WORLD CLIMATE PROGRAMME

WORLD CLIMATE APPLICATIONS AND SERVICES PROGRAMME

EXPERT MEETING ON SCOPING GLOBAL SEASONAL CLIMATE UPDATES

12-14 October 2010, Geneva/Switzerland

FINAL REPORT

WORLD METEOROLOGICAL ORGANIZATION
January 2011

The **World Climate Programme (WCP)** implemented by WMO in conjunction with other international organizations consists of the following major components:

- World Climate Research Programme (WCRP)
- World Climate Data and Monitoring Programme (WCDMP)
- World Climate Applications and Services Programme (WCASP)
- World Climate Impact Assessment and Response Strategies Programme (WCIRP)

World Meteorological Organization
7bis, av. de la Paix
Case postale 2300
CH 1211 Geneva
Switzerland

Telephone : +41 (0) 22 730 81 11
Telefax : +41 (0) 22 730 81 81
Email: wmo@wmo.int

NOTE

Participants at GSCU Scoping Meeting

List of Abbreviations

ACMAD	African Centre of Meteorological Application for Development
APCC	APEC (Asian-Pacific Economic Commission) Climate Centre
CCl	WMO's Technical Commission for Climatology
CIIFEN	Centro Internacional para la Investigación del Fenómeno de El Niño
ENSO	El Niño Southern Oscillation
GCM	Global Climate Model
GFCS	Global Framework for Climate Services
GPC	WMO Global Producing Centres for Long-range Forecasts
GSCU	Global Seasonal Climate Update
ICPAC	IGAD (Intergovernmental Authority on Development) Climate Prediction and Applications Centre
IOD	Indian Ocean Dipole
IRI	International Research Institute for Climate and Society
LC-LRFMME	WMO Lead Centre for Long-range Forecast Multi-Model Ensembles
LC-SVSLRF	WMO Lead Centre for Standard Verification System of Long-range Forecasts
LRF	Long-range Forecasting
NAO	North Atlantic Oscillation
NMHS	National Meteorological and Hydrological Service
PWS	WMO's Public Weather Services programme
SST	Sea Surface Temperature
RCC	WMO Regional Climate Centre
RCOF	Regional Climate Outlook Forum

TABLE OF CONTENTS

EXECUTIVE SUMMARY

WMO has been issuing consensus-based El Niño/La Niña Updates on a quasi-regular basis over the past more than a decade, providing useful information on these events of significant importance to regional climate impacts. There has been a widely expressed need to expand on these products, to provide more comprehensive information on the seasonal climate. The Fifteenth Session of the World Meteorological Congress (May 2007), while appreciating the WMO El Niño and La Niña Updates, recommended that other large-scale indices having regional impacts be considered for future Updates. It is considered important that the available multiple sources of monitoring and prediction products be appropriately consolidated, synthesized and communicated to the society as a consensus-based update, including the aspects of the robustness as well as uncertainty in the available information. Accordingly, the concept for a Global Seasonal Climate Update (GSCU) has been elaborated, for further development under the guidance of the Commission for Climatology (CCl) and the Commission for Basic Systems (CBS). CCl formed a Task Team on GSCU to coordinate the GSCU development in consultation with all the relevant stakeholders. WMO Executive Council, at its sixty-second session in June 2010, encouraged these efforts to develop the GSCU.

An international expert meeting on scoping the GSCU was organized by WMO from 12 to 14 October 2010 at WMO Headquarters, Geneva, Switzerland. The meeting was attended by representatives from potential globally-acting user organizations, by communication experts as well as by representatives from NMHSs and regional and global centres providing climate monitoring and prediction information.

The meeting discussed the GSCU concept which had been elaborated with a vision (i) to summarize – on a regular basis – the current status (monitoring) and the expected future behaviour (prediction) of the global climate system including major general circulation features and large-scale oceanic anomalies and (ii) to discuss briefly its likely impacts on continental-scale temperature and precipitation patterns. Respective user requirements as well as communication needs were also reviewed.

The meeting proposed to focus primarily on the development of a GSCU to serve the specific needs of Regional Climate Centres (RCCs), Regional Climate Outlook Forums (RCOFs) and NMHSs in order to elaborate their regional and national climate updates. In parallel, prospects of a GSCU version to be targeted at global user communities as well as the general public will be considered.

Eventually, the meeting developed an outline and an initial draft structure for GSCU, and recommended on its further evolution leading to a pilot phase to build, demonstrate and implement the GSCU on a sustainable basis. The meeting provided valuable inputs for the CCl Task Team on GSCU to co-ordinate its further development.

REPORT OF GSCU SCOPING MEETING

1. Opening

The Expert Meeting on Scoping Global Seasonal Climate Updates was opened at 09.00 hours on Tuesday, 12 October 2010, at WMO Headquarters in Geneva, Switzerland. On behalf of the Secretary-General, Dr Elena Manaenkova, Assistant Secretary-General, welcomed the participants, and noted the importance of the development and use of authoritative climate products. She mentioned the rapid advances in climate monitoring and seasonal prediction in recent years and highlighted the importance of appropriately consolidating and synthesising the available information to be communicated to society. The GSCU would represent an excellent example of an authoritative, new and useful product with great potential.

Mr Jean-Pierre Céron, chairperson of the expert meeting, noted the structure of WMO's Commission for Climatology and that many of its tasks have been designed to support the implementation of the Global Framework for Climate Services (GFCS). He highlighted the importance of the GSCU as one of WMO's contributions to the GFCS.

Mr Avinash Tyagi, Director of the Climate and Water Department of WMO welcomed the participants and encouraged a wide discussion on the subject of the GSCU by considering a range of different options on how best to implement the concept.

2. Organisation of the meeting

2.1 Adoption of the agenda

The agenda was adopted without any changes, as provided in Annex I and b to this report.

2.2 Working arrangements

The meeting agreed its hours of work and other practical arrangements. The list of participants in the meeting is provided in Annex II to this report. The Chairman introduced document INF 4 on the expected outcome of the meeting (Annex III) and set up several informal committees to facilitate the work for various agenda items: Ms Ahira Sanchez-Lugo, Ms Janita Pahalad and Dr Simon Mason were invited to support the GSCU working session under agenda item 7.2. Dr Arun Kumar and Dr Richard Graham were invited to lead discussions under agenda items 8.1 and 8.2 respectively.

3. Introduction: GSCU background and concept evolution

Dr Rupa Kumar Kolli introduced the concept of the GSCU (Annex IV). He referred to the requirements of global organisations in climate-sensitive sectors for, as well as to the keen media interest in, authoritative statements on global seasonal climate state and outlooks. Moreover, regional and national entities and mechanisms, such as RCCs, RCOFs and NMHSs require related global-scale products for respective regional and national services as a complementary source of information.

Dr Kolli described the vision of the GSCU as to update the current state and expected future behaviour of large-scale climate features around the world including their main impacts on continental-scale temperature and precipitation patterns. Amongst the targeted users are NMHSs, regional entities and mechanisms, such as RCCs and RCOFs, the 'globally acting' user community

(e.g. United Nations and aid agencies) and the general public incl. media. Finally, he addressed the expected outcomes of the meeting and highlighted the important task of the meeting to scope the content and format of the GSCU which would provide input to the CCl Task Team on GSCU, which had organised its meeting back-to-back to the expert meeting.

The subsequent discussion highlighted the following aspects recommended to be considered in scoping GSCUs:

- To explore the possibilities of issuing separate versions of the GSCU with tailored information for different user groups
- To identify means by which the GSCU could be 'translated' by related experts to support global planning and decision processes
- To carefully analyse the interface between the GSCU global-scale information content and the global-, regional- and national-scale services provided by regional and national entities with the aims (i) to make sure that the GSCU can be used most efficiently for improved climate services at regional and national scales (where appropriate), and (ii) to address means of ensuring the GSCU does not undermine forecasts issued by regional and national entities.
- To explore possibilities of addressing potential impacts of climate anomalies described in GSCU issues
- To carefully address all aspects involved in communicating uncertainties.

4. Review of user requirements relevant to the GSCU

The meeting was presented with, and discussed, needs for seasonal-scale climate information from different users, including relevant outcomes of the first meeting of the Task Team on Meteorological Services for Improved Humanitarian Planning and Response, which took place on 31 August – 2 September 2010 at WMO premises in Geneva/Switzerland. On the latter aspect, Ms Maryam Golnaraghi also introduced WMO's Disaster Risk Reduction Programme and addressed related requirements for climate products and services (Annex V).

The following relevant aspects of, and requirements for, GSCUs were highlighted:

(i) Global user community:

- Need for pre-analysed information in simple language, avoiding technical jargon
- Need for clear messages including on forecast skill and intensities of expected climate phenomena
- Need for regular information including updates if necessary
- Focus on information on associated impacts of observed and expected climate anomalies
- Need for regional and national-scale information on hazards and extremes
- Need for tailored information, easy to be integrated into users' planning and decision processes.

(ii) Media (and global public respectively):

- Need for clarification on the relevance of the GSCU: why should GSCUs be communicated by the media and to whom (target audience)
- Need for highlighting key messages in simple and understandable language
- To attract the interest of media it is necessary to understand how they work.

(iii) Meteorological community, including regional entities and mechanisms as well as NMHSs etc.:

- Need for timely information on the monthly scale of large-scale climate features as well as parameter-related prediction information relevant to the area of responsibility of RCCs, NMHSs etc.
- Need for easy information access in standardised format
- Need for information on predictability and accuracy

- Need for guidance information on global-scale climate anomalies, including large-scale circulation features, for regional entities and mechanisms, such as RCCs and RCOFs, including advice on how best to communicate skills and uncertainties
- On the receiving side: Need for appropriate technical, climatological and scientific knowledge on how to use GSCU forecast information
- Consider using, to the extent possible, the production process for the GSCU to facilitate capacity building for regional and national services as well as to build links and collaborations to address observational gaps and research needs.

5. Review of the current status of global-scale seasonal climate monitoring and prediction activities

5.1 Availability of operational global-scale climate monitoring products including regional-scale products relevant to global-scale climate monitoring

The meeting was presented with the National Climatic Data Center's (USA) and the UK Met Office's (UK) global climate monitoring activities, which comprise respective datasets, reference climatologies and time series, a broad range of products for different climate-relevant parameters as well as press releases, reports and bulletins. At the National Climatic Data Center the help of communication experts is used to release some of the Center's reports. The meeting was furthermore informed of respective global climate monitoring products generated routinely by the Climate Prediction Center (USA) and the Tokyo Climate Centre (Japan).

5.2 Availability of operational global-scale long-range forecasts including regional-scale products relevant to global-scale long-range forecasts

Dr Richard Graham introduced the concept of WMO Global Producing Centres (GPCs). GPCs have a mandate to provide global-scale long-range forecast information to RCCs, RCOFs and NMHSs following WMO defined standards (incl. mandatory products). He added that there are also other international and national centres (not designated as GPCs) which produce equivalent information, such as the APEC (Asian-Pacific Economic Cooperation) Climate Centre (APCC) and the International Research Institute for Climate and Society (IRI).

GPC, APCC and IRI representatives added specific information on LRF products and services provided by their individual institutions, including the provision of products on monsoon activities, tropical storms, circulation regimes etc. as well as climate information tool kits and tailored sector specific information.

5.3 Products of LC-LRFMME and LC-SVSLRF relevant to the GSCU

Dr Hyun-Suk Kang and Dr Bertrand Denis introduced the functions and goals of the Lead Centres on Long-Range Forecasting Multi-Model Ensembles (LC-LRFMME) and Standard Verification System of Long-Range Forecasts (LC-SVSLRF) respectively.

A list of the URLs of providers of global-scale seasonal climate monitoring and prediction services is included in Annex VI, for more detailed information about all aspects considered above.

6. Review of technical, scientific and general aspects relevant to, and feasibility assessment of, the GSCU concept

6.1 Review of scientific and technical aspects of WMO Climate Watch systems

Mr Omar Baddour introduced the WMO Climate Watch concept (Annex VII). Climate Watch systems are designed to detect, analyse, monitor and predict climate anomalies and related

extremes and to issue related national climate advisories including information on potential negative impacts of such anomalies on societies in close collaboration with, and tailored to the needs of, user communities. Global and regional institutions, mechanisms and products, such as RCCs, RCOFs, and the planned GSCU etc. are expected to provide guidance information to enable NMHSs to deliver such Climate Watch advisories to their users. The respective linkages were highlighted. A series of regional workshops is organised by WMO to assist Members to implement Climate Watch systems.

6.2 Review of scientific and technical aspects of WMOs El Niño/La Niña Update

Dr Rupa Kumar Kolli introduced the concept of WMO El Niño/La Niña Updates, which are being issued on a quasi-regular basis since 1997 (for the latest Update, see http://www.wmo.int/pages/prog/wcp/wcasp/enso_update_latest.html). The respective consensus reports are prepared in close collaboration with the IRI. Contributors include GPCs, RCCs, NMHSs and other global, regional and national entities. Following a call for contributions, contributors provide input, on which basis IRI prepares a first draft, which is circulated amongst all contributors for review and comments. Based on the respective feedback the product is finalised and provided to the NMHSs and issued through a press conference. It has become obvious, that media are strongly interested in information on potential impacts, and this is relevant to the design of the GSCU. Related information requests are usually directed to NMHSs.

6.3 Review of communication aspects of climate monitoring and climate prediction products

The meeting was presented with different aspects of how to communicate climate information to users including media. The following communication requirements were highlighted during this session:

- Need to clearly identify targeted user groups and to work closely with them: To properly communicate climate information requires a good knowledge of the target audience including their needs
- Need to involve user groups and communicators of sectoral user groups (including media) to tailor climate information appropriately
- Need to provide climate information in clear and simple terms to avoid misinterpretation
- Need to ensure (and to communicate) full credibility and legitimacy of climate information providers
- Need to collaborate with users on the issue of impact information, e.g. impact data bases etc.
- To improve the communication of climate information to the media requires a threefold approach: (i) to improve communication skills of climatologists, (ii) to train journalists on communicating climate information, and (iii) to consider engaging professional ‘translators’ for climate information (when appropriate)
- Need to improve the communication of aspects of uncertainty
- Need to involve users including media representatives in the development of the GSCU
- Climate information to be communicated must be relevant for users and users need to be enabled to understand this relevance.

Mr Samuel Muchemi addressed WMO’s Public Weather Services Programme, which assists NMHSs to acquire skills in effective communication through training, projects, publications and best practises etc. PWS can also assist to efficiently communicate the GSCU to users.

6.4 Review of consensus development processes for climate monitoring and climate prediction products

Mr Jean-Pierre Céron introduced the consensus processes involved in RCOFs as well as in generating the Global Climate Bulletin issued by Météo-France. The approach used in RCOFs basically includes the following steps:

- Discussion on SST evolution as predicted by the different GCMs
- Discussion on large-scale circulation features and impacts
- Draft of a respective intermediate forecast
- Consensus discussion to merge the intermediate forecast draft with national forecasts and related expertise on national and local scale
- Consensus discussion on the number and limits of the different zones and associated probabilities.

Based on these experiences, the following suggestions were made to guide the GSCU-related consensus process:

- Provision of clear guidance material on the approach and steps to be followed
- Identification of a lead co-ordinator
- Implementation of a stepwise approach with consolidated intermediate conclusions
- Allocation of enough time for full discussion, and
- Preparation of appropriate material prior to the consensus discussion.

6.5 Review of practical aspects of global-scale climate monitoring analyses and long-range forecasting and GSCU feasibility assessment

The experts discussed the pros and cons of subjective and objective consensus approaches for producing the GSCU. There was strong support for an automated, objective process, which need to be fully described in order to be transparent and reproducible. Though it was recognised that in practice there is value in using expert interpretation of e.g. known biases in model predictions to adjust the objective output, full understanding of such biases over the range of GPC models are not yet available. It was proposed that use of forecaster interpretation to modify the objective forecast should be explored in the pilot phase.

Further practical aspects to be considered comprise the challenge of achieving full consistency between the monitoring and prediction information provided (e.g. use of the same historical reference periods to express observed and predicted climate anomalies, use of the same presentation format, e.g. tercile categories for both observed and predicted quantities) as well as the timing issue of prediction information (GSCU issuance time must provide sufficient lead and forecast range to be useful to its users). Furthermore, based on current experiences with WMO's El Niño/La Niña Update, ways to accelerate the GSCU production process need to be explored. Eventually, aspects of forecast skill and its appropriate communication need to be considered very carefully.

It was further noted that it was not clear what would constitute a 'sufficient' set of climate indices that would enable the GSCU to cover likely influences over the globe. Definition of the sufficient set and a review of current understanding of their characteristics and influences on regional temperature and precipitation variability would be a very useful tool for the generation of the GSCU. It was recommended that the CCl Task Team on GSCU consider how this need might be addressed.

7. GSCU concept development

7.1 Content and structure of the GSCU

Mr Peer Hechler presented a proposal for an outline of the GSCU for discussion (Annex VIII). Mr Shotaro Tanaka provided skill information for different large-scale circulation features as produced by the Tokyo Climate Centre and proposed a Web portal for national seasonal forecasts.

The subsequent discussion resulted in the following proposal for a general structure of the GSCU, which shall be targeted to assist regional and national entities and mechanisms, such as RCCs, RCOFs, international organisations, such as ACMAD and ICPAC etc. as well as NMHSs.

The proposal reflects (i) the current prediction skill at LRF timescales for major global climate circulation features and climate parameters, and (ii) the fact, that SST patterns are the main source for predictive skill in operational LRF.

Proposed general structure of the GSCU:

Date of issuance

Introductory note

***0 Executive summary**:*
- *Most striking features of the current GSCU*

1 Global-scale climate monitoring results for the previous 3 months
- *Global temperature and SST anomalies (maps and text discussion)*
- *Linked major circulation features, such as ENSO (maps and text discussion)*
- *Global precipitation anomalies (map and text discussion)*
- *Global hazards (event map and text discussion) and attribution (where possible)*
- *For consideration: information on environmental impact (e.g. coral bleaching), tropical storms, monsoons, sea ice extent, snow cover*

2 Potential evolution of the state of the climate over the next 3 months
- *Note on prominent features as well as RCOFs scheduled during forecast period*
- *ENSO maps (incl. plumes) and text discussion*
- *Global SST evolution (forecast and skill map) and text discussion incl ENSO, IOD, NAO impacts*
- *Global temperature evolution (forecast and skill map) and text discussion*
- *Global precipitation evolution (forecast and skill map) and text discussion*

3 How to use the Global Seasonal Climate Update

4 References

5 Acknowledgements

It was proposed to link, to the widest extent possible, information provided in the monitoring and prediction sections and to issue the information in form of maps with some guiding expert assessment in text form. It was furthermore suggested to consider maintaining a GSCU Web Site with additional background and climate information.

7.2 Working session on compiling a GSCU 'on the spot'

In a special working session, the meeting was invited to compile a GSCU 'on the spot' using operationally available climate monitoring information and long-range forecasts. Mr. Peer Hechler introduced a document with relevant information to facilitate the working session (Annex VI) and also an initial GSCU outline (Annex VIII) as a starting point for discussions.

Annex IX illustrates -as a draft outcome of the working session -the principle style a GSCU could look like. The following aspects were highlighted during the working session and its subsequent discussion session:

- Consider noting the different seasonal events around the globe (e.g. Asian monsoon, East Africa short rains) addressed by one issue of the GSCU
- Need for a close co-ordination amongst the GSCU monitoring and prediction part contributors to ensure as much information consistency as possible
- Need to distinguish between data and products needed to facilitate the GSCU consensus discussions and those, which will be part of the final GSCU edition

- Need to thoroughly take account of production timetables of relevant GSCU input products
- The current practice of using different reference climatologies to express observed and predicted climate anomalies poses a huge challenge to the production of the GSCU
- Consider introducing tercile anomaly maps in the climate monitoring part of the GSCU
- Note that some desired GSCU input products are not yet available from all GPCs and associated Lead Centres. For example, multi-model probability forecast maps of tercile category, multi-model skill maps, ROC maps for the most likely tercile etc.
- Consider providing a timetable of RCOFs planned worldwide during the time period covered by the GSCU forecast information
- Explore the most suitable lead time for the GSCU prediction section, taking into account related user requirements
- Explore potentials for a monthly global climate update.

8. GSCU pilot phase

8.1 GSCU production aspects and working arrangements

The meeting discussed several practical aspects involved in the GSCU production and related working arrangements. It was agreed to work towards a set of minimum requirements for the GSCU production (see next paragraph).

8.2 Implementation plan for a pilot phase of GSCU production

The meeting discussed and specified aspects to be clarified for, and addressed in, an implementation plan for the GSCU pilot phase, such as:

- Specification of a GSCU minimum format
- Specification of the work that needs to be done to achieve a minimum format GSCU
- Organisation of preparatory work to be done
- Identification of a pilot phase team for GSCU development reviews
- Identification of an appropriate production scheme to routinely achieve the expected GSCU format.

The meeting agreed on the following stepwise approach for the specification and implementation of the pilot phase GSCU:

- Compilation of a GSCU Mark 0 version to be circulated amongst the participants in the scoping meeting (*Note: Mark 0 describes an illustrative example of the GSCU based on the outcome of the working session as provided in Annex IX*).
- Compilation of a GSCU Mark 1 version to be circulated amongst pilot phase participants (*Note: Mark 1 describes a pre-operational version of the GSCU following a minimum format to be defined*)
- Revision of the GSCU Mark 1 version based on comments received
- Start of 1 year pilot phase.

The meeting agreed on a set of related conclusions and recommendations (Rec3- Rec6) which were reviewed during the final session of the meeting (cf. section ‘Conclusions and Recommendations’ below).

9. Any other business

No further items were raised by the participants.

10. Conclusions and recommendations

In conclusion, the meeting recognised the importance of this GSCU initiative for the GFCS.

In summary, the following recommendations were made during the meeting:

Rec1 To start with the development of a tailored GSCU to address the needs of regional and national meteorological entities and mechanisms, such as RCCs, RCOFs, regional institutions (ACMAD, ICPAC, CIIFEN etc), NMHS, etc

Rec2 To start with a quarterly production and issuance of the GSCU Mark 1 and, during the pilot phase, to investigate the viability of a monthly production cycle

Rec3 To request the CCl Task Team on GSCU:

- To lead the definition of a GSCU Mark 1 minimum format, to circulate it amongst the scoping meeting participants (by December 2010) and to revise the proposal accordingly
- To lead the compilation of a GSCU Mark 0, to circulate it amongst the scoping meeting participants and to revise it accordingly (by March 2011)
- To lead the identification of the work required and the time needed to achieve the Mark 1 minimum format (by June)
- To determine the exact timing of the GSCU Mark 1 production taking into consideration aspects of lead time requirements
- To start, within the proposed GSCU pilot phase, a specific dialogue with potential GSCU global users including media to explore possibilities of tailoring its executive summary information to better meet their respective needs. This activity should consider existing collaborations and mechanisms with the global user community, including the work of the CBS Task Team on Meteorological Services for Improved Humanitarian Planning and Response. To tackle this activity, the Task Team should take into account the potential conflict of interests between WMO's mandate to serve its Members versus meeting global user's needs, and should propose a related appropriate co-ordination mechanism with WMO regional and national entities.

Rec4 WMO Secretariat to send a letter to all institutions represented at the scoping meeting and other relevant organisations, inviting them to express interest in contributing to the GSCU Mark 1 production process (by June 2011). It is suggested to attach to this letter a GSCU Mark 0 version for illustration as well as the proposed GSCU Mark 1 minimum format including an indication of the work required to achieve GSCU Mark 1. Furthermore, the letter should indicate the intent to investigate the viability of a monthly production cycle.

Rec5 To present to the 16th World Meteorological Congress a GSCU Mark 0 for illustration as well as the proposed GSCU Mark 1 minimum format including an indication of the work required and time needed to achieve GSCU Mark 1.

Rec6 To urge GPCs and their associated Lead Centres (e.g. LC-LRFMME and LC-SVSLRF) and other global producers of climate monitoring and prediction information (e.g. IRI, APCC, etc) to support the work of the CCl Task Team on GSCU in tackling the necessary preparations for the GSCU Mark 1 pilot.

11. Closing

In closing, Mr Jean-Pierre Céron thanked all the participants for their dedication and valuable inputs to the subject. On behalf of CCl, he expressed his satisfaction with the meeting outcomes and thanked the WMO Secretariat for their support to facilitate the meeting.

Dr Rupa Kumar Kolli on behalf of the Secretariat and its Secretary-General expressed his gratitude to all the voluntary support provided in preparing and conducting the meeting successfully. He stressed the fact that it is such kind of engagement which helps WMO to meet their Members' needs.

The meeting was closed by its chairperson on Thursday, 14 October 2010 at 4 p.m.

Annex I

PROVISIONAL AGENDA

1. OPENING

2. ORGANIZATION OF THE MEETING

2.1 Adoption of the agenda
2.2 Working arrangements

3. INTRODUCTION: GSCU BACKGROUND AND CONCEPT EVOLUTION

4. REVIEW OF USER REQUIREMENTS RELEVANT TO THE GSCU CONCEPT

5. REVIEW OF THE CURRENT STATUS OF GLOBAL-SCALE SEASONAL CLIMATE MONITORING AND PREDICTION ACTIVITIES

5.1 Availability of operational global-scale climate monitoring products including regional–scale products relevant to global-scale climate monitoring
5.2 Availability of operational global-scale long-range forecasts including regional–scale products relevant to global-scale long-range forecasts
5.3 Products of LC-LRFMME and LC-SVSLRF relevant to the GSCU

6. REVIEW OF TECHNICAL, SCIENTIFIC AND GENERAL ASPECTS RELEVANT TO, AND FEASIBILITY ASSESSMENT OF, THE GSCU CONCEPT

6.1 Review of scientific and technical aspects of WMO Climate Watch systems
6.2 Review of scientific and technical aspects of WMO's El Niño/La Niña Update
6.3 Review of communication aspects of climate monitoring and climate prediction products
6.4 Review of consensus development processes for climate monitoring and climate prediction products
6.5 Review of practical aspects of global-scale climate monitoring analyses and long-range forecasting and GSCU feasibility assessment

7. GSCU CONCEPT DEVELOPMENT

7.1 Content and structure of the GSCU
7.2 Working session on compiling a GSCU 'on the spot'

8. GSCU PILOT PHASE

8.1 GSCU production aspects and working arrangements
8.2 Implementation plan for a pilot phase of GSCU production

9. ANY OTHER BUSINESS (AOB)

10. CONCLUSIONS AND RECOMMENDATIONS

11. CLOSING

The meeting will be followed by a one day meeting of the CCl Task Team on GSCU (15 October 2010, Geneva/Switzerland).

EXPLANATORY MEMORANDUM RELATED TO THE PROVISIONAL AGENDA

1. OPENING

The Expert Meeting on Scoping Global Seasonal Climate Updates will be opened at 09.00 hours on Tuesday, 12 October 2010, at WMO Headquarters in Geneva, Switzerland.

2. ORGANIZATION OF THE MEETING

2.1 Adoption of the agenda

The Chairperson will invite the Expert Meeting to consider the provisional agenda with the view to its adoption.

2.2 Working arrangements

The Meeting will agree on the details concerning the organization of its work, including the working hours and any other practical session arrangements. The documentation for the meeting and the meeting itself will be in English. A documentation plan has been developed (INF 1) to assist participants to prepare for the meeting, which has been posted on the WMO Web site at:

http://www.wmo.int/pages/prog/wcp/wcasp/GSCU.html

3. INTRODUCTION: GSCU BACKGROUND AND CONCEPT EVOLUTION

The Meeting will be presented with the GSCU concept including its linkages to, and relevance for, NMHSs as well as existing climate-relevant entities and mechanisms, such as GPCs, RCCs and RCOFs, but also the GFCS. Furthermore, related background information will be provided recalling the relevant decisions of the Executive Council and statements adopted by the fifteenth session of the Commission for Climatology (Antalya, Turkey, February 2010) as well as recommendations of the CCl Management Group (Geneva, Switzerland, May 2010) and the CBS Expert Team on Extended and Long-range Forecasting (Exeter/UK, June/July 2010). The meeting will be informed on the implementation of a dedicated CCl Task Team on Global Seasonal Climate Updates including its Terms of Reference (ToR) and membership.

4. REVIEW OF USER REQUIREMENTS RELEVANT TO THE GSCU CONCEPT

The meeting will be presented with, and is invited to discuss, needs for seasonal-scale climate information of different users, amongst them the World Food Programme, the Red Cross, the Inter Agency Standing Committee's Sub-Committee on Early Warning and Early Action Reports, WMO Regional Climate Centres (RCCs) and related potential candidates, Regional Climate Outlook Forums (RCOFs), NMHSs etc.

Furthermore, the meeting will be briefed on relevant outcomes of the first meeting of the Task Team on Meteorological Services for Improved Humanitarian Planning and Response, which took place on 31 August – 2 September 2010 at WMO premises in Geneva/Switzerland.

5. REVIEW OF THE CURRENT STATUS OF GLOBAL-SCALE SEASONAL CLIMATE MONITORING AND LONG-RANGE FORECASTING ACTIVITIES

5.1 Availability of operational global-scale climate monitoring products including regional–scale products relevant to global-scale climate monitoring

The meeting will be presented with operationally available global-scale climate monitoring products including regional-scale products relevant to global-scale climate monitoring with a special focus on the seasonal scale including its production cycles, accessibility and product characteristics, such as reference climatologies used etc. The presentations include WMO climate system monitoring activities, such as the WMO Annual Statement on the Status of the Global Climate.

5.2 Availability of operational global-scale long-range forecasts including regional–scale products relevant to global-scale long-range forecasts

The meeting will be presented with operationally available global-scale long-range forecast products including regional-scale products relevant to global-scale long-range forecasts with a special focus on the seasonal scale including its production cycles, accessibility and product characteristics, such as model climatologies used etc.

5.3 Products of LC-LRFMME and LC-SVSLRF relevant to the GSCU

The meeting will be presented with operational products and services of the WMO Lead Centres for Long-Range Forecasting Multi-Model Ensemble (LC-LRFMME) and for Standard Verification System for Long-Range Forecasting (LC-SVSLRF) relevant to the generation of seasonal outlooks.

6. REVIEW OF TECHNICAL, SCIENTIFIC AND GENERAL ASPECTS RELEVANT TO, AND FEASIBILITY ASSESSMENT OF, THE GSCU CONCEPT

6.1 Review of scientific and technical aspects of WMO Climate Watch systems

The concept of climate watches is designed to provide advisories (climate watches) to inform the users, particularly those involved in natural hazards preparedness, mitigation and response on ongoing, pending and/or expected climate anomalies and their negative impacts. The meeting will be briefed on the different scientific and technical aspects involved in the implementation of climate watch systems including potential linkages to the GSCU as an important source of global-scale information.

6.2 Review of scientific and technical aspects of WMO's El Niño/La Niña Update

WMO, in close collaboration with its partners issues the El Niño/La Niña Update to inform Members as well as the general public of the latest development and most likely future evolution of the El Niño/La Niña phenomenon. The update, which is well received by the user community, is generated through an international subjective consensus process. The meeting will be briefed on the different scientific and technical aspects, and lessons learnt, involved in the generation of the WMO El Niño/La Niña Update.

6.3 Review of communication aspects of climate monitoring and climate prediction products

Communication of climate monitoring and prediction products requires user-oriented language including dedicated consideration of aspects of uncertainty and probability. Moreover, scientists might often face questions on the potential impact of their information on societies. The meeting will be invited to share related experiences and to discuss best practices relevant to the communication of the GSCU.

6.4 Review of consensus development processes for climate monitoring and climate prediction products

Building on the experiences made in the production of the WMO El Niño/La Niña Updates as well as in RCOFs worldwide, the meeting will be briefed on the consensus development process and will be invited to consider its pros and cons w.r.t. the production of the GSCU.

6.5 Review of practical aspects of global-scale climate monitoring analyses and long-range forecasting and GSCU feasibility assessment

Based on the information given under the previous agenda items, the meeting will be invited to discuss practical aspects for generating a global-scale climate monitoring analysis and long-range forecast product relying on existing products and information considering e.g. current production cycles, comparability of reference climatologies, existing coordination mechanisms, current levels of forecast skill etc.

GPCs will be invited to share methodologies on how to synthesise model outputs in order to issue a forecast.

On the basis of the information provided so far the meeting is invited to brainstorm on, and assess the feasibility of, the GSCU concept, discuss its opportunities and strengths as well as its challenges and constraints and provide recommendations for its further concept development.

7. GSCU CONCEPT DEVELOPMENT

7.1 Content and structure of the GSCU

The meeting will be invited to discuss the content and structure of the GSCU. Discussions are expected to include elaborating a list of large-scale climate features to be addressed, indices and parameters to be used and/or targeted on, geographical and temporal coverage of the GSCU etc. Furthermore, the potential of the GSCU for, its linkages to and its potential impact on, (i) existing publications and statements, such as the WMO El Niño/La Niña Update and the WMO Annual Statement on the Status of the Climate, (ii) mandates of, and services provided by, GPCs, RCCs, and RCOFs and (iii) responsibilities and products of NMHSs are expected to be addressed during the discussions.

7.2 Working session on compiling a GSCU ‘on the spot’

In a special working session, the meeting will be invited to compile a GSCU ‘on the spot’ using operationally available climate monitoring information and long-range forecasts.

8. GSCU PILOT PHASE

8.1 GSCU production aspects and working arrangements

The meeting will be invited to discuss aspects of producing GSCUs routinely and to recommend on information sources to be used. Specifically, the meeting will be invited to consider, and recommend on, working arrangements and responsibilities for the production of GSCUs, including identification of a lead co-ordinator, agreement on the flow of information in order to facilitate the generation of the GSCUs, production cycles, review processes, release mechanisms as well as a communication strategy for stakeholders (GPCs, RCCs, NMHSs) etc. The role of the CCl Task Team on the GSCU in the further evolution of the GSCU will be highlighted.

8.2 Implementation plan for a pilot phase of GSCU production

The meeting will be invited to discuss, and agree on, arrangements for a pilot phase for the quasi-operational production of the GSCU including the provision of a GSCU prototype to the World Meteorological Congress in June 2011.

9. ANY OTHER BUSINESS (AOB)

The meeting may consider any other issues requiring actions or discussion by the experts.

10. CONCLUSIONS AND RECOMMENDATIONS

The experts will develop their joint conclusions and recommendations as appropriate.

11. CLOSING

The expert meeting on scoping Global Seasonal Climate Updates is estimated to close at 17:00 on Thursday, 14 October 2010.

LIST OF PARTICIPANTS

Australia

Ms Janita PAHALAD
Bureau of Meteorology
700 Collins Street, Docklands
MELBOURNE, VICTORIA
Tel: +613 9669 4781
Fax: +613 9669 4678
E-mail: j.pahalad@bom.gov.au

Barbados

Mr Adrian TROTMAN
Caribbean Institute for Meteorology & Hydrology (CIMH)
Husbands, St. James,
P.O. Box 130
BRIDGETOWN
Tel: +1246 425-1362/65
Fax: +1246) 424 4733
E-mail: atrotman@cimh.edu.bb

Brazil

Dr Caio Augusto DOS SANTOS COELHO
Instituto Nacional de pesquisas Espaciais (INPE)
Centro de Previsão de Tempo e Estudos Climáticos (CPTEC)
Rodovia Presidente Dutra, Km 40, SP-RJ
CACHOEIRA PAULISTA, SP 12630-00
Tel: +5512 3186 8670
Fax: +
E-mail: Caio.coelho@cptec.inpe.br

Canada

Dr Alex CANNON
Meteorological Service of Canada
Environment Canada
201-401 Burrard Street
VANCOUVER, BC, V6C 3S5
Tel: +1 604 664 9245
Fax: +1 604 664 9004
E-mail: alex.cannon@ec.gc.ca

Dr Bertrand DENIS
Meteorological Service of Canada
2121 Trans-Canada Highway
Dorval (QC) H9P 1J3
Tel: +1 514 421 7264
Fax: +1 514 412 4657
E-mail: Bertrand.Denis@ec.gc.ca

China

Dr Peiqun ZHANG
National Climate Center
China Meteorological Administration
46 Zhongguancun Nandajie, Haidian
BEIJING
Tel: +86 10 6840 7175
Fax: +86 10 6840 6975
E-mail: zhangpq@cma.gov.cn

France

Mr Jean-Pierre CERON
Météo-France
42, avenue Gaspard Coriolis
31057 TOULOUSE, Cédex 1
Tel: +33 5 6107 8310
Fax: +33 5 6107 8309
E-mail: Jean-pierre.ceron@meteo.fr

Germany

Dr Peter BISSOLLI
Deutscher Wetterdienst
Department of Climate Monitoring (KU23b)
P.O. Box 10 04 65
63004 Offenbach
Tel. +49 69 8062 2936
Fax: +49 69 8062 3759
Email: peter.bissolli@dwd.de

Japan

Mr Shotaro TANAKA
Climate Prediction Division
Global Environment and Marine Dept
Japan Meteorological Agency
1-3-4 Otemachi, Chiyoda-ku
TOKYO 100-8122
Tel. +81 3 3211 8406
Fax: +81 3 3211 8406
Email: tanaka@met.kishou.go.jp

Kenya

Dr Christopher OLUDHE
University of Nairobi
Department of Meteorology
Box 30197
NAIROBI
Tel: +254 722 866106
Fax: +
E-mail: coludhe@uonbi.ac.ke

Korea, Republic of

Dr Hyun-suk KANG
National Institute of Meteorological Research
Korea Meteorological Administration
SEOUL
Tel: +82 2 6712 0306
Fax: +82 2 834 5922
Email: hyunsuk@kma.go.kr

The Netherlands

Prof. Holger MEINKE
Centre for Crop Systems Analysis
Department of Plant Sciences
Wageningen University
Droevendaalsesteeg 1,
6708 PB WAGENINGEN
Tel: +31 3174 84772
Fax: +31 6131 76077
Email: holger.meinke@wur.nl

Russian Federation

Dr Vladimir KRYJOV
Hydrometeorological Research
Centre of Russia
11-13 Bol. Predtechensky Pereulok
MOSCOW
Phone: +7 499 795 2326
Fax: +7 499 255 1582
Email: kryjov@mecom.ru;
kryjov@yahoo.co.uk

Slovenia

Mrs Tanja CEGNAR
Environmental Agency of the
Republic of Slovenia
Vojkova ulica 1/B
SI-1000 LJUBLJANA
Tel: +386 51 671 721
Fax: +386 1 280 4074
Email: tanja.cegnar@gov.sl

South Africa

Mr Jacobus Willem OLIVIER
South African Weather Service
442 Rigel Avenue South
Erasmusrand
PRETORIA, 0181
Tel: +27 12 367 6008
Fax: +27 12 367 6189
Email: cobus.olivier@weathersa.co.za

United Kingdom

Mr Richard GRAHAM
Met Office
Hadley Centre
Fitzroy Road
Devon EX13PB
EXETER
Tel: +44 1392 886 361
Fax: +44 1392 885 681
Email: richard.graham@metoffice.gov.uk

Mr David E. PARKER
Met Office
Hadley Centre
Fitzroy Road
Devon EX13PB
EXETER
Tel: +44 1392 886 649
Fax: +44 1392 885 681
Email: david.parker@metoffice.gov.uk

United States of America

Dr Arun KUMAR
Climate Prediction Center
National Centers for Environmental
Prediction
World Weather Building Room 605
5200 Auth Road
CAMP SPRINGS
Maryland (MD) 20746-4304
Tel: +1 301 763 8000 Ext 7579
Fax: +1 301 763 8125
E-mail: arun.kumar@noaa.gov

Ms Ahira SANCHEZ-LUGO
National Oceanic and Atmospheric
Administration (NOAA)
151 Patton Avenue
ASHEVILLE, NC 28801
Tel: +828-271-4380
Fax: +828-271-4876
Email: ahira.sanchez-lugo@noaa.gov

International Organizations

Mr Mohammed KADI
African Centre of Meteorological Applications for Development **(ACMAD)**
85, Avenue des Ministères
BP 13184 NIAMEY
Niger
Tel: +227 20 734 992
Fax: +213 21 723 627
E-mail: kadi_metdz@yahoo.com

Dr Bong-Geun SONG
APEC Climate Center **(APCC)**
1463 U-dong Haeundae-gu
Busan 612-020
Republic of Korea
Tel: +82-51-745-3931
Fax: +82-51-745-3949
Email: songbg@apcc21.net

Dr Laura FERRANTI
European Centre for Medium-Range Weather Forecasts **(ECMWF)**
Shinfield Park
READING RG2 9AX
United Kingdom
Tel: +44 118 949 9601
Fax: +44 118 986 9450
Email: Laura.ferranti@ecmwf.int

Dr Simon MASON
International Research Institute for Climate & Society **(IRI)**
232 Monell Building
61 Route 9W
PALISADES, NEW YORK 10964-8000
USA
Tel: +1 845 680 4514
Fax: +1 845 680 4865
Email: simon@iri.columbia.edu

Mr Patrick LUGANDA
Network of Climate Journalists for the Greater Horn of Africa
Off Kampala-Jinja Highway
Old Namily Yango Road
c/o Farmers Media Link Centre
SEETA-MUKONO, KAMPALA
Uganda
Tel: +256 752 814 134
Fax: +256 414 251 797
Email: patrick_luganda@yahoo.com

Frederick SPIELBERG
Office of Emergency Programmes
United Nations Children's Fund **(UNICEF)**
5-7 Avenue de la Paix
1211 GENEVA
Switzerland
Tel: +41 22 909 5627
Fax: +41 22 909 5902
Email: fspielberg@unicef.org

Ms Joy GUILLEMOT
Climate Change and Human Health
Public Health and Environment Department
World Health Organization **(WHO)**
20 Avenue Appia
CH-1211 GENEVA 27
Switzerland
Tel: +41 22 791 2606
Fax: +41 22
Email: guillemotj@who.int

WMO SECRETARIAT
7bis, Avenue de la Paix
CP 2300
CH-1211 GENEVA 2
Switzerland

CLIMATE AND WATER (CLW)

Mr Avinash C. TYAGI
Tel: +41 22 730 8355
Email: ATyagi@wmo.int

Dr Mannava V.K. SIVAKUMAR
Tel: +41 22 730 8380
Email: MSivakumar@wmo.int

Dr Rupa Kumar KOLLI
Tel: +41 22 730 8377
Email: RKolli@wmo.int

Mr Amir DELJU
Tel: +41 22 730 83607
Email: ADelju@wmo.int

Mr Robert STEFANSKI
Tel: +41 22 730 8305
Email: RStefanski@wmo.int

Ms Leslie MALONE
Tel: +41 22 730 8220
Email: LMalone@wmo.int

Mr Peer HECHLER
Tel: +41 22 730 8302
Email: PHechler@wmo.int

OBSERVING AND INFORMATION SYSTEMS (OBS)

Mr Omar BADDOUR
Tel: +41 22 730 8268
Email: OBaddour@wmo.int

WORLD CLIMATE RESEARCH PROGRAMME (WCRP)

Ms Valery DETEMMERMAN
Tel: +41 22 730 8242
Email: VDetemmerman@wmo.int

Mr Vladimir RYABININ
Tel: +41 22 730 8486
Email: VRyabinin@wmo.int

WEATHER AND DISASTER RISK REDUCTION SERVICES (WDS)

Ms Maryam GOLNARAGHI
Tel: +41 22 730 8006
Email: MGolnaraghi@wmo.int

Mr Samuel MUCHEMI
Tel: +41 22 730 8137
Email: SMuchemi@wmo.int

CABINET AND EXTERNAL AFFAIRS (CER)
Ms Carine VAN MAELE
Tel: +41 22 730 8315
Email : CVanmaele@wmo.int

Ms Clare NULLIS
Tel: +41 22 730 8478
Email: CNullis@wmo.int

Annex III

EXPECTED OUTCOMES

Proposed discussions during the meeting, and specifically under agenda items 7 (GSCU Concept Development) and 8 (GSCU Pilot Phase), are expected to address the following aspects:

- Target audience and respective user requirements
- Content of the GSCU monitoring component
- Content of the GSCU prediction component (including skill considerations)
- Operational production procedures including development of consensus and coordination mechanism
- Issuance schedule
- Access to the GSCU (public or restricted, or differentiated)
- Communication of the GSCU (including, e.g. aspects of uncertainty)
- GSCU in the context of related regional and national activities.

The expected outcome expert meeting is three-fold:

(i) To agree on, and recommend, a concept for GSCU including its outline and structure and how to proceed.

(ii) To agree on an outline of an implementation plan for a GSCU Pilot Phase including its length and review process, responsibilities and arrangements etc.

(iii) To mandate the CCl Task Team on GSCU on relevant follow-up actions.

GLOBAL SEASONAL CLIMATE UPDATES (GSCU)

Consensus Statements on the Status of Global Seasonal Climate and Outlook

Concept Note

Preamble

The Executive Council, at its Sixty first session (June 2009, Geneva), urged Members to avail themselves of the products of the network of Global Producing Centres of Long-Range Forecasts (GPCs) and Lead Centres, and urged the CCl and CBS to promote and guide the uptake of GPC products within Regional Climate Centres (RCCs), Regional Climate Outlook Forums (RCOFs) and National Meteorological and Hydrological Services (NMHSs) for operational climate prediction (EC-LXI Report, Paragraph 3.2.3.7).

The Fifteenth Session of the Congress (May 2007, Geneva), while appreciating the WMO publication of global consensus-driven El Niño and La Niña Updates, recommended that other large-scale indices having regional impacts be considered for future Updates (Cg-XV Report, Paragraph 3.2.5.12). CCl and CBS are actively cooperating in the development and communication of climate monitoring and prediction products. The need to strengthen the production, availability, delivery and application of science-based climate prediction and services was emphasised by the World Climate Conference-3. In this context, GPCs, RCCs, RCOFs and NMHSs have been recognized to be an effective conduit to facilitate the essential flow of climate information from global to local scales.

1. Vision

A Global Seasonal Climate Update is issued jointly by experts of the GPCs, related Lead Centres and monitoring centres acting on the global scale, with input from the Regions (RCCs, NMHSs etc.), a few days ahead of each of the standard seasons (DJF/MAM/JJA/SON).

The Update summarises the current status (monitoring) and the expected future behaviour (prediction) of major general circulation features and large-scale oceanic anomalies around the globe (e.g., ENSO, North Atlantic Oscillation, Indian Ocean Dipole, etc.) and discusses briefly its likely impacts on continental-scale temperature and precipitation patterns. The Update is designed, and thereby standardised, in a way that allows for comparing qualitatively the climate monitoring results of the current Update with the respective climate outlook issued in the previous Update.

Such an Update is used primarily by RCCs, RCOFs and NMHSs in order to elaborate regional and national climate Updates, and also by global user communities such as the Inter Agency Standing Committee (IASC), etc. as well as the general public.

The Global Seasonal Climate Updates, to be delivered routinely through WIS mechanisms (once available), provide the world community with an expert assessment and global consensus on the status of the climate for the current and the upcoming season along with information on robustness and uncertainty of the available signals, thereby contributing to an effective application of science-based climate information in climate risk management. The Global Seasonal Climate Updates feed into the *Annual Statements on the Status of the Global Climate* already being issued by WMO, incorporating both climate monitoring aspects and an assessment of the climate outlooks.

2. Motivation and justification

- Global organizations operating in climate sensitive sectors have expressed the need for a global statement on the coming season's climate;

- The envisaged service builds on existing WMO mechanisms and capabilities, demonstrates and strengthens WMO's service delivery component and, thereby, has the potential to contribute to the goals of the GFCS concept;

- WMO regularly provides global scale climate monitoring information in close co-operation with climate monitoring centres operating on global scales such as the Met Office Hadley Centre, the University of East Anglia/UK, the NCDC/NOAA, JMA, CMA, IMD, BOM and others;

- WMO is actively establishing regional components of a global infrastructure serving climate information and services improvements: RCCs and RCOFs. These regional mechanisms depend on global-scale products and assessments as indispensable input;

- WMO has established a global system for Long-range Forecasting as an integral part of its Global Data Processing and Forecasting System (GDPFS) and put in place a formal designation process. As of June 2010, it consists of 12 GPCs and two Lead Centres for Long-range Forecasting Multi Model Ensembles (LRFMME) and Standard Verification System of Long-range Forecasts (SVSLRF);

- WMO successfully established a consensus mechanism for the well-known El Niño/La Niña Update, which has been well-received worldwide and which has been instrumental in improving consistency, terminology and uptake;

- The success of the El Niño/La Niña Updates can be extended to other aspects of Long-Range Forecasts to enhance the visibility of the GPCs and the associated Lead Centres, the 'climate component' of the GDPFS as well as of WMO as a whole. Other centres operating on global scales for Long-Range Forecasting as well as climate monitoring can be involved in the consensus development process.

3. Endorsement of GSCU Concept

The GSCU concept was presented at the WMO Technical Conference on Changing Climate and Demands for Climate Services for Sustainable Development, which took place from 16 to 18 February 2010, immediately preceding CCl-XV at Antalya, Turkey. The concept was widely supported by the conference participants, and was included as part of the conference recommendations to CCl-XV for strengthening the development and use of climate-related WMO infrastructure and mechanisms. CCl-XV appreciated the initiatives for the development of GSCU,

providing regular global consensus statements on the seasonal climate, through expert assessments of global climate monitoring and outlook products. CCl agreed that the focus of such Updates would be to assist the NMHSs in the interpretation, tailoring and assessments of the reliability of seasonal predictions. CCl urged all GPCs, RCCs/RCC-Networks, RCOFs, NMHSs and other relevant institutions to provide the required inputs and actively support the development of this important product. In pursuance of this decision, GSCU has been included as part of the work plan for the fifteenth intersessional period of CCl (2010-2014). CCl-XV Management Group established a Task Team on GSCU with specific Terms of Reference including:

1. Develop, including through a scoping workshop, a mechanism to generate regular global consensus statements on the seasonal climate, termed Global Seasonal Climate Update (GSCU), through expert assessments of global climate monitoring products of the current season and the outlooks for the ensuing season in terms of the broad patterns of precipitation and temperature, along with the indication of the situation and expected evolution of the major general circulation features of both atmosphere and ocean;

2. Develop practical approaches to facilitate enhanced use of GPC and related Lead Centres' long-range forecast products by RCCs and other regional entities, RCOFs, and NMHSs, including through the GSCU concept;

3. Develop an outline for a consensus statement with a comprehensive assessment of current and coming seasonal global climate anomalies, including the uncertainty aspects, to assist in risk management, adaptation policies and decision making by global partners;

4. Develop an implementation plan to engage potential contributors to develop the GSCU on a trial basis in near-real-time and for limited circulation and peer review;

5. Liaise with the CCl-XV OPACE-2 expert/task teams on aspects of climate monitoring and assessment;

6. Identify lead coordinators for operational production of the GSCU.

CCl-XV Task Team on GSCU has Dr Won-Tae Yun (Korea) as the Lead and Dr Richard Graham (UK) as the Co-Lead.

WMO Executive Council, at its Sixty-second Session (EC-LXII, June, 2010), recognized the widely felt need for consensus-based products like WMO El Niño/La Niña Updates more generally on the seasonal climate prediction, and welcomed the concept of expanding these Updates to other planetary-scale oscillations and their interactions including large-scale climatic impacts. It noted that while challenges to WMO El Niño/La Niña Updates still remain, it encouraged, and urged CCl to work, in collaboration with CBS, to explore the possibility of expanding the Update to become the GSCU. EC-LXII agreed that GSCU should be started on a trial basis, allowing a sufficient period to gain experience and making it reliable and effective. In this context, the Council noted that a number of Members are engaged in sector oriented seasonal predictions (e.g. hydrological and agricultural applications) based on the seasonal climate outlooks and that there is need for bringing consistency in approach to the provision of such climate outlook products.

4. Proposal to convene an international expert meeting on scoping Global Seasonal Climate Updates

In order to facilitate the development of Global Seasonal Climate Updates, it is proposed to organise an international expert meeting, under the auspices of both CCl and CBS, on scoping Global Seasonal Climate Updates, tentatively planned for 12-15 October 2010 at WMO Headquarters, Geneva, Switzerland.

4.1 Objectives

The scoping meeting will consider the development, and outline the mechanism, of regular global consensus statements on the seasonal climate, through expert assessments of global climate monitoring products of the current season and the outlooks for the ensuing season in terms of the broad patterns of precipitation and temperature, along with the indication of the situation and expected evolution of the major general circulation features of both atmosphere and ocean.

4.2 Expected outcome

The scoping meeting will develop:

- a practical approach to facilitate the use of GPC and related Lead Centres' products by RCCs and other regional entities, RCOFs, and NMHSs, including a Global Seasonal Climate Update;

- an outline for a consensus statement with a comprehensive assessment of current and coming seasonal global climate anomalies to assist in risk management, adaptation policies and decision making by global partners;

- an implementation plan to engage potential contributors to develop the Global Seasonal Climate Update on a trial basis in near-real-time and for limited circulation and peer review; and

- identify lead coordinators for operational production of the Global Seasonal Climate Update.

4.3 Proposed agenda outline

Day 1: Setting the frame

- Status of operations of current GPCs and related Lead Centres and other centres providing global-scale Long-Range Forecasts (presentations by experts from GPCs, Lead Centres and other global centres as well as WDS/DPFS)
- Status of global-scale monitoring activities (presentations by climate monitoring centres' experts)
- Skills of monitoring and prediction methods/models (presentation on research perspectives)
    - Discussion based on experts' experiences and Lead Centres' verification activities results
- Formatting/communication of monitoring and prediction "outlook" products, incl. aspects of uncertainty, probability and confidence
    - Discussion based on experts' experiences; presentation of an RCOF expert
- The WMO El Niño/La Niña Update : current status and prospects

Day 2: Discussion of the concept elements

- User requirements for global-scale monitoring and prediction products (presentations by globally active users like the IFRC, IASC, WHO)
- The role of regional and national institutions and mechanisms: user requirements for global-scale monitoring and prediction products and potential contributions to the Update generation (presentations by RCOF-, RCC- and/or NMHS experts)

- Content and structure of the Global Seasonal Climate Update (brainstorming discussion)
- Linking climate monitoring and climate prediction services: The Climate Watch Concept (expert presentation)
- Consensus development process (expert presentation)
- Working arrangements and responsibilities for the Global Seasonal Climate Update, flow of information (brainstorming discussion)

Day 3: Concept development

- Review of the discussion outcomes of days 1 and 2
- Elaboration and presentation of the concept for the Global Seasonal Climate Update
- Implementation plan for a pilot phase of the production of Global Seasonal Climate Updates including the identification of lead coordinators

Note:

1. **In order to optimally utilize the available time and to ensure a certain degree of comparability of the information presented, it is proposed to provide a presentation template/format for describing activities of prediction/monitoring centres.**
2. **Discussion format to be developed in order to derive the information needed for the following days.**

4.4 Potential participants

It is expected that experts from the following institutions or organisations will participate in the scoping workshop:

a) Global users

- Experts from e.g. IASC, IFRC, WHO etc. (preferably Geneva based)

b) Regional providers and users

- Selected experts from RCCs and/or similar institutions, preferably with RCOF experiences (e.g. ACMAD, BCC, CIIFEN, TCC etc.)

c) Global providers

- Selected experts from GPCs and Lead Centres
- Selected experts from international centres active in climate prediction (e.g. IRI, APCC)
- Selected climate monitoring experts (e.g. NCDC, UK MetOffice Hadley Centre, JMA, CMA, IMD, BoMA)

d) Selected experts from CCl and CBS (climate predictions, climate monitoring, Climate Watches, consensus development, user liaison, communication)

e) WCRP scientific expert on seasonal prediction

f) WMO Secretariat: CLW (HWR, WCAS, AgM); OBS (WIS, DMA); WDS (DPFS, DRR, PWS); WCRP

5. Further evolution

It is envisaged to operate the seasonal climate Update mechanism **for one year or more on a pilot basis in *near-real-time*, pre-operational mode with a limited, informal circulation**. During the pilot phase, the consensus statement will be subject to peer review among climate experts, communicators as well as user representatives, and appropriate corrections will be made to the process. Once skills, usefulness and operational capabilities are stabilized at acceptable levels, the Update will be provided to the public (press release(s) / Websites) and released officially to RCOFs/RCCs/NMHSs and global users.

Annex V

REQUIREMENTS FOR CLIMATE PRODUCTS AND SERVICES TO SUPPORT DISASTER RISK REDUCTION: AN EXAMPLE

SUMMARY OF RELEVANT OUTCOMES OF THE MEETING OF THE CBS TASK TEAM ON METEOROLOGICAL SERVICES FOR IMPROVED HUMANITARIAN PLANNING AND RESPONSE

1. Background

1.1. Disaster Risk Management: A multi-Sectoral challenge

Nearly 80% of disasters caused by natural hazards are linked to climate-related extremes. IPCC Fourth Assessment Report has provided scientific evidence that the severity, intensity and frequency of climate related hazards such as droughts, heat waves, floods, forest fires and tropical cyclones are increasing as a result of human-induced climate change. When a disaster happens, it not only threatens human life, but also has profound impacts on various economic sectors and social systems, setting back development in many countries, particularly those with least resources.

Many socio-economic sectors, including water, agriculture, fisheries, health, forestry, transport, tourism and energy, are highly sensitive to weather and climate extremes such as droughts, floods, cyclones and storms, heat waves or cold waves. Decision-makers in these sectors are increasingly concerned by the adverse impacts of climate variability and change, but are not sufficiently equipped to make effective use of climate information to manage current and future climate risks. Consequently, there is not only an urgent need for enhanced global cooperation in the development of accurate and timely climate information but also equally urgent need for its exchange between the providers of climate services and various sectors, thus ensuring that relevant climate information is integrated into policies, planning and practices in various sectors and at various levels. Recent advances in science and technology offer the prospect of further improvements in quality of climate information and prediction services. Integrating seasonal to multi-decadal predictions and long-term climate projections into decision-making in all socio-economic sectors, through an effective two-way dialogue between providers and at-risk sectors on the range, timing, quality and content of climate products and services, will ensure that decisions relating to managing climate risks are well informed, more effective and better targeted. Furthermore, this must be augmented with systematic strengthening of institutional and operational capacities of climate information providers at the national, regional and international levels, to ensure sustainable development and availability of information for risk management and planning.

1.2. New Paradigm in Disaster Risk Management with focus on Prevention and Preparedness

Traditionally, many countries have been reactive to disasters. However, the adoption of “Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to disasters,” (Hereafter referred to as HFA) by 168 countries during the Second World Conference in Disaster Reduction (January 2005, Kobe, Japan), has led to a new paradigm in disaster risk management focused on prevention and preparedness to reduce the impacts of disasters. In this context, meteorological, hydrological and climate products and services are critical input for development of preparedness and preventive strategies. The UNFCCC Bali Action Plan has stressed the need for disaster risk management as a critical component of climate risk management and adaptation of all countries.

Effective disaster risk management must be founded on scientifically sound risk assessment, to quantify and understand the risks associated with natural hazards and their impacts. In many countries, the institutional capacities and cooperation for risk assessment need to be developed or strengthened. Risk assessment requires quality assured historical and real time data on hazards, and socio-economic impact data. Furthermore, there is need for development of disaster impact depositories for various sectors.1 There is also need for hazard and risk analysis tools for quantification of exposures and vulnerabilities (e.g., casualties, construction damages, crop yield reduction, water shortages).2

However, analysis of hazard patterns from historical data is necessary but not sufficient for risk assessment. Changing patterns of climate hazards are posing challenges with longer-term strategic planning and investments (e.g., infrastructure planning and retrofitting based on building codes and specifications, using only historical records (e.g., 100 year flood may become a 30 year flood). Such climate analysis tools for assessing changes in severity, frequency, and occurrences of hydro-meteorological hazards at seasonal, inter-annual, decadal, and longer climate change time lines need to become available operationally and applied for risk assessment.

With the risk knowledge, countries can develop risk management using (1) early warning systems and preparedness, (2) medium and long-term sectoral planning (e.g., land zoning, infrastructure development, agricultural management, water resource management, etc.) and (3) utilization of weather-indexed insurance and financing mechanisms to reduce and transfer the economic impacts of disasters at various levels and decision timelines (operational to strategic). All sectors require a wide range of meteorological, hydrological and climate information products and services, at different temporal and spatial scales, and with different information content. These information products include data products, forecasts, outlooks and analyses, and research products. Early warning systems have been demonstrated to be effective tools for reducing loss of life through improved emergency preparedness and response, however, emergence of climate prediction and forecasting tools provides unprecedented opportunities to provide outlooks and warnings with longer lead times that can be used for improved sectoral planning (e.g., supply/demand management and risk management practices in agriculture, urban planning, water resource management, etc.) and ultimately protection of livelihoods.

2. About WMO Disaster Risk Reduction Programme and its Implementation Strategy

WMO through the crosscutting framework of its disaster risk reduction (DRR) Programme (established by WMO Congress XIVI, in 2003) has developed a systematic approach engaging WMO Programmes, constituent bodies, Members and external partners to implement WMO DRR strategic priorities through national projects with a strong regional cooperation framework. This implementation plan is supported by a two-tier approach involving: 1) good practices and development of guidelines and know-how, and 2) national and regional coordinated projects, engaging WMO Members, WMO Programmes, Technical Commissions, Regional Associations and partner organizations.

2.1. Capacity needs of NMHS and WMO Operational Network of GDPFS (RSMCs and RCCs) in supporting DRR applications

As part of development of its implementation strategy, WMO conducted a national DRR survey in May 2006. The objective of the survey was to determine the capacities, gaps and needs of the national meteorological and hydrological services (NMHSs) to support disaster risk management

[1] WMO, through its technical commissions are developing guidelines for various hazard databases, metadata and analysis tools and is working through national DRM and Adaptation development projects with other partners such as the World Bank, UNDP and ISDR in several regions, to develop institutional capacities of the National Meteorological and Hydrological Services including modernization of their systems and networks and development of capacities in monitoring, data rescue and management, hazard mapping and analysis and operational forecasting of meteorlogical, hydrological and climate conditions. Through the Global Risk Identification Programme (GRIP) (http://www.gripweb.org/grip.php?ido=1000) national socio-economic disaster impact data depositories are being facilitated.

[2] Through World Bank's Risk Modelling Initiatives engaging a wide range of national agencies and experts (e.g., Central America Probabilistic Risk Assessment Programme, which is being considered to expand to other regions) probabilistic open-source risk modelling tools are being developed to support national sectoral risk assessment projects in Central America.

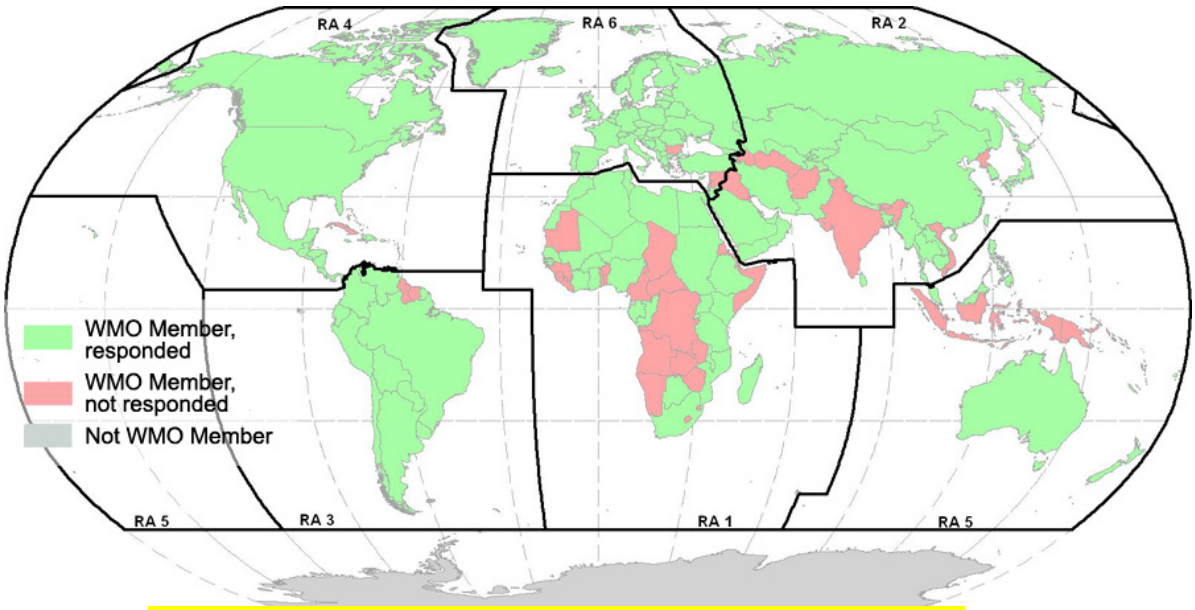
(DRM) and their respective involvement in national disaster management structures and mechanisms. The survey was distributed to 187 Member of which 139 provided responses, which revealed that NMHSs of WMO Members face a number of challenges, including:

(i) Legislation and Planning: Nearly 70% of countries are still focused on post-disaster response, lacking effective planning, legislation, coordination and institutional capacities in DRM. Even if NMHSs were able to provide good weather and climate information and services, in most countries there is no capacity in disaster DRM to carry out preparedness measures. However, partners such as UN-ISDR and development agencies are working with the national and local governments to facilitate the implementation of HFA. This has significant implications for receptivity of the government and DRM authorities for investing in and utilizing NMHSs information and services;

(ii) Infrastructure: Over 65% of NMHSs are significantly challenged with respect to their core infrastructure (observational networks, 24/7 forecasting systems, telecommunication, etc.) needing some level of modernization and sustainability of these capacities;

(iii) Technical and Scientific Capacity Development: On the operational side, nearly 80% of NMHSs lack various technical tools, guidelines and training for meteorological, hydrological and climate-related hazard database and meta data maintenance, hazard analysis and mapping, various forecasting and analysis tools;

(iv) Institutional Partnerships, Coordination and Service Delivery: Over 80 % of NMHSs responding to the survey have indicated the need for strengthening their partnerships with various DRM stakeholders, pertaining to management, coordination, operational and service delivery aspects.



139 out of 187 Members (74 %)

Least developed countries: 25/50 50 %

Developing countries: 85/137 54 %

Figure 1: Responses to the WMO Country-Level DRR Survey 2006

The results of the survey are continually being complimented with analysis of capacities of DRM agencies being carried out by key partners such as UN-ISDR, UNDP, UN-OCHA and World Bank, who are working with national governments in relation to governance (policy, planning and

legislation), funding and institutional capacities for DRM. The results of the analysis are the foundation for the strategic implementation of the DRR Programme.

2.2. DRR Implementation strategy for National/Regional Project development

A clear DRR Project Management Framework with criteria for initiation of projects and a resource mobilization strategy were developed, which are being used for the initiation of two types of DRR model projects in several WMO regions and sub-regions, with strong connection to the Regional Associations (RAs) DRR structures. These projects demonstrate the benefits of integrated programming across WMO Technical Programmes and Technical Commissions in collaboration with Regional Associations and external partners for development of capacities of NMHSs to support DRM and multi-hazard early warning systems. These include:

(i) First type: National and regional DRM and adaptation projects with the World Bank, UN–International Strategy for Disaster Reduction (UN-ISDR), and UNDP which focus on development of national capacities and regional cooperation along three components, including: (i) DRM institutional capacities across various economic sectors (e.g., health, infrastructure and urban planning, agriculture, energy, civil protection and emergency planning, etc.); (ii) NMHSs and their partnership with DRM stakeholders; and (iii) financial risk transfer and insurance markets. WMO is invited as a key partner for addressing capacity developments of the NMHSs and their partnerships. This type of project has been initiated in eight countries in Southeast Europe, eight countries in Central Asia and Caucuses, and five countries in Southeast Asia;
(ii) Second type: Comprehensive end-to-end multi-hazard early warning system (MH-EWS) projects building upon capacity development activities of WMO technical programmes in countries that have some institutional capacities for emergency preparedness and planning. The first step in initiating these projects involves a "MH-EWS Training Workshop with Focus on Institutional Partnerships and Coordination," held under the umbrella of the RAs, bringing together directors and senior-executives from NMHSs and DRM agencies, regional and international organizations as well as the development and funding agencies to identify the needs and priorities for the development of regional/sub-regional cooperation programmes complemented with national MH-EWS development projects.

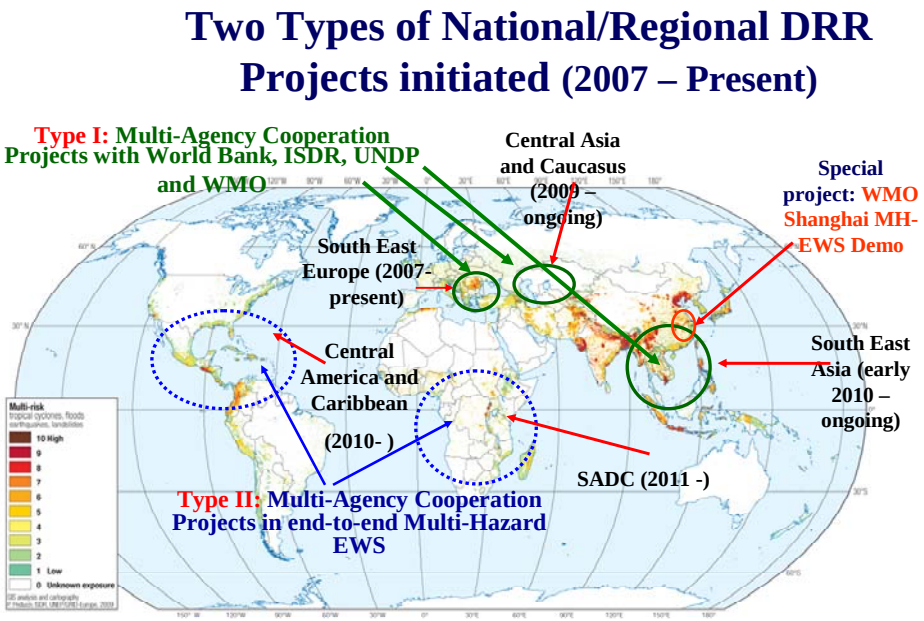


Figure 2: WMO DRR national/regional cooperation projects

3. Defining DRR User Requirements for Meteorological, Hydrological, Climate Products and Services:

World Climate Conference-3 (WCC-3) stressd the importance of climate information in supporting DRR and discussed the clear linkages of DRR as a critical component of climate adaptation and the Global Framework for Climate Services (GFCS). Since its adoption in 2005, the Hyogo Framework for Action (HFA) has provided clear priorities for action and justification for the need for cooperation at national, regional and international levels to significantly reduce the impacts of natural hazards. Coordination mechanisms for DRR are being strengthened or established at various levels providing opportunities to identify, segment users and determine their requirement within the spectrum of seamless products and services that can support the different decision processes in DRR (See Figure 3), for example:

1. At the national level, increasingly more countries are restructuring or strengthening their disaster risk management programmes, through establishment of national coordination mechanisms/committees/platforms, using a multi-ministerial, multi-sectoral, multi-hazard approach, to bring together the scientific and technical agencies such as NMHSs, disaster risk management agencies, other relevant ministries and sectors (e.g., agriculture, health, environment, infrastructure and urban planning, insurance and finance, tourism, etc). Users of meteorological and climate services range from various ministries and agencies in the government, and sectors to local government, communities and private sector. Furthermore, the UN Development Assistance Framework (UNDAF), World Bank Country Strategy for Development and NAPAs provide clear processes for inclusion of information development needs as part of the development agenda of the developing and least developed countries.

2. The implementation of the HFA at the regional and international levels is supported by the International Strategy for Disaster Reduction (ISDR) System, which is serviced by the ISDR Secretariat, and involves coordination across a large group of international and regional agencies from development, humanitarian, scientific and technical communities and bi-lateral donors, and inter-governmental economic grouping. For example,

    a. At the regional level, many countries are engaging in regional cooperation to better address their national DRM through data and information sharing and establishment of regional approaches and standards and priorities. Examples of regional cooperation and coordination include: (i) Regional intergovernmental economic groupings (African Union, SADC, ASEAN, SOPAC, APEC, etc) are developing regional disaster risk management strategies, areas of regional cooperation (e.g., regional risk assessment, information sharing to support cross-boundary early warnings, etc), (ii) Regional intergovernmental organization dedicated to disaster risk management (e.g., CEPREDENAC, CEDERA, ECLAC, ADPC, ACRD, DPPI, etc) are expanding their scope to address prevention and preparedness issues, serving as an effective platform for interacting with disaster risk management user community at the national levels, (iii) Regionally coordinated Disaster Risk Management and Adaptation Projects supported by multi-lateral partnerships involving World Bank/ISDR/UNDP/WMO are underway in a number of regions such as South East Europe, Central Asia and Caucasus, South East Asia (with other regions being considered), providing a coordinated forum for linking NMHS to DRM processes at the national and regional levels.
    b. At the international level, many users such as international humanitarian agencies are seeking climate information to support their contingency planning, development agencies and bi-lateral donors use information to direct funding to support disaster high risk countries, multi-nationals private sector companies (e.g., energy, agricultural, and reinsurance companies) use global information in strategic planning and managing risk portfolios across different regions. International coordination mechanism such as Interagency Standing Committee (consortium of 40 international humanitarian agencies), UN ISDR Global Platform for Disaster Reduction (which brings together all countries technical and disaster risk management experts together bi-annually),

network of UN development agencies (UNDG) with World Bank provide mechanisms to target these user groups to identify and understand their needs and requirements for global scale information. Furthermore, climate information could be used in the development of major global reports such as such as the bi-annual UN ISDR Global Assessment Report on Disaster Risk Reduction, Annual World Bank Global Development Report, Annual UNDP Human Development Report, IASC quarterly early warning/early action report.

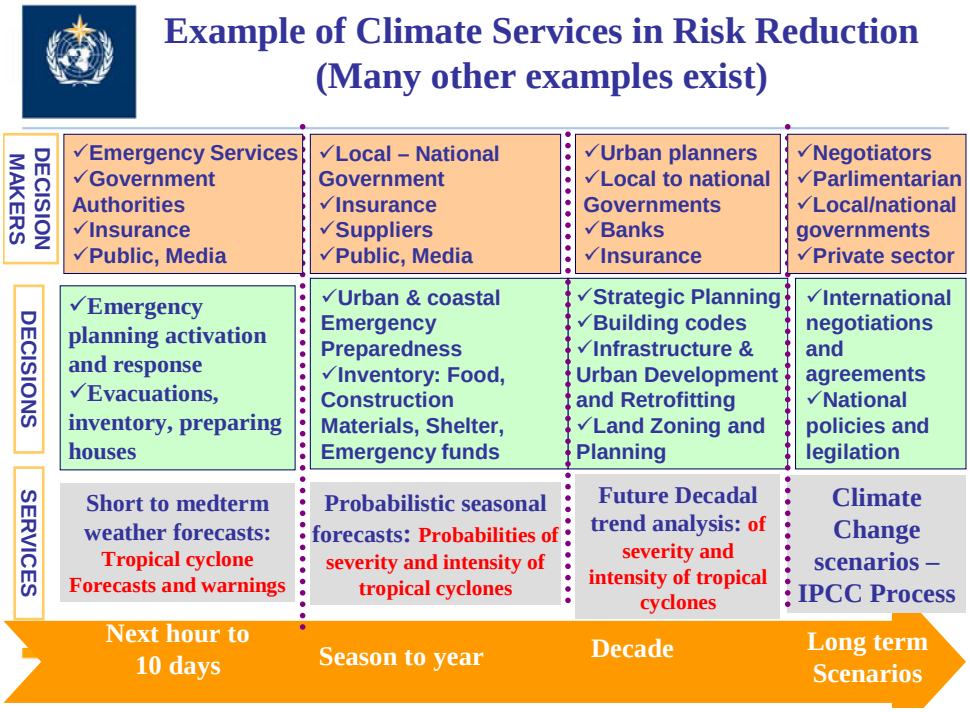


Figure 3: Examples of seamless Meteorological, Hydrological and climate services in disaster risk management

3.1. Example: Task Team on Meteorological Services for Improved Humanitarian Planning and Response

The Task Team on "Meteorological Services for Improved Humanitarian Planning and Response" (hereafter referred to as Humanitarian Task Team) was established by the Commission of Basic Systems (CBS) of WMO at its 14th Session (Croatia, April 2009). The objective of the Humanitarian Task Team is to work towards the development of operational capacities to provide meteorological, hydrological and climate information products and services to humanitarian agencies at international, regional and national levels to support their emergency contingency planning, preparedness and response.

Following the establishment of the Task Team, a brainstorming session on "Meteorological Services for Improved Humanitarian Emergency Contingency Planning and Response" was held at the WMO headquarters, in Geneva, on the 17 April 2009. The meeting was attended by experts from international and UN humanitarian agencies involved in humanitarian contingency planning, including IFRC, OCHA, UNICEF, UNITAR, UNHCR, WFP, WHO and staff from the WMO Secretariat. The session initiated the process of assessment of the needs of the humanitarian agencies for meteorological, hydrological and climate information products and services and recommended the inclusion of hydrological and climate aspects in the work of the Humanitarian Task Team. Pursuant to this request, the chair of the OPAG on PWS in coordination with the President of CBS liaised with the Presidents of the Commissions of Climatology (CCl) and Hydrology (CHy), who designated experts from these Commissions to the Humanitarian Task

Team. The president of CBS in consultation with the presidents of CCl and CHy approved revised Terms of Reference for the humanitarian Task Team.

The Task Team on "Meteorological Services for Improved Humanitarian Planning and Response" held its first meeting at the WMO Headquarters, in Geneva, Switzerland from 31 August to 2 September 2010. The meeting was attended by 29 experts from international and UN agencies involved in the coordination of humanitarian contingency planning and response, experts in operational meteorology, hydrology and climate forecasting and WMO Secretariat staff. The meeting:

(i) Reviewed the structure and decision making processes of the humanitarian agencies at global, regional and national levels;

(ii) Reviewed the meteorological hydrological and climate information products and services currently used by humanitarian agencies, including their sources and dissemination mechanisms;

(iii) Reviewed needs and requirements of humanitarian agencies for meteorological, hydrological and climate information products and services;

(iv) Reviewed the capacities available through the WMO operational network for provision of meteorological, hydrological and climate information products and services;

(v) Identified major gaps with respect to the utilization of meteorological, hydrological and climate information products and services at national, regional and international levels; and

(vi) Recommended concrete actions leading to the initiation of pilot projects for the development of prototype products and services targeted at the needs and requirements of the humanitarian agencies.

The meeting concluded that:

1. Currently there are already many meteorological, hydrological and climate information products and services available from different sources. This results in lack of systematic use of meteorological, hydrological and climate information products as different sources provide different products. Humanitarian agencies require systematic and consistent sources of information from the global to the national level.

2. There is a strong need of partnerships between the producers of meteorological, hydrological and climate information products and services and the users. Partnerships enable better understanding of user needs, building of trust and the provision of feed for the continuous improvement of service delivery.

3. As a first step to ensure that the requirements of humanitarian agencies for meteorological, hydrological and climate information products and services are met through the WMO operational network of NMHSs, Regional Specialized Meteorological Centres (RSMCs), Regional Climate Centres (RCCs), Drought Monitoring Centres etc., there is a need to take stock of the products that are currently available and being used within the structures of the humanitarian agencies for their emergency contingency planning, preparedness and response.

4. The work of the Humanitarian Task Team will focus on meteorological, hydrological and climate information products at global and regional levels. Aspects related to provision of this information at national level are being addressed through DRR Programme cooperation projects currently underway in South East Europe, Central Asia and Caucuses, Southeast Asia and Central America and the Caribbean.

5. To implement the first pilot, Central America and Southern Africa were considered as potential regions. Consideration was based on (i) need and impact such projects can have in the region; (ii) good governance including political will, existence of coordination structures for DRM, availability of institutional and technical capabilities, allocation of resources for DRM; (iii) demonstrated efforts and progress in; (iv) capacity development activities being carried out by WMO and partners; and (v) on-site presence of humanitarian agencies.

The final report of the first meeting is available at:
http://www.wmo.int/pages/prog/drr/events/HumanitarianTT/index_en.html.

Annex VI

WORKING SESSION ON COMPILING A GSCU 'ON THE SPOT'

Following the outcome of agenda item 7.1 on the content and structure of the GSCU it is envisaged to identify relevant sources of routinely available information and to examine possibilities to compile such information into a GSCU consensus statement.

The annexes to this document provide partial lists of potentially relevant links to routinely available information sources for global climate monitoring (Annex 1) and prediction (Annex 2). It has to be noted that this list is not exhaustive and might be completed during the meeting and afterwards. Participants are requested to assist the Secretariat in expanding the lists.

As a pragmatic approach for the working session it is suggested to go through the discussed GSCU outline section by section by relating relevant information sources and agreeing on the style of information to be compiled in the GSCU. Participants are invited to suggest a mechanism to work out a sample GSCU within the session, based on the available information. The purpose of this exercise is essentially to attempt developing a tangible example of the GSCU, and highlight the issues encountered in the process for further discussion. The emphasis in this exercise is not so much on the scientific robustness of the contents, but on the style of presentation and the aspects to be included.

Partial List of Examples of routinely available information sources for global climate monitoring products

Entity	Examples of specific GSCU-relevant links
APEC Climate Center http://www.apcc21.org/	http://www.apcc21.org/en/maps • Monthly monitoring • Seasonal monitoring
Beijing Climate Center http://www.bcc.cma.gov.cn/en	http://cmdp.ncc.cma.gov.cn/Monitoring/en_bulletin.php • Global section of 'Monthly Highlights'
Climate Prediction Center http://www.cpc.noaa.gov	http://www.cpc.ncep.noaa.gov/products/CDB/ • Monthly Climate Diagnostics Bulletin http://www.cpc.noaa.gov/products/precip/CWlink/MJO/enso.shtml • ENSO http://www.cpc.noaa.gov/products/precip/CWlink/pna/nao.shtml • NAO http://www.cpc.noaa.gov/products/expert_assessment/ • Relevant expert assessments incl. e.g. global ocean assessment http://www.cpc.noaa.gov/products/precip/CWlink/MJO/mjo.shtml • MJO http://www.cpc.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml • Teleconnections: NAO, AAO, AO, PNA http://www.cpc.noaa.gov/products/precip/CWlink/MJO/block.shtml • Blocking http://www.cpc.noaa.gov/products/precip/CWlink/stormtracks/mstrack.shtml • Storm tracks
National Climate Data Center http://www.ncdc.noaa.gov	http://www.ncdc.noaa.gov/sotc/?report=global • State of the climate, global section http://www.ncdc.noaa.gov/sotc/?report=hazard • Global Hazards
International Research Institute for Climate and Society http://portal.iri.columbia.edu/portal/server.pt	http://portal.iri.columbia.edu/portal/server.pt?open=512&objID=490&PageID=0&cached=true&mode=2&userID=2
Tokyo Climate Center http://ds.data.jma.go.jp/tcc/tcc/	http://ds.data.jma.go.jp/tcc/tcc/products/clisys/highlights/index.html • Monthly Highlights on Climate System http://ds.data.jma.go.jp/tcc/tcc/products/climate/seasonal.html • Seasonal Climate in the world
UK MetOffice Hadley Centre http://www.metoffice.gov.uk/climatechange/science/hadleycentre/	http://hadobs.metoffice.com/
World Meteorological Organization http://www.wmo.int	http://www.wmo.int/pages/prog/wcp/wcasp/wcasp_home_en.html • El Niño/La Niña Updates

Partial List of Examples of routinely available information sources for global long-range forecasts

Entity	Examples of specific GSCU-relevant links
APCC	http ://www.apcc21.org/en/services/apcc-operational-3-month-mme-prediction/forecasts/
GPC Beijing	http://bcc.cma.gov.cn/products/
GPC CPTEC	http://clima1.cptec.inpe.br/gpc
GPC ECMWF	http://www.ecmwf.int/products/forecasts/d/charts/seasonal
GPC Exeter	http://www.metoffice.gov.uk/science/specialist/seasonal/
GPC Melbourne	http://poama.bom.gov.au/experimental/poama15/r_gen.htm and http://poama.bom.gov.au/dataserver/index.htm
GPC Montreal	http://collaboration.cmc.ec.gc.ca/cmc/saison/glb/cmc_seasonal_fcst_global.html Password protected!
GPC Moscow	http://neacc.meteoinfo.ru/forecast
GPC Pretoria	http://old.weathersa.co.za/LONGTERM/meth_seas.html
GPC Seoul	http://wmolc.org/~GPC_Seoul/
GPC Tokyo	http://ds.data.jma.go.jp/tcc/tcc/products/model/index.html
GPC Toulouse	ftp://ftp.meteo.fr/dclimdev_ple/wmo_ple Password protected!
GPC Washington	http://www.cpc.ncep.noaa.gov/products/people/wwang/cfs_fcst/ and http://cfs.ncep.noaa.gov/menu/download
IRI	http://portal.iri.columbia.edu/portal/server.pt?open=512&objID=944&PageID=0&cached=true&mode=2&userID=2
LC-LRFMME	http://wmolc.org/
LC-SVSLRF	http://www.bom.gov.au/wmo/lrfvs/ and http://collaboration.cmc.ec.gc.ca/cmc/saison/glb/cmc_seasonal_fcst_global.html Password protected!
WMO	http://www.wmo.int/pages/prog/wcp/wcasp/wcasp_home_en.html • El Niño/La Niña Updates

Annex VII

CLIMATE WATCH SYSTEMS

for efficient monitoring and warning against extreme climate events

Growing economic losses, coupled with an increase in deaths caused by extreme climate and weather events, have drawn the attention of governments, the scientific community and the public at large. In addition, it is now well established that any change in the frequency and/or severity of extreme climate events will have a negative impact on the well-being of populations and the sustainable development of societies. Therefore, adaptive measures should be taken to improve climate risk management capabilities among nations. Setting up an efficient extreme weather and climate warning system has long been a focus of WMO. The climate watch system, based on the continuous monitoring and forecasting of climate anomalies, is such a warning system. Its main governing entity should be the National Meteorological and Hydrological Services.

Although climate information plays a key role in the risk management of climate-related hazards, decision-makers often implement crisis management policy when dealing with extreme climate events.

The climate watch system provides advisories and statements to inform users, particularly those involved in natural hazards preparedness, mitigation and response, about evolving or foreseen climate anomalies at the regional and national levels, thus allowing them to make informed decisions. To that effect, National Meteorological and Hydrological Services should continuously monitor and assess the status of the climate, evaluate available climate forecasts and, if warranted, issue appropriate advisories to users. The advisories should be based on all available climate information from National Meteorological and Hydrological Services, global producing centres and regional climate centres. This information includes observations on current conditions and weekly, 10-day, monthly, seasonal and annual monitoring and forecasting products.

A climate watch system provides a proactive mechanism for interacting with users and alerting them to major climate anomalies and extremes. This mechanism adds value to existing climate monitoring and forecasting systems within the National Meteorological and Hydrological Services and should be developed with a view to fully involving users in providing the conditional elements of the system: thresholds, indices, criteria and databases. Users should also take part in crafting the format and the content of the advisories, providing timely feedback and developing operational procedures and best practices.

Climate watch system components

Data and observations

Near-real-time and historical climate observations are necessary for efficient monitoring and forecasting of extreme climate events. Monitoring changes in climate extremes generally requires high-quality resolution data on a daily basis. National Meteorological and Hydrological Services, which are responsible for establishing and managing observation networks and performing data analyses, require reliable climate data management systems to successfully implement climate watches.

Monitoring and analysis

Before issuing a climate watch advisory, the current climate status and the magnitude of anomalies should be determined. During the validity period of a climate watch advisory, the issuing organization, generally a National Meteorological and Hydrological Service, must provide updated information to end-users on the evolution of climate anomalies (departures from the mean) and changes in climate outlooks. This may involve issuing a climate watch review at set stages after

the initial advisory. Once the validity has expired, the potential for further climate anomalies should be monitored.

Index-based climate change analysis provides National Meteorological and Hydrological Services and users with information on changes observed in the distribution of key climate parameters. This involves statistical analyses of trends, extreme values and frequencies drawn from historical daily climate data. Several climate indices defined by the CCl/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI) can be used to detect variability and trends in climate extremes. Some 27 core indices are based on daily temperature values and precipitation amount. Since they are computed according to fixed thresholds of relevance to particular applications or according to thresholds typically defined as a percentile of the relevant data series, the indices vary from location to location. Information on ETCCDI is available at http://www.clivar.org/organization/etccdi/etccdi.php. For a definition of the indices, see http://cccma.seos.uvic.ca/ETCCDI/. The indices computed for a given country can be used to put the observed climate anomalies and extremes in a historical context for further analysis and can be useful in evaluating climate watch advisories to improve the climate watch system.

Long-range forecasts

Long-range forecasting involves the following tasks: using global and/or regional climate model outputs from the global producing centres or regional climate centres, respectively; downscaling – relating large-scale phenomena, such as the El Niño Southern Oscillation, to localized climate variability; adapting regional climate forecasts generated by the regional climate outlook forums; performing statistical analysis of historical climate data; and developing national dynamical longrange forecasting systems.

Forecasts should be verified and results made available to the user community. It is also necessary to assess the effectiveness of climate watch criteria over a period of time, which includes monitoring false alarms and hit rates.

Outputs

A climate watch system generates the following outputs: an initial climate watch advisory outlining the expected climate anomaly; one or more climate watch updates informing end-users of the progress of a climate watch (updates may be issued at monthly intervals or at intervals agreed upon in partnership with the end-user); and a final climate watch statement confirming that the climate watch has expired and that the likelihood of risks associated with the climate anomaly has diminished significantly.

The content and the format of climate watch advisories and statements should be developed in conjunction with the appropriate user intermediaries based on user needs and requirements. The format generally includes the following details: heading, name of issuing organization, type of warning, area affected by the climate watch, date and time issued, validity period, general climate watch statement, update advice, contact details of the issuing organization and a list of attachments.

A dissemination plan is drawn up by the National Meteorological and Hydrological Service concerned and its partner intermediaries, including members of the media. Advisories should be issued in a timely manner so that the end-user can benefit from their early warning aspect.

User aspects

The National Meteorological and Hydrological Service identifies critical sets of prospective end-users and appropriate intermediaries. Users of climate information are individuals or organizations whose interests are affected by climate anomalies and who consider climate information when making decisions. The most vulnerable users are those involved in health, agriculture, food security, water resources, energy and transport. Climate and user databases need to be used

together to analyse climate hazards and related impacts. The output will provide the geographical and historical references to monitor climate anomalies and extremes. By using the geographic information system, both databases can be integrated readily.

User intermediaries are individuals or organizations – governmental or others – responsible for providing guidance to climate-sensitive sectors to enable informed decision-making.

User stakeholders are organizations that have user interests at heart and a stake in the effectiveness of the processes aimed at meeting those interests. They include aid agencies, international organizations involved in development or governance, non-governmental organizations and community-based organizations.

Climate watch requirements

National Meteorological and Hydrological Services should assess their capabilities and needs to establish an effective climate watch production and dissemination system meeting the following requirements:

- Provide timely observations of current climate conditions for their areas of responsibility and adequate historical climate data;
- Perform timely monitoring and analyses of current climate anomalies;
- Enjoy access to current global climate forecasts and possess the technical capabilities to interpret and downscale them to their region;
- Deliver probabilistic climate forecast products that the user community can understand;
- Regularly update records of past forecasts and analyses of past forecast performance;
- Employ effective methods for the routine dissemination of climate information to user groups and sectors;
- Develop active partnerships with the user community and feedback mechanisms to provide guidance for the design of climate watches and evaluate their effectiveness.

If some aspects of required capacities are lacking, they will need to be developed. There are two points to consider when planning to build climate watch system capacity: activities that are necessary to ensure that National Meteorological and Hydrological Service staff have the skills to operate a climate watch system, and the need to build user capacity, requiring dedicated and sustained efforts best achieved by regular interaction and partnership. To that end, an outreach programme is necessary to ensure adequate use of system outputs and an understanding of its limitations and problem areas so that improvements can be made.

Worldwide climate watch-related activities and examples

At the global level, the World Climate Data and Monitoring Programme (WCDMP) coordinates and facilitates international climate data and climate monitoring activities. It produces the annual WMO Statement on the Status of the Global Climate highlighting major global and regional climate anomalies that have occurred during the year. These and other publications provide users operating at the global, regional and national levels with useful information on the geographical extent and time scope of climate extremes such as drought, heatwaves, flooding, heavy precipitations and tropical cyclones. At the same time, efforts have been made to boost the capacities of National Meteorological and Hydrological Services in climate data management, data rescue and currently in climate watch implementation in the developing and least developed countries.

Since 1997, WMO and the International Research Institute for Climate and Society have issued the El Niño Update, with contributions from many meteorological services, regional centres and organizations. These updates are coordinated by the WMO World Climate Applications and Services Programme (WCASP).

At the regional level, the monthly Climate Watch Africa Bulletin is produced by the African Centre of Meteorological Applications for Development (ACMAD). The bulletin provides comprehensive analyses of the current status of the African climate, including the intertropical convergence zone, winds, rainfall, temperature and soil moisture. It also describes seasonal climate outlooks and possible related impacts on continental and subregional scales.

The International Research Centre on El Niño (Centro Internacional para la Investigación del Fenómeno El Niño, or CIIFEN) in Guayaquil, Ecuador, uses climate information from the global producing centres as the basis for El Niño outlooks for South America. The Centre also contributes to the regional climate outlook forums in that part of the world.

At the national level, the Hydrologic Information Center of the National Oceanic and Atmospheric Administration (NOAA) National Weather Service regularly monitors climate conditions, assesses flood risk and issues warnings in the United States.

The Institute for Environment and Sustainability of the Joint Research Centre of the European Commission develops methodologies and information systems for the prevention and prediction of weather-driven natural hazards throughout the European Union to complement national initiatives. It issues European flood alert bulletins and provides real-time flood-related information.

For more information:
http://www.wmo.int/pages/publications/showcase/documents/CWS_EN_v1.pdf

Annex VIII

GSCU OUTLINE

Annex 1 provides an initial outline for a typical issue of the Global Seasonal Climate Update (GSCU), as an illustrating basis for discussions. Text in *italics* was inserted for illustration (partly taken from one of the recent El Niño/La Niña Updates). The choice of climate phenomena to be addressed in the GSCU is subject to expert assessment and user perspectives, but limited to global/continental-scale aspects.

The appropriate structure and content of the GSCU as well as its language is highly dependent on the user groups to be targeted. Assuming that NMHSs and RCCs are amongst the potential users as well as international agencies outside the 'meteorological community' (operating in different regions around the globe) it becomes clear, that different options need to be considered. Amongst these options are the following:

(i) Extending the executive summary and providing a full GSCU summary for users outside the meteorological community in appropriate language. Sections 1-4 of the attached outline would provide more science/technical-related (background) information for NMHSs, RCCs etc.

(ii) Issuing 2 types of the GSCU: A 6-pager for NMHSs, RCCs etc. as outlined in the attachment and a 2-pager summarizing the GSCU for users outside the meteorological community. This special issue might avoid even mentioning the major general circulation features as described in sections 1 and 3 of the attached outline and might concentrate on messages derived from sections 2 and 4 (plus sections 5 to 7).

GLOBAL SEASONAL CLIMATE UPDATE

--- DRAFT OUTLINE ---

[Date of issuance: xx.yy.zzzz]

Note: The Update summarises the past and current status as well as the expected future behaviour of major general circulation features and large-scale oceanic anomalies around the globe (seasonal timescale) and discusses its likely impacts on large-scale temperature and precipitation patterns. The GSCU is proposed to be produced quarterly and issued on 1 March, 1 June, 1 September and 1 December.

0 Executive summary

[*most striking features of the current issue of the Update*]

1 Recent monitoring results for major general circulation features and related large-scale oceanic anomalies around the globe

- El Niño Southern Oscillation (ENSO)

[*Moderate to strong La Niña conditions are now present in the central and eastern equatorial Pacific, where sea surface temperatures are around 1.5 degrees Celsius cooler than average. The atmosphere across the tropical Pacific is now well coupled to this sea surface temperature pattern, with strengthened trade winds and markedly reduced cloudiness over a substantial portion of the central and eastern equatorial Pacific. The subsurface waters of the central and eastern equatorial Pacific also strongly reflect La Niña conditions, with temperatures of 2 to 6 degrees Celsius below average. This large volume of anomalously cold water will likely maintain or strengthen the cold waters already at the ocean surface…. This La Niña developed quickly in June and July 2010, following the dissipation of the 2009/10 El Niño in April. Unlike many El Niño or La Niña events that have unequal contributions from the oceanic and atmospheric components during onset, this event featured strong ocean-atmosphere coupling since its initial development in June, following a strong initial spell of enhanced trade winds in the western equatorial Pacific in May. By August the event had become moderate to strong, and currently continues at approximately the same strength.*]

- North Atlantic Oscillation / Arctic Oscillation
- South Pacific Convergence Zone
- Intertropical Convergence Zone (ITCZ)
- Interdecadal Pacific Oscillation (IPO)
- Antarctic Oscillation (AAO)
- Indian Ocean Dipole (IOD)
- Further important large-scale monitoring results

2 Discussion of observed impacts on large-scale temperature and precipitation patterns

[…]

Comments:
Text of GSCU Sections 1and 2 should not exceed 2-3 pages.
Text should provide clear messages and should avoid technical terms as far as possible!

3 Potential evolution of major general circulation features and related large-scale oceanic anomalies around the globe

- El Niño Southern Oscillation (ENSO)

[Given the good reinforcement of the oceanic and atmospheric aspects of the current event, and the large area of below-average subsurface ocean temperatures, the event is expected to sustain or increase its strength, and endure at least through the normal El Niño/La Niña life cycle into the first quarter of 2011. Almost all forecast models predict continuation, and possible further strengthening, of this La Niña episode for the next 4-6 months, taking the event well into the first quarter of 2011]

- North Atlantic Oscillation / Arctic Oscillation
- Antarctic Oscillation (AAO)
- Indian Ocean Dipole (IOD)
- Potential evolution of further important large-scale anomalies

Comments:
Text of Section 3 of GSCU should not exceed 2 pages.
Text should provide clear messages and should avoid technical terms as far as possible!

4 Discussion of likely impacts on large-scale temperature and precipitation patterns

[…(*level of detail to be discussed to avoid interference with mandates of NMHSs, RCCs and RCOFs; form of presentation to be discussed, e.g. provision of maps only and text explanations of how to interpret the maps*)]

5 How to use the Global Seasonal Climate Update

[…(*remarks on the probabilistic nature of the GSCU), users to consult tailored regional and national climate outlooks …*]

6 References

[…(*Weblinks to specific educational material and forecasts*) …]

7 Acknowledgements

[*contributors*]

Overarching Comment:
The entire GSCU should not exceed 6 pages.

Annex IX

GLOBAL SEASONAL CLIMATE UPDATE

--- DRAFT OUTLINE MARK 0---

[Date of issuance: xx.yy.zzzz]

Note: The Update summarises the past and current status as well as the expected future behaviour of the state of the global climate including major general circulation features and large-scale oceanic anomalies on the seasonal timescale and discusses.
The GSCU is produced quarterly and issued on 1 March, 1 June, 1 September and 1 December.

0 Executive summary

[most striking features of the current issue of the Update]

1 Global-scale climate monitoring results for the previous 3 months

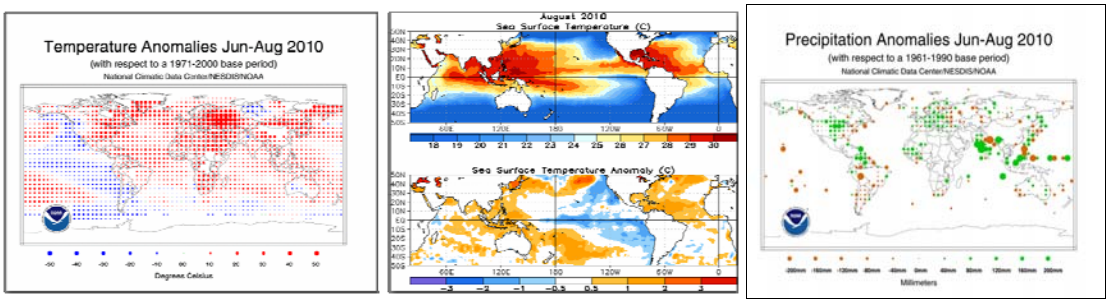
[The combined global land and ocean surface temperature during June–August 2010 was 16.2°C (61.3°F), which is 0.64°C (1.15°F) above the 20th century average of 15.6°C (60.1°F)—resulting in the second warmest June–August on record, behind 1998. Warmer-than-average temperatures were present across most of the world's land surface, with the warmest anomalies observed across eastern Europe, the eastern half of the contiguous U.S., and parts of eastern Canada, and eastern Asia. However, cooler-than-average conditions were present across parts of central Russia and southern South America. Overall, the worldwide land-only surface temperature ranked as the warmest on record, surpassing the previous record set in 1998 by 0.08°C (0.14°F). The June–August 2010 worldwide land-only surface temperature was 1.00°C (1.80°F) above the 20th century average of 13.8°C (56.9°F). Meanwhile, the worldwide ocean surface temperature was 0.51°C (0.92°F) above the 20th century average of 16.4°C (61.5°F), resulting in the fifth warmest such period on record. The Atlantic, Indian, and western Pacific oceans had warmer-than-average conditions, while the equatorial Pacific Ocean, and along the North and South American Pacific coast, experienced cooler-than-average conditions associated with a developing La Niña .(NOAA's Global August 2010 SotC)]

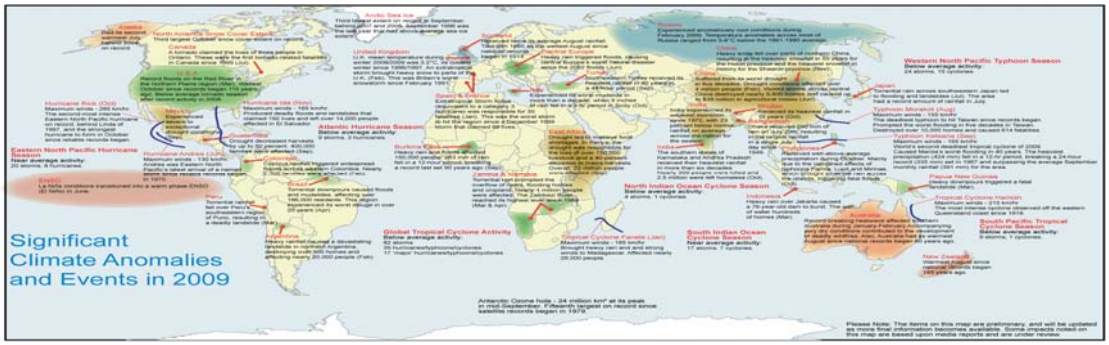
[Moderate to strong La Niña conditions was present in the central and eastern equatorial Pacific, where sea surface temperatures are around 1.5 degrees Celsius cooler than average. The atmosphere across the tropical Pacific is now well coupled to this sea surface temperature pattern, with strengthened trade winds and markedly reduced cloudiness over a substantial portion of the central and eastern equatorial Pacific. The subsurface waters of the central and eastern equatorial Pacific also strongly reflect La Niña conditions, with temperatures of 2 to 6 degrees Celsius below average. This large volume of anomalously cold water will likely maintain or strengthen the cold waters already at the ocean surface…. This La Niña developed quickly in June and July 2010, following the dissipation of the 2009/10 El Niño in April. Unlike many El Niño or La Niña events that have unequal contributions from the oceanic and atmospheric components during onset, this event featured strong ocean-atmosphere coupling since its initial development in June, following a strong initial spell of enhanced trade winds in the western equatorial Pacific in May. By August the event had become moderate to strong, and currently continues at approximately the same strength. (WMO ENSO report…other sources: NOAA's CPC, BoM)]

[*Precipitation Information/Hazards- During the June–August 2010 period, above-average precipitation fell over areas that included southeast Asia, the central U.S., northern South America, and parts of Europe.*

China floods (August 2010)… La Niña conditions—which officially began in July—were thought to be a contributing factor to the unusually heavy rains during this monsoon season. The worst Asian

Monsoon rains in decades continued to devastate Pakistan through the month of August (see also the July Global Hazards report for more detail on initial flooding and destruction).





2 Potential evolution of the state of the climate over the next 3 months

El Nino Southern Oscillation (ENSO)

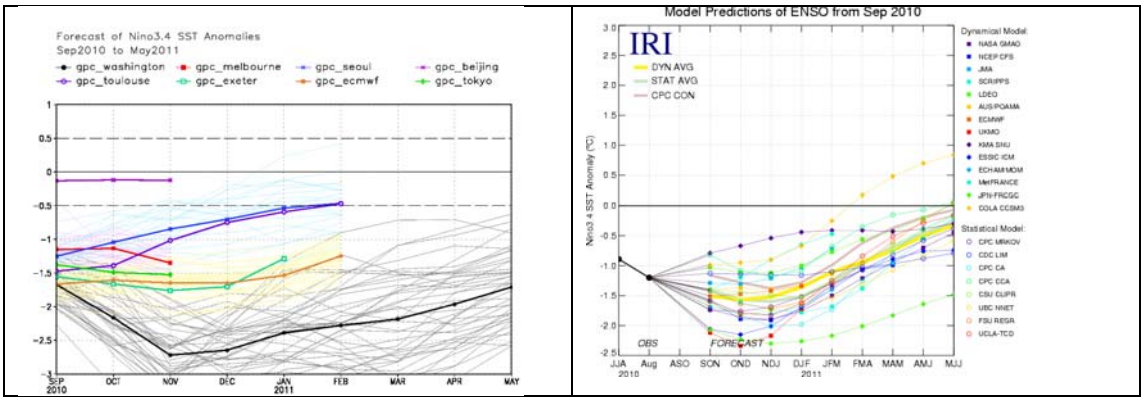
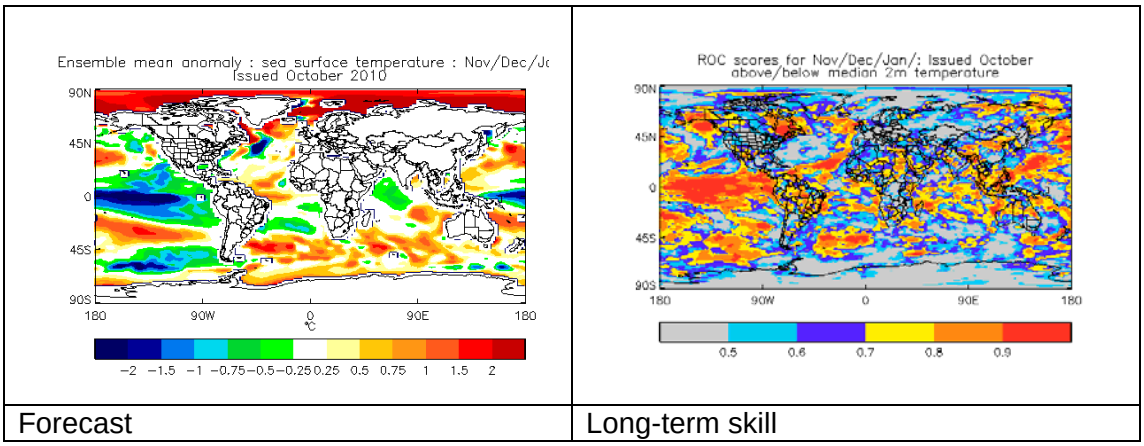


Fig. 1: ENSO plumes

Discussion, ENSO example: The La Nina is expected to sustain or increase its strength and endure at least through the normal El Nino/La Nina life cycle into the first quarter of 2011. Almost all forecast models predict continuation, and possible further strengthening, of this La Nina episode for the next 4-6 months, taking the event well into the first quarter of 2011 (Fig. 1).

Global SST evolution

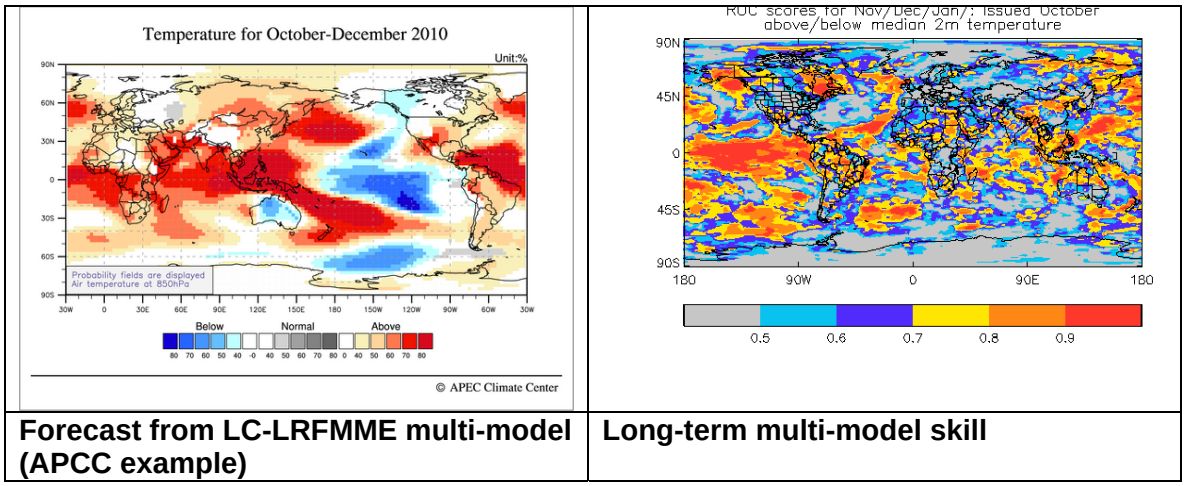


Forecast	Long-term skill

Fig. 2: SST tercile category probability forecasts (best available from LC-LRFMME coupled models plus 1-persistence projection) with skill.

Discussion, SST: on predicted evolution with reference to current anomalies in monitoring section, ENSO, IOD, North Atlantic etc. and prediction skill (Fig. 2)

Temperature



Forecast from LC-LRFMME multi-model (APCC example)	**Long-term multi-model skill**

Fig. 3: Tercile probability forecast. Skill will show ROC score for the most likely predicted category. (Tercile probability format selected for consistency with RCOF format)

Discussion, temperature: With reference to existing anomalies from the monitoring sections, and alerting to any new predicted anomaly developments, and consistency with SST evolution

APCC example: The forecast for October-December 2010 indicates persistent warm conditions over most of the Globe (except the Pacific Ocean), including Africa, central-to-eastern Russia, West Asia, Pakistan, northern parts of India, China, Korea, Japan and the adjoining regions, Maritime Continent, and southern Polynesian. It is also likely to be warmer than normal over USA and Latin America Below normal temperature is expected in the central and the eastern Pacific. Most of Australia, western parts of Canada may be slightly colder than normal.

Rainfall Outlook

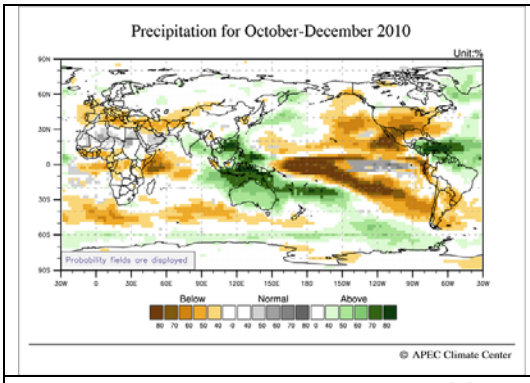
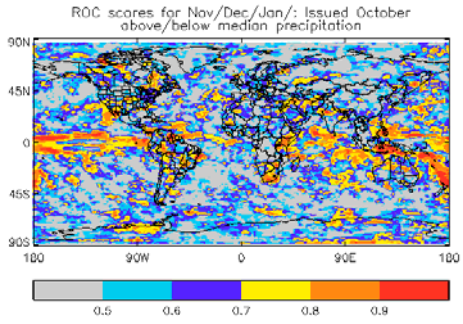
	
Forecast from LC-LRFMME multi-model (APCC example)	**Long-term multi-model skill**

Fig. 4: Tercile probability forecast. Skill will show ROC score for the most likely predicted category. (Tercile probability format selected for consistency with RCOF format)

Discussion, rainfall: With reference to existing anomalies from the monitoring sections, and alerting to any new predicted anomaly developments, consistency with SST prediction.

APCC example: There is a strong chance of above normal rainfall over the maritime continent, India adjoining the Bay of Bengal, southeastern coast of China and adjoining East China Sea ,the northwestern Pacific, Southeast Asia, Australia, South Polynesian Islands, equatorial Latin America, and the tropical Atlantic Ocean. Suppressed rainfall is expected over the central to eastern Pacific, and southern North America. Suppressed precipitation is also forecasted over few places over equatorial western Africa and adjoining Indian Ocean.

3 How to use the Global Seasonal Climate Update

[…(remarks on the probabilistic nature of the GSCU), users to consult tailored regional and national climate outlooks …]

4 References

[…(Weblinks to specific educational material and forecasts) …]

5 Acknowledgements

[contributors]