Leveraging CMIP5 and NASA GMAO Coupled Modeling Capacity for SERVIR East Africa Climate Prediction

Displaced people wait to be given food during a distribution organised by the UN World Food Programme, USAID and other local and international NGOs, in Mogadishu Somalia on September 2008. © Jamal Osman/IRIN

Why is the AST pursuing this project? In the East Africa, Hindu Kush-Himalaya (HKH), and Mesoamerica SERVIR regions, climate uncertainty intensifies chronic food shortages, inadequacy of water resources, and environmental stresses. Variability in global ocean temperatures and heat content influences future climate scenarios. Human-related factors must be accounted for as well.

It is important to understand the respective roles of these contributing factors in order to make sound decisions in regard to future climate variability and change adaptation and mitigation. However, the accuracy of new modeling tools in discerning and quantifying natural versus human-induced effects on climate variability is as yet unconfirmed.

Scenarios generated based on climate model projections can inform decision-support systems and environmental policy in developing nations. New Coupled Model Intercomparison Project Phase Five (CMIP5) model simulations, especially those integrated with initialized* ocean states (the base observed state of the ocean, used as input to the model before it is run with new conditions to project how that initial state will evolve), offer a promising but as yet unproven resource for producing realistic climate scenarios. New experimental seasonal forecasting capacity from the NASA Global Modeling and Assimilation Office and other US agencies provides another critical link to seasonal climate patterns.

[*"Initializing" a model means specifying the initial data or observations and initial conditions for the base model state to ensure optimal model forecasts for the specific system under study. Starting values are provided in this way for the variables the model will predict and derive other variables from.]

What does this project do? This work improves climate projections for the three SERVIR hub regions to provide sound guidance for decision making in regard to future climate variability and change adaptation and mitigation. The project investigates the roles of various natural and human mechanisms affecting climate variability in recent years. It leverages improved global climate modeling capabilities, various hydrometeorological data sets, and a new generation of reanalyses* to narrow uncertainties in projecting the exposure of the SERVIR regions to climate variability and change. This project also analyzes model projections to support realistic climate scenarios that will be downscaled and customized for use by other SERVIR Applied Sciences Team projects.

[*Atmospheric models ingest and process data from many different observations from various sources (sensors on radiosondes, satellites, buoys, aircraft, ships, etc.) over a certain time period to produce an atmospheric base state for that period. The changing observation mix that models use can produce false variability -- or biases -- in the results. Therefore it is useful to "reanalyze" all the models' results to remove biases and false trends in order to produce the most realistic atmospheric state.]

How will the AST perform this project? The team will use climate models (selected based on performance metrics) to develop climate scenarios for SERVIR hub regions. The team will then refine these scenarios by considering observed hydrometeorological, sea surface temperature, and atmospheric dynamics relationships, along with reanalysis results, to identify the respective roles of natural and human-induced changes in producing oceanic and atmospheric climate variability. And finally, these scenarios will be downscaled to meet the specifications of regional concerns other Applied Sciences Team members are addressing in SERVIR hub regions.

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Where is this project used? SERVIR-Africa
When will it be available? This data will support the research objectives of several other SERVIR AST projects.
Who are the co-developers?
Who are the contributors/partners? NASA MSFC, NASA GSFC, USGS Sioux Falls, Columbia University
Who uses it? Other SERVIR AST projects, IGAD Climate Prediction Center (ICPAC), Ministries of Agriculture in Ethiopia, Kenya, Somalia Water and Land Information Management (SWALIM), Kenya Meteorological Department, USAID FEWS NET
What Earth observations and NASA products contributed to this application? NASA GMAO experimental seasonal forecasts, gridded USGS station data, GPCP V2.2 and GPCC (Goddard) precipitation, NOAA extended and reconstructed SST data, OAFlux surface energy and momentum fluxes and near-surface meteorology, TAMSAT (Tropical Applications of Meteorology using SATellite) Meteosat and gauge-blend tem-daily, monthly, and seasonal precipitation data, ISCCP-FD Surface Radiative Flux Components, MERRA ERA-40 and EC-Interim reanalyses, GLDAS (Global Land Data Assimilation System) data, Princeton 50-year high-resolution global dataset of meteorological forcings for land surface modeling.
For more information:

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