

## Full CV as on 24 Aug, 2023

### Dr. RAAJ Ramsankaran

Professor

Department of Civil Engineering

Indian Institute of Technology Bombay

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### EDUCATION DETAILS:

Degree	Year	Subject	Institute	Place
Ph.D.	2010	Civil Engineering (Major: Remote sensing, GIS and Surface Hydrological Processes)	Indian Institute of Technology (IIT) Roorkee	Roorkee, Uttarakhand
M.E.	2004	Geoinformatics	College of Engineering Guindy (CEG), Anna University	Chennai, Tamil Nadu
B.E.	2002	Civil Engineering	Coimbatore Institute of Technology (CIT), Bharathiar University	Coimbatore, Tamil Nadu

### RESEARCH INTERESTS:

#### Hydro-Remote Sensing Applications with focus on the following areas

- Remote sensing (RS) of rainfall: Algorithm development, Validation and Applications
- Remote Sensing of Cryosphere: Snow depth, Glacier dynamics; Snow Avalanche monitoring
- Hydro-Geodesy: GNSS meteorology and GNSS Reflectometry for Cryosphere
- Data Assimilation in Hydrology
- Machine Learning (ML) Applications in Remote Sensing of Essential Climate Variables
- Distributed Hydrological Modelling: Simple to Complex process modelling
- Open GIS based Spatial Decision Support System
- UAV surveying in High Altitude Regions; UAV based 3D modelling, UAV Remote Sensing for Coastal Studies

### TEACHING INTERESTS:

Engineering Surveying; Elements of Geomatics Engineering; Remote Sensing Technology; Remote Sensing & GIS for Water Resources Management; GIS in Civil Engineering; Advanced Surveying

### AWARDS AND RECOGNITION:

- **Prof. R.J. Garde Research Award 2020** by Indian Society of Hydraulics for contribution to the field of hydrology and Water resources.
- **Asian Universities Alliance (AUA) Scholars Award 2019** to conduct short-term academic visit to Tsinghua University, Beijing, China during Dec 2019.
- **Water Advanced Research Innovation (WARI) Fellow 2018** to carry out collaborative research at University of Nebraska, Lincoln, USA awarded by Indo-US Science and Technology Forum (IUSSTF) and Department of Science and Technology (DST) New Delhi.
- **German Academic Exchange Service (DAAD) Visiting Faculty fellowship** to visit Technical University Munich, Germany from June 2015 to July 2015.
- **Department of Science & Technology, New Delhi (DST)-INSA INSPIRE Faculty Award 2012** for 5 years from June 2013-May 2018.
- **German Academic Exchange Service (DAAD) Long term Sandwich Scholarship** for pursuing a part of my doctoral studies at German Armed Forces University, Munich from June 2007-Sep 2008.
- **National Doctoral Fellowship (NDF)** awarded by **All India Council for Technical Education (AICTE)**, New Delhi, India for 4 years from July 2005- March 2009.

## **SCIENTIFIC COMMITTEES:**

- **Co-lead** for Cryosphere monitoring and modelling work group in ICIMOD's Upper Indus Basin (UIBN)- India Chapter Since March 2022 - till date
- **Member of the Expert Committee** for Capacity building and training on geo-spatial Science & Technologies of **National Geospatial Program (NGP, earlier NRDMS)**, Department of Science and Technology (DST), New Delhi Jan 2021- Dec 2023
- **Co-opted Member, Program Advisory and Monitoring Committee (PAMC) of Earth and Atmosphere Science Division**, Science and Engineering Research Board (SERB), Department of Science and Technology (DST), New Delhi since Jan 2021-June 2022
- **Expert Member** in Geoinformatics syllabus committee (2021) for Graduate Aptitude Test in Engineering (**GATE**), a national examination conducted jointly by Indian Institute of Science (IISc) Bangalore and seven Indian Institutes of Technology (IITs) for M.Tech/ M.S admissions.
- Debris covered Glaciers Working Group (WG) Member of International Association of Cryospheric Sciences (IACS) 2018-2022
- Member of Indian Scientific Expedition team to Arctic Region in 2018
- Glacier Ice thickness Estimation Working Group (WG) Member of International Association of Cryospheric Sciences (IACS) 2015-2019

## **RESEARCH GUIDANCE (Details available in Appendix I)**

<b>Student Category</b>	<b>Number</b>	<b>Remarks</b>
Post-doctoral fellows mentored	08	01 fellow under CV Raman International Fellowship for African Researchers
Post-doctoral fellows in progress	-	
PhDs graduated	11	Two best PhD Thesis awards (Institute level, National and International Awards)
PhDs in progress	14	Main supervisor – for 11 students (one has submitted the thesis)  Co-supervisor - for 1 IIT B student +1 student from University of Kashmir
Masters graduated (M.Tech)	16	
Masters in progress ((M.Tech)	01	
Undergraduate (B.Tech) project (Completed)	09	
Undergraduate (B.Tech) project (In Progress)	-	
Research internship supervision (External students)	15	Mentored undergraduate students for two months during summers selected under the Indian Academy of Sciences (IAS) Summer Research Fellowship program since 2014

## **RESEARCH OUTPUTS: (Details available in Appendix II)**

### **Number of Peer Reviewed Publications:**

<b>Category</b>	<b>Peer Reviewed Journals</b>	<b>Book Chapters</b>	<b>Conference Proceedings</b>	<b>Conference Presentations</b>
Published	62	06	20	55
In Press/Accepted	02	---	---	02
Communicated	06	---	---	---

**Google Scholar: Citations 1368; h Index: 18; i10 Index: 33 (as on 24 Aug, 2023)**

### Technology/Algorithms/Methods/Model/Tools/Development

Various algorithms; models and tools were being developed beyond traditional research products (e.g., manuscripts, books and book chapters, competitive funding) for observing the hydrologic cycle, glacier dynamics, watershed management, etc. to help in decision-making and to proliferate these across the community. Detailed information is given in [Appendix II](#).

### SPONSORED R&D PROJECTS AND INDUSTRY CONSULTANCY (Details available in Appendix III)

Total value of the projects (Sponsored & Consultancy) awarded is ₹ 1926.17 Lakhs (192.61 million)

Project Details	Number of projects Completed	Number of Ongoing projects	Number of projects Sanctioned	Total Outlay in Rs (₹)
Sponsored Project	16	09	-	~₹ 1285.5Lakhs (128.55 million)
R&D based Consultancy Project	09	-	-	~ ₹ 640.67 Lakhs (64.06 million)

### PROFESSIONAL ACTIVITIES (Editorial Board membership, Journal review, project assessments, membership of professional committees/bodies, conferences organized, etc.)

Sl. No	Category	Function
1	Journal editorial services	<b>Editorial Board Member</b> for the <i>Earth Science Informatics (ESIN)</i> Journal, Springer Nature Publication since June 2022 - till date. <b>Editorial Board Member</b> for the Journal <i>Geomatics Natural hazards and Risk</i> , Taylor & Francis Publication since Jan 2021 - till date. <b>Review Editor</b> for three journals viz., <i>Frontiers in Remote Sensing; Frontiers in Water; Frontiers in Earth Science</i> since Feb 2022 - till date.
2	Research project proposal reviews	<b>Reviewer for various R&amp;D proposals</b> submitted to Indian national agencies such as Ministry of Earth Sciences, Govt. of India, (DST), Govt. of India and other such agencies
3	Journal review	Reviewer Remote Sensing of Environment, International Journal of Remote Sensing, ISPRS Journal of Photogrammetry and Remote Sensing, GIScience and Remote Sensing, Transaction in GIS, environmental Research Letters, Journal of Hydrology, Journal of Glaciology; Water Resources Research, Frontiers in Earth Science; Frontiers in Water; Remote Sensing, Journal of Hydrometeorology, Journal of Earth System Sciences, Earth Science Informatics, Geocarta International, Journal of Indian Society for Remote Sensing, Earth Surfaces Processes and Landforms, Hydrological Sciences Journal, Journal of Applied Remote Sensing, Catena, ASCE J.Hydrol Engg., ISH Journal of Hydraulic Engg., Current Science, SADHANA, etc.
4	Conference/ Workshops Organized	Organized 5 days bi-lateral Partnership Development Workshop titled <b>Water sEcurity</b> assessment of Indian rivers oriGinating from the Himalayas ( <b>WEIGH</b> ) funded by DST and UK-India Education and Research Initiative (UKIERI) during 7-11 Sept 2021.

		One day Technical Workshop on Image Processing using Erdas Imagine and geospatial products development using M.App enterprise on 31 Aug 2019.
5	Contributions for National level competitive Graduate Aptitude Test in Engineering (GATE) - India	Question paper vetter (for 2023, 2024) Geomatics Engineering paper  Question paper vetter (for 2021) and setter (for 2022) for Civil Engineering paper.
6	Curriculum Development (Domestic)	Member Curriculum Committee 2019-23 for PG program (M. Tech Remote Sensing and Geomatics) at Institute of Remote Sensing, College of Engineering, Guindy, Anna University Chennai. Member Curriculum Committee 2019-2020 for Department of Civil Engineering, NIT Pondicherry
7	NPTEL MOOC evaluation	Reviewer for web course on Geomatics Engineering in 2017
8	Selection Committee Member for Prime Minister Research Fellowship (PMRF)	Selection and review of applications received from post graduate students across India in Geomatics and Hydrology Specializations during 2019 and 2021, 2022, 2023.
9	Conference advisory committee	<ul style="list-style-type: none"> <li>➤ Scientific Committee Member International Conference on Geomatics in Civil Engineering (ICGCE – 2024) organized by Indian Institute of Technology (IIT) Roorkee</li> <li>➤ Technical Reviewer Committee Member for “The 3rd International conference on Unmanned Aerial Systems in Geomatics, (UASG) 2023” organized by Indian Institute of Technology (IIT) Roorkee</li> <li>➤ International Scientific Committee Member for “International Conference on Mountain Hydrology and Cryosphere (ICMHC-2023)” organized by Nepal committee for the International Association of Hydrological Sciences (IAHS)</li> <li>➤ Technical Advisory Committee Member for “Hydro International Conference 2023” organized by National Institute of Technology (NIT) Warangal under the ageis of Indian Society for Hydraulics (ISH).</li> <li>➤ Technical Advisory Committee Member for “Hydro International Conference 2022” organized by Punjab Engineering College (PEC) Chandigarh under the ageis of Indian Society for Hydraulics (ISH).</li> <li>➤ Scientific Advisory Committee Member for “TROPMET 2022” organized by Indian Institute of Science Education and Research (IISER) Bhopal under the ageis of Indian Meteorological Society (IMS).</li> <li>➤ Technical Advisory Committee Member for The International Virtual Conference on Developments and Applications of Geomatics (DEVA-2022) organised National Institute of Technology (NIT) Warangal</li> <li>➤ Advisory Committee Member for “International Conference on Recent Advances in Water Resources, Environment and Geomatics Engineering” during 2022 organized by National Institute of Technology (NIT) Raipur</li> <li>➤ Scientific Committee Member for “The International Geoscience and Remote Sensing Symposium (IGARSS) 2021, 2022, 2023” organized under aegis of IEEE Geoscience and Remote Sensing Society (GRSS).</li> <li>➤ Technical Advisory Committee Member for “The Hydro International Conference 2021” organized by Sardar</li> </ul>

		<p>Vallabhahi National Institute of Technology (SVNIT) Surat under the ageis of Indian Society for Hydraulics (ISH).</p> <ul style="list-style-type: none"> <li>➤ Technical Reviewer Committee Member for “The 2nd International conference on Unmanned Aerial Systems in Geomatics, (UASG) 2020+1” organized by Indian Institute of Technology (IIT) Roorkee</li> <li>➤ Scientific Advisory Committee Member for the International Conference on “Sustainable Water Resources Development and Management”, SWARDAM 2021 - organized by Govt. College of Engineering, Aurangabad</li> <li>➤ Scientific Advisory Committee Member and Reviewer for the International Conference on “Resilient and Liveable City Planning RLCP 2020” organized by School of Planning and Architecture, Vijayawada (SPAV).</li> <li>➤ Technical Advisory Committee member for 3<sup>rd</sup> National Conference on “Sustainable Water Resources Development and Management” during 2016 organized by Govt. College of Engineering, Aurangabad</li> </ul>
10	Session chairs in conference (national and International)	<ul style="list-style-type: none"> <li>➤ Chaired multiple sessions related to Remote Sensing Applications theme during Hydro International Conference series held in 2013, 2014, 2015, 2016, 2017, 2018, 2020, 2021 organized under the aegis of Indian Society for Hydraulics (ISH)</li> <li>➤ Chaired a session in National Online Conference on Planning, Design and Management (NOCPDM 2021), College of Engineering Pune</li> </ul>
11	Research Advisory Role for other institutes	Member Research Advisory Board in Karpagam College of Engineering and Karpagam Academy of Higher Education. Coimbatore since 2018 – till date.
12	IIT Bombay PhD Students (internal) Research Progress Committee (RPC)	RPC member for about 35 students registered in Civil Engineering, CSRE, IDP Climate Studies, CTARA of IIT Bombay
13	PhD thesis evaluation (Internal Examiner) at IIT Bombay	<p>Total students: <b>22 students</b></p> <p>In 2023 – 02 (till 31 July)</p> <p>In 2022 – 2;</p> <p>In 2021 - 3; In 2020 - 5</p> <p>In 2019 - 5; In 2018 - 2</p> <p>In 2017 – 2; In 2016 - 1</p>
14	PhD thesis examiner (Outside IIT Bombay)	<p>External Examiner and oral exam committee (defense) member for about <b>32 PhD thesis</b> from IIT Roorkee, Kanpur, Delhi, IISc Bangalore, IIT ISM Dhanbad, IIT Gandhinagar, NIT Trichy, NIT Suratkal, VIT Chennai, HNB Garhwal University, Anna University, Visveswaraya Technological University, VJTI Mumbai, SRM Institute of Science and Technology, etc.</p> <p>In 2023 – 4 +2 (under review)</p> <p>In 2022- 4</p> <p>In 2021 – 8; In 2020 - 8</p> <p>In 2019 – 4; In 2018 - 5</p>

		In 2017 – 2; 2016 -1
15	Doctoral Advisory Committee (Outside IIT Bombay)	Advisory Member for 2 PhD students from <ul style="list-style-type: none"> <li>➤ CSIR-National Environmental Engineering Research Institute (NEERI) since July 2019;</li> <li>➤ School of Planning and Architecture, Vijayawada (SPAV) since Nov 2021.</li> </ul>
16	Technical Advisory for Pvt. Industry	Involved as an expert member during 2021 for KPMG India consultants who were the project management consultant for Municipal Corporation of Greater Mumbai (MCGM) for high resolution 3Dmapping of Mumbai city to monitor illegal construction activities.
17.	Textbook Review	Reviewer of a textbook on “Surveying and Geomatics” by Prof. P.K. Garg as per All India Council for Technical Education (AICTE) Syllabus 2022

#### EXTENSION ACTIVITIES (Outreach activities under CEP/QIP/NPTEL/ Invited lectures etc)

Sl. No	Category	Function
1	Continuing Education program (CEP) & Quality Improvement Program (QIP) Short term Courses for Indian Colleges Teachers	<ul style="list-style-type: none"> <li>➤ 2 days short course on Modern Surveying at SP College of Engineering, Mumbai during June 2023</li> </ul> <p>Organized following QIP &amp; CEP courses at IIT B</p> <ul style="list-style-type: none"> <li>➤ Water Resources Management Studies using Geospatial Techniques &amp; Numerical Modelling during 2013</li> <li>➤ GIS 4 Civil Engineers during 2014, 2016, 2017</li> </ul>
2	MOOC Lectures under Quality Enhancement in Engineering Education (QEEE) in 2017	<ul style="list-style-type: none"> <li>➤ 5-hour live lecture on selected topics in Engineering Surveying</li> </ul>
3	Invited/Plenary Talks at Workshops and Conferences	~20 invited keynote talks at conference/workshops held in India organized by Indian Institute of Remote Sensing (IIRS)-IRSO, Indian Institute of Technology (IIT) Mandi, IIT Roorkee, School of Planning and Architecture, Vijayawada, Karunya University and Conference such as TROPMET 22 by Indian Institute of Science and Research (IISER) Bhopal, Hydro International series by Indian Society of Hydraulics, 2 <sup>nd</sup> International conference on Unmanned Aerial Systems in Geomatics, (UASG) 2020+1 organized by (IIT) Roorkee.
4	Invited Lectures at different Institutes	Delivered around <b>50 invited lectures</b> in short term courses related to Remote Sensing Applications in Hydrology and Cryosphere; Land Surveying, etc.

## ADMINISTRATION ACTIVITIES (At IIT Bombay)

Sl. No	Category	Function
1	Department Level Civil Engineering	<ul style="list-style-type: none"> <li>➤ Department Coordinator for IRCC Internship 2022</li> <li>➤ Department Postgraduate Curriculum Committee (DPGC) member from Jan 2021- May 2022</li> <li>➤ Department Undergraduate Curriculum Committee (DUGC) member 2014-2020.</li> <li>➤ Department Policy Committee (DPC) member during 2013-2021.</li> <li>➤ Department Space Committee (DSC) member during 2019-2021.</li> <li>➤ Department Communication and Communications Committee (DCCC) member during 2014-till date</li> <li>➤ Department M. Tech and PhD Admissions Committee member 2013-2021</li> <li>➤ Department Curriculum Review Committee (DCRC) member 2013-2015</li> <li>➤ Faculty Coordinator for Civil Department- TechConnect 2013, 2014 and 2016</li> <li>➤ Faculty Advisor of B.Tech Civil Engineering batch of 2012, 2016, 2019, 2021</li> <li>➤ Faculty Advisor of M. Tech Remote Sensing batch of 2013, 2014, 2018, 2020</li> <li>➤ Group Coordinator for Remote Sensing Division from June 2013 – Dec 2021</li> <li>➤ Lab In-Charge for Remote Sensing Group labs (#4 Labs) (Surveying lab; Advanced Surveying lab, Photogrammetry lab and Remote Sensing Research lab) June 2013 – Dec 2021</li> </ul>
2	Department Level Inter Disciplinary Program (IDP) in Climate Studies	<ul style="list-style-type: none"> <li>➤ Seminar Coordinator since 2013 -till date.</li> <li>➤ Interdisciplinary Centre Policy Committee member during 2014-2016.</li> </ul>
3	Institute Level	<ul style="list-style-type: none"> <li>➤ Associate Warden for Hostel-6 since May 2022</li> <li>➤ Institute Representative for GATE: 2013-2022, JEE Advanced: 2020, 2021, 2022 and CEED-2021</li> <li>➤ Member of the paper setter committee for Executive Engineer recruitment 2021</li> </ul>

## INFRASTRUTURE DEVELOPMENTS

(Instruments/ Softwares)	Details
Instruments	<p><b>Unmanned Aerial Vehicles (UAV)s of different categories.</b></p> <ul style="list-style-type: none"> <li>➤ Sensefly eBeeX – Survey grade fixed wing UAV with SODA RGB camera and Parrot Sequa multispectral camera</li> <li>➤ DJI Mavic-a low-cost quadcopter UAV with fixed camera</li> <li>➤ DJI Phantom 3 – a low-cost quadcopter UAV with fixed camera</li> <li>➤ VTOL Lite—Quadcopter based UAV made in India (by Kambill Systems) capable of mounting different cameras.</li> </ul> <p><b>Terrestrial LiDAR-</b> Leica C-10 a medium range Terrestrial Laser Scanner (TLS)</p> <p><b>Autonomous Unmanned Surface Vehicle (USV) with echo sounder</b> for bathymetry surveys of inland water bodies and rivers- Satlab 1100 Hydro boat</p> <p><b>Kayak based Hydrographic Survey System-</b> Low-cost fish-finder mounted on an Inflatable Kayak for lake bathymetry surveys</p>

Software	<ul style="list-style-type: none"><li>➤ PIX4D; AgiSoft -UAV Photogrammetry Softwares (#1 license each)</li><li>➤ Intergraph Geomedia- GIS software (# 5 licenses)</li><li>➤ Leica Cyclone – TLS data processing software (#1 license)</li></ul>
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**MEMBERSHIP IN PROFESSIONAL SOCIETIES/INTERNATIOANL SCIENTIFIC GROUPS:**

1. Indian Society of Remote Sensing (ISRS)
2. Indian Society of Hydraulics (ISH)
3. Indian Association of Hydrologists (IAH)
4. International Water Association (IWA)
5. IEEE-GRSS (Geoscience and Remote Sensing)
6. International Glaciology Society (IGS)
7. International Society for Environmental Information Sciences (ISEIS)
8. International Association of Cryosphere Science (IACS)
9. Integrated Disaster Risk Management (IDRiM) society
10. American Geophysical Union (AGU)
11. European Geophysical Union (EGU)
12. International Precipitation Working Group (IPWG)
13. Consortium Member, National Centre for Geodesy (NCG), Indian Institute of Technology Kanpur

**RAAJ Ramsankaran**



## Research Guidance

## i. Post-doctoral fellows mentored

Sr. No	Name	From	To	Research area
8	Dr. Dhiraj Singh	Mar 2022	May 2023	High Resolution Snow Depth Estimations in Himalayas
7	Dr. Siddi Garg <sup>#</sup>	Dec 2021	Dec 2022	Glacio-Morphological Evolution Studies
6	Dr. Rakesh Sahu	Mar 2021	Feb 2022	Supraglacial Lake Changes from 1980 to 2020 across Hindukush Karakoram Himalayas (HKH) region
5	Dr. Anugya Shukla	Jan 2020	Till date	Remote Sensing of Inland Waterbodies
4	Dr. Prateek Verma	Feb 2020	Jan 2022	Remote Sensing of Glacial Lakes
3	Dr. Prateek Gantayat	Sept 2018	Aug 2019	Numerical Modelling of Glacial Lake Evolution
2	Dr. Bloodless Dzwairo	Oct 2013	Dec 2013	Hydrological Modelling for Water Quality Estimations of the Vaal Catchment, South Africa using SWAT Model.
1	Dr. Swagata Ghosh	April 2013	July 2014	A Knowledge-Based Approach for Mapping Supraglacial Covers of Debris-Covered Glaciers.

# Main host is Prof. Pennan Chinnasamy

## ii. Doctoral research supervision (IIT Bombay students)

Sr. No	Name	Status: Completed / Ongoing	Other supervisors, if any	Thesis topic
28	Ganga Shingal	Ongoing	Prof. Avik Bhattacharya	GNSS Reflectometry for Snow Depth Estimations
27	Luvkesh Attri	Ongoing	--	Land Subsidence in Permafrost Regions using SAR Interferometry
26	Tirthankar Ghosh	Ongoing	Prof. Andrew Mackintosh and Dr. Felicity McCormack (Monash University)	Glacier evolution modelling in Ladakh Himalayas: Reconstructing the Past, Present and Future
25	Greeshma Nair	Ongoing	--	Remote Sensing based Multi Variable Data Assimilation for Streamflow Estimations in Ungauged Catchments
24	Sudhir Dhamija (External Candidate from DGRE, DRDO)	Ongoing	Dr. HS. Negi DGRE	Remote Sensing based Snow Avalanche Mapping and Modelling Studies in Himalayas
23	Sai Krishna (External Candidate from NRSC, ISRO)	Ongoing	Dr. Simhadri Rao NRSC	Hydrological Modelling in Glacierized Basins in Western Himalayas

22	Shahid Iqbal	Ongoing	Prof. Balaji Devaraju IIT Kanpur	GNSS based Snow Depth Estimations in Mountainous Regions
21	Shuvojit Nath	Ongoing	Prof. Jeff Walker Monash University (Co-supervisor)	Improvement of Remote Sensing based Near Real Time Rainfall Estimates using Soil Moisture Information across India
20	Chandra Prabha	Ongoing		Development of Algorithms for High-Resolution Snow Depth Estimations in Mountainous Regions
19	Sanjay Safi	Ongoing		Geovisualization for Improving Flood Risk Communications
18	Sayantana Mandal <i>(Inter-Disciplinary Program in Climate Studies student)</i>	Ongoing	Prof. Karthikeyan Lanka (Co-supervisor)	Glacier lake evolution modelling in Western Himalayas: Reconstructing the Past, Present and Future
17	Samarjeet Salunke	Ongoing	Prof. Santhosh Venkata Delhi (Main supervisor)	Integrating UAV Photogrammetry, LiDAR and BIM for heritage Monument Documentation
16	Ajay Godara	Ongoing	--	Remote Sensing based Glacier Debris thickness modelling across Himalayas to understand the role of Debris Cover and Thickness on Glacier Mass Balance
15	Srinivasa Rao	Ongoing	--	Strategies for Estimation of High-Resolution Snow Depth over Himalayan Region using RS Data
14	Navin Kumar	Ongoing	--	Modelling Glacier Stored Ice Volume in Himalayan Karakoram Region
13	Vasaw Tripathi <i>(M.Tech and PhD DD student; PMRF scholar)</i>	Ongoing	Prof. Martin Horwath  TU Dresden (Co-supervisor)	Spatio-temporal Downscaling of GRACE Water Storage Changes
12	Visweshwaran	Submitted on 6 <sup>th</sup> July 2023	Prof. Eldho (Co-supervisor)	Efficient Data Assimilation Strategies for Streamflow Estimations
11	Anita Chandrasekharan	Completed 2022	--	Reconstruction of Annual Surface Mass Balance Estimates of Himalayan Glaciers since early days of EO Data (1980s) to 2021 using Remote Sensing Data.
10	Swathy Sundar <i>(M.Tech and PhD DD student)</i>	Completed 2021	Prof. Balaji Ramakrishnan (Co-supervisor)	Exploration of Data-Driven Approaches for Remote Sensing based Regional Scale Cloud-Free High-Resolution Daily Sea Surface Temperature Estimations
9	Sangita Singh <i>(IIT B-Monash student)</i>	Completed 2021	Prof. Jeff Walker Monash University (Co-supervisor)	Remote Sensing based Method for Glacier Surface Velocity and Ice Thickness Distribution Estimations
8	Ashish Kumar	Completed 2021		Machine Learning Approach for Improving Near Real Time Satellite Rainfall Estimates and Streamflow Simulations

7	Sathyakumar Vasu <i>(M.Tech and PhD DD student)</i>	Completed 2020	Prof, Ronita Bardhan (Co-supervisor)	Geospatial Techniques for Planning Sustainable Green Spaces in Rapidly Urbanizing Countries
6	Antara Dasgupta <i>(IIT B-Monash student)</i>	Completed 2020	Prof, Jeff Walker Monash University (Co-supervisor)	Optimizing SAR Based Flood Extent Assimilation for Improvement Change on Hydraulic Flood Inundation Forecasts
5	Estifanos Lemma Goshu <i>(International Student from Ethiopia)</i>	Completed 2019	--	Drought Monitoring across Ethiopia using Satellite based Rainfall Estimates
4	Pratiksha Jain <i>(M.Tech and PhD DD student)</i>	Completed 2019	--	Development of GIS-Based Decision Support System for Planning Watershed Management Projects
3	Amol Pati	Completed 2018	--	Advanced Strategies for Assimilation of Remotely Sensed Soil Moisture Estimates for Improving Streamflow Simulations
2	Ankur Pandit <i>(Inter-Disciplinary Program in Climate Studies)</i>	Completed 2018	--	Glacier Ice Thickness Modeling and Identification of Potential Sites for Future Glacial Lakes in Western Himalayas.
1	Shruti Upadhyaya	Completed 2017	-	Development of an Algorithm for Estimation of Near-Real Time Rainfall Rates using Satellite Remote Sensing Data.

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### iii. Masters' Students research guidance

Sr. No	Degree MTech/ MSc.	Name	Completed / ongoing	Other guides, if any	Thesis topic
17	M. Tech	Sparsh Shekar	Ongoing	--	Reservoir Volume Change Estimations using Satellite Remote Sensing
16	M. Tech	Sushanth Seepana	Completed	--	Improvement of Remote Sensing based Near Real Time Rainfall Estimates using soil moisture information
15	M.Tech	Safi Ur Rehman	Completed	--	Crop Growth Monitoring Using Geospatial Techniques
14	M.Tech	Prakash Nayak	Completed	--	Ground-Based Estimation of Atmospheric Precipitable Water Vapor using GNSS.
13	M.Tech	Vishal Waghmare	Completed	--	Comparison and Evaluation of open-source Glacier Surface Flow Velocity Algorithms in Indian Himalayan Region
12	M.Tech	Chandra Prabha (External student)	Completed	Prof. Srinivas Raju <i>(Anna University, Chennai)</i>	Snow depth estimations using SAR datasets for operational use.
11	M.Tech	Avinash Parla	Completed	--	Estimation of Glacier Ice Thickness Change and Mass

			2018		Balance Using Geodetic Method
10	M.Tech	Sujit Lokhande (External student)	Completed 2018	Prof. L.G. Patil ( <i>Shri Guru Gobind Singhji Institute of Engineering and Technology, Nanded, Maharashtra</i> )	Benchmarking the Indian National CartoDEM against SRTM for 1D Hydraulic Modelling: A Demonstration for Erai river flood modelling
9	M.Tech	Shivraj Patil	Completed 2017	--	Vulnerability Assessment of Heritage Building by an Integrated Approach Based on Terrestrial Laser Scanning and Finite Element Modeling.
8	M.Tech	Ankita Pradhan	Completed 2016	--	GIS Based Flood Plain Zoning of Chandrapur City Using HEC-HMS & HEC-RAS.
7	M.Tech	Mukesh Kiran K	Completed 2015	--	Development of Two Stage Extended Kalman Filter for Vehicle Tracking from GPS Enabled Smart Phones Through Crowd-Sourcing.
6	M.Tech	Ajay Kumar	Completed 2015	--	Snowmelt Runoff Simulation for Spiti Watershed in Western Himalayas Using Remote Sensing and GIS.
5	M.Tech	Shaikh Shahid Manjur	Completed 2014	--	Comparative assessment of Terrestrial Laser Scanner and Total Station Survey for Road Infrastructure Project.
4	M.Tech	Prashant Mishra	Completed 2014	--	Validation of TRMM 3B42 Satellite Rainfall Estimates over Different Climate Regions of India.
3	M.Tech	Sandeep Patil	Completed 2014	--	Integrated Urban Growth Modelling using Logistic Regression, Markov Chains and Cellular Automata.
2	M.Tech	Tilak Tena (International student from Ethiopia)	Completed 2014	Prof. Subhankar Karmakar (Main Supervisor)	A Holistic Geospatial Approach to Select Suitable Site for Wastewater Treatment Plant in Bahir Dar City, Ethiopia.
1	M.Tech	Sravan Kumar C V	Completed 2013	--	Prediction of Future Landuse of Mumbai Using Cellular Automata and Markov Analysis.

#### iv. BTP Students research guidance

Sr. No	Name	Completed / ongoing	Other guides, if any	Project topic
9	Dhananjay Kumar		--	

8	Shubham Jadhav	Ongoing since Jan 2023		Topographic Mapping of IIT Bombay Campus using Total Station and GNSS Surveying
7	Aditya			
6	Pranav Deo	Completed 2021	Prof. Biplab Banerjee (Co-supervisor)	Machine Learning Based Object Identification from Satellite Images
5	Ramaswaroop Kumawat	Completed 2018	--	Flood Depth Estimation from SAR Using DEM-Based Non-Linear Regression.
4	Sumit Patne	Completed 2015	--	Road Intersection Safety Analysis and Design Using Terrestrial Laser Scanning.
3	Mashal Kumar	Completed 2015	--	Semi-Automated Pothole Detection Using Terrestrial Laser Scanner (TLS) Point Cloud Data.
2	Divyansh	Completed 2015	--	Utilization of Yearly Equilibrium-Line Altitudes (ELA) for Glacier Mass Balance Estimations Over Chhota Shigri Glacier, Himachal Pradesh, India.
1	Mayank Sharma	Completed 2014	--	Glacier Facies Mapping and ELA Detection for Hamtah Glacier Using RISAT SAR Data.

Note: BTP refers B. Tech project

## Appendix-II

### Research Outputs

#### i. Algorithms, Models and Scientific Tools development

##### Algorithms:

##### **SWIFT:**

SWIFT stands for **S**patially Varying **W**indow based maximum likelihood **F**eature **T**racking Algorithm. It comprises two stages: i) determination of the spatially varying window size from optical image based on the Object Based Image Analysis (OBIA) concept, and ii) image matching based feature tracking using the maximum likelihood of SAR speckle as similarity measure. The proposed algorithm for feature tracking uses a spatially varying window size which cannot be provided by existing software like SNAP, SARscape, COSI-Corr.

##### **ML approach for Daily Sea Surface Temperature Estimations:**

Developed a framework and algorithms to estimate daily cloud free SST from a single sensor (MODIS Aqua) dataset using advanced machine learning techniques and successfully tested in Southern Arabian Sea and Bay of Bengal regions. The framework can be easily extended to different remote sensing datasets.

##### **ML approach Correction of Near Real Time (NRT) Satellite Rainfall Estimates (SRE):**

It is an integrated approach to improve NRT SRE accuracy by combining it with NRT soil moisture through a non-linear support vector machine-based regression (SVR) model. The approach was successfully tested in different catchments in India. Has potential to extend it to country scale applications.

##### **SWAT-DA**

Developed codes for En-KF based data assimilation into Soil and Water Assessment Tool (SWAT) Hydrological model, an open-source model. The code can be used for assimilation of soil moisture and streamflow into SWAT model to improve the model simulated streamflow.

##### **M-IMSRA:**

**Modified INSAT Multi-Spectral Rainfall Algorithm (M-IMSRA)** algorithm for Indian land region deviates from original IMSRA in two ways: first is by improvement in rain/no-rain area detection scheme using a Multi-Index Rain Detection (MIRD) index; second is based on the climate region-wise correction through Least Absolute Shrinkage and Selection Operator (LASSO) models developed for each climate regions using rainfall (obtained based on first improvement) and static topographic variables extracted from Digital Elevation Model (DEM)

#### **Models/Tools:**

##### **VOICE:**

Velocity based ShallOw ICe InveRsion (VOICE) model relies on inputs such as glacier surface ice flow velocity, surface slope and glacier inventory for estimation of ice thickness and glacier volume.

##### **GATHI:**

GIacier ice THickness distribution using remote sensing (GATHI) model consists of estimating a distribution of the glacier surface velocity, using which the ice flux is computed. The flux is then converted to an ice thickness using Glen's flow law and represented over the entire glacier.

##### **NEFFASR:**

The Neuro-Fuzzy Flood Mapping from SAR (NeFFSAR) package provides the codes for the production and validation of flood maps from Level-2 single SAR imagery. This independence from supporting ancillary datasets makes the algorithm easily applicable to operational scenarios. The workflow first optimizes window sizes and then extracts omnidirectional grey level co-occurrence matrices (GLCM). These GLCMs are subsequently used to derive texture features which are optimized using an independent component transform for dimensionality reduction. A supervised neuro-fuzzy classifier is then used to assign fuzzy membership values of flooding to the SAR image enhanced with the optimized texture layers.

##### **GlabTop2\_IITB:**

Glacier bedTopography2\_IITB Version is an independently implemented version of the GlabTop2 model. It is a fully automated model and requires only DEM, slope, and glacier outlines as inputs for estimating of glacier ice thickness. This model is based on the shear-stress equation which relates glacier ice thickness to the surface topography.

##### **IWAMS:**

The Indian WATershed Management support System (IWAMS) is a QGIS plugin for making appropriate scientific decisions in the planning watershed management projects. IWAMS is designed to perform necessary analysis for planning watershed management projects through the following three modules. Hydrological analysis module to perform process-based soil erosion modelling. Prioritization module to identify critical area based on hydrology as well as socio-economic aspects. Conservation module for optimal selection and allocation of soil and water conservation measures.

**Note: Model codes for GlabTop2\_IITB, IWAMS, NEFFSAR, SWAT-DA are available in Github for reuse by researchers. VOICE, SWIFT and GATHI codes are not yet uploaded in public domain but can be obtained upon request.**

#### **ii. List of Published/Accepted Articles in Peer Reviewed Journals**

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#### Edited Book Chapters (Published)

1. Antara Dasgupta, Stefania Grimaldi, **RAAJ Ramsankaran**, Renaud Hostache, Valentijn Pauwels and Jeffrey Walker, (2021). Earth Observation and Hydraulic Data Assimilation for Improved Hydraulic Flood Inundation Forecasting. *In Earth Observation for Flood Applications: Progress and Perspectives*, Chapter 12; Elsevier; Pages 255-294. DOI:10.1016/B978-0-12-819412-6.00012-2
2. Ashish Kumar and **RAAJ Ramsankaran**<sup>#</sup> (2021). Error analysis of TMPA near real-time precipitation estimates for an Indian Monsoon region. *In Climate Change Impacts on Water Resources Hydraulics, Water Resources and Coastal Engineering*, Water Science and Technology Library, Vol. 98, Chapter 45; Springer USA. DOI: 10.1007/978-3-030-64202-0 (In Press)
3. Swagata Ghosh and **RAAJ Ramsankaran** (2021). Knowledge-Based Mapping of Debris-Covered Glaciers in The Greater Himalayan Range. *In Advances in Remote Sensing for Natural Resource Monitoring*, Advances in Remote Sensing for Earth Observation Series, Vol.1, Chapter 15, Wiley: New York, USA. DOI: 10.1002/9781119616016.ch15
4. Antara Dasgupta, Stefania Grimaldi, **RAAJ Ramsankaran**, Valentijn Pauwels, Jeffrey Walker, Marco Chini, Renaud Hostache and Patrick Matgen (2018). Flood mapping using synthetic aperture radar sensors from local to global scales. *In Global Flood Hazard: Applications in Modeling, Mapping, and Forecasting*, AGU Geophysical monograph series, Vol. 233, Chapter 4; Wiley: New York, USA; pp. 55–77. DOI: 10.1002/9781119217886.ch4
5. **RAAJ Ramsankaran**<sup>#</sup>, Ankur Pandit and Avinash Parla (2018). Decadal Estimates of Surface Mass Balance for Glaciers in Chandra Basin, Western Himalayas, India—A Geodetic Approach. *In Climate Change Signals and Response*, Chapter 7; Springer; pp. 109-125. DOI: 10.1007/978-981-13-0280-0\_7
6. **RAAJ Ramsankaran**<sup>#</sup>, D. Sathish Kumar and T.I. Eldho (2017). Remote Sensing and Geographical Information Systems in Watershed Management: An Overview. *In Sustainable Water Resources Management*; Chapter 3; ASCE Books. pp. 51-79. DOI: 10.1061/9780784414767.ch03

#### Conference Proceedings (Refereed Articles)

1. Samarjeet Salunke; **RAAJ Ramsankaran**; Siddhartha Ghosh; Gabriele Milani; Bhumik Halani; Giuseppe Alfredo Cundari; Mahesh Varma; Venkata Santosh Kumar Delhi and Nikita Gangurde (2023) Global Vipassana Pagoda: Exterior Geometry Envelope Extraction Using UAV Photogrammetry. IEEE International Workshop on Metrology for Living Environment (MetroLivEnv), Milano, Italy. DOI:10.1109/MetroLivEnv56897.2023.10164027.
2. Satheeshkumar Jeyaraj, Balaji Ramakrishnan, **RAAJ Ramsankaran** (2022). Application of Unmanned Aerial Vehicle (UAV) in the assessment of beach volume change – A case study of Malgund beach," OCEANS 2022 - Chennai, India. Feb 21-24. DOI:10.1109/OCEANSSChennai45887.2022.9775290.
3. Sangita Kumari, **RAAJ Ramsankaran**<sup>#</sup> and Jeffrey Walker (2019). Impact of window size in glacier feature tracking- a study on Chhota Shigri glacier, Western Himalayas, India. *IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, Yokohama, Japan. July 28–August 02. DOI: 10.1109/IGARSS.2019.8899325
4. Antara Dasgupta, Stefania Grimaldi, **RAAJ Ramsankaran** and Jeffrey Walker (2017). Optimized GLCM -based texture features for improved SAR-based flood mapping. *IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, Fort Worth, Texas, USA. July 23–28. DOI: 10.1109/IGARSS.2017.8127692

5. Pratiksha Jain, **RAAJ Ramsankaran**<sup>#</sup> and Lakshman Kumar (2017). Development of an automated tool for GIS based soil erosion modeling. *22nd International Conference on Hydraulics, Water Resources, Coastal and Environmental Engineering (HYDRO 2017)*, L.D. College of Engineering Ahmedabad, India. December 21–23.
6. Antara Dasgupta, Stefania Grimaldi, **RAAJ Ramsankaran**, Valentijn Pauwels and Jeffrey Walker (2017). Use of crowd-sourced data to assess the skill of hydraulic flood forecast models. *22nd International Congress on Modelling and Simulation (MODSIM)*. Tasmania, Australia. December 3–8.
7. Smarika Kulshrestha and **RAAJ Ramsankaran**<sup>#</sup> (2017). Estimation of minimum land surface temperature using MODIS LST product for the Himalayan region. *The 38th Asian Conference on Remote Sensing (ACRS 2017)*, New Delhi, India. October 23–27.
8. Estifanos Lemma, Shruti Upadhaya and **RAAJ Ramsankaran**<sup>#</sup> (2017). Meteorological drought monitoring across different rainfall regimes of Ethiopia using CHIRPS V2- rainfall data. *The 38th Asian Conference on Remote Sensing (ACRS 2017)*, New Delhi, India, October 23–27.
9. Anisha Narendran, **RAAJ Ramsankaran**<sup>#</sup> (2017). Snow grain size mapping in Upper Himalayas using Hyperion data. *The 38th Asian Conference on Remote Sensing (ACRS 2017)*, New Delhi, India. October 23–27.
10. Swathy Sunder, **RAAJ Ramsankaran**<sup>#</sup>, and Balaji Ramakrishnan (2017). Ann based estimation of daily sea surface temperature over Arabian sea using MODIS-aqua data. *The 38th Asian Conference on Remote Sensing (ACRS 2017)*, New Delhi, India. October 23-27.
11. Vasu Sathyakumar, **RAAJ Ramsankaran**<sup>#</sup> and Ronita Bardhan (2017). Multiscale analysis of the relationship between Socio-Economic Status (SES) and remotely sensed spatial patterns of Urban Green Spaces (UGS) in Mumbai, India. *The 38th Asian Conference on Remote Sensing (ACRS 2017)*, New Delhi, India. October 23-27.
12. Ashish Kumar and **RAAJ Ramsankaran**<sup>#</sup> (2015). Evaluation of near real time satellite-based rainfall estimates over lower part of Krishna river basin (Muneru Sub-basin), India. *20th International Conference on Hydraulics, Water Resources and River Engineering (HYDRO 2015)*, Roorkee, India. December 17–19.
13. Amol Patil and **RAAJ Ramsankaran**<sup>#</sup> (2015). Reducing uncertainty in SWAT based hydrological modelling by weighted averaging of gridded rainfall estimates. *20th International Conference on Hydraulics, Water Resources and River Engineering (HYDRO 2015)*, Roorkee, India. December 17–19.
14. Sujit Satpute, **RAAJ Ramsankaran**<sup>#</sup> and T.I. Eldho (2015). Impact of climate change on irrigation water requirements in Mahanadi basin. *20th International Conference on Hydraulics, Water Resources and River Engineering (HYDRO 2015)*, Roorkee, India. December 17–19.
15. Ankur Pandit, Mayank Sharma, and **RAAJ Ramsankaran**<sup>#</sup> (2014). Comparison of the performance of the newly developed CDWM filter with enhanced LEE and enhanced frost filters over the SAR image. *9th International Conference on Industrial and Information Systems (ICIIS)*, ABV-Indian Institute of Information Technology & Management (IIIT), Gwalior, Madhya Pradesh, India. December 15–17.
16. Sujit Satpute, **RAAJ Ramsankaran**<sup>#</sup>, Deepashree Raje, and T.I. Eldho (2014). Agricultural risk analysis for Mahanadi Basin under climate change scenarios. *19th International Conference on Hydraulics, Water Resources, Coastal and Environmental Engineering (HYDRO 2014)*, NIT Bhopal, India. December 17–19.
17. Shruti Upadhaya, **RAAJ Ramsankaran** (2014). Evaluation of remote sensing based newly developed rain detection index over Indian region. *19th International Conference on Hydraulics, Water Resources, Coastal and Environmental Engineering (HYDRO 2014)*, NIT Bhopal, India. December 17–19.
18. Shruti Upadhaya, **RAAJ Ramsankaran**<sup>#</sup> (2013). Review of satellite remote sensing data-based rainfall estimation methods. *18th International Conference on Hydraulics, Water Resources, Coastal and Environmental Engineering (HYDRO 2013)*, IIT Madras, India. December 4–6.
19. **RAAJ Ramsankaran**<sup>#</sup>, Umesh Kothiyari, Sanjay Ghosh, Andreas Malcherek and K. Murugesan (2011). GIS based distributed rainfall-runoff model for simulation of distributed watershed responses in a lower Himalayan watershed. *16th National Conference on Hydraulics and Water Resources (HYDRO 2011)*, SVNIT, Surat, India. December 29–30.
20. **RAAJ Ramsankaran**<sup>#</sup>, Umesh Kothiyari, Sanjay Ghosh and Andreas Malcherek (2008). GIS based hydrological modelling of extreme events in a forested mountainous catchment. *12th Biennial International Conference on Hydrological Extremes in Small Basins*, Crackow, Poland. September 18–20.

## G. Conference Oral and Poster Presentations:

1. Ramesh Visweshwaran, Antara Dasgupta **RAAJ Ramsankaran**, and T I Eldho (2023). Improving the Performance of Hydrological Model Forecast using Time Varying Multivariate EnKF Assimilation. Hydrologic Ensemble Prediction Experiment (HEPEX) Workshop, Norrköping, Sweden, Sep 13–15.
2. Chandra Prabha R, Sudhir Dhamija, **RAAJ Ramsankaran** (2023). Automated Avalanche Detection and Susceptibility Mapping using time-series Medium Resolution satellite Data. The 13th International Conference of the International Society for the Integrated Disaster Risk Management, Indian Institute of Technology (IIT Roorkee, India, Sep 28 – 30.
3. Srinivasarao Tanniru, **RAAJ Ramsankaran** (2023). Use of extremely randomized trees approach for estimation of snow depth from AMSR-2 PMW data over Alaska. XXVIII General Assembly of the International Union of Geodesy and Geophysics (IUGG), Berlin, Germany, July 11-20.
4. Navinkumar Perumal Jayaraman, **RAAJ Ramsankaran** (2023). Early 21st Century Glacier Ice Volume Changes in the Teesta Basin, Eastern Himalayas. XXVIII General Assembly of the International Union of Geodesy and Geophysics (IUGG), Berlin, Germany, July 11-20.
5. Ramesh Visweshwaran, **RAAJ Ramsankaran**, and T I Eldho. Improving Streamflow Estimates using an Efficient Time Variant Multivariate Assimilation of Soil Moisture and Streamflow Observations. European Geosciences Union General Assembly, Vienna, Austria, Apr 24–28. 2023.
6. Antara Dasgupta, Stefania Grimaldi, **RAAJ Ramsankaran**, Valentijn Pauwels, and Jeffrey Walker (2023). Showcasing the Potential of Crowd-sourced Observations for Flood Model Calibration. European Geosciences Union General Assembly, Vienna, Austria, Apr 24–28. 2023.
7. Ramesh Visweshwaran, **RAAJ Ramsankaran** and T.I. Eldho (2022) Sequential EnKF Assimilation of Sensitive Soil Moisture Observations to Improve Streamflow Estimation. *In American Geophysical Union Fall Meeting*, Chicago, USA, Dec 12-16.
8. **RAAJ Ramsankaran (2022)** High Resolution Snow Depth Estimations in Himalayan -Karakoram Region using Remote Sensing: Challenges and Way Forward. *In UNESCO sponsored conference on Cryosphere and related Hazards in High Mountain Asia in a Changing Climate*, Almaty, Kazakhstan, Oct 31- Nov 04.
9. Ashish Kumar, **RAAJ Ramsankaran** and Francisco Munoz Arriola (2021) Assessment of Soil Moisture Driven Machine Learning Approach to Correct Satellite based Near Real Time Rainfall Estimates: A Case Study in Hirakud Catchment, Mahanadi Basin. *In Hydro International Conference*, Surat, India, Dec 23-25.
10. Ramesh Visweshwaran, **RAAJ Ramsankaran**, T.I. Eldho and Sivaramakrishnan Lakshmi varahan (2021) Dynamic Data Assimilation for Improved Streamflow Forecast Using Sensitive Soil Moisture Observations. *In American Geophysical Union Fall Meeting*, New Orleans, USA, Dec 13-17.
11. Antara Dasgupta, Renaud Hostache, **RAAJ Ramsankaran**, Valentijn Pauwels, Guy Jean-Pierre Schumann, Stefania Grimaldi and Jeffrey Phillip Walker (2021). Impact of observation spatiotemporal configuration on flood extent assimilation. *In Virtual Australian Earth Sciences Convention: Core to Cosmos*. Feb 9-12.
12. Antara Dasgupta, Renaud Hostache, **RAAJ Ramsankaran**, Valentijn Pauwels, Guy Jean-Pierre Schumann, Stefania Grimaldi and Jeffrey Phillip Walker (2020). Quantifying the Impact of Observation Operators on Flood Inundation Forecast Quality. *In American Geophysical Union Fall Meeting: Shaping the Future of Science*, Dec 7-11.
13. Antara Dasgupta, Renaud Hostache, **RAAJ Ramsankaran**, Valentijn Pauwels, Guy Jean-Pierre Schumann, Stefania Grimaldi and Jeffrey Phillip Walker (2020). Leveraging Earth Observation Data Assimilation for Improved Flood Inundation Forecasts. *In 2020 Bureau of Meteorology Annual Research and Development Workshop*, Nov 23-28.
14. Antara Dasgupta, Renaud Hostache, **RAAJ Ramsankaran**, Valentijn Pauwels, Guy Jean-Pierre Schumann, Stefania Grimaldi and Jeffrey Phillip Walker (2020). Harnessing the Potential of EO Data Assimilation for Improved Flood Inundation Forecasts. *In Earth Observation for Water Cycle Science Conference 2020*, Nov, 16-18

15. **RAAJ Ramsankaran** and P.J. Navinkumar (2020). Mapping surface features of Debris- covered Glaciers in Indian Himalayas using UAV Imagery. *International Conference on Himalayan Cryosphere*, Bengaluru, India. October 19 -23.
16. Antara Dasgupta, Renaud Hostache, **RAAJ Ramsankaran**, Valentijn Pauwels, Guy Jean-Pierre Schumann, Stefania Grimaldi and Jeffrey Phillip Walker (2020). Optimizing SAR-based Flood Extent Assimilation for Improved Flood Inundation Forecasts. *In European Geosciences Union: Sharing Geosciences Online*, May 4-8.
17. Ashish Kumar and **RAAJ Ramsankaran** (2020) A detailed investigation of errors in satellite-based real-time rainfall estimates: a pilot study across the Krishna river basin. *Roorkee Water Conclave-2020*, IIT Roorkee. Feb 26-28.
18. Swathy Sunder, **RAAJ Ramsankaran**, Balaji Ramakrishnan (2020). " Reconstruction of Daily Cloud Free MODIS Sea Surface Temperature over South Eastern Arabian Sea". *AGU Ocean Sciences Meeting*, San Diego, CA, USA. February 16 -21.
19. Antara Dasgupta, Renaud Hostache, **RAAJ Ramsankaran**, Valentijn Pauwels, Guy Jean-Pierre Schumann, Stefania Grimaldi and Jeffrey Phillip Walker (2019). Optimizing Targeted SAR Acquisitions for Flood Extent Assimilation to Improve Inundation Forecasts. *In American Geophysical Union Fall Meeting*, San Francisco, USA, Dec 9-13.
20. Antara Dasgupta, Renaud Hostache, **RAAJ Ramsankaran**, Valentijn Pauwels, Guy Jean-Pierre Schumann, Stefania Grimaldi and Jeffrey Phillip Walker (2019). Evaluating the Impact of Flood Extent Assimilation on Hydraulic Model Forecast Skill. *In MODSIM2019, 23rd International Congress on Modelling and Simulation*, Canberra, Australia, Dec 1-6.
21. Antara Dasgupta, Renaud Hostache, **RAAJ Ramsankaran**, Valentijn Pauwels, Guy Jean-Pierre Schumann, Stefania Grimaldi and Jeffrey Phillip Walker (2019). On the impacts of location, timing, and frequency of inundation extent assimilation on flood forecast skill. *In Hydrologic Ensemble Prediction EXperiment (HEPEX)*, Reading, UK, Nov 25-28.
22. Smarika Kulshreshtha and **RAAJ Ramsankaran** (2019). Spatiotemporal analysis of snow cover variation over Western Himalayan basins using improved MODIS snow cover area maps. *International Workshop on Climate Change and Extreme Events in the Himalayan Region (C2E2 Himalaya)*, Mandi, H.P., India. April 18–20.
23. Antara Dasgupta, Renaud Hostache, **RAAJ Ramsankaran**, Valentijn Pauwels, Guy Jean-Pierre Schumann, Stefania Grimaldi and Jeffrey Walker (2019). Improving flood forecasts using SAR-based flood extent assimilation. *European Geosciences Union General Assembly*, Vienna, Austria. April 7–12.
24. Pratiksha Jain, **RAAJ Ramsankaran** and Antara Dasgupta (2018). GIS based multi-criteria modelling framework for identifying critical areas aimed at watershed management. *American Geophysical Union Fall Meeting*, Washington D.C., USA. December 10–14.
25. Anita Chandrasekharan and **RAAJ Ramsankaran** (2018). Role of glacio-morphological factors on glacier mass balance variation: a case study of glaciers in Chandra Basin, Western Himalayas, India. *American Geophysical Union Fall Meeting*, Washington D.C., USA. December 10–14.
26. **RAAJ Ramsankaran** and Amol Ashok Patil (2018). Synergetic correction of satellite-based rainfall and soil moisture for improving streamflow simulations. *American Geophysical Union Fall Meeting*, Washington D.C., USA. December 10–14.
27. Antara Dasgupta, Stefania Grimaldi, **RAAJ Ramsankaran**, Renaud Hostache, Guy Jean-Pierre Schumann, Valentijn Pauwels and Jeffrey Walker (2018). On the spatiotemporal impacts of flood extent assimilation. *American Geophysical Union Fall Meeting*, Washington D.C., USA. December 10–14.
28. Smarika Kulshreshtha, Anita Chandrasekharan and **RAAJ Ramsankaran** (2018). Improving MODIS snow cover product's accuracy over Western Himalayas using MODIS LST data. *American Geophysical Union*, Washington D. C., USA. December 10–14.
29. Estifanos Lemma and **RAAJ Ramsankaran** and F.M. Arriola (2018). Use of MSWEPv2 rainfall product for meteorological drought monitoring across different rainfall regimes of Ethiopia. *American Geospatial Union Fall meeting*, Washington D.C., USA. December 10–14.
30. Ashish Kumar and **RAAJ Ramsankaran**<sup>#</sup> (2021). Error analysis of TMPA near real-time precipitation estimates for an Indian Monsoon region. *23<sup>rd</sup> International Conference on Hydraulics, Water Resources and River Engineering (HYDRO 2018)*, Patna, India. December 19–21.
31. Anisha Narendran and **RAAJ Ramsankaran** (2017). Glacier mapping using multi-sensor satellite data through knowledge based hierarchical classification approach. *American Geophysical Union Fall Meeting*, Washington D. C., USA. December 10–14.
32. Estifanos Lemma and **RAAJ Ramsankaran** (2018). Evaluation of Multi-Source Weighted-Ensemble Precipitation (MSWEP) product across different rainfall regimes of Ethiopia. *9th Workshop of International Precipitation Working Group (IPWG-9)*, Seoul, South Korea. November 5–9.

33. Vasu Sathyakumar, **RAAJ Ramsankaran** and Ronita Bardhan (2018). Relationship between remotely sensed distribution patterns of Urban Green Spaces (UGS) and neighbourhood Socio-Economic Status (SES) in Mumbai, India. *5th EARSeL Joint Workshop Urban Remote Sensing- Challenges & Solutions*, Ruhr University Bochum, Germany. September 24–27.
34. Swathy Sunder, **RAAJ Ramsankaran** and Balaji Ramakrishnan (2018). Exploring machine learning techniques to estimate cloud free daily Sea Surface Temperatures (SST) from MODIS aqua across South Eastern Arabian Sea. *Group on High Resolution Sea Surface Temperature (GHRSSST) 19th International Science Team Meeting (GHRSSST XIX)*, Darmstadt, Germany. June 4–8.
35. Antara Dasgupta, Renaud Hostache, **RAAJ Ramsankaran**, Valentijn Pauwels, Guy Jean-Pierre Schumann, Marco Chini, Stefania Grimaldi, Patrick Matgen and Jeffrey Walker (2018). Evolutionary assimilation of SAR-derived inundation extents into a flood model. *European Geosciences Union General Assembly*. Vienna, Austria. April 23–28.
36. Amol Ashok Patil, **RAAJ Ramsankaran** (2018). Improved ensemble representation of soil moisture in SWAT for data assimilation applications. *SWAT International Conference*, IIT Madras, Chennai, India. January 8–12.
37. Antara Dasgupta, Guy Jean-Pierre Schumann, Stefania Grimaldi, **RAAJ Ramsankaran**, Valentijn Pauwels and Jeffrey Walker (2018). Diagnostic Assessment of Localized Flood Flow Behaviour. *Hydrologic Ensemble Prediction EXperiment (HEPEX)*, Melbourne, Australia. February 6–8.
38. Sangita Kumari, **RAAJ Ramsankaran** and Ankur Pandit (2017). Geodetic mass balance modelling of Chhota Shigri glacier using the bias corrected SRTM and TanDEM-X DEMs. *The 2nd National Conference on Polar Sciences (NCPS 2017)*, Goa, India. May 16–17.
39. Shruti Upadhyaya, **RAAJ Ramsankaran** (2017). Improved TMPA 3B42 estimates across Indian land region using static topographic and climate region information. *European Geoscience Union General Assembly, Vienna, Austria*. April 23–28.
40. Anita Chandrasekharan and **RAAJ Ramsankaran** (2017). Remote sensing-based modelling of annual surface mass balances of Chhota Shigiri Glacier, Western Himalayas, India. *European Geoscience Union General Assembly, Vienna, Austria*. April 23–28.
41. Ankur Pandit, **RAAJ Ramsankaran** and Sangita Singh (2017). Modelling the glacier ice thickness change between 2000–2013 using bias corrected DEM differencing method for 18 glaciers in Chandra Baga Basin, Western Himalayas, India. *Cryosphere in a Changing Climate*, Wellington, New Zealand. February 12–17.
42. Smarika Kulshreshtha and **RAAJ Ramsankaran** (2017). Snowmelt Runoff Simulation considering temporal lapse rate for Spiti Basin in Western Himalayas. *National Conference on Himalayan Cryosphere, Divecha Centre for Climate Change*, IISC Bangalore, India. January 23–24.
43. Amol Patil and **RAAJ Ramsankaran** (2016). Improving subsurface error correlation in SWAT for EnKF based soil moisture data assimilation. *American Geophysical Union Fall Meeting*, San Francisco, USA. December 17–19.
44. Shruti Upadhyaya, **RAAJ Ramsankaran** and Amol Patil. (2016). Error modeling of the modified INSAT multi-spectral rainfall algorithm. *American Geophysical Union Fall Meeting*, San Francisco, USA. December 17–19.
45. Ankur Pandit and **RAAJ Ramsankaran** (2016). Utilization and evaluation RISAT-1 backscattering response for glacier zone mapping over Hamtah glacier, Western Himalaya, India. *Symposium on Thin Ice: Arctic, Antarctic and the Himalayas*, JNU, New Delhi, India. November 29.
46. Shruti Upadhyaya and **RAAJ Ramsankaran** (2016). Modified-INSAT multispectral rainfall algorithm (M-IMSRA) for Indian land region. *8th International Precipitation Working Group Meet (IPWG8)*, Bologna, Italy. October 3–7.
47. Ashish Kumar and **RAAJ Ramsankaran** (2016). Error Characterization of TMPA-RT V7 Estimates over Krishna River Basin in India. *8th International Precipitation Working Group Meet (IPWG8)*, Bologna, Italy. October 3–7.
48. Amol Patil and **RAAJ Ramsankaran** (2015). Comparison of different sampling methods for representing uncertainty in soil moisture data assimilation using EnKF. *Earth Observation for Water Cycle Science 2015. European Space Agency (ESA)*, ESRIN, Rome, Italy. October 20–23.
49. Ashish Kumar and **RAAJ Ramsankaran** (2015). Error reduction of satellite-based rainfall estimates-a case study of an Indian Basin. *Earth Observation for Water Cycle Science 2015. European Space Agency (ESA)*, ESRIN, Rome, Italy. October 20–23.
50. Pratiksha Jain and **RAAJ Ramsankaran** (2015). GIS based distributed process-oriented soil erosion modeling using modified Morgan–Morgan Finney model in Indian Region. *SWAT International Conference*, Sardinia, Italy. June 22–26.

51. **RAAJ Ramsankaran**, Ankur Pandit and Divyansh (2015). Utilization of ELA for mass balance estimations in Chotta Sighri glacier, Himachal Pradesh, India. *International Glaciology Society (IGS) International Symposium on Glaciology in High-Mountain Asia*. Kathmandu, Nepal. March 2–6.
52. Pratiksha Jain and **RAAJ Ramsankaran** (2014). GIS based distributed soil erosion modeling using modified Morgan–Morgan Finney model in Gharwal Himalayan Region. *International Conference on Modeling Tools for Sustainable Water Resource Management*, IIT Hyderabad, India. December 26–29.
53. Shruti Upadhyaya and **RAAJ Ramsankaran** (2014). Validation of near-real time satellite rainfall products and assessment of its bias over different homogeneous regions of India based on topographical analysis. *7th International Precipitation Working Group Meet (IPWG7)*, Japan. November 11–17.
54. **RAAJ Ramsankaran**, and Sravan Chinthaparthi (2013). Recognizing Biological Crusts in Civil Engineering Structures using Intensity Data from Terrestrial Laser Scanner. *International Conferences on Advances in Building Sciences & Rehabilitation and Restoration of Structures*, IIT Madras, Chennai. February 13-16.
55. **RAAJ Ramsankaran** and Umesh Kothiyari (2012). GIS based GIS based distributed modelling of soil erosion and sediment yield for isolated storm events - a validation study of DREAM. *SWAT International Conference*, IIT Delhi, New Delhi, India. July 18–22.
56. **RAAJ Ramsankaran**, M. Ramalingam, Sanjay Ghosh and Umesh Kothiyari (2006). Remote sensing and GIS applications for wetland management - a case study. *1st Indo-Australian International Conference on Information Technology in Civil Engineering (IAC-ITCE)*, IIT Roorkee, Roorkee, India. February 22–24.
57. **RAAJ Ramsankaran** (2004). Soil information system & its applications for watershed management. *National Symposium on Futuristic Steel Developments & GIS for Water Resource & Environmental Engineering*, Karunya Institute of Technology, Coimbatore, India. December 16–17.



## Sponsored Projects and Industrial Consultancy

## Sponsored Projects

## Ongoing Projects

Total value of the projects awarded is ₹ 480 Lakhs (48 million)

S. No	Project title	Role PI/ Co-PI	From	To	Sponsoring agency	~ Outlay In INR (₹)
1	Geo-Guru-Development of an educational app for school children	Co-PI	May 2023	Dec 2024	Technology Innovation Hub (TiH), IIT Bombay	₹ 49 Lakhs (4.9 million)
2	Low-cost photogrammetry for monitoring lake-terminating glaciers in the Himalayas	PI	April 2023	March 2024	Royal Society UK	₹ 15 Lakhs (1.5 million)
3	Safety Assessment and Long-Term Ageing monitoring of Heritage Masonry Structures using High-Definition Surveying and IoT Sensors	Co-PI	Oct 2022	Sep 2025	DST International Division under Indo-Italy Bilateral Program	₹ 38 Lakhs (3.8 million)
4	Establishment of Regional Centre for Geodesy	PI	Aug 2022	July 2025	DST	₹ 145 Lakhs (14.5 million)
5	Remote Sensing-based Modelling of Glacier Dynamics; Ice Thickness Estimations and Glacier Volume in Indian Himalayan Region	PI	Aug 2022	July 2025	DST through Geo-Information Science & Engineering (GISE) Hub, IIT Bombay	₹ 47 Lakhs (4.7 million)
6	Near-real time Monitoring of Snow Avalanches using UAV Remote Sensing	PI	July 2022	June 2025	IIRS- ISRO	₹ 40 Lakhs (4 million)
7	Modelling the Evolution of Large Glacier-fed Lakes in Western Himalayas	PI	July 2022	June 2025	SERB, DST	₹ 79 Lakhs (7.9 million)
8	Integration of UAV photogrammetry and terrestrial LIDAR for digital documentation of heritage monuments using building information Modelling (BIM)	Co-PI	May 2021	Mar 2024	SERB, DST	₹ 45 Lakhs (4.5 million)
9	Estimating mass balance of glaciers in the Bhaga Basin Western Himalaya using GPR and remote sensing methods	PI	Apr 2019	Oct 2023	Ministry of Earth Science (MOES)	₹ 22 Lakhs (2.2 million)

## Completed Projects

Total value of the projects awarded is ₹ 805.5 Lakhs (80.55 million). Excluding the cost of partnering institutes, the value of the projects is ₹ 500.89 Lakhs (50.08 million)

S. No	Project Title	Role	From	To	Sponsoring agency	~ Outlay In INR (₹)
16	Modelling and Mapping of Supraglacial Debris cover thickness using satellite remote sensing data in selected glaciers of western Himalayas	PI	Aug 2019	June 2023	ISRO under ISRO-IITB Space Technology Cell	₹ 35 Lakhs (3.5 million)
15	Estimation of Snow Depth at High Spatial Resolution over Indian Himalayan Region using Remote Sensing Techniques.	PI	Feb 2022	May 2023	DGRE-DRDO lab <i>Erstwhile Snow and Avalanche Study Establishment (SASE)</i>	₹ 23 Lakhs (2.3 million)
14	Collaborative activities between IIT Bombay and Ethiopian Science and Technology Universities (STUs) for strengthen the Center of Excellences (CoEs) in the Field of Geospatial Information System (GIS) under India-Ethiopia Science and Technology Framework	PI	Aug 2018	July 2022 <i>(Not started due to civil unrest in Ethiopia)</i>	DST – International Division	₹ 85 Lakhs (8.5 million)
13	Development of High-Resolution Coastal Relief Model (CRM) – A Pilot study in Maharashtra	Co-PI	March 2019	Jan 2022	DST – National Geospatial Programme (NGP) Division	₹ 28 Lakhs (2.8 million)
12	Impact of Climate Change on Water Resources in River Basins from Tadri to Kanyakumari	Co-PI	March 2018	March 2022	Ministry of Water Resources and Ganga Rejuvenation, Govt. of India	₹ 119 Lakhs (11.9 million)
11	Risk Assessment of Moraine Dammed Glacier Lakes Due to Climate Change <i>(A Multi Institutional Project lead by IISc Bangalore)</i> <b>Sub-project:</b> Modelling of Glacier Volume using Satellite Remote sensing, UAV and In-situ Measurements	Co-PI	July 2017	March 2022	MOES and MOE (erstwhile MHRD) under IMPRINT scheme Govt. of India	Total cost: ₹ 341 lakhs (34.1 million) IIT B Civil Dept. component: ₹ 82.39 Lakhs (8.23 million)

10	Indo-UK workshop on WEIGH (Water Security assessment of Indian Rivers Originating from the Himalayas) in Virtual mode	PI	Sept 2021	Oct 2021	DST-International Division	₹ 1.5 Lakhs (0.15 million)
9	Characterization & Modelling of Physical Properties of Snow and Ice using Field and & Hyperspectral Remote sensing Observation	PI	June 2016	March 2021	DST under Networked Programme on Imaging Spectroscopy and Applications (NISA)	₹45 Lakhs (4.5 million)
8	Modelling Glacier Stored Water in Eastern Himalayas	PI	Oct 2015	June 2019	SERB, DST	₹40 Lakhs (4 million)
7	Near Real Time Flood Forecasting in Lower reaches of Krishna River	PI	June 2013	May 2019	INSA-DST INSPIRE Faculty Fellowship Research Grant	₹35 Lakhs (3.5 million)
6	Velocity based estimation of glacier ice thickness in Indian Himalaya using high resolution TanDEM-X DEM	PI	April 2017	Nov 2018	German Aerospace Center (DLR), TanDEM-X Science Service System	In Kind support towards data
5	Error Characterization of GSMaP Products over India	PI	April 2016	March 2018	Japan Aerospace Agency (JAXA) under 8 <sup>th</sup> Precipitation measurement Mission Research Call	In Kind support towards data
4	Evaluation and mapping of flooding along Paradip coast due to storms and tides using Numerical modelling and Geo-Spatial Techniques	Co-PI	Jan 2015	Dec 2018	ISRO	₹28 Lakhs (2.8 million)
3	Estimation of glacier thickness change in the Indian Himalayan region using DEM Differencing method with bias corrected DEMs	PI	Oct 2015	Sep 2016	German Aerospace Center (DLR), TanDEM-X Science Service System	In Kind support towards data
2	Comprehensive Validation of GSMaP Products over India	PI	May 2015	April 2016	Japan Aerospace Agency (JAXA) under	In Kind support towards data

					7 <sup>th</sup> Precipitation measurement Mission Research Call	
1	Distributed Hydrological Modelling of Upper Bhima Catchment	PI	June 2013	Nov 2016	DST Fast Track Scheme	₹ 25 Lakhs (2.5 million)

### Industry Consultancy (Ongoing)

Total value of the projects awarded is ----

Sr. No.	Industry	Brief details	Role	~ Outlay In INR (₹)
1				

### Industry Consultancy (Completed)

Total value of the projects awarded is ₹ 640.17 Lakhs (64.01 million)

Sr. No.	Industry	Brief details	Role	~ Outlay In INR (₹)
9	Macrotech Developer Lodha Group	Storm Water Design Certification for Lodha Pallava Phase III Project at Ambarnath, Thane	PI	₹ 1.5 Lakhs
8	Navi Mumbai Special Economic Zone (NMSEZ) Ltd	Study of Landuse/Landcover Change Dynamics in Navi Mumbai Special Economic Zone (NMSEZ) area using Remote Sensing	PI	₹ 30 Lakhs (3 million)
7	Jalgaon Medium Irrigation Projects Division-1, (JMPD-1) Dept of Water Resources, Govt of Maharashtra	R&D based project involves Remote sensing, GIS and numerical modelling-based Flood Inundation Modelling in Upstream of Hatnur Dam for different return periods. Work involves hydrologic and hydraulic modelling.	PI	₹ 41.97 Lakhs (4.19 million)
6	JMPD-1, Dept of Water Resources, Govt of Maharashtra	UAV based Topographic and In-situ Bathymetry Survey of Tapi River Upstream of Hatnur Dam covering an area of ~ 300 Sq.km	PI	₹ 109.8 Lakhs (10.98 million)
5	Odisha State Disaster Management Agency (OSDMA)	R&D based project involves Remote sensing, GIS and numerical modelling-based Vulnerability Mapping of Landslide Prone Areas under cyclonic storm in the Gajapati district Odisha	Co-PI	₹ 211.8 Lakhs (21.1 million)
4	OSDMA	R&D based project involves Remote sensing and GIS based Gap analysis and design of multipurpose cyclone shelters for disaster management activities in the coastal region of Odisha	Co-PI	₹ 207.6 lakhs (20.76 million)
3	Taj Hotels Resorts & Palaces	2D and 3D modelling of South western Dome of TAJ Heritage hotel, Colaba, Mumbai using Terrestrial LiDAR data	PI	₹ 7.5 Lakhs (0.75 million)

2	Executive Engineer (Chandrapur Irrigation Division), Govt. of Maharashtra.	Backwater Study of Erai River in Chandrapur District.	PI	₹27 Lakhs (2.7 million)
1	National Green Tribunal; Lenzing Modi Fibres and The Watchdog Foundation	Mapping of Eco-Sensitive Zones around Karnala Bird Sanctuary.	PI	₹ 3.0 Lakhs (0.3 million)

### Funding Agency Details

- 1 DGRE-Defense Geoinformatics Research Establishment, a Defense Research and Development Organization (DRDO) lab, Govt of India (Gol)
- 2 DST- Department of Science and Technology, Govt of India Gol
- 3 SERB- Science and Engineering Research Board, Gol
- 4 Ministry of Jal Shakti (Erstwhile Ministry of Water Resources), Gol
- 5 MOES- Ministry of Earth Sciences
- 6 MoE- Ministry of Education (Erstwhile Ministry of Human Resources Development), Gol
- 7 ISRO- Indian Space Research Organization
- 8 IIRS- Indian Institute of Remote Sensing, Dehradun
- 9 JAXA- Japan Aerospace Agency
- 10 DLR- German Aerospace Center
- 11 Department of Water Resources, Govt of Maharashtra
- 12 Odisha State Disaster Management Agency (OSDMA), Govt of Odisha

**RAAJ Ramsankaran**