Santander Meteorology Group
A multidisciplinary approach for weather & climate

Multi-domain intercomparison and potential conflicts from CORDEX simulations:

An example for the Mediterranean region

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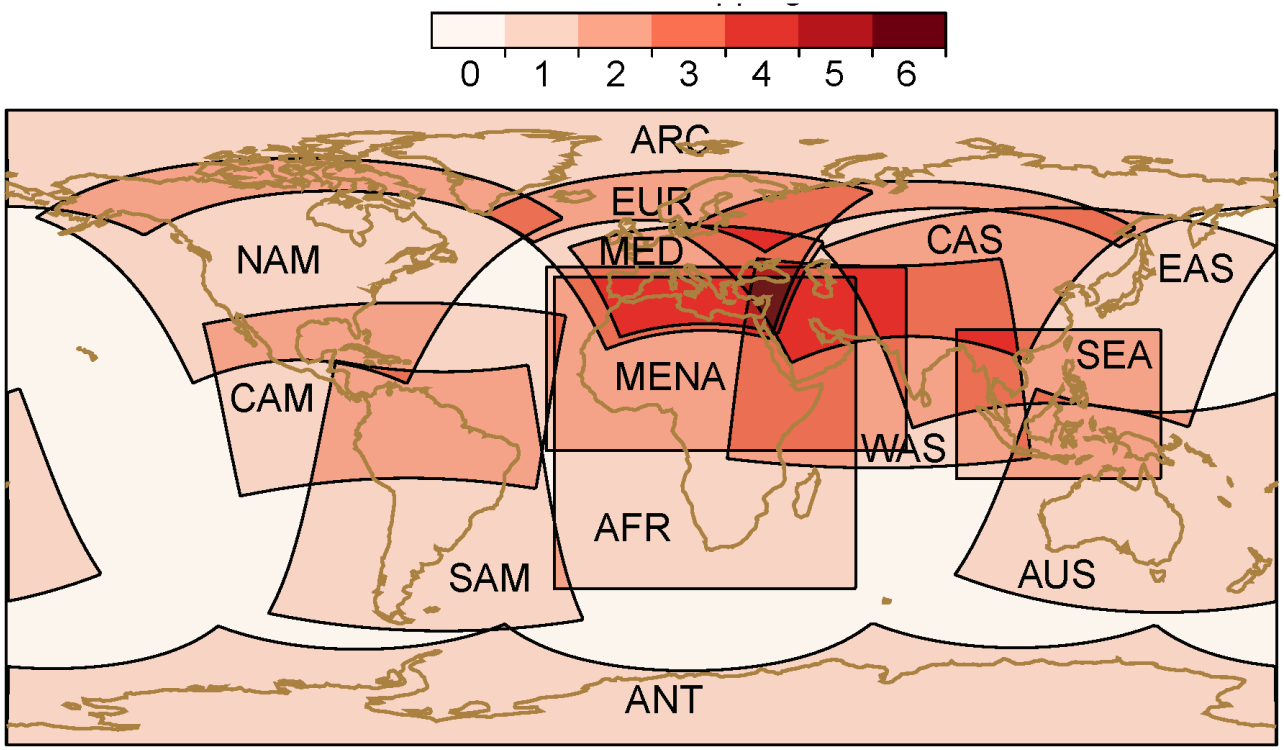
Motivation

Number of Overlapping Domains



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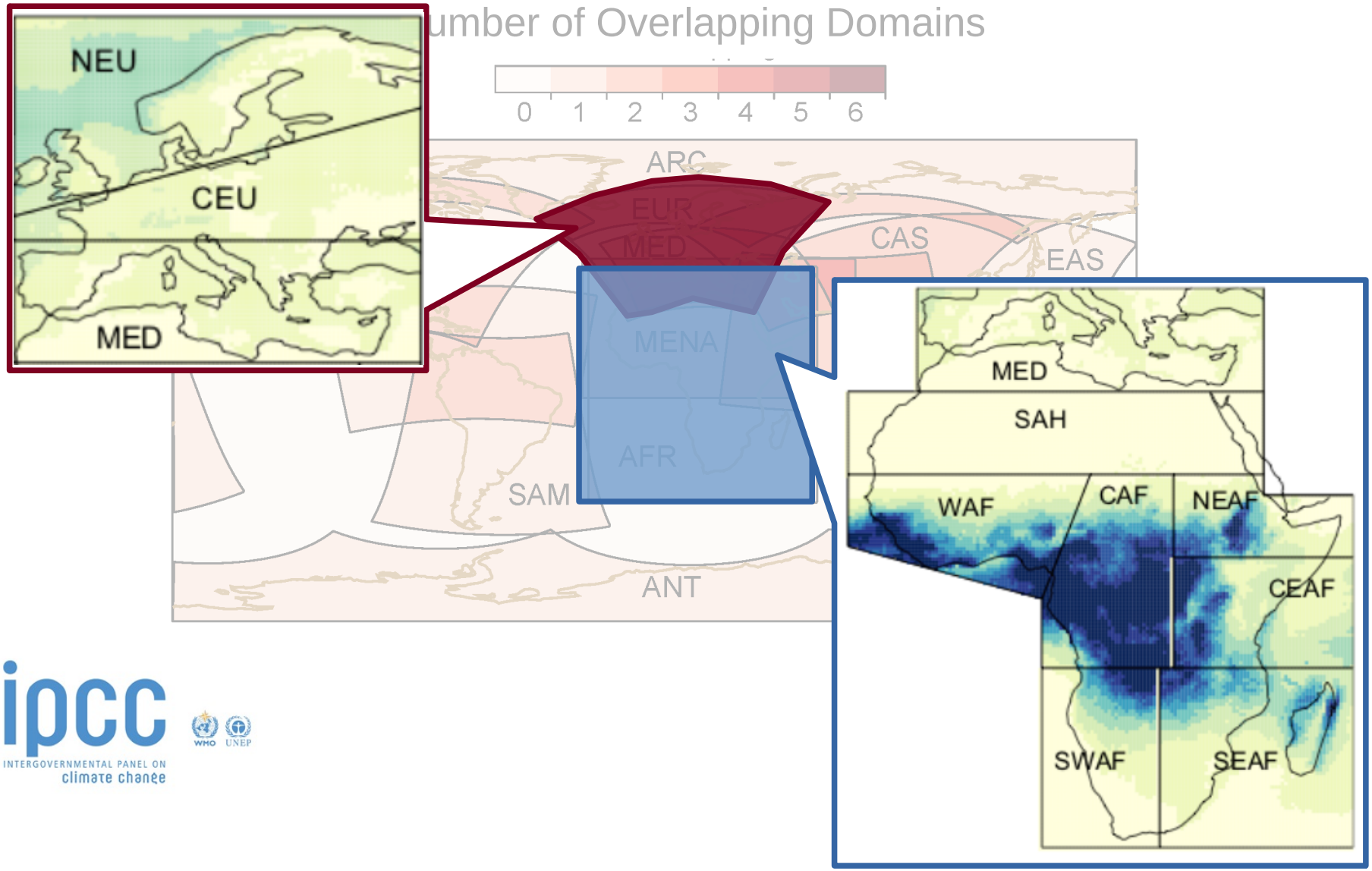

ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

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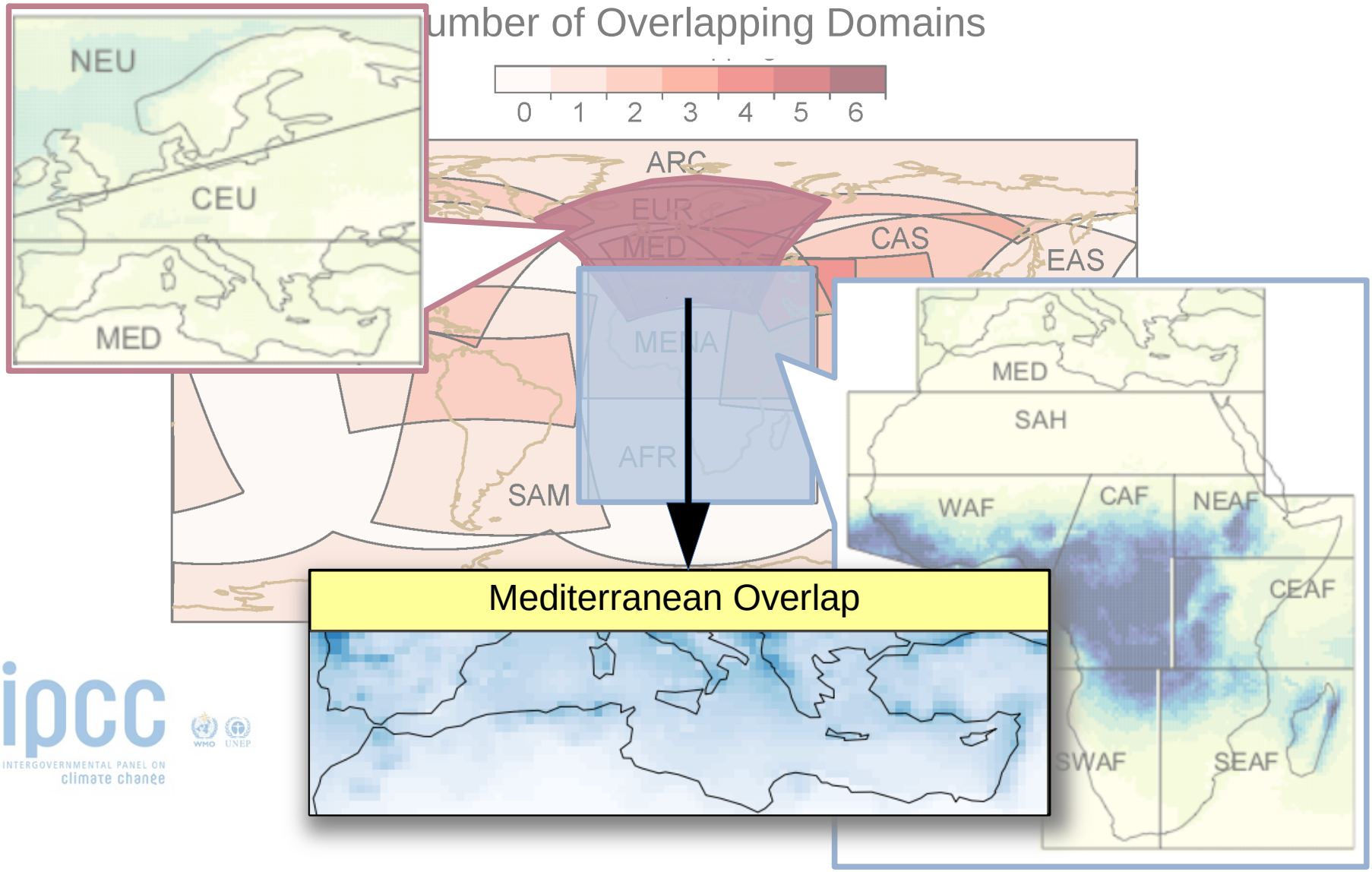

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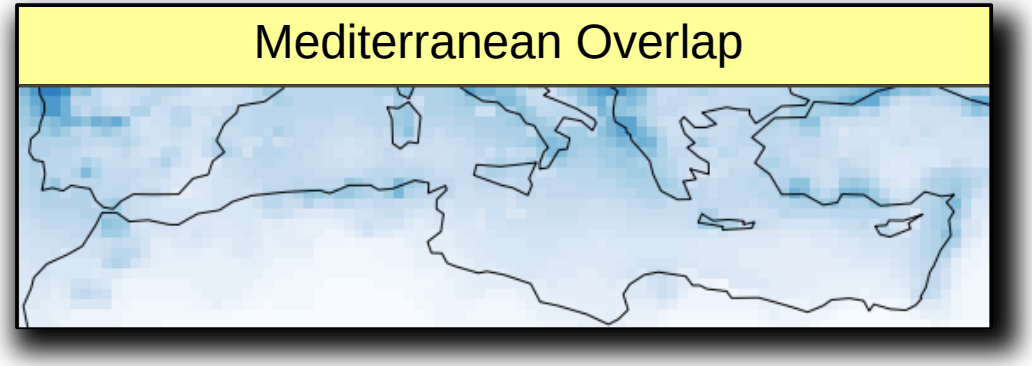
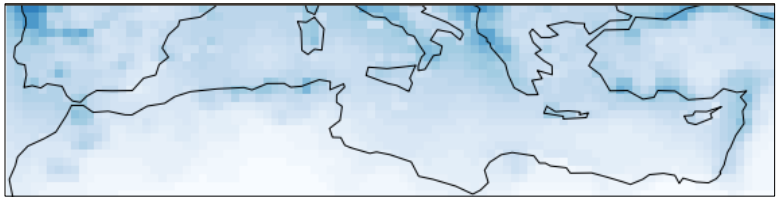
Are models consistent for overlapping regions across domains?



Experimental Framework

EUR-44 and AFR-44 overlap:



Precipitation

Evaluation runs
(ERA-Interim driven)

RCM
RCA4 v1
RACMO22E v1 (RACMO22T)
HIRHAM5 v1 (HIRHAM5 v2)
CCLM4-8-17 v1
REMO2009 v1

Period: 1989-2008

Resolution: 0.44º

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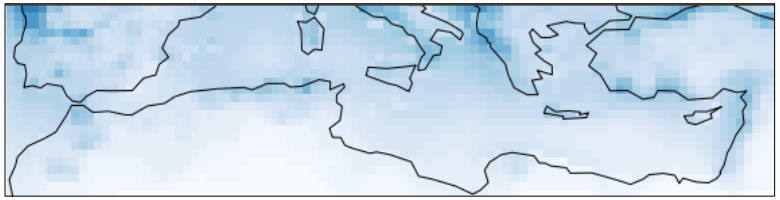

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Scenario (**RCP8.5** and RCP4.5) runs:

GCM	RCM
CanESM2 r1i1p1	RCA4 v1
CNRM-CM5 r1i1p1	RCA4 v1
CSIRO-Mk3-6-0 r1i1p1	RCA4 v1
EC-EARTH r1i1p1	RACMO22E v1 (RACMO22T)
EC-EARTH r3i1p1	HIRHAM5 v1 (HIRHAM5 v2)
EC-EARTH r12i1p1	RCA4 v1
GFDL-ESM2M r1i1p1	RCA4 v1
HadGEM2-ES r1i1p1	RCA4 v1 RACMO22E v2 (RACMO22T)
IPSL-CM5A-MR r1i1p1	RCA4 v1
MIROC5-r1i1p1	RCA4 v1
MPI-ESM-LR r1i1p1	CCLM4-8-17 v1 REMO2009 v1 RCA4 v1
NorESM1-M r1i1p1	RCA4 v1

Time-slice: 2071-2100 (w.r.t. 1981-2010)

Resolution: 0.44º

Evaluation Measures

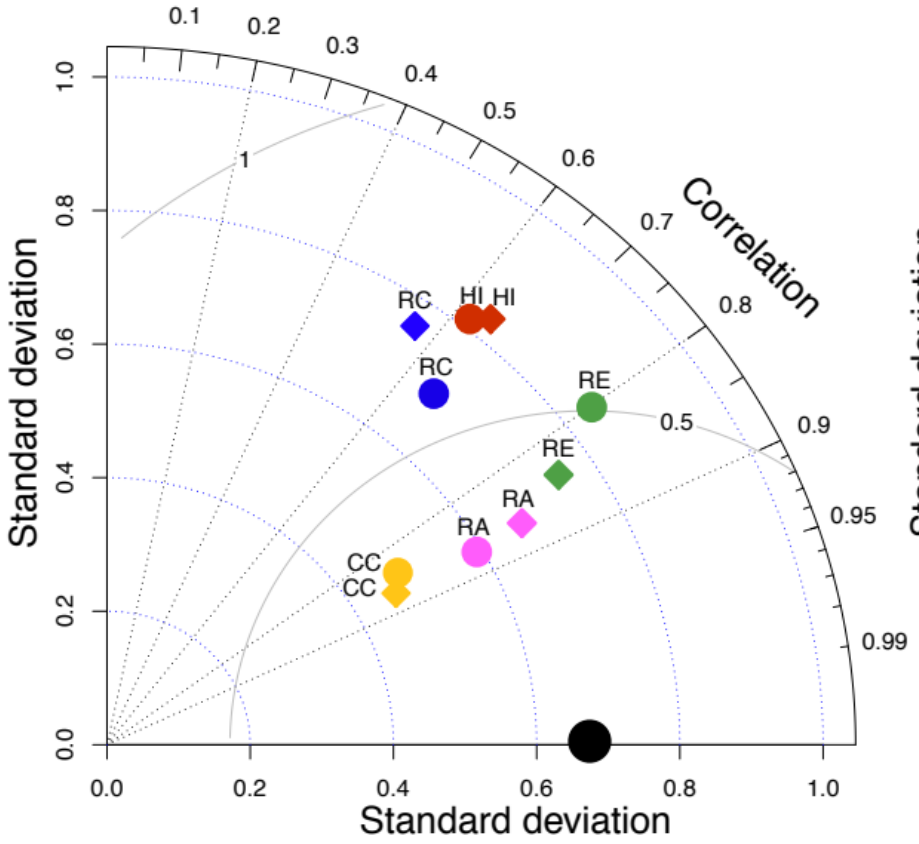
Code	Description
Mean	Mean of Precipitation
SDII	Mean of precipitation for wet days
R01	Relative Frequency of Wet Days
WWProb	Wet-wet transition probability
DWProb	Dry-wet transition probability
WetAnnualMaxSpellMedian	Median of the annual wet spell maxima
DryAnnualMaxSpellMedian	Median of the annual dry spell maxima
AnnualCycleRelAmp	Relative amplitude of the daily annual cycle
R95pTOT	Mean of the annual sum of precipitation when daily precipitation exceeds the 95th percentile

>= 1mm (Wet)

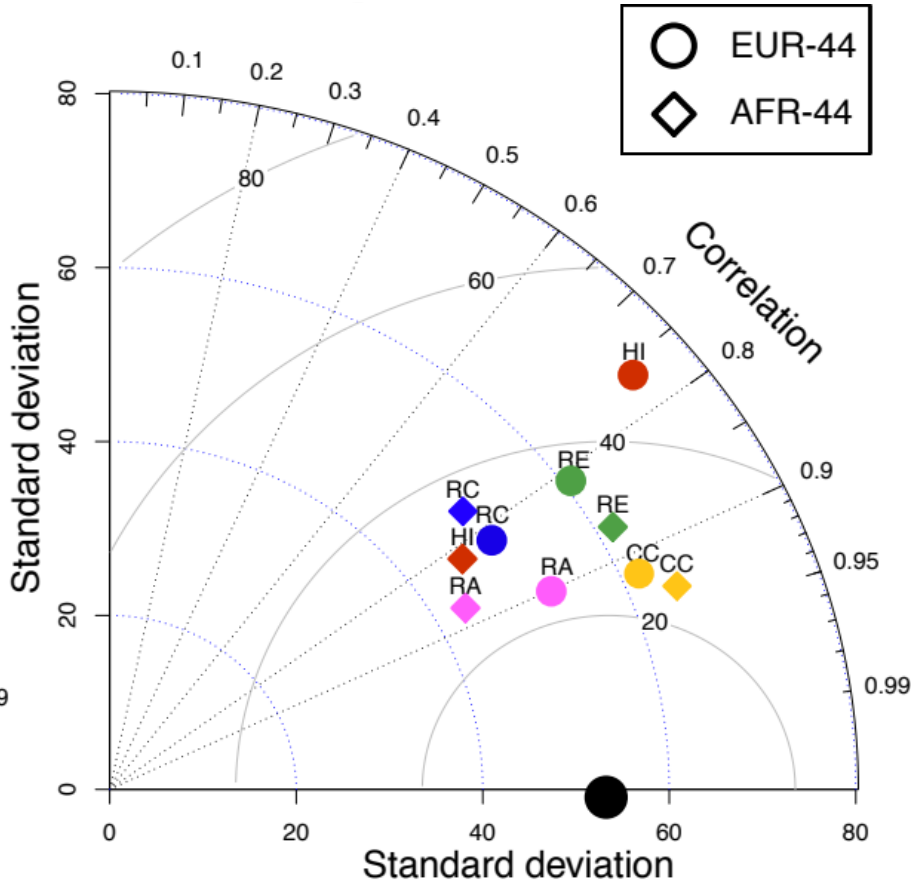
D. Maraun et al. (2019). The value perfect predictor experiment: Evaluation of temporal variability. International Journal of Climatology, 39(9), 3786-1503818.

Results: Climatology

Mean



Median of the annual dry spell maxima



Clustered RCMs

Results: Climatology

Illustrative Example:

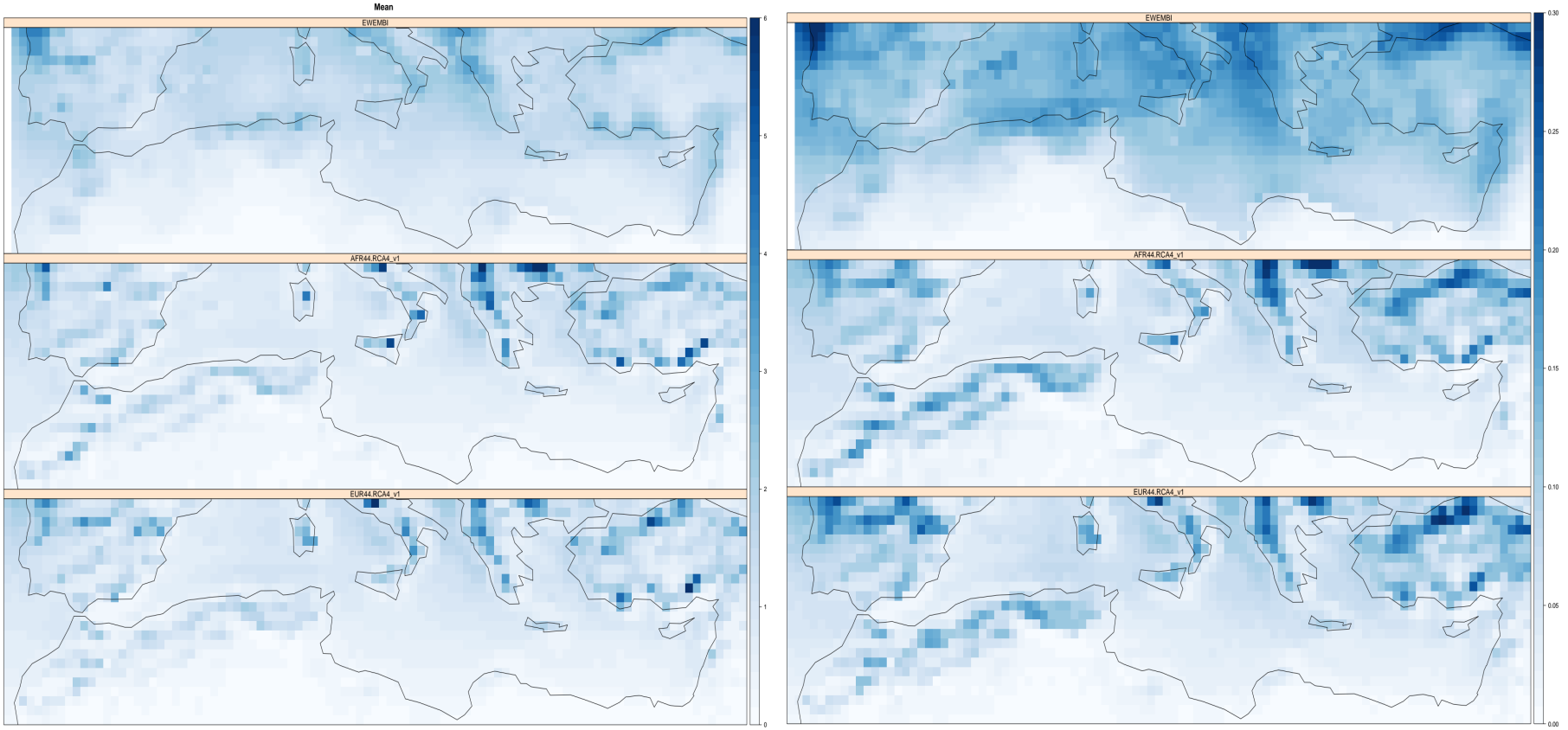
Mean

Median of the annual dry spell maxima

EWEMBI

AFR-44

EUR-44



RCA4_v1

Results: Deltas

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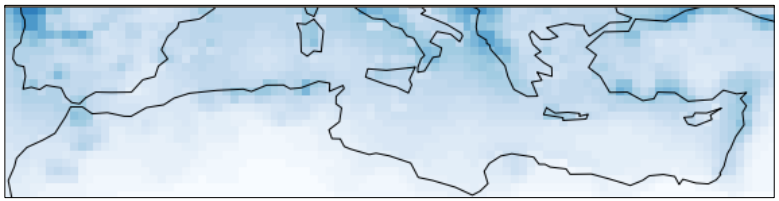

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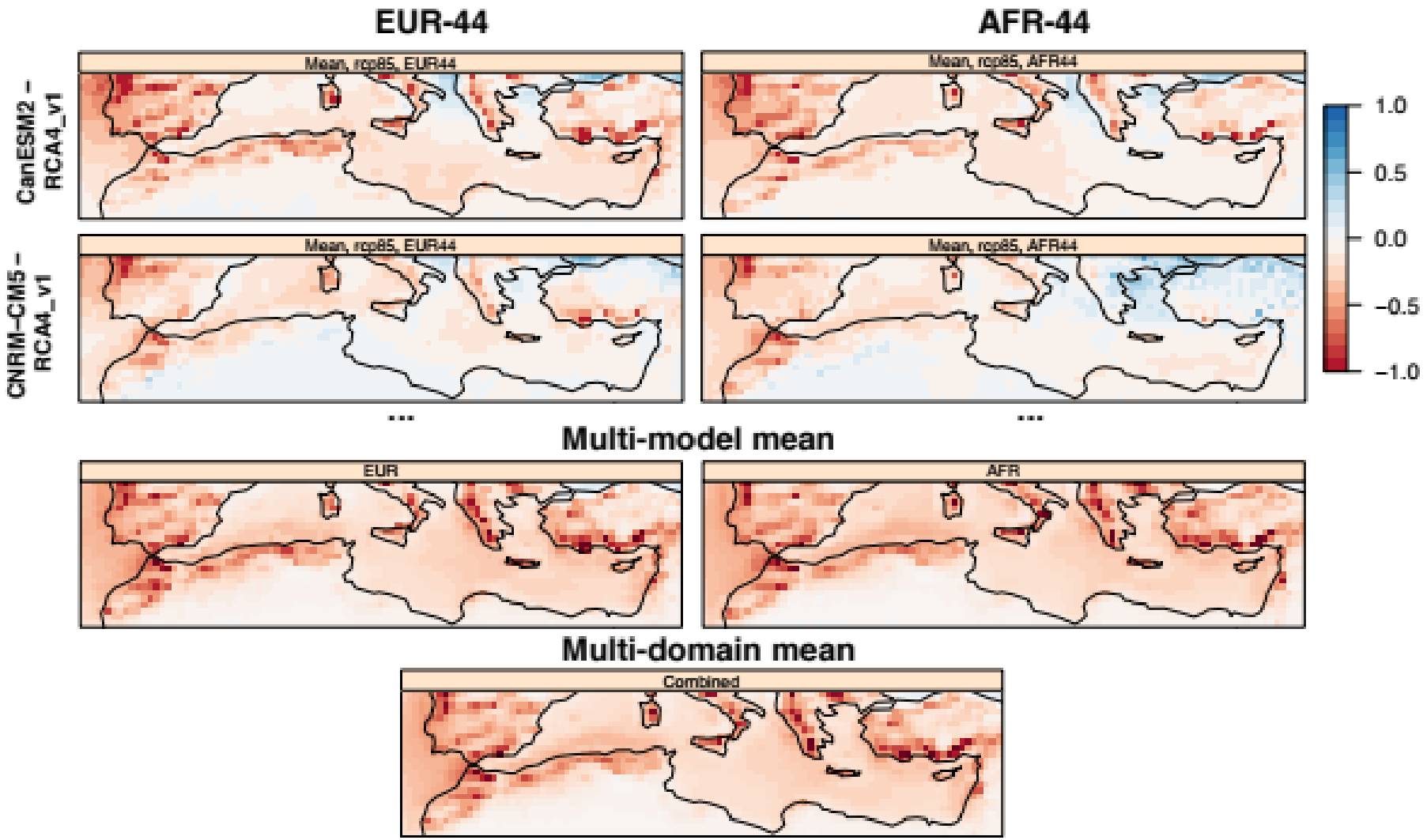

Variance Decomposition

$$\mathrm{M} = \frac{1}{15}\sum_{i=1}^{15}(\mathrm{X_{i.}} - \mathrm{X_{..}})^2 \qquad \mathrm{D} = \frac{1}{2}\sum_{j=1}^{2}(\mathrm{X_{.j}} - \mathrm{X_{..}})^2$$

$$\mathrm{C} = \frac{1}{2}\sum_{\mathrm{j}=1}^{2}\frac{1}{15}\sum_{\mathrm{i}=1}^{15}(\mathrm{X_{ij}} - \mathrm{X_{i.}} - \mathrm{X_{.j}} + \mathrm{X_{..}})^2$$

$$Var = M + D + C$$

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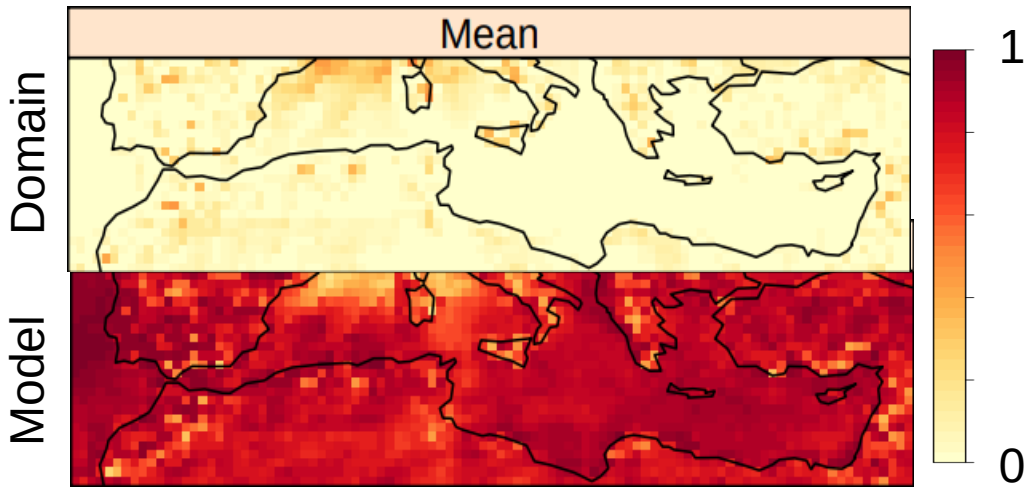
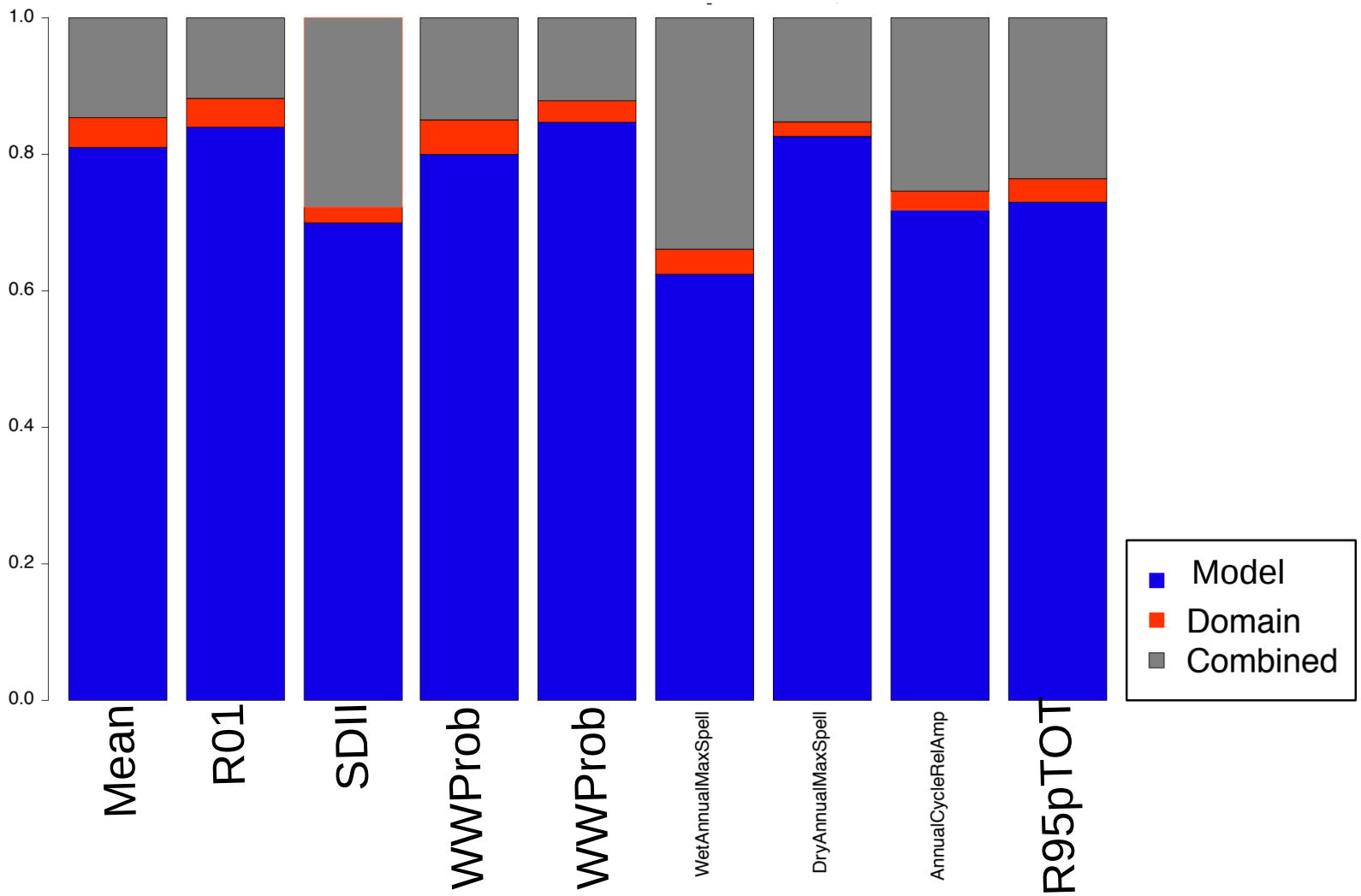


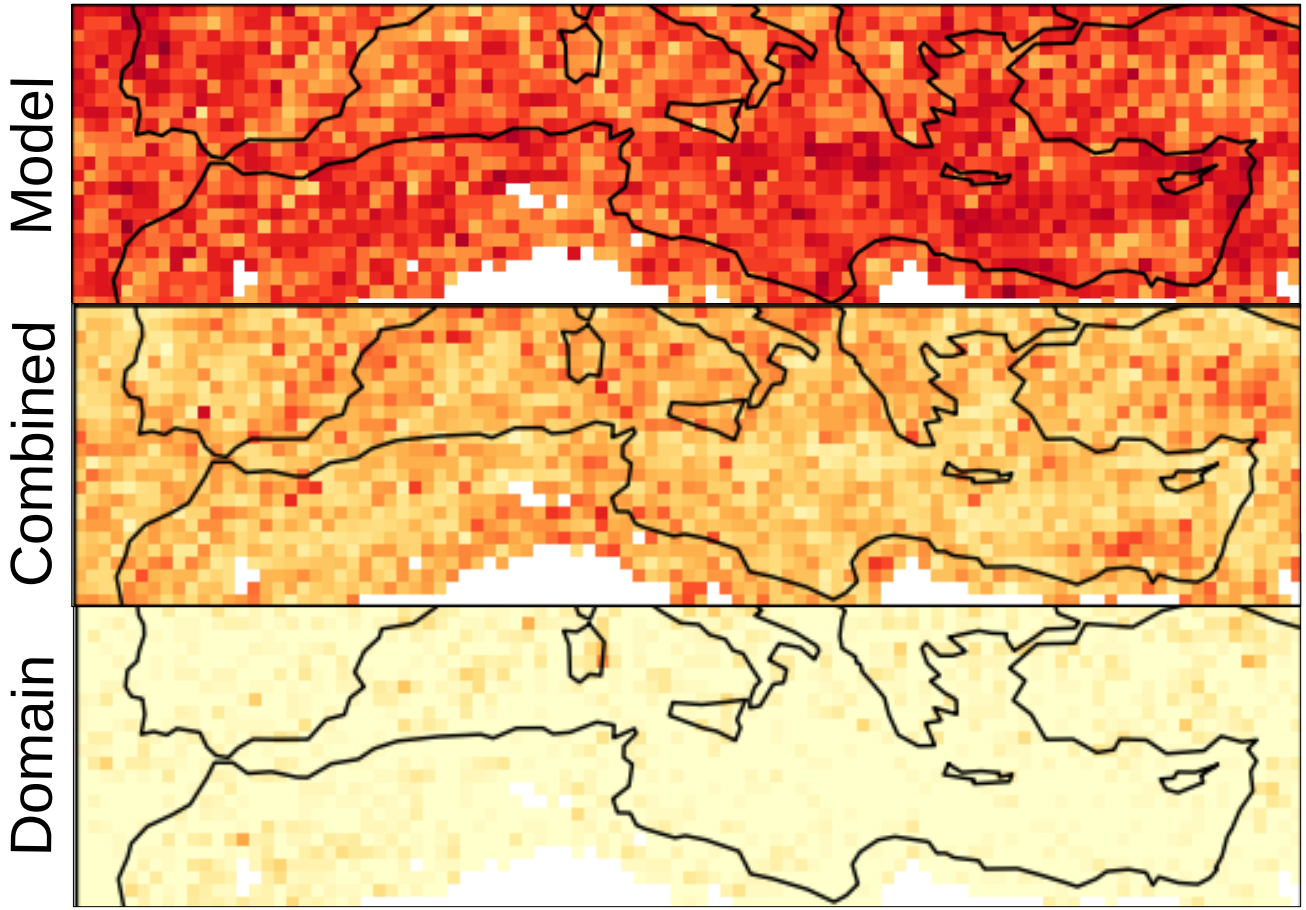
Deltas Decomposition

Variance Decomposition Summary, RCP85



Deltas Decomposition

Median of the Annual Wet Spell Maxima



Conclusions

1) First results generally show consistency across both domains, with the effect of the domain being generally small

2) Some measures display higher combined variability across domains and models

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2) Some measures display higher combined variability across domains and models

Future Lines of Work

1) Extend the analysis to other overlapping regions and variables

2) Further investigate the combined effect of models and domain

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