

# Emanuele Bevacqua

## Curriculum Vitae

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### Personal Data

Date of Birth 29th June 1990.  
Nationality Italian.

### Postdoctoral work experience

03/2019–**Postdoc scientist.**  
present Department of Meteorology, University of Reading, UK.  
09/2018–**Postdoc scientist.**  
02/2019 Wegener Center for Climate and Global Change, University of Graz, Austria.

### Research experience

I am studying the impact of past and future climate change on meteorological extreme events based on regional and global climate models. I am interested in compound events (CEs), such as compound flooding happening in low-lying coastal areas due to co-occurring large amounts of precipitation and high sea level. Throughout my PhD, within the international research project CE:LLO, I focussed my scientific research on multivariate statistical modelling and the analysis of CEs. I gained expertise in multivariate statistics, e.g. Pair-copula constructions, regional climate modelling, and collaborated on research about soil moisture drought and multivariate statistical downscaling.

### Education

11/2014–**PhD (Dr. rer. nat) in Physics (Climate Science).**  
09/2018 2016–2018: Wegener Center for Climate and Global Change, University of Graz, Austria.  
2014–2015: GEOMAR – Helmholtz Centre for Ocean Research Kiel, Germany.  
*Pass with distinction.*  
Thesis *Multivariate statistical modelling and analysis of compound events.*  
Supervisor Prof. Douglas Maraun.  
2012–2014 **Master of Science in Physics (Astrophysics and Geophysics).**  
University of Calabria, Cosenza, Italy.  
*Cum laude, and honourable mention for career.*  
Thesis *Analysis of the magnetohydrodynamic turbulence anisotropy based on a new definition of the mean magnetic field.*

2009–2012 **Bachelor's degree in Physics.**  
University of Calabria, Cosenza, Italy.  
*Cum laude, and honourable mention for career.*  
Thesis *Focus on the last glacial period.*

2004–2009 **Scientific High School.**  
Cosenza, Italy.  
Score of *100 out of 100.*

## Research visits

03/2019 **Laboratoire de Météorologie Dynamique (LMD)**, Paris, France.  
One-week short term scientific mission (STSM) within DAMOCLES project.

06/2015–  
12/2015 **Laboratoire des Sciences du Climat et de l'Environnement**, Gif-sur-Yvette,  
France.  
Development statistical model for the CE:LLO project.

Supervisor Dr. Mathieu Vrac.

02/2015 **Norwegian Computing Center**, Oslo, Norway.  
Training in Pair-copula constructions.

Supervisors Dr. I. Hobaek-Haff and Prof. A. Frigessi.

## Publications

- **Bevacqua, E.**, Maraun, D., Voudoukas, M. I., Voukouvalas, E., Vrac, M., Mentaschi, L., and Widmann, M. (2019). "Higher potential compound flood probability in Northern Europe under anthropogenic climate change". *Science Advances*, Vol. 5, no. 9, eaaw5531 DOI: 10.1126/sciadv.aaw5531.
- Manning, C., Widmann, M., **Bevacqua, E.**, Van Loon, A. F., Maraun, D., and Vrac, M. (2019). "Increased probability of compound long-duration dry & hot events in Europe during summer (1950-2013)". *Environ. Res. Lett.* 14 094006.
- **Bevacqua, E.** (2018). "Multivariate statistical modelling and analysis of compound events". PhD thesis, University of Graz, Graz, Austria.
- Manning, C., Widmann, M., **Bevacqua, E.**, Van Loon, A. F., Maraun, D., and Vrac, M. (2018). "Soil moisture drought in Europe: a compound event of precipitation and potential evapotranspiration on multiple timescales". *Journal of Hydrometeorology*, 19(8), 1255-1271.
- **Bevacqua, E.**, Maraun, D., Haff, I. H., Widmann, M., and Vrac, M. (2017). "Multivariate statistical modelling of compound events via pair-copula constructions: analysis of floods in Ravenna (Italy)". *Hydrology and Earth System Sciences*, 21, 2701-2723.
- **Bevacqua, E.** (2017). "CDVineCopulaConditional: an R package for conditional sampling from multivariate copula decomposed via C- or D-vines". R-package.

- Alberti, T., Lepreti, F., Vecchio, A., **Bevacqua, E.**, Capparelli, V., and Carbone, V. (2014). "Natural periodicities and Northern Hemisphere–Southern Hemisphere connection of fast temperature changes during the last glacial period: EPICA and NGRIP revisited". *Climate of the Past*, 10, 1751-1762.

Under review

- Jézéquel, A., **Bevacqua, E.**, D'Andrea, F., Thao, S., Vautard, R., Vrac, M., Yiou, P. (2019). "Conditional and residual trends of singular hot days in Europe". Submitted..

## Honours and awards

- 2019 Grant awarded for a *Short Term Scientific Mission* from the COST action DAMOCLES.
- 2018 Winner of the *Outstanding Student Poster and PICO (OSPP) Award contest of the EGU General Assembly 2018, including a fee waiver for the EGU General Assembly and for a publication in a EGU journal.*
- 2017 Winner of the *SWGEM-Hydro conference young scientist travel support.*
- 2012, 2014 Winner of scholarship for merit *John R. Mott Scholarship Foundation.*
- 2013 Grant. Selected international graduate student for attending the International Spring School on Towards a complete assessment of the impact of solar variability on the Earth's climate (*1st TOSCA training school "Sun2Climate school"*).
- 2006 Participation by invitation in the national stage of the *Olympics of mathematics, Honourable Mention.*
- 2005 Winner at the regional stages of the *Olympics of mathematics.*

## Skills

### Computer skills

**Programming languages:** R , IDL, Fortran, C, C++; Bash.

**Operating Systems:** Linux, Windows.

**Geophysical models:** FES astronomical tide model, COSMO-CLM (Regional Climate Model).

### Languages

Italian (mother tongue), English (fluent), German (conversant), French (basic).

## Experience

### Teaching

- 09/2019 Trainee at the "Training School on Statistical Modelling of Compound Events" (together with Prof. Carlo De Michele): supervision and organisation of the group project "Model evaluation of bivariate relationships with copulas", undertaken by a group of PhD students and early Postdocs..
- 10/2019 Invited lecturer at the "Training School on Statistical Modelling of Compound Events": "Physical processes driving compound flooding (CF) and its future changes".

### Memberships

- 2018-present Member and secondary proposer of the funded COST Action "DAMOCLES: Understanding And Modeling cOmpound CLimate and weather EventS", CA17109.
- 2019-present Management committee (MC) member for the United Kingdom in the COST Action "DAMOCLES" (CA17109).
- 2018-2019 Management committee (MC) member substitute for Austria in the COST Action "DAMOCLES" (CA17109).
- 2015-present European Geosciences Union (EGU).
- 2013-2014 Member of the amateur weather association "Cosenza Meteo".

### Organisational experience

- 2019-present Manager of the Group Workspace "storycc" on the JASMIN computing infrastructure.
- 2016-2019 Seminar series organiser for the Reloclim group at the Wegener Center for Climate and Global Change.
- 2016-12-15 Moderator of T4Science seminar "How to ask good scientific questions? A panel discussion" at the University of Graz.
- 2012-2014 Seminar series co-organiser for the CuboRisonante group at the Physics Department of the University of Calabria.

### Appearances in media

- 03/2019 Our paper on future changes of compound flooding was largely discussed by the media, for example by the BBC and the New Scientists. [Link to some articles] .
- 03/2019 "Visualizzazione dei cambiamenti climatici, cosa sta succedendo?" Scopriamone di più, calabrianews24.it.
- 03/2019 "Visualizzazione dei cambiamenti climatici, cosa sta succedendo? scopriamone di più. PARTE 2", MeteoCalabria.net.
- 12/2018 "Visualizzazione dei cambiamenti climatici, perchè è importante conoscere questa minaccia? Scopriamone di più. PARTE 1", MeteoCalabria.net.
- 12/2018 "Visualizzazione dei cambiamenti climatici, perchè è importante conoscere questa minaccia?", calabrianews24.it.
- 11/2018 Eguraldia show, EITB TV.

### Voluntary work

- 2013-2015 Student representative at the Physics Department of the University of Calabria.

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## Conference and workshop presentations

### Oral presentations

- 10/2019 **Bevacqua, E.**, "Physical processes driving compound flooding (CF) and its future changes". Climate and Ocean Dynamics (COD) group Seminars, University of Reading.
- 04/2019 Maraun, D., and **Bevacqua, E.**, "Storylines of a future precipitation extreme event - what is the event, what are the storylines, and are they sensible?". Workshop on physical modeling supporting a "storyline approach". Oslo Science Park, Norway.

- 04/2019 **Bevacqua, E.**, Maraun, D., Vousdoukas, M. I., Mentaschi, L., Voukouvalas, E., Zappa, G., and Vrac, M. "Changing compound flood probability at the global scale under anthropogenic climate change". EGU General Assembly 2019, Vienna, Austria.
- 03/2019 **Bevacqua, E.** Assessing the impact caused by compound events, with a focus on the future changes in the compound flooding hazard, Workshop on Compound Events, Paris, France.
- 01/2019 **Bevacqua, E.**, Maraun, D., Vousdoukas, M. I., Voukouvalas, E., Vrac, M., Mentaschi, L., and Widmann, M. "Higher compound flood probability in Europe under anthropogenic climate change". Jour-fixe, University of Graz, Austria.
- 10/2018 **Bevacqua, E.**, Piazza, M., Maraun, D., and Truhetz, H. "An attempt to estimate the climate change effect on the June 2009 Austrian extreme event based on the storyline approach". Annual CORDEX-FPS meeting on Convection over Europe and the Mediterranean, University of Lisbon, Portugal.
- 09/2018 **Bevacqua, E.** "Multivariate statistical modelling and analysis of compound events". Public PhD defence, University of Graz, Austria.
- 11/2017 **Bevacqua, E.**, Maraun, D., Vousdoukas, M. I., Voukouvalas, E., Vrac, M., Mentaschi, L., and Widmann, M. "Increasing likelihood of compound flooding over northern europe in response to anthropogenic climate change". Compound flood events meeting, European Joint Research Centre, Ispra, Italy (Invited).
- 11/2017 **Bevacqua, E.**, and Maraun, D. "On the link between cyclones and potential compound flooding". Compound flood events meeting, European Joint Research Centre, Ispra, Italy (Invited).
- 09/2017 **Bevacqua, E.**, Maraun, D., Haff, I. H., Widmann, M., and Vrac, M. "Multivariate statistical modelling of compound events via pair-copula constructions: analysis of floods in Ravenna (Italy)". International Workshop on Stochastic Weather Generators for Hydrological Applications (SWGen-Hydro), Berlin, Germany.
- 04/2017 **Bevacqua, E.**, Maraun, D., Haff, I. H., Widmann, M., and Vrac, M. "Multivariate statistical modelling of compound events via pair-copula constructions: analysis of floods in Ravenna (Italy)". EGU General Assembly 2017, Vienna, Austria.
- 04/2017 **Bevacqua, E.**, Maraun, D., Haff, I. H., Widmann, M., and Vrac, M. "The R-package CDVineCopulaConditional for modelling Compound Events". Workshop on Addressing the Challenge of Compound Events, ETH Zurich, Switzerland (Invited).
- 09/2016 **Bevacqua, E.**, Maraun, D., Haff, I. H., Widmann, M., and Vrac, M. "Statistical modeling of compound events via pair-copula constructions: Ravenna flooding case study". Statussymposium "Extremes" 2016: VolkswagenStiftung, Hannover, Germany (Invited).
- 06/2016 **Bevacqua, E.**, Maraun, D., Haff, I. H., Widmann, M., and Vrac, M. "A model based on Pair-Copula Construction to analyze and represent Compound Flooding". The 13th International Meeting on Statistical Climatology, Canmore, Canada.
- Poster presentations**
- 04/2018 **Bevacqua, E.**, Maraun, D., Vousdoukas, M. I., Voukouvalas, E., Vrac, M., Mentaschi, L., and Widmann, M. "Changing risk of compound flooding over Europe in response to climate change". EGU General Assembly 2018, Vienna, Austria.

- 09/2017 **Bevacqua, E.**, Maraun, D., Haff, I. H., Widmann, M., and Vrac, M. "The R-package CDVineCopulaConditional for modelling Compound Events". International Workshop on Stochastic Weather Generators for Hydrological Applications (SWGGen-Hydro), Berlin, Germany.
- 04/2017 **Bevacqua, E.**, Maraun, D., Voukouvalas, E., Vousdoukas, M. I., Widmann, M., Manning, C., and Vrac, M. "Analysis of present and future potential compound flooding risk along the European coast". EGU General Assembly 2017, Vienna, Austria.
- 04/2017 **Bevacqua, E.**, Maraun, D., Voukouvalas, E., Vousdoukas, M. I., Widmann, M., Manning, C., and Vrac, M. "Analysis of present and future potential compound flooding risk along the European coast". Workshop on Addressing the Challenge of Compound Events, ETH Zurich, Switzerland (Invited).
- 04/2016 **Bevacqua, E.**, Maraun, D., Haff, I. H., Widmann, M., and Vrac, M. "Statistical Modelling of Compound Floods: a Sensitivity Analysis". EGU General Assembly 2016, Vienna, Austria.
- 04/2016 **Bevacqua, E.**, Maraun, D., Vrac, M., Widmann, M., and Manning, C. "Statistical Modelling of Compound Floods". 17th Austrian Climate Day - "KlimaTag", Graz, Austria (Pitch and Poster).
- 11/2015 **Bevacqua, E.**, Maraun, D., Haff, I. H., Widmann, M., and Vrac, M. "Multivariate Statistical Modelling of Compound Floods". Statistical and mathematical tools for the study of climate extremes, Cargèse, France.
- 08/2015 **Bevacqua, E.**, Maraun, D., Haff, I. H., Widmann, M., and Vrac, M. "Statistical Modelling of Compound Floods". 14th Swiss Climate Summer School - "Extreme Events and Climate", Ascona, Switzerland.
- 03/2013 Alberti, T., **Bevacqua, E.** (presenter), Capparelli, V., Lepreti, F., Vecchio, A., and Carbone, V. "Natural periodicities and North–South hemispheres connection of fast temperature changes during the last glacial period: EPICA and NGRIP revisited". 1st TOSCA training school "Sun2Climate school", Thessaloniki, Greece.

## Contributions to presentations

### Oral presentations

- 04/2018 Manning, C. (presenter), Widmann, M., **Bevacqua, E.**, Van Loon, A., Maraun, D., and Vrac, M. "Soil Moisture Drought in Europe: A Compound Event of Precipitation and Potential Evapotranspiration on Multiple Timescales". EGU General Assembly 2018, Vienna, Austria.
- 09/2017 Manning, C. (presenter), Widmann, M., **Bevacqua, E.**, Van Loon, A., Maraun, D., and Vrac, M. "A multivariate statistical model describing the compound nature of soil moisture drought". International Workshop on Stochastic Weather Generators for Hydrological Applications (SWGGen-Hydro), Berlin, Germany.
- 04/2015 Alberti, T. (presenter), Lepreti, F., Vecchio, A., **Bevacqua, E.**, Capparelli, V., and Carbone, V. "Natural periodicities and Northern Hemisphere–Southern Hemisphere connection of temperature changes during the last glacial period: EPICA and NGRIP data sets revisited". EGU General Assembly 2015, Vienna, Austria.

### Poster presentations

- 04/2017 Manning, C. (presenter), Widmann, M., **Bevacqua, E.**, Maraun, D., Van Loon, A., and Vrac, M. "A Multivariate Statistical Model Describing the Compound Nature of Soil Moisture Drought". EGU General Assembly 2017, Vienna, Austria.
- 04/2017 Manning, C. (presenter), Widmann, M., Maraun, D., Vrac, M., Van Loon, A., and **Bevacqua, E.** "A Multivariate Description of Compound Events of Meteorological Drought and Heat Waves". EGU General Assembly 2017, Vienna, Austria.
- 04/2017 Manning, C. (presenter), Widmann, M., **Bevacqua, E.**, Maraun, D., Van Loon, A. and Vrac, M. "A Multivariate Statistical Model Describing the Compound Nature of Soil Moisture Drought". Workshop on Addressing the Challenge of Compound Events, ETH Zurich, Switzerland.
- 09/2016 Manning, C. (presenter), Widmann, M., Vrac, M., Maraun, D., Van Loon, A., and **Bevacqua, E.** "Soil Moisture Drought as a Compound Event of Meteorological Drought and Heat Waves". Statussymposium "Extremes" 2016: VolkswagenStiftung, Hannover, Germany.
- 08/2016 Manning, C. (presenter), Widmann, M., Vrac, M., Maraun, D., Van Loon, A., and **Bevacqua, E.** "The Relevance of Meteorological Drought and Heat Wave Compound Events to Soil Moisture". 15th International Swiss Climate Summer School: Climate Risks - Coping with Uncertainty, Grindelwald, Switzerland.
- 06/2016 Manning, C. (presenter), Widmann, M., Maraun, D., **Bevacqua, E.**, Van Loon, A., and Vrac, M. "Statistical Modelling of Drought and Heat Wave Compound Events". The 13th International Meeting on Statistical Climatology, Canmore, Canada.
- 04/2016 Manning, C. (presenter), Widmann, M., Vrac, M., Maraun, D., and **Bevacqua, E.** "Multivariate Statistical Modelling of Drought and Heat Wave Events". EGU General Assembly 2016, Vienna, Austria.