WORLD CLIMATE PROGRAMME

WORLD CLIMATE SERVICES PROGRAMME
(Climate Applications & Services)

MEETING OF THE COMMISSION FOR CLIMATOLOGY EXPERT TEAM ON CLIMATE SERVICES INFORMATION SYSTEM (ET-CSIS)

4 – 6 December 2012

Toowoomba, Queensland, Australia

FINAL REPORT

WORLD METEOROLOGICAL ORGANIZATION
December 2012

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)

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Participants at the ET-CSIS meeting, 4-6 December 2012, Toowoomba, Australia
Left to right: L Malone, S Mushtaq, R Stone, S Mason, A Watkins, M Brunet, P Hechler, A Kumar, M Rajeevan, B Tapia, R Kolli, L Brunton

1. Opening

The meeting of the World Meteorological Organization (WMO) Commission for Climatology (CCl) Expert Team on the Climate Services Information System (ET-CSIS) was formally opened at 09:00 on Tuesday, 4 December 2012, by Mr Peer Hechler, Chair of ET-CSIS. On behalf of Professor Jan Thomas, Vice-Chancellor, University of South Queensland, Professor Roger Stone, Professor in Climatology and Water Resources and Director, Australian Centre for Sustainable Catchments, University of Southern Queensland, welcomed the participants to Australia, to Toowoomba, and to the University.

Dr R Kolli, Officer-in-Charge, Climate Prediction and Adaptation Branch, WMO Secretariat, on behalf of Mr Michel Jarraud, Secretary-General of WMO, welcomed the participants; thanked the co-leads for the team, Mr Peer Hechler and Dr Simon Mason, for their efforts in setting the work for this team; and thanked Professor Roger Stone for his efforts in the local arrangements and as host. Dr Kolli noted that this meeting would be a landmark event for development of WMO's contribution to the CSIS pillar of the Global Framework for Climate Services (GFCS).

Mr Peer Hechler and Dr Simon Mason also welcomed participants and thanked the host. Mr Hechler expressed his hope that the University of Southern Queensland's reputation for success and its dynamic approach would provide the right spirit for a successful outcome for this meeting. Dr Mason noted that the CCl would have about two and a half years (before the next World Meteorological Congress) to show how GFCS can make a difference. In contributing to the CSIS, WMO has the advantage of being able to expand on many existing systems and resources, but faces a big challenge in that many parts of the existing systems need financial and technical assistance to make the changes needed under GFCS. He urged the team to make every effort to address the challenges.

Professor Roger Stone provided an overview of the climate situation of Australia, and the characteristics of good climate services; discussed linking climate information to decisions, noting the issues of scale. He discussed the value chain of decisions, and reviewed various programmes and accomplishments of the University of Southern Queensland. He stressed the need to produce information that can be understood, and used, to make a difference in outcomes (see the full presentation on the ET-CSIS website, http://www.wmo.int/pages/prog/wcp/ccl/opace/opace3/CCl-ET-CSIS-Meeting-2012.php).

2. Organization of the meeting

The Agenda for the meeting (see **ANNEX 1**) was adopted with no revisions. The meeting agreed to discuss agenda items 1 to 3 on the first day, items 5-8 on the third day, leaving sufficient time for agenda item 4. Mr Peer Hechler and Dr Simon Mason agreed to co-chair the meeting.

The objectives of the meeting were discussed, namely to review recent developments in the implementation aspects of the CSIS pillar of the GFCS, to define the core CSIS activities in GFCS, , , and to determine the future activities of the CCl ET-CSIS relevant to its Terms of Reference, including defining the requirements for the Climate Services Toolkit and scope of the contents of the technical reference manual. By defining the core CSIS functions and outputs, it is hoped to spur CSIS development, in much the same way that clarification of RCC functions and outputs spurred RCC implementation. The group agreed that the ET should have clear goals and identify clear deliverables. With respect to the work ahead, Dr Kolli noted that if additional resources would be needed to reach the goals over the next several years, the Secretariat could help support that.

The list of participants for the session is presented in **ANNEX 2**.

Working arrangements for the meeting (e.g. coffee and lunch breaks) were described. Participants expressed their thanks for these arrangements to Mrs Brunton (the local coordinator) and to Dr Stone.

The Secretariat agreed to record key decisions and actions of the ET and to prepare the draft report.

3. Update on CSIS evolution

Dr Kolli made a presentation on the CSIS, noting that the CSIS is the component of the GFCS that is the most concerned with the generation and dissemination of climate information, and described its role in the GFCS. He provided a detailed description of CSIS evolution, from World Climate Conference-3 (WCC-3) in 2009 and the fifteenth session of the Commission for Climatology in 2010, through to present time (see **ANNEX 3**). Highlights of CSIS evolution and related developments include:

i) CSIS evolution began with WCC-3, and the High Level Taskforce on GFCS (HLT-GFCS) report gave important guidance on CSIS structures and methods and outcomes. CSIS development was also influenced by CCl-XV focus on delivery mechanisms for climate products and services and the establishment of an Open Panel of CCl Experts (OPACE 3) to pursue the related work.

ii) The Sixteenth World Meteorological Congress (Cg-16) further highlighted CSIS (See Cg-16 Resolution 17 in **ANNEX 4**), and identified a central role for the CCl in GFCS implementation. The World Climate Programme (WCP) was reorganized, and now includes the Global Observing System (GCOS), the World Climate Research Programme (WCRP) and a new World Climate Services Programme (WCSP). The United Nations Environment Programme (UNEP) has approached WMO to include their Programme of Research on

Climate Change Vulnerability, Impacts and Adaptation (PROVIA) as the fourth component of WCP, and the proposal is under active consideration. Cg-16 also decided that WMO's Climate Information and Prediction Services (CLIPS) project, active since 1995, would close as a project in 2015 and its activities will be transitioned into the GFCS.

iii) The sixty-third session of WMO Executive Council (EC-63) set up the EC-Task Team on GFCS, to work on the draft implementation plan for the GFCS.

iv) EC-63 endorsed the establishment of the joint CCl-CBS Expert Team on Regional Climate Centres (RCCs).

v) CCl Management Group established ET-CSIS within OPACE 3 to support implementation of the GFCS CSIS, and intended it to closely collaborate with, *inter alia,* other OPACEs; OPACEs 2 and 4 were represented on ET-CSIS by Dr Manola Brunet and Professor Roger Stone.

vi) EC-64 reviewed the GFCS draft Implementation Plan (IP) progress, urged ET-CSIS to develop guidance on the role of the NMHSs, and to scope the development of a CSIS Technical Reference Manual. It requested a joint mechanism (CCl, CBS, WCRP, CAS) to coordinate support for CSIS implementation (Resolution 5, EC-64).

vii) EC-64 endorsed the establishment of the joint CBS/CCl Expert Team on Extended and Long Range Forecasting (ET-ELRF).

viii) EC-64 established an EC TT on international exchange of climate data and products.

ix) The WMO workshop on strategy for implementation of the CSIS (April 2011) recommended formalized structures for CSIS elements and mechanisms; 'seamless' provision of products; designation criteria for, inter alia, data and monitoring centres; standardization of CSIS operations and products; and capacity building to ensure prudent use of new climate products.

x) The Extraordinary Congress (Cg-Ext-2012) in October 2012 adopted the draft GFCS IP, which contained some clear implementation projects, and several annexes, including one on CSIS (note that the CSIS annex was not formally discussed at this Congress, nor specifically endorsed). The Executive Summary of the GFCS IP is attached as **ANNEX 5**. Cg-Ext-2012 established the Intergovernmental Board on Climate Services (IBCS), accountable to the Congress. It will have a management committee, and will establish subsidiary bodies. There will be a GFCS Office established to support the activities of the IBCS. Congress requested that the IBCS report to the seventeenth World

Meteorological Congress (2015) on GFCS implementation, and to recommend enhancements for 2016-2019.

xi) Much of what is CSIS is already in place, but it will be a challenge to re-orient these entities and practices to the GFCS requirements.

xii) NMHSs are expected to play a key role of CSIS operations at national levels.

In discussion, the following points were raised:

- The ET agreed that it could scope the CSIS Technical Reference Manual, but would need to then liaise with others through the above-noted inter-commission mechanism. For this to succeed, it would be very useful to have a clear understanding from CCl perspectives on CSIS operations first, to set the stage most appropriately.

- CSIS would include operational data aspects (especially as part of monitoring), and would need to liaise closely with the GFCS Observations and Monitoring (O&M) pillar on data management and data rescue activities.

- Although it is known where ET-CSIS fits into the CCl structure, it is not yet clear how GFCS will be structured in terms of management teams and where ET-CSIS would fit into related structures.

- The concepts and practices of CSIS (largely WMO entities) were set in place in inter-agency and inter-programme discussion with APCC, IRI and WCRP representatives of its Coupled Model Intercomparison Project (CMIP) and Coordinated Regional Downscaling Experiment (CORDEX), in the CSIS scoping workshop in 2011. WMO's initial goal was to link Global Producing Centres of Long Range Forecasts (GPCs), RCCs and NMHSs better, and it is gratifying to see this taken up in GFCS. In future work, the ET-CSIS should continue to consider the potential for external groups in development and operation of GFCS CSIS.

- Climate change activities should be part of CSIS operations (although not a mandatory function of RCCs), and will require linking with other players including with WCRP.

- ET-CSIS can give inputs to the EC-TT on climate data exchange.

4. Designing a prototype of core CSIS operations:

4.1 Relevant CSIS Implementation Plan priorities

From the GFCS Implementation Plan, the following were identified as the highest priorities for CSIS implementation and operations:

- Frameworks for climate services at national level
- Define, build and make available a Climate Services Toolkit
- Improve operational monitoring products
- Implement climate watch systems
- Standardize the operational CSIS products
- Promote effective CSIS-wide use of WIS
- Facilitate the effective use of GPC and other global climate products (also to an increasing extent, regional products)
- Strengthen regional systems for providing climate services (RCCs and RCOFs)
- Expand and sustain NCOF/NCF operations
- Provide guidance on best operational practices within RCCs and RCOFs

In discussion, the ET noted that national priorities will vary – CSIS will not attempt a 'one-size-fits-all' approach. Further, it was noted that the word 'prediction' is not present in the priorities above. It underpins many of these items, however (e.g. within the toolkit, operational products, mandatory RCC functions, COFs, etc). The ET noted that this should be made more explicit.

The high priority, fast-track projects for overall GFCS implementation were noted:

- Establish frameworks for climate services at the national level in developing countries
- Strengthening capacity for disaster risk reduction and early warning
- Improving communications between the climate and agriculture and food security communities
- Partnering climate services and water resources management
- Developing National Climate and Health Working Groups
- Improving decision-making processes concerning climate-related risks
- Strengthening regional systems for providing climate services
- Large-scale data recovery and digitisation

It was pointed out that CSIS is clearly highly relevant to national frameworks for climate services, and to strengthening regional systems (RCCs, RCOFs etc.). There are a number of CSIS priorities that should be linked to the priorities of the other pillars, and vice versa (successful data rescue, for example, will improve climate services).

4.2 Elements of a minimum set of climate information outputs expected from CSIS

A table encapsulating a proposed set of minimum CSIS outputs, or CSIS 'mandatory' functions, at global, regional and national scales had been provided by Mr Hechler for the consideration of the ET. The draft was based on the materials on the mandatory functions of WMO RCCs, as included in the manual on the Global Data Processing and Forecasting System (GDPFS). Following extensive discussion, the ET decisions on this matter are captured in **Table 1**. A number of key issues highlighted by the ET in these discussions included:

- There is a need for CSIS to operate at some level in all member countries and territories for the GFCS to be successful. Many countries will require technical and financial assistance in order to improve their CSIS capabilities. Many CSIS entities at national scale will be NMHSs, therefore WMO will be extensively involved in the required capacity development (this will take time) and in guiding their operations.

- There is also a need for CSIS to determine its activities and outputs from the 'demand' side, for GFCS to be successful. Users of climate information, especially in the GFCS priority sectors (food security, water, health) and the disaster risk reduction community, need to see some measure of response to their needs written into the CSIS mandatory functions and outputs. CSIS must increasingly respond to new developments, tools and requirements as developed through UIP.

- Many CSIS entities, particularly at national scale, will take part in the UIP dialogues between practitioners, providers and users, and will in all cases, take part in collection and response to user's feedback on products and services.

- For all CSIS products, it should be identified which entity will produce it, and for which user.

- For effective climate services, it is important to deal with quality assured, homogeneous data. RCCs (and capacity development projects) can assist in the homogeneity testing and any subsequent data adjustments, and software can be included in the Climate Services Toolkit. It is critical to retain the original data, and all metadata.

- Climate Outlook Forums (COFs) should cover both monitoring and prediction aspects. However, the ET notes that COFs are primarily concerned with prediction, and monitoring aspects are implicitly included in the outlook statements.

- With respect to reference periods, the ET decided that it was important to retain the WMO Climatological standard reference period (currently 1961-1990) in addition to the most recent 30-year normal period (currently 1981 to

2010), as well as to develop the flexibility to develop products for specific user needs using non-standard reference periods.

- Regarding standardization, the critical elements are temperature and precipitation, but to meet user's needs, other elements will be requested as important for the range of climate services envisioned (e.g. relative humidity, surface wind and its extremes, maximum and minimum temperature extremes, radiation, evapotranspiration, hail and snowfall in addition to total precipitation). In keeping with the user requirements noted in the GFCS annexes or exemplars, some additional elements could be identified in response to the GFCS users.

- The work of CSIS flows both ways – from global to national, but also from national to global. For example, national monitoring products and data feed upwards to global monitoring and modeling efforts.

- Although data rescue falls primarily under the Observations and Monitoring pillar of GFCS, successful regional and global efforts in data rescue will vastly improve the products and services of CSIS.

- While all the listed minimum set of functions need to be provided at national, regional, and global scales, it is not necessary for each centre to individually meet all these criteria; the minimum set of functions could be provided collectively through a set of partnerships.

- This ET will be responsible for reporting to Executive Council (May 2013) on progress on development of the scoping document on the CSIS Technical Reference Manual (see also item 4.5).

4.3 Elements of a minimum set of climate services expected from NMHSs (and relevant toolkit candidates)

The ET discussed expectations from the NMHSs that will take part as CSIS entities. Starting with the decisions made for national scale, as recorded in Table 1, the ET considered what subset of these functions the NMHSs (and nationally affiliated entities) should fulfill. It was noted that in many countries the NMHSs would be the primary (but not necessarily sole) CSIS entity. It was further noted that NMHSs (where their country so wishes) will also be engaged in discussions with users as part of the UIP. It is important not to relegate the role of NMHSs to producers/providers of purely climate information only – they also may need to engage in production/provision of user-targeted information, products and services and in user liaison. Advancement of an NMHS from basic to advanced categorization within the GFCS is related to capability to increasingly deal with user requirements.

As CSIS entities at national level, NMHSs should be able to:

- provide climate data
- deliver (but not necessarily develop) operational products
- support users in the interpretation of these products

The minimum set of services required would correspond with the functionality of a basic climate service within the NMHS. NMHSs with basic climate service capability or capacity may only have the ability to disseminate and support an entry-level set of climate information products. Intermediate and higher levels of services are able to support this minimum set, and an additional set of standard products, and can identify and develop new tailored products. At these higher levels of service, the functions of regional and global climate services may also be provided.

While the management of the observing system and of the national climate data, together with the issuance of official warnings, are necessarily in-country activities, the generation of operational products for national use could be conducted by regional and global centres if national capacity is lacking, at the request of the governments of the concerned countries.

The decisions of the ET on this item are presented in **Table 2**.

4.4 Climate services toolkit requirements and potential candidate tools

Considering the tremendous work done by the CCl Task Team on CLIPS Evolution (TT-CLIPS) on this particular issue, it was decided to develop an action plan to identify the next steps in the toolkit evolution (cf agenda item 5).

4.5 Aspects of operations including standardisation and CSIS Technical Reference Manual needs and contents

With respect to the Technical Reference Manual, the ET noted that it will likely be in the order of 50 pages long. The scoping document on the Technical Reference Manual could be perhaps 10 pages in length. The role of this manual, vis a vis the Guide to Climatological Practices needs to be discussed. The sensitive matter of possible 'derecognition' (withdrawal of a previously conferred formal designation following a transparent and objective assessment and after exhausting all reasonable opportunities to rectify the situation) of a CSIS entity needs to be tackled (learning from the past WMO experience with such cases). A plan for updating the Technical Reference Manual and maintenance needs to be developed. It was noted that the scoping document will be drafted by ET-CSIS, but then other relevant entities would be brought into the process to review and add to it, and to assist in writing

the manual. At present, the ET-CSIS is not responsible for taking the technical manual into publication, noris there a clear deadline at this point of time for that to occur.

The ET set up a small Task Team of ET-CSIS experts (see Table 3) to draft the content of the Manual. The Team felt that the task of writing a first draft version of such a Manual cannot be done by volunteers. The ET therefore requested the Secretariat to facilitate the services of a suitable consultant for this work (cf agenda item 5).

4.6 Liaison aspects relevant to 4.1-4.3

Once the ET-CSIS meeting report draft is available, Dr S. Mason will approach the team and invite suggestions for liaison activities (based on the members' expertise). Dedicated efforts should be made to identify CSIS interfaces to other GFCS pillars in order to optimally integrate CSIS as the GFCS operational product generation pillar.

4.7 Capacity building aspects

The team agreed that Capacity Building aspects have to be closely discussed with the related GFCS pillar. CSIS activities provide valuable input into the Capacity Building pillar, and by the same time contribute to the further specification of capacity development requirements. Examples for Capacity Building contributions are the CSIS toolkit initiative, planned workshops etc.

4.8 Impact on CSIS Implementation Plan priorities

Once the meeting report draft is provided to the ET members, Dr S. Mason will invite ET-CSIS members to review the current CSIS Implementation Plan priorities in light of the ET-CSIS meeting outcomes; related comments and proposals will be communicated to the appropriate GFCS bodies.

5 Activities and deliverables of the Expert Team in the current intersessional period

The current intersessional period will end in mid-2014 with the sixteenth Commission for Climatology session (CCl-16). Input from CCl Expert and Task Teams to CCl-16 are required 6 months in advance. The ET agreed to provide a report to CCl Management Group in December 2013.

The ET reviewed its Terms of Reference (ToR) and related deliverables, with respect to who can contribute, and practical aspects such as time and financial support required. The decisions in this regard are identified in **Table 3**.

6 Any other business

Mr Hechler informed the ET that he would be stepping down as chair of this team, as he would shortly be joining WMO Secretariat as staff (by Jan 2013). The ET warmly congratulated him on his appointment to WMO. The ET proposed, for the consideration of OPACE-3 Co-Chairs, that Dr Simon Mason, Co-Chair of ET-CSIS, be requested to take over the responsibilities as Chair. Dr Mason tentatively agreed (pending the concurrence of OPACE-3 Co-Chairs and endorsement of CCl Management Group), and requested that a new Co-Chair be identified to share his responsibilities. The ET noted that the CCl Management Group (CCl MG) would be advised of Mr Hechler's change of status and requested to consider for endorsement the recommendations of OPACE-3 Co-Chairs regarding the new Chair as well as Co-Chair of ET-CSIS. The ET also requested the OPACE-3 Co-Chairs to consider inducting additional members into the team, preferably an expert from the WCRP community on climate research/projection aspects and/or an expert representing climate data aspects.

7 Conclusions and recommendations

The decisions and recommendations of ET-CSIS are captured in Tables 1, 2 and 3, and as above in agenda item 6. The Secretariat agreed to draft the report for the Co-Chairs of the meeting and subsequently incorporate the team members' comments. Once final, the report will be posted on OPACE 3 web page, and sent to CCl MG. It may be further distributed as advised by CCl MG.

8 Closing

Dr Kolli thanked Proffesor Stone and Mrs Brunton for the excellent arrangements for the meeting, and thanked the participants for their time and for their active engagement in the discussions related to issues associated with ET-CSIS. He offered particular thanks to Mr Hechler and Dr Mason for their excellent leadership. The continued commitment of the entire team will be important to delivery of this important work. Mr Hechler and Dr Mason also offered their special thanks to the host and participants. The participants reiterated their appreciation for the dinner hosted on 5 December by Professor Janet Verblya, Deputy Vice-Chancellor of the University of Southern Queensland, and for the arrangements made for a visit to the McCreath ranch for a 'dinner under the stars'. The meeting closed at 13:15 on Thursday, 6 December, 2012.

Table 1: Elements of a minimum set of climate information outputs expected from CSIS (CSIS mandatory functions)

Function	Global level	Regional level	National level
Data services	Gridded global datasets based on homogeneous station data and oceanographic and satellite data where appropriate (at least daily data of mean temperature, Tmin, Tmax, and precipitation as well as monthly SST); time series as long as possible *Note: Neither the original national data nor the homogenised station data will be disseminated by the global entity*[1]*.* Climate database, archiving and dissemination services Support to regional and national climate database, archiving and dissemination services as well as data rescue activities *(e.g., by knowledge transfer, technology transfer, facilitating third party funding, seconding and hosting experts, hosting databases on the request of regional entities and countries).* Exchange of data as required and agreed for national, regional and global CSIS operations (footnote: liaise with EC TT on data policy …)	Gridded regional datasets based on homogeneous station data and oceanographic and satellite data where appropriate (at least daily data of mean temperature, Tmin, Tmax, and precipitation); time series as long as possible *Note: Neither the original national data nor the homogenised station data will be disseminated by the regional entity*[1]*.* Climate database, archiving and dissemination services Support to national climate database, archiving and dissemination services as well as national data rescue activities *(e.g., by knowledge transfer, technology transfer, facilitating third party funding, seconding and hosting experts, hosting databases on the request of countries).* Exchange of data as required and agreed for national, regional and global CSIS operations (footnote: liaise with EC TT on data policy …)	Historical homogenised national station datasets and real-time data in digital form (at least daily data of mean temperature, Tmin, Tmax, and precipitation), time series as long as possible, using as much of the instrumental record as possible while retaining the original observational and metadata; **Examples of targeted user products: SPI, SPEI, onset dates for rainy season, heating degree days, CCDI, CRSCI etc.…** Climate database, archiving and dissemination services Data rescue in collaboration with the GFCS OBS pillar Exchange of data as required and agreed for regional and global CSIS operations (footnote: liaise with EC TT on data policy …)

[1] To be reconciled with the language used for similar data arrangements made for the WMO Lead Centre for Long Range Forecast Multi-Model Ensemble (LC-LRFMME).

Function	Global level	Regional level	National level
Monitoring services	Perform climate diagnostics incl. analysis of climate variability, change and extremes (including monthly and annual bulletins) considering the NCMP[2] proposal Historical reference climatologies (currently at least 1961-90 and 1981-2010[3]) Global climate watch systems, such as Global Seasonal Climate Updates (GSCU), El Nino/La Nina Update etc	Perform climate diagnostics incl. analysis of climate variability, change and extremes (including monthly and annual bulletins) considering the NCMP[2] proposal Historical reference climatologies (currently at least 1961-90 and 1981-2010[3]) Climate Watch system implementation and provision of climate watch guidance information for national advisories	Perform climate diagnostics incl. analysis of climate variability, change and extremes (including monthly and annual bulletins) considering the NCMP[2] proposal **Examples of user targeted products: bulletins targeted at specific sectors, percentile information,** Historical reference climatologies (currently at least 1961-90 and 1981-2010[3]) **Examples of user targeted products: risk maps, PDFs, regularly updated reference climatologies** Climate Watch implementation and advisories

[2] NCMP: National Climate Monitoring Products, cf. proposal of WMO CCl OPACE 2 Task Team on National Climate Monitoring Products (12-14 September 2011, Geneva/Switzerland); http://www.wmo.int/pages/prog/wcp/wcdmp/documents/Final_Reportmeeting_NCMP.pdf.

[3] Please see CCl Discussion paper on the calculation of standard climate normals by W. Wright (OPACE 1 Co-Chair), reproduced in Annex 6.

Function	Global level	Regional level	National level
Climate prediction services (monthly to interannual forecasts)	Provision of global seasonal and intraseasonal forecasts (1 to 4 months –refer to GPC criteria), including information on uncertainties Provision of multi-model ensemble outputs, such as LC-LRFMME Global climate watch systems, such as Global Seasonal Climate Updates (GSCU), El Nino/La Nina Update etc Comprehensive verification of past forecasts and real-time assessment	Provision of regional seasonal and intraseasonal predictions where skill permits (1 to 4 months – refer to GPC criteria) considering global-/national scale information and including communication of the relevant climatological context as well as information on uncertainties Building of consensus statements, e.g. through RCOFs, teleconferences etc. **Examples of user targeted activities:** **Regional climate outlook forums including user interaction in close collaboration with UIP** Comprehensive verification of past forecasts and real-time assessment	Provision of national seasonal and intraseasonal predictions where skill permits (1 to 4 months – refer to GPC criteria) considering global-/regional scale information and including communication of the relevant climatological context context as well as information on uncertainties **Examples of user targeted products: outlooks, Monsoon onset prediction, heat wave prediction in collaboration with UIP** Comprehensive verification of past forecasts and real-time assessment
Climate projection services	Provision of global projections in close collaboration with the RMP pillar (CMIP) including information on uncertainties Validation of model simulations of observed climate	Provision of regional projections in close collaboration with the RMP pillar considering communication of the relevant climatological context as well as information on uncertainties Validation of model simulations of observed climate	Provision of national information on climate change projections in close collaboration with the RMP pillar considering communication of the relevant climatological context as well as information on uncertainties **Examples of user targeted products: scenario, information on change in significant weather events etc. (cf. IPCC SREX)** Validation of model simulations of observed climate

Function	Global level	Regional level	National level
Product dissemination, quality management and Capacity Building services	Online access to products and services incl. methodology information, product descriptions and user guidance Effective communication User feedback mechanisms Capacity development of national and regional capabilities including training, knowledge transfer, technological transfer etc.	Online access to products and services incl. methodology information, product descriptions and user guidance Effective communication **Examples of user targeted activities: forums, workshops, etc.** User feedback mechanisms Capacity development of national capabilities including training, knowledge transfer, technological transfer etc.	Online access to products and services incl. methodology information, product descriptions and user guidance Effective communication **Examples of user targeted activities: forums, workshops, press releases etc.** User feedback mechanisms Training for practitioners, providers and users

Table 2: Elements of a minimum set of climate services expected from NMHSs and nationally affiliated entities (CSIS mandatory functions and products) and relevant toolkit candidates

Domain	CSIS outcomes (National level)	Climate services expected from NMHSs and nationally affiliated entities	Toolkit candidates
Data services	Historical homogenised national station datasets and real-time data in digital form (at least daily data of mean temperature, Tmin, Tmax, and precipitation), time series as long as possible, using as much of the instrumental record as possible while retaining the original observational and metadata; *Examples of user targeted products: SPI, SPEI, onset dates for rainy season, heating degree days (via CCDI, CRSCI)* Climate database, archiving and dissemination services Data rescue in collaboration with the GFCS OBS pillar Exchange of data as required and agreed for regional and global CSIS operations (footnote: liaise with EC TT on data policy …)	Historical homogenised national station datasets and real-time data in digital form (at least daily data of mean temperature, Tmin, Tmax, and precipitation), time series as long as possible, using as much of the instrumental record as possible while retaining the original observational and metadata; Climate database, archiving and dissemination services Data rescue in collaboration with the GFCS OBS pillar Exchange of data as required and agreed for regional and global CSIS operations (footnote: liaise with EC TT on data policy …)	CLIDATA, CLIMSOFT, CLISYS, CLIWARE, Climate Explorer, ClimateView, IRI Data Library, NOAA's Weather and Climate Toolkit Other homogenization testing tools?

Domain	CSIS outcomes (National level)	Climate services expected from NMHSs and nationally affiliated entities	Toolkit candidates
Monitoring services	Perform climate diagnostics incl. analysis of climate variability, change and extremes (including monthly and annual bulletins) considering the NCMP[2] proposal *Examples of user targeted products: bulletins targeted at specific sectors, percentile information*, … Historical reference climatologies (currently at least 1961-90 and 1981-2010[3]) **Examples of user targeted products: risk maps, PDFs, regularly updated reference climatologies** Climate Watch implementation and advisories	Perform climate diagnostics incl. analysis of climate variability, change and extremes (including monthly and annual bulletins) considering the NCMP[2] proposal Historical reference climatologies (currently at least 1961-90 and 1981-2010[3]) Climate Watch implementation and advisories	CMT, Climate Explorer

Domain	CSIS outcomes (National level)	Climate services expected from NMHSs and nationally affiliated entities	Toolkit candidates
Climate predictions (monthly to interannual forecasts)	Provision of national seasonal and intraseasonal predictions where skill permits (1 to 4 months –refer to GPC criteria) considering global-/regional scale information and including communication of the relevant climatological context as well as information on uncertainties **Examples of user targeted products: outlooks, Monsoon onset prediction, heat wave prediction in collaboration with UIP** Comprehensive verification of past forecasts and real-time assessment	Provision of national seasonal and intraseasonal predictions where skill permits (1 to 4 months –refer to GPC criteria) considering global-/regional scale information and including communication of the relevant climatological context as well as information on uncertainties Objective verification of real-time assessment	Clik, CPT, PRECIS, SCOPIC

Domain	CSIS outcomes (National level)	Climate services expected from NMHSs and nationally affiliated entities	Toolkit candidates
Climate projections	Provision of national information on climate change projections in close collaboration with the RMP pillar considering communication of the relevant climatological context as well as information on uncertainties *Examples of user targeted products: scenario, information on change in significant weather events etc. (cf. IPCC SREX)* Validation of model simulations of observed climate	Provide support for expert assessment of climate change projections, as required Provide support (eg data and expertise) for validation of model simulations of observed climate	SimCLIM, PRECIS, RegCM
Product dissemination, quality management and Capacity Building	Online access to products and services incl. methodology information, product descriptions and user guidance Effective communication *Examples of user targeted activities: forums, workshops, press releases etc.* User feedback mechanisms Training for practitioners, providers and users	Online access to products and services incl. methodology information, product descriptions and user guidance Effective communication *Examples of user targeted activities: forums, workshops, press releases etc.* User feedback mechanisms Training for practitioners, providers and users	Web-page editors? WAMIS, IRI Data Library (portable version)

Table 3: Updates on ET-CSIS deliverables and work plan

Deliverables as defined by ToRs and EC-64	ET Activities
Action plan for transition of CLIPS into GFCS (ToR 3)	Contribution from A. Kamga available Invite A. Kamga (backup: S. Mason) to combine information from TT-CLIPS report and above mentioned contribution and outline an action plan for CLIPS transition into GFCS; outline to be shared amongst ET-CSIS members and then to be provided to WMO Secretariat for further advice on completing the action plan. Deadline: End of February 2013 for delivery of outline to Secretariat
Minimum set of climate information outputs from CSIS (ToR 4)	Cf. meeting outcome
Minimum set of climate services expected from NMSs (ToR 5)	Cf. meeting outcome
Primary set of climate service toolkit content and creation of a draft prototype (ToRs 6 and 7)	S. Mason to outline an action plan by the end of 2012 to be shared amongst ET-CSIS members to, inter alia, discuss identification and 'acquisition' of the software, permissions from software developers, development of the documentation, languages (UN has six) required for the CST, etc).
Concept note on a national CSIS Focal Point network incl. ToR, reporting process and co-ordination aspects (ToR 8)	Ms Tapia to provide a first draft by end of March 2013
Outline of a CSIS Technical Reference Manual [ToR 9 and EC-64, Doc 3.2(2), para 3.2.23]	Set up a Task Team composed of A. Kumar, R. Stone, Rajeevan and M. Coughlan (to be invited) to define the content of such a Manual and propose ToRs for a consultant Deadline: end of May 2013 Following steps: Review by ET-CSIS members, provision of guidance for hiring a consultant (tbc)
Final Report to CCl-XVI	Explore possibility of a drafting meeting of ET-CSIS shortly before the end of 2013 (ET Chair/Secretariat)

ANNEX 1

AGENDA

1. Opening
2. Organization of the meeting
    - Adoption of the agenda
    - Working arrangements
3. Update on CSIS evolution
4. Designing a prototype of core CSIS operations:
    - 4.1 Relevant CSIS Implementation Plan priorities
    - 4.2 Elements of a minimum set of climate information outputs expected from CSIS
    - 4.3 Elements of a minimum set of climate services expected from NMHSs
    - 4.4 Climate Services Toolkit requirements and potential candidate tools
    - 4.5 Aspects of operations incl. standardisation and CSIS Technical reference Manual needs and contents
    - 4.6 Liaison aspects (CCl, CBS, WIS, WCRP, GDPFS, other GFCS pillars etc.)
    - 4.7 Relevant capacity building aspects
    - 4.8 Impact on CSIS Implementation Plan priorities
5. Activities and deliverables of the Expert Team in the current intersessional period
6. Any other business
7. Conclusions and recommendations
8. Closing

ANNEX 2

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ANNEX 3

Background on CSIS evolution
(Agenda item 3)

1. High priority was given to the Global Framework for Climate Services (GFCS) by the Fifteenth Session of the Commission for Climatology (CCl-XV), which expressed need to fully utilize the skills and knowledge of the members of all the four Open Panels of CCl Experts (OPACEs) in this regard. While the OPACEs have appropriately integrated the relevant aspects in their work plans, this needs to be further elaborated keeping in view the report of the High Level Taskforce on GFCS (HLT-GFCS), and ongoing developments in GFCS implementation strategy following the Congress and Executive Council (EC) decisions. This is a critical phase in the implementation of the GFCS, and it is important to facilitate greater engagement of the Commission in all aspects of the related discussions, consultations and documentation.

2. The Sixteenth Session of World Meteorological Congress (Cg-XVI) endorsed the broad thrust of the HLT-GFCS Report, and entrusted the EC with the responsibility of developing proposals, for consideration by an Extraordinary Session of the Congress, addressing (i) Development of the draft implementation plan for the GFCS; and (ii) Establishment of the draft Terms of Reference and Rules of Procedure for the Intergovernmental Board and its substructures based on the draft implementation plan.

3. Cg-XVI recognized that CCl will have a central role in the implementation of the GFCS, but that the other technical commissions will also have important roles to play. Cg-XVI briefly outlined these roles, and urged each technical commission to assist in the development of the detailed implementation plan. Cg-XVI also urged the technical commissions to keep under review their work plans as the implementation of the GFCS proceeded so that they could give effective support to the initiative and also take advantages of the opportunities that it offered.

4. While CCl-XV has already decided to align the work of the Commission to the structure of the GFCS, the associated work elements can be more clearly delineated within the CCl as follows:

GFCS Component	Lead Role	Supporting Role
Observations and Monitoring	OPACE-1 & 2	OPACE-3
Research, Modeling and Prediction		OPACE-2 & 3
Climate Services Information System	OPACE-2 & 3	OPACE-1 & 4
User Interface Platform	OPACE-4	OPACE-3
Capacity Building	All OPACEs and MG	

5. EC-LXIII established an EC Task Team on GFCS (ECTT - GFCS) which worked on the development a draft implementation plan for the GFCS for consideration by the extra-ordinary session of Congress, through broad consultations with the relevant stakeholders. EC TT-GFCS was supported by a team of writers, in which Dr S. Mason, Co-Lead of ET-CSIS, played a major role, particularly with respect to the annexes of the pillars of GFCS, including the CSIS.

6. Two decisions made by Cg-XVI are of crucial importance to CCl in supporting the GFCS. The first is the reorganization of the World Climate Programme (WCP), with a new World Climate Services Programme (WCSP), and the acceptance of CCl-XV proposal to conclude the Climate Information and Prediction Services (CLIPS) project by 2015 and work towards its transition into the GFCS. CCl will have an overall responsibility to steer the WCSP implementation in a way that it effectively contributes to the GFCS, and also to consolidate CLIPS achievements and determine CLIPS legacy.

7. Cg-XVI recognized the critical role of WMO in putting in place operational mechanisms for providing climate information, products and services and takes the prime responsibility in their implementation. Congress agreed that the NMHSs, RCCs, GPCs and other mechanisms dealing with basic climate data and climate system monitoring at the global level will form the basis for development, production and delivery of climate services, constituting the CSIS pillar of the GFCS. Cg-XVI emphasized that CSIS would be required to have close interaction with users of climate services and contribute to communications and feedback processes under the User Interface Platform (UIP) pillar of GFCS. Taking into account the requirements for operational climate services around the world, WMO would play a major role in ensuring that the operational mechanisms needed for provision of climate information, products and services at different levels are put in place. Accordingly Congress adopted Resolution 17 (Cg-XVI) – Implementation of the Climate Services Information System (see Annex I).

8. CCl Management Group (MG), at its meeting in October 2011 (Denver, USA), noted that Cg-XVI adopted a resolution on the implementation of CSIS as part of the WCP, and decided that CSIS would be guided by the CCl. The MG agreed that concerted efforts should be made to pursue a lead position for CCl in the technical committee or other substructure for CSIS component within the governance mechanism being developed for the GFCS. Keeping in view the importance of the implementation of CSIS to CCl's work for the current intersessional period and beyond, the MG decided to establish an Expert Team on CSIS (ET-CSIS).

9. CCl MG appreciated the final report submitted by the Task Team on CLIPS Evolution (TT-CLIPS), including its recommendations on how CLIPS activities should be re-oriented to align with the emerging aspects of the GFCS implementation plan. The MG decided that TT-CLIPS, having completed its assigned task, be disbanded. The MG requested the ET-CSIS to take into account the recommendations of TT-CLIPS in the implementation of CSIS.

10. EC-64 noted with appreciation that CCl, keeping in view the importance of the implementation of CSIS to its work for the current intersessional period and beyond, established a dedicated Expert Team on CSIS (ET-CSIS), to support the implementation of CSIS. In consideration of the implementation of the GFCS at the national level, the Council urged ET-CSIS to develop guidance on the role of NMHSs in this regard.

11. EC-64 requested CCl to scope out the development of a CSIS Technical Reference Manual, building on the existing WMO manuals and guides, e.g. Global Observing System (GOS), GDPFS, WMO Information System (WIS), Global Climate Observing System (GCOS) climate monitoring principles, etc. The manual could provide, inter alia, definitions, product

elements and standards, technical procedures and organizational structures for the generation and dissemination of climate products and services. Development of such a manual should cover key activities that are carried out under WCSP (viz., climate data, monitoring, climate watches, predictions and projections and the associated operational entities) as well as the core competencies of the staff carrying out these tasks. The Council further emphasized the need for the CSIS manual to define the interfaces which facilitate the flow of information, interactions and support linkages with other GFCS pillars.

12. EC-64 recognized the advances in recent years in research as well as operational aspects of climate prediction and projection, and that the associated products are increasingly being sought by user sectors for climate risk management and climate adaptation. The Council noted that CCl, CBS, the Commission for Atmospheric Sciences (CAS) and the World Climate Research Programme (WCRP) have been making significant contributions in this regard, albeit with different perspectives. The Council recognized the need to improve coordination of these efforts, to ensure consistency and complementarity in the establishment of operational capabilities at all levels in the CSIS, and to better jointly support CSIS improvements and respond to feedback on CSIS products and services. The Council therefore requested the concerned entities to jointly establish an appropriate mechanism for such coordination, and adopted Resolution 5 (EC-64) – Joint mechanism to support implementation of the Climate Services Information System.

13. On the exchange of climate and related data, Cg-XVI had decided to task the EC with reviewing Annex 1 – Data and products to be exchanged without charge and with no conditions on use, to Resolution 40 (Cg-XII) – WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities, with a view to ensuring that the climate data and products needed for the GFCS climate services are included therein. EC-64 established an EC Task Team on the WMO Policy for International Exchange of Climate Data and Products to support the implementation of the GFCS.

14. A major priority for CCl in contributing to the GFCS implementation would be to address the needs of climate services at the national level. While the global and regional levels of the GFCS, particularly its CSIS component, are reasonably well-defined and partially in place, the national structures are still to be adequately conceptualized. The OPACE-3 Task Team on CLIPS Evolution provided some directions in this regard, which need to be taken forward, in terms of defining the functions, establishing the standards, providing guidance, establishing the baselines and supporting the capacity development strategy.

15. The CSIS is a key component of the GFCS and is being designed to routinely generate climate information, including data, diagnostics, assessments, monitoring, predictions, projections, etc. that users need for a broad range of climate sensitive decisions at different levels. It is widely recognized that for the generation of reliable operational climate information on the national scale, it is critical that adequate global and regional inputs and products are available. WMO has already put in place or identified several entities to specifically support NMHS climate operations; they include Global Producing Centres for Long Range Forecasts (GPCs), other centres providing climate information on the global scale, as well as several Regional Climate Centres (RCCs), Regional Climate Outlook Forums

(RCOFs) and regional Climate Watch systems. All of these efforts are directly relevant to the three-tiered structure recommended by the HLT.

16. In order to develop a systems approach that will incorporate all the global and regional CSIS entities in the most efficient way to support to NMHSs' climate service provision, a WMO international workshop was organized (5-7 April 2011, Geneva) with active support from OPACE-III, to develop a strategy for an effective implementation of the CSIS as an integral component of the GFCS. It helped bring clarity on the roles of each of the components as well as their linkages. The workshop also facilitated the articulation of CSIS within the GFCS briefings made at during the Cg-XVI session to inform Members on the effective roles they can play in the establishment and functioning of the CSIS as well as outline how they will be able to make use of its products to provide better climate services to users at the national level. The following are some of the key recommendations of the workshop:

- Formalized structures for CSIS elements and mechanisms are essential for standardization, sustainability, adherence to policies etc (following GDPFS formalisms);
- Existing WMO CSIS elements, particularly on the global level, do not yet fully cover all aspects of climate information, and there is a need for 'seamless' provision across timescale;
- There is a need to work up designation criteria covering e.g., data and monitoring centres, decadal prediction centres, centennial prediction activities, downscaling activities, etc.;
- Standardization is required in CSIS operations and products, e.g., common climate reference period for both observed and predicted climate anomalies;
- Enhanced programme of capacity building needed to ensure prudent use of new climate products.

Full report of the workshop is available at:

http://www.wmo.int/pages/prog/wcp/wcasp/documents/CSIS_Workshop_2011_Final_Report.pdf.

17. As a follow-up to the outcome of the CSIS workshop, and contribution to WMO efforts in developing a draft implementation plan for the GFCS, a document on the implementation strategy for the CSIS has been developed with support from Dr M. Coughlan, Lead of CCl Expert Team on RCCs. The draft document has subsequently been re-shaped by the ECTT-GFCS into CSIS Annex as part of the draft implementation plan for the GFCS.

18. Congress met in an extra-ordinary session (Cg-Ext-2012) from 29 to 31 October 2012 in Geneva to consider the draft Implementation Plan for the GFCS submitted by the EC and the draft terms of reference and rules of procedure of the Intergovernmental Board and its substructure. Cg-Ext-2012 was preceded by a "Dialogue for Climate Services Users and

Providers: Towards Implementation of the GFCS" from 26 to 27 October 2012, to facilitate interaction between users and providers of climate services (http://www.wmo.int/pages/gfcs/office/Dialogue.php). Cg-Ext-2012, through a Resolution, adopted the draft Implementation Plan of the GFCS for the subsequent consideration by the Intergovernmental Board on Climate Services (IBCS), to entrust the IBCS with the responsibility to oversee implementation of priority activities as set out in Chapter 4 of the draft Implementation Plan, with the involvement of relevant stakeholders, including other United Nations bodies and to regularly review the draft Implementation Plan of the GFCS, and to inform any changes to the subsequent session of Congress. The Executive Summary of the draft Implementation Plan is provided in Annex I.

19. Cg-Ext-2012 expressed the view that the outputs from the work of the EC Task Team on Data Policy would provide valuable input to, and a starting point for, the deliberations on data requirements and policies for implementation of the GFCS by the Intergovernmental Board on Climate Services.

20. Cg-Ext-2012 established the IBCS as an additional body accountable to the Congress under the Convention of the WMO, and approved its terms of reference, noting that the Board shall meet at least twice before the seventeenth World Meteorological Congress (Cg-XVII). Cg-Ext-2012 also approved the rules of procedure of IBCS and the specific functions of the Secretariat in support of the GFCS. Cg-Ext-2012 requested the IBCS to report to Cg-XVII on the implementation of the GFCS and provide recommendations on the ways to enhance the operational implementation for the period 2016-2019 and beyond.

21. Cg-Ext-2012 decided that each Member of WMO is entitled to designate representative(s) to serve as member(s) of the IBCS and to appoint a principal member, who will normally come from the National Meteorological and Hydrological Service, who shall be regarded as a main focal point of a Member for the matters relating to the IBCS. The IBCS shall establish a Management Committee at its first session to carry out the decisions and requests of the IBCS in the intersessional period. The Management Committee shall be composed of the Chair, the Vice-chair and Members' representatives from each WMO Regional Association. The IBCS shall also establish its subsidiary bodies to address, in particular capacity building, and define their terms of reference, designate chairs and select membership for the subsidiary bodies from amongst experts nominated by WMO Members. Cg-Ext-2012 further decided that the GFCS Office would be an integral part of the WMO Secretariat, and would support the activities of the IBCS and its subsidiary bodies.

References:

1. Report of the High Level Taskforce on the Global Framework for Climate Services, 2011 (http://www.wmo.int/pages/gfcs/documents/1065_HLT_report_en.pdf)

2. Report of the Sixteenth Session of the World Meteorological Congress, 2011 (ftp://ftp.wmo.int/Documents/PublicWeb/mainweb/meetings/cbodies/governance/congress_reports/english/pdf/1077_en.pdf)
3. Report of the Sixty-third Session of WMO Executive Council, 2011 (ftp://ftp.wmo.int/Documents/PublicWeb/mainweb/meetings/cbodies/governance/executive_council_reports/english/pdf/63_session_1078_part1_en.pdf)
4. Report of the Sixty-fourth Session of WMO Executive Council, 2012 (ftp://ftp.wmo.int/Documents/PublicWeb/mainweb/meetings/cbodies/governance/executive_council_reports/english/pdf/64_session_1092_part1_en.pdf)
5. Report of WMO Workshop on Strategy for Implementation of the Climate Services Information System (CSIS), 2011 (http://www.wmo.int/pages/prog/wcp/wcasp/documents/CSIS_Workshop_2011_Final_Report.pdf)
6. Approved documents of the Extra-Ordinary Session of World Meteorological Congress, 2012, including the Draft GFCS Implementation Plan and Annexes (http://cg-ext-2012.wmo.int/home/documents-english).
7. Report of the meeting of the Management Group of the CCl (Denver, USA, 26-29 October 2011) and updated ToR ET CSIS (http://www.wmo.int/pages/prog/wcp/ccl/mg/documents/CClMGMeetingReportFinal11112.pdf).
8. Draft final report of the CCl Task Team on CLIPS Evolution (http://www.wmo.int/pages/prog/wcp/ccl/opace/opace3/documents/CLIPSTTReportv2clean.doc).

ANNEX 4

Resolution 17 (Cg-XVI)

IMPLEMENTATION OF THE CLIMATE SERVICES INFORMATION SYSTEM

THE CONGRESS,

Noting:

(1) Resolution 13 (Cg-XV) – World Climate Applications and Services Programme, including the CLIPS project,
(2) Resolution 8 (Cg-XIII) – Climate Information and Prediction Services project,
(3) Resolution 4 (CCl-XV) – Further evolution of the Climate Information and Prediction Services project,
(4) The Abridged Final Report with Resolutions of the Sixty-first Session of the Executive Council (WMO-No. 1042),
(5) The Abridged Final Report with Resolutions and Recommendations of the Fourteenth Session of the Commission for Basic Systems (WMO-No. 1040),
(6) The Manual on the Global Data-processing and Forecasting System (WMO-No. 485),
(7) The Abridged Final Report with Resolutions of the Twelfth World Meteorological Congress (WMO-No. 827),

Recognizing:

(1) The progress made in the Climate Information and Prediction Services (CLIPS) project since its establishment by Twelfth Congress in 1995 and the establishment of Regional Climate Centres (RCCs) and the expansion of Regional Climate Outlook Forums (RCOFs),
(2) That many of the CLIPS concepts have been adequately reflected in the development of the Global Framework for Climate Services (GFCS),
(3) The critical role of WMO in establishing the Climate Services Information System (CSIS) component of the GFCS and thereby putting in place operational mechanisms to provide climate information, products and services at different levels,
(4) The need for strengthening capacities at the national level to deliver climate information and prediction products to users, and to enable mainstreaming of this information and knowledge into decision-making,
(5) The need for a systematic, regular and reliable flow of climate-related information and predictions from global to regional and national scales, for the eventual benefit of the research community, decision-makers in all climate-susceptible sectors, and governments,
(6) The interest and contributions of partnering agencies, including those within the United Nations system, with regard to this operational climate capability, in addition to the contributions by WMO to the climate knowledge base and expertise in provision of information related to the management of disaster risks,
(7) The role of the WMO Information System (WIS) and the Global Data-processing and Forecasting System (GDPFS) as the operational infrastructure underpinning the structure of CSIS,

Decides:

(1) To establish a Climate Services Information System with global, regional and national entities providing operational climate information, including data, monitoring and prediction products within the GFCS;
(2) To endorse the proposal made by the Commission for Climatology at its fifteenth session to effect the incorporation of CLIPS activities into the GFCS, and to conclude CLIPS as a project by 2015 at the latest;
(3) That CSIS operations shall adhere to the WMO Technical Regulations and should generate, as needed, new Technical Regulations pertinent to the advancement of operational climate services;
(4) That the implementation of CSIS should be guided by the Commission for Climatology;
(5) That the core operational CSIS products should be standardized in terms of production, presentation, delivery and verification;
(6) That CSIS will promote consensus-based approaches to facilitate common understanding and user appreciation of uncertainties through, inter alia, Climate Outlook Forums;
(7) That CSIS should be guided by the long-term vision of providing an authoritative source of climate information required for climate services at global, regional and national scales;

Requests the Secretary-General:
(1) To promote CSIS and its benefits to partnering agencies, particularly within the United Nations system in the spirit of the United Nations "delivering as one", and pursue partnerships at all levels to meet the objectives of CSIS within the GFCS;
(2) To raise the requirements for CSIS implementation (infrastructure and human resources aspects) with the relevant institutions and potential sponsors;
(3) To ensure that CSIS takes advantage of, and makes operational, advances in research that improve climate information and predictions, and that effective communications on requirements and feedback be established with the research community;

Requests the Commission for Climatology:
(1) To take the leading role in the implementation of CSIS;
(2) To work towards ensuring the quality of climate information underpinning the climate services, by establishing technical standards in the form of WMO Technical Regulations;
(3) To work closely with the Commission for Basic Systems to ensure that the development and implementation of CSIS takes full advantage of the capabilities of the WWW;

Urges all Members, regional associations and relevant technical commissions:
(1) To support the implementation of CSIS by hosting and operating centres of excellence for providing climate information; supporting the required education and training, hiring and retention of qualified climate specialists; developing and sharing the tools for production of high-quality climate products and predictions; making recommendations on standards for CSIS products; and facilitating the flow of information and feedback across global, regional and national scales;
(2) To help National Meteorological and Hydrological Services and other relevant climate entities to use the products derived from CSIS to address the climate-related

(3) To collaborate as needed in inter-commission and interregional efforts required for the effective and seamless operation of CSIS.

ANNEX 5

IMPLEMENTATION PLAN OF THE GLOBAL FRAMEWORK FOR CLIMATE SERVICES (GFCS)

EXECUTIVE SUMMARY

The Global Framework for Climate Services – Improving Society's Resilience to Climate-Related Hazards

Society's challenge

Living with, and adapting to, climate variability and change is an everyday reality. Society has always had to deal with climate variability, including extreme weather and climate events, but the assumption that past climatic and socio-economic conditions are indicative of current and future conditions is now not necessarily valid. The combined effects of climate change and of increasing vulnerability and exposure to hazardous conditions due to migration, infrastructural development and changing land use present unprecedented challenges to society.

There is a growing need to improve our understanding of climate, climate predictions and our use of climate information to serve society's needs better. Many countries are attempting to address these challenges by developing climate service capabilities. A climate service is considered here to be the provision of climate information in such a way as to assist decision-making by individuals and organizations. The service component involves appropriate engagement, an effective access mechanism and responsiveness to user-needs.

Effective climate services will facilitate climate-smart decisions that will reduce the impact of climate-related disasters, improve food security and health outcomes, and enhance water resource management, for example.

Although many of the foundational capabilities and infrastructure for climate services already exist or are being established, coordination of the numerous programmes and institutes that have addressed individual aspects of climate service is generally weak. These components often operate in isolation and with varying degrees of success.

Five key challenges have been identified through widespread consultation both at and subsequent to the World Climate Conference-3 in 2009. These challenges are as follows:

- Access to climate services needs to be established and/or improved in all countries;
- The capacity to deal with climate-related risks is lacking in many countries;
- The availability and quality of climate data are inadequate in many parts of the globe;
- Users and providers need to interact better;
- The quality of climate services needs improvement to match user requirements better.

A *Global Framework for Climate Services* (hereafter called the Framework) will strengthen and coordinate existing initiatives and will develop new infrastructure where needed in order to meet these challenges.

The Goals and Benefits of a Global Framework for Climate Services

The **vision** of the Framework is to enable society to manage better the risks and opportunities arising from climate variability and change, especially for those who are most vulnerable to climate-related hazards. This will be done through developing and incorporating science-based climate information and prediction into planning, policy and practice. The Framework is intended to be long-lived, and the current Implementation Plan is only a first step at achieving this long-term vision.

The Framework has five overarching **goals**:

1. Reducing the vulnerability of society to climate-related hazards through better provision of climate information;
2. Advancing the key global development goals through better provision of climate information;
3. Mainstreaming the use of climate information in decision-making;
4. Strengthening the engagement of providers and users of climate services;
5. Maximizing the utility of existing climate service infrastructure.

The Framework's long-term high-level outcomes and benefits are that user communities are able to make climate-smart decisions and that climate information is disseminated effectively and in a manner that lends itself more easily to practical action. While long-term, these outcomes need to be tackled at an early stage in order to demonstrate the usefulness of the Framework to decision makers, providers and potential funders. Effective development and use of climate services will be of great value for decision-making in many economic and social sectors, a value that has not yet been properly assessed by providers or users.

The Framework includes the following eight **Principles** for guiding successful achievement of its over-arching goals:

1. All countries will benefit, but priority shall go to building the capacity of developing countries vulnerable to the impacts of climate change and variability;
2. The primary goal will be to ensure greater availability of, access to and use of enhanced climate services for all countries;
3. Activities will address three geographic domains: global, regional and national;
4. Operational climate services will be the core element;
5. Climate information is primarily an international public good provided by governments, which will have a central role in its management;
6. Promote the free and open exchange of climate-relevant data, tools and scientifically based methods while respecting national and international policies;
7. The role of the Framework will be to facilitate and strengthen, not to duplicate;
8. The Framework will be built through user–provider partnerships that include all stakeholders.

The term "climate-relevant data" in Principle 6 highlights the point that many climate services need socio-economic and environmental data in addition to climate data. However,

the principle of free and open exchange of climate-relevant data needs to respect national and international policies. For example, some data may need to be restricted in light of national interests if it compromises national security, safety of citizens or national competitiveness. In such cases national policy may enable access to these data by climate service providers within a country's national borders.

Current Shortcomings

There have been major advances in our understanding of climate, its variations and related impacts. This, combined with investments made by governments in climate infrastructure over the years, has given us an impressive body of knowledge and systems upon which the Framework can build.

The quality, coverage and accessibility of climate-related data and the research, modelling and prediction of climate and its impacts are all steadily improving. However much more needs to be done, particularly to take account of and meet the needs of users and to develop services to meet those needs. The situation varies widely across the globe – some countries have access to well-developed services while others have very little or even none. In some cases information *is* available but is not known to or accessed by users. Developing countries are particularly likely to suffer from shortcomings in capacity and their needs should be given a higher priority.

There is scope for developing the capacity of users and professionals further and for better monitoring and evaluation of the use and effectiveness of climate services in decision-making. The user-driven focus of the Framework requires a much higher level of involvement of users in all aspects of climate service production, delivery and use. This area is generally under-developed in the climate services field but there are good examples from other disciplines that can provide useful lessons.

The Structure of the Global Framework for Climate Services

The Framework will be built upon the following five components, or pillars:

- *User Interface Platform:* a structured means for users, climate researchers and climate information providers to interact at all levels;
- *Climate Services Information System:* the mechanism through which information about climate (past, present and future) will be routinely collected, stored and processed to generate products and services that inform often complex decision-making across a wide range of climate-sensitive activities and enterprises;
- *Observations and Monitoring:* to ensure that climate observations and other data necessary to meet the needs of end users are collected, managed and disseminated and are supported by relevant metadata;
- *Research, Modelling and Prediction*: to foster research towards continually improving the scientific quality of climate information, providing an evidence base for the impacts of climate change and variability and for the cost-effectiveness of using climate information;
- *Capacity Development*: to address the particular capacity development requirements identified in the other pillars and, more broadly, the basic requirements for enabling any

Framework-related activities to occur.

The User Interface Platform is the most novel component and reflects the fact that the involvement of users in helping to establish the needs, develop appropriate products, identify capacity development requirements and influence the direction of observational investments and research efforts is crucial to achieving the Framework's goals.

The Framework will support and promote effective collaboration with global, regional and national stakeholders and efforts. At the global level the Framework will focus on defining the global goals, needs and large-scale activities required for successfully implementing the Framework. At the regional level the Framework will cooperate with multilateral efforts to address regional needs, for example through knowledge and data exchange, infrastructure development, research and training and by providing services regionally to meet requirements. At the national level the Framework will be developed and coordinated by each national government and key national organizations to ensure that all participants can express their needs and requirements for successfully implementing climate services that serve the population of the country.

What is Going to be Done?

In the initial stages, at least during the first two years, the Framework will prioritize developing and delivering services in four priority areas that address issues basic to the human condition and which present the most immediate opportunities for bringing benefits to human safety and well-being. These priority areas are Agriculture and Food Security; Disaster Risk Reduction; Health; and Water Resources. As the Framework evolves, the needs of users in other sectors will be addressed. The Framework will also give priority to building the capacities of climate-vulnerable developing countries. This does not mean that the needs of developed countries will be ignored, since capacity development applies to all.

The Framework's priority areas are closely aligned to the needs and goals addressed by the Millennium Development Goals, the Hyogo Framework for Action and the United Nations Framework Convention on Climate Change. Within the priority areas, particular benefits resulting from successful implementation of the Framework can be identified. For the Agriculture and Food Security sector these benefits include greater use of improved and better coordinated climate services, including seasonal forecasts, resulting in greater food production and reduced sensitivity to climate hazards. For Disaster Risk Reduction greater use of climate services will, among other benefits, lead to better asset protection and improved planning of responses to climate-related disasters. In the Health area greater understanding of the linkages of diseases to climate factors will result as well as better planning of disease control. Water resource management will benefit from improved infrastructure planning and better allocation of water resources.

Partnerships involving stakeholders at global, regional and national levels will be essential to the Framework's success. The Framework will need to ensure strong engagement from United Nations Agencies, other international organizations, existing climate service-related programmes, users, providers, donors, governments, private sector organizations and National Meteorological and Hydrological Services, many of whom have a strong weather service remit but not a strong one for climate service.

Recognizing the principle that the Framework should build upon existing initiatives and not duplicate, there are significant opportunities for synergy with existing programmes and activities within the partner agencies and other bodies such as NGOs and the private sector.

The Framework will be implemented by coordinating and promoting activities and projects that help to achieve its overall goals. Many of these activities will continue efforts already being made across the globe by many countries but will now fit these efforts into a coherent framework with common goals.

Activities and Projects

The Implementation Plan identifies a series of high priority projects, formulated through a consultative process, that will address the priority areas and make significant progress toward the Framework's goals. Undertaking these projects will demonstrate the value of the Framework to providers, users and donors and ensure their sustained commitment, while delivering significant benefits to society.

Key deliverables over the initial two years are implementing the necessary governance, management and reporting frameworks; implementing the initial projects; developing regional and national capabilities; and engaging user communities.

Over the first six years the Framework aims to facilitate access to improved climate services worldwide in the initial priority areas and initiate activities in additional areas. After ten years the Framework aims to facilitate access to improved climate services worldwide and across all climate-sensitive sectors.

The first projects within the initial priority areas will be selected using guidelines aligned with the Principles and will address identified gaps. They will also contribute to developing one or more national or regional capacities, enhancing access to observations or building research capacity. The general approach will be to work with existing entities, build upon activities already underway, identify and engage with key organizations. An important outcome of these initial projects will be to learn lessons from them in order to move steadily towards sustainable and valued services.

The Framework will need a suitable governance structure to support its work in a sustained manner, to implement the above activities successfully and ultimately to meet the needs of users. This governance structure will enable high level representation of governments while bringing experts in appropriate fields and sectors into its substructure. An Intergovernmental Board is proposed to oversee implementation and a Framework Secretariat will provide administrative support. The Board and Secretariat would oversee the Framework's activities, including the initial projects, but this should not preclude participants from designing and implementing other activities and projects that fill gaps and address the Framework's priorities.

To promote the Framework and to inform stakeholders of its activities, an effective communications strategy will be put in place. Publicising early success stories will be a particular focus of this strategy.

While continuing investments in the various elements of climate services will be the largest component of the resources committed to the Framework by far, additional investment will be required to help developing countries. Targeting sources of funding outside national budget processes will be required. Such sources include Development Banks, Climate Funds (such as the Adaptation Fund, Climate Investment Funds, Green Climate Fund and the Global Environment Facility), United Nations agencies, Overseas Development Assistance, regional economic groupings, national programmes and the private sector. Obtaining recognition from governments that climate services have considerable value and deserve support will be part of the challenge. In developed countries awareness of the value of climate services for economic development will need to be raised so as to encourage further investment in national facilities and also to demonstrate that investment in global services has value at the national level.

Conclusion

The Global Framework for Climate Services aims to enable society to manage the risks and opportunities arising from climate variability and change better, especially for those who are most vulnerable to such risks.

The Framework will have a strong emphasis on user involvement and capacity development, and the engagement of all partners in this concerted effort is designed to maximize benefits for all users. Though the initial focus will be on the four priority sectors, all climate-sensitive sectors stand to benefit in the long run.

The initial high priority projects will give impetus to the Framework. Their success will make significant progress towards the Framework's goals and build its credibility.

Providing climate services is not new, but the Framework represents a major, concerted, coordinated global effort to improve the well-being of all the parts of society vulnerable to climate variability and climate change. There are already mechanisms and institutions that provide climate services in a less coordinated way, as well as other activities and development plans such as the Millennium Development Goals and the United Nations Framework Convention on Climate Change that address climate issues. The Global Framework for Climate Services will be aligned with such activities, will benefit from them and vice versa, but will go beyond them by creating the structures needed to deliver needs-driven climate services across the globe.

ANNEX 6

Calculation of the Climate Normals: Proposal for a Dual System

A Discussion Paper developed for the CCl Management Group[4] by

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Introduction and need for change:

The Standard Climate Normals underpin many climate services and applications, including climatologies, and also comprise the reference period for the evaluation of anomalies in climate variability and change monitoring. The current method for calculation of these Normals is to average station data over a 30 year period, and update the Normals every 30 years. This might be referred to as the "30/30 model". The current Standard Normals period is 1961-90, and under current methodology, the next update will be in 2021, when the 1991-2020 period will become the new standard.

The question arises about the representativeness of a period such as 1961-90 after 15, 20, 25 years in a non-stationary climate. Many climate applications need to base fundamental planning decisions on average and extreme climate conditions, and it is plain that, for instance, an orchardist in 2015 trying to assess whether the climatic conditions in a region suit a particular variety of fruit, is not going to be receiving optimal guidance from 1961-90 Normals. At the same time, a set of Climate Normals that is stable over a long period is still required to anchor time-series of temperature, rainfall etc for climate monitoring purposes. Recognising these differing needs, the Commission for Climatology (CCl) wishes to propose the adoption of a dual system of normals, as described below.

In so doing, the CCl recognises that such a change to long-standing practice may result in considerable extra work for some NMHSs in amending products, and the possibility of other unintended consequences arising. For these reasons, we invite comment on the proposal from climate services and other Technical Commissions.

The proposal:

The CCl proposes that the standard period of climatological normals be redefined as a dual standard:

i) Retain the 30/30 model, i.e., a base period of 30 year normals, updated every 30 years, i.e retain 1961-90 as the base period until 2021, when 1991-2020 will become the new base period; AND

ii) Define a "rolling" set of 30 year Normals updated every 10 years (hereafter the 30/10 model), such that 1981-2010 becomes the current base-period, until 2021, when 1991-2020 will become the new base period, and in 2031, that 2001-2030 become the base period.

Other considerations:

Trewin (2007)[5] conducted an in-depth analysis of the representativeness of climate Normals, and concluded among other things that for many purposes and variables shorter periods, based on as few

[4] Presented at the meeting of the Commission for Climatology Management Group, 26-29 October 2011, Denver, USA (http://www.wmo.int/pages/prog/wcp/ccl/mg/documents/CClMGMeetingReportFinal11112.pdf).

as 10-15 years of data, could be used. This might enable Normals to be calculated for more stations than would be the case with a 30 year Normal. However it was felt that a consistent standard should apply for all variables, and that rainfall, at least, required at least 30 years of data to establish a reasonably stable average.

Arguments for the dual 30/10 and 30/30 models:

Considerations for and against the above proposal are summarised in Attachment 1.

The process:

i) Consent for, and comment on, the above proposal is to be sought from all Technical Commission (and… representative user Groups? Regional Associations?)

ii) Should there be general agreement for the Proposal, the CCl would draft a proposed revision of the calculation method for approval at the next WMO Executive Council?

The Case for changing the methodology:

- The use of more up-to-date Normals under the 30/10 model provides a more realistic base period for climate services. For instance, design standards and climatologies would be based on a more representative standard that better reflects possible changes in climate. By contrast, basing design standards etc on climate Normals that are up to 30 years out of date might raise significant credibility problems with the users of services and products ("can't we get more recent data that this?")
- The latter point is accentuated if we consider the possibility that, under a changing climate, some kind of tipping point could be passed, leading to a large and sudden change in one or more fundamental climate variables. Such tipping point changes have arguably already occurred (e.g., sudden rainfall drops in southwestern Australia, and more recently, in southeastern Australia).
- Some NMHSs already employ a 30/10 model, for instance NCDC in the United States. Australia is likely soon to adopt this model.
- More common updates mitigate the effects of technological change. For instance, the period 1961-90 averages were based largely on conventional observations, whereas by 1981-2010 (or 1991-2020), many observational systems were largely automated, and the former period corresponds roughly with the widespread adoption of satellite products. Thus comparisons of averages between periods (useful for some purposes) might reflect at least partially technological change as well as actual climatic differences.
- Similarly, a number of new products, including satellite products, have been introduced since 1981, hence the 1981-2010 period is the first opportunity to present normals for these products.
- Adopting the dual standard, so that one version of the Normals is kept constant for a lengthy period (the 30/30 model), provides the stability needed for referencing climate variability and change. To do otherwise would make the problem of communicating climate variability and change to the public harder. If we replaced the 1961-90 base period for climate anomalies with the warmer 1981-2010 standard, and continued to do this every ten years, the appearance of time-series would keep fluctuating, making it harder to demonstrate, for instance, a warming

[5] Trewin, B (2007): The role of climatological normals in a changing climate. World Climate Data and Monitoring Program No 61, WMO-TD No 1377. 46pp

trend. In particular, at the current time global debate and negotiations on climate change mitigation and adaptation are at a sensitive stage: many climate change scientists believe that failure to take immediate action could lead to irreversible, dangerous climate change. If only the 1981-2010 standard were adopted, time-series would suddenly start to show negative anomalies in some years, whereas previously anomalies were nearly all positive. This would make it harder to demonstrate a warming trend. Although an illusion, countering this illusion in the face of organised climate change scepticism would be a major communication challenge for NMHSs the world over, as well as for the IPCC and related bodies.

- Modern technologies such as enhanced computing capability and increasingly, modernised database systems (e.g, CCl's initiative of implementing Climate Database Management Systems) make it much easier to update Normals than previously.

The case against changing the methodology:

- Some NMHSs would face large increases in workload to revise products and services currently based on the 1961-90 period. Knowing that the base period will need to be updated in 2020 is a very different proposition to having to update within perhaps the next two to three years, and then (depending on what base period model is selected) having to face regular updates thereafter. This problem might be mitigated if, for instance, WMO provided software to regularly update normals (based on agreed common standards with regard to, e.g., missing data), which may be possible with CDMS. Alternatively, the normals could be calculated centrally by global agencies such as NCDC.
- There is a risk that more frequent changes of normals could lead to instability, with climate-linked design standards, for instance, varying too much between update periods.
- The use of two standards raises the prospect of confusion, and perhaps the inappropriate use of Normals for specific purposes. A communication strategy for NMHSs would be needed.