

## Appendix 5.2

# [Research and development for precise positioning with Artificial Intelligence (AI) during ionospheric disturbances in low-latitude region in ASEAN] [Traveling to install GNSS receiver at IGP seismic station Hue, Vietnam] Report Form

## I. Proposer:

Name:	Dr. PORNCHAI SUPNITHI
Position:	Professor
Institution:	King Mongkut's Institute of Technology Ladkrabang, Thailand

## II. Objective:

To install a new GNSS receiver system at the Institute of Geophysics, Vietnam Academy of Science and Technology (IGP, VAST), Hue, Vietnam for extending GNSS and ionospheric monitoring system and data products coverage and to use RTK base station for RTK applications development.

The project objectives include analyzing equatorial plasma bubble (EPB) statistics using data from the ASEAN region and developing/testing Real-Time Kinematic (RTK) applications based on a station in Vietnam. The receiver will be installed in Hue City, Thua Thien Hue Province (latitude: 16.4154 °N, longitude: 107.5687 °E, magnetic latitude: 9.58 °N). Figure 1 shows the seismic station building and surrounding in the installation day.

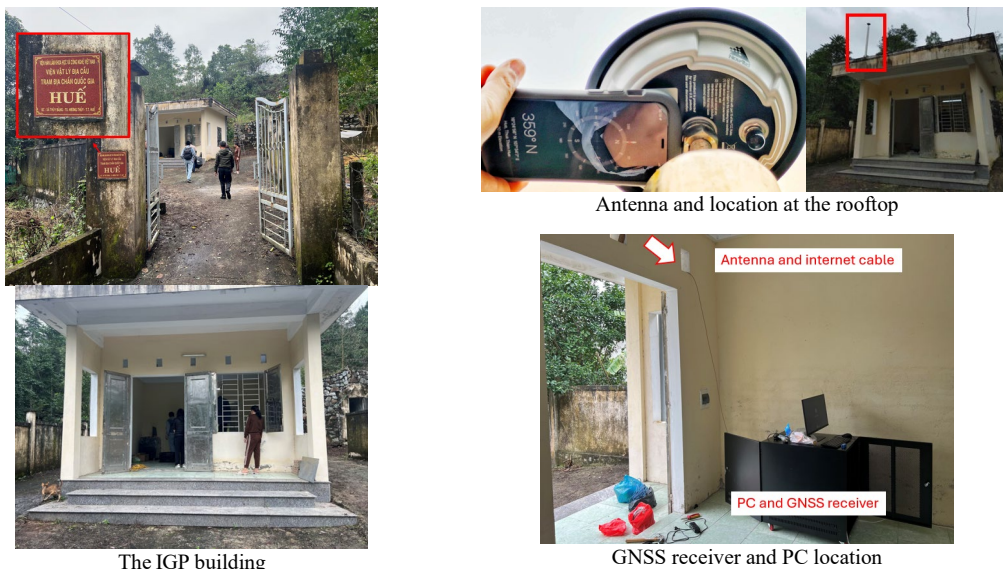


Fig. 1. Location of the GNSS receiver installation site (IGP seismic station) at Hue, Vietnam

The IGP seismic station has two main sections, the IGP building and the IGP equipment room (back site of IGP building). We place the GNSS equipment in the IGP building. The installation process, including antenna and receiver setup, configuring receiver and computer setting for data collection, conducting on-site testing for full-day data on positioning and ionospheric monitoring will be carried out by project members from KMITL and IGP-VAST.

### III. Schedule:

**The site location:** Hue's seismic station, Hue, Thua Thien Hue province, Vietnam

(latitude: 16.4154°N, longitude: 107.5687°E)

Date	Location	Work	Person in charge
10 Jan 2025	The receiver site, Hue, Vietnam	Setting up GNSS antenna, receiver & Computer	Prof. Pornchai Supnithi Dr. Jirapoom Budtho Mr. Napat Tongkasem Dr. Dung Thanh Nguyen Mr. Thanh Ha Nguyen
11 Jan 2025	Hue, Vietnam	Checking and Calibrating the GNSS system and collecting data for testing	Prof. Pornchai Supnithi Dr. Jirapoom Budtho Mr. Napat Tongkasem Dr. Dung Thanh Nguyen Mr. Thanh Ha Nguyen
12 Jan 2025	Hue, Vietnam	Checking and Calibrating the GNSS system and collecting data for testing	Prof. Pornchai Supnithi Dr. Jirapoom Budtho Mr. Napat Tongkasem Dr. Dung Thanh Nguyen Mr. Thanh Ha Nguyen

### IV. Participants:

No.	Name	Organization
1	Prof. Pornchai Supnithi	(Project leader) KMITL, Thailand
2	Dr. Jirapoom Budtho	KMITL, Thailand
3	Mr. Napat Tongkasem	KMITL, Thailand
4	Dr. Dung Thanh Nguyen	IGP-VAST
5	Mr. Thanh Ha Nguyen	IGP-VAST

### V. Summary of the activities corresponding to the objectives

New GNSS station was installed at IGP seismic station, Hue, Vietnam. The installation was successful that led by Prof. P. Supnithi (Project leader), the team comprised 4 members from KMITL, Thailand, and IGP-VAST, Vietnam.

#### Installation activities

On Thursday, January 9<sup>th</sup>, 2025, KMITL and IGP-VAST team arrived in Hue, Vietnam by flight and by car, respectively, and checked in the hotel that close to the installation site.

On Friday, January 10<sup>th</sup>, 2025, the team arrived at the IGP seismic station at 9:00 AM and prepare the equipment installation. Based on the installation plan, we place the GNSS equipment, as shown in figure 2, in the IGP building.

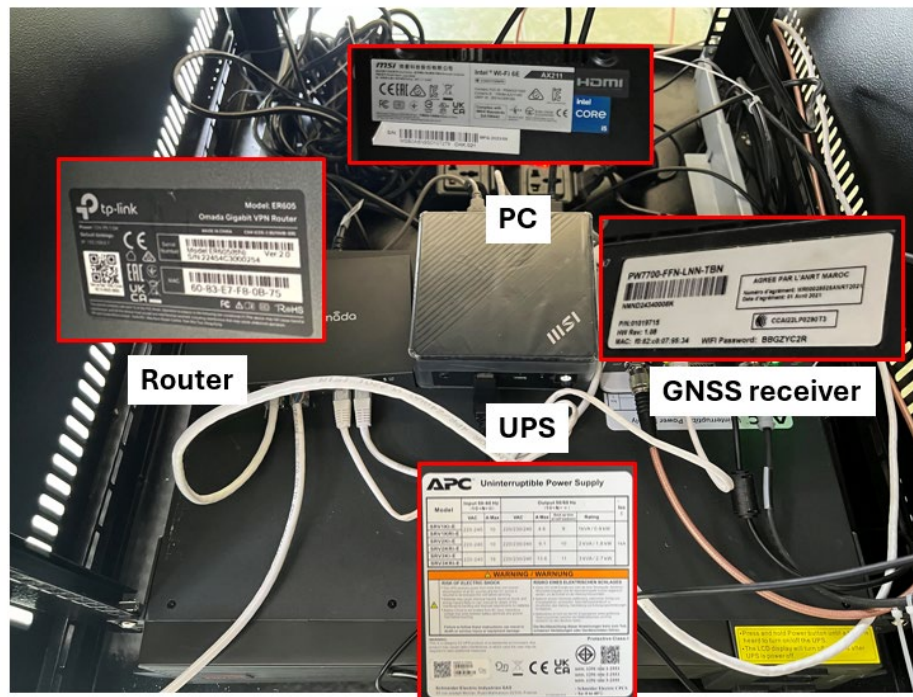


Fig. 2. The equipment in IGP building

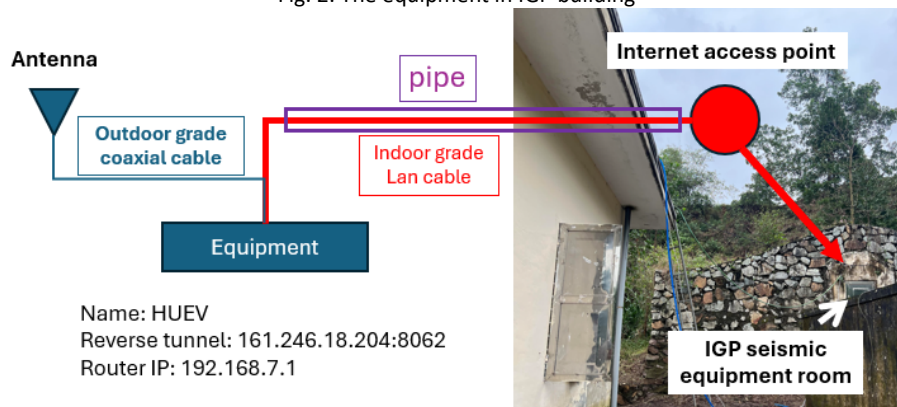
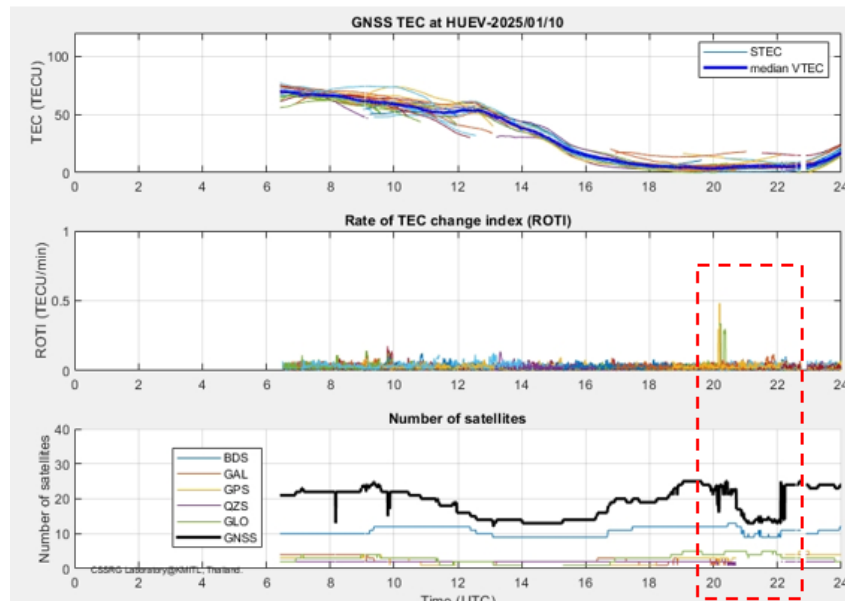


Fig. 3. Antenna cable and internet cable connecting.

From figure 3, we connect the antenna and receiver using the outdoor grade of coaxial cable successfully at 1:00 PM. For the internet connection, the internet access point is in the IGP seismic equipment room and need to connect with 10 meter lan cable. Regarding to the very long outdoor grade lan cable cannot be found in Hue. Therefore, we connect the lan cable using indoor grade and cover the cable using pipe to prevent the damage from sun ray at 5:00 PM. Based on the location, we found that the building is located near the mountains in a high-humidity area. The equipment is possibly to be damaged by humidity. Additionally, none of the equipment is sealed from the outside atmosphere, as the building and container have large airflow tunnels. We suggest that the equipment be checked and cleaned on-site one to two times per year.

On Saturday, January 11<sup>th</sup>, 2025, we check the connection, and data logging, and test the ionospheric product to check the data quality. We found that there are some fluctuation on total electron content (TEC) graph that are not concern to the ionospheric disturbance, as shown in figure 4. We assume that this irregularity came from ground interference. However, we remain to record the data to check the data quality for a daily period.



Ground interference

Fig. 4. TEC, ROTI, and number of satellite at HUEV on 10<sup>th</sup> January, 2024. The GNSS signal are disturbed during 21 to 22 UT (4-5 LT)

On Sunday, January 12<sup>th</sup>, 2025, we plot the whole-day TEC at HUEV station on January 11<sup>th</sup> for checking the data quality at 9:00 AM, as shown in figure 5. The results show that the data have good quality and are not affected by ground interference.

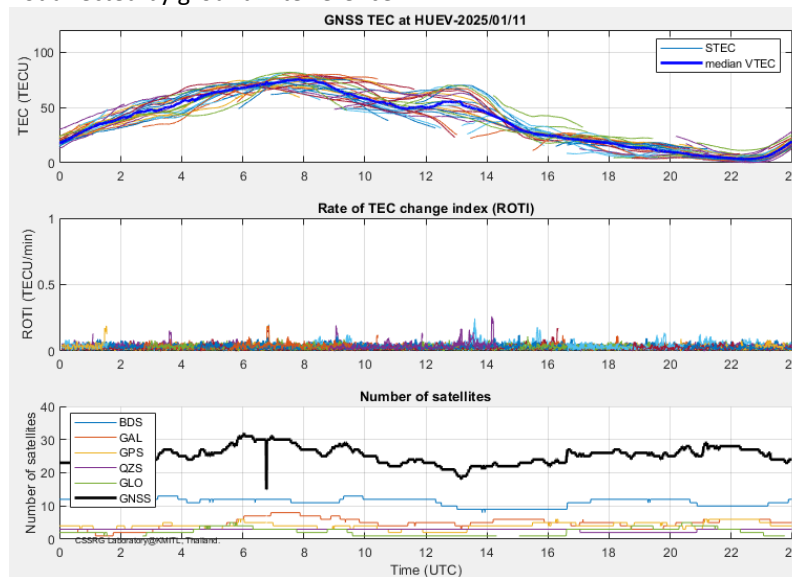


Fig. 5. TEC, ROTI, and number of satellite at HUEV on 11<sup>th</sup> January, 2024. The GNSS signal are clear and has no interference.

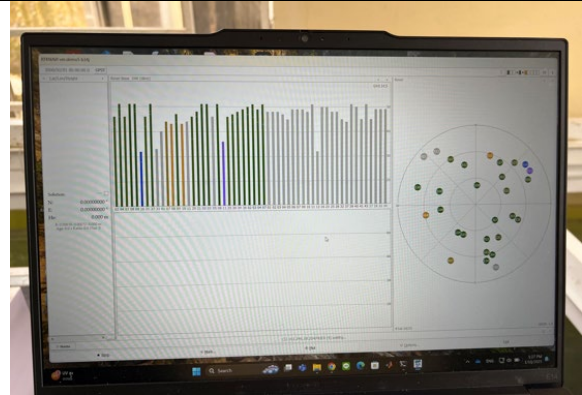
Currently, the GNSS receiver system at the HUEV station, Vietnam is operational. Data is collected and saved in the KMITL's main data center daily. As a result, the data are available for GNSS and space weather monitoring applications, and other research works



## VI. Others



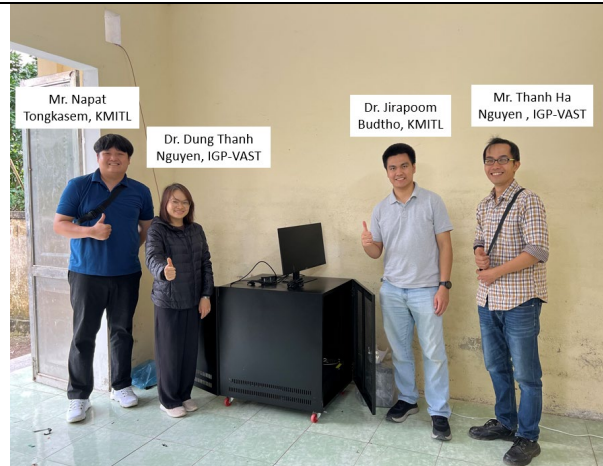
The main entrance of IGP Building



Checking the performance of the HUEV GNSS receiver station



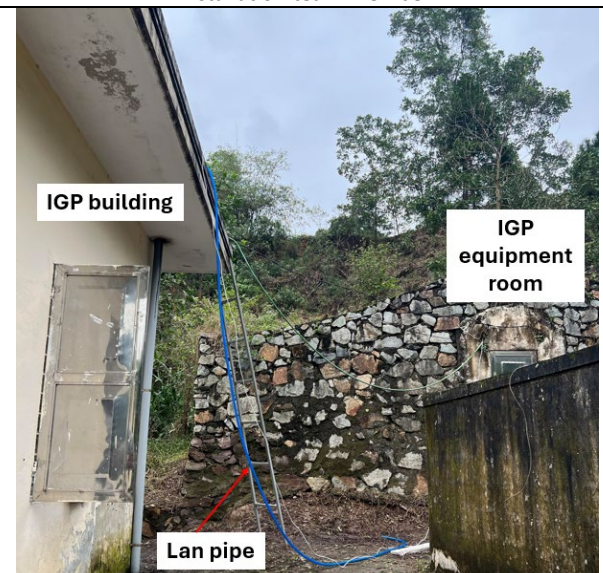
Fig. 5. Ladder for climbing to the rooftop.



Installation team member.



Equipment preparation inside IGP building.



Indoor grade lan cable are sealed by pipe and connect from IGP equipment room.