



Ujjwal Kumar (Ph.D.)

Asst. Professor

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AFFILIATIONS

- April-2015 onwards (1+ year): **Asst. Professor** at **Doon University**
- 2011-2014 (3+ years) : **Researcher** at **KNMI - Royal Netherlands Meteorological Institute, Netherlands.**
- 2009-2011 (2+ years) : **Post-doctoral Fellow** at **VITO - Flemish Institute for Technological Research, Belgium**
- 2007-2009 (1+ year) : Research Associate at **SES, JNU, Delhi**

RESEARCH ARENA

- Broadly,
 - *Atmospheric Science, Meteorology, Air quality Modelling, Energy Forecasting*
- Specifically,
 - **Data Assimilation for regional CTM**
(OI, EnKF, 3D-VAR)
 - **Chemical Transport Models (CTM)**
(AURORA, LOTOS-EUROS, WRF-CHEM)
 - **Statistical/Time Series Modelling and Forecasting of air pollutants**
(Regression, ARIMA, VAR, GARCH, SSA, Grey-Markov)
 - **Chaos and Nonlinear dynamics**
(Nonlinear time series analysis)
 - **Coupling of CTM with Meteorological model**
(Coupling of LOTOS-EUROS with HARMONIE)
 - **Lagrangian model (OZIPR)**
(to investigate O₃ sensitivity to NO_x and VOCs in ambient environment)
 - **Energy Consumption forecasting** for Coal, petroleum, electricity and natural gas
(essentially applied time series models GPRM, Grey-Markov, SSA)

Research Work Profile

- Worked on data assimilation (EnKF – Ensemble Kalman Filter) for the model LOTOS-EUROS at **KNMI, Netherlands** and data assimilation (OI – Optimal Interpolation) implementation for the model AURORA at **VITO, Belgium.**
- For more than 3 years, was involved in operational air quality forecasts for the Netherlands (in collaboration with RIVM) and also to produce near real time forecasts/assimilation for Europe and the reanalysis study for the European air quality within the framework of MACC-II project.
- was also in-charge of providing air quality forecasts for Europe for downstream services under the PASODOBLE project.

- worked on NMDC's project on coupling of high resolution meteorological model HARMONIE with LOTOS-EUROS
- Extensive work on Statistical/time series modeling and forecasting. Statistical/time series models for air pollutants forecasts are also operational for Belgium under SMOGPROG project operated by VITO, Belgium.
- 14 published peer-reviewed research papers in different high quality international scientific journals on various aspects of air quality modelling, data assimilation, statistical/deterministic modeling and forecasting of ambient air pollutants and Energy consumption and forecasting. 4 research papers are in progress.
- Representation at numerous International/National Conferences/workshops.
- Computer Programming Expertise : Skilled in computer programming Fortran90, C++, python/Matlab/R. UNIX-OS and shell scripting (bash and c-shell). Well adept in analyzing/handling the large chunk of climate datasets (hdf, netcdf, grib etc). Experienced in OpenMP and experience with MPI.
- Experienced in interpretation and comparison of atmospheric satellite data (OMI, GOME, MODIS).

RESEARCH PUBLICATIONS

- **Published/Accepted:**

- (1) Alka Singh, **Ujjwal Kumar**, Florian Seitz, 2015, Remote Sensing of Storage Fluctuations of Poorly Gauged Reservoirs and State Space Model (SSM)-Based Estimation, Remote Sensing, *Remote Sensing*, **7** (12), 17113-17134. (IF : **3.180**) (SJR : 1.17)
- (2) V. Marécal, V.-H. Peuch, C. Andersson, S. Andersson, J. Arteta, M. Beekmann, A. Benedictow, R. Bergström, B. Bessagnet, A. Cansado, F. Chéroux, A. Colette, A. Coman, R. L. Curier, H. A. C. Denier van der Gon, A. Drouin, H. Elbern, E. Emili, R. J. Engelen, H. J. Eskes, G. Foret, E. Friese, M. Gauss, C. Giannaros, J. Guth, M. Joly, E. Jaumouillé, B. Josse, N. Kadygrov, J. W. Kaiser, K. Krajsek, J. Kuenen, **Ujjwal Kumar**, N. Liora, E. Lopez, L. Malherbe, I. Martinez, D. Melas, F. Meleux, L. Menut, P. Moinat, T. Morales, J. Parmentier, A. Piacentini, M. Plu, A. Poupkou, S. Queguiner, L. Robertson, L. Rouïl6, M. Schaap, A. Segers, M. Sofiev, M. Thomas, R. Timmermans, Á. Valdebenito, P. van Velthoven, R. van Versendaal, J. Vira, and A. Ung, 2015: A regional air quality forecasting system over Europe: the MACC-II daily ensemble production ; *Geosci. Model Dev.*, **8**, 2777-2813. (IF : **3.654**) (SJR : 2.365) (SNIP : 1.228)
- (3) M. Sofiev, U. Berger, M. Prank, J. Vira, J. Arteta, J. Belmonte, K.-C. Bergmann, F. Chéroux, H. Elbern, E. Friese, C. Galan, R. Gehrig, D. Khvorostyanov, R. Kranenburg, **Ujjwal Kumar**, V. Marécal, F. Meleux, L. Menut, A.-M. Pessi, L. Robertson, O. Ritenberga, V. Rodinkova, A. Saarto, A. Segers, E. Severova, I. Sauliene, P. Siljamo, B. M. Steensen, E. Teinmaa, M. Thibaudon, and V.-H. Peuch, 2015: MACC regional multi-model ensemble simulations of birch pollen dispersion in Europe. *Atmos. Chem. Phys* **15**, pp 8115-8130 (IF : **5.053**)
- (4) **Ujjwal Kumar**, 2014. An Integrated SSA-ARIMA Approach to Make Multiple Day Ahead Forecasts for the Daily Maximum Ambient O₃ Concentration. *Aerosol & Air Quality Research*, DOI: 10.4209/aaqr.2014.03.0046 (IF : **2.094**) (SJR : 3.02) (SNIP : 1.574)

- (5) **Ujjwal Kumar**, Koen De Ridder, Wouter Lefebvre, Stijn Janssen, **2012**, Data assimilation of surface air pollutants (O₃ and NO₂) in the regional-scale air quality model AURORA, *Atmospheric Environment*, **60**, pp 99-108 (IF : **3.281**) (SJR : 1.431) (SNIP : 1.537)
- (6) Koen De Ridder, **Ujjwal Kumar**; Dirk Lauwaet; Lisa Blyth; Wouter Lefebvre, **2012**, Kalman filter-based air quality forecast adjustment. *Atmospheric Environment*. **50**, 381-384 (IF : **3.281**) (SJR : 1.431) (SNIP : 1.537)
- (7) Amit Prakash, **Ujjwal Kumar**, Krishan Kumar and V. K. Jain, **2011**, A Wavelet Based Neural Network Model to Predict Ambient Air Pollutants' Concentration, *Environmental Modeling & Assessment*, **16**, pp 503-517 (IF : **0.98**)
- (8) **Ujjwal Kumar**, Koen De Ridder, **2010**, GARCH Modelling in Association with FFT-ARIMA to forecast Ozone Episodes. *Atmospheric Environment*, **44**, pp 4252-4265 (IF : **3.281**) (SJR : 1.431) (SNIP : 1.537)
- (9) **Ujjwal Kumar**, V. K Jain, **2010**, Time Series Models (Grey-Markov, Grey Model with rolling mechanism and Singular Spectrum Analysis) to forecast energy consumption in India"; *Energy*, **35**, pp 1709-1716 (IF : **4.844**) (SJR : 2.576) (SNIP : 2.548)
- (10) **Ujjwal Kumar**, V. K. Jain, **2010**, ARIMA forecasting of ambient air pollutants (O₃, NO₂ and CO), *Stochastic Environmental Research and Risk Assessment*, **24**, pp 751-760 (IF : **2.086**) (SJR : 0.889, SNIP : 1.414)
- (11) **Ujjwal Kumar**, Amit Prakash, V. K Jain., **2008**, Characterization of Chaos in Air Pollutants: A Volterra-Wiener-Korenberg Series and Numerical Titration Approach, *Atmospheric Environment*, **42**, pp 1537-1551. (IF : **3.281**) (Citations = 7)
- (12) **Ujjwal Kumar**, Amit Prakash, V. K Jain, **2008**, A Photochemical Modelling Approach to Investigate O₃ sensitivity to NO_x and VOCs in the Urban Atmosphere of Delhi, *Aerosol and Air Quality Research*, **8**, pp 147-159. (IF : **2.094**) (Citations = 11)
- (13) **Ujjwal Kumar**, Amit Prakash, V. K Jain, **2008**, A Multivariate Time Series approach to Study the Interdependence among O₃, NO_x and VOCs in Ambient Urban Atmosphere"; *Environmental Modeling and Assessment*, **14**, pp 631-643 (IF : **0.98**) (Citations = 5)
- (14) A. K. Attri, **Ujjwal Kumar**., V. K. Jain, **2001**, Formation of ozone by fireworks, *Nature*, **411**, pp-1015. (IF : **41.456**)

REVIEWER for the following JOURNALS

1. *Atmospheric Environ.,*
2. *Energy*
3. *Energy Conversion & Manangement*
4. *Applied Computing & Informatics,*
5. *Environ. Modeling & Software,*
6. *Environ. Modeling & Assess.,*
7. *Environmental Pollution*
8. *Stochastic Environ. Research & Risk Assess.,*
9. *Aerosol & Air Quality Research,*
10. *Applied Mathematics & Computation*
11. *Applied Energy,*
12. *Atmospheric Pollution Research,*
13. *Computational Statistics*
14. *Desalination and Water Treatment*
15. *International Journal of Air Quality, Atmosphere and Health*
16. *Journal of Atmopshere, and Solar Terrestrial Physics*
17. *Open Atmos. Sc.*

TECHNICAL EXPERTISE

- **Computer/Software Expertise:**
 - Programming : **Fortran90** and **C++**
MATLAB, Python and **R.**
 - Shell-Scripting : **BASH shell** and **C-shell**
 - **Unix/Linux** Operating system
 - **Parallel programming** with OpenMP and MPI
 - High Performance Computer Cluster (**HPCC**) with different architecture
 - BULL supercomputer (HPCC with 396 nodes)
 - climate/scientific data formats (**HDF, netCDF, grib** etc).
- **Atmospheric Remote sensing:**
 - OMI, MODIS and GOME satellite data analysis
- **User-level experience in Instrumentation:**
 - High Volume Sampler, continuous analyzer for O₃ NO₂ VOCs, Radiosonde balloon,

Courses Taught at SENR, Doon University

- Atmosphere, Weather and Climate (EES 520)
- Science of Climate Change (EES 612)
- Environmental Modeling (EES 752)
- Statistics & Computer Applications (EES 554)
- Statistical Applications (ETC 591)
- Computer Applications in Environmental Engineering (ETC 596)
- Environmental System Analysis & Modelling (ETC 597)

TRAINING COURSES/WORKSHOPS :

- (i) ***Modeling and Forecasting of Atmospheric Composition at different scales***
Organisation : Meteo-France, Anglet, France
Duration : 8 days (June 10-17, 2013)
- (ii) ***Earth System Monitoring & Modelling"***
Organisation : European Space Agency (ESA), Rome, Italy
Duration : Two weeks (Aug 4-14, 2012)
- (iii) ***Data Assimilation in Numerical weather prediction models and satellite data***
Organisation: ECMWF (European Centre for Medium Range Weather Forecasts), UK
Duration: Two weeks (May, 2010)
- (iv) ***Aerosol - Cloud interactions and microphysical processes***
Organisation : Dept. Of Civil Engineering, IIT Kanpur
Duration: two weeks (March-2009)
- (v) ***Geospatial Education and Training Workshop on Management of Water Resources, Glaciers and Climate Change with Special reference to Uttarakhand***
Organisation : Uttarakhand Space Application Center (USAC), Dehradun
PGDAV College, Roorkee
NIH – National Institute of Hydrology, Roorkee
Duration : 3 days (24-26 May, 2015)

PAPER/ABSTRACTS IN CONFERENCES

- (1) Invited talk on “Ensemble Kalman Filter to assimilate surface (O₃, NO₂, PM₁₀ and PM_{2.5}) and satellite (OMI-NO₂) data into chemical transport model (CTM) LOTOS-EUROS to assess the air quality of Europe” at NARL – National Atmospheric Research Laboratory, Tirupati. 28-29 July, 2015
- (2) Ujjwal Kumar, Arjo Segers, Henk Eskes, Renske Timmerman, Lyana Curier: LOTOS-EUROS contribution to MACC-II-reanalysis-2011 to assess the air quality of Europe. 9th International Conference on Air Quality - Science and Application. 24-28 March, 2014. Garmisch-Partenkirchen, Germany (<http://www.airqualityconference.org/>)
- (3) Ujjwal Kumar, Lefebvre Wouter, Koen De Ridder, Stijn Janssen; “A Stochastic-Deterministic air quality forecasting system: Combining time series models with data assimilation”. Geophysical Research Abstracts, Vol. 14, EGU2012-13540, 2012 (EGU General Assembly 2012, 22-27 April), Vienna, Austria
- (4) Ujjwal Kumar: “A Comparative Study of SSA-ARIMA and FFT-ARMIA to forecast daily maximum O₃ concentration in Urban environment”. The 31st Annual International Symposium on Forecasting, Prague, Czech Republic, 29-May to 2-June 2011. (http://forecasters.org/isf/pdfs/ISF11_Proceedings.pdf)
- (5) Ujjwal Kumar, Lefebvre Wouter, Koen De Ridder, Stijn Janssen; “Data Assimilation of surface air pollutants in a high resolution air quality model AURORA”. Geophysical Research Abstracts, EGU2011-7350 (EGU General Assembly 2011), Vienna, Austria.

- (6) Ujjwal Kumar, Amit Prakash, Krishan Kumar, Naresh Kumar, V. K. Jain:“ A Study of Statistical Distribution Pattern of PM_{2.5} Concentration in the urban environment of Delhi”; Proceedings of the IASTA-2007 conference on “Emerging trends in Aerosols: Technology and Applications”. Vol. 18 (1 & 2), November 2007 (NPL, New Delhi), pp 52-54. Delhi, India
- (7) Ramesh Agarwal, Ping Wang, Lee Chusak, B. B. Bhattacharya, V. K. Jain, Ujjwal Kumar, Amit Prakash, Hung-Ju Chen and Jun Zhang. An Integrative Economic Model of Electricity Generation from Non-renewable and Renewable Energy Sources: Demand and Supply Factors, Environmental Constraints and Policy Evaluations. 2nd International Symposium of Energy and Environment, Hong-Kong, December 8-10, 2008.
(<http://magep.wustl.edu/symposium08>)
- (7) Ujjwal Kumar, Koen De Ridder; “ Synergy between Stratospheric-tropospheric Ozone: An EOF analysis”. Aura Science Team Meeting 2009, 14-17 September, Leiden, The Netherlands.

PROJECT REPORTS/DELIVERABLES

1. Ujjwal Kumar, Henk Eskes, Martijn Schaap, Arjo Segers, Lyana Curier, **2014, 2013a,b, 2012a,b, 2011**, *LOTOS-EUROS regional forecasting system and performances*. MACC-II Deliverables D102.36 (new) & D106.42 (new)
(<http://www.gmes-atmosphere.eu/documents/maccii/deliverables/ens/>)
2. Mikhail Sofiev, Uwe Berger, Marje Prank, Julius Vira, Karl-Christian Bergmann, Joaquim Arteta, Hendrik Elbern, Elmar Friese, Henk Eskes, Ujjwal Kumar, Richard Kranenburg, Arjo Segers, Frederik Meleux, Anna-Mari Pessi, Annika Saarto, Lennart Robertson, Viktoria Rodinkova, Birthe Marie Steensen, Erik Teinmaa, Michel Thibaudon, **2014**, *Report on pollen forecasting*, MACC-II Deliverable D104.3
(<http://www.gmes-atmosphere.eu/documents/maccii/deliverables/ens/>)
3. Michael Gauss, Alvaro Valdebenito, Anna Benedictow, Julius Vira, Mikhail Sofiev, Hendrik Elbern, Elmar Friese, Patricia Schmid, Frederik Meleux, Anthony Ung, Laurence Rouil, Gilles Foret, Matthias Beekmann, Adrianna Colman, Benjamin Gaubert, Virginie Marécal, Matthieu Plu, Daniel Cariolle, Emanuele Emili, Lennart Robertson, Henk Eskes, Robert van Versendaal, Ujjwal Kumar, Arjo Segers, **2014**, *Report on the impact of assimilation on forecasts of observed and unobserved species*, MACC-II Deliverable D105.2
(<http://www.gmes-atmosphere.eu/documents/maccii/deliverables/ens/>)
4. Michael Gauss, Alvaro Valdebenito, Anna Benedictow, Julius Vira, Mikhail Sofiev, Hendrik Elbern, Elmar Friese, Patricia Schmid, Frederik Meleux, Anthony Ung, Laurence Rouil, Solen Queguiner, Marion Pithon, Sylvie Guidotti, Virginie Marécal, Matthieu Plu, Lennart Robertson, Henk Eskes, Robert van Versendaal, Ujjwal Kumar, Arjo Segers, **2014**, *Report on operational implementation with analysis of opportunity for ISO 9001 service certification*, MACC-II Deliverable D108.2

(<http://www.gmes-atmosphere.eu/documents/maccii/deliverables/ens/>)

5. Michael Gauss, Alvaro Valdebenito, Anna Benedictow, Julius Vira, Mikhail Sofiev, Hendrik Elbern, Elmar Friese, Patricia Schmid, Frederik Meleux, Anthony Ung, Laurence Rouil, Solen Queguiner, Marion Pithon, Sylvie Guidotti, Virginie Marécal, Matthieu Plu, Lennart Robertson, Henk Eskes, Robert van Versendaal, **Ujjwal Kumar**, Arjo Segers, **2014, Report on end-to-end analysis for the seven individual production lines and for ensemble production**, MACC-II Deliverable D108.2
(<http://www.gmes-atmosphere.eu/documents/maccii/deliverables/ens/>)
6. A.-M. Blechschmidt (IUP-UB), H. Eskes (KNMI), F. Hendrick (BIRA-IASB), **Ujjwal Kumar (KNMI)**, E. Peters (IUP-UB), G. Pinardi (BIRA-IASB), A. Piters (KNMI), A. Richter (IUP-UB), M. Van Roozendaal (BIRA-IASB), T. Vlemmix (Delft University), **2014, Using MAX-DOAS measurements of NO₂ tropospheric columns for MACC-II model validation**, MACC-II Deliverable VAL 5.4
(<http://www.gmes-atmosphere.eu/documents/maccii/deliverables/val/>)
7. Peter Bultjes, Joost van der Brugh, Henk Eskes, Bas Henzing, Sander Jonkers, **Ujjwal Kumar**, Astrid Manders, Ernst Meijer, Erik van Meijgaard, Addo van Pul, Ferd Sauter, Martijn Schaap, Eric van der Swaluw, J.M. Tomas, Bert van Ulft, Henk Verhagen, Peter Zandveld, **2012, NMDC-Summary Report of the Innovation project “ Air Quality and External Safety”**.
8. **Ujjwal Kumar**, Henk Eskes, 2012, *Coupling meteorological fields of the HARMONIE model with LOTOS-EUROS*, NMDC Luchtkwaliteit, meteorologische velden, LOTOS-EUROS, HARMONIE,
9. **Ujjwal Kumar**, Dirk Lawuet, **2011, Data Assimilation tool (offline) for PASODOBLE**
(<http://www.myair.eu/technical-product/technical-prod-interface-preview/validation/>)

Ph.D. and M.Phil. thesis

- Ph.D. thesis title “A Modelling Study of Ozone Concentration in Ambient Urban Environment”
- M.Phil. thesis title "A Study of the Correlation between NO_x and O₃ concentrations in the urban environment of Delhi"

FELLOWSHIP/SCHOLORSHIP

- CSIR-JRF, UGC-NET awarded
- GATE qualified in Physics: 95.67 percentile.
- Among top 25 in all India NGPE (National Graduate Physics Examination)-97.

Educational Qualifications:

- **Ph.D. awarded (2007)** from School of Environmental Sciences, JNU, New Delhi.
- **M.Phil. (2001)** from ‘School Of Environmental Sciences, JNU, New Delhi’.
- **M. Sc. (1999)** from ‘School of Environmental Sciences, JNU, New Delhi’ in 1999.
- **B.Sc.(Hons.) (1997)** Physics (Hons.) ‘Faculty of Science, BHU, Varanasi in 1997.