Training School on Statistical Modelling of Compound Events

Lake Como School of Advanced Studies, September 26-October 7, 2022

Home

2nd Como Training School on Compound Events

Compound weather and climate events originate from multiple climate drivers that act in combination to amplify societal or environmental risk, posing serious threats to natural systems and human societies. Modelling compound events and their risks under current and future climates requires knowledge about advanced statistical and numerical methods, and about underlying physical mechanisms.

After the success of the first Training School on Statistical Modelling of Compound Events in 2019, we are excited to announce the second edition of this school to train the next generation of compound event researchers. The school will provide a comprehensive introduction to compound events and to various statistical approaches and frameworks for their assessment, focusing on key issues like causality, dynamics, and impacts.

In addition to lectures from experts in the field, a key component of the school will be group projects to provide a hands-on application of the concepts and to socialize with the other participants and lecturers.

When: 26.9. – 07.10.2022

Where: Lake Como School of Advanced Studies (Como, Italy)

For whom: PhD students and early postdocs (maximum 2 years after completion of PhD). The number of participants is limited to 25.

How to apply: Please send motivation letter (1 page), CV, preference for student project (1st, 2nd, and 3rd choice; see below) and at least one reference (e.g. PhD advisor) as one pdf file to organizercomoschool2022@gmail.com .

Application deadline: 15 July 2022

Notification of acceptance: 30 July 2022

Registration (only accepted students): 5th September 2022

Registration fee: 550 euro (VAT 22% included). The fee covers: all lectures; wi-fi; lunches and coffee breaks; and a social dinner during the first week.

Organizing committee: Carlo De Michele, Radley Horton, Kai Kornhuber, Gabriele Messori, Colin Raymond, Alexandre Tuel, Wim Thiery, Jakob Zscheischler

For information, please contact organizercomoschool2022@gmail.com.

The Training School is partially supported by

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Topics & Lecturers

Topics

- Concept of compound events
- Copula theory
- Causality
- Dependence
- Impact modeling
- Machine learning methodologies
- Multivariate extreme value theory
- Physical Drivers and Mechanisms
- Societal Impacts

Lecturers

Prof. Carlo De Michele (Politecnico di Milano, Italy)
Dr. Emanuele Bevacqua (Helmholtz Centre for Environmental Research – UFZ, Germany)
Prof. Fabrizio Durante (University of Salento, Italy)
Prof. Sebastian Engelke (University of Geneva, Switzerland)
Prof. Radley Horton (Columbia University, U.S.A.)
Dr. Kai Kornhuber (LDEO-Columbia University, DGAP, U.S.A.)
Prof. Gabriele Messori (Uppsala University, Sweden)
Dr. Colin Raymond (NASA Jet Propulsion Laboratory, U.S.A.)
Prof. Jakob Runge (German Aerospace Center and TU Berlin, Germany)
Prof. Gianfausto Salvadori (University of Salento, Italy)
Prof. Sonia Seneviratne (ETH Zurich, Switzerland)
Prof. Deepti Singh (Washington State University, U.S.A.)
Prof. Wim Thiery (Vrije Universiteit Brussel, Belgium)
Dr. Jakob Zscheischler (Helmholtz Centre for Environmental Research – UFZ, Germany)

Student-Project – Instructors

Corey Lesk (LDEO, Columbia University, U.S.A.)
Giorgia DiCapua (PIK, Germany)
Batibeniz Fulden (ETH Zurich, Switzerland)
Lisa Thalheimer (Princeton, U.S.A.)
Alexandre Tuel (University of Bern, Switzerland)

Student Projects

Participants of the Training School are requested to choose from one of the following 5 student projects. During the two weeks there will be ample time for the groups to work on their projects, with the intended outcome of each project being a submittable manuscript in the months following the School.

Project 1: Impacts of compound sequential heat extremes on global crops

Supervision: Kai Kornhuber and Corey Lesk

The responses of many living systems to climate extremes can shape their vulnerability to subsequent climate extremes. With climate warming, the onset of the growing season will arrive sooner in many regions, while peak growing seasons become warmer. In this project, we examine whether exposure to earlier and more intense spring heat reduces or enhances the impacts of summer heat on an essential weather-sensitive system: food crops. To answer this question, which remains an important uncertainty of compound extreme impacts, we bring statistical methods to bear on global weather observations, reanalysis, and climate models together with crop production and management datasets.

Project 2: Assessing causality in compound events

Supervision: Carlo De Michele and Giorgia Di Capua

The aim is to investigate the interdependencies among the different variables involved in a compound event. Note that, the interdependence relationships among variables may be causal or spurious. Distinguishing between causal and spurious dependence is a key issue in understanding the behavior of compound events. To do this, causal discovery tools, based on the conditional mutual information (Runge, 2018; Runge et al., 2014). Causal discovery tools have been useful to investigate and quantify boreal summer tropical – extratropical links (Di Capua et al., 2020), polar vortex dynamics (Kretschmer et al., 2016), Silk Road pattern variability (Stephan et al., 2019) and tropical cyclones activity (Pfleiderer et al., 2020). In the project, causal discovery tools will be applied to a meteorological compound event as exemplary case study. The project will put also emphasis on the importance of causal investigations in the different typologies of compound events.

Project 3: Compound extremes and teleconnection patterns

Supervision: Colin Raymond and Alexandre Tuel

Are compound extreme events often just an expression of canonical teleconnection patterns? This project will center on examination of several recent episodes where persistent atmospheric-flow patterns led to extremes with severe impacts. The key components will be an analysis of spatiotemporally filtered reanalysis and model data that illuminates the key features characterizing compound events, leading to identification of distinctive transient components that differ from typical teleconnection behavior and to evaluation of models in properly representing these drivers.

Student project 4: Pathways linking compound extremes and human displacement

Supervision: Radley Horton and Lisa Thalheimer

Compound weather and climate events contribute to societal and economic disruptions and increase the risk of displacement. During such events, multiple weather and climate-related drivers come together and surpass the coping capacity of the underlying physical systems and socio-economic systems. In this project, we examine the links between compound events that led to human mobility responses such as internal displacement, preexisting vulnerabilities such as food insecurity and structural vulnerabilities such as poverty, and climate change. We will be using statistical methods from extreme event attribution to achieve a dual goal: One, is to determine the role of climate change in compound events and second, to better understand non-climatic drivers in mobility responses to compound events.

Student project 5: Impacts of lake flood compound events

Supervision Wim Thiery and Batibeniz Fulden

Compound flooding is recently assessed in literature in correspondence of coast lines or at the confluence of two rivers. Compound flooding in correspondence of lakes is a phenomenon less investigated, despite the importance of lakes in the dynamics of global freshwater. Here, using the outputs of ISIMIP project (Lange et al. 2020), we intend to investigate this phenomenon with reference to some key lakes located in the African continent (Van de Walle et al. 2021). The project will put attention to historical and future conditions.