APHH PROGRAMME TOWARDS IMPROVING AIR QUALITY IN DELHI

STAKEHOLDER CONSULTATION PROCEEDINGS

"CONSULTATION FOR CHOICES & PATHWAYS FOR CLEAN AIR IN DELHI"

26th April, 2018

At

Arnav Hall, Prithvi Bhawan - Ministry of Earth Sciences - H.Q.

Lodhi Road, New Delhi

Organised by: APHH Programme Management Board

Lead Organiser: Integrated Research & Action for Development, New Delhi

Ministry of Earth Sciences
Government of India

NERC SCIENCE OF THE ENVIRONMENT

DEPARTMENT OF BIOTECHNOLOGY
Ministry of Science & Technology

MRC Medical Research Council

Newton-Bhabha Fund

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AIR POLLUTION & HUMAN HEALTH PROGRAMME

Atmospheric Pollution and Human Health (APHH) in an Indian Megacity is a four-year research programme jointly funded by the Governments of India and UK through the Ministry of Earth Sciences (MoES), Department of Biotechnology (DBT), the Natural Environment Research Council (NERC), the Medical Research Council (MRC) and the Newton–Bhabha Fund. Urban air pollution is a severe problem in India with significant impacts on the economy and the health of the population. This programme, which has been organised into four interrelated themes, will support research on the sources and emissions of urban air pollution in New Delhi, India, the processes underlying and impacting on these, and how air pollution then impacts on health. Existing and new findings will be combined to understand the effectiveness of potential interventions and thus identify appropriate solutions for the benefit of the economy and population. For more details, log on to: http://www.urbanair-india.org/

BACKGROUND

Urban air pollution is a severe and an urgent problem in India with significant impacts on the economy and the health of the population. Air pollution is a major public health issue for megacity like Delhi which has 2 million plus inhabitants. With frequent incidences of air pollution levels going beyond the safe levels for humans there is an obvious need to prioritize research and actions on identifying and assessing sources and emission, measuring and predicting the distribution of air pollutant concentrations, quantify impacts of air pollution to design and implement appropriate and affordable solutions for clean air in Delhi.

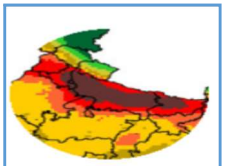
APHH will support research on the sources and emissions of urban air pollution in Delhi, the underlying processes that control air pollution and how air pollution then impacts on health. Existing and new findings will be combined to understand the cost-effectiveness of potential interventions and thus identify appropriate solutions for the benefit of the economy and population. The five projects under this program are:

ASAP-Delhi

Assessment of the sources, formation process, burden and characteristics of air pollutants in Delhi, with a focus upon particulates.

DelhiFlux

Characterization, quantification and modelling of air pollutant emissions for Delhi, providing emission estimates at higher resolution, together with temporal profiles describing diurnal and annual variability.



PROMOTE

Reduced uncertainties in air quality prediction and forecasting for Delhi by undertaking process orientated analyses and deriving sensitivity relationships linking air pollutant concentrations and emissions.

DAPHNE

Understanding the association between prenatal exposure and the health of the child in early years, and the impact of personal exposure and exercise on asthma exacerbations in adolescents.

CADTIME

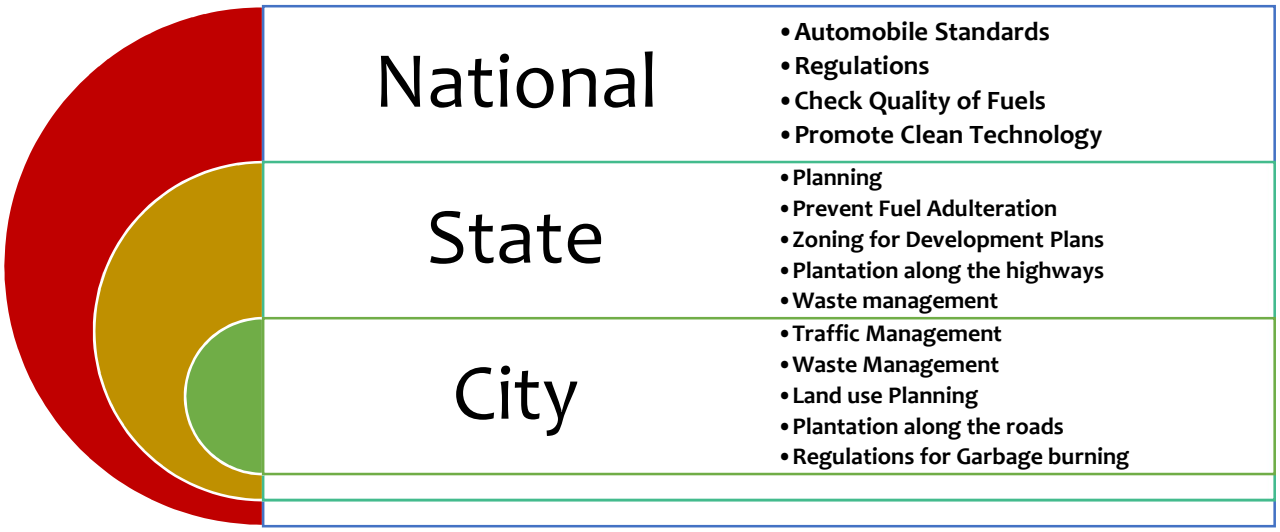
Developing a better understanding of the activities that lead to emissions, high concentrations of pollution and population exposures and scenario modelling to meet clean air targets by 2030 and 2050.

NEED FOR STAKEHOLDER CONSULTATION

Improving and sustaining air quality in Delhi needs sustained and coordinated actions by stakeholders. However, there are multiple stakeholders involved and it is not straight forward that who will take responsibility for action and implement the action plan. Transport and construction sectors are considered one of the major sources of pollution.

The vehicular emission and their contribution to ambient air concentration is the significant to PM10 and PM2.5 both in winter and summer. In winter, on average vehicles can contribute 25% to PM2.5 and at certain locations this

contribution could be above 35%. In summer, vehicular contribution is masked by other prominent sources. There is a significant contribution of diesel vehicles to PM10, PM2.5 and NOx. And construction and demolition contributes to around 5166.83 PM10 and 1291.71 PM2.5 (Sharma, 2016).



Addressing air pollution needs close cooperation between national and international experts, policymakers, center and state governments, local governing bodies, non-governmental organizations (NGOs) and society. To achieve the objectives of APHH program it was very important to bring disparate stakeholders together and develop mechanisms for co-operation amongst city, state and center stakeholders.

The workshop provided a platform to understand the perspectives of the stakeholders regarding the focus points such as reducing congestion, promoting connected/electric mobility, and encouraging public transport and come up with measures to adopt a graded response action plan in terms of transport. It also aimed to identify choices and pathways in the transport sector based on socio-economic and demographic projections for 2030.

OBJECTIVES OF THE WORKSHOP

The consultation focused to bring together people from various backgrounds – vulnerable sections, emitters, regulatory bodies and solution providers, particularly in the fields of Transport and Low Emission Development building technologies. Identification of bodies who can regulate and promote such measures will also be another priority of the workshop.

The discussion focused on the following key objectives:

- To prioritize the choices and pathways for the implementation for an action plan with effective mitigation solutions for reducing air pollution over Delhi and surroundings regions.
- To understand what are the gaps in the existing action plans for Air Quality Management for Delhi with a focus on transport sector.
- What actions can be taken in order to fill these gaps?
- What are needs and expectations of the stakeholders in order to make an efficient and implementable action plan?

WORKSHOP SUMMARY

The stakeholder consultation was organised at Prithvi Bhawan on 26th April, 2018 to address four interrelated themes that will support the research on the sources and emissions of urban air pollution in New Delhi, the underlying processes governing air pollution in Delhi, its impacts on health and mitigation options. The consultation was attended by more than 40 stakeholder representatives from NGT, IAAPC, MoRTH, CPCB, DPCC,

Civil bodies, research institutes and academia. The meeting provided an opportunity for all projects to update on initial results and plans for the next set of observations. The stakeholder engagement delineated the dialogue with regulators and policy makers in Delhi, ensuring that the programme outcomes deliver the science needed to improve air quality and human health.

On behalf of APHH Programme, IRADe lead to organise the stakeholder consultation at Prithvi Bhavan, Lodhi Road on 26th April 2018. The consultation was designed around the following topics of discussion:

- *Introduction to Atmospheric Pollution and Human Health Programme*
- *Perspective of Choices & Pathways – Transport Sector, Other Sources & Health*
- *Perspectives on Air Pollution Action Plan of Delhi-Learnings and Challenges*

KEY TAKEAWAY MESSAGES

The key takeaway notes, perspectives, suggestions made during the consultation are summarized below:

- Lack of implementation of measures to reduce air pollution is a major pitfall for bad air quality in Delhi.
- Emissions from the aircrafts and airports should be considered under source apportionment
- NCR has approx. 3-5 lakhs Diesel Generator sets which stands in need of regulations & guidelines.
- The NCR region in itself has 19 coal based power stations where the standards have been made by MoEFCC and deferred by Ministry of Power. Sox and Hg need to be monitored from such power plants.
- The percentage contribution of all air pollution sources needs to be quantified. Transport sector should not be solely held responsible for the poor air quality in Delhi.
- The pollution control boards at Center and State level are in dire need of manpower strengthening for example CPCB has only 4 technical staff appointed for air quality monitoring. This also questions the grade of data collected.
- Only small part of studies caters to epidemiology but the nuances are huge. The advocacy to decrease health vulnerability to air pollution at policy level.
- The stakeholder sought suggestions for improvement in the source apportionment SoP documented by CPCB.
- The construction activities are adding up to the severity of air pollution in Delhi and need to be closely monitored and carefully regulated.
- The burning of biomass in slums also contributes to air pollution.
- The transport sector could be bifurcated as it will strengthen the source apportionment and % contribution, since their contributions are skewed.
- Bringing in of economic instrumentation/policy for crop producing states like Punjab and Haryana.
- Legally binding standards for smog, ozone and air toxins are also to be considered in the action plan for air pollution control.
- Health risk perception needs to be analysed and documented. It needs to be sustained and scaled, as health policy for the country lacks air pollution severity. The source control recommendations should look at other health aspects.

PROCEEDINGS FROM WORKSHOP

Session I: Opening Remarks & Introduction to Atmospheric Pollution and Human Health Programme

Chaired by: Shri. Ranjan Chatterjee, Former Expert Member, National Green Tribunal
Panelists:
ASAP-Delhi - Prof. Bloss (University of Birmingham)
DelhiFlux - Dr. Nemitz (CEH) and Prof. Gurjar (IIT-Roorkee)
PROMOTE - Prof. Sokhi (University of Hertfordshire)
DAPHNE - Prof. Arvind (University of Edinburgh) and Dr. Balakrishnan (Sri Ramachandra University, Chennai)
CADTIME - Dr. Namdeo (Newcastle University) and Dr. Shiva Nagendra (IIT-Madras)

The consultation began with an overview of the air pollution scenario in Delhi. The stage was set by Shri. Ranjan Chatterjee who gave an insight to the aspects of air pollution and the measures taken at policy level for mitigation. The project teams gave an introduction to the 5 projects under APHH programme viz. ASAP-Delhi, DELHIFLUX, PROMOTE, DAPHNE & CADTIME, by their respective project teams. This platform provided an opportunity for all projects to update on initial results and their future plans.

Key Messages:

- PROMOTE is focusing on the understanding of sources and processes causing air pollution and to identify appropriate and effective solutions for the benefit of the economy and population.
- Authoritative assessment will be provided by ASAP and DelhiFlux of the sources, formation process, burden and characteristics of air pollutants in Delhi, and the influence of the surrounding NCR (National Capital Region)
- Focus should be on particulate matter as the pollutant with the greatest impact upon health
- Detailed characterization, quantification and modelling of air pollution will be delivered by APHH Projects for Delhi, using emission estimates at higher resolutions, together with updated temporal profiles describing their diurnal and annual variability
- Contributions made by primary and secondary aerosols to the overall air pollution burden in Delhi need to be quantified by ASAP and PROMOTE
- Coupled local-urban-regional modelling system is being develop by PROMOTE for predicting high resolution concentrations of $PM_{2.5}$, PM_{10}, NO_2 and other pollutants with source attribution is needed for Delhi.
- DAPHNE is focusing on understanding the early life effects of air pollution in Delhi is required by estimating exposure-response relationships between ambient air pollution exposures and health effects (birth weight, acute respiratory infections in children < 2 years) and asthma exacerbations in adolescents aged 12-18 years.
- Exposure measurements will be performed by DAPHNE using novel body-worn personal exposure and respiratory monitors, supported by stationary indoor and local outdoor ambient air quality monitors, data from the SAFAR network, satellite, land-use regression and chemical transport based methods.
- DAPHNE will establish a pregnant mother-child cohort (M-C) and a panel of adolescent asthmatic subjects to collect longitudinal health and exposure data to develop robust exposure-response estimates.
- CADTIME is developing practical interventions with stakeholders through DELPHI methodology.
- Design and quantify impacts of interventions for mitigating air pollution in Indian Megacity Delhi for current, medium-term (2030) and long-term (2050) horizons will be examined by PROMOTE and CADTIME.

SAFAR emissions from Delhi are being superimposed upon the regional air pollutant emissions for Delhi and NCR area. Background contributions include dust input, exacerbated by low relative humidity (RH) in summer enhancing particle re-suspension, seasonal biomass burning, and long-range transport of precursor emissions.

Session II: Stakeholder Perspective of Choices & Pathways – Transport Sector, Other Sources & Health

Chaired by: Prof. Jyoti Parikh, Executive Director, IRADe
Panelists:
Dr. Sengupta, Former Member Secretary, CPCB & Sr. Advisor IRADe
Dr. Tyagi, Former Additional Director, CPCB
Shri. Guite, Advisor Transport Research, MoRTH
Dr. Moitra, Vice President, IAAPC

The second session discussed the choices and pathways in Transport sector and its impact on health. The pulmonary diseases caused due to PM10 accumulation, the sputum tests of children indicate presence of Pb as a

key issue of concern. The studies conducted in India only recognizes PM 2.5, however a detailed study/research on NOx, SOx and chemical transformation of pollutant can help build upon the work done and prioritize the needs. In the face of development & in light of this consultation, the AHPP Programme will deliver detailed analysis of interventions to identify those that will curtail air pollution in Delhi.

Key Messages:

- Source apportionment is conducted by CPCB and Dept of Environment (Govt. of Delhi by engaging IIT-Kanpur) for Delhi viz. transport sector (2/3/4 wheeler & commercial vehicles), industry (red category- power plants, brick kilns, stone crushers), DG sets, construction dust, MSW burning, crop residue burning, etc. An air quality improvement action plan (source emission based) is the needed for Delhi.
- PM contribution from construction activities have been estimated to be: 20%, road dust: 38%; NOx contribution from vehicles: 36%, industry & power sector: 52%. The contributions of SOx, NOx, Volatile organic compounds, Polycyclic Aromatic Hydrocarbons should also be considered for air pollution study, as these gases react with atmosphere to form Particulate matter.
- Bharat Stage VI is now under implementation (Leap frogged to 2019-20) which sets the sulphur content to 10ppm.
- Retrofitting of old commercial diesel driven vehicles, to control carbon black.
- Government is in process of implementing 20% E.V.s by 2030, restricting the total no. of vehicles, use of green fuel, promotion of mass transport system. Delhi Govt is in the process of ordering Electric Buses.
- National Capital Region has about 3-5 lacs DG sets (<1010 KVA). All the mobile towers run on Electricity but have DG sets that are used during power failure. These DG sets have no defined emission standards except stack height. Hence, emissions standards to be defined and regularized.
- 19 Coal based power plants are present around Delhi where the 2017 emission standards were deferred for next 5 years by MOEF, on the request of Ministry of Power.
- 1500 brick kilns located in the ganga basin region are the major contributor for which CPCB has issued closure notices and directed them to adopt new technology.
- Technical strengthening of central and state pollution control board is of priority for better understanding of air quality related issues and implementation of target specific action plans.
- The models used have a linearity of upto 60µg/m^3 and post that it grows exponentially therefore observations are higher.
- The data quality control and validation of sensors should be being mandated for data viability.
- The online monitoring systems (ambient as well as stack) have been installed by the industries but instrument calibration and data quality checks are not done by the industry or any third party.
- Congestion charges could be included in plan along with increase in parking charges.
- Emissions from the aircrafts and airports should be considered under source apportionment studies
- SAFAR is developing the latest emission inventory for vehicular emissions for Delhi.
- Alternate fuels for mobility options should be considered which do not create new hazardous issues for the city. However, they should be of comparable prices.
- Chemical transformation of pollutants (conversion to sulphate and nitrates) need to be included in the source appropriation study.
- Pollution peak is observed between 6-7 am and post 5 pm during winter season. Advisory is required to be published along with AQI to prevent health issues for elderly, sick and infants.
- Exposure to emissions of persons working at the power plants/ industries to study time-exposure levels.
- Time specific dissemination of emission level should be done for awareness & preparedness of people.

- Only small part of studies caters to epidemiology but the nuances are huge. There should be advocacy to decrease health vulnerability to air pollution at policy level.
- Can the EC-OC (Elemental carbon and Organic carbon) be controlled in PM for the Indian context and Delhi sub-context?
- Suggestions were sought for the calibration manual currently being drafted by CPCB, so that meaningful information will be generated from the ~700 monitoring stations.
- Suggestions were also sought for improvement in the source apportionment SoP documented by CPCB.
- Suggestions were sought for the development of national facility for certification & calibration of sampling/monitoring instruments for air & emissions

The session setup priorities to setup mechanisms to prioritize the needs of stakeholders. The session gave a brief of the work that has already been done in this sector and to have access to those datasets.

Session III: Stakeholder Perspectives on Air Pollution Action Plan of Delhi-Learnings and Challenges

Chaired by: Dr. Kirit S. Parikh, Chairman, IRADe
Panelists:
Dr. Tyagi, Former Director General, IMD & Sr. Advisor IRADe
Dr. Sharma, Vice President, IAAPC
Mr. Chattopadhyay, Programme Manager, CSE

The third session focused on the already existent air quality action plans and the challenges in the face of development. The stakeholders discussed the role of implementing agency as per the graded action plan (by CPCB) & EPCA. The monitoring data is available with CPCB/DPCC with respect to source apportionment and demarcation of critically polluted areas, therefore the conditions, sources and issues are very well known through various studies conducted. An improved air pollution action is required to be implemented for the city of New Delhi.

Key Messages:

- The construction activities are adding up to the severity of air pollution in Delhi which needs to be closely monitored and carefully regulated. However, fossil fuel sources contribute much toxic particles/ emissions therefore, should be targeted with urgency, which will require use of cleaner fuels, implementing stringent emissions standards (vehicles, power plants, industries among others) and monitoring to check compliance on regular basis.
- The studies on source appropriation are many but all have different percentage contribution, hence a more stable and validated source appropriation study needed to guide policy action.
- The burning of biomass in slums also adds up to pollutants, for this LPG transition must be expedited at much nominal rates.
- The transport sector could be bifurcated in terms of contribution to total emission load and population exposures (because a large fraction of population live, work along roads) so total load often does not capture the population exposures. as it will strengthen the source appropriation and % contribution, since their contributions are skewed.
- Bringing in economic instrumentation/policy for crop producing states like Punjab and Haryana is also important for the options to be acceptable to the state governments.
- Legally binding ambient air quality standards must be implemented to make cities responsible and accountable to control smog, specifically to control PM, NOx ozone and other air toxins are also to be considered in the action plan for air pollution control.
- Health risk perception needs to be analysed and documented for better risk assessment and communication. It needs to be sustained and scaled, as health policy for the country lacks due consideration on air pollution

severity in cities. The source control recommendations should look at other health aspects. Credible & reliable studies are critical.

ANNEXURES

A. Workshop Agenda

ATMOSPHERIC POLLUTION AND HUMAN HEALTH PROGRAMME
"Stakeholder Consultation Towards Improving Air Quality in Delhi"

Agenda for Stakeholder Consultation for Choices & Pathways for Clean Air in Delhi

Date: 26th April, 2018
Venue: Arnav Hall, Prithvi Bhawan, Ministry of Earth Sciences - H.Q., Lodhi Road, New Delhi

9.30 am – 10.00 am	**Registration & Tea/Coffee**
10.00 am to 11.10 am	**Welcome Note:** Prof Jyoti Parikh, Executive Director, IRADe
	Session I: Opening Remarks & Introduction to Atmospheric Pollution and Human Health Programme - Hon'ble Shri. Ranjan Chatterjee, Former Expert Member, National Green Tribunal
	Overview of APHH Projects An Integrated Study of Air Pollutant Sources in the Delhi NCR (ASAP-Delhi) - Prof. William Bloss (University of Birmingham) and Prof. Mukesh Khare Megacity Delhi atmospheric emission quantification, assessment and impacts (DelhiFlux) - Dr. Eiko Nemitz (CEH) and Prof. Bhola Gurjar (IIT-Roorkee) Process analysis, observations and modelling - Integrated solutions for cleaner air for Delhi (PROMOTE) - Prof. Ranjeet Sokhi (University of Hertfordshire) Delhi Air Pollution: Health and Effects (DAPHNE) - Prof. DK Arvind (University of Edinburgh) and Dr. Kalpana Balakrishnan (Sri Ramachandra University, Chennai) Clean Air for Delhi Through Interventions, Mitigations and Engagement (CADTIME) – Dr. Anil Namdeo (Newcastle University) and Dr. S.M. Shiva Nagendra (IIT-Madras)
	Q & A: Stakeholder Inputs
11.10 am – 11.30 am	**Tea & Networking**
11.30 am to 12.45 pm	**Session II: Stakeholder Perspective of Choices & Pathways – Transport Sector, Other Sources & Health** **Chaired by:** - Prof. Jyoti Parikh, Executive Director, IRADe
	Panelists: - Dr. B. Sengupta, Former Member Secretary, CPCB & Sr. Advisor IRADe - Dr. S.K. Tyagi, Former Additional Director, CPCB - Shri. K. Guite, Advisor Transport Research, MoRTH - Dr. J.K. Moitra, Vice President, IAAPC
	Q & A
12.45 pm – 1.30 pm	**Lunch**
1.30 pm to 2.30 pm	**Session III: Stakeholder Perspectives on Air Pollution Action Plan of Delhi-Learnings and Challenges** **Chaired by:** - Dr. Kirit S. Parikh, Chairman, IRADe
	Panelists: - Dr. Ajit Tyagi, Former Director General, IMD & Sr. Advisor IRADe - Dr. J.S. Sharma, Vice President, IAAPC - Mr. Vivek Chattopadhyay, Programme Manager, CSE
2.30 pm to 3.15 pm	**Open Discussion - Aligning Stakeholder needs and Project ambitions** **Moderated by:** - Prof. Ranjeet Sokhi, University of Hertfordshire, U.K.
3.15 pm to 3.30 pm	**Summing up - Way Forward - Vote of Thanks**
3.30 pm	**Close of Workshop – Tea/Coffee & Networking**

B. List of Participants

Sn	Department	Name	Designation
1	Ministry of Road Transport and Highways	Mr. K. Guite	Adviser- Transport Research
2	National Green Tribunal	Hon'ble Shri Ranjan Chatterjee	Former Expert Member
3	Central Pollution Control Board (CPCB)	Dr. B. Sengupta	Former Member Secretary
4	ONGC/ Indian Association for Air Pollution Control (IAAPC)	Dr. J. S. Sharma	General Manager/Vice President
5	Indian Association for Air Pollution Control (IAAPC)	Dr. J. K. Moitra	Vice President
6	Integrated Research & Action for Development (IRADe)	Prof Ajit Tyagi	Sr. Advisor
7	Petroleum Planning and Analysis Cell	Mr. Shyam Gupta	Joint Director
8	Cement Manufactures Association	Mr. KK Roy Choudhary	Consultant
9	Indian Institute of Public Health- Delhi	Dr. Jyoti Sharma	Associate Professor
10	Shakti Foundation	Ms. Ashpreet Kalsi	Program Manager
11	Center for Science & Environment	Mr. Vivek Chattopadhyay	Programme Manager
12	Clean Air Initiative – Asia	Ms. Prarthana Borah	India Director
13	The Energy and Resources Institute	Dr. Isha Khanna	Fellow - Transport
14	Central Pollution Control Board	Dr. SK Tyagi	Former Additional Director
15	Indian Meteorological Department	Dr. RK Jennamani	Scientist F
16	Integrated Research & Action for Development (IRADe)	Mr. Harish Chandra	Sr. Advisor
17	Consultant	Mr. Manoj Mishra	Env. Consultant & modeler
18	Centers for Disease Control & Prevention (CDC)	Dr. Kapil Goel	Sr. Medical Consultant
19	University of Birmingham	Prof. William Bloss	Professor
20	Centre for Ecology & Hydrology	Dr. Eiko Nemitz	Professor
21	Indian Institute of Technology-Roorkee	Prof. Bhola Gurjar	Professor
22	University of Hertfordshire	Prof. Ranjeet Sokhi	Professor
23	University of Edinburgh	Prof. DK Arvind	Professor
24	Sri Ramachandra University	Dr. Kalpana Balakrishnan	Professor
25	Newcastle University	Dr. Anil Namdeo	Professor
26	Indian Institute of Technology -Madras	Dr. S.M. Shiva Nagendra	Professor
27	Integrated Research & Action for Development (IRADe)	Prof Jyoti Parikh	Executive Director
28	Integrated Research & Action for Development (IRADe)	Dr. Kirit Parikh	Chairman
29	Integrated Research & Action for Development (IRADe)	Mr. Rohit Magotra	Deputy Director

Sn	Department	Name	Designation
30	Integrated Research & Action for Development (IRADe)	Mr. Mohit Kumar	Sr. Research Associate
31	Integrated Research & Action for Development (IRADe)	Ms. Ananya Mukherjee	Research Associate
32	Integrated Research & Action for Development (IRADe)	Mr. Anshuman Behera	Research Assistant
33	Indian Institute of Technology -Madras	Mr. Shobham	Research Assistant
34	Indian Institute of Tropical Meteorology	Ms. Pooja Panwar	Junior Research Fellow
35	Indian Institute of Technology -Madras	Mr. Mallikajun	Research Associate
36	Indian Institute of Technology-Roorkee	Mr. Rajmal pat	
37	University of York	Prof. R. Dunmore	Professor
38	University of Manchester	Dr. J. Allan	Professor
39	World Meteorological Organisation	Dr. Alexander Baklanov	Professor
40	University of Manchester	Dr J Allan	Professor
41	Centre for Ecology & Hydrology	Dr. N. Mullinger	Professor
42	Indian Institute of Tropical Meteorology	Ms. Aditi	Junior Research Fellow
43	University of the West of England	Dr. Jo Barnes	Senior Research Fellow

C. Photographs from the Conference