Tarun Verma
Atmospheric and Oceanic Sciences
Princeton University

CONTACT INFORMATION
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EDUCATION

Department of Atmospheric Sciences
Texas A&M University, College Station, Texas, USA

Ph.D., Atmospheric Sciences (GPA: 3.93/4) Fall 2017

- Topic: *Role of ocean-atmosphere coupling in regional climatic impacts of anthropogenic sulfate aerosols.* Advisor: Ramalingam Saravanan, Ph.D

Centre for Atmospheric and Oceanic Sciences
Indian Institute of Science (IISc), Bengaluru, INDIA

M.Tech., Climate Science June 2010

- Topic: *Data assimilation experiments with low-order models.*
  Advisor: Ravi Shankar Nanjundiah, Ph.D

Sri Sathya Sai Institute of Higher Learning (SSSIHL)
Andhra Pradesh, INDIA

M.Sc., Physics March 2008

- Topic: *Investigation of resonant third-order optical nonlinearity in Rhodamine B.* Advisor: Sivarama Krishnan, Ph.D

RESEARCH EXPERIENCE

Postdoctoral Research Associate October 2021 - October 2023
Princeton University, Princeton, NJ

- Machine learning modeling of systematic ocean general circulation model errors.
- Neural network parameterization of ocean data assimilation increments based on local state in GFDL's operational SPEAR-ODA system.
- Interpretable and explainable machine learning approaches.

Postdoctoral Research Associate April 2018 - September 2021
Los Alamos National Laboratory, Los Alamos, NM

- Understanding the role of ocean circulation change in recent freshening of the Arctic Ocean using CESM simulations.
- Deep learning forecasting of high latitude climate variability.
- Dynamical bias correction techniques for decadal prediction systems.

Graduate Research Assistant September 2011 - May 2017
Texas A&M University, College Station, TX

- Tropical Pacific response to short-term sulfate aerosol forcing using coupled climate model experiments.
- Effect of SST variability on climate extremes over the continental United States using regional climate model experiments.

Graduate Researcher September 2014 - December 2014
Oak Ridge National Laboratory, Oak Ridge, TN

- Topic: Setting up and designing of CESM simulations to study climate response to sulfate aerosols.

Project Associate August 2010 - June 2011
Indian Institute of Science, Bengaluru, INDIA

- Topic: Assimilation of NCEP Reanalysis and AIRS data in Community Atmospheric Model (CAM3) using Data Assimilation Research Testbed.

Field Experience

1. Continental Tropical Convergence Zone (CTCZ) observation program in the Bay of Bengal, July 2009. Collection of near-surface observations using automatic weather station and upper air observations using radiosondes onboard Ocean Research Vessel-Sagar Kanya.

Computing Skills

Computer Programming

Python, Julia, NCL, Matlab, GRADS, FORTRAN, C, C++, shell scripting and others

Numerical Models

Community Earth System Models (CESM)
Weather Research and Forecasting model (WRF)
Seamless System for Prediction and EArth System Research (SPEAR)

Journal Publications

1. Verma, Tarun, R. Saravanan, P. Chang, S. Mahajan, 2019: Tropical Pacific ocean dynamical response to short-term sulfate aerosol forcing, *Journal of Climate*, 10.1175/JCLI-D-19-0050.1
2. Nadiga, Balu, T. Verma, W. Weijer, N. Urban, 2019: Enhancing skill of initialized decadal predictions using a dynamical model of drift, *Geophysical Research Letters*, 46, 10.1029/2019GL084223
3. Hunke, Elizabeth, A. Roberts, G. D'Angelo, T. Verma, M. Chen, J. Dan, J. Urrego-Blanco, C. Wilson, N. Urban, M. Maltrud, 2019: Diagnosing near-future changes in Arctic sea ice and ocean conditions, *Los Alamos Tech. Report*, LA-UR–19-29886.
4. Zhang, Jiaxu, W. Weijer, M. Steele, W. Cheng, T. Verma, M. Veneziani 2021: Labrador Sea freshening linked to Beaufort Gyre freshwater release, *Nature Comm.*, 12, 1229 (2021). https://doi.org/10.1038/s41467-021-21470-3
5. Kurtakoti, Prajvala, W. Weijer, M. Veneziani,, P. J. Rasch, T. Verma, 2024: Sea ice and Cloud Processes Mediating Compensation between Atmospheric and Oceanic Meridional Heat Transports across the CMIP6 Preindustrial Control Experiment, *Journal of Climate*, 37(2), 505-525.
6. Verma, Tarun, W. Weijer, T. Haine, M. Veneziani, W. Kim, J. Zhang 2024: Role of ocean circulation changes in the recent increase of Arctic liquid freshwater content, *In Review.*
7. Verma, Tarun, F. Lu, A. Adcroft, L. Zanna, A. Gnandesikan 2024: Deep learning of systematic ocean model errors using data assimilation increments, *In Preparation.*
8. Verma, Tarun, T. Haine, P. Kurtakoti 2024: Understanding shifts in Arctic Mediterranean ocean circulation and its uncertainty. *In Preparation.*

Conference Publications

1. Urban, Nathan, Lu D., et al., Surrogate models and emulators, 2022:, *Department of Energy AI4ESP workshop report.*
2. Bhat, G. S., T. Verma, D. Jain, S. Muralidharan, S.S. Prijith, 2010: Intercomparison of Vaisala and Pisharoty derived atmospheric boundary layer properties over Bay of Bengal during CTCZ pilot, *Continental Tropical Convergence Zone (CTCZ) Workshop, IITM Pune, India.*

Invited Talks

1. Verma, Tarun, W. Weijer, N. Urban, B. Nadiga, S. Yeager, G. Danabasoglu, "Variability and predictabilty of Arctic Freshwater Content in CESM Decadal Prediction Large Ensemble" *SIAM talk at Texas A&M University, College Station, TX*, March 2019.

Oral Presentations

1. Verma, Tarun, F. Lu, A. Adcroft, L. Zanna, "Deep learning of systematic ocean model errors using data assimilation increments." *Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, MD*, October 2023.
2. Verma, Tarun, F. Lu, A. Adcroft, "Data-driven state-dependent ocean model error correction from data assimilation increments" *CESM Ocean Model Working Group Meeting, Boulder, CO*, March, 2023.
3. Verma, Tarun, F. Lu, A. Adcroft, "Learning ocean model errors from data assimilation increments" *American Meteorological Society (AMS) Annual Meeting, Denver, CO*, January, 2023.
4. Verma, Tarun, N. Urban, "Deep learning forecasting of high latitude climate variability" *RGMA PI Meeting (online)*, November 2020.
5. Zhang, Jiaxu, W. Weijer, W. Cheng, M. Steele, T. Verma, "Impact of the Beaufort Gyre freshwater release on deepwater formation in the North Atlantic" *Ocean Sciences Meeting, San Diego, CA*, February 2020
6. Verma, Tarun, W. Weijer, S. Yeager, G. Danabosuglu, "Drift of Arctic freshwater system in CESM initialized decadal prediction system" *15th Conference on Polar Meteorology and Oceanography, Boulder, CO*, May 2019.
7. Verma, Tarun, W. Weijer, J. Zhang, C. Veneziani, "Recent Freshening of the Arctic Ocean in CESM Large Ensemble JRA55 forced Ocean-Sea ice Simulations" *HiLAT-RASM meeting, Boulder, CO* May 2019.
8. Verma, Tarun, R. Saravanan, P. Chang, "Cloud response to short-term sulfate aerosol forcing over the tropics" *American Meteorological Society (AMS) Annual Meeting, Seattle, WA*, January, 2017.
9. Verma, Tarun, S. Mahajan, W. C. Hsieh, R. Saravanan, P. Chang, "Ocean feedback in regional climate response to sulfate aerosol forcing" *American Meteorological Society (AMS) Annual Meeting, New Orleans, LA*, January 2016.
10. Verma, Tarun, C. M. Patricola, J. S. Hsieh, R. Saravanan, P. Chang, "Remote influences of atmospheric and oceanic variability on heat waves and cold spells in a regional climate model" *American Meteorological Society (AMS) Annual Meeting, Phoenix, AZ*, January 2015.
11. Verma, Tarun, C. M. Patricola, R. Saravanan, P. Chang, "Climate extremes over the United States in a regional climate model: Role of remote atmospheric and oceanic variability" *Oak Ridge National Laboratory, Oak Ridge, TN*, December 2014.

Poster Presentations

1. Verma, Tarun, F. Lu, A. Adcroft, L. Zanna "Learning Systematic Errors in the Ocean using Data Assimilation Increments" M^2LInES *Site Visit, New York, NY*, September, 2023.
2. Verma, Tarun, W. Weijer, J. Zhang, W. Kim, W. Maslowski, C. Veneziani, "Potential Fram Strait Circulation Feedback Freshens the Arctic Ocean" *16th Conference on Polar Meteorology and Oceanography, Online*, June 2021
3. Verma, Tarun, W. Weijer, J. Zhang, C. Veneziani, "Drift of Arctic Freshwater System in CESM Initialized Decadal Predictions" *Ocean Sciences Meeting, San Diego, CA*, February 2020

4. Verma, Tarun, W. Weijer, S. Yeager, D. Comeau, N. Urban, B. Nadiga, G. Danabasoglu, "Predictability of Arctic Freshwater Content in CESM Decadal Prediction Large Ensemble" *EESM PI meeting, Potomac, MD*, November 2018.

5. Verma, Tarun, S. Mahajan, R. Saravanan, P. Chang, "Transient tropical Pacific response to anthropogenic sulfate aerosols" *CESM workshop, NCAR, Center Green Auditorium, Boulder, CO*, June 2017.

6. Verma, Tarun, S. Mahajan, R. Saravanan, P. Chang, "Short-term tropical Pacific response to Sulfate Aerosol Forcing" *Regional and Global Climate Model (RGCM) Principal Investigators meeting, Rockville, MD*, November 2016.

7. Verma, Tarun, J. S. Hsieh, C. M. Patricola, R. Saravanan, P. Chang, "Effect of sea surface temperature variability on rainfall extremes in a regional climate model" *American Meteorological Society (AMS) Annual Meeting, Austin, TX*, January 2013.

Teaching Experience

Graduate Teaching Assistant — Fall 2017
ATMO 202 − Weather & Climate Laboratory
Department of Atmospheric Sciences
Texas A&M University

Graduate Teaching Assistant — Fall 2017
ATMO 321 − Computer Applications in the Atmospheric Science
Department of Atmospheric Sciences
Texas A&M University

Volunteering Experience

Big Event Community-wide Service Project, Texas A&M University — 2011 - 2015

Annual Rural Community Service Project, SSSIHL, India — 2003 - 2007

Scholarships

Graduate Aptitude Test for Engineering (GATE) scholarship — 2008 - 2010
Ministry of Human Resource and Development, India

Junior Research Fellowship (JRF) — 2008
Council of Scientific and Industrial Research, India

Professional Societies

Member of American Meteorological Society

Member of American Geophysical Union