The 5th Meeting of the Coordinating Group
of the RA II WIGOS Satellite Project
21 October 2017, Vladivostok city, Russky Island, Russia
Far Eastern Federal University

Weather Satellite Data Applications for Monitoring and Warning Hazard at BMKG

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BMKG

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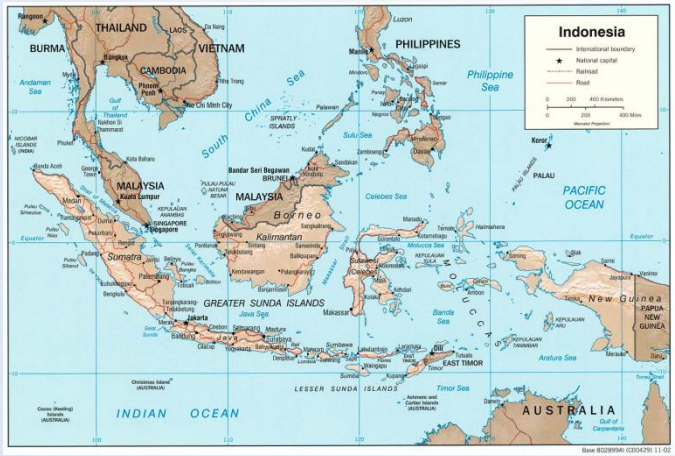
INTRODUCTION

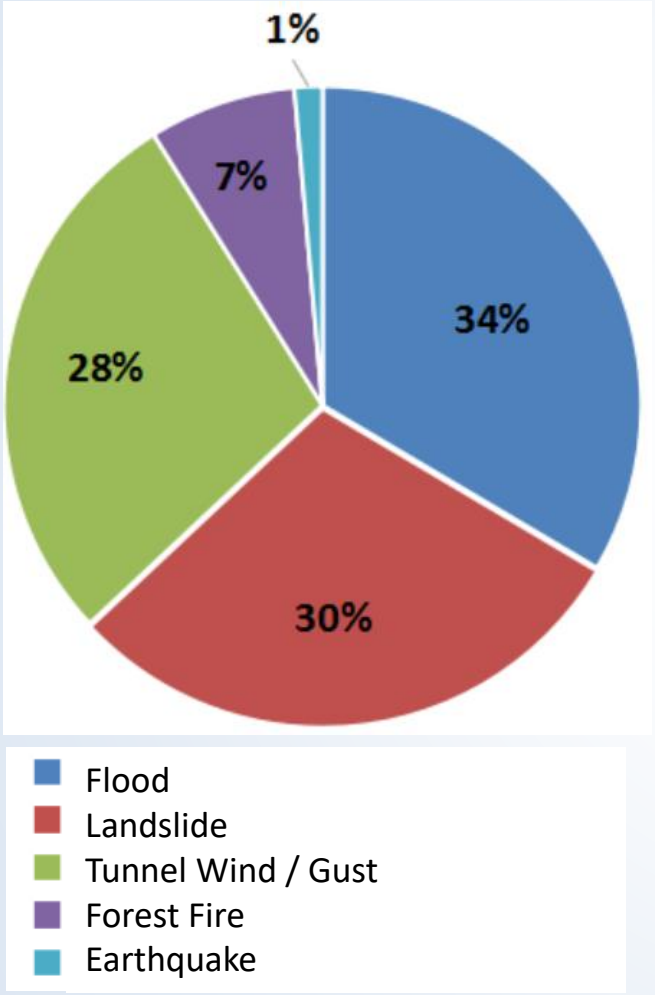
INDONESIA

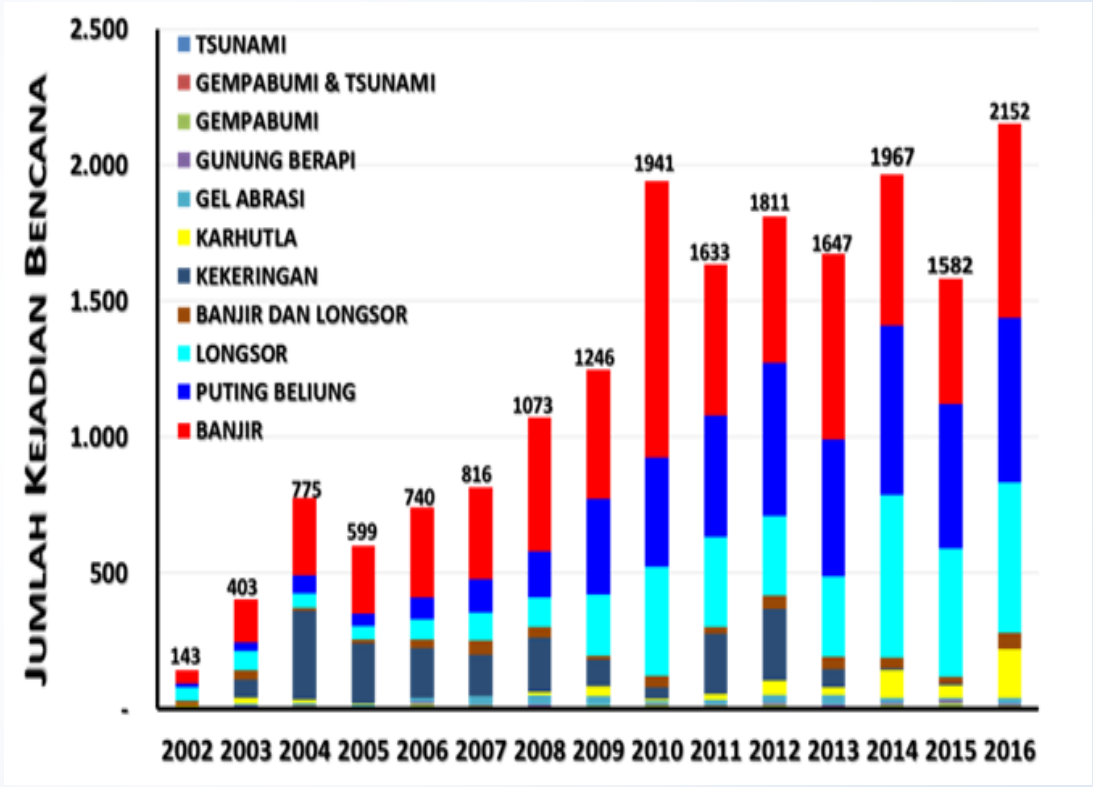


- Archipelagic country ~ 17,504 islands (10,000 small islands), right at the equatorial line;
- 4 M-km2 width of ocean and 2 M-km2 land, 6,000 km distance from east to west, and 80,000 km of coastal length;
- Flanked by 2 ocean (India and Pacific) and 2 continents (Australia and Asia);
- Lays above three plates moving on different speed of creeping ➔ prone to Earthquake and Tsunami;
- Exposed by 3 types of rain, 2 extreme weather on the east and west, more than 220 seasonal variation zone.

HYDRO-METEOROLOGICAL DISASTERS

Hydro Meteorological Hazards in Indonesia (2015-2016)





ECONOMIC SECTORS RELYING ON NMHSs

Agriculture

Fisheries

Alternative Energy

Transportation

Tourism

Mining

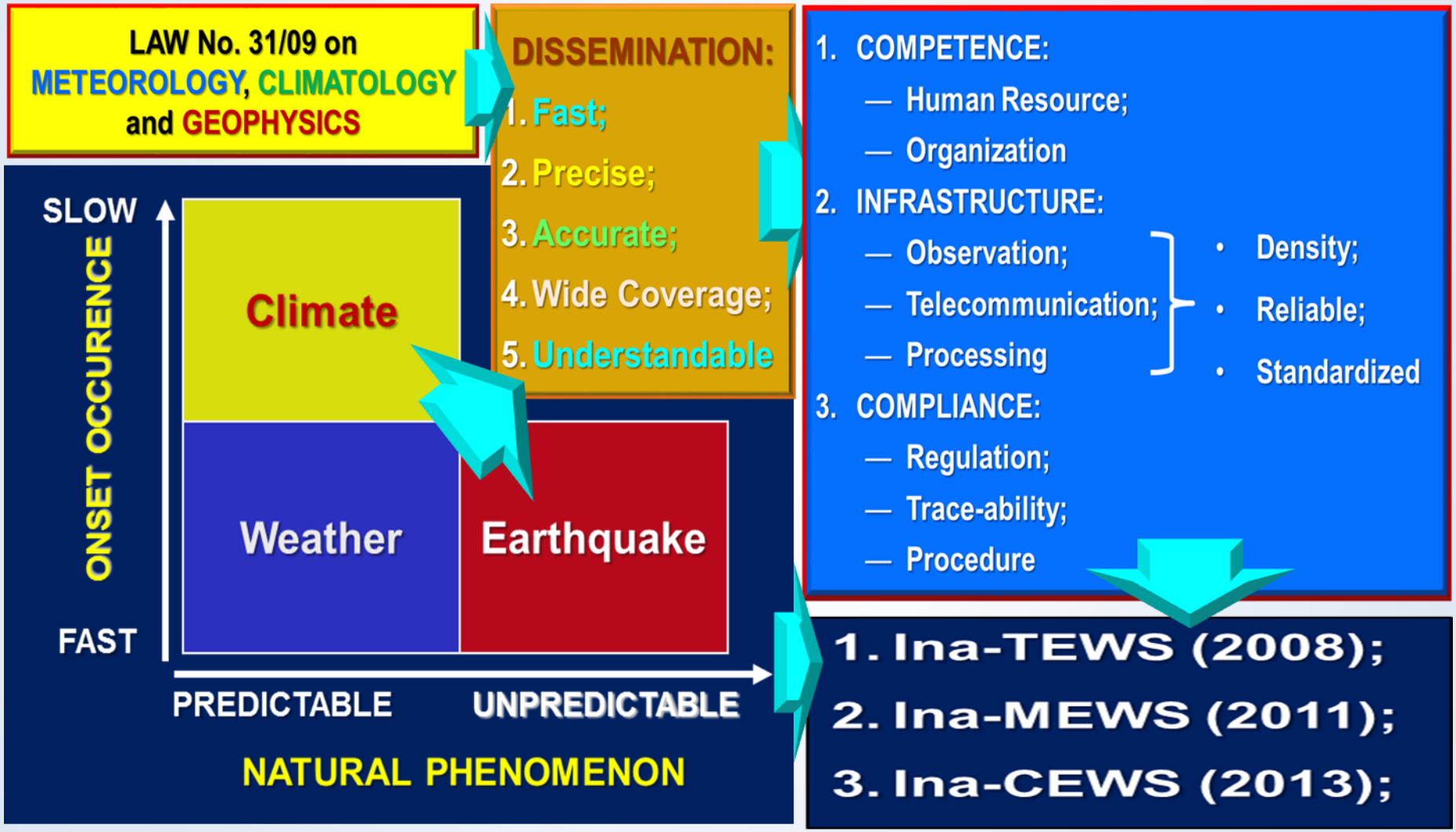
Forestry

Construction

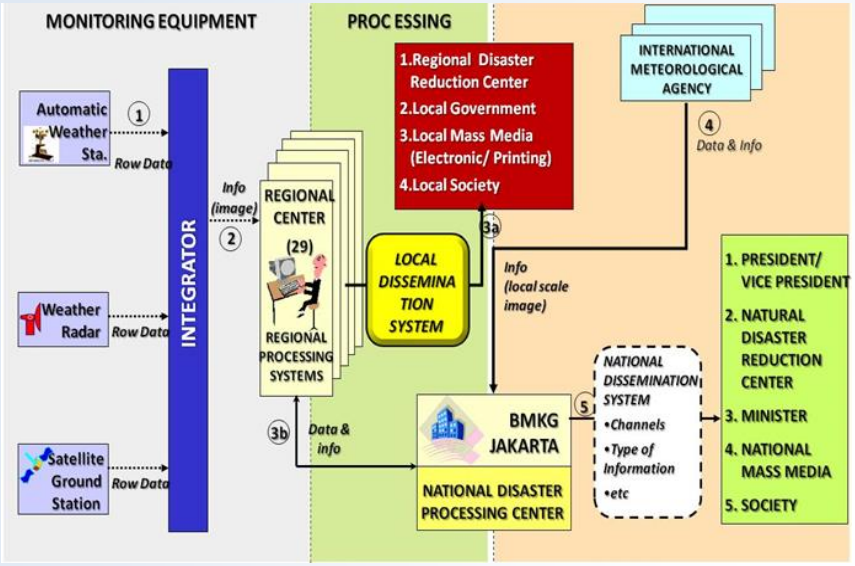
Farming

INDONESIA MULTI-HAZARD EARLY WARNING SYSTEMS

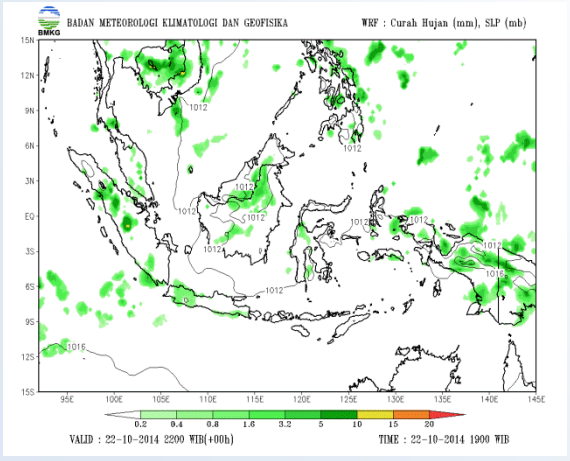
MANDATE OF BMKG

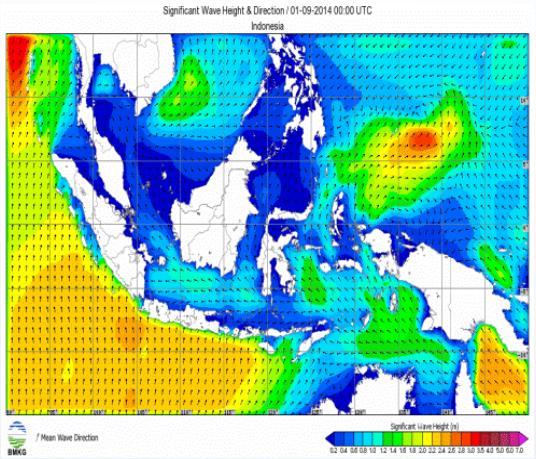


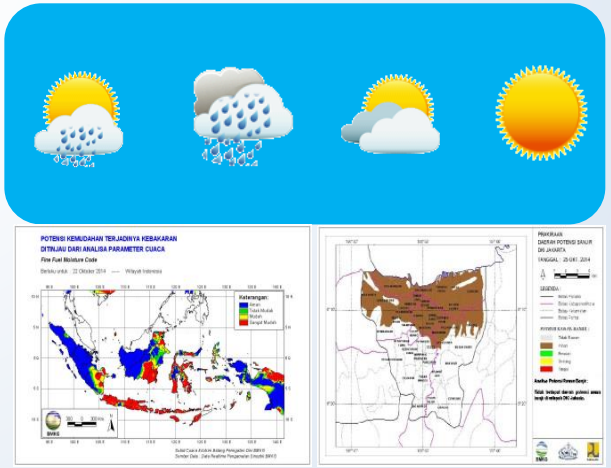
METEOROLOGICAL EARLY WARNING SYSTEM



- **Completed by 2011;**
- **Public Weather Service:**
  - Daily Weather Prediction;
  - Hevay Rain and Potential Flood;
  - Hot Spot and its Trajectory;
  - Fire Danger Rating System
- **Aviation;**
  - METAR, TAFOR, Aerodrome;
  - Volcanic Ash;
  - Extreme Wather
- **Marine;**
  - Wave Heights;
  - Weather Port

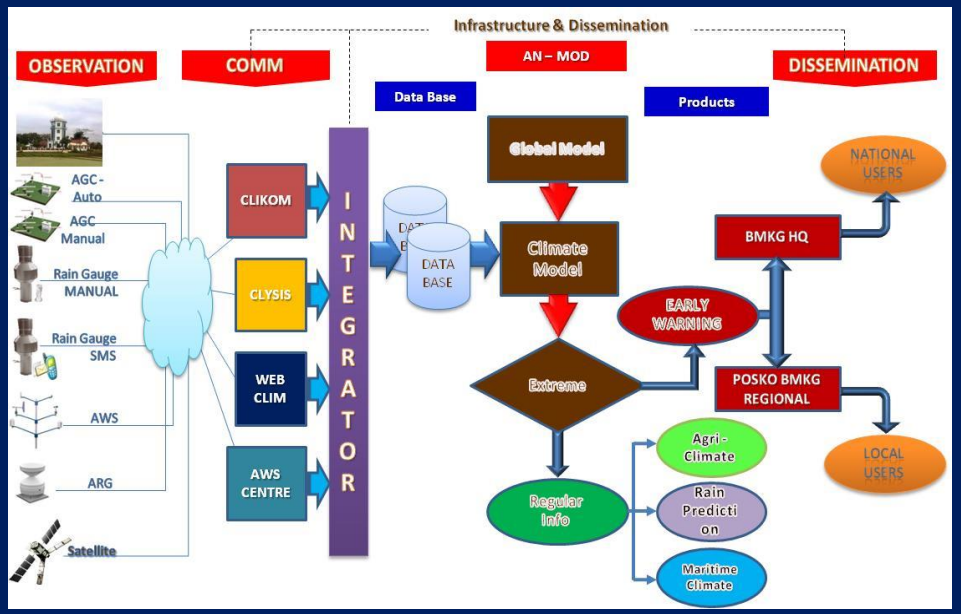




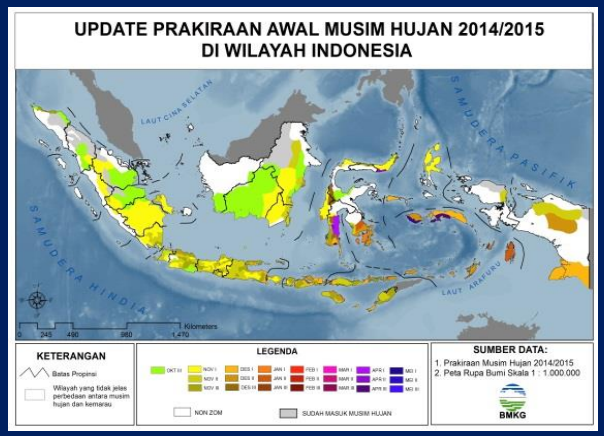


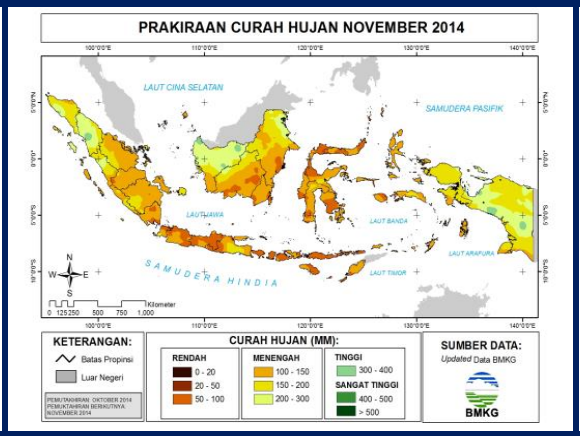
PUBLIC WEATHER AND CLIMATE SERVICES

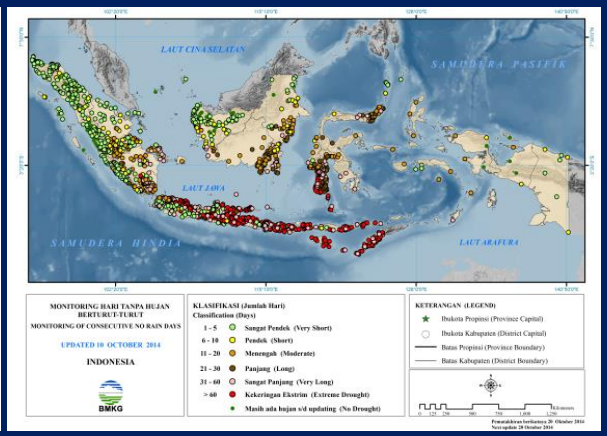
Climatological Early Warning System



- 2013;
- Focused on Extreme Climates →
  - Seasonal Onsets;
  - Atmospheric Dynamics;
  - Soil Water Contents;
  - Drought:
    - SPI;
    - Consecutive No-Rain Days;
  - ENSO and IOD, etc

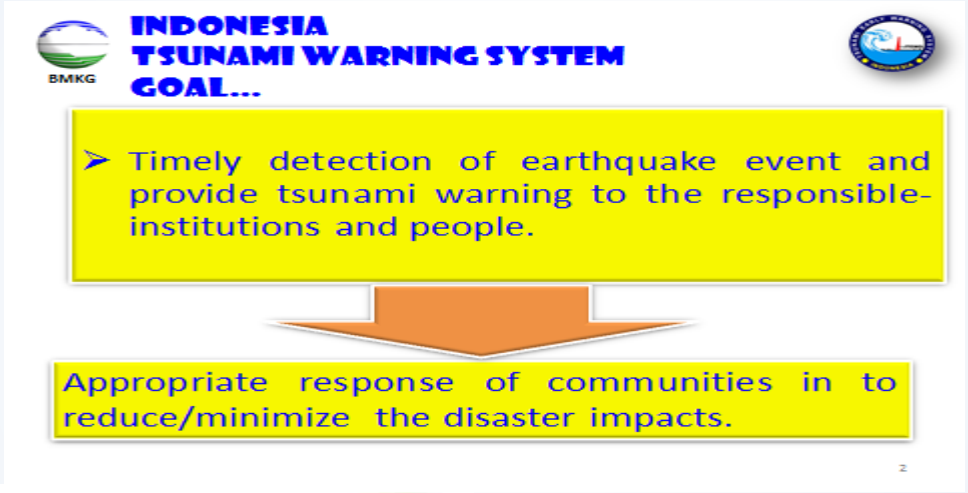


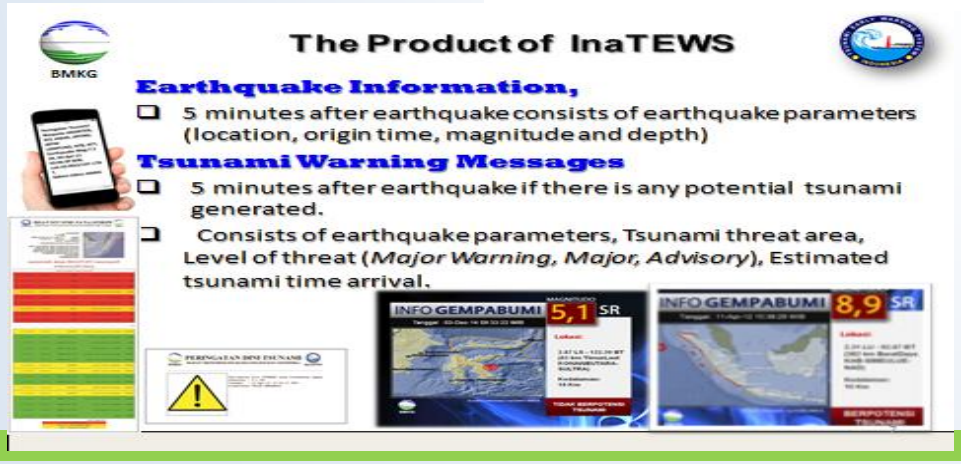




Tsunami Early Warning System

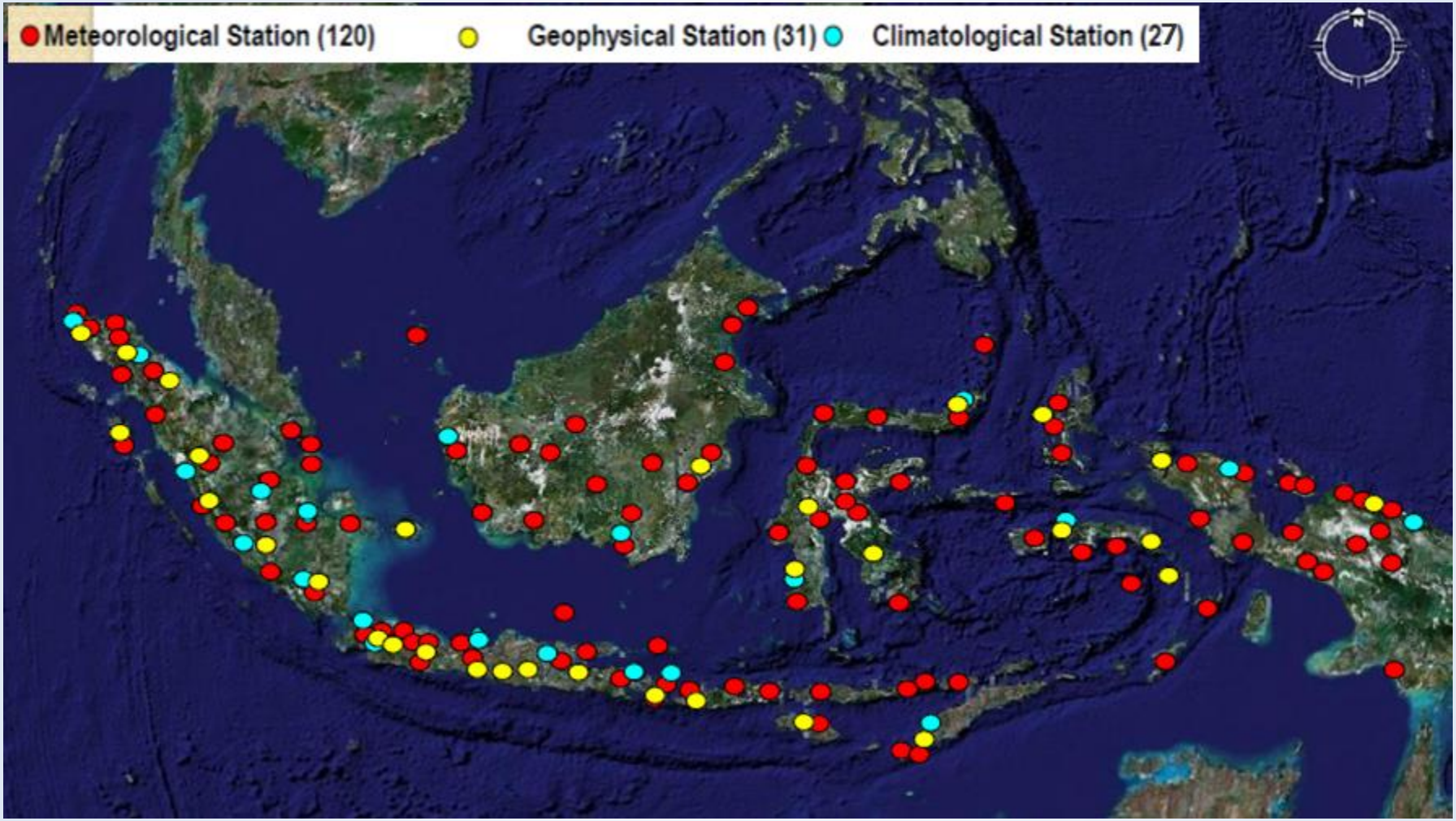
- **The Indonesia Tsunami Warning System (InaTEWS) has been officially operated since 2008, which provide earthquake Information and Tsunami warning**



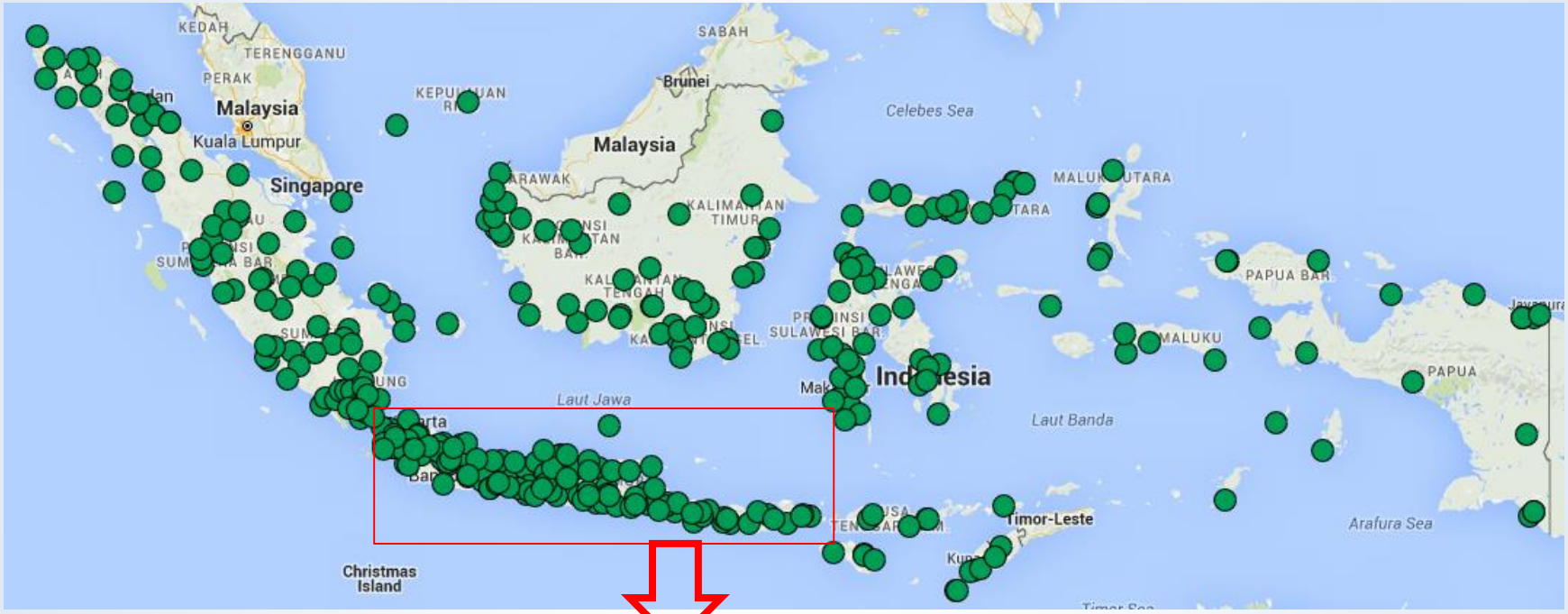


CURRENT OBSERVATIONAL SYSTEM

Indonesia Manned Observation Stations

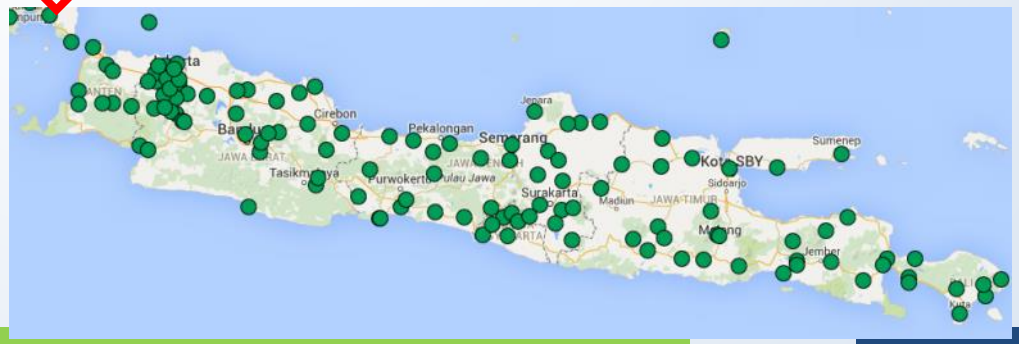


Automatic Weather Station Network



Total 361 sites :

178 BMKG Station
183 outside BMKG Station



Aerodrome Weather Observing System

AWOS 91 sites

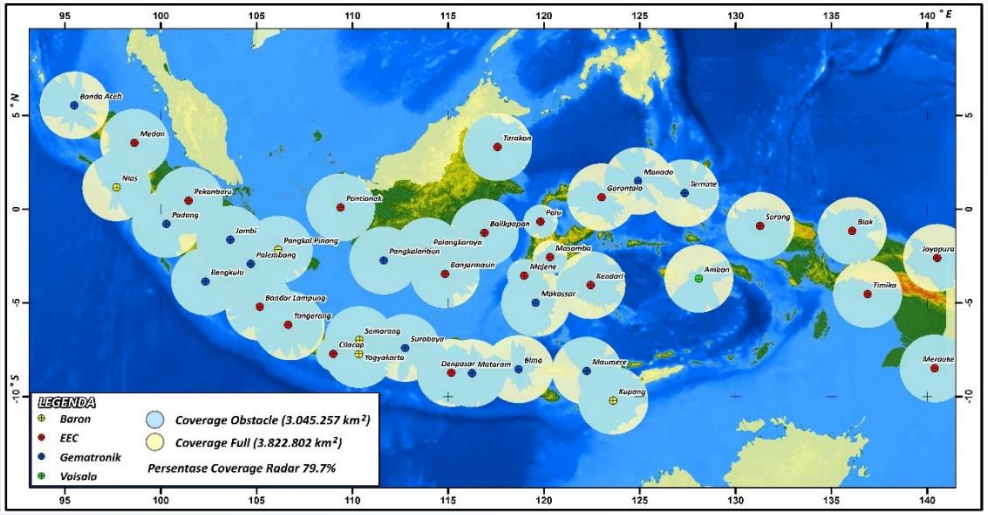
Upper-air / Radiosonde dan Wind Profiler

Total 22 radiosonde station & 2 Wind Profiler

Aviation Meteorological Services

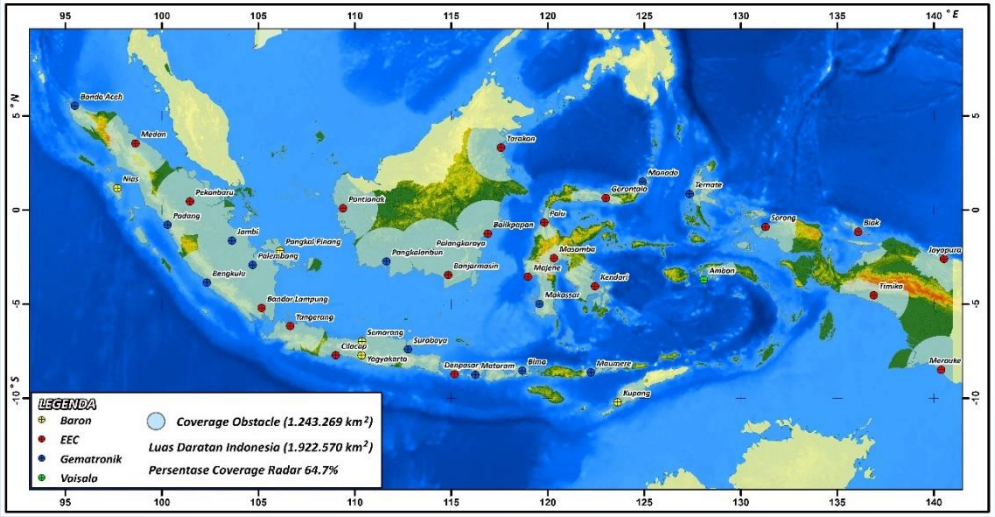
109 airport meteorological stations & 2 MWOs

WEATHER RADAR NETWORK



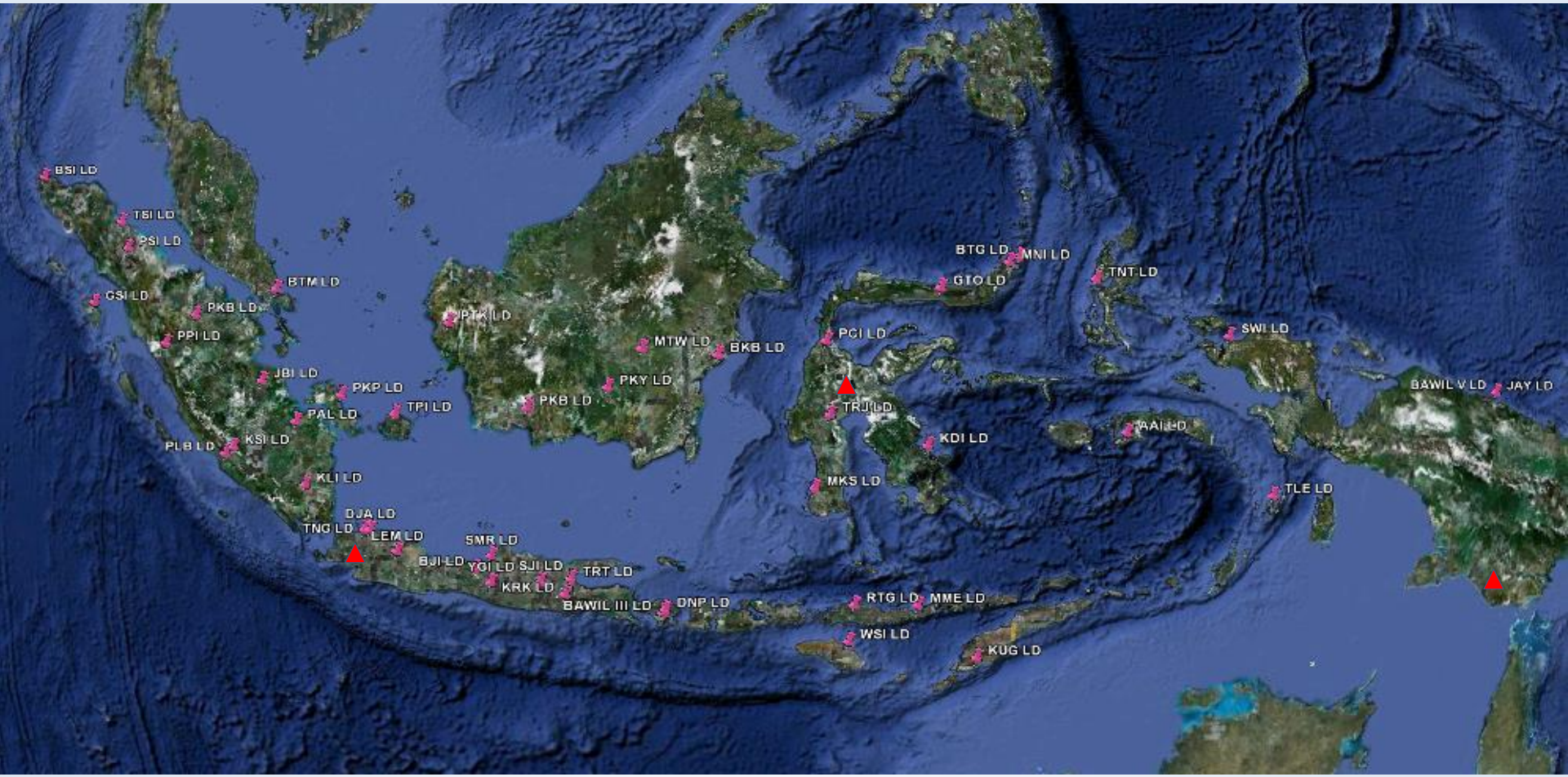
Total 40 radar (2015)
Observation Range :
C-band =150 km ; X-band = 75 km

a. Total coverage land + ocean areas (blocked area included)



b. Effective "clean" coverage for land area (blocked area removed)

Lightning Detection Network



Total 61 location (since 2003)

SATELLITE DATA AND PRODUCTS

WEATHER SATELLITE INFORMATION SYSTEM

Data Acquisition

- Himawari-8
- FY-2
- Terra, Aqua
- NOAA, NPP
- GSMaP
- Others

Delivery System

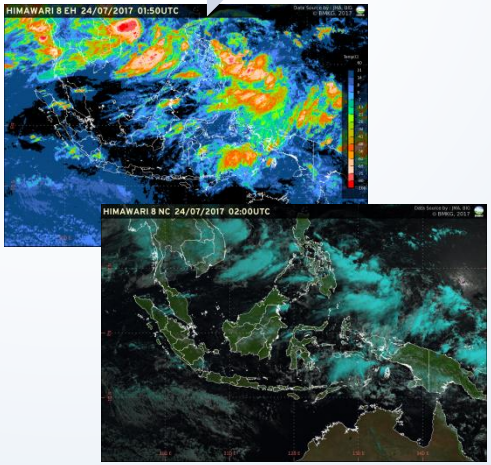
- Website
- Media Social

User

- Public
- Forecaster
- Research Institution
- Disaster Mitigation
- University

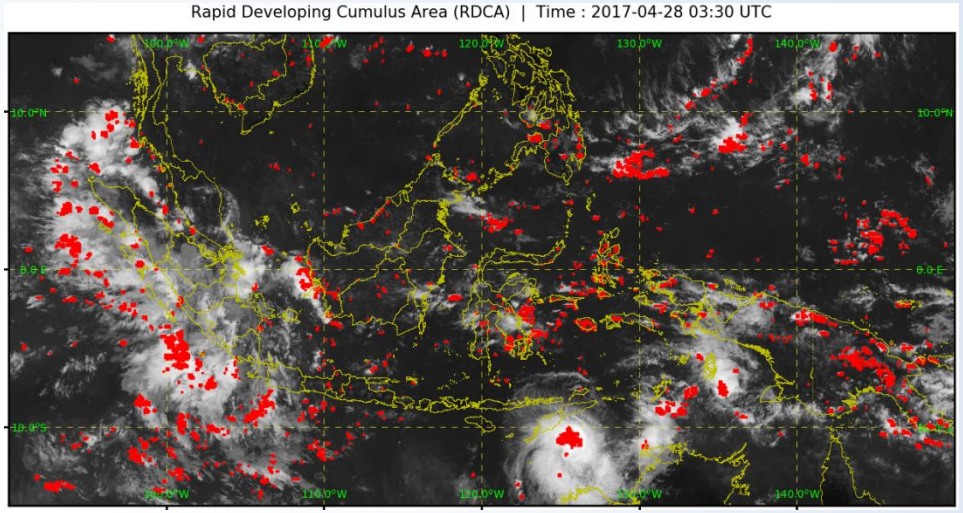
Image Processing

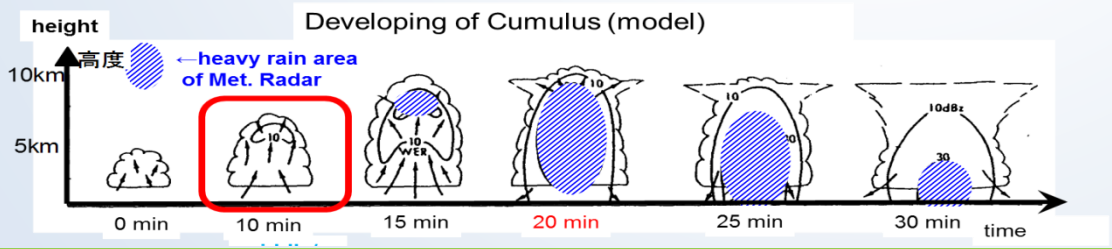
- Enhanced Products
- RGB Images
- Potential Rainfall
- RDCA
- Hotspot and Smoke
- Volcanic Ash
- HCAI
- Others



IMPLEMENTATION OF RDCA ALGORITHM AT BMKG

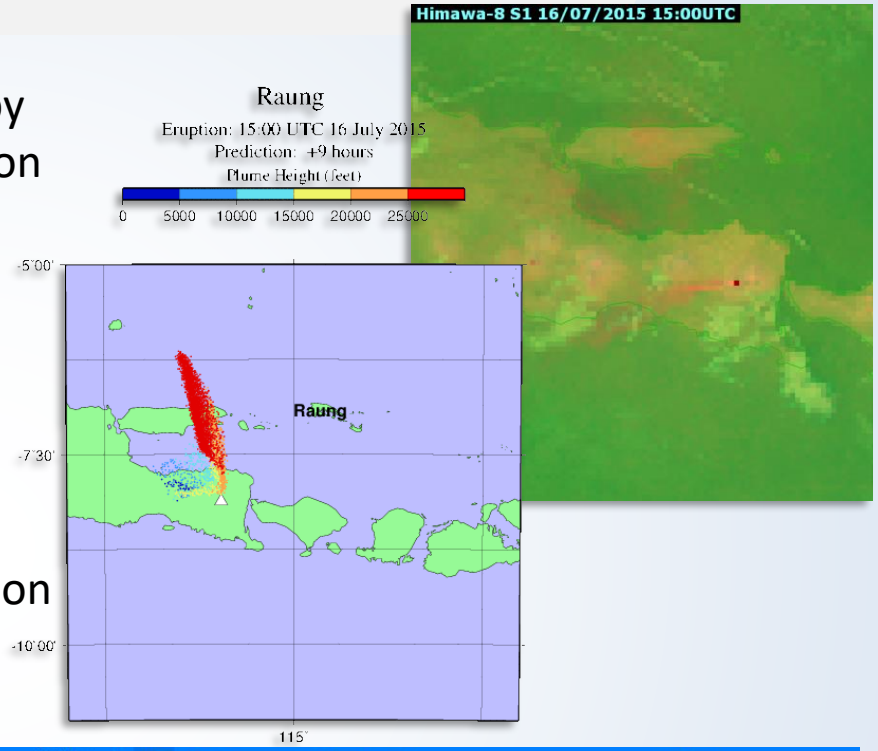
- The diurnal cycle of convective cloud generation is quite remarkable along coastlines of major islands in Indonesia maritime continent. Flood events are usually caused by these cloud generation.
- Early warning of Cumulonimbus appearance is important to many sectors (public, transportation, disaster mitigation, etc)
- Capability of Himawari-8 to detect early stage of Cumulonimbus based on 10 minutes observation frequency
- In 2016 BMKG's staffs was invited to JMA for applying RDCA algorithm for Indonesia region and it has been installed at BMKG since 2017





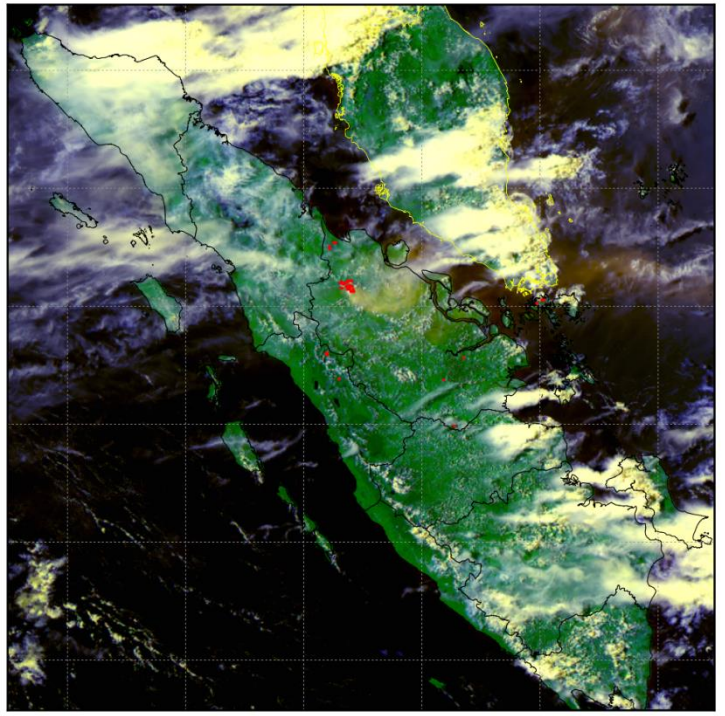
VOLCANIC ASH DETECTION BY HIMAWARI-8

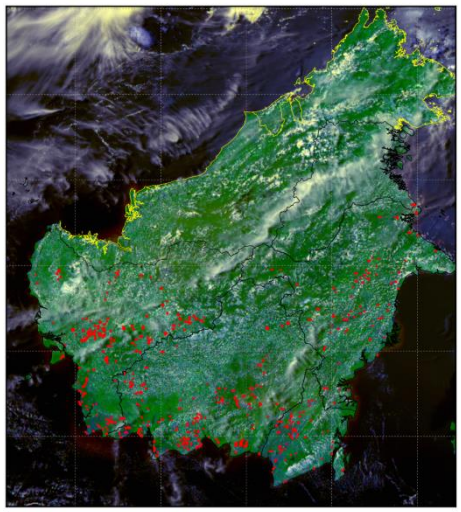
- The geography of Indonesia is dominated by volcanoes that are formed due to subduction zones between the Eurasian plate and the Indo-Australian plate.
- Himawari-8 RGB is continously used to monitor volcanic ash dispersion and issued flight safety zone near the volcano area.
- Joint collaboration under SATREPS-JICA framework to develop volcanic ash dispersion model integrated with volcanic hazard mitigation system.

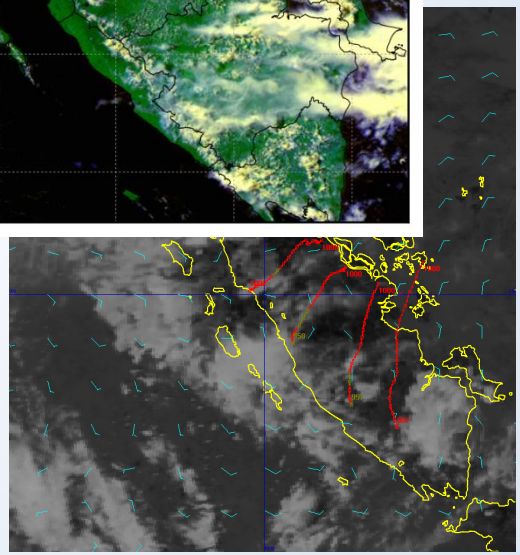


TRANSBOUNDARY HAZE AND HOTSPOT MONITORING

- Forest and land fires are perennial problems in Indonesia, with the latest massive fires related to El Nino in 2015 resulting in a choking haze blanketing numerous areas in Sumatra and Kalimantan.
- BMKG developed RGB smoke image from Himawari-8 and applied hotspot detection algorithm to cover absence of MODIS observation.







CHALLENGES

CHALLENGES

1. Customized satellite-based products for specific users (oil/gas refinery plant, electric power, mining, aviation) → early detection of lightning, icing, clear-air turbulence.
2. Development of satellite climatology products for supporting climate services.
3. Multi-satellite data processing system for better spatial and temporal resolution derived products.
4. Preparation for GeoKompsat data receiption and processing in order to get every 5 minutes observation combined with Himawari-8.