ASIA PACIFIC GEOSPATIAL FORUM

Geodetic Reference Frame, Infrastructure and Their Applications in Indonesia

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Workshop on Geodetic Reference Frame – WG1 UN-GGIM-AP

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Organized by:

UN-GGIM-AP Regional Committee of United Nations Global Geospatial Information Management for Asia & the Pacific

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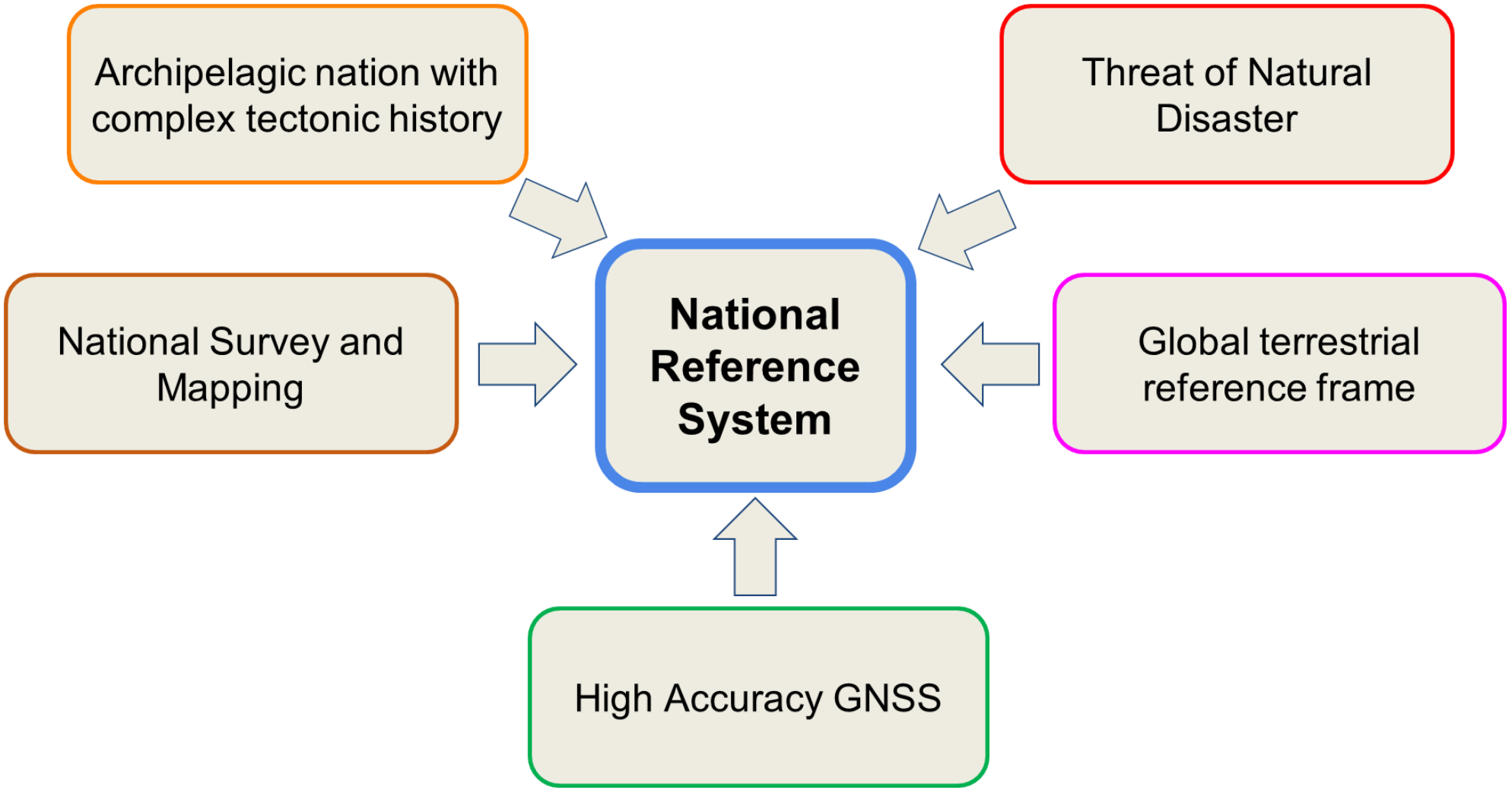
International Association of Geodesy

FIG International Federation of Surveyors
Fédération Internationale des Géomètres
Internationale Vereinigung der Vermessungsingenieure

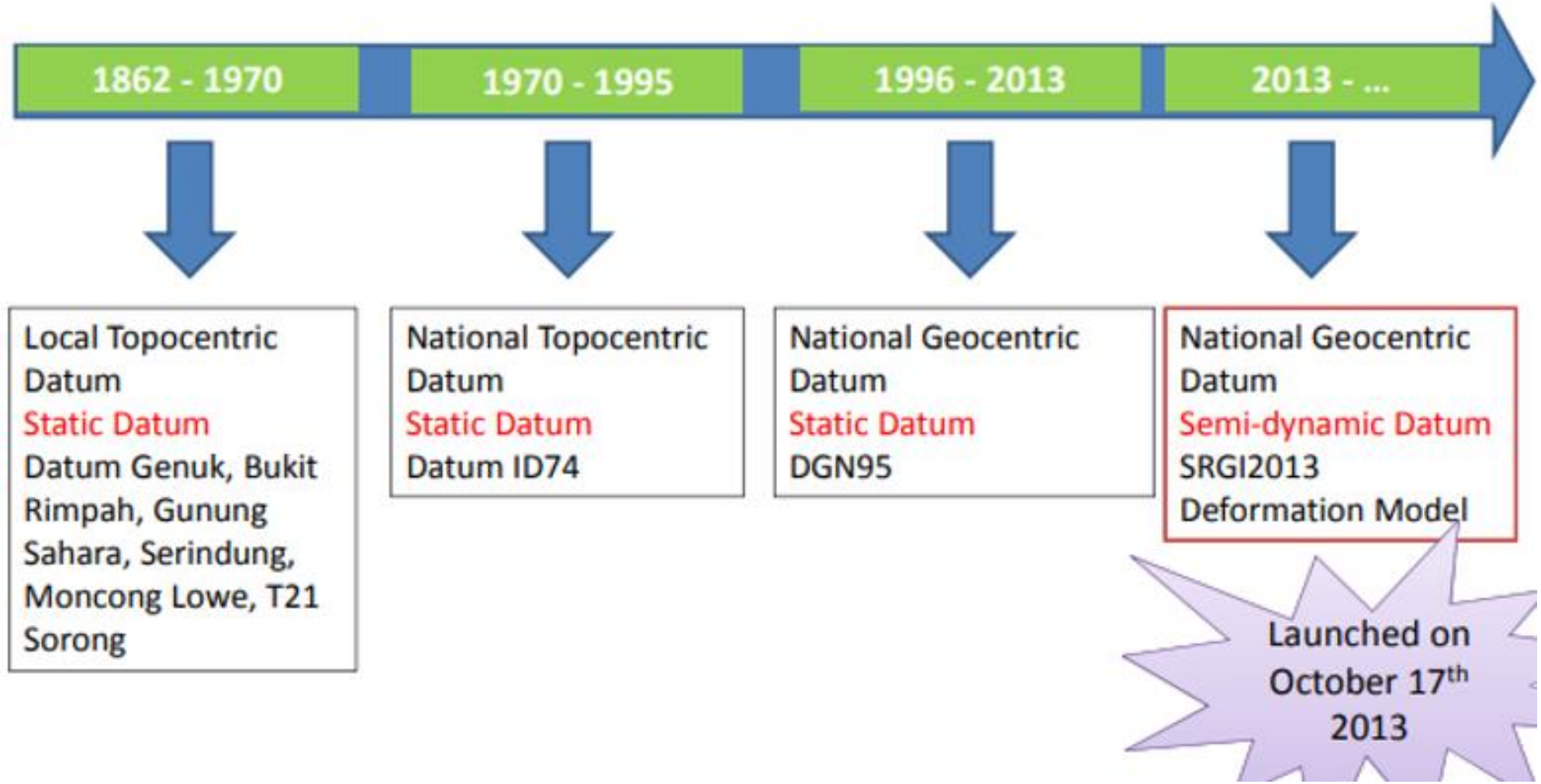
Pointer

1. Background
2. Indonesia Geospatial Reference System 2013 (SRGI2013)
3. Current Status of National Geodetic Infrastructure
4. Some Applications of National Geodetic Infrastructure
5. Summary

Background


Archipelagic nation with complex tectonic history
Threat of Natural Disaster
National Survey and Mapping
National Reference System
Global terrestrial reference frame
High Accuracy GNSS

History of Indonesian Geodetic Datum Development



Indonesia Geospatial Reference System (IGRS)

- First launched in 17 October 2013.
- IGRS is a geospatial reference system which is used nationally and consistent for all Indonesian area and it is compatible with the global geospatial reference system (ITRS).
- Consists of:
  a. Horizontal Geospatial Reference System; and
  b. Vertical Geospatial Reference System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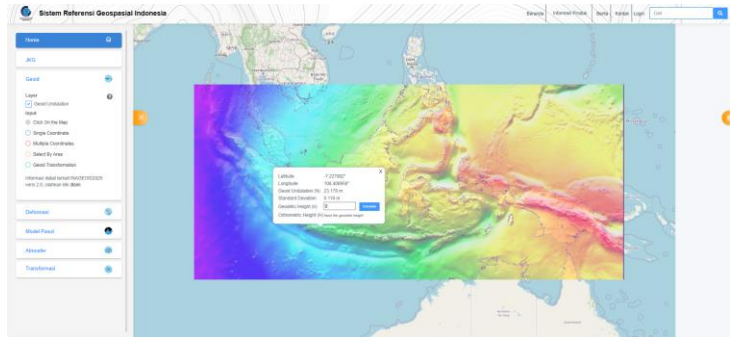
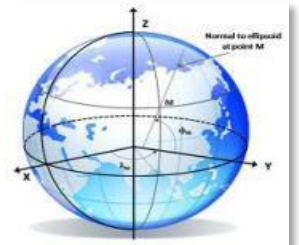
PERATURAN BADAN INFORMASI GEOSPASIAL
REPUBLIK INDONESIA
NOMOR 13 TAHUN 2021
TENTANG
SISTEM REFERENSI GEOSPASIAL INDONESIA



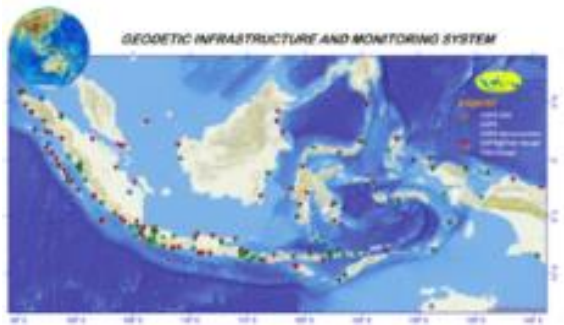
Indonesian Geospatial Reference System (IGRS)

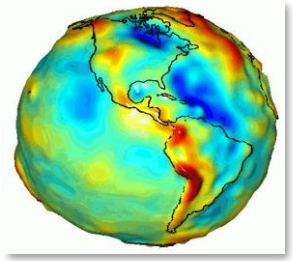
1. **Horizontal Geospatial Reference System - SRGI2013 (2021.0)**
   a. **Coordinate Reference System** → *International Reference Terrestrial System (ITRS);*
   b. **Coordinate Reference Frame** → Geodetic Control Network with set of coordinate at certain epoch (1 January 2021) and connected to global terrestrial reference frame (ITRF2014) or its update
   c. **Geodetic Datum** → WGS84;
   d. **The change of coordinate over time** (velocity rate) → Vx, Vy, Vz.

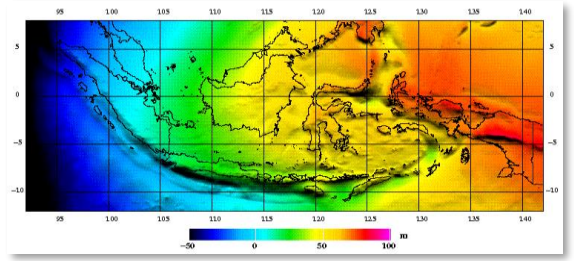
2. **Vertical Geospatial Reference System**:
   a. Geoid → InaGEOID 2020; and
   b. **Tidal Datum** → HAT, MHWS, MSL, MLWS, LAT.

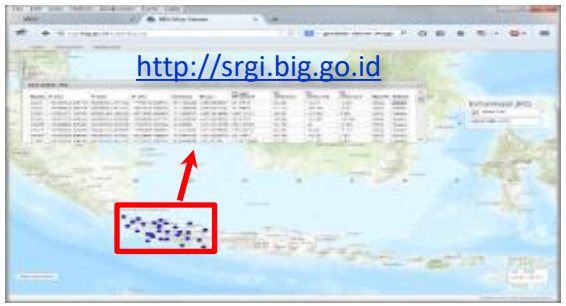


ECEF
(Earth Centered Earth Fixed)

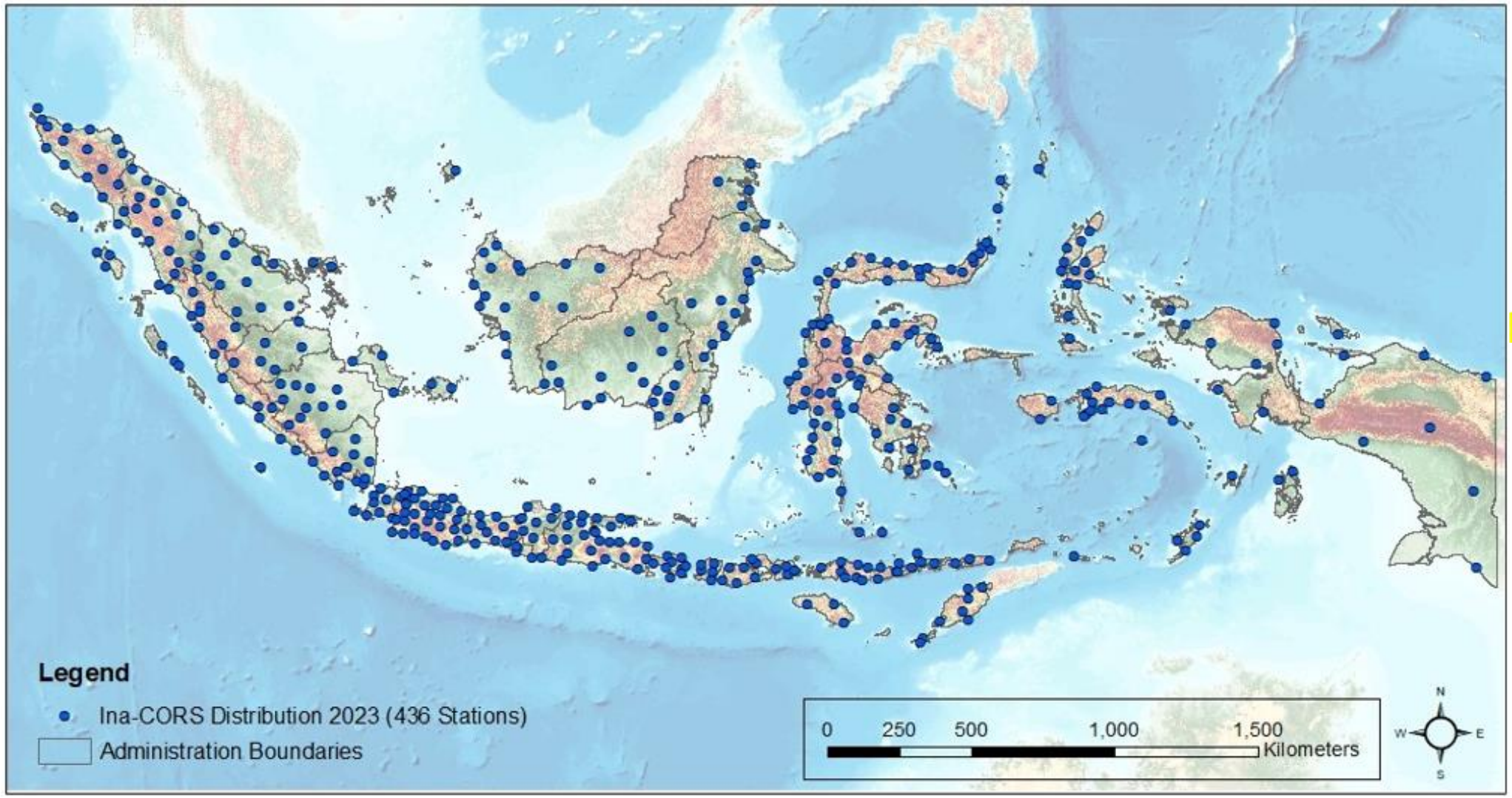








Geodetic Control Network
(Indonesian CORS Station Distribution)



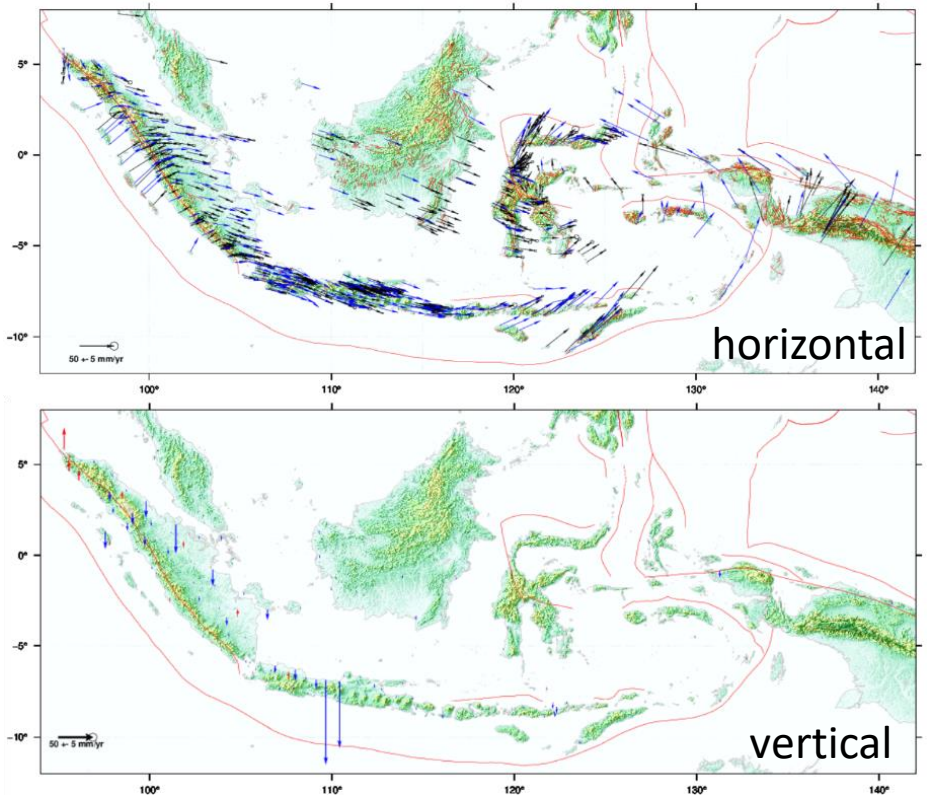

Concrete Monument


meteorology Sensor

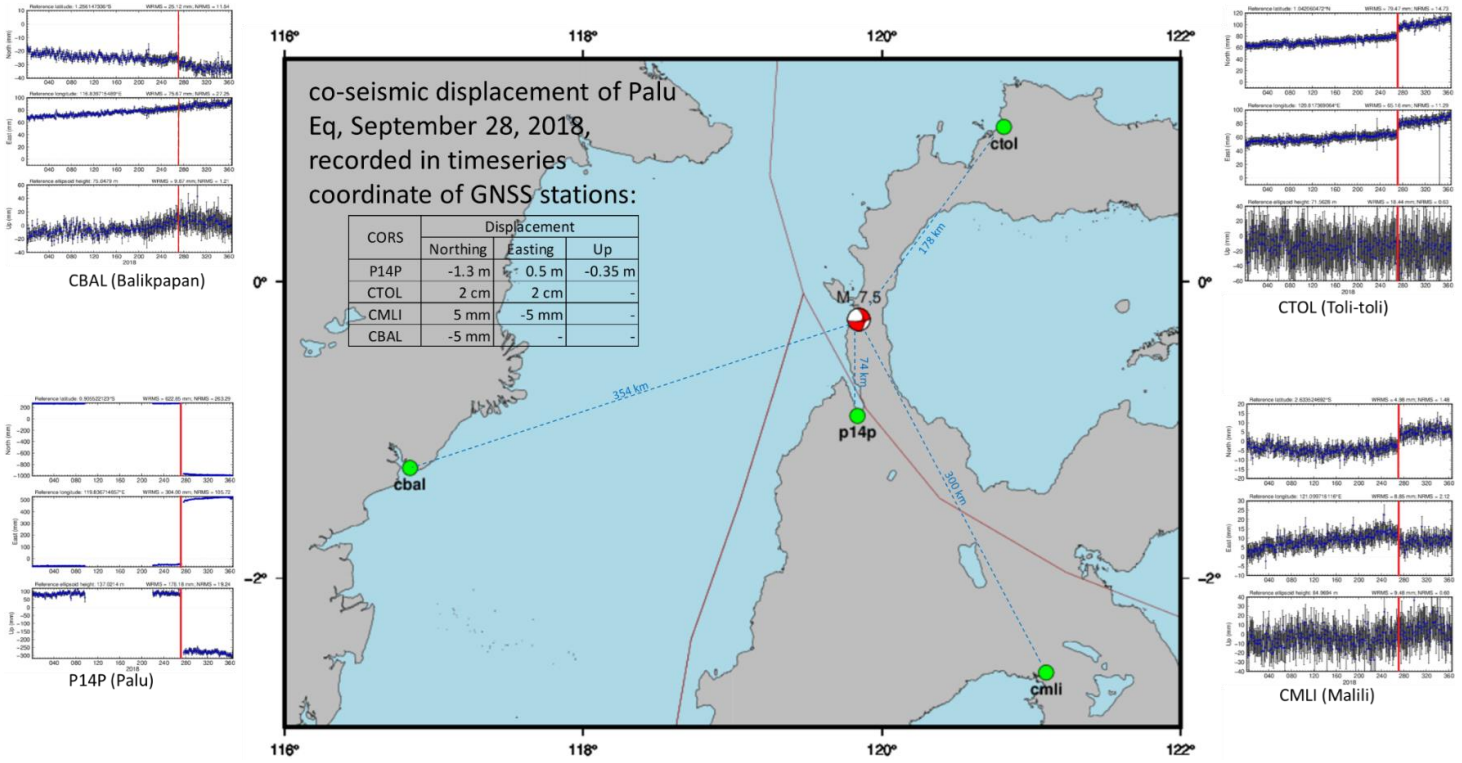

Solar Cell

Ina-CORS is used to monitor the tectonic plate movement and maintain geospatial reference frame accuracy

velocity rate vector



co-seismic displacement



CORS	Displacement		
	Northing	Easting	Up
P14P	-1.3 m	0.5 m	-0.35 m
CTOL	2 cm	2 cm	-
CMLI	5 mm	-5 mm	-
CBAL	-5 mm	-	-

THE GRAVITY DATASET AND INFRASTRUCTURES TO DEFINE INDONESIAN GEOID **(INAGEOID)**

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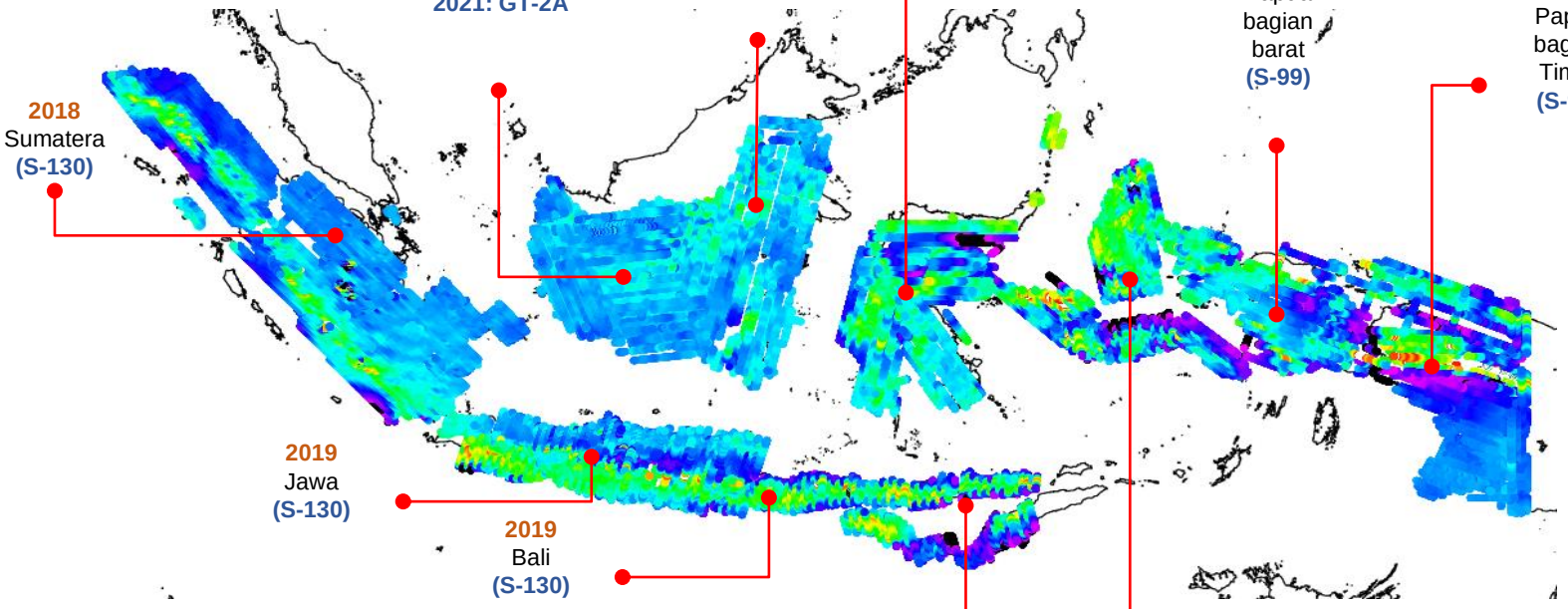
The Distribution of Gravity Anomaly Generated from Airborne Gravity Surveys in Indonesia
(for years 2008 up to 2022)



Indonesia Geoid 2020 (INAGEOID 2020)

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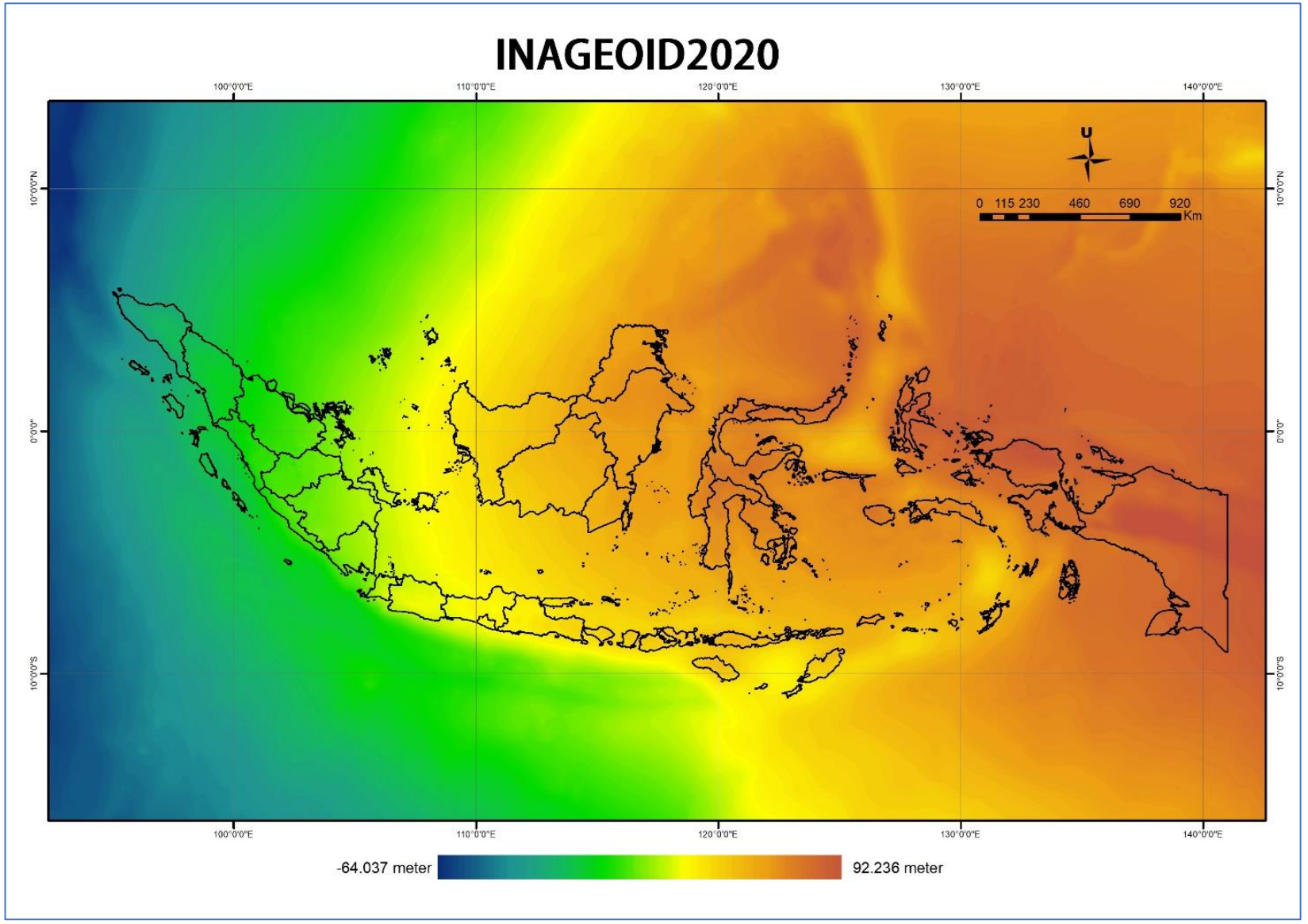
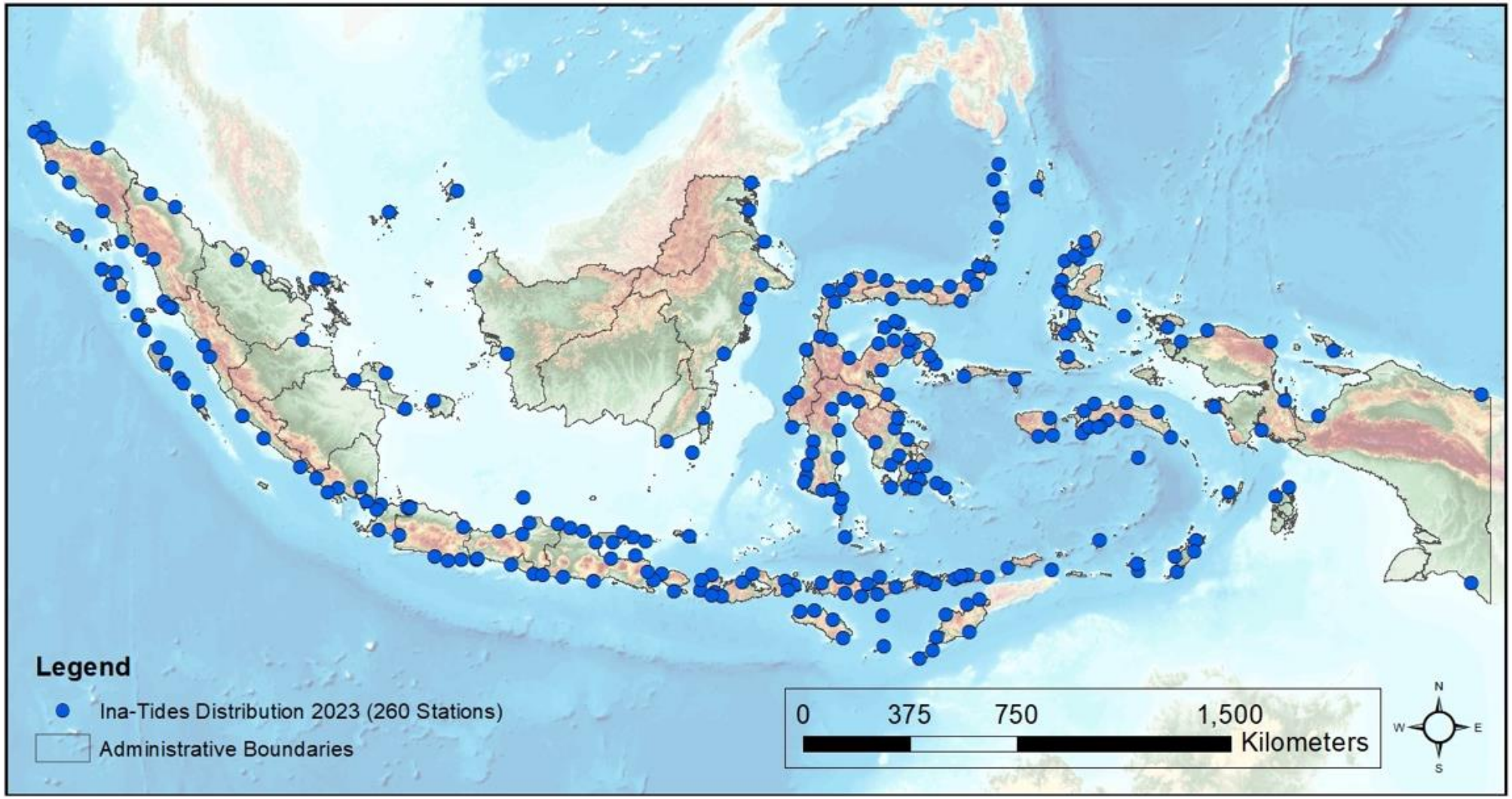
- INAGEOID2020 as national vertical geospatial reference frame of Indonesia
- The use of INAGEOID2020 in Indonesia is mandatory.

Spatial resolution:	0,01 x 0,01 degree
Unit:	Meter
Reference system:	SRGI2013
Gravity reference frame:	IGSN71 or its update including IGRS
Coverage:	The whole area of Indonesia

https://srgi.big.go.id



Indonesian Tides Station (Ina-Tides) Distribution



Ina-Tides System

Modem

Data Logger

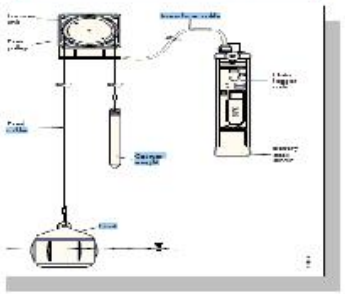
Float Gauge

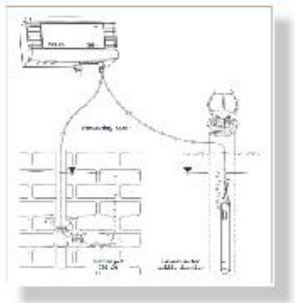
Bubble Gauge

Radar Gauge

BIG-Tide Gauge System:

- Sensor 1 : Bubble Gauge
- Sensor 2 : Float Gauge
- Sensor 3 : Radar Gauge





IGRS Service and Access System

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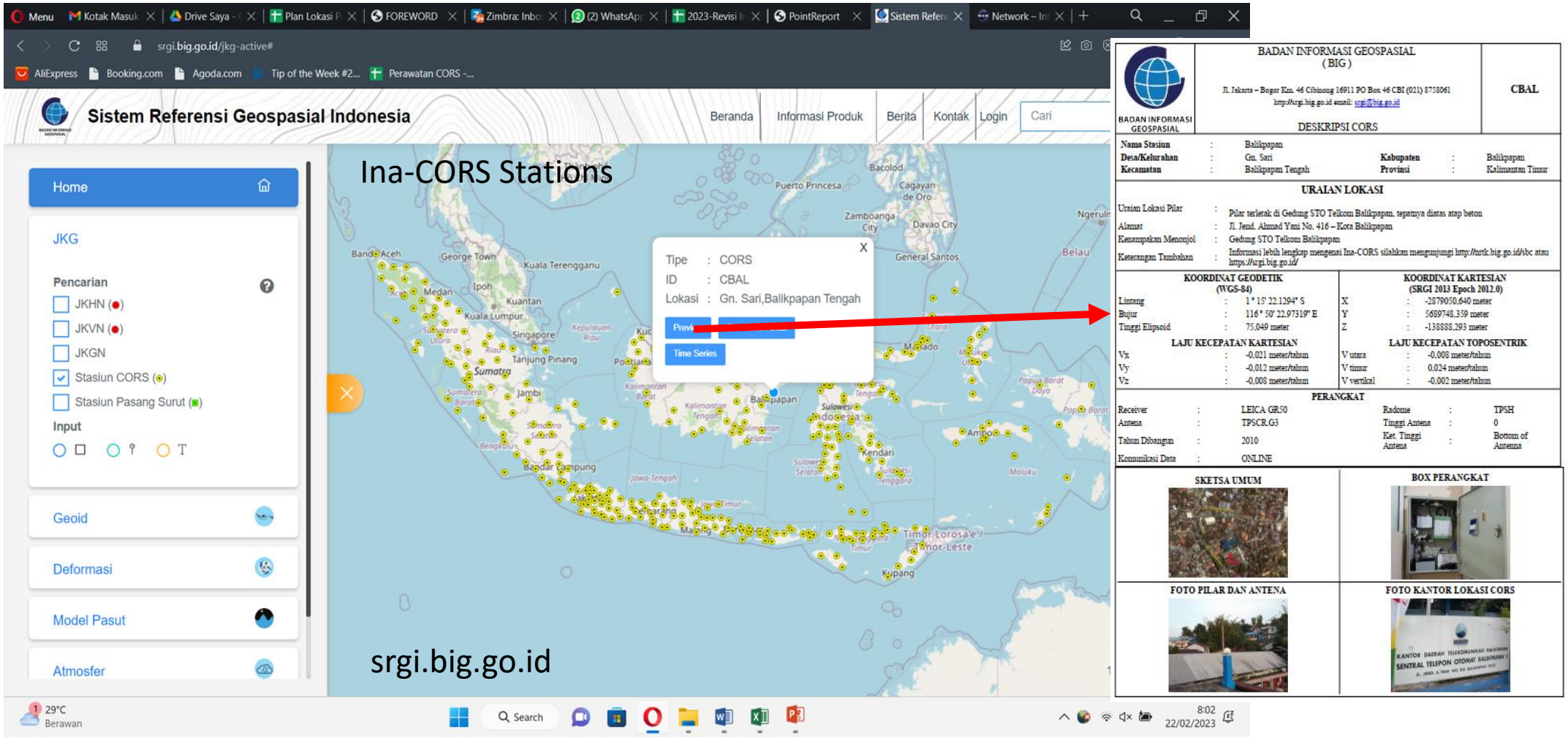

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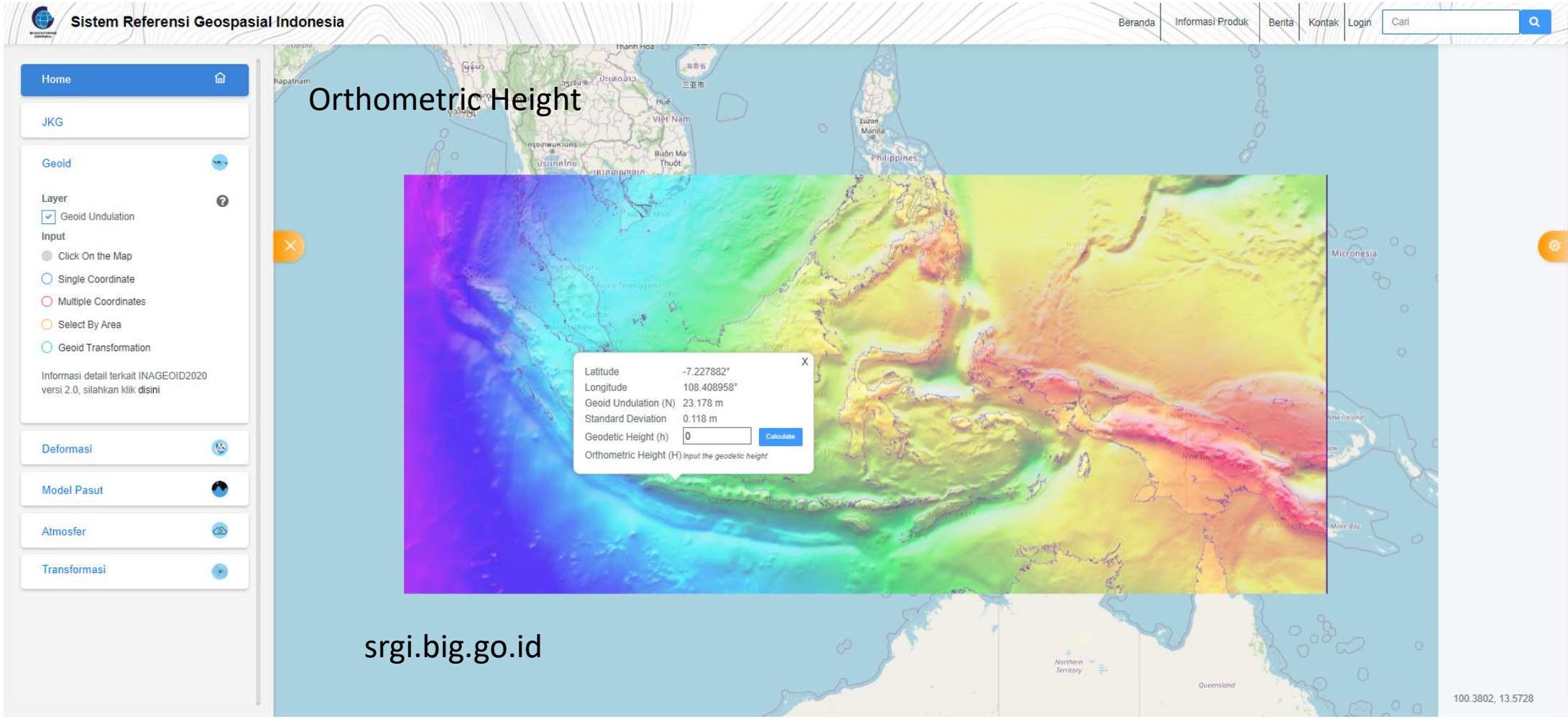
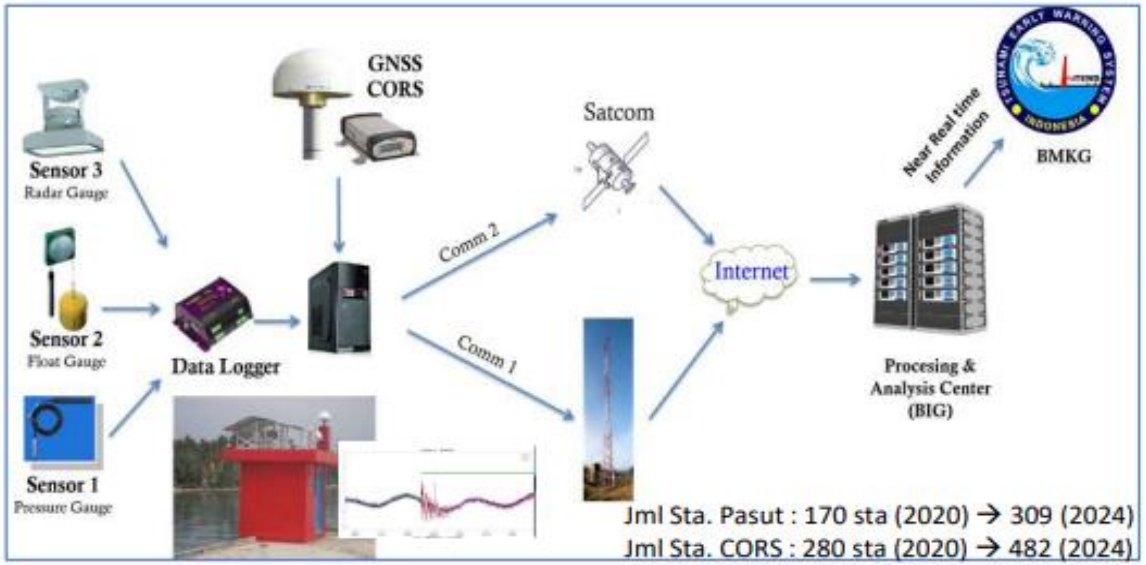
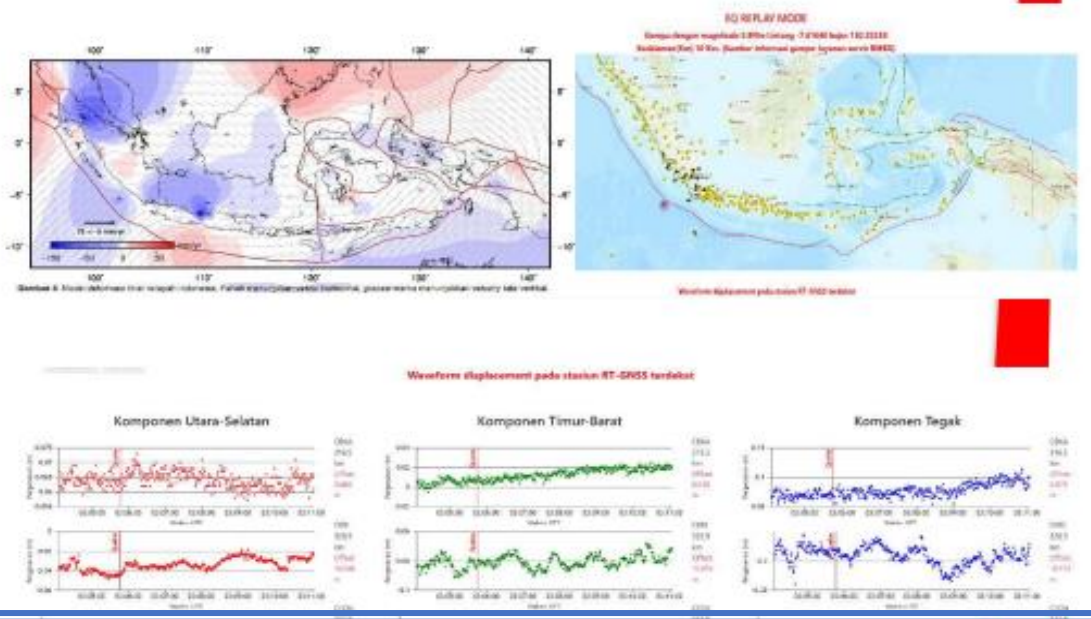


Support on Indonesian Tsunami Early Warning System (InaTEWS)



- ***Indonesian Tides System (Ina-Tides)*** 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.

- ***Indonesian Continuosly Operating Reference Stations (Ina-CORS)*** 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*.



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

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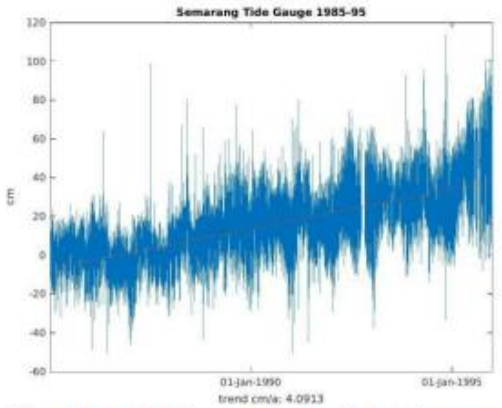
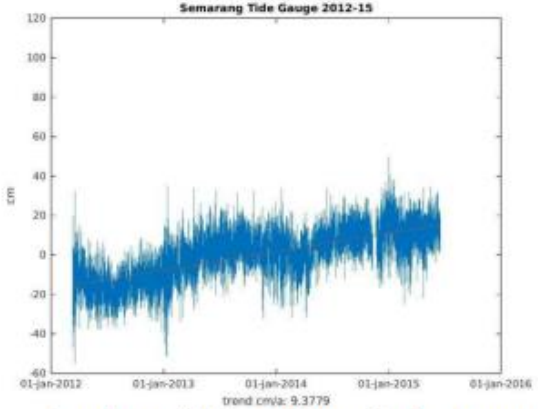
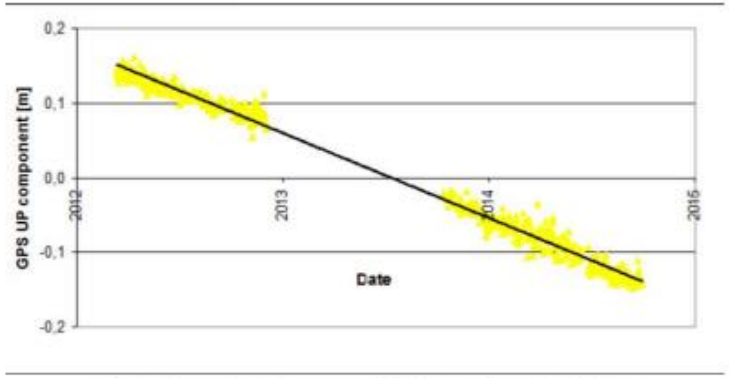
Case Study: **SEMARANG**



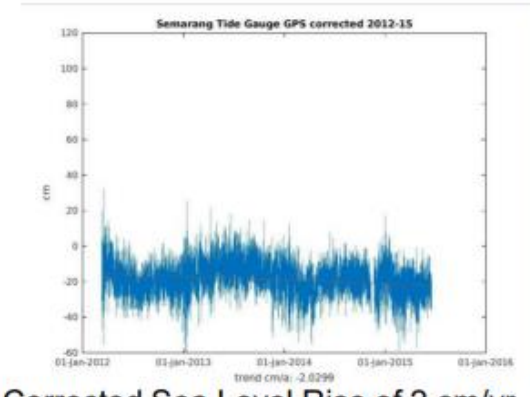
Sea Level Rise of 4 cm/yr between 1985-1995.



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

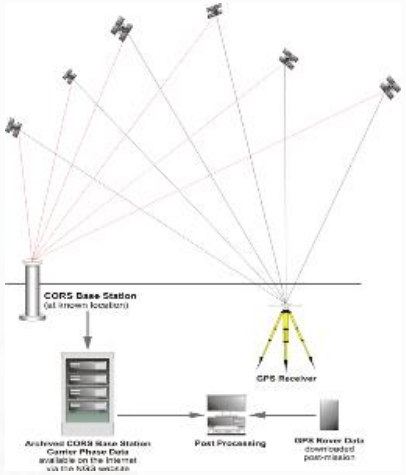
1. The IGRS plays important roles in survey and mapping activities to implement One Map Policy in Indonesia.
2. The development of geodetic infrastructures will continue to cover most of Indonesian area.
3. Geodetic infrastructure in Indonesia is utilized in a wide range of applications, such as:
  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


Thank you ....
srgi.big.go.id

Main Use of IGRS

The IGRS is mainly used for:

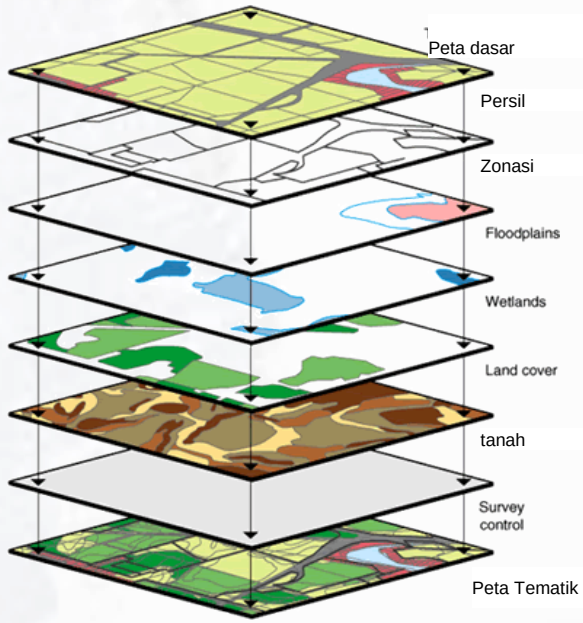
(1) IGT wajib mengacu pada IGD.
(2) Dalam hal terdapat IGD yang paling mutakhir, IGT wajib diselarasakan dengan IGD yang paling mutakhir.
(3) Dalam hal IGD belum tersedia, penyelenggara IGT dapat membuat IGD untuk kepentingan sendiri dengan mengikuti standar dan spesifikasi teknis yang ditetapkan oleh Badan.
(4) Pembuatan IGD dimaksud pada ayat (3) oleh penyelenggara IGT harus mendapat persetujuan Badan.
(5) Salinan IGD yang dibuat oleh penyelenggara IGT wajib diserahkan ke Badan.
(6) Badan dapat menyebarluaskan IGD sebagaimana dimaksud pada ayat (5) yang dibuat oleh penyelenggara IGT.



Penentuan posisi IG wajib mengacu pada SRGI.

Yang dimaksud mengacu pada IGD adalah:

- Posisi IG wajib mengacu pada SRGI.
- Menggunakan peta dasar yang sama sebagai referensi geometris dalam pembuatan IGT.
- Peta dasar digunakan sebagai acuan dalam integrasi dan sinkronisasi IGT.
- Menggunakan peta dasar dengan skala yang sama atau lebih besar dari IGT yang akan dibuat.



Peta dasar digunakan sebagai acuan dalam pembuatan IGT.