



# Establishment of GNSS Lab at Pashchimanchal Campus Tribhuvan University, Pokhara, Nepal

**United Nations International Meeting on the  
Applications of Global Navigation Satellite Systems**

**Vienna, Austria  
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# Outline of the Presentation

- Background
- Goals
- Activities
- Establishment of GNSS Lab
- Future plan

# Background

- Pashchimanchal Campus, Tribhuvan University established Bachelor Degree in Geomatics Engineering in 2013 and Master of Science in Geospatial Engineering in 2020 to meet the demands of Geospatial engineering human resources in Nepal.
- Center for Space Science and Geomatics Studies (CSSGS), at Pashchimanchal Campus has initiated the research activities and establishment of GNSS Lab for capacity building in the field of Global Navigation Satellite Systems (GNSS)

# Background

- The center was established in 2018
- The center is devoted to space science research and Geomatics education.
- This center response in terms of specific needs country and society's economics, and the environment in the field of land monitoring, disaster research, agriculture planning, atmospheric analysis and GNSS Applications.

# Goal of GNSS Lab, CSSGS

CSSGS established GNSS Lab to promote the technology in Nepal.

## *Our Goal is:*

- *Become a Center of Excellence in GNSS applications, system development, research and capacity development for academic, industry and government organizations both at academic and decision-making levels.*

# Establishment of CORS station at Pashchchimanchal Campus



CORS Antenna



CORS Receiver: PolaRx5  
Capable to receive all GNSS signals in all frequencies  
Data from this receiver is available for R&D

# Collaborative Research Activities

- CSSGS has collaboration with national and international institutes for the establishment and development of the GNSS lab.
- CSSGS has been providing GNSS training in collaboration with
  - International Committee on GNSS (ICG)
  - Center for Spatial Information Science (CSIS), The University of Tokyo
  - University Grants Commission (UGC), Nepal
- CSSGS has established
  - A CORS at Pashchimanchal Campus
  - Pillar Benchmarks to calibrate and study of GNSS Receiver and Antenna performance analysis
    - Undergoing construction
- Conducts joint research projects in collaboration with universities
  - Your institution is highly welcomed to join our research projects

## Activities with Provincial Government in Nepal

- Proposal to **establish Early Warning System in Highways** using Low-Cost Global Navigation Satellite System (GNSS) Receiver and Machine Learning in Gandaki Province , Nepal
- **Policy Level talk programs for establishment of CORS** in Gandaki Province, Nepal
- **Formation of task committee for Natural Disaster Reduction and Management based on GNSS Technology** in Gandaki Province ,Nepal





# Collaboration with Center for Spatial Information Science (CSIS) The University of Tokyo

- Conduction of Pilot Projects in the fields of GNSS applications
  - Low-Cost High-Accuracy Position Assessment using MADOCA-PPP
  - Traffic congestion analysis
  - Dynamic Air Quality Monitoring using Low-Cost GNSS receiver systems

# Statistics of UTOKYO/ICG GNSS Training Program hosted by CSSGS Pashchimanchal Campus, Tribhuvan University, Pokhara , Nepal

Training Mode / Location	Hybrid-Training Venue: Nepal	
<b>Date and Duration</b>	<b>11 – 14 Jan 2022 3 days</b>	<b>28 Jan 2022 1 day</b>
Course Type	Course A	Course B
(A) ICG Funded International (travel only)	(5 awarded but Cancelled due to Corona Situation, attended online)	NA
(B) Other Funding (travel only)	NA	NA
(C) Self Funded International	(3 but cancelled due to Corona Situation, attended online)	NA
(D) Self-Funded Domestic (Thailand or Nepal)	30 (On-site Nepal)	NA
(E) Online Participants	45	25
<b>Total (A + B + C + D + E)</b>	<b>75</b>	<b>25</b>
Number of Applicants	90	40
Number of Resource Persons	13	3
Number of Countries	16	10
Resource Persons' Countries	7	2





# Master Thesis on GNSS Applications

- **Master students have selected GNSS as a part of their Master Thesis.**
  - Air Quality Monitoring Using Low-Cost GNSS Receivers and Air Quality Sensors in Urban Environment.
  - Analysis of Perceptible water vapor using Global Navigation Satellite System Observation
  - Total Electron Content Estimation and Comparison Using Multi-GNSS Constellations

# Pilot Projects: Dynamic Air-Quality Monitoring

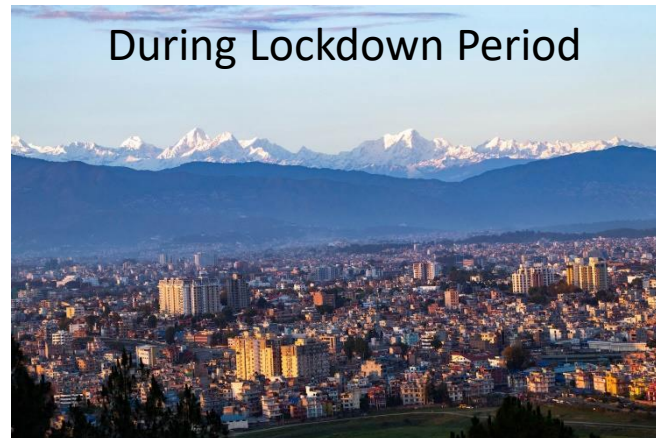
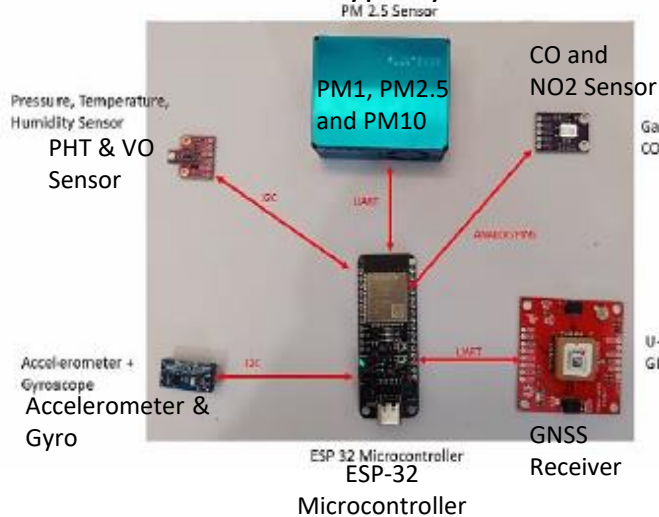
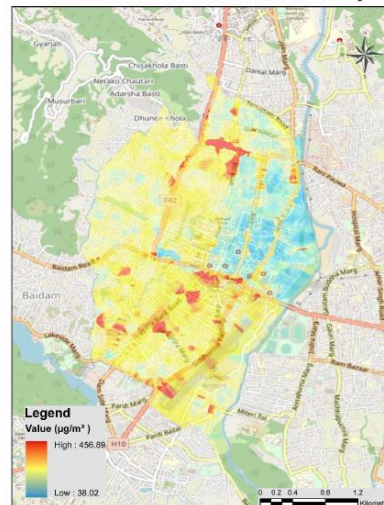


Photo Sources: [https://www.nepalitimes.com/here-now/nepals-smoky-mountains/?fbclid=IwAR31xbeCKSSj9\\_gNOAU7BKMquQAzTg0Z6J-LUTmtsZu9o7o9ozsddu8Z5Vo](https://www.nepalitimes.com/here-now/nepals-smoky-mountains/?fbclid=IwAR31xbeCKSSj9_gNOAU7BKMquQAzTg0Z6J-LUTmtsZu9o7o9ozsddu8Z5Vo)

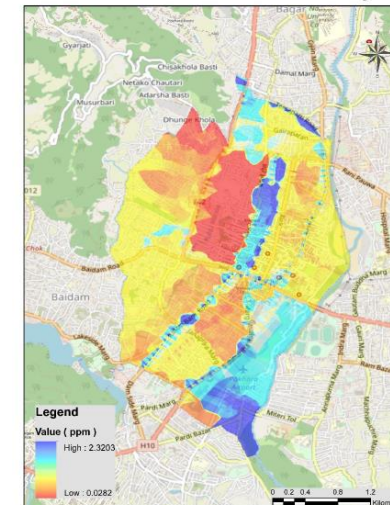
## Prototype System



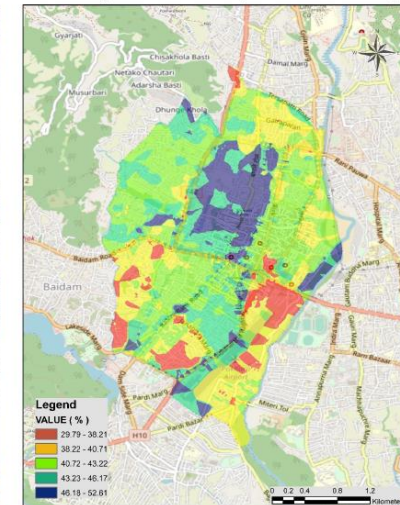
## PM2.5 Concentration in Pokhara Valley



## NO2 Concentration in Pokhara Valley

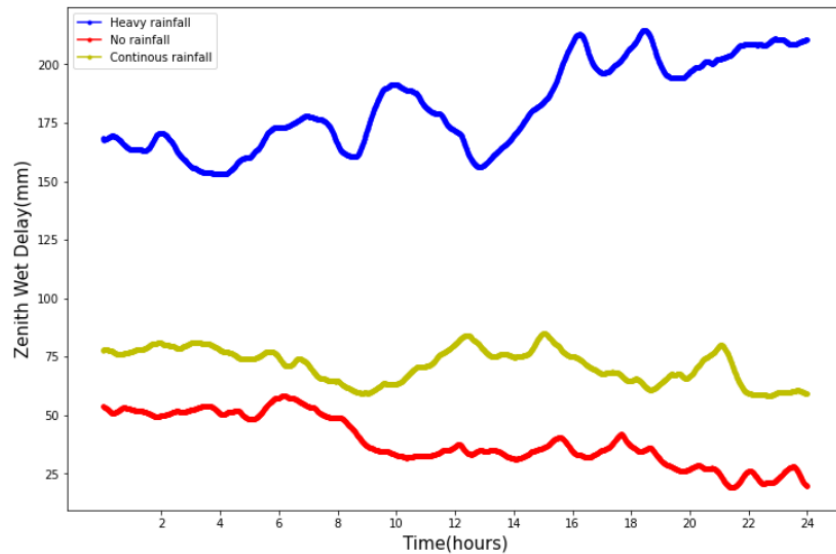


## Humidity Distribution Map of Pokhara Valley



# Analysis of Perceptible water vapor using GNSS Data

Site	Type	Date	Geographic Location
1. WRC CORS station	PolaRx5e	2022/7/1-2022/7/31 (rainy month)	28°15'18.36''mN, 83°58'35.04''E
2.Nagarkot CORS station	NetR9	2021/12/1 -2022/12/31 (cold month) 2022/4/1 - 2022/4/31 (dry month)	27°41'33.68'N, 83°31'15.80'E



Comparison of Zenith Wet Delay during heavy rainfall, no rainfall, and continuous rainfall day- Nagarkot GNSS Station.

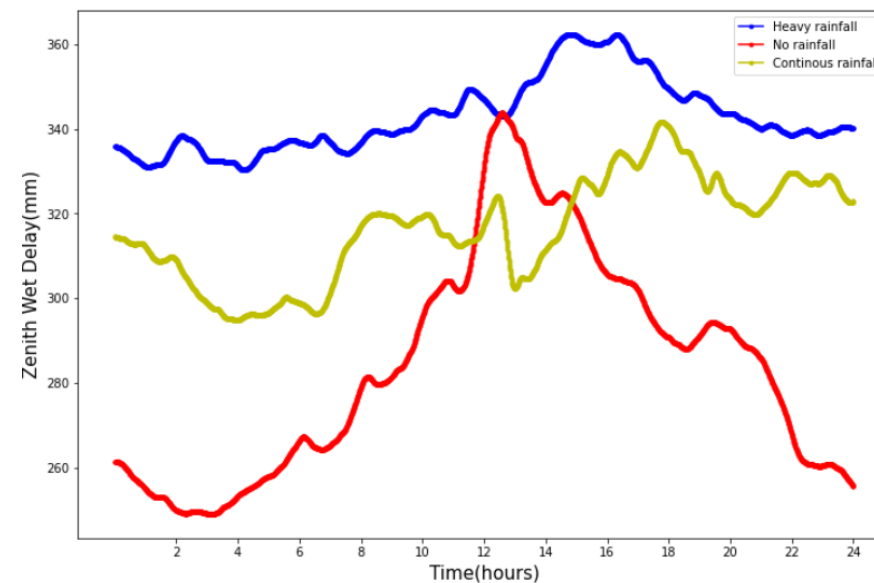
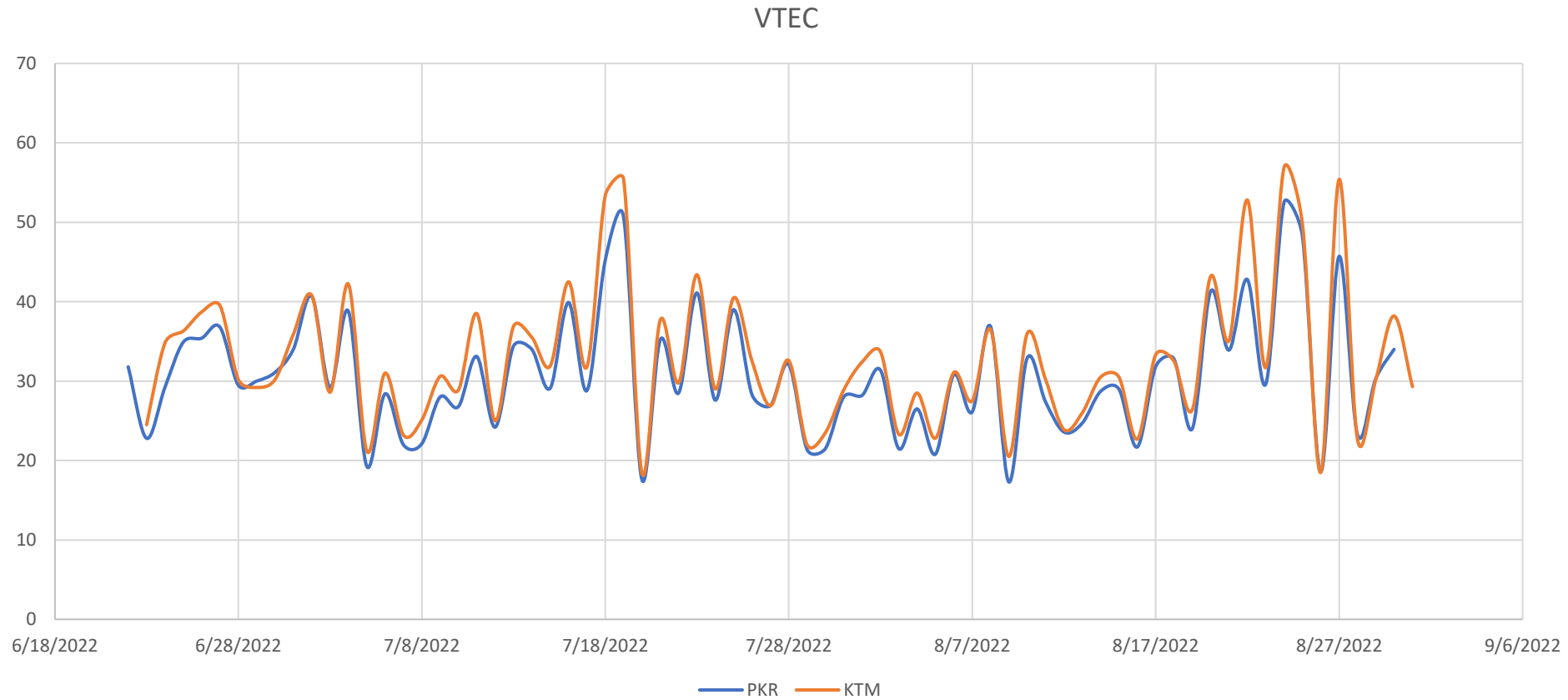


Figure : Comparison of Zenith Wet Delay during heavy rainfall, no rainfall, and continuous rainfall day- Pachimanchal Campus GNSS Station.

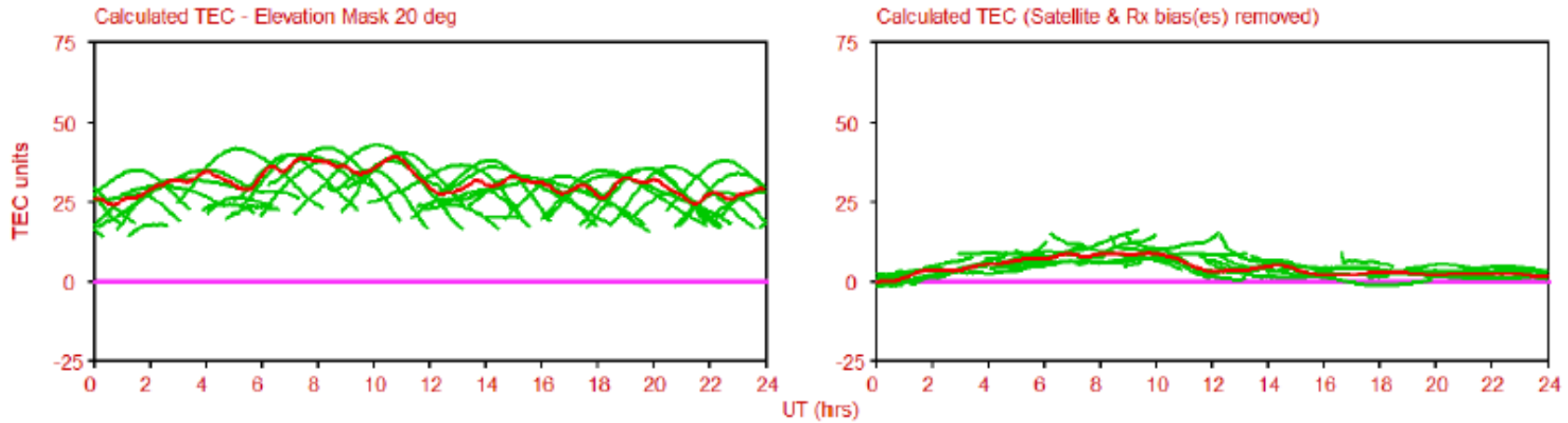
# Total Electron Content Estimation and Comparison Using Multi-GNSS Constellations

- Variation of VTEC over Pokhara and Kathmandu

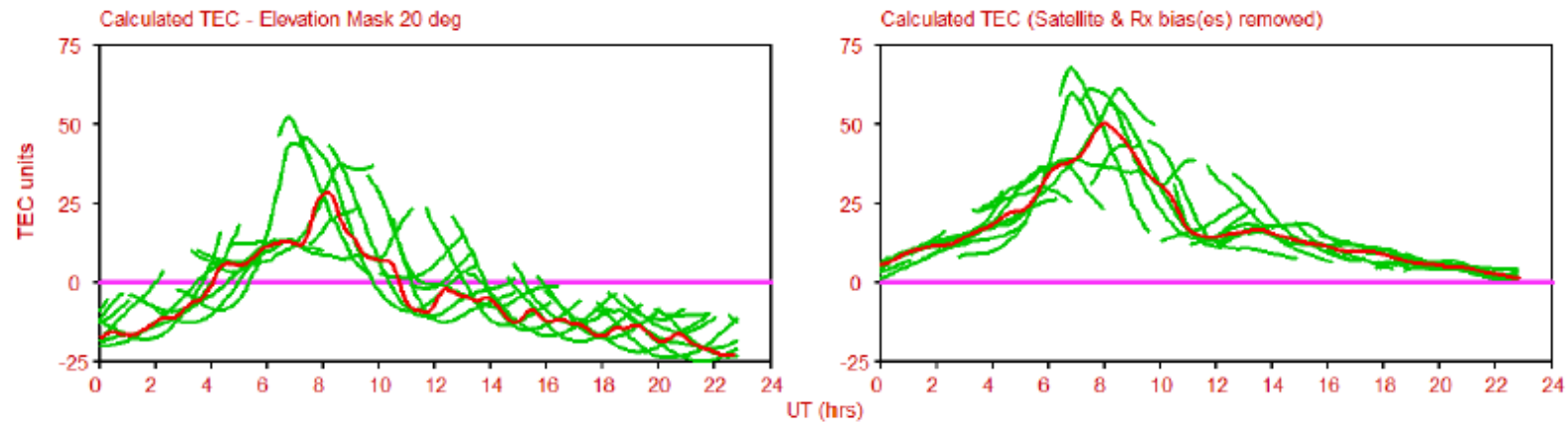


# Total Electron Content Estimation and Comparison Using Multi-GNSS Constellations

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## Future Plans

- Establish and improve infrastructures necessary for GNSS education, research and capacity development.
- We would also like to invite you to join us to achieve our goal together and help promote GNSS technology in Nepal further to improve the socio-economic development of the country.



**Thank You**