United States of America Statement
Nairobi Work Programme Workshop on climate modeling, scenarios and downscaling

The United States supports several applied regional climate modeling efforts
Regional climate models are one of many tools that can be used to inform decisions on practical adaptation actions and measures in response to climate change and variability in support of the Nairobi work programme. As these models and the ability to communicate their outputs improve, they could be of considerable assistance in adaptation planning worldwide. While they are currently being used in pilot projects around the world, there are still many challenges in their successful application and there is still a need for substantive and rigorous analysis of downscaling practices in order to avoid misinterpretation and wasted resources.

The United States supports several applied regional climate modeling efforts including those at the International Research Institute for Climate and Society (IRI)[1], the Geophysical Fluid Dynamics Laboratory (GFDL), the Goddard Institute for Space Studies (GISS), and the Earth System Research Laboratory (ESRL).

Examples of specific regional climate modeling efforts that are being applied in decision-making processes:
1) Downscaling (statistical) of IPCC AR4 as part of the Famine Early Warning System (FEWS) for eastern and for southern Africa to better understand long-term food needs.
2) Downscaling (statistical) of IPCC AR4 for Central Valley Biological Assessment 2030 time horizon: addressing impacts to fish populations in California.
3) Downscaling (statistical) of IPCC AR4 for reconciling projections of future Colorado River Stream Flow, with the goal of conveying to policy and decision maker the nature of the uncertainties associated with the information being provided. [2]
4) Downscaling projections of Indian monsoon rainfall using a statistical method (nonhomogeneous hidden Markov model).[3]

Multiple downscaling techniques have been developed
Multiple downscaling techniques have been developed and they each have strengths and weaknesses. All of them share the problem of addressing variability: both models and the natural climate system have a large amount of variability. When a smaller spatial region is sampled (like a continent, or individual country), the role of variability becomes quite large. This can greatly impact forecasts. [4]

Importance of emphasizing uncertainty

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[1] For more information from the IRI on this topic see: FCCC/SBSTA/2007/MISC.24/Add.1.
[2] Specifics can be obtained from Robin Webb, NOAA ESRL
[3] Specifics can be obtained from Haresh Bhojwani, IRI
[4] Levi Brekke, US Bureau of Rec

The IRI, ESRL, GFDL and other modeling groups and applied climate researchers note the extreme importance of emphasizing uncertainty in the use of downscaled climate projections. Estimates of uncertainty in projections will at best be just estimates, and likely very qualitative. In many regions, decadal variability (like El Nino) is at least as large, if not larger than climate trends.[5]

Multi-model ensembles can reduce uncertainty in outputs
One way that US modelers and others (such as the World Climate Research Program) are working to improve the model outputs at regional or local scales is to obtain outputs of multiple models or a large multi-model ensemble to get good estimates of signals on these small scales. However, this can be extremely resource intensive, and still requires concise and clear communication about the uncertainties in the outputs. [6]

There are two major downscaling approaches
Most techniques can be classified into two different approaches: 1) *Dynamical downscaling*, where a regional climate model with finer resolution is embedded in a global model and is capable of simulating regional climate features, such as rain-shadows, mountainous regions, and extreme climate events; and 2) *Statistical downscaling*, where large scale climate features are statistically related to fine scale climate for the region and can easily incorporate observations into the method. [7]

Both approaches have strengths and weaknesses
Each downscaling technique has strengths and weaknesses. However, no single best downscaling technique is obviously identifiable. Different techniques work better for different needs (how fine of a scale do you need, does the region have complex terrain, etc..) Simple statistical downscaling methods seem to perform well and at low computational cost when the goal is to reproduce mean climate characteristics. If the goal is to reproduce extreme characteristics, a more sophisticated, computationally demanding, and resource intensive approach may be warranted.[8]

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[5] Steve Zebiak, IRI
[6] Ron Stouffer, NOAA GFDL
[7] Levi Brekke, US Bureau of Rec
[8] Levi Brekke, US Bureau of Rec

Gaps and Capacity building needs and examples

-Need for substantive and rigorous analysis of downscaling practices;

- This is being supported by the United States through work at several laboratories and institutions including:
    - International Research Institute for Climate and Society (IRI) (http://portal.iri.columbia.edu/portal/server.pt?open=512&objID=590&PageID=0&cached=true&mode=2&userID=2)
    - North American Regional Climate Change Assessment Program (NARCCAP) at the National Center for Atmospheric Research (NCAR) (http://www.narccap.ucar.edu/)
    - Earth System Research Laboratory (ESRL) (http://esrl.noaa.gov/)
    - Geophysical Fluid Dynamics Laboratory (GFDL) (http://www.gfdl.noaa.gov/)
    - Goddard Institute for Space Studies (GISS) (http://www.giss.nasa.gov/)

Need to educate potential users of regional climate models on the variability in and uncertainty associated with different models and regions;

- This is being supported by the United States through programs including:
    - International Conference on Climate Impacts and Assessments (Run by the Climate Impacts Group every other year in different host countries) (http://www.narccap.ucar.edu/)
    - Sectoral Applications Research Program Projects (funded by NOAA to provide sector-focuses (water, coasts and drought) climate decision support internationally and domestically) (www.climate.noaa.gov)
    - Collaboration and support of the Africa Climate Outlook Forums (now taken over by the participating countries) (http://iri.columbia.edu/outreach/project/RCOFSupportAfrica/)

Need to provide education for and support of decision-making under uncertainty;

- This is being supported by the United States through programs including:
    - The National Science Foundation's (NSF) Decision Making Under Uncertainty Centers (http://dcdc.asu.edu/dmuu/)
    - Regional Integrated Sciences and Assessments Projects (funded by NOAA to provide regional climate decision support) (www.climate.noaa.gov)
    - The National Integrated Drought Information System (NIDIS) (www.drought.gov)
    - International Research Institute for Climate and Society (IRI) (http://portal.iri.columbia.edu/portal/server.pt?open=512&objID=388&PageID=0&cached=true&mode=2&userID=2)

-Need for regional dialogue to prioritize pilot projects and research ;

- *The Pacific Climate Information System (PaCIS) (http://research.eastwestcenter.org/ideacenter/Flyers/PaCIS%20flyer%20071307a.pdf)*

-Need for long-term, robust observations to maintain the core quality of the models, projections and hindcasts;

- The United States is working to meet the essential climate variables laid out in the GCOS Implementation Plan in coordination with GEOSS. (http://grdc.bafg.de/servlet/is/2470/)