Preliminary study of Compound Events in Greece using high-resolution downscaled climate data

Iason Markantonis, Nadia Politi, Diamando Vlachogiannis, Nikolaos Gounaris, Stylianos Karozis, and Athanasios Sfetsos

NCSR 'Demokritos', INRASTES, Agia Paraskevi, Greece

(jasonm@ipta.demokritos.gr)

Presentation Overview

1. Abstract
2. Objectives-area of study
3. Methods-models
4. Results
5. Conclusions
6. References-Acknowledgments

Abstract

Climate change is set to result in an increase of extreme weather events such as extreme precipitation, heatwaves, floods, droughts etc. The study of the possibility of the increase of such events is of high importance, but equally important is to study the combination of these events, meaning the study of **Compound Events.** In our case we focus on the combination of extreme precipitation with extreme wind speed for the region of Greece.

Greece located in the region of the Eastern Mediterranean Sea is prone to Climate Change as the whole region of the Mediterranean Basin. So, it is crucial to understand how the country is affected by Compound Events of extreme precipitation and extreme wind speed. As a first step, we study the historic period 1980-2009 using the model output data. The data for the historic period analysis have been produced from Weather Research Forecast (WRF) 5km downscaled model output with temporal resolution of 6 hours, using as input ERAINTERIM data. The downscaling study that has produced the atmospheric model dataset is described in Politi, et al. (2018). The methodology for studying Compound Events in the area is presented together with the preliminary results.

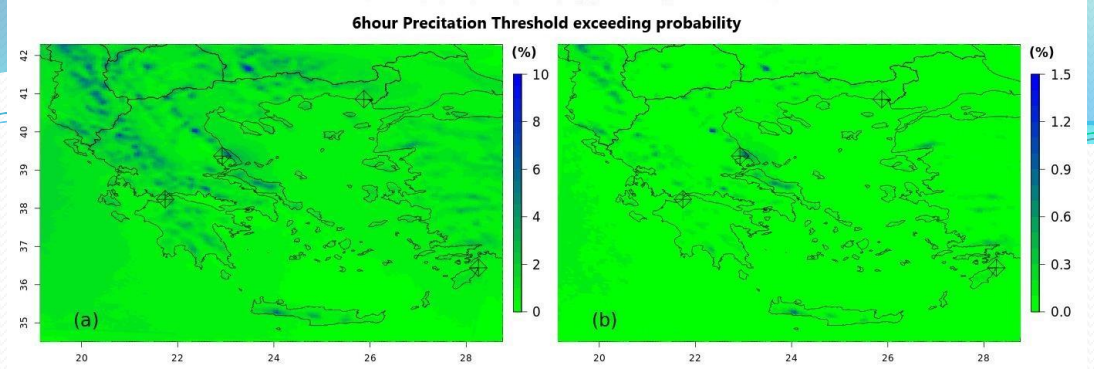
Objectives-area of study

The goal of this study is to find the probability of compound events of 6hour temporal resolution extreme wind speed and precipitation happening simultaneously in different regions of Greece. The matter of damages caused by such events also concerns insurance companies and is important to define the regions that are more vulnerable to dangerous storms.

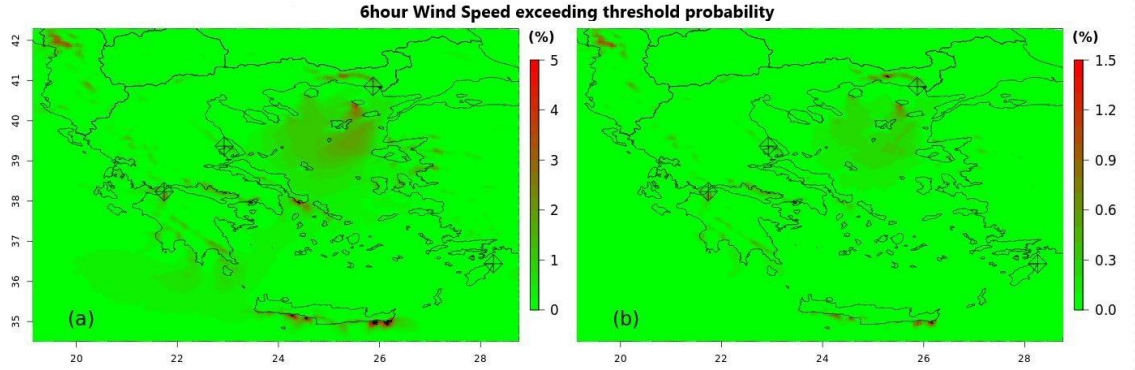
Methods-models

1. We obtain the data from the dynamical downscaling of WRF model (Politi, et al. 2018) at 6 hour temporal resolution and 5km grid space.
2. We calculate the 90^{th},95^{th} and 99^{th} percentile threshold for wind speed and precipitation out of 43832 values at each grid point and calculate the possibility of both variables exceeding these thresholds.
3. We calculate the probability of precipitation exceeding the threshold of 10 and 35 mm and wind speed 17 and 20 m/s. Also we calculate the possibility of the combination these thresholds are exceeded respectively.
4. We choose 4 Greek cities to see how possible is these extreme events to affect some residential areas.

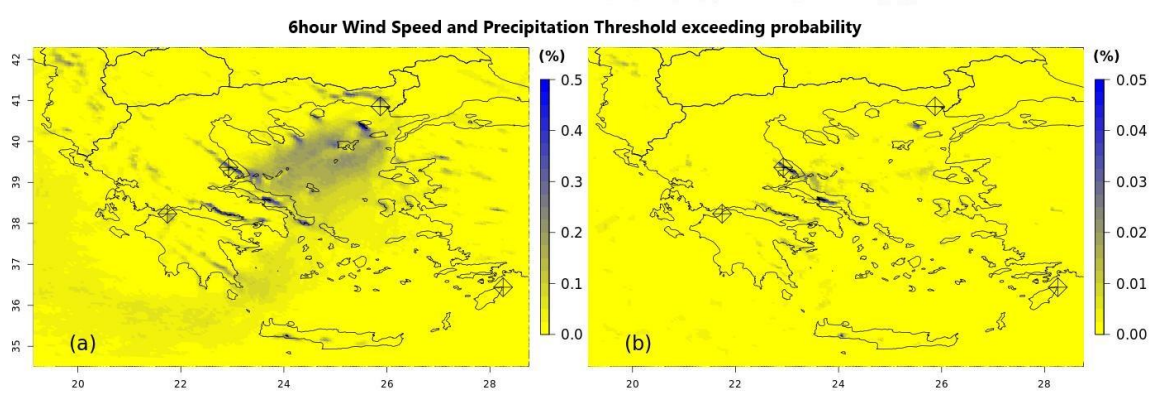
Results



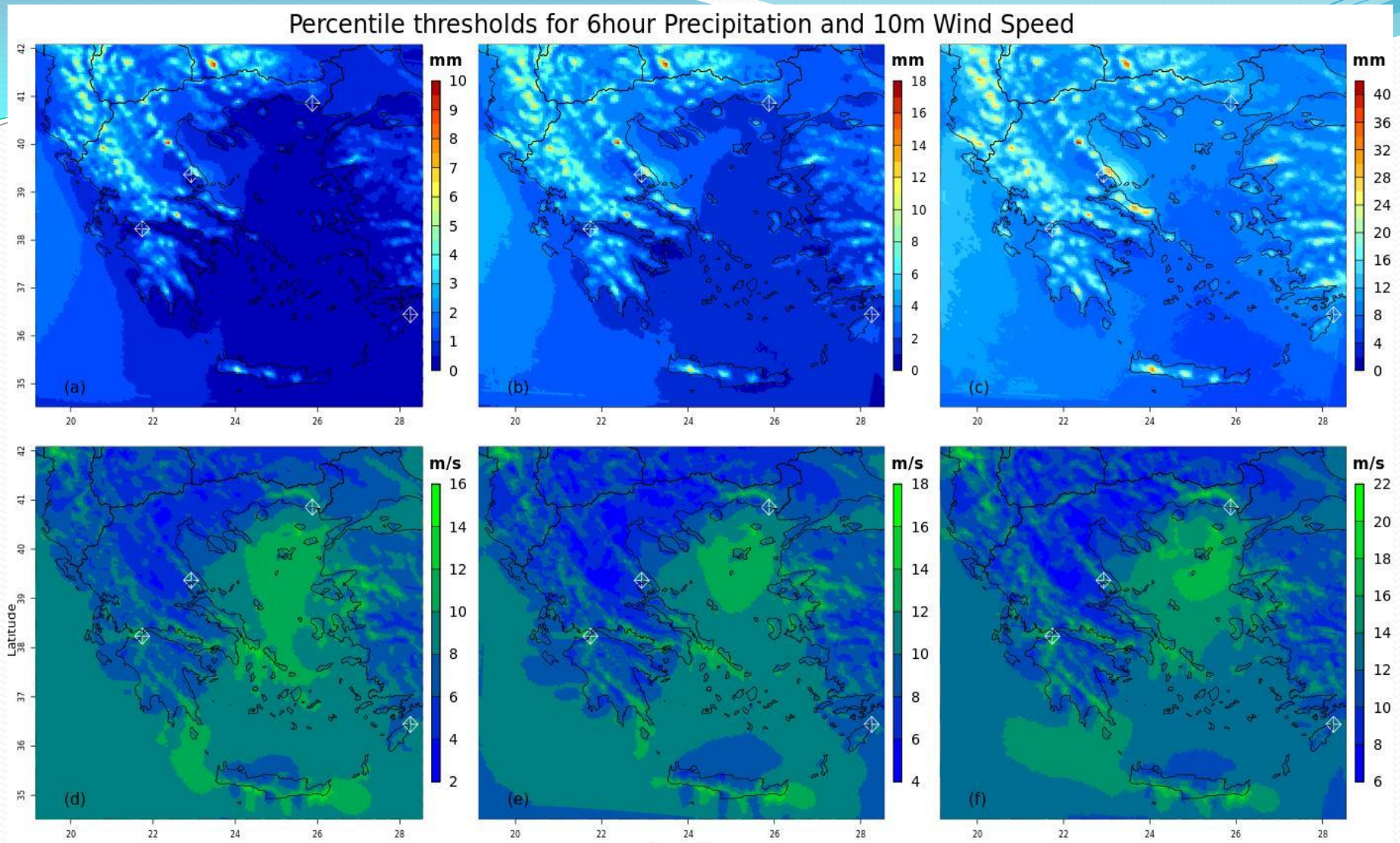
Probability of 6hour precipitation exceeding the threshold of a) 10mm and b) 35 mm



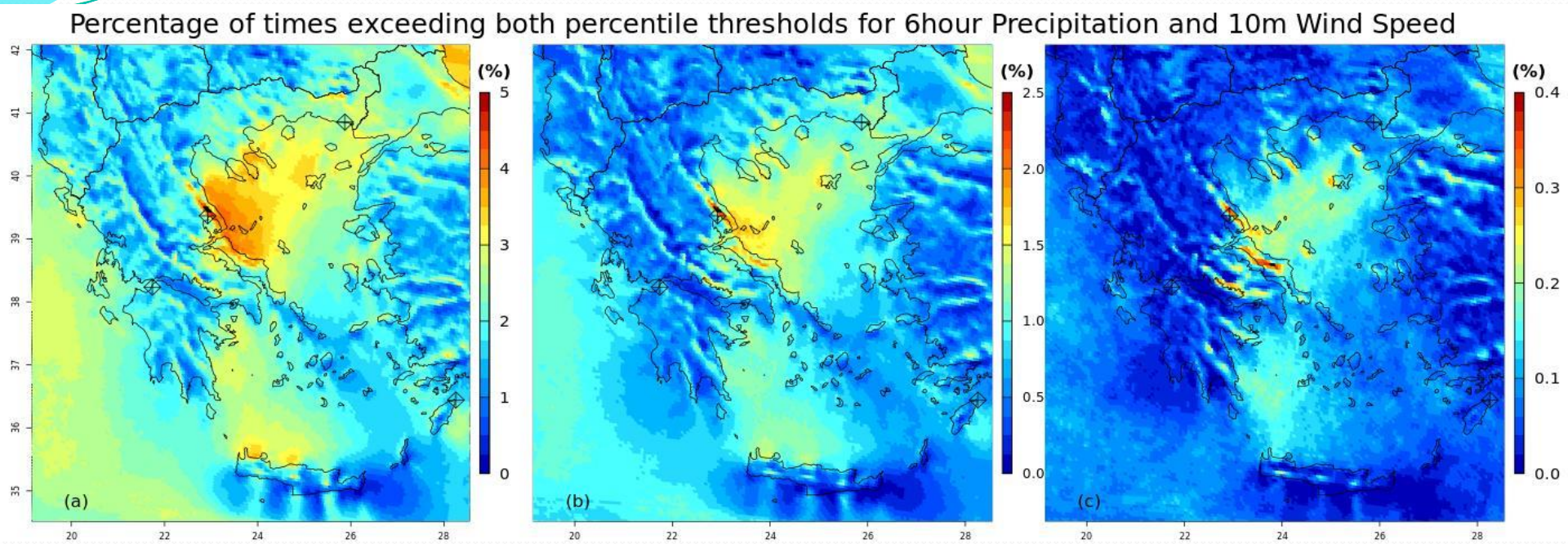
Probability of 6hour average wind speed exceeding the threshold of a) 17 m/s and b) 20 m/s



Probability of 6hour average wind speed and precipitation exceeding the threshold of a) 17 m/s and 10 mm and b) 20 m/s and 35 mm respectively



Percentile thresholds for each grid point for 6 hour cumulative precipitation a) 90th, b) 95th and c) 99th and for average 6 hour wind speed d) 90th, e) 95th and f) 99th .



Probability that the percentile thresholds for each grid point are exceeded for both precipitation and wind speed. The percentiles are the a) 90^{th} , b) 95^{th} and c) 99^{th} respectively.

WIND SPEED			90th	95th	99th	> = 17 m/s	> = 20 m/s			> = 17 m/s	> = 20 m/s
PRECIPITATION			90th	95th	99th			> = 10 mm	> = 35 mm	> = 10 mm	> = 35 mm
CITY	LATITUDE	LONGITUDE	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
VOLOS	*39.367*	*22.926*	2.996	1.054	0.135	0.6479	0.0228	0.545	0.2167	0.0844	0
RHODES	*36.442*	*28.255*	1.903	0.787	0.055	1.0654	0.0776	0.162	0.0137	0.0114	0
PATRAS	*38.234*	*21.739*	1.875	0.666	0.046	0.7278	0.0274	1.141	0.3399	0.0365	0
ALEXANDROUPOLIS	*40.855*	*25.874*	2.503	1.022	0.075	0.7985	0.0319	0.335	0.0912	0.0274	0

Table that shows the values of the probability exceeding the thresholds for precipitation and wind speed for the cities that are shown with the markers on the maps.
The first two rows indicate which variable is shown. At the columns that we have values for precipitation and wind speed we examine if the threshold is exceeded in both variables.

Conclusions

- Highest precipitation values on mountainous regions
- Highest wind speed values over the Aegean Sea
- Combination of extreme precipitation and extreme wind speed mostly located on the coastal regions of Magnesia, Mount Pelion, Sporades islands, Northeast Evia Island and Southern Chalkidiki.
- We also observe high values over other regions of Aegean and Ionian Sea.
- The regions with the highest values are being affected by strong Northern winds carrying moisture from the Aegean and falling on the obstacles of the mountains of mainland Greece create violent storms.

References

- Politi, N. et al. 2018) 'Evaluation of the AWR-WRF model onfiguration at high resolution over the domain of Greece'. Atmospheric Research Volume 208, 1 August 2018, Pages 229-245.

Acknowledgments: .This work was supported by computational time granted from the Greek Research & Technology Network (GRNET) in the National HPC facility - ARIS - under project ID HRCOG.

Thank you !!!