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EPICC (East Africa Peru India Climate Capacities)

Implementing Organisation:

Potsdam Institute for Climate Impact Research (PIK)

Implementing Partners:

The Energy and Resources Institute (TERI)
Deutscher Wetterdienst (DWD; German Meteorological Service)

EAST AFRICA PERU INDIA CLIMATE CAPACITIES

India: Research Overview

Climate

Capacity building to strengthen resilience against disruptive weather phenomena and climate change in India is the main goal of the EPICC project. The Potsdam Institute for Climate Impact Research (PIK) is applying its new methodology of forecasting monsoon timing in central India. This is a new kind of long-term forecast, which allows predicting the date of the upcoming monsoon onset 40 days in advance, and the withdrawal date 70 days in advance. Moreover, the withdrawal date forecast is the only one available in India. The monsoon forecasting method showed to be successful already four years in a row. At the time, the Monsoon Research Group revealed that (i) withdrawal of the monsoon shifts from the beginning of October to the second half of October as a result of climate change, (ii) there are tipping elements in Outgoing Longwave Radiation (OLR) over the Arabian Sea and the Bay of Bengal, (iii) dry spell regularly appears after monsoon onset in Telangana. The Monsoon Research Group extended the scope of expertise this year by developing a new methodology for forecasting the regional amount of monsoon rainfall. All forecasts, including the monsoon in 2020, can be found on the PIK Monsoon Page. In collaboration with the Deutscher Wetterdienst (DWD), the applicability of forecasts of the German Climate Forecast System (GCFS) for customized seasonal predictions across different sectors (climate, hydrology, agriculture) is being tested and developed. Currently, the DWD verifies and validates different models, with a plan to provide different skill scores for the models in India. It focuses especially on flood and drought condition outliers. Moreover, the DWD is also continuing to work on the methods for providing data. In addition, TERI provides climate information on sub-regional scales over India with particular focus on extreme events. It allows to generate extreme climate information over a few cities of India using observational datasets and extreme value theory. TERI is also generating district level climate projections for the state of Uttarakhand to be utilized in Migration Work Package (WP). Finally, EPICC provides regional high-resolution climate information from the most current observational datasets and climate model projections. These outputs of the Climate WP will be implemented into new or existing internet based platforms.

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Water

The goal of the hydrological WP in EPICC is to support national and local policy- and decision-makers by analyzing and quantifying impacts of long-term climate change and short-term climate variability on water resources in three reservoirs of the Godavari River Basin. Driven by user demands, data and information from weather forecast, medium-range predictions and long-term climate scenarios are being developed, processed and provided in a user-friendly format and are being fed into available hydrological models. The work has a strong link to the Climate WP. PIK's hydrological and water resources model system SWIM (Soil and Water Integrated Model) has been adapted and will be implemented for the watershed of Godavari River, where the date of monsoon on/offset prediction is delivered by the Climate WP. In addition, different seasonal forecasts for the Godavari River Basin are being tested together with the DWD. Thus, EPICC will assess if the 2019 floods were detectable from the seasonal forecasts. The SWIM model system allows to test short- and medium-term forecasts and predictions as well as long-term scenarios for their impacts on hydrological patterns and water resources availability and the water-energy-food nexus, taking into account water management infrastructure (reservoirs, hydropower).

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Agriculture

Within the EPICC project, it is proposed to supplement the existing agricultural information systems by agricultural crop risk assessments for changing climate conditions and extreme weather events. These assessments are being developed and implemented in close cooperation with local, national and international experts and other stakeholders from the private and public sectors and civil society. Our work focuses on staple crops in India. For this purpose, we make use of process-based crop models, semi-empirical modeling frameworks and combine them with satellite remote sensing earth observation data. We have developed a methodology to produce high resolution (5km) rice yield outputs to provide quantitative information of crop yields and crop failures incurred by weather events either in the immediate aftermath or even before the occurrence of such an event. We believe that our study presents an efficient method for estimating real-time yield loss at high resolution with low input requirements. Gridded or district-level yield outputs can be a reliable source for the latest Indian crop insurance scheme, Pradhan Mantri Fasal Bima Yojona (PMFBY). In addition, the information might enable farmers – informed e.g. by ministries and farmers' associations – to adjust their agronomic management practices in order to minimize the scope of weather-related crop losses and to increase their capacity to cope with climate risks. Currently, ongoing work focuses on remote sensing and machine learning approaches to estimate field level outputs for adaptation and mitigation strategies which we are expected to be complete in September 2020.

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Migration

The migration Work Package (WP) focuses on climate change and migration linkages in Uttarakhand. The proposed research includes empirical case study on different forms of mobility as well as inability to move (trapped populations) in the context of climate impacts. Uttarakhand is a Himalayan state in Northern India, where both climate change impacts and migration are already a challenge for the state government. The state is experiencing climate change impacts, such as receding glaciers, an upward moving snowline, erratic rainfall, reduction in winter snow, advancing cropping seasons, shifting of cultivation zones, and drying up of perennial streams. These changes have immediate consequences for people's livelihoods, as three-fourth of the state's population is rural and dependent on rain-fed agriculture. On the other hand, out-migration from the hill to plain districts is also a twin concern in the state as i) people migrating from rural hill areas results in

depopulated villages and a dwindling primary (agriculture) sector in the sending regions, ii) while it also creates additional pressure in destination areas due to overcrowding, competition for resources, and limited basic infrastructure. Targeting these twin challenges the proposed research aims to conduct an exhaustive scientific exploration of climate change and migration linkages in the state. The research will also aim at co-producing knowledge by regularly engaging with partner institutions in Uttarakhand. The results will be published as a risk report, which is being jointly co-produced with TERI and is expected to be published by the end of 2020 with the aim to inform and support climate change adaptation policy and planning in the state.

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Data Visualization

For capacity development within the EPICC project, the Visualization Work Package (WP) provides and evaluates several climate services and visualizations, integrating seasonal forecast, climate, and climate impact modules. The idea is to provide tailored interactive climate data and information for different stakeholder groups, using advanced visualization techniques. Besides, the WP is developing visual exploration tools for scientists to improve the analysis of ensembles of regional climate and climate impact data. EPICC is aiming to apply and enhance interactive state-of-the-art visualization techniques for exploration and communication of heterogeneous seasonal prediction, water resources, agricultural, and migration data. The visualizations are of many types, such as interactive maps, line charts, bar graphs, and scatter plots. The goal is to integrate those applications into already existing web solutions that are available in India.

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Capacity Building

EPICC works closely with a wide range of different partners at national, state and local level to identify opportunities for mainstreaming the above mentioned climate data and information into ongoing activities. It is providing a wide range of opportunities, methods, tools and formats for capacity development and climate services, ranging from trainings, workshops and stakeholder dialogues, to research exchanges, collaborations, joint publications and web-based tools. However, some of these activities have currently been put on hold due to the corona crisis.

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