CGMS-45-WMO-WP-05

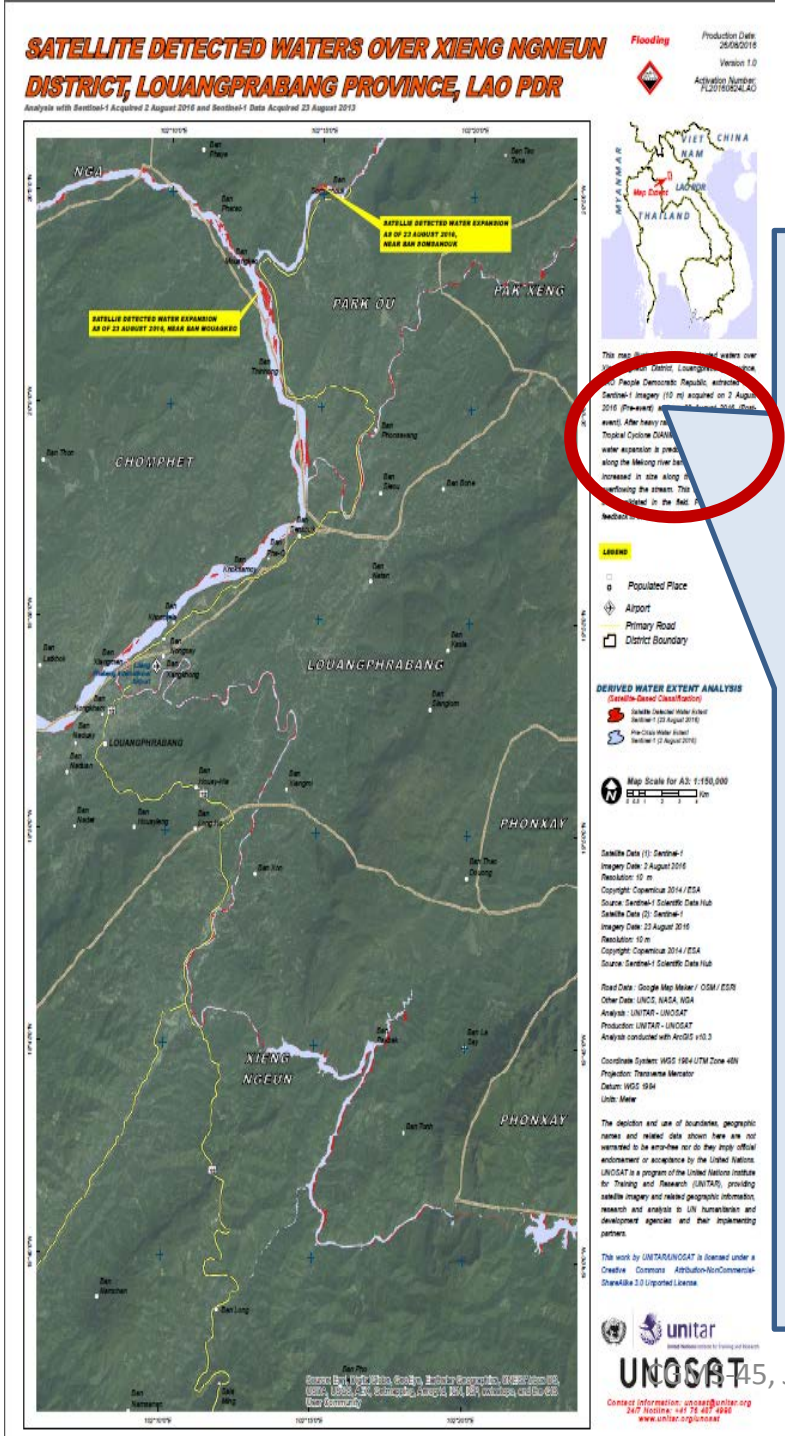
Monitoring Extreme Weather and Climate from Space

WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION

World Meteorological Organization (WMO)
Space Programme

Introduction



UNOSAT Report

Satellite Detected Waters over Xieng Ngneun District, Louangprabang Province, Lao PDR

This map illustrates satellite detected waters over Xieng Ngneun District, Louangprabang province, LAO People Democratic Republic, extracted from Sentinel-1 imagery (10 m) acquired on 2 August 2016 (Pre-event) and on 23 August 2016 (Post-event). After heavy rains in early August, caused by Tropical Cyclone DIANMU-16, it is observed that the water expansion is predominantly located in areas along the Mekong river banks. Nam Khan River has increased in size along the banks but without overflowing the stream.

DERIVED WATER EXTENT ANALYSIS
(Satellite-Based Classification)

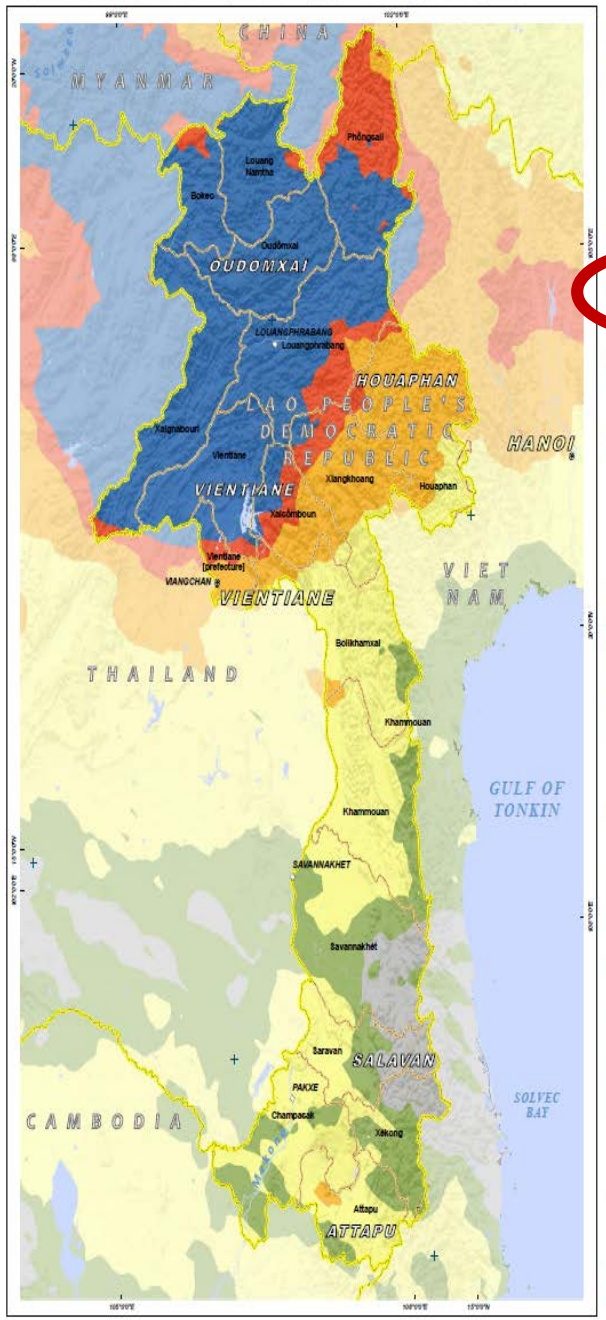
Satellite Detected Water Extent
Sentinel-1 (23 August 2016)

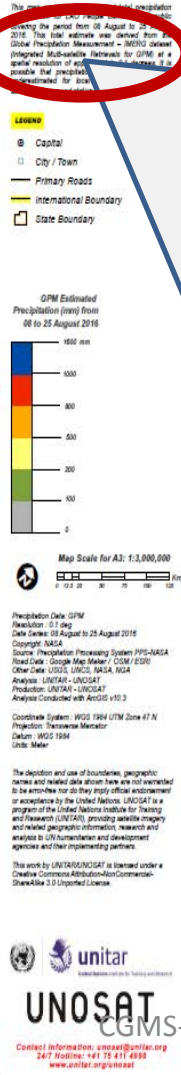
Pre-Crisis Water Extent
Sentinel-1 (2 August 2016)

Satellite Data (1): Sentinel-1
Imagery Date: 2 August 2016
Imagery Date: 23 August 2016
Resolution: 10 m
Copyright: Copernicus 2014 / ESA
Source: Sentinel-1 Scientific Data Hub

http://www.unitar.org/unosat/node/44/2448?utm_source=unosat-unitar&utm_medium=rss&utm_campaign=maps

UNOSAT Report

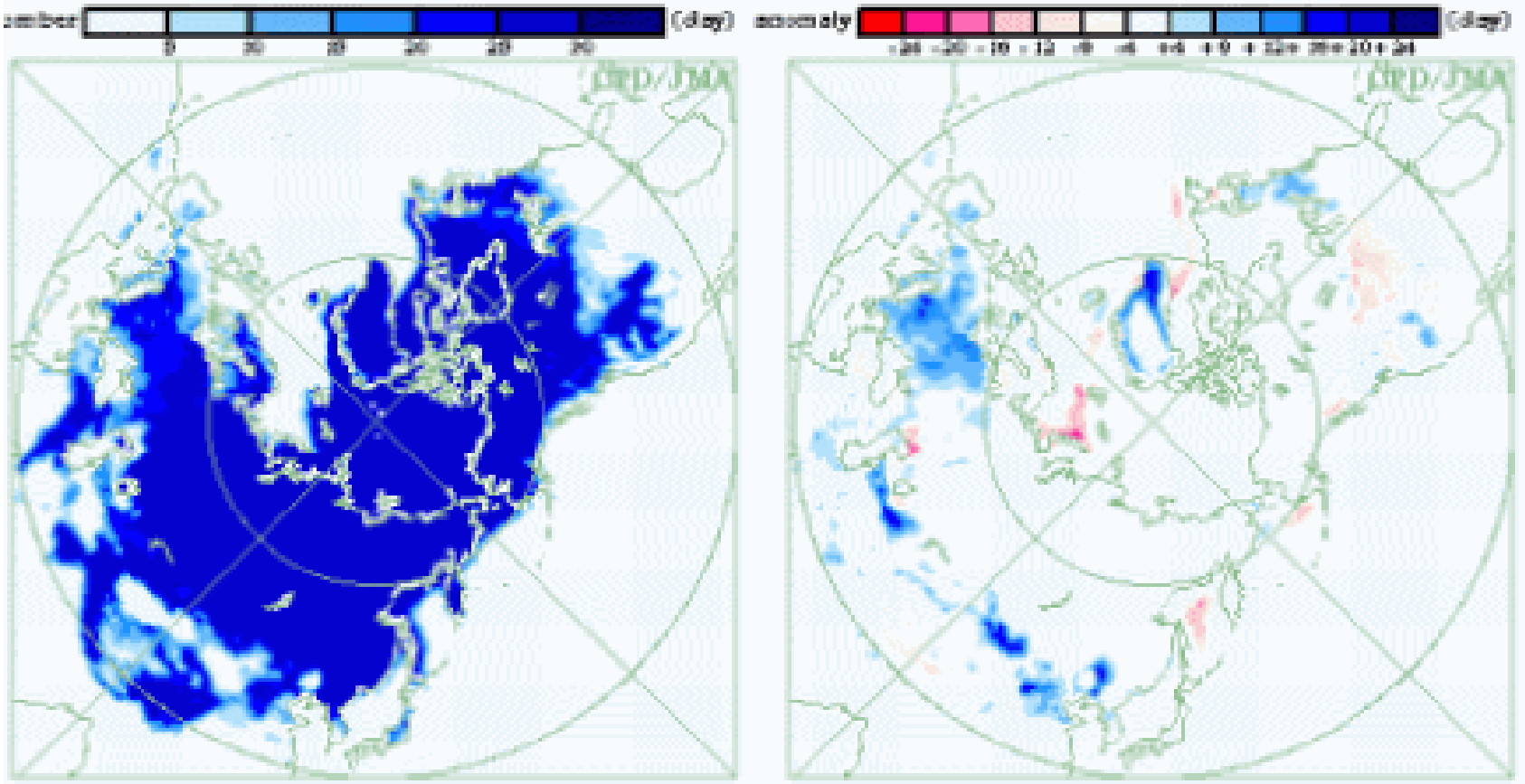




Estimated Precipitation Accumulation from 08 to 25 August 2016 in Lao People Democratic Republic

This map presents the estimated total precipitation accumulation for LAO People Democratic Republic covering the period from 08 August to 25 August 2016. This total estimate was derived from the Global Precipitation Measurement – IMERG dataset (Integrated Multi-satellite Retrievals for GPM) at a spatial resolution of approximately 0.1 degrees. It is possible that precipitation levels may have been underestimated for local areas, and are not a substitute for ground station measurements.

http://www.unitar.org/unosat/node/44/2447?utm_source=unosat-unitar&utm_medium=rss&utm_campaign=maps



The number of days of cover with snow or sea ice as observed by SSM/I in the Northern Hemisphere (left panel), and the anomaly (right panel)

http://ds.data.jma.go.jp/tcc/tcc/about/products/aboutClisys.html

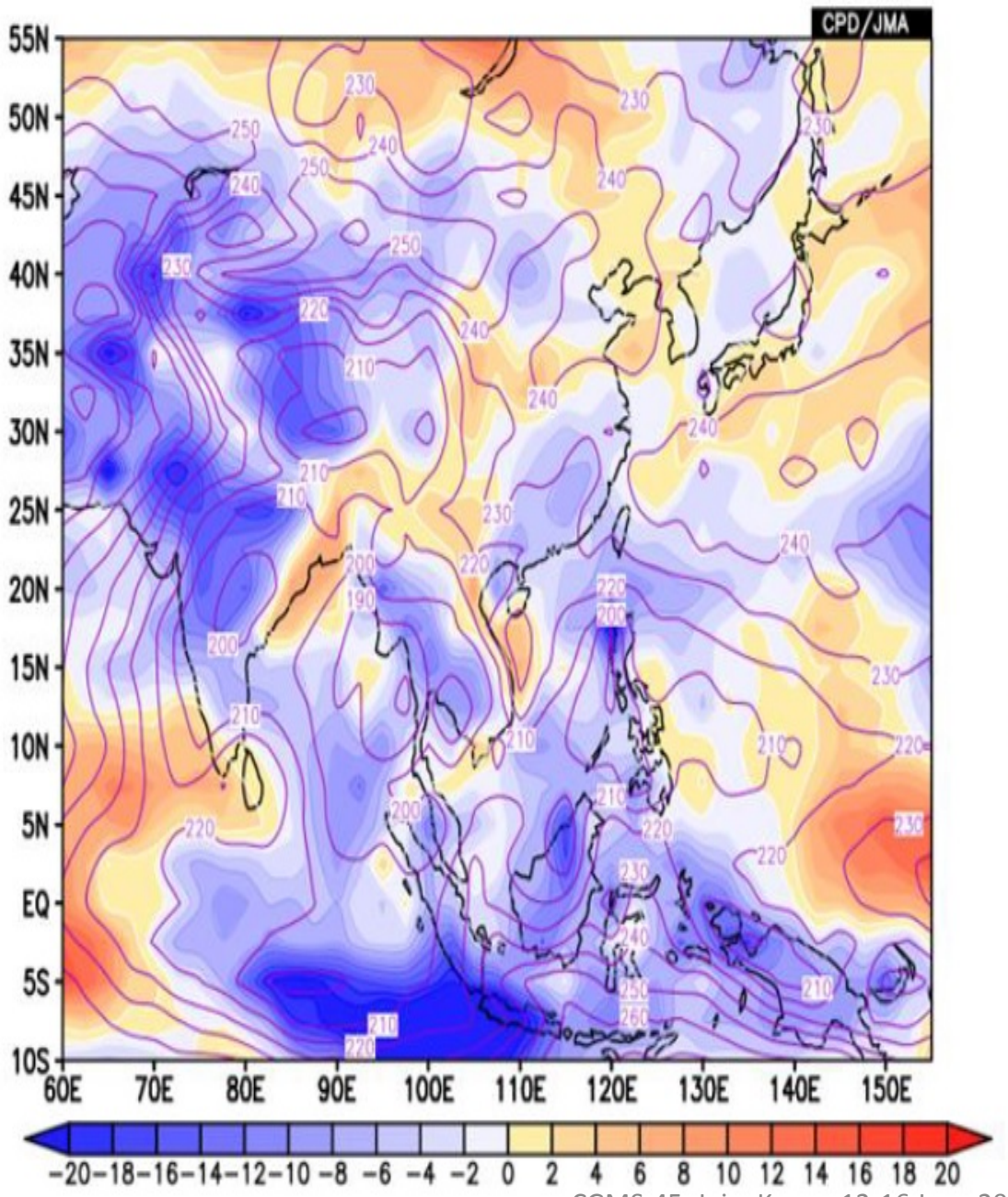


Figure 3 Four-month mean OLR and its anomaly for June–September 2016

The contours indicate OLR at intervals of 10 W/m^2, and the color shading denotes OLR anomalies from the normal (i.e., the 1981–2010 average). Negative (cold color) and positive (warm color) OLR anomalies show enhanced and suppressed convection compared to the normal, respectively. Original data are provided by NOAA.

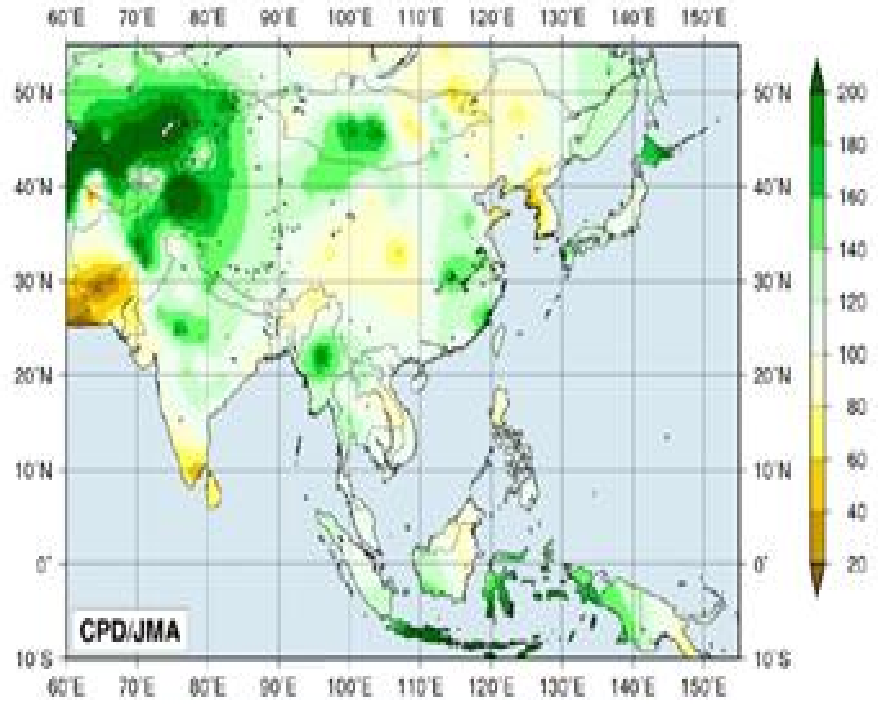


Figure 1 Four-month precipitation ratios (%) from June to September 2016

The base period for normal is 1981 – 2010. Note that the data in Vietnam, Thailand and Cambodia are interpolated due to the lack of CLIMAT report or climatological normal.

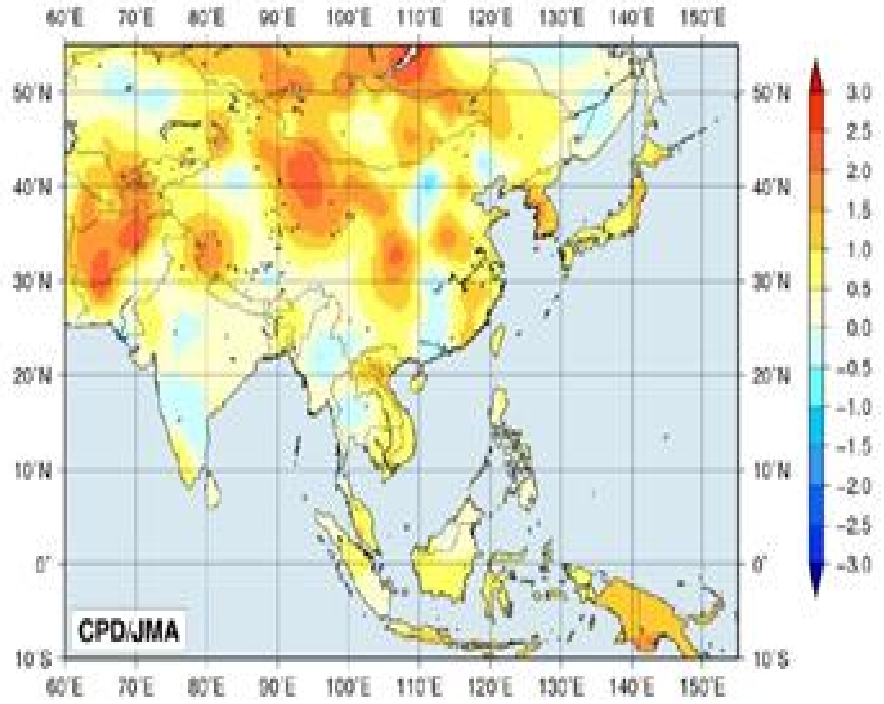
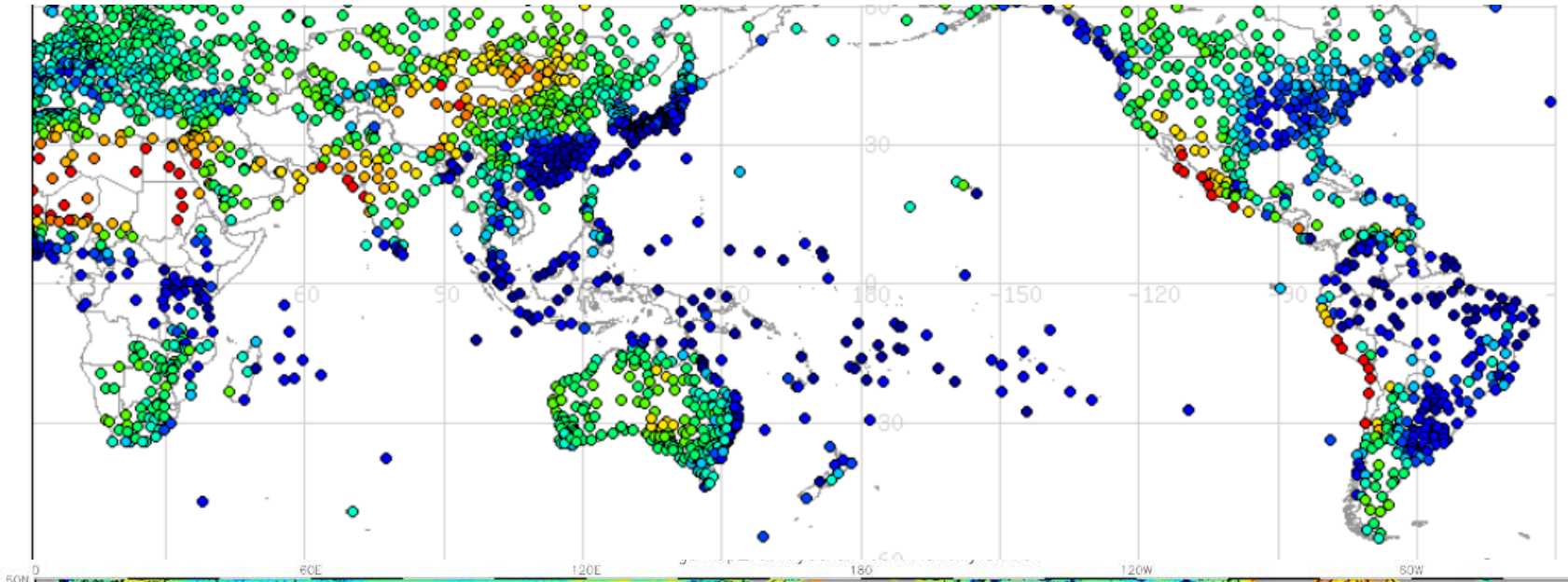


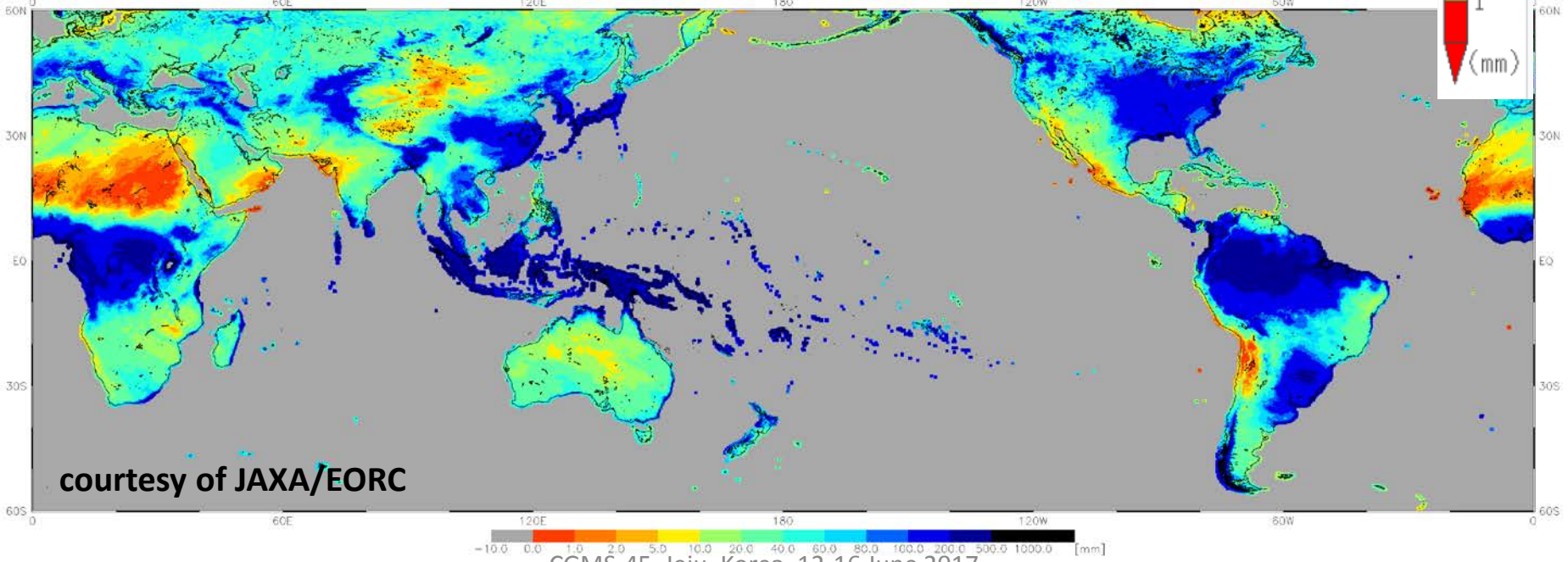
Figure 2 Four-month mean temperature anomalies (°C) from June to September 2016

The base period for normal is 1981 – 2010. Note that the data in Vietnam, Thailand and Cambodia are interpolated due to the lack of CLIMAT report or climatological normal.

Monthly Mean Precipitation (mm) in April - CLIMAT (30-year mean) vs GSMaP (17-year mean)

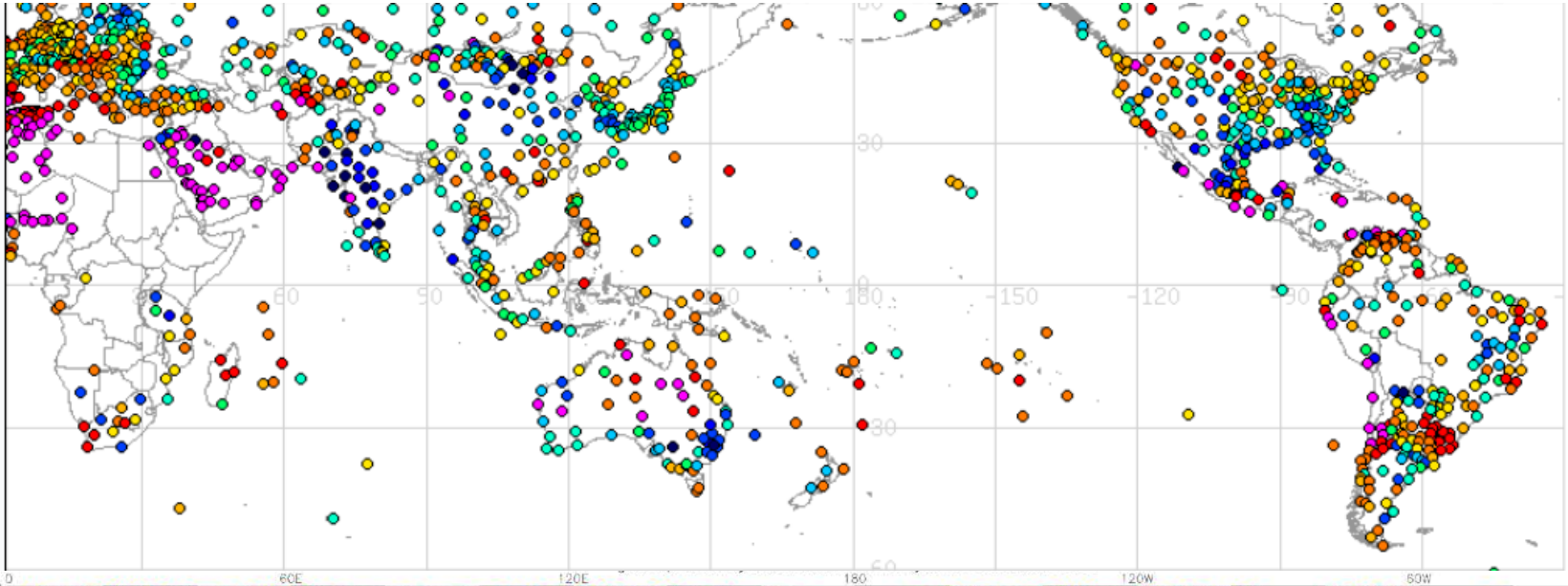
JMA CLIMAT Viewer: http://www.data.jma.go.jp/gmd/cpd/monitor/climatview/frame.php?&s=1&r=0&y=2015&m=4&e=7&t=22&l=87&k=0&s=1

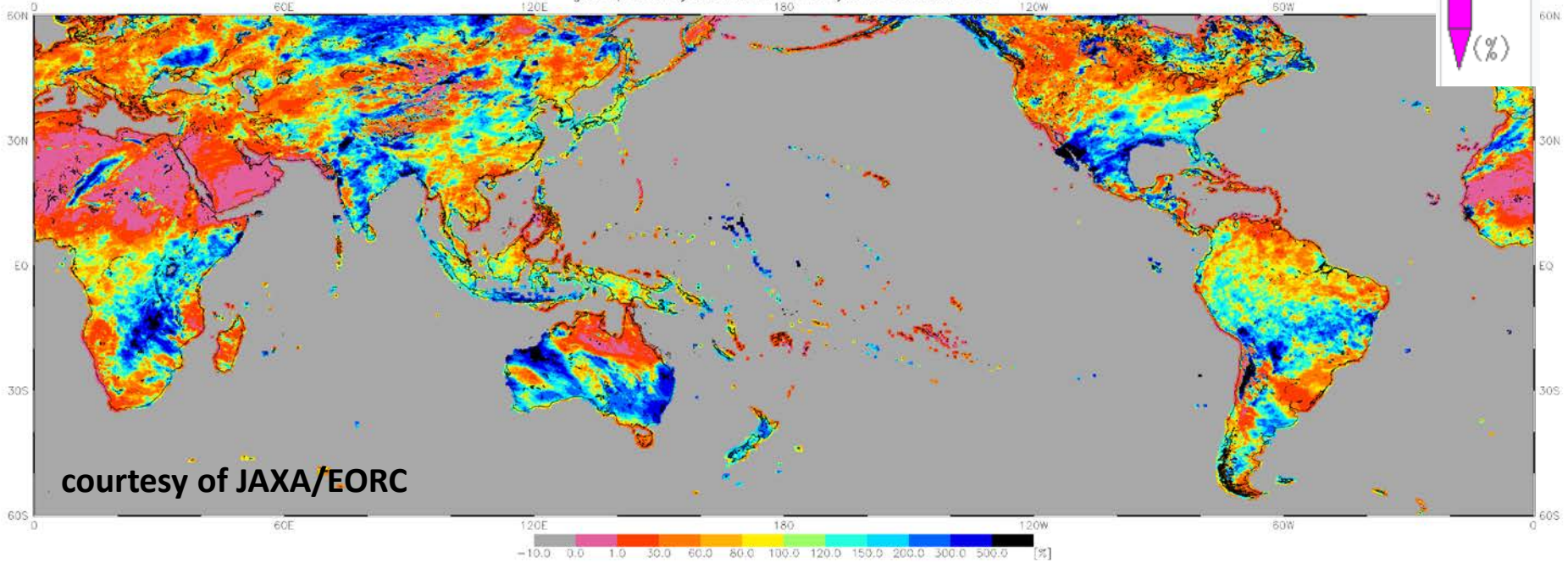




Monthly Mean Precipitation ratio (%) in April, 2015 - CLIMAT (30-year normal) vs GSMaP(17-year normal)

JMA CLIMAT Viewer: http://www.data.jma.go.jp/gmd/cpd/monitor/climatview/frame.php?&s=1&r=0&y=2015&m=4&e=5&t=22&l=87&k=0&s=1





Q1: What is "Weather and Climate Extremes"?

WMO Meteoterm Definition: “Extreme Weather Event“

- An **extreme weather event is** an event that is **rare at a particular place and time of year**. Definitions of rare vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of a probability density function estimated from observations.

- By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense.

- **When a pattern of extreme weather persists for some time**, such as a season, it may be classed as an **extreme climate event,** especially if it yields an average or total that is itself extreme (e.g., drought or heavy rainfall over a season).

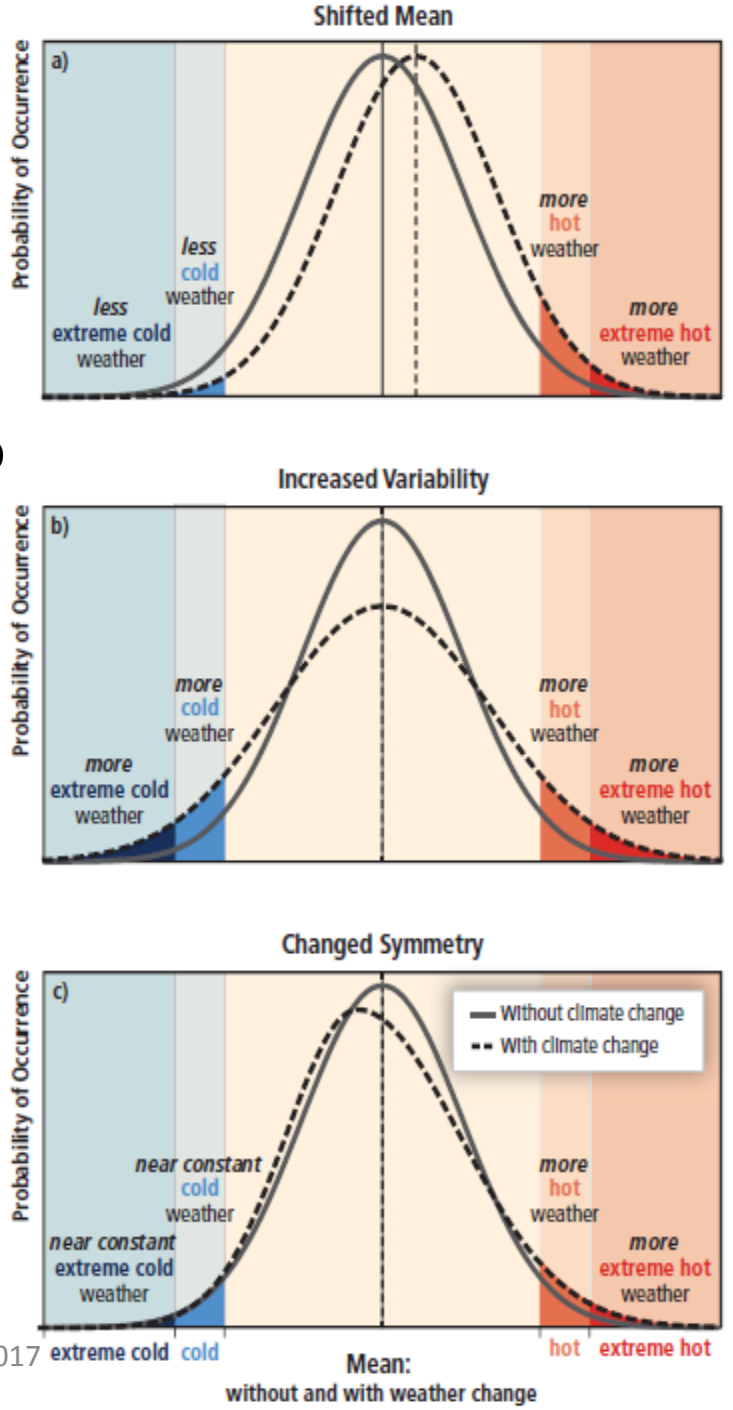
(DEFINITION SOURCE: IPCC 5th Assessment Report, WG 1 Glossary)

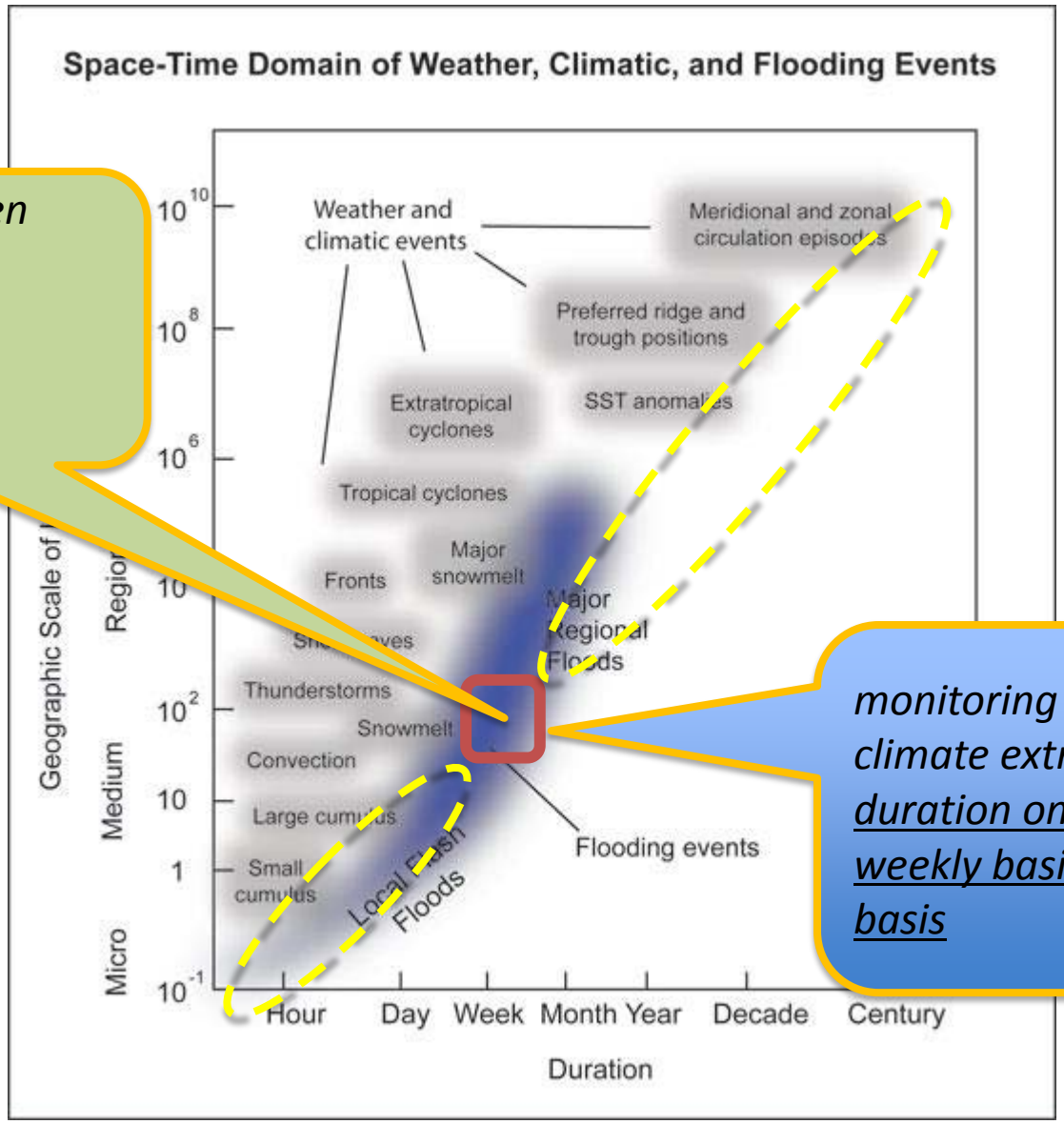
According to IPCC Report

- Some types of extreme weather and climate events have increased in frequency or magnitude, but populations and assets at risk have also increased, with consequences for disaster risk.

- Opportunities for managing risks of weather- and climate-related disasters exist or can be developed at any scale, local to international.

(IPCC report on "Managing the Risks of Extreme Events and Disasters to Advance Climate Change and Adaptation", 2012)





filling a gap between space-based "nowcasting" and "climate change monitoring"

monitoring weather and climate extremes <u>in short duration on pentad or weekly basis up to monthly basis</u>

Space-time domain of weather, climatic, and flooding events
(*Katie Hirschboeck, The University of Arizona)*
(http://www.southwestclimatechange.org/impacts/water/floods#references)

Q2: How to Identify the Extreme Values or Percentiles from satellite derived products?

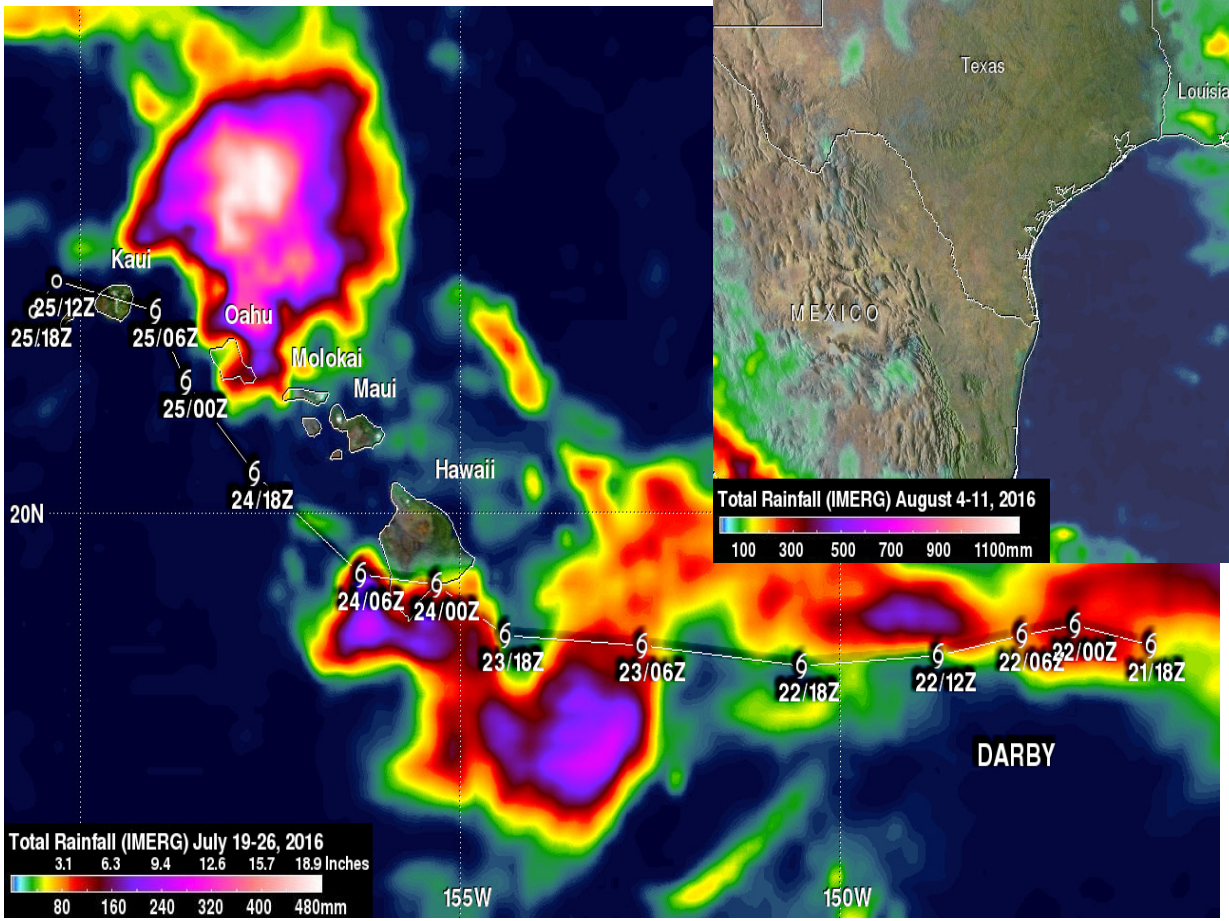
Our Challenging is …

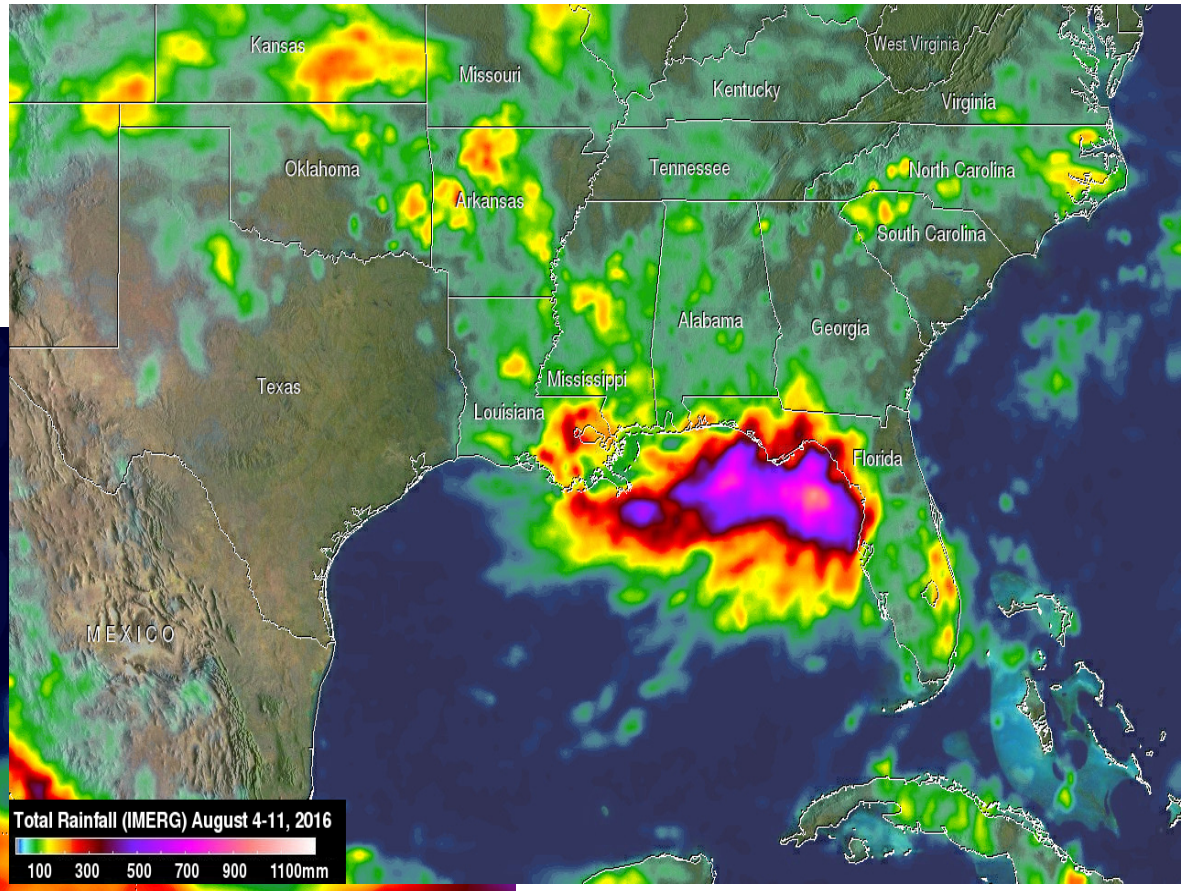
Our challenging is to “detect” the extreme values or percentiles from satellite derived products, such as precipitation, land surface temperature, vegetation to be used for monitoring weather and climate extremes;

- If the satellite products already covers a reasonably long period (i.e. > 10 years), we can perform a calibration against co-located in situ data, so that the percentiles for the satellite derived variables are equivalent to those for the in situ data.

Extreme Rainfall derived from GPM (weekly accumulated)

Extreme Rainfall from Hurricane Darby
7-day accumulated July 19-26, 2016

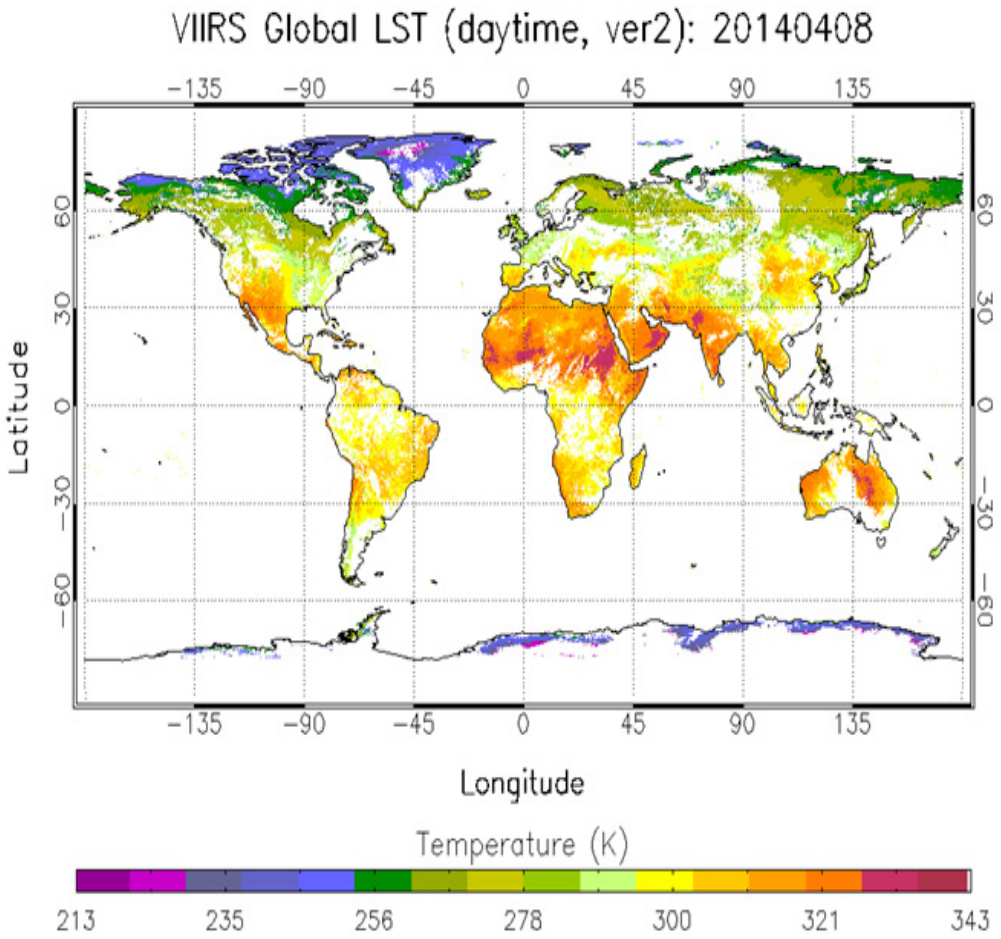


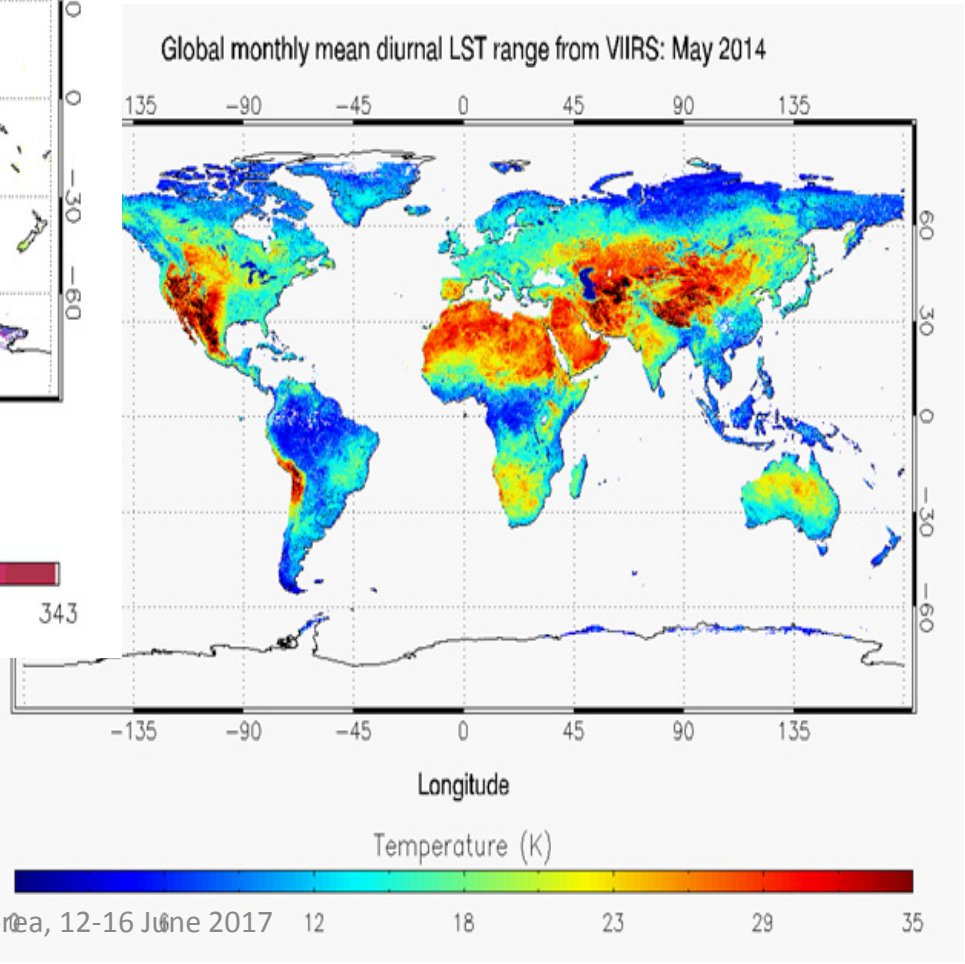


Extreme Rainfall Along the Gulf Coast
7-day accumulated August 4-11, 2016

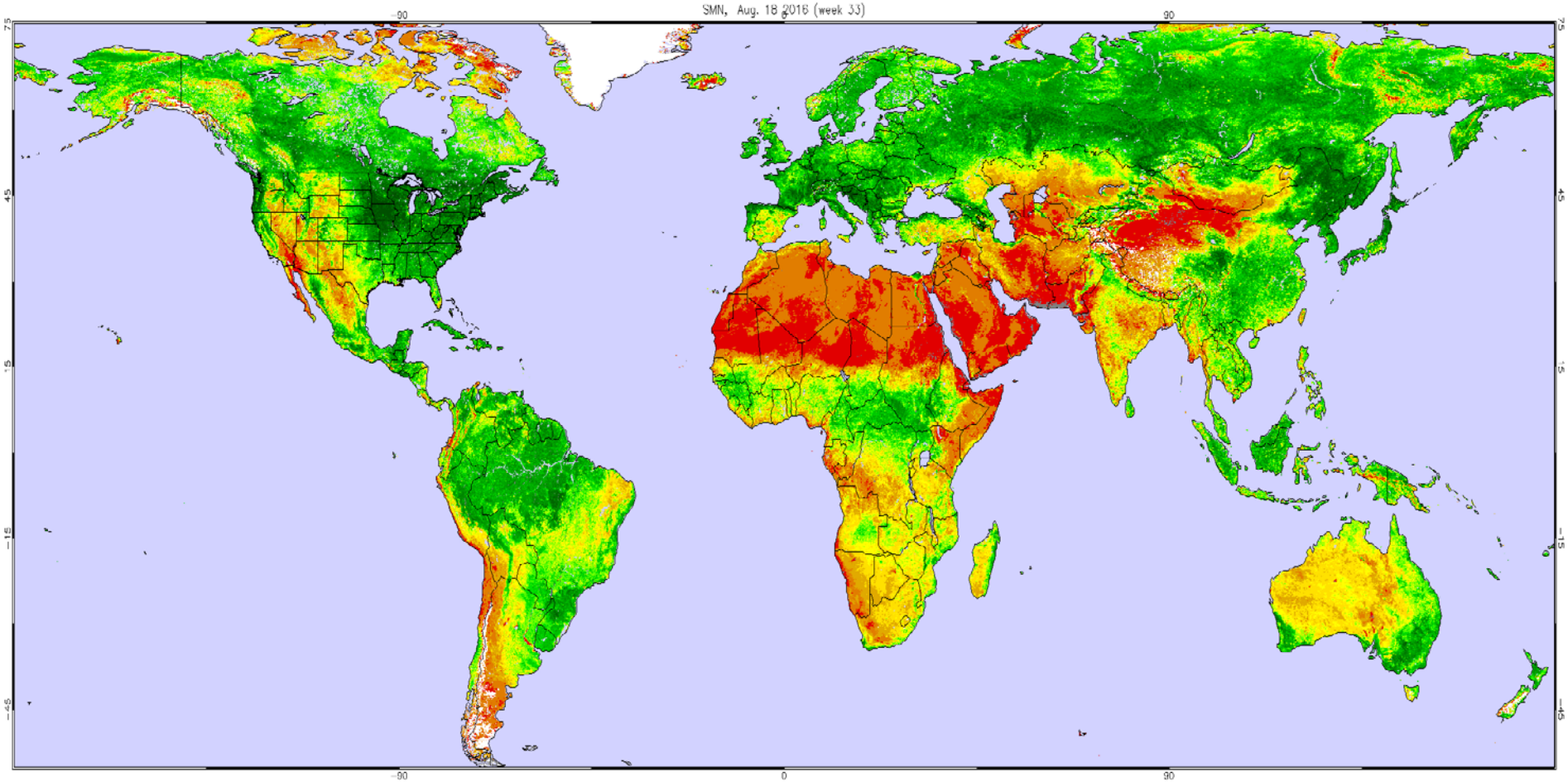
https://pmm.nasa.gov/category/keywords/imerg

Land Surface Temperature derived from SNPP/VIIRS





Global Vegetation Health Products derived from SNPP/VIIRS



No noise (smoothed) Normalized Difference Vegetation Index (SMN)

Global, 4 km, 7-day composite, validated. The SMN is derived from no noise NDVI, which components were pre- and post-launch calibrated. SMN can be used to estimate the start and senescence of vegetation, start of the growing season, phenological phases.

http://www.star.nesdis.noaa.gov/smcd/emb/vci/VH/vh_browse.php

Q3: Satellite Operators have already contributed to Climate Monitoring by producing TCDRs and FCDRs. It is enough !?!?

- TCDR and FCDR are to be produced in the “sustained architecture of climate” whereas a common and accepted definition of an **Interim Climate Data Record (ICDR)** is still needed to provide best practices to RCCs in setting up operations on extreme monitoring.

- ICDR as a CDR regularly updated with an algorithm / system having maximum consistency to TCDR generation algorithm / system. The update cycle depends on the user needs for climate extremes and might range from pentad to monthly.

Schematic diagram of production pathway for various climate data record products

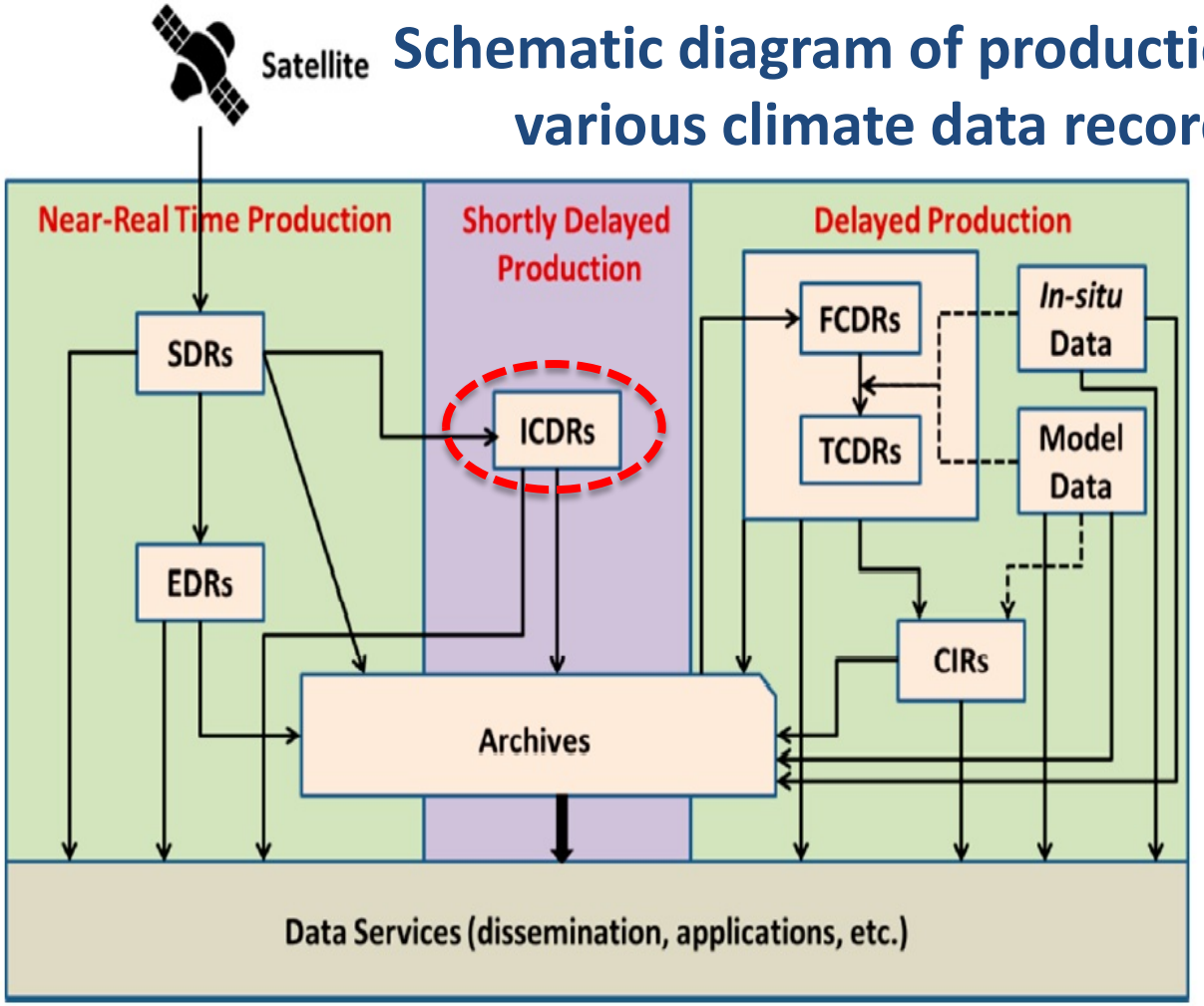


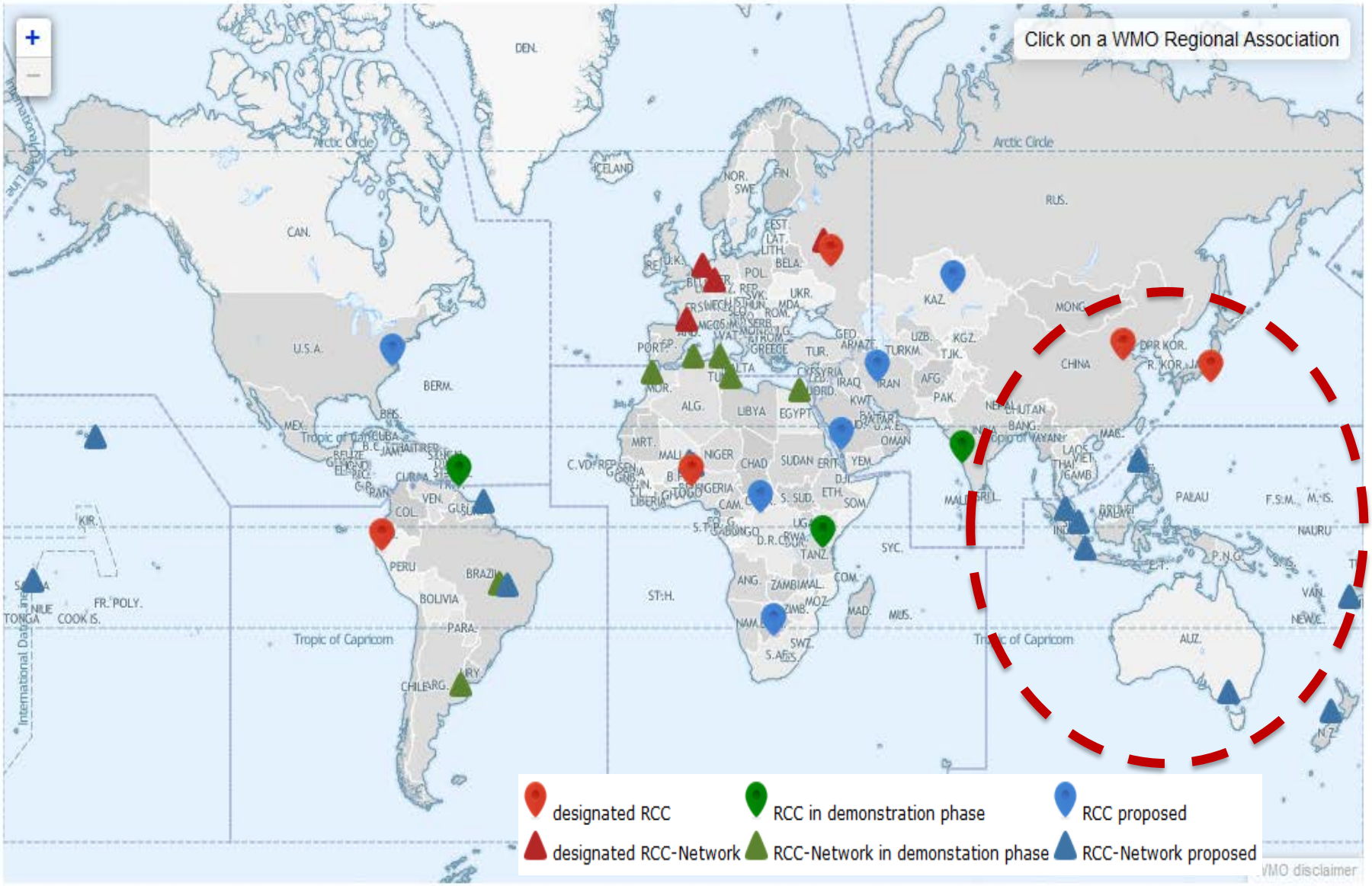
Figure 1. Schematic diagram of production pathways for various climate data record (CDR) products (ICDR—interim CDR, FCDR—fundamental CDR, TCDR—thematic CDR, and CIR—climate information record) and their relative dependence along with their relationship with near-real time products: Sensor Data Records (SDRs) and Environmental Data Records (EDRs). Dash lines indicate optional paths.

Q4: What is the Space-based Weather and Climate Extremes Monitoring Demonstration Project (SEMDP)?

General Objective of SEMDP

SEMDP will be organized to foster a dialogue amongst satellite operators and WMO Regional Climate Centres (RCCs) with NMHSs;

- *to guide NMHSs and relevant institutes to be able to properly and practically use the space-based observation data and products for monitoring selected 'Weather and Climate Extremes' with a focus on 'accumulated high precipitation' and 'drought'*
- *on a routine basis for climate monitoring, and for the development of improved climate services.*



The GPCLRFs and the RCCs constitute integral components of WMO's Global Data Processing and Forecasting System (GDPFS) underpinning the generation of climate information products by the NMHSs.

Summary

- WMO Secretariat to define with the WMO RCCs, NMHSs and relevant institutes in East Asia/Western Pacific region to set up a space-based weather and climate extremes monitoring demonstration project (SEMDP);
- WMO Secretariat to establish an ad hoc expert team, consisting of Satellite Operators, R&D Space Agencies, WMO RCCs, NMHSs and relevant institutes, for drafting an implementation plan for SEMDP in East Asia/Western Pacific region by December 2017;
- The project should demonstrate the use of existing satellite-derived products in quasi-real-time operations for two years in 2018-2020 timeframe;
- Products should consist of time series of measurements specific to the regional and national levels, along with related in-situ and/or model reanalysis data, and incorporating relevant research.

Actions Proposed;

- *NOAA/NESDIS is kindly requested to support the project by providing satellite observations of heavy precipitation events, and land surface parameters for monitoring droughts. The observations are required with a short latency of about one day. Furthermore the project requires the creation of climate reference data sets which will be used by the RCCs to classify observations as extreme event or not. (Due date: December 2017);*
- *JAXA is kindly requested to support the project by providing a short-term (from 5-day up to monthly) climate normal from GSMaP data archives as a reference precipitation data set for the initial SEMDP areas, i.e. East Asia and Western Pacific regions. JAXA is also requested to set-up the on-line environment to provide GSMaP data with short latency to be utilized in the SEMDP (Due date: December 2017);*
- *CGMS requests IPWG (i.e. the co-chairs and the rapporteur) to provide guidance on the estimation of uncertainties and representativeness of the short-latency precipitation products;*
- *CEOS/CGMS Working Group on Climate is asked to provide feedback on the proposed definition for ICDR.*

WEATHER CLIMATE WATER

Thank you

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