CIVIL AND ENVIRONMENTAL ENGINEERING

ENI Young Talent Award - Climate change impact on water resources and implications for the sustainable development in East Africa

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Context of the research activity	The research aims at evaluating the sustainable production potential of marginal lands of the Horn of Africa taking into account climate change projections. The idea is to quantify, through statistical analysis and hydrological modelling, the current and future water resource components at different time scales. The results of the research will allow to improve the knowledge of the hydrology in the area, to design strategies for the sustainable development of agriculture and for coping with droughts and water crises in current conditions and in future scenarios. The position is reserved to candidates who have participated in the selection of the competition "Debut in Research: Young Talents from Africa" of the year 2023.

Objectives	East African nations are grappling with significant water stress due to unpredictable and (often) insufficient rainfall. The impact of rainfall variability is compounded by the effects of climate change, which has further strained the region's limited climate-resilient water infrastructure. These factors may result in significant reductions in the availability and accessibility of safe and adequate water for both human and agricultural needs, as well as for livestock, which hinders economic growth and sustainable development in the Horn of Africa. While, on the one side, there is potential for better management and use of the available water, specially in degraded and abandoned agricultural lands (i.e., the so called "marginal lands"), on the other side, change in land use may increase pressure on ecosystem services and on communal/informal/traditional non-intensive customary livelihood activities in the marginal lands, and in some cases even exacerbate water scarcity and food insecurity. The assessment of water resources in current and future (projected) conditions is required for designing strategies for the sustainable development of agriculture and for coping with droughts and water crises in the Horn of Africa. The work of the PhD student will address the quantification of the water resources in East Africa by scrutinizing climate variability and

change using earth observation data, satellite data, and climate model outputs. The use of statistical analyses, machine learning techniques, and hydrological modelling is envisaged.

The research questions are:
(i) What is the temporal-spatial distribution of the water balance components (in particular those related to droughts) in the Horn of Africa?
(ii) How have these components changed in the past and how could they change based on climate change projections?
(iii) What are the implications of the water resources assessment for sustainable agricultural production potential?

In essence, this research aims to facilitate the monitoring of potential impacts of climate change on water resources, contributing to well-informed decision-making that accounts for all stakeholders, including traditional users and the ecosystem, in a sustainable way. The need for comprehensive strategies addressing climate change, improving water infrastructure resilience, and strengthening community institutions is crucial in mitigating the consequences of drought-driven emergencies in the Horn of Africa.

Skills and competencies for the development of the activity	It is expected that the PhD student will spend part of her/his research time abroad. Good knowledge of English is mandatory. Programming skills are required, and knowledge of Geographic Information Systems (GIS), machine learning techniques, and cloud computing platforms is to be considered preferable. Experience in issues related to Hydrology and Climatology is required. Experience in using rainfall-runoff models is an advantage.