



Subject: Hydrologist
for a Research Grant on hydrological forecasting in the Great Horn of Africa
region. PROGETTO UNU-EARLYWARNING4IGAD.
CUP B53B24000000005

BACKGROUND AND CONTEXT

Funded by the Italian Ministry of Foreign Affairs and International Cooperation and the Agency for International Cooperation (AICS), the Program for a continental coordination, early warning and action system in Africa is implemented by the United Nations Office for Disaster Risk Reduction (UNDRR) and CIMA Research Foundation. The program is dedicated to strengthening continent-wide risk management, focusing on the development of a warning system and information exchange. In addition, a UNDRR project has recently started, entitled "Strengthening Disaster Risk Governance and Recovery Capacities: Towards actionable impact-based early warning in Africa: integrating exposure and vulnerability into early warning systems – a pilot study in the IGAD region". Such a project, referred to as EWS4IGAD, will be a collaboration of CIMA Foundation with the United Nations University - Institute for Environment and Human Security (UNU-EHS, Germany), the IGAD Climate Prediction & Applications Centre (ICPAC, Kenya), and the Regional Centre for Mapping of Resources for Development (RCMRD, Kenya). This project will co-design and co-develop a sound approach and methodology for impact-based early warning systems (EWS) that incorporates data on exposure and vulnerability in existing early warning approaches and decision support systems (DSS) tools piloted in the IGAD region

In this framework, in collaboration with ICPAC and with the aim of strengthening hydrological forecasting capabilities in the Greater Horn of Africa (GHA) region, CIMA Foundation has implemented and operationalized the FloodPROOFS East Africa (FPEA) impact-based hydrological forecasting chain (Alfieri et al., 2023).

The system is based on the open source FloodPROOFS (FP) framework (<https://github.com/c-hydro>) that allows to operationally manage all the steps of a flood forecasting chain: from the download and preprocessing of the meteorological forcings, to the hydrological modelling with the fully distributed hydrological model Continuum (Silvestro et al., 2013) for developing region-wide discharge forecasts 5 days in advance. Discharge scenarios are then linked to inundation maps, providing detailed information on the extent of potential flooding. Finally, a risk assessment framework is employed to evaluate the potential impacts of floods on people, livelihoods and infrastructures.

The most critical phase in the setup of the system has been the calibration of the hydrological model. The calibration of spatially distributed hydrological models is a complex and multi-dimensional problem, due to the scarcity of reliable data, uncertainty in representing the physical features of a river catchment, and the inevitable simplifications of hydrological processes in a

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simulation model. These challenges are amplified in the large portion of global land where in-situ data are not shared, nonexistent or of poor quality, like in the GHA region.

After two years of operation, during which the potential and weaknesses of the system emerged, it was therefore decided to invest in further development of the modeling system, focusing on the review and in-depth analysis of aspects related to calibration, validation and input-output modelling chain also in the view of transferring the management of the system to ICPAC.

The main objectives are to improve the operational results of the FPEA operational system with reference to:

- Identify the best calibration strategy for the Continuum hydrological model to better represent the physical phenomena at the basis of the rainfall-runoff transformation in the area, also with reference to the best meteorological products to be used in the calibration and operational phase
- Perform a new calibration run and validate the modelling results, even using new discharge data if available
- Improve the knowledge of ICPAC to operate and manage the system

SCOPE OF THE POSITION

The selected hydrologist will initially become familiar with the tools of the FloodProofs suite, to gain independence in carrying out routine tasks. The candidate will perform a set of experiments to identify and quantify the sensitivity of the calibration parameters, objective function, hydrological regime, number and configuration of benchmark data in multi-site calibration, with the objective to maximize the information content of available data and optimize the performance of simulated variables, particularly with reference to river discharges. The effect of different rainfall products and model parameterizations will be evaluated on the resulting impact estimates to inform the assessment of uncertainty and as a means of model validation.

On the other hand, the candidate will help ICPAC in interpreting and managing the FloodProofs system and its results, to enhance the ownership of the tool, independently of CIMA's support, with the view of transferring the full operational system to the ICPAC facilities.

SPECIFIC DUTIES

- Gaining independence in the use of the open-source FP system (<https://github.com/c-hydro>)
- Facilitating the system ownership, by assisting the ICPAC staff in accessing the FPEA system and its results
- Improving the model calibration strategy through a set of experiments and sensitivity analysis, to define guidelines on the selection of calibration parameters, benchmark variables, multi-objective function, cascading vs. multi-site approach, search algorithm, among others.
- Creating a database of several satellite products (rainfall and soil moisture) for evaluating

the best products (or combination of products) to be used both in the model calibration, validation and in the operational setup

- Evaluating the model results against the output of other operational models in the area, provided their results are timely available and provided by the system owner, to address the model's strengths and weaknesses and identify possible further improvements.

QUALIFICATIONS/REQUIREMENTS

The ideal candidate should have the following expected profile:

- A master's degree or equivalent in the field of environmental or civil engineer or other relevant academic fields
- Experience in the use of hydrological models
- Experience in hydrological data analysis.
- Good knowledge of programming languages (e.g., Python, Fortran).
- Good knowledge of GIS (including scripting).
- Knowledge of English.

Further desirable assets are:

- Experience in the use of satellite data.
- Experience in flood forecasting.
- Communication skills (spoken, written and presentation).
- Good record of scientific publications.
- Knowledge of the UNIX environment and of communication protocols with servers.

OVERVIEW OF THE ASSIGNMENT

- Position: Hydrologist;
- Location: Home with field missions at CIMA (Savona, Italy) and ICPAC (Nairobi, Kenya);
- Estimated Duration: 12 months;
- Expected starting date: 2 weeks after completion of the selection procedure;
- Reporting and responding to: CIMA Foundation and ICPAC;
- Contract: Consultancy position;
- Compensation range: gross amount from 15.000,00 to 20.000,00 euro.

** The Hydrologist must have a status of self-employed/legal entity. It will be his/her sole responsibility to comply with all legal requirements for self-employment as well as to cover all related taxes and charges including insurance.



****The Hydrologist must not be in any situation of conflict of interest or professional conflict of interest.**

Interested candidates should submit their CV to the email ricerca.personale@cimafoundation.org (cover letter and reference letters can be attached) within **23.02.2024**. The subject of the email should be: **Research Grant on hydrological forecasting in the Great Horn of Africa region.**

The successful candidates, after CV evaluation, will be contacted for an online interview. Based on the interview outcomes, a proposal for the position and remunerations within CIMA will be made to the candidates.

Any questions related to this call can be directed in English via email at: Andrea Libertino (andrea.libertino@cimafoundation.org) and Lorenzo Alfieri (lorenzo.alfieri@cimafoundation.org). All clarification questions and the responses provided will be shared with all possible candidates on the website of CIMA Foundation/Open calls/Vacancies.

Savona, 15 gennaio 2024

Managing Director

Luisa Michela Colla

A handwritten signature in black ink, appearing to read "Luisa Michela Colla".

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