Atmosphere Initiative

ICIMOD

FOR MOUNTAINS AND PEOPLE

The Hindu Kush Himalaya (HKH) is among the most vulnerable regions in the world to impacts of changing atmospheric composition and climate. With increasing emissions of air pollutants from urban, industrial, and rural sources within and upwind of the HKH, the region is facing a rapidly growing air pollution problem. It affects the health of people and ecosystems, as well as agricultural productivity. Melting of glaciers and snowfields is accelerated. Atmospheric circulation patterns and cloud microphysics are changing, affecting monsoon rainfall patterns. Thick haze and increased winter fog over the plains south of the mountains reduce visibility and ground-level sunlight, affecting aviation, mountain tourism, agriculture, and the livelihoods of the poorest.

While the role played by long-lived greenhouse gases, such as carbon dioxide, in changing the earth's present and future climate has been under attention for quite some time, the impacts of black carbon (BC) and other short-lived climate pollutants (SLCPs) have only recently received attention. The Atmosphere Initiative at the International Centre for Integrated Mountain Development (ICIMOD) was established in 2013 as part of the centre's Regional Programme on Cryosphere and Atmosphere. The initiative aims to promote the adoption of effective measures and policies to reduce air pollution and its impacts within the HKH through improved knowledge and enhanced capacity of our regional partners. Its work includes improving scientific understanding of emissions sources, atmospheric processes and change, and air pollution impacts in the HKH, as well as identifying, testing, and piloting mitigation solutions; capacity building and outreach; fostering regional collaboration and cross-border network building, and contributing to policy at local, national, regional, global levels.

The Atmosphere Initiative's recent work

Improving understanding of **emissions** of air pollutants within and upwind of the HKH

- This includes improving understanding of the socioeconomic processes that lead to emissions; understanding the chemical composition of emissions from different sources; and the development and improvement of emission inventories relevant to the HKH.
- We carried out measurements to quantify emissions from brick kilns, cook stoves, garbage fires, agricultural open burning, diesel pumps and generators together with research partners from the United States. We are building an improved gridded emissions inventory. Community-based studies are improving our understanding of the causes and drivers of the recent increase in setting fields on fire to get rid of agricultural residue, and of the cultural significance of open fires in certain communities.

Improving understanding of **atmosphere processes** and change.

- This includes monitoring atmospheric composition and meteorology to detect changes, as well as improve understanding of physical and chemical processes of pollutant's atmospheric transport, transformations, and removal through:
    - in situ long-term monitoring stations
    - coordinated multi-country field campaigns
    - computer modelling and satellite data analysis
- Eight observatories and air quality stations in Chitwan, Lumbini, Ratnapark, Pulchowk and Dhulikhel, Nepal, as well as in Thimphu, Phuentsholing and Pasakha, Bhutan, are in operation.

- Construction of the observatory in Gedu, Bhutan, and prerequisite paperwork for building on national forest land for its twin in Ichhyakamana, Nepal, are in progress.

Improving understanding of **impacts** of short-lived climate pollutants (SLCPs) and atmospheric change on the cryosphere, water cycle, ecosystems, agriculture, human health, income, tourism, gender and livelihoods.

- Solar and wind powered autonomous instrument packages to measure black carbon and meteorology at high altitude glacial locations have been installed in Langtang, Nepal (4,900 m) and will be installed in Chele La, Bhutan (4,100 m). These will help assess the role of black carbon in the melting of Himalayan snow and ice.
- As part of a broader study on persistent winter fog over the Indo-Gangetic Plain, ICIMOD has carried out a community-based study of the impacts of the fog on the lives and incomes of the poorest.

Pins showing the GPS locations of the air quality observatories in Bhutan and Nepal.

Selected site where the observatory will be installed

Installed observatories

Identifying, testing, piloting, and disseminating **mitigation** technologies and other solutions to reduce emissions from key sectors, including cooking, brick making, agricultural burning, and transport

- We are studying why open burning of agricultural residue has increased, and potential mitigation options.
- We are studying impacts on indoor air quality of different cook stoves, and evaluating the adoption and performance of improved biomass stoves.
- We are embarking on an ambitious plan to convert 80% of Nepal's brick kilns to cleaner technologies. We have already set up a new initiative focussing on clean brick production.

Reconstruction of Brick Kilns in Nepal

After the earthquake in Nepal in 2015, ICIMOD promoted the use of more efficient and less polluting zig zag kiln technology and seismically safer chimneys in rebuilding the Kathmandu Valley's affected kilns. With the support of the Climate and Clean Air Coalition, meetings were hosted that brought together engineers, architects, kiln owners, and policy makers and a manual with detailed engineering drawings was produced which served as a guideline for construction of improved brick kilns. By early 2017 19 kilns were fully reconstructed according to the new guidelines and were showing significantly reduced coal consumption and air pollution emissions. Around 50 more underwent conversion, and most of the remaining kilns in the valley have adopted some of the improvements.

Meanwhile, the establishment of training hubs to improve brick kilns has commenced in India and Nepal.

Building **capacity** in the region among policy makers, academics, technicians, students, and media through workshops, targeted training courses, and an advanced degree programme.

- PhD fellowship programme: Women and men working on their PhDs at universities in the region spend a year working with ICIMOD scientists at the centre.
- Regional media training workshop: A week long course was organized for journalists in the region to improve their understanding of atmospheric issues. Twenty-nine journalists from eight ICIMOD member countries participated in this training workshop.
- Regional workshop on air quality instrument operation and maintenance: A training course with a combination of presentations and hands-on-experience on installation, maintenance, calibration, trouble shooting, and daily operational aspects of instruments was organized for the technical staffs of government and partner organizations in Bhutan and Nepal.
- Likewise, a trainings on WRF Chem model and on remote sensing applications were also organized.
- A story grant programme was organized to provide journalists in the region with an opportunity to do in-depth reporting on atmospheric issues. Twelve journalists representing print, radio, television, and internet media outlets from seven countries produced over 60 stories.

Knowledge sharing and **network** building

Disseminating knowledge to the broad public through websites, articles, film, and other outreach activities, while building a network of scientists and practitioners across the region that share data and knowledge, and collaborate across borders.

- A comedy telefilm entitled, Dhuwa was produced by partnering with two famous Nepali comedians. It depicted the health effects and other negative impacts of agricultural open burning and garbage fires. The film was aired on different channels and is also available on YouTube <http://bit.ly/2fZfjlB>.
- Through regular updates to the initiative website and knowledge products, publishing high quality peer-reviewed scientific journals, and disseminating findings through staff articles and other medias, the initiative tailors knowledge to the needs of different audiences.
- ICIMOD has brought together atmospheric scientists from the region in a series of meetings. We are coordinating a study of persistent winter fog over the Indo-Gangetic Plains with scientists from six countries working at 15 field sites in five countries.

Physical and social scientists are working together on field data collection, satellite data analysis, modelling, and community-based research to gain a better understanding of why persistent winter fog has increased in recent decades, its impacts on the lives of several hundred million poor people, and how changing pollution emissions and agricultural practices may be contributing to the fog.

Contributing to **policy**making at local, national and global levels.

This is achieved through direct interaction with policy makers, contributing to national documents, bringing together the region's policy makers, and speaking at global fora.

- A series of national-level policy gap analyses has been initiated. The analysis on Nepal is complete and analyses on Bhutan and India are being conducted.
- The Atmosphere Initiative worked with Nepal's Department of Environment to develop a master plan for Nepal's air quality monitoring network, which is being built with contributions from multiple sources.
- ICIMOD's engagement with the Climate and Clean Air Coalition (CCAC) increased significantly in 2015, serving not only as a lead partner in its health and regional assessment initiatives, but also on the CCAC Steering Committee.
- ICIMOD hosted CCAC's Working Group meeting in Kathmandu in February 2015. This allowed ICIMOD to highlight HKH-specific issues at a global level, while also raising awareness of ICIMOD's unique position to address regional and transboundary issues in the region.

Issues that motivate us

The Himalayan cryosphere is melting rapidly. What role does black carbon play in this?


Air pollution affects monsoon rainfall patterns. What will be the consequences?


Regional haze covers the Indo-Gangetic Plain during the dry season and often penetrates deep into mountain valleys.


What are the impacts, including the economic impacts of reduced visibility?


Air pollution affects many of our cities. What are its health impacts?

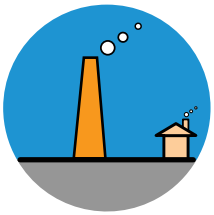

Persistent winter fog over the Indo-Gangetic Plain affects the lives of several hundred million people, especially the poorest. Why has it increased?

Our working areas

Understanding emissions

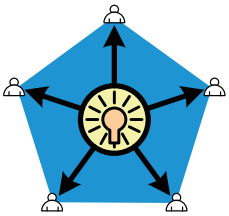
Understanding atmosphere processes and change

Understanding impacts



Mitigation

Capacity building



Knowledge sharing and network building

Contributing to policy making

Partners

Bangladesh

- University of Dhaka
- North South University

Bhutan

- College of Science and Technology
- National Environment Commission

China

- Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Science (CAREERI CAS)
- Institute for Tibetan Plateau Research, Chinese Academy of Sciences

India

- Aryabhatta Research Institute of Observational Sciences
- Greentech Knowledge Solutions
- Indian Institute of Science (IISc), Bangalore
- Indian Institute of Science Education and Research (IISER), Mohali
- Indian Institute of Technology, Kanpur (IITK)
- Indian Institute of Tropical Meteorology (IITM), Pune

Nepal

- Alternative Energy Promotion Center
- Department of Environment
- Federation of Nepal Brick Industries (FNBI)
- Kathmandu University
- Kathmandu Municipal Corporation
- Lumbini International Research Institute (LIRI)
- Maha Sanchar
- Ministry of Population and Environment (MoPE)
- MinErgy Pvt. Ltd.
- National Trust for National Conservation (NTNC)
- Nepal Academy of Science and Technology (NAST)
- Nepal Health Research Council
- Nepal Wireless
- Tribhuvan University

Pakistan

- Institute of Space Technology (IST)
- National University of Sciences & Technology (NUST)

International

- Clean Air Asia, Philippines
- Climate and Clean Air Coalition (CCAC)
- Climate and Health Research Network (CHeRN), USA
- Institute for Advanced Sustainability (IASS Potsdam)
- Institute for Global Environmental Strategies (IGES), Japan
- Molina Center for Energy and the Environment, USA
- Seoul National University, Korea
- Stockholm Environment Institute, York, United Kingdom
- University of Illinois, USA
- University of Montana, USA
- Drexel University, USA
- Emory University, USA
- University of Virginia, USA
- Yale University, United States for America

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