MEETING OF THE
COMMISSION FOR CLIMATOLOGY TASK TEAM ON
GLOBAL SEASONAL CLIMATE UPDATES

5-7 June 2012
Busan, Republic of Korea

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

- Global Climate Observing System (GCOS)
- World Climate Research Programme (WCRP)
- World Climate Services Programme (WCSP)
Participants at the TT-GSCU meeting, 5-7 June 2012, Busan, Republic of Korea

Left to right: T Barnston, R Kolli, V Krylov, C Oludhe, W Yun, A Brookshaw, A Sanchez, W Wang, J Seo, T Cegnar, J Ceron, H Kim and K Takano
1. OPENING

The second meeting of the CCI Task Team on Global Seasonal Climate Updates (TT-GSCU) was opened by its Chair, Dr Won-Tae Yun (Republic of Korea), at 9:00 on Tuesday, 5 June 2012, at Hotel Novotel Ambassador, Busan, Republic of Korea. The Chair informed the Task Team that its co-chair, Dr Richard Graham (UK) was unable to attend the meeting due to other pressing commitments, and that he was being represented by Dr Anca Brookshaw (UK). Dr Yun noted that two more members, namely Ms. Janita Pahalad and Dr K. Ashok, also were unable to attend; while Ms. Pahalad was being represented by Dr Xiang Dong Wang (Australia), Dr Ashok offered to contribute through email and teleconference. On behalf of the host, Korea Meteorological Administration (KMA), Dr Yun welcomed the Team and invited experts to the meeting, and introduced the overarching objectives of the Team’s work.

Mr Jean-Pierre Céron, co-chair of the CCI OPACE 3, made some opening remarks welcoming the Task Team and highlighting the need to put in concerted efforts to successfully complete the trial phase of the GSCU and come up with a robust prototype for operational production. On behalf of WMO Secretariat, Dr R. Kolli, Chief, World Climate Applications and Services Division, addressed the meeting and expressed gratitude to the Permanent Representative of the Republic of Korea with WMO for agreeing to host the meeting and making excellent arrangements.

The meeting then went through a brief tour de table of self-introductions of members and invitees.

2. ORGANISATION OF THE MEETING

Adoption of the agenda

The Team adopted the provisional agenda without any change, as provided in Annex I to this report.

Working arrangements

The Team agreed on the details concerning the organization of its work, including the daily working hours, coffee/lunch breaks and other practical session arrangements. The Local Coordinator, Dr Hyun-kyung Kim, briefed the participants on the local logistics. The Team noted that a Documentation Plan has been developed to assist participants to prepare for the meeting, which was posted on the WMO web site along with other meeting documents at:


The list of participants in the meeting is provided in Annex II to this report.
3. INTRODUCTION

3.1 Review of Cg-XVI and CCI MG-2011 decisions relating to GSCU, including the terms of reference of TT-GSCU

The Team was presented with background information related to the GSCU, including recalling the relevant decisions of the sixteenth session of the World Meteorological Congress (Cg-XVI, May 2011, Geneva, Switzerland) and the second meeting of CCI Management Group (MG-2011, October 2011, Denver, USA). The Team was also be briefed on the presentation of GSCU concept in the poster session of the World Climate Research Programme (WCRP) Open Science Conference (24-28 October 2011, Denver, USA). The Team was apprised of a concept note on the GSCU prepared on this occasion (Annex III) and presented to the Secretary-General of WMO for his use in communicating the concept at high-level meetings. The Team noted with satisfaction that Congress endorsed the GFCS initiative, and had urged all GPCs, RCCs, ROFs and NMHSs and other relevant institutions to provide the required inputs and actively support the development of GSCU. The Team also noted the agreement of Congress that the aim of such Updates would be to assist the NMHSs as well as RCCs and ROFs in the interpretation, characterization and assessments of the reliability of seasonal predictions. In this context, the Team discussed the pros and cons of the release of GSCU in the public domain and to the media. In any case, the Team agreed that the operational GSCU should not conflict or overlap with the LRF activities of the NMHSs. Keeping in view that the GSCU in trial phase is not open to the public any way, the Team agreed that this issue should be revisited after the GSCU takes a final shape for operational production.

The Team noted that MG-2011 endorsed the proposed contents of GSCU Mark 1 for the trial phase, but urged a wider review for improvement during the course of the trial phase. The Team noted with satisfaction that MG-2011 had endorsed the implementation strategy for the GSCU, as developed by it:

- **Monitoring**: Information will be contributed by global data and monitoring centres.
- **Outlook**: Information will be contributed principally by WMO GPCs with data collected, processed and displayed by the WMO Lead Centre for Long-range Multi-Model Ensembles (LC-LRFMME). Two prediction lead times will be covered in the Mark 1 version: 2-4 months ahead and 3-5 months ahead.
- Monitoring and prediction information will also included for selected climate indices.
- Maps showing the prediction skill of the prediction products will be provided via the WMO Lead Centre for the Standard Verification System for Long-range Forecasts (LC-SVSLRF).
- **Trial phase**: The Mark 1 GSCU will be trialed with the target users for a period of 1-year. Feedback on the content and usefulness will then be used to develop a final version to be considered for implementation.

The Team also noted that MG-2011 had endorsed the minor revisions proposed by it to its Terms of Reference, and that the MG had decided to continue the TT-GSCU in its present composition and the revised Terms of Reference (Annex IV), in order to guide the implementation of the trial phase to be hosted by the WMO LC-LRFMME.
3.2 Review of previous expert meetings relevant to GSCU (e.g., CSIS Workshop, CCI/CBS ET-RCC, CBS ET-ELRF, etc.)

The Team reviewed the progress in wider consultations on the GSCU on the concept, content, trial phase as well as planning for operational production, including its consideration at the WMO Workshop on Strategy for Implementation of the Climate Services Information System (CSIS) held from 5-7 April 2011 at Geneva, Switzerland, Joint CCI/CBS Expert Team on Regional Climate Centres (CCI/CBS ET-RCCs, 12-14 October 2011, Offenbach, Germany) and the Commission for Basic Systems Expert Team on Extended and Long Range Forecasting (ET-ELRF, 26-30 March 2012, Geneva, Switzerland). The Team was briefed on the roles of the Global Producing Centres of Long Range Forecasts (GPCs) including their Lead Centres and RCCs in the development and use of the GSCU, as highlighted at the above meetings. The Team noted with satisfaction the emphasis placed by the ET-RCCs on the user role of WMO RCCs with respect to GSCU. In addition, the Team noted that WMO RCCs might provide regional perspectives as input for the GSCU as well as contribute to the GSCU pilot phase by providing dedicated feedback on the structure, content and timeliness of the GSCUs. The Team agreed to work with ET-RCCs on specific input requirements from, and roles to be played by, WMO RCCs in the generation and uptake of the GSCU. The Team appreciated the strong support provided by CBS ET-ELRF for the development of GSCU, and welcomed the proposal to convert the team into joint CBS/CCI ET-ELRF. The Team agreed that the ET-ELRF has an important role in facilitating the core inputs from WMO LC-LRFMME for the generation of GSCU, and requested it to provide the necessary technical guidance to complement the efforts of CCI TT-GSCU.

3.3 Expert Mission on GSCU and starting of trial phase

Dr Vladimir Kryjov (Russian Federation) had undertaken an expert mission with WMO support to the WMO LC-LRFMME, from 5-13 September 2011 to work on the preparation of GSCU Mark 1 and development of guidance for its operational production. The Team was briefed by Dr Kryjov on the outcomes of this mission (see Annex V). The Team reviewed the work done and discussed the various issues relevant to the operational guidance.

3.4 GFCS implementation plan and GSCU

The Team was presented with a brief report on the recent activities for the development of a Global Framework for Climate Services (GFCS), in particular its Climate Services Information System (CSIS). In this context, taking into account the fact that the GFCS will be built upon operational structures that involve global-regional-national levels of generating and exchanging climate information products, the Team considered the ways in which the importance of GSCU can be highlighted in the implementation plans under development for the GFCS. The Team requested its members to actively participate in the open review of the draft implementation plan being developed for the GFCS, and ensure that the GSCU development is adequately reflected in the proposed activities.

4. REVIEW OF THE FIRST ISSUE OF GSCU TRIAL PHASE

The Team was briefed on the commencement of the trial phase of the GSCU, which was issued for the target season of MAM 2012. This issue was distributed for limited circulation, including the members of TT-GSCU. Comments submitted in advance of the meeting formed the
basis of in-depth discussion of some of the features of GSCU, from items in the content, to matters of process and operational implementation.

Many of the comments were taken into account in the update to the format of the document presented separately – these are not repeated here.

However, some of the issues raised do not have an easy, immediate answer. These outstanding issues are summarized below, and the Team agreed to revisit them during the course of the trial phase for possible resolution:

- methodology for multi-model combination: when using anomalies, need to ensure a common baseline and that the contribution from each model has the same mean and variance;
- selection of variables for prediction: potential mismatch between requirements and capability;
- new indices – e.g., indices for the Southern Hemisphere – find list and sources, ET-ELRF may be requested to facilitate documentation of indices relevant to the GSCU, SOI: check how ECMWF does it;
- skill information, verification techniques (data not yet provided, new variables for which skill is not currently assessed, lack of MME verification partly related to the methodology aspects);
- access to real-time document: password protection of part or all of the document;
- map of climatology of events: users for which this may be of interest?
- too many summaries?
- user feedback mechanism and other communication issues
- the drafting/reviewing process

5. **REVISION OF GSCU CONTENT**

Following discussion focused on comments received ahead of the meeting, the Team agreed on the revised content of the GSCU; the current proposal is detailed below.

The document will consist of a **main part (body)** and **two appendices** containing supplementary information: one on observed conditions over the preceding three months, the other on the seasonal forecast. In addition, (up to) **three summary statements** are expected: a technical summary, an executive summary and a statement for press release (optional). The schematic content of each of these sections is described below:

**Main part**

*Monitoring section*

- a selection of climate indices; values for the most recent 3 months (monthly means): ENSO (Nino1+2, 3, 4, 3.4 and SOI), IOD, NTA, STA; display values in a table.
- temperature – map of anomalies in degrees and quantiles: tercile categories, with outer deciles and extremes overlaid, all calculated relative to the reference period. (Values outside the range of the selected climatology are designated extreme and marked on the map is a separate colour.)
- precipitation – anomalies in amounts and quantiles (as for temperature)
Text describing briefly the phase of the relevant climate oscillations/anomalies and the main features on the maps will be provided.

- (self-contained) map of selected climate and weather events during the last three months.

Suggestion was made to include a map of expected events over the next three months, derived from climatology. After discussion of options, a map covering the whole year will be drafted, with the aim of using it in the appendix, following review.

**Prediction (for months 2-4 and beyond)**

- selection of climate indices (ensemble mean and error bars derived from theoretical distribution - +/- 1stdev):
  - ENSO: brief summary of prediction; reference to appendix and link to WMO ENSO update
  - IOD, NTA, STA for the next three months (table, three-month mean)
- temperature and precipitation, multi model combination (probabilities). Before combination, anomalies will be expressed relative to the same baseline for all models.

No skill information will be provided at this stage; it was suggested to attempt to derive verification for multi-model product.

Text will provide brief description of the predictions, both for maps and indices; expert interpretation is encouraged in this section.

**Appendices**

**Monitoring**

- global average temperature (use the average of the three available data sets; explain clearly how the value is derived),
- other indices: use list of indices and values from selected providers:
  - atmospheric indices: CPC;
  - MJO: Wheeler&Hendon diagram from BOM, covering 90 days;
  - monsoon indices: regional/national sources – to be identified (A Sanchez-Lugo),
  - indices for southern hemisphere? – to investigate, both candidate indices and relevant source for monitoring information (X Wang)
- no commentary

**Prediction**

- for variable listed below, ensemble mean from each model (directly from LC website)
  - each model keeps its baseline;
  - accompanied by verification – MSSS and anomaly correlation - (where available) from each model
  - for plumes, plot observations on past forecast (but not consider it substitute for verification)

In principle, it was agreed to use as many lead times as available for each model with interactive ocean.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Forecast</th>
<th>Verification</th>
</tr>
</thead>
<tbody>
<tr>
<td>2m temperature</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>precipitation</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>SST</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Z500</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>mslp</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>velocity potential</td>
<td>not yet</td>
<td>not yet</td>
</tr>
<tr>
<td>global average temperature</td>
<td>yes</td>
<td>maybe (need to be investigated)</td>
</tr>
</tbody>
</table>

Summaries

- technical summary: current format (maps with highlighted areas and some complementary technical information, including statements on uncertainty; intended for NMHSs and RCCs);
- executive summary: accessible language, covering ‘robust’ signals, no maps;
- press release – based on executive summary, drafted by WMO, reviewed by task team during the trial phase, with a more permanent arrangement to be put in place for the operational phase.

The potential for conflict with information from other sources (RCCs, RCOFs, NMHSs) was identified. To avoid this, coordination with information from these sources, available at the time of issue, is necessary. However, it is recognized that coordination with all the NMHSs is practically impossible in the tight schedules required for an operational GSCU. Therefore, it is important to restrict the information to the global scales and avoid sub-regional and local aspects. In addition, the guidance for use should include:

- statement on the remit of GSCU (it is a model-informed consensus, rather than consensus based all sources of information)
- statement explaining that GSCU provides a global view, potentially to be superseded by regional/national monitoring/forecast products where appropriate.

Some basic guidelines for the text were agreed (captions to explain all symbols/colours on the graphs, avoid acronyms and mention of individual countries, use British English)

Also, following discussion on methodology, it was agreed to use a common baseline for multimodel products, and for this baseline to be also used in monitoring products. At present, the multimodel forecasts considered for inclusion in the GSCU trial phase are estimated with a common baseline of 1983-2002 because it is the common period of the hindcasts of eight GPCs. While the period 1981-2010 is considered to be desirable, a solution is not so obvious in practical terms because it implies that a bias in model climatology remains the same for these periods which is rather doubtful. The Team therefore agreed that ET-ELRF may be requested to further examine this problem and recommend an appropriate way forward.

The issue of accessibility of the information was also discussed, with password protection being suggested for all or part of the document. As opinions did not converge, it was decided to delay the decision until it becomes unavoidable (at the point of operational implementation).

The issue of intended target audience was also discussed by the Team. Keeping in view that the NMHSs have varying capacities to interpret/assimilate the given information, the Team agreed that an optimal approach should be evolved to ensure that the GSCU addresses the needs of most
of the NMHSs, facilitated by RCCs and RCOFs. There was also a suggestion to include the individual GPC products in an appendix, along with information on the consistency of the predictions as well as the individual skills. However, the Team agreed that caution should be exercised not to cause information overload, which may inhibit communication of key messages. The Team also agreed that the GSCU should have a sustainable mechanism of collecting and using feedback for product improvement.

6. OPERATIONAL SCHEDULING AND GUIDANCE

6.1 Optimal and sub-optimal processes

In order to establish the requirements for the operational setup required for the sustained and timely production of the GSCU, the Team deliberated on the identification of both the optimal and sub-optimal processes, not only at the central production facility, but also at the major contributing centres. The Team considered the ways to fully exploit the optimal processes and work with the sub-optimal processes in the best way possible. The various aspects are detailed in Annex VI.

6.2 Methodology

The Team discussed the various methodological aspects for each of the technical elements of the GSCU (e.g., monitoring and LRF products, MME approaches, probabilistic representation, global indices, etc.). The Team also discussed the expert assessment approaches and the development of a consensus statement including the communication of uncertainty. The methodological aspects considered by the Team are outlined in Annex VII.

6.3 Role of LC-LRFMME for sustained production of GSCU

The Team was briefed by the LC-LRFMME coordinators on their operational procedures, and how the production of the GSCU can be assimilated as a routine activity (see Annex VIII). The Team considered how the operational guidance being developed could be effectively used by the LC-LRFMME. The Team agreed that the LC-LRFMME should endeavour to implement cut-off dates for model forecasts in close alignment with the GSCU schedules and requirements. Further, the Team discussed the formal steps required for a long-term commitment of LC-LRFMME to produce and distribute the GSCU. The Team suggested that the WMO Secretariat may arrange a formal communication to the Permanent Representative of the Republic of Korea requesting his support to ensure a sustained ownership of GSCU by LC-LRFMME as one of their operational products. However, while LC-LRFMME could routinely generate the LRF products needed for the GSCU, the Team recognized that it needs inputs on monitoring products and also expert support in generating text summaries based on consensus discussions. The Team recommended that a suitable expert panel under WMO auspices be formally constituted to guide LC-LRFMME in real-time generation of GSCU.

6.4 Discussion on communication issues

The Team discussed the communication issues, keeping in view the target audience, which primarily includes the RCCs, RCOFs and NMHSs. The communications advisor of OPACE-3, Ms. Tanja Cegnar, briefed the team on the key communications aspects to be considered in this
context (Annex IX). The Team agreed to continue consultations on the overall communication strategy to be adopted for the GSCU. There may also be some communications aspects relevant to the general public, but these should only refer to the executive summary prepared for the GSCU.

7. THE WAY FORWARD FOR THE TRIAL PHASE

7.1 Identification of gaps and challenges

The Team considered the major gaps and challenges already experienced with the first issue of the GSCU, and those expected to come up during the further implementation of the trial phase. The Team discussed possible ways to address the gaps and challenges. Based on the discussions and decisions on several components of the GSCU content, as well as on the process, the main points on gaps and challenges are summarised below.

Selection of climate indices: The GSCU cannot be all-inclusive; it must focus on a limited but useful set of climate indices which provide a sufficient description of the past and future global climate state. Consistency of variable from monitoring to prediction was not considered essential. However, certain degree of predictability was a requirement when including predicted indices. Guidance from ET-ELRF needs to be sought in this regard.

Geographical variations in prediction skill: Regions and indices for which prediction skill is generally low (e.g., extra-tropics) are presented in similar format and alongside indices/regions for which skill is significant. Wherever possible, the text will specify differences. However, as skill for some of the indices included has not been quantified, this kind of limitation cannot be comprehensively quantified.

Insufficient consistency in presentation: The format of forecast products is not consistent throughout the document. The primary reason is lack of robust methodology for deriving multi-model products which are self-contained (with clear indication of confidence/skill, in the absence of bespoke expert assessment). Moreover, there is inconsistency with the format of some of the monitoring information.

Both these limitations were considered acceptable for the time being: for the forecast, in each place, the best information available was included, and in the case of monitoring, the different format was deemed potentially of more interest to users.

In the longer term, it is desirable to unify formats wherever appropriate.

Expert interpretation: Experience has shown that expert interpretation of forecast information (e.g. predicted seasonal circulation patterns) can improve on direct model predictions of temperature and rainfall. The key question in this context is how and to what extent this semi-subjective information should be incorporated into the GSCU. The answer is likely highly dependent on the availability of such experts for operational delivery, preferably at the drafting stage. There is need to identify panel of drafting authors and panel of expert reviewers.

Production schedule: Text input will be generated through an international consensus, and this will need to be done on a very tight production schedule. Closely related, the issues of institutional commitment and identification of support to operational roles were raised. Additional challenges
are the scarcity of human resources available for this task and the need to align GSCU with the quality management framework (QMF).

Availability of data and/or relevant information: There are currently discrepancies between the products identified as necessary and data available to derive them (e.g. forecasts at lead time longer than 1 month, hindcast data to calculate skill information). In places, this can be overcome by additional requirements to the GPCs (provide verification scores already calculated). However, it looks unlikely that all these issues will be resolved before operational implementation.

Verification issues: It was noticed that not every GPC completed all the recommended verifications (WMO-No.485, Volume 1). Some of the verification data and maps collected by WMO LC-SVSLRF could be already out of date (see http://www.bom.gov.au/cgi-bin/climate/wmo.cgi). As a result, it is a great challenge to verify the skill of MME or the so called consensus forecast in order to provide skill maps which are supposed to be the components of the prediction information of GSCU. Besides, there is no WMO-endorsed documentation for verification of Z500, SLP and T850.

Relatively limited scope of GSCU: The consensus forecast to be presented by GSCU is based on only one multi model – albeit one containing all GPC GCMs. Other sources of information on seasonal predictions are available (other GCMs, other MME products such as those by APCC, IRI, EuroSIP, etc., statistical/empirical models, theoretical studies), and these will not, at present, be taken into consideration in the consensus of GSCU.

Communication: The communication of the key messages, especially to the global user community, is a crucial point to avoid any misinterpretation and to facilitate the best possible use of the GSCU. Although the scope of the current version has been somewhat restricted – to that of a consensus informed by a specific multi-model, rather than by all sources of information available – and the intended audience has been selected to minimise the need to communicate to non-specialists, the potential for misinterpretation remains high.

7.2 Work plan (including TT-GSCU and LC-LRFMME responsibilities)

The Team discussed the work plan for the further implementation of the GSCU trial phase, and also its own work according to the Terms of Reference. The Team prioritized its work and agreed on the key deliverables and their timelines. The Team also agreed on a specific set of responsibilities that the LC-LRFMME may be requested to take on. At present, the forecast anomalies from various GPCs (for the sea surface temperature, 2-meter surface temperature, precipitation, mean sea level pressure, 850hPa temperature, and 500hpa height) are collected at the LC-LRFMME, and the forecast data are to be used for generating scientific contents of GSCU. The Team agreed that the trial phase of GSCU should be continued with the next issue for SON to be completed in August 2012. The Team further agreed that this issue of GSCU should be opened for a wider peer review, including not only the operational community but also the academic and research community such as WCRP CLIVAR.

8. ANY OTHER BUSINESS

The Team discussed the various aspects related to the operational readiness of LC-LRFMME to take on the responsibility of GSCU. The Team appreciated that, while the LC-LRFMME is quite enthusiastic to provide all possible support to the development and operational production of GSCU, the responsibility for the overall content of GSCU is essentially much broader, and that a suitable and sustainable mechanism should be put in place to complement the efforts of the LC-LRFMME, particularly on monitoring.
information, consensus development and text summaries. The Team also recognized the need to develop further expertise on climate variability and prediction at the LC-LRFMMME. The Team also discussed the importance of pursuing greater engagement of EUROSIIP in the development of GSCU, and requested WMO Secretariat to arrange formal communications in this regard.

9. CONCLUSIONS AND RECOMMENDATIONS

In addition to the various aspects of the Team’s discussions and conclusions described above, the following are some key conclusions and recommendations:

- Continue with the trial phase of the GSCU, with the standard seasons DJF, MAM, JJA and SON, and consider possible changes to the seasonal definitions based on feedback in due course;
- Discuss the GSCU concept in the GPC-RCC-RCOF Technical Workshop being planned by WMO under the guidance of CCI and CBS;
- Establish a formal expert panel to develop and guide the text summaries to be prepared for GSCU, with clear instructions on the timelines to be strictly followed;
- LC-LRFMMME is requested to take on the responsibility of coordinating the production of GSCU both in the trial and operational phase;
- GSCU must include verification of probabilistic forecasts;
- Methodology of producing multi-model combinations needs to be examined and, if necessary, further investigation into short- and long-term solutions will be undertaken, paying greater attention to the need for a common baseline for different models used; Guidance from CBS ET-ELRF may be sought on these aspects;
- While averaging forecast probabilities of individual models in the multi-model context, it must be ensured that appropriate consideration or weightage is given to the respective ensemble sizes;
- Considering that only NOAA is involved in providing monitoring inputs to the GSCU trial phase at present, efforts should be made to broaden the monitoring information sources;
- More active linkages with the climate monitoring teams under OPACE-2 should be pursued;
- Communication experts with experience in operational products need to be consulted to improve the content, style and terminology to be adopted for GSCU;
- CCI Management Group may be approached for guidance on the communication and dissemination of GSCU;
- LC-SVSLRF is requested to ensure that verification data for all the GPCs is made available; Guidance of ET-ELRF should be sought to update the SVSLRF documentation to include verification of Z500, SLP and T850, and to coordinate the collection of verification data from each GPC. A contact person should be made available from each GPC for LC-SVSLRF to contact regarding any verification issue.
- WMO Secretariat should formally invite all the GPCs and global climate monitoring centres to contribute to the GSCU and participate in its trial phase as well as operational production.

10. CLOSING

The second meeting of the CCI Task Team on Global Seasonal Climate Updates closed at 16:00 on Thursday, 7 June 2012.
AGENDA

1. OPENING

2. ORGANIZATION OF THE MEETING
   2.1 Adoption of the agenda
   2.2 Working arrangements

3. INTRODUCTION
   3.1 Review of Cg-XVI and CCI MG-2011 decisions relating to TT-GSCU terms of reference
   3.2 Review of previous expert meetings relevant to GSCU (e.g., CSIS Workshop, CCI/CBS ET-RCC, CBS ET-ELRF, etc.)
   3.3 Expert Mission on GSCU and starting of trial phase
   3.4 GFCS implementation plan and GSCU

4. REVIEW OF THE FIRST ISSUE OF GSCU TRIAL PHASE
   4.1 General comments
   4.2 Detailed comments (by section/topic)

5. REVISION OF GSCU CONTENT
   5.1 Outline for revised GSCU for trial phase
   5.2 Key technical inputs and their sources

6. OPERATIONAL SCHEDULING AND GUIDANCE
   6.1 Optimal and sub-optimal processes
   6.2 Discussion on methodology
   6.3 Role of LC-LRFMME for sustained production of GSCU
   6.4 Discussion on communication issues

7. THE WAY FORWARD FOR THE TRIAL PHASE
   7.1 Identification of gaps
   7.2 Work plan (including TT-GSCU and LC-LRFMME responsibilities)

8. ANY OTHER BUSINESS

9. CONCLUSIONS AND RECOMMENDATIONS

10. CLOSING

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Global Seasonal Climate Update (GSCU): A New Initiative for Consensus-Based Real Time Monitoring and Prediction of Seasonal Climate of the World

Introduction

Socio-economic decisions can benefit substantially from better knowledge of both contemporary and near-future climate conditions. Consensus-based climate outlook products which take advantage of the recent advances in climate science help improve climate services with a user focus. WMO successfully established a consensus mechanism for the well-known El Niño/La Niña Update, which has been well-received worldwide and has been instrumental in improving consistency, terminology and uptake of climate products. Building upon the success of the WMO El Niño/La Niña Updates for over a decade, WMO has taken up a new initiative, endorsed by the Sixteenth World Meteorological Congress in 2011, to develop a much broader Global Seasonal Climate Update (GSCU) that includes other large-scale climate indices having important regional impacts on seasonal climate. The objective of the GSCU is to provide the world community global-scale expert assessments of the ongoing and upcoming seasonal climate along with information on robustness of the available forecast signals. The GSCU is also a means to strengthen international collaboration and information flow between global, regional and national level operational climate monitoring and prediction centres – thereby contributing to the goals of the Global Framework for Climate Services (GFCS) which was established by the World Climate Conference-3. While the GSCU is intended primarily for use in the operational generation of regional and national climate updates, the requirements of global user communities will also be addressed and in this context the GSCU will contribute to application of science-based climate information in climate risk management.

The GSCU at a glance

GSCU summarizes the current status (monitoring) and the expected future behaviour (prediction) of the seasonal climate including major general circulation features and large-scale oceanic anomalies around the globe (e.g., El Niño/Southern Oscillation, North Atlantic Oscillation, Indian Ocean Dipole, etc.) and their likely impacts on continental-scale surface temperature and precipitation patterns. It is being designed to be used primarily by Regional Climate Centres (RCCs), Regional Climate Outlook Forums (RCOFs) and National Meteorological and Hydrological Services (NMHSs) in order to elaborate regional and national climate Updates. Additionally, it also caters to the global user needs such as the Early Warning Early Action Reports of the Inter Agency Standing Committee (IASC), etc. It is proposed to be regularly issued a few days ahead of each of the standard seasons.

ANNEX III
The proposed GSCU Content

1. Global-scale climate monitoring (current season)
   - Observed temperature
   - Observed precipitation
   - Climate anomalies and events
2. Potential evolution of the state of the climate (coming season)
   - Predicted mid-troposphere circulation
   - Predicted temperature
   - Predicted precipitation
3. How to use the Global Seasonal Climate Update

Appendices
- Observed large-scale sea surface temperature indices
- Observed large-scale surface pressure indices
- Predicted large-scale sea surface temperature indices
- Predicted variables with the two-month lead time

The GSCU Implementation Strategy

A prototype of GSCU for operational implementation (Mark 1) has been developed by an international task team under the WMO Commission for Climatology. Monitoring information for Mark 1 will be contributed by global climate data and monitoring centres. Outlook information will be contributed principally by the 12 WMO Global Producing Centres for Long-range Forecasts (GPCs) with data collected, processed and displayed by the WMO Lead Centre for Long-range Multi-Model Ensembles (LC-LRFMME). Example products incorporated in Mark 1 are shown in the Annex. It includes a schematic depiction of the main climate events which are leading to potential vulnerabilities. Example prediction products incorporated in Mark 1 are also shown in the Annex. In addition to the example products shown, monitoring and prediction information will also include selected climate indices. Maps showing the prediction skill of the prediction products will also be provided. Both monitoring and prediction information will be synthesized in the form of text summaries based on expert consensus involving a globally extensive network of experts.

Trials of the Mark 1 GSCU will be organized in real time, under the guidance of WMO Commission for Climatology, with the target users for a period of at least one year starting in the first quarter of 2012. Peer review of the content and feedback on its usefulness will then be used to effect improvements and develop a final version to be considered for operational implementation.

GSCU Implementation Challenges

WMO recognizes that the science and practice of seasonal forecasting is a developing area. This gives rise to a number of challenges for the GSCU which will be addressed during the trial phase. These include, inter alia:

- *Production schedule*: Text input will be generated through an international consensus, and this will need to be done on a very tight production schedule;
- *Developing consistency in presentation*: Forecast products typically use a tercile format: monitoring centres typical use an absolute anomaly format;
• **Priority Climate indices**: The GSCU cannot be all-inclusive; it must focus on a limited but useful set of climate indices which provide a sufficient description of the past and future global climate state;

• **Geographical variations in prediction skill**: Regions and indices for which prediction skill is generally low (e.g., extratropics) must be made clear;

• **Expert interpretation**: Experience has shown that expert interpretation of forecast information (e.g. predicted seasonal circulation patterns) can improve on direct model predictions of temperature and rainfall. The key question in this context is how and to what extent this semi-subjective information should be incorporated into the GSCU.

• **Communication**: The communication of the key messages, especially toward global user community, is a crucial point to avoid any misinterpretation and to facilitate the best possible use of the GSCU.
Examples of monitoring products provided showing global climate anomalies and the associated climate events leading to potential vulnerabilities.

Examples of Multi-Model Ensemble forecasting products available showing the most likely evolution of the climate system for the next 3 months and its consequences in terms of rainfall and temperature.
CCI Task Team on Global Seasonal Climate Update  
(CCI TT-GSCU)

Revised Terms of Reference  
As approved by CCI Management Group in October 2011

1. Develop, including through a scoping workshop, a mechanism to generate regular global consensus statements on the seasonal climate, termed Global Seasonal Climate Updates (GSCU), through expert assessments of global climate monitoring products of the current season and outlooks for the ensuing season;

2. Develop the content of GSCU, including the uncertainty aspects, to assist in risk management, adaptation policies and decision making taking into consideration requirements of global climate users, global and regional WMO entities and mechanisms, such as GPCs, RCCs, RCOFs, etc. as well as NMHSs;

3. Develop an implementation plan for a pilot phase by engaging potential contributors to develop the GSCU on a trial basis in near-real-time and for limited circulation and peer review;

4. Liaise with the CCI-XV OPACE-2 expert/task teams on aspects of climate monitoring and assessment, particularly in relation to climate watches, and with the CBS Expert Team on Extended and Long-range Forecasts on aspects of climate prediction;

5. Identify lead coordinators for operational production of the GSCU;

6. Report to OPACE-3 co-chairs on the progress; and

7. Task team lead to inform the OPACE co-chairs that the task is finished and that the team can be dissolved.
EXPERT MISSION ON GSCU AND STARTING OF TRIAL PHASE

Dr Vladimir Krylov (Russian Federation) had undertaken an expert mission with WMO Lead Centre for Long Range Forecast Multi-Model Ensemble (LC-LRFMME), Korea Meteorological Administration (KMA), Seoul, Republic of Korea, from 5-13 September 2011 to work on the preparation of GSCU Mark 1 and development of guidance for its operational production. The “WORK PLAN On the development of the Mark-1 GSCU prototype and the Operational Guidance for the production line of the GSCU” is attached (Appendix Va).

The main particular tasks were

**General:**
1. To design a structure of the GSCU as a basis for the pilot phase version (taking Richard Graham’s Mark 0 version as a basis).
2. To design a logistical scheme of the GSCU issuance procedures (data flow and processing and analysis chart).
3. To provide consistency between shown items (monitoring and prediction reference periods, variables, various lead time forecasts, etc.)

**Technical:**
1. To select the model training period (basis for constructing of climatological probability distribution) as a compromise between the number of MME participating models and period length.
2. To select the atmospheric indices to be posted in the monitoring section.
3. To select the oceanic indices to be posted in the forecast section and develop an estimation procedure for them.
4. To find solution for estimation of the percentiles of the observed temperature and precipitation.

**SOLUTIONS**

**Structure (see Appendix Vc)**

Taking into account that the GSCU must meet the requirements from a wide range of the users from professionals through mass media, it was suggested that GSCU should have a block structure: the main body for all the users and appendices for professionals of different levels of processing, with monitoring items and temperature and precipitation forecasts being posted in the main body, while specialized forecasts (in need only for professionals) being posted in the appendices.

Technical tasks also were solved, at least on the tentative basis (see Appendix Vb and Vc) as well as time table of issuance procedures.

**What was not resolved (the main)**

1. Inconsistency between monitoring reference period (1961-1990) and model forecast reference period (1983-2002). I insisted on 1981-2010 for monitoring (“the closer to models’ the better”), however...
2. Verification.
3. Inconsistency between model sets in 1-month lead and 2-month lead forecasts, which was strongly pronounced in inconsistency between those forecasts. The tentative solution was just that block structure.
4. Percentile maps in monitoring
5. Complete set of responsibilities, particularly, verification part.
The main achievement

The pilot phase version of GSCU has been issued.

Acknowledgments

I’d like to thank Ms. Jiyun Seo, Dr. Won-Tae Yun, Dr. Jean-Pierre Ceron, Dr. Richard Graham, Dr. Rupa Kumar Kolli for the help during my mission.
Annex Va

WORK PLAN
On the development of the Mark-1 GSCU prototype and the Operational Guidance for the production line of the GSCU

<table>
<thead>
<tr>
<th>Time</th>
<th>Work</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 hw</td>
<td>Development of the Mark-0 GSCU final version based on the draft-1-1 and draft-1-2 and the received comments – purpose: bulletin structure and coverage to be applied in Mark-1</td>
<td>Final Mark-0 GSCU bulletin sent to TT members for approval of the structure and coverage</td>
</tr>
<tr>
<td>2 hw</td>
<td>Collection of the responses from TT members</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Communication with data providers: agreements on the lists of the products, time tables and tools of GSCU data provision for GSCU production team</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Development of the poster sketch</td>
<td>Poster sketch</td>
</tr>
<tr>
<td>3 hw</td>
<td>Collection and analysis of the responses from TT members</td>
<td>List of reasonable corrections to GSCU</td>
</tr>
<tr>
<td></td>
<td>Communication with data providers: agreements on the lists of the products, time tables and tools of GSCU data provision for GSCU production team at LC LRFMME/KMA Tests</td>
<td>Draft of the operational guidance</td>
</tr>
<tr>
<td></td>
<td>Preparation of the figures for the poster</td>
<td>Poster sketch sent to TT leaders</td>
</tr>
<tr>
<td>4 hw</td>
<td>Development of the mixed Mark-0/1 GSCU draft based on the Mark-0 and received comments</td>
<td>Mark-0/1 GSCU bulletin sent to TT leaders for approval</td>
</tr>
<tr>
<td></td>
<td>Communication with data providers: agreements on the lists of the products, time tables and tools of GSCU data provision for GSCU production team at LC LRFMME/KMA Tests</td>
<td>Draft of the operational guidance</td>
</tr>
<tr>
<td></td>
<td>Final Poster sketch with all accessories</td>
<td>Final Poster sketch with all accessories sent to CCI (the poster to be constructed by CCI specialists)</td>
</tr>
<tr>
<td>5 hw</td>
<td>Development of the Mark-1 GSCU draft based on the Mark-0/1 and received comments</td>
<td>Mark-1 GSCU bulletin sent to TT leaders for approval</td>
</tr>
<tr>
<td></td>
<td>Development of the GSCU operational guidance</td>
<td>Draft of the operational guidance sent to data providers for final agreement on the lists of the products, time tables and tools of GSCU data provision</td>
</tr>
<tr>
<td>6 hw</td>
<td>Development of the Mark-1 GSCU based on the Mark-0/1 and received comments</td>
<td>Mark-1 GSCU bulletin prototype approved by TT</td>
</tr>
<tr>
<td></td>
<td>Development of the GSCU operational guidance</td>
<td>Operational guidance approved by LC LRFMME and data providers</td>
</tr>
</tbody>
</table>

Note: Total time is 3 weeks (6 half-weeks); time unit in the table (the first column) is half-week (hw).
OPERATIONAL GUIDANCE
(version as of January 2012 with that time available software)
(black – clear; red – to be solved)

GENERAL INFORMATION

Basic period for Monitoring section is 1981-2010 (30 yrs) – to be implemented in the future. Now a need for decision on: (1) basic period; (2) anomaly or percentiles or both

Basic period for Prediction section is the common period of the hindcasts of the GPCs’ models participating in MME: 1983-2002 (20 yrs, 8 GPCs – 11 models).
One month lead forecast participating GPCs: Beijing, Exeter, Melbourne, Montreal (x 4 models), Moscow, Seoul, Tokyo, Washington.

Two month lead forecast participating GPCs: Exeter (?), Melbourne, Seoul (?), Washington (?) – (?) means a need for corresponding hindcasts.

MONITORING SECTION

Monitoring covers: Large scale oceanic indices, large scale circulation indices, T2m, Precipitation, overview of extreme events.

The figures to be completely drawn at NCDC and provided for Analysis and Compilation Team by e-mail by Month 15. The text should be written by the Analysis and Compilation Team or NCDC (to be decided by them).

PREDICTION SECTION

Prediction section should be made by LC LRF-MME and provided for Analysis and Compilation Team by e-mail by Month 21.

Multimodel Ensemble Seasonal Forecast

MME Probabilistic Forecast should be produced at LC LRF-MME.

Operational procedure includes

1. Collection of the GPCs’ model outputs (usually it is 1st – 18th of the Month).

2. Estimation of probabilistic multimodel ensemble seasonal forecast (PMME) in accordance with the method described by Min et al. (WAF, 2009), with the forecast being displayed as a combined map of the prevailing tercile probabilities. The T2m and Precipitation forecast maps should be displayed in the main part of the GSCU, with all all six variable forecasts (Z500, SLP, T850, T2m, Precipitation, SST) being shown in Appendix.

3. The two month lead time forecasts are to be estimated similarly to Point 2 (see above) on the basis of the relevant model forecasts, with all six forecast maps being shown in Appendix.

4. Estimation of the oceanic indices based on the GPCs’ couple model outputs. Each index is estimated for each model separately based on the ensemble members and ensemble mean. Indices are shown as a set of model plumes with monthly resolution in Appendix.
Verification Maps Supporting the Forecast Maps

Verification assessments of the historical forecasts are shown side by side with the corresponding forecast maps. Verification is performed in terms of Relative Operational Characteristic Scores (ROCS). ROCS is shown for the prevailing category (AN or NN or BN) for each grid-point.

The work that should be done in advance: For each variable:
1. LC LRF-MME estimates historical crossvalidated three PMME tercile probability maps for each season for each year of the hindcast period on the basis of the collected historical GPCs’ outputs and provides these maps (in digital form) for LC SVS;
2. LC SVS estimates three ROCS maps based on the provided historical PMMEs for tercile categories and provides them for LC LRF-MME.

In operational mode, after PMME has been estimated and the prevailing category for each gridpoint defined, LC LRF-MME constructs the verification map based on the PMME map and three ROCS maps.

Oceanic Indices

Oceanic indices are estimated on the basis of the SST forecast fields. The indices are shown as a combination of the individual model plumes. Anomalies are estimated in respect to historical model ensemble mean.

Nino 3.4 is defined as SST anomaly averaged over the rectangle [5°N - 5°S, 170° - 120°W]

Nino 1+2 is defined as SST anomaly averaged over the rectangle [0° - 10°S, 90° - 80°W]

Indian Ocean Dipole is defined as a difference between SST averaged over the rectangles [10°N - 10°S, 50° - 70°E] and [0° - 10°S, 90° - 110°E]

North Tropical Atlantic index is defined as SST anomaly averaged over the rectangle [20° N - 5°N, 60° - 30°W]

South Tropical Atlantic index is defined as SST anomaly averaged over the rectangle [0° - 20°S, 30°W - 10°E]

IRI Nino 3.4 forecast

Should be taken from the IRI site (?) or received by e-mail
http://iri.columbia.edu/climate/ENSO/currentinfo/SST_table.html

Time Table of GSCU Production Line

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date of the Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring section preparation</td>
<td>2 4 6 8 10 12 14 16 18 20 22 24 26 28 30</td>
</tr>
<tr>
<td>Collection of GPCs’ model forecasts</td>
<td></td>
</tr>
<tr>
<td>Estimation of PMME and indices</td>
<td></td>
</tr>
<tr>
<td>Verification maps based on hindcasts</td>
<td></td>
</tr>
<tr>
<td>IRI Nino 3.4 forecast</td>
<td></td>
</tr>
<tr>
<td>Analysis and compilation of GSCU</td>
<td></td>
</tr>
</tbody>
</table>
Summary
A moderate to strong La Niña event has been sustained over the previous 3-month period (October to December). Predictions indicate that La Niña conditions will most likely continue, but weaken over the next 4 months (February to May). Dynamical forecast signals for February-April temperature and precipitation broadly consistent with continuing La Niña are evident in:

- probabilities biased to below-normal temperatures over northwestern North America, the western and southern tropical east coasts of South America, southern Africa, and northeastern Asia.
- probabilities biased to above-normal rainfall over northern South America, southern Africa, and western North America and below-normal over equatorial western South America as well as parts of the southern half of the continent, equatorial East Africa, and southern parts of North America and the Caribbean.

The Indian Ocean Dipole (IOD) Index has been negative throughout October to November, with strongest amplitude in November. Dynamical model predictions indicate that the IOD will most likely become positive over the February to May period. This is consistent with forecast probabilities favouring below-normal rainfall over southwestern parts of the maritime continent of southeast Asia.

Forecast signals with relatively strong and spatially coherent signals over land are indicated below (for details, including on forecast skill, see the body of the report):

Figure 1: Left: tercile category probability forecasts for 2m temperature, October-December 2011. Blue shading: below-normal most likely; red shading: above-normal most likely; grey shading: near normal most likely; white: equal chances. Left: tercile category probability forecasts for precipitation, October-December 2011. Orange shades: below-normal most likely; green shades: above-normal most likely; grey shading: near normal most likely (no probability given); white: equal chances. Land regions with relatively strong and spatially coherent signals are highlighted.
Global-scale climate monitoring

1.1 Observed temperature

The global land-surface temperature average was xx°C, 0.95°C above the 1971-2000 average, and the fifth warmest global OND temperature on record. Regional temperature anomalies consistent with La Niña were evident in the observed positive anomalies over the southern USA and the negative anomalies over western coastal regions of South America. Anomalies consistent with negative phase NAO were evident in the quadrupole pattern of positive anomalies over Canada and southwestern Europe/northern Africa and negative anomalies over southeastern USA and northwest Europe.

Figure 2: Observed June – August 2011 near-surface temperature anomalies relative to 1971-2000 (left panel) and near-surface temperature percentiles (from blue to red: 15%, 33%, 67%, 85%) relative to 1983-2002 (right panel).

RA I: Positive temperature anomalies were observed over most of the region, peaking at 2°C to 3°C over central Sahel and northern Africa.
RAII: Positive anomalies were observed over most of the region, with peaks of 2°C to 3°C in the southwestern and northeastern parts of the region.
RAIII: Positive anomalies (mainly less than 2°C) were observed over much of the South America. Negative anomalies, associated with La Niña, were observed over the east Pacific and the west coast of South America.
RAIV: Positive anomalies were observed over most land areas, peaking at 3-4°C over parts of northern Canada. Negative anomalies (mainly less than 2°C) were observed over southeastern USA, Mexico and Central America.
RAV: Negative anomalies, peaking at 2-3°C were observed over much of non-coastal Australia. Positive anomalies (less than 2°C) were observed over most other land regions.
RAVI: Positive anomalies were observed over parts of Greenland (4-5°C) and over the eastern Mediterranean (2-3°C). Negative anomalies (peaks of 3-4°C) were observed over much of northwestern Europe.
1.3 Observed precipitation

Regional precipitation anomalies consistent with La Niña were evident in the observed positive anomalies over central and eastern Australia, southern Africa and western North America and in the negative anomalies over southern South America, Tanzania and southeastern USA. Anomalies consistent with negative phase NAO were evident in negative anomalies over northwestern Europe and southeastern USA and positive anomalies over southern Europe.

Figure 3: Observed June – August 2011 precipitation anomalies relative to 1971-2000 (left panel) and precipitation percentiles (from brown to green: 15%, 33%, 67%, 85%) relative to 1983-2002 (right panel).

RA I: Spatial coherent regions of below-normal rainfall were observed over West Africa (up to 200% of normal) and South Africa (up to 180%). Spatially coherent regions of below-normal rainfall were observed over a region including southern Kenya, northern Tanzania (order 20% of normal) and Madagascar.

RAII: Above-normal rainfall (in excess of 200%) was observed over parts of India, northwestern China and coastal regions of the South China Sea. The main coherent region with below-normal rainfall (around 20%) was observed in eastern parts of the region from Caspian Sea to Pakistan.

RAIII: Below-normal rainfall (40-60%) was observed over much of the southern half of the South American continent. Above-normal rainfall (exceeding 200%) was observed over parts of the extreme northwest of the continent.

RAIV: Above-normal rainfall (exceeding 200%) was observed over parts of the western half of the USA, while below-normal rainfall was observed over the eastern half (less than 10% in southern areas). Above-normal rainfall (exceeding 200%) was observed in southern parts of Central America.

RAV: Above-normal rainfall was observed over much of the eastern half of the Australia continent, with values in excess of 200%, particularly over Eastern Australia.

RAVI: Below-normal rainfall (40-60%) was observed over much of northern Europe. Above-normal rainfall (reaching 180%) was observed over much of southern Europe.
1.4 Climate anomalies and events, June - August 2011

![Map of climate anomalies and events from June to August 2011](image)

**Selected Significant Climate Anomalies and Events June–August 2011**

- **Canada**: An EF-3 tornado struck the town of Goderich, Ontario on August 21, 2011. This was the most powerful tornado recorded in Ontario in over a decade.
- **United States of America**: Persistent, recurring heat across the United States during most of summer 2011 contributed to the nation’s second warmest June–August on record.
- **United Kingdom**: The United Kingdom experienced its coolest June–August since 1993.
- **China**: Torrential rainfall caused deadly floods across central and southern China during June 2011. Hundreds of thousands of residents were affected and more than 250 people were killed.
- **Pakistan**: Heavy monsoon rains in northwestern Pakistan triggered flash floods on August 24th.
- **Eastern Africa**: A speaking drought pushed much of the Horn of Africa into July. Two consecutive seasons of poor rainfall contributed in one of the driest years since 1950–51.
- **South Africa**: Unseasoned rainfall was prevalent across parts of the country. Some areas received over 10 times their average monthly rainfall in June 2011.
- **Typhoon Nock-ten (July 24–31, 2011)**: Maximum winds - 120 km/hr. Nock-ten was a Category 1 typhoon. The storm made a total of three landfalls across Southeast Asia, resulting in deadly floods and landslides.
- **Typhoon Ma-on (July 12–24, 2011)**: Maximum winds - 215 km/hr. Ma-on, a Category 4 typhoon, was the second typhoon of the 2011 Pacific Typhoon season. On July 18th, Ma-on dumped a total of 801.1 mm of rain across the village of Umai in Kochi Prefecture, resulting in a single-day Japanese record.

**Figure 4**: Selected significant climate anomalies and events, June - August 2011
2. Potential evolution of the state of the climate over the next three months (October-December) 2011

2.1. Predicted mid-troposphere circulation, October-December 2011

Necessary notification: continental scale “no signal” areas in Figs. 6 - 8 indicate essential inconsistency between the individual model forecasts which is typical for the near neutral ENSO state and associated weak forcing. Prevailing of near normal conditions, with probabilities of anomalies of both signs being quite small. Aleutian high is expected to be weaker than normal which tends to provide an anomalous NW advection to North America.

ROC map to be done in October

**Figure 6:** Left: Tercile category probability forecasts for Z500, October-December 2011. Blue shading: below-normal most likely; red shading: above-normal most likely; grey shading: near normal most likely; white: equal chances. Right: ROC scores, at each point displayed for the category forecast as most likely at that location. Skill values are not plotted at points with no forecast signal. The ROC score may be interpreted as the fraction of hindcast years for which the forecast correctly discriminated the observed category, with a score of 0.5 indicating no skill (i.e. no better than guesswork).

2.2. Predicted temperature, October-December 2011

Prevailing of near normal conditions, with probabilities of anomalies of both signs being quite small.

ROC map to be done in October

**Figure 7:** Left: Tercile category probability forecasts for 2m temperature, October-December 2011. Blue shading: below-normal most likely; red shading: above-normal most likely; grey shading: near normal most likely; white: equal chances. Right: ROC scores, at each point displayed for the category forecast as most likely at that location. Skill values are not plotted at points with no forecast signal. The ROC score may be interpreted as the fraction of hindcast years for which the forecast correctly discriminated the observed category, with a score of 0.5 indicating no skill (i.e. no better than guesswork).

**RA I:** Near normal conditions prevail over the whole Africa continent.
RAII: Prevailing of the positive anomaly over South-East Asia. No signal (inconsistent forecasts) for North Asia.
RAII: near normal conditions prevail, with inconsistency between the forecasts being essential.
RAIV: Near normal conditions prevail with slightly increased probability of negative anomalies over the North West of the continent.
RAV: Near normal conditions prevail over the whole continent, with inconsistency between the forecasts being essential.
RAVI: No signal (inconsistent forecasts) for most of Europe.

2.3. Predicted precipitation. October-December 2011
Prevailing of near normal conditions, with probabilities of anomalies of both signs being quite small.

![ROCFigure][1]

Long-term skill

RA I: Prevailing of near normal conditions with enhances probability of anomalously dry weather in the Equatorial Africa.
RAII: No signal (inconsistent forecasts) throughout the whole continent with exception of low precipitation anomaly around the Persian Gulf.
RAIII: No signal (inconsistent forecasts) throughout the whole continent.
RAIV: Prevailing of near normal conditions.
RAV: Prevailing of near normal conditions
RAVI: No signal (inconsistent forecasts) throughout the whole continent.

3. How to use the Global Seasonal Climate Update
a) Seasonal outlooks for any region or nation should be obtained from the relevant Regional Climate Centre (RCC) or National Meteorological and Hydrological Service (NMHS). The GSCU is intended as guidance for RCC and NMHSs. It does not constitute an official forecast for any region or nation.
b) Seasonal forecasts are probabilistic in nature. Although the text and figures used in the GSCU highlight the tercile categories with highest predicted probability, it is important to recognise that the other tercile categories may also have substantial (though lower) probability.
c) The geographical areas occupied by the forecast signals should not be considered precise. Similarly, signals with small spatial extent may be unreliable.
d) The skill of seasonal forecasts is substantially lower than for shorter range and skill may vary considerably with region and season. It is important to view the forecast maps together with the skill maps provided.
e) In general each forecast statement in sections 1 and 2 is followed by a comment on forecast skill. We use the ROC score. We define the skill to be GOOD if ROC score is above the 90% confident level (for 20-25 years it is above appr. 0.7); VARIABLE of 0.5<ROC score<=0.7; LOW if ROC score <= 0.5.
f) For reference the 6 WMO Regional Association regions are provided in the figure below.

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References

Sources for the graphics used in the GSCU:
NOAA National Climatic Data Centre: http://www.ncdc.noaa.gov/oa/ncdc.html
The WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble prediction (LC-LRFMME):
http://www.wmoocl.org
International Research Institute for Climate and Society (IRI):
http://portal.iri.columbia.edu/portal/server.pt
APEC Climate Center: www.apcc21.net
The WMO Lead Centre for the Standard Verification System for Long-Range Forecasts (LC-SVSLRF):

WMO resources:
WMO portal to the Global Producing Centres (GPC) for Long-range Forecasts:
http://www.wmo.int/pages/prog/wcp/wcasp/clips/producers_forecasts.html
WMO Portal for Regional Climate Outlook Forums (RCOFs):
http://www.wmo.int/pages/prog/wcp/wcasp/clips/outlooks/climate_forecasts.html

Acknowledgements
This Global Seasonal Climate Update is an international effort, with contributions coming from:
- National Climate Data Center;
- Global Producing Centres: Beijing, CPTEC, ECMWF, Exeter, Melbourne, Montreal, Moscow, Pretoria, Seoul, Tokyo, Toulouse, Washington;
- WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble;
- International Research Institute for Climate and Society;
- Met Office;
- Meteo France.
Large-scale sea surface temperature (SST) indices

The ENSO state is neutral

A near neutral phase of the Indian Ocean Dipole (IOD) has been maintained since spring 2011.

Positive SST anomalies have been maintained over both North and South Tropical Atlantic.

<table>
<thead>
<tr>
<th>Month</th>
<th>Niño3.4</th>
<th>Niño 1+2</th>
<th>IOD</th>
<th>NTA</th>
<th>STA</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>-0.18</td>
<td>0.85</td>
<td>0.01</td>
<td>0.79</td>
<td>0.01</td>
</tr>
<tr>
<td>July</td>
<td>-0.26</td>
<td>0.45</td>
<td>-0.13</td>
<td>0.46</td>
<td>0.11</td>
</tr>
<tr>
<td>August</td>
<td>-0.64</td>
<td>0.00</td>
<td>-0.06</td>
<td>0.46</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Table 1: Large-scale SST indices: June-August 2011

Large-scale circulation indices

The Arctic Oscillation (AO) and North Atlantic Oscillation (NAO) were in negative phase throughout the period, with other Northern Hemisphere Teleconnection indices significantly varying.

<table>
<thead>
<tr>
<th>Month</th>
<th>AO</th>
<th>NAO</th>
<th>PNA</th>
<th>EA/WR</th>
<th>SCAND</th>
<th>POL</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>-0.858</td>
<td>-0.93</td>
<td>1.80</td>
<td>-0.44</td>
<td>0.01</td>
<td>-1.45</td>
</tr>
<tr>
<td>July</td>
<td>-0.472</td>
<td>-1.62</td>
<td>-0.84</td>
<td>-0.71</td>
<td>-0.30</td>
<td>0.84</td>
</tr>
<tr>
<td>August</td>
<td>-1.063</td>
<td>-1.85</td>
<td>-2.08</td>
<td>0.30</td>
<td>-3.09</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Table 2: Large-scale circulation indices: June - August 2011
Predicted large-scale sea surface temperature (SST) indices

Neutral to weak La Niña conditions are expected to continue over the forthcoming season. Neutral to positive phase of Indian Ocean Dipole (IOD) is favoured. Both North and South Tropical Atlantic indices are expected to be near normal.

Figure 5: Multi-model forecasts for the oceanic indices. Upper panel: Nino 3.4 index, left: the IRI’s analysed set of dynamical and statistical systems (http://iri.columbia.edu/climate/ENSO/currentinfo/SST_table.html); right: LC LRFMME; middle panel: left: Nino 1+2; right: IOD from LC LRFMME; lower panel: left NTA; right STA from LC LRFMME.
## Predicted variables with the one month lead time: October - December’11

<table>
<thead>
<tr>
<th>Forecast (tercile probabilities)</th>
<th>Historical Skill (ROC scores)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Z500</strong></td>
<td>ROC map to be done in October</td>
</tr>
<tr>
<td><img src="image" alt="Z500 ROC map" /></td>
<td></td>
</tr>
<tr>
<td><strong>SLP</strong></td>
<td>ROC map to be done in October</td>
</tr>
<tr>
<td><img src="image" alt="SLP ROC map" /></td>
<td></td>
</tr>
<tr>
<td><strong>T850</strong></td>
<td>ROC map to be done in October</td>
</tr>
<tr>
<td><img src="image" alt="T850 ROC map" /></td>
<td></td>
</tr>
</tbody>
</table>
ROC map to be done in October
### Predicted variables with the two month lead time: November’11-January’12

<table>
<thead>
<tr>
<th>Forecast (tercile probabilities)</th>
<th>Historical Skill (ROC scores)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Z500</strong></td>
<td></td>
</tr>
<tr>
<td>melbourne HGT500mb FCST us</td>
<td>ROC map</td>
</tr>
<tr>
<td>Sep2011 + NDJ</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Z500 ROC map" /></td>
<td></td>
</tr>
</tbody>
</table>

| **SLP**                           |                               |
| melbourne PRMSLmsI FCST us       | ROC map                       |
| Sep2011 + NDJ                     |                               |
| ![SLP ROC map](image)             |                               |

| **T850**                          |                               |
| melbourne TMP850mb FCST us       | ROC map                       |
| Sep2011 + NDJ                     |                               |
| ![T850 ROC map](image)            |                               |

| **T2m**                           |                               |
|                                   |                               |

**Note:** Only GPC Melbourne forecasts are available today. Real time of implementation of this table is when most of the GPCs provide these data to construct the PMME.
**Precipitation**

**SST**

**ROC map**
Last season (OND 2011) predicted and observed anomalies

<table>
<thead>
<tr>
<th>Predicted anomalies (tercile probabilities)</th>
<th>Observations (percentiles)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Z500</strong></td>
<td>...&lt; 15 &lt; ...&lt; 33 &lt; ...&lt; 67 &lt; ...&lt; 85 &lt; ...</td>
</tr>
<tr>
<td><img src="image" alt="Z500 Predicted Anomalies" /></td>
<td><img src="image" alt="Z500 Observations" /></td>
</tr>
<tr>
<td><strong>SLP</strong></td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="SLP Predicted Anomalies" /></td>
<td></td>
</tr>
<tr>
<td><strong>T850</strong></td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="T850 Predicted Anomalies" /></td>
<td></td>
</tr>
<tr>
<td><strong>T2m</strong></td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="T2m Predicted Anomalies" /></td>
<td></td>
</tr>
</tbody>
</table>
OPERATIONAL SCHEDULING AND GUIDANCE: OPTIMAL AND SUB-OPTIMAL PROCESSES

1. The GSCU process (see Vladimir’s document):

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date of the Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>2</td>
</tr>
<tr>
<td>Monitoring section preparation</td>
<td></td>
</tr>
<tr>
<td>Collection of GPCs’ model forecasts</td>
<td></td>
</tr>
<tr>
<td>Estimation of PMME and indices</td>
<td></td>
</tr>
<tr>
<td>Verification maps based on hindcasts</td>
<td></td>
</tr>
<tr>
<td>Analysis and compilation of GSCU</td>
<td></td>
</tr>
</tbody>
</table>

2. Optimal Process vs sub-optimal process:

An optimal process is built on the hypothesis that all things are timely running and nothing neither nobody is missing or unavailable. Also no adverse events during the period the process is running are observed. If anything is wrong or missing or delayed, we have move to a sub-optimal process which must be planned and described prior to the operational implementation.

3. Some questions to address in order to keep the process under control

- What is missing in the present process?
- Are the dates sustainable? Are alternative dates acceptable? What could lead to some date shift?
- Can we define some replacement (or complementary) products which should be considered as “working” document (so likely useful for the analysis) but could be ready in case of concern with the products used for final edition?
- In each concerned team is the timely availability of key persons ensured?
- Can we propose some alternative people or team in case of concern?
- Is a guideline available (in order than an alternative person could easily take responsibility of one part of the process)?

4. Details on the optimal process and possible adjustments

- **Monitoring section:**
  Large scales indices for Ocean and for Atmosphere, T2m anomalies, Precipitation anomalies, major climate events (over the period ??? and for the season ???)
  Optimal date*: 15th of current month
  Sub-optimal date*: 20th at the latest (events up to the 15th of the month)

- **Forecasting section 1 & 2 month LT:**
  Probabilistic MME for T2m and rainfall, expected date for model collection 10th; Cut Off date: 15th; Data quality check needs about 3 days, MME product needs about 1 or 2 days
  Large scale indices forecasts for ocean and for atmosphere (plumes, climagrams, others?), expected date for model collection 10th; Cut Off date: 15th; Data quality check needs about 3 days, (deterministic forecasts for the plumes – check for available verification on oceanic indices – Niño 3.4) At least for MME report the observation onto the forecast MME plumes.
  Take care with common model baseline for both fields and indices

*Keep in mind day off, week-end, etc.
Prepare a table with scores of individual models (MSSS and ACC) – (ask GPCs to provide!)
Atmospheric indices: SOI (how to compute?) check with ECMWF (asking for the forecast) and CBS
ET-ELRF (for including the outcomes of the report mater on)

Optimal date*: 18\textsuperscript{th} of the current month
Sub-optimal date*: 20\textsuperscript{th}

- Analysis and compilation of GSCU:
  Analysis, compilation and drafting, taking care to get the right person(s) for analysis and
  compilation (for a more efficient review)
  Expert assessment, Consensus (2 days minimum but very short – cf different time zone)
  Optimal date*: 22\textsuperscript{th}
  Sub-optimal date*: 24\textsuperscript{th}
  Institutional commitment needed on the long term
  Starting with quarterly issuance (still some open question on the relevant seasons)
  Starting with the current season and discussing with RCCs and RCOFs for further adjustments
  Consensus process: options of acceptance/rejection should be included in the draft
  Need to identify the expert for writing the consensus (and take final decision)
  Need to identify experts participating to the consensus (GPCs + ...)

- Publication of GSCU:
  Edition of the document, final review, (panel of experts to be identified) release and dissemination
  LC-MME responsible for this part
  Press release by WMO
  Optimal date*: 25\textsuperscript{th}
  Sub-optimal date*: 28\textsuperscript{th}

5. Revised Process Overview

<table>
<thead>
<tr>
<th>Process/products</th>
<th>Responsible entity/remarks</th>
<th>Availability dates</th>
<th>Alternate solution</th>
<th>Comment Actors</th>
</tr>
</thead>
<tbody>
<tr>
<td>MONITORING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2m anomalies</td>
<td>NOAA</td>
<td>15 (of current month) / 20</td>
<td>tbd</td>
<td>To be sent to the entity responsible for analysis and compilation</td>
</tr>
<tr>
<td>Rainfall anomalies</td>
<td>Percentiles map + anomaly maps</td>
<td>15 / 20</td>
<td>tbd</td>
<td>NOAA</td>
</tr>
<tr>
<td>Oceanic Indices Pacific, Atlantic and Indian oceans</td>
<td>Anomaly map</td>
<td>15 / 20</td>
<td>tbd</td>
<td></td>
</tr>
<tr>
<td>Atmospheric Indices for North, South hemispheres and Tropics</td>
<td>Anomaly map</td>
<td>15 / 20</td>
<td>tbd</td>
<td></td>
</tr>
<tr>
<td>Major Climate Events</td>
<td>Text and map</td>
<td>20 / 21</td>
<td>tbd</td>
<td></td>
</tr>
</tbody>
</table>

<p>| FORECASTING            |                           |                    |                    |                |
| Probabilistic T2m forecast (1 and 2 LT) | Probability map | 20/21 | EuroSIP, APCC, IRI? |                |
| Probabilistic rainfall forecast (1 and 2 LT) | Probability map | 20/21 | EuroSIP, APCC, IRI? |                |</p>
<table>
<thead>
<tr>
<th>Topic</th>
<th>Product Type</th>
<th>Date</th>
<th>Distribution Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oceanic Indices Pacific, Atlantic and Indian oceans</td>
<td>Plume diagrams</td>
<td>20/21</td>
<td>EuroSIP, APCC, IRI ?</td>
</tr>
<tr>
<td>Atmospheric Indices for North, South hemispheres and Tropics</td>
<td>Plume diagram (or climagrams ?)</td>
<td>20/21</td>
<td>EuroSIP, APCC, IRI ?</td>
</tr>
<tr>
<td>Verification products</td>
<td>ROC maps of the most likely categories</td>
<td>20/21</td>
<td>ROC maps of upper and lower terciles ? Question of the period and cross validation</td>
</tr>
<tr>
<td><strong>ANALYSIS AND COMPILATION</strong></td>
<td>Editorial board ?</td>
<td></td>
<td>To be sent to the entity responsible for final edition, review and dissemination</td>
</tr>
<tr>
<td>Selection of key issues in the state of the climate system</td>
<td>Discussion and text (+ inclusion of highlight onto the maps ?)</td>
<td>24/25</td>
<td>Alternate persons ? especially focusing on Tropical SSTs, Large Scale Atmospheric Patterns and Large Climate Anomalies</td>
</tr>
<tr>
<td>Selection of key issues in the SST forecasts</td>
<td>Discussion and text (+ inclusion of highlight onto the maps ?)</td>
<td>24/25</td>
<td>Alternate persons ?</td>
</tr>
<tr>
<td>Selection of key issues in the Large Scale Indices forecasts</td>
<td>Discussion and text (+ inclusion of highlight onto the maps ?)</td>
<td>24/25</td>
<td>Alternate persons ?</td>
</tr>
<tr>
<td>Selection of key issues in the temperature forecasts</td>
<td>Discussion and text (+ inclusion of highlight onto the maps ?)</td>
<td>24/25</td>
<td>Alternate persons ? Without forgetting potential vulnerable zones (see monitoring section)</td>
</tr>
<tr>
<td>Selection of key issues in the precipitation forecasts</td>
<td>Discussion and text (+ inclusion of highlight onto the maps ?)</td>
<td>24/25</td>
<td>Alternate persons ? Without forgetting potential vulnerable zones (see monitoring section)</td>
</tr>
<tr>
<td><strong>PUBLICATION OF GSCU</strong></td>
<td></td>
<td></td>
<td>To be sent to the entity responsible for the final dissemination (WMO ?)</td>
</tr>
<tr>
<td>Identification of the key messages</td>
<td>Discussion</td>
<td>24/25</td>
<td></td>
</tr>
<tr>
<td>Edition of the GSCU</td>
<td>Text and figures</td>
<td>24/25</td>
<td></td>
</tr>
<tr>
<td>Final review</td>
<td></td>
<td>24/25</td>
<td></td>
</tr>
<tr>
<td>Release/dissemination of the GSCU</td>
<td></td>
<td>24/26</td>
<td>In addition Press release, Press conference, ... ?</td>
</tr>
</tbody>
</table>
OPERATIONAL SCHEDULING AND GUIDANCE:
METHODOLOGY

GENERAL

- Basic period for Monitoring section is 1981-2010 (30 yrs) – to be implemented in the future. Now a need for decision on: (1) basic period; (2) anomaly or percentiles or both;
- Basic period for Prediction section is the common period of the hindcasts of the GPCs’ models participating in MME: 1983-2002 (20 yrs, 8 GPCs – 11 models);
- One month lead forecast participating GPCs: Beijing, Exeter, Melbourne, Montreal (x 4 models), Moscow, Seoul, Tokyo, Washington;
- Two month lead forecast participating GPCs: Exeter (?), Melbourne, Seoul (?), Washington (?) – (?) means a need for corresponding hindcasts.
- At the end of the pilot phase, is should be particularly helpful to issue a kind of guidance document with clear indication on how to coordinate GSCU discussion, build consensus and develop/finalize text summaries. This guidance document should ensure some consistency in the timing of the GSCU and also help in case of possible need to move to a sub-optimal process. It should prevent or minimize subjective interpretation in the analysis prior to the final edition.
- Just as an illustration of the lack of such a guidance, in the MAM version nobody commented the Tropical Atlantic while we had a dramatic change, namely moving from warm to cold conditions, especially in the South Tropical Atlantic. In this context, it is clear that the sea surface temperature (SST) anomalies must be analyzed differently in the 3 tropical basins as the interannual variability is very different (e.g., stronger over the Pacific, weaker over the Atlantic).
- It could be also very helpful to have some "prededined" terms e.g. for translating the probabilities (likely, very likely, possible, ...) or the strength of the anomalies (strong very strong, ...).
- An important aspect that we should keep in mind is that the forecast (outlook) is issued through the analysis step (and potential expert assessment especially for the predictability issues) and not already done once the maps are ready.
- A suitable check list could help for each step of the process.
- The vocabulary issue is in the landscape as a cross cutting issue.

MONITORING SECTION

- Monitoring covers: Large scale oceanic indices, large scale circulation indices, T2m, Precipitation, overview of extreme events.
- The figures to be completely drawn at NCDC and provided for Analysis and Compilation Team by e-mail by Day 15 of the Month. The text should be written by the Analysis and Compilation Team or NCDC (to be decided by them).
- Large-scale oceanic indices: where to look at and what kind of anomalies to comment (obviously tropical basins, but mid-latitudes or sub-tropical gyres ?).
- Similar questions for large-scale atmospheric indices, T2m anomalies, Precipitation anomalies, major climate events, etc.
- One can focus only on anomalies and events which are related to seasonal forecasting or on “strong” events and anomalies but which are not necessarily related to SST tropical forcing. Which relationship should be highlighted with maps/graphics ? What are the associated vocabulary issues ?

PREDICTION SECTION

- Prediction section should be made by LC LRF-MME and provided for Analysis and Compilation Team by e-mail by Day 21 of the Month.
• SST forecasts (including oceanic indices): where to look at and what kind of anomalies to comment? Are indications of skill necessary?
• Similar questions for probabilistic MME for T2m, rainfall and large-scale atmospheric indices (which indices to look at?)
• Maps of ROC scores related to the most likely category: Is any comment useful? Which threshold to use for comments (if any) and which relationship with the map?
• It seems quite obvious to focus only on predictable information (see also above). However, some preliminary predictability assessment is necessary prior to the comments (and text). So some questions remain about this predictability assessment (quite easy for ENSO influenced regions but for the others?). Some specific vulnerable regions (see monitoring section) could request specific focuses. Also consider vocabulary issue.

• **Multimodel Ensemble Seasonal Forecast**
  - MME Probabilistic Forecast should be produced at LC LRF-MME.
  - Operational procedure includes
    1. Collection of the GPCs’ model outputs (usually it is 1st – 18th of the Month).
    2. Estimation of probabilistic multimodel ensemble seasonal forecast (PMME) in accordance with the method described by Min et al. (WAF, 2009), with the forecast being displayed as a combined map of the prevailing tercile probabilities. The T2m and Precipitation forecast maps should be displayed in the main part of the GSCU, with all all six variable forecasts (Z500, SLP, T850, T2m, Precipitation, SST) being shown in Appendix.
    3. The two month lead time forecasts are to be estimated similarly to Point 2 (see above) on the basis of the relevant model forecasts, with all six forecast maps being shown in Appendix.
    4. Estimation of the oceanic indices based on the GPCs’ couple model outputs. Each index is estimated for each model separately based on the ensemble members and ensemble mean. Indices are shown as a set of model plumes with monthly resolution in Appendix.

• **Verification Maps Supporting the Forecast Maps**
  - Verification assessments of the historical forecasts are shown side by side with the corresponding forecast maps. Verification is performed in terms of Relative Operational Characteristic Scores (ROCS). ROCS is shown for the prevailing category (AN or NN or BN) for each grid-point.
  - The work that should be done in advance: For each variable:
    1. LC LRF-MME estimates historical crossvalidated three PMME tercile probability maps for each season for each year of the hindcast period on the basis of the collected historical GPCs’ outputs and provides these maps (in digital form) for LC SVS;
    2. LC SVS estimates three ROCS maps based on the provided historical PMMEs for tercile categories and provides them for LC LRF-MME.
  - In operational mode, after PMME has been estimated and the prevailing category for each gridpoint defined, LC LRF-MME constructs the verification map based on the PMME map and three ROCS maps.

• **Oceanic Indices**
  - Oceanic indices are estimated on the basis of the SST forecast fields. The indices are shown as a combination of the individual model plumes. Anomalies are estimated in respect to historical model ensemble mean.
  - Nino 3.4 is defined as SST anomaly averaged over the rectangle [5°N - 5°S, 170° - 120°W]
  - Nino 1+2 is defined as SST anomaly averaged over the rectangle [0° - 10°S, 90° - 80°W]
  - Indian Ocean Dipole is defined as a difference between SST averaged over the rectangles [10°N - 10°S, 50° - 70°E] and [0° - 10°S, 90° - 110°E]
- North Tropical Atlantic index is defined as SST anomaly averaged over the rectangle [20° N - 5°N, 60° - 30°W]
- South Tropical Atlantic index is defined as SST anomaly averaged over the rectangle [0° - 20°S, 30°W - 10°E]

- **IRI Nino 3.4 forecast**
  - Should be taken from the IRI site (?) or received by e-mail

- **Analysis and compilation of GSCU**
  - Identification of the key messages to highlight from the monitoring and forecast sections:
    - Implications of the orientation chosen above, e.g., for the forecast we could recommend to highlight only regions where the predictability is present. In addition, this section should likely carefully address the uncertainty messages.

- **Publication of GSCU**
  - Edition of the document, final review, release and dissemination:
    - Do we need an editorial board to review the final version? To be highlighted that, at this level, the full consistency of the GSCUs and verification in accordance with the guiding principles must be ensured.
    - The communication staff should support this step. How is the final release managed? How is effective communication ensured?

- **Time Table of GSCU Production Line**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date of the Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring section preparation</td>
<td>2 4 6 8 10 12 14 16 18 20 22 24 26 28 30</td>
</tr>
<tr>
<td>Collection of GPCs' model forecasts</td>
<td></td>
</tr>
<tr>
<td>Estimation of PMME and indices</td>
<td></td>
</tr>
<tr>
<td>Verification maps based on hindcasts</td>
<td></td>
</tr>
<tr>
<td>IRI Nino 3.4 forecast</td>
<td></td>
</tr>
<tr>
<td>Analysis and compilation of GSCU</td>
<td></td>
</tr>
</tbody>
</table>
ROLE OF LC-LRFMME FOR SUSTAINED PRODUCTION OF GSCU

1. LC-LRFMME PRODUCTS: GPC digital data and graphical products

At present, the forecast anomalies from 12 GPCs (CPTEC has joined since January 2011) for 2-meter surface temperature, precipitation, mean sea level pressure, 850hPa temperature, 500hPa geopotential height, and sea surface temperature (if available) are collected at the LC-LRFMME between the 1st to 18th of each month, and the forecast data are used in displaying various seasonal forecast products. The basic prediction lead time of LC-LRFMME is 1-3 months (2-4 months ahead of date of issue). Table 1 shows the provided GPC digital data and graphical products in standard format available from LC-LRFMME. The product display at the Lead Centre website includes monthly and seasonal mean anomalies from individual GPCs and also a synthesis of information in terms of consistency in the sign of anomalies from all GPCs. In addition to this, 3 types of deterministic MME (Simple Composite Mean, Regular Multiple Regression, and Singular Value Decomposition) and probabilistic MME prediction are shown on the LC-LRFMME website (www.wmolc.org). Since hindcasts from all GPCs are not yet available, skill-dependent weighting for constructing multi-model average has some limitations.

Table 1. LC-LRFMME Products: GPC digital data and graphical products

<table>
<thead>
<tr>
<th>Digital products</th>
<th>Graphical products</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Both forecast and hindcast of monthly mean anomalies of the GPC’s ensemble mean for lead 1~3), following the month of submissions</td>
<td>- Individual forecast</td>
</tr>
<tr>
<td>· 2m surface temperature</td>
<td>· plots for each GPC forecast anomalies in common graphical format (Rectangular, Time series, Stereographic type, etc.)</td>
</tr>
<tr>
<td>· Precipitation</td>
<td>· Consistency map</td>
</tr>
<tr>
<td>· Mean sea level pressure</td>
<td>· SST Plume (Nino3.4 SST anomalies)</td>
</tr>
<tr>
<td>· 850hPa temperature</td>
<td>- Deterministic Multi-model Ensemble</td>
</tr>
<tr>
<td>· 500hPa geopotential height</td>
<td>· Simple composite mean(SCM)</td>
</tr>
<tr>
<td>· Sea surface temperature</td>
<td>· Regular Multiple Regression</td>
</tr>
<tr>
<td></td>
<td>· Singular Value Decomposition(SVD)</td>
</tr>
<tr>
<td></td>
<td>- Probabilistic Multi-model Ensemble</td>
</tr>
<tr>
<td></td>
<td>· tercile-based categorical probabilities</td>
</tr>
</tbody>
</table>

The products from LC-LRFMME for GSCU February 2012 show on Table 2. Two prediction lead times (1-3 months, 2-4 months) of PMME of 2-meter surface temperature, precipitation, mean sea level pressure, 850hPa temperature, 500hPa geopotential height and simple composite MME of sea surface temperature are provided to predict potential evolution of the state of the climate over the next season. As well as these MME forecasts large-scale sea surface temperature indices such as Nino 3.4, Nino 1+2, Indian Ocean Dipole (IOD), North Tropical Atlantic (NTA) and South Tropical Atlantic indices are analysed for trial version of GSCU.
Table 2. The products from LC-LRFMME for GSCU

<table>
<thead>
<tr>
<th>Tercile category</th>
<th>Probability forecast (PMME)</th>
<th>Large-scale SST indices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Both 1-3 and 2-4 months lead time of</td>
<td>· Nino 3.4</td>
</tr>
<tr>
<td></td>
<td>· 2m surface temperature</td>
<td>· Nino 1+2</td>
</tr>
<tr>
<td></td>
<td>· Precipitation</td>
<td>· IOD (Indian Ocean Dipole)</td>
</tr>
<tr>
<td></td>
<td>· Mean sea level pressure</td>
<td>· NTA (North Tropical Atlantic)</td>
</tr>
<tr>
<td></td>
<td>· 850hPa temperature</td>
<td>· STA (South Tropical Atlantic)</td>
</tr>
<tr>
<td></td>
<td>· 500hPa geopotential height</td>
<td></td>
</tr>
<tr>
<td></td>
<td>· Sea surface temperature</td>
<td></td>
</tr>
</tbody>
</table>

2. OPERATIONAL PROCEDURE

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date of the Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection of GPCs’ model forecasts</td>
<td>2     4   6  8    10 12 14 16 18 20 22 24</td>
</tr>
</tbody>
</table>
| Standardization of GPC’s forecasts to common format | 6
| Calculation of DMME and PMME      | 18
| Displaying seasonal forecasts on the homepage | 20
| Calculating relevant products of GSCU | 22

3. Some issues to address in order to sustain production of GSCU with LC-LRFMME data

According to Table 2, the system configurations of 12 GPCs,

- not only the hindcasts from all GPCs are not provided but the hindcast periods are also different.
- the basic period of forecasts are 1-3 month lead so that there are some limitation to produce 2-4 month PMME. Even though GPC ECMWF and Toulouse provide more than 3 month range of forecast, their hindcast data are not given. Therefore only 6 GPCs (Exeter, CPTEC, Melbourne, Montreal, Seoul, Washington) forecast data are available to calculate PMME
### Table 3. System Configurations of 12 GPCs

<table>
<thead>
<tr>
<th></th>
<th>Beijing</th>
<th>CPTEC</th>
<th>ECMWF</th>
<th>EXETER</th>
<th>Melbourne</th>
<th>Montreal</th>
<th>Moscow</th>
<th>Pretoria</th>
<th>Seoul</th>
<th>Tokyo</th>
<th>Toulouse</th>
<th>Washington</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Res.</td>
<td>(BCC)</td>
<td>(CPTEC)</td>
<td>(ECMWF)</td>
<td>(EXETER)</td>
<td>(POAMA)</td>
<td>(MSC)</td>
<td>(HMC)</td>
<td>(SAWS)</td>
<td>(GDAPS)</td>
<td>(TCC)</td>
<td>(toulouse)</td>
<td>(NCEP)</td>
</tr>
<tr>
<td>T63/L16</td>
<td>T62/L28</td>
<td>T255/L91</td>
<td>T47/L17</td>
<td>T63</td>
<td>1.28ºx 1.875º /L85</td>
<td>T42/L19</td>
<td>T106/L21</td>
<td>1.875º x1.875º /L40</td>
<td>T63/L91</td>
<td>T62/L64</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Forecast

<table>
<thead>
<tr>
<th>Forecasting range</th>
<th>3 months</th>
<th>6 months</th>
<th>6 months</th>
<th>5 months</th>
<th>6 months</th>
<th>11 months</th>
<th>3 months</th>
<th>3 months</th>
<th>6 months</th>
<th>3 months</th>
<th>6 months</th>
<th>9 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>Mean, Climate</td>
<td>Mean, Climate</td>
<td>Anomaly</td>
<td>Mean</td>
<td>Mean, Anomaly</td>
<td>Mean, Climate</td>
<td>Mean</td>
<td>Anomaly</td>
<td>Mean, Climate</td>
<td>Mean, Anomaly</td>
<td>Mean, Anomaly</td>
<td>Anomaly</td>
</tr>
<tr>
<td>Members</td>
<td>8</td>
<td>15</td>
<td>41</td>
<td>42</td>
<td>30</td>
<td>20 (2model x 10)</td>
<td>20</td>
<td>6</td>
<td>20</td>
<td>51</td>
<td>41</td>
<td>40</td>
</tr>
</tbody>
</table>

#### Hindcast

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>O</td>
<td>O</td>
<td>X</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>Members</td>
<td>8</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>10</td>
<td>20 (2model x 10)</td>
<td>10</td>
<td>6</td>
<td>20</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

1-Tier(CGCM)  2-Tier(AGCM)
COMMUNICATION ISSUES

Global Seasonal Climate Updates are new product compared to other climate services. It is not very intuitive for all the potential users what benefits could be obtained using such information, therefore special attention should be devoted to communication among information providers and information users.

There is a need to establish a communication strategy tailored to this specific product and its potential users. As the product is relatively new and has specific characteristics compared to more widely used climate services, capacity building should be essential part of product promotions, as it should be regular monitoring of lessons learned in communication process with stakeholders.

The main issues for discussion:

Objective and tasks:

1. Prepare the scientific information in an easy understandable form which is enabling end-users, journalists and general public to make the best use of it
2. Ensure regular two-way communication, strengthen and expand the cooperation with the users
3. Capacity building for information providers and on the other hand for information users
4. Raise visibility of the product among potential users and general public
5. Investigate the perception of provided information among users
6. Regular monitoring of communication process and its assessment
7. Investigate potential benefits of use of new media

1. **Prepare the scientific information in an easy understandable form which is enabling users, journalists and general public to make the best use of it**

   - WMO, Regional Climate Centres and NHMSs as communication points
   - Communication language (no jargon, explain scientific terminology); define original language and official translation in all official WMO languages and in the language of users
   - Provide clear definitions and explanations of terms used in information provision including list of definitions with examples and dictionary for GSCU purpose
   - Highlighting benefits for users and society resulting from use of GSCU
   - Maintaining swift flow of products/information
   - Maintain the right balance between figures and text

2. **Ensure regular two-way communication, strengthen and expand the cooperation with the users**

   - Development of new communication strategies and use of “new media”
   - Involvement of stakeholders in improvement of GSCU
   - Providing assistance for users

We need to adjust our tone to the recipients. The most common mistake in communication is formulating information in an incomprehensible manner.

The Internet is getting more popular every day. Nowadays, it is the user’s basic tool when looking for weather information. Users look for interaction and wish to start a debate and communicate their thoughts. The time when the primary forms of communication were written reports, statements or press
releases has gone. Currently, in the era of technological developments the social media, websites, instant messaging and multimedia should compliments the old channels of communication.

3. **Capacity building for information providers and on the other hand for information users. Organizing workshops and online training**

- Applied climate education, identification of climate sensitive sectors that could benefit from GSCU
- Mutual understanding and involvement in communication activities
- Increasing awareness about the climate integrity with global economy and society

Training and workshops cover: theoretical background, case study and individual communications training, new technologies and potential benefits when using the seasonal outlooks, information interpretations and misunderstandings, media tricks, interviews and time management. As example see EMS Communication skills workshop for climatologists (separate material provided).

4. **Raise visibility of the product among potential users and general public**

- Reaching each and every user
- Developing unified tools and methods for information provision
- Develop a tool to support governments, business and society in coping with climate variability
- Identifying potential end users including political elites and the decision makers, United Nations Agencies and other international organizations
- Informing users and the decision-makers about the importance of GSCU and potential benefits
- Promote examples of good practice

Use every opportunity to highlight the GSCU (e.g. Expert opinion or specialist data, particular events or activities, press release, sensation, ‘crisis situation’, how to react to the issue “does not concern us”).

Unfortunately there is no best and verified method. Direct forms of communication are among others: conferences, briefings, seminars or workshops. During conferences or briefings journalists are allowed to familiarise themselves with particular information or a problem and they are able to ask questions and make interviews.

Consider tips on how to interact with users and journalists:
Speak clearly and briefly, provide examples, interesting cases, respond swiftly to questions and comments, control what you say in press conference.

There is no proven way of good media relations. Regular and direct contact with editorial staff is the best and most desirable form of media relations. Therefore, it is wise to build a media database and to systematically gather and update such information. Knowledge of particular journalists will make it easier for us to disseminate information.

Journalists look for information that:
- is up-to-date and newsworthy: journalists always tend to be the first and the only source of information;
- applies to a great number of people: the information that may affect lives finds a great interest in audience;
- is interesting, distinctive and original.

5. **Investigate the perception of provided information among users**

- Questionnaires, interviews
6. **Regular monitoring of communication process and its assessment**

- Establish a process to monitor communication process and evaluate improvement in visibility of provided products
- In regular intervals collect feedbacks from stakeholders and define measures to be implemented in order to improve the process
- Collect examples of good practice and establish the inventory

7. **Investigate potential benefits of use of new media**

- Social media: (e.g. Facebook.com, MySpace.com) - make it easy to make new friends and maintain virtual friendship
- Network media: (e.g. LinkedIn.com) - its task is to create business relations and to interact with sectoral and thematic groups
- Photo/video hosting services (e.g. YouTube.com, Flickr.com) - provide video, music and photo content for its users
- Citizen Journalism (e.g. Wikinews.org) - collect information from amateur journalists, provide amateur videos and pictures;
- Forums - virtual places to exchange opinions and beliefs for both specialists and laymen
- Blogs - present personal beliefs and opinions concerning particular topic;
- Repositories: (e.g. Wiki-Books, Wikipedia) - information transferred into a global encyclopaedia, dictionary or database.

**Recommendations**

1. Establish a websites and forums, feature articles, disseminate forecasts via e-mail for subscribers, provide audio-video forecasts/bulletins.
2. Maintain continuous manner of informing the users, media and the public, including wider use of most popular social media/networks.
3. Prepare and regularly update information about conditions, return period, historical information, authority and responsibility. Cover probabilities and provide information ready as soon as it is available.