

CURRICULUM VITAE: Rajesh Kumar

Project Scientist II

Research Application Laboratory (RAL), National Center for Atmospheric Research (NCAR)

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EDUCATION:

- Jul 2001 - Jun 2004 **Bachelor of Science (B. Sc.)** (First Division – 79%)
I. B. College, Panipat, India
- Jul 2004 - Jun 2006 **Master of Science (M. Sc.)** (First Division – 79%)
Department of Physics, Kururkshetra University, India
- June 2012 **Ph. D. In Earth Sciences** (magna cum laude)
University of Hamburg, Germany
Thesis Title: “Weather Research and Forecasting Model with Chemistry (WRF-Chem) over South Asia”

PROFESSIONAL EXPERIENCE:

- Feb 2018 – Present
 Project Scientist II, RAL, NCAR
- Mar 2016 – Feb 2018
 Project Scientist I, RAL, NCAR
- Oct 2015 – Feb 2016
 Post-doctoral Scientist, RAL, NCAR
- Aug 2015 – Sep 2015
 Post-doctoral Scientist, RAL and ACOM, NCAR
- Jan. 2015 – Aug. 2015
 Post-doctoral Scientist, ACOM, NCAR
- Jan. 2013 – Dec 2014
 Post-doctoral fellow, Advanced Study Program (ASP), NCAR
- Dec 2011 – Oct 2012
 Visiting Scientist, Max Planck Institute for Meteorology and Climate Service Center, Hamburg, Germany
- Jul 2008 – Jun 2012
 Senior Research Fellow, Aryabhata Research Institute of Observational Sciences, Nainital, India
- Jul 2006 – Jul 2008
 Junior Research Fellow, Aryabhata Research Institute of Observational Sciences, Nainital, India

RESEARCH EXPERIENCE AND TOOLS

In situ measurements

- In situ measurements of surface ozone, carbon monoxide, nitrogen oxides, sulphur dioxide, black carbon, aerosol optical depth, aerosol size distribution, particulate matter and meteorological parameters
- Air-sample collection and their analysis using gas chromatography (for CO and greenhouse gases)

- Balloon-borne measurements of ozone and meteorological parameters

Satellite and Reanalysis Data Products

- MODIS retrieved fire and aerosol products
- OMI retrieved tropospheric column NO₂, ozone profiles and aerosol product
- MOPITT retrieved tropospheric CO products
- TES retrieved ozone and CO products
- AIRS retrieved temperature, tropopause pressure and water vapor products
- TRMM retrieved rainfall products
- CALIPSO retrieved aerosol profiles
- NCEP/NCAR reanalysis products

Modeling

- Weather Research and forecasting model coupled with Chemistry (WRF-Chem – regional chemistry transport model)
- Community Multi-scale Air Quality (CMAQ) Model
- Chemical data assimilation, WRF-CMAQ and GSI
- Model for Prediction Across Scales (MPAS)
- NCAR Master Mechanism (box model)
- Air trajectory models (METEX and HYSPLIT)
- Optical properties of aerosols and clouds (OPAC – aerosol composition model)
- SBDART (A one dimensional model of radiative transfer)

SCIENTIFIC/TECHNICAL ACCOMPLISHMENTS

- Lead developer of chemistry component in MPAS
- Lead developer of the CMAQ-GSI chemical data assimilation system
- Chemical weather forecasting in support of FRAPPE field campaign.
- Studied the role of regional and distant sources in controlling surface ozone variations at Nainital
- Identified the impact of north Indian agricultural biomass burning on surface ozone, black carbon, AOD and radiation budget at Nainital
- Set-up the WRF-Chem model for the first time over the South Asian region and conducted detailed meteorological and chemistry evaluations
- Source contribution analysis of CO and BC in South Asia
- Studied the impact of a dust storm on regional scale aerosol optical properties, radiation budget and tropospheric chemistry in northern India
- Updated F-TUV photolysis scheme of the WRF-Chem model to include the effects of dust aerosols on photolysis rate calculation in WRF-Chem (**This update is available in official version of WRF-Chem since version 3.5.1**)
- Added heterogeneous chemistry occurring on the surface of dust particles in WRF-Chem
- Implementation of source, sector and region specific BC and CO tracers in WRF-Chem
- Chemistry Climate simulations over South Asia

AWARDS AND HONORS

- FRAPPE field campaign special recognition award
- Advanced Study Program (ASP) Postdoctoral Fellowship
- ASP Graduate Student Visitor Program Fellowship
- 1st position in university in M. Sc. (**Jindal Jubilee Gold Model**).

PROFESSIONAL ACTIVITIES

- Professional reviewer for peer-reviewed journals
 - Atmospheric Chemistry and Physics (ACP)
 - Geoscientific Model Development (GMD)
 - Journal of Geophysical Research (JGR)
 - Geophysical Research Letters (GRL)
 - Atmospheric Environment
 - Aeolian Research
 - Advances in Space Research
 - Atmospheric Pollution Research
 - Urban Climate
 - Environmental Science and Pollution Research
 - International Journal of Remote Sensing
 - Journal of Atmospheric Chemistry
 - Geohealth
 - Journal of Atmospheric and Oceanic Technology
- Professional reviewer for funding agencies
 - NSF panel and single-proposal reviewer
 - NASA proposal reviewer
 - Pazi foundation proposal reviewer
- Internal reviewer for publications and proposals in NCAR.
- Member of UCAR innovation council.
- Member of ASP seminar committee at NCAR.
- Representative of various (computer, canteen and library) committees in ARIES.

COMPUTING EXPERIENCE

- Programming Languages: IDL, NCL, FORTRAN and C
- Operating Systems: Windows, Linux, Mac and Unix
- File Handling: ASCII, NetCDF, HDF, HDF-EOS

GRANTS AND RESEARCH AWARDS

| Period | My Role | Title | Agency | Amount (USD) |
|-----------|---|--|--------|--------------|
| 2015-2017 | PI (Jul 2018–Jan 2019), Co-I (Oct 2015 – Jun 2018) | Chemical data assimilation and analog-based uncertainty quantification to improve decision-making in public health and air quality | NASA | \$1,266,168 |
| 2016-2019 | PI (June 2018 – Present), Co-I (June 2016 - | A novel ensemble design for PM _{2.5} Probabilistic predictions | NOAA | \$449,249 |
| 2018-2021 | Co-I | Multi-scale Chemical Forecasting and Analysis for FIREChem | NASA | \$605,617 |
| 2018-2021 | Co-I | Coordination, evaluation and ensemble prediction of multiple atmospheric composition forecasts in support of the FIREChem campaign | NASA | \$60,000 |

PUBLICATIONS THESIS

1. **R. Kumar**: Weather Research and Forecasting Model with Chemistry (WRF-Chem) over South Asia, 116, Reports on Earth System Science, ISSN 1614-1199, Max Planck Institute for Meteorology, Hamburg, Germany.

PEER-REVIEWED PUBLICATIONS

1. **R. Kumar**, M. Naja, S. Venkataramani, and O. Wild (2010), Variations in surface ozone at Nainital: A high-altitude site in the central Himalayas, *J. Geophys. Res.*, 115, D16302, doi:[10.1029/2009JD013715](https://doi.org/10.1029/2009JD013715).
2. **R. Kumar**, M. Naja, S. K. Satheesh, N. Ojha, H. Joshi, T. Sarangi, P. Pant, U. C. Dumka, P. Hegde, and S. Venkataramani (2011), Influences of the springtime northern Indian biomass burning over the central Himalayas, *J. Geophys. Res.*, 116, D19302, doi:[10.1029/2010JD015509](https://doi.org/10.1029/2010JD015509).
3. **R. Kumar**, Naja, M., Pfister, G. G., Barth, M. C., and Brasseur, G. P.: Simulations over South Asia using the Weather Research and Forecasting model with Chemistry (WRF-Chem): set-up and meteorological evaluation (2012), *Geosci. Model Dev.*, 5, 321-343, doi:10.5194/gmd-5-321-2012.
4. **R. Kumar**, Naja, M., Pfister, G. G., Barth, M. C., Wiedinmyer, C., and Brasseur, G. P.: Simulations over South Asia using the Weather Research and Forecasting model with Chemistry (WRF-Chem): chemistry evaluation and initial results (2012), *Geosci. Model Dev.*, 5, 619-648, doi:10.5194/gmd-5-619-2012.
5. **R. Kumar**, M. Naja, G. G. Pfister, M. C. Barth, and G. P. Brasseur (2013), Source attribution of carbon monoxide in India and surrounding regions during wintertime, *J. Geophys. Res. Atmos.*, 118, 1981–1995, doi:[10.1002/jgrd.50134](https://doi.org/10.1002/jgrd.50134).
6. **R. Kumar**, Barth, M. C., Pfister, G. G., Naja, M., and Brasseur, G. P. (2014), WRF-Chem simulations of a typical pre-monsoon dust storm in northern India: influences on aerosol optical properties and radiation budget, *Atmos. Chem. Phys.*, 14, 2431-2446, doi:10.5194/acp-14-2431-2014.
7. **R. Kumar**, M. C. Barth, S. Madronich, M. Naja, G. R. Carmichael, G. G. Pfister, C. Knute, G. P. Brasseur, N. Ojha, and T. Sarangi (2014), Effects of dust aerosols on tropospheric chemistry during a typical pre-monsoon season dust storm in northern India, *Atmos. Chem. Phys.*, 14, 6813-6834, doi:10.5194/acp-14-6813-2014.
8. **R. Kumar**, M. C. Barth, V. S. Nair, G. G. Pfister, S. S. Babu, S. K. Satheesh, K. K. Moorthy, G. R. Carmichael, Z. Lu and D. G. Streets (2015), Sources of black carbon aerosols in South Asia and surrounding regions during the Integrated Campaign for Aerosols, Gases and Radiation Budget (ICARB), *Atmos. Chem. Phys.*, 15, 5415-5428, doi:10.5194/acp-15-5415-2015.
9. **R. Kumar**, M. C. Barth, G. G. Pfister, V. S. Nair, S. D. Ghude, N. Ojha (2015), What controls the seasonal cycle of black carbon aerosols in India? *J. Geophys. Res.*, 120, 7788-7812, doi: 10.1002/2015JD023298.
10. **R. Kumar**, M. C. Barth, G. G. Pfister, L. Delle Monache, J-F. Lamarque, S. Archer-Nicholls, S. Tilmes, S. D. Ghude, C. Wiedinmyer, M. Naja, and S. Walters (2018), How will air quality change in South Asia by 2050?, accepted for publication in *J. Geophys. Res. – Atmos.*
11. **R. Kumar**, V.-H. Peuch, J. H. Crawford, G. P. Brasseur (2018), Five steps to improve air quality forecasts, *Nature*, 561, 27-29, doi: 10.1038/d41586-018-06150-5.
12. U. C. Dumka, K. K. Moorthy, **R. Kumar**, P. Hegde, R. Sagar, P. Pant, N. Singh and S. S. Babu, “Characteristics of Aerosol Black Carbon Mass Concentration over a High Altitude location in the Central Himalayas from multi-year measurements”, *Atmospheric Research*, 96 (4), Pages 510-521, doi: 10.1016/j.atmosres.2009.12.010, 2010.

13. N. Ojha, N., M. Naja, K. P. Singh, T. Sarangi, **R. Kumar**, S. Lal, M. G. Lawrence, T. M. Butler, and H. C. Chandola (2012), Variabilities in ozone at a semi-urban site in the Indo-Gangetic Plain region: Association with the meteorology and regional processes, *J. Geophys. Res.*, 117, D20301, doi:[10.1029/2012JD017716](https://doi.org/10.1029/2012JD017716).
14. Ghude, S. D., G. G. Pfister, C. Jena, R.J. van der A, L. K. Emmons, and **R. Kumar**, (2012), Satellite constraints of nitrogen oxide (NO_x) emissions from India based on OMI observations and WRF-Chem simulations, *Geophys. Res. Lett.* 40, doi: [10.1029/2012GL053926](https://doi.org/10.1029/2012GL053926).
15. S. Dipu, T. V. Prabha, G. Pandithurai, J. Dudhia, G. Pfister, **R. Kumar**, B. N, Goswami, (2013), Impact of elevated aerosol layer on the cloud macrophysical properties prior to monsoon onset, *Atmos. Environ.*, 70, 454-467.
16. T. Sarangi, M. Naja, N. Ojha, **R. Kumar**, S. Lal and H. C. Chandola, Variability in Meteorological Parameters and Trace Gases over the Central Himalayas: Observations and Model Simulations, *Vayumandal*, 38, 10-25.
17. T. Sarangi, M. Naja, N. Ojha, **R. Kumar**, S. Lal, S. Venkataramani, A. Kumar, R. Sagar, H. Chandola, (2013), First simultaneous measurements of ozone, CO and NO_y at a high altitude regional representative site in the central Himalayas, *J. Geophys. Res.*, 119,1-17, doi: 10.1002/2013JD020631
18. N. Ojha, M. Naja, T. Sarangi, **R. Kumar**, P. Bhardwaj, S. Lal, S. Venkataramani, R. Sagar, A. Kumar, H. C. Chandola (2014), On the Processes Influencing the Vertical distribution of ozone over the central Himalayas: Analysis of Yearlong ozonesonde observations, *Atmos. Environ.*, 88, 201-211.
19. P. Mahapatra, Sipra Panda, P. P. Walvekar, **R. Kumar**, Trupti Das, B. R. Gurjar (2014), Seasonal trends, meteorological impacts and health risks associated with atmospheric concentrations of gaseous pollutants at an Indian coastal city, *Environ. Sci. Pollu. & Res.*, 19, 11418-32, doi: 10.1007/s11356-014-3078-2.
20. S. D. Ghude, C. Jena, D. M. Chate, G. Beig, G. G. Pfister, R. Kumar and V. Ramanathan (2014), Reduction in India's crop yield due to ozone, *Geophys. Res. Lett.*, 41, 5685-5691, doi: 10.1002/2014GL060930.
21. C. Jena, S. D. Ghude, G. G. Pfister, D. M. Chate, R. Kumar, G. Beig, D. E. Sundran, S. Fadnavis, and D. M. Lal (2014), Influence of springtime biomass burning emissions in South Asia on regional ozone: A model based case study, *Atmos. Environ.*, 100, 37-47, DOI: 10.1016/j.atmosenv.2014.10.027.
22. C. Jena, S. D. Ghude, G. Beig, D. M. Chate, **R. Kumar**, S. Fadnavis, G. G. Pfister, L. K. Emmons, R. J. van der A (2015), Inter-comparison of different NO_x emission inventories and associated variation in simulated surface ozone (O₃) in Indian region, *Atmos. Environ.*, 117, 61-73.
23. H. Joshi, M. Naja, K. P. Singh, **R. Kumar**, P. Bhardwaj, S. S. Babu, S. K. Satheesh, K. K. Moorthy, H. C. Chandola (2015), Investigations of Aerosol Black Carbon from a Semi-urban Site in the Indo-Gangetic Plain Region, *Atmos. Environ.*, in Press, doi: <http://dx.doi.org/10.1016/j.atmosenv.2015.04.007>
24. D. E. Surendran, S. D. Ghude, G. Beig, L. K. Emmons, C. Jena, R. Kumar, G. G. Pfister, D. M. Chate (2015), Simulations over South Asia using Hemispheric Transport of Air Pollution version-2 (HTAP-v2) emission inventory and Model for Ozone and Related chemical Tracers (MOZART-4): Initial Results, *Atmos. Environ.*, 122, doi: 10.1016/j.atmosenv.2015.08.023.
25. T. Sarangi, M. Naja, S. Lal, S. Venkataramani, P. Bhardwaj, N. Ojha, **R. Kumar**, H. C. Chandola (2016), First observations of light non-methane hydrocarbons (C₂–C₅) over a high-altitude site in the central Himalayas, *Atmos. Environ.*, 125, 450-460, doi: 10.1016/j.atmosenv.2015.10.024.

26. P. Bhardwaj, M. Naja, **R. Kumar**, H. C. Chandola (2016), Seasonal, interannual and longterm variabilities in biomass burning activity over South Asia, *Environ. Sci. Poll. Res.*, 23, 5, 4397-4410, doi:10.1007/s11356-015-5629-6.
27. S. D. Ghude, D. M. Chate, C. Jena, G. Beig, **R. Kumar**, M. C. Barth, G. G. Pfister and P. Rao (2016), Premature mortality in India due to PM2.5 and ozone exposure, *Geophys. Res. Lett.*, 43, 4650–4658, doi:[10.1002/2016GL068949](https://doi.org/10.1002/2016GL068949).
28. S. Archer-Nicholls, E. M. Carter, **R. Kumar**, Q. Xiao, Y. Liu, J. J. Frostad, M. H. Forouzanfar, A. Cohen, M. Brauer, J. Baumgartner and C. Wideinmyer (2016), The Regional Impacts of Cooking and Heating Emissions on Ambient Air Quality and disease Burden in China, *Environ. Sci. & Tech.*, 50 (17), doi: 10.1021/acs.est.6b02533
29. S. D. Ghude, C. K. Jena, G. Beig, **R. Kumar**, S. H. Kulkarni and D. M. Chate (2016), Impact of emission mitigation on ozone-induced wheat and rice damage in India, *Current Science*, 110 (8), 1452-1458, doi: 10.18520/cs/v110/i8/1452-1458.
30. S. Tiwari, **R. Kumar**, P. Tunved, S. Singh, and A. S. Panicker (2016), Significant cooling effect on the surface due to soot particles over Brahmaputra River Valley region, India: An impact on regional climate, *Science of the Total Environment*, 15, 562-504, doi: 10.1016/j.scitotenv.2016.03.157.
31. M. Naja, P. Bhardwaj, N. Singh, P. Kumar, **R. Kumar**, N. Ojha, R. Sagar, S. K. Satheesh, K. K. Moorthy, and V. R. Kotamarthi (2016), SPECIAL SECTION: RAWEX–GVAX: High-frequency vertical profiling of meteorological parameters using AMF1 facility during RAWEX–GVAX at ARIES, Nainital, *Current Science*, 111 (01), doi: 10.18520/cs/v111/i1/132-140.
32. S. Singh, S. Tiwari, U. C. Dumka, **R. Kumar**, and P. K. Singh (2017), Source Region and Sector Contributions of Atmospheric Soot Particle in a Coalfield Region of Dhanbad, Eastern part of India, *Atmos. Res.*, 197, 415-424.
33. P. J. Young, V. Naik, A. M. Fiore, A. Gaudel, J. Guo, M. Y. Lin, J. Neu, D. D. Parrish, H. E. Rieder, J. L. Schnell, S. Tilmes, O. Wild, L. Zhang, J. Brandt, A. Delcloo, R. M. Doherty, C. Geels, M. I. Hegglin, L. Hu, U. Im, **R. Kumar**, A. Luhar, L. Murray, D. Plummer, J. Rodriguez, A. Saiz-Lopez, M. G. Schultz, M. Woodhouse, G. Zeng, and J. Ziemke (2017), Tropospheric Ozone Assessment Report: Assessment of global-scale model performance for global and regional ozone distributions, variability, and trends, *Elem Sci Anth* . 2018; 6 (1) :10 . DOI: <http://doi.org/10.1525/elementa.265>.
34. Tang, Y., M. Pagowski, T. Chai, L. Pan, P. Lee, B. Baker, **R. Kumar**, L. Delle Monache, D. Tong, and H.-C Kim (2017), 3D-Var versus Optimal Interpolation for Aerosol Assimilation: a Case Study over the Contiguous United States, *Geosci. Model Dev. Discuss.*, <https://doi.org/10.5194/gmd-2017-147>, 10, 4743-4758, <https://doi.org/10.5194/gmd-10-4743-2017>.
35. Rama Krishna K., S. D. Ghude, G. Beig, S. Nivdange, P. Gupta, **R. Kumar** and D. M. Chate (2018), High-resolution surface PM2.5 estimate using satellite-derived aerosol optical depth over India, accepted for publication in *Aerosols and Air Quality Research.*, 2018
36. S. Kedia, **R. Kumar**, S. Islam, Y. Sathe and A. Kagainalkar (2018), Radiative impact of a heavy dust storm over India and surrounding oceanic regions, accepted for publication in *Atmos. Environ.*, 2018.
37. Alvarado, M. J., Winijkul, E., Adams-Selin, R., Hunt, E., Brodowski, C., Lonsdale, C. R., Shindell, D. T., Faluvegi, G., Kleiman, G., Moiser, T. M., and **R. Kumar** (2018), Sources of Black Carbon Deposition to the Himalayan Glaciers in Current and Future Climates, accepted for publication in *J. Geophys. Res. - Atmos.*, 2018.
38. Piyush Bhardwaj, Manish Naja, Maheswar Rupakheti, Arnico Panday, **R. Kumar**, Khadak Mahata, Shyam Lal, Harish Chandola, and Mark Lawrence (2018), Variations in

surface ozone and carbon monoxide in the Kathmandu Valley and surrounding broader regions during SusKat-ABC field campaign: Role of local and regional sources, accepted for publication in *Atmos. Chem. & Phys.*, 2018

39. P. Mahapatra, **R. Kumar**, C. Mallik, S. C. Sahu and T. Das (2018), An episode of anomalous low surface ozone at a tropical coastal city in Eastern India, accepted for publication in *Journal of Applied Meteorology and Climatology*.
40. Dumka, U. C., Kaskaoutis, D. G., Devara, P. C. S., **R. Kumar**, S. Kumar, and S. Tiwari (2018), Year-long variability of the fossil fuel and wood burning black carbon components at a rural site in southern Delhi outskirts, accepted for publication in *Atmospheric Research*, September 2018.

PEER-REVIEWED PUBLICATIONS: Under Review

41. **R. Kumar**, L. Delle Monache, J. Bresch, P. E. Saide, Y. Tang, Z. Liu, A. M. da Silva, S. Alessandrini, G. G. Pfister, D. Edwards, P. Lee, I. Djalalova (2018), *J. Geophys. Res.*, Towards improving short-term predictions of fine particulate matter over the United States via assimilation of satellite aerosol optical depth retrievals, under review, *J. Geophys. Res. – Atmos.*, submitted: May 2018.
42. **R. Kumar**, J. A. Lee, L. Delle Monache, and S. Alessandrini, Effect of meteorological variability on fine particulate matter simulations over the contiguous United States, under review, *J. Geophys. Res. – Atmos.*, submitted: September 2018.
43. S. D. Ghude, A. Mahajan, R. Karumuri, U. Badimella, G. Pfister, **R. Kumar**, D. Lal, P. R. Pithani, R. Kulkarni, D. Chate (2018), What is driving the diurnal variation of tropospheric NO₂ columns over a cluster of high emitting thermal power plants in India?, under review, *J. Geophys. Res. – Atmos.*
44. T. Amnuaylojaroen, M. C. Barth, and **R. Kumar** (2018), Model analysis of processes contributing to high ozone over the Bay of Bengal during winter 2009, under review, *Atmos. Environ.*
45. Wu, X., Xu, Y., **R. Kumar**, M.C. Barth (2018), Understanding the meteorological drivers of future air quality over Indian megacities based on multi-year chemistry-climate simulations, under review, *J. Geophys. Res. - Atmos.*, submitted: May 2018.
46. Delle Monache, L., Alessandrini, S., Djalalova, I., Wilczak, J., Knierel, J. C., and **R. Kumar**: Air Quality Predictions with an Analog Ensemble, *Atmos. Chem. Phys. Discuss.*, <https://doi.org/10.5194/acp-2017-1214>, in review, 2018.
47. Lund, M. T., Myhre, G., Haslerud, A. S., Skeie, R. B., Griesfeller, J., Platt, S. M., **R. Kumar**, Myhre, C. L., and Schulz, M.: Concentrations and radiative forcing of anthropogenic aerosols from 1750–2014 simulated with the OsloCTM3 and CEDS emission inventory, *Geosci. Model Dev. Discuss.*, <https://doi.org/10.5194/gmd-2018-133>, in review, 2018.
48. Archer-Nicholls, S., Lowe, D., Lacey, F., **R. Kumar**, Carter, E., Baumgartner, J., and Wiedinmyer, C.: Radiative Effects of Residential Sector Emissions in China: Sensitivity to Uncertainty in Black Carbon Emissions, *Environ. Sci. & Tech.*, submitted, Aug 2018.

CHAPTERS in BOOKS

1. **R. Kumar**, M. C. Barth, L. Delle Monache, S. D. Ghude, G. G. Pfister, M. Naja and G. P. Brasseur (2017), An Overview of Air Quality Modeling Activities in South Asia. In: Bouarar I., Wang X., Brasseur G. (eds) *Air Pollution in Eastern Asia: An Integrated Perspective*. ISSI Scientific Report Series, vol 16. Springer, Cham, doi: https://doi.org/10.1007/978-3-319-59489-7_2, ISBN: 978-3-319-59488-0.
2. T. Sarangi, M. Naja, K. P. Singh, Y. Kant, N. Ojha, **R. Kumar**, K. Pandey, S. Venkataramani, S. Lal and Ram Sagar, Observations of radiatively and chemically active

trace gases in the central Himalaya and Indo-Gangetic Plain region, *Climate change in the Himalayas*, Editors- Vir Singh et al., ISBN 978-81-7387-228-0, pp. 61-74, 2011.

MEDIA REPORTS BASED ON MY RESEARCH

1. India Climate Dialogue. “Black carbon particles travelling further than thought”. 19 Oct 2015, Available online at: <http://indiaclimatedialogue.net/2015/10/19/black-carbon-particles-travelling-further-than-thought/>
2. Atmos News UCAR/NCAR. “What’s driving soot across India?”, 12 Oct 2015, Available online at: <https://www2.ucar.edu/atmosnews/just-published/17318/whats-driving-soot-across-india>
3. The Times of India. “Fossil fuels far away pollutes sky near home”, Pune edition, 4 Oct 2015, Available online at: <http://timesofindia.indiatimes.com/city/pune/Fossil-fuel-far-away-pollutes-sky-near-home/articleshow/49212045.cms?from=mdr>
4. The Hindustan Times. “Weather Systems turn one region’s waste into another’s pollutant”, Front page Mumbai edition, 5 Sept. 2015. Available online at: <http://www.hindustantimes.com/india-news/one-region-s-waste-another-s-pollutant-weather-systems-give-wings-to-pollutants/article1-1387867.aspx>
5. Atmos News UCAR/NCAR. “Ground-level ozone’s toll in India”. 9 Sep 2014. Available online at: <https://www2.ucar.edu/atmosnews/just-published/12320/ground-level-ozone-toll-india>
6. AccuWeather. “Weather model to help monitor devastating ozone pollution levels in India”, 30 Oct 2014, available online at: <http://www.accuweather.com/en/weather-news/weather-models-used-to-determi/36173364>
7. NCAR Fellow News. “An excellent high altitude atmospheric observation facility in the central Himalayas”, Feb 2015. Available online at: http://www.asp.ucar.edu/asp_update/15/February2015.pdf

PAPERS IN CONFERENCES/SYMPOSIUMs

1. **R. Kumar** “Study of trace species in Different Environments in the Tropical Troposphere”, Third International SOLAS Summer School, 2007, Cargese, Corsica, France.
2. **R. Kumar**, M. Naja, S. Lal, S. Venkataramani, U.C. Dumka, P. Hegde, P. Pant and R. Sagar, “Maiden observations of surface ozone at a high altitude site, Nainital, in the central Himalayas”, International Symposium on Aerosol Chemistry and Clouds- 2007, Ahmedabad, India.
3. M. Naja, **R. Kumar**, S. Lal, S. Venkataramani, P. Hegde, U.C. Dumka, P. Pant and R. Sagar, “Study of trace species over the Central Himalayas: Influences of local sources and long range transport”, International Symposium on Aerosol Chemistry and Clouds- 2007, Ahmedabad, India.
4. **R. Kumar**, M. Naja, S. Lal, S. Venkataramani, P. Hegde, U.C. Dumka, P. Pant and R. Sagar, “Influence of long range transport and local sources on surface ozone during spring at a high altitude site (Nainital)”, National Space Science Symposium, 2008, Ooty, India.
5. P. Hegde, P. Pant, M. Naja, U.C. Dumka and **R. Kumar** et al. “Observations of Columnar Water Vapor Content and Aerosol optical Depth at Manora Peak, Nainital”, National Space Science Symposium, 2008, Ooty, India.

6. **R. Kumar**, M. Naja, S. Venkataramani, P. Pant, K. P. Singh and N. Ojha “Spring Maximum in ozone in the central Himalayas: Influence of regional pollution and long range transport”, MOCA-09 Joint Assembly, 2009, **Montréal, Canada**.
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