Swarandeep Sahoo

CONTACT INFORMATION

Assistant Professor,
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Department of Applied Geophysics,
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PERSONAL DETAILS

Date of birth: 16th May 1989
Sex: Male
Nationality: Indian
Languages known: Oriya, Hindi, and English

RESEARCH INTERESTS

Planetary Fluid Dynamics:	*Earth's Core-mantle Interaction, Geodynamo, Geomagnetic field reversals,.*
Rotating Flows:	*Thermal convection, Magneto-convection Double diffusive convection*
Geophysical Flows:	*Vorticity Dynamics, Magnetohydrodynamics, Stratified flows, Fluid-Solid Interaction Flows in Porous Media.*

EDUCATION

Ph. D., (2018)
Centre for Earth Sciences,
Division of Mechanical Sciences,
Indian Institute of Science, Bangalore

M. Tech., (2012)
Dept. of Aerospace Engineering,
Indian Institute of Technology, Kanpur.

B. Tech., (2012)
Dept. of Aerospace Engineering,
Indian Institute of Technology, Kanpur.

HONORS AND AWARDS

DST-INSPIRE Faculty Award, 2018
SEDI-Travel Grant for attending SEDI-2018, Edmonton, Canada.
SERB-StartUp Research Grant, 2020
IUGG-Travel Grant for attending IUGG-2023, Berlin, Germany

RESEARCH POSITIONS

Institute Research Associate (Jan-Dec, 2018), Centre for Earth Sciences, IISc Bangalore.
Research Assistant (June, 2012 – May, 2013), Dept. of Aerospace Engineering, IIT Kanpur.

JOURNAL PUBLICATIONS

1. A. Seal, **S. Sahoo,** A. Peresan, P. K. Khan and N. Jana**,** Statistical analysis on background seismicity of Southern California region: application of nearest neighbour declustering and network analysis. J. *Seismol.*, 29, 2025.

2. D. Sharma and **S. Sahoo,** On the onset of thermal convection in a rotating spherical shell with spatially heterogeneous heat source distribution. *Phys. Fluids.*, 36, 124104, 2024.

3. P. Mukherjee and **S. Sahoo,** Coherent flow structures and magnetic field patterns in rotating spherical shell convective dynamos: A data-driven approach. *Phys. Fluids.*, 36, 116604, 2024.

4. A. Shukla, **S. Sahoo** and P. Sarkar**,** Assessment of micro-structure and flow entrapment in Indian Gondwana shale reservoir using digital rock analysis. *Mar. Pet. Geol.*, 169, 107066, 2024.

5. S. E. Sreenivasan and **S. Sahoo,** Oscillatory onset of rotating thermal convection subject to spatially varying magnetic fields and stable stratification. *Phys. Fluids.*, 36, 086616, 2024.

6. S. E. Sreenivasan and **S. Sahoo,** Weak time-scale separation at the onset of oscillatory magnetoconvection in rapidly rotating fluids. *Phys. Scr.*, 99, 085031, 2024.

7. P. Sarkar, **S. Sahoo,** U. Nagpal and T. N. Singh, A quantitative study of the microstructure of Indian Gondwana shale: a fractal and algebraic topology approach. *Pet. GeoSci.*, 30, 105, 2024.

8. T. Barman and **S. Sahoo,** Role of partial stable stratification on fluid flow and heat transfer in rotating thermal convection. *Phys. Fluids.*, 36, 046613, 2024.

9. P. Mukherjee and **S. Sahoo,** Thermal convection and dynamo action with stable stratification at the top of the Earth's outer core. *Phys. Earth Planet. Inter.*, 345, 107111, 2023.

10. **S. Sahoo** and Sethulaksmy E S, Onset of oscillatory magnetoconvection under rapid rotation and spatially varying magnetic field. *Phys. Fluids.* 35, 024113, 2023.

11. S. Garai and **S. Sahoo** , On convective instabilities in a rotating fluid with stably stratified layer and thermally heterogeneous boundary. *Phys. Fluids.* 34, 124101, 2022.

12. **S. Sahoo** and B. Sreenivasan, Response of Earth’s magnetic field to large lower mantle heterogeneity. *Earth Planet. Sci. Lett.* 549, 116507, 2020.

13. **S. Sahoo** and B. Sreenivasan, Convection in rapidly rotating cylindrical annulus with laterally varying boundary heat flux. *J. Fluid Mech.* 883, A1 2020.

14. **S. Sahoo** and B. Sreenivasan, On the effect of laterally varying boundary heat flux on rapidly rotating spherical shell convection, *Phys. Fluids*, 29, 086602, 2017. (***Editor's Pick***).

15. **S. Sahoo**, B. Sreenivasan and H. Amit, Dynamos driven by weak thermal convection and heterogeneous outer boundary heat flux, *Phys. Earth Planet. Inter.*, 250, 35-45, 2016.

16. B. Sreenivasan, **S. Sahoo** and G. Dhama, The role of buoyancy in polarity reversals of the geodynamo, *Geophys. J. Int.*, 199, 1698-1708, 2014.

17. **S. Sahoo**, P. Sohoni and D. Das, Transition map for vortex rings over an axial rod, *Int. J. Str. Anal. Des.*, 1, 2014.

18. **S. Sahoo**, P. Sohoni and D. Das, Robustness of a vortex ring interacting with an axial rod, *Int. J. Str. Anal. Des.*, 1, 2014.

EDITORIAL VOLUME

1. Strong Motion Earthquake: Structural Response Modelling and Aided Design *Eds.* P. K. Khan, **S. Sahoo,** U. Borah, N. Jana and Y. Giri, *K P Books Publishers*, 2025

CONFERENCE PROCEEDINGS
**Speaker*

1. **S. Sahoo* and** B. Sreenivasan**,** Core convection influenced by large lower mantle heterogeneity: Implications for the geomagnetic field. The American Geophysical Union (AGU) General Assembly, 2020, Online everywhere, on 1-17 Dec, 2020. (**Invited Talk**)

2. **S. Sahoo* and** B. Sreenivasan**,** A laboratory model for thermal core—mantle interaction. The European Geophysical Union (EGU) General Assembly 2019, Vienna, Austria, on 7-12 April, 2019.

3. B. Sreenivasan* and **S. Sahoo,** The preference for the axial dipole and the polarity reversal problem. The 14th international symposium on Study of Earth's Deep Interior (SEDI), Kanagawa, Japan on 3-8 August, 2014.

4. **S. Sahoo*,** P. Sohoni and D. Das, Robustness of a vortex ring interacting with an axial rod, International conference on Advances in Structural, Civil and Environmental Engineering, Kuala Lumpur, Malaysia on 3-7 May, 2013.

5. **S. Sahoo,** P. Sohoni* and D. Das, Transition map for vortex rings over an axial rod, International conference on Advances in Structural, Civil and Environmental Engineering, Kuala Lumpur, Malaysia on 3-7 May, 2013.

6. **S. Sahoo*** and B. Sreenivasan**,** Experimental study of rotating convection subject to laterally varying boundary heat flux. *The 16th international symposium on Study of Earth's Deep Interior (SEDI), Edmonton*, Canada on 8-13 July, 2018.

7. **S. Sahoo***, G. Narasimhan and B. Sreenivasan**,** Experimental investigation of rapidly rotating convection in a cylindrical annulus. Discussion meeting on Buoyancy driven flows ICTS-TIFR, Bangalore on 16-20 June 2017.

8. **S. Sahoo***, G. Narasimhan and B. Sreenivasan**,** Experimental investigation of the thermal core-mantle interaction. GdR Dynamo Discussion meeting at ICTS-TIFR, Bangalore on 8-12 June 2015.

9. Debopam Ghosh* and **Swarandeep Sahoo**, Unraveling Mars' Magnetic Mysteries: Insights from Crustal Magnetization and Spherical Harmonic Coefficient Analysis, INDIAN GEOPHYSICAL UNION - Diamond Jubilee Annual Convention on Advances in Geosciences with Special Reference to Coastal Hazards (22-24 NOVEMBER 2023); Kochi, Kerala **(Best Poster Award)**

10. Dheeraj Kumar Sharma* and **S. Sahoo**, "Multilayer shallow water modeling of equatorially trapped wave in a stratified region in the Earth's outer core", AGU Annual Fall Meeting, San Francisco, CA 12 December 2023

11. Tirtharaj Barman*, **S. Sahoo**,The effect of thermally stable stratification at the onset of rotating magnetoconvection. On 18 - 22 December, 2023 at ICTS-TIFR discussion meeting on "Field Theory and Turbulence" , Bengalore, Karnataka, India.

12. Susmita Garai* and **S. Sahoo**, Penetrative convection in the Earth's outer core with thermal core-mantle coupling, IAGA-IASPEI Joint Scientific Assembly , Chiba, Hyderabad, 2021

13. Tirtharaj Barman*, **S. Sahoo**, Thermal core-mantle interaction and stable stratification effects on supercritical convection, Japan Geoscience Union Meeting (JpGU) , Chiba, Japan , 2022.

14. **S Sahoo*** and Susmita Garai, Onset of convection in a rotating plane fluid layer subject to non-uniform boundary heating and stable thermal gradients, IUGG-2023, Berlin, 10-21 July,2023

15. Priyabrata Mukherjee* and **S Sahoo**, Penetrative convection with heat sources in a spherical shell model of the Earth's core, The 17th international symposium on Study of Earth's Deep Interior (SEDI), ETH Zurich, Switzerland on 11-15 July 2022.

16. Priyabrata Mukherjee* and **S Sahoo**, Geomagnetic field generation mechanisms driven by outer core convection with a stably stratified layer.Japan Geoscience Union Meeting (JPGU), Makuhari Messe, Chiba, Japan on 21-26 May 2023.

17. Priyabrata Mukherjee* and **S Sahoo**, Dynamical consequences for dynamo action subject to thermal core-mantle interaction in presence of stably stratified layer. The 28th General Assembly of the International Union of Geodesy and Geophysics (IUGG) 2023, Berlin, Germany on 11-20 July 2023.

18. Abhay Shukla* and **S. Sahoo**, Rock Model Generation and its classification using Deep Learning Method, 84th EAGE Annual Conference & Exhibition, Vienna, Austria, Jun 2023

19. Abhay Shukla*, **S. Sahoo** and Piyush Sarkar, Rock Model Generation and its classification using Deep Learning Method, AGU 23 Fall Meeting, San Franscisco, USA, Dec 2023,

20. P. P. Mandal*, Adil Mirda and **S. Sahoo,** Criticality of data for permanent CO2 storage in deep geological formations, 14th Conference & Exposition on Petroleum Geophysics (SPG 2023), Kochi, India, November 2023

21. P. Mukherjee* and S. Sahoo, Geomagnetic field morphology due to dynamo action subject to a stably stratified layer near the core-mantle boundary. AGU Fall meeting, San Francisco on 11-15 December 2023.

22. T. Haldar*, T. Barman and S. Sahoo. Influence of heterogeneous thermal structure on the onset of convection in the presence of magnetic field at the Earth's core. IGU Annual Convention, BHU, Varanasi, Uttar Pradesh on 3-5 December 2024.

23. Shashank Singh*, Tirtharaj Barman, S. Sahoo, Impact of boundary condition on the onset of thermo-chemical convection at the Earth's core. EGU General Assembly 2025, Vienna on 27 April–2 May 2025.

24. D. K. Sharma*, S Sahoo, Equatorially trapped waves in a stratified region in the Earth's outer core modeled using 2-layer shallow water equations. EGU General Assembly 2024, Vienna, Austria from 14 April to 19 April 2024.

25. M. Kumar*, S. Sahoo, Multidisciplinary Development of a Prototype Instrumentation System with Reinforced Foundation and Electromechanical System for Core-Mantle Fluid Study, SME IIT(ISM), Dhanbad, March 21-23, 2025.

26. R. S. Rathore, T. Barman, S. Sahoo, Back-reaction of uniform magnetic field on Earth's core convection under high thermal forcing. 61st Annual Convention of IGU on Advances in Earth System Sciences with special reference to weather and climate, Varanasi from December 3-5, 2024

27. T. Barman, T. Halder, S. Sahoo, Back reaction of magnetic field on rotating convection in presence of thermal heterogeneity. EGU General Assembly, Vienna, 27 April–2 May 2025.

28. T. Barman, S. Sahoo, "Impact of thermal core-mantle interaction on back-reaction of magnetic field on rotating penetrative convection". JpGU-2024, Planetary cores: Structure, formation, and evolution, 29th May, 2024.

29 T. Barman, S. Sahoo, Onset of penetrative convection subject to background rotation and magnetic field". On 21st May, 2024. (

30. T. Barman, A. Das, S. Sahoo, "Back-reaction of magnetic field on rotating penetrative convection", 16th April, 2024. Earth's and planetary cores: structure, dynamics, and evolution. (EGU - 2024) (Oral, Online)

31. T. Barman, S. Sahoo, "Effect of core-mantle (CMB) interaction on

magnetoconvection at the Earth's core", 7th March 2024. Solid Earth Geoscience.

32. T. Barman, S. Sahoo, "Localisation of fluid flow for super-critical penetrative convection in the Earth's outer core.", 24th January, 2024. Nonlinear Geophysics. (AGU - 2023)

33. P. Mukherjee and S. Sahoo, Prediction of the Evolution of Dynamo Action by Core-Mantle Interaction, Using Unsupervised Learning. National Conference on Geophysical advances, (CGA-2023), IIT(ISM) Dhanbad, Jharkhand, India on 26 March 2023.

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TEACHING EXPERIENCE

1. Course Instructor (**IIT-ISM Dhanbad**)
   Mathematical Functional Analysis (Fall 2019, Fall 2020)
   Finite Element Analysis (Fall 2019, Fall 2020)
   Research Methodology and Statistics (Spring 2019)
   Geophysical Signal Processing (Spring 2019)
   Advvanced Numerical Methods (Spring 2020, Spring 2021)
   Mathematical Geophysics (Spring 2021)
   Numerical Analysis and Data Structures (Spring 2022)

2. Course Instructor (**SWAYAM NPTEL**)
   Mathematical Geophysics (2024-25)

2. Teaching Assistant for the following courses:
   Fluid Mechanics and Rate Process.(IIT Kanpur)
   Engineering Graphics, (IIT Kanpur)
   Mathematics for Geophysicists. (IISc Bangalore)

R & D PROJECTS

1. Inspire Faculty Grant, DST, India. (Value: Rs. 35,00,000/-) as PI
2. Faculty Research Scheme, IIT(ISM) Dhanbad. (Value: Rs. 10,00,000/-) as PI
3. Lab Development Grant, IIT(ISM) Dhanbad. (Value: Rs. 20,00,000/-) as PI
4. Start-Up Research Grant, SERB, India (Value: Rs. 26,00,200/-) as PI
5. National Geospatial Programme Grant (Value: Rs. 26,62,461/-) as PI

SCHOOLS AND SEMINARS ATTENDED

1. ICTS Summer School on "Buoyancy driven Flows" at ICTS-TIFR, Bangalore on 12-15 June, 2017.

2. GdR Dynamo School on "Experimental, Computational and Theoretical investigations of dynamos" at ICTS-TIFR, Bangalore on 1-5 June, 2015.

3. INDO-FRENCH SEMINAR ON DYNAMICS OF EARTH AND PLANETARY CORES at IISc, Bangalore on 23-26 September, 2013.

4. IUTAM Symposium on Bluff Body Flows at IIT Kanpur on 12-16 December, 2011.

5. Discussion meeting on Earth and Planetary interiors, Indian Academy of Science (IASc), Coorg, Karnataka, India 26 - 30, November, 2023

SUPERVISION

Ph. D. Thesis (Ongoing) : 4 (Full-time) + 1 (Part-time) + 1 (International)
Post Graduate Dissertation : 20 (Completed) + 5 (Ongoing)

PROFESSIONAL ACTIVITIES

1. Manuscript Reviewer
   Physics of fluids (Journal)
   Physics of Earth and Planetary Interiors (Journal)
   Heat Transfer (Journal)
   Wind Engineering (Journal)
   Heliyon (Journal)
   International Journal of Fluids Engineering (Journal)

   ASME Power (International Conference)

2. Co-Convener, IAGA-IASPEI 2021, Hyderabad, India

3. Coordinator, NEP Short Term Faculty Development Programme, MMTTC, IIT(ISM) Dhanbad, 2025

4. Co-Convener, SME 2025, National Seminar, IIT(ISM) Dhanbad, 2025