Enabling S2S Prediction Applications: WMO Climate Services Information System Operations

Rupa Kumar Kolli

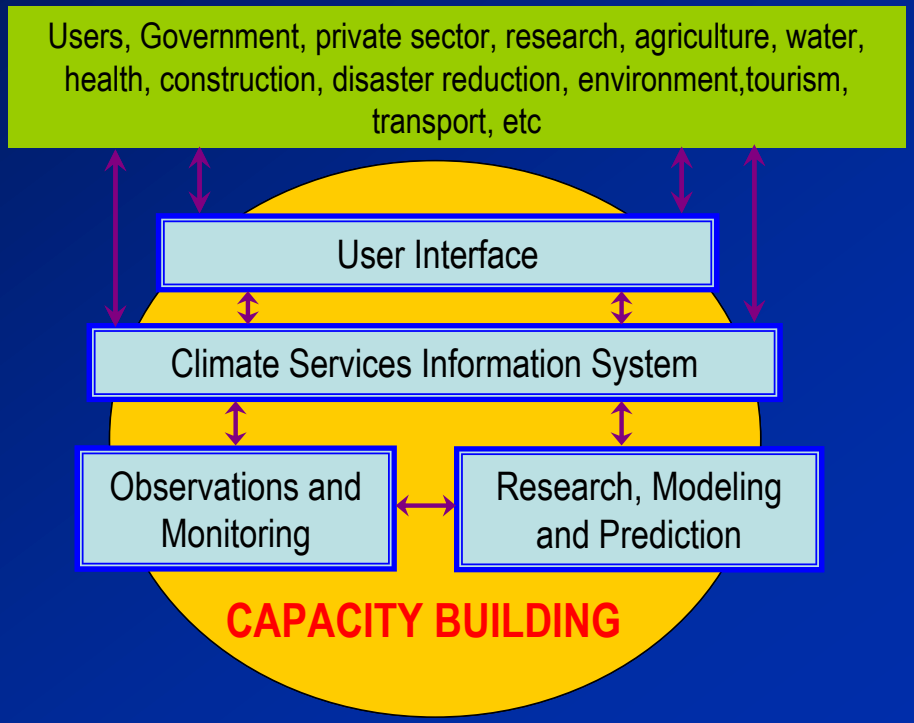
International CLIVAR Monsoon Project Office (ICMPO)

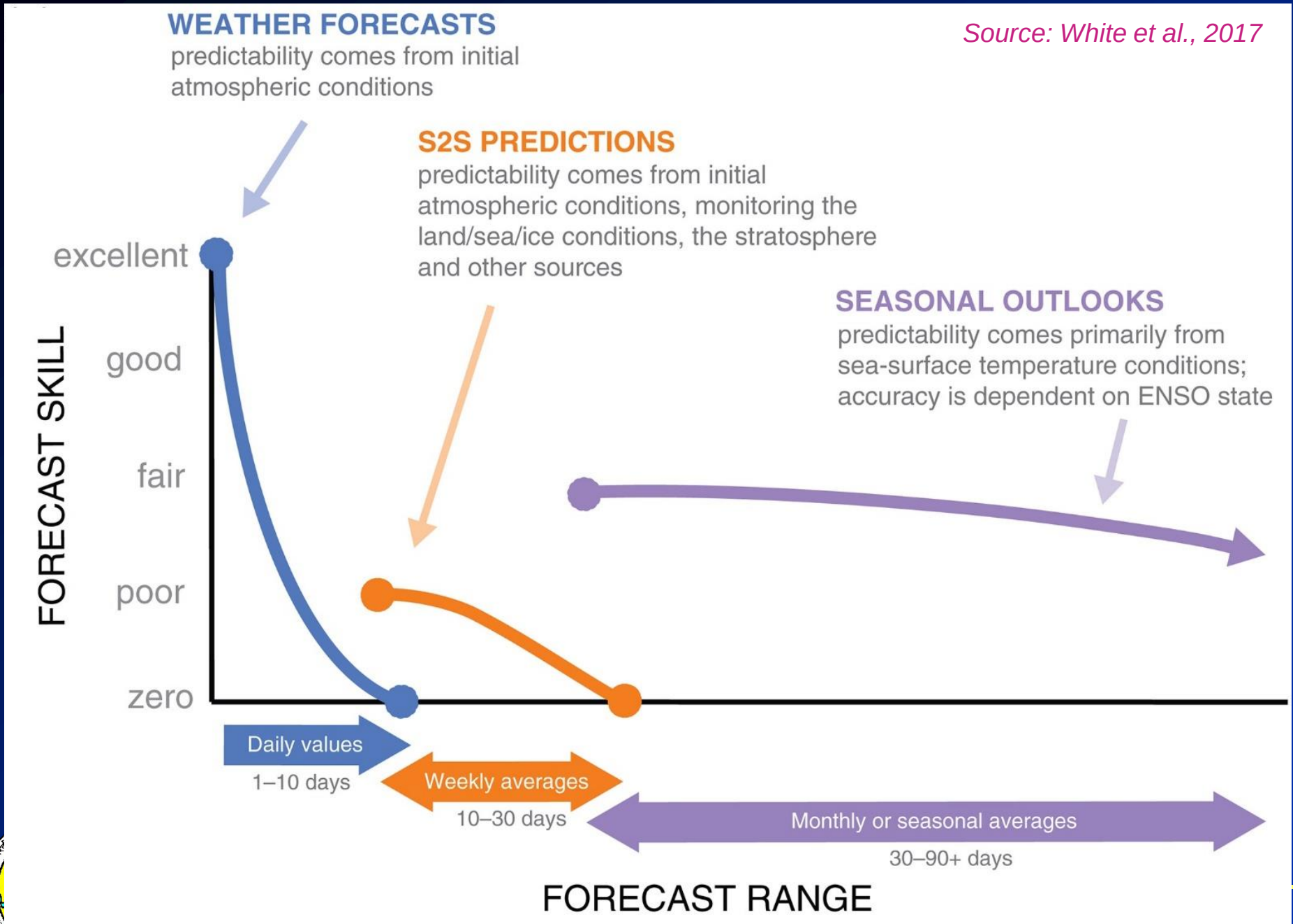
Indian Institute of Tropical Meteorology (IITM)

Pune, India

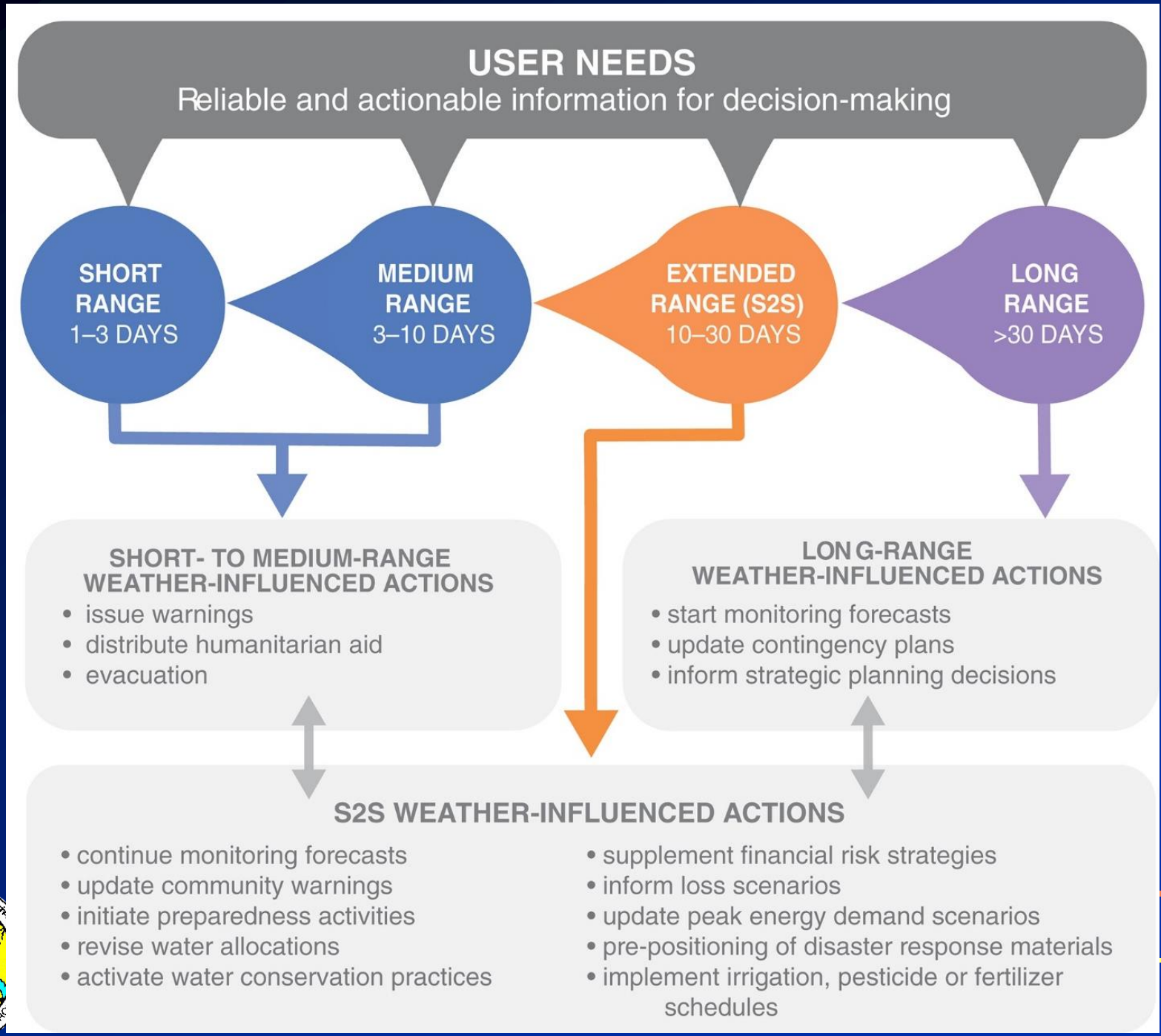
Global Framework for Climate Services (GFCS)

- 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.



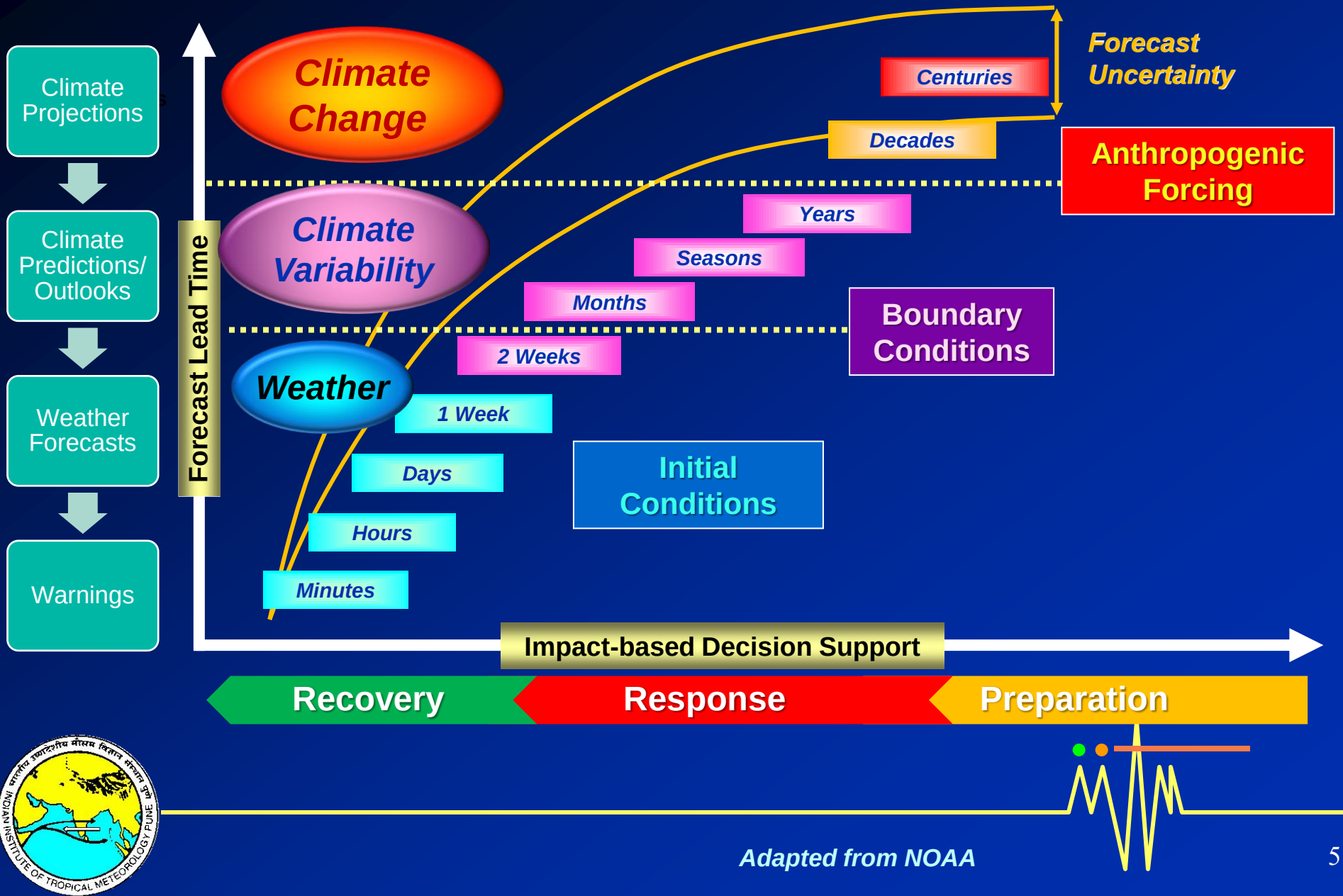


Source: White et al., 2017



Source: White et al., 2017

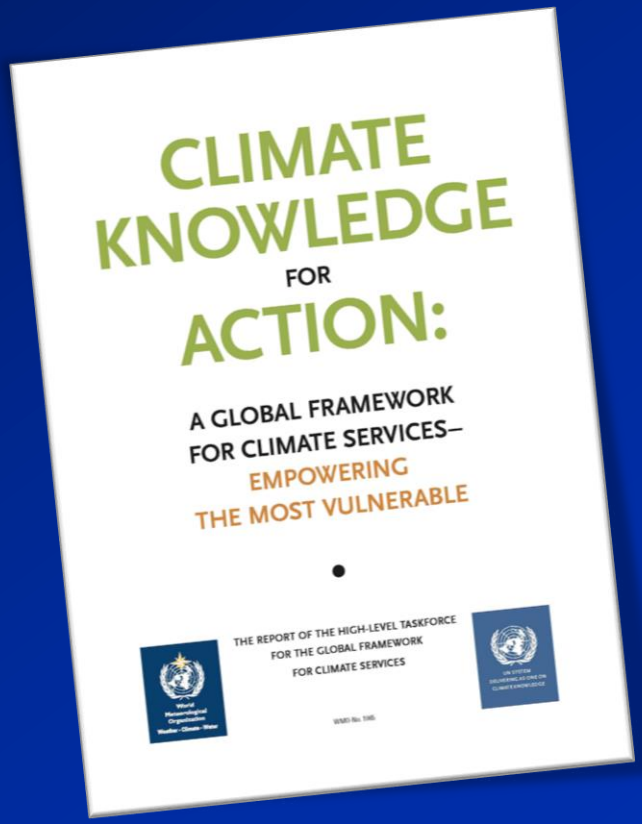
Seamless Prediction Framework



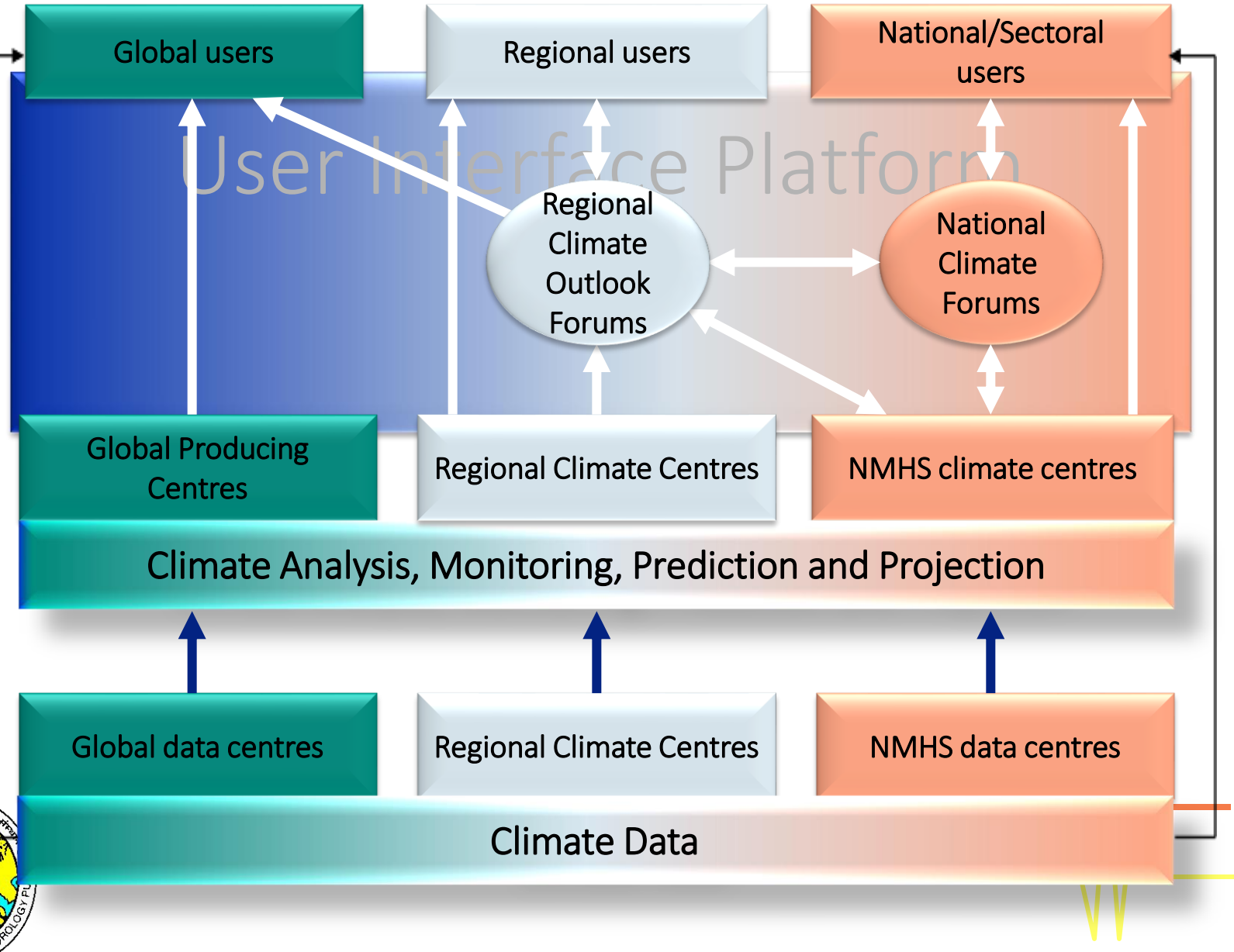
Adapted from NOAA

Climate Service Information System (CSIS)

- The CSIS is the component of the GFCS most concerned with the generation and dissemination of climate information.
- It is the '**operational centre**' of the GFCS. It deals with climate data, monitoring, prediction (monthly, seasonal, decadal) and projection (centennial) activities.
- "CSIS is the system needed 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." (*High Level Taskforce on GFCS*)

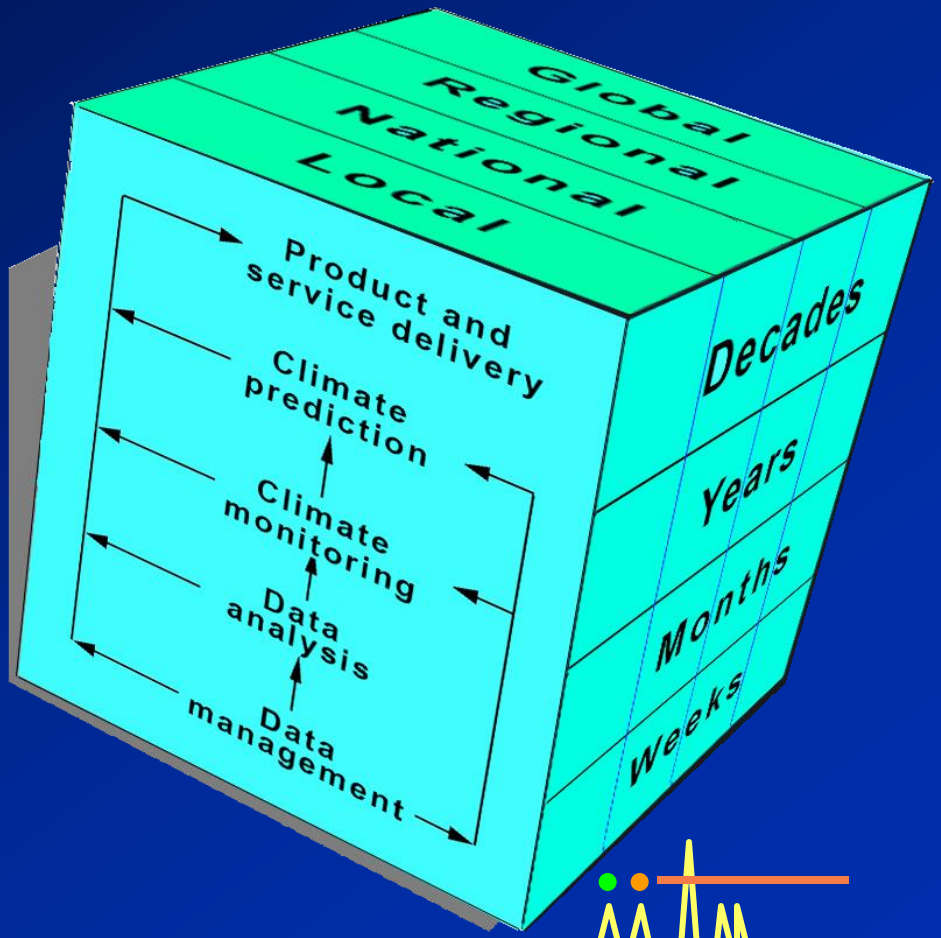


CSIS Infrastructure Layout



CSIS Implementation Strategy

- Developing and implementing CSIS architecture
  - Functional descriptions and product development (Data/Monitoring/Prediction/ Projection)
  - Operational infrastructure: GPCs, RCCs, RCOFs, NMHSs, NCOFs/NCFs
  - Climate Services Toolkit
  - Capacity Development



OUTPUTS FLEXIBLY GENERATED AT MULTIPLE LEVELS:

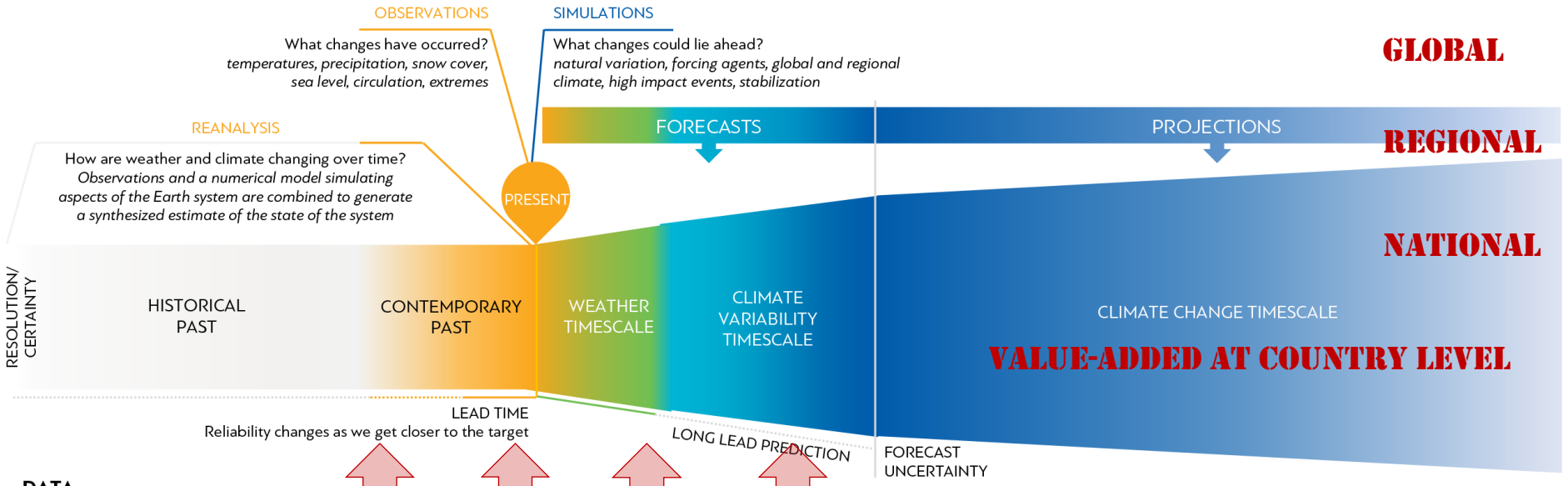
GLOBAL

REGIONAL

NATIONAL

CLIMATE SERVICES INFORMATION SYSTEM

Data and Products for Climate Services



VALUE-ADDED AT COUNTRY LEVEL

DATA

Historical data consists of
Instrumental data - century-long measurements of surface temperature and precipitation, records of daily data
Paleoclimate data - derived from natural sources such as tree rings, ice cores, corals, and ocean and lake sediments

Monitoring

Uses data from recent past and the present

Sub-seasonal to Seasonal

Flash flood guidance
Severe weather forecasting
Tropical cyclone forecasting

Interannual

Climate Change Indices

PRODUCTS

Past climate

Climate trends, Extreme climate indices, Sector-specific climate indices, Reanalyses, Return periods of extremes, Climate Normals , World Weather Records

Weather

Initial conditions

Climate variability

Boundary conditions (sea surface, snow cover, land), Climate monitoring and watch

Multi-decadal

Projections

Operational projections on climate change timescales

TOOLKIT - facilitates operations and used typically by forecasters

TAILORED PRODUCTS FOR DECISION SUPPORT – products can either be tailored in space and time or according to the decision relevance

DECISION SUPPORT APPLICATIONS – climate services apply past climatological records, contemporary monitoring and expected future conditions to socio-economic sectors

In agriculture, to inform crop choice, planting to optimize yield and minimizing crop failure risk
Disaster risk identification based on extreme event return periods and trends

Emergency response, Disaster Risk Reduction

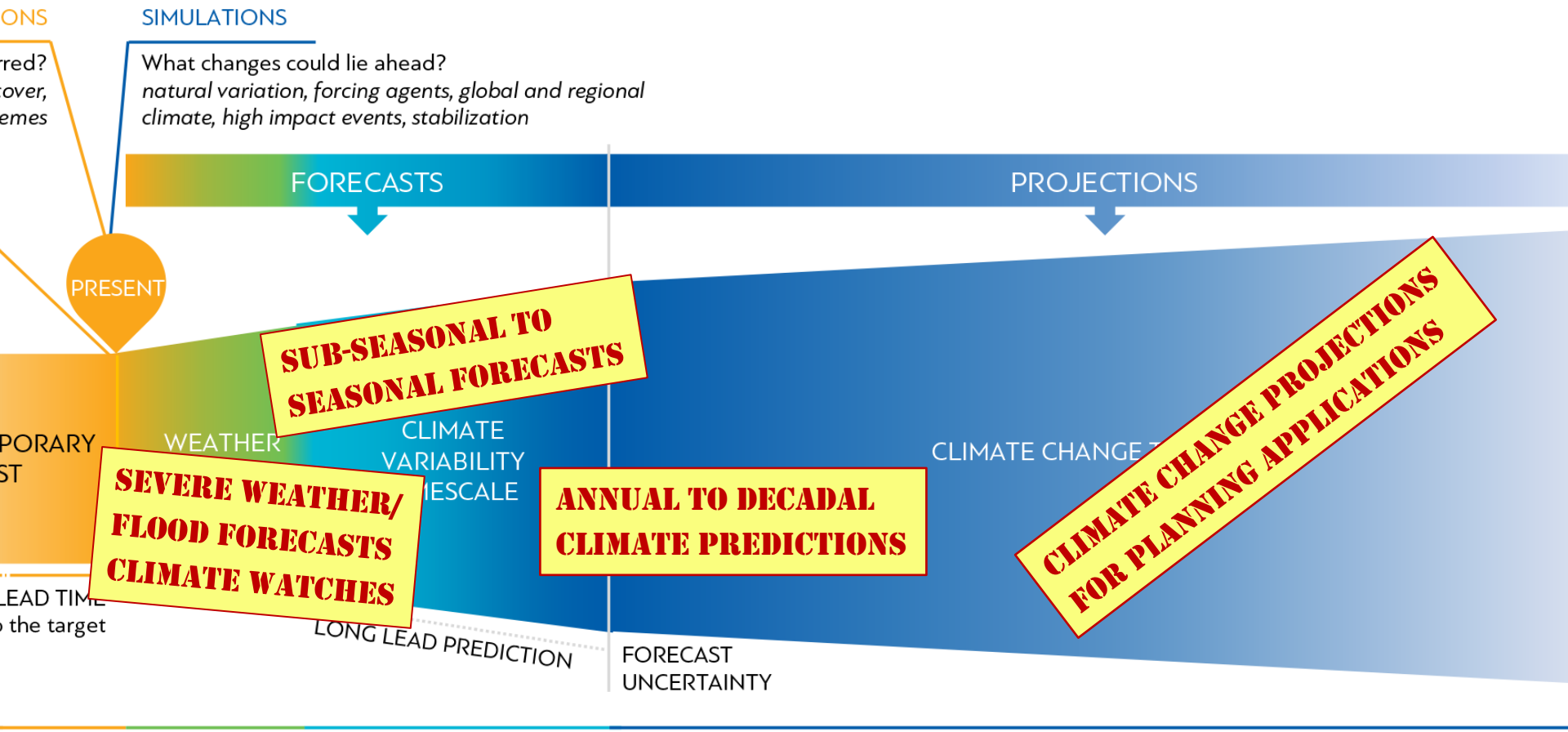
Contingency plans, humanitarian response, government and private infrastructure investment

Informs mitigation policy and adaptation choices
Impacts on water resources, heat stress, crops, infrastructure

SERVICE DELIVERY AT COUNTRY LEVEL

CLIMATE SERVICES INFORMATION SYSTEM

Data and Products for Climate Services



Sub-seasonal to Seasonal

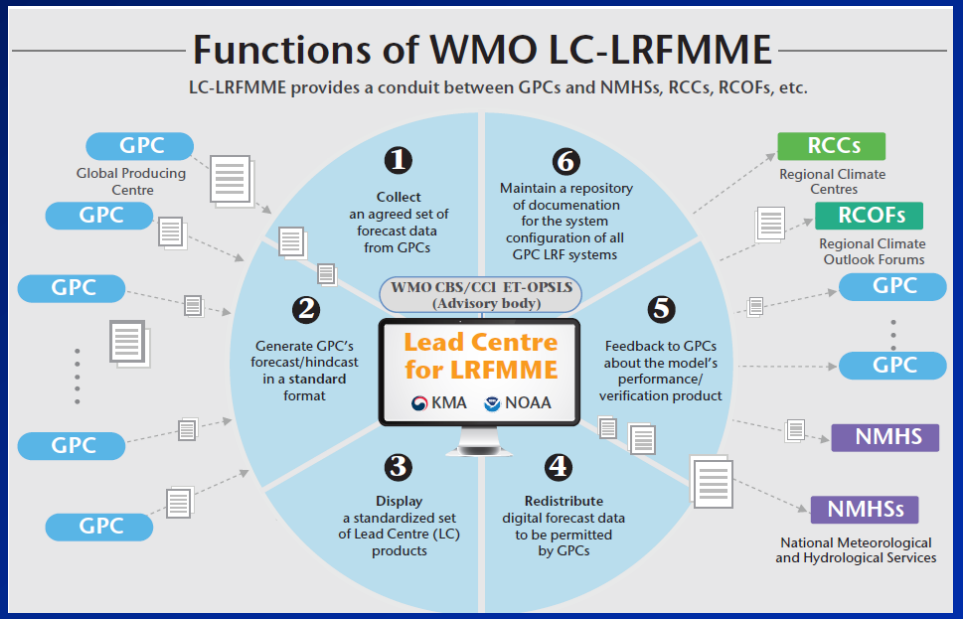
Flash flood guidance
Severe weather forecasting
Tropical cyclone forecasting

Interannual

Climate Change Indices

WMO Global Producing Centres

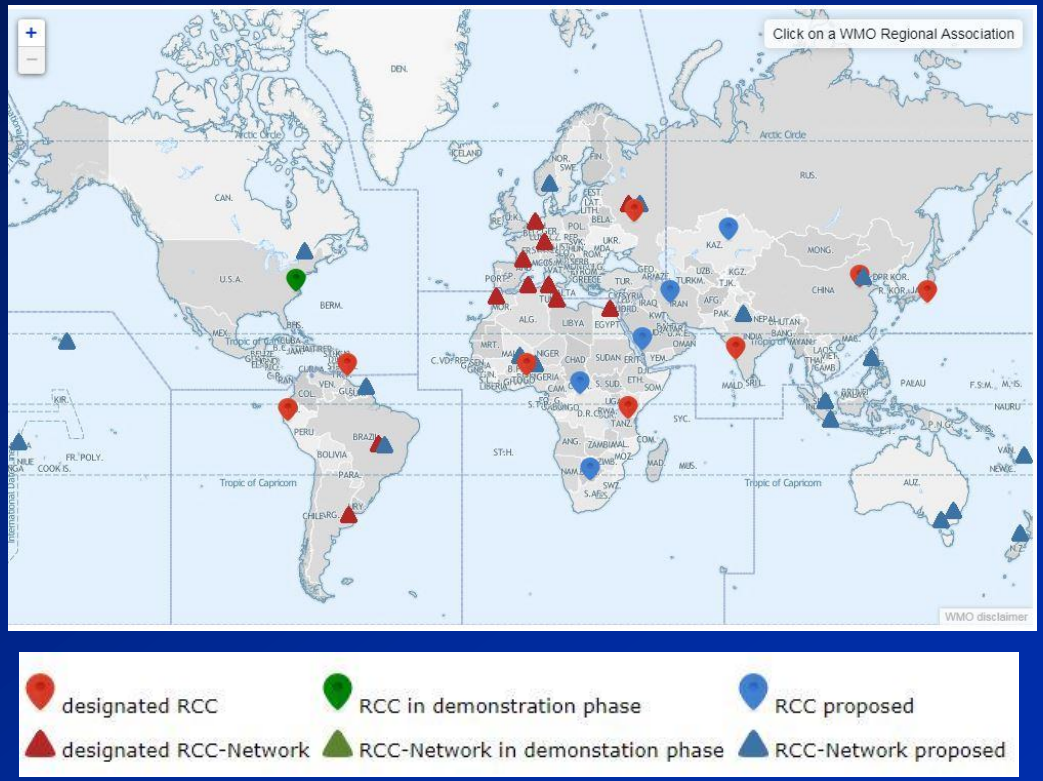
- WMO GPCs adhere to commonly defined standards – aiding consistency and usability of output:
  - a fixed forecast production cycle
  - a standard set of forecast products
  - WMO-defined verification standards
- Long Range Forecasts (GPCs-LRF)
  - 13 GPCs-LRF designated so far
  - 1 ready for designation; 1 applied (India)
  - Lead Centre: LC-LRFMME (KMA/NOAA)
- Annual to Decadal Climate Prediction (GPCs-ADCP)
  - LC-ADCP (UKMO)
- Sub-Seasonal Forecasts (GPCs-SSF)
  - *in the pipeline*
- GPCs for Data ? Monitoring ?



Links to GPCs-LRF:
https://www.wmolc.org/

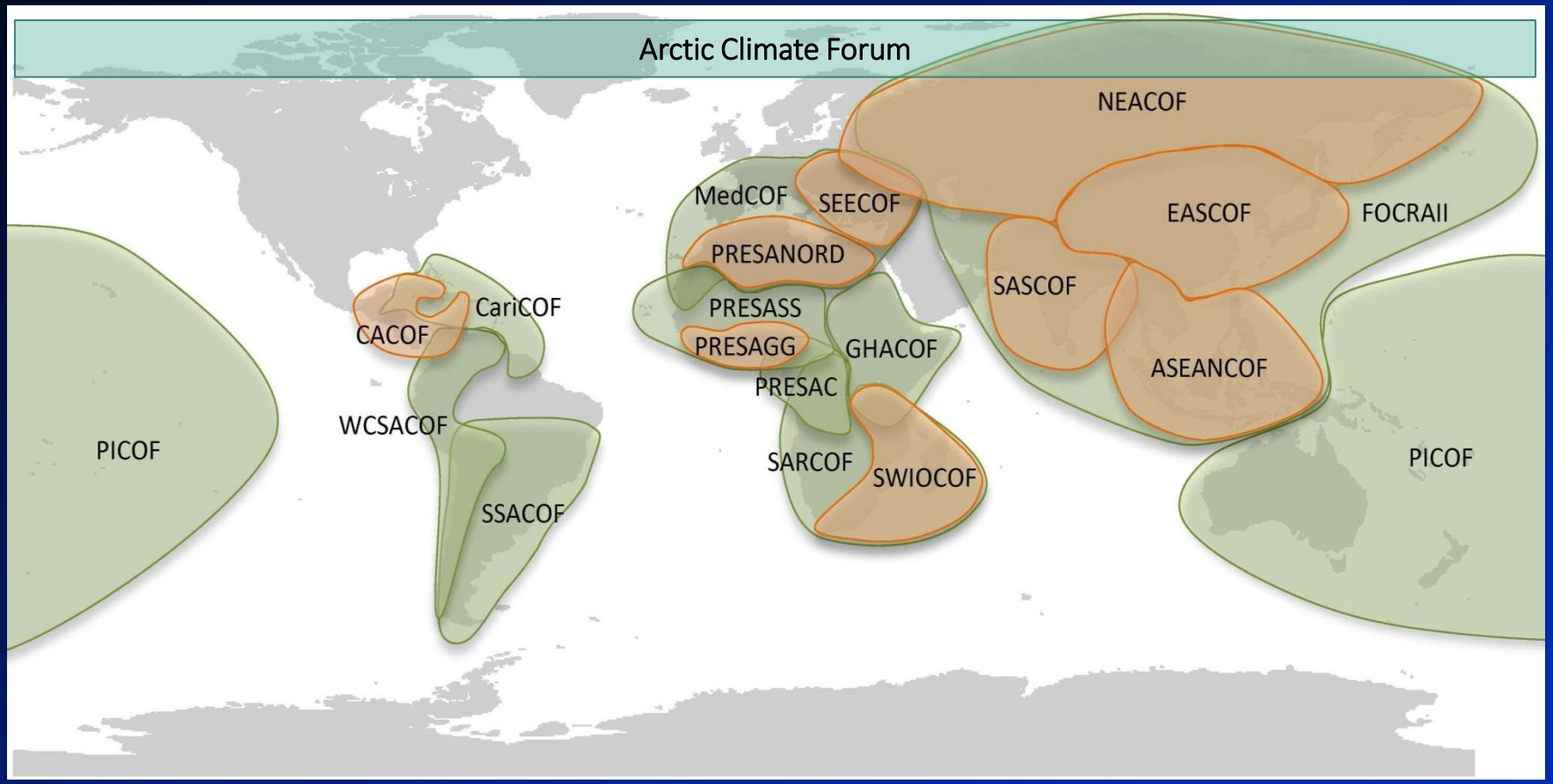
WMO Regional Climate Centres (RCCs)

- WMO RCCs provide regional climate products in support of regional and national climate activities
- Mandatory Functions:
  - LRF, Climate Monitoring, Data Services, Training
- Highly Recommended Functions:
  - S2S and decadal prediction, climate change projection, Non-operational data services, Coordination, Training and capacity building, Research and development
- Two modes: fully self-contained RCCs or distributed-function RCC-Networks
- RCCs in India
  - RCC Pune designated as WMO RCC
  - Third Pole RCC-Network under development (India to lead the Southern Node)



https://public.wmo.int/en/our-mandate/climate/regional-climate-centres

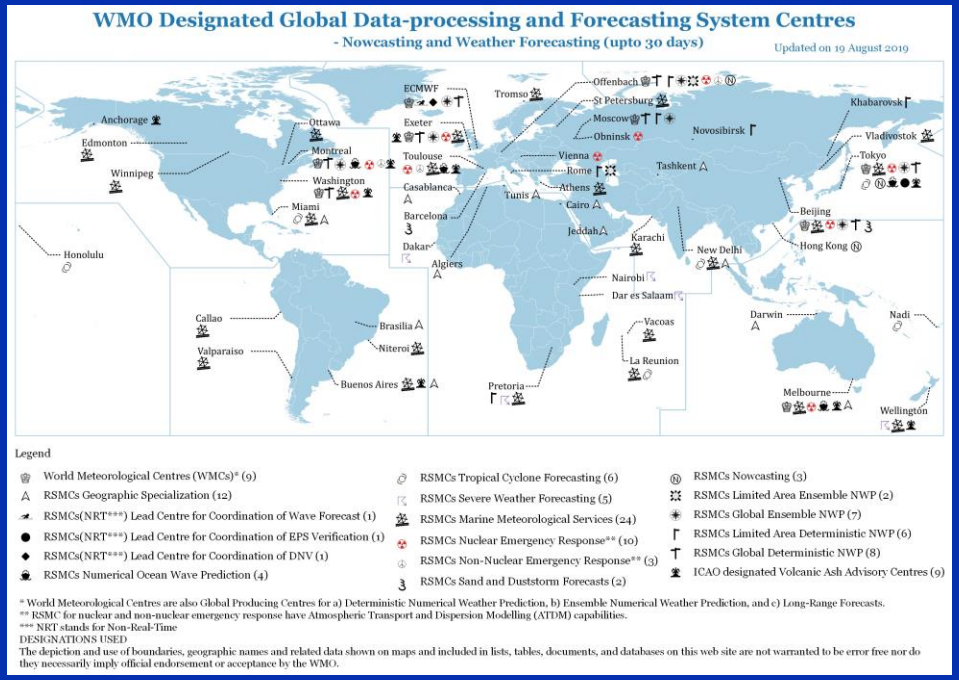
RCOFs Worldwide

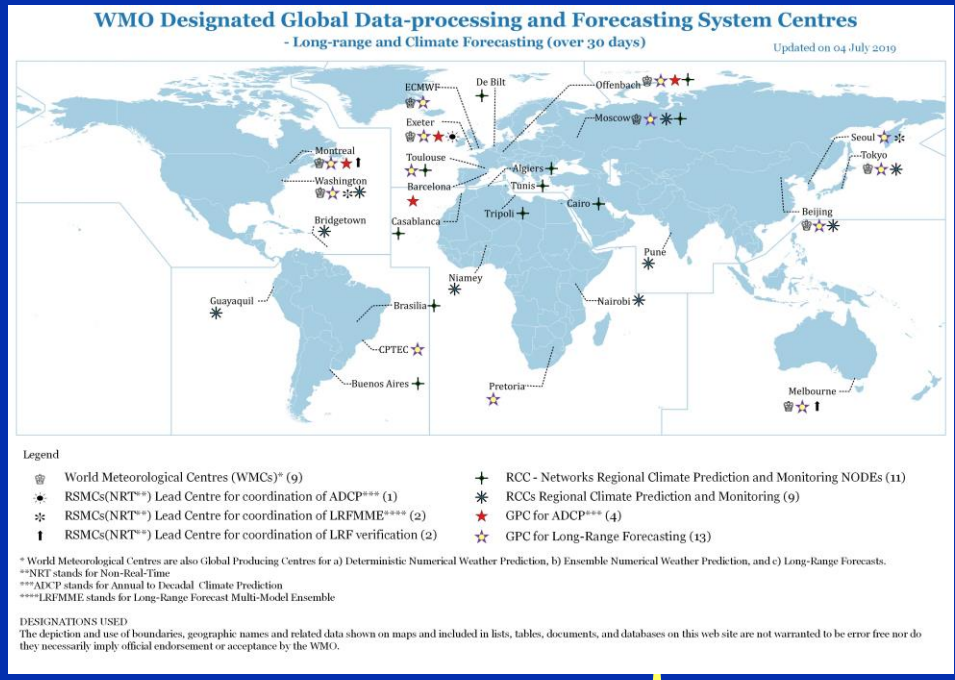


https://public.wmo.int/en/our-mandate/climate/regional-climate-outlook-products

WMO Thrust on Earth System Modeling and Prediction: Seamless GDPFS

- To address societal needs for relevant, coherent and authoritative weather, water climate and other related environmental information
- To harness opportunities from coupled Earth System Modelling and Prediction: Seamless predictions across time and space scales
- to strengthen involvement of social scientists enabling improved understanding of human behaviour and response



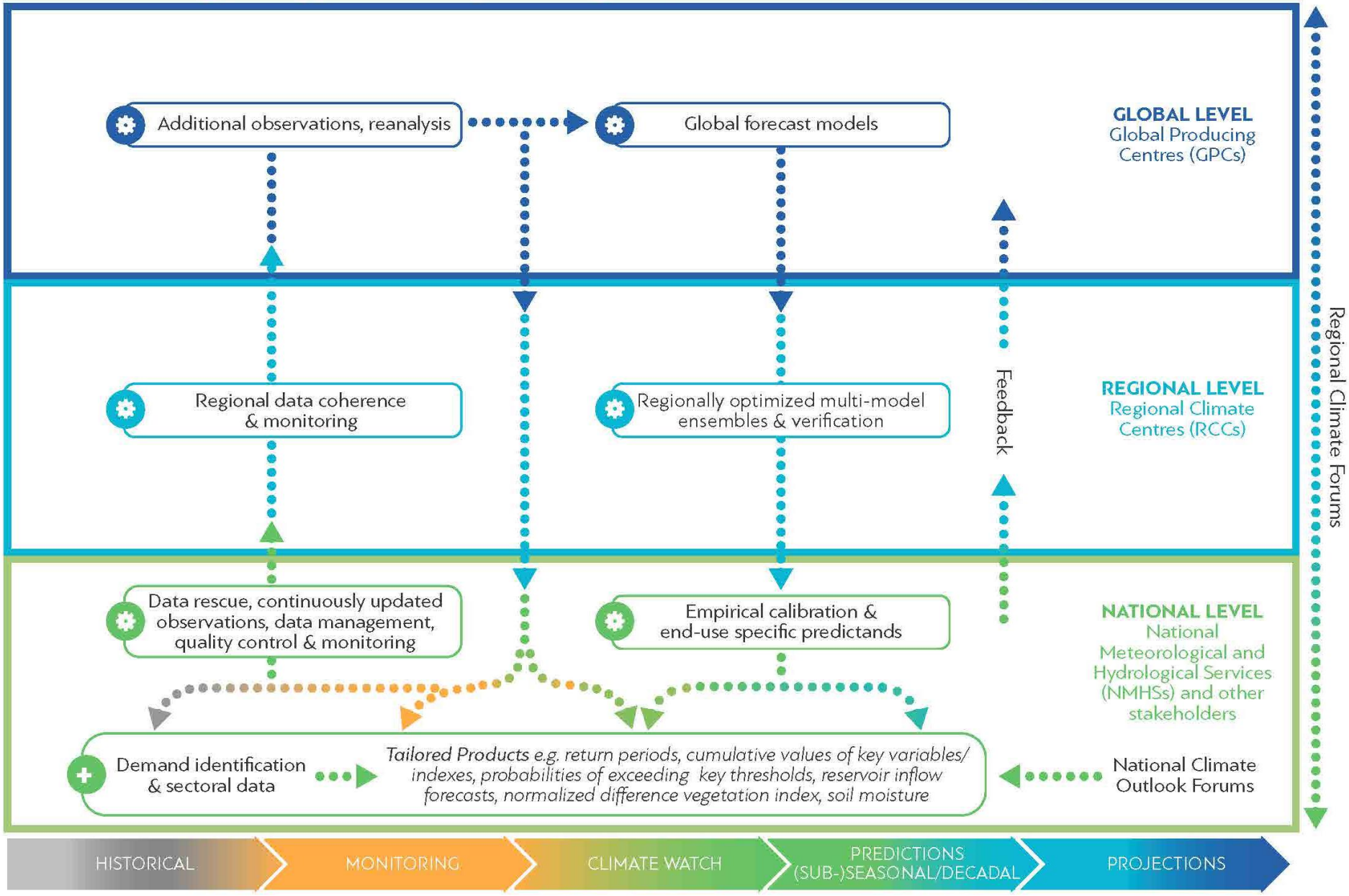


Regional Approach Rationale

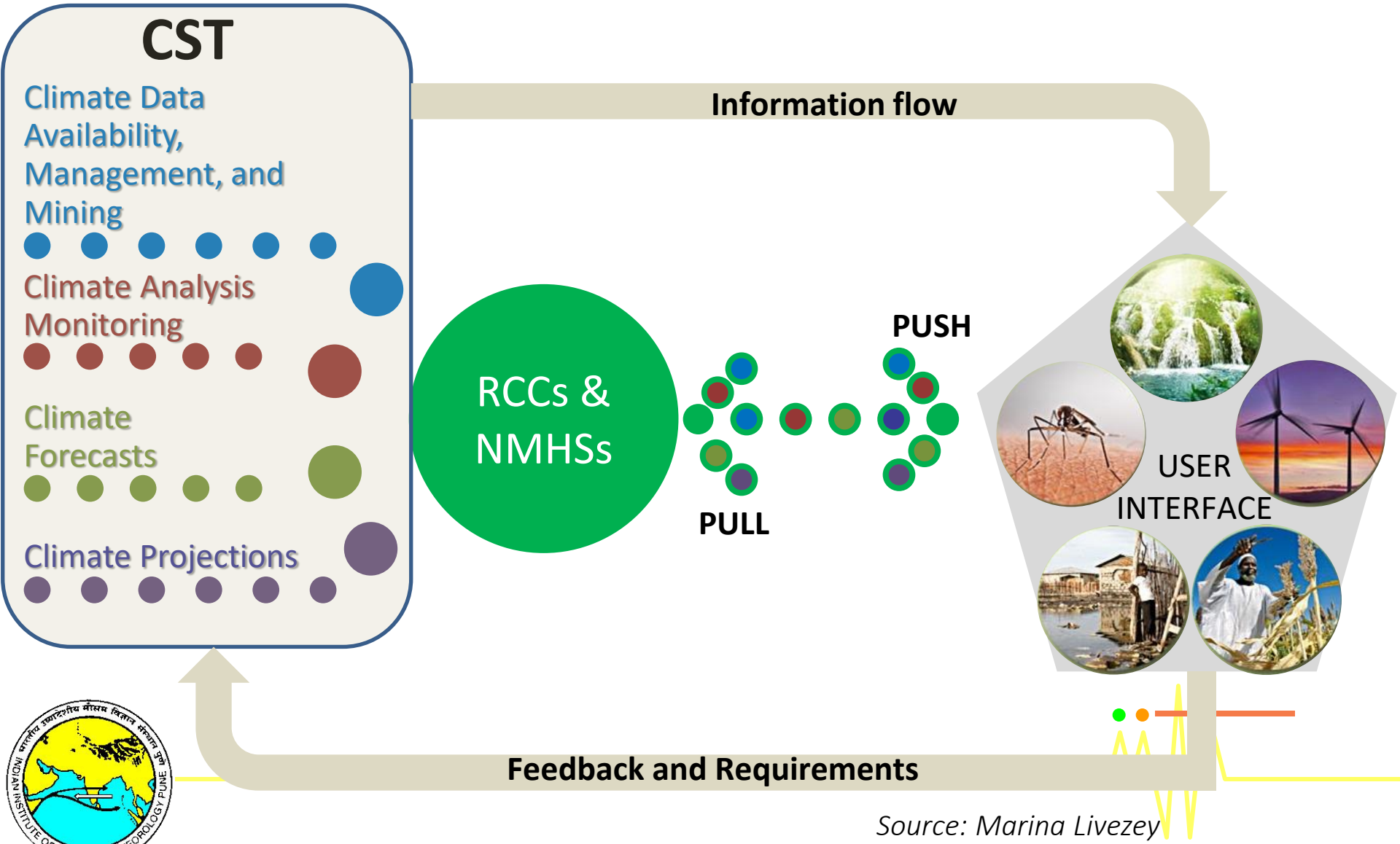
- The country-focused results-based framework for WMO contributions to the GFCS focuses on creating the regional delivery systems, tools and methods, and national capacities for improving climate-related outcomes;
- A focused regional effort would facilitate systematic strengthening of early warning services in a comprehensive manner that would help countries in the region achieve this goal;
- Facilitated access to optimized regional information is an essential input for national climate services, ensuring consistency in understanding and interpreting shared regional climate drivers;
- The approach can be demonstrated in a few target regions and up-scaled to other regions.

WMO

A Regional Approach to Implementing the Climate Services Information System (CSIS-R)



Climate Services Toolkit (CST)



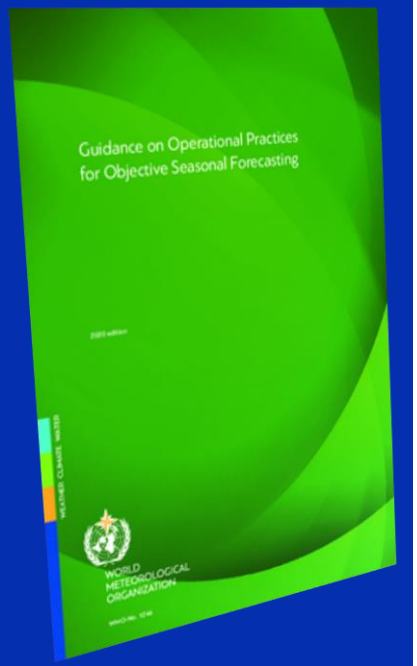
Source: Marina Livezey

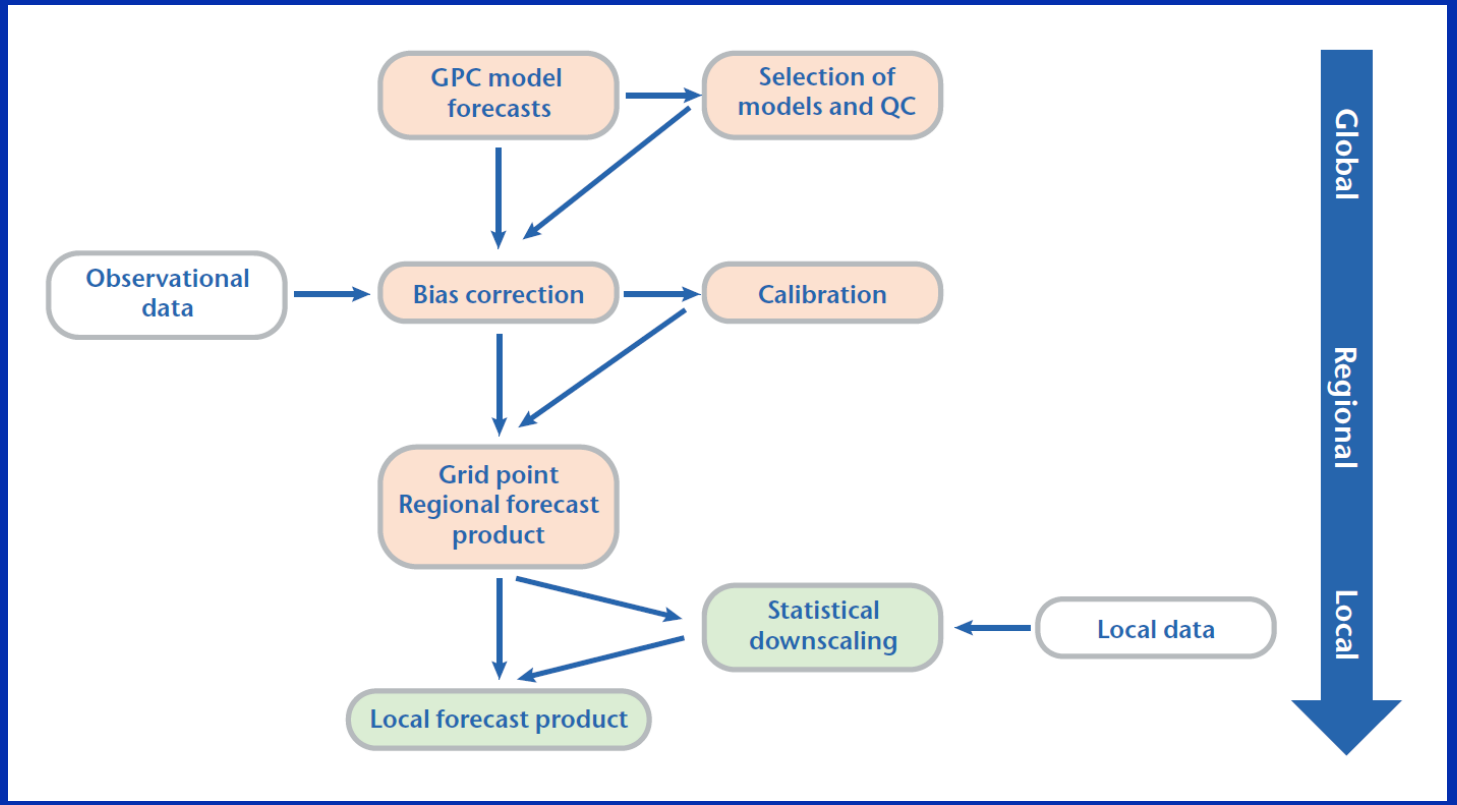
Impact-based Climate Information

- Climpact is a software package to calculate climate indices that are relevant for the health, agriculture and water sectors;
- The indices calculated by Climpact are derived from daily temperature and rainfall data;
- Get started: https://climpact-sci.org/

Objective Seasonal Forecasting

WMO Recommended Procedures





https://library.wmo.int/doc_num.php?explnum_id=10314

National Level Components of Climate Services

GFCS National Consultations

National agencies

agriculture and forestry, marine (coastal and ocean), water resources, health, energy, the environment and disaster management, and other climate sensitive sectors;

National and local Govt. committees

dealing with policy formulation involving a consideration of climatic issues

NMHSs

Primary climate information provider

National Climate Outlook Forums (NCOFs/NCFs)

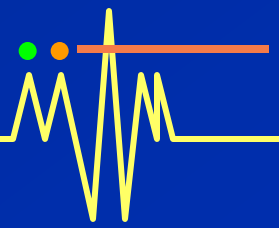
Universities and other Research institutions

Non-governmental organizations

Private/public partnerships

WMO Services Commission
Standing Committee on Climate Services

- Expert Team on CSIS Operations
- Aim: Lead the development and implementation of standardized and user-targeted approaches for the systematic generation and exchange of climate data, monitoring, prediction and projection products that are required for the operational functioning of the CSIS at global, regional and national levels.
- Co-Leads: Mr Roger Pulwarty (USA) and Mr Rupa Kumar Kolli (India)
- Members: Mr Caio Coelho (Brazil), Mr Jean Pierre Céron (France), Ms Valentina Khan (Russia), Mr Adam Scaife (UK), Ms Marina Timofeyeva-Livezey (USA), Mr Simon McGree (Australia), Ms Aïda Diong-Niang (Senegal), Ms Ana Bucher (World Bank), Mr Andrew Robertson (USA), Mr Huanping Wu (China)
- Key Deliverables: CSIS Technical Reference; Coordination of National CSIS Focal Points; Objective regional seasonal forecasting; RCC development; RCOF operational practices; Climate Services Toolkit; Guidance on regional climate change projections



Towards International Monsoons Project Office (IMPO)

- The WCRP JSC and the WWRP SSC have endorsed the proposal for ICMPO to move towards a more holistic support facility for monsoon research coordination spanning the entire WCRP and WWRP; **ICMPO → IMPO…**
- IMPO to provide consolidated support to all the monsoon research activities of both WCRP and WWRP, including the relevant expert groups and governing structures, through a much wider portfolio
- A revised draft agreement in final stages of development
- IMPO to continue supporting CLIVAR/GEWEX interests in monsoons, including their joint role in the Monsoons Panel

WWRP/WCRP S2S Training Workshop

A pilot activity in the run-up to the Seventh WMO International Workshop on the Monsoons (IWM-7), expected to be held in India in early 2022;

The S2S Training Workshop is being planned for the third quarter of 2021, in virtual form;

Topics will be based on a survey of operational requirements and expected target audience;

An International Organizing Committee with excellent participation from the global S2S community is currently working on the scope, structure and organizational elements;

ICMPO/IMPO will provide the required organizational support.

Way Forward

- Pursue GPC roles for India
- Enhance RCC products (RCC Pune/TPRCC-Network) and services and their routine use
- Expand RCOF product portfolio (monitoring, S2S products, regional climate change, etc.), including evolution towards a more generalized Regional Climate Forum
- Sustained Climate Services User Forums, especially for the key sectors water, agriculture and health
  - Co-production of climate inputs for decision support
- National CSIS implementation including National Climate Forums
  - Partnerships to mobilize stakeholder participation
  - National/sub-national Climate Forums in local languages
- Greater and sustained engagement of regional implementation partners (e.g., RIMES) including research partners
- Regional consolidation and complementarity of investments in support of climate services (e.g., linkage of Monsoon Mission activities to relevant global/regional activities)

Thank You

RKolli@tropmet.res.in