WMO OMM

World Meteorological Organization

Working together in weather, climate and water

Climate Services Information System (CSIS): Facilitating the Flow of Climate Information

R. Kolli
WMO

Global Framework for Climate Services

- Goal:
  - Enable better management of the risks of climate variability and change and adaptation to climate change at all levels, through development and incorporation of science-based climate information and prediction into planning, policy and practice.

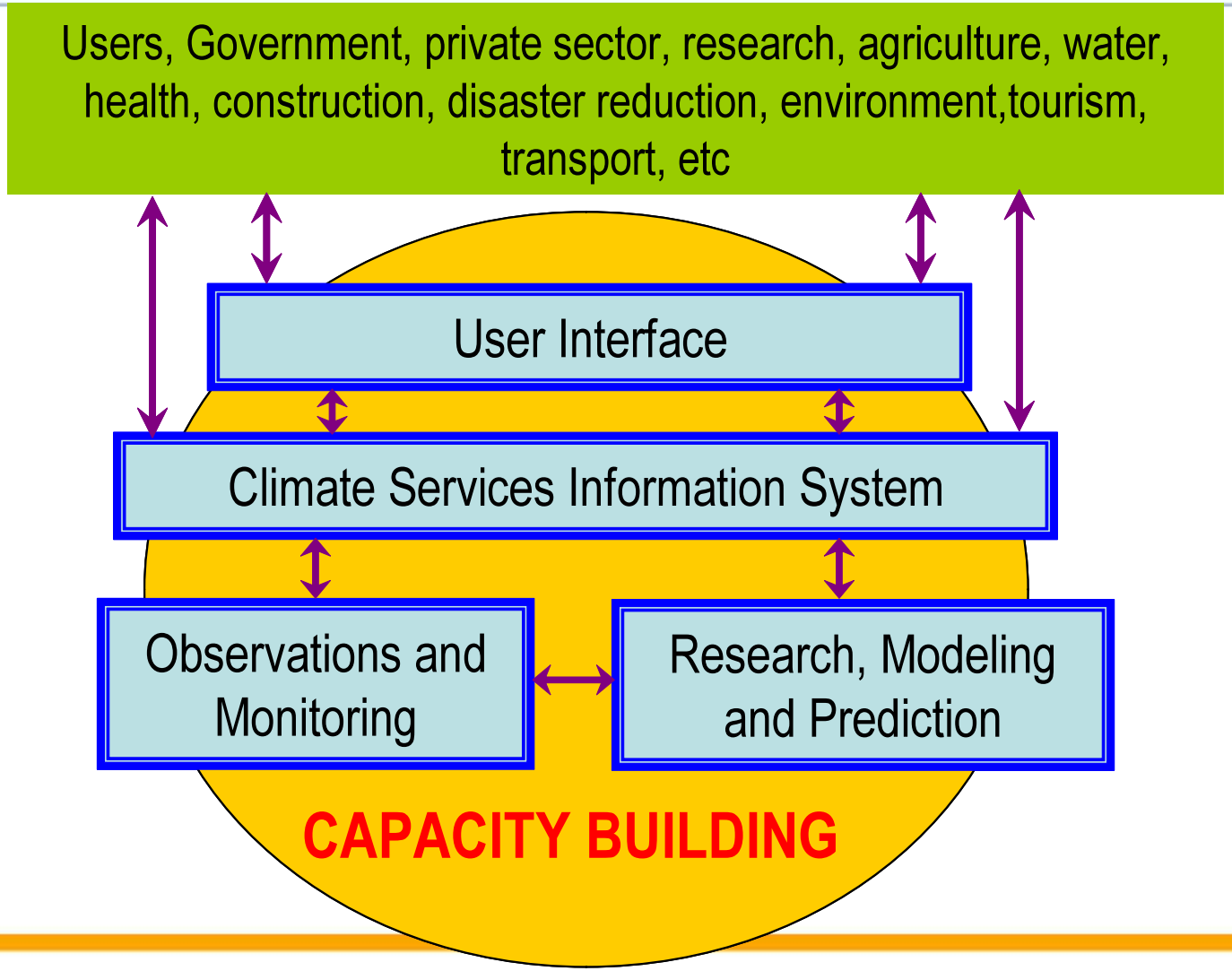
WCC · 3

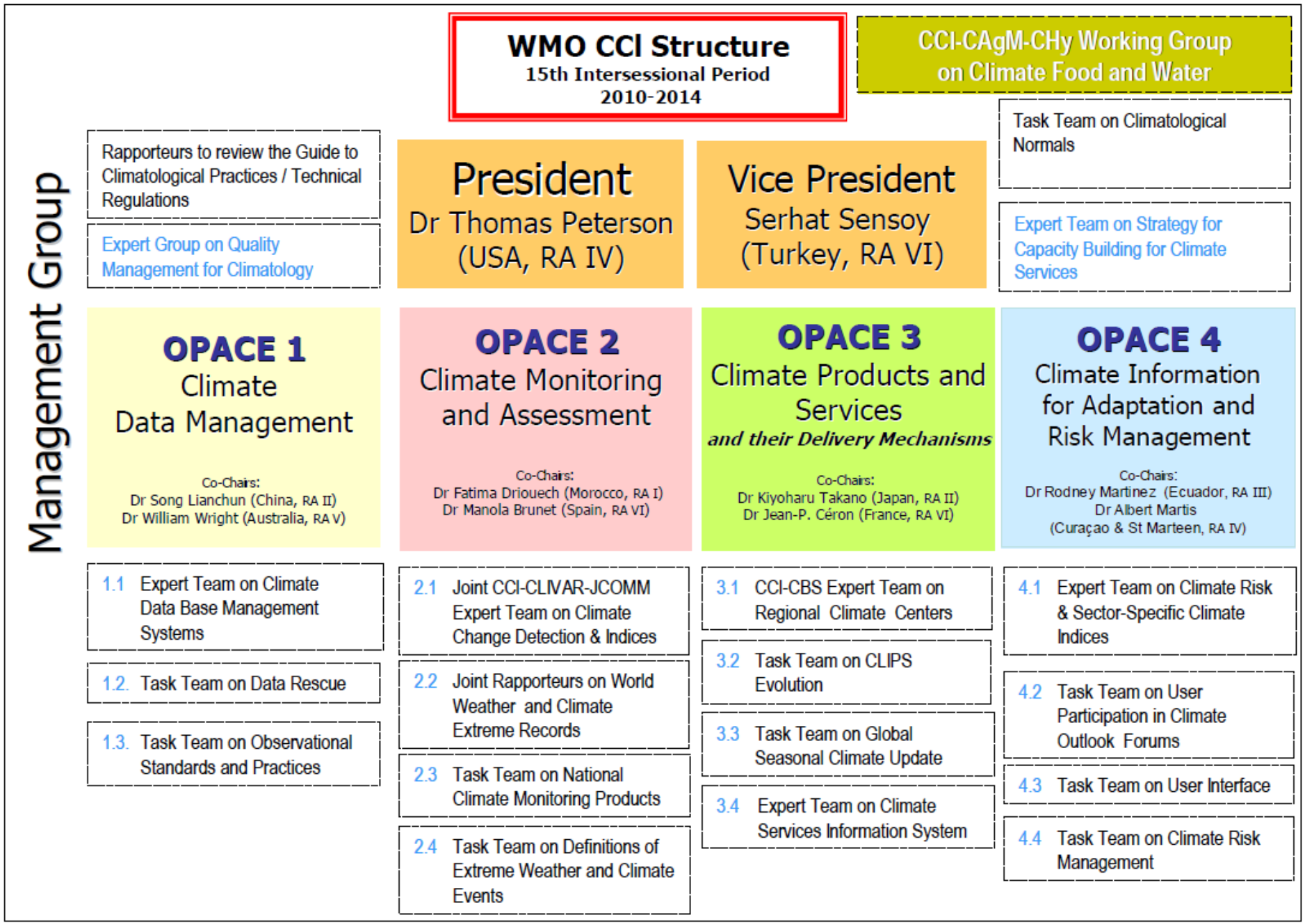
"Now is the time to invest in science, and to commit to rigorous and sustained climate observation, research, assessments and the provision of information. The establishment of the Global Framework for Climate Services will be an important step toward strengthening the application of climate knowledge in local, regional, national and international decision-making".

Ban Ki-moon,
Secretary-General of the United Nations

World Meteorological Organization
Weather • Climate • Water

Global Framework for Climate Services (GFCS)





OPACE: Open PAnel of CCl Experts

WMO

WMO WCRP World Climate Research Programme

Working together towards strengthened Research and Operations Linkages for Enhancing the use of Climate Information

Joint Session of
WMO Commission for Climatology and
Joint Scientific Committee for the WCRP

STATEMENT

Antalya, Turkey, 18 February 2010

JSC-31 for WCRP(15-19 Feb).
CCl-XV (19-24 Feb)

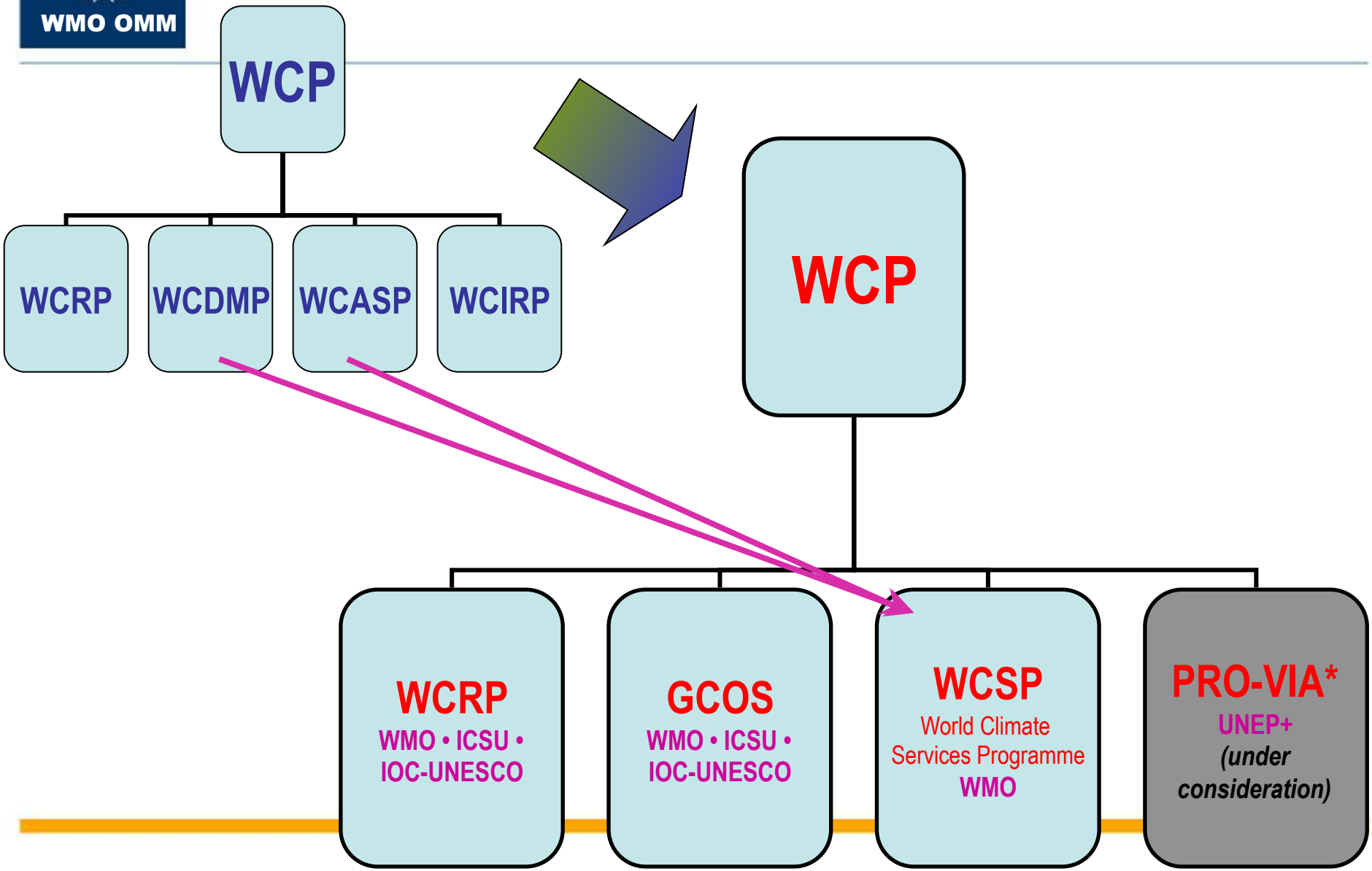
A special joint session of technical conference of CCl experts with the JSC was held (18 Feb)

Excerpt from the Statement

To support the successful implementation of GFCS, WCRP and CCl agree to closely collaborate to address the following topical issues of direct relevance to climate adaptation and risk management in general and the GFCS in particular:

1. Strengthen and mainstream research observations to serve as prototypes for future climate observing systems, in cooperation with GCOS and WIS;
2. develop climtate prediction systems with lead times from seasons to centuries;
3. ensure development of reliable high-resolution products needed for climate adaptation and risk management;
4. promote interdisciplinary research to develop sector applications, tools and tailored information;
5. facilitate flow of user requirements to the research community and climate services producers through user feedback;
6. support the RCCs, NCSs and the Climate Outlook Forums (COFs) mechanism as well as consensus assessments (Annual State of the Global Climate;
7. foster links between WMO Regional Associations (RAs), NMHSs, WCP, CCl and WCRP, for regional and national activities
8. improve the availability of highly-skilled talent to undertake climate research, operational prediction, and communication, particularly in the developing countries;

Revised WCP Structure (2011)



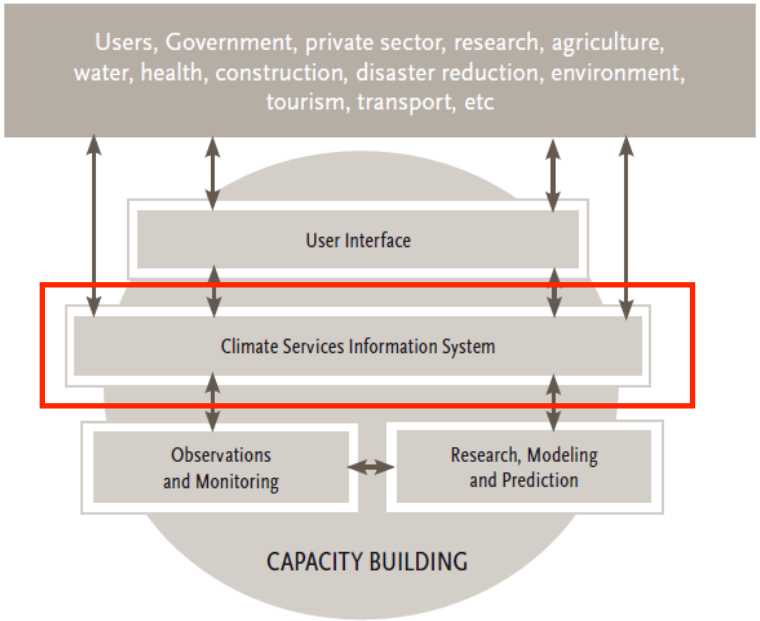
*Programme of Research On climate change Vulnerability, Impacts and Adaptation

The Climate Service Information System (CSIS)

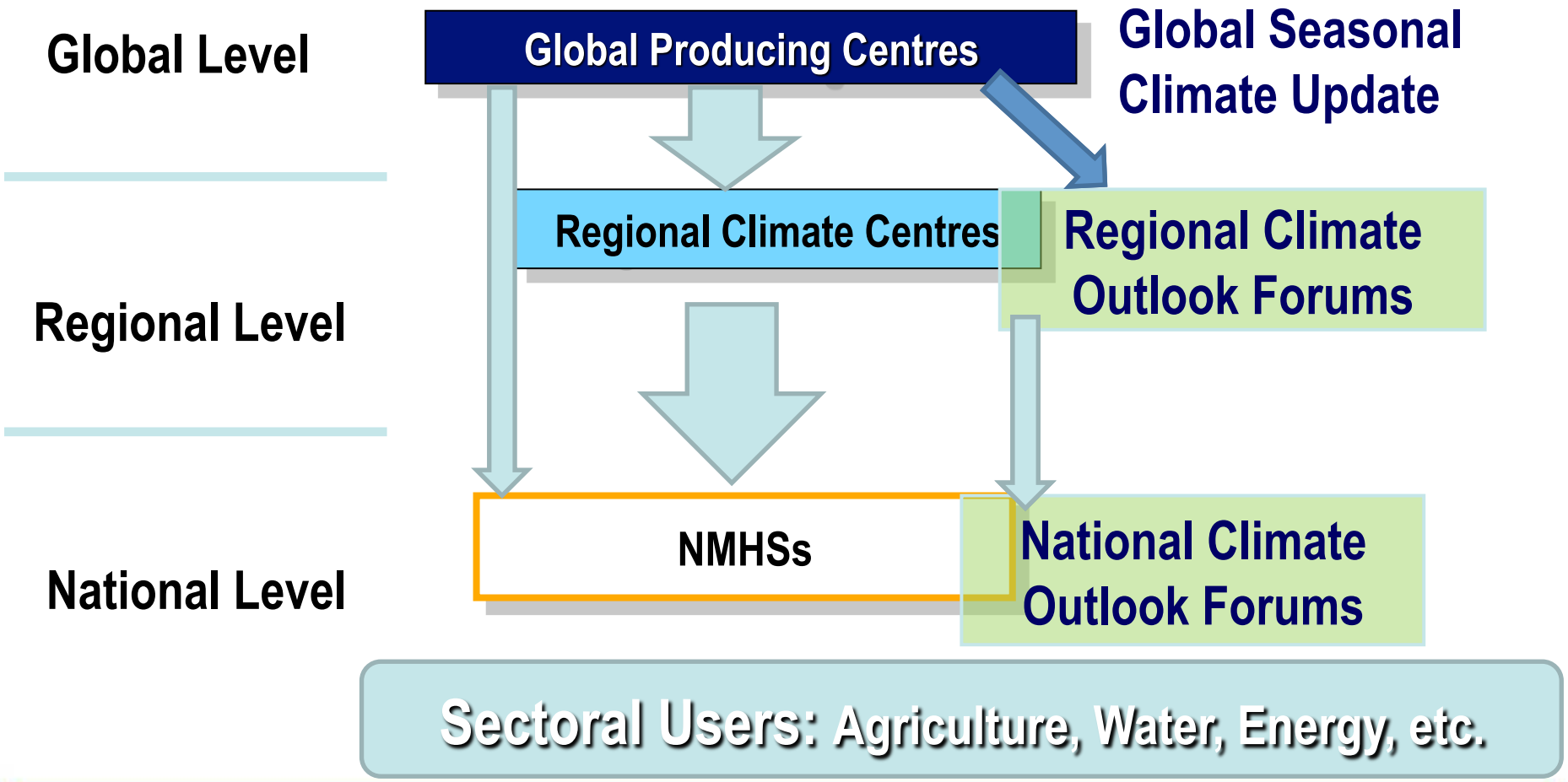
- The CSIS is the component of the GFCS most concerned with the generation and dissemination (data flow) of climate information.
- It is the 'operational centre' of the GFCS. It will include climate monitoring, prediction (monthly, seasonal, decadal) and projection (centennial) activities.
- *HLT report (p. 192): 'This is the system needed to collect, process and distribute climate data and information according to the needs of users as well as to the procedures agreed by governments and other data owners.'*

Role of CSIS within the GFCS

- The CSIS is the means of delivery of climate data and products.
- It comprises global, regional and national centres and entities that generate/process climate information (observations/monitoring and predictions), and the exchange of data and products to agreed standards and protocols.
- It must be supported by observation and research programmes. With 'pull through' facilitated by strong links.
- Capacity building initiatives will increase 'conductivity' of data flow
- Part of the CSIS is in place (as part of GDPFS), but new infrastructure is needed to fulfil the GFCS vision.



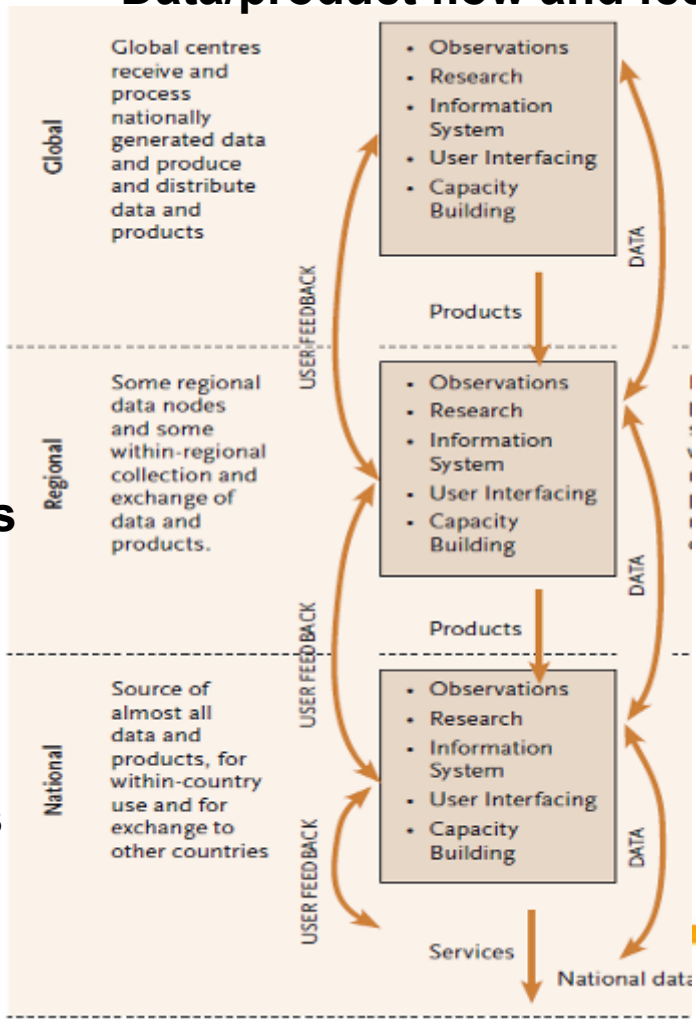
Climate Services Information System



GFCS activities will address three geographic domains: global, regional and national

Domain	Nodes
Global	Global monitoring centres Global prediction centres
Regional	Regional Climate Centres Regional Climate Outlook Forums
National	National Meteorological Services National Climate Outlook Forums Other national entities

Data/product flow and feedback



Existing WMO infrastructure for global seasonal forecasting

- 12 WMO-designated Global Producing Centres (GPC) for long-range forecasts
  - adhering to agreed procedures/standards in delivery of global long-range forecasts (e.g. products, timeliness, verification/validation info, system documentation)
  - forming an integral part of the WMO GDPFS
- 2 Lead Centres, facilitating user access to GPC products
  - Collection/display of forecast products: Lead Centre for Long-range Forecast Multi-model Ensembles (LC-LRFMME) – jointly operated by KMA/NOAA NCEP
  - Collection/display of verification products: Lead Centre for the Standard Verification System for Long-range Forecasts (LC-SVSLRF) – jointly operated by BoM/MSC
- Facilitating the flow and useability of global seasonal forecast information
- Outstanding example of international coordination – a template for new GFCS infrastructure that will extend and strengthen data flow
- http://www.wmo.int/pages/prog/wcp/wcasp/clips/producers_forecasts.html

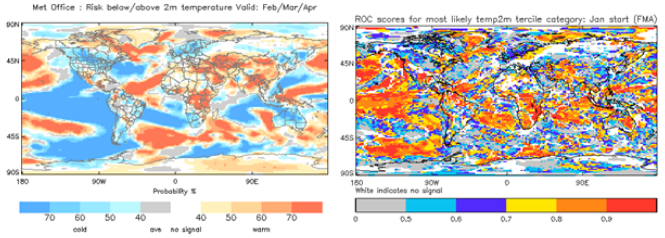
The Global Seasonal Climate Update

- Background: Long experience with WMO El Niño/La Niña Update based on global consensus
- Purpose: International consensus on current state of climate plus outlook next for 3-4 months;
- Addresses: major climate modes and indices; temperature and precipitation;
- Issued: ahead of each conventional season (at least);
- Target users: Regional and national centres and entities (also globally acting users, e.g. aid agencies);
- Designed by WMO scoping meeting (Oct 2010);
- Draft versions of GSCU have been developed and are under review by a dedicated CCl Task Team.

2.3.1 February-April 201.'

Influence of predicted large-scale climate modes

Predicted regional temperature anomalies broadly consistent with continuing La Niña conditions are evident in probabilities favouring below-normal temperatures over northwestern North America, the western coast and southern equatorial east coast of South America, southern Africa, and northeastern Asia.



LC-LRFMME (pending) **Long-term MME skill (pending)**

Figure 3: Left: Tercile category probability forecasts for 2m temperature, February-April 2011. Blue shading: below-normal most likely; red shading: above-normal most likely; grey shading: average most likely (no probability given); 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: Probabilities favour above-normal temperatures over much of equatorial Africa, and below-normal temperatures over southwestern parts of the continent (skill=good, both regions). There is no signal for much of the Sahel region (skill=low) where above-normal OND temperatures were observed (cf. Fig. 1).
RAII: In general, probabilities favour the same sign anomalies as observed in OND. Notably, above-normal anomalies are predicted with high probability in the southwest of the region and in countries border the Bay of Bengal (skill=good, both regions).
RAIII: There are relatively strong signals for below-normal anomalies over western coasts of South America (SC, OND; skill=modest) and over southern tropical regions of Atlantic coast as well as for the southern half of the continent (skill=low). Elsewhere signals are either weak or favour the average category.
RAIV: In high latitudes probabilities favour positive anomalies (SC, OND; skill=low). Below-normal anomalies are favoured over much of the rest of the continent (skill=low). Above-normal anomalies are favoured over southern North America (skill=good) and over Central America (skill=variable).
RAV: Development of below-normal anomalies is favoured over western and northern maritime southeast Asia (skill=good). Above-normal anomalies are favoured over eastern maritime Asia (skill=low). Below-normal anomalies are indicated for much of Australia (SC, OND; skill=variable). Above-normal anomalies are indicated for New Zealand (SC, OND; skill=low).
RAVI: Skill is low over most of the region. Below-normal anomalies are indicated for the northwest and above-normal anomalies for parts of the southeast (SC, OND – both regions).

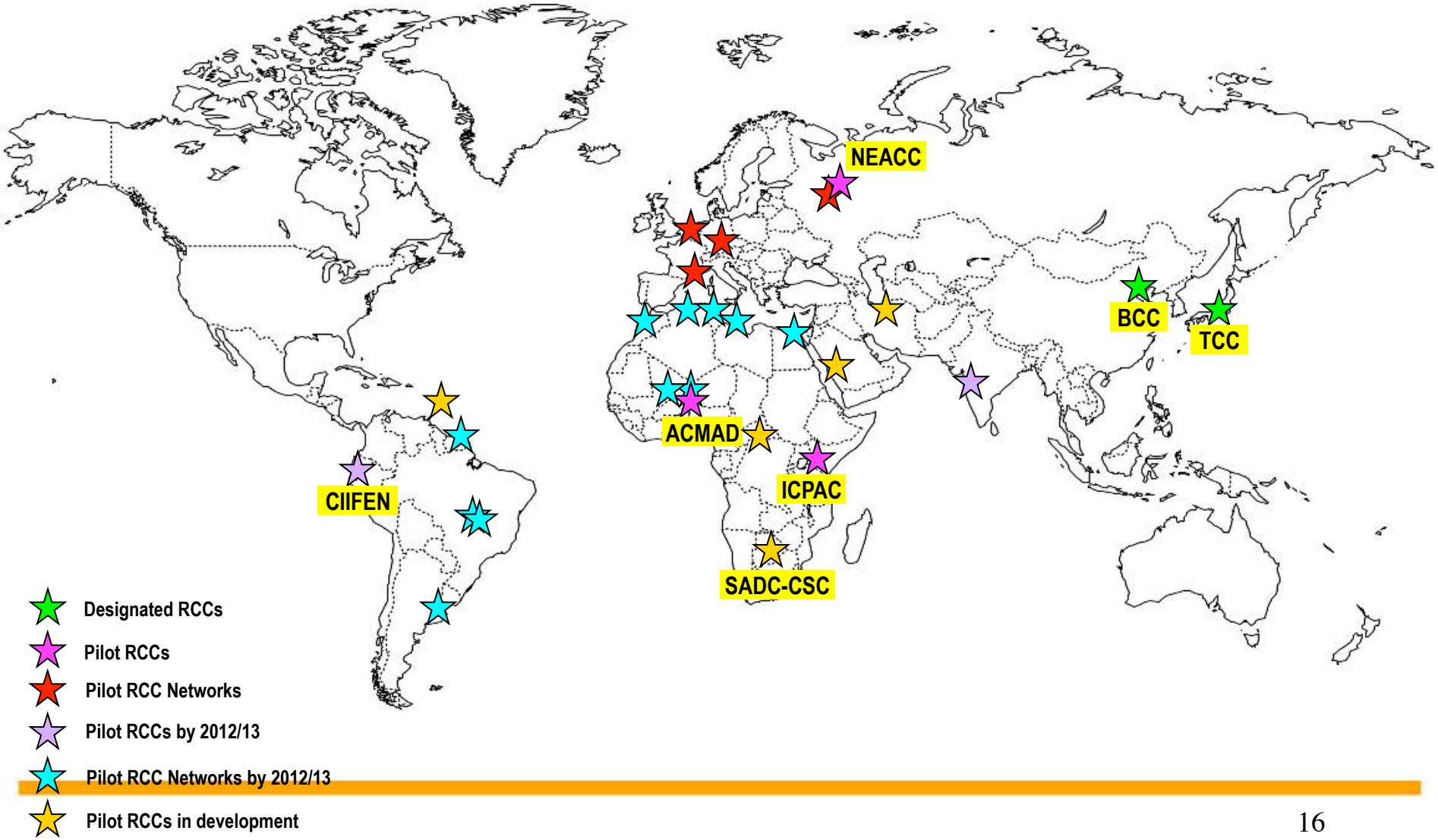
Regional Climate Centres (RCCs)

- WMO RCCs/RCC Networks, initiated by RAs and designated by WMO through its CBS and CCI, perform well-defined regional-scale climate functions
- Mandatory Functions:
  - Operational Activities for LRF; Operational Activities for Climate Monitoring; Operational Data Services to support operational LRF and climate monitoring; Training in the use of operational RCC products and services
- Highly Recommended Functions:
  - Climate prediction and projection; Non-operational data services; Coordination functions; Training and capacity building; Research and development
- RCCs/RCC Networks will be complementary to and supportive of NMHSs, who will deliver all Warnings and national-scale products

RCC Implementation

- Implementation Status:
  - RA II (Asia): Beijing and Tokyo designated as WMO RCCs in June 2009; NEACC (Russia) recommended for designation; India, Iran and Saudi Arabia pursuing RCC implementation
  - RA VI (Europe): RCC Network, recommended for designation (3 Nodes: LRF - France-Russia; Climate Monitoring - Germany; Climate Data - The Netherlands).
  - RA I (Africa): Decides to work towards the establishment of six RCCs (ACMAD, AGRHYMET, ICPAC, SADC-CSC, Central Africa, North Africa); ACMAD and ICPAC commence demonstration phase.
  - RA III (South America): Decides to work towards the establishment of three RCCs (CIIFEN, Brazil, Argentina)
  - RA IV (North America, Central America and the Caribbean): CIMH preparing for a demonstration phase

WMO RCC Status Worldwide



Regional Climate Outlook Forums (RCOFs) - Background

- A major component of WMO Climate Information and Prediction Services (CLIPS) project activities.
- First established in 1996 at a Meeting in Victoria Falls, Zimbabwe.
- Gained momentum as a regional response to the major 1997–1998 El Niño event.
- RCOF Concept was pioneered in Africa and spread worldwide.
- WMO and a number of national, regional and international organizations (e.g., NOAA, IRI, Meteo France, World Bank, etc.) have supported their growth and expansion.
- RCOFs now recognized to be key elements of the emerging Global Framework for Climate Services (GFCS)

Regional Climate Outlook Forums (RCOFs) - Concept

- RCOFs help ensure consistency in access to and interpretation of climate information for groups of countries having similar climatological and socio-economic characteristics.
- They facilitate improved understanding and interpretation of available climate prediction information and promote more coherent action among scientists, sectoral users, extension agencies and policy makers.
- RCOFs bring together experts in various fields, operational climate providers and end users of forecasts in an environment that encourages interaction and learning.

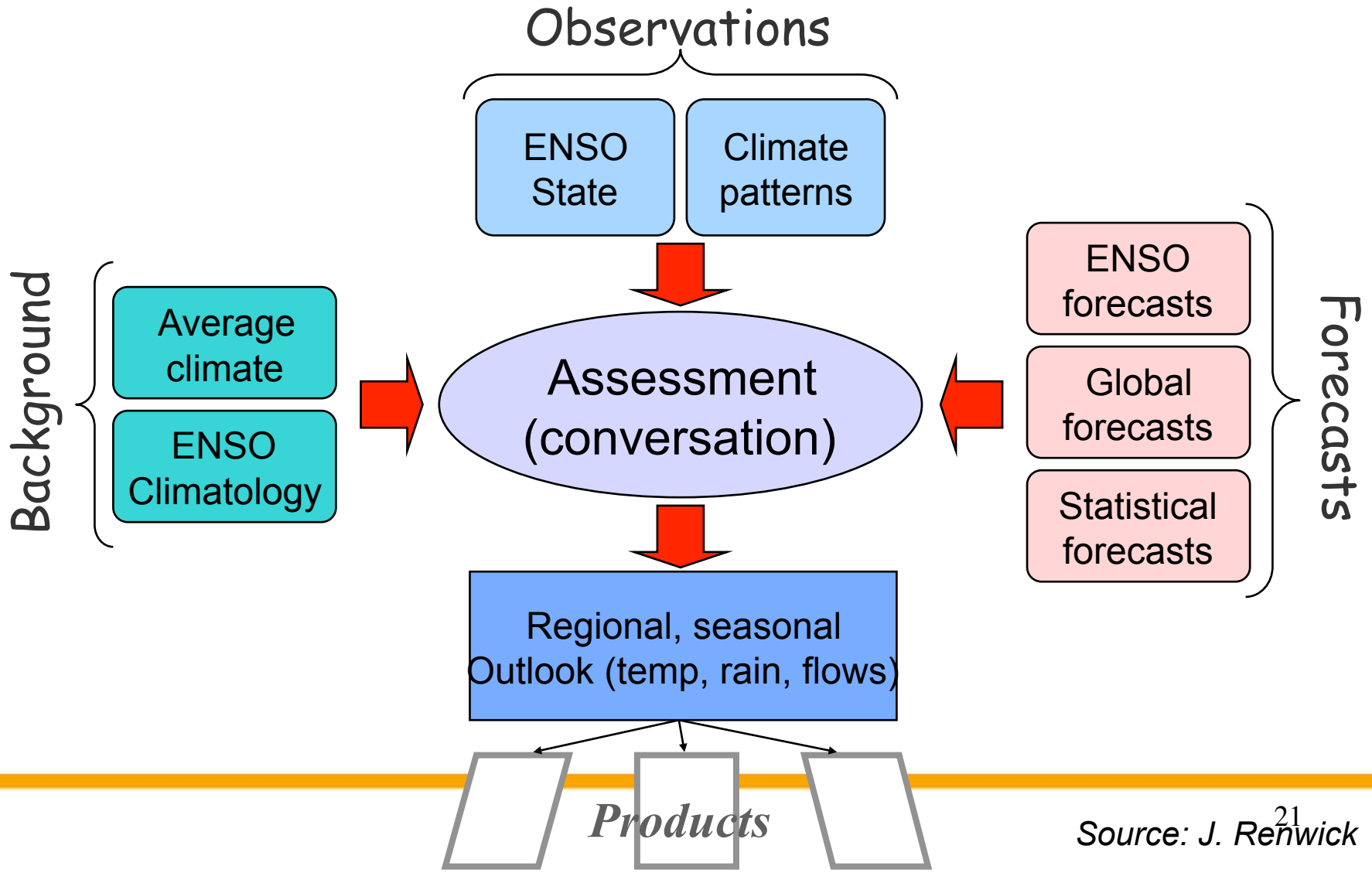
RCOF Process (1/3)

- RCOFs are essentially meetings of national, regional and global climate experts with a core objective to develop a consensus-based regional climate outlook for the season(s) of critical socio-economic importance, typically in a probabilistic form;
- Training programmes on seasonal climate prediction and tailoring to strengthen the capacity of the national and regional climate scientists to provide better inputs to the RCOF process;
- Include formal sessions that involve climate scientists, key user groups, decision makers as well as media, for identification of impacts and implications, and the formulation of response strategies;
- Outreach sessions involving sector specialists as well as media experts to develop effective communications strategies.

RCOF Process (2/3)

- Identify the key season(s) and determine the critical time for development of climate outlook for the region in question;
- Assemble a group of experts:
  - Large scale prediction specialists,
  - Regional and local climate applications and prediction/downscaling specialists,
  - National climate experts providing country perspectives
  - Stakeholders representing climate-sensitive sectors;
- Review current large scale (global and regional) climate anomalies and the most recent predictions for their evolution;
- Review their impacts at local, national and regional levels, and implications for national-scale predictions;

Consensus Process in RCOFs: Mostly Subjective



Source: J. Renwick

RCOF Process (3/3)

- Considering all factors, produce a climate outlook with related output including uncertainty information (e.g., maps showing probabilistic outlooks for temperature and precipitation anomalies along with a consensus statement) that can be applied and fine-tuned by NMHSs to meet national needs;
- Discuss applications of the outlook and related climate information to climate-sensitive sectors in the region; consider practical products for development by NMHSs;
- Develop strategies to effectively communicate the information to decision-makers in all affected sectors;
- Critique the session and its results:
  - document achieved improvements to the process and any challenges encountered,
  - Establish steps required to further improve the process for subsequent sessions.

PreCOF consensus

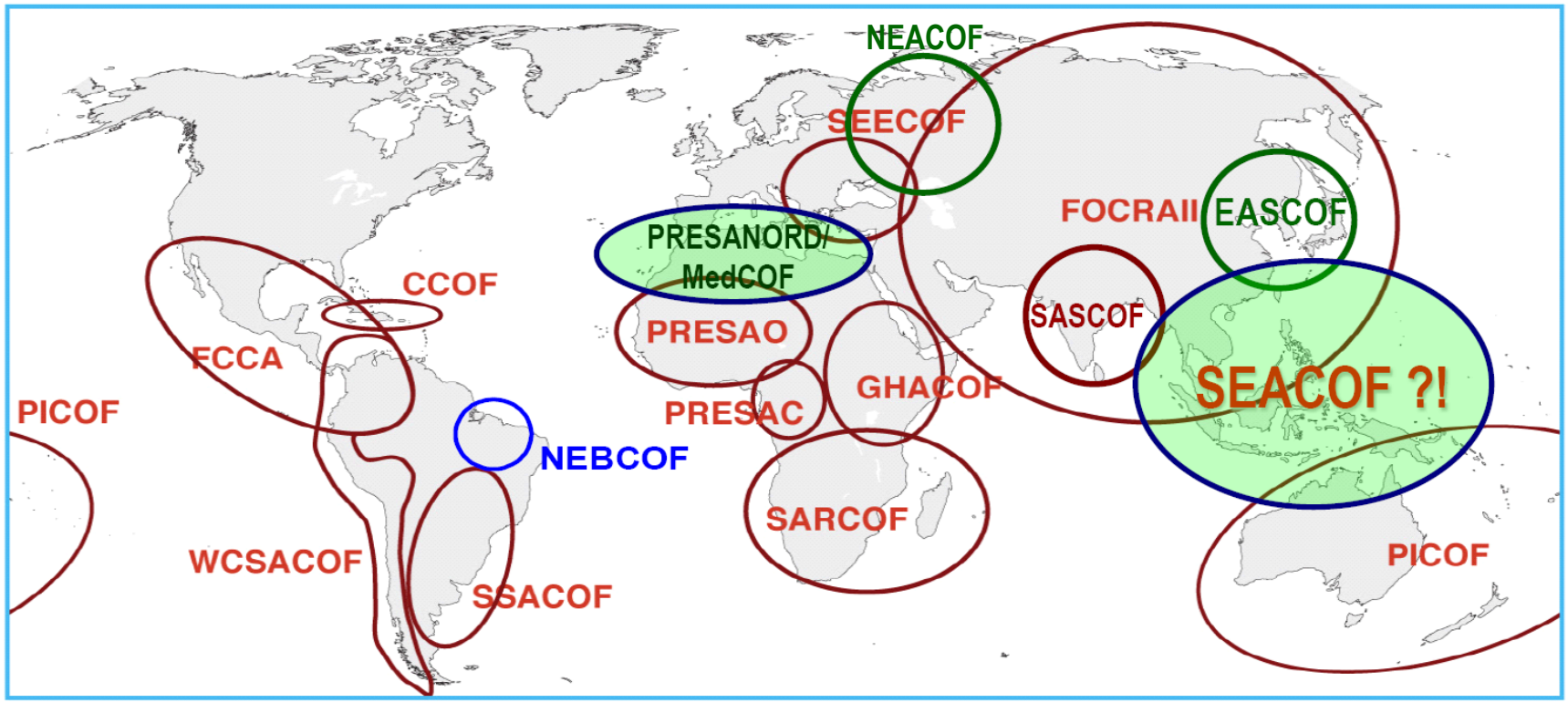
- Major inconsistencies are resolved by:
  - Democratic forecast combination rather than simple averaging.
  - Consideration of model viability as opposed to skill (sometimes some of the predictors have weak theoretical basis).
  - The large-scale structure of the forecast.
  - Redefinition of regions, perhaps with examination of predictions for individual stations.
  - Further analyses.

Source: S. Mason

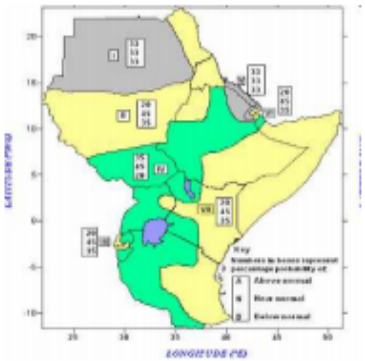
UNFCCC Precautionary Principle

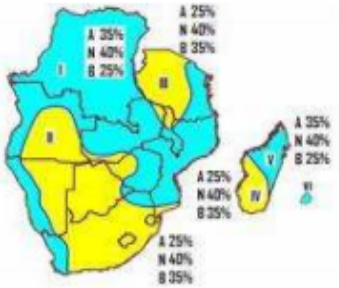
- The Convention's precautionary principle implies that "activities that threaten serious or irreversible damage can be restricted or even prohibited before there is absolute certainty about their effects".
- Indeed, under Article 3, the Convention calls for "precautionary measures" to combat climate change even if there is a lack of "full scientific certainty" regarding a cause & effect relationship.

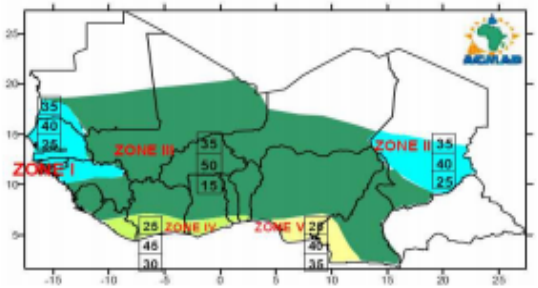
Regional Climate Outlook Forums worldwide

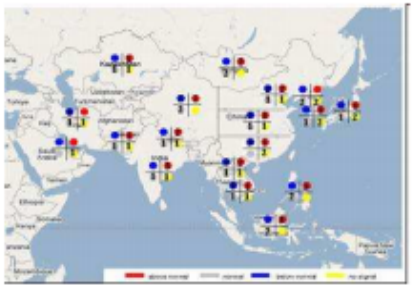


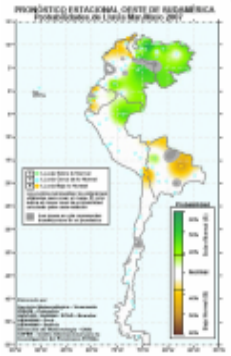
Some RCOF products worldwide

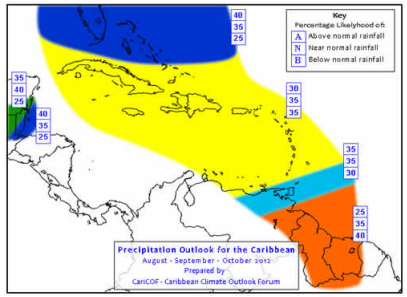


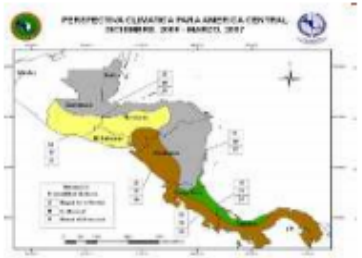


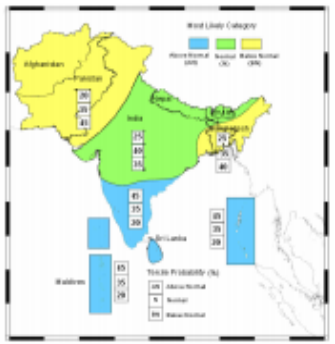






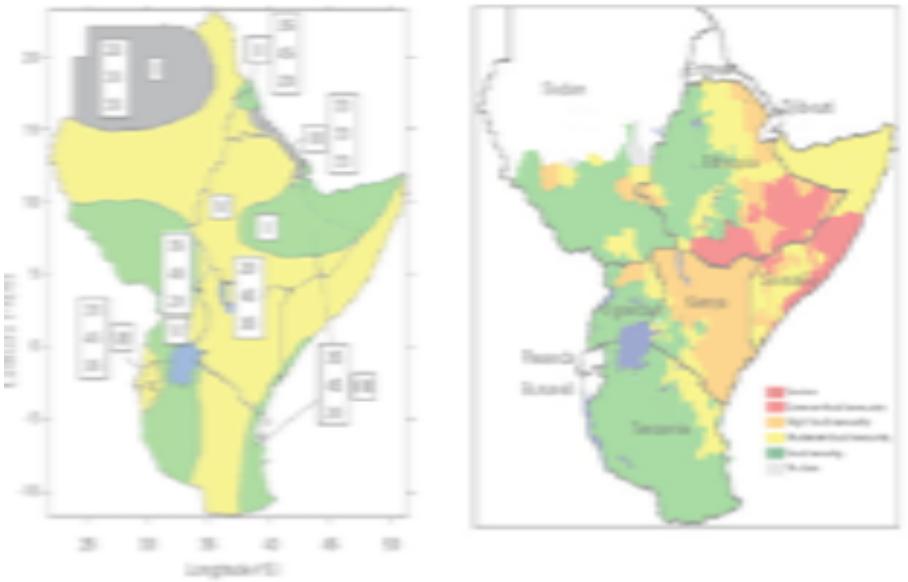






RCOFs and Food Security Outlooks

- Regional agriculture and food security outlooks are now regularly produced based on the climate outlooks produced by GHACOF
- Severe drought conditions persisted over most parts of the eastern sector of equatorial GHA since the last quarter of 2010 with far-reaching socio-economic consequences. This unusual climate situation has been very effectively monitored and assessed by ICPAC including reliable and very useful seasonal outlooks. ICPAC has proactively issued climate watch bulletins to provide early warning of the drought situation in GHA.



RCOFs and Public Health

- Many diseases are indirectly or directly associated with climate. Vector-borne diseases are sensitive to changes in meteorological parameters such as rainfall, temperature, wind and humidity. These include malaria, dengue and Rift Valley Fever (RVF). Extreme climate events can trigger rampant outbreaks of waterborne diseases such as cholera and typhoid in areas where they are not common.
- Some efforts are now being made to provide warning of changes in epidemic risk by integrating rainfall, temperature and other non-climate information.
- For example, Malaria Outlook Forums (MALOFs) are now regularly held in association with RCOFs in southern Africa and the Greater Horn of Africa.
- The information developed jointly by climate and health experts in these sessions, together with information on population vulnerability, food security, immuno-suppression and adequacy of control coverage, gives the health community a longer lead-time over which to optimize the allocation of the resources available to combat malaria.

WMO and RCOFs

- WMO assists developing countries hold and benefit from these forums through CLIPS:
  - facilitating training workshops,
  - coordinating the collection and dissemination of training materials,
  - capacity building initiatives including some initial (limited) financial support, and
  - coordination of special applications to sectors (e.g. health and agriculture)
- Regional institutions (e.g. DMCs, ACMAD, CRRH, CIIFEN) play key roles in the organization and overall implementation of these forums
- NMHSs, the regions and the users of the products must contribute to the sustainability of COFs in the regions: demonstrate utility of the forums and value of the products to those who need the information
- Research capacities at the regional and national levels need to be enhanced, to assess the forecast skills as well as to work towards their improvement
- Media has an important role to play in RCOF process, which needs to be factored in.

RCOF Success

- The RCOF process has facilitated a better understanding of the links between the climate system and socio-economic activities.
- An increasing demand for climate services, particularly seasonal outlooks, has been observed in many parts of the world as a result of these developments.
- Awareness has been created that climate information, including short-range climate predictions, is an essential element in coping with the impacts of climate variations.
- RCOFs have fostered interactions and exchange of information between the climate scientists and users of climate information.

Challenges to Consensus Prediction (1/2)

- Climate products that are timely, and understandable to the end-users, and that translate easily into decision models and processes (e.g. tercile output) can still require considerable explanation to users
- Reliability of climate outlook products, from the perspectives of the producers and the users (e.g. systematic biases inherent to numerical models)
- Need for improved spatial and temporal resolution/downscaling
- Implementation of reliable communication linkages to the sectors and institutions who use forecasts
- Consistent evaluation by producers and users of the use, impact and value of climate outlook products

Challenges to Consensus Prediction (2/2)

- In addition to such technical issues:
  - There is a need to continue to improve mutual understanding, between climate outlook producers and users, of the opportunities, capabilities and needs of each other, and to enhance two-way information sharing.
  - Trained climate prediction and service specialists are assets anywhere, and keeping critical levels of skilled staff in all services and centres is difficult.
  - In some regions there is a scarcity of funding to sustain regular climate outlook forums. Steps must be taken to establish the value of these efforts to attract the required resources.

CCI Perspectives on RCOFs

- RCOFs are operational processes which improved in time (e.g., PRESAO and PRESAO-SG)) and need to move toward a more continuous provision of seasonal outlooks (e.g., monthly updates) to meet user needs.
- Access to research-based SIP products for operational use – promoting wider application of CHFP database for improved operational SIP.
- Operational SIP products and services are provided through established standards (especially through CBS with CCI). Need to establish cooperation mechanism between WCSP and WCRP in the establishment of these standards
- Optimizing skills in tailoring large scale forecasts to sub-regional/national/local scales; ensuring adequate use of skilful large-scale forecasts in RCOF processes.
- Climate Services Toolkit – software, data, guides, manuals, etc.
- Roles and capacities of RCCs in coordinating RCOFs
- Sustained human resource development in the operational arena: training workshops, training material
- Coordinated and enhanced research focus on local SIP needs (e.g., onset dates of rainy season; extremes)
- Packaging and communication of RCOF products
- Verification of RCOF products

Summary

- The Climate Services Information System is the system needed to collect, process and distribute climate data and information
- Three-tier structure: global, regional and national
- Global elements:
  - Some elements of the CSIS are formally designated and developing to GFCS vision (e.g., GPCs)
  - Other elements need policy for formal designation e.g. data monitoring, decadal prediction, centennial prediction
- Some regional elements (RCCs, RCOFs) are also in place, but need to be further expanded and strengthened.
- National elements need to be developed to enable them to optimally utilize global and regional inputs, and meet the needs of the national users.

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World Meteorological Organization

Working together in weather, climate and water

Thank You

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