



Strategic Funds for the Promotion
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MEXT

Strategic Funds for the Promotion of Science and Technology by MEXT (Promotion of International Joint Research)

Research Enhancement and System Establishment for Space Weather in Indonesia

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Contents and Summary

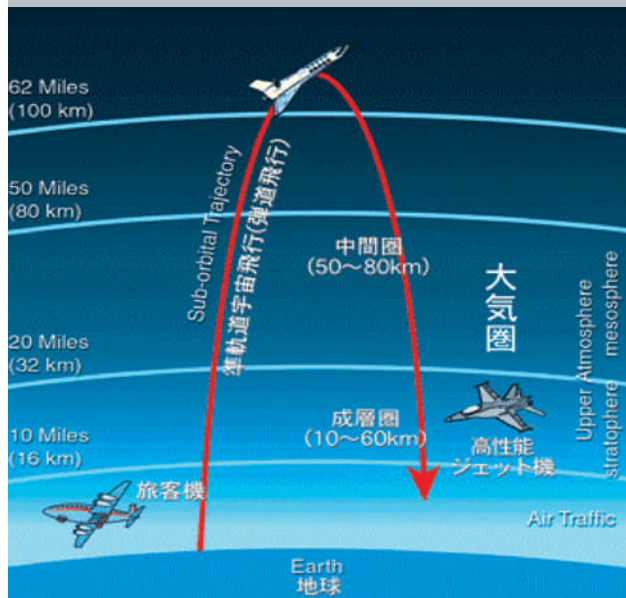
1. “Regional” studies are important even for space weather.
2. Japan-Indonesia 3-year collaborative research project “Indonesia Space Weather” started in 2010, based on our long-time collaboration and strong interest from Indonesia (LAPAN) side.
3. Equatorial Atmosphere Radar (EAR) is the major facility of the project. EAR continues long-term “Atmosphere” observations, but is shifted to more “Ionosphere” observations since July 2010.
4. EAR site is equipped with many supporting instruments.
5. SEALION of NICT, OMTI of STEL, and beacon-receivers of RISH help the project by giving horizontally wide-coverage data.

What is Space Weather?

Space weather: study of near-Earth space environment



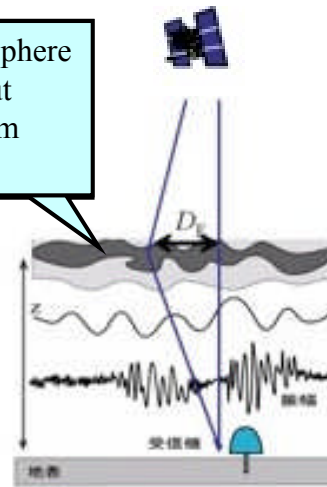
Ionosphere is the height range for ISS and Space Shuttle



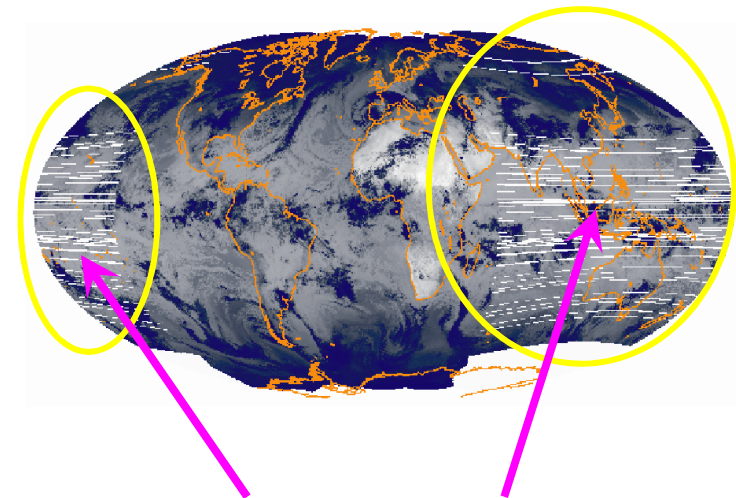
Space weather is a program to observe, assess, and forecast the space environment, which is very important for constant operation of satellite systems and reliable communication / navigation purposes.

Not only the study of the Sun-to-Earth system, but also studies of vertical coupling of the atmosphere / ionosphere is important. Regional observations (especially in the low latitudes) are thus necessary.

Ionosphere
(about 300km high)



Satellite signal is scintillated by the disturbance of the ionosphere.



LAPAN's serious interest to space weather



LAPAN is now running the 5-year space weather program aiming for start of service. These are pictures from the panel discussion by LAPAN with the Minister of RISTEK and a member of congress.

Minister of RISTEK
Mr. Suharna Surapranata

LAPAN Chairman
Dr. Adi Sadewo Salatun

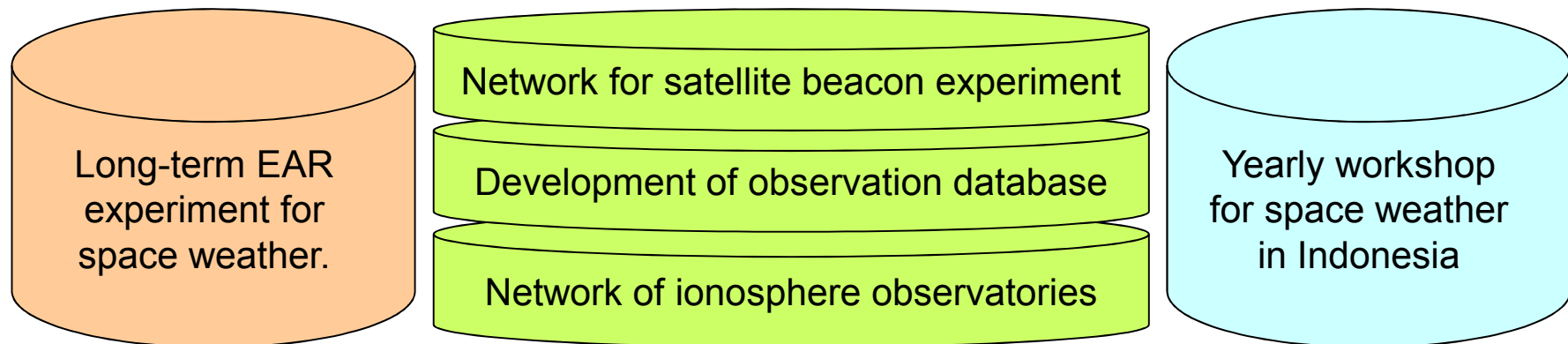
Member of Congress
Mr. Agus Sulistiono



Research Enhancement and System Establishment for Space Weather in Indonesia



The collaborative project is funded in FY2010-2012 to promote space weather study in Indonesia by providing long-term and high-quality data of the region from the EAR and related facilities. Hold yearly workshop for space weather in Indonesia.



Institute & Personnel



LAPAN

Sri Kaloka, Buldan Muslim, Afif Budiyo



RISH, Kyoto Univ.

Mamoru Yamamoto, Masayuki Yamamoto,
Hiroyuki Hashiguchi



STEL, Nagoya Univ.

Yuichi Otsuka



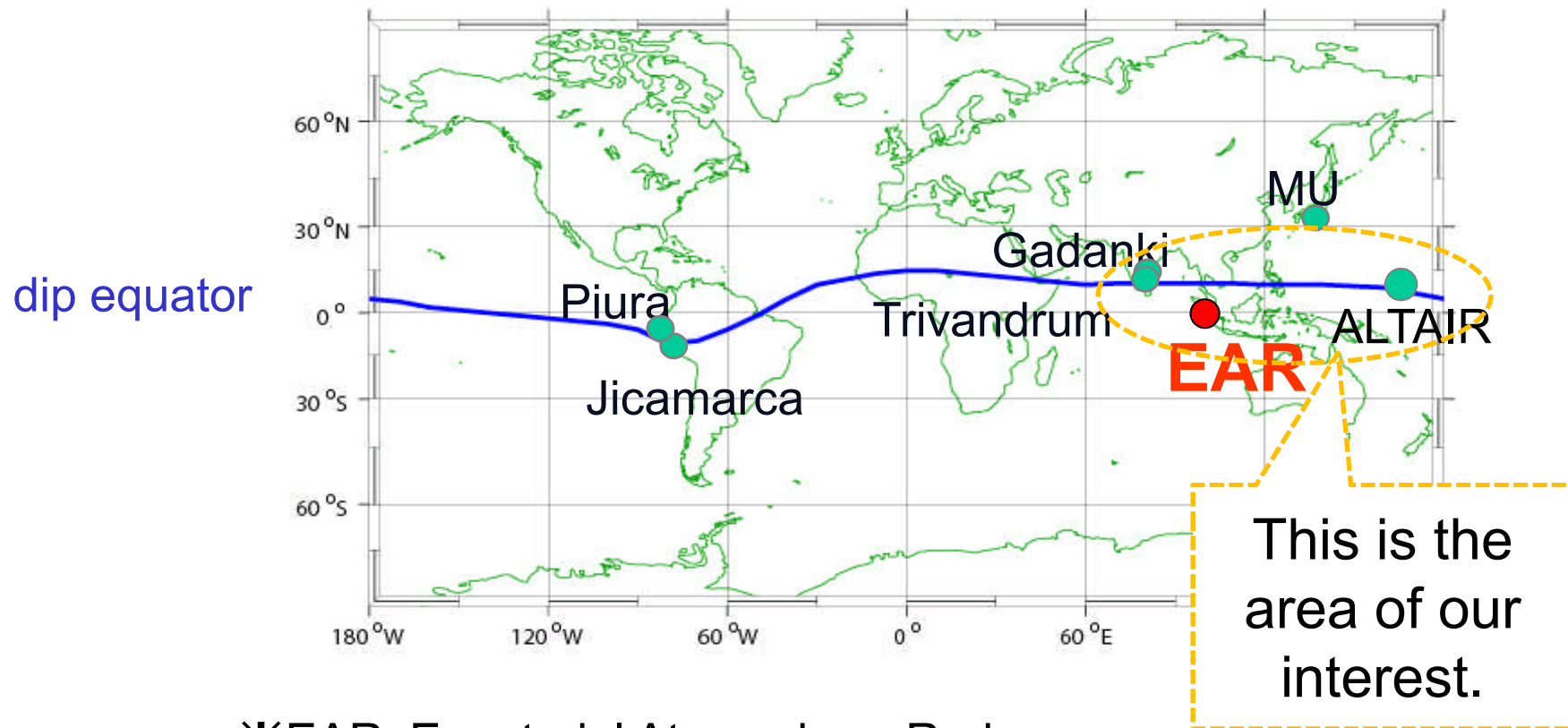
NICT

Tsutomu Nagatsuma, Takuya Tsugawa

Long-time
collaboration
for EAR

Ionosphere
experiment
in south-
east Asian
countries;
SEALION
etc.

VHF Radars in the Low-Latitude Region



✂EAR: Equatorial Atmosphere Radar
(located right at the geographic
equator and in the geomagnetic
southern hemisphere)

Equatorial Atmosphere Radar (EAR)



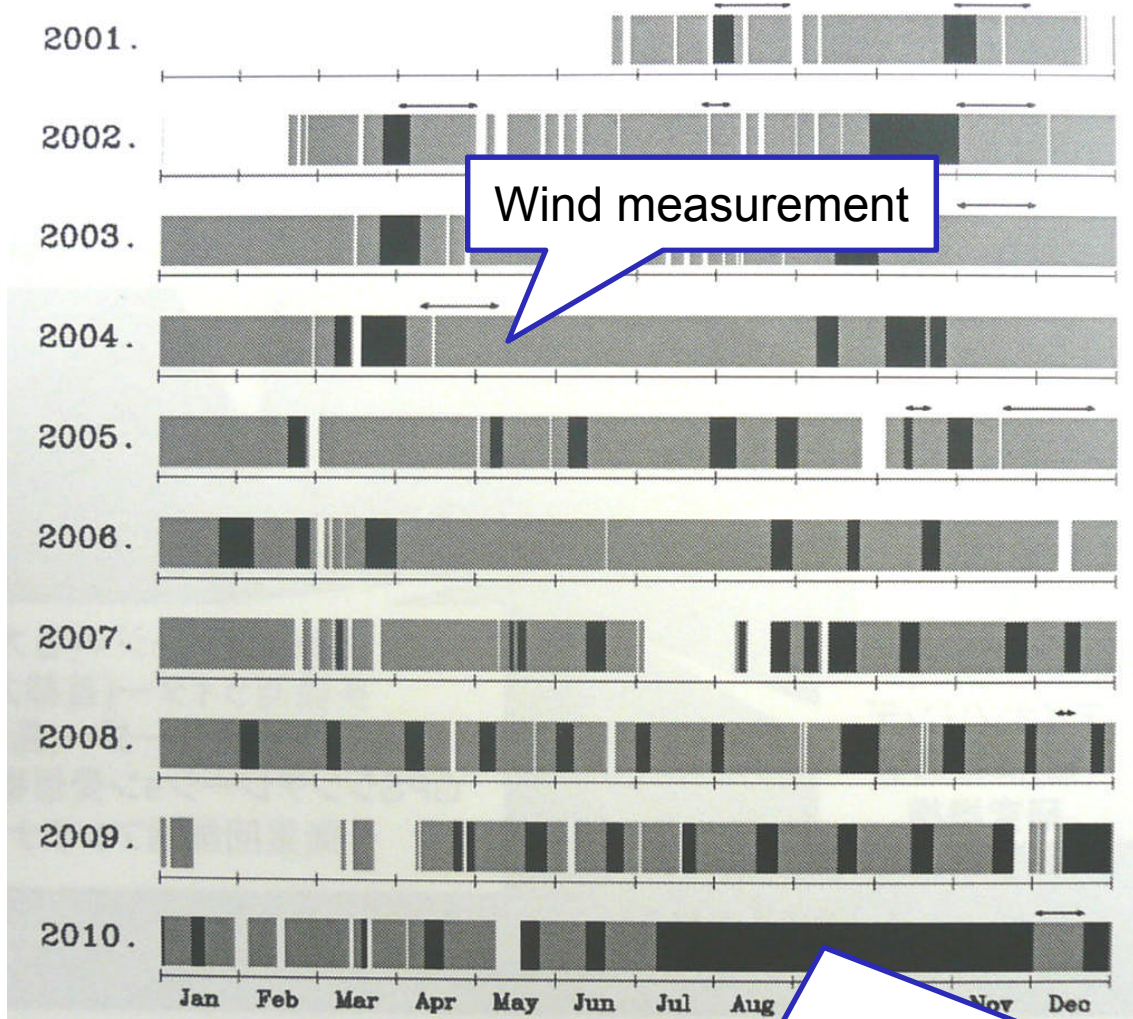
Antenna field (110m in diameter)

Location:
Kototabang,
West Sumatra,
Indonesia
(0.20° S, 100.32° E)



100 kW, 560 Yagi antennas

EAR long-period experiment



EAR continues long-period continuous observations since June 2001. Most of them were for wind measurement of the troposphere and stratosphere.

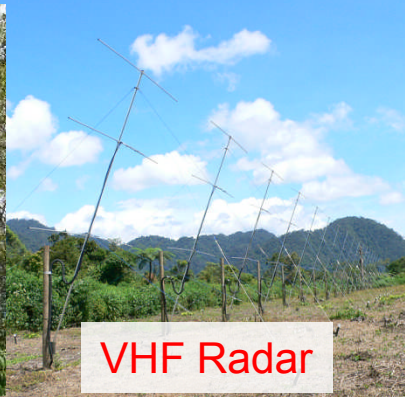
From July 2010, we shift the observation mode to more ionosphere studies owing to the current research program of "Indonesia Space Weather"

Continuous ionosphere measurement started in July 2010

Observation facilities at the EAR site



FM-CW Radar



VHF Radar



EAR RX system



Meteor Radar



X-band radar



RASS



EAR



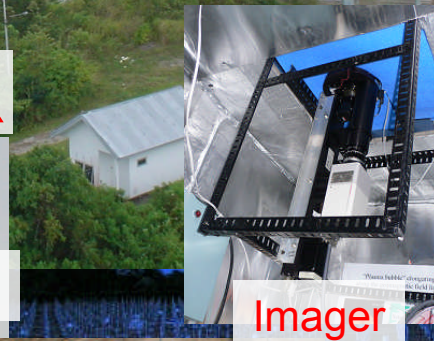
Micro-rain radar

Optical rain gauge

Ceilometer

Radiometer

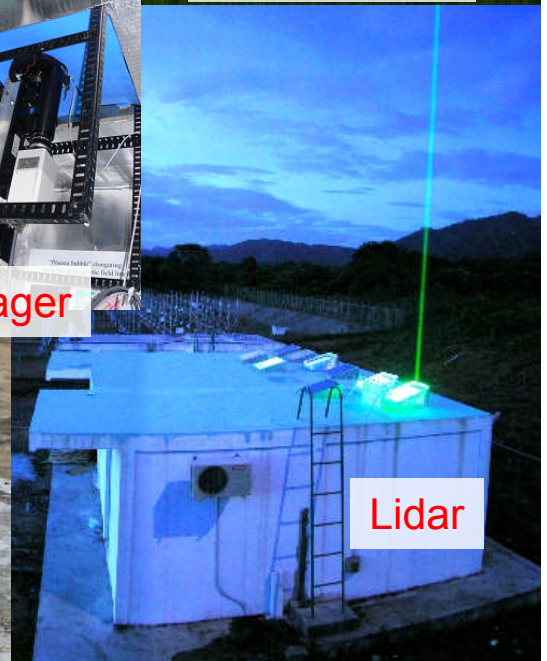
Disdrometer



Imager



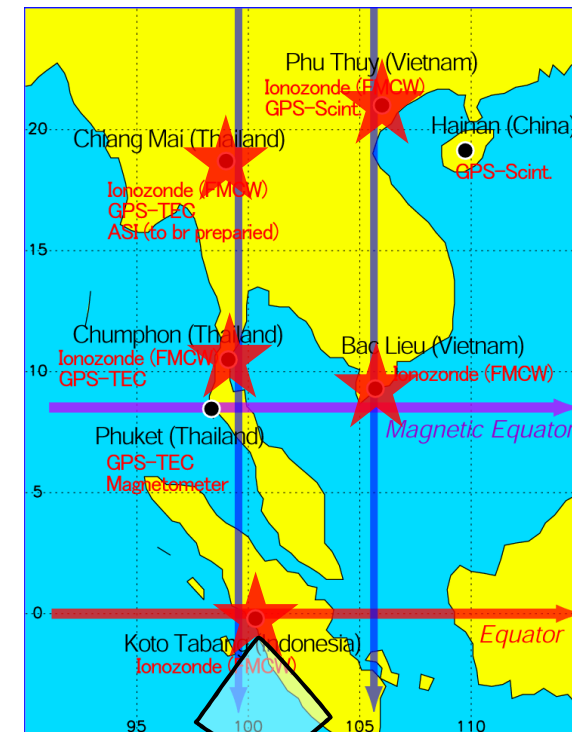
GPS Receiver



Lidar

EAR and SEALION

- SEALION (by NICT)
 - Southeast Asia Equatorial Ionospheric Network
 - Network of FM-CW ionosondes
- NICT = National Institute of Information and Communications Technology
- Ionosonde sites
 - Kototabang (=EAR site)
 - Chumphon (Thailand)
 - Chiang Mai (Thailand)
 - Phu Thuy (Vietnam)
 - Bac Lieu (Vietnam)



EAR site

★ SEALION ionosonde

EAR and SEALION

OPTICAL INSTRUMENTS

Chiang Mai

Airglow imager (NICT)

F-P Interferometer (STEL)

Kototabang

Airglow imager (STEL)

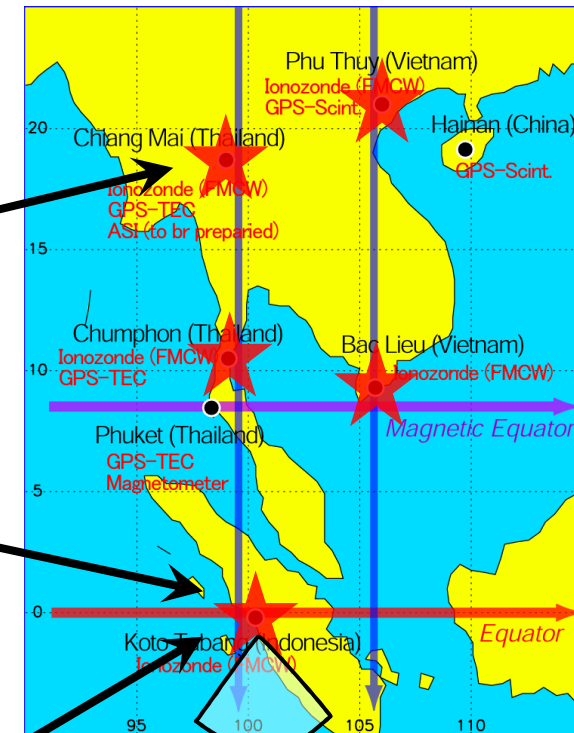
F-P Interferometer (STEL)

Other RADARS

Kototabang

30MHz FAI Radar (STEL)

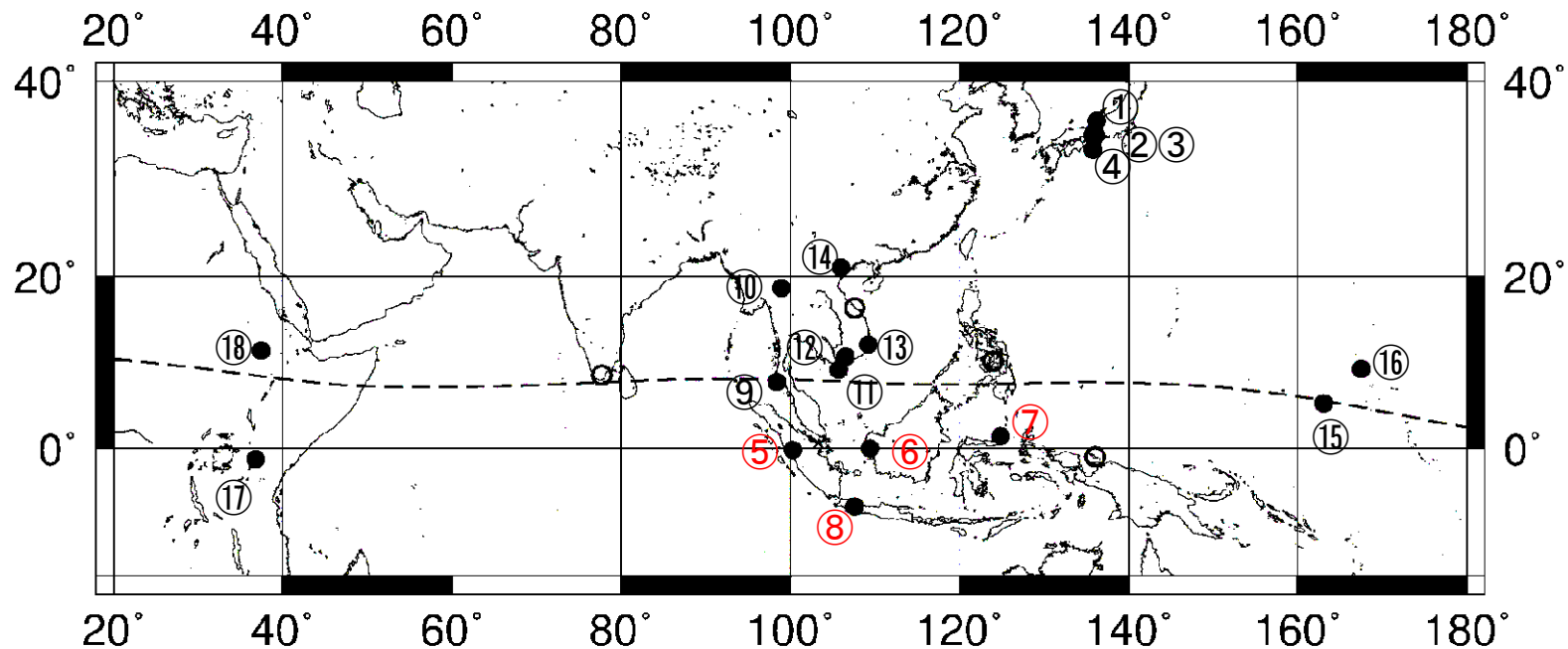
Meteor radar (RISH)



EAR site

★ SEALION ionosonde

Satellite-ground beacon receiver network in Indonesia and more



Japan (FUT)

- ①Fukui, ②Shigaraki, ③Uji,
④Shionomisaki

Indonesia (LAPAN)

- ⑤Kototabang, ⑥Pontianak,
⑦Manado, ⑧Bandung

Thailand (KMITL/NICT)

- ⑨Phuket, ⑩Ciang Mai

Vietnam (HGI/SRI)

- ⑪Bac Lieu, ⑫Ho Chi Minh,
⑬Nhatrang, ⑭Phu Thuy

Pacific (SRI)

- ⑮Kosrae, ⑯Kwajalein

Africa (local univ./AFRL)

- ⑰Nairobi, ⑱Bahir Dar

On schedule / Planned

- Biak, Hue, Tirunelveli / Cebu

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