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 by using newly developed transport diagnostic tools i.e. trace gas atmospheric river [TGAR] detection algorithm.
- Data validation obtained from JPL chemical data assimilation system with new state of art satellite CrIS product.

The International Centre for Integrated Mountain Development (ICIMOD) — *Nepal*

Air Quality Modeler — *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
- Performed extensive model to observation validation, model-to-satellite validation, and model-to-model validation.

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*

- Supported the establishment of a real-time black carbon observatory at high altitude, encompassing testing functionality to instrument deployment and data transmission.

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, Matlab, NCL, CDO
Models/Tools WRF-Chem, HYSPLIT/PySPLIT, SBDART, OPAC, ArcGIS, TrajStat, IPART, GMT,Github
Others Linux, 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 *U.S.A*

2010 **Greenhood Nepal**, Team Member *Nepal*

Community Services

2024 **Panelist Reviewer**, NASA FINESST23 Earth: Air Quality Modeling and Impacts *U.S.A*

2023 **JPL Exploreer**, Volunteering *U.S.A*

2015 **Seed to Feed Campaign**, Organized the campaign after the 2015 earthquake *Nepal*

Presentation

American Geophysical Union 2024 *Washington DC*

Presenter for <American Geophysical Union 2024> *Dec 9-13, 2024*

- Exploring the role of trace gas atmospheric rivers in extreme air pollution events: Case studies illustrated using TROPESS-CrIS products and TCR-2 reanalysis

NASA/AIRS Sounder Meeting *Pasadena, CA*

Presenter for <NASA Joint AIRS/Sounder Science Team Meeting 2024> *Sept 24-June 27, 2024*

- Long-range pollution transport and air quality events in Los Angeles: Case studies illustrated using TROPESS-CrIS products and TCR-2 reanalysis

NASA Health and Air Quality Applied Sciences Team *MIT - Cambridge, MA*

Presenter for <NASA Health and Air Quality Applied Sciences Team> *June 3-June 5, 2024*

- Poster presentation on exploring the role of atmospheric rivers in extreme air pollution events

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.**, 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

2. **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

3. **Rai, M.**, Kang, S., Yang, J., Rupakheti. M., Rupakheti, D., Tripathee, 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

4. 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

5. Hu, Y., Yu, H., Kang, S., Yang, J., **Rai, M.**, Yin, X., Chen, X., and Chen, P. (2024). Aerosol-meteorology feedback diminishes the transboundary transport of black carbon into the Tibetan Plateau. 2024. Atmospheric Chemistry and Physics. https://doi.org/10.5194/acp-24-85-2024

6. 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

7. 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

8. 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

9. 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

10. 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

11. 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 PM2.5 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

12. 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

13. 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

14. 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

15. 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

16. 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

17. 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

In Preparation and Submmitted

1. **Rai, M.**, Miyazaki, K., Payne, V., Guan, B., Waliser, D. (2025). Exploring the role of trace gas atmospheric rivers in extreme air pollution events

2. **Rai, M.**, Miyazaki, K., Payne, V., Guan, B., Waliser, D. (2025). Trace gas atmospheric rivers: remote drivers of air pollutants. doi:10.5194/egusphere-2025-399.