Prajeesh Ag

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Experience

Climate Change Center, KAUST, Research Specialist — Jeddah, KSA — Jan 2023 – present

- Developed a regional coupled climate model for seasonal scale forecasting across the Arabian Peninsula region. Integrated WRF and MITgcm through ESMF coupler, optimizing performance and accuracy
- Created a Python Command-Line Interface (CLI) tool to simplify data generation, manipulation, and visualization for the model, making the process more efficient and user-friendly.
- Set up an automated, fault-tolerant workflow using the Cylc engine to manage a 50-member ensemble system for seasonal predictions in the Arabian Peninsula.

Indian Institute of Tropical Meteorology, Scientist-D — Pune, India — Jan 2020 – Dec 2022

- Developed a new spectral dynamical core (Spec2d) for the atmospheric model of IITM-ESM. Used non-blocking MPI communications, distributed array traspose and FFT capabilities of FFTW library to enable efficient 2D domain decomposition. This vastly improved scalability and throughput.
- Developed a high-resolution (6km) global forecast model (HGFM) for Short Range Forecasting by implementing a novel TCO grid, enhancing prediction accuracy and resolution (Phani et al., 2024).
- Implemented MPI parallelization in the Ocean Dynamics Thermodynamic Model (ODTM), boosting model throughput by up to 30 times, thus accelerating simulations and analysis.
- Investigated Monsoon, IOD, and ENSO phenomena, employing CMIP6 data to explore the interactions and feedback mechanisms, with publications in peer-reviewed journals
- Lead a team of 3-4 scientists in developing and enhancing IITM-ESM, overseeing project milestones and ensuring alignment with research objectives.

Indian Institute of Tropical Meteorology, Scientist-C — Pune, India — Jan 2016 – Dec 2019

- Managed and oversaw the CMIP6 experiments conducted with IITM-ESM.
- Developed production workflows essential for CMIP6 simulations of IITM-ESM on High-Performance Computing (HPC) systems
- Designed and developed an intuitive and modular Input/Output manager for IITM-ESM, harnessing modern Fortran's Object-Oriented Programming capabilities alongside NetCDF4 library.
- Implemented mosaic grid for surface flux computation IITM-ESM, resolving flux-transfer inconsistencies over sea-ice and land-ocean boundaries. This significantly improved the sea-ice simulations and the global energy budget (Swapna et al., 2018).
- Developed post-processing software in Python, C, and Fortran, leveraging NetCDF4 and GRIB libraries to streamline data analysis and visualization workflows.
- Conducted climate change analysis, contributing to understanding of anthropogenic influences on climate dynamics

Indian Institute of Tropical Meteorology, Scientist-B — Pune, India — Jan 2013 – Dec 2015

- Implemented concurrent coupling using FMS coupler to enhance the throughput

of the IITM-ESM model, optimizing resource utilization and computational efficiency.
- Identified and resolved memory leak issues in the IITM-ESM using Valgrind, ensuring model stability and reliability.
- Conducted comprehensive performance analysis of IITM-ESM using Allinea MAP, pinpointing and addressing bottlenecks to optimize overall performance and efficiency.

Education

PhD **University of Pune**, Atmospheric Science — Apr 2018 – Mar 2024

- **Thesis:** Indian Ocean Dipole variations in a warming climate and associated linkages to monsoon and marine primary productivity (pdf)
- **Course work**: Earth System Sciences and Climate, Physics & Chemistry of Atmosphere, Weather, Climate & General Circulation, Geophysical Fluid Dynamics, Statistical Methods, Large scale Air-sea Interaction, Observational Techniques
- Used advanced statistical techniques such as cross-correlations, principal component analysis, significance tests and anomaly composites

MSc **Cochin University of Science and Technology**, Physical Oceanography — May 2008 – Apr 2010

- **Main Subjects**: Physical Oceanography, Ocean Observation, Coastal and Estuarine Oceanography, Computer Programming, Ocean Modelling, Ocean Engineering
- **Marks**: 7.84/10 (Transcript)

Skills

Languages: Fortran (proficient), Python (proficient), Bash (proficient), C (Familiar), JavaScript (Prior Experience)

Data Formats: NetCDF4, GRIB1/2, JSON, XML, Binary, ASCII, YAML

High performance computing: Parallel Programming (MPI, OpenMP), Job Schedulers (Slurm, PBS, LSF)

Data processing and Visualization: CDO, NCO, Matplotlib, Cartopy, Xarray, Numpy, Iris, NCL

Software Libraries and Tools: Git, GitHub CI, Django Web Framework, Pytest, Cylc Workflow Engine, Debuggers and Profilers, Earth System Modeling Framework, Flexible Modeling System, FFTW, WRF model, MITgcm, Modular Ocean Model

Open Source Projects

Clios - prajeeshag.github.io/clios

- **Clios** is a python library to create chainable Command-Line Operators.
- It is a library to create CDO like application in Python.
- In this project, I used test-driven development, implemented automated documentation, and set up GitHub CI for automated testing and documentation building.
- Applied design patterns such as composite and strategy to structure the code effectively.

Additional Experience and Awards

Instructor (2015 - 2022): Taught Computer Application for Climate Science course at Indian Institute of Tropical Meteorology, Pune.

Publications

Madden Julian Oscillation Moves Faster as the Meridional Moisture Gradient Intensifies in a Warming World 2024

Dasgupta, Panini, Roxy, M. K., Nam, SungHyun, **Prajeesh, A. G.**, Saranya, J. S., Zhang, Chidong, Ling, Jian, Kim, Daehyun

Geophysical Research Letters

Simulating the Ecosystem-Atmosphere Carbon, Water and Energy Fluxes at a Subtropical Indian Forest Using an Ecosystem Model 2024

Deb Burman, Pramit Kumar, **Prajeesh, A. G.**, Chakraborty, Supriyo, Tiwari, Yogesh K., Sarma, Dipankar, Gogoi, Nirmali

Ecological Modelling

IITM High-Resolution Global Forecast Model Version 1: An Attempt to Resolve Monsoon Prediction Deadlock 2024

Krishna, R. Phani Murali, Kumar, Siddharth, **Prajeesh, Athippatta Gopinathan**, Bechtold, Peter, Wedi, Nils, Roy, Kumar, Ganai, Malay, Reddy, B. Revanth, Tirkey, Snehlata, Goswami, Tanmoy, Kanase, Radhika, Mukhopadhyay, Parthasarathi

Geoscientific Model Development Discussions

The Indian Summer Monsoon and Indian Ocean Dipole Connection in the IITM Earth System Model (IITM-ESM) 2022

Prajeesh, A. G., Swapna, P., Krishnan, R., Ayantika, D. C., Sandeep, N., Manmeet, S., Aditi, M., Sandip, I.

Climate Dynamics

On the Weakening Association between South Asian Monsoon and Atlantic Multidecadal Oscillation 2022

Sandeep, N., Swapna, P., Krishnan, R., Farneti, R., Kucharski, F., Modi, Aditi, **Prajeesh, A. G.**, Ayantika, D. C., Manmeet, S.

Climate Dynamics

Increasing Frequency of Extremely Severe Cyclonic Storms in the North Indian Ocean by Anthropogenic Warming and Southwest Monsoon Weakening 2022

Swapna, Panickal, Sreeraj, P., Sandeep, N., Jyoti, J., Krishnan, R., **Prajeesh, A. G.**, Ayantika, D. C., Manmeet, S.

Geophysical Research Letters

Numerical Investigation of Tropical Indian Ocean Barrier Layer Variability 2022

Valsala, Vinu, **Prajeesh, A. G.**, Singh, Shikha

Journal of Geophysical Research: Oceans

Understanding the Combined Effects of Global Warming and Anthropogenic Aerosol Forcing on the South Asian Monsoon 2021

Ayantika, D. C., Krishnan, R., Singh, M., Swapna, P., Sandeep, N., **Prajeesh, A. G.**, Vellore, R.

Climate Dynamics

On the Variability of Arabian Sea Mixing and Its Energetics 2019

Singh, Shikha, Valsala, Vinu, **Prajeesh, A. G.**, Balasubramanian, Sridhar

Journal of Geophysical Research: Oceans

Long-Term Climate Simulations Using the IITM Earth System Model (IITM-ESMv2) With Focus on the South Asian Monsoon 2018

Swapna, P., Krishnan, R., Sandeep, N., **Prajeesh, A. G.**, Ayantika, D. C., Manmeet, S., Vellore, R.

Journal of Advances in Modeling Earth Systems

Towards a Realistic Simulation of Boreal Summer Tropical Rainfall Climatology in State-of-the-Art Coupled Models: Role of the Background Snow-Free Land Albedo 2018

Terray, P., Sooraj, K. P., Masson, S., Krishna, R. P. M., Samson, G., **Prajeesh, A. G.**

Climate Dynamics

The IITM Earth System Model: Transformation of a Seasonal Prediction Model to a Long-Term Climate Model 2015

Swapna, P., Roxy, M. K., Aparna, K., Kulkarni, K., **Prajeesh, A. G.**, Ashok, K., Krishnan, R., Moorthi, S., Kumar, A., Goswami, B. N.

Bulletin of the American Meteorological Society

Falling Monsoon Depression Frequency: A Gray-Sikka Conditions Perspective 2013

Prajeesh, A. G., Ashok, K., Rao, D. V. Bhaskar

Scientific Reports