BIDYUT BIKASH GOSWAMI *he/him*

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Institute of Science and Technology Austria (ISTA)
Klosterneuburg, Austria 3400

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RESEARCH INTEREST

Climate dynamics, Atmospheric convection and its organization, Climate change, Indian monsoon.

My research focuses on understanding atmospheric dynamics and variability, and their response to warming, with an emphasis on the role of atmospheric convection, its organization, and the subsequent dynamic interactions. To this end, I perform experiments using a hierarchy of models. In my research, the Indian summer monsoon is an elemental component.

I have significantly contributed to the development of the stochastic multi-cloud model (SMCM) convection parameterization from a theoretical framework to incorporate it in the Community Atmosphere model (CAM) as a shallow-deep unified stochastic mass flux cumulus parameterization scheme.

RESEARCH EXPERIENCE

Apr 2022 - present **Institute of Science and Technology Austria, Austria**
Researcher, with Caroline Muller

Aug 2019 - Mar 2022 **Yonsei University, Seoul, South Korea**
Research Professor at the Irreversible Climate Change Research Center, with Soon-Il An

Aug 2017 - Aug 2019 **New York University Abu Dhabi, Abu Dhabi, UAE**
Post-Doctoral Associate at the Center for Prototype Climate Modeling, with Andrew Majda

Jun 2014 - Jun 2017 **University of Victoria, Victoria, Canada**
Post-Doctoral Fellow at the Department of Mathematics, with Boualem Khouider

EDUCATION

Indian Institute of Tropical Meteorology, Pune, India
Ph.D. awarded by the University of Pune in Atmospheric and Space Sciences, May 2014.
Thesis: *Study of Indian Summer Monsoon Intraseasonal Oscillation in Multiscale Modelling Framework.*
Advisors: P. Mukhopadhyay; B.N. Goswami

Gauhati University, India
M.Sc. in Physics, 2005.
[Dissertation: *A consequence of Electromagnetic Quantum Vacuum*]

B.Sc. in Physics, 2003.

FUNDING

Project Title: A Data-Driven Multicloud and Multiscale Parameterization of Organized Convection to Improve the Predictions of Monsoon Extreme Weather and Extreme Precipitation Events.
Duration: 2025-2027
Funding agency: Monsoon Mission, Ministry of Earth Sciences, India.
Total Grant: US Dollars 450,000
Role: Co-PI [with *Boualem Khouider* (PI) and *Courtney Schumacher* (Co-PI)]
Responsibilities: To provide expertise in implementation of the stochastic multicloud model (SMCM) and work directly with a post-doc (to be recruited) throughout the project duration.

HONORS & AWARDS

- 23rd Silver Jubilee Award - Indian Institute of Tropical Meteorology (2011) for the best research paper published in a peer-reviewed journal in the year 2010.
- International Travel Support : Science and Engineering Research Board, DST, Govt. of India - Department of Science and Technology, Government of India, September, 2012.
- Best Presentation Award - Annual Monsoon Workshop, 2013; Indian Meteorological Society Pune Chapter - Indian Meteorological Society, Pune Chapter, February, 2013.
- Professor Roddam Narasimha Best Research Award - Workshop on Atmospheric Satellites for Asian Monsoon Cloud-Precipitation Science and Applications (WASAMSA22), June, 2022.

TEACHING

Institute of Science and Technology Austria, Austria
General circulation of the atmosphere [Fall of 2022, & 2023; 6 ECTS* (Full Course)]
Climate modeling [Spring of 2023, 2024, & 2025; 3 ECTS]
Weather and Climate: Apps to Maps [Fall 2024; 6 ECTS]

University of Vienna, Austria
Tropical Meteorology [2025 Spring; Block course - 1 ECTS]

All are Graduate level courses.
**ECTS - European Credit Transfer and Accumulation System*

MENTORING *[co-Advising With Prof. Caroline Muller]*

Riddhima Puri	*[Scientific Intern, Ecole normale supérieure, France. (Summer, 2022)]*
Ziyin Lu	*[Graduate Student (Rotation) at ISTA. (Summer, 2022)]*
Andrea Polesello	*[Scientific intern, University of Milano-Bicocca, Italy. (2022-2023)]*
Ivan Kramarenko	*[Graduate Student (Rotation) at ISTA. (Fall, 2023)]*
Ritwik Das	*[Graduate Student (Rotation) at ISTA. (Winter, 2023-24)]*
Sara Bonomelli	*[Graduate Student (Rotation) at ISTA. (Spring, 2024)]*
Alexis Aubel	*[Scientific intern, École Polytechnique, Palaiseau, France. (Spring, 2024)]*
Stefanie North	*[Scientific intern, Technischen Universität Wien, Austria. (Fall, 2024)]*

OUTREACH ACTIVITIES

Initiatives

Climate Dialogues: Way Forward (2022-present)
It is a webinar series designed to spread awareness about Climate Science and excite young students to pursue careers in this field *(especially designed for the people of Assam & other northeastern states of India)*.
[Youtube Link: https://t.ly/edZk8]

Talks

Career in Earth Science
Webinar by Advancing North East, an initiative by Ministry of Development of North Eastern Region (MDoNER) & North Eastern Council (NEC) and implemented by the North Eastern Development Finance Corporation Ltd (NEDFi), India, June 5,2022.

Climate change Lessons and Actions
International Webinar organized by the Department of Zoology, Gauhati University, Zoological Society of Assam, and the Department of Zoology, Morigaon College, Assam, July 10, 2021.

Atmospheric sciences, Climate change & our knowledge about it
'Bigyan Sora' by All India Radio Tezpur center, September 14, 2020.

I shared my story
An interview by the AGU narratives, December 12, 2018.

Other

Story of a Hailstone
HUMAN-MODEL-WORLD: A collection of scientific images by the BRIDGE Network, 2024.

PUBLICATIONS *(Student's names are in Blue.)*

In preparation

- Aubel, A., **Goswami, B. B.**, & Muller, C. (*In preparation*). Convective self-aggregation in a large-scale mean flow.
- Roy, K., Mukhopadhyay, P., Krishna, R. P. M., Kalapureddy, M. C. R., **Goswami, B. B.**, Khouider, B., & Pandithurai, G. (*In preparation*). Evaluation of mean state in NCEP Climate Forecast System (version 2) simulation using a Stochastic Multicloud Model calibrated with Indian RADAR data.

2025

22. **Goswami, B. B.**, Lu, Z., & Muller, C. (*In review*). Convective self-aggregation over land versus ocean: Insights from diurnally oscillating sea surface temperature experiments. *J. Adv. Model. Earth Syst.*
21. **Goswami, B. B.**, Polesello, A., & Muller, C. (*In review*). An assessment of representing land-ocean heterogeneity via convective adjustment timescale in the Community Atmospheric Model 6 (CAM6). *J. Adv. Model. Earth Syst.*
20. Roy, K., Khouider, B., P., **Goswami, B. B.** , Krishna, R. P. M. (*In review*). Sensitivity to convection time scale parameter of the MJO in deterministic and stochastic Community Atmosphere Model. *J. Adv. Model. Earth Syst.*
19. **Goswami, B. B.**, & Muller, C. (*In review*). What advances monsoon onset over India? Wea. & *Clim. Dyn.*

2024

18. Paik, S., Kim, D., An, S.-I., Oh, H., Shin, J., **Goswami, B. B**., Min, S.-K., & Mondal, S. K. (*2024*). Exploring causes of distinct regional Indian summer monsoon precipitation responses to CO2 removal. *npj Clim. Atmos. Sci., 7(1). doi:10.1038/s41612-024-00858-0*
17. **Goswami, B. B.** (2024). A pre-monsoon signal of false alarms of Indian monsoon droughts. *Geophys. Res. Lett., 51*(5), e2023GL106569. doi:10.1029/2023GL106569

2023

16. Khouider, B., **Goswami, B. B.**, Phani, R., & Majda, A. J. (2023). A Shallow-Deep Unified Stochastic Mass Flux Cumulus Parameterization in the Single Column Community Climate Model. *J. Adv. Model. Earth Syst., 15*(11). doi:10.1029/2022MS003391
15. **Goswami, B. B.**, & An, S.-I. (2023). An assessment of the ENSO-monsoon teleconnection in a warming climate. *npj Clim. Atmos. Sci., 6*(1), 82. doi:10.1038/s41612-023-00459-1
14. **Goswami, B. B.** (2023). Role of the eastern equatorial Indian Ocean warming in the Indian summer monsoon rainfall trend. *Clim. Dyn., 60*(1), 427–442. doi:10.1007/s00382-022-06243-3

2022

13. **Goswami, B. B.**, An, S.-I., & Murtugudde, R. (2022). Role of the Tibetan plateau glaciers in the Asian summer monsoon. *Clim. Change, 173*(3), 29. doi:10.1007/s10584-022-03337-7
12. **Goswami, B. B.**, Murtugudde, R., & An, S.-I. (2022). Role of the Bay of Bengal warming in the Indian summer monsoon rainfall trend. *Clim. Dyn.* doi:10.1007/s00382-021-05853-8

2021

11. Roy, K., Mukhopadhyay, P., Krishna, R. P. M., Khouider, B., & **Goswami, B. B.** (2021). Evaluation of mean state in NCEP Climate Forecast System (version 2) simulation using a stochastic multicloud model calibrated with DYNAMO RADAR data. *Earth Space Sci., 8*(8), e2020EA001455. doi:10.1029/2020EA001455

2010-2020

10. Goswami, T., **Goswami, B. B.**, Krishna, R. P. M., & Mukhopadhyay, P. (2020). Evaluation of SP-CAM and SP-CCSM in capturing the extremes of summer monsoon rainfall over Indian region. *J. Earth Syst. Sci., 129*, 1–13. doi:10.1007/s12040-020-01430-8
9. **Goswami, B. B.**, Khouider, B., Phani, R., Mukhopadhyay, P., & Majda, A. J. (2017). Improved tropical modes of variability in the NCEP Climate Forecast System (version 2) via a stochastic multicloud model. *J. Atmos. Sci., 74*(10), 3339–3366. doi:10.1175/JAS-D-16-0231.1
8. **Goswami, B. B.**, Khouider, B., Phani, R., Mukhopadhyay, P., & Majda, A. J. (2017). Implementation and calibration of a stochastic multicloud convective parameterization in the NCEP Climate Forecast System (CFSv2). *J. Adv. Model. Earth Syst.* doi:10.1002/2017MS001093
7. **Goswami, B. B.**, Khouider, B., Krishna, R. P. M., Mukhopadhyay, P., & Majda, A. J. (2016). Improving Synoptic and Intra-Seasonal Variability in CFSv2 via Stochastic Representation of Organized Convection. *Geophys. Res. Lett., 43*. doi:10.1002/2016GL069923
6. **Goswami, B. B.**, & Goswami, B. N. (2016). A road map for improving dry-bias in simulating the South Asian monsoon precipitation by climate models. *Clim. Dyn*. doi:10.1007/s00382-015-2739-1
5. **Goswami, B. B.**, Krishna, R. P. M., Mukhopadhyay, P., Khairoutdinov, M., & Goswami, B. N. (2015). Simulation of the Indian summer monsoon in the superparameterized Climate Forecast System version 2: Preliminary results. *J. Clim., 28*(22), 8988–9012. doi:10.1175/JCLI-D-14-00454.1
4. **Goswami, B. B.**, Deshpande, M., Mukhopadhyay, P., Saha, S. K., Rao, S. A., Murthugudde, R., & Goswami, B. N. (2014). Simulation of monsoon intraseasonal variability in NCEP CFSv2 and its role on systematic bias. *Clim. Dyn., 43*, 2725–2745. doi:10.1007/s00382-014-2073-1
3. **Goswami, B. B.**, Mukhopadhyay, P., Khairoutdinov, M., & Goswami, B. N. (2013). Simulation of Indian summer monsoon intraseasonal oscillations in a superparameterized coupled climate model: Need to improve the embedded cloud resolving model. *Clim. Dyn., 41*, 1497–1507. doi:10.1007/s00382-013-1706-7
2. **Goswami, B. B.**, N. J. Mani, P. Mukhopadhyay, D. E. Waliser, J. J. Benedict, E. D. Maloney, M. Khairoutdinov, and B. N. Goswami (2011), Monsoon intraseasonal oscillations as simulated by the superparameterized Community Atmosphere Model, *J. Geophys. Res.*, 116, D22104, doi:10.1029/2011JD015948.
1. **Goswami, B. B.**, P. Mukhopadhyay, R. Mahanta, and B. N. Goswami (2010), Multiscale interaction with topography and extreme rainfall events in the northeast Indian region, *J. Geophys. Res.*, 115, D12114, doi:10.1029/2009JD012275.

H-index: 12; i10-index: 12; Citations: 572 (google scholar, Mar 2025)

OTHER PUBLICATIONS

- Khouider, B., Roy, K., Krishna, R. P. M., & **Goswami, B. B.** (2024). Toward a breakthrough in convection parameterization using multiscale and multicloud modeling constrained by observations—Part II: Implementation in CAM and preliminary results (2024). In Mukhopadhyay, P., Khouider, B., & Shige, S. (Eds.), Multi-Scale Precipitation Variability Over the Tropics (pp. 141-164). Elsevier. doi: 10.1016/B978-0-443-14030-3.00013-9
- Khouider, B., **Goswami, B. B.**, Krishna, R. P. M. (2024). Toward a breakthrough in convection parameterization using multiscale and multicloud modeling constrained by observations—Part I: Motivation and model development (2024). In Mukhopadhyay, P., Khouider, B., & Shige, S. (Eds.), Multi-Scale Precipitation Variability Over the Tropics (pp. 105-140). Elsevier. doi: 10.1016/B978-0-443-14030-3.00010-3
- **Goswami, B. B.**, Khouider, B., Krishna, R. P. M., Mukhopadhyay, P., & Majda, A. (2019). The Stochastic Multi-cloud Model (SMCM) convective parameterization in the CFSv2: Scopes and opportunities. In Randall, D., Srinivasan, J., Nanjundiah, R., & Mukhopadhyay, P. (Eds.), *Current Trends in the Representation of Physical Processes in Weather and Climate Models* (pp. 157-181). Springer Atmospheric Sciences. Springer, Singapore. doi:10.1007/978-981-13-3396-5_8
- Krishna, R. P. M., Santra, A., **Goswami, B. B.**, Ganai, M., Mahakur, M., Deshpande, M., Mukhopadhyay, P., Das, R. S., Khairoutdinov, M., Dudhiya, J., & Goswami, B. N. (2016). Improvement of cloud and convective parameterizations in Climate Forecast System Version 2 (CFSv2): Indian summer monsoon perspective. *Research Report 135*, Indian Institute of Tropical Meteorology, Pune, India.
- Mukhopadhyay, P., Krishna, R. P. M., **Goswami, B. B.**, Abhik, S., Ganai, M., Mahakur, M., Khairoutdinov, M., & Dudhia, J. (2016). Improvement of systematic bias of mean state and the intraseasonal variability of CFSv2 through superparameterization and revised cloud-convection-radiation parameterization. In *Proceedings Volume 9882, Remote Sensing and Modeling of the Atmosphere, Oceans, and Interactions VI*; 98820Z. doi:10.1117/12.2222982 Event: SPIE Asia-Pacific Remote Sensing, 2016, New Delhi, India.

CONFERENCE PRESENTATIONS

Invited

1. **(2024).** False alarms of Indian monsoon droughts. *AGU Atmospheric Science Early Career Webinar*, August 13, 2024.
2. **(2024).** Pre-monsoon rainfall over northeast India: A signal of false alarms of Indian monsoon droughts. *58th Prof. R. Ananthakrishnan Colloquium, Ministry of Earth Sciences, Government of India*, April 2, 2024.
3. **(2021).** Indian Ocean warming and its impact on the Indian summer monsoon. Impacts & Consequences of Environmental Degradation on Animal Health and Human Wellbeing [Virtual International Conference], Abhayapuri College in association with Department of Zoology, Gauhati University and Aaranyak, Assam, India, September 2-4, 2021.

4. **(2019).** Stochastic Multi-cloud Model (SMCM) in the Climate Forecast System Model (version 2). Workshop on Moist Processes in the Atmosphere, Mathematisches Forschungsinstitut Oberwolfach, Germany, February 17-23, 2019.
5. **(2017).** An attempt to break the deadlock: A Stochastic convective parameterization approach. *Indian Institute of Tropical Meteorology*, Pune, India, July 19, 2017.
6. **(2016).** Better representation of organized convection in the Climate Forecast System via Stochastic Multi-Cloud Model. *The Center for Ocean-Land-Atmosphere Studies, George Mason University*, Fairfax, USA, December 20, 2016.
7. **(2015).** Is Superparameterization capable of breaking the "deadlock"? ... Seeking the answer in Superparameterized CFSv2 664-day climate. *Workshop on Stochasticity and Organization of Tropical Convection, Banff International Research Station*, Canada, April 26 - May 1, 2015.
8. **(2011).** Multiscale interaction with topography and extreme rainfall events in the North-East Indian region. *23rd Indian Institute of Tropical Meteorology Silver Jubilee Award Lecture*, Pune, India, November 17, 2011.

Contributed (Oral)

1. **(2024).** What advances monsoon onset over India? European Geosciences Union (EGU) General Assembly, Vienna, Austria, April 14-19, 2024.
2. **(2022).** A shallow-deep unified stochastic mass flux cumulus parameterization. Workshop on Atmospheric Satellites for Asian Monsoon Cloud-Precipitation Science and Applications, Bengaluru, India, June 21-24, 2022.
3. **(2019).** Stochastic plume ensembles for a unified shallow-deep mass flux cumulus parameterization in the single column Community Earth System Model (CESM). *Convection Parametrization: Progress and Challenges workshop, CPPC2019*, Met Office, Exeter, UK, July 15-19, 2019.
4. **(2017).** Accurate representation of organized convection in CFSv2 via a stochastic lattice model. *97th AMS Annual Meeting*, Seattle, USA, January 22–26, 2017.
5. **(2014).** Superparameterized Climate Forecast System (SP-CFS) for improved simulation of Indian summer monsoon. *The World Weather Open Science Conference (WWOSC 2014)*, Montreal, Canada, August 16-21, 2014.
6. **(2013).** SUPERPARAMETERIZATION - A promise towards a better Global Climate Model simulation of Indian Summer Monsoon and Monsoon Intra-Seasonal Oscillations. *Annual Monsoon Workshop-2012*, Indian Institute of Tropical Meteorology, Pune, India, February 19-20, 2013.

Contributed (Poster)

1. **(2024).** A pre-monsoon signal of false alarms of Indian monsoon droughts. *American Geophysical Union Annual Meeting*, Washington D.C., USA, December 9-13, 2024.
2. **(2024).** How does a convection cluster responds to a large-scale mean wind? *American Geophysical Union Annual Meeting*, Washington D.C., USA, December 9-13, 2024.

3. **(2023).** Response of convection organization to diurnally varying surface forcing. The 2023 Joint CFMIP-GASS Meeting on Cloud, Precipitation, Circulation and Climate Sensitivity, Sorbonne University, Paris, France, July 9-13, 2023.
4. **(2023).** Participant. Tropical tropospheric temperature lapse rate: observations and modeling of past, present and future variations. *Paris, France*, July 6-7, 2023.
5. **(2023).** Response of the Indian monsoon to a warming Indian ocean. *European Geosciences Union General Assembly*, Vienna, Austria, April 24–28, 2023.
6. **(2022).** Participant only. *European Geosciences Union General Assembly*, Vienna, Austria, May 23–27, 2022.
7. **(2019).** A shallow-deep unified stochastic mass flux cumulus parameterization in the single column Community Earth System Model (CESM). *American Geophysical Union Fall Meeting*, San Francisco, USA, December 9-13, 2019.
8. **(2019).** Stochastic plume ensembles for a unified shallow-deep mass-flux cumulus parameterization in the Community Earth System Model (CESM). *Scientific Grand Challenges and New Perspectives in Applied Mathematics: Ocean, Atmosphere and Climate Sciences, Majda Fest*, University of Victoria, Canada, July 24-26, 2019.
9. **(2018).** A road map for improving dry-bias in simulating the South Asian monsoon precipitation by climate models. *European Geosciences Union General Assembly*, Vienna, Austria, April 8–13, 2018.
10. **(2018).** Stochastic Multicloud Model (SMCM) Implemented NCEP Climate Forecast System Version 2 (CFSv2): Sensitivity to the Middle Tropospheric Moisture Parameter in the SMCM. *98th American Meteorological Society Annual Meeting*, Austin, USA, January 7–13, 2018.
11. **(2017).** A stochastic multicloud convective parameterization in the NCEP Climate Forecast System (CFSv2): implementation and calibration. *American Geophysical Union Fall Meeting*, New Orleans, USA, December 9-15, 2017.
12. **(2016).** Accurate representation of organized convection in CFSv2 via a stochastic lattice model. *American Geophysical Union Fall Meeting*, San Francisco, USA, December 12-16, 2016.
13. **(2015).** Implementation of the Stochastic Multicloud Model in the NCEP Climate Forecast System version 2 (CFSv2). *American Geophysical Union Fall Meeting*, San Francisco, USA, December 12-16, 2015.
14. **(2014).** Investigating the systematic biases on intraseasonal time-scale in NCEP CFSv2 simulated Indian Summer Monsoon – an effort of improvement through superparameterization technique. *American Geophysical Union Fall Meeting*, San Francisco, USA, December 15-19, 2014.
15. **(2012).** SUPERPARAMETERIZATION - A promise towards a better Earth System Model: An Indian Summer Monsoon perspective. *3rd International Conference on Earth System Modelling, Max Planck Institute for Meteorology*, Hamburg, Germany, September 17-21, 2012.
16. **(2012).** Participant only. Conference on Opportunities and Challenges in Monsoon Prediction in a Changing Climate, OCHAMP-2012, IITM, Pune, India, February 21–25, 2012.
17. **(2011).** Simulation of Monsoon ISO in superparameterized CAM. *Workshop on Indian Monsoon Variability, CAOS, IISc*, Bangalore, India, August 17-19, 2011.

SKILLS

Climate models (**familiarity at source code modification level**)

- CFS -National Centers for Environmental Prediction (NCEP) Climate Forecast System
- CESM -The National Center for Atmospheric Research (NCAR) Community Earth System Model
- SAM -Prof Marat Khaoiroutdinov's System For Atmospheric Modeling

High Power Computation experience

- Prithvi -Ministry of Earth Sciences, India
- Nestor -Compute Canada, Canada
- Cedar -Compute Canada, Canada
- Dalma -New York University Abu Dhabi, United Arab Emirates
- KISTI -Korea Institute of Science and Technology Information, South Korea
- ISTA-HPC -Institute of Science and Technology, Austria

Programming language

- Fortran
- Python

Scientific data visualization software

- GrADS, by COLA/IGES, George Mason University
- Ferret, by NOAA/PMEL
- NCL, by NCAR
- Python (Including convening short courses at EGU24 and EGU25)

BIG data analysis

- Popular dataset include ERA5 reanalysis, NCEP reanalysis, TRMM (level 3 data)
- Largest model output analyzed: 28 ensembles of CESM simulation (each ensemble = 1400 years)

Manuscript writing and presentation

- 2 single-author and 12 first-author publications
- 2 best presentation awards and several invited/public talks

Graduate teaching and mentoring

- Completed teaching 4 courses at graduate level at ISTA
- Mentored 7 doctoral/pre-doctoral researchers

Social **skills**

- Former member of a music band VOX-POPULI
- Former radio-jockey at NYUAD university fm-station (hosted a program titled '*Right from the Ruh.*')
- Photography

COLLABORATORS & POTENTIAL REFEREES

Caroline Muller
Institute of Science and Technology Austria
Klosterneuburg 3400
Austria

Boualem Khouider
Department of Math and Stats
University of Victoria
Victoria V8W 3P4
Canada

Raghu Murtugudde
IDP in Climate Studies
Indian Institute of Technology Bombay
Mumbai 400 076
India

Soon-Il An
Irreversible Climate Change Research Center
Yonsei University
Seoul 03722
Republic of Korea

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Indian Institute of Tropical Meteorology
Pune 411008
India

Bhupendra Nath Goswami
Cotton University
Guwahati 781001
India

Marat Khairoutdinov
School of Marine & Atmospheric Sciences
Stony Brook University
NY 11790
USA

REVIEWER ACTIVITY

Manuscript Reviewed for:

Geophysical Research Letters, Journal of Climate, Climate Dynamics, International Journal of Climatology, Journal of the Atmospheric Sciences, Atmosphere, Climate, Water, Journal of Earth System Science, Pure and Applied Geophysics, Scientific Reports, Atmospheric Research, Quarterly Journal of the Royal Meteorological Society, Physics and Chemistry of the Earth, Journal of Atmospheric and Solar-Terrestrial Physics, Journal of Geophysical Research: Atmospheres.

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