“Improvement of Ocean Forecasting System for Enhancing Marine Information in Maritime Continent”

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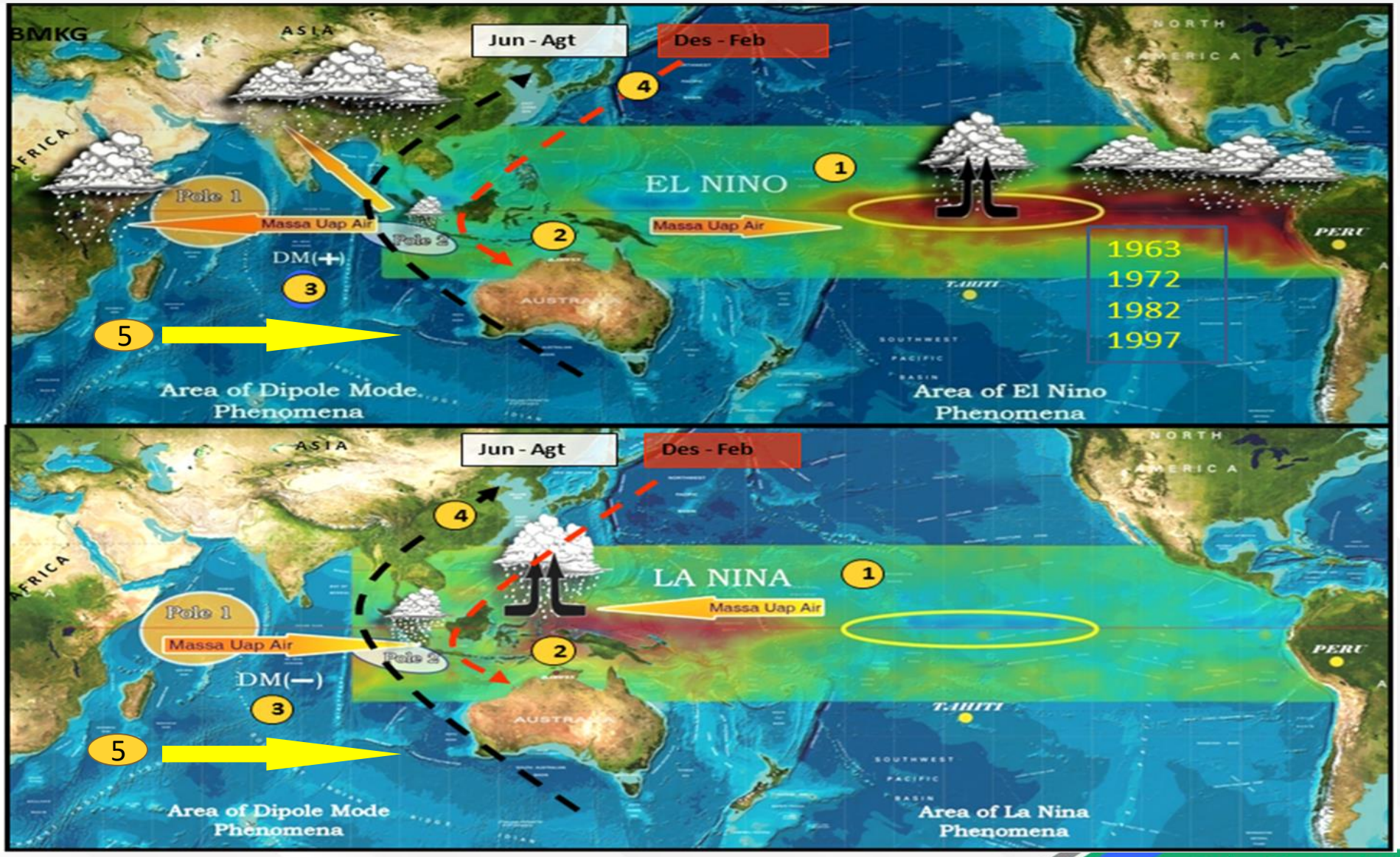
THE AGENCY FOR METEOROLOGY CLIMATOLOGY AND GEOPHYSICS **(BMKG)**

Weather and Climate Phenomenon in the Region



1. El nino / La nina
2. SST
3. IOD / DM
4. Monsoon
5. MJO

El Nino	La Nina
0.5 – 1 Weak	-1 – 0.5 Weak
1 – 2 Moderat	-2 – -1 Moderat
> 2 Strong	< -2 Strong

WIND DIRECTION	
Jun – Agt EASTERN	eq
Des - Feb WESTERN	eq

INTRODUCTION

Marine Meteorology and Oceanography occupy a global role, serving a wide range of users, from international shipping, fishing and other met-ocean activities on the high seas, to the various activities which take place in coastal and offshore areas and on the coast itself.

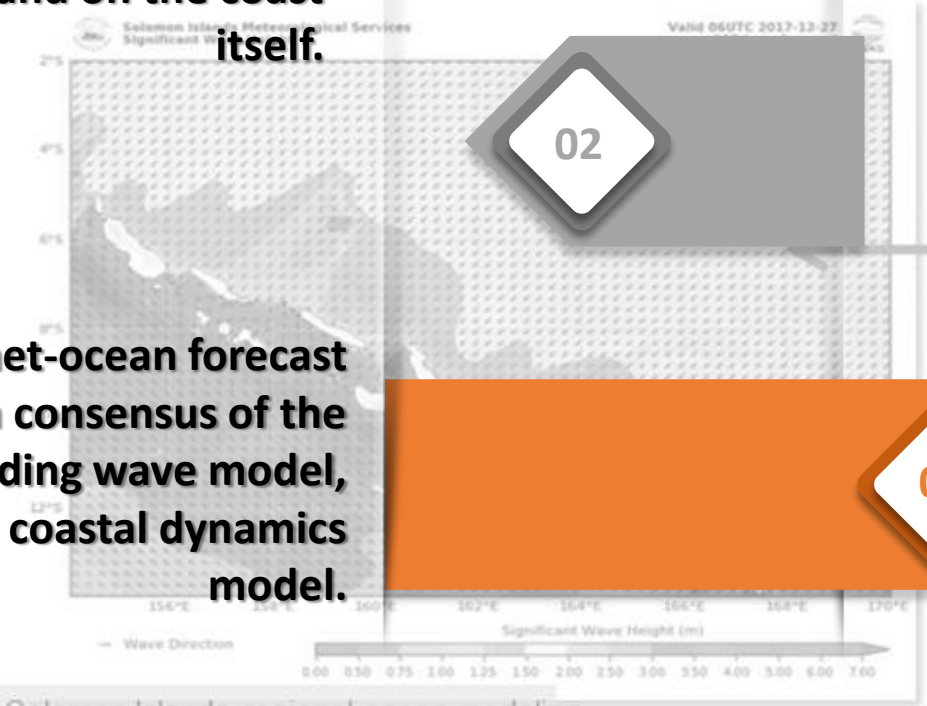
01

02

In preparation of analyses, synopses, forecasts and warnings, knowledge is required of the present state of the atmosphere and ocean.

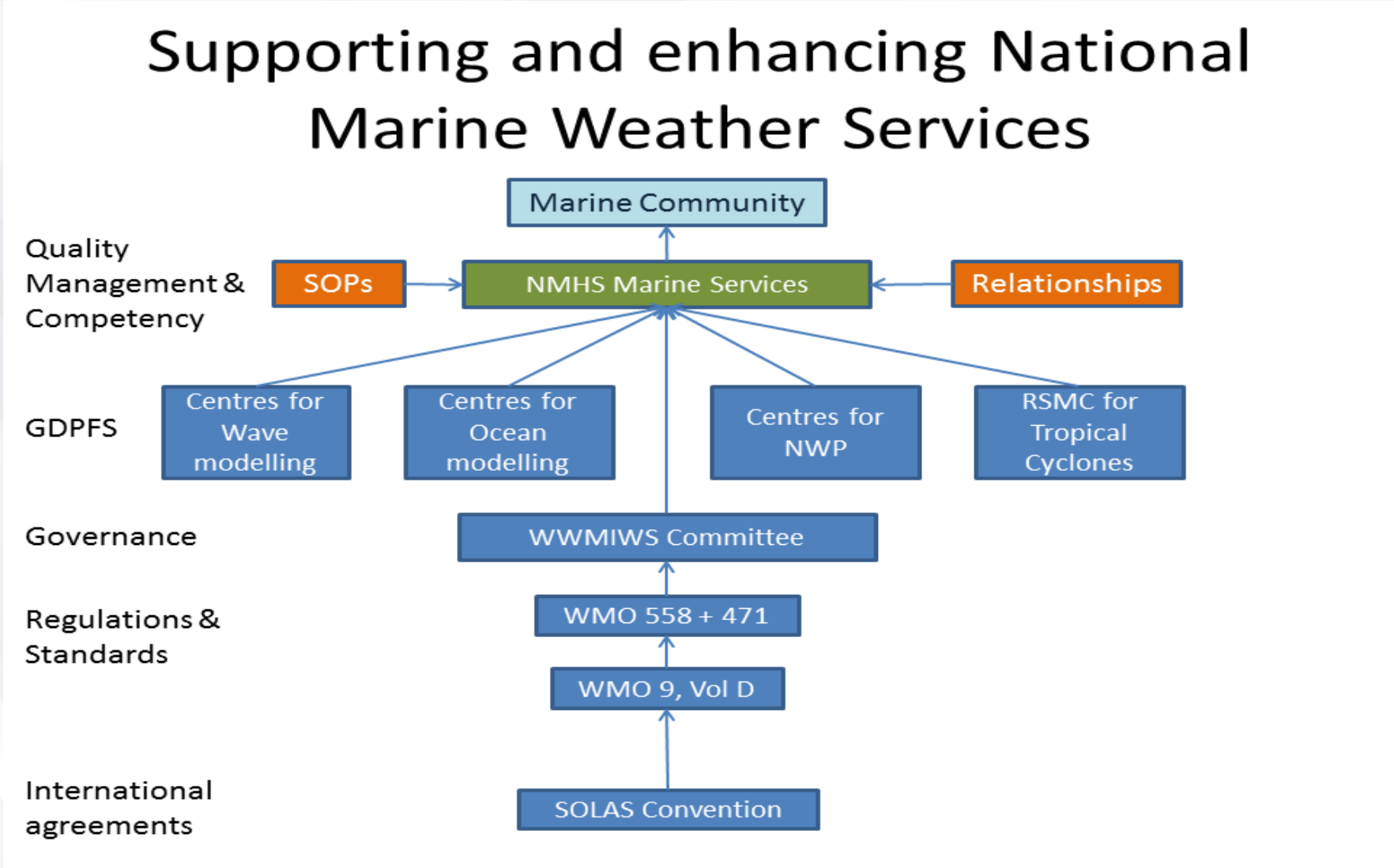
The requirements for met-ocean forecast and services are based on a consensus of the ocean modelling, including wave model, ocean circulation and coastal dynamics model.

03



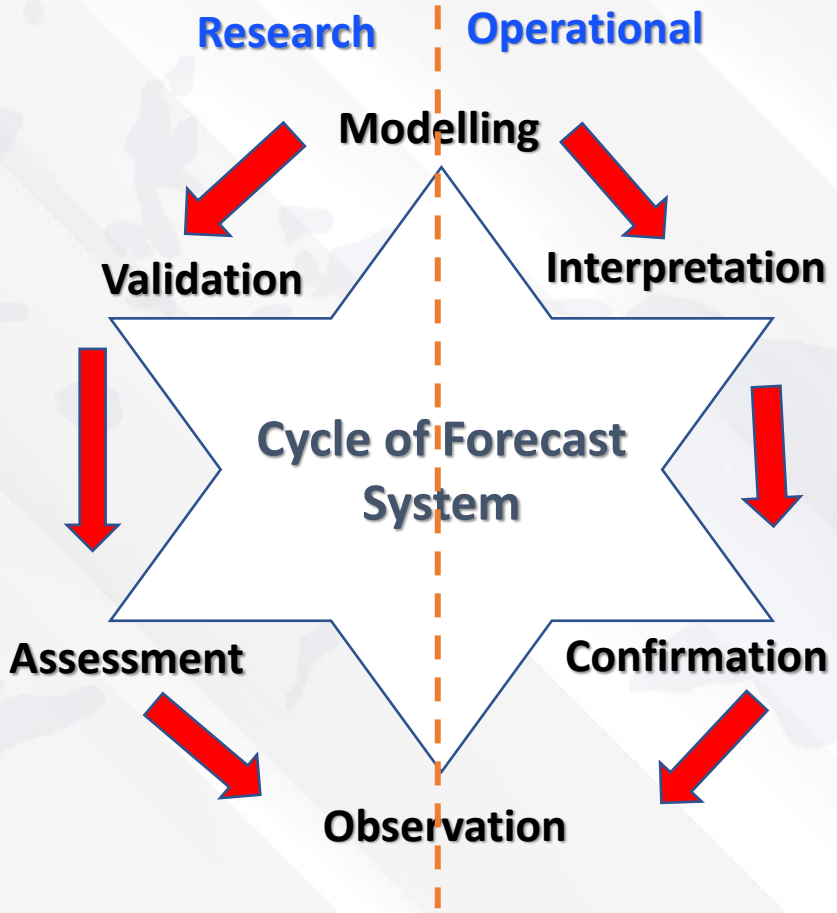
Solomon Islands regional ocean modeling

WMO Guidelines For Marine Meteorological Services



Modelling (Research Vs Operational)

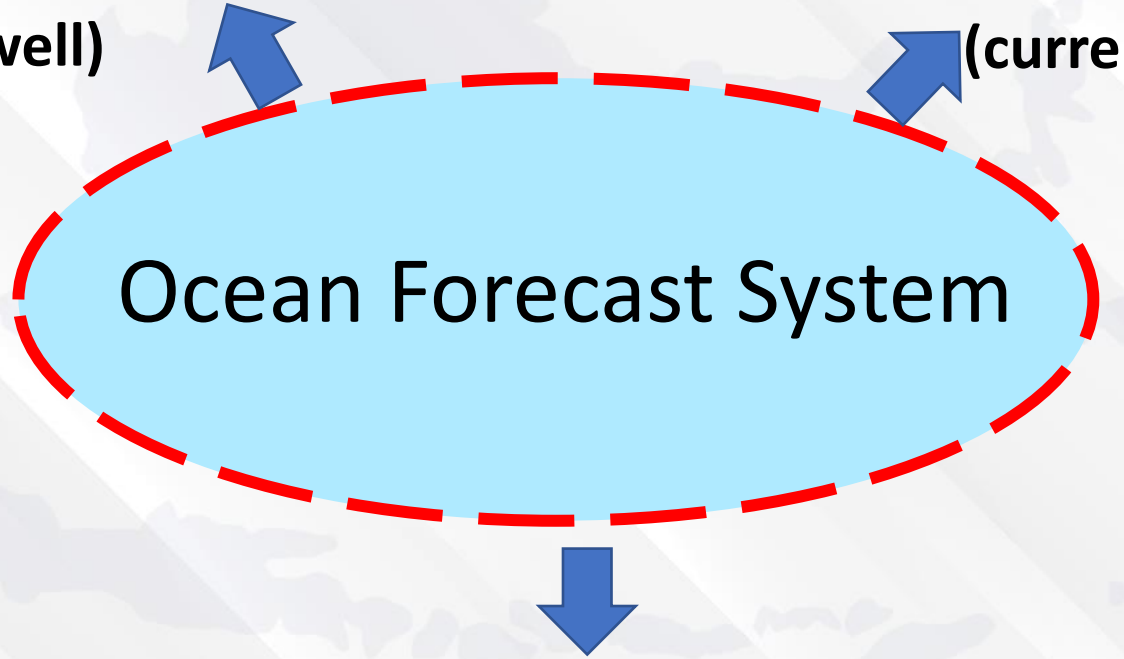
- High Performance Computing (HPC)
- Modelling:
  - Governing Equation;
  - Scheme;
  - Dynamics;
  - Ocean And Atmospheric Interaction;
- Observation:
  - Equipment;
  - Density;
  - Historical Data Base;



OCEAN FORECAST SYSTEM

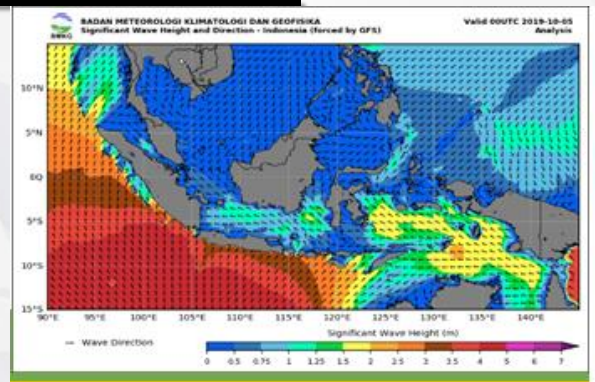
Ocean Waves Model
(wind, waves, swell)

Ocean Circulation Model
(currents, sea temp., salinity)



Coastal Dynamic Model
(tide, sea level, coastal inundation)

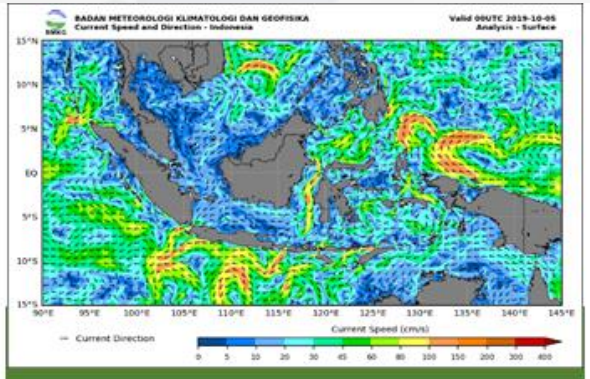
BMKG - OCEAN FORECAST SYSTEM (OFS)



INAWAVES

1. Significant Wave
2. Swell Wave
3. Surface Wind

Surface



INAFLOWS

1. Sea Current
2. Sea Temperature
3. Salinity

Surface to 250 Meter depth

INACIFS

1. Coastal Inundation

EXISTING

1. Res : 9 Km
2. Without Assimilation
3. 3 hours time step
4. Forcing : GFS

NEXT PROJECT

1. Res : 3 Km
2. With Assimilation
3. Ensemble Model
4. 1 hour time step
5. Forcing : GFS, ECMWF, WRF

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BMKG WAVE MODEL – Ina Waves

01

WAVEWATCH III community model (https://github.com/NOAA-EMC/WW3): operational at vn4.18-local;

02

Model configurations are forced by GFS and WRF;

03

JONSWAP bottom friction and Battjes-Janssen shallow water terms; the interaction between these and ST4 needs review for large waves in shallow water;

04

Spherical Multiple-Cell grid used:

- Improved description of energy flows around headlands and islands
- Allows higher resolution cells to be defined in areas of special interest

05

- 2x daily update of short to medium range (T+0->10 day) wave forecasts;
- Hindcast models to generate long term past climate;

06

Global models based on 'refined' grids

BMKG Wave Model Domain

RECENT WORK – Ocean Wave Model

Ina-Waves ~

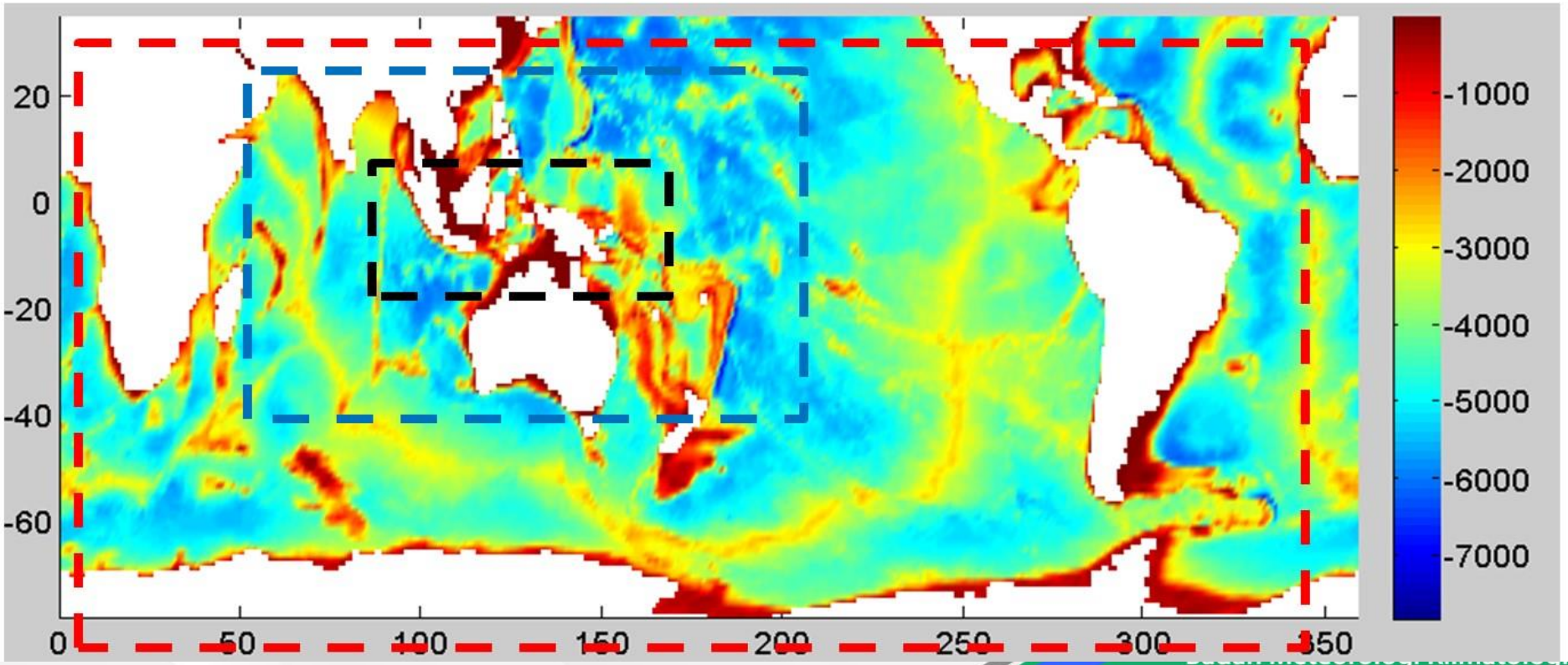
WW3- Model Domain & Grid Resolution.

Global: 1^0 x 1^0 (lat/lon)

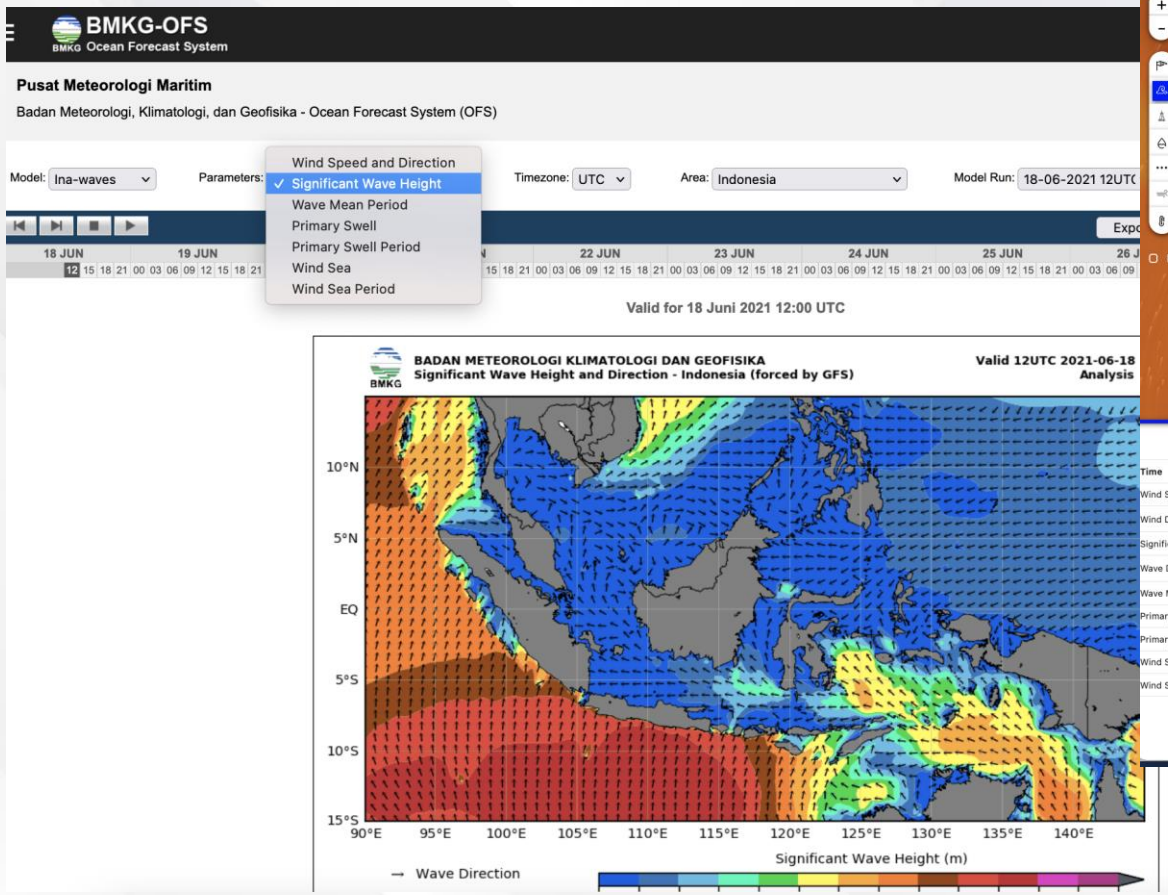
Asia – Austalia : 0.25^0 x 0.25^0 (lat/lon)

Indonesia Low Res : 0.125^0 x 0.125^0 (lat/lon)

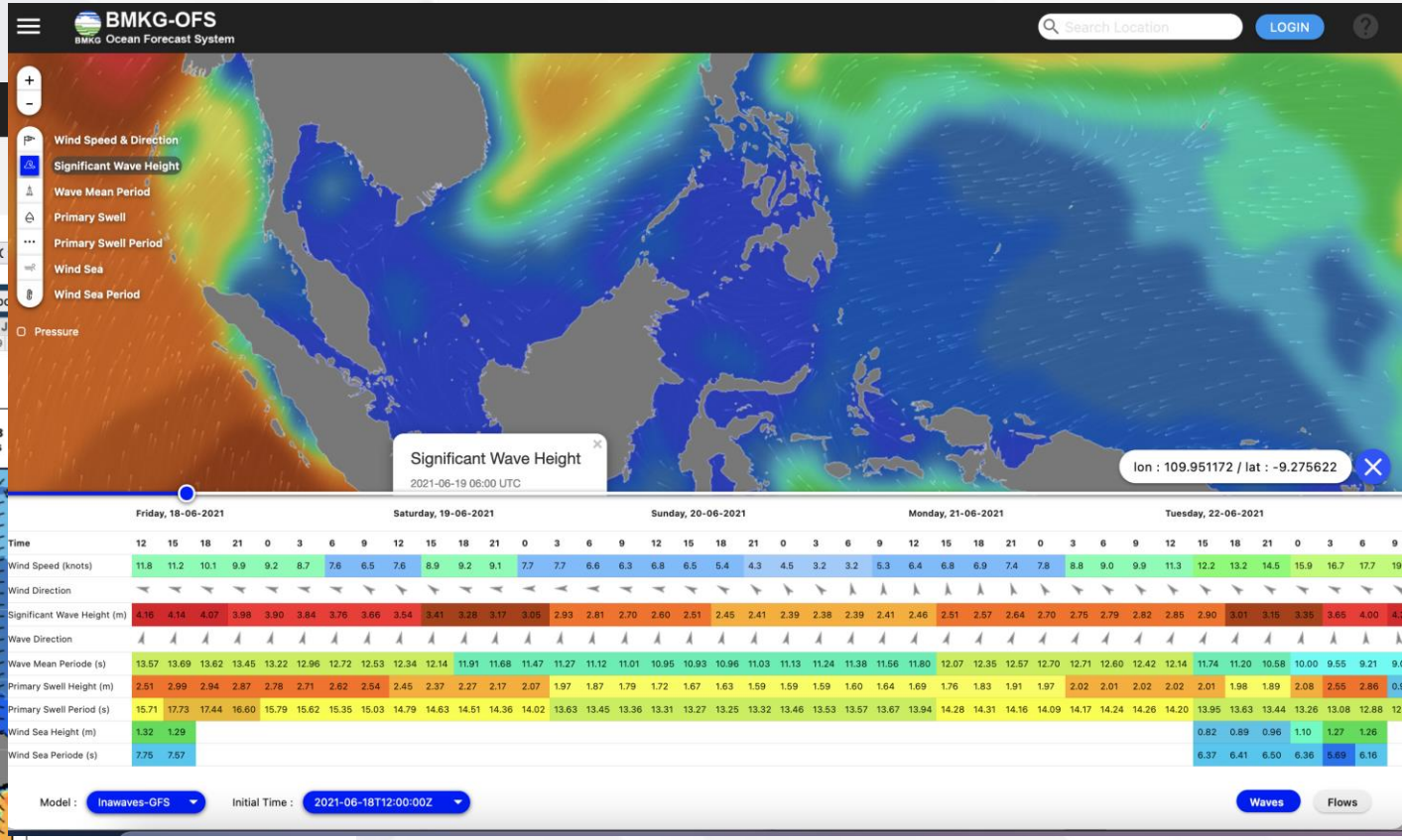
Indonesia High Res : 0.0625^0 x 0.0625^0 (lat/lon)



Wave Model Output Visualization



http://peta-maritim.bmkg.go.id/ofs-static



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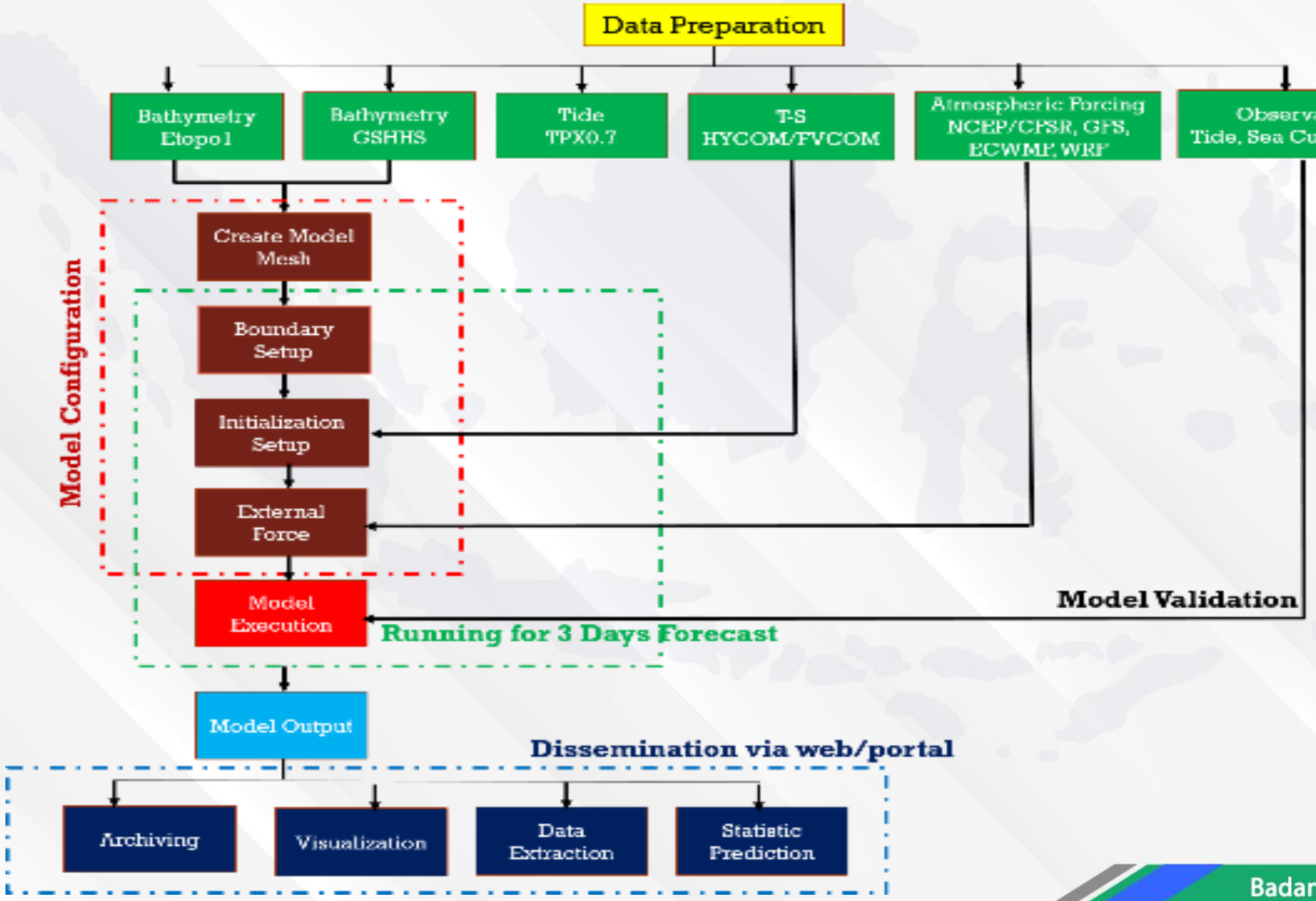
BMKG OFS : The Flow Chart



Forecast

Up to 3 Days forecast:

Surface, 5 m, 10 m, 100 m, 250m

- **Currents: speed, direction**
- **Sea temp: speed, direction**
- **Salinity**

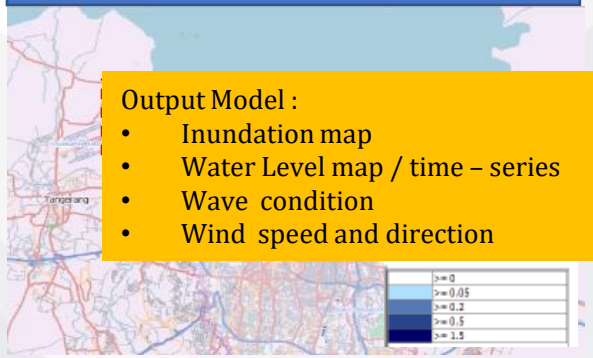
Hindcast / Reanalysis:

Current, Sea Temp, and Salinity

Climatology

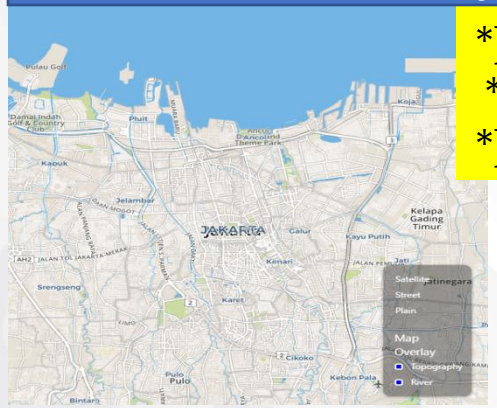
End to End Coastal Inundation Forecast System

OUTPUT MODEL



Output Model :
- Inundation map
- Water Level map / time – series
- Wave condition
- Wind speed and direction

Dashboard Early Warning System



*) Spaatial and Timeseries
*) Expertize by Forecaster
*) Impact base forecast

1. API Platform to bridge to another system

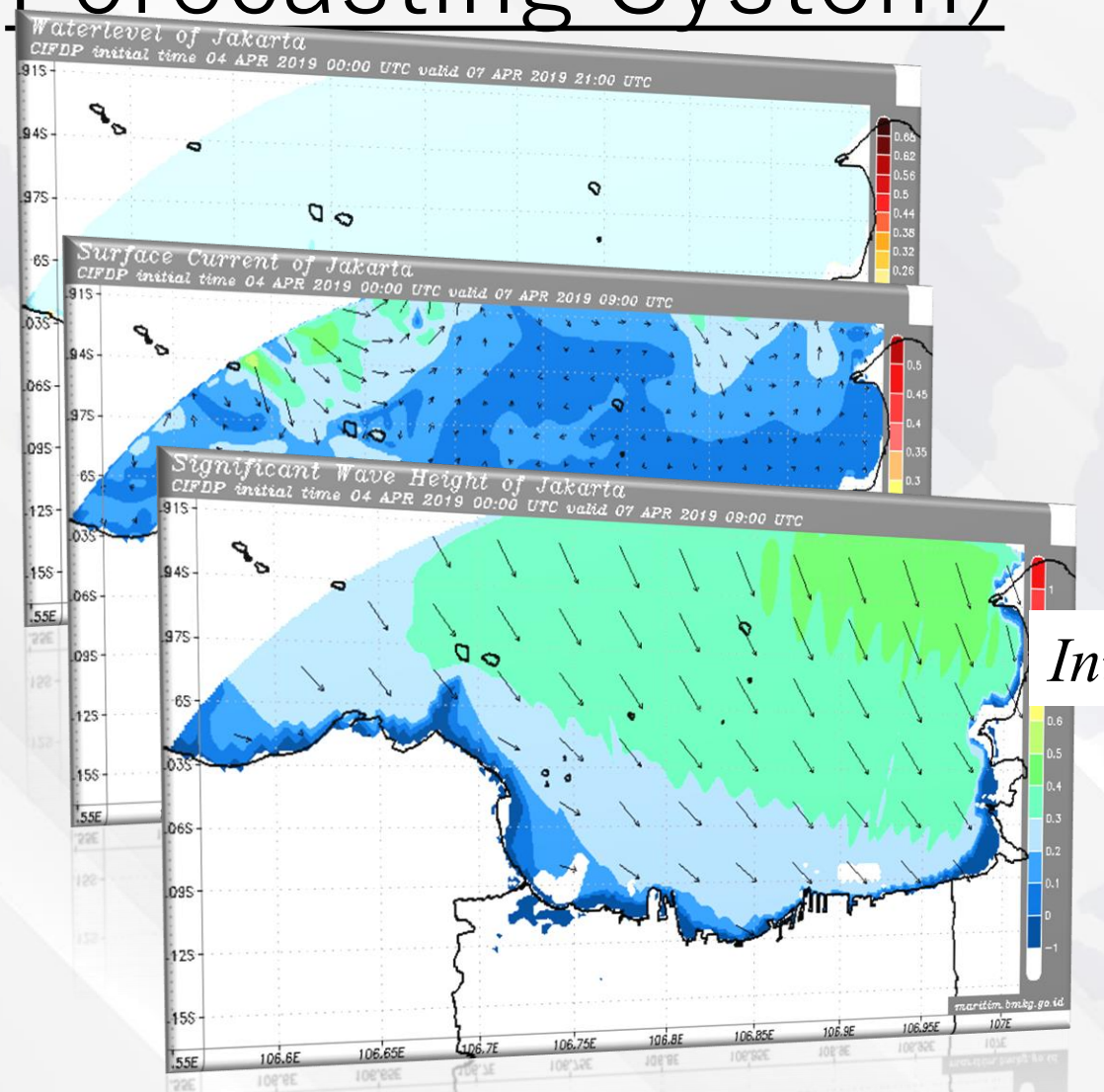
2. Image Output
3. Web Base interactive

Location : District warning

Emergency Response

- ✓ Vulnerability Assesstment
- ✓ Risk Assestment
- ✓ Impact Assestment

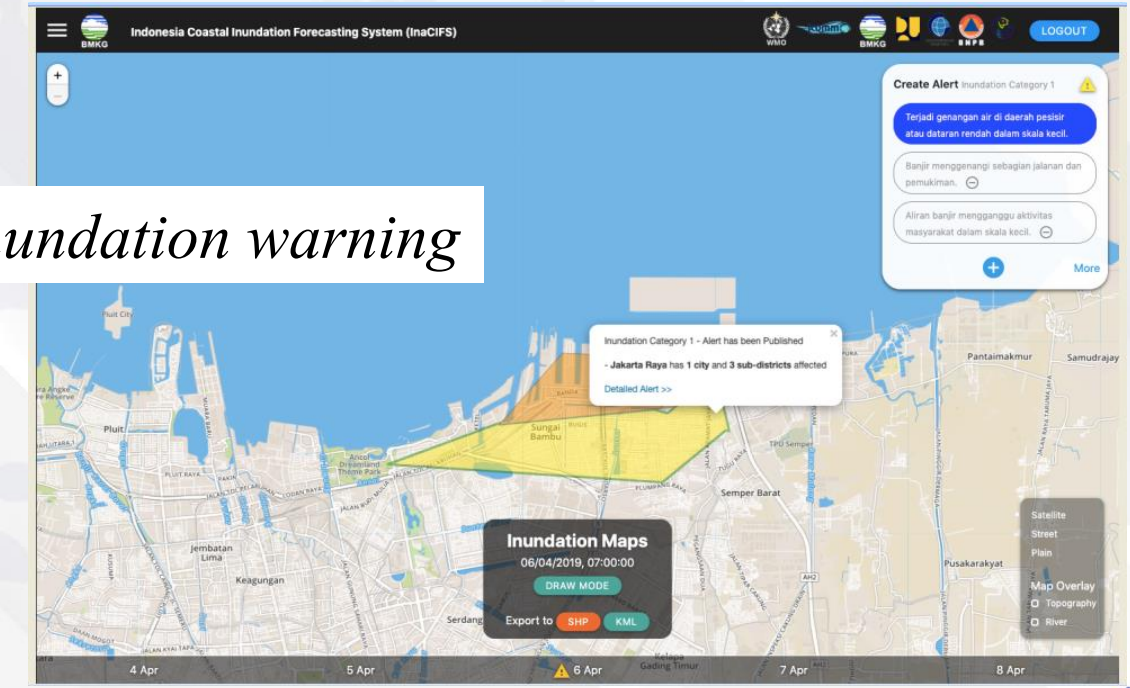
OUTPUT OF INACIFS (Coastal Inundation Forecasting System)



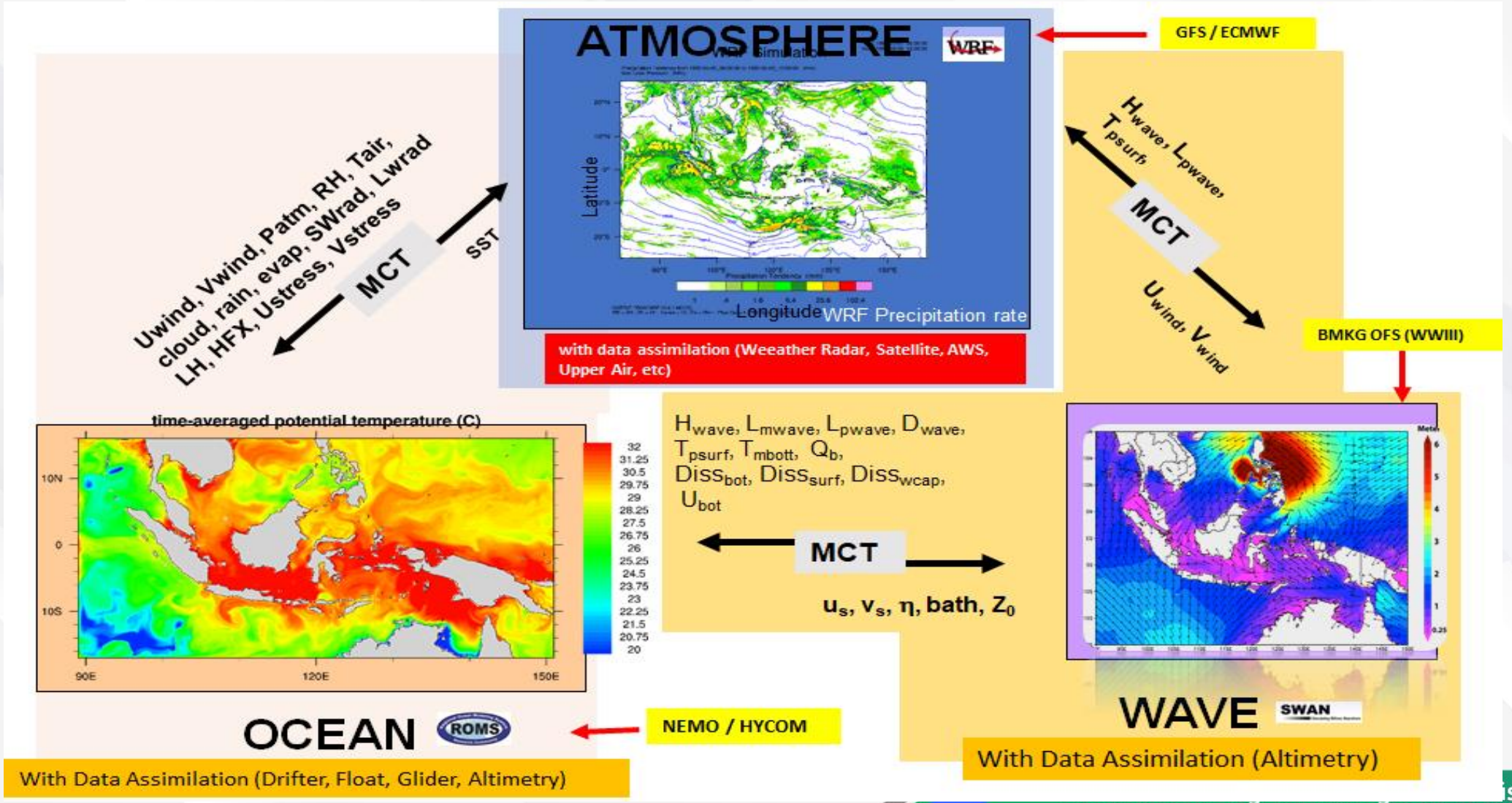
High Resolution and Coupled model for Water Level, Surface Current, Wave Height and Inundation.

Forecast up to 5 days

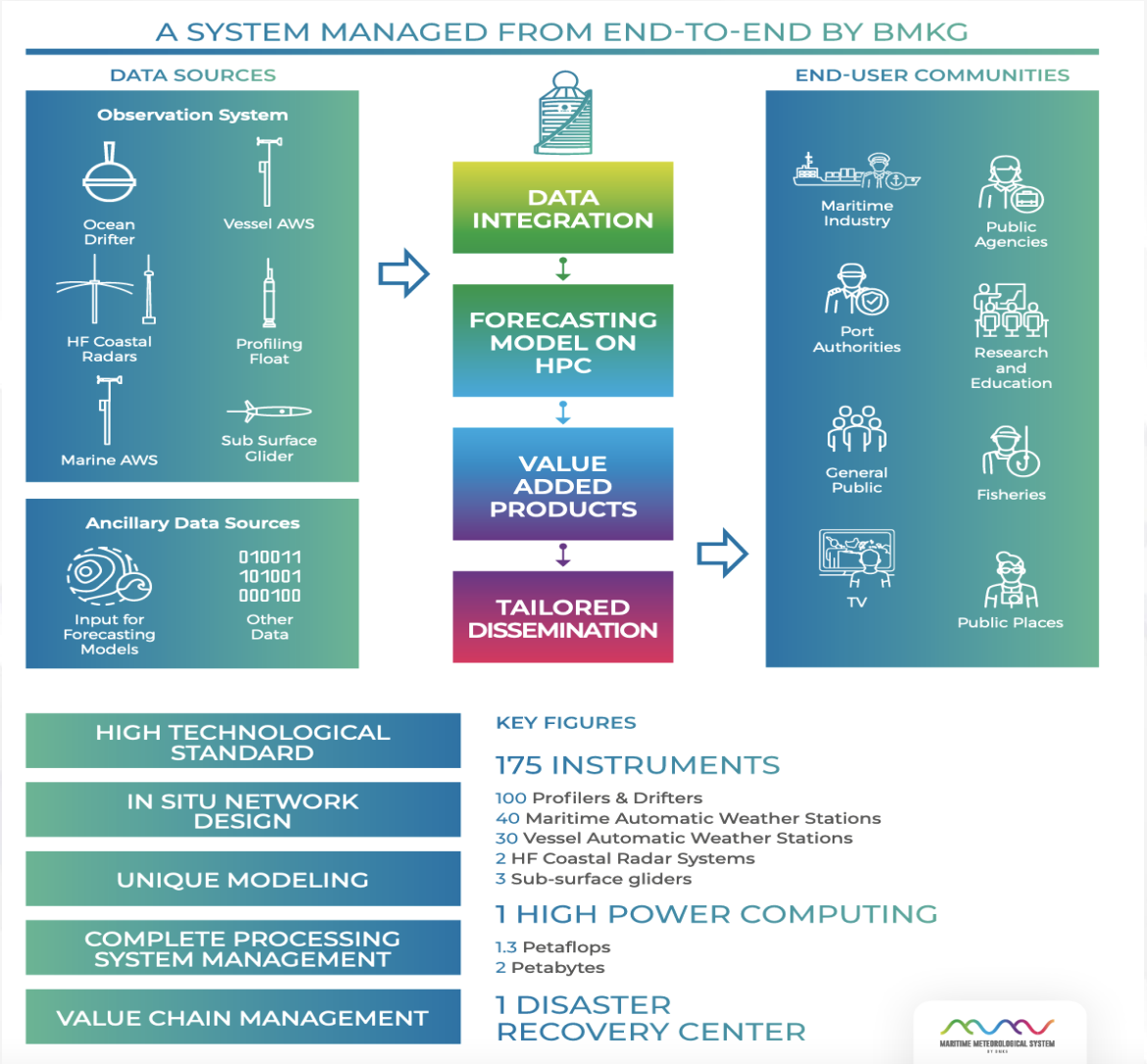
Inundation warning



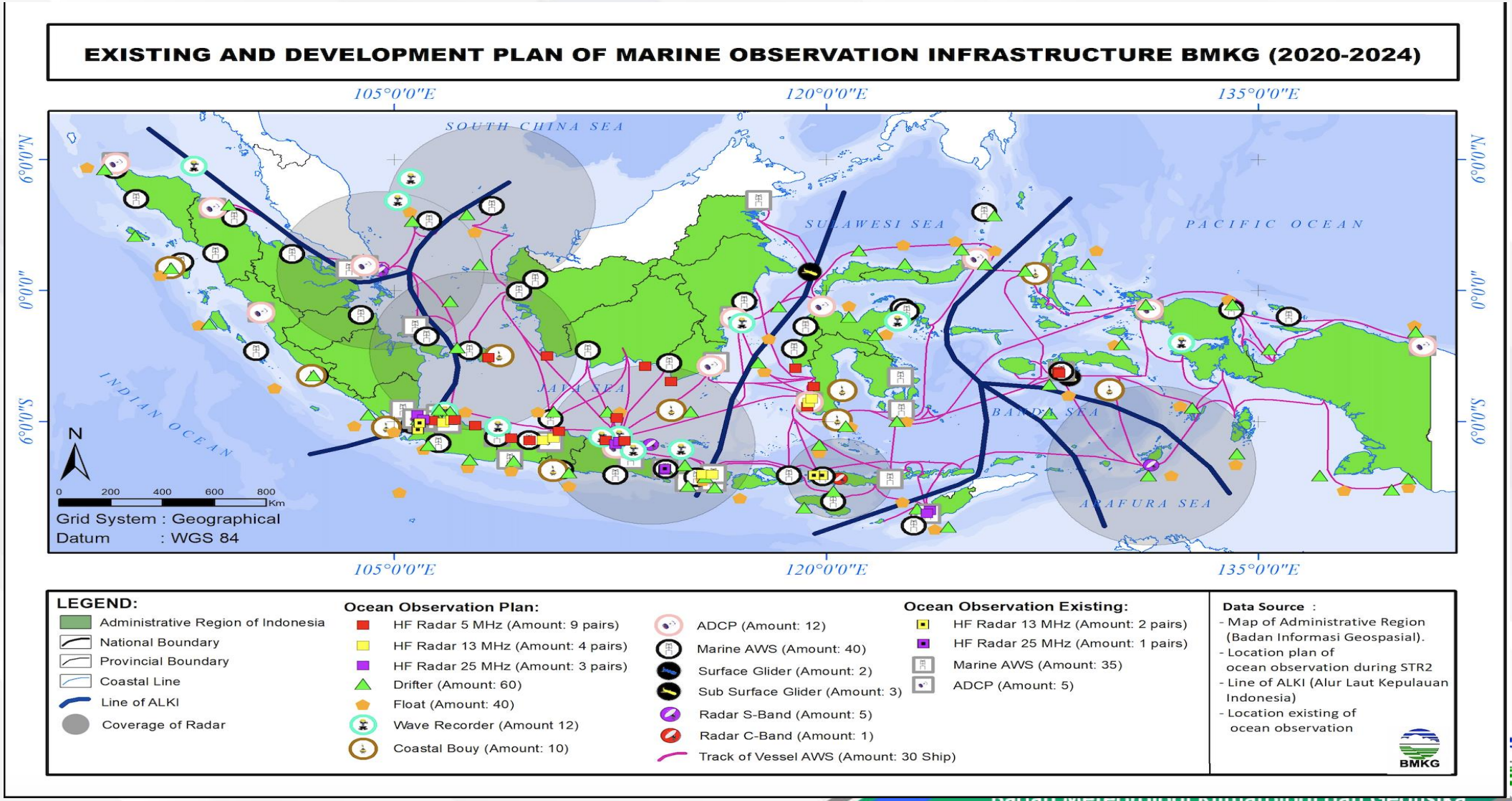
Enchancing BMKG-OFS (2021 – 2023)
Coupled Atmospheric – Ocean Wave Ocean Model (CAWO)



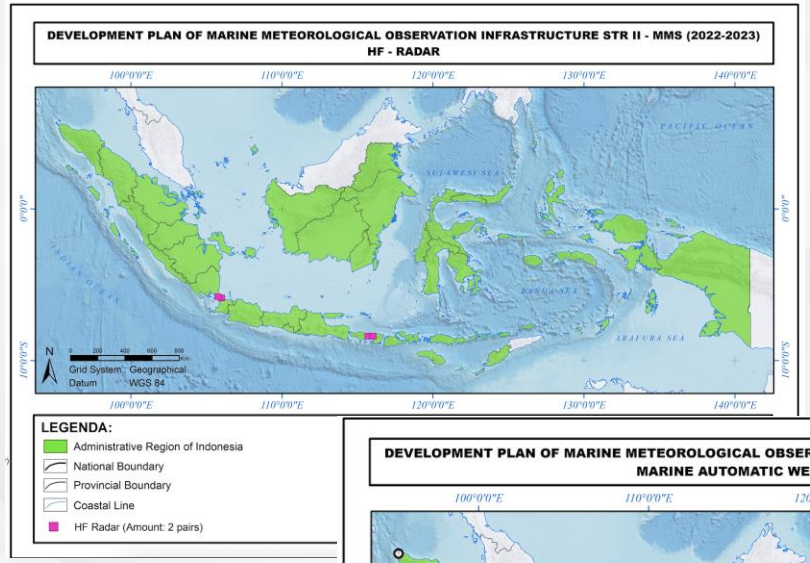
MARINE METEOROLOGICAL SYSTEM (MMS1)

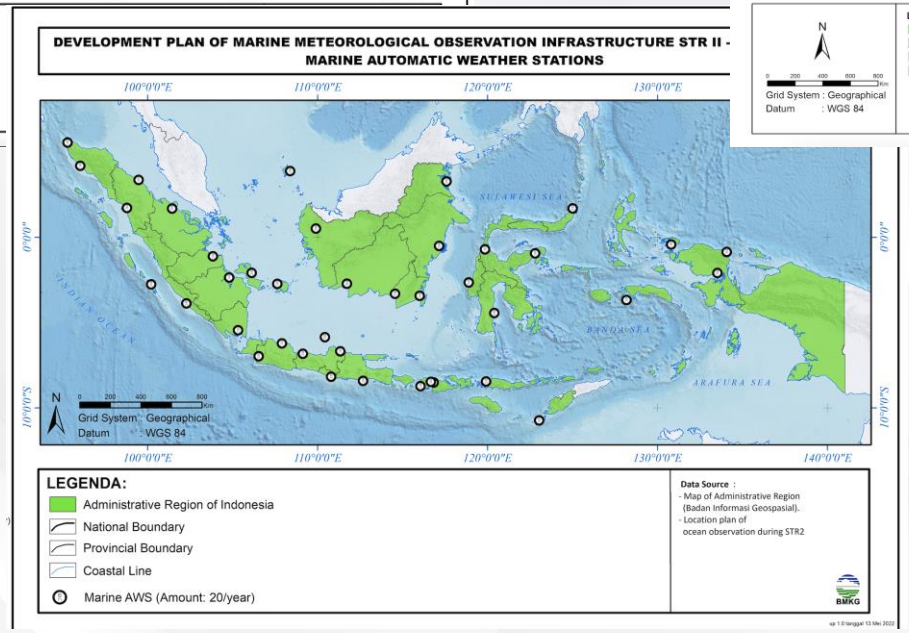


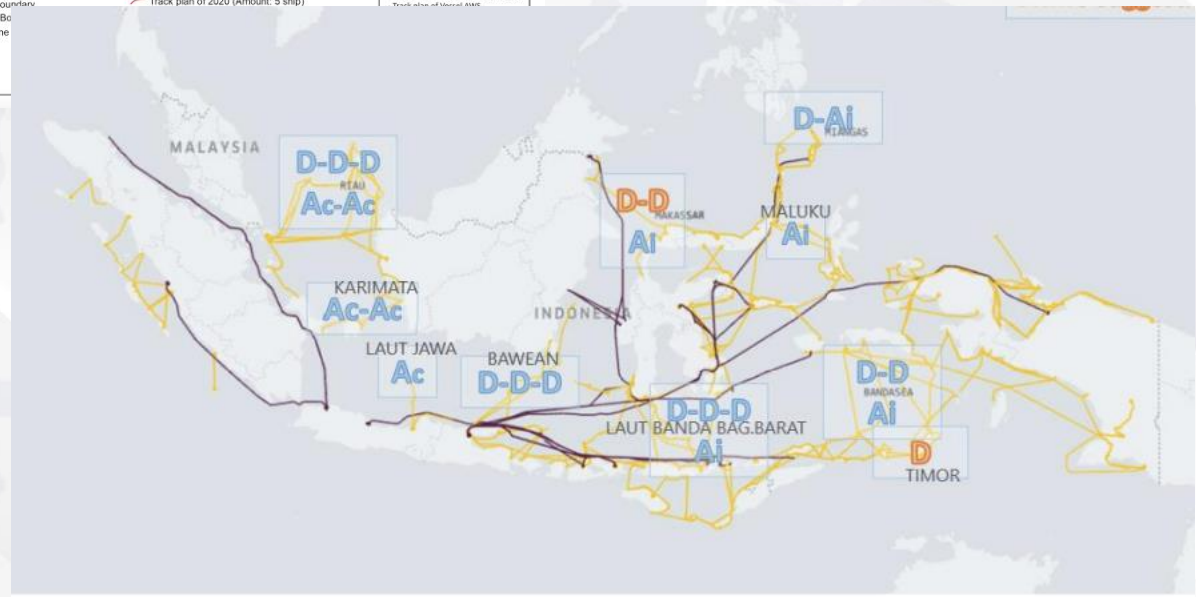
Development of Maritime Observation Infrastructure Through MMS Project



MMS-1 Obs. location







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Thank You