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Economic and Social Commission for Western Asia (ESCWA)

Expert Group Meeting on Assessing Climate Change Impacts
on Water Resources and Socio-Economic Development in the Arab Region
6-7 July 2011
Beirut, Lebanon

Summary

The objectives of the expert group meeting (EGM) were to discuss technical and operational issues related to the implementation of the Regional Initiative for the Assessment of the Impact of Climate Change on Water Resources and Socio-Economic Vulnerability in the Arab Region. These issues included a review of climate change modelling activities in the region, the examination of scenarios to be used in generating climate change projections, the proposed delineation of the Arab Domain for regional climate downscaling to the Arab region, and the identification of criteria for developing a regional knowledge management platform. The meeting was the third in the series of meeting convened to support the elaboration and implementation of the Regional Initiative along its four pillars, which comprise: (a) a baseline review; (b) an impact assessment and vulnerability assessment; (c) awareness raising and information dissemination efforts; and (d) capacity building and institutional strengthening activities. The EGM was attended by representatives of Arab countries, United Nations organisations, League Arab States specialized agencies as well as regional and international institutions.

The EGM found that observational and historical climate data is generally available in the region, albeit not in a consolidated format, and that advanced climate modelling capacities are available at some universities and research centres in the Arab region. It was also understood that regional climate models (RCMs) are necessary to complement the results of coarse resolution general circulation models (GCMs) to improve climate change projections, and that regional hydrological models can further improve the results of RCMs related to the water sector. To this end, it was concluded that it is beneficial to run an ensemble of projections to better characterize uncertainty associated with climate and hydrological modelling applications, but that such efforts require access to high quality observed data for validation and calibration.

The EGM recommended the need to account for regional specificities in climate modelling and to establish an Arab Domain within CORDEX to support consistent and comparable climate modelling efforts in the Arab Region in accordance with international standards. To this end, the EGM recommended the establishment of a technical task force to coordinate climate modelling activities in the Arab region within the framework of the Regional Initiative, and that the expert members of the task force would agree upon the selection of the scenarios that would be applied to prepare climate projections based on available information and resources.

The meeting concluded with Arab Governments and regional organizations reconfirming their support for the Regional Initiative and its implementation within the framework of cooperation between the United Nations and League of Arab States.

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INTRODUCTION

1. The Economic and Social Commission for Western Asia (ESCWA) in partnership with the League of Arab States (LAS) and the United Nations Environment Program/Regional Office for Western Asia (UNEP/ROWA) organized the Expert Group Meeting (EGM) on Assessing Climate Change Impacts on Water Resources and Socio-Economic Development in the Arab Region from 6 to 7 July 2011 in Beirut, Lebanon. The meeting was the third regional meeting organized within the framework of the Regional Initiative for the Assessment of the Impact of Climate Change on Water Resources and Socio-Economic Vulnerability in the Arab Region.

2. The main objectives of the meeting were to:

- (a) Exchange information on current climate change modelling activities in the region;
- (b) Select the scenarios that will be used for generating climate change projections;
- (c) Discuss the delineation of the Arab Domain for regional climate downscaling to the Arab region;
- (d) Define criteria for developing a regional knowledge management platform for meteorological and hydrological information based on experiences gained at the national level.

3. The meeting spanned over two days and consisted of seven sessions. Chapter I of this meeting report highlights the main conclusions and recommendations of the meeting, while chapter II provides a summary of the presentations and the main topics of discussions held during each session. Chapter III reviews the organization of work, including information regarding the meeting agenda, participants and evaluation. Full documentation of the meeting is available at the following address:

<http://www.escwa.un.org/information/meetingdetails.asp?referenceNum=1338E>

I. CONCLUSIONS AND RECOMMENDATIONS

4. A series of consultative discussions involving representatives from Arab Governments, United Nations organizations, the League of Arab States Secretariat and its specialized organizations, as well as experts from regional and international institutions engaged in climate modelling at the Arab regional level allowed for informed and interactive discussions on the methodological framework and the way to move forward with the Regional Initiative for the Assessment of the Impact of Climate Change on Water Resources and Socio-Economic Vulnerability in the Arab Region. The meeting resulted in the following findings and recommendations, which are presented within the framework of the four pillars that guide the work of the Regional Initiative.

A. BASELINE REVIEW

5. While the EGM largely focused on issues related to climate change impact assessment and knowledge management, the following findings and conclusions were identified regarding the information base:

- (a) Many countries have historical observational data sets, but with varying quality and spatial distribution. Some of these countries have engaged in data rescue and the development of indices for climate change detection and assessment.
- (b) Global data sources and data sets are available for climate and geo-physical data (e.g., land use, topography), but more comprehensive regional observational data based on additional national sources are needed to undertake sensitivity analysis, as well as validate climate and hydrological models for application in the region.

6. The following recommendation were thus issued related to the need for baseline information:

- (a) Efforts should be undertaken to consolidate and analyze available climate data in the Arab region in order to characterize the observed change in climate in the region and to validate the baseline simulations that are used to support climate models.
- (b) Arab Governments are encouraged to provide the climate and hydrological observational data that is needed to support the validation and calibration of climate and hydrological models being pursued within the context of the Regional Initiative.
- (c) The LAS through its relevant bodies should adopt resolutions requesting Arab Governments to provide information to support the Regional Initiative.

B. IMPACT ANALYSIS AND VULNERABILITY ASSESSMENT

7. The meeting found that several Arab Governments and research institutions in the region are engaged in climate modelling activities at the national and regional levels using different methodological approaches. The following findings resulted from the meeting:

- (a) Work is being undertaken in region on GCM and RCM applications; however there is limited experience in the region on using RCM outputs to run regional hydrological models (RHMs).
- (b) There are climate modelling capabilities being conducted at the national level in Egypt, Iraq, Jordan, Saudi Arabia, Syrian Arab Republic and Yemen that can assist with the calibration of RCM applications and the identification of regional specificities.
- (c) Some universities in the Arab region are engaged in advanced climate modelling applications with high performance computing facilities that can support seasonal forecasting, global climate modelling, regional climate modelling, as well as scientific research and capacity building. These include the Centre of Excellence for Climate Change Research at King Abdulaziz University (KAU) and King Abdullah University of Science and Technology (KAUST).
- (d) Most GCMs have too coarse a resolution to examine climate change effects at the regional, national or local level.
- (e) RCMs provide an additional source of information for supporting national modelling efforts, and can provide feedback for improving GCM outputs.
- (f) Hydrological models that build upon RCM outputs can provide more detailed results on the impact of climate change on water resources, but require good local data for calibration. Particularly needed are daily observations of precipitation, temperature and river discharge for the last 50 years.
- (g) The results from multi-model ensembles help in reducing the uncertainty associated with climate modelling outputs and hydrological modelling, including those of RCMs and RHMs.

8. These findings resulted in the following recommendations:

- (a) Models should be selected and fine-tuned to account for regional specificities, e.g., wadis, sand storms, dust storms, deserts, sea water intrusion, salinity of water and land resources, foliage differences associated with palm trees, etc.

- (b) Arab experts should increase their contribution to the development, review, and validation of GCMs and RCMs.
- (c) Arab experts should support and apply validation techniques suitable for arid and semi-arid regions.
- (d) In delineating the Arab Domain through sensitivity analysis, consideration should be given to geographic coverage and computing efficiency, without sacrificing accuracy, model boundary areas, inclusion of headwaters of shared rivers, inter-tropical convergence zone (ITCZ), desert climates, and the targeted resolution for analysis.
- (e) Validation of RHMs should be supported by test basins of appropriate size which demonstrate representative characteristics and geographical distribution that take into consideration the different requirements needed for modelling large and small scale catchments.
- (f) The LAS should encourage member states to provide needed data; for example, each Arab country could be asked to identify at least one basin in their territory and provide specific information on that basin to support the calibration of the regional hydrological model.
- (g) Considering the technical and resource constraints associated with modelling the Arab region as a single contiguous domain, climate modelling will be undertaken in two segments: a larger Arab domain covering countries situated on the Asian continent and African mainland; and a smaller domain covering Comoros.
- (d) Climate change projections conducted within the framework of the Regional Initiative should be based on one or more of the representative concentration pathway (RCP) newly adopted by the International Panel on Climate Change (IPCC) for its Fifth Assessment Report (AR5), rather than those included in its Special Report on Emissions Scenarios (SRES), which were used as the basis for generating projections in its previous assessment reports.

C. AWARENESS BUILDING AND INFORMATION DISSEMINATION

9. The meeting agreed that there was a need to disseminate information about the Regional Initiative and recommended the following:

- (a) The development of an on-line database or e-knowledge hub that would increase access to information about the Regional Initiative and its associated activities and outputs.
- (b) A set of criteria should be adopted to determine the preferred platform for storing and disseminating information about the Regional Initiative and its associated activities.
- (c) There is a need to increase complementary and coherence among climate modelling activities in the Arab region, provide additional information about the Regional Initiative, and coordinate with other actors working in the region who can contribute to that end.

D. CAPACITY BUILDING AND INSTITUTIONAL DEVELOPMENT

10. In considering the capacity and strength of institutions in the Arab region to engage in climate modelling, the following conclusions were drawn:

- (a) Regional Climate Outlook Forums (RCOFs) and Regional Climate Centres (RCCs) being supported by the World Meteorological Organization (WMO) can provide important mechanisms to facilitate a common understanding of climate monitoring, prediction and projection, but are still not fully developed in the Arab region.
- (b) The Arab region can be served by three WMO-related RCC groupings, namely the: (1) RCC Network for Europe; (2) RCCs in Asia based in China and Japan, including a prospective RCC in Saudi Arabia; and (3) RCC Network for North Africa, which is under development and is implemented through a network of institutions based in Morocco, Tunisia and Egypt.

11. Discussions resulted in the following recommendations:

- (a) Cooperative efforts among Arab countries, through joint workshops and regional activities such as RCOFs, are essential to overcome climate data challenges related to data rescue, data quality, indices, diagnostics and climate change assessments.
- (b) National capacity building and on-the-job training (including participation in workshops and expert group meetings) are needed to improve understanding and capacity for climate modelling, prediction and projection as well as to use the state-of-the-art climate information products for decision-making.
- (c) Improved coordination is needed between national water ministries and national meteorological services to support climate and hydrological modelling efforts.

E. COORDINATION AND IMPLEMENTATION

12. The EGM resulted in the following outcomes and agreement on next steps for implementing the Regional Initiative.

- (a) The EGM welcomed the announcement by the Swedish International Development Agency (SIDA) that it had committed support for the Regional Initiative through a project led by ESCWA and implemented in partnership with the LAS, Swedish Meteorological and Hydrological Institute (SMHI), the Arab Centre for the Studies of Arid Zones and Dry Lands (ACSAD) and the World Meteorological Organization (WMO).
- (b) Arab Governments (particularly the Government of Egypt), United Nations organizations (particularly ESCWA, UNEP, UNESCO, UNISDR, UNU and the WMO), the LAS (through its Secretariat and ACSAD), and research centres engaged in climate modelling in the Arab region (namely SMHI, KAUST, KAU) expressed their interest in contributing substantively to the implementation of the Regional Initiative and were invited to participate in a coordination meeting following the EGM to discuss the implementation of the Regional Initiative and next steps.
- (c) It was agreed that a Technical Task Force would be established involving the institutions engaged in climate modelling in the region that would be coordinated by SMHI and invited to carry out the following tasks:
 - Coordinate the application of climate modelling activities in the Arab region being conducted within the framework of the Regional Initiative based on a common set of assumptions and scenarios.

- Finalize the delineation of the Arab Domain.
 - Determine the most reasonable RCPs from which to generate climate projections based on international practice and the availability of GCM outputs based on RCPs in which to nest RCMs. Special consideration would be given to seeking coherence and comparability with other modelling activities underway globally and regionally, whereby two RCPs were recommended for consideration, namely RCP4.5 and RCP8.5, given preliminary consideration of available GCM outputs and technical parameters.
 - Apply regional climate downscaling to the Comoros based on the same RCPs to be used for generating climate change projections for Arab countries within the Arab Domain.
- (d) The SIDA-sponsored project would support the collection of information needed for climate and hydrological modelling, the delineation of the Arab Domain; RCM downscaling to the Arab region; the application of an ensemble of two to three regional hydrological models (RHM) for the Arab Domain based each of the RCM outputs.
- (e) The National Water Research Center of the Government of Egypt announced its plans to apply the VIC hydrological model for the Nile Basin and that the results of that model could feed into the Regional Initiative. The Government of Egypt indicated that the input data files could contribute to the regional modelling efforts.
- (f) Experts from KAUST and KAU expressed their interest in running RCMs within the Arab Domain or draw findings from a GCM for the Arab Domain according to planned, coordinated and well-defined assumptions.
- (g) A timeline for generating outputs was recommended in order to inform regional stakeholders and better coordinate the outputs of the Regional Initiative with other climate modelling efforts.

II. MAIN TOPICS OF DISCUSSIONS

13. Presentations and discussions are presented in the following sections which are organized according to meeting sessions. The participants were welcomed by opening statements from UNEP/ROWA, LAS and ESCWA.

A. REGIONAL INITIATIVE – OVERVIEW AND REVIEW OF THE INTEGRATED ASSESSMENT METHODOLOGICAL FRAMEWORK

14. ESCWA opened the session by presenting an overview of the Regional Initiative focusing on its mandate and development. The presentation highlighted that following the recommendation of UN and LAS agencies to prepare a regional assessment of the impact of climate change on water resources, a first EGM was convened in October 2009 that defined the main four pillars of the initiative, namely: (a) a baseline review of the current status of freshwater resources and related socio-economic conditions; (b) the preparation of a climate change impact assessment and vulnerability assessment; (c) awareness raising and information dissemination; and (d) capacity building and institutional strengthening. It also highlighted that the Regional Initiative focuses on the socio-economic and environmental implications of climate change impacts on freshwater resources, and underscored the importance of reaching consensus on defining the Arab Domain and the scenarios to be used for generating projections. ESCWA emphasized the need for better cooperation among climate modelling centres in the region and donor initiatives, particularly with respect to the sharing of information and expertise. In setting the stage for discussions, ESCWA articulated the main objectives, activities and indicators of achievement for the four pillars of the Regional Initiative.

15. The Swedish International Development Cooperation Agency (SIDA) presented its regional strategy and activities in the Arab Region which focus on capacity development, integrated water resources management (IWRM), networking and facilitation of dialogue on transboundary water resources. SIDA subsequently announced its substantial support for the Regional Initiative through a three year project led by ESCWA and implemented in partnership with the LAS, SMHI, ACSAD and WMO.

16. ESCWA introduced the methodological framework for conducting the integrated assessment that would guide the impact assessment and vulnerability assessment components of the project. It also emphasized that the purpose of the framework is to bridge the gap between science and policy-making in view of supporting informed decision-making on regional issues and challenges posed by climate change.

17. Questions were raised regarding the input/output of the regional climate model and the timeline to complete the assessment. ESCWA clarified that the SIDA-sponsored project is expected to run for three years in line with the Regional Initiative, and would support the on-going consultation process established under the Regional Initiative. ESCWA emphasized the importance of establishing a consistent set of methods, assumptions, scenarios and variables for coordinating different modelling activities in the region and the need to facilitate communication with regional stakeholders. SMHI explained that impact assessment is not static and would continue to evolve as new information and models become available. The WMO emphasized the importance of developing baselines based on observed climate data. This underscored the importance of Arab states support in supplying and verifying the information and data used during the climate modelling component. The WHO indicated that it is keenly interested in accessing the outputs from the impact assessment study, particularly as it relates to food security issues.

B. CURRENT CLIMATE CHANGE MODELLING ACTIVITIES IN THE ARAB REGION

18. Representatives from Arab countries were subsequently invited to introduce their activities in climate modelling related to the water sector. Jordan provided an overview of current projects in Jordan, which are carried out under two initiatives and with national universities. The MDG Achievements project supported by UNDP undertook several climate research activities including an assessment of climatic trends, the development of baseline scenarios, statistical downscaling of GCMs, and the assessment of climate change impact on water resources. The results indicate that temperatures (especially minimum temperature) in Jordan have been on the rise for the past few decades. Climate modelling results show that Jordan will also undergo warming and a reduction in precipitation for the coming decades. The GLOWA project focuses on water and land resources management in the Jordan Basin under changing conditions. The project supports development of regional climate change scenarios as well as regional development and land use scenarios.

19. Egypt presented an overview of national climate change activities related to modelling, adaptation and mitigation. In doing so, Egypt introduced the activities of the Environment and Climate Research Institute (ECRI), which include climate change modelling, impact assessment, data collection and analysis. Climate projections for the Nile Basin based on several GCMs were presented. The results indicate that the basin will experience a general warming over the next few decades. In comparison, precipitation projections do not show a clear trend. This was followed by an overview of several climate change impact assessment studies undertaken examining water security, water quality and agriculture. Three adaptation efforts were presented that address the impact of sea level rise on the Nile Delta, sea water intrusion and flash floods. Mitigation efforts in Egypt focus on developing renewable energy resources, mainly solar and wind energy.

20. Issues were raised with respect to the quality and benefits of GCM downscaling, inadequate communication and coordination among Arab countries, and the mechanism for improving data and information sharing among Arab countries. Jordan indicated that there is certainly room for improvement in regional climate modelling.

21. Iraq gave an overview of the impact of climate change in Iraq, particularly on runoff from the Tigris River. Two climate change studies that included Iran and Turkey, from where most of Iraq's water resources originate, were presented. An extensive stream runoff trend analysis study focused on Iran shows that runoff characteristics have changed considerably with a rising trend in winter runoff and a decreasing trend in spring runoff mainly due to earlier melting of snowpack induced by higher temperatures. The climate change study in Turkey shows that temperatures are poised to rise, while precipitation is expected to decline. The presentation indicated that Iraq is experiencing major decline in stream runoff, which led to the disappearance of a major reservoir and the drying of substantial areas of agricultural land. It was noted that reduce runoff has also increased salinity in the Shatt Al Arab.

22. Yemen presented its main climate change activities, particularly the preparation of its First National Communication and National Adaptation Program of Action (NAPA). The presentation started with an overview of the climate in Yemen. Several observational records seem to indicate that climate change is underway in Yemen. These include record-setting high temperatures (particularly in the winter) and changes in the intensity and timing of rainfall events and dust storms. It was noted, however, that longer records are required to provide more confidence in the findings to determine whether these changes are part of longer-term changes in climate.

23. During the discussions, it was noted that changes in runoff in Iraq cannot only be attributed to climatic changes since Turkey has considerably dammed the headwaters of the Euphrates River and is increasingly doing so on the Tigris River. Extensive irrigation in Turkey near the Syrian border has also substantially decreased the amount of water available downstream to the Syrian Arab Republic and Iraq.

24. The WMO gave an overview of its various activities including the development of data management systems, data rescue, development of climate indices, climate monitoring and climate watches, regional climate outlook forums (RCOFs), regional climate centres (RCCs), monitoring of sand storms and dust storm, and the establishment of a new Global Framework for Climate Services (GFCS). The WMO also indicated that the Regional Initiative can leverage existing national climate modelling capabilities to support the development of a regional perspective. Reference was made to the existence of large amounts of climate data that are collected and used mostly by national weather forecasting agencies, and that this existing capacity is valuable for supporting climate change studies. For instance, the WMO supported the development of over 80 climate data management systems and offers a climate data rescue training program to build capacity in this area. The objective of data rescue is to retrieve and make accessible valuable climate data stored in perishable media. An example is the Mediterranean Climate Data Rescue (MEDARE) initiative that serves the Greater Mediterranean Region. The WMO also supports national meteorological centre in building the capacity of national climate monitoring systems and infrastructure for early detection of extreme climate events through the WMO Climate Watch System. The WMO also supports the development of climate change indices for transferring raw data into indices that can be made accessible to regional stakeholders and providing other climate services through RCCs, such as climate prediction. The WMO has also set up RCOFs to support seasonal forecasting and climate prediction under the GFCS.

25. Inquiries were raised with respect to accessing climate services provided by the WMO and information collected by RCCs. WMO indicated that RCCs are mandated to liaise with national counterparts and not directly with national users of data. WMO indicated that it honours commitments made to countries regarding access to data and information, noting that member countries have agreed to provide full access to indices calculated based on their observed data and information.

26. Several universities and research institutes in Jordan and Egypt are engaged in climate change modelling and impact assessment activities. Analysis of climate records in several Arab countries indicates that these countries are undergoing a general warming and reduction in precipitation levels. The persistent decline in the Euphrates runoff over the past few decades is believed to be a result of both general regional drying and

water resources development in upstream countries. Some Arab countries have joined WMO-coordinated initiatives for data rescue and the development of indices for climate change detection and assessment. Arab countries are encouraged to actively engage in WMO RCOFs and RCCs to leverage global and regional climate change assessment efforts.

C. REGIONAL CLIMATE DOWNSCALING: DELINEATING THE ARAB DOMAIN

27. KAUST presented climate simulation results for the Arab region for the past three decades. The simulation results were produced by a GFDL/HIRAM model run on 25km x 25km regular grid using a supercomputer at KUAUST. The results indicate that the region is undergoing an overall warming. The simulations show a seasonal shift of the ITCZ, which is having a direct impact on precipitation in the region. These climate modelling efforts at KAUST show that some research centers in the region are rapidly developing capacity in climate modelling.

28. The Centre of Excellence for Climate Change Research (CECCR) of King Abdulaziz University provided an overview of its activities. The CECCR director explained that RegCM4, WRF and PRECIS models were used to simulate past climate and make climate projections for the Arab region. The models have in general adequately represented past climates. Its climate projections show an overall warming trend and a general decline in precipitation, particularly in the north of the region. The CECCR hosts high performance computing facilities to support high resolution simulations. The CECCR indicated its interest in conducting regional climate modelling and collaborating with other partners in the Regional Initiative.

29. In response to a question regarding validity and accuracy of climate models, CECCR explained that an ensemble of models is used to help characterise uncertainty. CECCR also emphasized the importance of carrying out hydrological modelling to assess the impact on water resources. In response to a question by WMO regarding the operational value and use of these models, CECCR indicated that it cooperates with the national meteorological centre in Saudi Arabia. CECCR is also seeks cooperation with doctoral students to support its research program.

30. The UNESCO/Cairo Office gave an overview of UNESCO's strategy for action on climate change. The strategy focuses on building a climate change knowledge base and supporting climate change mitigation and adaptation. As an implementation component of this strategy, UNESCO is supporting regional climate modelling of the Arab region, which will produce results available to the scientific community by the end of the year. The effort is based on a PRECIS RCM, with an ensemble of runs are being produced to conduct a probabilistic analysis of the outcomes. The baseline climate scenario has already been produced.

31. SMHI presented the preliminary results of the sensitivity analysis undertaken to support selection of the regional climate domain for pursuing climate modelling the Arab region. The assessment process involved comparing performance of alternative domains. The results indicate that there is limited gain in performance by expanding the boundaries of preliminary domain eastward or northward. It also noted that adopting a larger domain requires more expensive computing resources.

32. SMHI indicated that the simulations were produced without tuning the models against observations. WHO reiterated its interest in getting the RCM and vulnerability assessment outputs as soon as possible. The LAS inquired regarding the status of progress and coordination with other initiatives, including those being pursued by the UNDP and the World Bank.

33. The session demonstrated that some Arab research institutes (KAUST, CECCR) have developed capacity (expertise and facilities) to conduct advanced regional climate modelling activities. These institutes along with international organizations (UNSECO/Cairo Office and SMHI) are developing or planning to develop regional climate projections for the Arab region. Preliminary sensitivity analysis results conducted

by SMHI indicate that extending the size of the Arab domain will not add significantly to the performance to RCM. The participants agreed that an ensemble of climate projections is necessary to more adequately characterize uncertainty when generating regional climate projections.

D. SELECTING EMISSIONS SCENARIOS FOR GENERATING CLIMATE CHANGE PROJECTIONS

34. ESCWA gave a general overview of the earlier set of greenhouse gas (GHG) emission scenarios endorsed by the IPCC, and outlined the new set of scenarios endorsed by the IPCC, referred to as representative concentration pathways (RCPs). The presentation explained that RCPs are defined based on the outcome radiative forcing at year 2100 and work backward to present. Two RCPs were proposed for application in the Regional Initiative, namely RCP4.5 and RCP8.5.

35. The WMO gave an overview of the main issues considered in designing the new RCPs. In particular, the new RCPs provide policy-makers with a clear output from given emission scenarios. The previous Special Report on Emissions Scenarios (SRES) storylines started out from a set of global socio-economic conditions and ended in a wide range of potential outputs shrouded in a high degree of uncertainty. The new RCPs are flexible in facilitating the incorporation of regional socio-economic conditions. WMO cautioned against getting too involved in the technical details of RCPs since they are quite complicated and may distract attention from the core issues considered in the Regional Initiative.

36. SMHI summarized the issues to consider in selecting the GCMs and RCPs to be used in the Regional Initiative. It was explained that projections using the same RCM based on different GCMs tend to differ. Consequently, it is important to run several GCMs to more properly capture the uncertainty in the output. It was suggested that the Regional Initiative partners develop a matrix similar to the one used by a European initiative to represent the combination of different RCMs and GCMs that can be applied in order to optimise the use of resources to a cover most combinations. Among the criteria highlighted when selecting a GCM were its ability to represent regional climatic conditions, its availability (since some GCMs may not be available based on the targeted RCP scenarios), and other practical matters such as ease of use and the availability of regional skills to run these models. In discussing the process for selecting RCPs for the Regional Initiative it was emphasized that only few – possibly two – RCPs can be considered for application given limited resources. Also, it was recommended to choose the RCPs being applied by CORDEX members in order to facilitate inter-comparison and leverage of modelling efforts by other institutions and in other domains. It was noted that RCP4.5 and RCP6 only diverge towards the end of the century. Consequently, SMHI proposed that RCP4.5 and RCP8.5 be pursued since they bracket the lower and upper bounds available and since both have been adopted by CORDEX.

37. The participants discussed the selection of RCPs and concurred that RCP4.5 and RCP8.5 be adopted by the Regional Initiative since they reasonably cover the range of potential emissions and are both being used by CORDEX. It was also suggested and approved to form a Technical Task Force to deal with technical issues such as the final selection of the RCPs and GCMs for pursuing regional climate modelling.

38. In response to inquiries by participants on the first day of the EGM regarding the size and scope of the proposed Arab Domain, CECCR presented options for modelling the Comoros in a separate domain which would complement and complete modelling undertaken in the proposed Arab Domain. To assess these options, CECCR developed two climate simulations of the Comoros islands, one at a resolution of 25km x 25km and another at 50km x 50km. The results show that the islands will not be recognized in a model undertaken at a 50km x 50km resolution. However, the 25km x 25km simulation captures the main features of Comoros climate and is therefore recommended as an alternative solution to the less feasible option of expanding the Arab Domain southward to cover Comoros, which would require also modelling most of the African continent.

39. The new IPCC RCPs are preferable to the earlier SRESs as they are better suited for policy-making and constitute the new basis for climate modelling by the international community. The participants recommended RCP4.5 and RCP8.5 for use in the Regional Initiative. These RCPs cover the most plausible range of GHG emission levels and were also chosen for application by CORDOX. A Technical Task Force for coordinating modelling efforts was approved by the participants. A preliminary assessment indicated that regional climate modelling of Comoros be conducted separately, but in complementarity with the Arab Domain projections generated at the 25km x 25 km scale.

E. MOVING FROM REGIONAL CLIMATE MODELLING TO HYDROLOGICAL MODELLING

40. ESCWA gave an overview of the general considerations for moving from regional climate modelling to hydrological modelling. Issues of scale and data requirements were particularly emphasized.

41. SMHI presented the process of selecting hydrological models and associated data requirements. It was proposed that two to three hydrological models be used to simulate hydrological responses from each regional climate projection. A set of criteria were identified for selecting these models that includes: 1) the ability of the model to run at a regional scale; 2) the ability to assess the water balance; 3) the ability to model key hydrological processes; 4) the ability produce daily outputs; 5) determining if the data requirements for running the model are feasible; and 6) confirming that the model is in the public domain and well-documented as being reliable for use. Several hydrological models have been considered, with preliminary results favouring the use of the HBV, HYPE and VIC models.

42. SMHI indicated that hydrological models in the project can be used to simulate extreme flooding events. However, this would require extensive post-analysis of projections which is beyond the current scope of the project. It was noted that although setting up hydrological models can be undertaken in parallel with regional climate modelling efforts, running hydrological models requires outputs from the RCMs. To overcome gaps in data, calibration parameters from selected test basins can be used in non-calibrated basins. To assist in securing this information, the LAS offered to request clearly specified data and information from Arab member states.

43. ACSAD gave an overview of hydrological modeling capabilities at ACSAD and the general rainfall and aquifer recharge conditions in the Arab Region. ACSAD noted its involvement in several surface and groundwater modeling activities, including flash runoff modeling for flood management in Lebanon and groundwater modeling to support water resources management in Damascus.

44. ACSAD gave an overview of the drought conditions in the Mediterranean region with special focus on the Syrian Arab Republic. Different types of indices used in monitoring drought conditions were explained. ACSAD highlighted the drought conditions in Northwest Syria over the past decades which led to the mass migration of farmers, which were turned into internal refugees. Several maps reflecting vulnerability and drought preparedness in Northwest Syria were also presented.

45. ACSAD indicated that they have experience in the modeling mid-size shared watershed such the Orontes river basin, which is shared by Lebanon, the Syrian Arab Republic and Turkey. It was noted that Arab countries contributed significantly to second United Nations Global Assessment Report on Disaster Risk Reduction (GAR2011), particularly in relation to droughts. The issue of whether extreme events can be estimated using RCMs was raised. SMHI – supported by CECCR – indicated that significant post-processing is required to assess extreme events given that RCMs are grid-based and extreme events are point-based, which causes difficulty with respect to scale.

46. The discussion highlighted that hydrological modelling requires extensive regional observational data, which requires access to national hydro-meteorological data. To overcome potential data gaps, the

participants agreed to calibrate models based on test basins where adequate data is available and extrapolate calibration parameters to other basins. It was recommended that at least test one basin is identified in each Arab country. Although output from hydrological models can be used to assess the severity of droughts, it was deemed impractical for assessing extreme flooding events, as this would require extensive post-analysis which is beyond the scope of current projects supporting the Regional Initiative.

F. DEVELOPING A REGIONAL KNOWLEDGE MANAGEMENT PLATFORM

47. UNEP/ROWA presented the main elements of the Nairobi Work Programme (NWP) on impacts, vulnerability and adaptation, including its nine work areas. The assessment component aims at understanding vulnerability to develop adaptive capacity and resilience. Adopted first in 2005 and recently extended, the NWP aims to support developing – particularly least developing – countries in enhancing their capacity to assess impacts and vulnerability to support adaptation to climate change.

48. UNDP presented the main features of the UNDP Arab Climate Change Resilience Initiative. With three consultation workshops completed in 2010, the initiative aims at enhancing the climate change resilience of Arab states in three areas: water and food security, sea level rise and coastal erosion, and sustainable areas. The initiative project document is under preparation, but is expected to be ready in three months.

49. Concern was expressed regarding the pursuit of several UN climate change initiatives in the Arab region with seemingly overlapping roles. UNEP argued that the level of overlapping is not significant. The LAS indicated that they had not been kept informed regarding the status of some of these initiatives.

50. UNISDR emphasized the need to develop reliable baselines on climate-related disasters to properly assess and manage disaster risks. UNISDR cautioned against relying on internationally published databases on disasters since they frequently overlook small and medium-sized disasters which collectively contribute to the bulk of losses in developing countries. Consequently, national governments should work on developing their own databases. UNISDR presented recent efforts pursued in Lebanon, the Syrian Arab Republic and Yemen to compile this information, noting that UNISDR is helping Arab Governments to develop their disaster losses database and offers technical support in conducting disaster risk and adaptation cost-benefit analysis.

51. UNU-INWEH presented their knowledge management strategy and three systems it has implemented, namely IWScience, the Stewardship Tracking System and Dreamcatcher. The IWScience was developed to support the Global Environment Facility (GEF) International Waters project in managing and providing access to their database on shared water resources. The Stewardship Tracking System was developed to manage conservation spatial data. Dreamcatcher is designed to provide mapping services to aboriginal communities. UNU-INWEH concluded by offering to host the Regional Initiative's Arab knowledge management platform in one of its knowledge management systems.

52. ESCWA presented ArcHydro as a potential tool to manage data in the proposed Arab knowledge management platform. Based on ArcGIS (a commercial GIS application) ArcHydro can facilitate the management of spatio-temporal water resource data. The presentation remarked that ArcHydro has been implemented in several knowledge management systems and is potentially valuable in managing the vast simulation outputs that would be generated by from the RCM projections and hydrological models.

53. ESCWA provided a general overview of the type of input and output variables expected from the regional climate and hydrological models, noting that further information was available in a methodological guidance note to be released later in the year.

54. ESCWA subsequently presented the main criteria and activities for setting up a regional knowledge platform. Activities include the collection of baseline data on water resources, establishment of a regional knowledge hub for water information and modeling, archiving of hydrological and meteorological data, and the provision of analytical tools. Several criteria for selecting the knowledge management platform were also proposed including: availability, accessibility, reliability, credibility, affordability, ownership, comprehensiveness and sustainability.

55. The representative from Iraq raised concern regarding the use of different data collection methods in the region and he gave examples of difference among Iraq, the Syrian Arab Republic and Turkey on measuring runoff in the Euphrates river basin. Several participants also emphasized the need for data quality control.

56. Concern was raised over the potential overlap among different climate change initiatives in the region. Participants also identified a pressing need to develop a regional database on climate-related disasters considering that internationally published databases tend to overlook a large number of events. It was also noted that there are several technologies and platforms available to establish the regional knowledge hub.

G. NEXT STEPS

57. In the concluding meeting sessions ESCWA revisited the objectives of the EGM, its main findings and recommendations and proposed a general implementation plan for the Regional Initiative. These recommendations are presented in the “Conclusions and Recommendations” section of this report above.

III. ORGANIZATION OF WORK

A. VENUE AND DATE

58. The Expert Group Meeting on Assessing Climate Change Impacts on Water Resources and Socio-Economic Development in the Arab Region was held from 6 to 7 July 2011 at the United Nations House in Beirut, Lebanon.

B. OPENING

59. The meeting was formally opened by Ms. Anhar Hegazi, Deputy Executive Secretary, a.i. of ESCWA, who delivered the opening statement on behalf of Ms. Rima Khalaf, Executive Secretary of ESCWA. Opening statements were also delivered by Ms. Shahira Hassan Wahbi on behalf of the League of Arab States and Mr. Abdul-Majeid Haddad on behalf of the United Nations Environment Programme Regional Office for West Asia (UNEP/ROWA) and as coordinator of the Regional Coordination Mechanism Thematic Working Group on Climate Change (RCM/TWG-CC).

C. PARTICIPANTS

60. The meeting was attended by 33 participants, including government representatives from ministries working in climate change and water resources from eight ESCWA member countries. In addition, experts in the fields of water resources and climate science from regional and international organizations, as well as representatives from United Nations and League of Arab States organizations, participated in the deliberations. The list of participants is included in the annex of this report.

D. AGENDA

61. Presentations and discussions were made over seven sessions. The agenda of the meeting is summarized below:

- (a) Opening session.
- (b) Presentations on the Regional Initiative – overview and review of the integrated assessment methodological framework.
- (c) Presentations and discussions on current climate change modelling activities in the Arab Region.
- (d) Presentations on regional climate downscaling: delineating the Arab Domain.
- (e) Presentations and discussions on selecting emissions scenarios for generating climate change projections.
- (f) Presentations and discussions on moving from regional climate modelling to hydrological modelling.
- (g) Presentations and discussions on developing a regional knowledge management platform for meteorological and hydrological information.
- (h) Discussion of next steps and closing session.

62. A side event and press conference was organized on the first day of the meeting to release the Second United Nations Global Assessment Report on Disaster Risk Reduction "Revealing Risk and Redefining Development" (GAR2011): Arabic Report. The event was organized by the United Nations International Strategy for Disaster Risk (UNISDR), ESCWA and the United Nations Information Centre (UNIC).

E. EVALUATION

63. An evaluation questionnaire was distributed to assess the relevance, effectiveness and impact of the meeting. The feedback received was positive with nearly all the participants rating the quality of the meeting as very good. The majority of the participants found that the workshop met its objectives and their expectations. The organization was found to be very good and the presentations were deemed to be of good quality by most participants. Almost all the participants found that their expertise was very well suited for the meeting, in addition to providing them with an excellent opportunity to establish contacts and exchange information with other experts from the region.

64. Most of the participants indicated that they would like follow-up activities within the context of the Regional Initiative, greater coordination on the delineation of the Arab Domain, increased involvement of meteorological centres to support data exchange and analysis, and more information on the outputs of RCM applications once available. Regional training workshops on climate change and its impact on the water sector and on climate modelling were also requested.

65. In their written evaluations, some participants recommended the formation of two expert working groups to provide: (1) a matrix showing which RCP projections were available from which GCM models; and (2) a framework for the knowledge management platform. It was also suggested to create a website for exchanging of data and disseminating information on the Regional Initiative; to convene a task force meeting; and to follow-up on the recommendations emanating from this expert group meeting.

F. DOCUMENTATION

66. The list of documents submitted to the meeting is available on the ESCWA website at: <http://www.escwa.un.org/information/meetingdetails.asp?referenceNum=1608E>

ANNEX

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