



# PhD in INGEGNERIA AMBIENTALE E DELLE INFRASTRUTTURE / ENVIRONMENTAL AND INFRASTRUCTURE ENGINEERING - 39th cycle

Research Area n. 1 - Water Science and Engineering

**PNRR 118 PA Research Field: THE ROLE OF SPATIAL VARIABILITY OF RAINFALL IN  
COMPOUND FLOODING VIA WEATHER RADAR AND PROCESS-BASED HYDROLOGICAL  
MODELLING**

**Monthly net income of PhDscholarship (max 36 months)**

**€ 1195.5**

In case of a change of the welfare rates during the three-year period, the amount could be modified.

**Context of the research activity**

**Motivation and objectives of the research  
in this field**

Population increase and climate change are enhancing flood risk, especially in urban areas, where the flooding may happen with complicated and compound mechanisms. In this context, the spatial variability of rainfall has a key role, it is fundamental for a reliable designing flood defence structures and also as input of flood early warning systems. The spatial distribution of rainfall is often highly variable and heterogeneous in urban areas. Thus, detailed rainfall measurements are essential to support urban hydrological applications. To this purpose, radar-based rainfall data may be an effective alternative to ground rain gauges that can accurately measure the spatial structure of precipitation fields in short time. Therefore, the effective derivation of precipitation from radar retrievals has been a subject of interest from the beginning of radar meteorology and hydrology and still remains a relevant area of research. The PhD will contribute to renew competences and instruments of public administration with the final goal of improving its knowledge towards the compound mechanisms of flooding.



<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>Weather radar measurements are associated to non-negligible errors that are due to measuring techniques and their extent depends on weather conditions, in particular on precipitation processes and the size distribution of precipitation particles. In terms of the estimation of quantitative precipitation, the well-known Marshall–Palmer formula for converting radar reflectivity into precipitation intensity is still often used today and requires calibration and validation against local data. The study area of the thesis is the Regione Lombardia where 2 fixed and one mobile radars have been recently put into operation under the management of ARPA Lombardia. The objectives of the PhD are 1) assess the errors associated to radar precipitation measurements; 2) investigate advanced methods to convert radar reflectivity into precipitation; 3) assess the mechanisms of compound flooding in some key events using using process-based hydrological modelling. The research will be conducted in collaboration with the Regional Environmental Protection Agency of Regione Lombardia.</p>
<p><b>Educational objectives</b></p>	<p>The PhD project will provide to the candidate: methodological competences at both theoretical and applied levels in hydrometeorology, and compound flooding modeling; capabilities to interact with people of diverse background; problem setting and solving capabilities.</p>
<p><b>Job opportunities</b></p>	<p>Academy; environmental protection agencies; civil protection authorities; river basin authorities.</p>
<p><b>Composition of the research group</b></p>	<p>1 Full Professors 1 Associated Professors 0 Assistant Professors 0 PhD Students</p>
<p><b>Name of the research directors</b></p>	<p>Carlo De Michele and Giovanni Ravazzani</p>

<p style="text-align: center;"><b>Contacts</b></p>	
<p>carlo.demichele@polimi.it phone: +390223996233</p>	
<p>giovanni.ravazzani@polimi.it phone: +390223996231</p>	



--

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	597.5 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Regional Environmental Protection Agency of Lombardy Region - <a href="https://www.arpalombardia.it/">https://www.arpalombardia.it/</a>
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	Meteo Svizzera <a href="https://www.meteosvizzera.admin.ch/">https://www.meteosvizzera.admin.ch/</a> - Meteo France <a href="https://meteofrance.com/">https://meteofrance.com/</a>
By number of months abroad	6

**Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information**

Educational activities (purchase of study books and material, funding for participation to courses, summer schools, workshops and conferences): approximately 1660,00 euros per PhD candidate per year, on average.

Teaching assistantship (availability of funding in recognition of support to teaching activities by the PhD student): there are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

Computer availability and desk availability: individual assignment for the entire career.