Report on GNSS Training Jointly Organized by CSIS/UT and ICG/UNOOSA

Course A:

GNSS Data processing for High-Accuracy Positioning using Low-Cost Receiver Systems

19 – 21 January 2021

Course B:

GNSS for Policy and Decision Makers

28 January 2021

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Acronym

AIT	Asian Institute of Technology
CSIS	Center for Spatial Information Science
GIC	Geomatics Information Center
GNSS	Global Navigation Satellite System
ICG	International Committee on GNSS
PPP	Precise Point Positioning
TUMSAT	Tokyo University of Marine Science and Technology
UNOOSA	United Nations Office for Outer Space Affairs
UT	The University of Tokyo

1 Introduction

CSIS has been conducting GNSS trainings every year in joint collaboration with ICG/UNOOSA since January 2018. The past trainings in 2018, 2019 and 2020 were conducted at AIT, Thailand jointly by GIC/AIT, ICG/UNOOSA and CSIS/UT. This year the training was conducted online due to COVID-19. Although, online training has limitations regarding field work to collect data, the participants were provided pre-logged sample data files for data processing.

In this year's training, the following trainings were organized:

- Course A: GNSS Data processing for High-Accuracy Positioning using Low-Cost Receiver Systems
  This is a 3-day training program to provide GNSS data processing skills for high-accuracy using low-cost GNSS receiver systems. Refer Figure 1 for course objectives, Figure 3 and Figure 4 for course details.
- Course B: GNSS for Policy and Decision Makers
  This is a 1-day training program to provide general introduction, importance and applications of GNSS for policy and decision makers. It is expected that educating the policy and decision makers about the importance of GNSS will ease implementation of GNSS-related projects at the field level wherever applicable. Refer Figure 2 for course objectives and Figure 5 for course details.

There were about 270 participants from 70+ countries for Course A and 160 participants from 60+ countries for Course B. Refer Figure 6 for training participation statistics including the past trainings.

Since the training was conducted online and there were participants from around the globe (70+ countries), it was quite difficult for some participants to attend the training due to large difference in time zones. Nevertheless, many participants cope with this difficult situation to attend the training at odd hours. We thank all the participants for their very interactive participation.

All program schedule, presentation materials and recorded audio/video are available online at ICG/UNOOSA's homepage and CSIS/UT homepage. Please refer [Link to Resource Materials] for access links.

2 Training Brochure

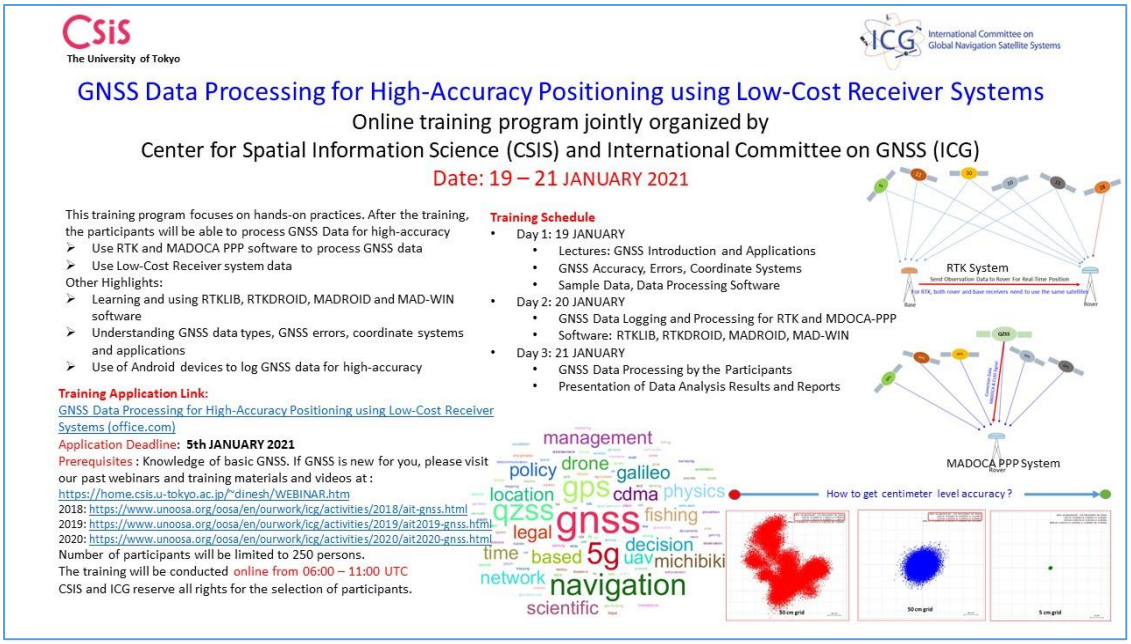

Figure 1: Training brochure of Course A

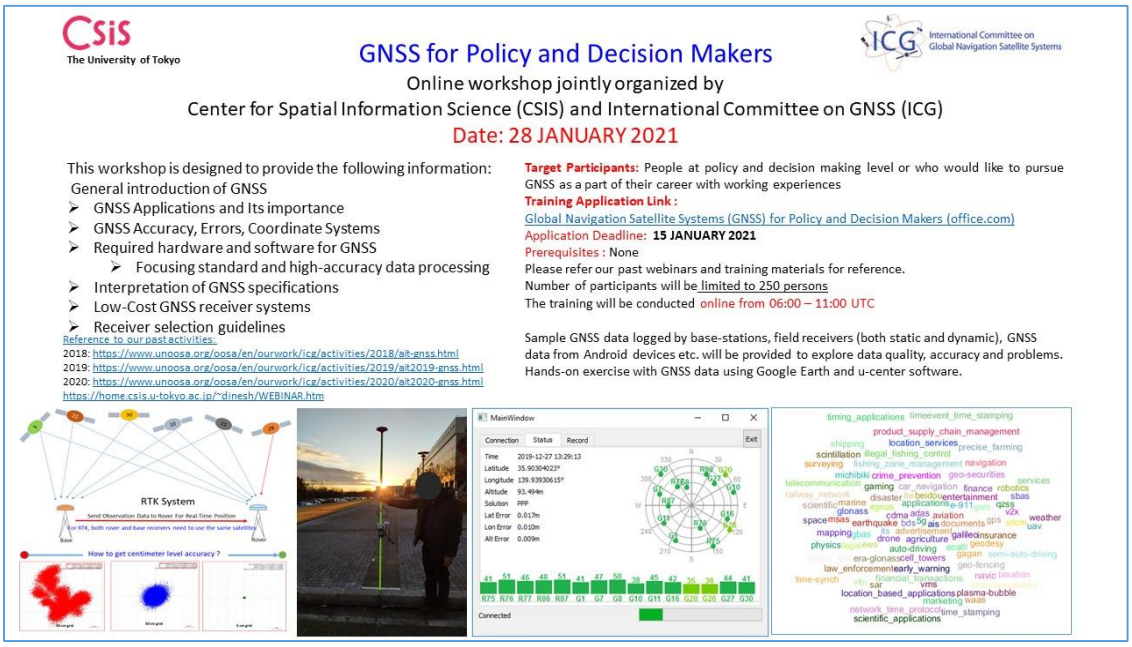

Figure 2: Training brochure of Course B

3 Training Course Details

3.1 Course A, Day 1

Day - 1		
19-JAN-2021, Tuesday, 06:00 - 11:00 UTC		
Time (UTC)	Course Description	Speaker
05:45 - 06:10	Registration / Attendance	
06:10 - 06:20	Opening Remarks and Activitites of the International Committee on GNSS (ICG)	Ms. Sharafat Gadimova, Office for Outer Space Affairs
06:20 - 06:30	Opening Remarks and Activities of the University of Tokyo	Mr. Dinesh Manandhar, the University of Tokyo
06:30 - 08:00	**Introduction to Global Navigation Satellite Systems (GNSS) and applications**	
06:30 - 07:00	Introduction to GALILEO and applications	Mr. Dominic Hayes, European Commission
07:00 - 07:15	Introduction to ISRO's Navigation Programmes NavIC and GAGAN	Dr. N K Philip, India
07:15 - 07:30	NavIC Applications	Mr. Nishkham Jain, India
07:30 - 08:00	Introduction to QZSS and applications	Mr. Satoshi Kogure, Japan
08:00 - 08:50	BREAK	
08:50 - 10:00	**High-Accuracy Data Processing Requirements**	
08:50 - 09:20	Galileo High Accuracy Service	Mr. Daniel Blonski, European Space Agency
09:20 - 09:35	NavIC position errors	Mr. Anand Dwivedi, India
09:35 - 09:50	NavIC S band signal performance	Mr. Ghan Shyam, India
09:50- 11:00	GNSS Accuracy, Errors, Coordinate Systems Software Installation, Setup, Check Data	Dinesh (Software Explanation etc)

Figure 3: TrainingCourse A, Day 1 details

3.2 Course A, Day 2 and 3

Day - 2		
20-JAN-2021, Wednesday, 06:00 - 11:00 UTC		
Time (UTC)	Course Description	Speaker
05:45 - 06:10	Registration / Attendance	ICG/UT
06:10 - 07:00	Introduction to RTK	TUMSAT: Nobuaki Kubo
07:00 - 08:00	RTK Data processing: How to get cm level accuracy? Static and Dynamic Data Sets Low-cost and High-End Receiver Data sets	TUMSAT: Nobuaki Kubo Kobayashi Yize UT: Dinesh Avinab
08:00 - 08:30	BREAK	
08:30 - 11:00	RTK Data processing: How to get cm level accuracy? Static and Dynamic Data Sets Low-cost and High-End Receiver Data sets	TUMSAT: Nobuaki Kubo Kobayashi Yize UT: Dinesh Avinab

Day - 3		
21-JAN-2021, Thursday, 06:00 - 11:00 UTC		
Time (UTC)	Course Description	Speaker
05:45 - 06:10	Registration / Attendance	ICG/UT
06:10 - 07:00	Introduction to MADOCA MADOCA Data Processing Demo	UT: Dinesh
07:00 - 08:00	RTK Data processing	UT: Dinesh Avinab TUMSAT: Kobayashi Yize
08:00 - 09:00	BREAK / Course Evaluation Comments and Suggestions from participants	
09:00 - 10:30	Presentation of work by the participants: 3 mins each (Those who would like to present) Report submission	ICG/UT
10:30 - 11:00	Q&A Closing Remarks	ICG/UT

Figure 4: TrainingCourse A, Day 2 and 3 details

3.3 Course B

GNSS for Policy and Decision Makers		
28-JAN-2021, Thursday, 06:00 - 11:00 UTC		
Time (UTC)	Course Description	Resource Persons
05:45 - 06:10	Registration / Attendance	ICG/UT
06:10 - 06:20	Opening Remarks and ICG Activities	ICG: Sharafat
06:20 - 06:30	Opening Remarks and UT Activities	UT: Dinesh
06:30 - 07:30	GNSS Introduction, Coordinate Systems, Accuracy and Errors	
07:30 - 08:00	GNSS Applications Example Sample Data	
08:00 - 08:50	BREAK	
09:00 - 10:00	Introduction of Low-Cost High-Accruacy Receiver Systems RTK and PPP Hardware, Software etc.	UT: Dinesh
10:00 - 11:00	Interpretation of GNSS Receiver Specification Receiver Slection Guidelines Q & A	

Figure 5: TrainingCourse B details

4 Training Statistics

Number of Participants	Online GNSS Training Course A: 19 – 21 Jan 2021 Course B: 28 Jan 2021		Past GNSS Trainings held at AIT, Thailand		
			JAN 2020	JAN 2019	JAN 2018
	Course A	Course B	T-151	T-151/T-131	T-141
(A) ICG Funded International (travel only)	NA	NA	19	23	14
(B) Other Funding (travel only)	NA	NA	X	4[E]	X
(C) Self Funded International	NA	NA	34	40	11
(D) Self-Funded Thailand	NA	NA	18	27	42 (24 + 18)
Total (A + B + C + D)	**270**	**160**	**71**	**94**	**67**
Number of Applicants	360	190	160+	180+	80+
Number of Resource Persons	15	6	16 7 (Int) + 9 (GIC)	20 11 (Int) + 9 (GIC)	13 7 (Int) + 6 (GIC)
Number of Countries	70+	60+	15	15	15
Resource Persons' Countries	4	3	4	7	4

Figure 6: Summary of training status for Course A and B and the past trainings

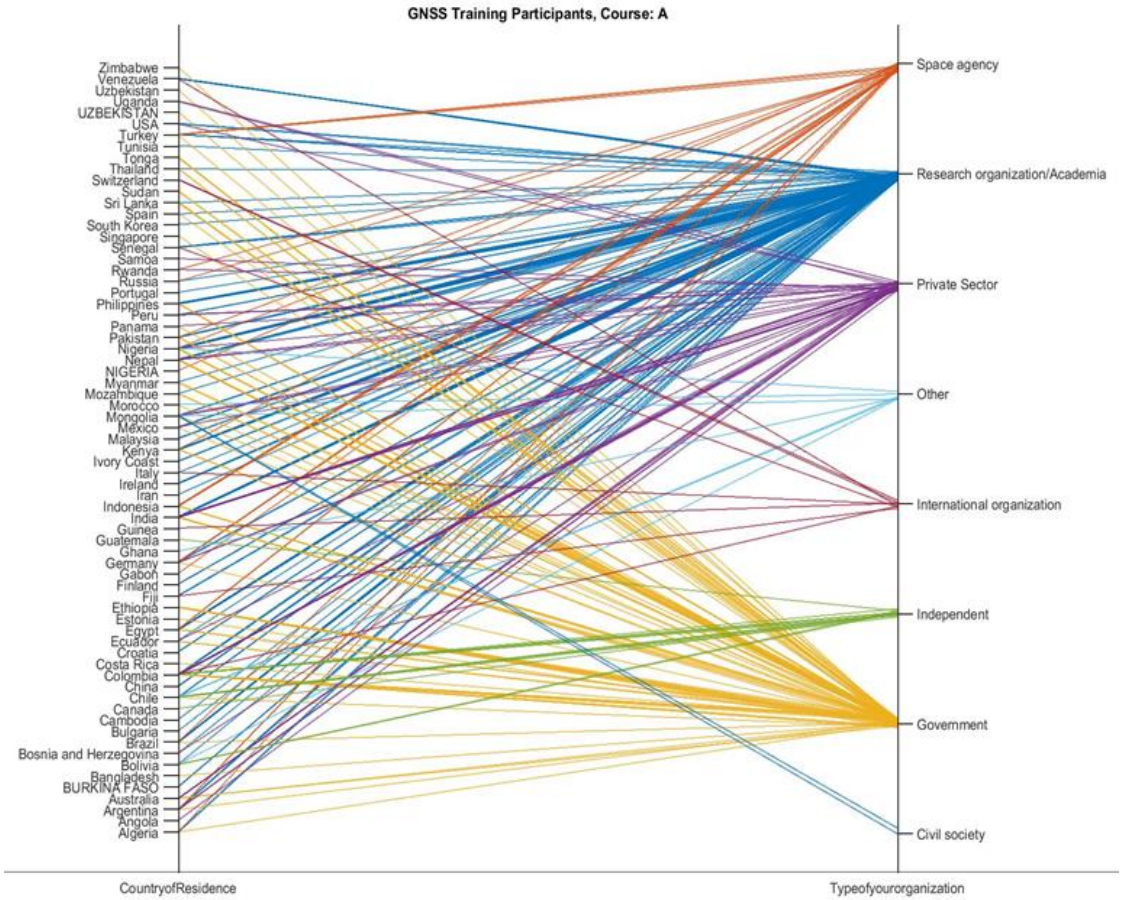

Figure 7: Training participants based on organization types

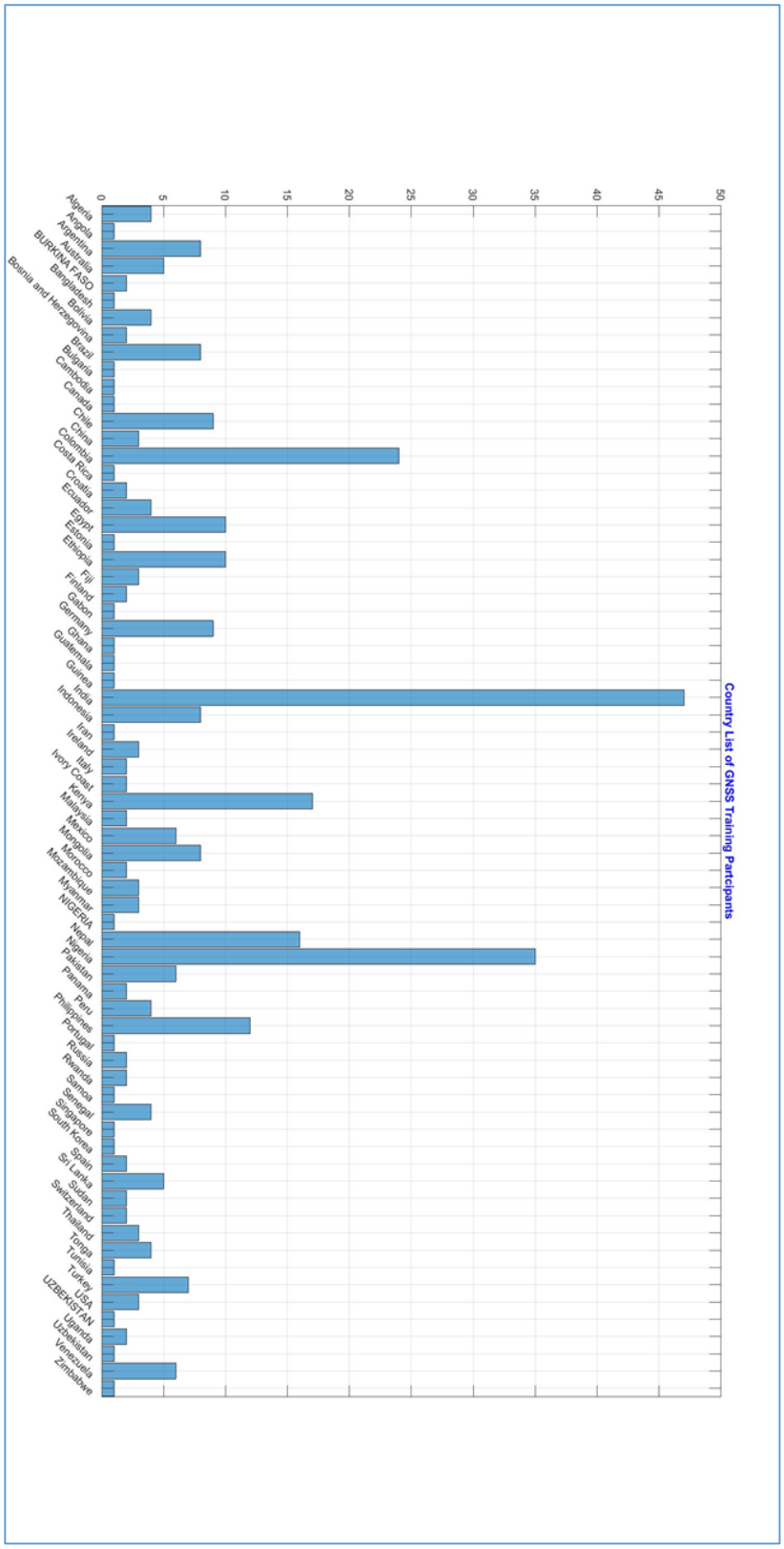

Figure 8: List of participating countries in the training programs

Figure 9: Text plot of participating countries

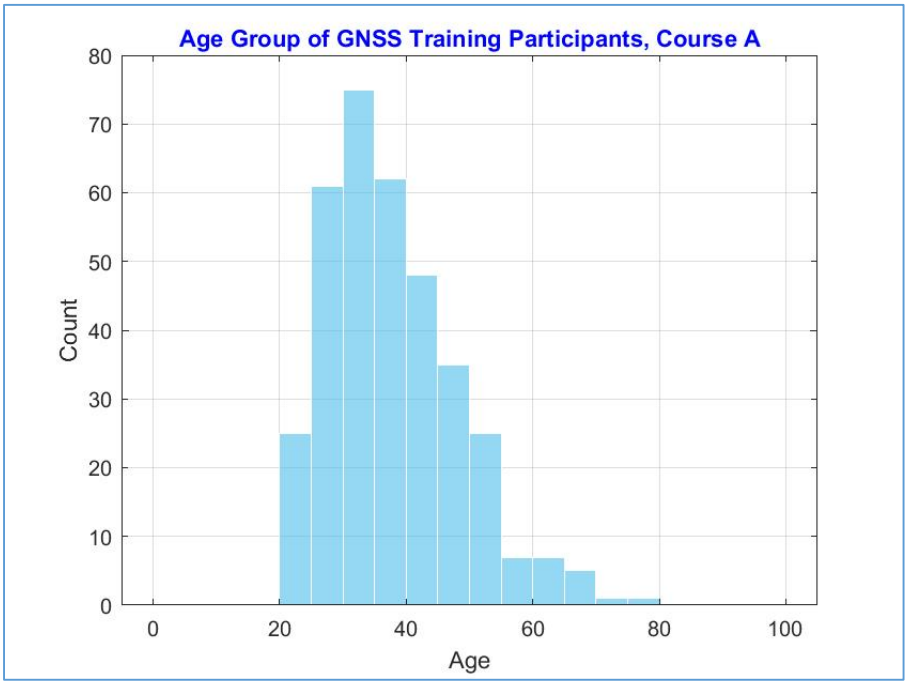

Figure 10: Age group of the participants

5 Course Evaluation by the Participants

The participants were requested to evaluate training courses based on the following questions in the google form:

- ID, Country of residence, Gender, Age range, Type of organization
- From where did you learn about the workshop?
- Were the topics of the workshop relevant to your work/job/position?
- Did the workshop meet your professional needs and expectations? If answer is NO, why?
- What were your professional needs and expectations related to the objectives of the workshop?
- What was the overall level/quality of lectures at the workshop? Please give your reasons
- What is your view of the overall organization of the workshop? Please give your reasons
- Did your participation in the workshop help you to (please check as many boxes as appropriate)?
- Please describe your actions/project(s) in more details
- In your opinion, how would the above-described actions/project(s) benefit or impact your country locally after being implemented in the future?
- What challenges do you face in introducing?
- What have you learnt at the workshop for your work or the programme/policies of your country/organizations?
- Your comments, suggestions or recommendations related to any aspect of the workshop

5.1 Selected Comments from the Participants

A total of 84 completed questionnaires were submitted to the organizers, including 60 (22%) from participants of Course A and 24 (15%) from participants of Course B. Some selected comments are presented below:

- The speakers give very detail explanations on the topics and answer all the questions by the participants.
- In general, each of the speakers had a lot of mastery on the subject, a lot of knowledge to impart and knew how to spread it optimally to all participants
- The knowledge of the speakers is world-class. The information presented is up to date and high quality. The practical exercises are useful and well prepared. I already have knowledge on RTKLIB and u-center so I could understand everything, but this section has a lot of details that may leave attendees a bit lost. The practical exercises were sometimes too fast and difficult to follow remotely.
- I really learned new software/techniques on how to get a high position accuracy with low cost receivers. As a beginner in the research carrier, I gratefully enjoyed the way you did your best and showed as how to proceed with many methods, it is really encouraging even if it is online. I hope next time it will be help offline for more physical details. I hugely appreciated the flawless initiatives/targets of the UNOOSA and ICG in collaboration with the University of Tokyo. Please keep it up for the utmost interests of everyone in the world.
- Some presentations were easy to follow while taking notes, also noting some websites or sources that might be interesting to check offline. I found those incredibly helpful and still have a lot of

material to go through thanks to them. But some others were too fast for my taste and not as thoroughly explained as I would have needed. This was especially critical when doing practice examples. Some of us got lost at the beginning of the presentation and the rest was impossible to follow. Also, there is no possibility of catching up, as the difficulty increases over the time, and giving feedback over the chat is very limited, as the questions are only addressed at the end of the presentation. The second presentation where RTKLIB was used was much friendlier for non-expert users and also easier to understand.

- Very good presentations, positive side is, that enough time is for the QA
- This workshop is really give me new idea in processing the GNSS data for better accuracy with low cost. With online platform, it's easy and i think save a lots of money on travelling cost thus more participants able to join. I hope the secretariat will organize more online workshop like this in the futures.
- My suggestion would be the expansion of these programs, if possible, to other many countries by creating research centers and training local researchers.
- Some presentations were being at a low level, which means that wouldn't be able to cover key points at all. Maybe due to the time issue. The ideology underneath of this workshop is precious. Providing free charges courses and analysis and data as well can mean a lot to those who can't be able to reach this kind of program.
- More time for practice is required
- I would encourage you very strongly to continue this type of events.
- The presentations were research based with valid results. The presentations gave a general operation of RTKlib which I have failed to use for the last 2 year. I got to know about the different PPP available. I got more insight on the operation of Galileo Constellation.

6 Link to Resource Materials

6.1 ICG/UNOOSA Link

- GNSS Data Processing for High-Accuracy Positioning using Low-Cost Receiver Systems, 19 - 21 January 2021

https://www.unoosa.org/oosa/en/ourwork/icg/activities.html

- Information Note

https://www.unoosa.org/documents/pdf/icg/2021/Tokyo2021/GNSS_Training_2021.pdf

- Presentation Materials

https://www.unoosa.org/oosa/en/ourwork/icg/activities/2021/CSISTokyo/presentations.html

GNSS for Policy and Decision Makers, 28 January 2021

- Information Note

https://www.unoosa.org/documents/pdf/icg/2021/Tokyo2021/GNSS_Training_2021_Policy.pdf

- Presentation Materials:

Course A: GNSS Data Processing for High-Accuracy Positioning using Low-Cost Receiver Systems

https://www.unoosa.org/oosa/en/ourwork/icg/activities/2021/CSISTokyo/presentations.html

Course B: GNSS for Policy and Decision Makers

https://www.unoosa.org/oosa/en/ourwork/icg/activities/2021/CSISTokyo/presentations2.html

6.2 CSIS/UT Link

- Main Page

https://home.csis.u-tokyo.ac.jp/~dinesh/

- Software, Training Data and Report

https://home.csis.u-tokyo.ac.jp/~dinesh/GNSS_Train.htm

6.3 YouTube Link

Recorded Videos are available at Youtube link:

https://www.youtube.com/playlist?list=PLaOqa4cng0GFGUas1LSlpC43QxVtBbs2M

Contact: Dinesh Manandhar, dinesh@csis.u-tokyo.ac.jp