Extremeclimtwin - building excellence in hydro-climate research

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Abstract: It is recognized that the global mean surface temperature strongly influences the intensity of extreme precipitation increases during spring than mean precipitation increases. Due to the enormous impact that climate extremes have on the environment and human societies, they have been studied worldwide, from global, continental, and regional to the national scale. Southeast Europe is predicted to become even more vulnerable to climate extremes due to climate change. Increasing heat extremes constitute a significant risk for societies in southeast Europe. Therefore, the EXtremeClimTwin project aims to study hydro-climatic extremes over Southeast Europe.

Keywords: Climate change; Southeast Europe; ExtremeClimTwin; European Union's Horizon 2020.

1. Introduction

The latest IPCC report demonstrates that climate change is already affecting all regions of the world, with frightening and inconceivable warming projections [1]. It has become clear that hydro-meteorological impacts often result from the compounding nature of several variables and/or events [2]. For natural hazards, it is thus important to consider compound, or mul-ti-variate, events [3] as well as cascading events [4]. The spatial domain of research is SEE and the Mediterranean since this region saw an increase in the number of extreme and compound hot and dry (CHD) events/decade during the period 2011–2020. This increase has devastating results, as the (urban) wildfires that occurred in July 2018 in seaside Athens, Greece, claimed the lives of 102 people, and left 250 injured, while approximately 2,500 houses were damaged. In July 2021, European floods claimed the lives of more than 230 people. The occurrences of recent compound droughts and heatwaves in 2022 impacted the agricultural sectors, with an estimated reduction of 16%, 15%, and 12% in yield for maize, grain, and sunflower, respec-tively [5]. These examples are just a glimpse of what the future holds for the citizens of Europe. The Balkan peninsula was identified as a hotspot of compound drought and extreme heat events [6]. People in eastern Europe are, on average, less concerned about climate change than those in western Europe, with climate-

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related legislative efforts reflecting the low political importance of climate change in the region. However, the complexity of the relationships be-tween atmospheric conditions, extreme and compound events in SEE indicates the need to de-velop more sustainable and actionable research and training programs. SEE has been identified as one of the planet's "warming hot spots", with more frequent heat waves anticipated if tem-peratures rise by 4°C by 2100. European state of the climate 2021 [7] report clearly states that SEE saw the most-above-average temperatures, had more wet days than average, but also dri-er-than-average conditions in spring. Thus, research in the region must be urgently scaled up what is the overreaching objective of EXtremeClimTwin

The Southeast Europe was affected by a particularly intense heat wave during summer 2007. Daily maximum temperature anomalies exceeded 14 °C in some places. Severe social and environmental consequences, such as heat related deaths, heat strokes, serious problems in the electrical supply and forest fires were associated with these extremely high temperatures. Ser-bia, Bulgaria and Greece were the European countries most affected by the heat wave. Increas-ing drought frequency and severity have been observed in southern Europe over recent dec-ades, with the Mediterranean region as a hotspot especially in spring and summer. Additional-ly, a clear increase was also evident in the Carpathian region.

The Southeast Europe is predicted to become even more vulnerable to climate extremes due to the climate change. Increasing heat extremes constitute a major risk for societies in southeast Europe. When combined with less summertime precipitation or drought, these fac-tors can raise the danger of health hazards, have large impacts on agriculture. Moreover, in-crease in summertime energy consumption could lead to problems of energy security. Howev-er, there is a knowledge gap in this part of Europe to properly understand how climate change will continue to affect the region. Cold waves, heatwaves and droughts in the summer, put a strain on the health system and the economy. However, little is known about the complexity of the relationships between atmospheric conditions, extreme precipitation events and flooding along with the observed trends in flood occurrence rate and their future effects of climate change in this part of Europe. Faculty of Sciences, University of Novi Sad (UNSPMF) recognized the need to build capacities in the detection and attribution of these extreme hydro-climate events through collaborations and training with institutions that have knowledge in this area of research.

2. About the project

EXtremeClimTwin is a three-year project (2020-2023) that is aimed at raising scientific excellence in the field of hydro-climate extremes in Southeast Europe. Through networking, knowledge transfer, and technical expertise, top international research organizations from Germany, Climate Risk Analysis (CRA); United Kingdom, Loughborough University, Depart-ment of Geography and Environment (LU); and Norway, the Center for

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International Climate Research (CICERO) are assisting the University of Novi Sad Faculty of Sciences (UNSPMF) in realizing its full scientific potential in the study of hydro-climatological extreme events. The overall objective of EXtremeClimTwin is very relevant, now more than ever when Europe faces extremely high temperatures and unprecedented drought [5]. The EU-funded EXtremeClimTwin project will reinforce and improve the research and innovation capacity of the University of Novi Sad Faculty of Sciences (UNSPMF) in Serbia in the domains of climate change and hydro-climate extremes. The overall objective EXtremeClimTwin is to sustainably strengthen research and en-hance networking skills in the field of hydro-climate extremes between UNSPMF and interna-tionally-leading counterparts in Europe and to make the results available to the international community and relevant stakeholders (companies, citizens, and authorities). The project has five main objectives identified to contribute to the aim of the project (Fig. 1).

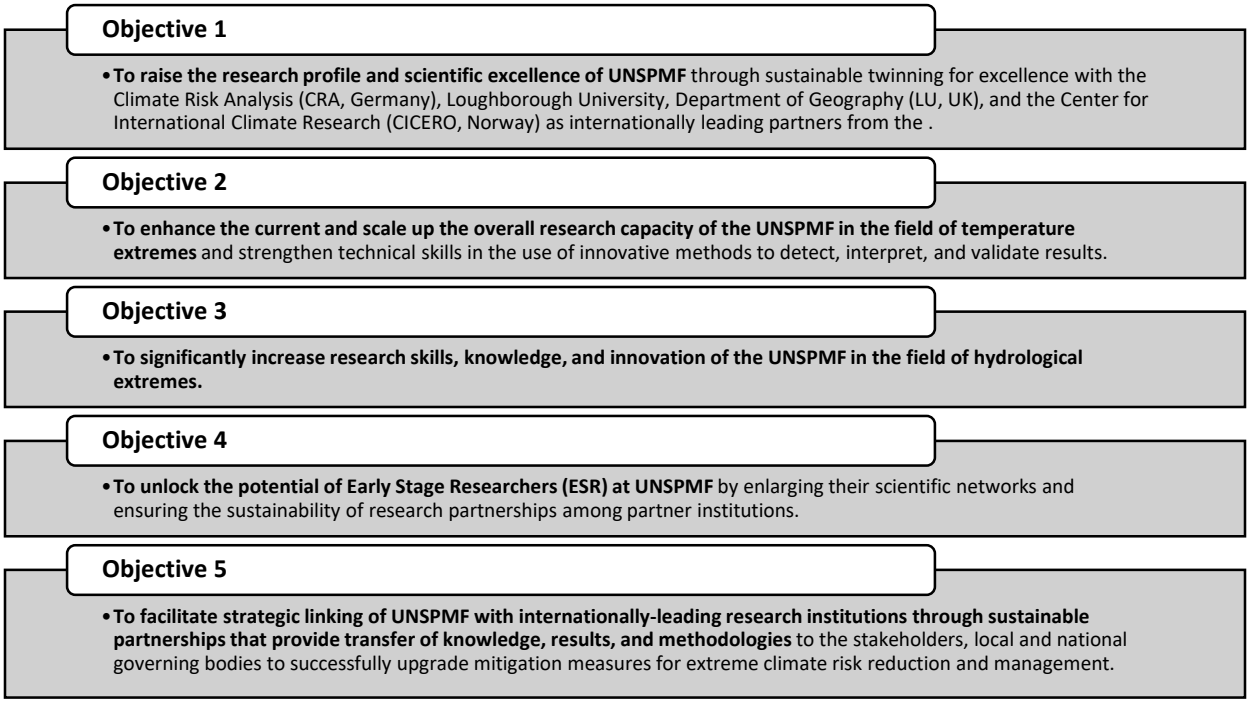

Figure 1. Objectives of the EXtremeClimTwin

3. Impact

Having competent researchers to tackle the challenges of hydro-climate extremes is cen-tral to the society. Serbia (and the region of Southeast Europe) lacks a skilled scientific task force to investigate these issues. Importance of the EXtremeClimTwin to society is building capacities on multiple levels: research competences, timely proposals for solutions based on the state-of-the-art research and continuous dialogue between the stakeholders

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UNSPMF re-searchers working on the problem, policy makers translating solutions into practice, and citi-zens who should absorb and benefit from the results. Raising awareness at the local level is critical for southeast Europe as climate change impacts are exacerbating the number and extent of hazards in this disaster-prone region. People in eastern and southeastern Europe are, on av-erage, less concerned about climate change than those in Western Europe, with climate-related legislative effort reflecting the low political importance of climate change in the region [8]. For example, it has been widely accepted that climate change is coal's most serious, long-term, global impact. In the new report by the International Energy Agency, Serbia is ranked 6th in the world in the share of coal in electricity production. But unlike other coal "addicts", Serbia is seriously lags behind in the energy transition. Of the 40 countries with the largest share of coal in electricity production, Serbia is also in a small group of only 6 countries that have not com-mitted to the gradual abandonment of coal, nor have they adopted a national plan for net zero greenhouse gas emissions, other five countries are Mongolia, Bosnia and Herzegovina, Zimbabwe, Niger and Guatemala [9]. Since Serbia was rated as most susceptible to floods and heat waves (more than 55% of all natural hazards [10]. increasing research skills and improving knowledge and innovation in the field is vital. The implementation of mitigation is mostly de-pendent on perceived susceptibility to threats and severity of climate change impacts, whereas adaptation is largely dependent on the availability of information relevant to climate change. Thus, the EXtremeClimTwin aims to promote transparency and education, knowledge sharing, greater public awareness and to support the uptake of project outputs to relevant communities. It also intends to engage directly with practitioners and relevant stakeholders in the field and to create sustainable measures to improve inclusive environment for further development. EX-tremeClimTwin activities has been strongly contributing to the proposed Objectives and long-term impacts (Table 1).

Table 1. Comparison between expected and achieved long-term impacts of the EXtremeClimTwin project

Indicators	Expected	Achieved
Total number of peer review papers	7	8
Citation index	63	257
Key note lecture at intentional scientific conferences	2	2
Number of visiting professors	4	3[1]
The number of applications for projects HORIZON 2020 involving teams from UNSPMF	10	43
Number of COST[2] actions	3	7

[1] Some indicators were not achieved due to the COVID-19 pandemic.
[2] European Cooperation in Science and Technology.

4. Results so far

According to the cordis.europa.eu, ExtremeClimTwin project in 2021, significant scien-tific contributions were made by the members of the project (Table 2).

During the last two years EXtremeClimTwin organized six different workshops, climatron, popular lectures and expert visits. In those events participants were not only from UN-SPMF but also from different countries in SEE (Croatia, Slovenia, Romania, Bosnia and Herce-govina).

Table 2. The scientific contribution of the EXtremeClimTwin project

Contribution	Number
Peer reviewed articles	25
Conference proceedings	2
Datasets via OpenAIRE	1

[1] Source: https://cordis.europa.eu/project/id/952384/results .

5. Conclusions

The Horizon 2020 Programme for Research and Innovation developed the Spreading Ex-cellence and Widening Participation (SEWP) indicators on the basis of extensive evidence showing that the road to economic growth and competitiveness is substantially related to re-search and innovation. Twinning projects is one of the SEWP actions.The primary goal of Twinning programs is to strengthen networking between research institutions in Widening countries and their EU-level, globally renowned equivalents (i.e., "advanced" partners). As a result of the Twinning Action, institutions in the Widening Country should improve their technological and scientific capabilities and contribute to raising the institution's and its staff's profile in research. As a twinning activity, EXtremeClimTwin achieved all of the desired re-sults.Outstanding outcomes from the project have had a major immediate or future impact. The project's results to date, which include expert visits, training of young researchers, scientific publications, and dissemination/communication efforts directed at certain pertinent target au-diences, such as policymakers, are significant. These findings benefit the coordinating institu-tion's research excellence and the development of its networking infrastructure. Twinning ac-tions are necessary for Widening countries to achieve the peak of excellence in science and in-novation efforts.

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