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WMO Space-based Weather and Climate Extremes Monitoring (SWCEM) for East Asia and Western Pacific

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Outline

WMO SWCEM (Space-based Weather and Climate Extremes Monitoring):

- SWCEM demonstration project in the Asia-Pacific region
- Global satellite data providers: JAXA and NOAA/CPC
- SWCEM products

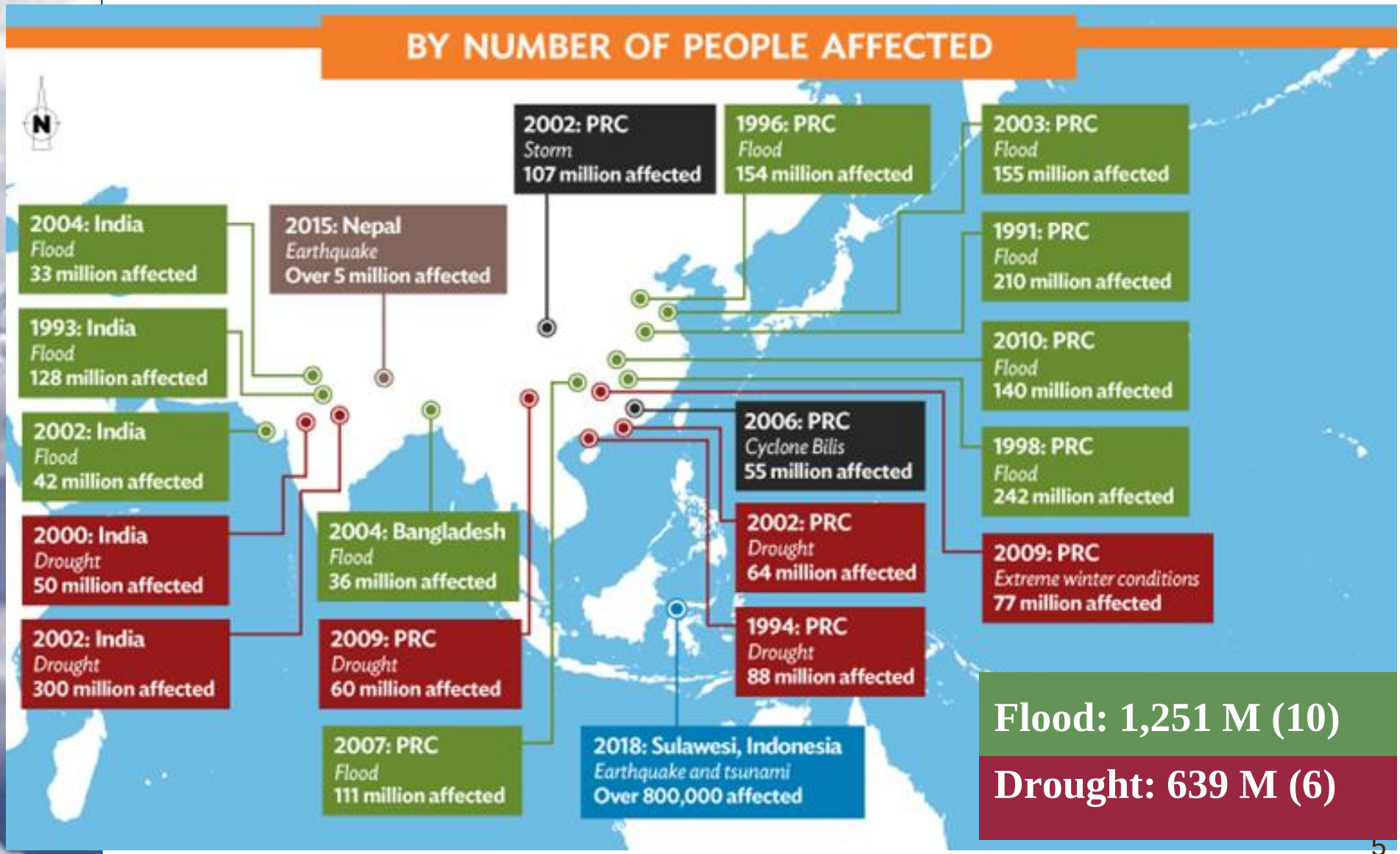
WMO SWCEM

- Recognizing high impact of weather and climate extremes on society, the WMO established the Space-based Weather and Climate Extremes Monitoring (SWCEM) International Initiative.
- Provision of timely and accurate information on monitoring extreme events helps to build greater resilience of society against drought, floods, storms and other hydro-meteorological hazards.

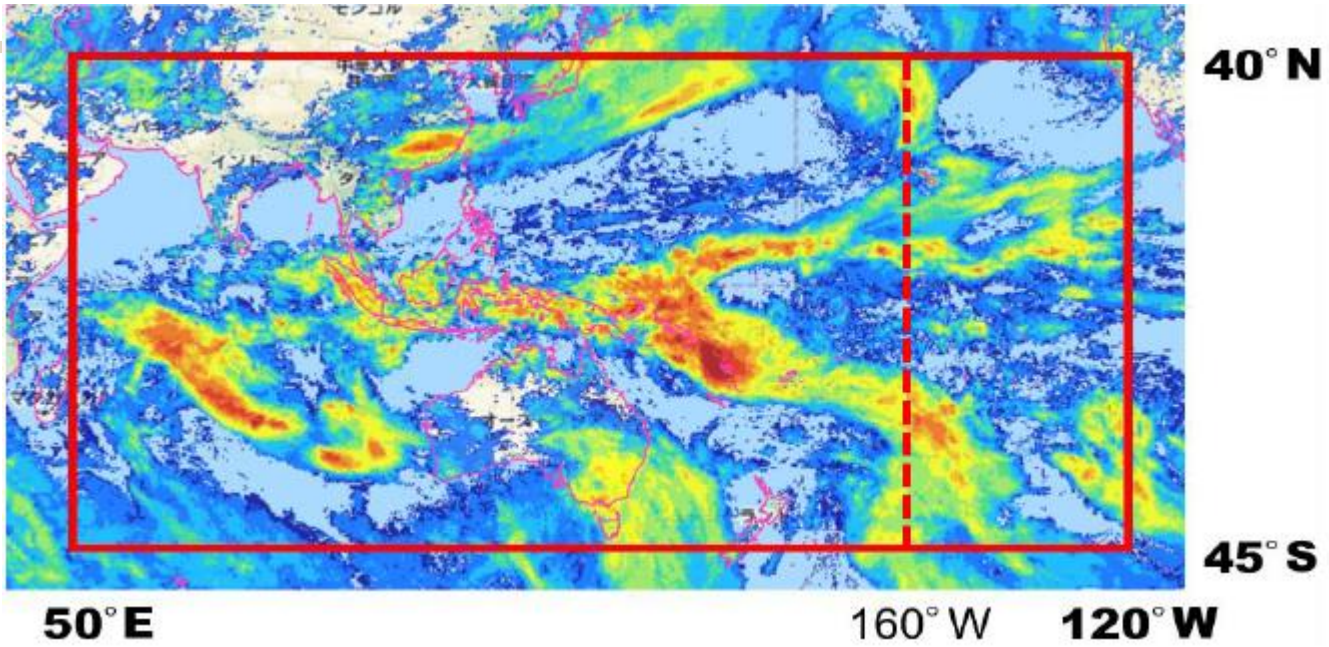


The Workshop on Operational Space-based Weather and Climate Extremes Monitoring (SWCEM) was held in Geneva, Switzerland on 15-17 February, 2017.

Asian Development Bank: Significant Disasters in the Asia and Pacific Region (1991 – 2018)



SWCEM Demonstration Project in RA-II and V



The first SWCEM demonstration project was successfully implemented in WMO Region II (Asia) and Region V (the South-West Pacific) in 2018-2019. The project was focused on monitoring **drought** and **heavy precipitation** and implemented in geographical domain which covers the **South-East Asia** region and the **Western Pacific Ocean** area from 40°N to 45°S; 50°E to 120°W.

Global Satellite-derived Product Providers

- Global Satellite-derived Product Providers for the SWCEM – JAXA and NOAA
- JAXA provides the Global Satellite Mapping of Precipitation (GSMaP; Kubota et al. 2007) data for detecting extreme precipitation
- GSMaP data are available from March 2000; thresholds for detecting the extreme events are calculated using the GSMaP data during 22 years (2000 – 2022).

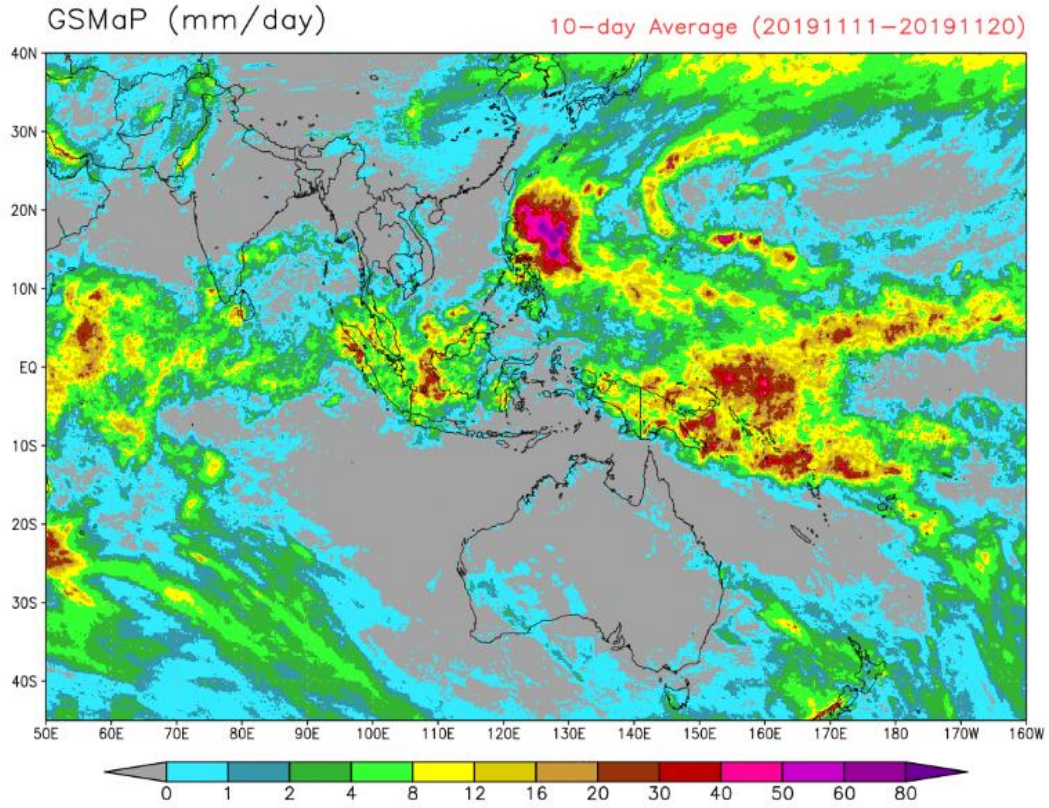
Kubota T, Shige S, Hashizume H, Aonashi K, Takahashi N, Seto S, Hirose M, Takayabu YN, Ushio T, Nakagawa K, Iwanami K, Kachi M & Okamoto K. Global Precipitation Map Using Satellite-borne Microwave Radiometers by the GSMaP Project: Production and Validation. IEEE Transactions on Geoscience and Remote Sensing. 2007:45(7, part 2):2259-2275. DOI: 10.1109/TGRS.2007.895337

Global Satellite-derived Product Providers

- NOAA/CPC provides products using the Climate Prediction Center morphing technique (CMORPH; Xie et al. 2017); satellite precipitation estimates are available from 1998.
- SWCEM precipitation products include mean precipitation estimates for hourly, daily, pentad, weekly, 10 days and monthly precipitation. In addition, statistics for daily, pentad and weekly extreme precipitation and percentage of rainy days in a month is provided.
- In addition to precipitation estimates, derived products – the SPI, the NDVI and the VHI are also available for the SWCEM region.

Xie P, Joyce R, Wu S, Yoo S-H, Yarosh Y, Sun F & Lin R. Reprocessed, Bias-Corrected CMORPH Global High-Resolution Precipitation Estimates from 1998. Journal of Hydrometeorology. 2017:18(6):1617-1641. DOI: 10.1175/JHM-D-16-0168.1.

SWCEM Operational Products



JAXA GSMaP 10-day average precipitation, mm/day (11-20 Nov 2019)

Mean precipitation estimates

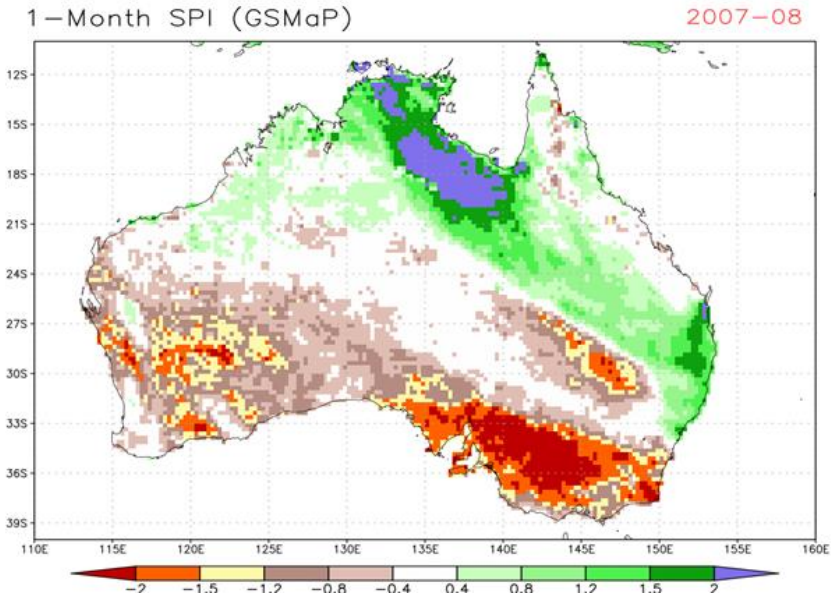
hourly
daily (00-23UTC)
pentad (5-day)
weekly (Monday– Sunday)
10-days
monthly

Statistics:

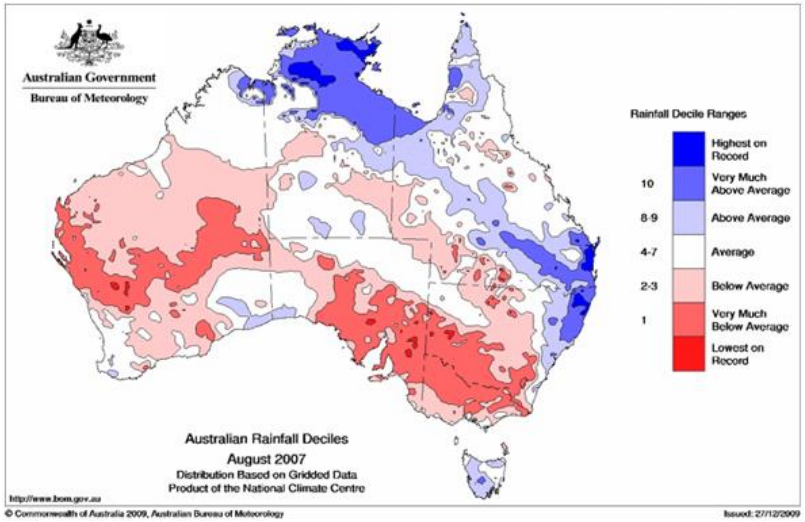
Climate normal
90th ～ 99th Percentiles
Percentage of rainy days (>=1mm/day) in a month

Indices: SPI, NDVI, VHI

Drought Monitoring
Using SWCEM Products

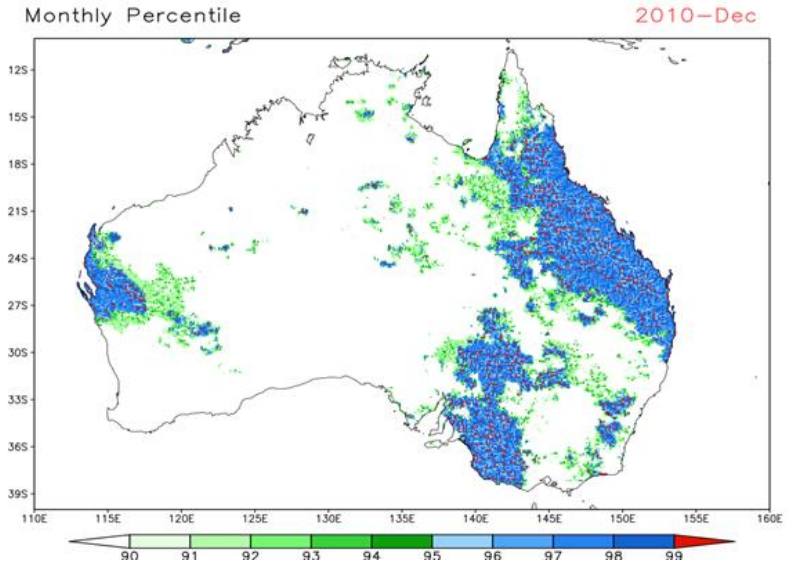


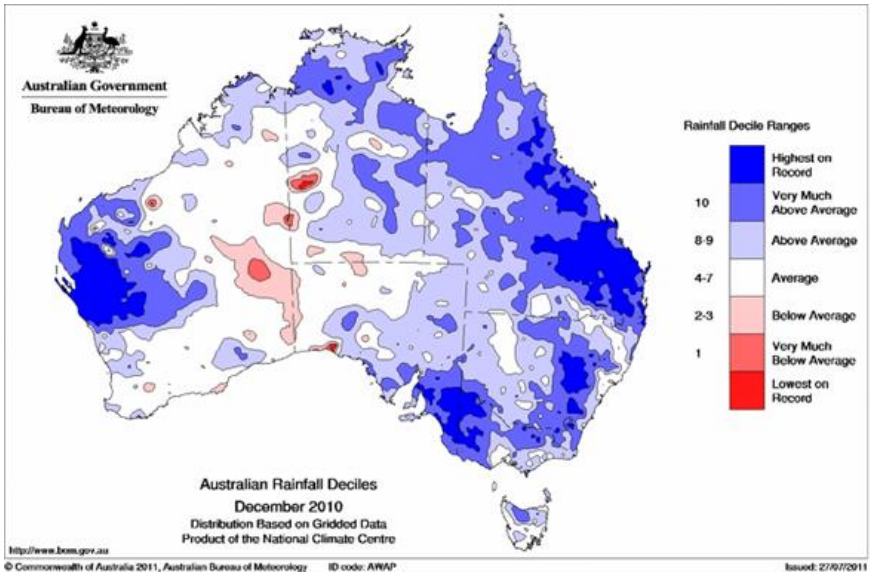
SPI for Australia in August 2007 derived from JAXA GSMaP data.



Rainfall deciles for Australia in August 2007; BoM rain gauge observations.

Heavy Precipitation Monitoring Using SWCEM Products





JAXA GSMaP rainfall percentile over Australia for December 2010.

Australian rainfall deciles for December 2010; BoM rain gauge observations.

SWCEM Contribution to CREWS

- SWCEM observations of precipitation have been incorporated into other WMO projects strengthening capacity of Members, especially Small Island Developing States (SIDS) and Least Developed Countries (LDCs), in climate change adaptation and disaster risk reduction.
- Satellite precipitation estimates and derived products are significant contribution to strengthening Multi-Hazard Early Warning Systems. Currently, we are implementing this through the Climate Risk and Early Warning Systems (CREWS) projects with focus on Asia - Oceania.

CREWS

- Developing and least developed countries are particularly vulnerable to the impact of climate extremes, including drought.
- Recognizing the urgency of enhancing early warning systems to assist vulnerable countries with climate change adaptation, the Climate Risk and Early Warning Systems (CREWS) international initiative has been established at COP-21 in Paris in 2015.

CREWS CLIMATE RISK & EARLY WARNING SYSTEMS

CREWS

CREWS has already supported 73 countries through

- 9 country projects
- 7 regional projects
- 1 global project.

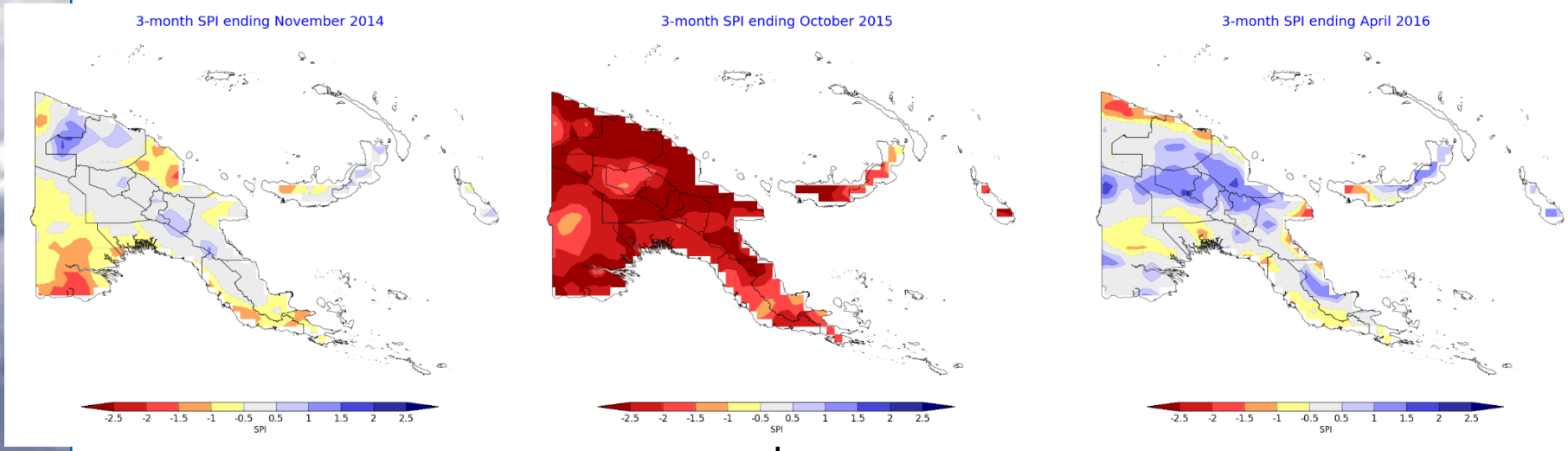
WORLD METEOROLOGICAL ORGANIZATION

WORLD BANK GROUP

GFDRR

UNDRR
UN Office for Disaster Risk Reduction

Drought Monitoring Using SWCEM Products: WMO RA-V, Papua New Guinea (PNG)

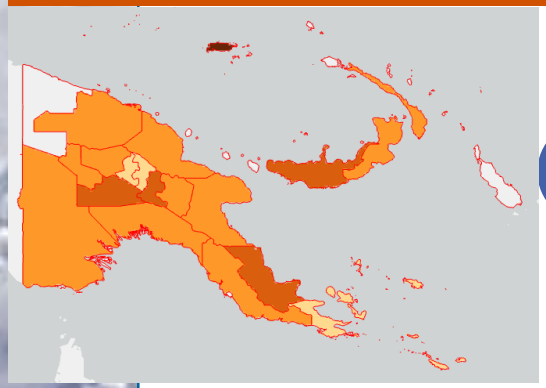


a b c

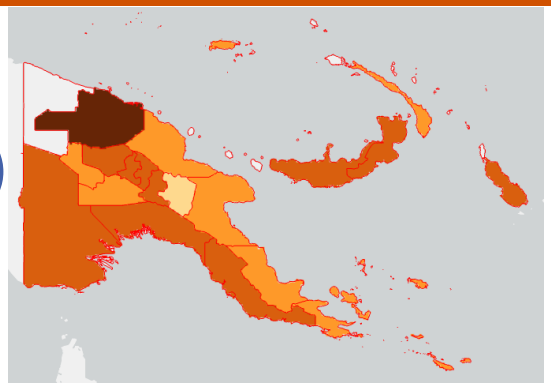
3-month SPI showing the progression of drought event in PNG: (a) November 2014 showing initial signs of dry conditions towards the southeast of the mainland; (b) October 2015 showing widespread severely dry conditions; (c) April 2016 showing the easing of dry conditions.

CREWS: Drought Risk Assessment

Drought Hazards Index (DHI) Inputs

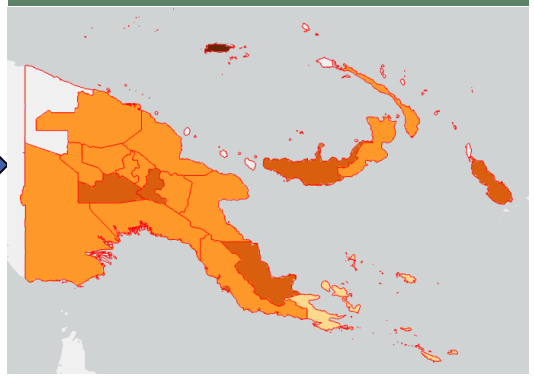


WMO SWCEM: SPI



WMO SWCEM: VHI

DHI



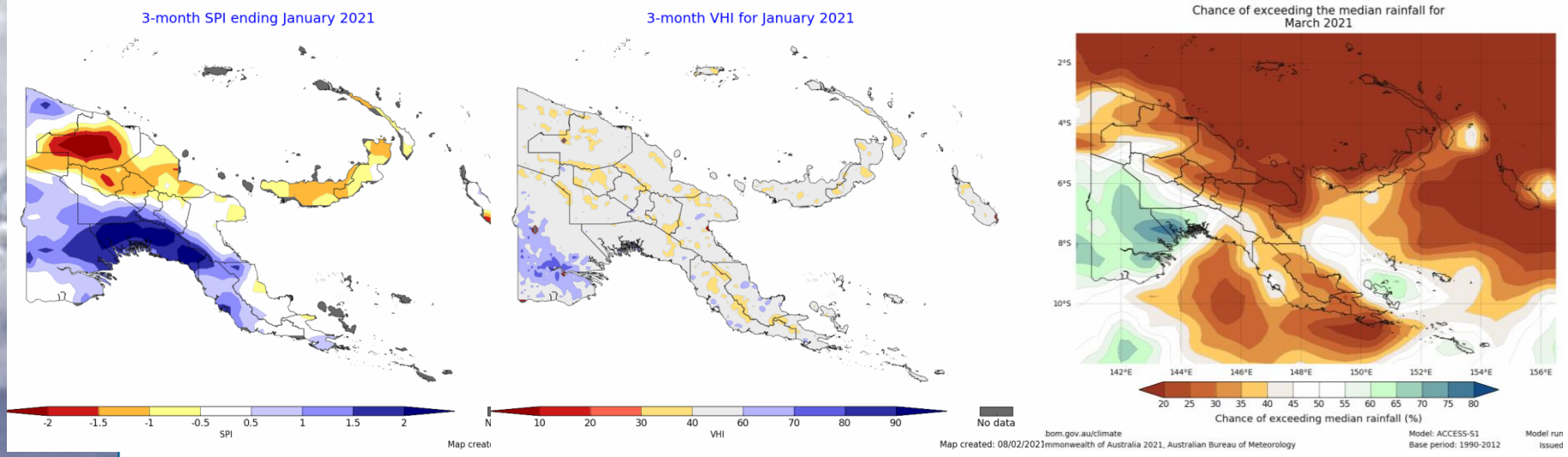
SPI + VHI => DHI

Drought Risk Assessment: WMO SWCEM satellite-derived products – SPI and VHI - are combined using GIS, to produce maps of Drought Hazard Index (DHI) for PNG at the provincial level.

CREWS: Drought EWS

Monitoring Inputs

Forecasting Inputs

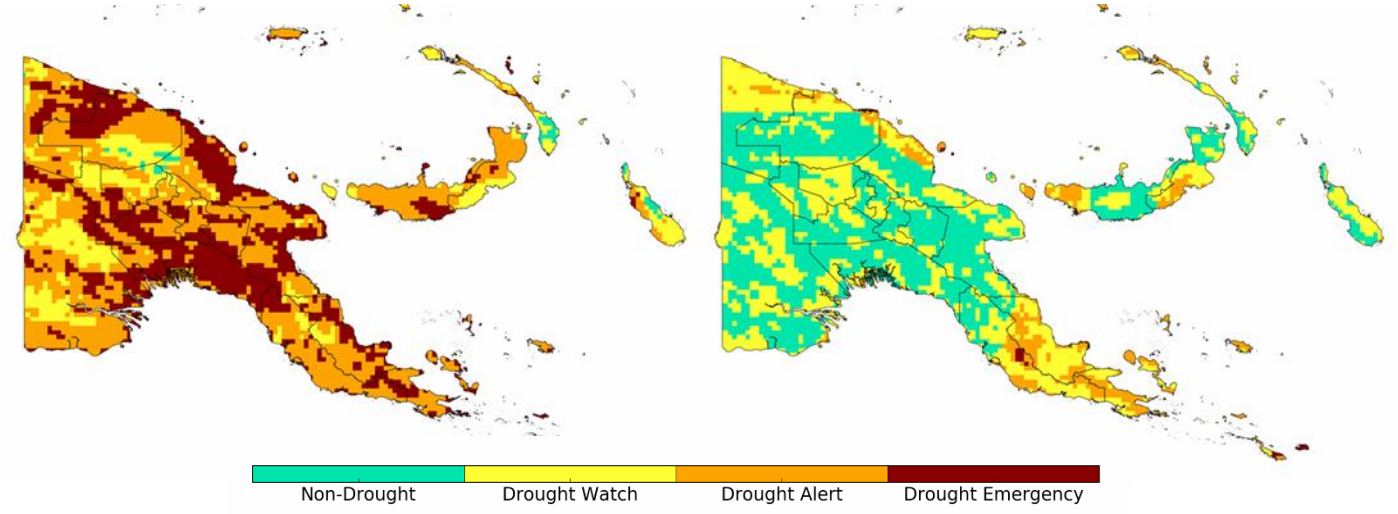


WMO SWCEM: SPI **WMO SWCEM: VHI** **WMO GPC LRFs: Rain**

Drought EWS: WMO SWCEM satellite-derived products - monitoring component and ACCESS-S S2S products – forecasting component

CREWS PNG

- The CREWS-PNG project developed an improved drought monitoring and early warning system (EWS) for Papua New Guinea.

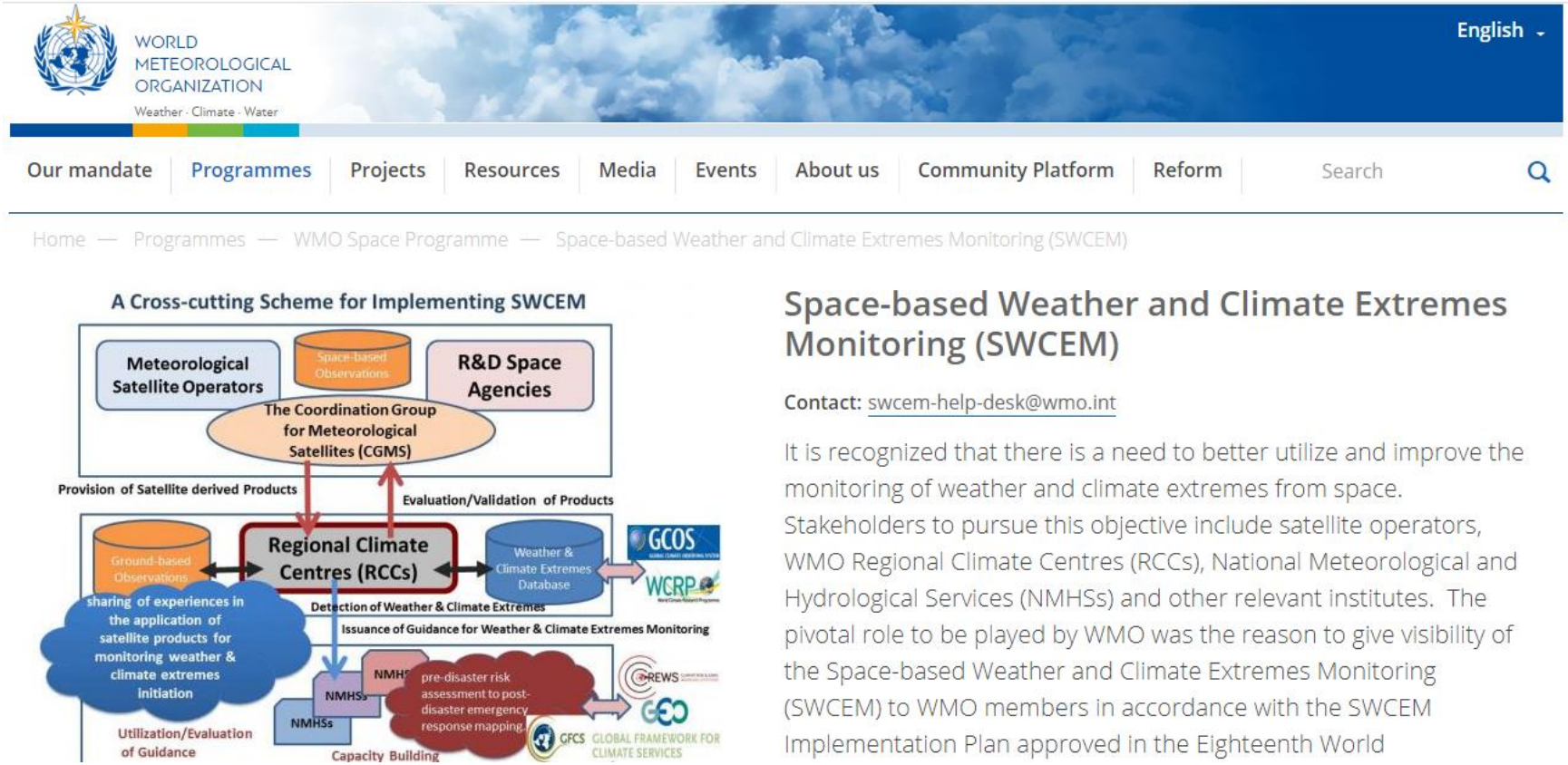


- EWS for drought will enable better strategic decision making for agriculture, water management, health and other climate-sensitive sectors.

SWCEM in Operations

- The Eighteenth World Meteorological Congress (Cg-18) - recognizing significant achievements of SWCEM in Asia-Pacific, adopted project implementation plan for 2020-2021
- Cg-18 – to progress with the implementation of the SWCEM regional **operational** subproject in East Asia and Western Pacific
- Cg-18 – to consider the possibility of implementing similar projects in Africa (RA I) and South America (RA III)

SWCEM Web Portal



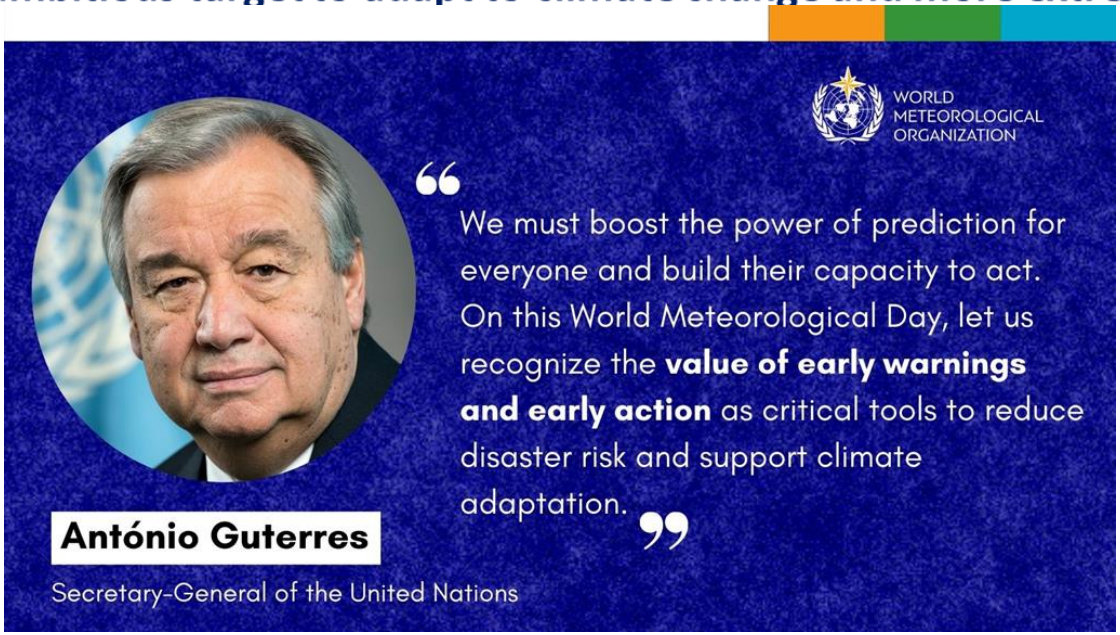
https://public.wmo.int/en/programmes/wmo-space-programme/swcem

SWCEM Newsletter

https://public.wmo.int/en/programmes/wmo-space-programme/swcem

Early Warning and Early Action

UN unveils ambitious target to adapt to climate change and more extreme weather



WMO SWCEM and CREWS are important contributors to new UN target "Early warning systems must protect everyone within five years"

Summary

- ✓ WMO SWCEM
- ✓ Demonstration project for the Asia-Pacific region
- ✓ Satellite precipitation estimates – JAXA and CPC/NOAA
- ✓ Derived products and indices e.g. SPI, NDVI, VHI
- ✓ SWCEM products - encouraging results for drought and heavy precipitation monitoring
- ✓ SWCEM outstanding achievements – thanks to international cooperation !