Collaborative Research based on Equatorial Atmosphere Radar (EAR)

Research Institute for Sustainable Humanosphere (RISH), Kyoto University

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The Equatorial Atmosphere Radar (EAR) is an atmospheric radar located in Kototabang, West Sumatra in the Republic of Indonesia. It is operated by collaboration between the Research Institute for Sustainable Humanosphere (RISH), Kyoto University and National Institute of Aeronautics and Space of Indonesia (LAPAN), Indonesia since 2001. RISH has conducted a collaborative research program (EAR collaboration) by using the EAR and its related facilities since October 2005. We call for research proposals from scientists in the world. This document describes the instructions to apply for the EAR collaboration.

1. Description of the Program

This program aims to enhance scientific research activity conducted with the EAR and associated facilities, or by using their database. We can also accommodate research facilities of visiting scientists at the EAR site so that they can use it as a base for their studies. Major research areas are studies of the entire equatorial atmosphere, but a variety of fields covering the science of the humanosphere is encouraged in the program.

The collaborative research is divided into the following three categories.

(A) Observations with the EAR and its related facilities

Observations of the atmosphere and the ionosphere by means of the EAR and other facilities at the EAR site（see next section for facilities）

(B) Usage of the EAR site

Variety of research activities conducted at the EAR site. The applicants can bring their own facilities, or use the EAR site as a base for their research activities.

(C) Research by using EAR observation database

Usage of observation data that were obtained with the EAR and other facilities

In the actual operation, LAPAN might require some kind of agreement with applicant’s institute.

2. Facilities at the EAR site

2.1. EAR

The EAR is a large Doppler radar built for atmospheric observation at the equator in West Sumatra in the Republic of Indonesia (100.32E, 0.20S). The EAR has a circular antenna array of

approximately 110 m in diameter, consisting of 560 three-element Yagis. It is an active phased array system with each Yagi driven by a solid-state transceiver module. This system configuration makes it possible to direct the antenna beam electronically up to 5,000 times per second. The EAR transmits an intense radio wave of 47 MHz into the sky, and receives extremely weak echoes scattered back by atmospheric turbulence. It can observe winds and turbulence in the altitude range from 1.5 km to 20 km (troposphere and lower-stratosphere). It can also observe echoes from ionospheric irregularities at heights more than 90 km.

The EAR has the following observation modes, and has been continuously operated in the standard observation and ionospheric coherent modes except for special observation periods or maintenance periods.

Standard observation mode:

Atmospheric turbulence echoes in the troposphere and the lower stratosphere are observed.

Beam directions:	(Az, Ze)=(0, 0), (0, 10), (90, 10), (180, 10), (270, 10)
Sampling height range:	1-23 km
Data output:	Echo power spectra (Permit to estimation of wind velocity, echo power, turbulence intensity etc.)
Time resolution:	1.5 min
Height resolution:	150 m

Ionospheric coherent mode (FAI mode) :

Echoes from field-aligned irregularities (FAI) in the ionospheric E- and F-regions are observed.

FDI (Frequency Domain Interferometry) mode:

The detailed structure of atmospheric turbulence can be observed with frequency-domain interferometric (FDI) measurements by switching the transmitting frequency.

RASS (Radio Acoustic Sounding System) mode:

Temperature in the troposphere can be observed by RASS (Radio Acoustic Sounding System) by receiving echoes from acoustic wave fronts generated by the loud speaker system. (It is necessary to contact the responsible person.)

See the following paper for details of the EAR system:

Fukao *et al*., Equatorial Atmosphere Radar (EAR): System description and first results, *Radio Sci*., **38**, 1053, doi:10.1029/2002RS002767, 2003.

2.2. Other facilities at the EAR site

RISH operated instruments:

Surface weather instruments (Pressure, temperature, humidity, wind velocity, and precipitation), Ceilometer, Satellite communication link, Meteor radar(*)

(To use of the instruments marked with asterisk(*), please contact the responsible persons to discuss possible observation periods.)

(Note: The EAR site can be connected to the Internet through a satellite communication link. However, it is necessary to contact the responsible person when using it because the communication band is limited.)

Other related instruments operated by other universities and organizations:

Multi-wavelength all-sky airglow imager, VHF ionospheric radar, GPS receivers, Magnetometer (STE, Nagoya Univ.), Rayleigh lidar, Resonance scattering lidar for metallic ions, Mie lidar (Tokyo Metropolitan Univ.), X-band weather radar, Disdrometer, Radiometer, Optical raingauge (Shimane Univ.), Ionosonde (NICT)

(Could be used as a collaborative study with the principal investigator (PI) of each instrument. Inquire in advance with the PI of each instrument regarding availability.)

3. Cost for operation and support

1. Operation cost for the EAR is supported by RISH. Typical observation time allocated for a proposal is 12 to 48 hours.
2. Operation cost for other instruments is basically supported by RISH.
3. Travel and living expenses from Japan or Indonesia are supported by RISH within the limits of the budget. (Travel expenses from other countries are not supported.) When a cooperative researcher needs them, his/her e-mail address should be filled in ‘Planned schedule of visit to the EAR site’ in the proposal. The PI of the proposal should be present at the EAR site during his/her observation for Categories (A) and (B), but this is not compulsory.

4. Applicants, period of study, how to apply

At this moment applicants to this program are limited to scientists. They can apply for this program by submitting their proposal in a fixed format. Proposals related to any international scientific programs are welcome. If scientists from other countries wish to apply for this program, it is requested that they find a collaborating scientist in Japan or in Indonesia to formally apply on their behalf.

The proposal for the EAR (and related facilities) collaborative research should be written in English (or Japanese) on the application format and submitted through the following web page or

E-mail.

Web: http://www.rish.kyoto-u.ac.jp/ear/collaboration.html

E-mail: ear@rish.kyoto-u.ac.jp

The form can be downloaded from the above web page. All proposals will be reviewed and evaluated by the steering committee in February or March, and acceptance and observation schedule will be decided.

Period of a proposal should be one year starting from Apri1 l of each year. There is one chance of extension for continuing projects. However, new proposals can be applied for at any time to the committee chairman (Dr. Hiroyuki Hashiguchi of RISH). End of such study is set at the following March 31. To continue the study further, application for the next-year continuation [renewal] is necessary.

5. Deadline for proposal submissions

January 20, 2012

6. Contact address

For inquiry, please contact the following address:

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