NARAYANARAO BHOGAPURAPU

PhD, Geoinformatics and Natural Resources Engineering

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PROFILE

My work focuses on the advancements and applicability of Synthetic Aperture Radar (SAR) techniques for crop and forest monitoring, ground deformation mapping, and soil moisture estimation. In my work, I have devised a novel methodology to estimate soil moisture over croplands solely using dual-pol GRD SAR data. The advantages of this method include continuous monitoring of soil moisture over a larger scale at higher resolutions. Besides, I have also developed a novel methodology to estimate soil moisture using full and compact polarimetric SAR data. On the other hand, monitoring and quantifying vegetation content directly helps better estimate soil moisture. In this regard, I have developed different vegetation descriptors for dual-pol GRD SAR data. Besides, these descriptors are also capable of estimating crop biophysical parameters. These techniques are successfully implemented using Amazon Web Services (AWS), Google Earth Engine (GEE), and Google Colaboratory (Google Colab). These novel techniques and strategies might be helpful in developing operational agricultural crop monitoring platforms through the Joint Experiment for Crop Assessment and Monitoring (JECAM) international research network, as well as upcoming satellite missions. My current focus is developing forest canopy height estimation algorithms using InSAR and LiDAR data. My career objective is to obtain a researcher position in the field of remote sensing application to agriculture and forestry to associate myself with a progressing science and the nation. In addition, I want to put my expertise to the best use for the remote sensing, agricultural, and forest ecosystems community, as well as widen my technical spectrum.

EDUCATION

Ph.D. in Geoinformatics and Natural Resources Engineering 2019 - 2023
Institute: *Indian Institute of Technology Bombay, Mumbai, India.*
Thesis title: Soil moisture retrieval over croplands using PolSAR data
Advisors: Prof. Y.S.Rao & Prof. Avik Bhattacharya
CPI: 9.43/10.0 (**Best Thesis award**)

M.Tech. in Remote sensing and GIS 2016 - 2018
Institute: *National Institute of Technology Warangal, India*
Thesis title: Subsurface physical parameters sensitivity analysis using GPR modeling and simulations
Advisors: Prof. K. V. Reddy & D. K. Pandey (SAC-ISRO, Ahmedabad)
CPI: 8.95/10.0 (**Highest CPI in the division**)

B.E. in Civil Engineering 2012 - 2016
University: *Andhra University, India*
Thesis title: Analysis of multi-storied office building (manual design)
Advisor: Prof. K. Santosh Kumar
CGPA: 8.45/10 (**Highest CPI in the division**)

Higher secondary (10+2) Science 2005 - 2012
School: *Jawahar Navodaya Vidhyalaya, Kiltampalem, India*
Marks: 84.8 %

EXPERIENCE

Division of Geological and Planetary Sciences, Caltech August 2024 - Present
Visiting Postdoctoral fellow *Pasadena, USA*

- ISRO L- & S-band Airborne SAR (ASAR) data calibration
- Above Ground Biomass (AGB) estimation using SAR data
- Forest height estimation using InSAR and LiDAR data

Microwave Remote Sensing Laboratory, UMass Amherst Jan 2023 - Present
Postdoctoral fellow *Amherst, USA*

- Above Ground Biomass (AGB) estimation over Boreal forests using SAR data
- Forest height estimation using InSAR and LiDAR data

Microwave Remote Sensing Laboratory, UMass Amherst Jan 2022 - Dec 2022
Visiting research scholar *Amherst, USA*

- Above Ground Biomass (AGB) estimation over Boreal forests using SAR data
- Forest height estimation using InSAR and LiDAR data

CropIn Technology Solutions Jan 2022 - Dec 2022
Earth Observation Fellow *Bengaluru, India*

- Soil moisture estimation and crop monitoring using dual polarimetric SAR data
- Large-scale soil moisture mapping and crop monitoring using Sentinel-1 GRD SAR data and cloud-based platforms

Microwave Remote Sensing Lab, Indian Institute of Technology Bombay 2019 - 2023
Research Scholar *Mumbai, India*

- Soil moisture estimation and crop monitoring using PolSAR data
- Global soil moisture mapping and crop monitoring using GRD SAR data and cloud-based platforms

Centre of Studies in Resources Engineering, Indian Institute of Technology Bombay 2019 - 2023
Teaching Assistant *Mumbai, India*

- Courses involvement: **GNR647**: Microwave Remote Sensing | **GNR805**: Advanced Concepts in Polarimetric SAR Image Analysis | **GNR617**: Image Interpretation Laboratory | **GNR792**: Communications Skills | **GNR621**: Natural Resources: Hydrosphere, Cryosphere and Atmosphere

Microwave Techniques Development Division, Space Applications Centre (ISRO) July 2017 - May 2018
Graduate trainee *Ahmedabad, India*

- Subsurface physical parameters sensitivity analysis using Ground Penetrating Radar modeling and simulations

PUBLICATIONS

-OryAUsAAAAJ | **0000-0002-6496-7283** | **37088752318**

Citation: 340; h-index: 9; i10-index: 8 (records based on Google Scholar December 2024)

Peer Review Journal Articles:

[J12] S. S. Ghosh, D. Mandal, S. Kumar, **N. Bhogapurapu**, B. Banerjee, P. Siqueira and A. Bhattacharya 2024 "An Evidence Modified Gaussian Process Classifier (EM-GPC) for Crop Classification Using Dual-Polarimetric C- and L- band SAR Data ", *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 17, pp. 18683-18702.

[J11] **N. Bhogapurapu**, P. Siqueira and J. Armston 2024 "A new InSAR temporal decorrelation model for seasonal vegetation change with dense time-series data. ", *IEEE Geoscience and Remote Sensing Letters*, 21, pp. 1-5.

[J10] S. Dey, **N. Bhogapurapu**, I. Hajnsek, A. Bhattacharya, and P. Siqueira 2023 "Soil permittivity estimation over vegetative fields using dual polarimetric SAR data ", *Remote Sensing Applications: Society and Environment*, p.101130.

[J9] **N. Bhogapurapu**, S. Dey, A. Bhattacharya, C. López-Martínez, I. Hajnsek, and Y. S. Rao 2022 "Soil Permittivity Estimation Over Croplands Using Full and Compact Polarimetric SAR Data ", *IEEE Transactions on Geoscience and Remote Sensing*, 60, pp. 1-17.

[J8] **N. Bhogapurapu**, S. Dey, S. Homayouni, A. Bhattacharya, and Y. S. Rao 2022 "Field-Scale Soil Moisture Estimation Using Sentinel-1 GRD SAR Data ", *Advances in Space Research*, 70, 3845–3858.

[J7] S. S. Ghosh, S. Dey, **N. Bhogapurapu**, S. Homayouni, A. Bhattacharya, and H. McNairn 2022 "Gaussian process regression model for crop biophysical parameter retrieval from multi-polarized C-band SAR data ", *Remote sensing.* 14(4):934.

[J6] **N. Bhogapurapu**, S. Dey, D. Mandal, A. Bhattacharya, L. Karthikeyan, H. McNairn and Y. S. Rao 2022 "Soil Moisture Retrieval Over Croplands Using dual-pol L-band GRD SAR Data ", *Remote Sensing of Environment.* 271, p.112900.

[J5] S. Dey, **N. Bhogapurapu**, S. Homayouni, A. Bhattacharya, and H. McNairn 2021 "Unsupervised Classification of Crop Growth Stages with Scattering Parameters from Dual-Pol Sentinel-1 SAR Data", *Remote Sensing*, 2021, 13, 4412.

[J4] S. Dey, U. Chaudhuri, **N. Bhogapurapu**, J. Lopez-Sanchez, B. Banerjee, A. Bhattacharya, D. Mandal, and Y. S. Rao 2021 "Synergistic Use of TanDEM-X and Landsat-8 Data for Crop-type Classification and Monitoring ", *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 14, pp.8744-8760.

[J3] **N. Bhogapurapu**, S. Dey, A. Bhattacharya, D. Mandal, J. Lopez-Sanchez, H. McNairn, C. López-Martínez and Y. S. Rao 2021 "Dual-polarimetric descriptors from Sentinel-1 GRD SAR data for crop growth assessment ", *ISPRS Journal of Photogrammetry and Remote Sensing* 178 (2021): 20-35.

[J2] S. Dey, **N. Bhogapurapu**, A. Bhattacharya, D. Mandal, J. Lopez-Sanchez, H. McNairn, and A. C. Frery 2021 "Rice Phenology Mapping Using Novel Target Characterization Parameters from Polarimetric SAR Data ", *International Journal of Remote Sensing*, 42:14, 5519-5543.

[**J1**] **N. Bhogapurapu**, S. Dey, D. Mandal, A. Bhattacharya and Y. S. Rao 2021 "PolSAR tools: A QGIS plugin for generating SAR descriptors", *Journal of Open Source Software*, 6(60), 2970.

Conference Proceedings:

[**C23**] P. K. Bellam, M. K. Gumma, **N. Bhogapurapu**, and V. R. Keesara 2024 "Soil organic carbon mapping using Sentinel-1 and ALOS-2 SAR data ", *IEEE India Geoscience and Remote Sensing Symposium (InGARSS),* IEEE.

[**C22**] **N. Bhogapurapu**, P. Siqueira, J. Armston, M. Urbazaev, K. Wessels, and L. Duncanson 2024 "Canopy height estimation using C- and L-band InSAR coherence over savannas and dry forests ", *Geoscience and Remote Sensing Symposium (IGARSS),* (pp. 2290-2293). IEEE. (invited session).

[**C21**] S. S. Ghosh, D. Mandal, S. Kumar, **N. Bhogapurapu**, B. Banerjee, P. Siqueira, and Avik Bhattacharya, 2024 "Enhancing crop type classification from multi-frequency dual-pol SAR data by probabilistic fusion of Gaussian processes ", *Geoscience and Remote Sensing Symposium (IGARSS),* (pp. 8629-8632), IEEE.

[**C20**] Partha Deb Roy, S. Dey, **N. Bhogapurapu**, Somsubhra Chakraborty 2023 "Estimation of Surface Soil Moisture Using Modified Oh Model and Dual-Polarimetric Sentinel-1 SAR Data ", *IEEE India Geoscience and Remote Sensing Symposium (InGARSS),*(pp. 1-4), IEEE.

[**C19**] S. S. Ghosh, D. Mandal, S. Kumar, **N. Bhogapurapu**, P. Siqueira, B. Banerjee and A. Bhattacharya 2023 "Phenology-based crop classification from multi-frequency dual-pol sar data utilizing gaussian processes ", *2023 8th Asia-Pacific Conference on Synthetic Aperture Radar (APSAR),*(pp.1-6), IEEE.

[**C18**] D. Murugan, **N. Bhogapurapu**, J. Roy, A. Bhattacharya, and P. Pankajakshan 2023 "Sentinel-1 data sensitivity for soil moisture estimation and its application for in-season monitoring of small land holding farmer plots ", *Geoscience and Remote Sensing Symposium (IGARSS),* (pp. 2906-2909), IEEE.

[**C17**] S. S. Ghosh, **N. Bhogapurapu**, A. Bhattacharya, and S. Homayouni 2023 "Enhancing Plant Area Index Retrieval Using Gaussian Process Regression from Dual-Polarimetric SAR Data ", *Machine Intelligence for GeoAnalytics and Remote Sensing (MIGARS 2023)*, (pp.1-4), IEEE.

[**C16**] S. Dey, **N. Bhogapurapu**, and A. Bhattacharya 2022 "Ground and Volume Scattering Separation in Compact Polarimetric Interferometric SAR Data ", *URSI Regional Conference on Radio Science (URSI-RCRS 2022)*,(pp. 1-4), IEEE.

[**C15**] **N. Bhogapurapu**, S. Dey, A. Bhattacharya, C. López-Martínez, I. Hajnsek, and Y. S. Rao 2022 "Soil permittivity estimation over croplands using PolSAR data", *Geoscience and Remote Sensing Symposium (IGARSS),* (pp. 8000-8003), IEEE. (**Student Paper competition winner**).

[**C14**] **N. Bhogapurapu**, S. Dey, Saeid Homayouni, A. Bhattacharya, and Y. S. Rao 2022 "Scattering Parameters from Sentinel-1 SAR Data for crop growth assessment", *IEEE Mediterranean and Middle-East Geoscience and Remote Sensing Symposium (M2GARSS),*(pp. 58-61), IEEE.

[**C13**] S. S. Ghosh, S. Dey, **N. Bhogapurapu**, S. Homayouni, A. Bhattacharya, and H. McNairn 2022 "Crop biophysical parameter retrieval using Gaussian process regression from C-band polarimetric SAR data", *IEEE Mediterranean and Middle-East Geoscience and Remote Sensing Symposium (M2GARSS),*(pp. 181-184), IEEE.

[**C12**] **N. Bhogapurapu**, S. Dey, A. Verma, A. Bhattacharya, C. López-Martínez and P. Pankajakshan 2021 "Crop growth assessment using Sentinel-1 GRD SAR descriptors", *IEEE India Geoscience and Remote Sensing Symposium (InGARSS),*(pp. 545-548), IEEE.

[**C11**] S. Dey, **N. Bhogapurapu**, A. Verma, S. Homayouni, C. López-Martínez, and A. Bhattacharya 2021 "Simultaneous evaluation of the target scattering-type parameter and scattering power components from polarimetric SAR images", *IEEE India Geoscience and Remote Sensing Symposium (InGARSS),*(pp. 537-540). IEEE.

[**C10**] A. Verma, S. Dey, **N. Bhogapurapu**, C. López-Martínez, and A. Bhattacharya 2021 "Dual polarimetric SAR signature for human-made target characterization", *IEEE India Geoscience and Remote Sensing Symposium (InGARSS),* (pp. 520-523). IEEE.

[**C9**] **N. Bhogapurapu**, S. Dey, A. Bhattacharya, and Y. S. Rao 2021 "Soil Moisture Estimation Using Simulated NISAR Dual Polarimetric GRD Product over Croplands", *2021 7th Asia-Pacific Conference on Synthetic Aperture Radar (APSAR),* (pp. 1-6).

[**C8**] S. Dey, **N. Bhogapurapu**, A. Bhattacharya, D. Mandal, H. McNairn and Y. S. Rao 2021 "Novel Clustering Technique for Monitoring Crop Phenology Using SAR Data", *2021 7th Asia-Pacific Conference on Synthetic Aperture Radar (APSAR),* (pp. 1-6).

[C7] **N. Bhogapurapu**, A. Bhattacharya, and Y. S. Rao 2021 "Chandrayaan-2 Dual Frequency Synthetic Aperture Radar (DFSAR) Full and Compact Polarimetric Data Analysis for the Lunar Surface ", *2021 7th Asia-Pacific Conference on Synthetic Aperture Radar (APSAR),* (pp. 1-5).

[C6] **N. Bhogapurapu**, S. Dey, D. Mandal, A. Bhattacharya, and Y. S. Rao 2021 "Monitoring wheat crop growth using a new vegetation index from Sentinel-1 GRD SAR data ", *Geoscience and Remote Sensing Symposium (IGARSS),* (pp. 5921-5924), IEEE.

[C5] S. Dey, **N. Bhogapurapu**, A. Bhattacharya, Alejandro C. Frery, and Paolo Gamba 2021 "Built-up area mapping using full and dual polarimetric SAR data", *Geoscience and Remote Sensing Symposium (IGARSS),* (pp. 1693-1696), IEEE.

[C4] A. Verma, S. Dey, **N. Bhogapurapu**, D. Mandal, D. Haldar, A. Bhattacharya 2021 "Polarimetric SAR Signature for Crop Characterization ", *Geoscience and Remote Sensing Symposium (IGARSS),* (pp. 503-506), IEEE.

[C3] **N. Bhogapurapu**, D. Mandal, Y. S. Rao and A. Bhattacharya 2020 "Soil Moisture retrieval using SAR derived vegetation descriptors in water could model", *Geoscience and Remote Sensing Symposium (IGARSS),* (pp. 4696-4699). IEEE.

[C2] **N. Bhogapurapu**, D. Mandal, Y. S. Rao and A. Bhattacharya 2020 "Soil moisture estimation for wheat crop using dual-pol L-band SAR data", *IEEE India Geoscience and Remote Sensing Symposium (InGARSS),* (pp. 33-36), IEEE.

[C1] D. Mandal, **N. R. Bhogapurapu**, V. Kumar, S. Dey, D. Ratha, A. Bhattacharya, J. M. Lopez-Sanchez, H. McNairn, Y. S. Rao 2020 "Vegetation monitoring using a new dual-pol radar vegetation index: A preliminary study with simulated NASA-ISRO SAR (NISAR) L-band data", *Geoscience and Remote Sensing Symposium (IGARSS),* (pp. 4870-4873). IEEE.

Book Chapter:

[BC1] **N. R. Bhogapurapu**, Pandey, D.K., Reddy, K.V. and Putrevu, D., 2020. "Study of Subsurface Roughness Impact on GPR Performance Using Modelling and Simulation ", *In Applications of Geomatics in Civil Engineering* (pp. 471-477). Springer, Singapore.

Preprints:

[PP3] Roy, D. P. and Dey, S. and **Bhogapurapu, N.**, and Chakraborty, S. 2024. "Retrieval of Surface Soil Moisture at Field Scale Using Sentinel-1 SAR Data. "SSRN preprint 10.2139/ssrn.5029813.

[PP2] Wilson, B., Kumar, R., **Bhogapurapu, N.**, Singh, A. and Sethi, A., 2022. "Deriving Surface Resistivity from Polarimetric SAR Data Using Dual-Input UNet."arXiv preprint arXiv:2207.01811.

[PP1] Mandal, D., Vaka, D.S., **Bhogapurapu, N.R.**, Vanama, V.S.K., Kumar, V., Rao, Y.S. and Bhattacharya, A., 2019. "Sentinel-1 SLC preprocessing workflow for polarimetric applications: A generic practice for generating dual-pol covariance matrix elements in SNAP S-1 toolbox."Preprints 2019, 2019110393.

Keynote/Guest/Tutorial Lectures:

[L1] **Exploring synthetic aperture Radar (SAR) data on Google Earth Engine**
Tutorial Lecture: AICTE - ATAL Proposed Faculty Development Program on Geo-AI: Innovations in AI for Improved Spatial Data Processing, Mumbai, 2-7 December 2024 (Virtual).

Conferences/Presentations:

[W16] **N. Bhogapurapu**, P. Siqueira 2024 "Canopy height estimation using ALOS-2 L-band and Sentinel-1 C-band coherence over various forest types ", *AGU Fall Meeting 2024.*

[W15] **N. Bhogapurapu**, P. Siqueira, Michael J. Battaglia, Laura Bourgeau Chavez 2024 "Above Ground Biomass mapping over the NA boreal region using ALOS-2 SCANSAR data ", *AGU Fall Meeting 2024.*

[W14] **N. Bhogapurapu**, P. Siqueira, J. Armston, M. Urbazaev, Xiaoxuan Li, K. Wessels, L. Duncanson 2023 "Forest canopy height estimation using C- and L-band InSAR coherence over savannas and dry forests ", *AGU Fall Meeting 2023.*

[W13] **N. Bhogapurapu**, P. Siqueira, Michael J. Battaglia, Laura Bourgeau Chavez 2023 "Forest biomass and soil moisture estimation using multi-temporal SAR data over the great slave lake region ", *AGU Fall Meeting 2023.*

[W12] M. Urbazaev, J. Armston, Xiaoxuan Li, K. Wessels, L. Duncanson **N. Bhogapurapu**, P. Siqueira 2023 "Improving the applicability of canopy structure measurements from GEDI and ICESat-2 to global savannas ", *AGU Fall Meeting 2023.*

[W11] **N. Bhogapurapu**, P. Siqueira, J. Armston, Xiaoxuan Li, M. Urbazaev, K. Wessels, and L. Duncanson 2023 "Large-scale forest stand height estimation using C-band InSAR correlation ", *Geoscience and Remote Sensing Symposium (IGARSS), IEEE International.*

[**W10**] **N. Bhogapurapu**, P. Siqueira, B. D. Chapman, S. Kraatz 2023 "LS-ASAR dual-frequency polarimetric calibration and data analysis over various crops ", *Geoscience and Remote Sensing Symposium (IGARSS), IEEE International.*

[**W9**] **N. Bhogapurapu**, S. Dey, A. Bhattacharya, U.Khati, and Y. S. Rao 2023 "Global sentinel-1 GRD descriptors over various forest types ", *Geoscience and Remote Sensing Symposium (IGARSS), IEEE International.*

[**W8**] **N. Bhogapurapu**, P. Siqueira, J. Armston, Xiaoxuan Li, M. Urbazaev, K. Wessels, and L. Duncanson 2023 "Large-Scale Canopy Height Estimation using C-band InSAR Correlation ", *PolInSAR 2023: 11th International Workshop on Science and Applications of SAR Polarimetry and Polarimetric Interferometry and BIOMASS Workshop.*

[**W7**] U. Sahu, Y.S. Rao, and **N. Bhogapurapu**, 2023 "Comparison of Soil Moisture Retrieval Models using Polarimetric SAR data ", *PolInSAR 2023: 11th International Workshop on Science and Applications of SAR Polarimetry and Polarimetric Interferometry and BIOMASS Workshop.*

[**W6**] M. Urbazaev, J. Armston, Xiaoxuan Li, K. Wessels, L. Duncanson **N. Bhogapurapu**, P. Siqueira, 2023 "The Efficacy Of GEDI And ICESat-2 For Estimation Of Vegetation Cover And Height In Savannas ", *PolInSAR 2023: 11th International Workshop on Science and Applications of SAR Polarimetry and Polarimetric Interferometry and BIOMASS Workshop.*

[**W5**] **N. Bhogapurapu**, P. Siqueira, J. Armston, Xiaoxuan Li, K. Wessels, L. Duncanson 2022 "Temporal analysis of C-band InSAR decorrelation for canopy height mapping over dry forests and tropical savannas ", *AGU Fall Meeting 2022.*

[**W4**] **N. Bhogapurapu**, Paul Siqueira, John Armston, Xiaoxuan Li, Konrad Wessels, Laura Duncanson 2022 "Sentinel-1 decorrelation for forest canopy height estimation over dry forests and tropical savannas ", *October 2022 NISAR Science Team Meeting, Boston, USA.*

[**W3**] **N. Bhogapurapu**, Paul Siqueira, John Armston, Xiaoxuan Li, Konrad Wessels, Laura Duncanson 2022 "Sentinel-1 C-band InSAR temporal decorrelation analysis over dry tropical savannas and other forests ", *2022 NISAR Science Community Workshop, Pasadena, USA.*

[**W2**] **N. Bhogapurapu**, S. Dey, A. Bhattacharya, and Y. S. Rao 2021 "Soil moisture estimation over canola crop using Simulated NISAR Dual Polarimetric GRD Product", *PolInSAR 2021: The 10th International Workshop on Science and Applications of SAR Polarimetry and Polarimetric Interferometry.*

[**W1**] S. Dey, **N. Bhogapurapu**, A. Bhattacharya, and Y. S. Rao 2021 "Crop Monitoring Using Sentinel-1 GRD Product in GEE Platform", *PolInSAR 2021: The 10th International Workshop on Science and Applications of SAR Polarimetry and Polarimetric Interferometry.*

RESEARCH PROJECTS/ THIRD PARTY FUNDING ACQUIRED

Acquired Funding	Funding Agency	Project Duration	Project Title	Role in the Project	Remarks
200000 Cloud credits	National Science Foundation (NSF)	NOV/2024-NOV/2025	Large-scale Above Ground Biomass (AGB) estimation using multi-sensor remote sensing data and deep learning	PI	This research grant was through the ACCESS advanced computing and data resource program supported by the U.S. National Science Foundation (NSF)
$ 120000	Group on Earth Observations (GEO) and Microsoft Planetary Computer Programme	JUN/2022-JUN/2025	Azure4GEO - Deep learning based crop characterization with synergistic use of SAR and optical data on cloud computing platform	Team member	This research grant was through the GEO-Microsoft Planetary Computer Programme Programme
$ 66000	Group on Earth Observations (GEO) and Amazon Web Services (AWS)	JUN/2019-JUN/2022	AWS4AgriSAR: Crop Inventory Mapping from SAR Data on Cloud Computing Platform	Team member	This research grant was through the GEO-Amazon Earth Observation Cloud Credits Programme
–	GEO Global Agricultural Monitoring (GEOGLAM) / Joint Experiment for Crop Assessment and Monitoring (JECAM)	JUN/2017-JUN/2020	JECAM SAR Inter-Comparison Experiment: Crop Type Identification & Mapping and crop biophysical parameter retrieval	Team member	JECAM network provided numerous Earth Observation datasets free of charge to the partners through agreement with Canadian Space Agency.

PRODUCT DEVELOPMENT AND TECHNOLOGY TRANSFER

- **PolSARtools PyPI package** https://pypi.org/project/polsartools/ 2022
- **Dual-pol descriptors Google Earth Engine app:** https://github.com/Narayana-Rao/dual_pol_descriptors 2021
- **PolSAR tools-QGIS Plugin** https://plugins.qgis.org/plugins/polsar_tools/ 2021
- **Soil moisture estimation code for dual-pol SAR data** - EO-browser Custom script contest shortlisted 2019

FIELD EXPEDITIONS/ CAMAPIGNS

- Team member in the field campaign with collaboration by the Michigan Tech Research Institute (MTRI).The aim of this campaign was to create forest canopy inventory for North American boreal forest, collect soil moisture, biophysical parameters, wildfire parameters over a Canadian test site. — August 2024
- Team member in the field campaign with collaboration by the University of Maryland and George Mason University, USA. The aim of this campaign was to create forest canopy inventory for 1 Ha plots, collect Terrestrial LiDAR scanner (TLS), and Airborne LiDAR data over South African test sites. — October 2023
- Volunteered the SMAPVEX-2022 field Campaign with joint collaboration by NASA JPL, USDA and MIRSL-UMass, at Harvard Forest Test site in Massachusetts, USA. The aim of this campaign was to collect Forest canopy and Soil parameters in synchronous with Satellite (SMAP, Sentinel-1A) overpasses. — April 2022
- Co-lead the Field Campaign with joint collaboration by MRSLab – IIT Bombay, and APSAC, at JECAM Test site in Andhra Pradesh, India. The aim of this campaign was to collect Crop and Soil parameters in synchronous with Satellite (Radarsat-2, TerraSAR-X, ALOS-2, Sentinel-1A, Sentinel-2) overpasses. — Jun 2019 - Dec 2019

AWARDS, FELLOWSHIPS, & GRANTS

Name of award	Description	Year
Naik and Rastogi Excellence in Ph.D. Thesis Award	This prestigious award is given to Ph.D. Candidates for outstanding research carried out as part of their doctoral work at IIT Bombay.	August 2024
Mikio Takagi Student Prize	This prestigious award is given to a student who has presented an outstanding paper at the IEEE Geoscience and Remote Sensing Symposium (IGARSS).	July 2022
IEEE GRSS Travel Grant	This grant is awarded by IEEE GRSS society to support the travel for participating in the IEEE Geoscience and Remote Sensing Symposium (IGARSS).	July 2022
Visiting Scholar Fellowship	This competitive fellowship award is provided by the University of Massachusetts Amherst, United States, under the NISAR project.	Jan 2022 - Dec 2023
Fulbright-Nehru Doctoral Research Fellowship	This competitive fellowship award is provided by United States – India Educational Foundation (USIEF).	2022
Earth Observation Fellowship	This competitive fellowship award is provided by the Cropin Technology Solutions Pvt. Ltd. India	July 2021 - Dec 2021
Shortlisted as EO-browser Custom script contest 2019	Sentinel-hub and the Copernicus EU Earth Observation programme and the European Space Agency organized EO-browser custom script contest for globally scripting hackathon	2020
Ph.D. Assistantship	This competitive fellowship award is provided by the Ministry of Human Resource Development, the Government of India	2019 - 2023
M.Tech Assistantship	This competitive fellowship award is provided by the Ministry of Human Resource Development, the Government of India	2016 - 2018
Post-matric Scholarship	This competitive sponsorship award is provided by the Government of Andhra Pradesh, India	2012 - 2016

TEACHING EXPERIENCE

Institute: CSRE, Indian Institute of Technology Bombay, India

Title of course	Level: Postgraduate/ Undergraduate	Role: Instructor/ Teaching Assistant (TA)	Year - session
GNR647: Microwave Remote Sensing	Postgraduate	TA	2021 - Spring
GNR617: Image Interpretation Laboratory	Postgraduate	TA	2021 - Spring
GNR647: Microwave Remote Sensing	Postgraduate	TA	2020 - Spring
GNR792: Communications Skills	Postgraduate	TA	2020 - Autumn
GNR617: Image Interpretation Laboratory	Postgraduate	TA	2020 - Autumn
GNR621: Natural Resources: Hydrosphere, Cryosphere and Atmosphere	Postgraduate	TA	2020 - Autumn
GNR401: Remote sensing and Image Processing	Postgraduate	TA	2020 - Autumn

CODING SKILLS

Programming Skill	C | C++ | Python | MATLAB | R | JS
Software and Tools	ArcGIS | QGIS | ERDAS Imagine | ENVI | Autocad | PolSARPro | SNAP | Git
Python packages	GDAL | Rasterio | Geopandas | Spectral | Pandas | PYRAT | Scipy | Numpy
Cloud based platforms	Google Earth Engine | Amazon Web services (AWS) | Google cloud platform Multi-Mission Algorithm and Analysis Platform (NASA MAAP)

SYNERGISTIC ACTIVITY

Reviewer: Journals/Conferences/Projects

- **Journals:** Remote Sensing of Environment —IEEE Geoscience and Remote Sensing Magazine— Nature Scientific data —International Journal of Remote Sensing — IEEE Geoscience and Remote Sensing Letters — IEEE Access — Canadian Journal of Remote Sensing — Current Science Journal — Journal of Open Source Software — Progress In Electromagnetics Research
- **Conferences:** ICETCI 2021 : International Conference on Emerging Techniques in Computational Intelligence — M2GARSS 2022: IEEE Mediterranean and Middle-East Geoscience and Remote Sensing Symposium

Peer Recognition:

- Session chair in sessions: TU1.R8, THU4.R7, and FR1.R7 in IEEE International Geoscience and Remote Sensing Symposium-IGARSS 2023, Pasadena, United States of America.
- Session manager in sessions: MO2.R6, TU2.R15, WE1.R1, WE2.R10, THU2.R15, and FR2.R5 in IEEE International Geoscience and Remote Sensing Symposium-IGARSS 2020, Hawaii, United States of America.
- Session manager in sessions: WE1.R2, FR2.R1 in IEEE International India Geoscience and Remote Sensing Symposium 2020, Gujarat, India.
- Session manager in sessions: Tutorial HD-3, Young Professional Events, FR2.H2 in IEEE International India Geoscience and Remote Sensing Symposium 2021, Gujarat, India.

Professional Membership:

- American Geophysical Union (S'22, M'23)
- IEEE Geoscience and Remote Sensing Society (S'19 M'23)
- Indian Society of Remote Sensing (Life Member'21)