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An Investigation of cold-wet Compound Events in Greece

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SCOPE

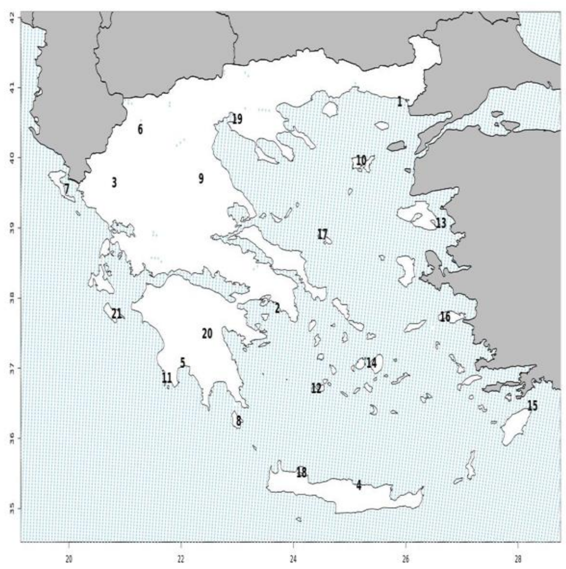
1. Comprehensive study of daily cold-wet compound events (CE) in Greece using i) percentile driven analysis (95th for precipitation-5th for TN) and ii) fixed thresholds (20 mm for precipitation, 0°C for TN).
2. Comparative study of CE with NCSRD very high resolution climate simulation and CORDEX-0.11 models.
3. Spatial representation of cold-wet CE in Greece based on historic data.

DATA

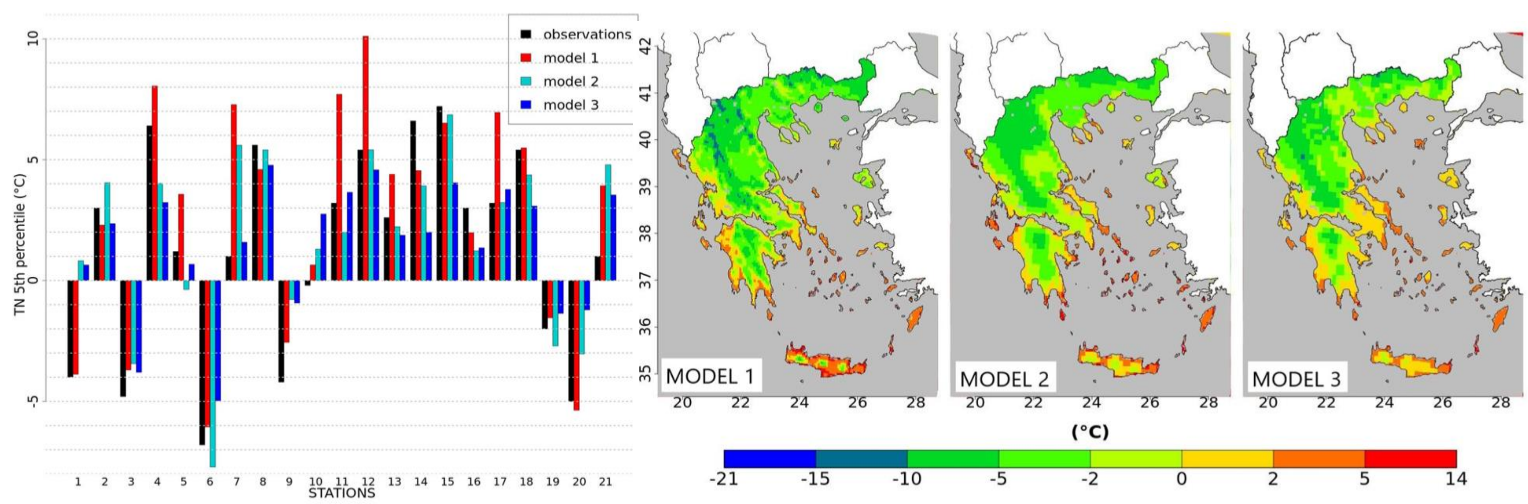
- DAILY MINIMUM TEMPERATURE (TN) AND DAILY TOTAL PRECIPITATION (RR)
- TIME PERIOD 1980-2004 COLD SEASON (NOVEMBER-APRIL)
- 21 HNMS GROUND STATIONS
- MODEL 1: DOWNSCALED **WRF ERA-INTERIM** REANALYSIS PRODUCT (0.05 DEGREE X 0.05 DEGREE)
- MODEL 2 : (RCM) **CLMCOM-CLM-CCLM4-8-17** – (GCM) **MOHC-HADGEM2-ES** (0.11 DEGREE X 0.11 DEGREE)
- MODEL 3 : (RCM) **SMHI-RCA4** – (GCM) **MPI-M-MPI-ESM-LR** (0.11 DEGREE X 0.11 DEGREE)

1	Alexandroupoli
2	Elliniko
3	Ioannina
4	Irakleio
5	Kalamata
6	Kastoria
7	Kerkira
8	Kithira
9	Larisa
10	Limnos
11	Methoni
12	Milos
13	Mitilini
14	Naxos
15	Rhodes
16	Samos
17	Skyros
18	Souda
19	Thessaloniki
20	Tripoli
21	Zakinthos

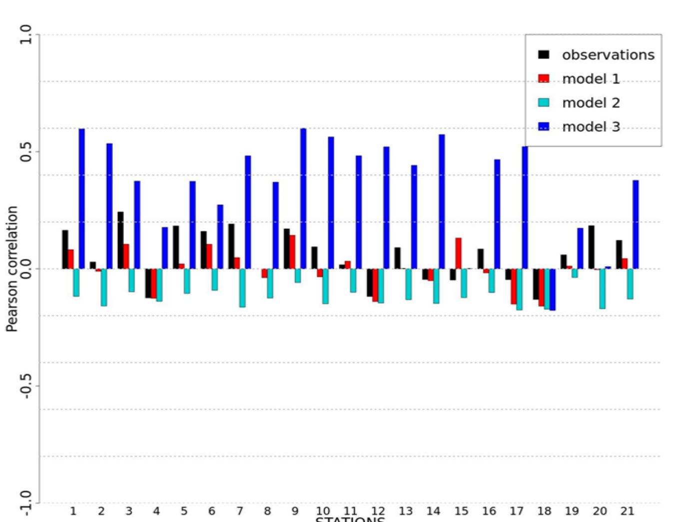
Hnms stations



TN 5th percentile (°C)



TN-RR Correlation

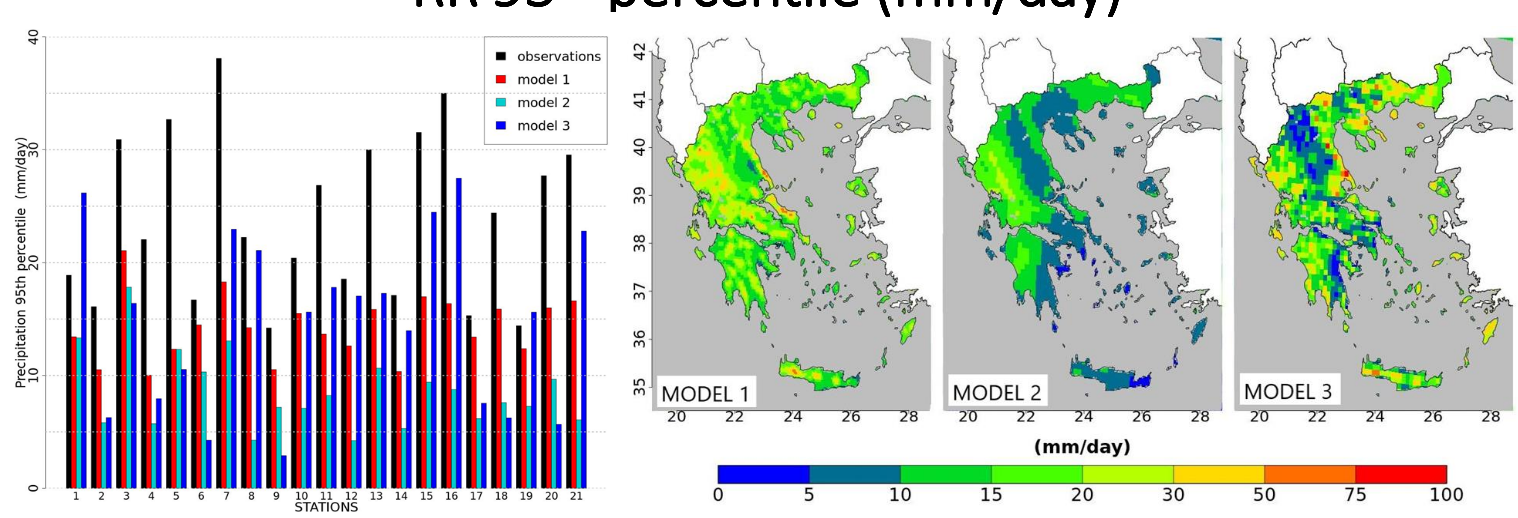


Pearson correlation, in each station for observations and models data.

- Observations and model 1 shows greater agreement
- Model 3 shows mainly positive correlation and model 2 mainly negative.

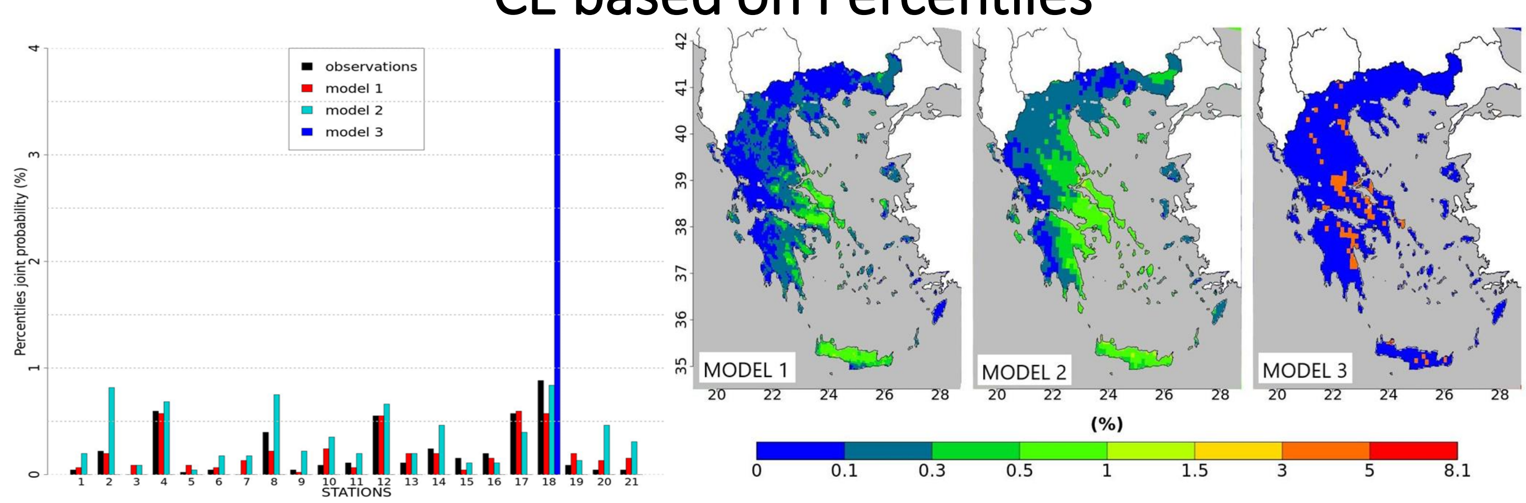
- Few differences are observed at modeled TN results between the models.

RR 95th percentile (mm/day)



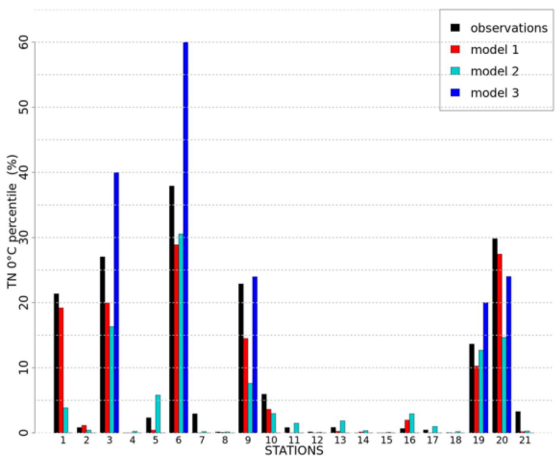
- Models tend to underestimate RR .
- model 1 shows more accuracy,
- model 3 shows greater spatial variability and is closer to observations than model 2.

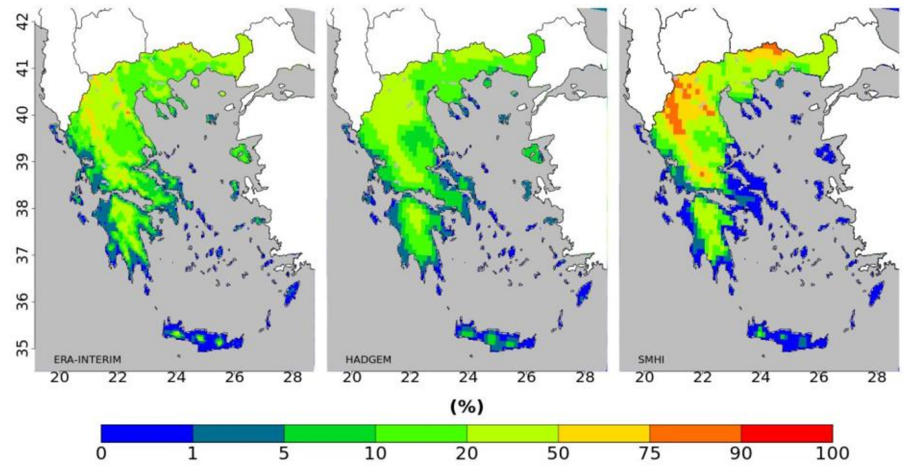
CE based on Percentiles



- Model 1 assimilates better the probability of the CE
- Model 2 shows a good agreement with model 3,
- Model 3 shows extremely high probabilities in few grid points and very low in the rest of the map. (example, station 18, Souda).

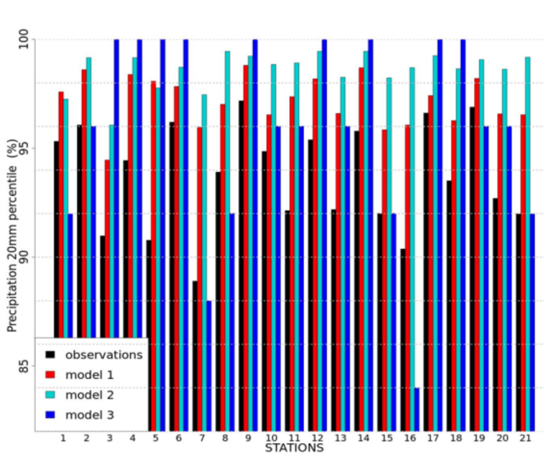
TN 0 °c probability (%)

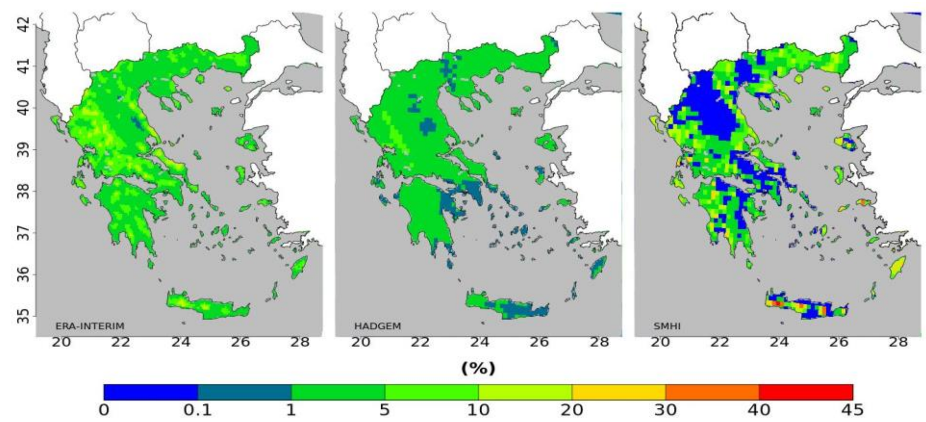




- Model 1 is the closest to observations
- Model 3 shows greater extent to the tails of percentile distribution than model 2.

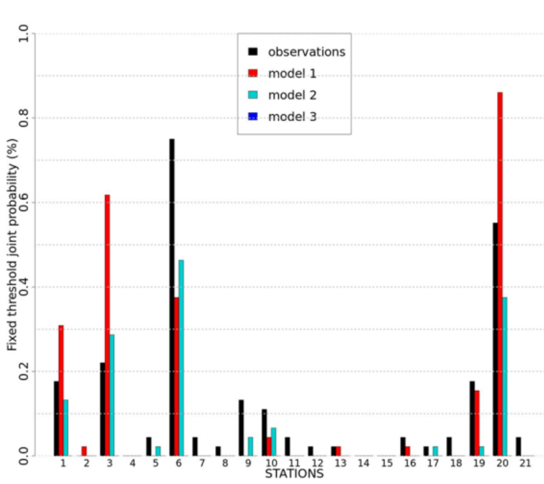
RR (20 mm/day) probability (%)

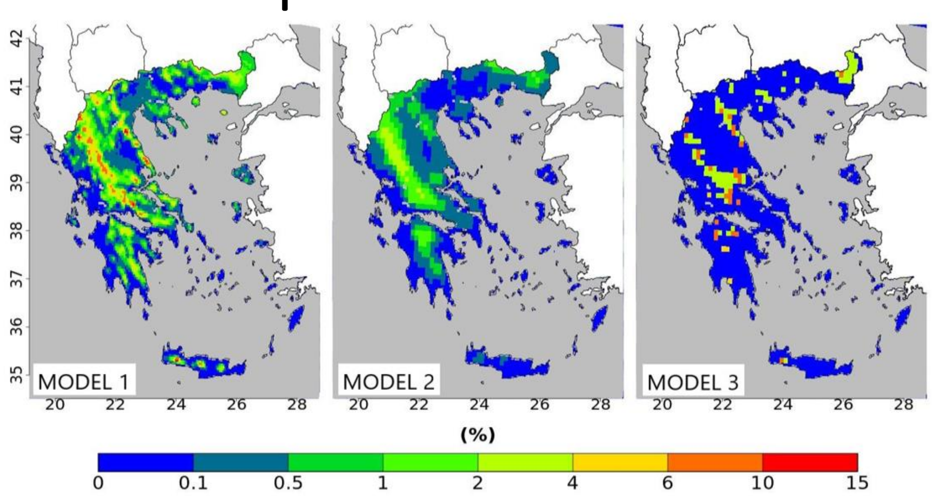




- The **lower** the percentile the **more frequent** the occurrence of 20mm/day RR.
- The models except for model 3 at some stations underestimate the probability of RR exceeding 20mm/day.
- Model 3 map shows spatial distribution similar to model 1 and at some points more extreme values.

Fixed threshold compound events





- At most stations, models underestimate the probability of these CE occurring.
- Model 1 shows the best spatial resolution while the other 2 models lose a lot of CE due to the coarser horizontal resolution.

TOTAL EVENTS OSERVATIONS-MODELS

CE BASED ON PERCENTILES

	OBSERVATIONS	MODEL 1	MODEL 2	MODEL 3
TOTAL EVENTS	202	207	335	181

The number of events are out of the sum of 4532 days for 21 stations, meaning a total of 95172 days.

CE BASED ON FIXED THRESHOLDS

	OBSERVATIONS	MODEL 1	MODEL 2	MODEL 3
TOTAL EVENTS	112	110.00	65	0

SUMMARY

- At <u>station grid points</u> MODEL 1 shows the best agreement to the observations.
- MODEL 2 overestimates the extreme CE for percentile thresholds and underestimates the extreme CE for the defined thresholds.
- MODEL 3 underestimates the probability of CE for both threshold cases.
- The finest resolution of MODEL 1 shows with greater detail where CE occur.

Acknowledgements

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