Hydro Climate Tools Developed by UNESCO's International Hydrological Programme and its "Water Family" to Address Water-Related Sustainable Development Goals (SDGs) and Related Commitments

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Abstract

Hydro climate services, such as early warning systems and monitoring and forecasting services for floods and droughts, are required to deal with climate risk management and adaptation. Those tools also contribute to achieving international goals and commitments such as Sustainable Development Goals (SDGs), the Paris Agreement and the Sendai Framework for Disaster Risk Reductions. Recognizing these needs, UNESCO's International Hydrological Programme (IHP) has fostered the creation and application of many such products in recent years. This has been accomplished through unique formal and informal partnerships among IHP programs, such as the Global Network on Water and Development Information for Arid Lands (G-WADI) and the International Flood Initiative (IFI); UNESCO regional and country offices in Africa, Latin America and Asia; university engineering and hydrology departments; and UNESCO's network of affiliated ("category 2") centers, such as the International Center for Integrated Water Resources Management (ICIWaRM) and the International Centre for Water Hazard and Risk Management (ICHARM). The presentation will include an overview of the products, tools and services developed through these collaborations among IHP and its "water family" and their effectiveness in providing such services to Member States.
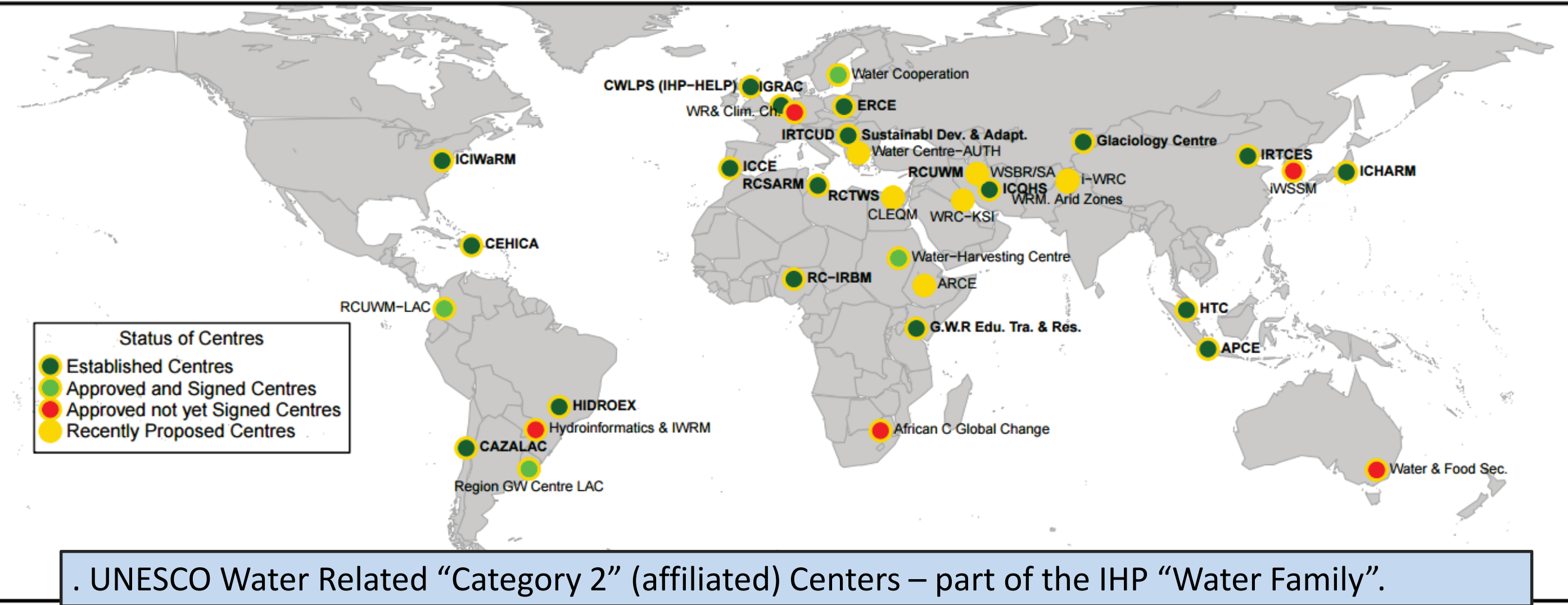
Hydro-Climate Tools Developed by UNESCO's International Hydrological Programme and its "Water Family" to Address Water-Related Sustainable Development Goals (SDGs) and Related Commitments (H51S-1568)

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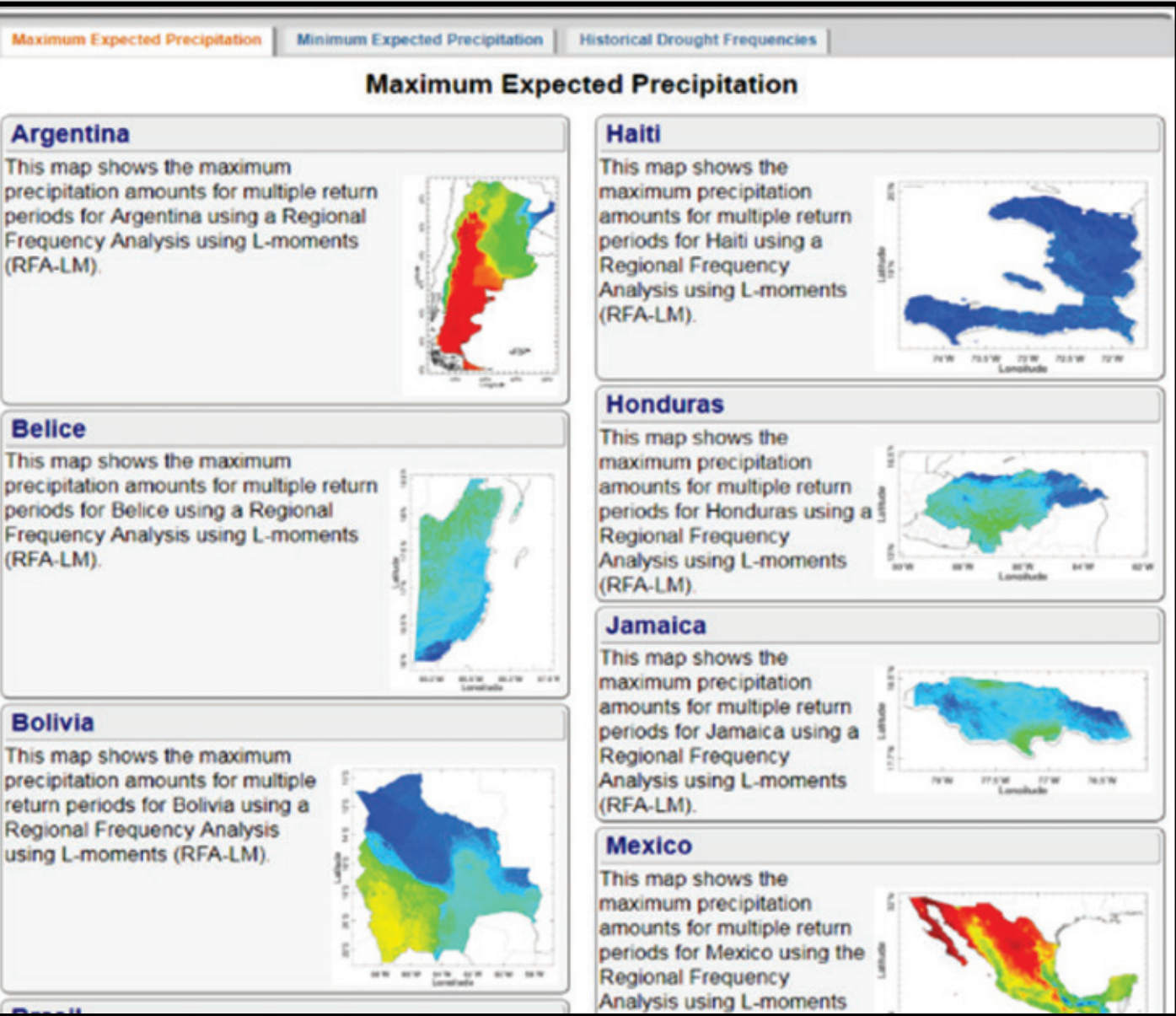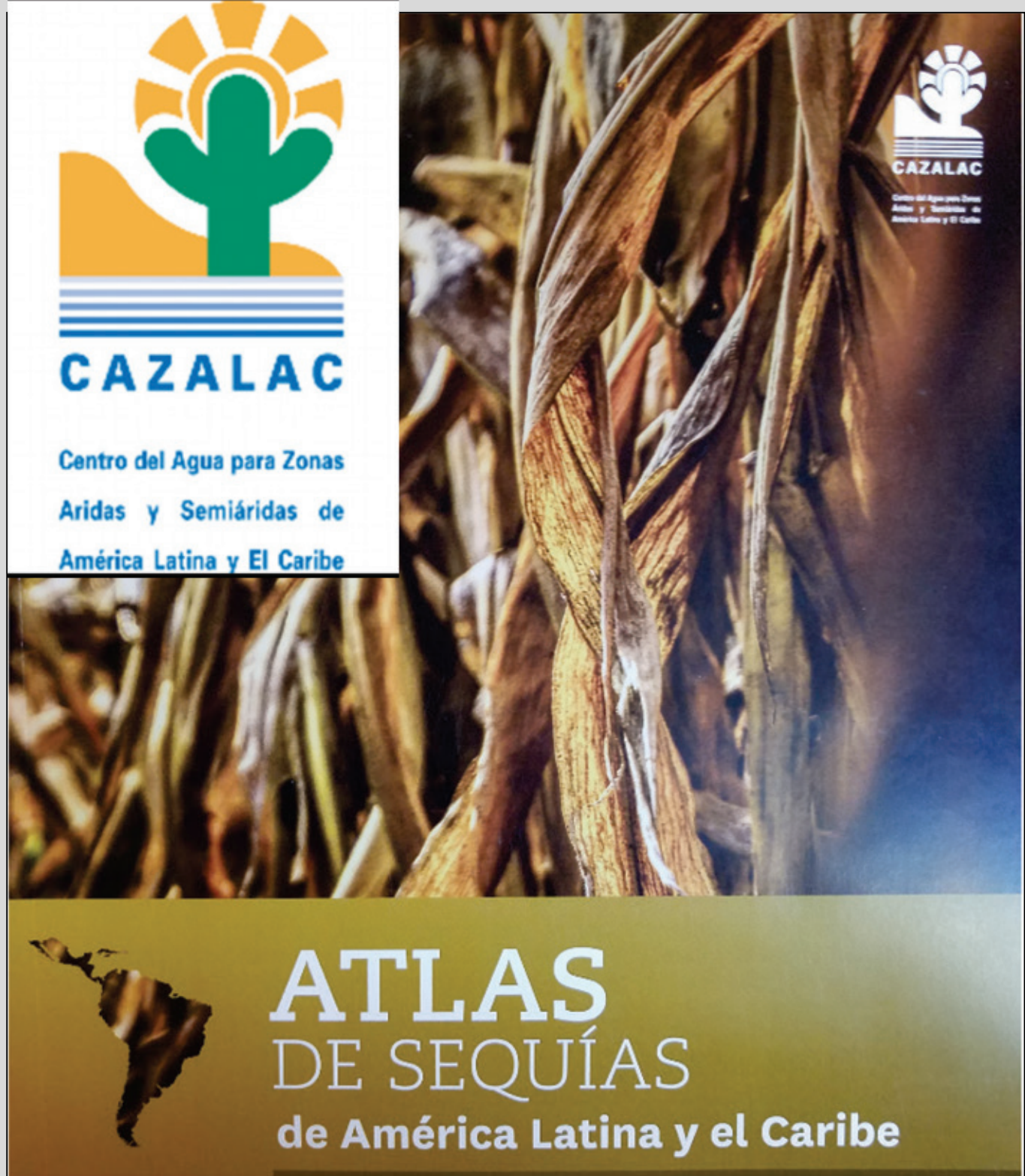
G-WADI

Summary: The International Hydrological Programme (IHP) is the only intergovernmental programme of the UN system devoted to water research, water resources management, and education and capacity building. Along with other elements of UNESCO's "water family"—the World Water Assessment Programme and a global network of affiliated water centers and chairs—it is uniquely qualified to make a broad contribution to attaining the Sustainable Development Goals (SDGs).
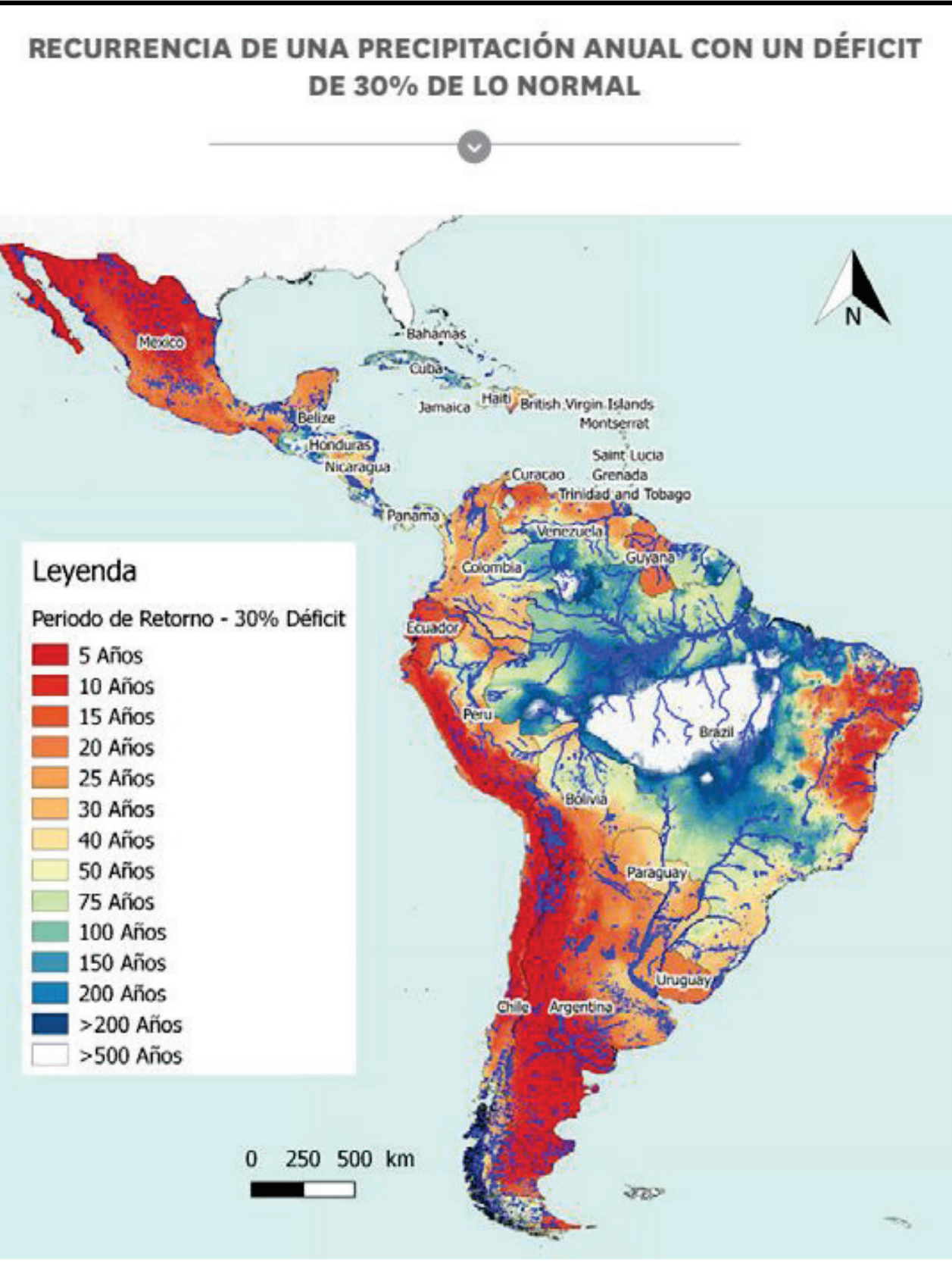
This presentation summarizes some of the hydro-climate models, tools, frameworks and approaches developed by the water family to address SDGs related to floods, droughts, water supply and sanitation, food and agriculture, energy and others. They include A) the Latin American and Caribbean Drought Atlas, B) the African and Latin American Flood and Drought Monitors, C) the ICHARM Platforms on Water Resilience and Disasters, D) the PERSIANN family of real-time and historical precipitation estimation tools, and E) the Climate Risk Informed Decision Analysis approach to water resources management.
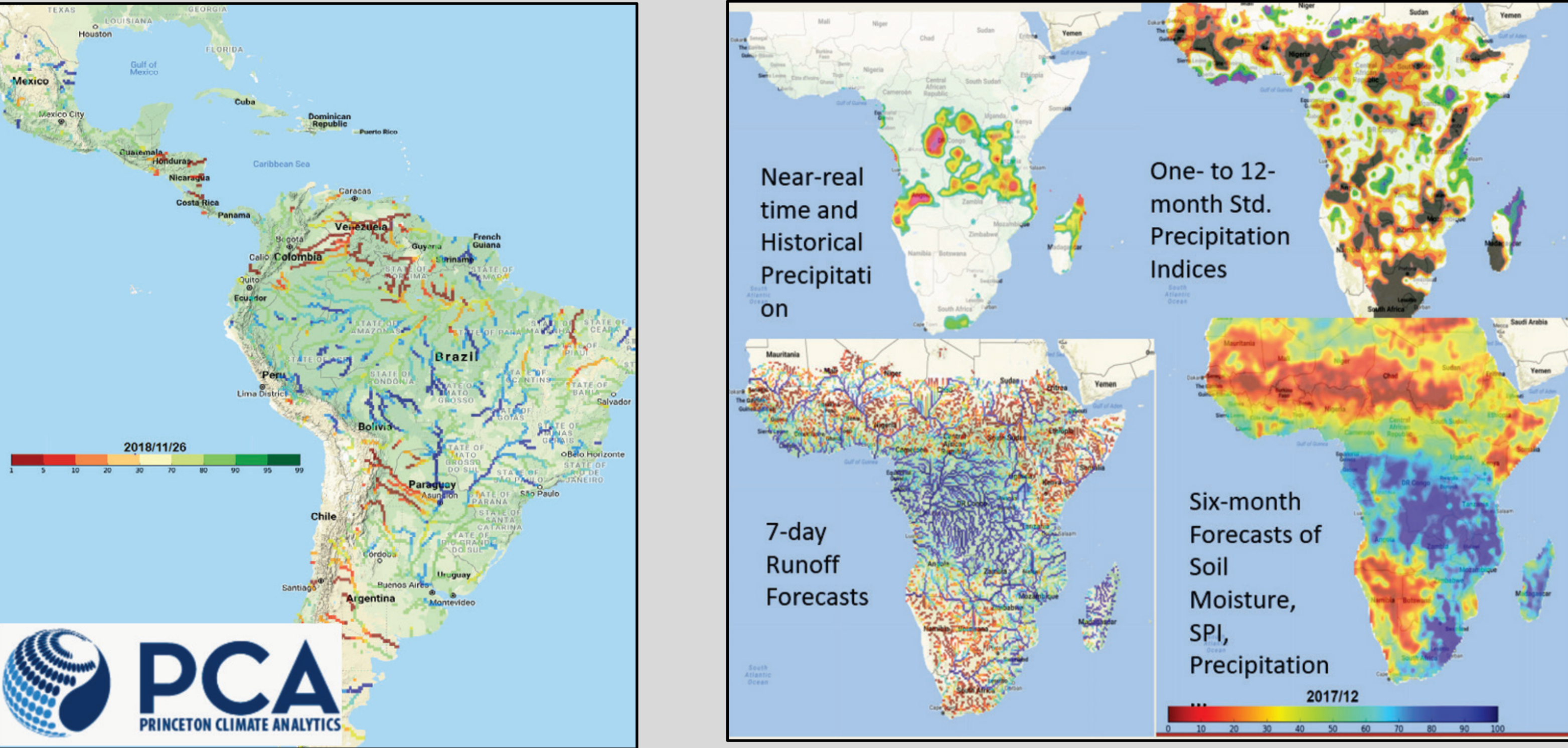
. UNESCO Water Related "Category 2" (affiliated) Centers – part of the IHP "Water Family".

Status of Centres
- ● Established Centres
- ● Approved and Signed Centres
- ● Approved yet not Signed Centres
- ● Recently Proposed Centres

A) Drought Atlas for Latin America and the Caribbean

CAZALAC Centro del Agua para Zonas Áridas y Semiáridas de América Latina y El Caribe

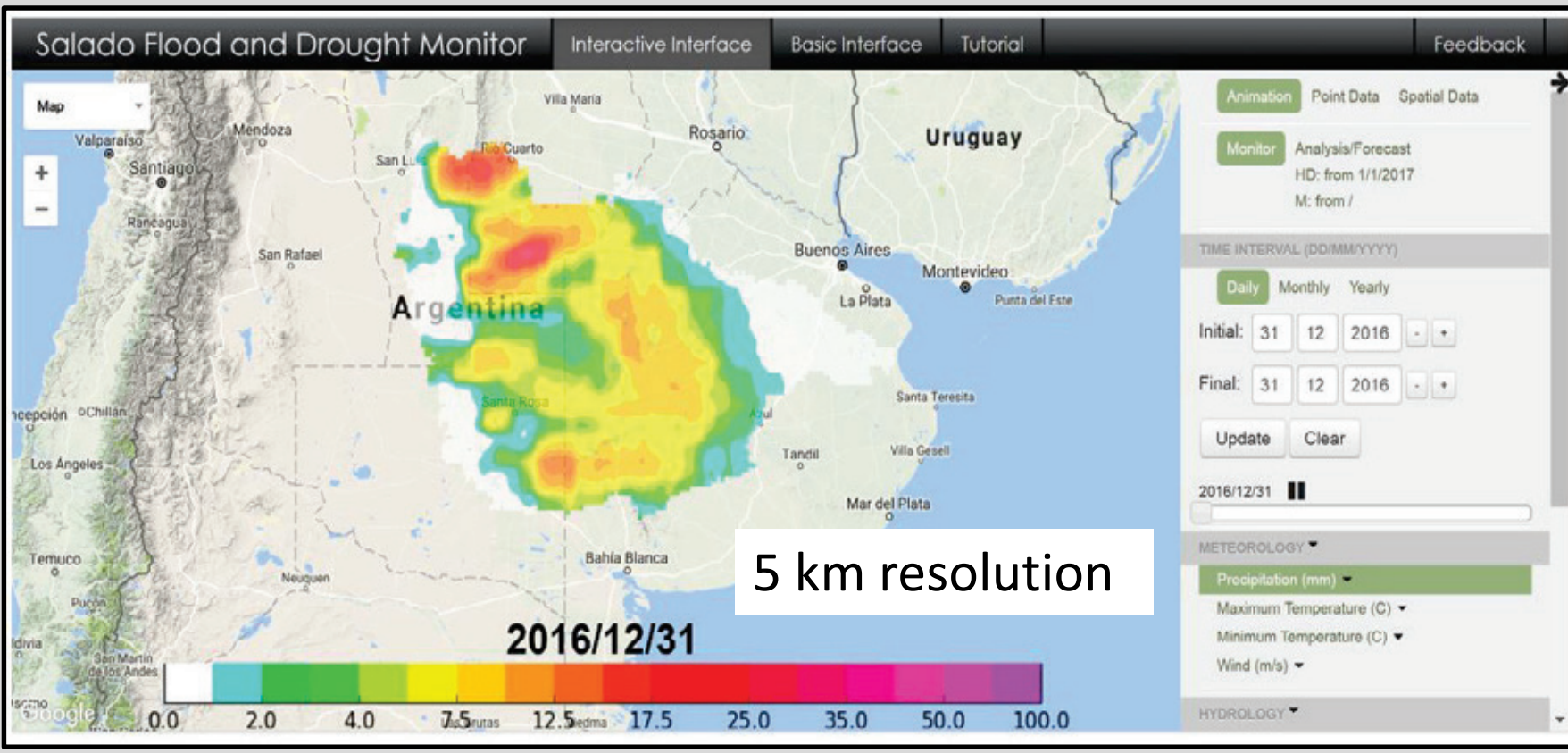ATLAS DE SEQUÍAS de América Latina y el Caribe

The Drought Atlas, published in 2018 by UNESCO and the Water Center for Arid and Semiarid Zones of Latin America and the Caribbean (CAZALAC), is a tool for historical drought frequency analysis. Using the statistical framework of L-moments to aggregate data from multiple precipitation gauges, maps of minimum and maximum expected precipitation for different return periods for each country in the region were produced. In addition, the Atlas contains 10 country-level case studies, primarily from South America, a summary of the methodology, and maps of return intervals for given rainfall deficits.

RECURRENCIA DE UNA PRECIPITACIÓN ANUAL CON UN DÉFICIT DE 30% DE LO NORMAL

Leyenda
Período de Retorno - 30% Déficit
- 5 Años
- 10 Años
- 15 Años
- 20 Años
- 25 Años
- 30 Años
- 40 Años
- 50 Años
- 75 Años
- 100 Años
- 150 Años
- 200 Años
- >200 Años
- >500 Años

Maximum Expected Precipitation

Argentina
This map shows the maximum precipitation amounts for multiple return periods for Argentina using a Regional Frequency Analysis using L-moments (RFA-LM).

Haiti
This map shows the maximum precipitation amounts for multiple return periods for Haiti using a Regional Frequency Analysis using L-moments (RFA-LM).

Belice
This map shows the maximum precipitation amounts for multiple return periods for Belice using a Regional Frequency Analysis using L-moments (RFA-LM).

Honduras
This map shows the maximum precipitation amounts for multiple return periods for Honduras using a Regional Frequency Analysis using L-moments (RFA-LM).

Jamaica
This map shows the maximum precipitation amounts for multiple return periods for Jamaica using a Regional Frequency Analysis using L-moments (RFA-LM).

Bolivia
This map shows the maximum precipitation amounts for multiple return periods for Bolivia using a Regional Frequency Analysis using L-moments (RFA-LM).

Mexico
This map shows the maximum precipitation amounts for multiple return periods for Mexico using a Regional Frequency Analysis using L-moments (RFA-LM).

B) Latin American and African Flood and Drought Monitors

Near-real time and Historical Precipitation

One- to 12-month Std. Precipitation Indices

7-day Runoff Forecasts

Six-month Forecasts of Soil Moisture, SPI, Precipitation
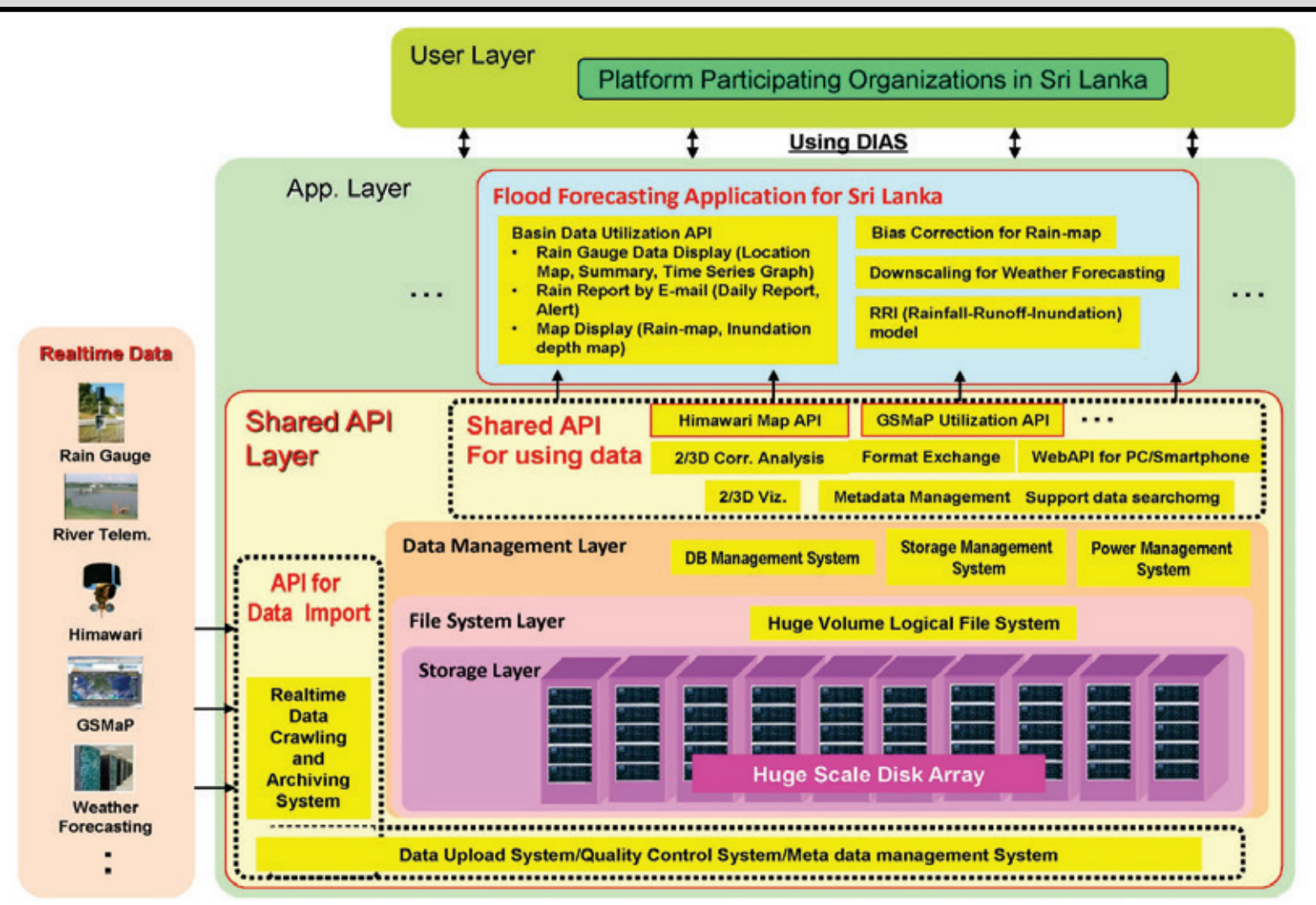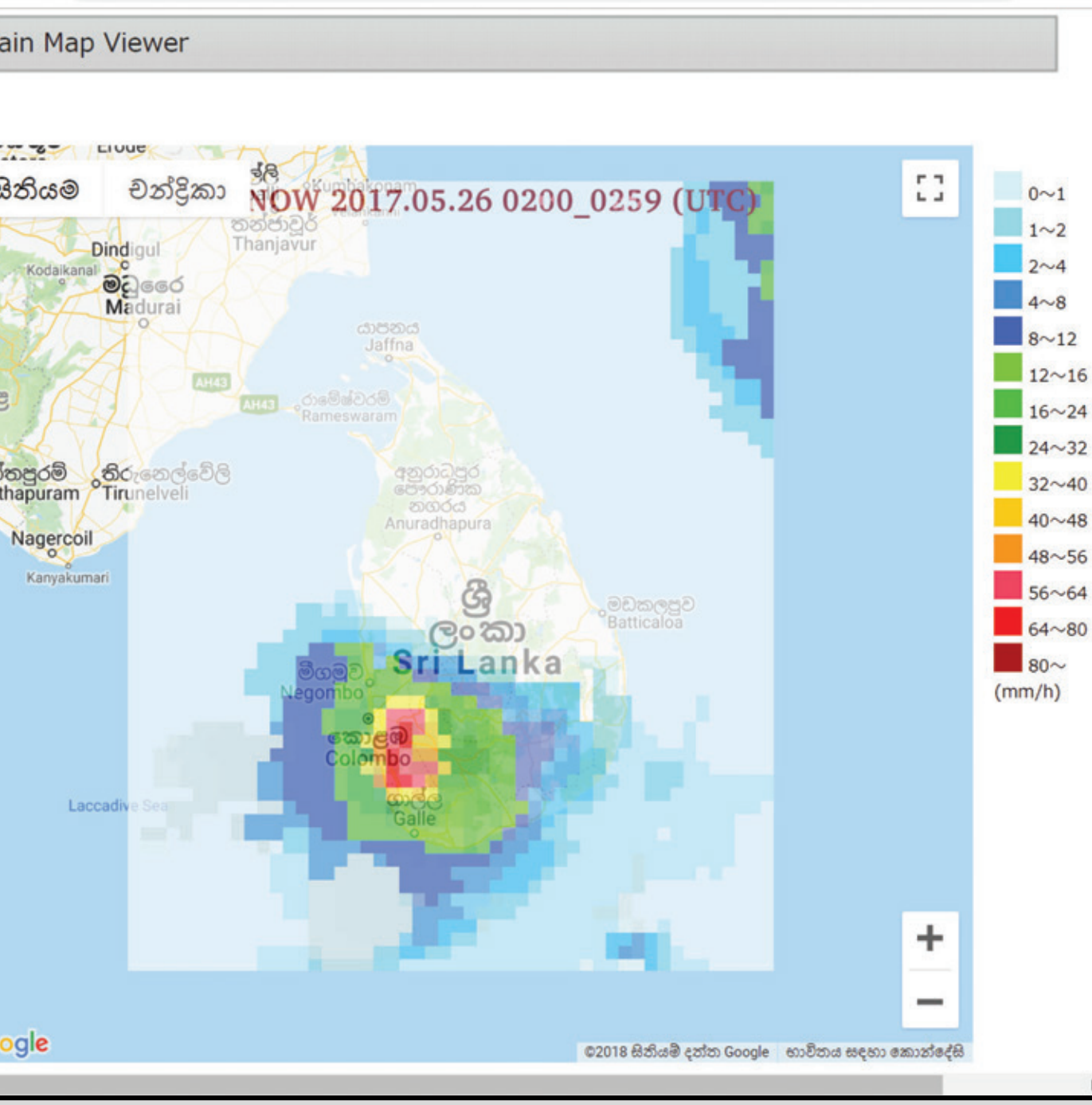
PCA PRINCETON CLIMATE ANALYTICS

Princeton University & Princeton Climate Analytics, with UNESCO and ICIWaRM collaboration, have developed flood and drought monitors and forecasting systems for Africa and Latin America/ Caribbean. Driven by climate forcing data and downscaling methods, the Google Maps-based system uses land surface and other models to produce 25 km resolution historic reconstructions, near-real time monitoring and 7-day and seasonal forecasts. Five-km products have been developed for Lake Chad & the Salado River Basin, Argentina.

Salado Flood and Drought Monitor
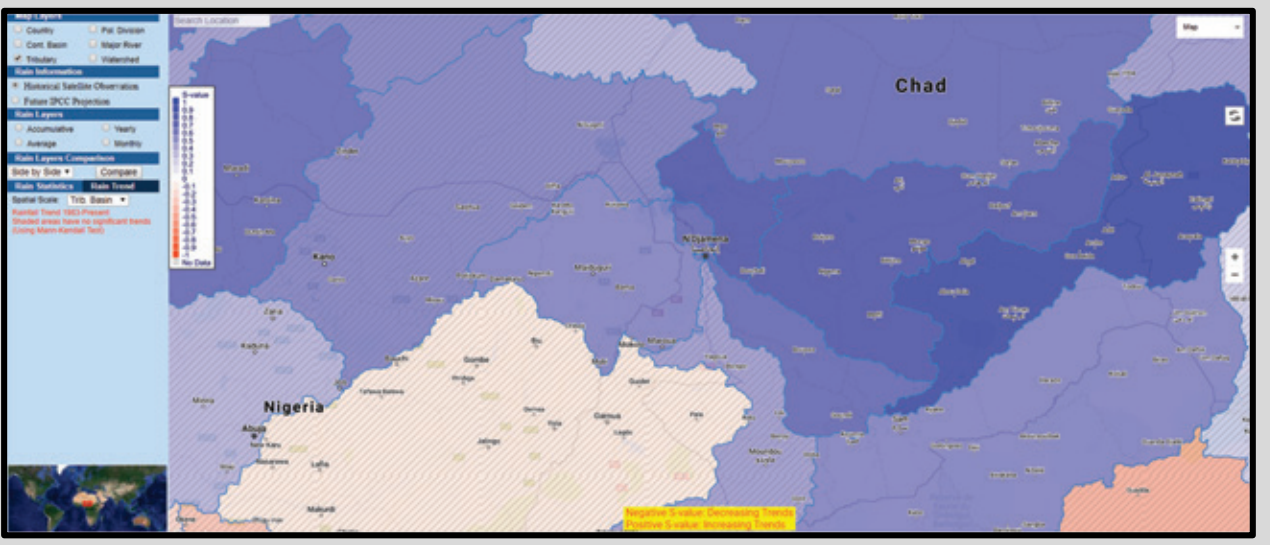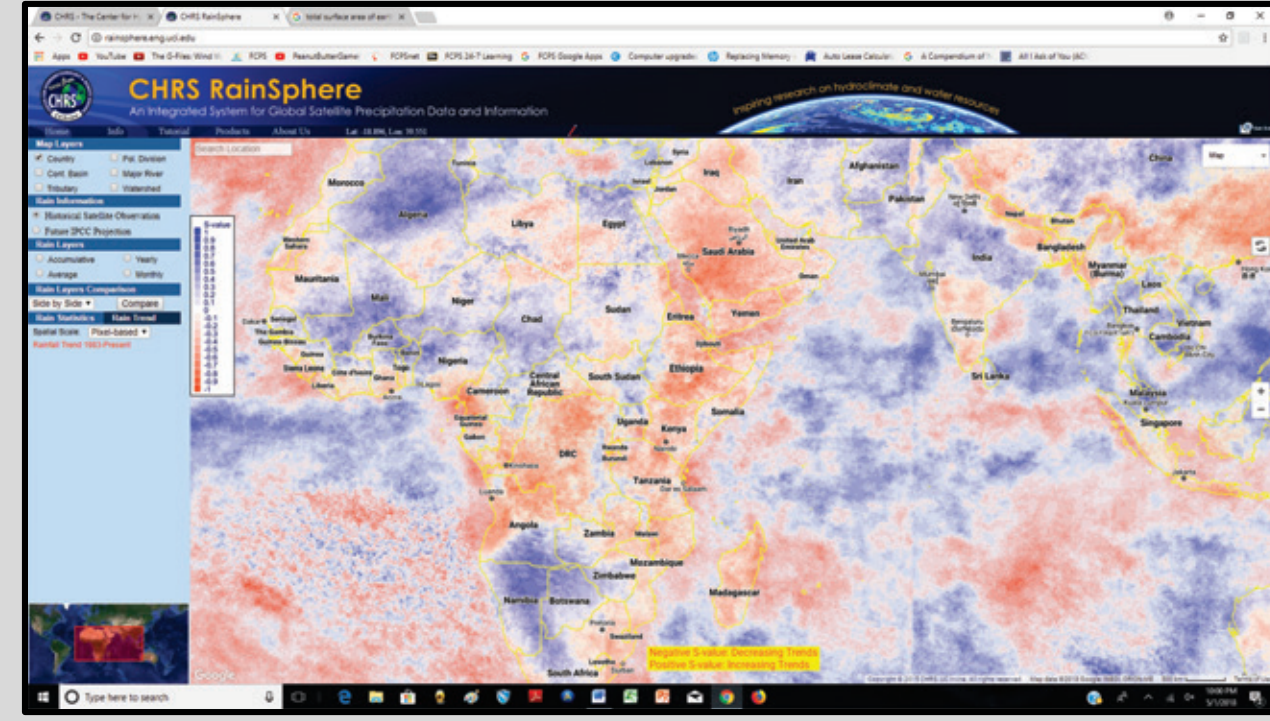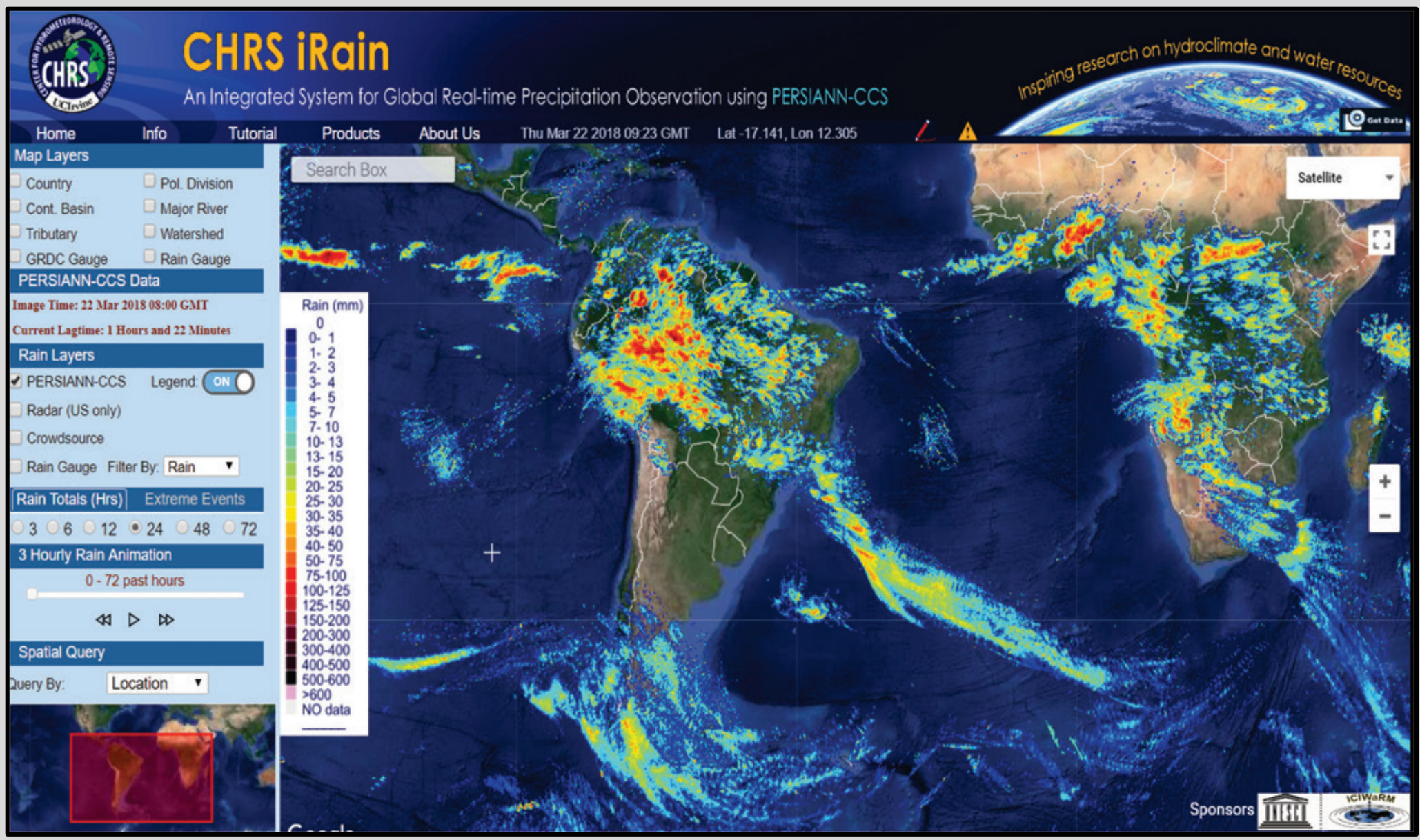
5 km resolution
2016/12/31

C) Data Integration and Analysis Platforms for Water Resilience and Disasters

Hundreds of lives were lost in 2017 flooding in Sri Lanka. In response, ICHARM and the University of Tokyo developed a data sharing application of flood forecasting on their Data Integration and Analysis System (DIAS). Real-time data from DIAS are used to generate flood forecasts, also in real time. These forecasts are then visualized and provided to local stakeholders.
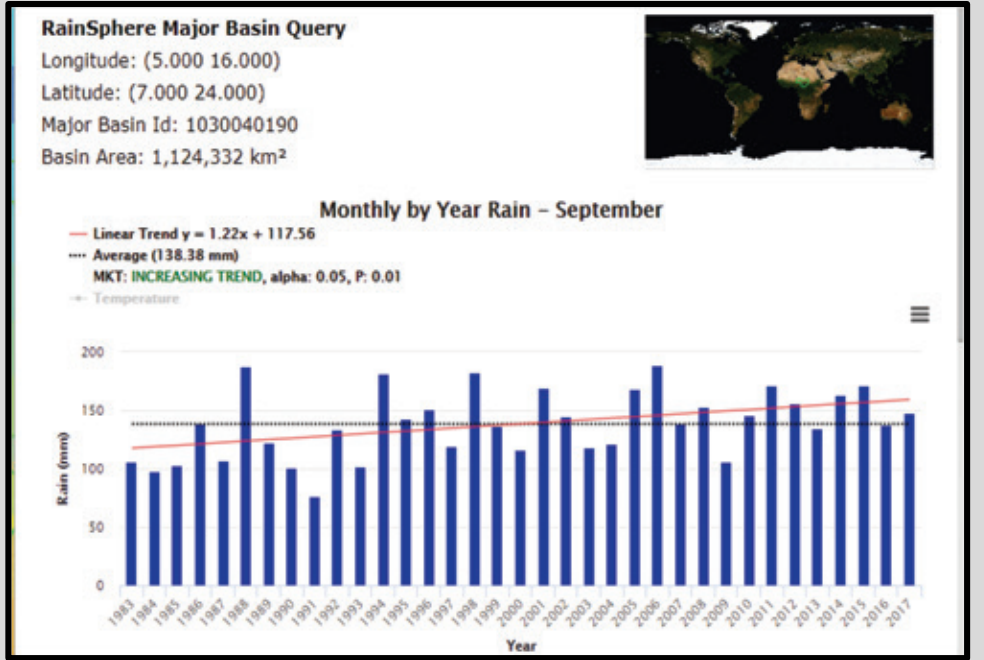
In Pakistan (not shown), ICHARM also provided a flood forecasting system covering a large part of the Indus River basin, using their Integrated Flood Analysis System (IFAS). This provided floodplain and hazard maps of the lower Indus.
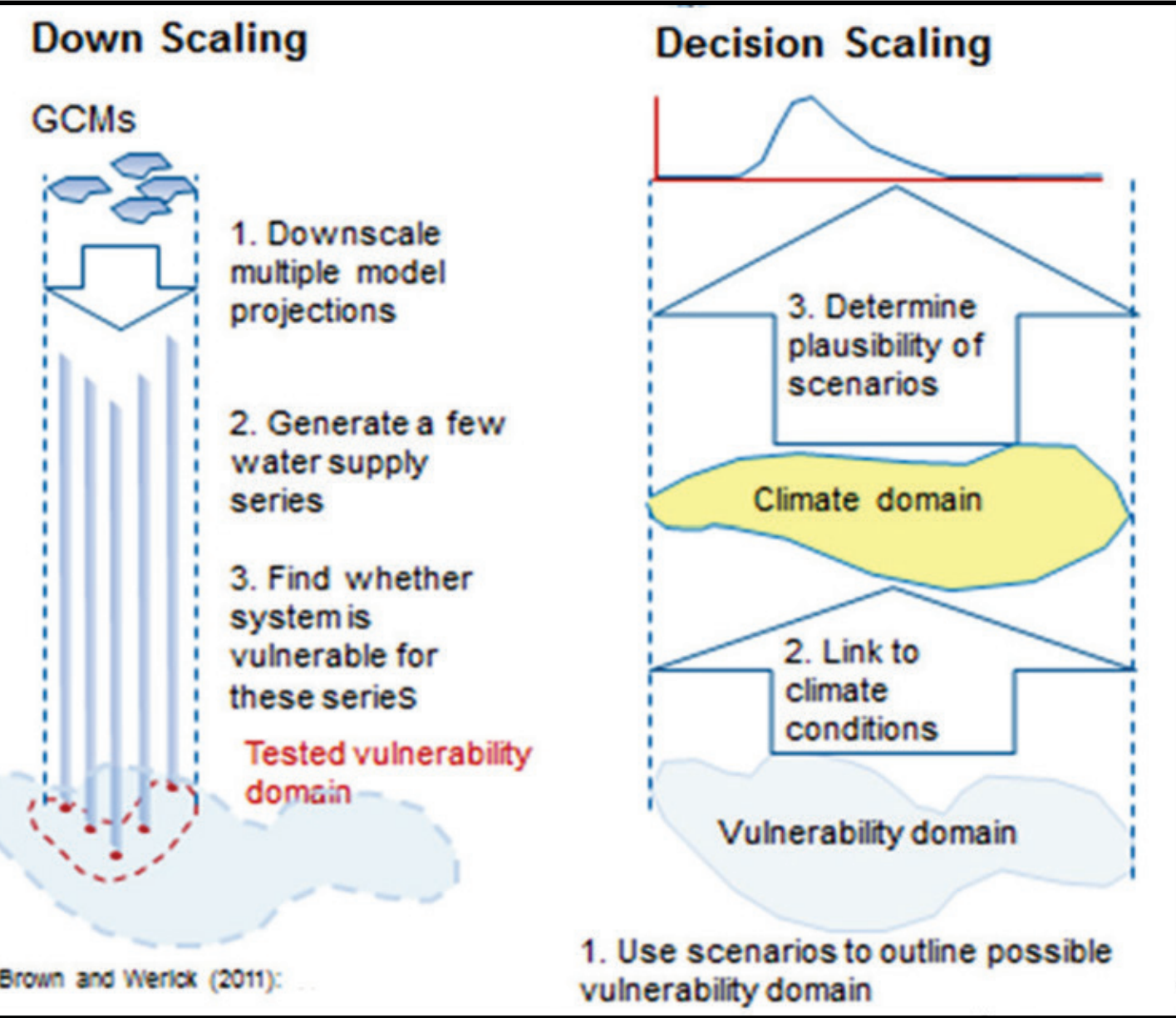
Rain Map Viewer
NOW 2017.05.26 0200_0259 (LT)

UNESCO International Centre for Water Hazard and Risk Management under the auspices of UNESCO **ICHARM**

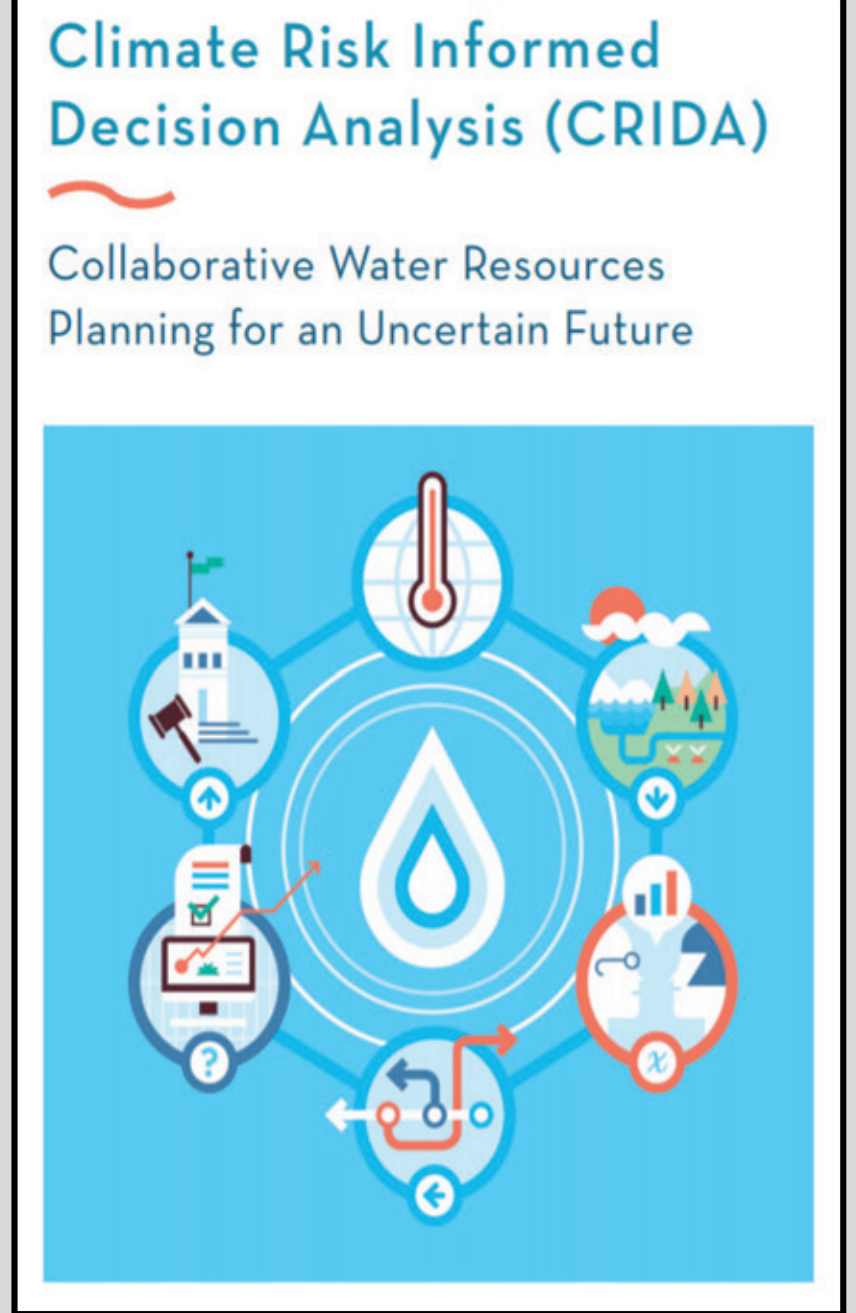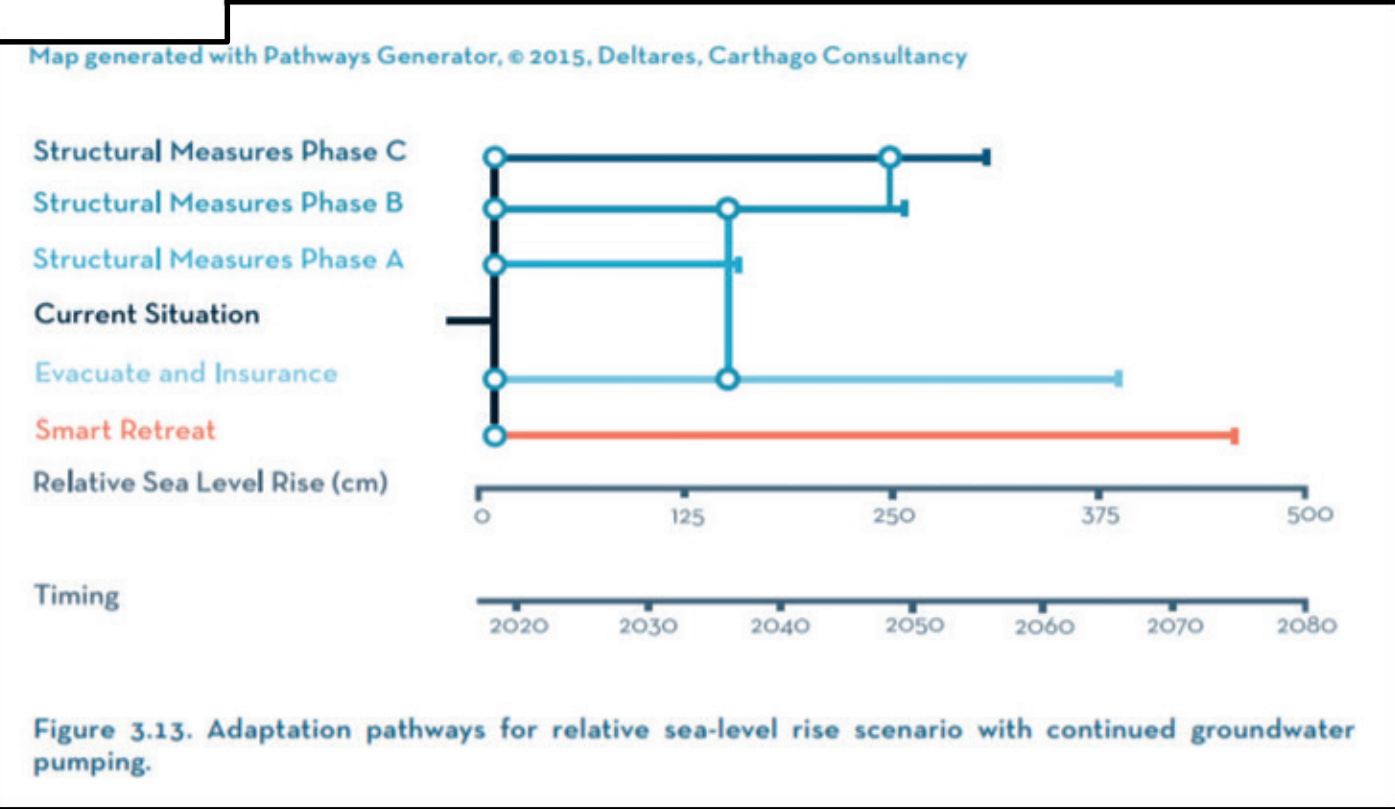## D) Real-Time and Historical Precipitation Products

CHRS iRain

A major component of UNESCO G-WADI's ongoing programs and services is the PERSIANN (Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks) family of products. These include near real-time precipitation products and platforms (e.g., iRain, based on PERSIANN CCS) and a climate data record (PERSIANN-CDR and derived products such as RainSphere), and others. RainSphere helps visualize precipitation trends over time, including whether those trends are statistically significant or not. For example, much of the Sahel, including the Lake Chad region, seems to be getting wetter since 1983.

CHRS CENTER FOR HYDROMETEOROLOGY & REMOTE SENSING UCIrvine

E) Bottom-up, Collaborative, Climate Risk-Informed Decision Analysis for Water Resources Planning and Management

Down Scaling / **Decision Scaling**

Down Scaling
GCMs
1. Downscale multiple model projections
2. Generate a few water supply series
3. Find whether system is vulnerable for these series
Tested vulnerability domain

Decision Scaling
3. Determine plausibility of scenarios
Climate domain
2. Link to climate conditions
Vulnerability domain
1. Use scenarios to outline possible vulnerability domain

Brown and Werick (2011)

Water resources engineers, planners and decision-makers cope with a broad range of risks and uncertainties that may negatively impact users. In addition to climate change (e.g., temperature; precipitation amount, timing and phase; floods and droughts…), changing demographics and land use and natural climate variability, may need to be accounted for. This report presents a planning approach that incorporates climate risk into the well-worn, bottom-up planning pathway most familiar to water resources professionals involved in designing resilient, robust systems.

Climate Risk Informed Decision Analysis (CRIDA)
Collaborative Water Resources Planning for an Uncertain Future

Structural Measures Phase C
Structural Measures Phase B
Structural Measures Phase A
Current Situation
Evacuate and Insure
Smart Retreat
Relative Sea Level Rise (cm)
Timing

UNESCO United Nations Educational, Scientific and Cultural Organization **ICIWaRM** International Center for Integrated Water Resources Management under the auspices of UNESCO

AGWA Alliance for Global Water Adaptation

Many of IHP's Hydro Climate tools were developed through its Global Network on Water and Development for Arid Lands (gwadi.org). Through its partners, G-WADI is developing and testing a variety of tools related to satellite-based precipitation estimates, flood and drought monitoring and forecasting, regional frequency analysis, and other topics.