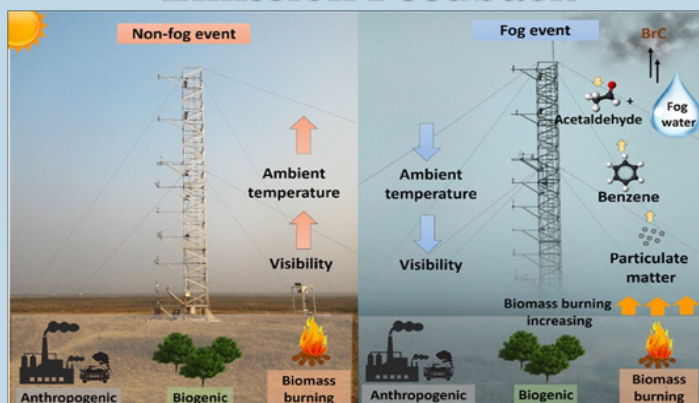


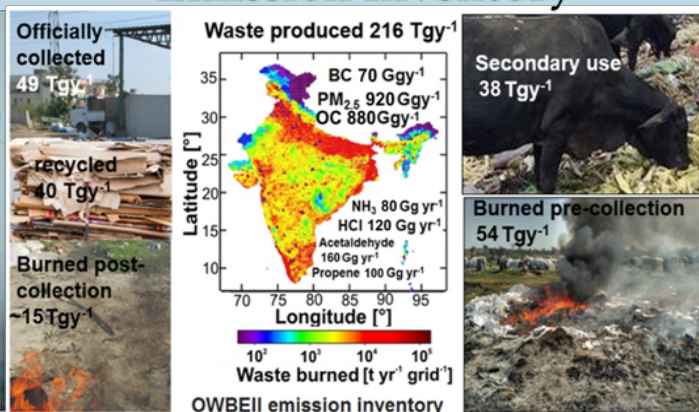
Department of EARTH AND ENVIRONMENTAL SCIENCES



Emission Feedback



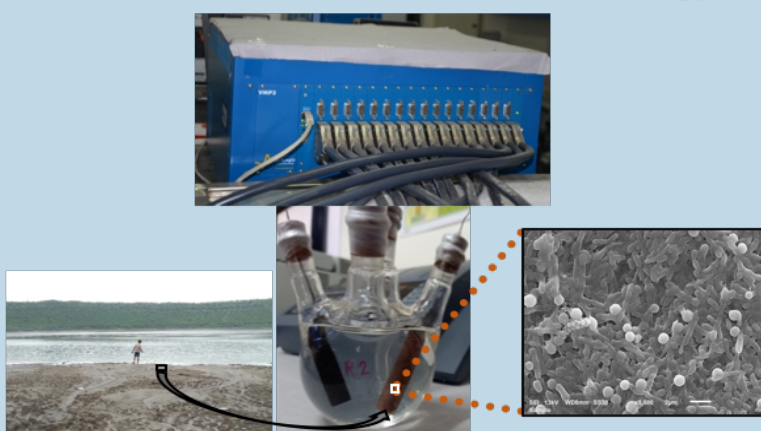
Emission Inventory



Coring Campaign



Environmental Electromicrobiology



Weather and Climate Modelling



Indian Institute of Science Education and Research
Mohali (IISERM)

Foreword

The Indian Institutes of Science Education and Research (the IISERs) are a group of institutes set up by the Ministry of Human Resource Development (MHRD) of the Government of India (GOI), to facilitate high quality science education and research in the country. The first two IISERs were set up in Pune and Kolkata in 2006. The IISER at Mohali (IISER-M) began functioning in 2007. In subsequent years four more IISERs were set up at Bhopal, Trivandrum, Berhampur, and Tirupati. After functioning out of a transit campus located in Chandigarh for few years, IISER Mohali moved into its own permanent campus completely in 2013.

In June 2012, the institute organized itself into separate departments for administrative efficiency. In terms of research and teaching IISER Mohali continues to foster interdisciplinary teaching and research across disciplines.

In its educational aspects, IISER Mohali is modelled on the highly successful Indian Institutes of Technology (the IITs). In its research-related aspects, IISER Mohali is modelled on the Indian Institute of Science (IISc) Bangalore.

All five IISERs were originally set up to bring together researchers who are pursuing cutting edge research in their individual disciplines and highly motivated graduate and undergraduate students.

The Department of Earth and Environmental Sciences is a vibrant department which seeks to pursue high profile research in the broad subject areas of Earth and Environmental Sciences, motivate undergraduates and graduates to undertake cutting edge research and provide them international exposure.

The Department now has five regular faculty members and one Inspire Faculty and is constantly looking for extremely motivated scientists with a high-profile research agenda and a flair for teaching to join the faculty team.

The Department currently conducts a PhD program and participates in undergraduate teaching by offering core elective courses as well as advanced interdisciplinary elective courses open to 3rd, 4th and 5th year students from all the major disciplines and supervising MS thesis projects across disciplines.

Faculty Profiles

S.No	Name	Designation	Research Area	Email (@iisermohali.ac.in)
1	Baerbel Sinha	Head, Associate Professor	Environmental Science	bsinha
2	Vinayak Sinha	Associate Professor	Atmospheric and Analytical Chemistry	vsinha
3	Anoop Ambili	Assistant Professor	Paleoclimatology & Geochemistry	anoop
4	Sunil A. Patil	Assistant Professor	Environmental Electromicrobiology & Biotechnology	sunil
5	Raju Attada	Assistant Professor	Atmospheric Modelling	rajuattada
6	Sharmila Bhattacharya	Inspire Faculty	Geochemistry	sbhattacharya

Joined August 2010

Vinayak Sinha



Associate Professor

M.Sc., Sri Sathya Sai Institute of Higher Learning, Prashantinilayam, 2002

M.Tech, Indian Institute of Technology Delhi, 2004

Ph.D., Johannes Gutenberg University & MPIC Mainz, 2007

Post Doc, Max Planck Institute for Chemistry, 2007-2010

Vinayak Sinha is guiding/has guided 6 Ph.D. & 12 M.Sc. thesis students

Selected Publications

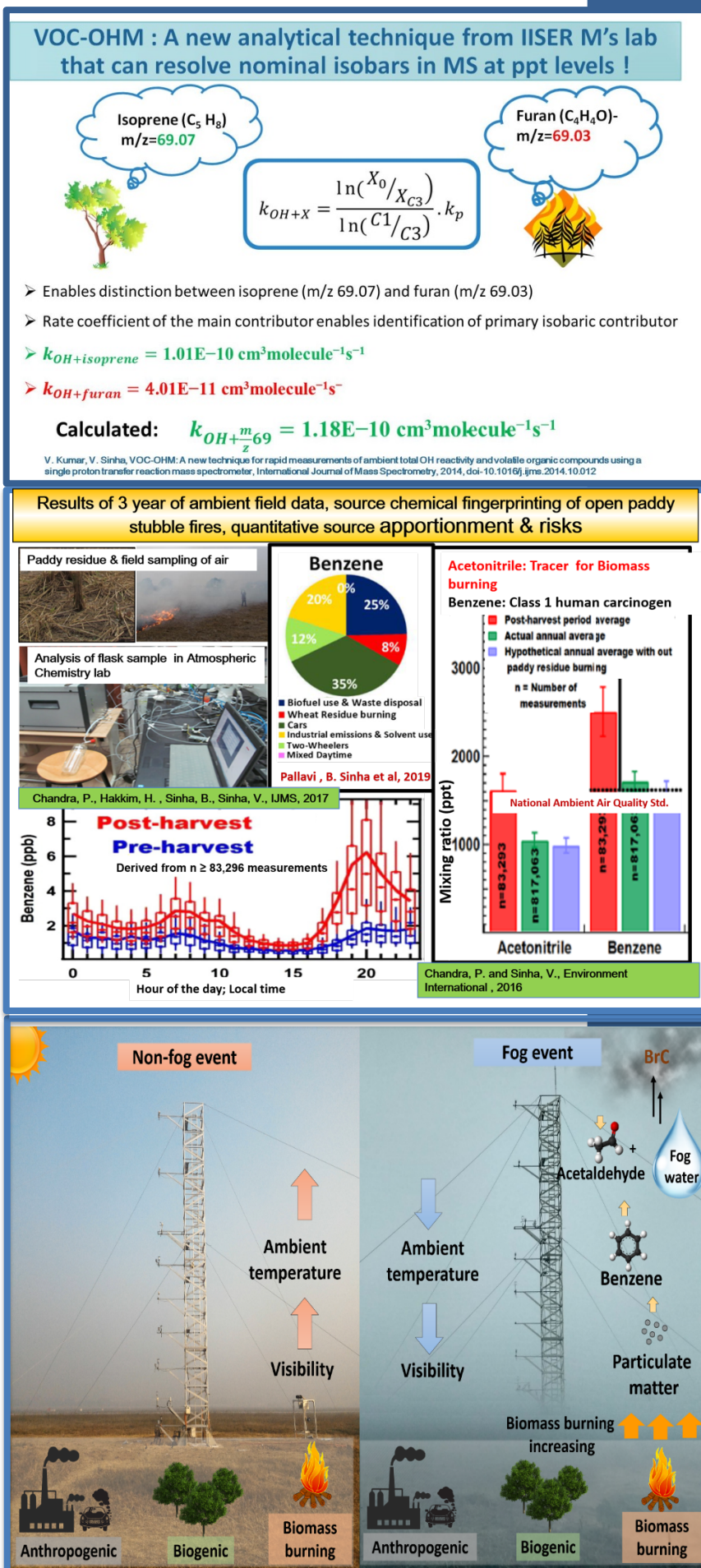
- Vettikkat, L., **Sinha, V.**, Datta, S., Kumar, A., Hakkim, H., Yadav, P., and Sinha, B., Significant emissions of dimethyl sulfide and monoterpenes by big-leaf mahogany trees: discovery of a missing dimethyl sulfide source to the atmospheric environment, **Atmos. Chem. Phys.**, 20, 375–389, 2020.
- Hakkim, H., **Sinha, V.**, Chandra, B. P., Kumar, A., Mishra, A. K., Sinha, B., Sharma, G., Pawara, H., Sohpaal, B., Ghude, S. D., Pithani, P., Kulkarni, R., Jenamani, R. K., Rajeevan, M., Volatile organic compound measurements point to fog-induced biomass burning feedback to air quality in the megacity of Delhi, **Science of the Total Environment**, 689, 295-305, 2019.
- Kumar, V., Chandra, B. P., Sinha, V., Large unexplained suite of chemically reactive compounds present in ambient air due to biomass fires, Scientific Reports, 8, 626, <https://www.nature.com/articles/s41598-017-19139-3>, 2018.
- Chandra, B.P., Sinha, V., Hakkim, H., Sinha, B., Storage stability studies and field application of low cost glass flasks for analyses of thirteen ambient VOCs using proton transfer reaction mass spectrometry, International Journal of Mass Spectrometry 419, 11-19, 2017.
- Sarkar, C., **Sinha, V.**, Kumar, V., Rupakheti, M., Panday, A.K., Mahata, K., Rupakheti, D., Kathayat, B., Lawrence, M.G., Overview of VOC emissions and chemistry from PTR-TOF-MS measurements during the SusKat-ABC campaign: High acetaldehyde, isoprene and isocyanic acid in wintertime air of the Kathmandu Valley, **Atmos. Chem. Phys.**, 16, 3979- 4003, 2016.
- Chandra, B.P., **Sinha, V.**, Contribution of post-harvest agricultural paddy residue fires in the N.W. Indo-Gangetic Plain to ambient carcinogenic benzenoids, toxic isocyanic acid and carbon, **Environment International** 88, 187-197, 2016.
- **Sinha, V.**, Kumar, V., Sarkar, C., Chemical composition of pre-monsoon air in the Indo–Gangetic Plain measured using a new PTR-MS and air quality facility: high surface ozone and strong influence of biomass burning, **Atmos. Chem. Phys.**, 14, 5921-5941, 2014.
- **Sinha, V.**, Williams, J., Crowley, J., Lelieveld J., The Comparative Reactivity Method – A new tool to measure the total OH Reactivity of ambient air, **Atmos. Chem. Phys.**, 8, 2213-2227, 2008.



Research Interests

Our current research focus is centred on the real time atmospheric reactivity of hydroxyl radicals, emissions and chemistry of volatile organic compounds and the instantaneous ozone formation photochemistry, so as to develop a fundamental understanding of the processes that control the self cleansing (oxidizing) capacity of ambient air over the Indo Gangetic Plain. Towards this end, my group builds instruments (e.g. for quantifying OH reactivity) and deploys very sensitive online spectroscopic and mass spectrometric techniques for quantifying the ultra trace atmospheric chemical constituents.

We are the only laboratory in India to have developed an instrument for quantifying atmospheric OH reactivity directly based on the innovative Comparative Reactivity Method (CRM) (Kumar and Sinha, 2014), that has been emulated by leading research groups worldwide (e.g. USA, France and Germany). OH reactivity is the key chemical parameter that constrains the total reactive pollutant loading of air masses and enables instantaneous ozone production rates and regimes to be quantified (Sinha et al. 2012). Our laboratory is also the first to deploy proton transfer reaction mass spectrometry (PTR-MS) technology within India and houses India's first PTR-MS. This instrument quantifies highly reactive volatile organic compounds (VOC's) in real-time at parts per trillion (ppt) level and has already been used to compile the first ambient dataset for reactive VOCs such as isoprene and acetaldehyde over the Indian region (Sinha et al. 2014).



Baerbel Sinha



Associate Professor

M.Sc., TU-Bergakademie Freiberg, Germany, 2004

Ph.D., Johannes Gutenberg University & MPIC Mainz, 2007

Post Doc, Max Planck Institute for Chemistry, 2007-2011

Baerbel Sinha is guiding/has guided 7 Ph.D students and 18 M.Sc. thesis students

Selected Publications

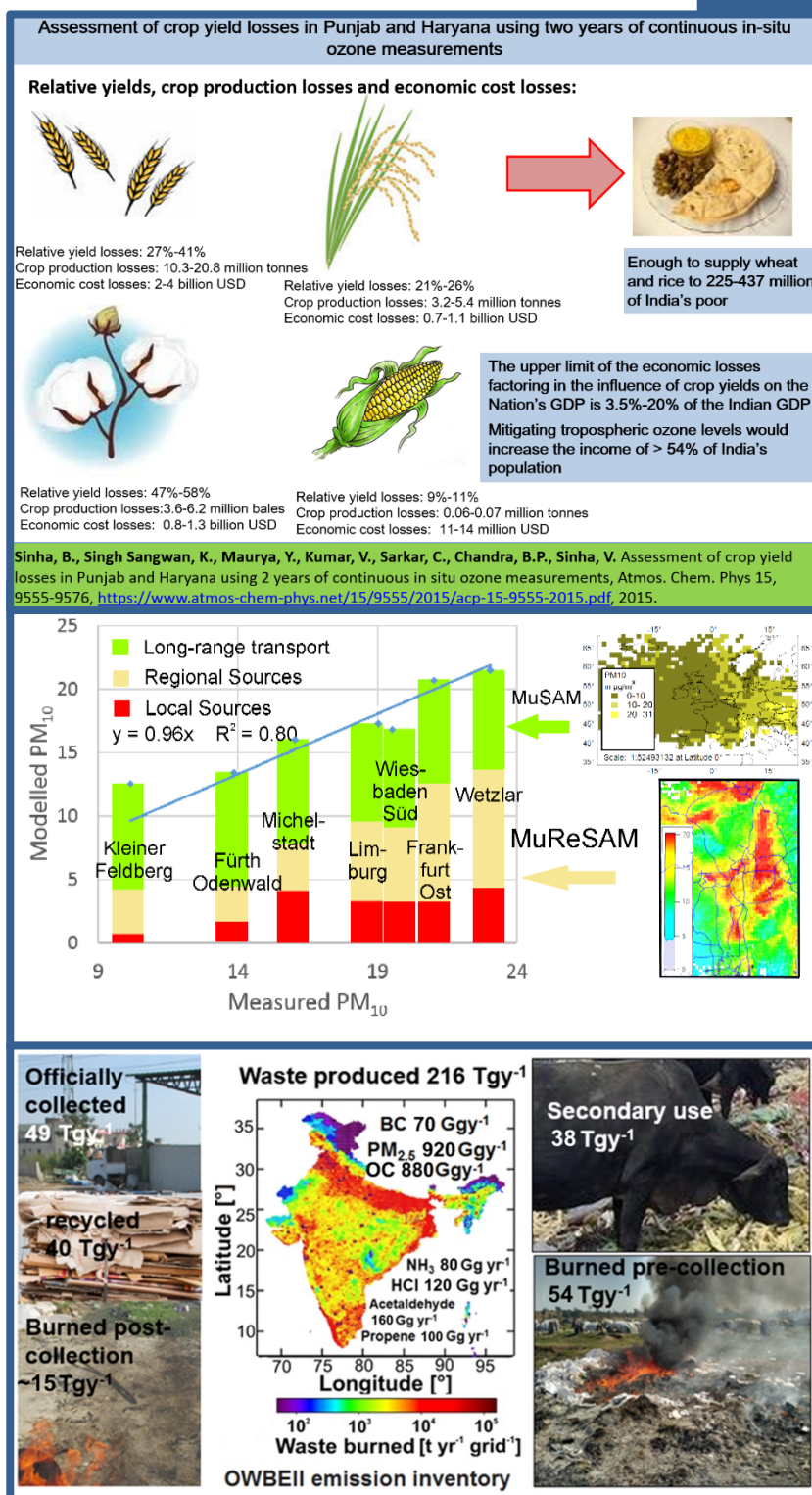
- Pawar, H. and **Sinha B.**, Humidity, density, and inlet aspiration efficiency correction improve accuracy of a low-cost sensor during field calibration at a suburban site in the north-western Indo-Gangetic Plain (NW-IGP). **Journal of Aerosol Science and Technology**, 54(6), 685-703, 2020.
- Pallavi, **Sinha, B.**, Sinha, V., Source apportionment of volatile organic compounds in the north-west Indo-Gangetic Plain using positive matrix factorisation model, **Atmospheric Chemistry and Physics**, 15467–15482, 2019.
- Sharma, G., **Sinha, B.**, Pallavi, Hakkim, H., Chandra, B.P., Kumar, A., Sinha, V.: Gridded Emissions of CO, NO_x SO₂, CO₂ NH₃, HCl, CH₄, PM_{2.5}, PM₁₀, BC, and NMVOC from Open Municipal Waste Burning in India, **Environmental Science and Technology**, 53, 4765-4774, 2019.
- Garg, S. and **Sinha, B.**, Determining the contribution of long-range transport, regional and local source areas, to PM₁₀ mass loading in Hessen, Germany using a novel multi-receptor based statistical approach, **Atmospheric Environment** 167, 566-575, 2017.
- Harris, E., **Sinha, B.**, van Pinxteren, D., Tilgner, A., Fomba, K. W., Schneider, J., Roth, A., Gnauk, T., Fahlbusch, B., Mertes, S., Lee, T., Collett, J., Foley, S., Borrmann, S., Hoppe, P., Herrmann, H., Enhanced role of transition metal ion catalysis during in-cloud oxidation of SO₂. **Science** 340, 727-730, 2013.
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- Pöschl, U., Martin, S. T., **Sinha, B.**, Chen, Q., Gunthe, S. S., Huffman, J. A., Borrmann, S., Farmer, D. K., Garland, R. M., Helas, G., Jimenez, J. L., King, S. M., Manzi, A., Mikhailov, E., Pauliquevis, T., Petters, M. D., Prenni, A. J., Roldin, P., Rose, D., Schneider, J., Su, H., Zorn, S. R., Artaxo, P., Andreae, M. O., Rainforest aerosols as biogenic nuclei of clouds and precipitation, **Science**, 329, 1513-1516, 2010.
- Musat, N., Halm, H., **Winterholler, B.**, Hoppe, P., Peduzzi, S., Hillion, F., Horreard, F., Amann, R., Jørgensen, B. B., Kuypers, M. M.M., A single cell view on the ecophysiology of anaerobic phototrophic bacteria. **Proceedings of the National Academy of Science of the United States of America**, 105, 17861-17866, 2008.



Research Interests

Poor air quality over the Indo Gangetic Plain has become a matter of public debate and concern. Our research group works on improving air quality action plans by conducting source apportionment studies (Pallavi et al., 2019), deploying low cost air pollution sensors (Pawar and Sinha 2020) and developing emission inventories (Sharma et al., 2019). We also seek to understand the impact of air pollution on vegetation.

We also use sophisticated single particle techniques such as Scanning Electron Microscopy, Atomic Force Microscopy and Nano Secondary Ion Mass Spectrometry aim to understand the effect of aerosol surface properties and mixing state on initiating and sustaining rainfall (Pöschl et al. 2010, Pöhlker et al. 2012) and on the direct climate forcing of aerosol. We investigate multiphase and heterogeneous reactions taking place on the surface of aerosol particles (Harris et al. 2013) with the purpose of improving global climate model predictions of secondary inorganic (Harris et al. 2013) and secondary organic particle formation (Pöschl et al. 2010).



Joined March 2017

Anoop Ambili



Assistant Professor

M.Sc., Pondicherry Central University, Pondicherry, India, 2007

Ph.D., University of Potsdam, Potsdam, Germany, 2013

PostDoc, German Research Center for Geoscience (GFZ Potsdam), Germany, 2013-2014

PostDoc, Indian Institute of Science Education and Research Kolkata, 2014-2015

Inspire Faculty, Indian Institute of Science Education and Research Mohali, 2015-2017

Dr. Anoop Ambili is guiding/has guided 4 Ph.D students and 7 M.Sc. thesis students

Selected Publications

- Misra, S, Bhattacharya, S., Mishra, P.K., Misra, K.G., Agrawal, S., **Anoop, A.**, Vegetational responses to monsoon variability during Late Holocene: Inferences based on carbon isotope and pollen record from the sedimentary sequence in Dzukou valley, NE India, *Catena* 194, Article number 104697, 2020.
- Mishra, P.K., Ankit, Y., Gautam, P.K., C.G., L., Singh, P., **Anoop, A.**, Inverse relationship between south-west and north-east monsoon during the late Holocene: Geochemical and sedimentological record from Ennamangalam Lake, southern India, *Catena* 182, Article number 104117, 2019.
- Mishra, P.K., Chauhan, P.R., Diwate, P., Parth, S., **Anoop, A.**, Holocene climate variability and cultural dynamics in the Indian subcontinent, *Episodes* 43 (1), 552-562, 2020.
- Ankit, Y., Mishra, Praveen K., Kumar, P., Jha, Deepak K., Kumar, Vivek V., Ambili, V., **Anoop, A.**, 2017. Molecular distribution and carbon isotope of n-alkanes from Ashtamudi Estuary, South India: Assessment of organic matter sources and paleoclimatic implications. **Marine Chemistry**, 196, Pages 62-70, 2017
- Prasad, S., **Anoop, A.**, et al., Prolonged monsoon droughts and links to Indo-Pacific warm pool: a Holocene record from Lonar Lake, Central India. **Earth and Planetary Science Letters** 391, 171-182, 2014. (Top 2% cited)
- Anoop, A.**, Prasad, S., Plessen, B., Naumann, R., Menzel, P., Basavaiah, N., Weise, S., Gaye, B., Brauer, A., Palaeoenvironmental implications of evaporative Gaylussite crystals from Lonar Lake, Central India. **Journal of Quaternary Science** 28 (4), 349-359, 2013. (Top 10% cited)
- Anoop, A.**, Prasad, S., Basavaiah, N., Brauer, A., Shahzad, F., Deenadayalan K., Tectonic versus climate influence on landscape evolution: a case study from the upper Spiti valley, NW Himalaya. **Geomorphology** 145-146, 32-44, 2012. (Top 25% cited)

Research Interests

Our research is aimed at multi-proxy paleoclimate reconstruction, with special focus on developing transfer functions for quantification of climate variability and understanding the impact of climate change on different components of the geo-ecosystems. We use lacustrine sediments from the Indian subcontinent as climate archives for deciphering past environmental changes. The developed paleoclimate dataset aims to improve the understanding of monsoon variability and the complex forcing mechanisms (solar insolation, internal teleconnections for e.g., El Niño-Southern Oscillation, tropical-midlatitude interactions).

A combination of geomorphic, sedimentological, geochemical, biomarker (*n*-alkane) in conjunction with isotopic data is used to understand the Holocene paleoclimate fluctuations. We are currently working on lacustrine sediments (e.g. Ahansar Lake, Kashmir valley; Ashtamudi Estuary, Kerala; Rushikulya

continental shelf sediments; Ennamangalam Lake, Tamil Nadu) from various climate sensitive zones of Indian subcontinent. We perform modern calibration approach to identify proxies that are sensitive to environmental changes and use the identified proxies to generate long-term high-resolution palaeoclimate data.

Research Highlights

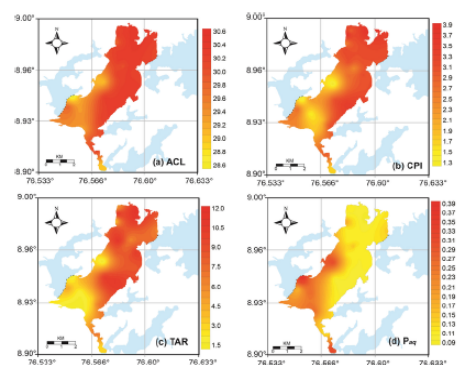


Fig.1. Spatial distribution of *n*-alkane indices (a) ACL, (b) CPI, (c) TAR and (d) P_{aq} .

- Baseline information on *n*-alkanes and carbon isotope in Ashtamudi Estuary sediments.
- Estimation of terrigenous versus recycled Organic Matter.
- Estimation of terrigenous versus aquatic productivity.
- Quantitative apportionment of organic matter sources in Ashtamudi sediments using End-member modelling of compound-specific carbon isotope values.
- The modern calibration from Ashtamudi Estuary provides potential in using *n*-alkane distribution in conjunction with carbon isotope as part of a high-resolution multi-proxy paleoclimate reconstruction from the region.

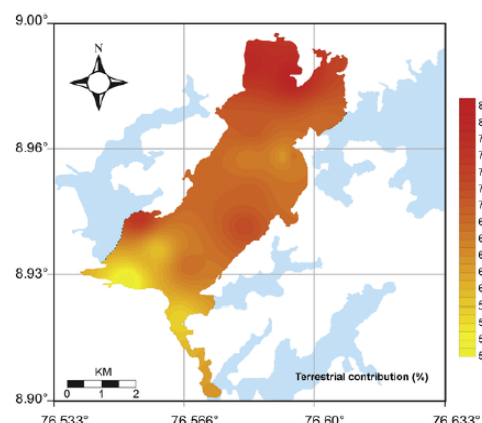


Fig.2. Spatial representation of terrigenous contribution in Ashtamudi Estuary based on the end member modelling of compound specific $\delta^{13}C$ values.

Ankit, Y., Prem, K., Mishra, P.K., Anoop, A., 2017. Molecular distribution and carbon isotope of *n*-alkanes from Ashtamudi Estuary, South India: Assessment of organic matter source and paleoclimatic implications. *Marine Chemistry*. (doi.org/10.1016/j.marchem.2017.08.002)

Sunil A Patil



Assistant Professor

M.Sc., Shivaji University, Kolhapur, 2005

Ph.D*, S.P. Pune University, Pune, 2011

*DAAD doctoral scholar at TU Braunschweig, Germany, 2008-2010

Marie Skłodowska-Curie postdoc, Lund University, Sweden, 2011-2012

Marie Skłodowska-Curie fellow, Ghent University, Belgium, 2013-2016

Senior Alexander von Humboldt fellow, TU Braunschweig, Germany, 2016-2017

Dr. Sunil is guiding/has guided 5 doctoral & 8 M.S. thesis students

Selected Publications

- Chiranjeevi P. and **Patil S.A.** Strategies for improving the electroactivity and specific metabolic functionality of microorganisms for various microbial electrochemical technologies. **Biotechnology Advances**, 39, 107468. 2020
- Yadav R.K., Chiranjeevi P., Sukrampal and **Patil S.A.** Integrated drip hydroponics-microbial fuel cell system for wastewater treatment and resource recovery. **Bioresource Technology Reports**, 9, 100392. 2020
- Moss, C., **Patil S.A.**, and Schröder, U. Scratching the surface – How decisive are microscopic surface structures on growth and performance of electrochemically active bacteria? **Frontiers in Energy Research** 7, Article 18. 2019
- Chen S., **Patil S.A.**, Brown R.K., Schröder U. Strategies for optimizing the power output of microbial fuel cells: Transitioning from fundamental studies to practical implementation, **Applied Energy**, 233, 15-28. 2019
- Arends, J.B.A., **Patil, S.A.**, Roume, H. and Rabaey, K. Continuous long-term electricity-driven bioproduction of carboxylates and isopropanol from CO₂ with a mixed microbial community. **Journal of CO₂ Utilization**, 20, 141–149. 2017
- **Patil, S.A.**, Arends, J.B.A., Vanwonterghem, I., van Meerbergen, J., Guo K., Tyson, G.W. and Rabaey, K. Selective enrichment establishes a stable performing community for microbial electrosynthesis of acetate from CO₂. **Environmental Science and Technology**, 49, 8833-8843. 2015
- **Patil, S.A.**, Gildemyn, S., Pant, D., Zengler, K., Logan, B.E. and Rabaey, K. A logical data representation framework for electricity-driven bioproduction processes. **Biotechnology Advances**, 33, 736-744. 2015
- **Patil, S.A.**, Górecki, K., Hägerhäll, C. and Gorton, L. Cisplatin-induced elongation of *Shewanella oneidensis* MR-1 cells improves microbe–electrode interactions for use in microbial fuel cells. **Energy and Environmental Science**, 6, 2626–2630. 2013
- Millo, D., Harnisch F., **Patil, S.A.**, Schröder, U., Hildebrandt, P. In situ spectroelectrochemical investigation of electrocatalytic microbial biofilms by surface-enhanced resonance Raman spectroscopy. **Angewandte Chemie International Edition**, 50(11), 2625-2627. 2011
- **Patil, S.**, Harnisch, F. and Schröder, U., Toxicity response of electroactive microbial biofilms- a decisive feature for potential biosensor and power source applications. **ChemPhysChem**, 11, 2834–2837, 2010.
- **Patil, S. A.**, Harnisch, F., Kapadnis, B. and Schröder, U., Electroactive mixed culture biofilms in microbial bioelectrochemical systems: The role of temperature for biofilm formation and performance. **Biosensors and Bioelectronics**, 26, 803–808, 2010.

Research Interests

Our research activities are aimed at advancing the understanding of Electromicrobiology, a new sub-discipline of Environmental Microbiology, and contributing to the development of sustainable biotechnologies for the valorization of liquid and gaseous wastes. To this end, we use highly interdisciplinary microbial electrochemistry approaches wherein microbial respiratory and metabolic reactions are linked to the electrodes or conductive materials in bioelectrochemical systems. In addition to the anaerobic microbiology and electrochemistry toolkit, we use microscopy, metagenomics, bioengineering, and analytical tools and techniques routinely in our research.

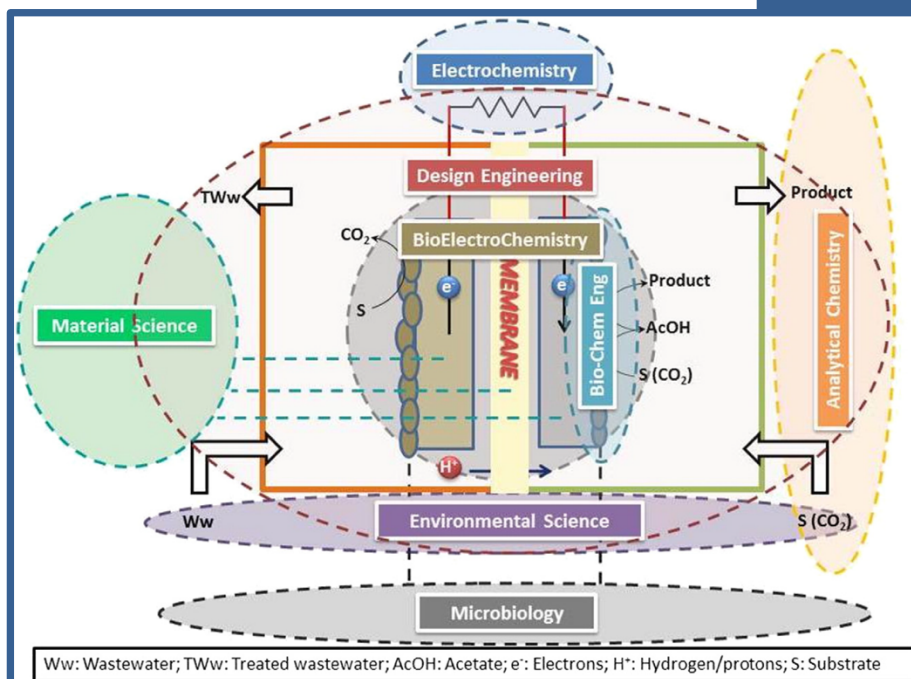


Figure 1. An overview of the key aspects of microbial (bio)electrochemical systems, spanning across various disciplines. (Patil et al. Biotechnology Advances, 2015, 33, 736-744).



For more details on our research activities, please refer to

<http://14.139.227.202/Faculty/eemblab/research.html>

Raju Attada



Assistant Professor

M.Sc., Andhra University, Visakhapatnam, India, 2008

Ph.D., Indian Institute of Tropical Meteorology, Pune, India, 2015

Postdoctoral Researcher, King Abdullah University of Science & Technology (KAUST), Saudi Arabia, 2015-2019

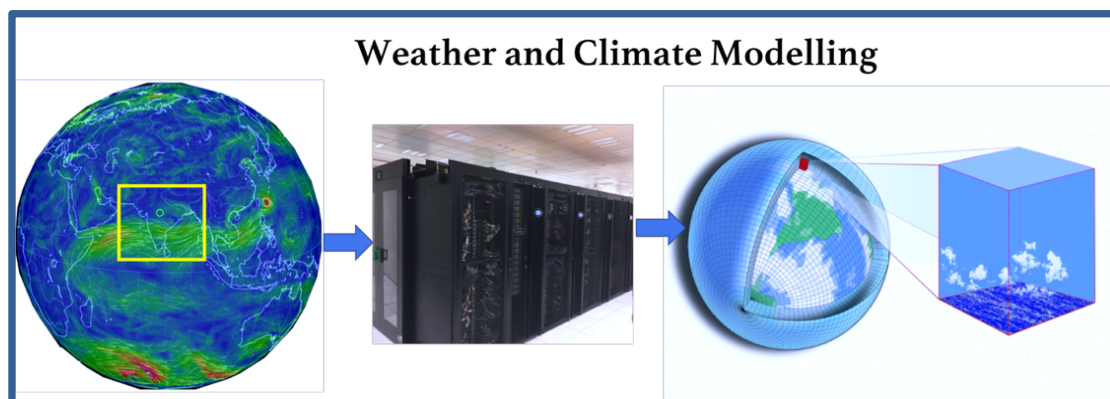
Dr. Raju is guiding 1 Postdoctoral and 1 Ph.D & 2 M.S. thesis students

Selected Publications

- **Raju Attada**, Hari Prasad Dasari, Ravi Kumar Kunchala, Sabique Langodan, Niranjan Kumar Kondapalli, Omar Knio and Ibrahim Hoteit. Evaluating Cumulus Parameterization Schemes for the Simulation of Arabian Peninsula Winter Rainfall. *J. Hydrometeor.*, 21, 1089–1114, 2020
- **Raju Attada**, Prashant Kumar, Anant Parekh, Ravi Kumar K, C. Nagaraju, J. S. Chowdary and Nagarjuna D, (2019) Evaluation of Upper Tropospheric Humidity in WRF Model during Indian Summer Monsoon. *Asia-Pacific Journal of Atmospheric Sciences*, doi:10.1007/s13143-018-0090-3.
- **Raju Attada**, Anant Parekh, J. S. Chowdary and C. Gnanaseelan, (2018a) Reanalysis of the Indian Summer Monsoon: Four-dimensional data assimilation of AIRS retrievals in a regional data assimilation and modeling framework. *Climate Dynamics*, DOI 10.1007/s00382-017-3781-z.
- **Raju Attada**, Hari Prasad Dasari, Anant Parekh, J. S. Chowdary, Sabique Langodan, Omar Knio and Ibrahim Hoteit, (2018b) The Role of the Indian Summer Monsoon Variability on Arabian Peninsula Summer Climate. *Climate Dynamics*, 50:2905–2923.
- **Raju Attada**, Hari Prasad Dasari, J. S. Chowdary, Ramesh Kumar Yadav, Omar Knio and Ibrahim Hoteit, (2018c) Surface Air Temperature Variability over the Arabian Peninsula and its Links to Circulation Patterns. *International Journal of Climatology*, 1–20, <https://doi.org/10.1002/joc.5821>.
- **Raju Attada**, Prashant Kumar and Hari Prasad, (2018d) Assessment of land surface models in a high resolution atmospheric model during Indian Summer Monsoon. *Pure and Applied Geophysics*, <https://doi.org/10.1007/s00024-018-1868-z>.
- **Raju Attada**, Anant Parekh, J. S. Chowdary and C. Gnanaseelan, (2015a) Assessment of the Indian summer monsoon in the WRF regional climate model. *Climate Dynamics*, Volume 44, Issue 11, 3077-3100.
- **Raju Attada**, Anant Parekh, Prashant Kumar and C. Gnanaseelan, (2015b) Evaluation of the impact of AIRS profiles on prediction of Indian summer monsoon using WRF variational data assimilation system. *Journal of Geophys. Res. Atmos.*, 120, DOI: 10.1002/2014JD023024.

Research Interests

Atmospheric processes and climate change take place on a wide range of spatial scales from global to regional and local scales. Our group aims at analyzing, simulating and predicting the regional weather and climate aspects, including extremes, over India using high-resolution climate models.



The high-resolution information will be beneficial for climate assessments, to study the impacts of climate change on human and natural systems, and to develop national adaptation and mitigation strategies. The group is also focusing on understanding the regional/local weather and climate phenomena, and their variability and changes, through dynamical downscaling and analysis of observations. We are also working on developing cloud-resolving modelling systems of mesoscale convective systems and their predictions at seasonal scales, and the future projections of extremes at regional and local scales. Our group research activities at IISERM also involve advanced data assimilation techniques to improve the simulations and forecast of regional weather extremes, including rainfall and dust storms. We are also interested in prediction of meteorological variables using Machine learning approaches.



From left: Raju, Krishna Kumar, Nischal Sharma, Abhishek Kumar, Deepanshu

Sharmila Bhattacharya



Inspire Faculty

B.Sc. Geology, Presidency College, Kolkata, 2007

M.Sc. Applied Geology, Presidency College, Kolkata, 2009

Ph.D. Organic Geochemistry, IIT Bombay, 2015

D. S. Kothari Fellow, University of Calcutta, 2017

Selected Publications

- Misra, S., **Bhattacharya, S.**, Mishra, P.K., Misra, K.G., Agrawal, S., Anoop, A., 2020. Vegetational responses to monsoon variability during Late Holocene: Inferences based on carbon isotope and pollen record from the sedimentary sequence in Dzukou valley, NE India. **Catena** 194, 104697.
- Tewari, A., D’Rozario, A., **Bhattacharya, S.**, Barua, A., Bera, M., Bera, S., Dutta, S., 2019. Biomarker signatures of iconic Glossopteris plant. **Palaeogeography, Palaeoclimatology, Palaeoecology** 531, Part B, 108887.
- **Bhattacharya, S.**, Khan, M.A., More, S., Paruya, D.K., Chakraborty, T., Bera, S., Dutta, S., 2018. Amber embalms essential oils: A rare preservation of volatile biological compounds in fossil resins from eastern Himalaya. **Palaaios** 33, 218–227.
- Dutta, S., Mehrotra, R.C., Paul, S., Tiwari, R.P., **Bhattacharya, S.**, Srivastava, G., Zoramthara, C., 2017. Remarkable preservation of terpenoids and record of volatile signalling in plant-animal interactions from Miocene amber. **Scientific Reports** 7, 1–6.
- **Bhattacharya, S.**, Dutta, S., Summons, R.E., 2017. A distinctive biomarker assemblage in Infra-Cambrian oil and sediment from western India: Molecular signatures of eukaryotic sterols and prokaryotic carotenoids. **Precambrian Research** 290, 101–112.
- **Bhattacharya, S.**, Dutta, S., 2015. Neoproterozoic-Early Cambrian biota and ancient niche: A synthesis from molecular markers and palynomorphs from Bikaner-Nagaur Basin, western India. **Precambrian Research** 266, 361–374.
- **Bhattacharya, S.**, Dutta, S., Dutta, R., 2014. Molecular fossils in Cretaceous condensate from western India. **Journal of Earth System Science** 123, 923–934.
- Dutta, S., **Bhattacharya, S.**, Raju, S.V., 2013. Biomarker signatures from Neoproterozoic-Early Cambrian oil, western India. **Organic Geochemistry** 56, 68–80.
- Chatterjee, A., **Bhattacharya, S.**, 2013. Identification of regional-scale cusped-lobate folds in Singhbhum region, India using satellite remote sensing. **Current Science** 104, 31–34

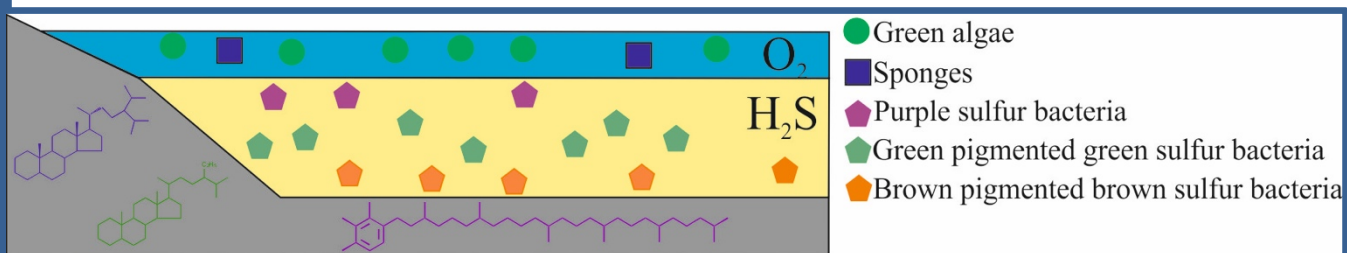
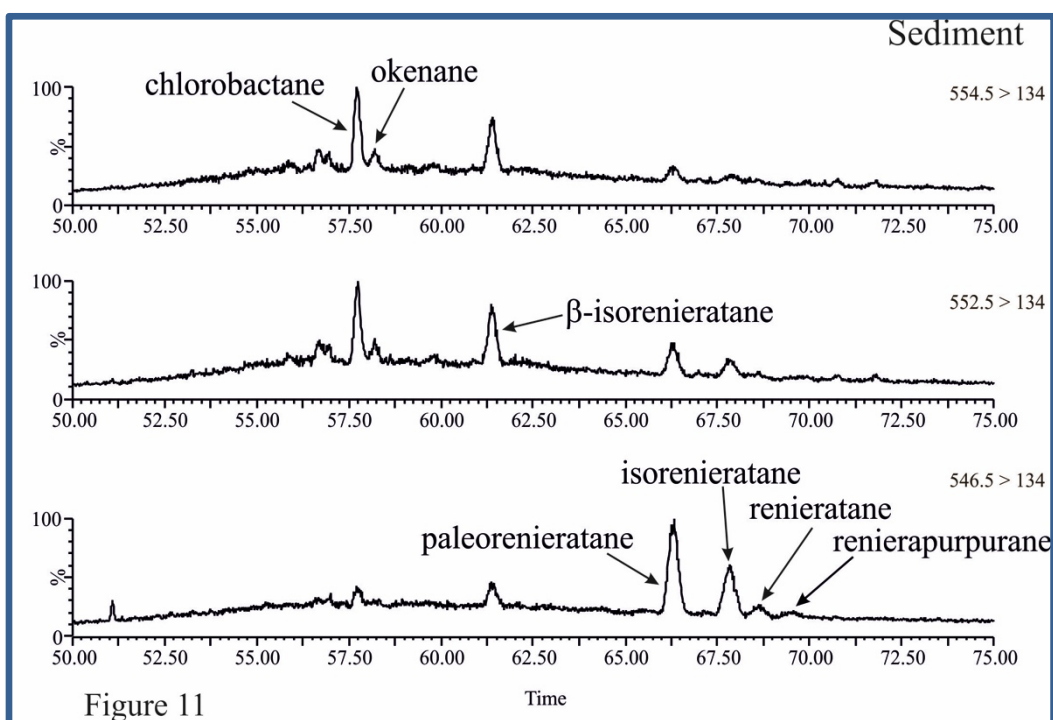
Research Interests

I am an organic geochemist and my fundamental research interest lies in deciphering the ancient biotic forms and palaeo-ecosystems. The “molecular organic fossils” (n-alkanes and terpenoids) and their stable isotopes are utilized to unravel a plethora of information spanning a diverse range of biota from microbes to complex flora and fauna and across the entire geological time scale. Over the last few decades, precise identification of hundreds of biomarkers and the isotopic compositions has significantly improved our understanding of the biogeochemical cycles of deep time on Earth. With the expanding database of organic compounds in soil and sediments, we are now using organic geochemical techniques for identifying pollutants and detrimental anthropogenic activities in the various environmental realms, particularly in lacustrine systems (Renuka and Rewalsar lakes, Himachal Pradesh).

A wide spectrum of natural organic products such as crude oil, coal, carbonaceous mudrocks, fossilized flora and ambers has been sampled from sedimentary basins in India. The various analytical techniques such as gas chromatography mass spectrometry (GC-MS), two dimensional gas chromatography time-of-flight mass spectrometry (GC×GC TOFMS), Rock-Eval Pyrolyzer, Fourier Transform Infrared (FTIR) Spectroscopy, Pyrolysis GC-MS (Pyro GC-MS), gas chromatography isotope ratio mass spectrometry (GC-IRMS) and multiple reaction monitoring (MRM) have been employed for the acquisition of data. The organic constituents (acyclic compounds and cyclic terpenoids) and stable carbon isotope data derived from the investigated samples provide information pertaining to ancient life forms and past operative processes on the planet elucidating marine biota and their palaeohabitats; characterizing the biological affinity of terrestrial vegetation; fluctuating biodiversity; ancient biosynthetic pathways; past redox potential and salinity; taphonomic alteration of deceased organic remains upon burial, diagenesis and catagenesis. The elucidation of the molecular structures in the sediments and correlation studies particularly shed light on the structural innovations of biota responding to the perpetually changing environmental conditions and offer broader perspective on the palaeobiogeography of the continents. Additionally, the biomarker dataset have been applied to develop insights of Petroleum Geochemistry such as crude oil-source rock correlation, thermal maturity of rocks and oil and degree of biodegradation thus fingerprinting the provenance and evolution of hydrocarbons over time which is valuable knowledge for practising geochemists in petroleum industries.

Research Highlights

- Molecular fossils reported from Infracambrian sequences from western India.
- This unique consortium was not recorded in other global Infracambrian successions.
- The molecular relicts aided in the reconstruction of the palaeowater column.



The distribution of carotenoid compounds in the aromatic hydrocarbon fractions in (sediment (RAC-A/B/D.LST/5) of Neoproterozoic-Early Cambrian Bikaner-Nagaur Basin sample. An array of biomarkers diagnostic for photic zone anoxia are detected in the oil and sediment samples. A graphical representation of the biota and habitat in the marine column and molecular fossils in the sediments is provided. Bhattacharya et al. (2017)

Details and Indices

Former Honorary, Adjunct & Visiting Faculty

Professor Ashok Sahni

Ex Department of Earth Sciences, Punjab University, Chandigarh

Former Inspire Faculty

Dr. V. Lakshmi Narayanan

Dr. Shubhra Sharma

Faculty – Research Support

Dr. Vinayak Sinha

Max Planck Research Partner Group (2011-2016)

Rs 119.37 Lakh

DST Climate Change with B. Sinha as Col(2017-2019)

Rs 151 Lakh

UGC Indo-Israel project (2018-2021)

Rs 141 Lakh

Dr. Barbel Sinha

NCAP-COALESCE (2016-2021)

Rs 106 Lakh

Dr. Anoop Ambili

INSPIRE Faculty Grant (2015-2020)

Rs 35 Lakh

MOEF-CC research grant with S. Bhattacharya as Col (2019-20.

Rs 40 Lakh

Dr. Sunil Patil

DBT research grant (2019-2022)

Rs 50.60 Lakh

SERB Start-up research grant (2019-2021)

Rs 32.27 Lakh

Dr. Sharmila Bhattacharya

INSPIRE Faculty grant (2018-2022)

Rs 35 lakhs

Dr. Shubhra Sharma

INSPIRE Faculty grant (2018-2022)

Rs 35 lakhs

Dr. V. Lakshmi Narayanan

INSPIRE Faculty Grant (2014-2017)

Rs 17.5 Lakh

Faculty - Recognitions

Dr. Vinayak Sinha

- **NASI-SCOPUS Young Scientist Award 2016:** in the subject area of Earth, Atmospheric and Oceanic Sciences
- **Best Teacher Award 2017** given by Indian Institute of Science Education and Research Mohali
- **Scientific Steering Committee (SSC) Member since 2015 and Co-chair** (since Sep 2017 SSC meeting held at Oxford) of **iLEAPS** (Integrated Land Ecosystem-Atmosphere Processes Study), an ICSU, WCRP and Future Earth Global Research Project
- **Scientific Steering Committee Member** (2019-2022) of the International Commission on Global Atmospheric Chemistry and Air Pollution (iCACGP) under the International Science Council.
- **Editor** (Subject: Atmospheric Chemistry and Physics) for **Earth System Science Data**, an international peer reviewed open access journal (I.F: 10.9 in 2020) published by EGU's Copernicus Publications, Gottingen, Europe

Dr. Baerbel Sinha

- **Scientific Steering Committee (SSC) Member** for the Tropospheric Ozone Assessment Report, Phase II (TOAR-II, 2020-2024) and International Global Atmospheric Chemistry Programme (IGAC) Program

Dr. Anoop Ambili

- Awarded INSPIRE Faculty position, India (2015 - 2020)

Dr. Sunil Patil

- **Guest Editor**, Special issue on "Microbial Electrochemical Technologies", Journal - Bioresource Technology Reports (Dec. 2019)
- **Founding Member**, Electrochemical Society in India (ECSI), Chandigarh Local Chapter (Nov. 2019)
- **Editorial board member:** Bioresource Technology Reports (since 2017)

Student - Recognitions

Chinmoy Sarkar (PhD scholar, EES, IISER Mohali)

- **Fulbright-Kalam Climate Fellowship** for Postdoctoral studies in USA

Ashish Kumar (PhD scholar, EES, IISER Mohali)

- **European Geosciences Union (EGU) Outstanding Student Poster Presentation (OSPP) award** in atmospheric sciences at the EGU General Assembly 2019 held in Vienna Austria.

Ankit Yadav (PhD scholar, EES, IISER Mohali)

- Awarded **VW-Stiftung travel grant** provided by Volkswagen Foundation in 2018.
- **Best presentation award** at summer school titled 'Stable Isotopes in Ancient and Contemporary Environments, University of Konstanz' in 2018.
- **International travel grant** from INQUA 2019 Congress Support to attend 20th INQUA Congress in Dublin, 2019.
- **International travel grant** by Helmholtz Centre Potsdam-GFZ German Research Centre for Geosciences to attend 5th International Young Earth Scientists (YES) Congress 2019 "Rocking Earth's Future" in Berlin, 2019.
- **Best presentation award** at 5th International Young Earth Scientists (YES) Congress 2019 "Rocking Earth's Future"

Vinod Kumar (PhD scholar, EES, IISER Mohali)

- **Alexander von Humboldt Postdoctoral Fellowship** for pursuing postdoctoral studies in Germany
- **INSPIRE fellowship** (2014-2018) for pursuing doctoral studies
- **International travel grant** from DST, to present a talk at iLEAPs Open Science Conference in Oxford, UK, 2017.
- **International travel grant** from Max Planck Institute for Chemistry, Mainz to take part in CINDI 2 field campaign in Cabauw, Netherlands, 2016.
- **First prize in poster presentation** in 7th national seminar on Synergistic Aspects of Chemistry and Other Sciences (SACOS) 2015, Punjabi University Patiala, India.
- [2014 International Journal of Mass Spectrometry Best Student Paper Award from Elsevier and American Society of Mass spectrometry](#)
- **Member of the organising committee for the International Integrated Land Ecosystem Atmosphere Processes Study (iLEAPS) Early-Career Scientist Workshop 10-12 May 2014, Nanjing, China.**
- **International Travel Grant** from Integrated Land Ecosystem-Atmosphere Process Study to participate in 4th iLEAPS science conference in Nanjing, China. 2014.
- **International Travel Grant** from International Centre for Integrated Mountain Development (ICIMOD) to participate in WRF-CHEM workshop in Kathmandu, Nepal and to present a talk at SARAS workshop in Pokhran, Nepal. 2014.

Lejish Vettikat (MSc thesis student, EES, IISER Mohali)

- **European Geosciences Union (EGU) Outstanding Student Poster Presentation (OSPP) award** in atmospheric sciences at the EGU General Assembly 2019 held in Vienna Austria.

B. Praphulla Chandra (PhD scholar, EES, IISER Mohali)

- **IGAC Early Career Travel Grant** to attend the IGAC Science Conference, 2016.
- **International Travel Grant** from Institute for Advanced Sustainability Studies (IASS), Potsdam to present a talk at European Geosciences Union (EGU) general assembly in Vienna, Austria, 2016.
- **International Travel Grant** from the German Federal Environment Agency and World Meteorological Organisation (WMO) to participate in the 29th GAWTEC Training Course, 2015.

- **Travel Grant** from Indian Institute of Science (IISc), Bangalore to present the poster at National Climate Science Conference” at IISc Bangalore, 2015.
- **International Travel Grant** from the Max Planck-DST project to present the poster at The Second Workshop on Atmospheric Composition and the Summer Monsoon (ACAM) and training school at Bangkok Thailand, 2015.

Abhishek Mishra (PhD scholar, EES, IISER Mohali)

- **International travel grant** from Atmospheric Composition and the Asian Monsoon (ACAM) to present a talk in The Third Workshop on Atmospheric Composition and the Asian Monsoon (ACAM) and Second ACAM Training School at Jinan University, Guangzhou, China, 2017.
- **International travel grant** from Max Planck Institute for chemistry, Mainz to take part in CINDI 2 field campaign in Cabauw, Netherlands, 2016.
- **2018 NCAR Advanced Study Program's Graduate Student (GVP) Fellowship** at National Center of Atmospheric Research (NCAR), Boulder USA.

Haseeb Hakkim (PhD scholar, EES, IISER Mohali)

- **First prize in poster presentation** in National Climate Science Conference, Divecha Centre for Climate Change, Indian Institute of Science (IISc), Bangalore, 2015

Harshitha Pawar (PhD scholar, EES, IISER Mohali)

- **Best poster presentation award** at National Climate Science Conference, IISc Bangalore, 2015
- **International travel grant** from International Centre for Integrated Mountain Development (ICIMOD) to participate and to present a talk at Second Workshop On Atmospheric Composition And The Asian Monsoon (ACAM)”, Bangkok (July 08-10, 2015).
- **International travel grant** from the American Geophysical Union for attending the AGU Fall meeting 2018, 10-14 December 2018 in Washington, D.C., U.S.A.

Pallavi (PhD scholar, EES, IISER Mohali)

- **International travel grant** from the American Geophysical Union for attending the AGU Fall meeting 2018, 10-14 December 2018 in Washington, D.C., U.S.A.

Gaurav Sharma (PhD scholar, EES, IISER Mohali)

- **International travel grant** from the American Geophysical Union for attending the AGU Fall meeting 2018, 10-14 December 2018 in Washington, D.C., U.S.A.

Ravi Kumar Yadav (PhD scholar, EES, IISER Mohali)

- **Best oral presentation award** at the SPARC-funded Indo-Belgian workshop on “Upscaling and field-scale application of bioelectrochemical systems for wastewater treatment and bioenergy recovery” held at IIT Kharagpur (26-27th Feb 2020).

Rashmi Kiran (PhD scholar, EES, IISER Mohali)

- **Travel grant** from the Biotech Research Society of India (BRSI) to present research work at the “International Conference on New Horizons in Biotechnology (NHBT) 2019” Trivandrum, Kerala (20-24 Nov 2019).

Sukrampal (PhD scholar, EES, IISER Mohali)

- **Travel grant** from the Biotech Research Society of India (BRSI) to present research work at the “International Conference on New Horizons in Biotechnology (NHBT) 2019” Trivandrum, Kerala (20-24 Nov 2019).

Moumita Roy (PhD scholar, EES, IISER Mohali)

- **Travel grant** from the Biotech Research Society of India (BRSI) to present research work at the “International Conference on New Horizons in Biotechnology (NHBT) 2019” Trivandrum, Kerala (20-24 Nov 2019).

Alumni – Current Position

M.Sc. Final year thesis students

Name	Batch	(M.Sc. Thesis guide) and current position
Apurv Saxena	MS07	(Dr. Vinayak Sinha) Faculty at Allen Career Institute
Vinod Kumar	MS08	(Dr. Vinayak Sinha) Ph.D. scholar at IISER Mohali
Himanchu Sachan	MS08	(Dr. Baerbel Sinha) Assistant Manager, Canara Bank
Prabhanjan Borwankar	MS08	(Dr. Baerbel Sinha) Software Engineer, Light Information Systems
Yash Maurya	MS09	(Dr. Vinayak Sinha) Marketing officer, Gujarat Gas Limited
Harshita Pawar	MS10	(Dr. Vinayak Sinha) Ph.D. scholar at IISER Mohali
Haseeb Hakim	MS10	(Dr. Vinayak Sinha) Ph.D. scholar at IISER Mohali
Tess George	MS11	(Dr. Baerbel Sinha) Ph.D. scholar at IISER Mohali
Vaishali Vardhan	MS11	(Dr. Baerbel Sinha) Ph.D. scholar at Forschungszentrum Jülich, Germany
Bharti Sophaul	MS12	(Dr. Vinayak Sinha) Postgraduate student, Sheridan College, Canada.
Mohammad Shabin	MS12	(Dr. Vinayak Sinha) Ph.D. scholar at IISER Mohali
Ankit Yadav	MS12	(Dr. Anoop Ambili) Ph.D. scholar at IISER Mohali
Nimya S.S.	MS12	(Dr. Baerbel Sinha) Ph.D. scholar at IITM Pune
Ebin George	MS12	(Dr. Baerbel Sinha) Assistant branch manager, SBI
Sunil Kumar	MS13	(Dr. Anoop Ambili) Ph.D. scholar at IISER Mohali
Shah Parth Dharmendrabhai	MS13	(Dr. Anoop Ambili) Ph.D. scholar Haifa University, Israel
Aditya Kumar Singh	MS13	(Dr. Baerbel Sinha) Junior Associate, SBI
Kalik Kumar Vishisth	MS13	(Dr. Vinayak Sinha) Ph.D. scholar at IITM Pune
Abhishek Verma	MS13	(Dr. Vinayak Sinha) Faculty at Allen Career Institute
Lejish V P	MS14	(Dr. Vinayak Sinha) Ph.D. scholar University of Eastern Finland
Ravi Kumar Yadav	MS14	(Dr. Sunil Patil) Ph.D. scholar at IISER Mohali
Ravineet Yadav	MS14	(Dr. Sunil Patil) Ph.D. scholar at IISER Mohali

Ph.D. students

Name	year	(Ph.D. supervisor) and current position
Dr. Chinmoy Sarkar	2016	(Dr. Vinayak Sinha) Postdoctoral Research Fellow at the University of California, Irvine.
Dr. Vinod Kumar	2018	(Dr. Vinayak Sinha) Alexander von Humboldt Postdoctoral Fellow, Max Planck Institute for Chemistry, Germany
Dr. Prafulla Boggarapu Chandra	2018	(Dr. Vinayak Sinha) Postdoctoral Research Associate at the University of Washington, USA
Dr. Saryu Garg	2018	(Dr. Baerbel Sinha) Science Educator, Punjab, India

Publications from the Department

IISER Mohali authors bold, Publications until June 2020 are listed

2020

1. **Raju Attada**, Hari Prasad Dasari, Ravi Kumar Kunchala, Sabique Langodan, Niranjana Kumar Kondapalli, Omar Knio and Ibrahim Hoteit. Evaluating Cumulus Parameterization Schemes for the Simulation of Arabian Peninsula Winter Rainfall. *J. Hydrometeorol.*, 21, 1089–1114, 2020.
2. **Chiranjeevi P. and Patil S.A.** Strategies for improving the electroactivity and specific metabolic functionality of microorganisms for various microbial electrochemical technologies. *Biotechnology Advances*, 39, 107468. 2020.
3. **Kumar R., Sukrampal and Patil. S.A.** Bioanode-assisted removal of Hg^{2+} at the cathode of microbial fuel cells. *Journal of Hazardous, Toxic, and Radioactive Waste*, 24(4), 04020034:1-6, 2020
4. **Yadav R.K., Chiranjeevi P., Sukrampal and Patil S.A.,** Integrated drip hydroponics-microbial fuel cell system for wastewater treatment and resource recovery. *Bioresource Technology Reports*, 9, 100392, 2020.
5. Zhao, W., Fu, W., Chen, S., Xiong, H., Lan, L., Jiang, M., **Patil, S.A.**, Chen, S., High-capacitance bioanode circumvents bioelectrochemical reaction transition in the voltage-reversed serially-stacked air-cathode microbial fuel cell, *Journal of Power Sources*, Volume 468, Article number 228402, 2020.
6. **Pawar, H. and Sinha B.** Humidity, density, and inlet aspiration efficiency correction improve accuracy of a low-cost sensor during field calibration at a suburban site in the north-western Indo-Gangetic Plain (NW-IGP). *Journal of Aerosol Science and Technology*, Volume 54(6), 685-703, 2020.
7. **Vettikkat, L., Sinha, V., Datta, S., Kumar, A., Hakkim, H., Yadav, P., and Sinha, B.** Significant emissions of dimethyl sulfide and monoterpenes by big-leaf mahogany trees: discovery of a missing dimethyl sulfide source to the atmospheric environment, *Atmos. Chem. Phys.*, 20, 375–389, <https://doi.org/10.5194/acp-20-375-2020>, 2020.
8. Misra, S., **Bhattacharya, S.**, Mishra, P.K., Misra, K.G., Agrawal, S., **Anoop, A.**, Vegetational responses to monsoon variability during Late Holocene: Inferences based on carbon isotope and pollen record from the sedimentary sequence in Dzukou valley, NE India, *Catena* 194, Article number 104697, 2020.
9. Shukla, A.D., **Sharma, S.**, Rana, N., Bisht, P., Juyal, N., Optical chronology and climatic implication of glacial advances from the southern Ladakh Range, NW Himalaya, India, *Palaeogeography, Palaeoclimatology, Palaeoecology* 539, Article number 109505, 2020.
10. Mishra, P.K., **Chauhan, P.R.**, Diwate, P., **Parth, S., Anoop, A.**, Holocene climate variability and cultural dynamics in the Indian subcontinent, *Episodes* 43 (1), 552-562, 2020.
11. Kulkarni, S.H., Ghude, S.D., Jena, C., Karumuri, R.K., **Sinha, B., Sinha, V.**, Kumar, R., Soni, V.K., Khare, M., How Much Does Large-Scale Crop Residue Burning Affect the Air Quality in Delhi?, *Environmental science & technology* 54, 4790-4799, 2020.
12. Kreher, K., Roozendaal, M. V., Hendrick, F., Apituley, A., Dimitropoulou, E., Frieß, U., Richter, A., Wagner, T., Abuhassan, N., Ang, L., Anguas, M., Bais, A., Benavent, N., Bösch, T., Bogner, K., Borovski, A., Bruchkouski, I., Cede, A., Chan, K. L., Donner, S., Drosoglou, T., Fayt, C., Finkenzeller, H., Garcia-Nieto, D., Gielen, C., Gómez-Martín, L., Hao, N., Herman, J. R., Hermans, C., Hoque, S., Irie, H., Jin, J., Johnston, P., Butt, J. K., Khokhar, F., Koenig, T. K., Kuhn, J., Kumar, V., Lampel, J., Liu, C., Ma, J., Merlaud, A., **Mishra, A. K.**, Müller, M., Navarro-Comas, M., Ostendorf, M., Pazmino, A., Peters, E., Pinardi, G., Pinharanda, M., PETERS, A., Platt, U., Postolyakov, O., Prados-Roman, C., Puente-dura, O., Querel, R., Saiz-Lopez, A., Schönhardt, A., Schreier, S. F., Seyler, A., **Sinha, V.**, Spinei, E., Strong, K., Tack, Tian, X., Tiefengraber, M., Tirpitz, J., Gent J. V., Volkamer, R., Vrekoussis, M., Wang, S., Wang, Z., Wenig, M., Wittrock, F., Xie, P. H., Xu, J., Yela, M., Zhang, C. and Zhao, X., Intercomparison of NO₂, O₄, O₃ and HCHO slant column measurements by MAX-

DOAS and zenith-sky UV-Visible spectrometers during the CINDI-2 campaign, *Atmos. Meas. Tech.* 13, 2169–2208, <https://doi.org/10.5194/amt-13-2169-2020>, 2020.

13. **Chiranjeevi P. and Patil S.A.**, Microbial fuel cell coupled with microalgae cultivation for wastewater treatment and energy recovery. In *Integrated Microbial Fuel Cells for Wastewater Treatment*, 213-227, Publisher- Elsevier, 2020.
14. **Sukrampal, Kumar R. and Patil S.A.**, Removal of heavy metals using bioelectrochemical systems. In *Integrated Microbial Fuel Cells for Wastewater Treatment*, 49-71, Publisher – Elsevier, 2020.

2019

15. K. Ravi Kumar, **Raju Attada**, Hari Prasad Dasari, Ramesh K. Vellore, Yasser O. Abualnaja, Ashok Karumuri and Ibrahim Hoteit. On the Recent Amplification of Dust over the Arabian Peninsula during 2002-2012. *Journal of Geophys. Res. Atmos.*, 124, 13220-13229, 2019.
16. **Hakkim, H., Sinha, V., Chandra, B. P., Kumar, A., Mishra, A. K., Sinha, B., Sharma, G., Pawara, H., Sohpaal, B., Ghude, S. D., Pithani, P., Kulkarni, R., Jenamani, R. K., Rajeevan, M.**, Volatile organic compound measurements point to fog-induced biomass burning feedback to air quality in the megacity of Delhi, *Science of the Total Environment*, 689, 295-305, 2019.
17. **Pallavi, Sinha, B. and Sinha, V.**, Source apportionment of volatile organic compounds in the north-west Indo-Gangetic Plain using positive matrix factorisation model, *Atmos. Chem. Phys.*, 19, 15467–15482, <https://doi.org/10.5194/acp-19-15467-2019>, 2019.
18. **Sharma, G., Sinha, B., Pallavi, Hakkim, H., Chandra, B. P., Kumar, A. and Sinha, V.**, Gridded emissions of CO, NO_x, SO₂, CO₂, NH₃, HCl, CH₄, PM_{2.5}, PM₁₀, BC and NMVOC from open municipal waste burning in India, *Environ. Sci. Technol.*, 53, 9, 4765-4774, 2019.
19. **Kiran R. and Patil S.A.**, Microbial electroactive biofilms, In *Introduction to Biofilm Engineering*, Chapter 8, pp 159-186, ACS Symposium Series, Vol. 1323, Publisher – ACS, 2019.
20. **Chiranjeevi P., Bulut M. Breugelmans T., Patil S.A. and Pant, D.**, Current Trends in Enzymatic Electrosynthesis for CO₂ Reduction. *Current Opinion in Green and Sustainable Chemistry* 16, 65-70, 2019.
21. **Patil, S.A.**, Schievano, A., Santoro, C., Pant, D., Preface - Microbial electrochemical technologies, *Bioresource Technology Reports* 8, Article number 100336., 2019.
22. Rana, N., **Sharma, S.**, Ali, S.N., Singh, S., Shukla, A.D., Investigating the sensitivity of glaciers to climate variability since the MIS-2 in the upper Ganga catchment (Saraswati valley), *Central Himalaya, Geomorphology* 346, Article number 106854, 2019.
23. Chen S., **Patil S.A.**, Brown R.K., Schröder U., Strategies for optimizing the power output of microbial fuel cells: Transitioning from fundamental studies to practical implementation, *Applied Energy* 233, 15-28, 2019.
24. Moss, C., **Patil S.A.**, and Schröder, U., Scratching the surface – How decisive are microscopic surface structures on growth and performance of electrochemically active bacteria? *Frontiers in Energy Research* 7 (Article 18), 1-10, 2019.
25. Mishra, P.K., **Parth, S., Ankit, Y., Kumar, S., Ambili, V., Kumar, V.V., Singh, S., Anoop, A.**, Geochemical and sedimentological characteristics of surface sediments from Ashtamudi Estuary, Southern India: implications for provenance and modern sedimentary dynamics, *Environmental Earth Sciences* 78(14), Article number 395, 2019.
26. Sati, S.P., **Sharma, S.**, Rana, N., Dobhal, H., Juyal, N., Environmental implications of Pancheshwar dam in Uttarakhand (Central Himalaya), India, *Current Science* 116 (9), 1483-1489, 2019.
27. Chen S., Brown R.K., **Patil S.A.**, Huber K.J., Overmann J., Schröder U., Aerobic microbial electrochemical technology based on the coexistence and interactions of aerobes and exoelectrogens for synergistic pollutant removal from wastewater, *Environmental Science: Water Research and Technology* 5, 60-69, 2019.
28. Mishra, P.K., **Ankit, Y.**, Gautam, P.K., C.G., L., Singh, P., **Anoop, A.**, Inverse relationship between south-west and north-east monsoon during the late Holocene: Geochemical and sedimentological record from Ennamangalam Lake, southern India, *Catena* 182, Article number 104117, 2019.

29. David, L. M., Ravishankara, A. R., Brewer, J.F., Sauvage, B., Thouret, T., Venkataramani, S. and **Sinha, V.**, Tropospheric ozone over the Indian subcontinent from 2000 to 2015: Data set and simulation using GEOS-Chem chemical transport model, *Atmospheric Environment*, 219, 2019.
30. Rivera I., Schröder U. and **Patil S.A.**, Microbial Electrolysis for Biohydrogen Production: Technical Aspects and Scale-Up Experiences, In *Microbial Electrochemical Technology: Sustainable Platform for Fuels, Chemicals and Remediation*, Pages 871-898, Publisher – Elsevier, 2019.
31. Mateos R., Escapa A., Vanbroekhoven K., **Patil S.A.**, Moran A. and Pant, D., Microbial Electrochemical Technologies for CO₂ and Its Derived Products Valorization, In *Microbial Electrochemical Technology: Sustainable Platform for Fuels, Chemicals and Remediation*, 2019, Pages 777-796, Publisher – Elsevier. 2019.

2018

32. **Sharma, S.**, Shukla, A.D., Factors governing the pattern of glacier advances since the Last Glacial Maxima in the transitional climate zone of the Southern Zaskar Ranges, NW Himalaya, *Quaternary Science Reviews* 201, 223-240, 2018.
33. **Kumar, V., Chandra, B. P., Sinha, V.**, Large unexplained suite of chemically reactive compounds present in ambient air due to biomass fires, *Scientific Reports*, 8, 626, <https://www.nature.com/articles/s41598-017-19139-3>, 2018.
34. **Chandra, B. P., Sinha, V., Hakkim, H., Kumar, A., Pawar, H., Mishra, A. K., Sharma, G., Pallavi, Garg, S.**, Ghude, S. D., Chate, D. M, Pithani, P., Kulkarni, R., Jenamani, R. K., and Rajeevan, M., Odd-even traffic rule implementation during winter 2016 in Delhi did not reduce traffic emissions of VOCs, carbon dioxide, methane and carbon monoxide, *Current Science*, 114, 6, 1318-1325, 2018.
35. **Sharma, S.**, Hussain, A., Mishra, A.K., Lone, A., Solanki, T., Khan, M.K., Geomorphic investigation of the late-quaternary landforms in the southern Zaskar Valley, NW Himalaya, *Journal of Earth System Science* 127(1), Article number 9, 2018.
36. Pillai, A.A.S., **Anoop, A.**, Prasad, V., Manoj, M.C., Varghese, S., Sankaran, M., Ratnam, J., Multi-proxy evidence for an arid shift in the climate and vegetation of the Banni grasslands of western India during the mid- to late-Holocene, *Holocene* 28 (7), 1057-1070. 2018.
37. Wu, S., **Patil, S.A.** and Chen S., Auto-feeding microbial fuel cell inspired by transpiration of plants. *Applied Energy* 225, 934-939, 2018.
38. Chen S., **Patil S.A.**, Schröder U., Substrate Crossover Effect and Performance Regeneration of the Biofouled Rotating Air-Cathode in Microbial Fuel Cell, *Frontiers in Energy Research* 6 (Article 85), 1-7, 2018.
39. Chen S., **Patil, S.A.** and Schröder U., A high-performance rotating graphite fiber brush air-cathode for microbial fuel cells. *Applied Energy*, 211, 1089-1094, 2018.
40. Sonawane, J.M., **Patil, S.A.**, Ghosh, P.C. and Adeboju, S.B., Low-cost stainless-steel wool anodes modified with polyaniline and polypyrrole for high-performance microbial fuel cells. *Journal of Power Sources*, 389, 103-114, 2018.
41. Mishra, P.K., Prasad, S., Marwan, N., **Anoop, A.**, Krishnan, R., Gaye, B., Basavaiah, N., Stebich, M., Menzel, P., Riedel, N., Contrasting pattern of hydrological changes during the past two millennia from central and northern India: Regional climate difference or anthropogenic impact?, *Global and Planetary Change* Volume 161, 97-107, 2018.
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Publications with undergraduate co-authors (bold)

2020

1. Mishra, P.K., Chauhan, P.R., Diwate, P., **Parth, S.**, Anoop A. Holocene climate variability and cultural dynamics in the Indian subcontinent. *Episodes*, 43(1): 552-562, 2020.
2. **Vettikkat, L.**, Sinha, V., Datta, S., Kumar, A., Hakkim, H., **Yadav, P.**, and Sinha, B., Significant emissions of dimethyl sulfide and monoterpenes by big-leaf mahogany trees: discovery of a missing dimethyl sulfide source to the atmospheric environment, *Atmos. Chem. Phys.*, 20, 375–389, <https://doi.org/10.5194/acp-20-375-2020>, 2020.
3. **Kumar R.**, Sukrampal and Patil. S.A. Bioanode-assisted removal of Hg²⁺ at the cathode of microbial fuel cells. *Journal of Hazardous, Toxic, and Radioactive Waste*, 24(4), 04020034:1-6, 2020.
4. **Yadav R.K.**, Chiranjeevi P., Sukrampal and Patil S.A., Integrated drip hydroponics-microbial fuel cell system for wastewater treatment and resource recovery. *Bioresource Technology Reports*, 9, 100392, 2020.
5. Sukrampal, **Kumar R.** and Patil S.A., Removal of heavy metals using bioelectrochemical systems. *Integrated Microbial Fuel Cells for Wastewater Treatment*, 49-71, 2020.

2019

6. Mishra, P.K., **Parth, S.**, Ankit, Y., **Kumar, S.**, Ambili, V., Kumar, V.V., Singh, S., Anoop, A., Geochemical and sedimentological characteristics of surface sediments from Ashtamudi Estuary, Southern India: implications for provenance and modern sedimentary dynamics. *Environmental Earth sciences*, 78(14), p.395, 2019.

2017

7. **Ankit, Y.**, **Kumar, P.**, Anoop, A., Mishra, P.K., Varghese, S., Mid-late Holocene climate variability in the Indian monsoon: Evidence from continental shelf sediments adjacent to Rushikulya river, eastern India. *Quaternary International* 443, 155-163, <http://dx.doi.org/10.1016/j.quaint.2016.12.023>, 2017.
8. **Ankit, Y.**, Mishra, Praveen K., **Kumar, P.**, Jha, Deepak K., Kumar, Vivek V., Ambili, V., Anoop, A., Molecular distribution and carbon isotope of n-alkanes from Ashtamudi Estuary, South India: Assessment of organic matter sources and paleoclimatic implications., *Marine Chemistry*, , <http://dx.doi.org/10.1016/j.marchem.2017.08.002>, 2017.

2015

9. **Nandy, B.**, Sharma, G., Garg, S., **Kumari, S.**, **George, T.**, **Sunanda, Y.**, Sinha, B., Recovery of consumer waste in India - A mass flow analysis for paper, plastic and glass and the contribution of households and the informal sectors, *Resources, Conservation and Recycling* 101, 167-181, <http://dx.doi.org/10.1016/j.resconrec.2015.05.012>, 2015.
10. Sinha, B., **Singh Sangwan, K.**, **Maurya, Y.**, Kumar, V., Sarkar, C., Chandra, B.P., Sinha, V. Assessment of crop yield losses in Punjab and Haryana using 2 years of continuous in situ ozone measurements, *Atmospheric Chemistry and Physics* 15, 9555-9576, <https://www.atmos-chem-phys.net/15/9555/2015/acp-15-9555-2015.pdf>, 2015.
11. Pawar, H., Garg, S., Kumar, V., **Sachan, H.**, **Arya, R.**, Sarkar, C., Chandra, B.P., Sinha, B., Quantifying the contribution of long-range transport to particulate matter (PM) mass loadings at a suburban site in the north-western Indo-Gangetic Plain (NW-IGP), *Atmospheric Chemistry and Physics* 15, 9501-9520, <https://www.atmos-chem-phys.net/15/9501/2015/acp-15-9501-2015.pdf>, 2015.

12. Sarkar C., Kumar, V., Sinha, V: Massive Emissions of Carcinogenic Benzenoids from Paddy residue burning in North India, Current Science, Volume 104 (12) , pp. 1703-1709, 2013.
<http://www.currentscience.ac.in/Volumes/104/12/1703.pdf>, 2013.

International Collaborations

Sustainable Atmosphere for the Kathmandu Valley (SusKat):

The IISER Mohali team (C. Sarkar, V. Kumar & Dr. V. Sinha) operated a PTR-TOF-MS during this international field campaign. The SusKat measurement campaign was conducted in December 2012 - January 2013 in Kathmandu, Nepal, provided a comprehensive assessment of various aspects of air pollution in the Kathmandu valley through a combination of intensive sampling and focused model simulations. The initiative was spearheaded by the Institute for Advanced Sustainability Studies (IASS) Potsdam, Germany and the International Centre for Integrated Mountain Development (ICIMOD). Eighteen research groups from nine countries participated in the SusKat field experiment.

Multi Axis Doas aerosols and trace gases intercomparison (MADCAT):

The IISER Mohali team (V. Kumar, V. Sinha) participated in the MADCAT campaign with their DOAS system. Thirteen international research groups participated in this intercomparison campaign which was held at the Max Planck Institute (MPI) for Chemistry in Mainz, Germany, in June-July 2013.

Cabauw Intercomparison of Nitrogen Dioxide Measuring Instruments (CINDI-2):

In September 2016 the IISER Mohali team participated in the CINDI-2 campaign, held in Cabauw, the Netherlands. The campaign involves the comparison of a host of ground-based DOAS instruments for measuring atmospheric Nitrogen Dioxide (NO₂) amounts. It is the second large scale international campaign addressing the intercalibration of remote sensing instruments using the DOAS technique to monitor air quality in support of satellites. More than 40 instruments operated by 30 groups participated to this field campaign.

International DST- Max Planck Research Partner Group on Tropospheric OH reactivity and VOC measurements:

The international Max Planck Research Partner Group is a collaboration between Dr. Vinayak Sinha (IISER Mohali) and Prof. Jos Lelieveld (Director Air Chemistry, MPI for Chemistry Mainz). The research group provides ample opportunity for student exchange. Vinod Kumar (MS08) and Biplob Nandi (MS10) visited the MPIC Mainz for a summer project and Hella Ride (PhD student, MPIC-Mainz) visited IISER Mohali. Six senior scientists from MPIC, Mainz also visited IISER Mohali. The group has been operating a DOAS jointly with Dr. Thomas Wagner MPIC for five years.

First direct measurements of chemical ozone production in India

The IISER Mohali Atmospheric Chemistry group in collaboration with TERI University Delhi hosted a research group from Birmingham University, UK, to perform the first direct measurements of atmospheric ozone production in India.

Admissions

Integrated BS-MS program admissions : Admissions to the integrated BS-MS program are handled centrally by a joint admissions committee consisting of members representing all five IISERs, and all admitted candidates are provided with a fellowship, subject to a minimum level of academic performance.

BS-MS students that have finished two years of coursework in all the science subjects are required to choose any one out of the four main science subjects (i.e., biology, chemistry, physics or mathematics) as a 'major' subject. The Department of Earth and Environmental Sciences does not currently offer a major.

MS thesis project: The Department of Earth and Environmental Sciences accepts MS-students from all major disciplines with research interests in earth and environmental sciences for MS-thesis projects. The department strongly recommends that prospective MS thesis project students undertake a summer project with their prospective advisor or take an elective course offered by the department prior to finalizing their choice for a 5th year MS-project.

Integrated MS-Ph.D program admissions : Admissions to this program are overseen by the respective departments. Eligibility criteria are routinely advertised on the institute's website, and the admissions are conducted in the summer of each year. The Department of Earth and Environmental Sciences does not currently offer an integrated MS-Ph.D program.

Ph.D admissions : Ph.D admissions are done at the beginning of each semester, twice a year, and advertisements appear on the website towards the end of each semester. Candidates who apply through an online application process are screened for eligibility and shortlisting criteria, and invited for examinations/interviews.

Summer Programs : The department participates in three kinds of summer research training programs : (i) IISER's own BS-MS students are required to do summer projects. Some do it at IISER-M; (ii) IISER participates in an inter-academy summer program co-ordinated by the Indian Academy of Sciences, Bangalore, which allots some summer students to research supervisors at IISER; (iii) IISER-M advertises a summer program open to students from around the country, in the month of February/March.

Administration

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