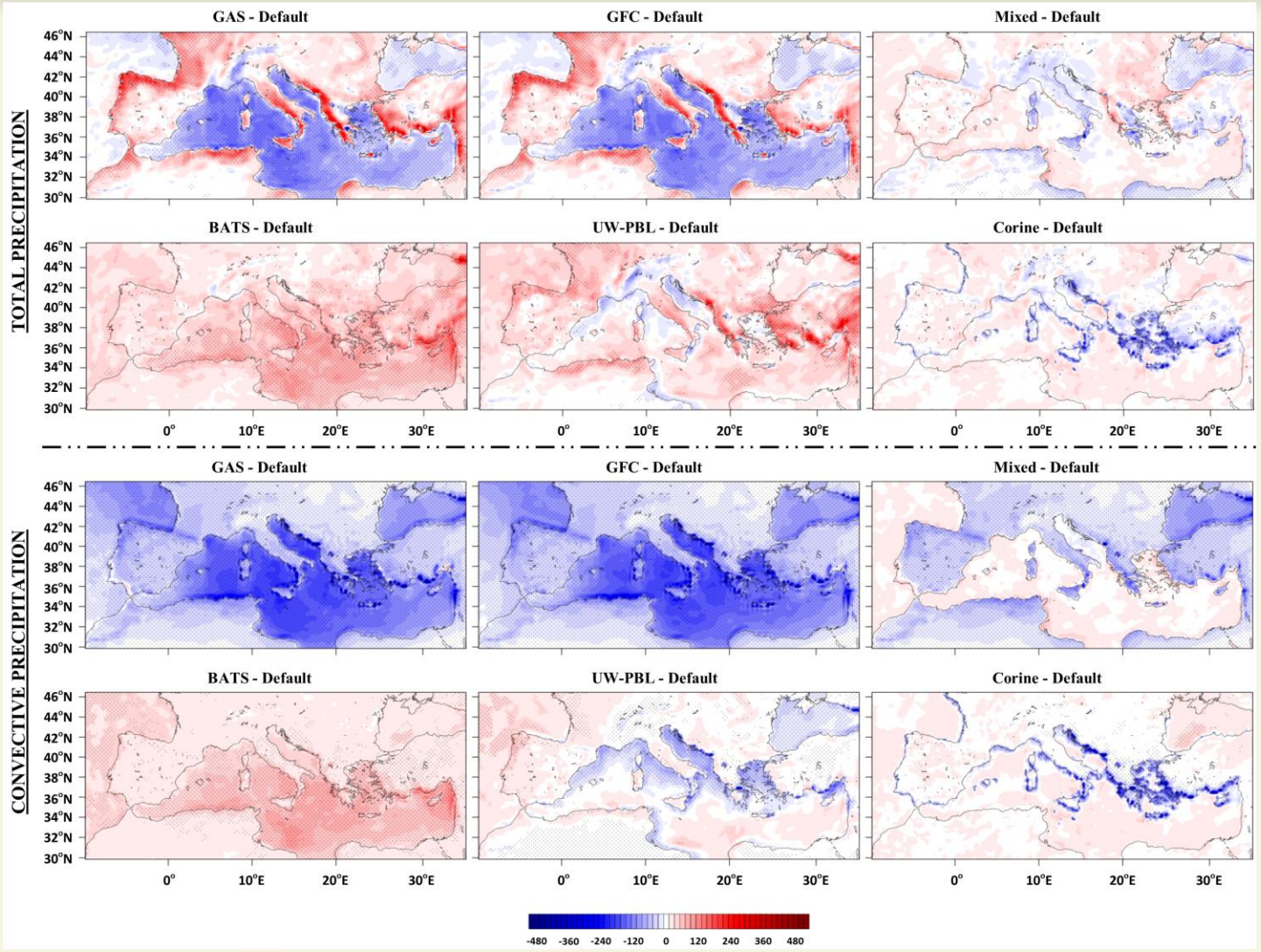
- More detailed evaluation
- Division into 5 sub-regions
- Taylor diagrams



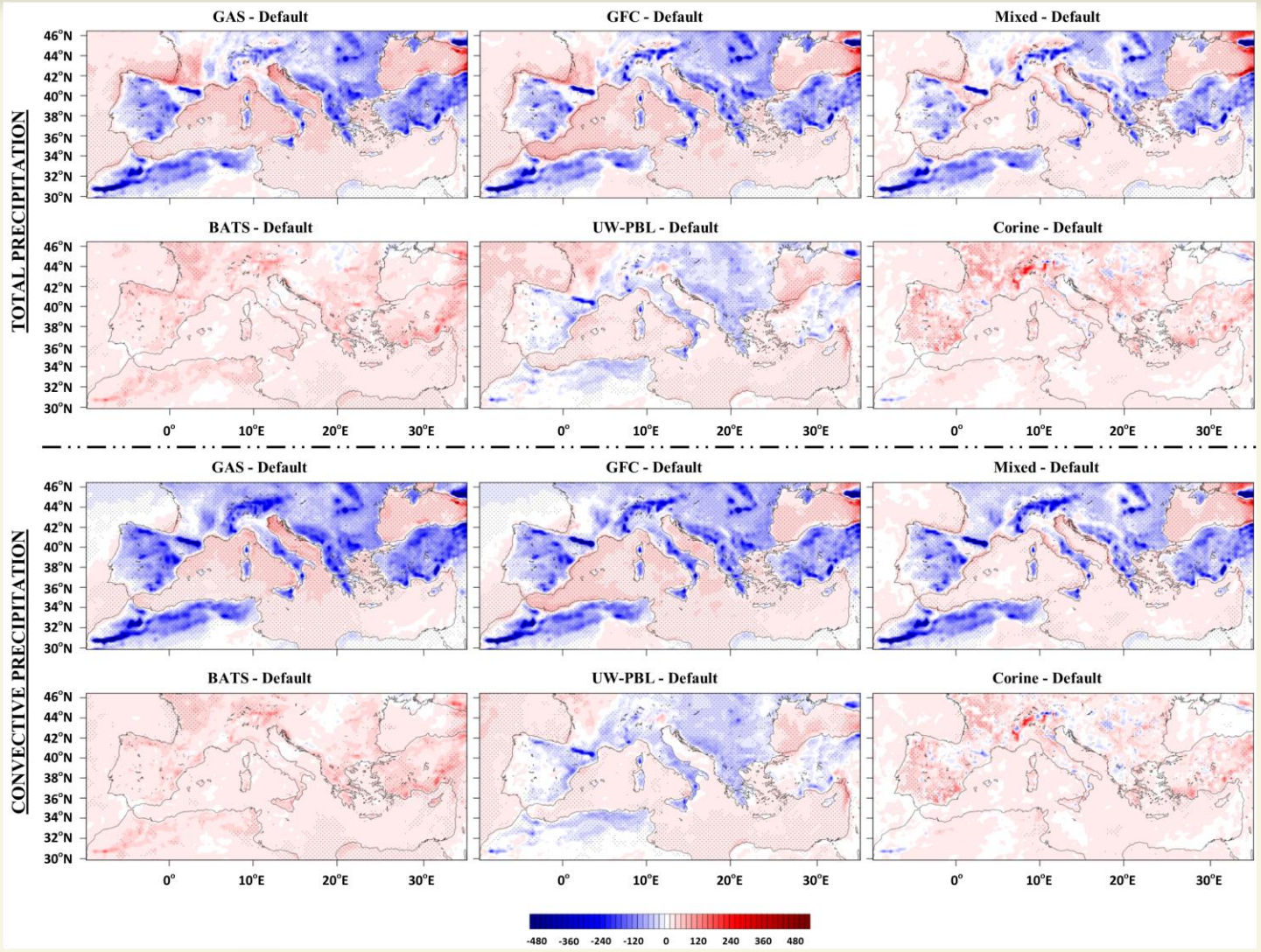
"Default" run as reference data

How well simulations fit each other (RMS, stdev, corr)

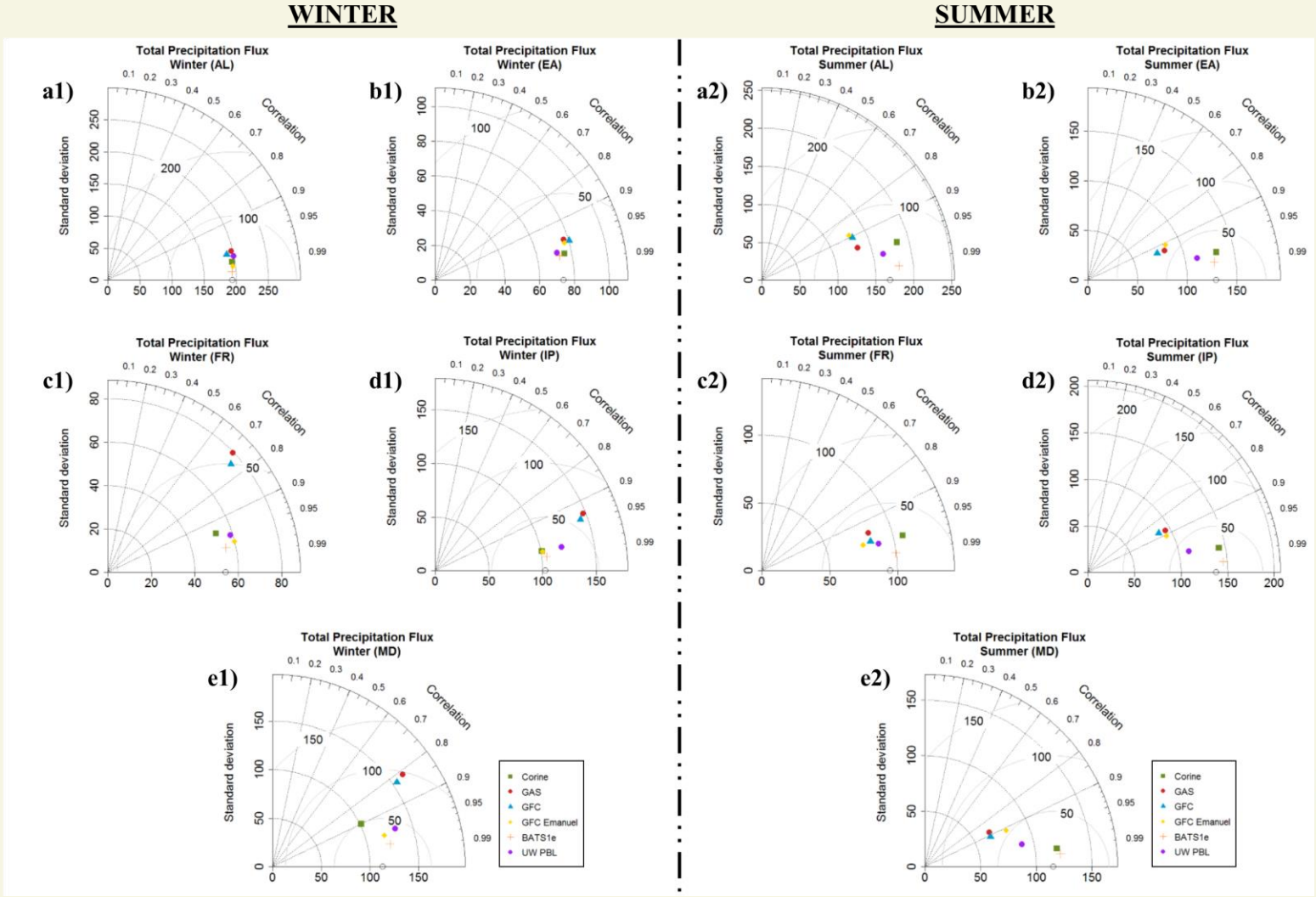
PRECIPITATION (WINTER)



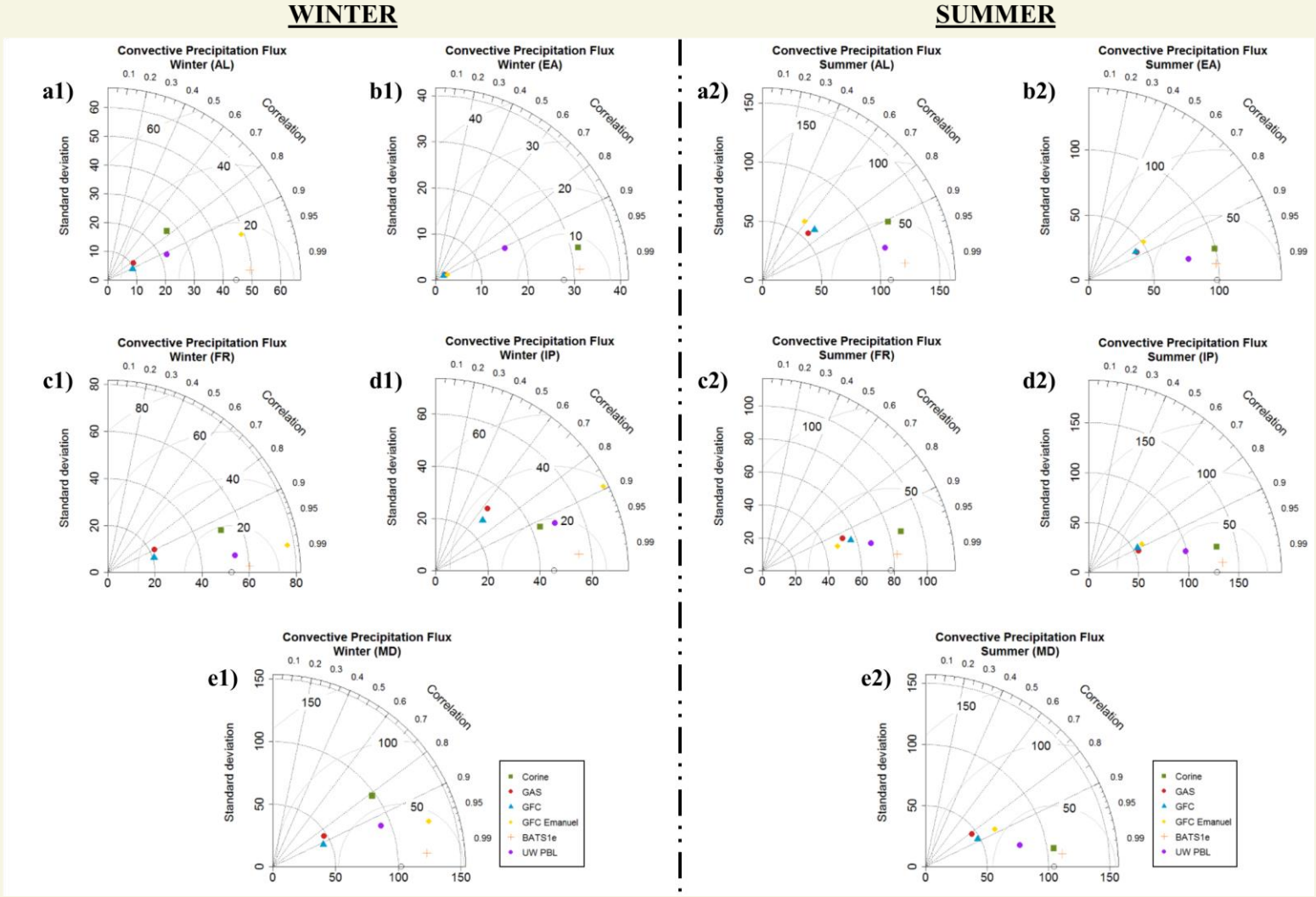
PRECIPITATION (SUMMER)



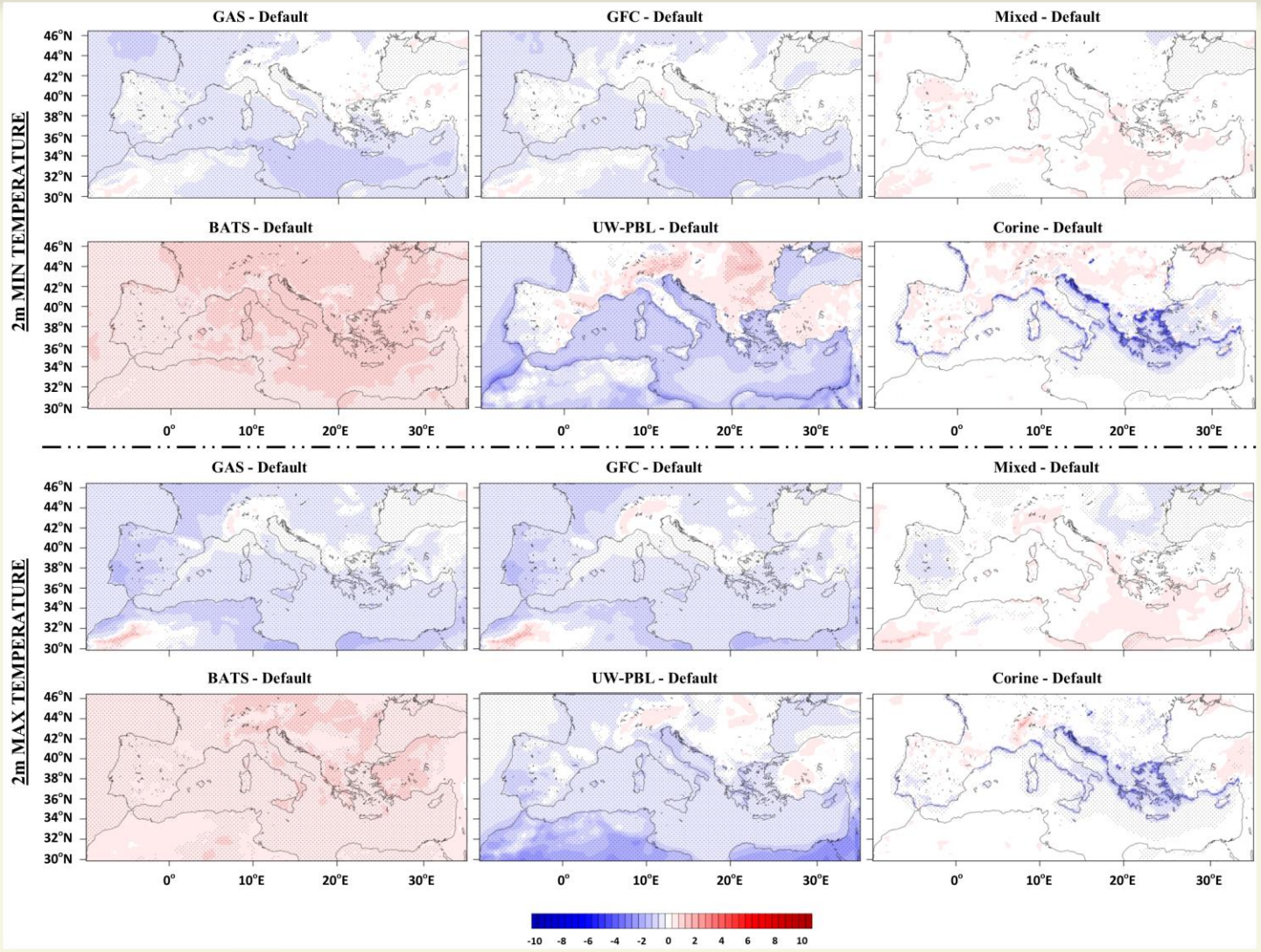
TOTAL PRECIPITATION



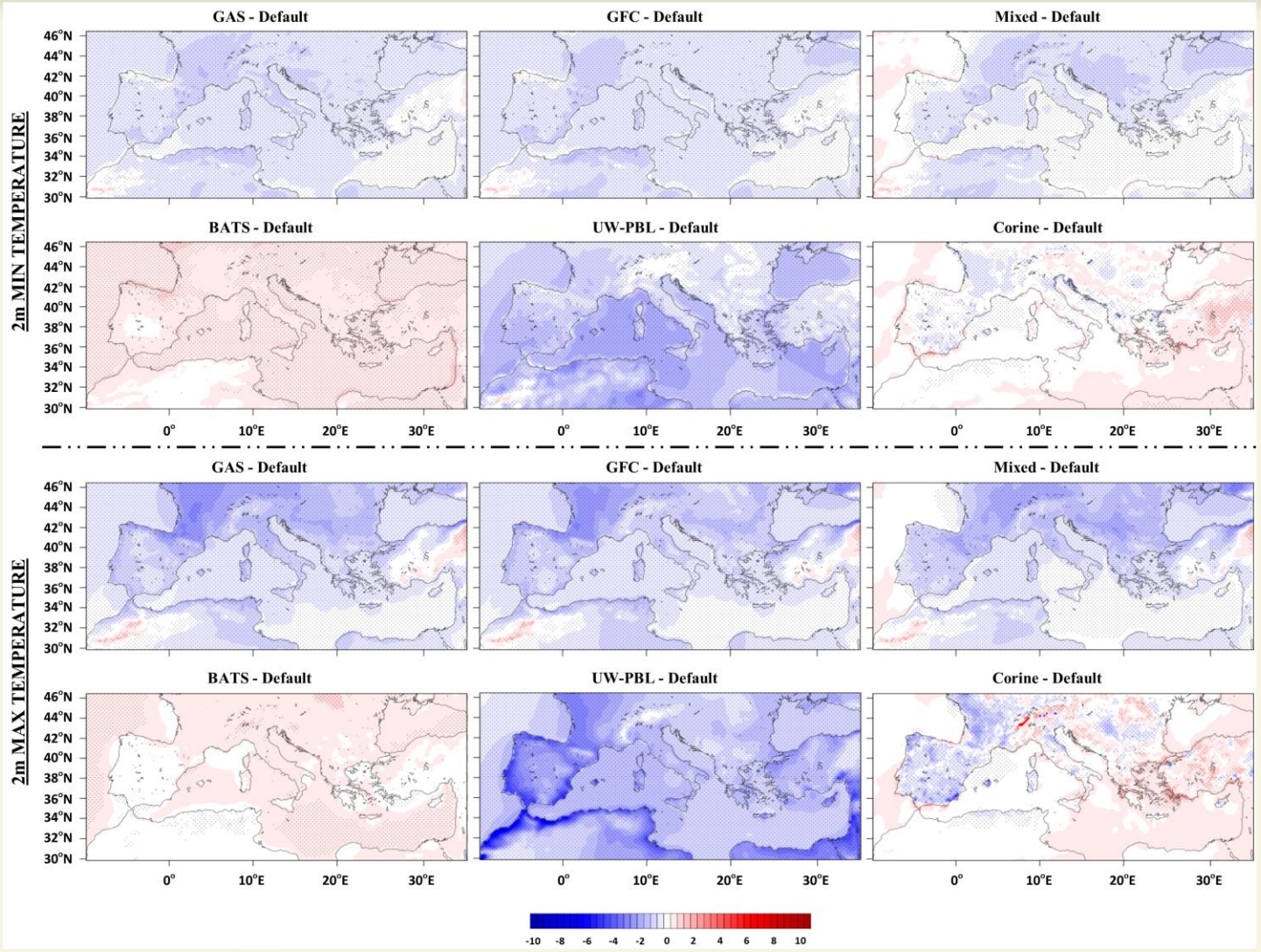
CONVECTIVE PRECIPITATION



TEMPERATURE (WINTER)

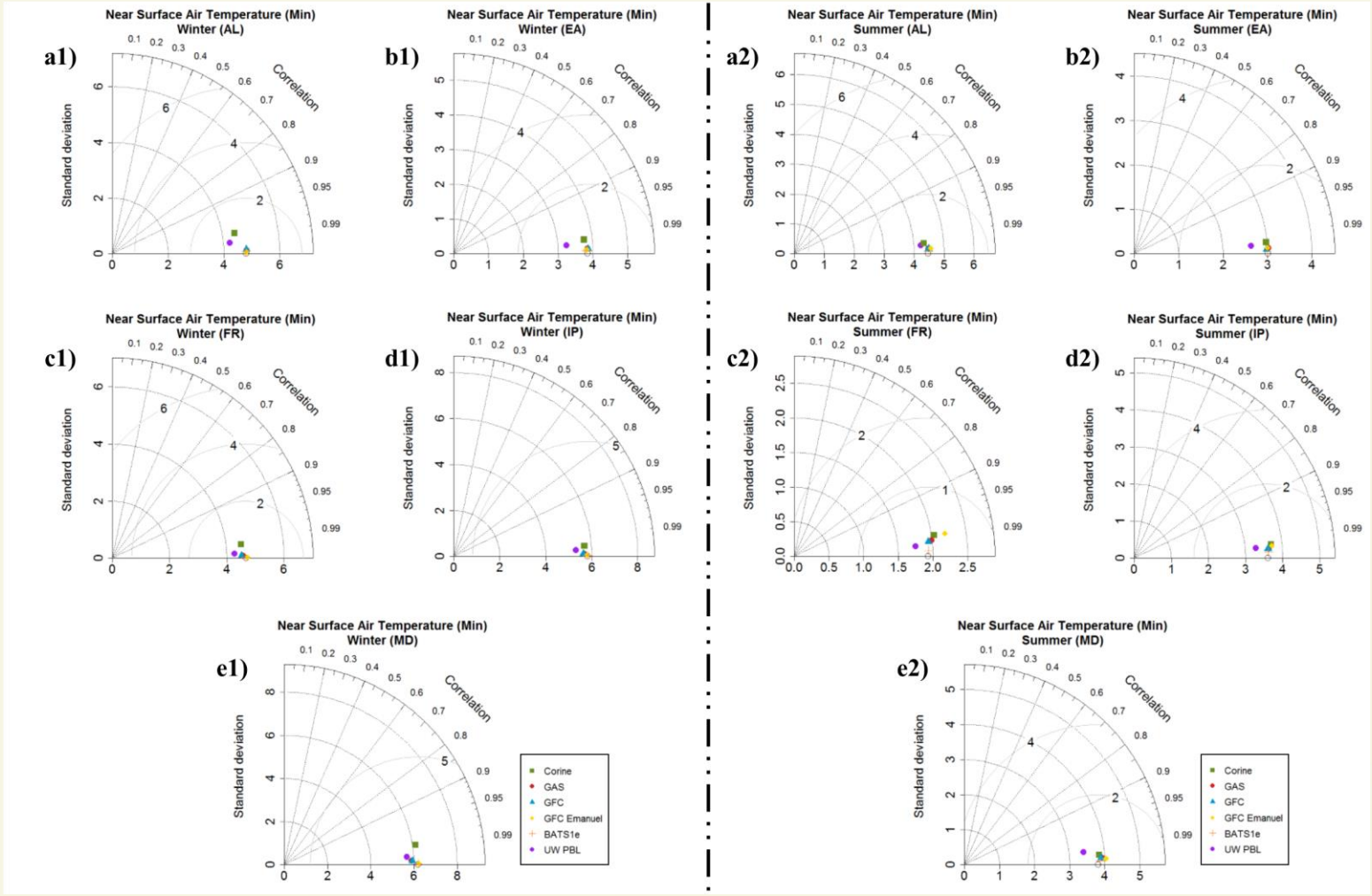


TEMPERATURE (SUMMER)



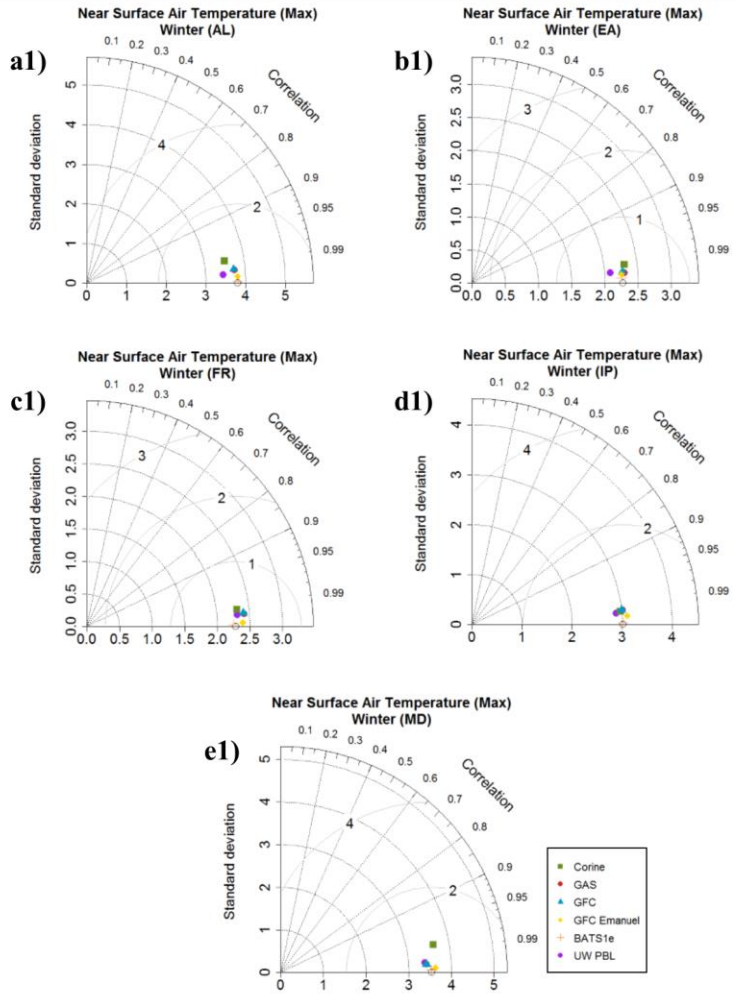
2m Min Temperature

WINTER **SUMMER**

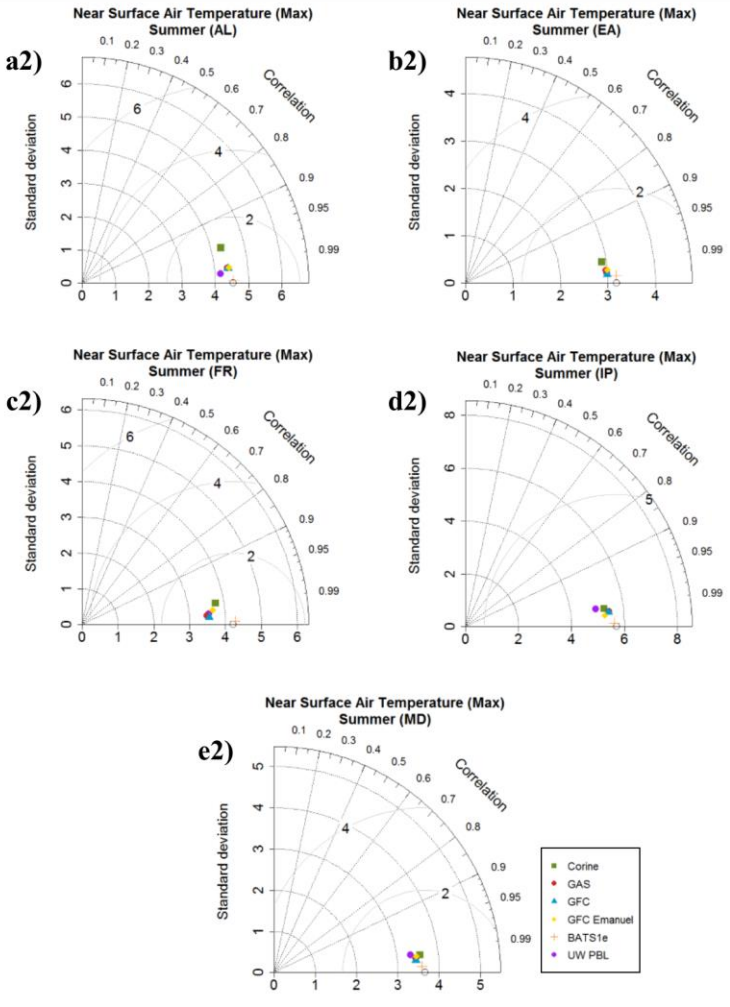


2m Max Temperature

WINTER



SUMMER



CONCLUSIONS

Precipitation

- UW-PBL → Reduction in the majority of the area of study
- BATS1e → Increase mainly in maritime areas
- GAS, GFC → Increase in continental areas and decrease in maritime areas (Opposite during summer)
- Mixed → Decrease in continental areas
- CORINE → Decrease during winter and increase during summer

CONCLUSIONS

Temperature

- UW-PBL → Reduction of warm biases
- BATS1e → Reduction of cold biases
- CORINE → Reduction of temperature
- Grell → Presents cold bias (in contrast to MIT-Emanuel)

THANK YOU

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