

PhD in INGEGNERIA AMBIENTALE E DELLE INFRASTRUTTURE / ENVIRONMENTAL AND INFRASTRUCTURE ENGINEERING - 41st cycle

Research Area n. 1 - Water Science and Engineering

Number of scholarship offered	1
Department	DIPARTIMENTO DI INGEGNERIA CIVILE E AMBIENTALE

Description of the Research Area

This research area includes 7 main topics:

Hydrogeological hazard. Focus is on analysis and prediction of hydrogeological hazards and on actions for risk mitigation. Specific topics are: methods for process observation, data assimilation, fusion and scaling techniques based on remote sensing and ground telemetering, flood early warning, flood real-time forecasting and long-term prediction. Also field analysis and mathematical modeling of hydrogeological processes, including storms and flash floods, debris flows, firefloods, soil slips, woody debris and bulk flood transport, are addressed. Integrated water resources management. Focus is on modelling of water resources systems for planning and optimal management. Specific topics are: water resources assessment, stochastic calibration and long-term simulation of water resources systems, water footprint and water trade issues, exploration of medium and long range horizon of water safe supply and water security, minimum stream flows, droughts. Snow, ice and glacier dynamics. Focus is on in situ experiments to evaluate snow and glacier ablation and stream flow production, study of ice and snow cover variation, study of trends of climate and stream flows, assessment and development of downscaling schemes for GCM models, hydrological budgets of mountainous snow and ice fed areas and hydrological projections under climate change. Land surface processes. Focus is on hydrological modeling of soil-water balance and soilvegetation-atmosphere transfer and on monitoring water and energy fluxes between surface, vegetation and atmosphere in field experiments by micrometeorological stations and satellites. Specific topics are: integrate soil moisture dynamics, runoff assessment, surface water-groundwater interaction, hydrological control of biota. Hydraulic structures and infrastructures. Focus is on modelling and design of hydraulic structures as river dams, hydroelectric plants, water supply systems, urban drainage and river works. Specific topics are: design models of sewer networks and facilities, real-time control of urban drainage systems, planning and management of urban water supply, safety of hydraulic structures, dam-break modelling, hydro-electrical plant design, assessment of environmental impact of flow regulation. A special research focus is on sustainable urban water management in smart cities. Field and laboratory analyses of river dams and diversions by physical models are included. Ocean and coastal engineering. Focus is on sea waves dynamics and ocean convective circulation and their effects on sea bed and marine structures, including the assessment of wave-current field on structures (seawalls and breakwaters for harbour protection, offshore structures for deep sea exploitation) and the forecasts of long term effects of human activities on coastal dynamics, shore dynamics, coastal sediment transport, water quality. Environmental fluid and pollutant dynamics. Focus is on theoretical and laboratory investigation on boundary layer interaction in channels and rivers. Specific topics are sediment deposition and control, erosion and nutrient fluxes for the aquatic biota. Experimental activities involve methods for shear stress measurement and skin friction assessment in complex channel geometry. Both field experiments and simulation studies are developed to understand pollutants transport and diffusion dynamics in artificial and natural streams, including effects on the aqua



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THEMATIC Research Field: SUSTAINABLE STRATEGIES FOR SUPPORTING RESILIENT AGRICULTURAL PRODUCTION UNDER GLOBAL CHANGES

Monthly net income of PhDscholarship (max 36 months)	
€ 1400.0	
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	The research aims to identify, critically quantify and assess the environmental impacts of alternative strategies for supporting agricultural production and potential expansion on a global scale. The analysis will be framed within the context of global challenges, including the FAO Sustainable Development Goals, resilient production systems, and the EAT-Lancet Commission's recommendations for a healthy diet, the Water-Energy- Food-Environment NEXUS among others.
Methods and techniques that will be developed and used to carry out the research	To address these challenges, the research will integrate hydrological, physically-based modeling, statistical modeling, and GIS analysis. These methodologies will be applied across different spatial and temporal scales, ranging from local to regional analyses and from present conditions to future scenarios. Key factors such as climate change, demographic growth, dietary shifts, and other dynamic influences on agricultural production will be considered. Proficiency in MATLAB, R, and GIS software is required.
Educational objectives	The PhD student will develop the ability to critically evaluate alternative strategies for achieving a sustainable



	transition and optimizing resource management. The candidate will join a dynamic and well-established international research group, actively participating in national and international conferences.
Job opportunities	Working within international organizations such as the FAO, World Bank, or UN, focusing on global agricultural policies, climate adaptation strategies, and sustainable development goals. National and international research institute for supporting water management as well as irrigation consortia and conservation institute.
Composition of the research group	1 Full Professors 0 Associated Professors 4 Assistant Professors 3 PhD Students
Name of the research directors	Davide Danilo Chiarelli, Maria Cristina Rulli

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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	
Housing - Out-of-town residents	

Scholarship Increase for a period abroad		
Amount monthly	700.0 €	
By number of months	6	

Stage and period abroad	
Institution or company where the candidate will spend the period abroad (name and brief description)	
By number of months abroad	0



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): financial aid per PhD student per year: max 1766.75 euros per student on average.

Teaching assistanship (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.

<u>Computer availability and desk availability</u>: 1st year +2nd year +3rd year: individual use.