Research options available

Research topic(s) offered by every Doctoral Course involved in UNIPhD are frameworks within which every applicant has to present an original research project in collaboration with a Supervisor at the University of Padua.

Potential Supervisors at Unipd have proposed the following detailed research options, which are related to the research topic. They are offered as a guideline and should facilitate your contact with potential Supervisors. Supervisors' e-mail is specified in every research option table. You are welcome to contact them directly.

Note that this research option list is not at all exhaustive and, within the topic you have chosen, you are free to propose a different research project.

Doctoral Course	LAND, ENVIRONMENT, RESOURCES AND HEALTH
Macro-area	Cross-domain Physical Sciences and Engineering / Life Sciences
Department name	Department of Land, Environment, Agriculture and Forestry
Webpage	http://www.tesaf.unipd.it/en/lerh
Research topic	**Projected changes in flood occurrence at convection-permitting scale across an alpine transect** Relationship between future changes in extreme precipitation and flooding for extreme events.
Link to the UNIPhD Call (Academic Year 2023/2024)	https://uniphd.eu
Latest Update	02.12.2022
#Number of available Research Options	1 Scroll down to see all the Research Options

#1 Research Option Description

Doctoral Course	**Land, Environment, Resources And Health (LERH)**
Department name	Land, Environment, Agricolture And Forestry (LEAF)
Research topic	Projected changes in flood occurrence at convection-permitting scale across an alpine transect
Research option	To what extent are changes in flood magnitude related to changes in precipitation extremes? An examination across an alpine transect.
Supervisor	Supervisor: Marco BORGA, email: marco.borga@unipd.it Other members of the research group: Eleonora DALLAN, email: eleonora.dallan@unipd.it
Webpage	https://www.tesaf.unipd.it/category/ruoli/personale-do-cente?key=C30991B1AD192E9A73A316AEEF7BCB41
Context of the research activity and objectives	There is clear theoretical, model-based, and empirical evidence that global precipitation extremes, i.e. precipitation exceeding a high threshold, will increase in a warming climate. However, there is greatly more uncertainty regarding the hydrologic response regarding flooding and there is not yet clear evidence for widespread increases in flood occurrence either in observations or in model simulations. While there is still a theoretical expectation that flood events will increase in a warming climate, and while such flood increases have been documented regionally, the absence of broader observational trends supporting this hypothesis is conspicuous. In the literature on hydrological processes, the lack of such trends is often attributed to changes in non-precipitation-flood drivers, such as temperature-driven decreases in snow accumulation and increases in evaporation that yield decreases in soil moisture. Because of the compounding nature of different flood drivers, establishing a direct link between increases in extreme precipitation and increases in flooding is challenging. Indeed, previous studies suggest that the strength of the relationship between precipitation and discharge may depend on a range of factors including catchment size, event magnitude, and season though the details of these complex relationships remain largely unknown and are hard to generalize. Further complicating such investigations is the rarity of extreme events with long return intervals and their sparseness in observed precipitation and streamflow records. The research project will address this data scarcity problem by using a variety of methods, including stochastic streamflow generation and ensemble modelling using Single Model Initial-condition Large Ensembles (SMILEs) across an Alpine transect where accurate long- term series of flood events and climate simulation at convection permitting scale are available. This will shed light on the relationship between future changes in extreme precipitation and flooding – particularly

	high-end extreme events (i.e., those occurring twice or fewer times per century), which are rare to nonexistent in observed time series.
Infrastructures	The candidate will be hosted at the Land, Environment, Agriculture and Forestry Department of the University of Padova, and will have access to all the excellent research facilities and infrastructures offered to PhD candidates at the Department and Campus. These facilities include those provided by the University e.g., the access to an extensive Library System (including more than 2,200,000 books and journals and 100,000 e-books), to all major scientific database and international journals (i.e. 260 online databases and 81,000 e-journals) and to the University's data storage network; as well as those provided by the Department, e.g. a working station with personal desk, PC, telephone, printer, Wi-Fi access, personal e-mail, web profile on institutional website, software licenses, automatic data security backups and internal IT support, free access to high-quality training and academic courses.
Skills and competencies for the development of the activity	• Background in hydro-meteorology and statistics • Significant programming skills (matlab, fortran, c++, python) • Proven experience with hydrological models and GIS software • A good attitude to positive interpersonal relationships, networking capacities, proactiveness as well as the capacity to work in group and multidisciplinary and international contexts are positively considered.
Training offer	The LERH PhD course offers extensive training opportunities, with a number of compulsory and eligible courses. At least 20 ECTS are expected to be acquired by the PhD students during the 1st year. The courses are updated each year. Those available on the academic year 2022-2023 are described at https://www.tesaf.unipd.it/en/research/doctoral-degrees-phd-lerh-program/teaching.
Possible Secondments	Non-academic secondment: InsideClimateService – spin off (3 months) Academic secondment: Potsdam University (6 months)