GNSS APPLICATIONS AND PROSPECTS IN INDONESIA: ACADEMIC PERSPECTIVE

Dr. Lin Yola
School of Strategic and Global Studies, Universitas Indonesia
• Population: 279,798,049
• Area: 1,904,569 km²
• Water Area: 3,257,357 km² (62%)
• Number of islands: 17,500 (81,000 km coastal line)

• The world's largest archipelagic state and the 14th-largest country by area
• the world's fourth-most-populous country
Typology of Indonesian Communities Settlement

Alamsyah (2017)
Communities Living along the Coastal Lines and on Water
Terrestrial surface vs. anthropogenic earth uses

CITY A

Ocean Terrestrial

Sea level

Mountain forests

Mainland settlements

Coastal cities

Anthropocentric developments

Sea level rise

Water zone of Coastal City

Anthropocentric developments

VERTICAL IMPACT OF SEA LEVEL RISE TO COASTAL CITY

modification of Alamsyah 2010
Terrestrial surface vs. anthropogenic earth uses

CITY B

Ocean Terrestrial

Sea level

Mountain forests

Coastal cities

Mainland settlements

Anthropocentric developments

2000 m dpl

TERRESTRIAL SURFACE VS. SEA LEVEL RISE

CITY B

Ocean Terrestrial

Sea level rise

Mountain forests

Mainland settlements

Anthropocentric developments

2000 m dpl

VERTICAL IMPACT OF SEA LEVEL RISE TO COASTAL CITY

modification of Alamsyah 2010
Figure 4.a
Map of Bedono village
Once was terrestrial village
Become water based village

Source: Google Earth

Previous coastal line

Previous rice field and fish ponds

II. Karya Semarang-Demak
Jakarta Northern Coast National Capital Integrated Coastal Development (NCICD), the Giant Sea Wall
Informal Settlement Along Musi River in Palembang City

52.47% on Water
0.63% by the Water
46.91% within low land area
Musi River in Palembang City
Landslide in the main access road in Toraja Utara, Sulawesi
Flash floods occurred almost throughout Jakarta during the rainy season due to the overnight rain which dumped nearly 400 millimeters (15 in) of rainwater, causing the main rivers to overflow. At least 66 people have been killed, and 60,000 displaced in the worst flooding in the area since 2007.
Jakarta is the world’s most polluted city
(CNN, Augt 11 2023)

Air pollution has cost an estimated 11,000 deaths* in Jakarta in 2023, also cost approximately $2,800,000,000 USD (IQAir, Oct 13 2023)
Fire burns a plot of land in Kalimantan on Aug. 31, 2023

*The Jakarta Post 2023*

Heavy smoke in Palembang due to peatland fire

*Kompas, 2023*
The Potential Tsunami Map is made based on tsunami event which occurred in Indonesia since 1629. About 110 significant tsunami occurred in Indonesia since 1629 until 2017 and 100 tsunami caused by tectonic earthquake, 9 tsunami caused by volcanic activity in the sea and 1 tsunami caused by landslide in the sea. North of West and Central Java is red line is caused by Krakatau explosion on 1883.

Indonesia Natural Hazard
22 million vehicle units per day (Greater Jakarta Metropolitan Regional Police, 2023)

Jakarta’s traffic index at 29th out of 389 cities in the world in 2022 with average travel time for a 10-kilometre trip in Jakarta is 22 minutes 40 seconds (TomTom International BV, Feb 23 2023)

5,735,712 (21.7%) city dwellers of Jakarta use daily public transportation modal share (DKI Jakarta Government, 2019). However, the public transport facilities and services still not well managed.
Online Bike Taxi
Need of improved technology of toll gates
Indonesia shipping monitoring by using VTS station, AIS technology
Indonesia International Shipping Sea Lane (ALKI)
GNSS APPLICATIONS, SATELLITE BASE TECHNOLOGY
INDONESIA NATIONAL SPACE PROGRAM 2016-2040:

Vision:
Mastery, Advanced and Sustainable in Indonesian Space Activities

Mission:
1. To strengthen research and development in space science and applications;
2. To strengthen remote sensing activities and services;
3. To strengthen research, development, and engineering in aeronautics and space technologies and applications towards enhanced national capacity;
4. To create mastery in space launching through development of space port in Indonesia;
5. To promote commercial space activities by involving industries.
INDONESIA NATIONAL SPACE PROGRAM 2016-2040:

Main Target
1. Launching micro satellites to LEO from Indonesia launching site
2. Space launching services at launching sites in Indonesia
3. Satellite telecommunication
4. Space-based platforms for decision support system for national development
5. Active participation in international space forum and organizations
6. Operation earth observation, telecommunication, and navigation satellites
7. Mastery in satellite development of various missions
8. Communication satellite development and operation
9. Space launching site operation for satellite launching
10. Navigation satellite constellation for regional (ASEAN) services
11. Operation of satellite constellation for earth observation and data communication
Satellites in Indonesia

1. Palapa A1, 1976
2. Palapa A2, 1977
4. Palapa B2, 1984
7. Palapa B4, 1992
8. Palapa C1, 1996
10. Indostar I (Cakrawarta I), 1997
11. Telkom-1, 1999
12. Garuda-1, 2000
13. Telkom-2, 2005
14. INASAT-1, 2006
15. LAPAN-TUBSAT, 2007
16. Indostar II (Cakrawarta II), 2009
17. Palapa D, 2009
18. Telkom-3, 2012
20. LAPAN-A2, 2015
22. LAPAN-A3, 2016
23. Telkom-3S
24. Telkom-4 (Merah Putih), 2018
25. Nusantara Satu, 2018
26. Palapa N1 (Nusantara Dua), 2020
27. SS-1, 2022
28. SATRIA-1, 2023
29. Merah Putih 2, 2024
INASA, BRIN 2024

Current Space Program
“Nusantara-Satellite Constellation”

- SAR
- VHR
- HR
- TDRSS
- S or Ka-Band
- S or Ku-Band
- 4 HR Satellites & 2 VHR Satellites @SSO;
- 2 SAR Satellites @NeQ 10deg;
- 10 Satcom LEO @Eq 0 deg;
- 1 Comm GEO
- Forward
- Return
- Space to Space (Multiple Accesses)
- SBAS

VHR: Very High Resolution
HR: High Resolution
SAR: Synthetic Aperture Radar
Comm: Data Communication
TDRSS: Tracking and Data Relay Satellite System
Indonesia currently mostly concerns on the Earth Observation Satellites and Communication Satellites
Promoting International Space Cooperation

SOME CHALLENGES IN ASIA:

- Growing economy
- Increasing awareness in space sector (science, technology, applications, industries)
- Big international market of space technology & applications (communications, IoT, EO, navigation, etc)
- Growing GNSS providers/industries and users
Traffic and Air Pollution Study in Jakarta
Likupang Islands, Sulawesi
Likupang Islands, Sulawesi
Data Logging in Sulawesi Island using MADOCA PPP (from city center, to coastal, and small island)
Working with local government
GNSS Workshops with Cross Stakeholders
Resources
- Economic growth
- Huge area, big population
- Human resources, natural resources
- Environment benefit

Technology readiness
- Regulatory framework, sectoral interest, depending on external technology services
- Public trust, education and awareness
- Cost barriers
- Un-integrated technologies

The Urgency of Problem Solving
- Disaster early warning system
- Intelligent transportation system, marine shipping
- Security and defense
- Environmental degradation
- Smart cities

Future Challenges
- Development Disruption
- Cyber Security
- Technology competition
- Social vulnerability and environmental degradation
Thank You
lin.yola@ui.ac.id