

Mukesh Rai

POSTDOCTORAL RESEARCH ASSOCIATE

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Experience

NASA-Jet Propulsion Laboratory/Caltech

USA

POSTDOCTORAL FELLOW

Jan. 2023 - Present

- Investigation of the impacts of human activity on composition and air quality.
- Introduce the new transport diagnostic tools i.e. trace gas atmospheric river [TGARs] detection algorithm.
- Identify and characterize key atmospheric transport events across the globe.
- Data validation obtained from JPL chemical data assimilation system with satellite retrieval from NASA's TES, AIR/OMI, NOAA's CrIS.

The International Centre for Integrated Mountain Development (ICIMOD)

Nepal

AIR QUALITY DASHBOARD – MODELLING (CONSULTANT)

Sep. 2022 - Dec. 2022

- Support incorporating NASA/SERVIR Hindu Kush Himalaya project air quality model and satellite products in the atmospheric watch initiative (AWI) program
- Evaluations of the air quality observation models and satellite products.
- Support server maintenance, data storage, and management aspects.

ICIMOD

Nepal

RESEARCH ASSISTANT

Oct. 2017 - Mar. 2018

- Contributed to a workshop and Science Policy Dialogue: Air Pollution, Climate, and Health in South Asia and the Hindu Kush Himalaya.
- Involved in research paper writing by using the real-time BC aerosol source, sink, optical and physical properties, radiative forcing, heating rate, and its implication.

ICIMOD

Nepal

INTERN

Jan. 2017 - Jun. 2017

- Test functionality of successful testing of autonomous black carbon station: Complete instrument deployment and data transmission.
- Assisted research group leader in the project.

Education

Department of Geography, University of Chinese Academy of Sciences

China

PH.D. IN ATMOSPHERIC PHYSICS AND ATMOSPHERIC ENVIRONMENT

Sep. 2018 - May 2022

- Tracing atmospheric aerosol distribution, transport mechanism, and their radiative effects over Third Pole region using WRF-Chem simulation

Department of Environmental Science And Engineering [DESE], Kathmandu University

Nepal

M.S BY RESEARCH IN GLACIOLOGY

Sep. 2015 - Aug. 2017

- Aerosol radiative forcing estimation over a remote high-altitude location (4900 masl) near yala glacier, Nepal

Center Department of Environmental Science [CDES], Tribhuvan University

Nepal

MASTER IN ENVIRONMENTAL SCIENCE

Feb. 2011 - Jan. 2013

- Climate Change and air pollution control

Skills

Programming Python, R, Matlab, Linux, NCL, CDO, Github, Obsidian

Models/Tools WRF-Chem, HYSPLIT/PySPLIT, SBDART, OPAC, ArcGIS, TrajStat, IPART, GMT

Others High performance computing, Satellite data handling, \LaTeX , publishing

Honors & Awards

2022 **NASA-JPL/Caltech**, Postdoctoral Fellow

U.S.A

2018 **CAS-TWAS Presidents Fellowship**, Ph.D

China

2015 **Cryospheric Monitoring Project, ICIMOD**, M.S grant

Nepal

2012 **SEAM-Nepal**, Master thesis grant

Nepal

Membership & Community Services

MEMBERSHIP

2023 **The American Geophysical Union**, General Member
2010 **Greenhood Nepal**, Team Member

U.S.A
Nepal

COMMUNITY SERVICES

2024 **NASA NSPIRES**, Panelist NASA F.5 FINESST23 Earth: Air Quality Modeling and Impacts
2023 **JPL Explorer**, Volunteering
2015 **Seed to Feed Campaign**, Organized the campaign after the 2015 earthquake

U.S.A
U.S.A
Nepal

Presentation

104th American Meteorological Society 2024

Baltimore USA

PRESENTER FOR <ATMOSPHERIC COMPOSITION MODELING AND ANALYSIS PROGRAM (ACMAP)>

Jan 28-Feb 01, 2024

- Poster presentation on Trace Gas Atmospheric Rivers: Remote Drivers of Air pollutants

American Geophysical Union 2023

San Francisco USA

PRESENTER FOR <ADVANCES IN THE INTEGRATED GLOBAL OBSERVING SYSTEM FOR AIR QUALITY: SCIENCE AND SOCIETAL BENEFIT>

11, Dec, 2023

- Oral presentation on Trace Gas Atmospheric Rivers: Remote Drivers of Air pollutants

Jet Propulsion Laboratory Postdoc research day 2023

Pasadena, CA, USA

PRESENTER FOR <RESEARCH POSTER DAY 2023>

29, Nov, 2023

- Presented results from my first project on trace gas atmospheric river

International Conference on Mountain and Hydrology and Cryosphere

Kathmandu, Nepal

CONVENER FOR <IAHS CONFERENCE>

09-10, Nov, 2023

- Session chaired on Mountain Hydrology

NASA joint AIRS Sounder Science team meeting 2023

Maryland, USA

PRESENTER FOR <TRACE GAS ATMOSPHERIC RIVERS: REMOTE DRIVERS OF AIR POLLUTANTS>

03-07, Oct, 2023

- Presented on trace gas atmospheric river pollution transport

Meteorology and Climate - Modeling for Air Quality Conference (MAC-MAQ)

UC Davis, USA

PRESENTER FOR <TRACE GAS ATMOSPHERIC RIVERS: REMOTE DRIVERS OF AIR POLLUTANTS>

13-15, Sep, 2023

- Presented lightning talk about the trace gas atmospheric river pollution transport

Atmospheric Composition and the Asian Monsoon (ACAM)

Virtual

PRESENTER FOR <ATMOSPHERIC CHEMISTRY AND AEROSOLS IN THE ASIAN MONSOON REGION USING SATELLITE AND MODEL DATA>

22 Oct. 2021

- Presented on aerosol-climate feedback on regional study

4th Congress of China geodesy and geophysics

Qingdao, China

PRESENTER FOR <MARITIME SILK ROAD AND EARTH SYSTEM SCIENCES>

24 Jul. 2020

- Presented synoptic scale study on trans-boundary air pollution and its driving mechanism

International forum hosted by ICIMOD

Kathmandu, Nepal

PRESENTER FOR <INTERNATIONAL FORUM ON THE CRYOSPHERE AND SOCIETY THE VOICE OF THE HINDU KUSH HIMALAYA>

28-30. Aug. 2019

- Introduced the results on how pollution may impact on cryospheric body and society

Publications

PUBLISHED

1. **Rai, M.**, Miyazaki, K., Payne, V., Guan, B., Waliser, D. (2023). Trace gas atmospheric rivers: remote drivers of air pollutants. (In prep)
2. **Rai, M.**, Kang, S., Yang, J., Chen, X., Hu, Y., & Rupakheti, D. (2022). Tracing atmospheric anthropogenic black carbon and its potential radiative response over pan-third pole region: A synoptic-scale analysis using wrf-chem. *Journal of Geophysical Research-Atmosphere*, 127, e2021JD035772. <https://doi.org/10.1029/2021JD035772>
3. **Rai, M.**, Mahapatra, P. S., Gul, C., Kayastha, R. B., Panday, A. K., & Puppala, S. P. (2019). Aerosol radiative forcing estimation over a remote high-altitude location (4900 masl) near yala glacier, nepal. *Aerosol and Air Quality Research*, 19(8), 1872–1891. <https://doi.org/10.4209/aaqr.2018.09.0342>
4. **Rai, M.**, Kang, S., Yang, J., Rupakheti, M., Rupakheti, D., Tripathi, L., , Hu, Y.,Chen (2022) Insight into seasonal aerosol concentrations, meteorological influence, and transport over the Pan-Third Pole region using multi-sensors satellite and model simulation. *Atmospheric Chemistry and Physics Discussion*, 2022, 1-36. <https://doi.org/10.5194/acp-2022-199>

5. Yang, J., Kang, S., Chen, D., Zhao, L., Ji, Z., Duan, K., Deng, H., Tripathee, L., Du, W., **Rai, M.**, Yan, F., Li, Y., Gillies, R.R (2022), South Asian black carbon is threatening the water sustainability of the Asian Water Tower. *Nature Communication*. 13, 7360. <https://doi.org/10.1038/s41467-022-35128-1>
6. Hu, Y., Yu, H., Kang, S., Yang, J., **Rai, M.**, Yin, X., Chen, X., and Chen, P. (2024). Aerosol-meteorology feedback diminishes the trans-boundary transport of black carbon into the Tibetan Plateau. 2024. *Atmospheric Chemistry and Physics*. <https://doi.org/10.5194/acp-24-85-2024>
7. Li, C., Zhang, C., Kang, S., Hu, Y., Yang, F., Liu, Y., **Rai, M.**, Zhang, H., Chen, P., Wang, P., He, C., Wang, S., Slim transport of atmospheric organic carbon into Tibet from South Asia in monsoon season (2024). *Science of The Total Environment*. <https://doi.org/10.1016/j.scitotenv.2024.171321>
8. Rupakheti, D., Rupakheti, M., **Rai, M.**, Yu, X., Yin, X., Kang, S., Orozaliev, D.O., Sinyakov, Sinyakov, V.P., Abdullaev, S.F., Sulaymon, I.D., & Hu, J., (2022) Spatio-temporal characteristics of air pollutants over Xinjiang, northwestern China. *Environmental Pollution* 316: 115907. <https://doi.org/10.1016/j.envpol.2022.120501>
9. Yang, J., Kang, S., Hu, Y., Chen, X., **Rai, M.** (2022). Influence of South Asian Biomass Burning on Ozone and Aerosol Concentrations Over the Tibetan Plateau. *Advances in Atmospheric Sciences* 10(1007): <https://doi.org/10.1007/s00376-022-1197-0>
10. Rupakheti, D., Aculinin, A., Rupakheti, M., Dahal, S., **Rai, M.**, Yin, X., Yu, X., Abdullaev, SF, Hu, J. (2023). Insights on aerosol properties using two decades-long ground-based remote sensing datasets in Moldova, Eastern Europe. *Environmental Pollution*. <https://doi.org/10.1016/j.envpol.2023.122535>
11. Hu, Y., Kang, S., Yang, J., Chen, X., Ji, Z., & **Rai, M.** (2022). Transport of black carbon from Central and West Asia to the Tibetan Plateau: Seasonality and climate effect. *Atmospheric Research* 809: 151095. <https://doi.org/10.1016/j.atmosres.2021.105987>
12. Chen, P., Kang, S., Hu, Y., Pu, T., Liu, Y., Wang, S., **Rai, M.**, Wang, K., Li, C., 2024. South and Southeast Asia controls black carbon characteristics of Meili Snow Mountains in southeast Tibetan Plateau. *Science of The Total Environment* 14: 172262. <https://doi.org/10.1016/j.scitotenv.2024.172262>
13. Regmi, J., Poudyal, K.N., Pokhrel, A., Malakar, N., Gyawali, M., Tripathee, L., **Rai, M.**, Ramachandran, S., Wilson, K., Aryal, R. (2023). "Analysis of Surface Level PM_{2.5} Measured by Low-Cost Sensor and Satellite-Based Column Aerosol Optical Depth (AOD) over Kathmandu." *Aerosol and Air Quality Research* 23: 1. <https://doi.org/10.4209/aaqr.220311>
14. Yang, J., Kang, S., Hu, Y., Chen, X., **Rai, M.** (2023). "Springtime biomass burning impacts air quality and climate over the Tibetan Plateau". *Atmospheric Environment*. <https://doi.org/10.1016/j.atmosenv.2023.120068>
15. Mehra, M., Shrestha, S., AP, Krishnakumar, Guagenti, M., Moffett, CE., VerPloeg, Coogan, MA., **Rai, M.**, Kumar, R., Andrews, E., Sherman JP, Flynn III, JH., Usenko, S., Sheesley. (2023). "Atmospheric heating in the US from saharan dust: Tracking the June 2020 event with surface and satellite observations". *Atmospheric Environment*. 310:119988. <https://doi.org/10.1016/j.atmosenv.2023.119988>
16. Chen, P., Kang, S., Li, C., Hu, Z., Tripathee, L., **Rai, M.**, Pu, T., Yin, x., Gustafsson, Ö., 2022. Carbonaceous aerosol transport from the Indo-Gangetic Plain to the Himalayas: Carbon isotope evidence and light absorption characteristics. *Geoscience Frontiers* 14: 101516. <https://doi.org/10.1016/j.gsf.2022.101516>
17. Dhital, Y.P., Tang, J., Pokharel, A.K., Tang, Q., **Rai, M.** (2022). Impact of aerosol concentration on elevation-dependent warming pattern in the mountains of Nepal. *Atmospheric Science Letter*. <https://doi.org/10.1002/asl.1101>
18. Yang, M., Zhongqin, L., Anjum, M. N., Kayastha, R., Kayastha, R. B., **Rai, M.**, Chunhai, X. (2022). Projection of Streamflow Changes Under CMIP6 Scenarios in the Urumqi River Head Watershed, Tianshan Mountain, China. *Frontiers in Earth Science*. 809: 151095. <https://doi.org/10.3389/feart.2022.857854>
19. Li, C., Yan, F., Zhang, C., Kang, S., **Rai, M.**, Zhang, H., & He, C (2022). Spatio-temporal characteristics of air pollutants over Xinjiang, northwestern China. *Science of the Total Environment*. 809: 151095. <https://doi.org/10.1016/j.scitotenv.2021.151095>
20. Rupakheti, D., Yin, X., Rupakheti, M., Zhang, Q., Li, P., **Rai, M.**, & Kang, S. (2021). Spatio-temporal characteristics of air pollutants over Xinjiang, northwestern China. *Environmental Pollution*. 268: 115907. <https://doi.org/10.1016/j.envpol.2020.115907>
21. Maharjan, L., Kang, S., Tripathee, L., Gul, C., Zheng, H., Li, Q., **Rai, M.**, & Santos, E. Atmospheric particle-bound polycyclic aromatic compounds over two distinct sites in Pakistan: Characteristics, sources and health risk assessment. *Journal of Environmental Science* 112: 1-15. <https://doi.org/10.1016/j.jes.2021.04.024>
22. Rupakheti, D., Rupakheti, M., Yin, X., Hofer, J., **Rai, M.**, Hu, Y. & Kang, S. (2021). Spatio-temporal characteristics of air pollutants over Xinjiang, northwestern China. *Geoscience Frontier* 12:101251. <https://doi.org/10.1016/j.gsf.2021.101251>
23. Neupane, B., Wang, J., Kang, S., Zhang, Y., Chen, P., **Rai, M.**, & Thapa, P. (2021). Black carbon and mercury in the surface sediments of Selin Co, central Tibetan Plateau: Covariation with total carbon. *Science of the Total Environment* 19: 1872-1891. <https://doi.org/10.1016/j.scitotenv.2020.137752>
24. Gul, C., Mahapatra, P.S., Kang, S., Singh, P.K., Wu, X., He, C., Kumar, R., **Rai, M.**, Xu, Y. and Puppala, S.P. (2021). Black carbon concentration in the central Himalayas: Impact on glacier melt and potential source contribution. *Environmental Pollution* 275: 116544. <https://doi.org/10.1016/j.envpol.2021.116544>

SUBMITTED

1. Yang, J., Kang, S., Chen, D., Duan, K., Wang, N., Du, W., Zhao, L., Deng, H., Wang, R., Zhang, Z., **Rai, M.**, Gillies, R. 2023. Tibetan Plateau freshwater availability reduced by glacial responses to black carbon. 2023. PNAS Nexus