

Progress of Geodetic Infrastructure Development in Indonesia

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The 9th Plenary Meeting of UN-GGIM-AP
3 – 5 November 2020

Outline

- **Indonesia Geospatial Reference System 2013 (IGRS 2013)**
 - Horizontal IGRS
 - Vertical IGRS
- **Geodetic Infrastructure Utilization in Indonesia**

Indonesian Geospatial Reference System 2013 (IGRS 2013):

- National geospatial reference system in Indonesia.
- Launched on **17 October 2013**

IGRS 2013 consists of:

1. Horizontal Geopstial Reference System (HGRS)

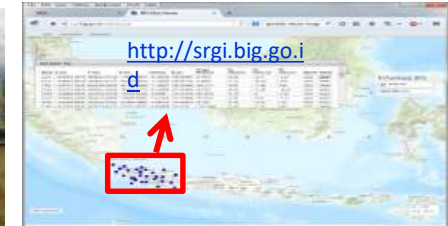
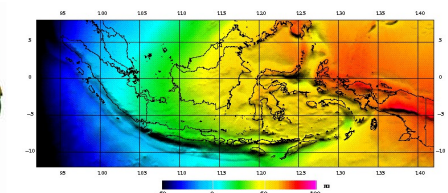
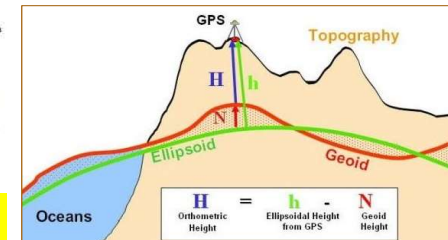
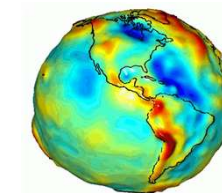
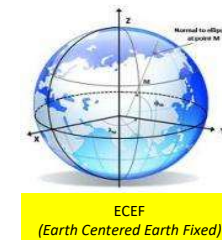
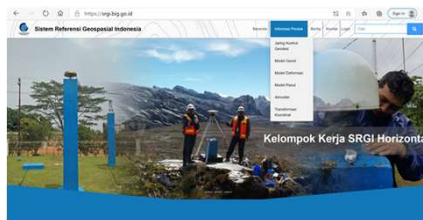
- a. Coordinate Reference System: **International Reference Terrestrial System (ITRS);**
- b. Reference Frame: **Geodetic Control Network;**
- c. Referenced Elipsoid: **WGS84;**
- d. Changes on coordinate value due to tectonic crustal movement :
Velocity Rate & Deformation Model;

2. Vertical Geospatial Refernce System (VGRS):

- a. VGRS is **Geoid** which is called **Indonesian Geoid (InaGeoid 2020);**

3. IGRS Access System and Services

<http://srgi.big.go.id>



PERATURAN
KEPALA BADAN INFORMASI GEOSPASIAL
NOMOR 15 TAHUN 2013

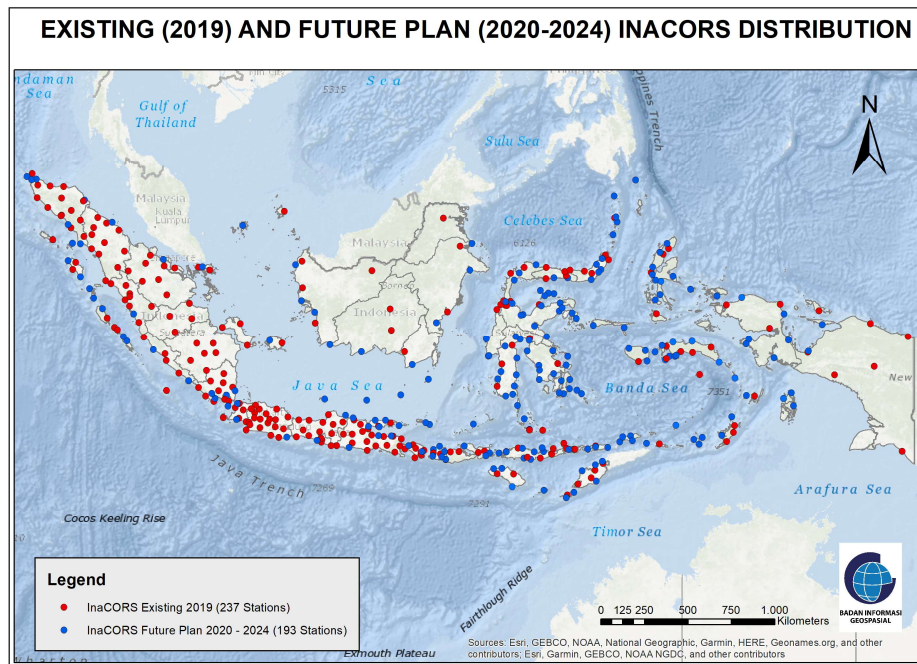
TENTANG

SISTEM REFERENSI GEOSPASIAL INDONESIA 2013

DENGAN RAHMAT TUHAN YANG MAHA ESA

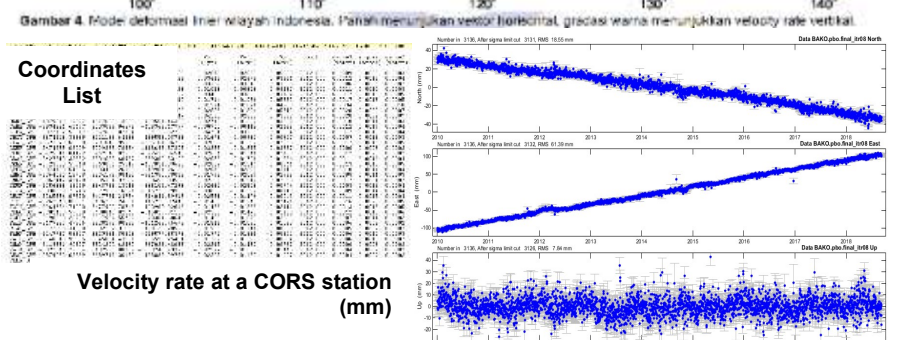
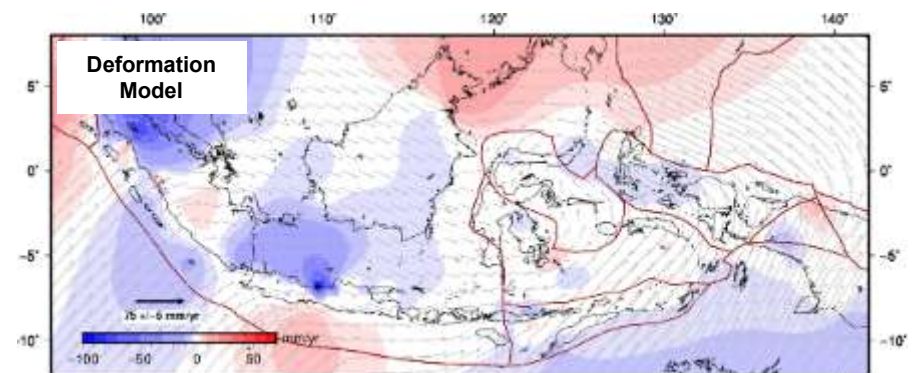
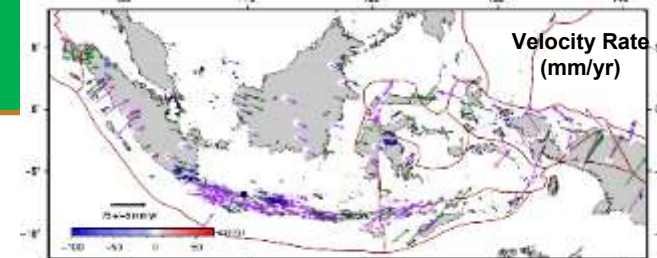
KEPALA BADAN INFORMASI GEOSPASIAL,

Horizontal IGRS 2013



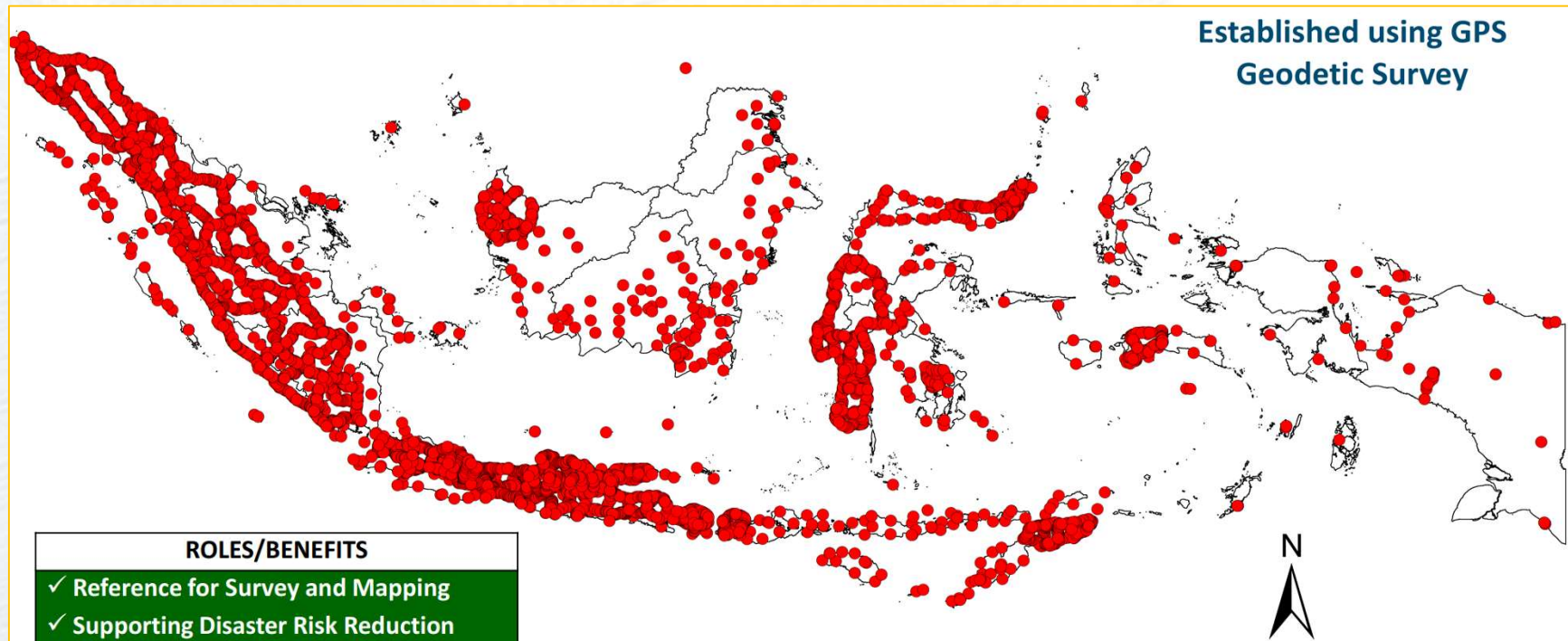
Currently 246 CORS Stations in Operational
Total of 430 CORS Stations will be available in 2024

Indonesian CORS Stations Distribution



Static Geodetic Control Network in Indonesia

7,328 Pillars



ROLES/BENEFITS

- ✓ Reference for Survey and Mapping
- ✓ Supporting Disaster Risk Reduction
- ✓ Supporting Research & Development

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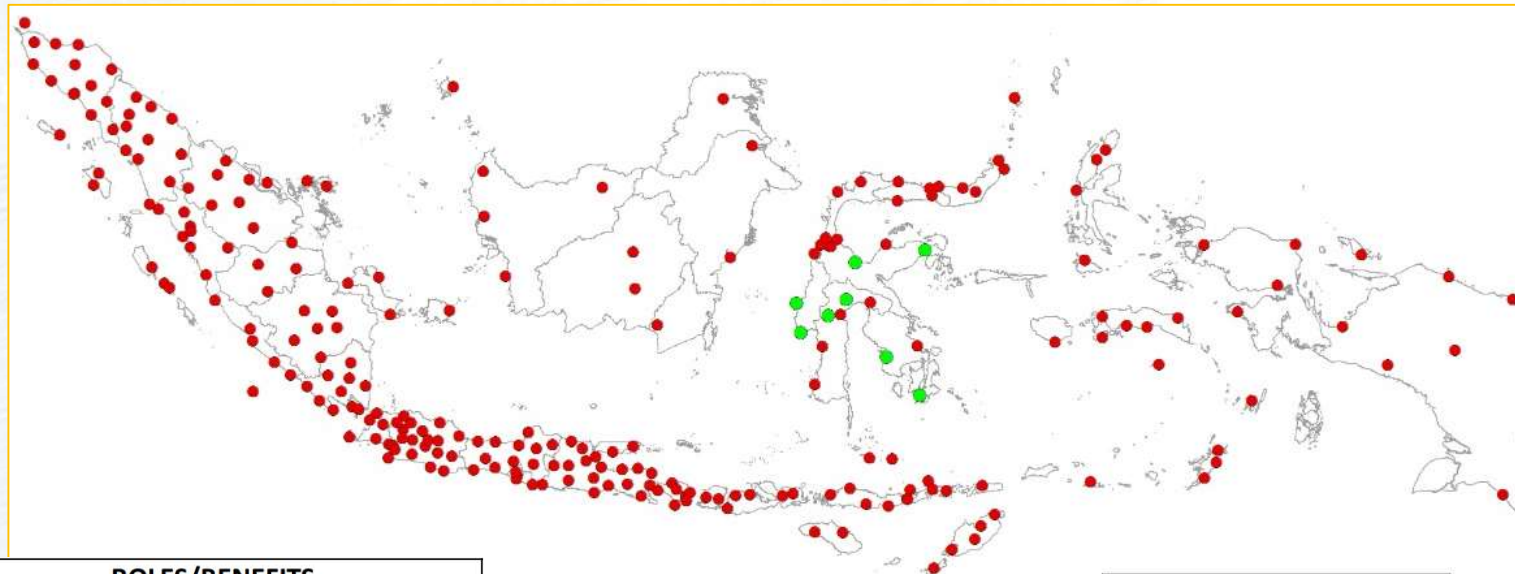
[@infogeospasial](https://twitter.com/infogeospasial)



[badan informasi geospasial](https://www.youtube.com/badaninformasigeospasial)

GNSS CORS Network in Indonesia

246 Stations



ROLES/BENEFITS

- ✓ Reference for Survey and Mapping
- ✓ Supporting Real-time Positioning
- ✓ Supporting Disaster Risk Reduction
- ✓ Supporting Research & Development

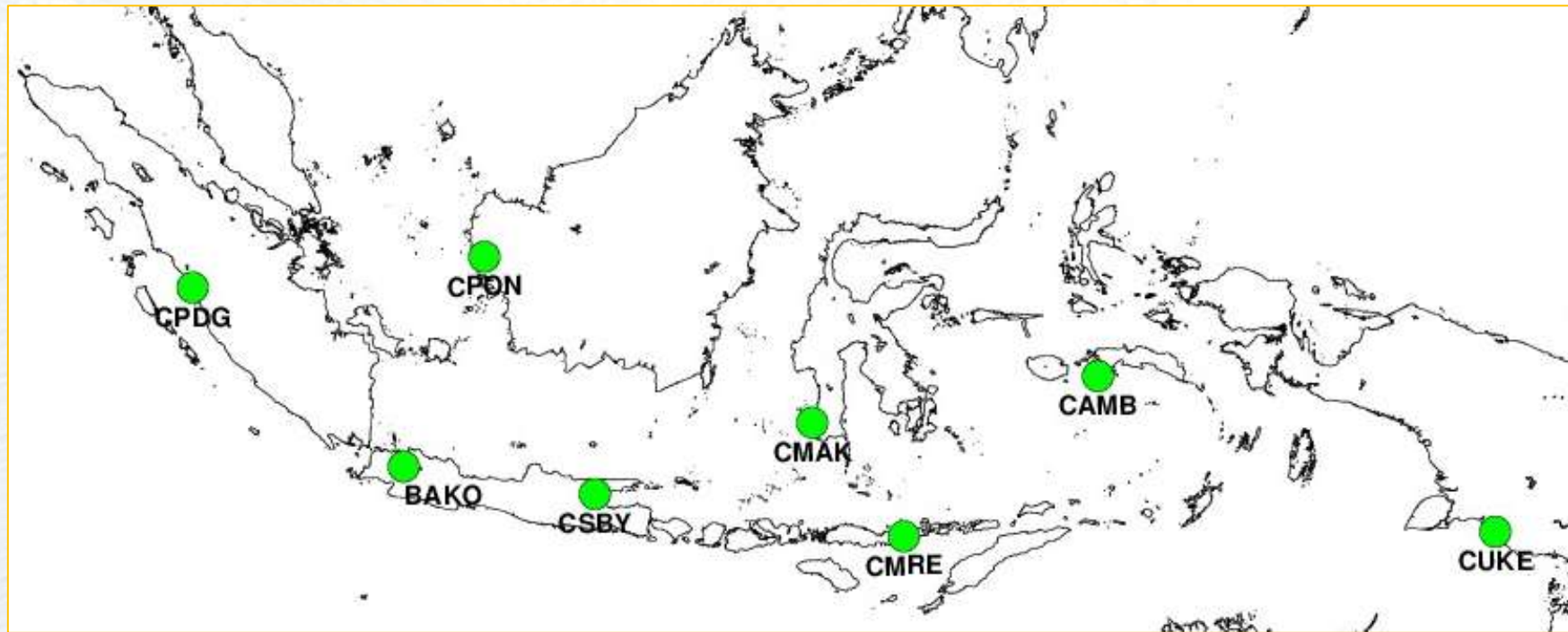
LEGEND

- Ina-CORS until 2019 (237)
- Ina-CORS constructed in 2020 (8)
- Province boundary

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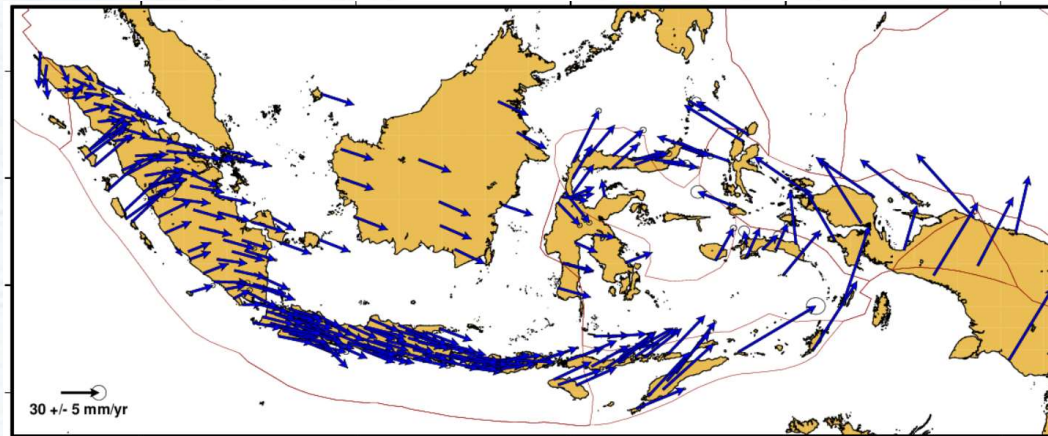
Contributions to APRGP 2020

8 Stations

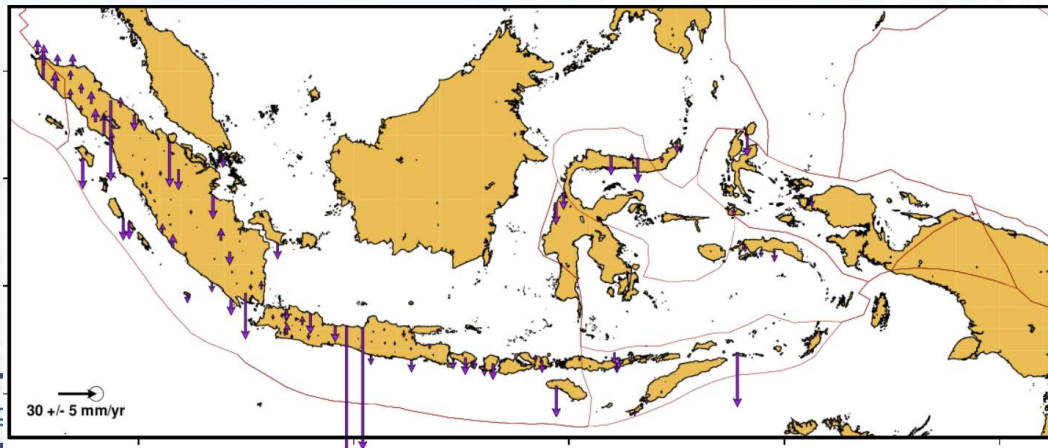


Velocity Rate at CORS

Horizontal

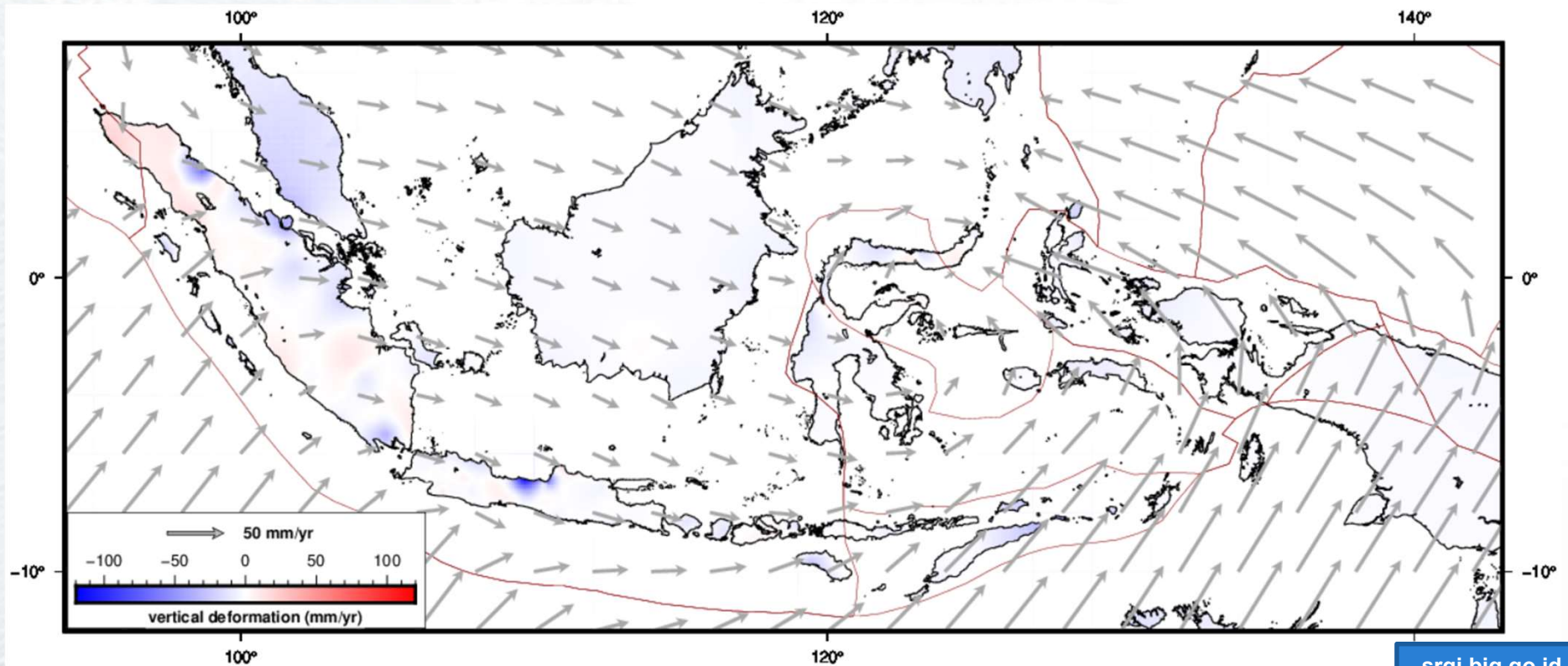


Vertical



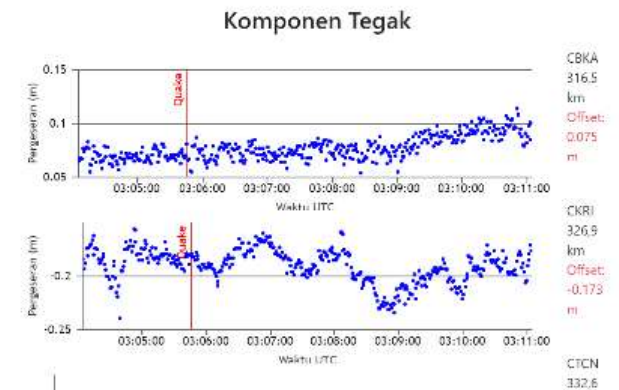
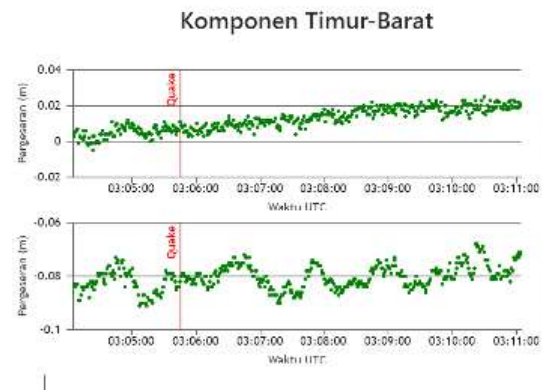
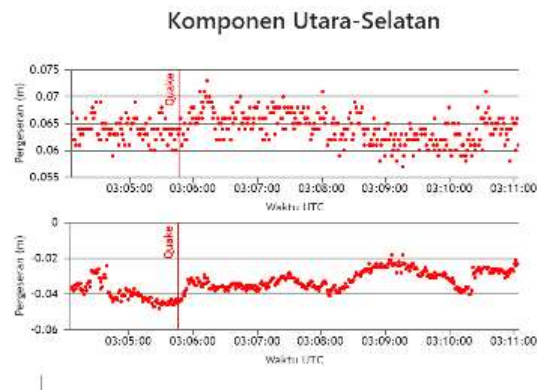
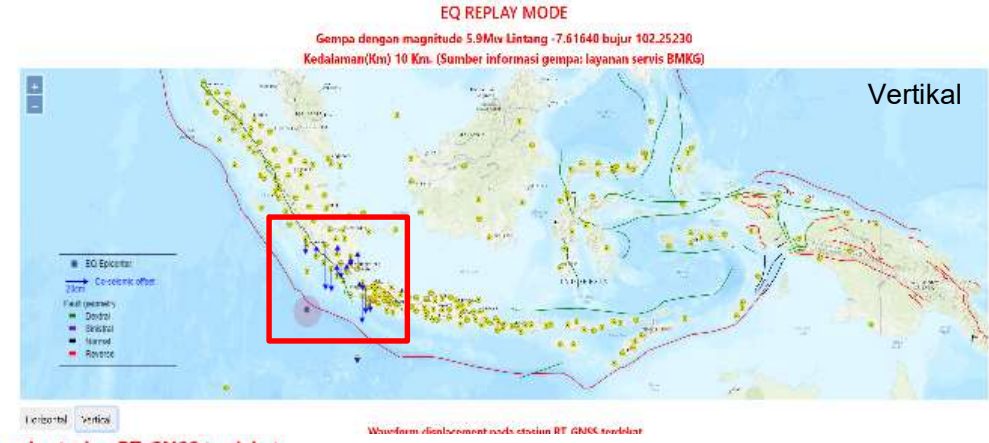
Rahmawan, et.al. (2020)

Preliminary Deformation Model



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Co-Seismic Offset dan Displacement



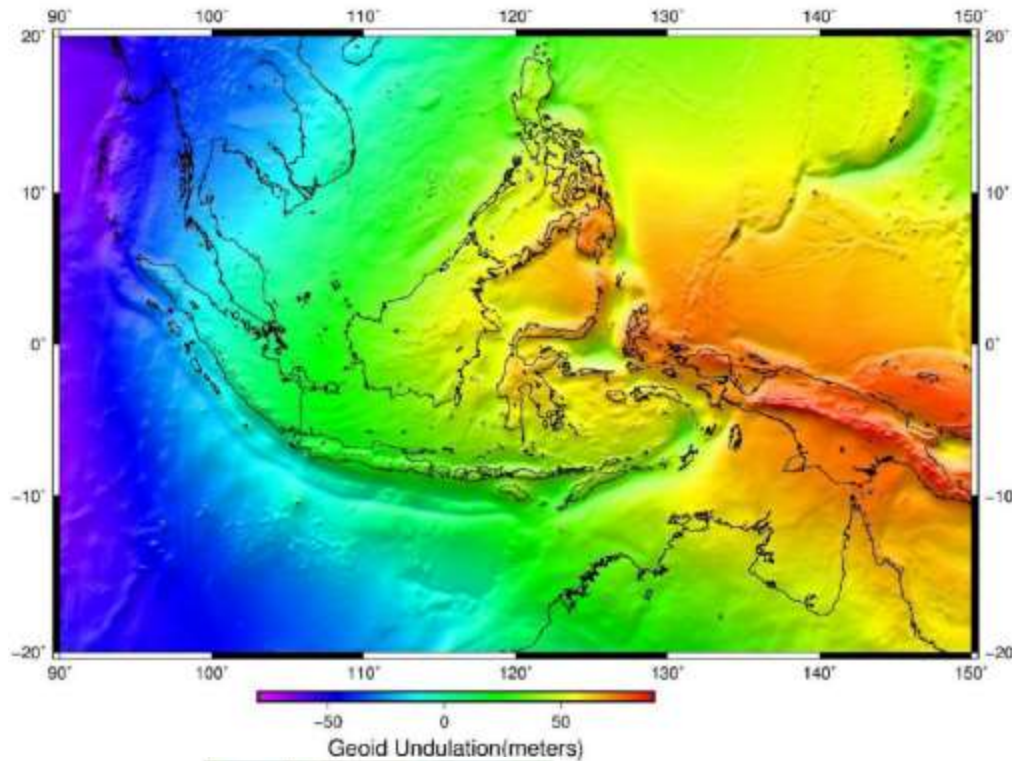
Indonesian Geospatial Reference System (SRGI2013)

- Vertical Datum

- Indonesian Vertical datum is Geoid
- INAGEOID2020 (Indonesian Geoid 2020) was launched as Vertical Geospatial Reference Frame
- The INAGEOID2020 was tied to SRGI2013 as its reference system and connected to IGSN71 or its new version include IGRS (International Gravity Reference Sistem)
- INAGEOID2020 as Vertical Geospatial Reference Frame expressed by the vertical distance relative to the ellipsoid reference



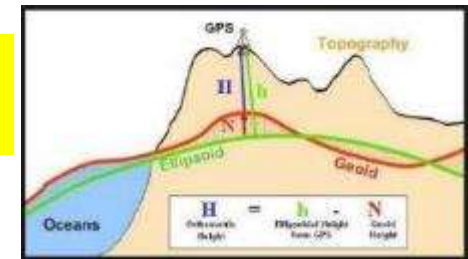
Vertical IGRS 2013 (Indonesian Geoid)



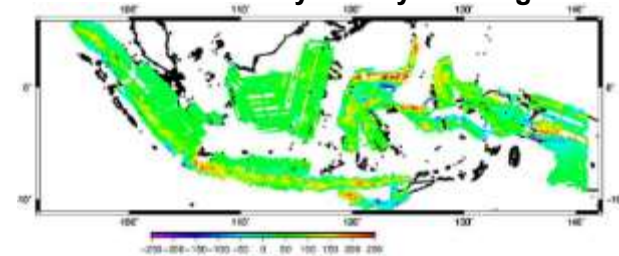
Gravity main control point distribution



InaGeoid:
A unified vertical datum for
throughout Indonesia



Airborne Gravity Survey Coverage

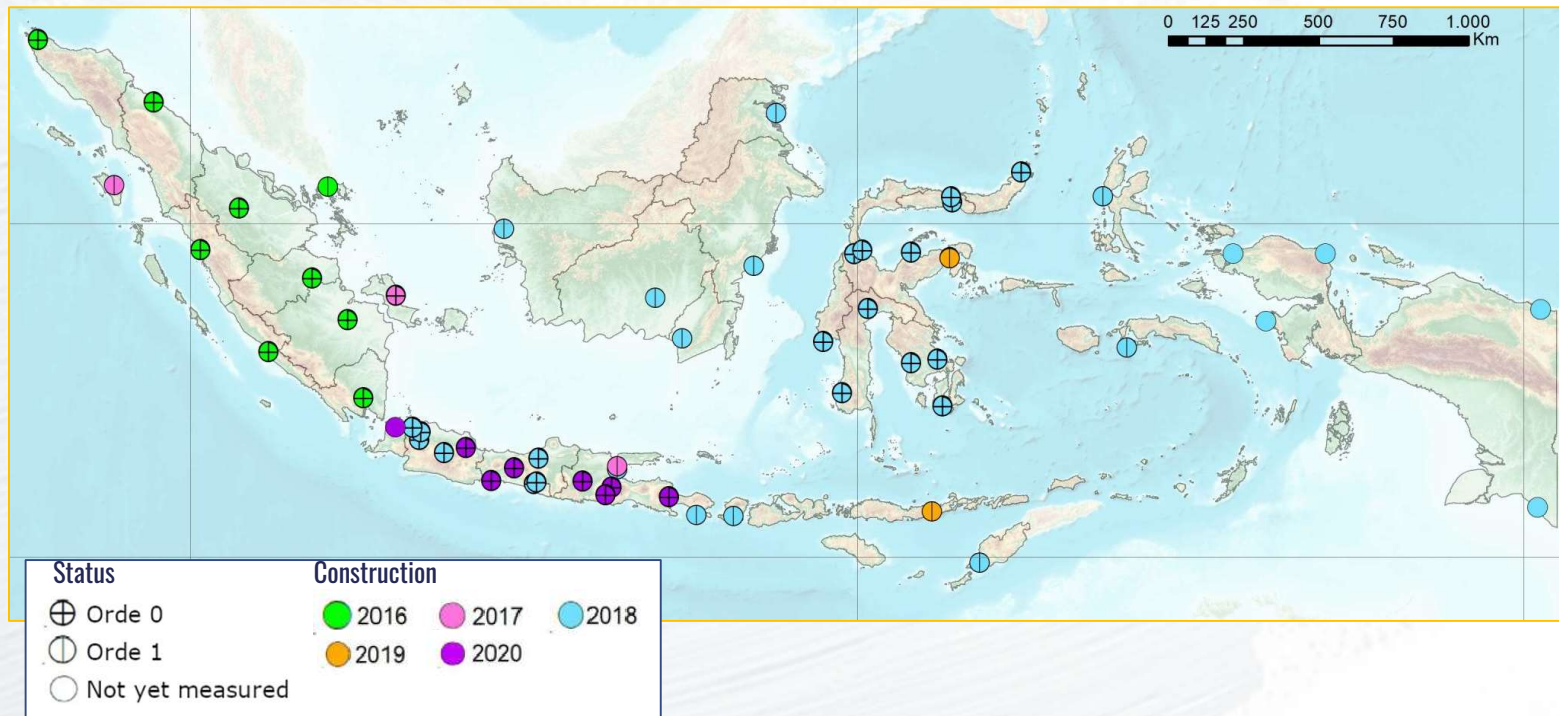


90% coverage

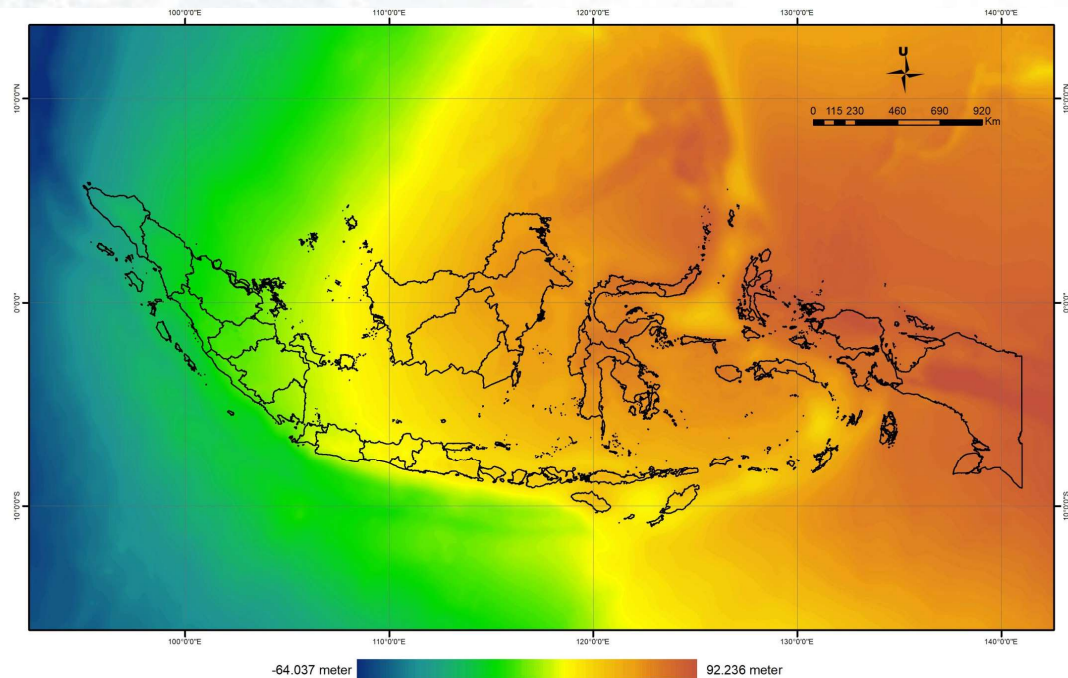


Absolute Gravity Control Network in Indonesia

60 Pilars



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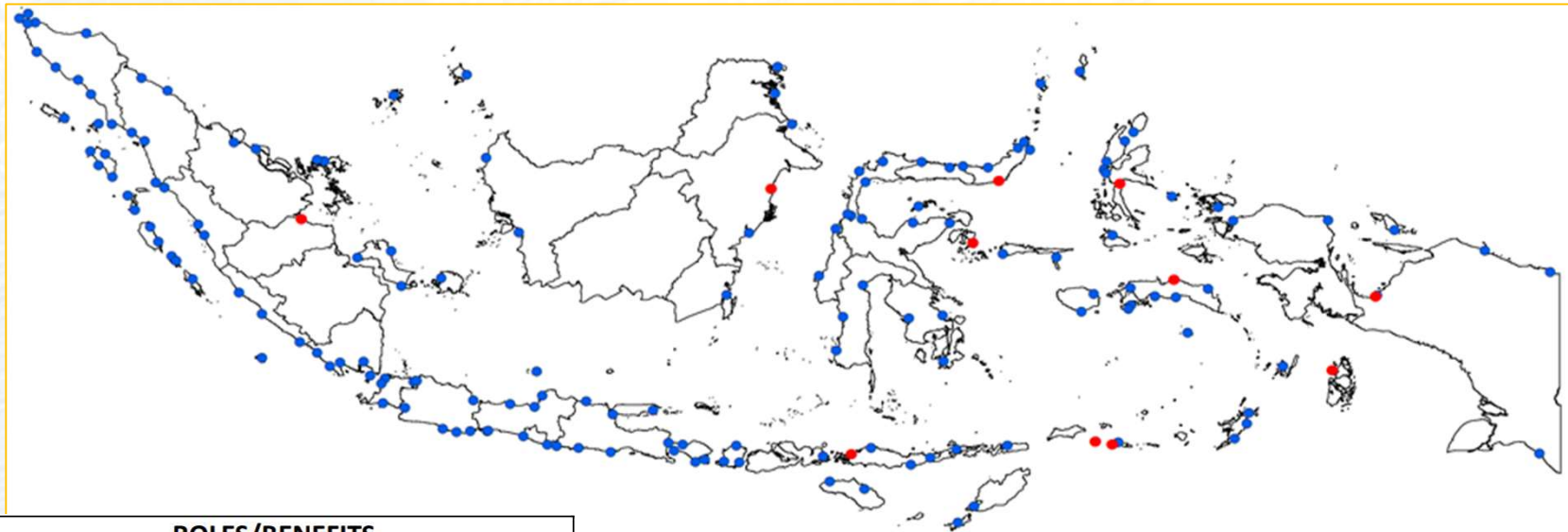


- INAGEOID2020 was obtained with an accuracy of **5-20 cm** - island base.
- It is derived from gravity data (**airborne and terrestrial gravity**), global geoid model (EGM2008), and elevation data (SRTM30, DEMNAS, BATNAS)
- It will be updated annually to achieve a higher accuracy supporting One Map Policy and large scale map project

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Tide Gauge Network in Indonesia

170 Stations



ROLES/BENEFITS

- ✓ Reference for Survey and Mapping
- ✓ Supporting Tsunami Early Warning System
- ✓ Supporting Maritime Navigation
- ✓ Supporting Research & Development

0 200 400 800 1,200 1,600 2,000 Kilometers

Legend

- BIG Tide Gauges Constructed in 2020 (11 Stations)
- BIG Tide Gauges up to 2019 (159 Stations)

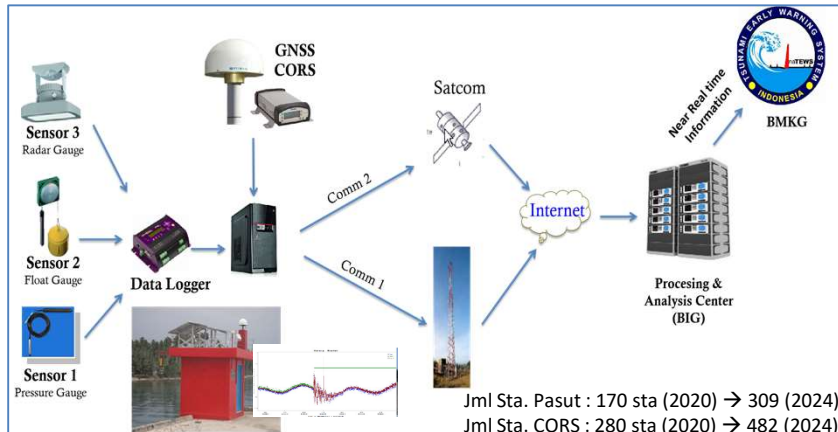
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- Indonesian Geospatial Reference System can be accessed freely at <https://srgi.big.go.id/>

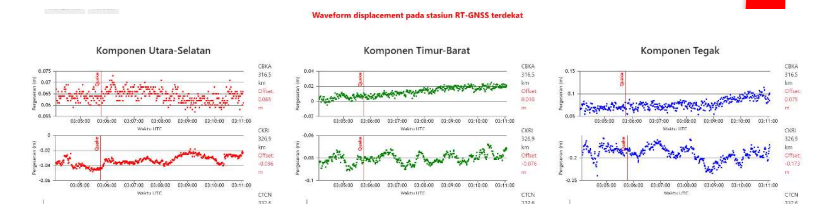
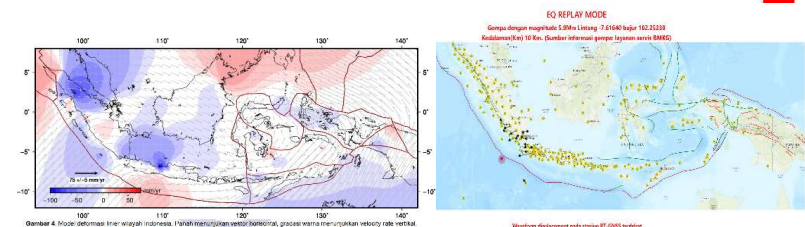
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Geodetic Infrastructure Support to Indonesia Tsunami Early Warning System (InaTEWS)



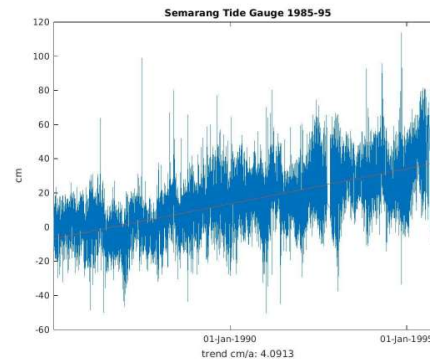
- **Indonesian Continuously Operating Reference Stations (InaCORS)** is a realtime and continuous positioning system at Geodetic Control Points in Indonesia.
- **InaCORS** support the information system of earthquake and tsunami early warning, on:
 - ❑ Detection of *displacement waveforms* when earthquake happen to provide additional data for earthquake parameters computation by BMKG.
 - ❑ Provide *information on tectonic plate movement* to study the earthquake potential area → *Strain Map & Stress Map*.

- **Indonesian Tides System (InaTides)** is a realtime and continuous sea level measurement at tide stations in Indonesia.
- **InaTides** support the information system of earthquake and tsunami early warning, on:
 - ❑ Detection of *rapid sea level changes* as a confirmation to tsunami early warning in the area when there is a tsunami.
 - ❑ A confirmation to end the tsunami early warning if the tsunami does not happen.

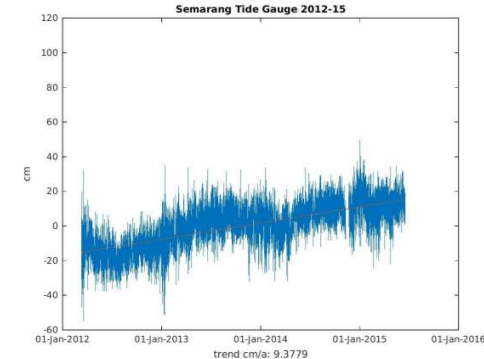


GNSS Controlled Tide Gauges For Sea Level Rise and Land Subsidence Monitoring

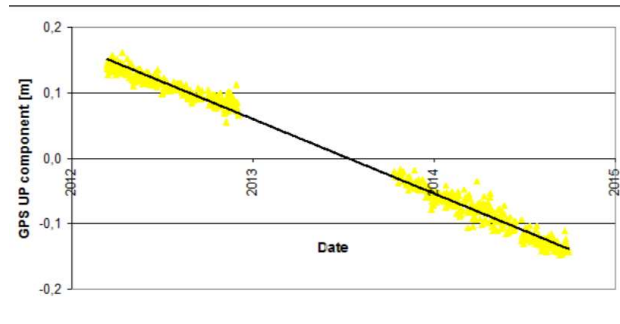
Case Study: **SEMARANG**



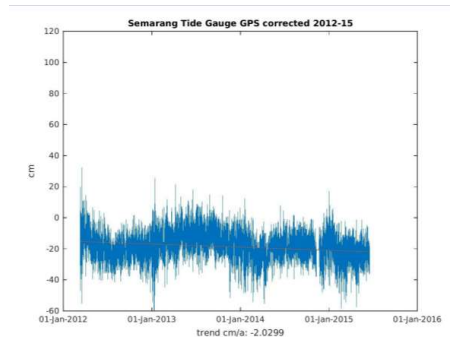
Sea Level Rise of 4 cm/yr between
1985-1995.



Sea Level Rise of 9 cm/yr between
2012-2015.



Land subsidence of 11 cm/yr (2015)



Corrected Sea Level Rise of 2 cm/yr

Concluding Remarks

- The Indonesian Geospatial Reference System 2013 play important roles in survey and mapping activities to implement One Map Policy in Indonesia.
- The development of geodetic infrastructures will continue to cover most of Indonesia area.
- Geodetic infrastructure in Indonesia is utilized in a wide range of applications, such as:
 - Surveying and Mapping
 - Earth System Monitoring
 - Indonesian Tsunami Early Warning System (Ina TEWS)
 - Land Subsidence Monitoring
 - Sea Level Rise Study



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GEOSPASIAL**



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