



World Meteorological Organization  
Working together in weather, climate and water

# GFCS Implementation and Capacity Development

Robert O. Masters  
(and Rupa Kumar Kolli)



# What are Climate Services ?

- Generating and providing information on past, present and future climate, and on its impacts on natural and human systems
  - Historical climate data sets
  - Climate monitoring
  - Climate watches
  - Monthly/Seasonal/Decadal climate predictions
  - Climate change projections
- Helping the user
  - access the right product for decision making, and
  - use it appropriately including aspects of uncertainty



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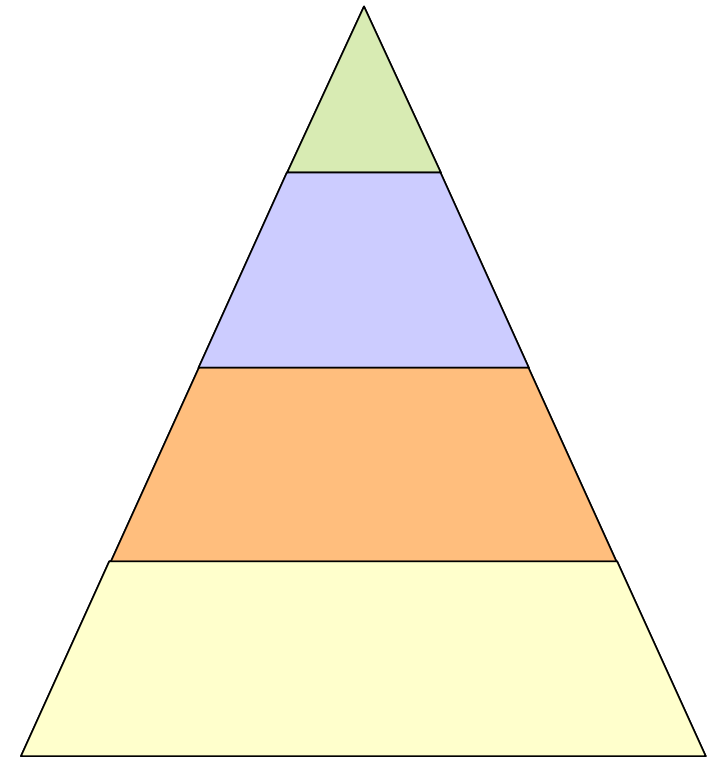
# Climate Services

- The term “climate services” refers to the delivery of climate information and predictions from the scientific sources to end-users
- A service is a service only when it is used; our goal is to make people use climate services in real-world context
- Climate information is just one of the elements in the decision making matrix
- Databases of information gathered over many years; NMHSs have great potential to exploit these resources to provide “effective” climate services
- Operational predictions of climate variability over the next season or two (seasonal to interannual scale) are of immediate relevance; decadal predictions in the offing
- Projections of climate change, both near-term and long-term, provide critical inputs to adaptation and mitigation policy



# Pre-requisites for climate services

- **Available:** at time and space scales that the user needs,
- **Dependable:** delivered regularly and on time,
- **Usable:** presented in user specific formats so that the client can fully understand,
- **Credible:** for the user to confidently apply to decision-making
- **Authentic:** entitled to be accepted by stakeholders in the given decision contexts
- **Responsive and flexible:** to the evolving user needs, and
- **Sustainable:** affordable and consistent over time.





# Why a Framework ?

- Present capabilities for providing climate services do not exploit all that we know about climate.
- Present capabilities fall far short of meeting current and future needs and delivering their full and potential benefits, **especially in developing countries.**
- A Framework for Climate Services will build on existing capacities and leverage these through coordination to address these shortcomings.
- Envisaged as a set of international arrangements to coordinate global activities and build on existing efforts to provide climate services focused on user needs, wider access and greater benefits of climate knowledge.
- NMHSs are the key building blocks for the Framework.





# 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.



*"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



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# HLT Vision for GFCS

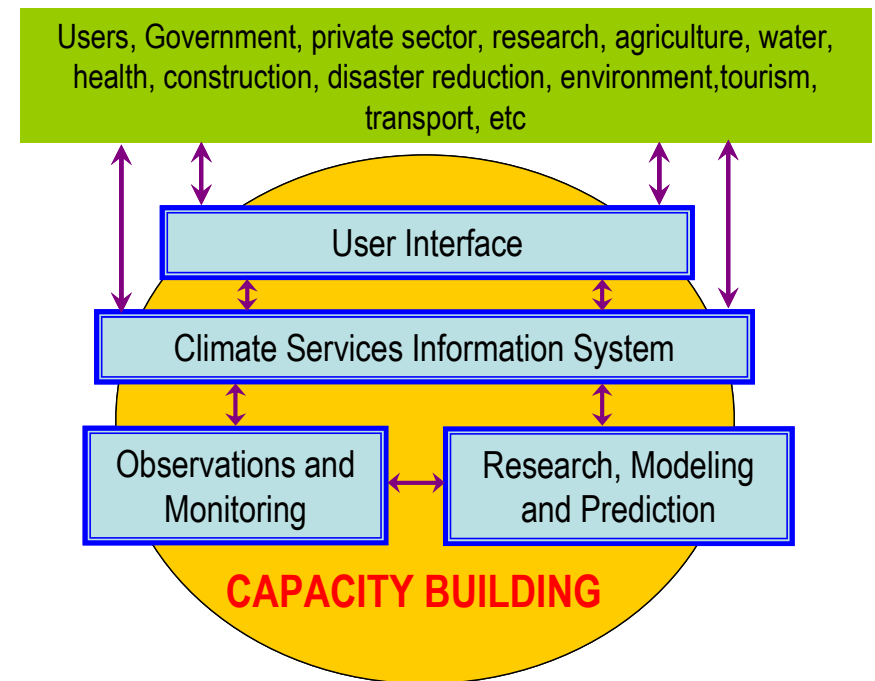
By 2015, the Framework will establish:

- A global system to routinely generate and electronically exchange an extensive set of defined climate data and data products
- An initiative in developing countries to upgrade the climate service capacities and strategies of all vulnerable and low-capacity countries to a baseline level
- An initial suite of new knowledge products – protocols, tools, products and services – developed through multiple initiatives on user interfacing and services development
- An ongoing governance mechanism that drives the Framework's development, particularly by engaging and mobilising stakeholders, user communities and new resources



# Components of GFCS

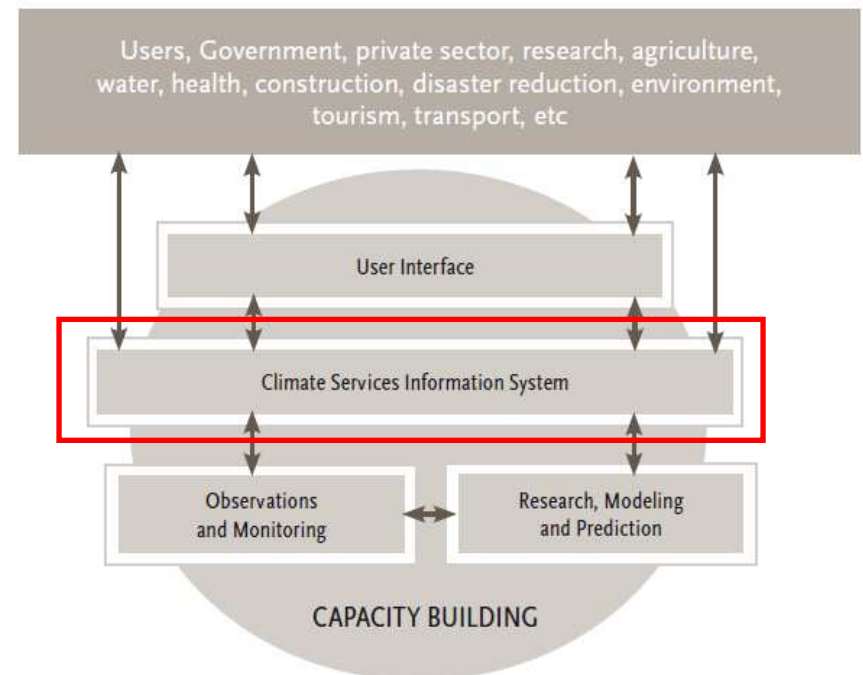
- **User Interface Platform** - to provide a means for users, user representatives, climate researchers and climate service providers to interact
- **Climate Services Information System** - to collect, process and distribute climate data and information according to the needs of users and according to the procedures agreed by governments and other data providers
- **Observations and Monitoring** - to ensure that the climate observations necessary to meet the needs of climate services are generated.
- **Research, Modelling and Prediction** - to assess and promote the needs of climate services within research agendas
- **Capacity Building** - to support systematic development of the necessary institutions, infrastructure and human resources to provide effective climate services.





# 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.





# The Climate Service Information System (CSIS)

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- 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.'*



## Some key outcomes of the WMO workshop on strategy for implementation of the CSIS, April 2011

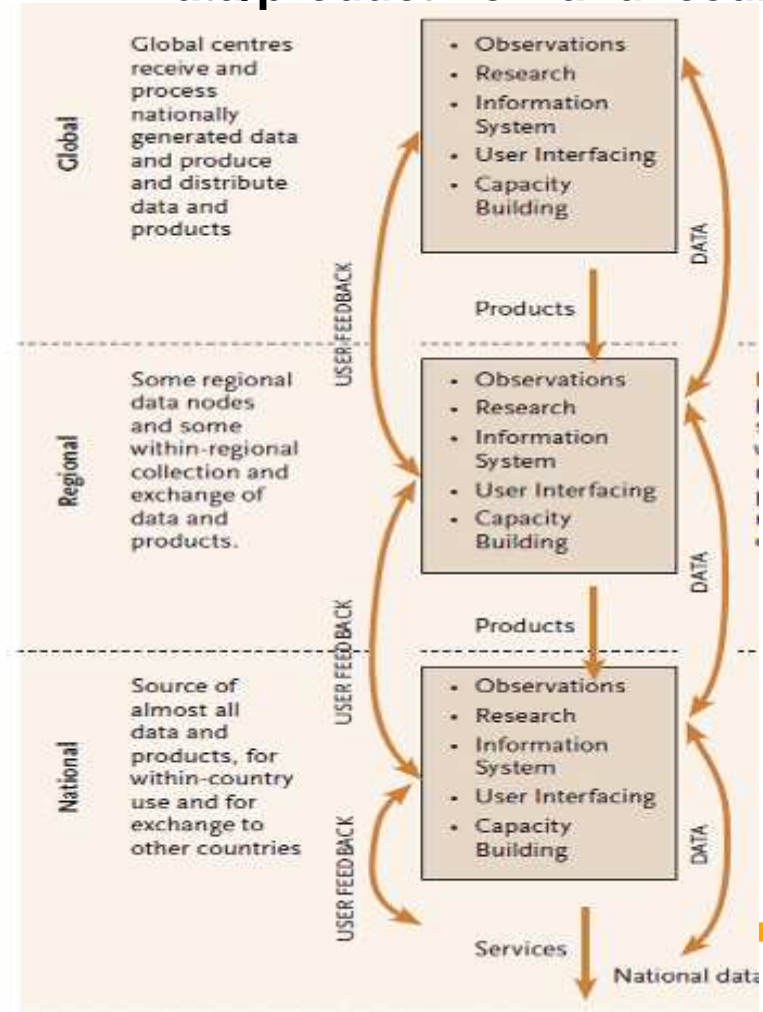
- Formalised structures for CSIS elements and mechanisms are essential for standardisation, sustainability, adherence to policies etc (following GDPFS formalisms)
- Existing WMO CSIS elements, particularly on the global level do not yet fully cover all aspects of climate data. Need 'seamless' provision across timescales...
  - need to work up designation criteria covering e.g.
    - data and monitoring centres
    - decadal prediction centres
    - centennial prediction activities
    - downscaling activities
- Standardisation required 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



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

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

## Data/product flow and feedback





# Global Producing Centres of LRF

- In 2006, WMO set up a process to designate centres making global seasonal forecasts as WMO Global Producing Centres (GPCs) of Long Range Forecasts
- GPCs adhere to defined standards – aiding consistency and usability of output:
  - a fixed forecast production cycle
  - a standard set of forecast products
  - WMO-defined verification standards (for retrospective forecasts)
- A comprehensive set of standard verification measures, with which to communicate the skill of forecasts, has been defined (the WMO Standard Verification System for Long-Range Forecasts – SVSLRF)



# Currently Designated GPCs



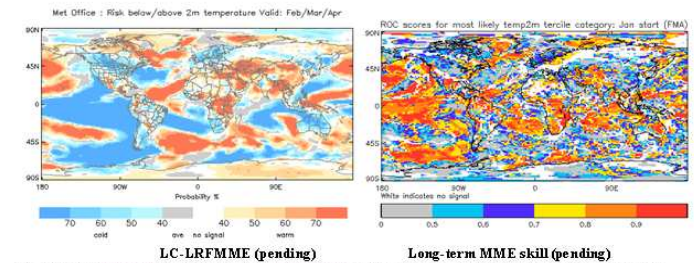
# The Global Seasonal Climate Update

- 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 CCI Task Team.

## 2.3.1 February-April 2011

### 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.



**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).

**RA II:** 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).

**RA III:** 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.

**RA IV:** 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).

**RA V:** 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).

**RA VI:** 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).



# WMO Lead Centres for LRF

- **WMO Lead Center for Long Range Forecast Multi-Model Ensemble (LC-LRFMME)**  
Jointly coordinated by Korea Meteorological Administration (KMA) and NOAA/NCEP  
<http://www.wmolc.org/>
- **WMO Lead Center for Standard Verification System of Long Range Forecasts (LC-SVSLRF)**  
Jointly coordinated by Bureau of Meteorology (BoM), Australia and Meteorological Service of Canada (MSC)  
<http://www.bom.gov.au/wmo/lrfvs/>



# Regional Climate Centres (RCCs)

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- WMO RCCs are Centres of Excellence performing regional-scale climate functions, designated by CBS and CCI.
- RCCs will be complementary to and supportive of NMHSs; warnings and national-scale products will continue to be the responsibility of NMHSs
- Establishment of RCCs is initiated by Regional Associations, based on regional needs and priorities



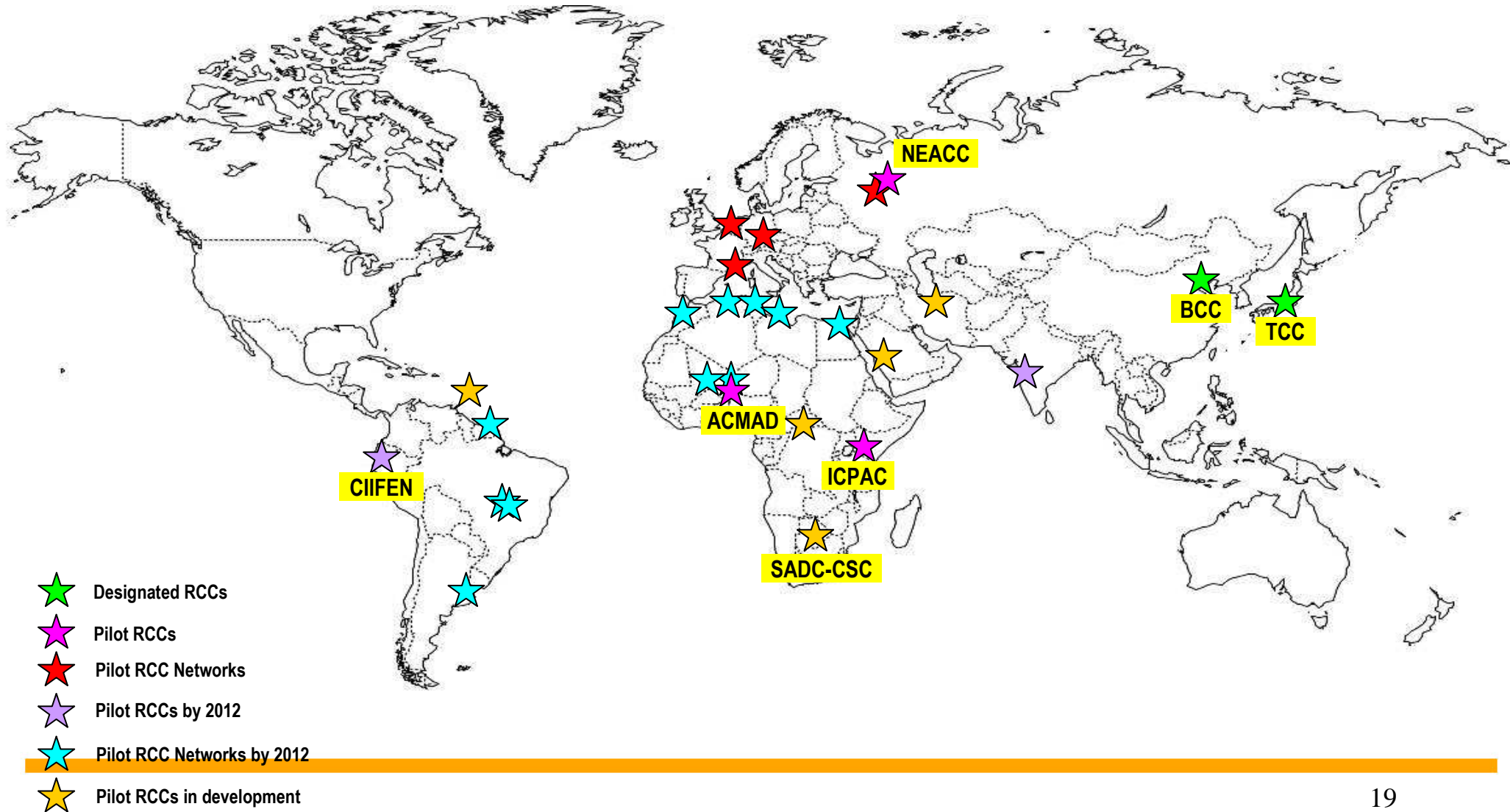
# RCC Functions

- 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

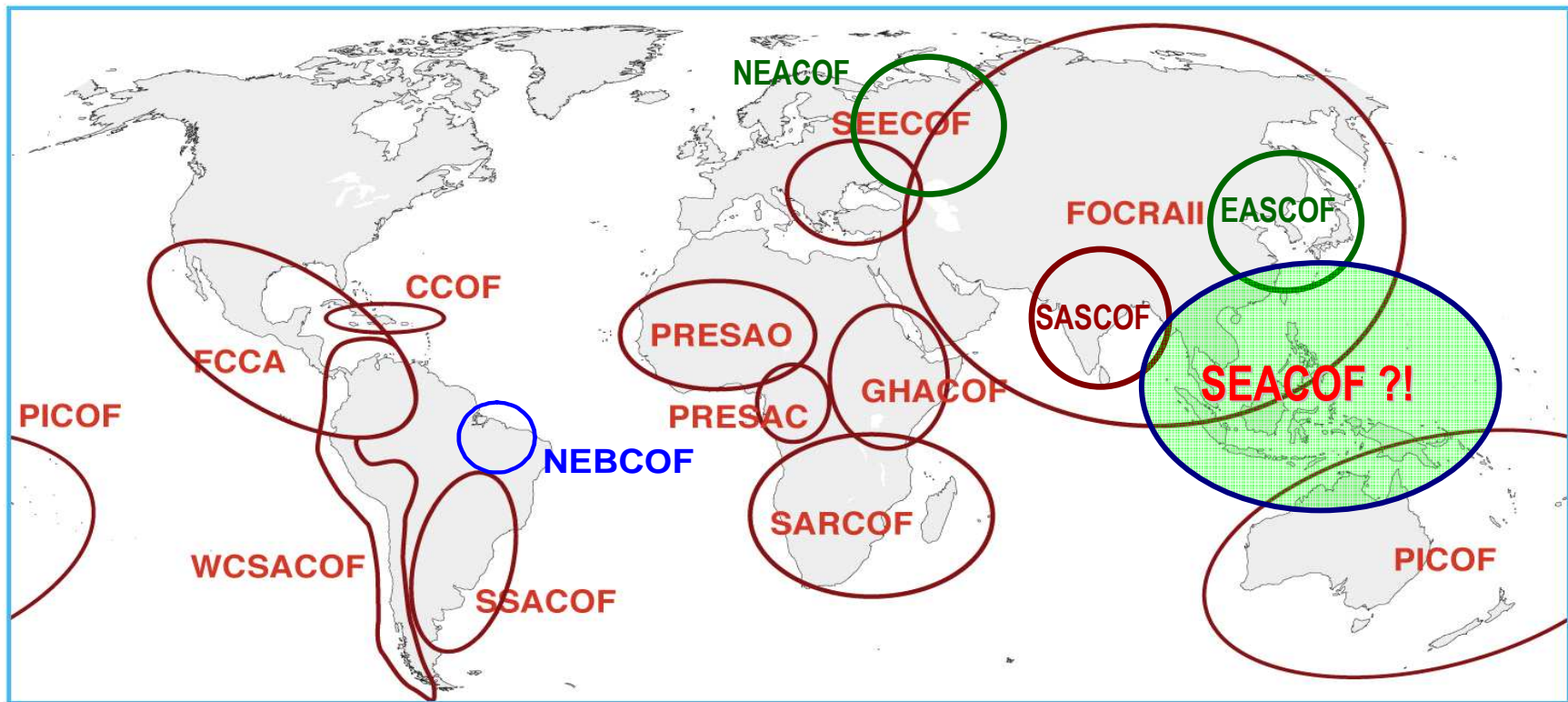




# WMO RCC Status Worldwide

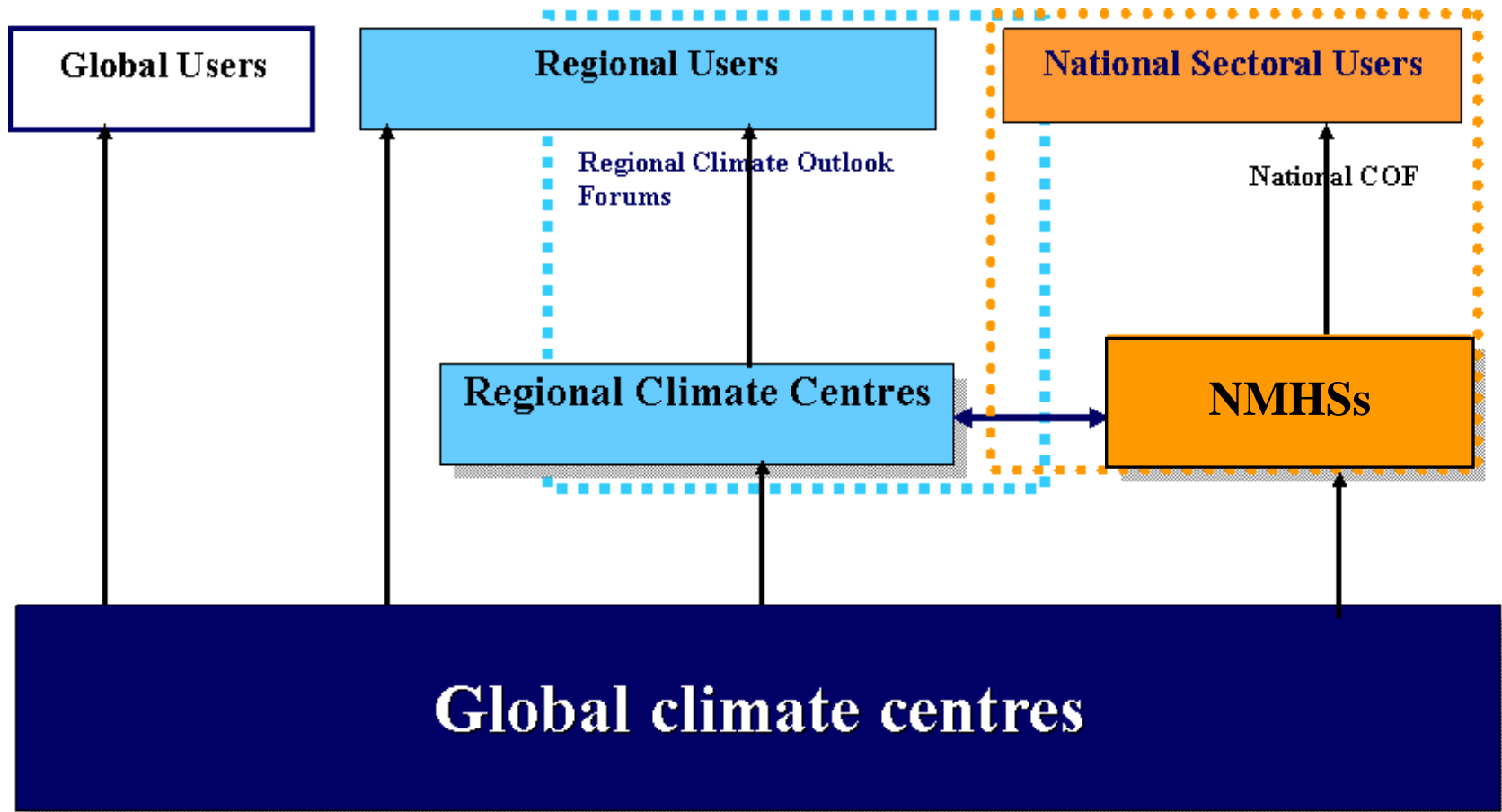


# Regional Climate Outlook Forums worldwide





# Elements of Climate Services Information System





# NMHSs: Underpinning the GFCS

- NMHSs already provide climate services based on the historical archives of observational data collected for weather services; several of them also provide operational climate prediction products, up to seasonal time scales
- NMHSs are mandated by the WMO Convention to observing and understanding of weather and climate and in providing meteorological (including climatological), hydrological and related services in support of relevant national needs, ensuring authenticity to their products and services
- NMHSs are structured and trained to provide 24/7 services
- NMHSs through collaborative mechanism have established standard practices across the globe for weather services that can be easily extended for delivering climate services
- Users deal with weather and climate information in a seamless manner, and it greatly helps them to meet all their weather and climate information needs through a 'single window'; NMHSs can effectively provide such a single window.
- NMHSs and their partners constitute a large pool of technical experts dealing with weather and climate



# Roles of National Meteorological Services

- NMHSs own and operate most of the infrastructure that is needed for providing the weather, climate, water and related environmental services, including observing systems, data management, prediction, communications and data exchange, etc.
- GFCS will contribute to the further development of this capability by working with the NMHSs.





# Categories of Climate Services





# GFCS Capacity Development

- Capacity Building in developing countries
  - Linking climate service users and providers.
  - Building national capacity in developing countries (institutional, infrastructure, human).
  - Strengthening regional climate capabilities.
- Building capacity to implement the User Interface Platform in the developing world
- Improving climate observations in data sparse areas
- Building the capacity of the climate research sector in developing countries



# Essential climate related capabilities of NMHSs

- **Observations**
  - Data management with quality assurance (archives & rescue)
  - Climate standards (i.e. those of GCOS)
  - Historical & real-time observations of the Essential Climate Variables
  - Contribute data to WIS
  - Improve station density
- **Research**
  - Participate in field experiments and applied research
  - Develop new products
- **Operations**
  - Generation of climate information and prediction products (including GPC/RCC/RCOF linkages)
  - Tailoring/downscaling
  - Dissemination/communication
- **Capacity Development**
  - Participate in/organize training activities
  - Participate in Regional Climate Outlook Forums
- **User Interface**
  - Interact with user to meet requests and improve products
  - Contribute to Regional Climate Outlook Forums
  - Coordinate or National Climate Outlook Forums



# GFCS Capacity Building areas

*(as articulated by HLT-GFCS)*

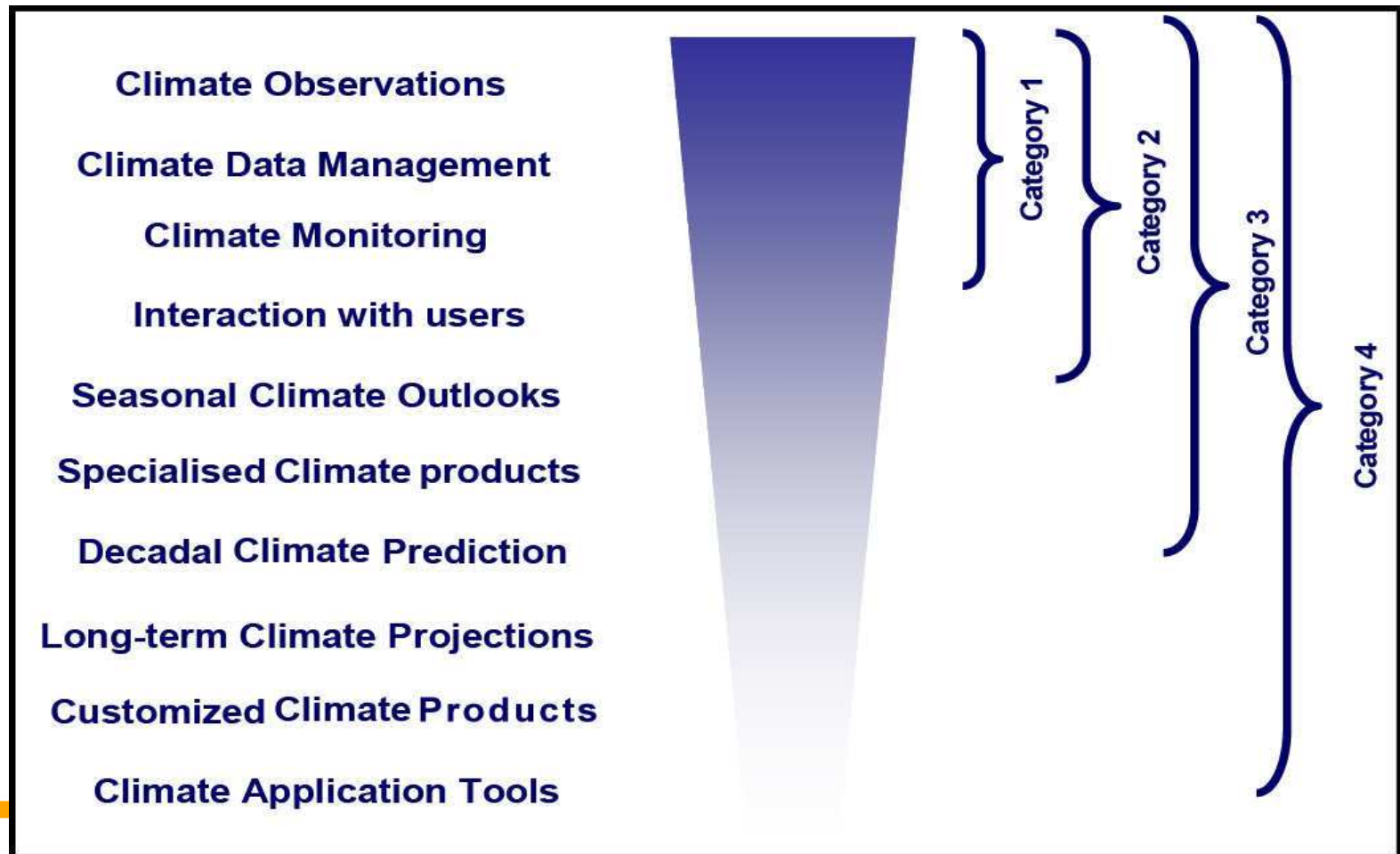
- **Human resource** capacity
  - equipping individuals with the understanding, skills, information, knowledge and training to enable them to generate, communicate and use decision-relevant climate information;
- **Infrastructural** capacity
  - enabling access to the resources that are needed to generate, archive and use climate data and decision-relevant information, including observing networks, data management systems, computer hardware and software, internet, manuals and scientific literature;
- **Procedural** capacity
  - defining, implementing and advancing best practices for generating and using climate information;
- **Institutional** capacity
  - elaborating management structures, processes and procedures that enable effective climate services, not only within organizations but also in managing relationships between the different organizations and sectors (public, private and community, including international collaboration).



# Levels of services categories

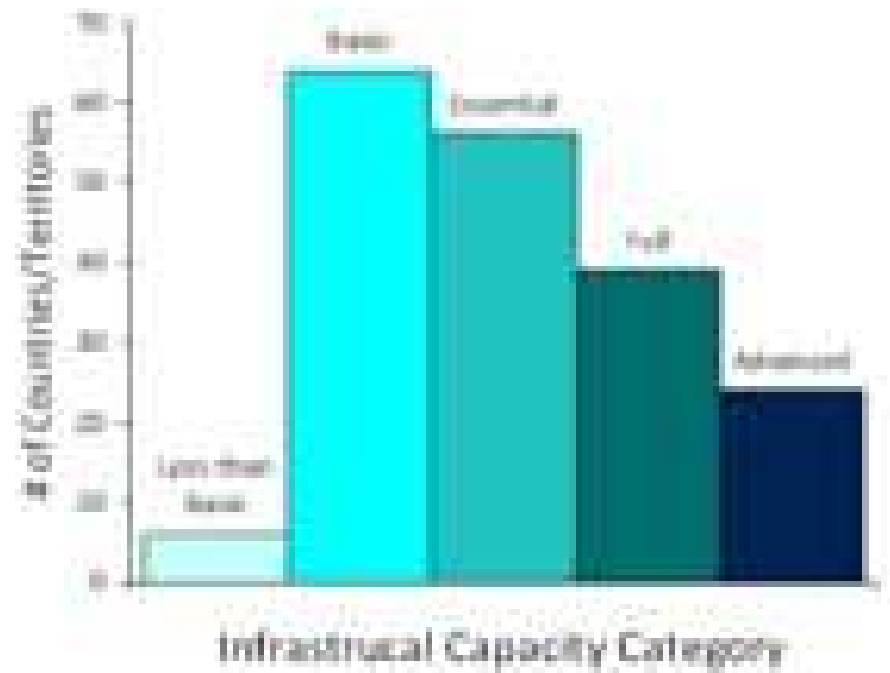
NMHSs to provide 4 different climate services levels

1. Basic
2. Essential
3. Full
4. Advanced





# Profile of climate service providers





# HLT Findings on Capacity Building (1/2)

- Climate change adaptation is a specific focus for many capacity building activities, but the importance of building capacity to manage shorter term weather and climate variability is also recognized.
- Many United Nations agencies and programmes, as well as bilateral donors, provide capacity building support for climate-related activities but current efforts generally lack coordination.
- Capacity building requires long-term, institutional strengthening in governance, management and human resources development.
- Many of the relatively small-scale projects in building capacity in climate-related research, observations, data management and service delivery need to be scaled up.
- All countries need a new generation of well-trained professionals.
- Standards and guidance on best practices for climate service delivery need to be defined and implemented.



# HLT Findings on Capacity Building (2/2)

- Building capacity in climate services should look to strengthen existing capabilities, particularly in the area of partnerships, guidelines on best practices, user engagement, etc.
- Regional centres could form the focus of a coordinated, climate-services capacity building programme.
- RCOFs are a set of natural alliances around which future improvements in the development and delivery of climate services could be focused.
- Much greater effort is required to engage representatives from the user communities in these processes.
- Countries should be actively encouraged to devise clear definitions of mandates for the provision of climate services.
- Given that many WMO Members may not be in a position to provide a full range of climate services, one solution is to provide regional support and promote regional collaboration.



# Report from the **NMHS** GFCS Capacity Development Requirements Workshop

Geneva 10 to 12 October 2011





# Five Main findings

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1. Need for national mandates on climate services to be established and working arrangements agreed
  2. NMHSs to take lead in establishing national fora for identifying the user requirements (User Interface Platform)
  3. To get GFCS started, education and training of NMHS staff required in areas of leadership, advocacy, strategic planning and building productive relations with partners and users
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# Main findings (continued)

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4. Build sub regional / regional alliances founded around delivering climate services (MoUs between institutions to spell out the working arrangements)
  5. Global alliances to support the research, production and delivery of climate services to regional level (MoUs between institutions to spell out the working arrangements)
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# Four Recommendations for EC TT GFCS

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1. Continue outreach on why we need to implement GFCS and how it will develop.

WMO and partners to communicate / engage with Missions:

advising them of GFCS; and,  
strongly advocate the fundamental role NM(H)S can play in the development of GFCS.

2. Establish National / Regional foci (individuals / groups / institutions).

Follow-on national workshops to be held with WMO support to explain and advocate for GFCS

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# Recommendations for EC TT GFCS

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3. WMO position paper on '*Guidelines for National Meteorological Services in the establishment of national climate services*' to be promoted to all Members and used to inform the work of the EC TT on GFCS

4. Highlight benefits of investing in climate services through success stories across a range of sectors.

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# Recommendations for RA V (1/3)

- Capacity development at the **national** level
  - Establish baseline of RA member capabilities
  - Target resource mobilization on deficiencies
  - Work into sub-regional and national development plans
  - Establish national focal points in NMHSs
    - organize and follow-up on national multi-agency workshops
    - Clarify national roles in climate services: Build relationships/linkages
    - Pursue national outreach
  - Operational climate activities within NMHSs (e.g., National Climate Centres)



# Recommendations for RA V (2/3)

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- Set **regional** development goals
  - E.g., Move NMHSs from Cat 1 to Cat 2
  - Clarify and institutionalize Roles of GPC, RCC and National Centres within region
    - Enhanced use of GPC and other global products at the regional and national levels
    - Implementation of RCCs/RCC-Networks
  - Expansion of RCOF operations (e.g., SEACOF?)





# Recommendations for RA V (3/3)

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- At Regional and National levels
  - Linkages with academic/research community (e.g., links with CLIVAR Asian-Australian Monsoon Panel, Pacific Ocean Panel, etc.)
  - Integration of GFCS aspects into existing and proposed multi-lateral projects on climate applications and services
  - Partnerships with user sectors (e.g., RCOFs, NCOFs)



# Potential RA V approaches towards GFCS implementation

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- Enhanced use of GPC and other global products at the regional and national levels
- Implementation of RCCs/RCC-Networks
- Expansion of RCOF operations (e.g., SEACOF?)
- Operational climate activities within NMHSs (e.g., National Climate Centres)
- Capacity development at the national level
- Linkages with academic/research community (e.g., links with CLIVAR Asian-Australian Monsoon Panel, Pacific Ocean Panel, etc.)
- Integration of GFCS aspects into existing and proposed multi-lateral projects on climate applications and services
- Partnerships with user sectors (e.g., RCOFs, NCOFs)



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Thank You

Rob Masters  
RMasters@wmo.int