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Nairobi work programme on impacts, vulnerability and adaptation to climate change

Report on the workshop on climate modelling, scenarios and downscaling under the Nairobi work programme on impacts, vulnerability and adaptation to climate change

Note by the secretariat

Summary

This note provides a summary of the in-session workshop on climate modelling, scenarios and downscaling under the Nairobi work programme on impacts, vulnerability and adaptation to climate change. The workshop was held in Bonn, Germany, on 7 June 2008 during the twenty-eighth sessions of subsidiary bodies. Discussions at the workshop focused on opportunities for, and experiences in, applying climate model outputs and downscaled data to construct regional and subregional climate scenarios, as well as improving availability and applicability of climate model outputs and downscaled data for policymakers. This note also contains information on gaps and needs identified by participants in the area of work on climate modelling, scenarios and downscaling as well as a list of recommendations and issues for follow-up and further consideration.

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I. Introduction

A. Mandate

1. The Subsidiary Body for Scientific and Technological Advice (SBSTA), at its twenty-fifth session, requested the secretariat to organize, under the guidance of the Chair of the SBSTA, an in-session workshop, at its twenty-eighth session, to advance consideration of ways to promote the development of, access to and use of information and data on projected climate change. The workshop should involve the participation of experts from Parties and representatives from the Intergovernmental Panel on Climate Change (IPCC) and other relevant organizations, and take into account submissions under this area of work.[1] The SBSTA further requested the secretariat to prepare a report on the workshop, to be made available to the SBSTA by its twenty-ninth session.

B. Scope of the note

2. This note provides information on the workshop referred to above. It draws upon the discussions and presentations at the workshop, including on possible next steps under the Nairobi work programme on impacts, vulnerability and adaptation to climate change.

3. As requested by the SBSTA,[2] this document contains information on, inter alia:

(a) An analysis of the issues addressed in the workshop, including current status and lessons learned;

(b) A summary of identified gaps, needs (including any capacity needs), opportunities (including possible synergy among activities), barriers and constraints;

(c) A summary of recommendations.

C. Possible action by the Subsidiary Body for Scientific and Technological Advice

4. The SBSTA may wish to consider this report at its twenty-ninth session as part of its general consideration of the outcomes of completed activities under the Nairobi work programme.

D. Background

5. The overall objective of the Nairobi work programme is to assist all Parties, in particular developing countries, including the least developed countries and small island developing States (SIDS), to improve their understanding and assessment of impacts, vulnerability and adaptation, and to make informed decisions on practical adaptation actions and measures to respond to climate change on a sound scientific, technical and socio-economic basis, taking into account current and future climate change and variability.[3]

6. Activities in the area of climate modelling, scenarios and downscaling under the Nairobi work programme are undertaken in line with the objective stated in the annex to decision 2/CP.11 to advance the sub-theme stated in paragraph 3 (a) (iii), “Promoting the development of, access to, and use of information and data on projected climate change”.

[1] FCCC/SBSTA/2006/11, paragraph 43.
[2] FCCC/SBSTA/2006/11, paragraph 24.
[3] Decision 2/CP.11, annex, paragraph 1.

II. Proceedings

7. The secretariat organized the workshop on climate modelling, scenarios and downscaling on 7 June 2008 during the twenty-eighth sessions of the subsidiary bodies in Bonn, Germany. Ms. Helen Plume, Chair of the SBSTA, chaired the workshop.

8. The workshop was attended by over 100 representatives from Parties and relevant intergovernmental and non-governmental organizations, United Nations agencies and constituted bodies, as well as by individual experts and practitioners.

9. As requested by the SBSTA, discussions at the workshop were informed by submissions from the IPCC and other relevant international, regional and national organizations, and modelling centres and agencies on ways to contribute to climate modelling, scenarios and downscaling.[4] At the opening, the chair reminded delegates of the objective of the Nairobi work programme and the mandate for, and the expected outcomes of, the workshop.

10. The discussions at the workshop were organized in two parts. The first part focused on the development of regional and subregional climate scenarios and ways to improve access to, and application of, climate model outputs. The second part concentrated on the analysis of availability and applicability of climate model outputs and downscaled data for policymakers.

11. In the first part, the key issues were introduced in overview presentations by the World Climate Research Programme (WCRP) and the IPCC Task Group on Data and Scenario Support for Impact and Climate Analysis (TGICA). This was followed by brief presentations by Parties on their national experiences in applying climate model outputs and downscaled data to develop regional and subregional climate scenarios, and by four organizations on their regional modelling and related capacity-building activities.

12. In the discussion that followed, participants focused on the following topics: (1) identification of gaps and needs, including in capacity-building, in developing regional and subregional climate scenarios for adaptation purposes; and (2) possible actions by organizations and the Nairobi work programme partners to bridge the identified gaps, and to assist Parties in improving access to, and in applying, model outcomes.

13. In the second part, the representative from the United Nations Development Programme (UNDP) introduced key characteristics of policy-relevant climate information, and current barriers to and gaps in applying climate information for adaptation decision-making. This was followed by brief presentations by Parties on their experiences in incorporating climate model outputs into the policymaking process. In the following discussion, participants considered practical steps to improve the relevance and use of climate information as well as to make relevant data more accessible to policymakers at all levels.

14. In addition, participants provided information on priority issues, gaps, needs and recommendations, and shared information on their experiences, good practices and sources of expertise throughout the discussion. They also shared information on ways in which they could respond to recommendations (including making pledges for follow-up activities).

[4] Submissions from relevant organizations are compiled in document FCCC/SBSTA/2007/MISC.24 and Add.1. Online documentation is available at <http://unfccc.int/4377.php>.

III. Analysis of the issues addressed at the workshop

A. Development of regional and subregional climate scenarios and improvement of access to, and application of, climate model outputs

1. Development of regional and subregional climate scenarios

15. Developments in climate modelling and understanding of the physical processes of the climate system over the years have led to a considerable increase in confidence in projecting future climate change on continental and larger scales. However, submissions and discussions confirmed insufficiency in the spatial and temporal resolution associated with outputs from climate model experiments carried out to date. This, coupled with issues related to model uncertainties (see chapter III B below), has placed constraints on the development of regional and subregional climate scenarios to support policy-relevant impact and vulnerability assessments.

16. The coarse spatial resolution of global models, typically of a few hundred kilometres, limits the ability to develop meaningful country-level climate change scenarios. This is especially so for SIDS, because some of the small islands are treated as ocean area in the models. Similarly, a range of climatic differences within countries or regions with complex topography, such as coastlines and volcanic mountains, is not clearly represented in the coarse resolution of the global models. There is a need for data on smaller spatial scales (regional, national and local); participants from the SIDS emphasized the importance of making data from climate models at a spatial resolution of 25 km or higher widely available so that local geographic conditions (e.g. small islands, mountain topographies, watersheds, coastlines, etc.) may be captured in order to enable realistic impact assessments.

17. Participants provided information on a number of efforts that are being undertaken to construct regional and subregional scenarios, including: Eta/CPTEC, based on the coupled global climate model of the Met Office Hadley Centre of the United Kingdom of Great Britain and Northern Ireland (HadCM3) and of the Max Planck Institute for Meteorology (ECHAM4), enables vulnerability assessments in key sectors for watersheds, provinces or regions in South and Central America and the Caribbean at a resolution of 40 km (presented by the representative from Brazil); PRECIS (Providing Regional Climates for Impacts Studies), a tool for generating high-resolution regional scenarios of future climate that can run on personal computers (presented by the representatives from Cuba, the Caribbean Community Climate Change Centre (CCCCC) and the Met Office Hadley Centre); and Earth Simulator, a supercomputer that computes outputs at a resolution of 20 km to allow projections such as extreme weather events (e.g. tropical cyclones and heat waves) and diurnal precipitation change (presented by the representatives from Japan).[5]

18. The representative from the IPCC-TGICA outlined examples of high-resolution scenarios developed from regional climate models for various parts of the world, including initiatives by PRUDENCE (Europe), CREAS (South America), PRECIS (China, Brazil and Southern Africa) and CSAG-UCT (Africa).[6]

19. Regional climate models, by adding features captured at higher resolution to the large-scale projections of Atmosphere–Ocean General Circulation Models, are able to provide more detailed climate information, such as strength of extreme weather events (e.g. typhoons, hurricanes or intense rainfall), regionally detailed extreme events (e.g. heat or cold waves, or droughts) and temporally detailed behaviour (e.g. precipitation intensity). Such data are an important component of assessments of the vulnerability of a country to the impacts of climate change.

[5] For the modelling activities presented, see <http://unfccc.int/4377.php>.
[6] For further information, see <http://unfccc.int/files/adaptation/application/pdf/ipcc.pdf>.

20. While the number of regional projections that are now available for many parts of the world is increasing, many of them are still in the exploratory phase. Participants noted that the quality of regionalized model projections at present is often inadequate for providing the specific and detailed information needed for adaptation planning, and that therefore regional models are having to be used in collaboration with global models. Challenges remain to improve climate projections on regional and subregional scales for adaptation purposes. At the same time, as global models provide the range of possible future climates as well as necessary inputs (e.g. boundary conditions) for all the regional and subregional climate simulations, participants reiterated the importance of further enhancement and refinement of global models to improving climate information in support of adaptation strategies.

21. It was generally noted that for the Africa region, few downscaled data exist for a limited number of General Circulation Models (GCMs) and scenarios. Participants also drew attention to the gaps in regional and subregional climate projections in Central America, the Caribbean, the Indian subcontinent and small islands.

22. Accurate observational data are a critical element of modelling and are also vital for minimizing gaps in climate projections. Participants discussed the limitations associated with insufficient observations of the climate system (e.g. atmosphere, terrestrial, ocean, cryosphere, biosphere). Increased support for data recording facilities was deemed particularly critical in the Africa region, as some participants mentioned that there is only one recognized weather reporting station in the Upper Zambezi basin – a region covering several climatological zones. There is a need to ensure that observation of current climate is sustained, especially in the Africa region. Model developers further noted the importance of standardizing observations of the current climate.

23. In the case of Africa, much of the climate information is being produced either outside the region or at a very small number of well-equipped and well-staffed facilities in the region, creating a technological and informational divide within the region. Long-term training (such as fellowships or masters degree programmes hosted at African universities) is needed to foster ownership and to increase national capacity to develop and use climate models. An absence of training centres for each of the linguistically different regions in Africa was also viewed as a limitation in building capacity.

24. Participants, especially those from the Africa region, drew attention to the problem of inadequate resources hindering the dissemination of existing local data and knowledge. Creating networks of experts in the region has been found to be useful for improving the availability of data.

2. Improving access to, and application of, climate model outputs

25. Although several data sources that are available free of charge (e.g. the WCRP CMIP3 multi-model dataset archive[7] and the IPCC Data Distribution Centre[8]) were referred to during the workshop, participants called for more data to be made available through open and free access, as the scarcity of resources for purchasing necessary data was viewed as one of the largest barriers to enhancing climate scenarios.

26. Regional centres play a key role in producing regionally relevant climate scenarios by facilitating collaboration in the following areas: exchange of experiences and region-specific solutions, especially regarding data collection and storage; coordination of efforts to incorporate diverse models when constructing regional scenarios; provision of technical advice and consultancy; facilitation of capacity-building for national and regional experts; and collaboration with international organizations. Participants therefore stressed the importance of strengthening the role of regional centres to assist in the training of national experts in the region.

[7] <http://www-pcmdi.llnl.gov/ipcc/about_ipcc.php>.
[8] <http://www.ipcc-data.org>.

27. The representative from \ elaborated on its initiatives to provide training for its members in installing and using the PRECIS model, including assisting regional institutions[9] in coordinating their modelling efforts. CCCCC is also sharing its experiences with counterparts in Central America though collaboration with Centro del Agua del Trópico Húmedo para América Latina y el Caribe.

28. Some data providers pointed out that it is crucial for users to actively communicate their specific needs because in some cases, the data and expertise that they need are already available through, for instance, regional centres. Challenges for the data providers themselves include providing easier access to model outputs, finding ways to deliver knowledge to users more efficiently, such as in user-friendly formats (e.g. three-dimensional visualization), and timely updating. Participants highlighted the value of model developers working closely with user groups, especially in the least developed countries, in order to determine the types of information required and to build users' capacity to compile and interpret the data and information.

29. Given the wide range of assumptions that different models make, inconsistencies between projections and observations, and the inherent variability of both models and the natural climate system, participants emphasized the importance of understanding the context and the limitations of data produced by various models. It was noted that the variability factor becomes more significant on smaller spatial scales (e.g. region, country). Despite a number of international collaboration efforts to provide practical training for researchers and practitioners in various parts of the world,[10] challenges remain in improving the ability of users to interpret complex model outputs and effectively make use of them, particularly among stakeholders in developing country Parties.

30. Participants discussed the limitations associated with the documentation and description of climate models. These are often optimized for the use of climate scientists and researchers, and not for a wider audience in the adaptation community, including policymakers. Language was also identified as one of the constraints in understanding climate science and in interpreting outputs correctly. There is a need for improvement in the guidance available for choosing models that best suit users' specific requirements, as there is no single climate model which can be applied adequately to various conditions and different users' needs (e.g. geographical feature of the region, available resources, necessary scales, etc).

31. In order to assist users in selecting models and in applying outputs, several participants discussed the value of a collaborative platform or forum, where users could share feedback on scenario products, available data, methods and tools. Some participants indicated the importance of such a web platform being housed on the UNFCCC website (under the technology transfer and capacity-building area) to ensure neutrality and the inclusion of a wider range of models.

B. Increasing availability and applicability of climate model outputs and downscaled data for policymakers at all levels

32. In order to increase the applicability of model outputs and downscaled data for policymakers, it is essential to understand what is of relevance to the policymaking process. During the second part of the workshop, participants acknowledged that policymakers need to know what is expected to change (variables), where and when these changes are likely to occur, and the level of confidence in the information.

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[9] The Cuban Institute of Meteorology, the University of the West Indies in Jamaica and Barbados, and CCCCC in Belize.

[10] Examples of international collaboration referred to at the workshop include training activities by Brazil, Spain and the World Bank on the production and use of regional climate change models in South and Central America, initiatives by the United Kingdom via the PRECIS program and training activities by Japan on the application of the Earth Simulator model. For further information on training opportunities presented, see: <http://unfccc.int/4377.php>.

33. As adaptation policymaking involves adaptation measures for varying planning horizons, it requires model outputs in relevant time frames at appropriate temporal resolutions (e.g. daily, monthly, annual, decadal). Participants noted that the long time horizons of widely available GCM projections – to the 2060s, 2080s or 2100 – are also hindering attempts to engage policymakers in taking urgent adaptation action, and emphasized the value of making available climate scenarios for shorter time horizons (e.g. to the 2030s). Such scenarios are important for increasing the applicability of climate information to impact and vulnerability assessments in key sectors.

34. Climate model outputs and downscaled data may also have greater applicability if the geographical extent is taken into account. Climate information is likely to be of more interest to policymakers if it reflects administrative or geographic scope (e.g. state, province, river basin, etc.).

35. Participants presented a number of tools for making outputs of climate models accessible to a wider range of adaptation practitioners, including decision makers. These tools include Climate Mapper,[11] which enables three-dimensional visualization of climate projections for a limited area. However, further improvements are needed in the provision and dissemination of information relevant to adaptation decision-making in a format that is appropriate to users' needs.

36. Many participants highlighted a need to bring together the climate science community and adaptation practitioners, including decision makers, in order to determine requirements and parameters for modelling activities so that model outputs may be more relevant to impact and vulnerability assessments in key sectors. This would also increase support for adaptation planning at all levels.

Addressing uncertainties

37. Participants, noting that the extent to which uncertainties associated with climate information are communicated to users may affect the credibility of model outputs, discussed extensively how to account for the uncertainty element when integrating climate scenarios into decision-making.

38. The representative from the WCRP reiterated that research is being undertaken to reduce scientific uncertainties, such as uncertainties in ice-sheet stability and its impact on sea level, noting that the current sea level rise is near the upper end of the IPCC projections and is accelerating. Several participants suggested adopting a set of scenarios or large multi-model ensembles in order to reduce and quantify the range of uncertainty within and across the models. However, this approach can be resource-intensive and would require high competency to interpret the outputs.

39. It was noted that some adaptation measures could be planned without sophisticated models and that high-resolution scenarios alone would not be sufficient in facilitating decision-making for adaptation. Several participants advocated a risk assessment approach (also referred to as a risk management or risk-based approach), which is a systematic approach to manage the current and future risk associated with the full spectrum of climate-related impacts. This approach does not necessarily require high-resolution climate scenarios. While acknowledging that this is a viable option, participants generally agreed on the value of supplementing such an approach with the use of a range of models in order to understand some of the physical factors involved and identify a full range of outcomes. Some climate scientists highlighted a recent trend of framing science around impacts, adaptation and mitigation, using a risk management framework.

40. As uncertainty is inherent in climate scenarios and the development of regional scenarios is still at an early stage, participants reiterated the importance of users being able to make value judgements. This requires greater involvement from experts in interpreting outputs and minimizing misunderstandings of techniques and their application. The challenge remains, especially in developing country Parties, to strengthen local expertise in this regard.

[11] <http://unfccc.int/files/adaptation/application/pdf/usa.pdf>.

41. Noting that ensuring appropriate application of downscaled data in impact studies requires further interaction beyond workshops, participants underscored the importance of increasing dialogue among stakeholders, including local authorities, researchers, data providers and the private sector, in the production and evaluation of scenario data products. This would help to define needs and problems, and may contribute to a more effective integration of climate science into adaptation policy.

IV. Summary of recommendations

42. Gaps, needs and constraints identified in this workshop were consistent with the findings of the previous workshop on the status of modelling activities.[12] With a view to addressing gaps in the development of regional and subregional climate scenarios and improvement of access to, and application of, climate model outputs, participants proposed the following actions:

(a) Promote the development of climate information that is more relevant to adaptation, including:

(i) Enhancing and refining global climate models;

(ii) Making model outputs available at higher spatial resolution (25 km or higher) in order to capture features of small islands and geographic characteristics (e.g. topography, coastlines, etc.);

(iii) Making model outputs available for shorter time horizons and on various temporal scales in order to provide information on the various time frames required for different adaptation measures;

(iv) Improving climate projections on regional and subregional scales in order to enhance the quality of country-level adaptation measures as well as sectoral planning;

(b) Enhance the observation of the climate system, especially in the Africa region, to ensure continuous observation and to minimize gaps in climate projections;

(c) Strengthen networks of regional and national experts in order to increase data availability and collaboration at regional and country levels;

(d) Promote open access or easier access to data from both observations and models, and in more user-friendly formats, in order to make the necessary data available to researchers around the world;

(e) Enhance support for the dissemination of existing local knowledge and/or data in order to reduce gaps in data and ensure continuity in projections;

(f) Enhance national capacity in the development and application of climate models by promoting long-term training opportunities (e.g. fellowships, masters degree programmes) to narrow the technical and information divide;

(g) Promote guidance and information on climate models, downscaling methods and resulting data in languages other than English in order to minimize misconceptions and the misinterpretation of data;

(h) Improve guidance on selecting models to best suit users' needs and conditions in order to minimize misinterpretation of outputs;

[12] See document FCCC/SBI/2002/9 for the report of the workshop on the status of modelling activities to assess the adverse effects of climate change and the impact of implemented response measures.

(i) Develop a collaborative platform to facilitate the sharing of good practices and feedback on available data, methods and tools;

(j) Strengthen the role of regional centres to promote efficient sharing and transfer of knowledge, collaboration on scenario development using various models, and capacity-building at regional and national levels.

43. To increase the availability and applicability of climate model outputs and downscaled data for policymakers at all levels, participants recommended the following actions:

(a) Increase dialogue between adaptation policymakers and developers of models to facilitate the provision of the specific and detailed information that is required in the adaptation policymaking process;

(b) Provide and disseminate climate information that is more relevant to adaptation policymakers (e.g. more relevant timescales and geographical coverage) in user-friendly formats;

(c) Continue efforts to quantify and reduce uncertainty within and across models in order to increase the accuracy of projections;

(d) Strengthen research on biophysical and physical climate systems to reduce scientific uncertainties associated with climate projections and thus improve the quality of scenarios and increase the confidence of decision makers in climate information;

(e) Improve the representation and communication of uncertainties to ensure the credibility of model outputs and climate data, and to increase their potential application;

(f) Strengthen the capability of stakeholders (e.g. policymakers at all levels, adaptation practitioners, researchers, etc.), especially those in developing country Parties, to analyse and interpret existing climate information and apply the results to adaptation measures.

V. Issues for follow-up and further consideration

A. Related activities that may address the recommendations from the workshop

44. The representative of Brazil announced a training activity which would take place in July 2008 in Brazil in collaboration with the Government of Spain, the Ibero-American Network of Climate Change Offices (RIOCC) and the Economic Commission for Latin America and the Caribbean, on the use of the Eta/CPTEC model and interpretation of the results for application in key areas (e.g. agriculture and health).

45. UNDP is preparing two action pledges in response to the gaps and needs identified in the workshop. The UNDP representative drew attention to the diverse adaptation portfolio of the UNDP, which includes technical and financial support for Parties not included in Annex I to the Convention to improve access to, and application of, climate model outputs for constructing climate scenarios relevant to the development of adaptation policies, programmes and projects at national, sectoral and community levels.

46. The representative of the Met Office Hadley Centre informed delegates of a series of workshops on regional climate modelling to support the efforts of developing country Parties in meeting their commitments under the Convention and its Kyoto Protocol. The next PRECIS workshop, scheduled to take place in August 2008 at Reading University, United Kingdom, would focus on recent tools and methods developed to support the Nairobi work programme. It would bring together various stakeholders and a multidisciplinary team of scientists working on climate change issues to discuss

generation of high-resolution regional climate models, data analysis, visualization and interpretation of results (including uncertainties) as well as the use of climate data in application models.

B. Possible next steps under the Nairobi work programme on impacts, vulnerability and adaptation to climate change

47. The recommended activities listed in paragraphs 42 and 43 above could be undertaken by Parties, relevant organizations and other stakeholders engaged under the Nairobi work programme in order to address the identified gaps, needs, barriers and constraints and to take advantage of opportunities in the area of climate modelling, scenarios and downscaling under the Nairobi work programme.

48. The recommendations from the workshop could also serve as input into the summary report for the first phase of the Nairobi work programme, which will consolidate the results of the implementation of the Nairobi work programme for the period up to SBSTA 28. The outcomes from the workshop could also serve as input into the technical workshop on ways in which regional centres and networks undertaking work relevant to climate change could collaborate,[13] following the request of the SBSTA at its twenty-eighth session that relevant matters related to sub-theme a (iii), "Promoting the development of, access to, and use of information and data on projected climate change", are considered in the technical workshop.[14] This workshop is mandated to take place before SBSTA 32.

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[13] FCCC/SBSTA/2008/6, paragraph 32.
[14] FCCC/SBSTA/2008/6, paragraph 45.