



# Climate Information Services for Various Sectors

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**Director Education and Training Center**

**The Agency for Meteorology Climatology and Geophysics**  
**BMKG - INDONESIA**

*UNESCO/IOC-ODC TRAINING COURSE ON PREDICTION AND  
PROJECTION OF CLIMATE, Qingdao-online August 25,2022*

# OUTLINE

The Climate System

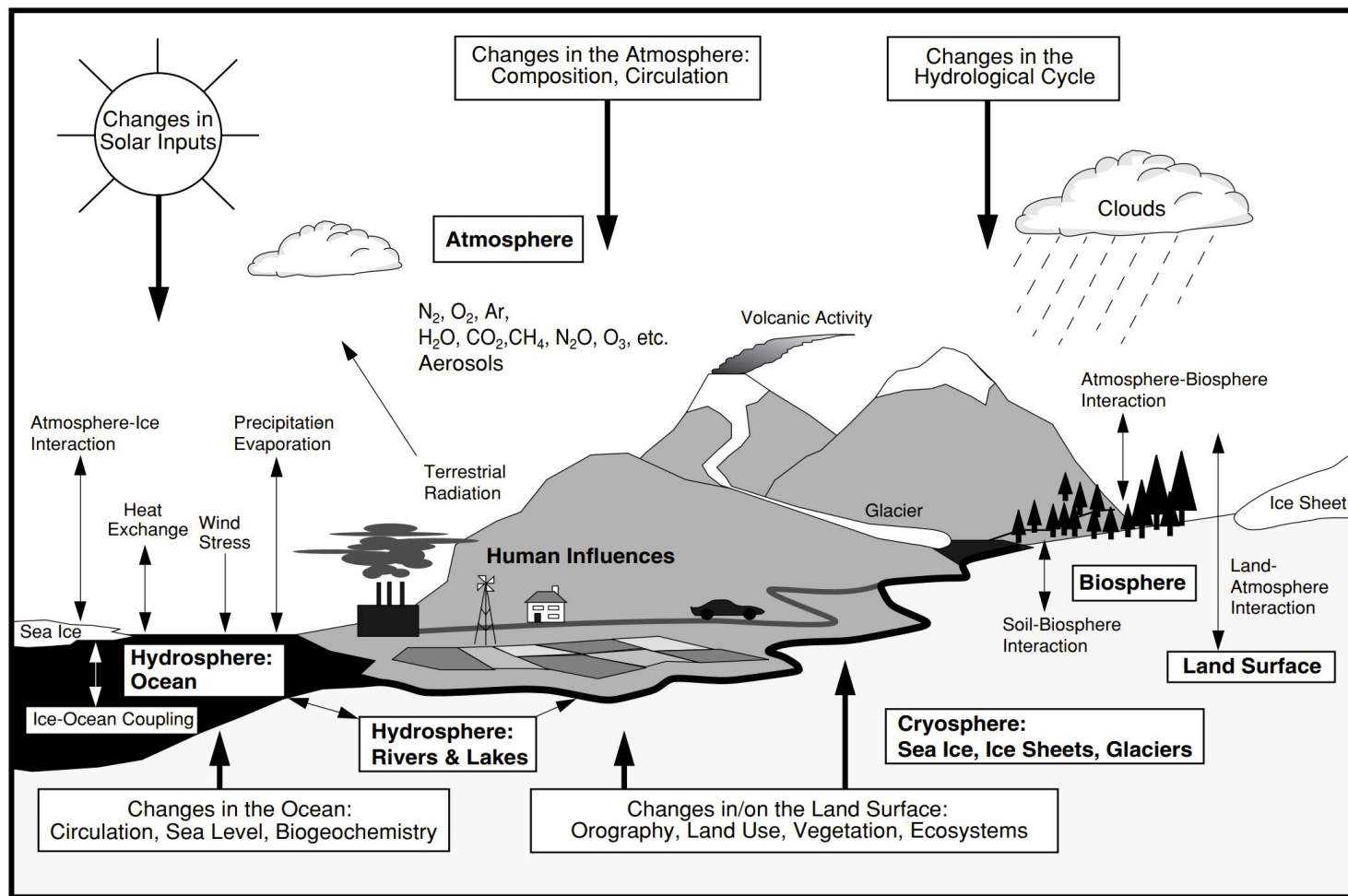
Climate Prediction

Climate Information for Specific Sector

Climate Change Impact for Sector

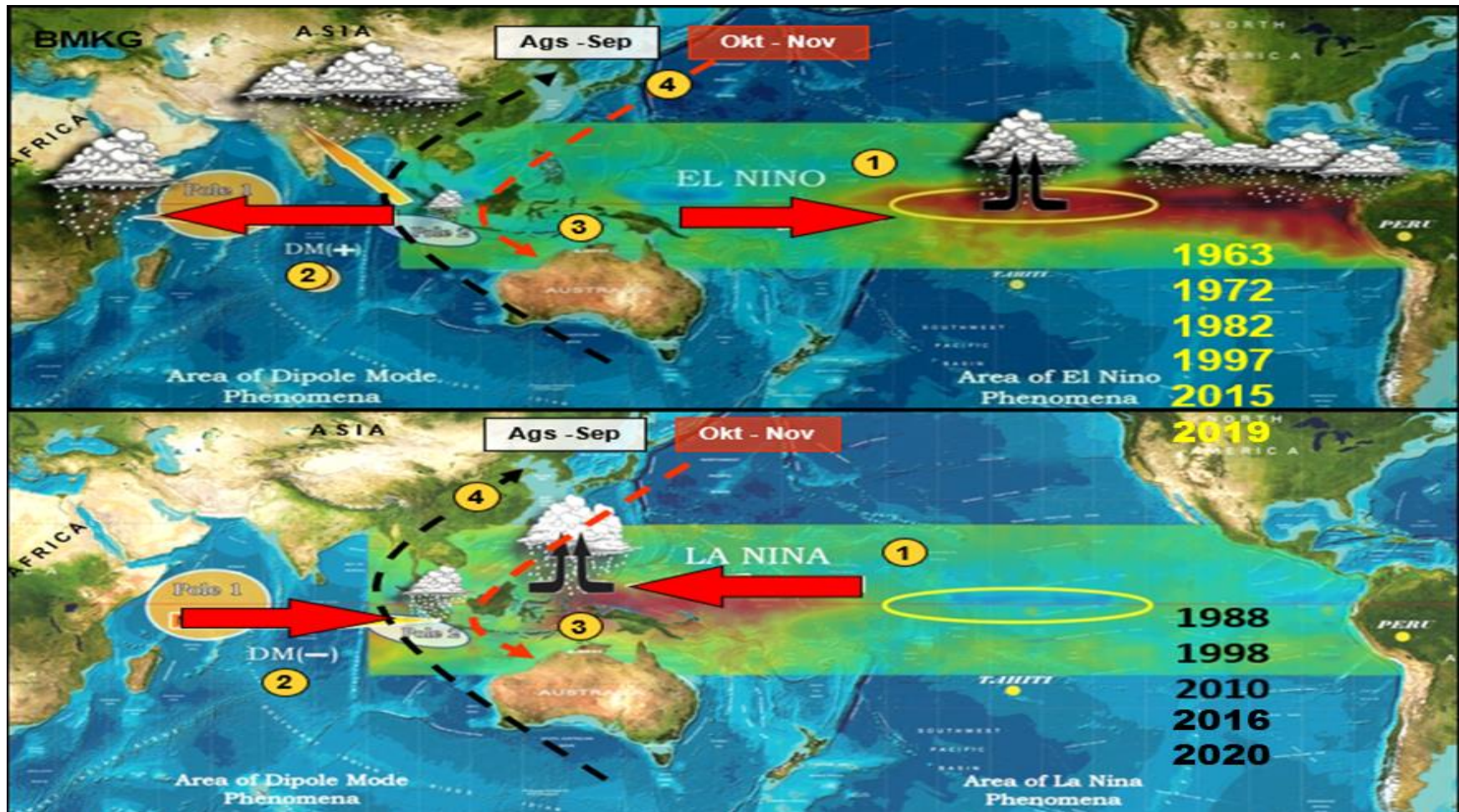
Climate Literacy

# COMPONENTS OF THE GLOBAL CLIMATE SYSTEM



**Figure 1.1:** Schematic view of the components of the global climate system (bold), their processes and interactions (thin arrows) and some aspects that may change (bold arrows).

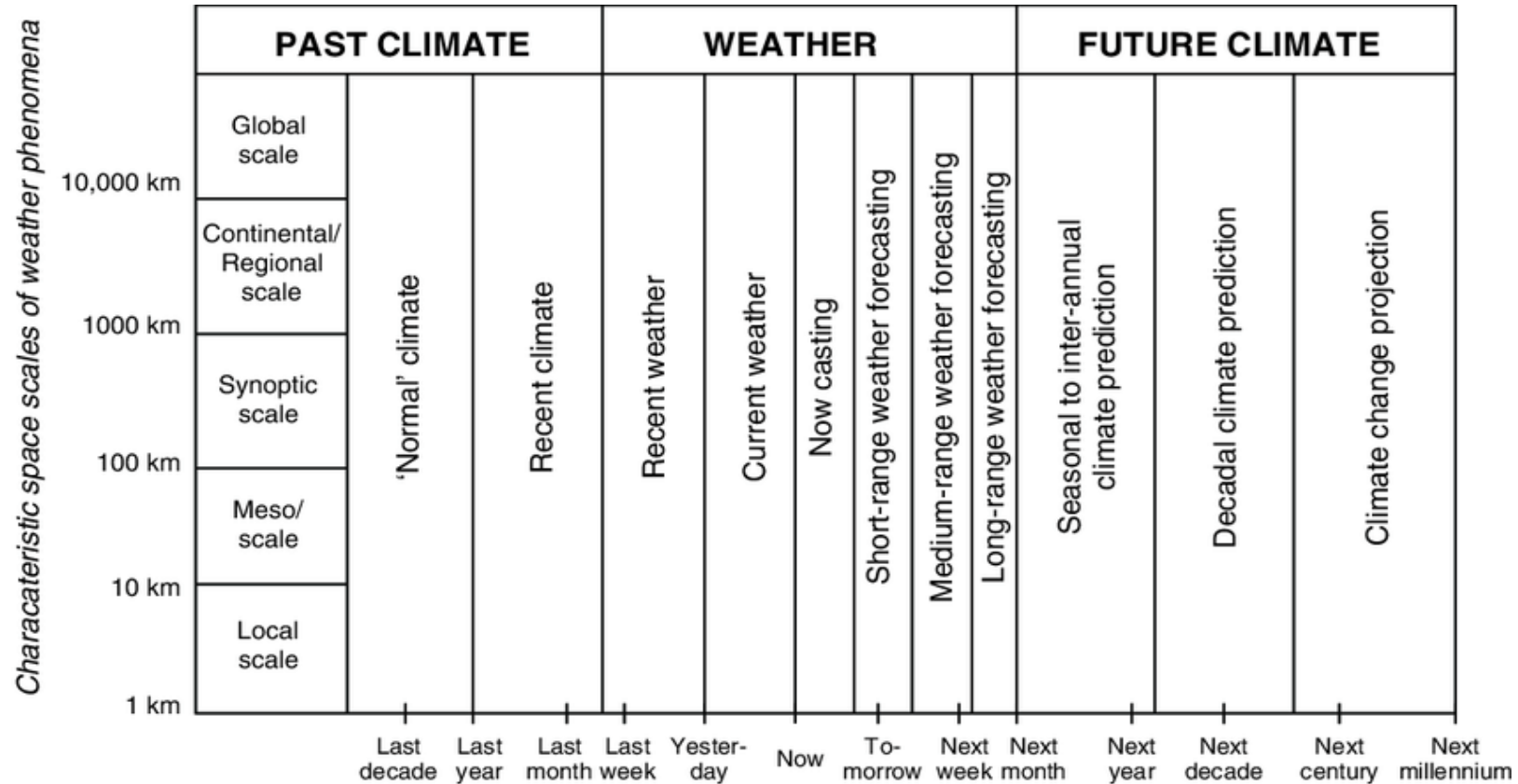
# CLIMATE SYSTEM IN MARITIME CONTINENT



Climate Variability in Maritime Continent affected by:

- ENSO (El Niño/ La Niña)
- IOD (Indian Dipole Mode)
- Monsun
- SST di perairan Indonesia

# TIME SCALE WEATHER -CLIMATE



*Approximate time-scale terminology for weather and climate description and prediction*

*"climate is what you expect and weather is what you get"*



# CLIMATE SERVICES

A climate service is a decision aide derived from climate information that assists individuals and organizations in society to make improved ex-ante decision-making (WMO)

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**appropriate and iterative engagement**

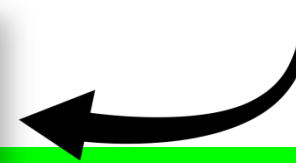


**to produce a timely advisory**



**end-users**

**decision making, early action and preparedness**



# Delivering Climate Services for End-Users

- 1. Understand the demand side**
- 2. Bridging the gap between climate forecasters and sector expertise**
- 3. Co-producing climate services to address end-user climate service needs**
- 4. Communicate to reach 'the last mile'**
- 5. Assess and re-assess**

*Source: WMO*

# Types of Climate Information

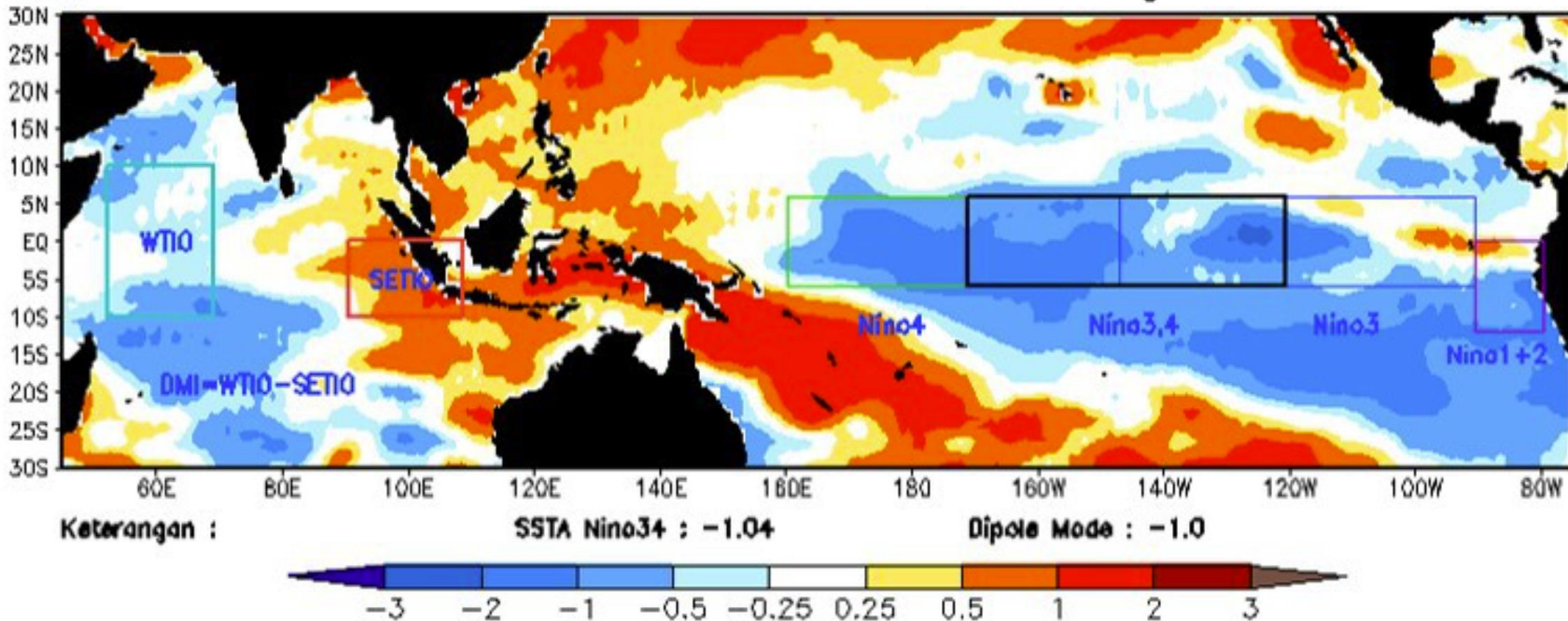
- The onset of Dry and Wet Season
- Weekly/Monthly Rainfall prediction
- Climate Outlook (Temperature, Precipitation)
- SST Anomaly
- Consecutive dry days (CDDs)
- Consecutive wet days (CWDs)
- La Nina/El Nino monitoring



# SEA SURFACE TEMPERATURE ANOMALY



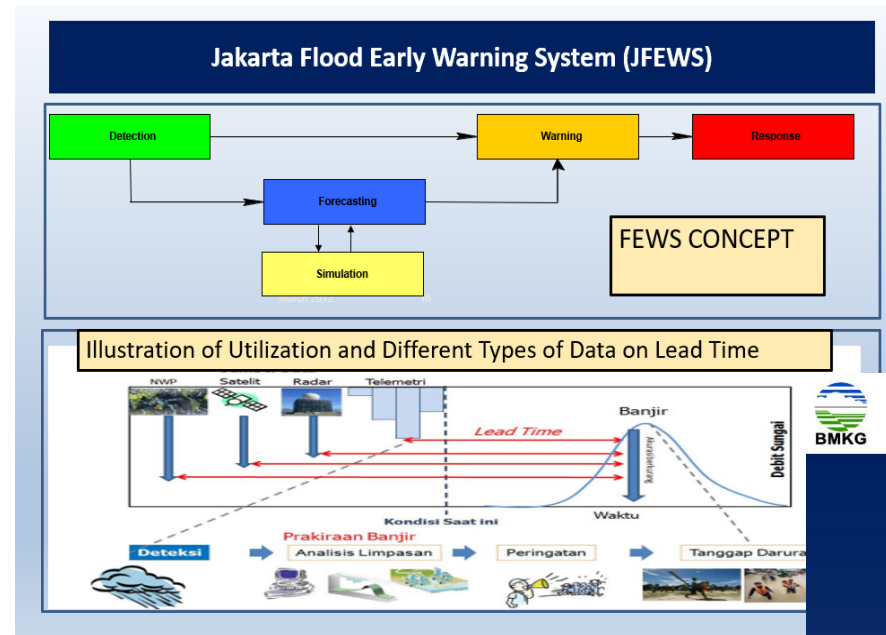
Anomali Suhu Muka Laut Dasarian II Agustus 2022



**Indeks Nino3.4 Index : -0.92 [Weak La Nina] ;  
Dipole Mode Index : -0.96 [IOD-]**

# FLOOD PREDICTION

disaster risk reduction effort, especially regarding flood forecast and warning.



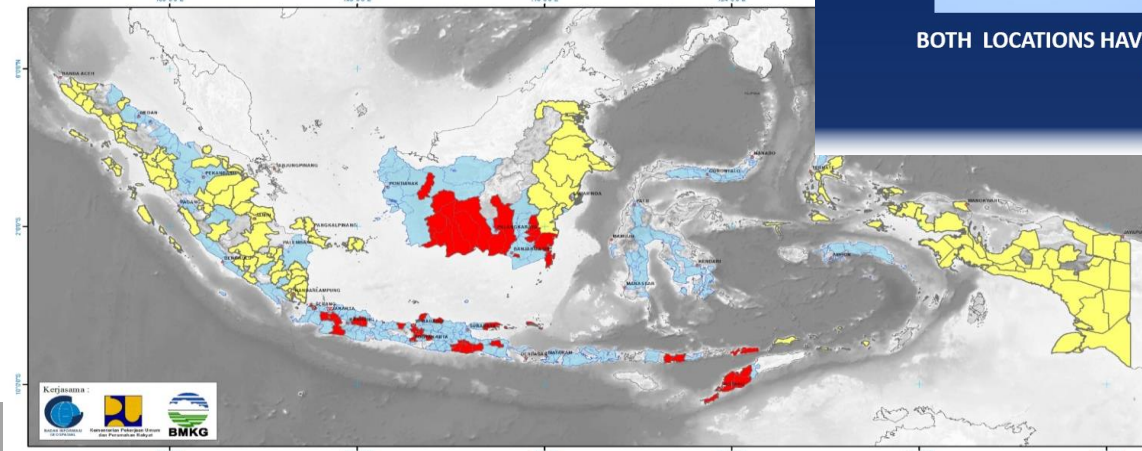
**COASTAL INUNDATION FORECASTING DEMONSTRATION PROJECT INDONESIA (CIFDP-I)**

**PILOT PROJECT**



**BOTH LOCATIONS HAVE FREQUENT FLOOD FROM COASTAL INUNDATION**

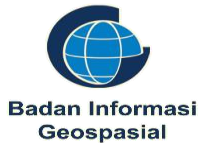
**INDEKS LOKASI KEGIATAN PEMETAAN RAWAN BANJIR**



# INTEGRATED FLOOD FORECAST



**Ministry of Public  
Works** Historical Flood  
Events



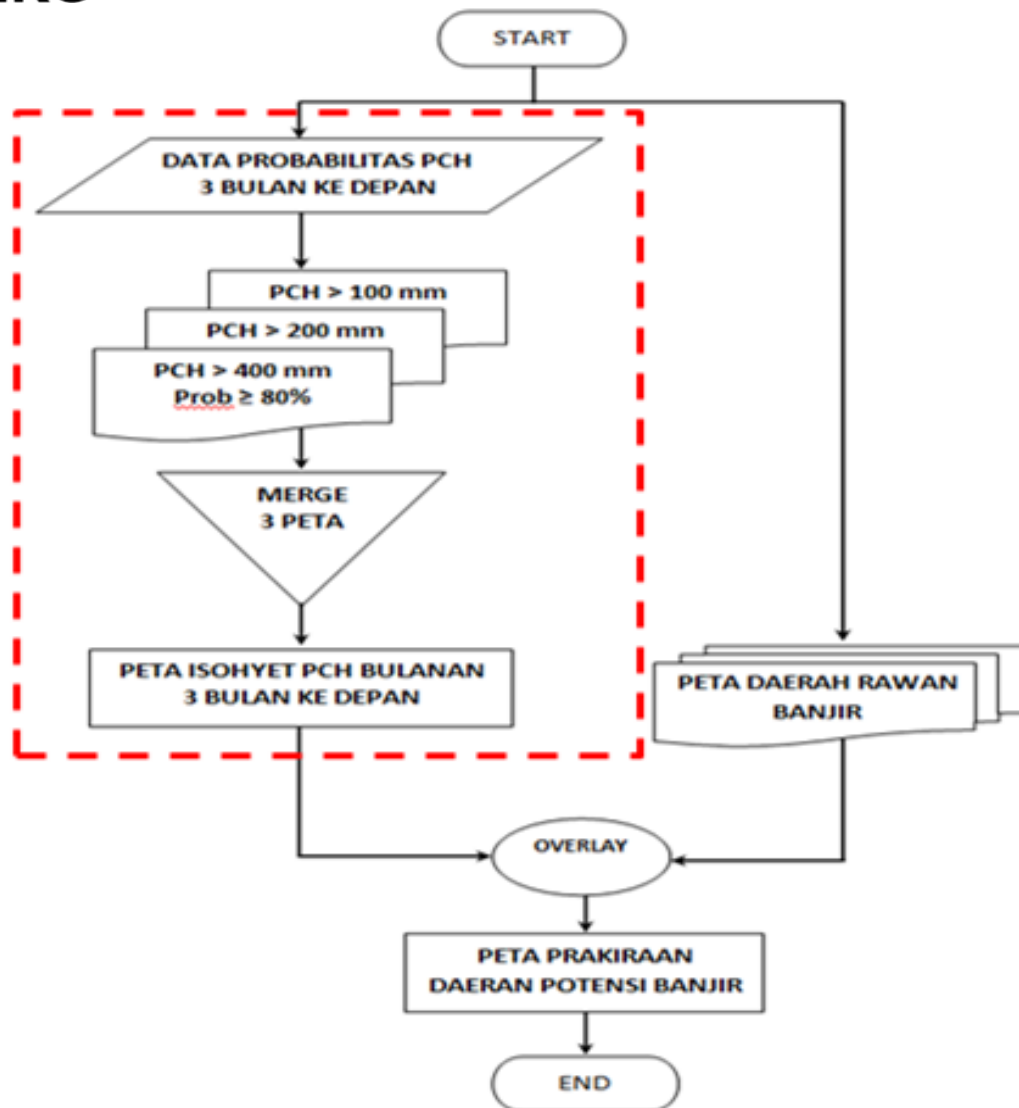
**National Mapping Agency**  
Indonesia Base map standard



**Indonesian Agency for  
Meteorology Climatology and  
Geophysics**  
Monthly Rainfall Forecast

**Monthly Forecast of  
Flood-prone-region**





Currently, BMKG released monthly flood forecast, using **probabilistic rainfall forecast**.

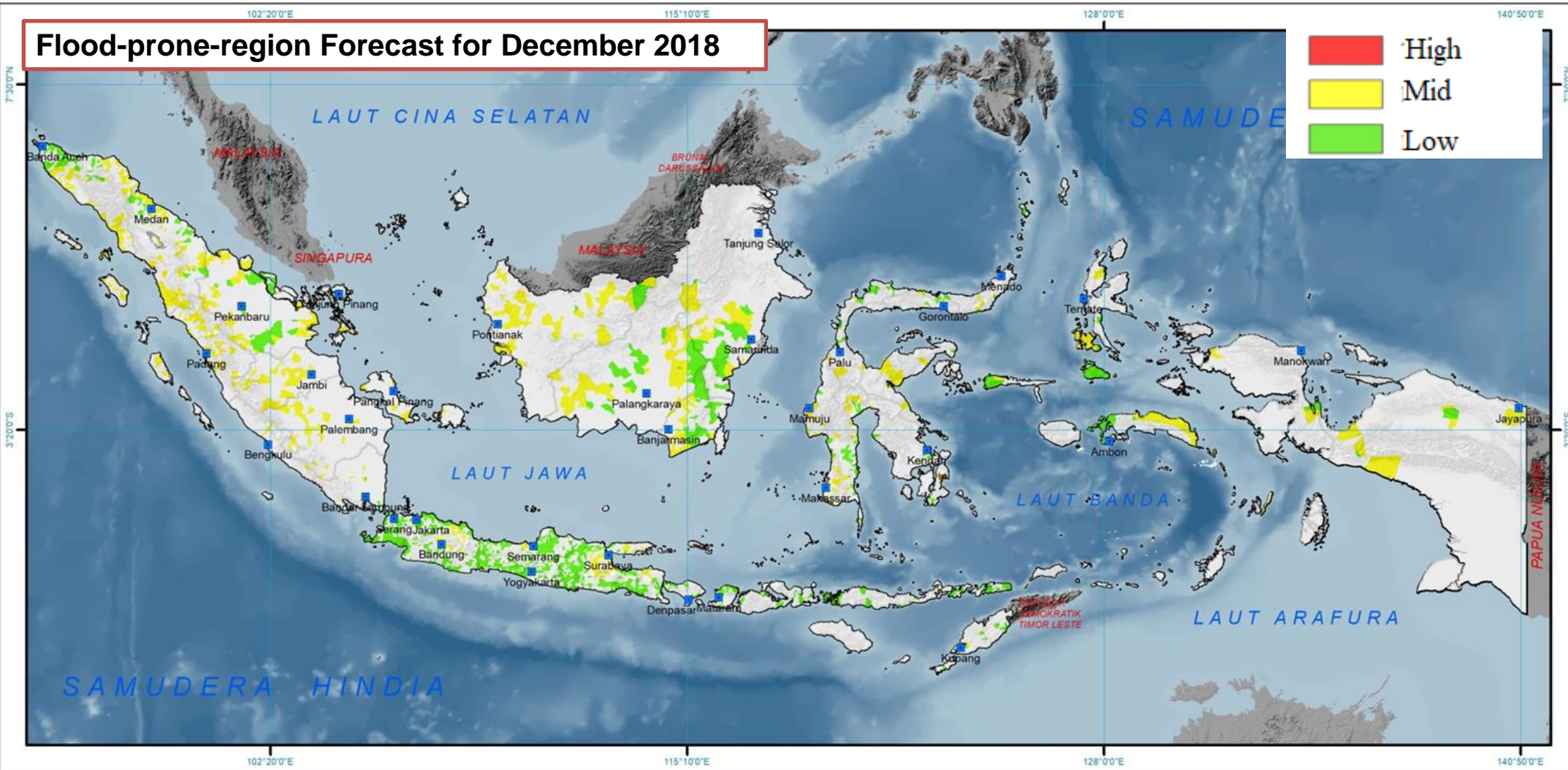
Flood forecast is published on district level.

During the peak of rainy season (start from **December**), the flood warning is updated every **10-days period** (decadal forecast).






## Flood-prone-region Forecast for December 2018



## The Information is disseminated via website and email to related stakeholders

WEDNESDAY, DECEMBER 12, 2018

INDONESIA STANDARD TIME 10:02:23 WIB / 03:02:23 UTC


**METEOROLOGICAL, CLIMATOLOGICAL, AND GEOPHYSICAL AGENCY**

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[IT & INFRASTRUCTURE](#)

CLIMATE FORECAST

Monthly Precipitation Forecast

Seasonal Forecast

**Flood Potential**

CLIMATE ANALYSIS

Monthly Precipitation

Atmosphere Dynamics

Extreme Climate Analysis

Standardize Precipitation Index

Water Balance


CLIMATE INFORMATION

Sea Surface Temperature

El Nino Index

Pacific Subsurface Temperature

### Peta Prakiraan Daerah Potensi Banjir Bulanan update Desember 2018


**iklim infrastruktur**

ke amsari\_ms, Ardhi, joko\_1908, mia.rosmiati, Staklim.Banjarbaru, staklim.indrapuri, Staklim.Kairatu, staklimgenyem, steven.andika, vivi3\_vi2, Adi, ADIP, Agie, Agung, Andhika, Andi, Ard

Sel, 11 Des 13.25 (20 jam ya

Dengan Hormat,

Terlampir kami kirimkan Peta Prakiraan Daerah Potensi Banjir Bulanan, update Desember 2018

1. Peta Prakiraan Daerah Potensi Banjir Januari 2019
2. Peta Prakiraan Daerah Potensi Banjir Februari 2019
3. Peta Prakiraan Daerah Potensi Banjir Maret 2019

Demikian kami sampaikan. Mohon dapat diterima dengan baik.

Terima kasih.

Salam,

Subid Informasi Iklim Infrastruktur

[BANJIR\\_INDO\\_FEB\\_UP101218.docx](#)

[BANJIR\\_INDO\\_JAN\\_UP101218.docx](#)

[BANJIR\\_INDO\\_MAR\\_UP101218.docx](#)

dari: **iklim infrastruktur** <iklim.infrastruktur@gmail.com>

kepada: amsari\_ms@yahoo.com, Ardhi Tama <ardhi.tama@gmail.com>, joko\_1908@yahoo.com, mia.rosmiati@bmg.go.id, Staklim.Banjarbaru@bmg.go.id, staklim.indrapuri@bmg.go.id, Staklim.Kairatu@bmg.go.id, staklimgenyem@yahoo.com, steven.andika@bmg.go.id, vivi3\_vi2@yahoo.com, Adi Ripaldi <adi.ripaldi@bmg.go.id>, ADIP PUSYANKLIM <addip18@gmail.com>, Agie Wandala <agie.wandala@bmg.go.id>, Agung Fauzi <agung.nimbocaster@gmail.com>, Andhika <andhikaher@gmail.com>, Andi Eka Sakya <andi.eka.sakya@gmail.com>, Ardhasena Sopaheluwakan <ardhasena@gmail.com>, ardin <sakuragiardin@gmail.com>, BMKG Bengkulu <bmg Bengkulu@yahoo.com>, BMKG Kalimantan <bmg Kalimantan@yahoo.com>

# CLIMATE SERVICE IN THE HEALTH SECTOR

## DENGUE FEVER EARLY WARNING



FGD assessment of climate & dengue data & information needs, data exploration, prediction model development, model trial, Cooperation Agreement preparation

Climate-based dengue early warning products can be accessed at <http://dbd.bmkg.go.id>

November 2018

Signing Cooperation Agreement between BMKG - DKI Jakarta Health Office on Commemoration of National Health Day at the Monas Field



9 December 2018



21 January 2019

DKI Jakarta Health Office issues a Circular to prepare Dengue fever cases, using Dengue Fever early warning products as a warning.



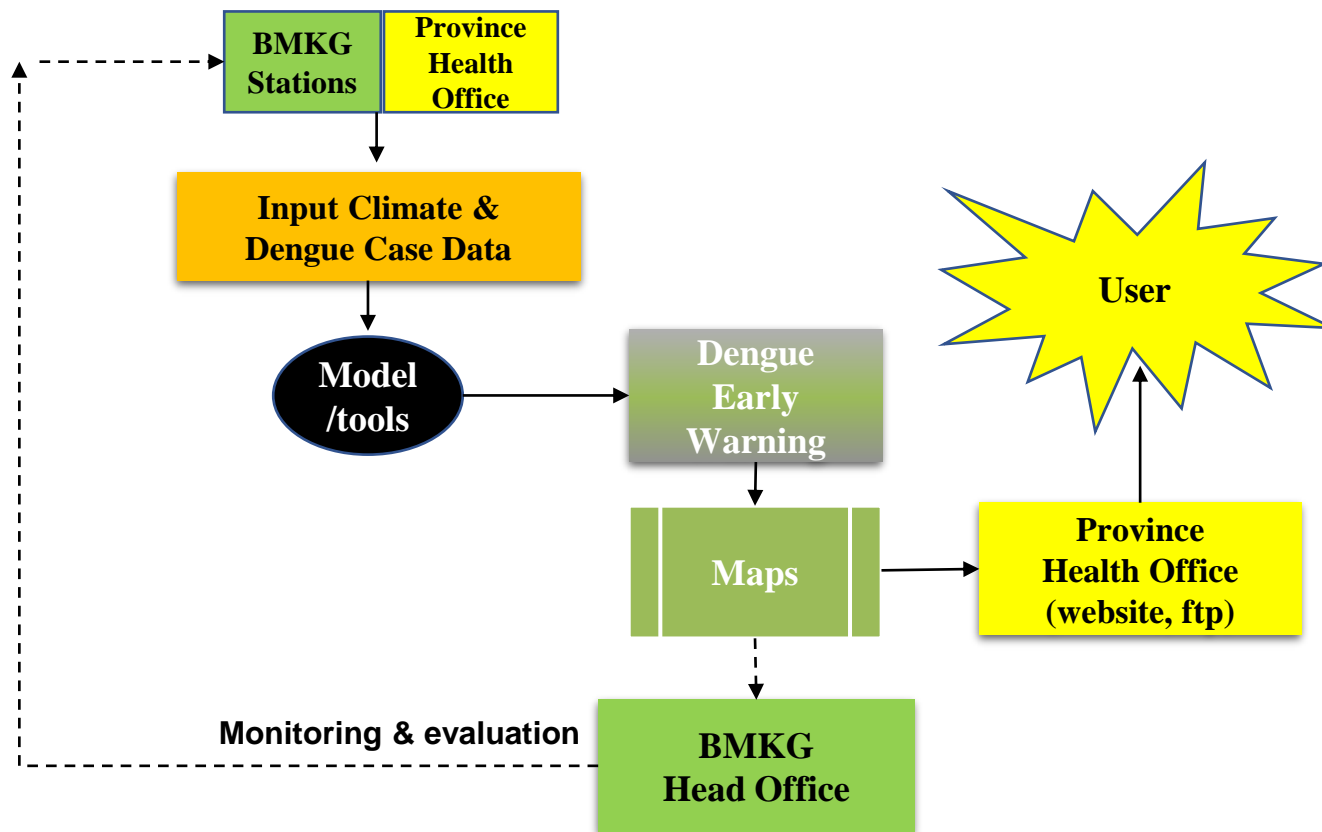
30 January 2019

Launching of climate-based dengue fever early warning products (DBDKLim) by the Governor of DKI Jakarta at City Hall along with other health products (e-jiwa and Jaktrack)



# CLIMATE SERVICE IN THE HEALTH SECTOR

## OPERATIONAL PROCEDURE CLIMATE-BASED



Center for Applied Climate Information – Deputy Climatology

# CLIMATE SERVICE IN THE HEALTH SECTOR

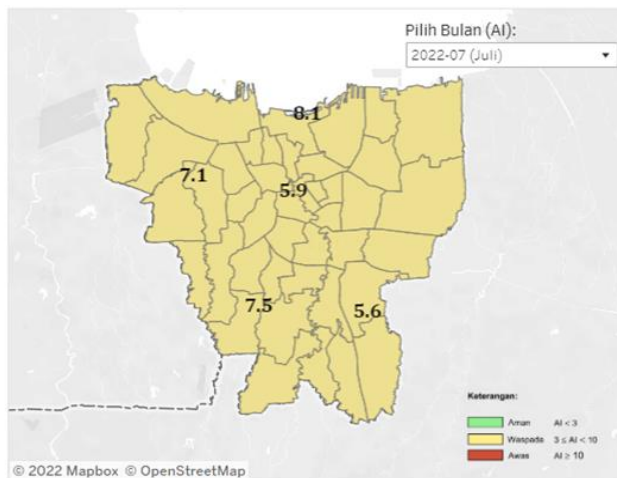
## EARLY WARNING DISSEMINATION

### PERINGATAN DINI DEMAM BERDARAH DENGUE WILAYAH DKI JAKARTA [Update: 18 Juli 2022]

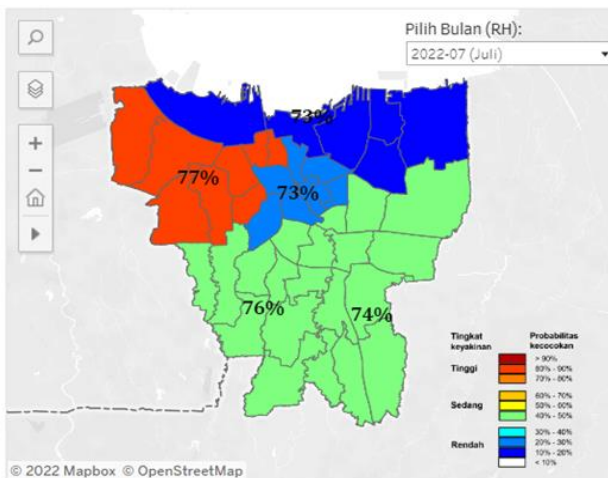
Hasil kolaborasi dari :



#### Prediksi Angka Insiden DBD [Bulanan]



#### Prediksi Kesesuaian Iklim untuk DBD [Bulanan]



Keterangan Angka Insiden : Aman (AI < 3) Waspada (3 ≤ AI < 10) Awas (AI ≥ 10)

Probabilitas Kecocokan : < 10 % 10 - 20 % 20 - 30 % 30 - 40 % 40 - 50 % 50 - 60 % 60 - 70 % 70 - 80 % 80 - 90 % > 90 %

Peringatan Dini Kekeringan Meteorologis

Peringatan Dini Curah Hujan Tinggi

Prakiraan Musim Kemarau

Prakiraan Musim Hujan

Prakiraan Curah Hujan

Monitoring Hari Tanpa Hujan

Perkembangan ENSO dan IOD

Indeks Presipitasi Terstandarisasi

Prakiraan Daerah Potensi Banjir Bulanan

Prakiraan Daerah Potensi Banjir Dasarian

Informasi Potensi Energi Surya Stasiun

Informasi Potensi Energi Surya Spasial

Prakiraan Potensi Energi Surya

Analisis Ketersediaan Air Bagi Tanaman

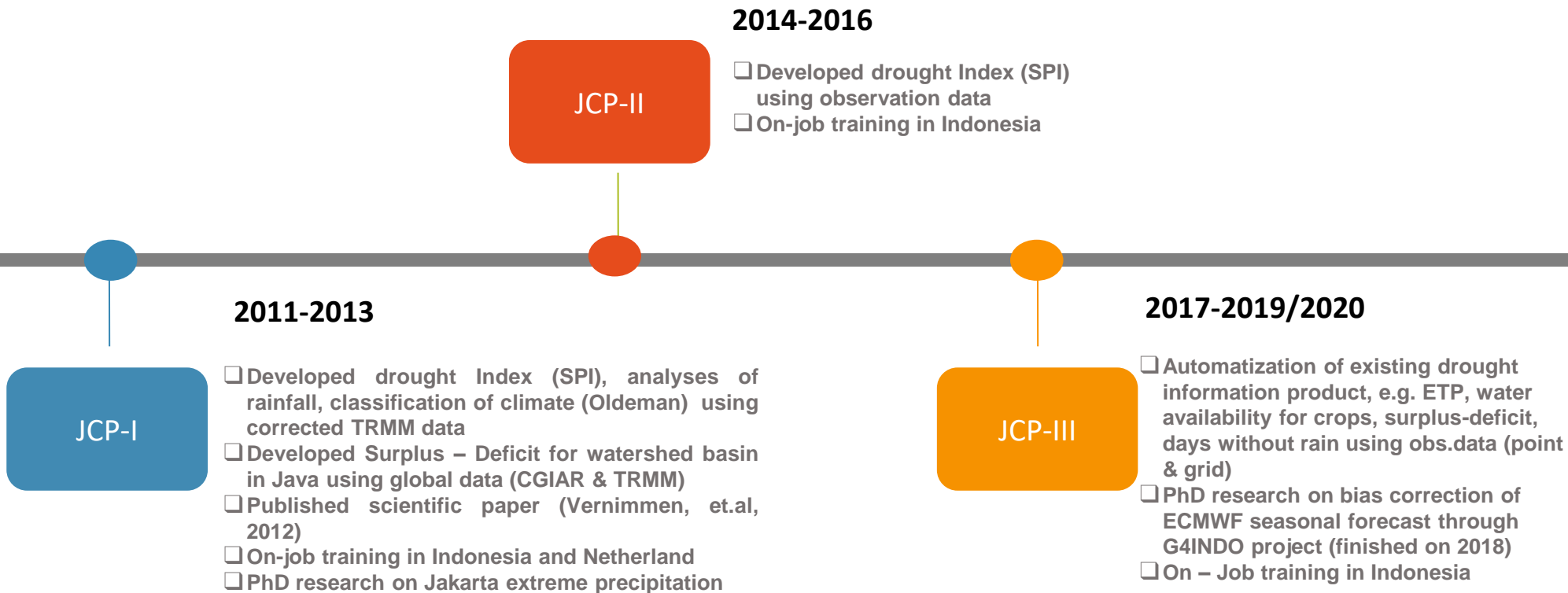
Prakiraan Ketersediaan Air Bagi Tanaman

Prediksi Indeks Potensi Karhutla

\*)can be accessed at <https://iklim.bmkg.go.id/>

# CLIMATE SERVICE IN THE WATER SECTOR

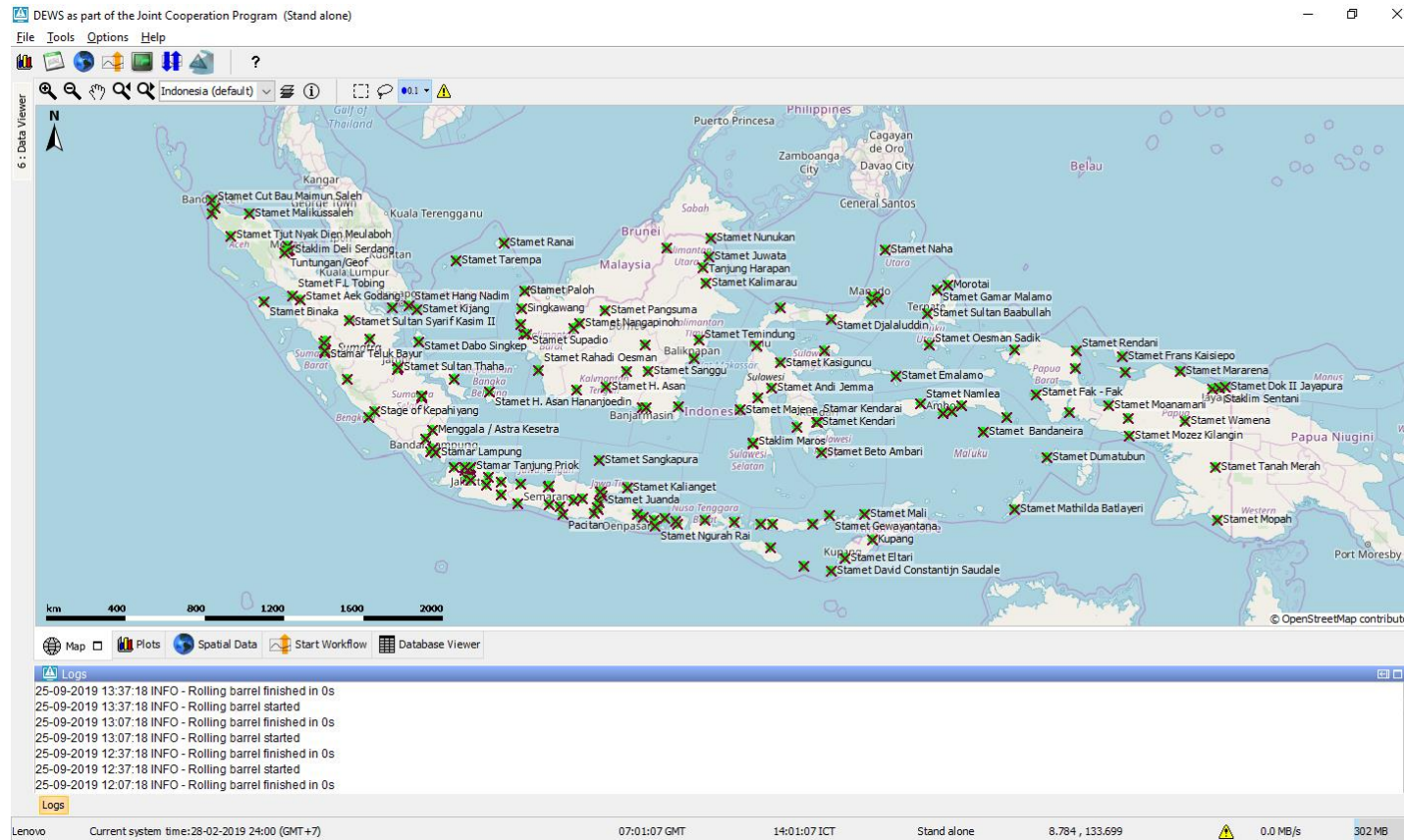
## OVERVIEW DEVELOPMENT OF DEWS THROUGH JCP



*\*Vernimmen, R. R. E., Hooijer, A., Mamenun, Aldrian, E., and van Dijk, A. I. J. M.: Evaluation and bias correction of satellite rainfall data for drought monitoring in Indonesia, Hydrol. Earth Syst. Sci., 16, 133-146, doi:10.5194/hess-16-133-2012, 2012.*

# CLIMATE SERVICE IN THE WATER SECTOR

## OVERVIEW DEVELOPMENT OF DEWS THROUGH JCP



**Drought Early Warning System (DEWS)** is a technology for monitoring and early warning of possible meteorological drought events and the affected areas in Indonesia.

DEWS produces meteorological drought parameters such as potential evapotranspiration maps, water availability for plants, and Standardized Precipitation Index.

# CLIMATE SERVICE IN THE WATER SECTOR

## WATER AVAILABILITY OR PLANTS

### Water Availability Prediction

PRAKIRAAN TINGKAT KETERSEDIAAN AIR TANAH BAGI TANAMAN  
BULAN AGUSTUS, SEPTEMBER, DAN OKTOBER 2022  
[Pemutakhiran: 15 Juli 2022]

### Water Availability Information July 2022

TINGKAT KETERSEDIAAN AIR BAGI TANAMAN - BULAN JULI 2022  
[Pemutakhiran : 10 Agustus 2022]



\*can be accessed at <https://iklim.bmkg.go.id/>



# THE BENEFITS OF WEATHER AND CLIMATE INFORMATION TO SUPPORT FISHERIES ACTIVITIES

**Safety for fishermen** during extreme weather conditions such as heavy rain, lightning, strong winds, high waves, fog.

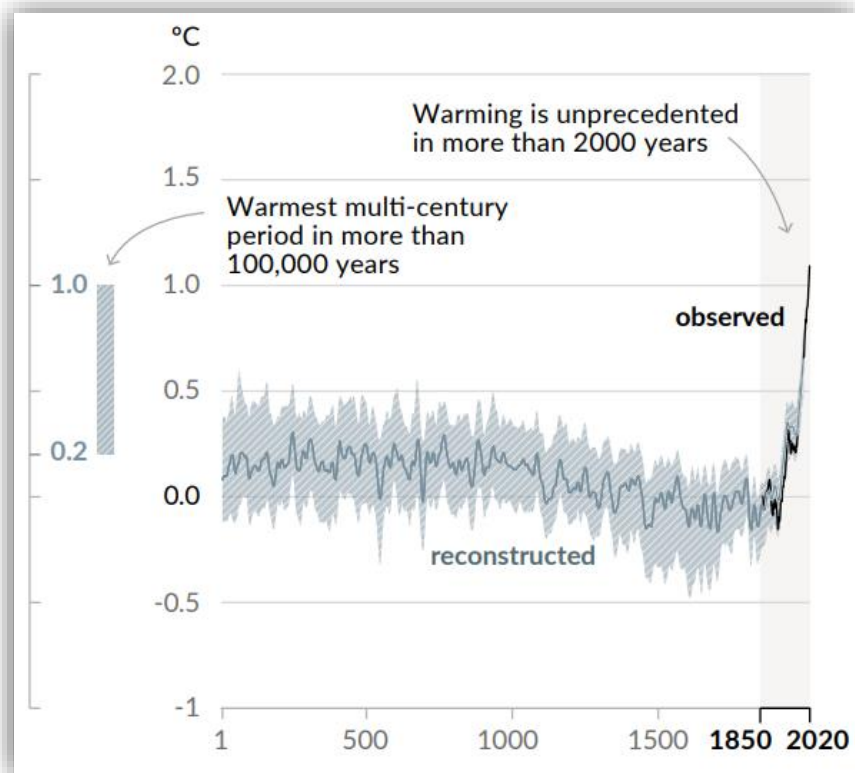
**Predict** the behavior, abundance, distribution and migration through weather information such as solar radiation, wind, rainfall.

**Forecast** the location of the fish through information on ocean currents, sea surface temperature, solar radiation.

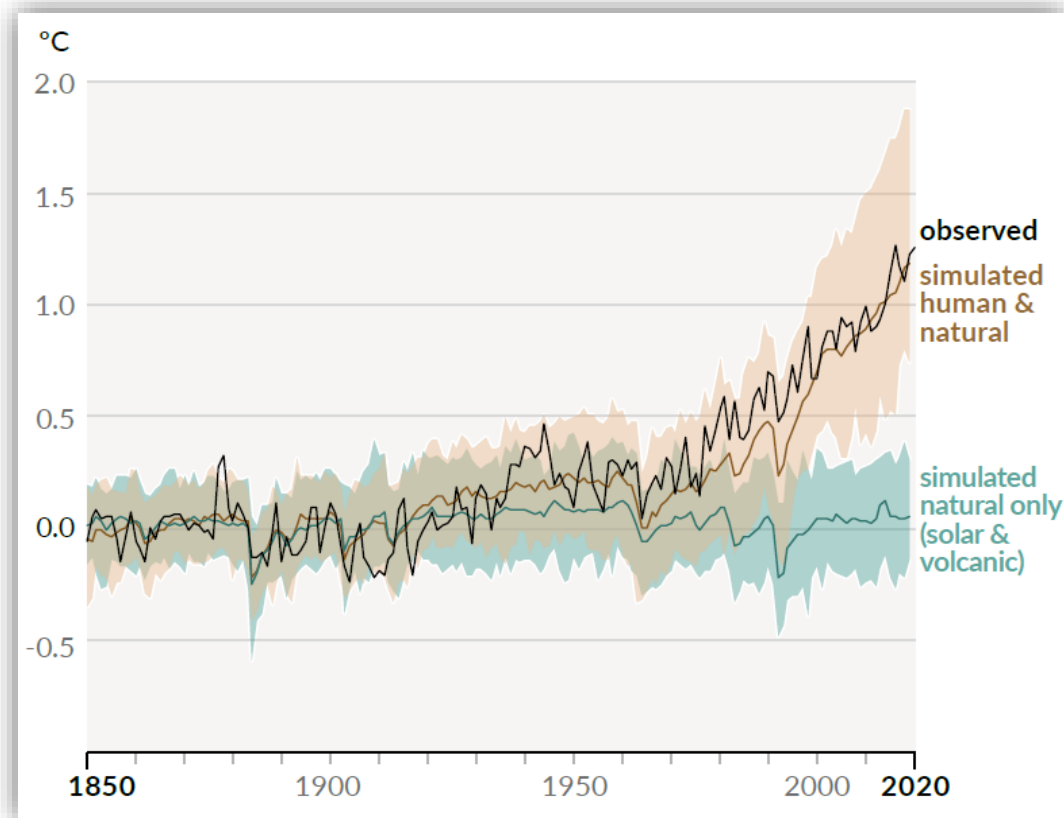
**Forecast ocean conditions** (wave, currents, upwelling, downwelling) through wind information, sea surface temperature, El Nino, La Nina.

**Forecast fish potential area** through climate information such as dry season, rainy season, El Nino, La Nina.

# CHANGES IN GLOBAL SURFACE TEMPERATURE RELATIVE TO 1850–1900



Change in global surface temperature (decadal average) as reconstructed (1–2000) and observed (1850–2020)

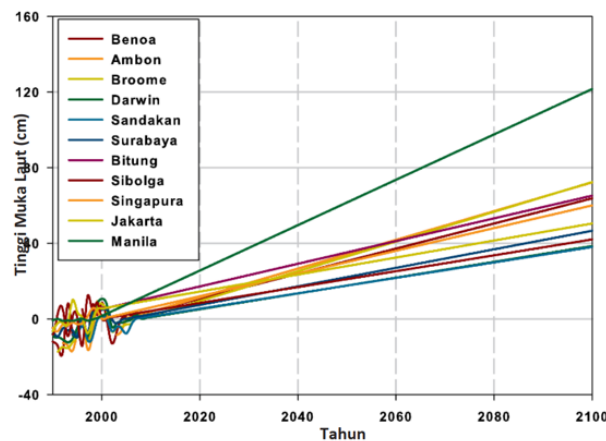
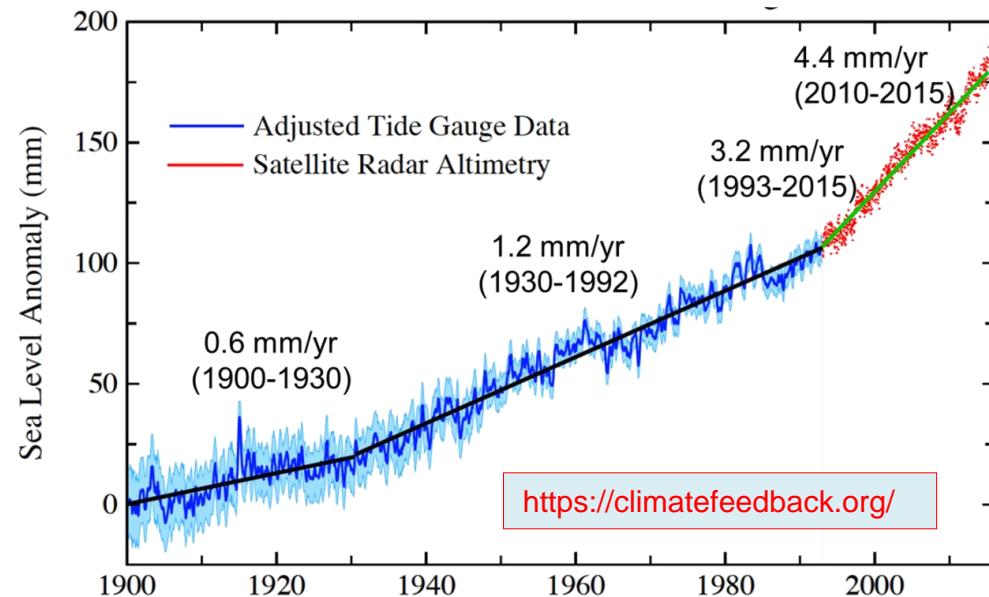
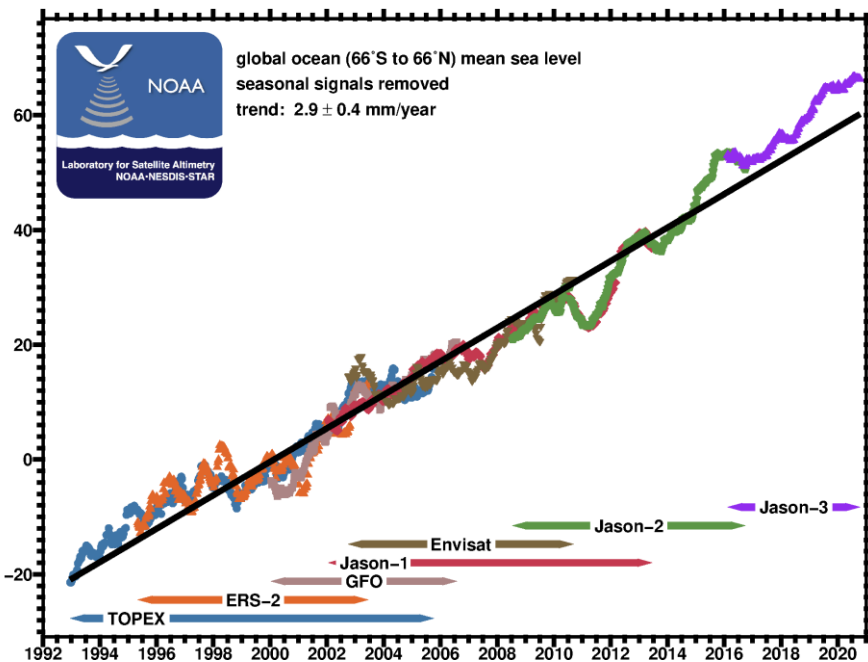


Change in global surface temperature (annual average) as observed and simulated using human & natural and only natural factors (both 1850–2020)



# SEA LEVEL RISE

Change in mean sea level [mm]

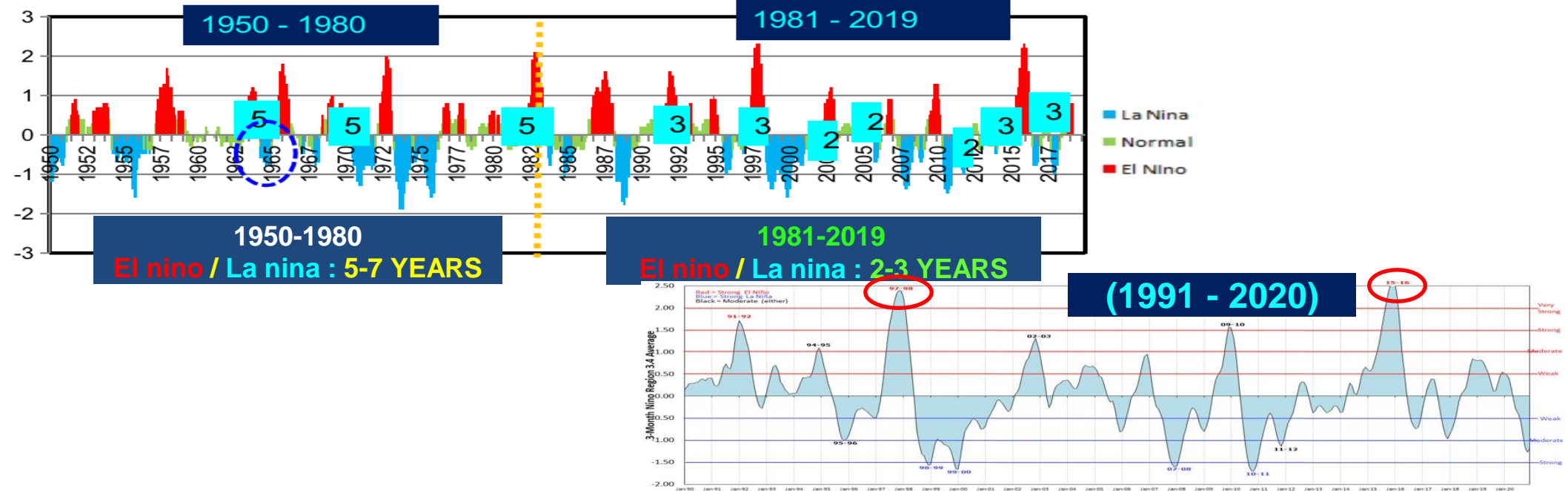


- ❑ Prediction using UHSLC tidal data (ICCSR, 2010)
- ❑ Trend : 0.7 - 0.8 cm/year
- ❑ Projection 2000:
  - 2030:  $24 \pm 16$  cm
  - 2100:  $80 \pm 40$  cm

[https://www.star.nesdis.noaa.gov/socd/lisa/SeaLevelRise/LSA\\_SLR\\_time\\_series\\_global.php](https://www.star.nesdis.noaa.gov/socd/lisa/SeaLevelRise/LSA_SLR_time_series_global.php)

Kajian Ulang RAN API: Kajian Basis Ilmiah Proyeksi Iklim Laut, Bappenas 2018

# MORE FREQUENT EVENTS OF LA NINA – EL NINO



- Statistically, the return period for El Niño / La Niña in the 1981-2019 period has a tendency to recur more quickly than the 1950-1980 period.
- The percentage of La Niña events followed by EL Niño is 16.7%, Special for El Niño - La Niña - El Niño events is only 1.5% (it happened in 1963-64-65).

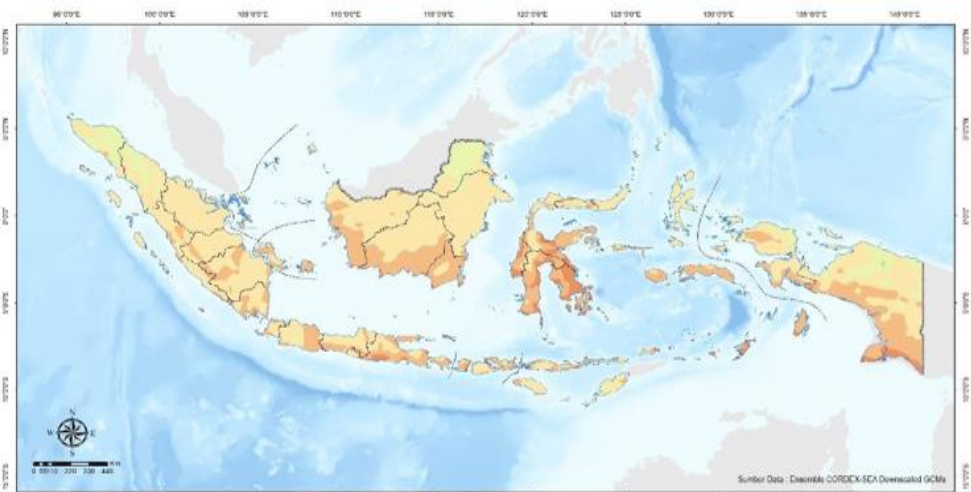
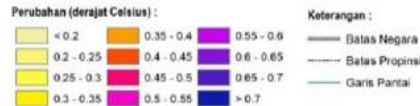
# CLIMATE PROJECTION TO THE YEAR OF 2030 TEMPERATURE AND HUMIDITY CHANGE

## HOW ARE THE DRY SEASONS IN THE FUTURE?

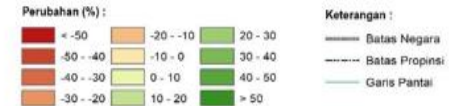
Baseline 2006 - 2016: current climatic conditions as a starting point for adaptation action plans



PROYEKSI PERUBAHAN  
SUHU RATA-RATA TAHUNAN  
PERIODE 2020-2030 TERHADAP 2006-2016  
SKENARIO RCP8.5



PROYEKSI PERUBAHAN  
CURAH HUJAN MUSIMAN  
PERIODE 2020-2030 TERHADAP 2006-2016  
JUNI-JULI-AGUSTUS  
SKENARIO RCP8.5



Air temperature is projected to increase by 0.5 C in the next 10 years (left). Rainfall in the dry season is projected to decrease by around 20% (right).

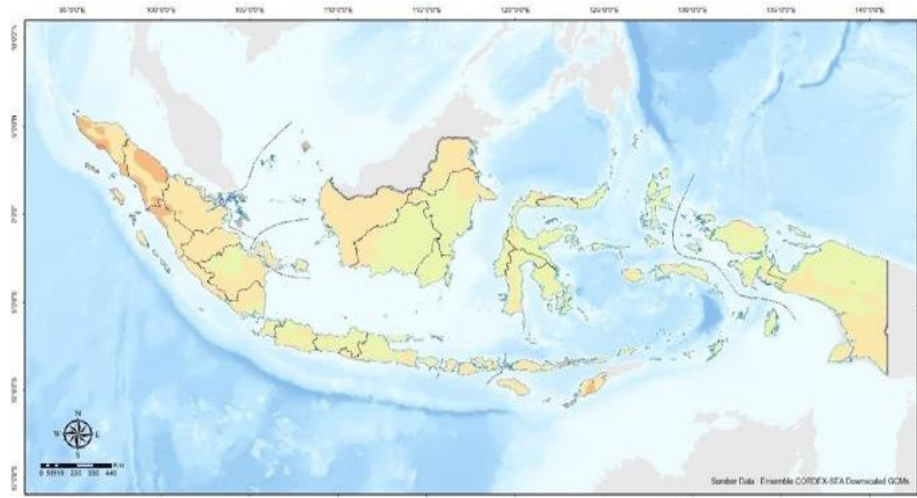


**The dry season in the future will be hotter and drier**

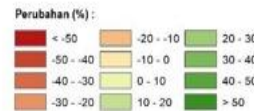
# CLIMATE PROJECTION TO THE YEAR OF 2030 RAIN CHARACTERISTIC CHANGE

## HOW ARE THE FUTURE RAIN SEASONS?

Baseline 2006 - 2016: *current climatic conditions as a starting point for adaptation action plans*

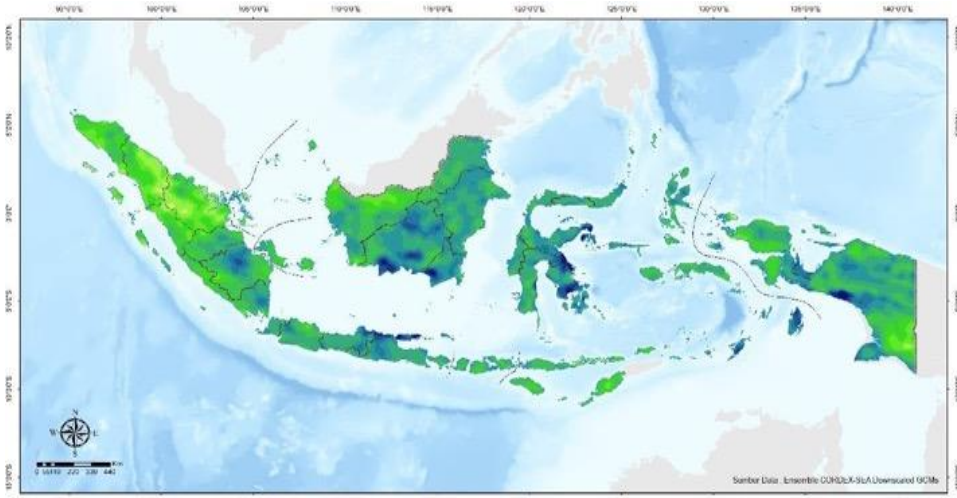


PROYEKSI PERUBAHAN  
CURAH HUJAN MUSIMAN  
PERIODE 2020-2030 TERHADAP 2006-2016  
DESEMBER-JANUARI-FEBRUARI  
SKENARIO RCP8.5

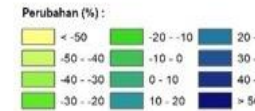


Keterangan :

- Batas Negara
- Batas Propinsi
- Garis Pantai



PROYEKSI PERUBAHAN  
HARI HUJAN LEBAT ( >50mm / hari )  
PERIODE 2020-2030 TERHADAP 2006-2016  
DESEMBER-JANUARI-FEBRUARI  
SKENARIO RCP8.5



Keterangan :

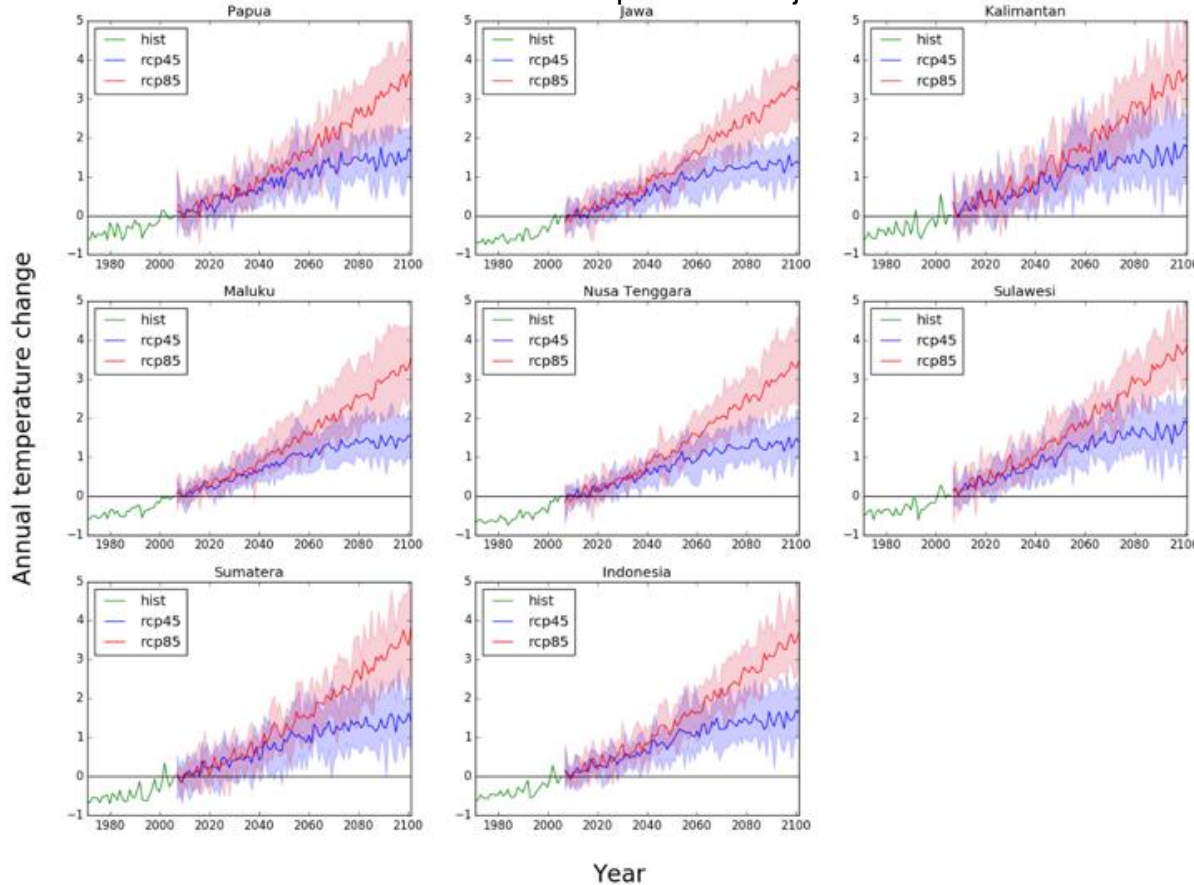
- Batas Negara
- Batas Propinsi
- Garis Pantai

The amount of rainfall in the rainy season period did not change much (left), but the number of days of heavy rain increased (right) → **potency of hydrometeorological disasters are increasing.**



# CLIMATE PROJECTION TO THE YEAR OF 2100 TEMPERATURE CHANGE

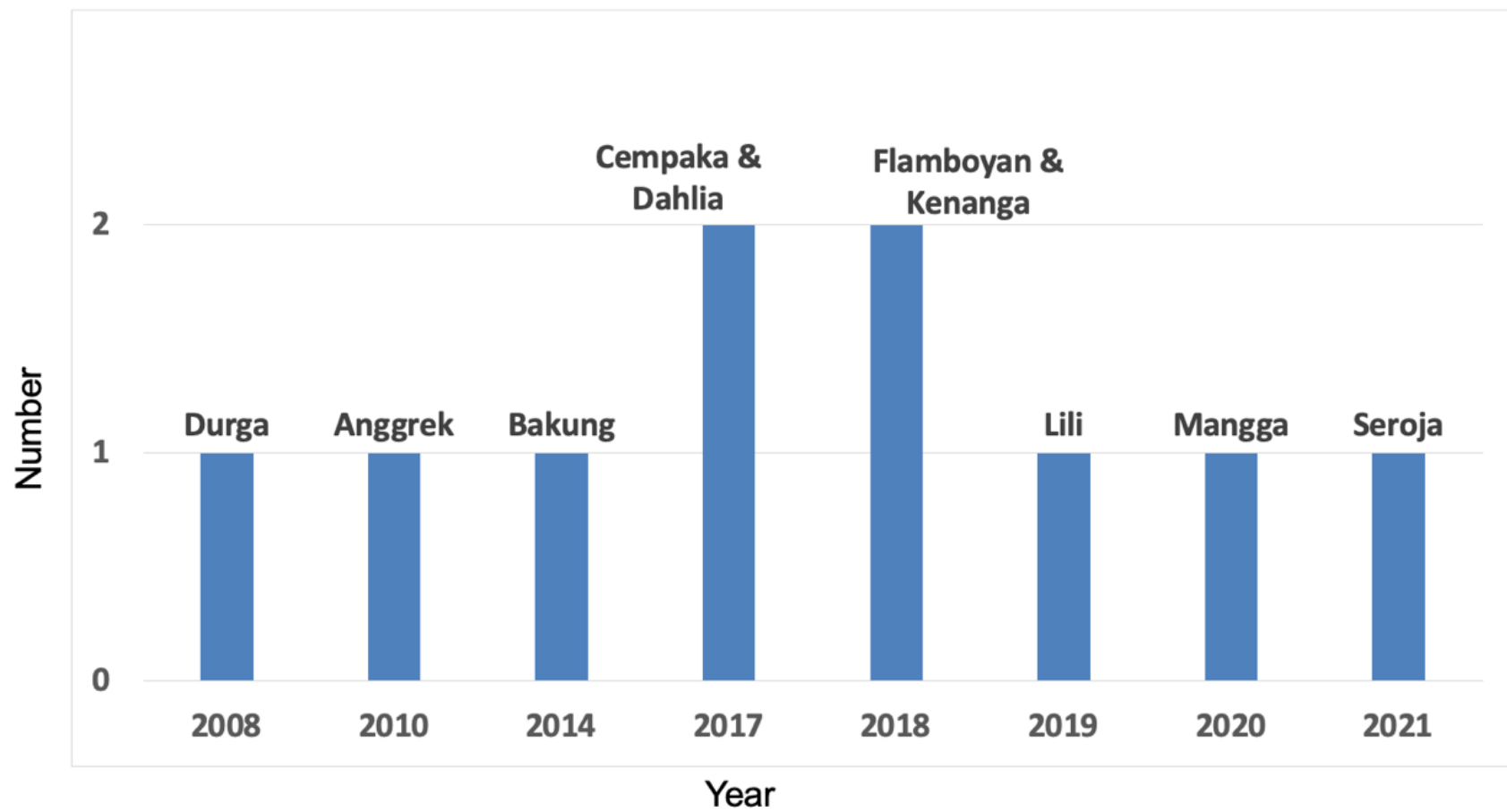
Maximum Temperature Projection



The impact of global climate change will also be felt in Indonesia (illustration on the main islands):

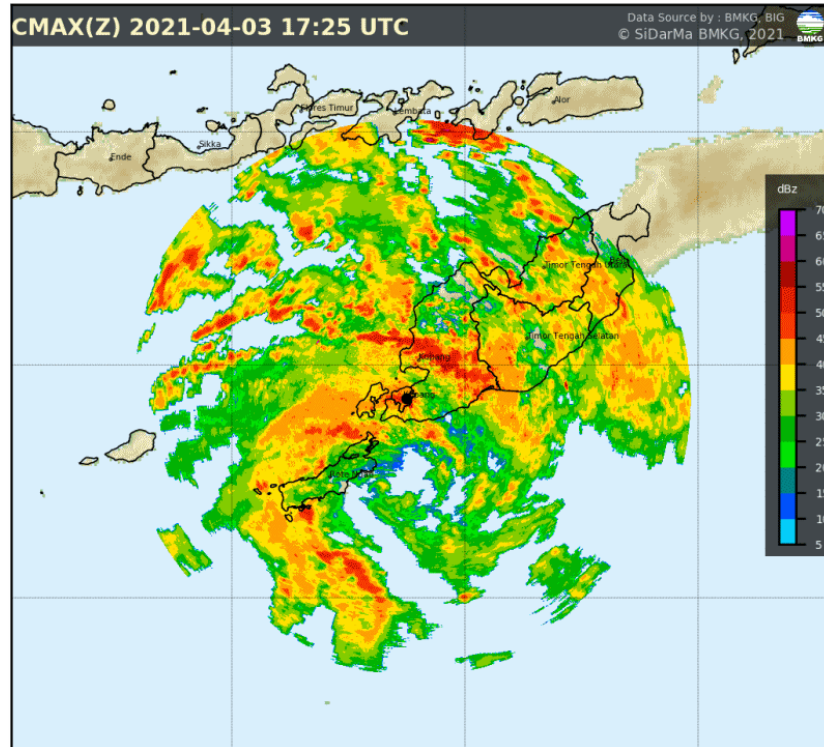
- The temperature continues to rise until the end of the 21st century.
- Blue Curve: if greenhouse gas emissions can be minimized then the temperature rise curve (will slope towards 2100).
- Red Curve: The temperature rise will be higher if greenhouse gas emissions are not controlled.
- Every region in Indonesia will experience a significant increase in temperature at the end of the century.

# MORE FREQUENT TROPICAL CYCLONE EVENTS

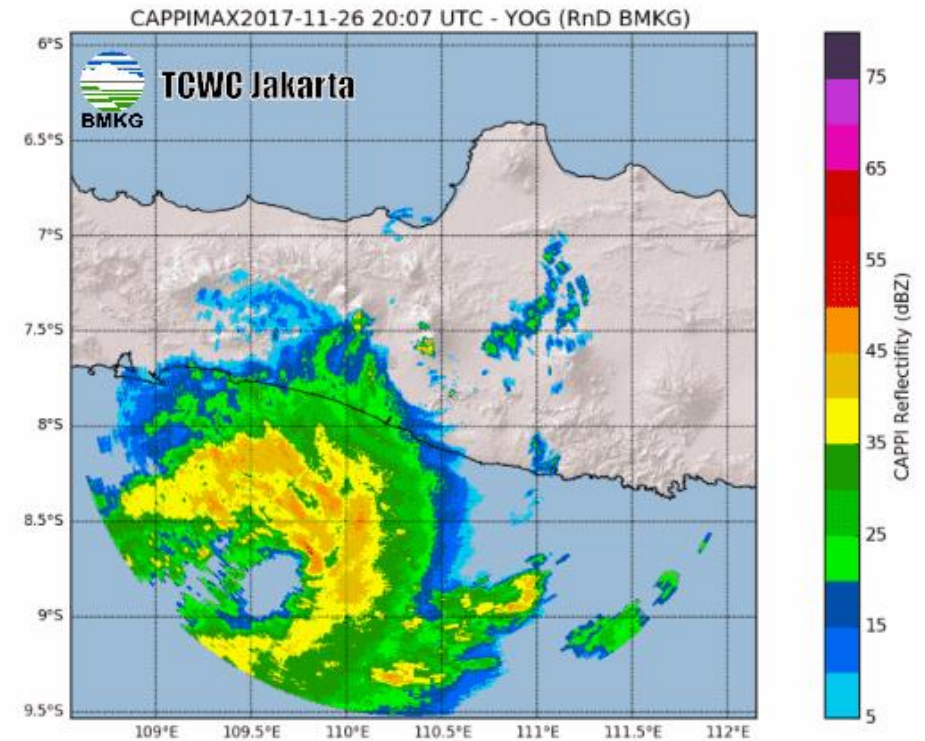


# MORE FREQUENT TROPICAL CYCLONE EVENTS

## EXAMPLE : CEMPAKA & DAHLIA (2017), SEROJA (2021)



TC SEROJA  
04 April 2021 time 18.00 UTC  
or 05 April 2021, 01.00 WIB

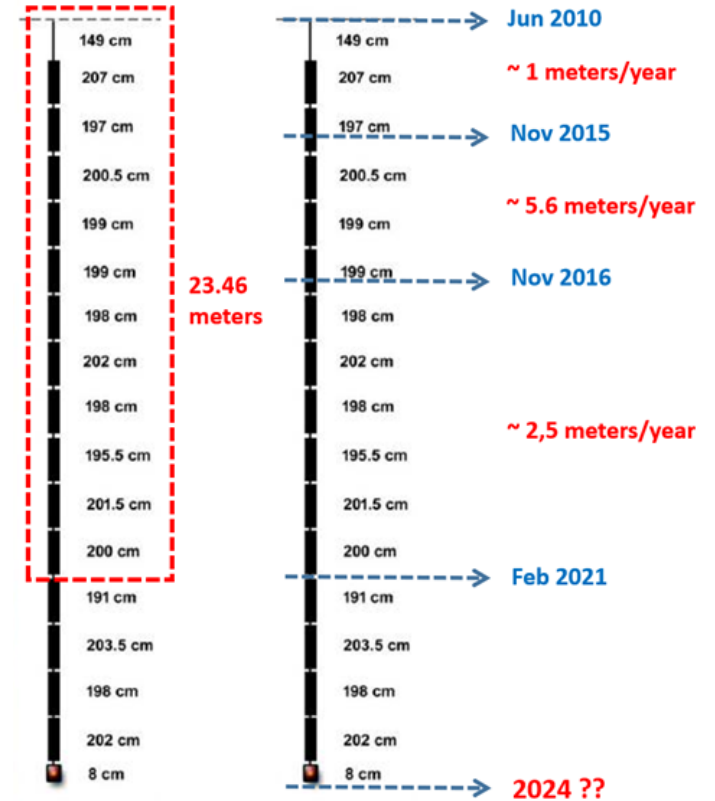
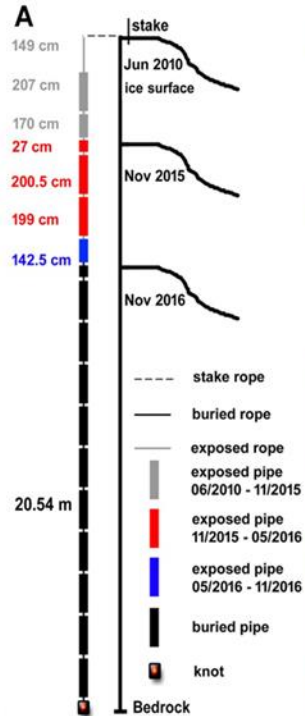


TC CEMPAKA  
26 November 2017 time 21.00 UTC  
or 27 November 2021, 04.00 WIB

generated by IRIS-BMKG

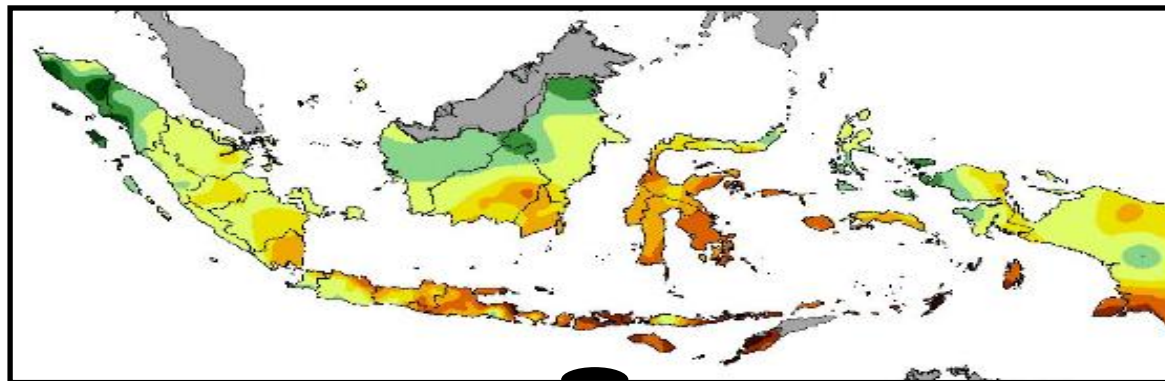


# ICE THICKNESS REDUCTION IN PAPUA, INDONESIA



Permana et al (2019)

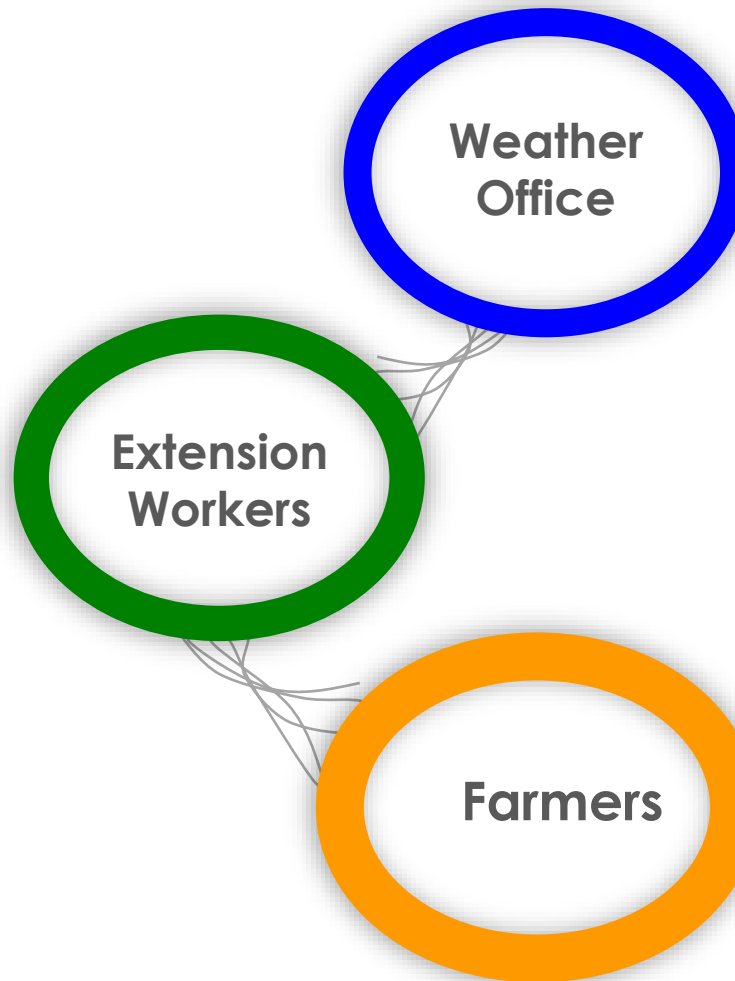
# CLIMATE FIELD SCHOOL: TRANSLATE TECHNICAL TERMS TO PRACTICAL LANGUAGE



# CLIMATE INFORMATION LITERACY FOR FARMER

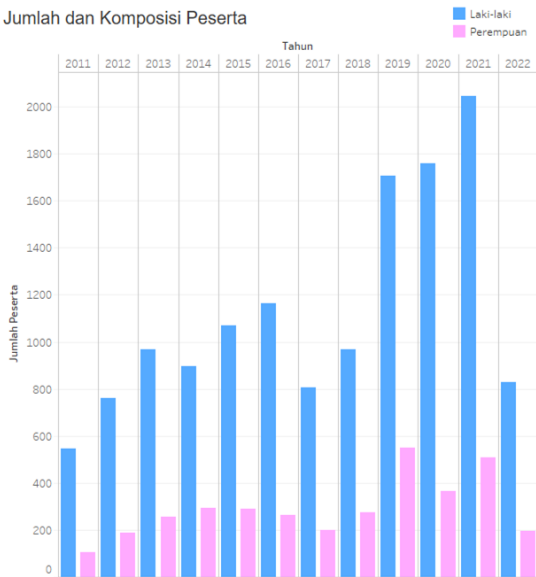
## Climate Field School

- Bridging climate information from Weather Office as a provider to translate climate information into a language that is easier for farmers to understand as end users.
- To adapt with extreme climates and climate change through the adjustment of strategies and appropriate cropping patterns to the climatic conditions in their respective regions.
- To encourage independent agribusiness by farmers, where climate information is a primary input for the strategy and policy-making process.

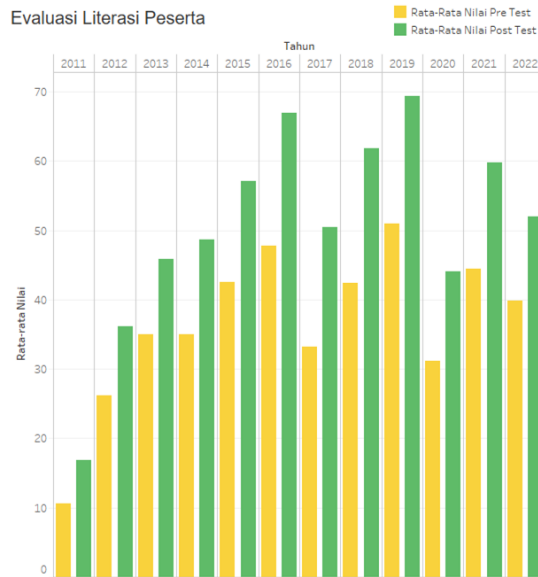


# CLIMATE FIELD SCHOOL: PARTICIPANTS AND PRODUCTIVITY

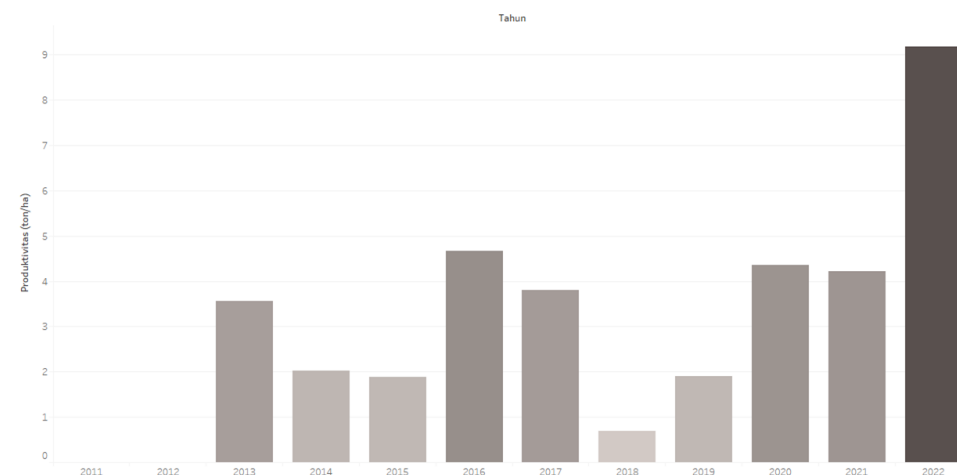
Jumlah dan Komposisi Peserta



Evaluasi Literasi Peserta



Produktivitas Rata-rata

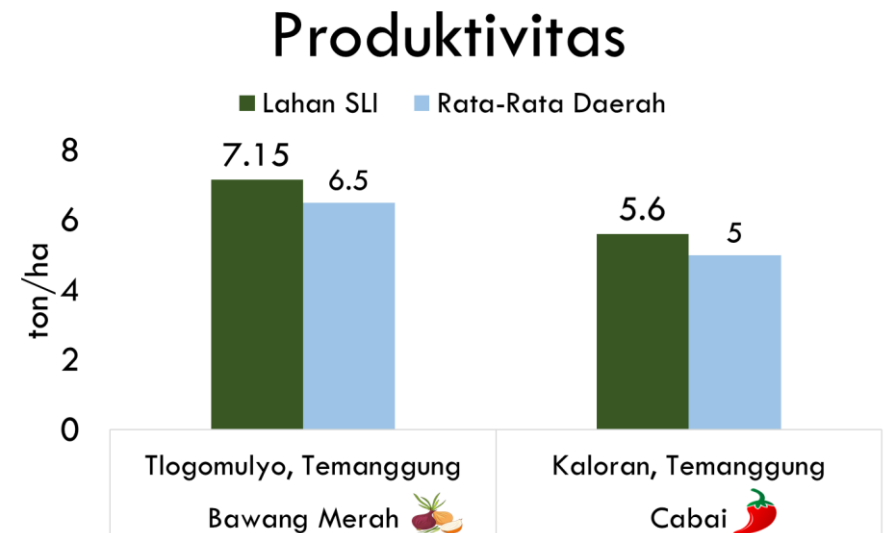


\*)can be accessed at <https://iklim.bmkg.go.id/SLI>

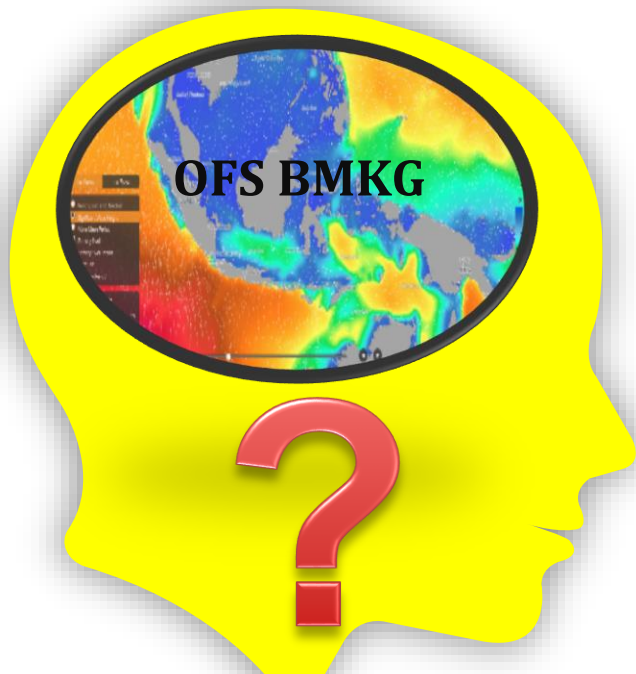




The yield of onions reached 7.15 tons/ha, at that time the price of onions soared due to heavy rains (extreme). The harvest achievement in the Climate Field School area was very satisfying because the farmers managed to minimize the impact of extreme climates that caused crop failure.



# ENHANCING OCEAN LITERACY THROUGH FFS



IMPROVED  
UNDERSTANDING OF  
OCEAN INFORMATION

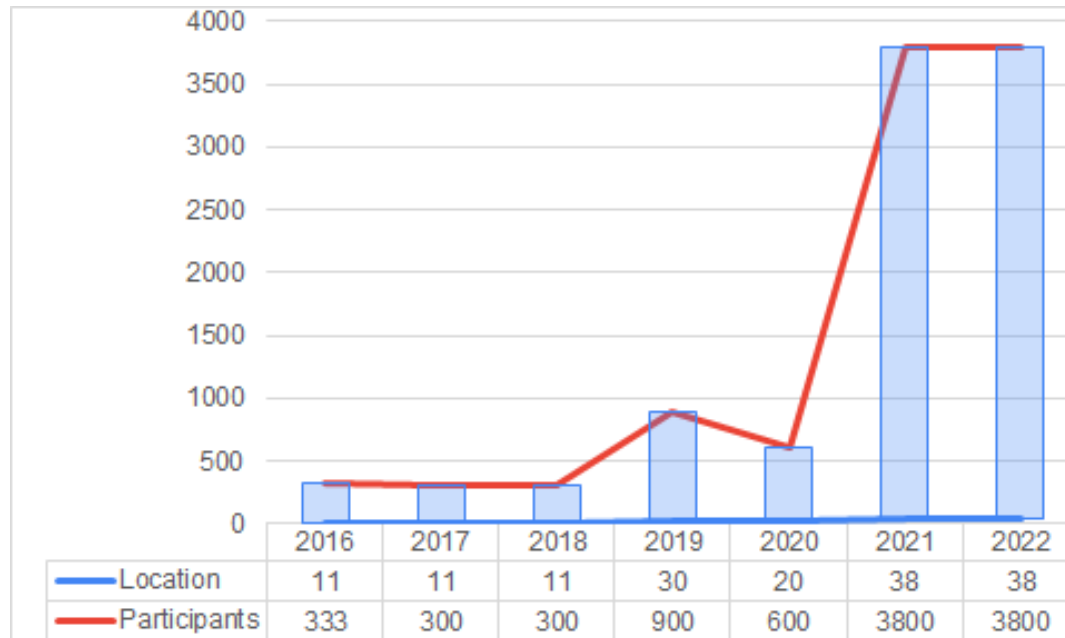
EASY ACCES  
TO WEATHER  
INFORMATION

ACCURACY AND  
COMPREHENSIVE  
OF WEATHER  
INFORMATION

OCEAN COMMUNITY  
FOR FISHERMEN  
AWARE MARINE  
WEATHER  
INFORMATION



# PARTICIPANTS AND LOCATIONS OF SLCN 2016 - 2022 ACTIVITIES

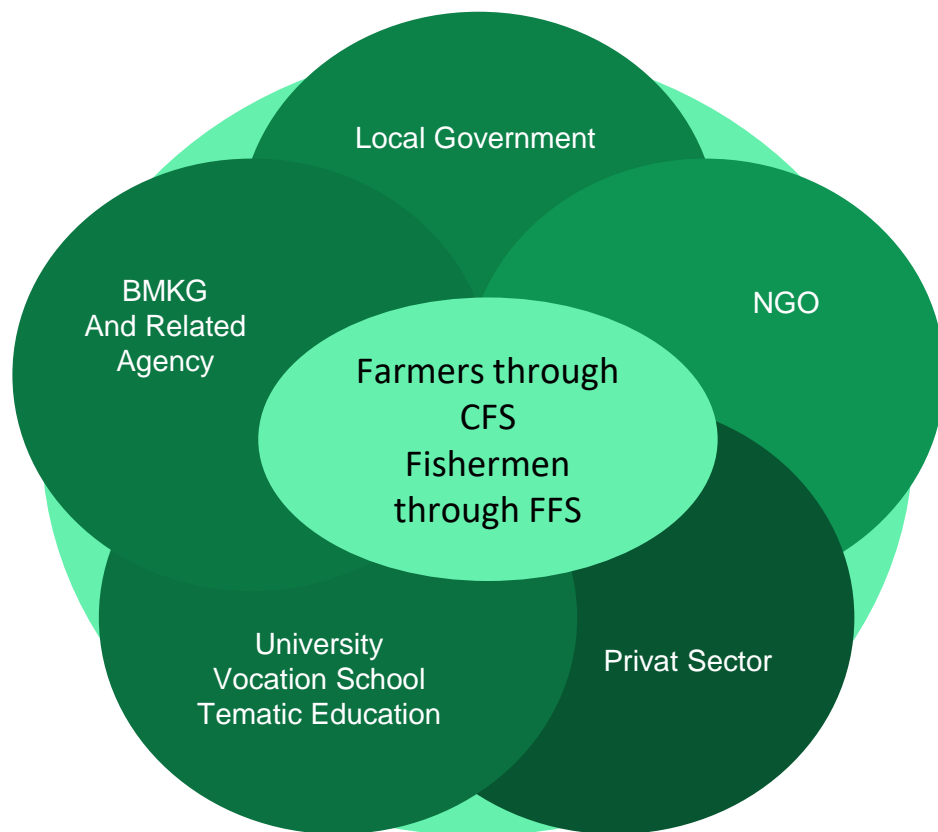


- Since 2016 - 2021 SLCN has been held in 121 locations spread across 33 provinces in Indonesia with a total of 10,033 participants.
- Starting in 2021, SLCN brings the operational concept to the field (fishermen participants) which aims to expand the reach of beneficiaries of SLCN activities.
- In 2022, SLCN will be held in 38 locations spread across 29 provinces.
- BMKG also collaborates with *Ocean Teacher Global Academy (OTGA)* in organizing other Ocean Literacy activities to support understanding of modeling and tsunami ready which participants from several countries in 2021.





# MULTI SECTOR ENDORSEMENT



→ Develop long term impact from CFS/FFS and have value all levels.

- Enhancement capacity and resources
- Collective – Collaboration
- Good Governance
- Inclusive and sustainable development
- Support from multi stakeholder
- Partnership and cooperation:
  - Public-private partnership
  - crowdfunding
  - Applicative implementation



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***THANK YOU***