Report from the February 2013 Dar es Salaam workshop on climate data exemplars

Report produced by Jon Padgham (START) and Chris Lennard (CSAG) for CDKN

START
global change SysTem for Analysis, Research & Training

Climate System Analysis Group

SUMMARY

A workshop was held in Dar es Salaam on 13-15 February 2013 to develop a guidance framework (exemplar) for using climate model data to support adaptation planning in Africa. The main purpose of this workshop was to pilot the methodology together with interdisciplinary teams from five African cities (Addis Ababa, Kampala, Dar es Salaam, Maputo and Lusaka). The participants for this event were technical experts in the areas of meteorology/climatology, agriculture, water resource management, disaster risk management and land-use planning, within government, university and non-government spheres. The climate-application focus of the workshop was on peri-urban areas of these five cities, which typify the intensive land-use change pressures from urban encroachment that African cities are facing. These pressures have implications for, among others, food production, water resources and flood risk management for cities.

The learning process for integrating climate data into decision making took place through the development of a matrix that encompassed interlocking non-climatic and climatic stressors that act on important exposure units in peri-urban areas. The matrix development occurred through a step-wise process that involved identifying critical exposure units related to livelihoods, infrastructure and services that occur in peri-urban areas, identifying non-climate stressors that act on these exposure units and then identifying where climate stressors have an important influence on the exposure units. This step-wise process allowed the city teams to identifying critical vulnerabilities in livelihoods, infrastructure and services of their peri-urban environments that then provided a targeted, contextual basis for identifying climate sensitivities to which they could integrate climate information. Additionally, the focus on a place-based situation, rather than a sectoral one, promoted discovery of critical linkages between energy, transport health, food, etc. that shape vulnerability and resilience.

The three days of discussions provided an excellent opportunity for co-exploration (among and between teams and between workshop organizers and teams) of applying climate data to decision making, which served to advance the development of an exemplar based methodology that when fully developed will be widely applicable to other settings and groups. The workshop also served to highlight areas of further development, which will be addressed in the follow-up workshop in Lusaka, Zambia in June.

This workshop represented an important step in addressing a key objective of CORDEX-Africa in fostering inter-disciplinary investigations and engaging users of climate information in transforming climate data into useful, usable information. The organizers wish to thank CDKN for their support.

DAY 1

The workshop began with an icebreaker exercise that allowed participants from the different cities to become acquainted with each other. The exercise consisted of clustering the groups by professional expertise (i.e. meteorologists/climatologists, disaster risk management, agriculture, and city planning/resource management), and posing the question—*From the perspective of your profession / sector, what are three headline policy priorities in African peri-urban areas?*

During the reporting back session, the meteorology group determined that poor uptake and use of climate products for decision making was the critical issue and one that cut across areas and sectors; they provided nothing specific about peri-urban areas. The other groups' responses did not touch on the issue of climate data but instead identified critical policy priorities around ramifications of heightened land pressures from a shrinking land base, which result in reduced food production potential and environmental degradation, and lack of coherent policies and enforcement mechanisms to protect peri-urban environments.

The icebreaker provided a logical segue into the main morning session, which focused on examining:

- key resources, infrastructure, services and economic / livelihood activities that occur in the peri-urban spaces of the five cities, and
- stressors and critical factors (both climatic and non-climatic) that these areas are exposed to / dependent on, drawing upon recent events that have impacted these areas.

The items identified in this morning session provided the basis for the matrix upon which they would identify climate sensitivities over the remaining period of the workshop. Key peri-urban livelihoods and resources the city teams identified included crop and livestock production, fisheries production, transportation, informal trade, brickmaking, and quarrying and mining. The non-climate stressors that the city teams identified as critical in peri-urban areas included 1) unplanned and unregulated housing in hazard-prone areas; 2) poor infrastructure, experienced through inadequate water and sanitation provision, malfunctioning stormwater drainage systems, and poorly constructed roads and bridges; 3) inadequate energy, health and education services; and 4) environmental degradation, including pollution. Governance failures were identified as a key cross-cutting factor that influenced the magnitude of impacts of these various stressors.

In the afternoon, the organizers introduced the 6-step matrix concept, which provides a layered process for identifying climate sensitivities. The six steps are:

1. Identify elements (exposure units).
2. Identify non-climate stressors.
3. Rank the influence of the non-climate stressor on the element (Low, Medium or High influence) in terms of contributing to vulnerability.
4. Determine whether climate stressors overlaid on the matrix changes the cell rankings (e.g. do low or medium stressed elements become high stressed when the climate dimension is included?).
5. Based on which cells increase in stress-level at step 4, identify areas of climate sensitivities, make a judgment about the robustness of the finding (based on available climate data) and develop messages about climate change.
6. Construct a story of climate change in the peri-urban area.

The city teams divided their matrix into three clusters 1) economic and livelihoods activities 2) infrastructure and 3) access to services, and assigned elements and non-climate stressors to each cluster. Steps 1 and 2 went rather quickly because of the morning exercise, so much of the afternoon was spent on steps 3 through 5. Figure 1 provides an illustration of the matrix.

The organizers circulated among the city teams and helped them to conceptualize and identify what kinds of climate risks might interact with vulnerabilities experienced by these elements. The day concluded with the teams having got through step 5. Given the extensive range of climate sensitivities the teams identified, the organizers concluded that the time needed for the climate data analysis exercises in Day 2 would only allow for one or, at most, two cells in the matrix to be considered in step 5 (which was revisited using climate data in Day 2) and step 6.

Figure 1. Sample matrix from the City of Maputo

Non-Climate Stressors → / **Elements** ↓	Population Growth		Water and Soil Pollution		Poor Road Building		Increase in food prices		Poor urban planning		Malaria and Cholera	
Economic Activities and Livelihoods												
Agriculture (Specifically Maize)	H	M	H	H+	M	H	H	H+	H	H+	H	H+
Fishing	H	/	H	H+	/	/	H	H+	/	/	H	H+
Informal Trading	H	/	L	M	H	H+	H	H+	H	H+	H	H+
Infrastructure												
Roads and Railways	M	/	/	/	H	H+	/	/	H	H+	/	/
Drainage/ Sewage and dumping sites	H	/	H	H+	H	H+	/	/	H	H+	/	/
Coastal Protection Line	H	/	/	/	H	H+	/	/	H	H+	/	/
Services												
Water Supply	H	/	H	H+	L	M	/	/	H	H+	L	M
Transport	H	/	L	L	H	H+	H	H+	H	H+	L	M

Note: Each cell within the matrix is divided in half. The left half corresponds to the impact of the non-climate stressor on the element (**L**ow, **M**edium or **H**igh), and the right half corresponds to the change in impact when bringing in the climate stressor.

DAY 2

Reflections on Day 1

The second day began with a lengthy discussion of non-climate stressors following out of Day 1. In developing the matrix, the organizers observed that the groups faced difficulties in differentiating drivers from stressors and in adequately defining stressors so that causal factors could be appropriately identified. For example, many of the teams identified land degradation/deforestation as a stressor. This is is not a sufficiently descriptive stressor because the underlying causes of land degradation/deforestation can be quite different depending on the context. Addis Ababa is a case in point. In one forested area of Addis Ababa, the driver of deforestation is unsustainable extraction of resources (fuelwood) while in another forested area it is encroachment of urban settlement into forested areas. Given that deforestation has multiple forces acting upon it, a more appropriate approach, using the Addis example, may be to consider primary drivers (urban encroachment and fuelwood energy needs) acting on secondary drivers (deforestation) that then produce a

stressor (increased stormwater runoff onto farming operations downslope). Thus, in developing a narrative to animate the matrix it is important to consider how linkages between primary and secondary drivers affect stressors, as this will produce different responses in terms of policies and measures. Another example of mixing drivers and stressors concerned population growth, which was identified as a stressor but which is actually a driver that results in increased demand for housing and services, which leads to unplanned urban growth (the non-climate stressor), which then acts on elements such as peri-urban food production, increased demand on infrastructure, and other effects.

The need for finer specificity was also apparent in determining the elements (exposure units) of the matrix. For example, describing an element as food production may not be sufficiently descriptive when pairing that up with a non-climate stressor such as surface water pollution. However, breaking food production down into finer elements (i.e. rainfed cereal production as separate from irrigated vegetable production) allows the influence of the non-climate stressor to become more apparent, as in the case of polluted river water strongly influencing vegetable production but having virtually no influence on rainfed cereal production. Greater specificity becomes critically important when determining actual and potential future climate sensitivities. Again in the case of a polluted river, biological contaminants may become more impactful as surface water temperatures increase under future warming, which has implications for vegetable producers in terms of exposure to pathogens, whereas rainfed cereal farmers are not directly affected by this particular element x stressor interaction. In planning the follow-on workshop in Lusaka, the organizers will develop exercises to help the groups more accurately identify and describe appropriate non-climate stressors and guide them in differentiation drivers from stressors.

Climate data analysis

Following the plenary discussion on drivers and stressors, the city teams reformed in order to determine what square in their matrix they would focus on. (As mentioned above, the matrix indicated several potential areas of climate sensitivity but the organizers asked them to just focus on one or two squares in order to make the process manageable.)

The workshop then shifted in focus from the matrix to an examination of climate data, and its uses and misuses. This session was intended to orient participants to a later session on applying climate projections information to the matrix, and was premised on:

- What kind of information do we have on hand?
- What kind of information do we need?
- Where do we get our information from?
- How much information is enough to make a decision?

The session began with the *Crossing the River* game, which exposed the participants to the concept of consequences linked to making decisions based on varying levels of information. This game has direct analogies with decision making processes that occur in using climate model data of varying detail and spatial resolution. The game session was followed by a pair of presentations that explored different types of climate data (GCMs, regional climate models, etc.), with a focus on the possibilities for its use and perils associated with its misuse (such as scale mismatch between the climate data resolution and the decision making scale). Some of the learning foci and caveats that came out of this session were:

- questions need to be thought about and clearly articulated before climate information is sought.
- knowing the scale you are working at helps form this question.
- where do you source your climate information, why do you trust this information?
- the need to be aware that observation/reference/station data may not have been quality controlled and may not represent a true reflection of the climatological history of a region.
- use climate information skeptically.
- use more than one data source in developing messages – messages developed based on only one data source have a large potential for mal-adaptation if the data source presents incorrect data.
- interpreting climate data should involve both users of climate information as well as producers of this information. A climate scientist is aware of the methodological caveats in creating climate data/information which need to be considered when developing adaptation strategies.
- developing an impact-adaptation message is an iterative process as questions become more defined.

The groups were then given different data sets to work with (GCM and regional downscaled data, other data?) to discern what the data was telling them about future climate change in their cities. They were given the coarsest scale data first (GCM outputs) in which they made inferences about future temperature, rainfall and wind projections to see if there were any general conclusions that they could draw about their region (not city). They were then given another set of data (regionally downscaled data) to examine a number of rainfall and temperature parameters which included monthly daily minimum & maximum temperatures, monthly rainfall, dry spell duration, temperature and rainfall threshold exceedences for an observed period (usually 1979-2008) and the near (2046-2065) future. Working with the climate specialists in each group, key messages about changes in each of the parameters, appropriate to each sector,

were elucidated. These changes were then incorporated into the matrix developed during the previous day to identify potential changes in stressors and their impacts. Once this had been done groups were asked to prioritize one key stressor-element combination in each sector (exposure unit) particularly vulnerable to the climate change. Having at least one climate specialist in each group was important in that the climate specialists were able to constrain the expectations of the users of climate information at the given scales (global, regional) and explain why for example, global scale data is not suitable for a regional study if it is the only data available.

DAY 3

Reporting back

The day began by breaking the city teams out one final time to construct a brief story about what the climate data told them about the cell in their matrix on which they were focusing. The questions posed to the group were: Did the climate data indicate anything about the interacting climate risks identified in the focal cell or elsewhere in the matrix? Where were there limits to what the data told them, what were these limits?

The reporting back period, which followed directly from this last session, brought to light many common discoveries that the teams made in going through the climate data analysis. These included such things as the:

- substantial limits of GCM data in applying to a city context in terms of both spatial and temporal resolution;
- poor relevance to decision making needs of how GCM climate projections reported (i.e. mean changes);
- existence of both convergence and divergence in the data between GCMs and RCMs and the implications of that in terms of applying different streams of data;
- usefulness of RCMs in that they provide a broader set of climate parameters relevant to decision making than do GCMs;
- importance of heavy rainfall as a key parameter identified across the teams;
- need to be prepared to adapt to increased variability produced by the climate system not to mean changes in climate parameters;
- need more historical data to understand if projected rainfall characteristics show up as part of natural variability (based on past observations) or if they represent potential change;
- importance of understanding compound effects, such as where a heatwave coincides with a dry spell, and implications of that for crossing thresholds where impacts substantially increase; and,

- a common concern about weak and insufficient infrastructure (roads, bridges, stormwater drainage, water treatment, etc.) as a critical vulnerability and one that produces cascading effects on people and systems.

Reflections on the workshop

The workshop concluded with a lengthy plenary discussion about the workshop process and actions to take in further refining the exemplar. This workshop was the first time most of the team members had been exposed to climate data and yet, in their professional lives, many of them are making decisions where climate figures in, and in which the need for climate data literacy will become increasingly important with climate change.

The low baseline knowledge that participants had of climate data created a challenge for proceeding more rapidly through the analysis, for example in becoming comfortable with new terminology, such as 'resolution' and 'uncertainty', which have very different connotations in settings outside of climate data. Two of the common observations made by the teams concerned the usefulness of integrating non-climate stressors with climate stressors in identifying where sensitivities occur, and the use of a place-based, as opposed to sectoral-based, approach, which served to ground the analysis in a holistic problem-solving context. Many of the teams also remarked that they found the exploration of "the good, the bad and the ugly" related to climate data portals to be quite useful in helping them to be more skeptical users of climate data.

The Addis Ababa group summarized their impressions of the workshop in this way "There needs to be knowledge transfer after this workshop to Addis Ababa's Climate Change Forum. We need to talk about how many people are illiterate in climate information. We have learned a lot and gained knowledge on elements and sectors affected by climate change. But we need to continue these things with other people and other projects to enhance their abilities." Similarly, the Kampala group noted that as a result of the workshop they better understand the importance of bringing many different sectors around the table to work together and complement each other. In Uganda, they struggle to bring authorities together and the authorities do not have the right information and what climate information they do have is often not used properly. They expressed a strong need for workshop participants to clarify these mistakes and explain to authorities how to use climate information correctly.

In terms of modifications to the process, the teams and the organizers agreed on the following:

- Devise a glossary of climate data terminology and a primer on climate modeling that would help those new to the world of climate data to get up to speed more quickly.

- Allow more overall time in the workshop to reflect on the learning process, and for city teams to become acquainted with one another and the findings that are coming from the different cities, the process felt rushed.
- Allow time for a field trip, which would help to cement learning and prompt other insights.
- Before identifying the elements, each city should be given the opportunity to present their current meteorological forecast process. They should explain their current situation on how different user-groups are utilizing and applying climate information
- Modify the sequence of matrix-development steps such that the climatology/ meteorology experts meet together, and separately from their team mates. This would allow them to delve deeper into the data and discover the main changes for each variable and in doing so gain emergent message of climate change that they could take back to the teams for application to the matrix analysis.

A revised sequence was developed as a result of these discussions.

1. Identify elements
2. Do separate analysis

2.a Climatology/meteor. group	2.b Policy/development planner group
Matrix of climate change signals & distill leading messages of change	Identifying non-climate drivers and stressors and identifying vulnerabilities

3. Come back together and integrate climate messages to matrix
4. Identifying key sensitivities to climate change
5. Construct a story of climate change, including a description of data gaps

There was a sense from this workshop that having climate change messages distilled from the data earlier on in the process would allow them to more effectively see where the climate data supports decision making and where there are significant holes in climate data for which information is needed for adaptation planning.

Highlighted too was the desire of many group members to have some form of continuous engagement/training for themselves as well as training of colleagues involved in other sectors in their cities. We believe this is critically important in order to develop an ethos of co-exploration of climate data that engages both climate science practitioners as well as users of this data. Leading up to the workshop (the Addis Ababa group met twice before the meeting to prepare for it) and throughout it's duration, the cross-sectoral engagements highlighted the need for different agencies (universities, met institutes, DRM etc) to work together in drawing out climate messages and relating these to on the ground impacts. For example, the small Maputo delegation included a senior city manager, a university lecturer and a Ph.D. student who worked very well together to

distill important messages. The continued development of the relationship between the parties is important for in-house development of (a) persons with skills to interpret climate information and engage end users and in turn (b) climate related impacts messages. However, without the continued facilitation of capacity development in the context of climate data co-exploration, it is very likely that the brief exposure these groups received to the ideas presented at the workshop will not survive into application. This has bearing on the very large potential for an incorrect application of climate data/information to particular sectors and the consequent development and implementation of wrong strategies in response to a changing climate.

APPENDIX 1

Agenda

Climate Information for Decision Making—Focus on Peri-Urban Areas

13-15 February 2013

Kunduchi Beach Hotel, Dar es Salaam

Organized by START and the Climate Systems Analysis Group-University of Cape Town with support from CDKN

DAY 1	
Time	**Activity**
09.00 – 10.00	***Opening session*** • Welcome comments • Over-arching expectations, and what the outputs will be • Walk through the agenda for the 3 days briefly explaining the purpose and how the sessions contribute to building toward the outcomes. • Opening exercise—brief examination of peri-urban priorities
10.00 – 10.30	*Tea/coffee break and group photograph*
10.30 – 12.30	***Session 1:*** **Assessing vulnerabilities in a variable climate, the peri-urban context**
10.30 – 12.00	• City groups identify key resources, infrastructure, services and economic / livelihood activities that occur in the peri-urban spaces of their city • Identify stressors and critical factors (both climatic and non-climatic) that these areas are exposed to / dependent on i.e. what has impacted these areas in the recent past, what critical dependencies do they have that if removed will negatively impact the sector?
12.00 – 12.30	Brief report back to plenary
12.30 – 14.00	*Lunch*
14.00 – 17.00	***Session 2:*** **Identifying climate sensitivities in a multi-stressor environment**
14.00 – 15.30	Developing a sensitivity matrix of peri-urban areas

15.30 – 16.00	*Tea/coffee break*
16.00 – 17.00	Groups report back to plenary Discussion of prioritization of matrix, in preparation for Day 2
18.30	*Workshop reception (TBC)*

DAY 2	
Time	**Activity**
09.00 – 11.45	***Session 3:* Exploring uncertainty and the value of information in making robust decisions**
09.00 – 10.15	Crossing the river exercise
10.15 – 10.45	*Tea/coffee break*
10.45 – 17.00	***Session 4:* Examining and interpreting climate information**
10.45 – 12.30	Applying climate information and exploring its utility and limits (GCM gridcells, downscaling means, and derivative attributes)
12.30 – 14.00	*Lunch*
14:00 – 15.00	Applying climate information (continued)
15.00– 15.30	*Tea/coffee break*
15.30– 16.00	Integrating multiple lines of evidence; what have we learned from today?
16.00 – 17.00	Developing a storyline based on climate information—what does climate change mean for our city's peri-urban areas?
Evening group work	Cities develop up to 3 messages based on storyline to present at next joint sitting of the City Council and National Treasury

DAY 3	
Time	**Activity**
09.00 – 10.15	***Session 5:*** **Communication of policy messages**
09.00 – 10.15	Groups present their messages in plenary
10.15 – 10.45	*Tea/coffee break*
10.45 – 16.30	***Session 6:*** **Developing exemplars**
10.45 – 12.00	Introduction to the exemplar concept – how can we transfer what we've done and learned here to other contexts?
12.00 – 13.30	*Lunch*
13.30 – 15.00	Document the case study / exemplar describing steps taken, resultant messages, lessons learned and noteworthy precautions for others doing something similar – a template will be provided and the output published online to share more broadly
15.00 – 15.30	*Tea/coffee break*
15.30 – 16.30	In plenary, share key lessons learned / precautions for others to take – these will be written up into a guidance note to be circulated after the workshop and published online to share more broadly
16.30	Adjourn

APPENDIX 2

List of Participants

Participants in 5-city climate exemplars workshop Dar es Saalam, 13-15 February 2013		
Person	**Institutional affiliation**	**City of origin**
Gebru Jember Endalew	Climate Change Forum	Addis Ababa
Lebeta Dula Shanko	National Met. Agency of Ethiopia	Addis Ababa
Azeb Worku Teffera	Institute Sustainable Dev. NGO	Addis Ababa
Alemayehu Taye	Addis Ababa Urban Agric. Office	Addis Ababa
Beletu Tefera	Min. Agric., Food Security Cordination Directorate, Disaster Risk Management and	Addis Ababa
Berehe Gebre Hiwot	Addis Ababa City Administration, Urban Plannnig Institute	Addis Ababa
Abiy Girma Woldeselassie	Min. Water and Energy, Water Supply and Sanitation Directorate	Addis Ababa
Tesfaye Tulu Melka	Head of Special Zone of Oromia	Addis Ababa
Getu Woldesemayat Gelagay	Ministy of Agriculture	Addis Ababa
Pius Z. Yanda	Univ. Dar es Salaam	Dar es Salaam
Abdallah Henku	Univ. Dar es Salaam	Dar es Salaam
Nico A. Malik	Univ. Dar es Salaam	Dar es Salaam
Donald Mwiturubani	Univ. Dar es Salaam	Dar es Salaam
Aldophine Kateka	Univ. Dar es Salaam	Dar es Salaam
Harrison Chinyuka	Disasters Risk Management - Prime Ministers Office (PMO)	Dar es Salaam
Md. Theresia Massoy	Ministry of Agriculture, Food Security and Cooperatives (MAFSC)	Dar es Salaam
Adolphe Lupala	Ardhi University	Dar es Salaam
Godwin Ndossi	NGO - Tanzania National Health Research Forum (TANHER Forum)	Dar es Salaam
George Lugomelo	Ministry of Water (MoW)	Dar es Salaam
Yusta Kibona	Environmental Protection and Management Services	Dar es Salaam
Elly Sabiiti	Makerere Univ	Kampala
Lukiya Tazalika	Ministry Water and Environment	Kampala
Charles Basalirwa	Makerere Univ	Kampala
Constantine Katongole	Makerere Univ	Kampala
M Azuba Semwanga	Agricultural Extension, NGO	Kampala
Sylevester Katuromunda	Ministry of Education and Sports	Kampala
Hannington Sengendo	Makerere Univ	Kampala
Everline Komutunga	NARO, Ministry of Agriculture	Kampala
Sheila Kiconco	Ministry Water and Environment	Kampala
Izidine Pinto	PhD student - extreme weather	Maputo
Genito Maure	Univ. Maputo	Maputo
Jose Alvaro Malanco	National water Directorate	Maputo
Suman Jain	University of Zambia	Lusaka
Esnart Makwakwa	DMMU	Lusaka
Joel Kabika	University of Zambia	Lusaka
Jon Padgham	International START Secr.	Washington, DC
Chris Lennard	Univ. Cape Town	Cape Town
Bruce Hewitson	Univ. Cape Town	Cape Town
Anna Taylor	Univ. Cape Town	Cape Town
Claire Van WYK	Univ. Cape Town	Cape Town