

Global Change Impact Studies Centre (GCISC)

(A Body Corporate established under the GCISC Act 2013)

Year 2015-16

The Global Change Impact Studies Centre (GCISC) was first established as a development project in April 2002, with the mandate to undertake research on climate change and its impacts and potential remedies. Subsequently, GCISC's status was formalized through the passage of the GCISC Act 2013 by the Parliament (notified vide Gazette of Pakistan on 26 March 2013 as Act No. XVII of 2013). The Act defines GCISC as a body corporate governed by an independent Board of Governors (BoG), which is chaired by the Federal Minister in-charge of the concerned Ministry dealing with the subject of climate change.

a) Mission Statement

To undertake scientific investigations of the phenomenon of climate change at regional and sub-regional levels and study its impact on various sectors of socio-economic development in order to prepare the country to meet threats to its water resources, agriculture, ecology, energy, health, bio-diversity etc.

b) Main Functions

Under the GCISC Act, the Center is tasked with three functions, namely research, capacity building, and outreach and awareness:

- **Research:** the research program is driven by national policy goals, namely protecting people against the impacts of climate change, promoting economic growth and sustainable development in a climate-constrained future, and honoring Pakistan's international commitments. To these ends, research is organized in three groups:
 - ***Climatology and Environment:*** using climate system models to predict future climate behavior in Pakistan, including monsoons, temperature, precipitation, and climate extremes.
 - ***Water Resources and Glaciology:*** using glacio-hydrological and water models to assess future behavior of glaciers, aggregate and seasonal flows in the Indus Basin System, and changes in watershed behavior.
 - ***Agriculture, Forestry & Land Use:*** use of crop simulation modeling to predict the impact of projected changes in temperature, precipitation, and water availability, Forestry, Land Use
- **Capacity building:** imparting technical and communication skills to GCISC staff as well as students and climate scientists at other national research organizations and universities.
- **Dissemination of research findings:** to the scientific community, planners, policymakers, and to the public at large, in order to raising awareness of climate change among policymakers as well as the citizenry.

c) Ongoing Research Activities

I. Climatology Section

- Assessment of past climate changes in various parts of Pakistan using statistical analysis techniques;
- Projection of future climate changes in Pakistan based on: (a) Ensemble of projections using the outputs of various Global Circulation Models (GCMs) (b) Statistical and dynamical downscaling using regional climate models (RCMs).
- Development of indicators and indices for extreme climate events in the South-Asia region;
- Development of methodological tools for projecting future frequency and intensity patterns of extreme events;
- Development of seasonal, inter-annual and decadal climate predictability systems;
- Predictability of Asian Summer Monsoon rains.
- Updating of GHG Inventory of Pakistan using latest IPCC guidelines.
- Analysis of alternative Energy Sector Strategies for Pakistan in relation to GHG and other pollutant emissions using Pakistan's Integrated Energy Planning Model and IIASA's GAINS-Asia Model

II. Water Resources Section

- Assessment of temporal changes in the extent of HKH glaciers using advanced Remote Sensing (RS) and GIS techniques;
- Analysis of hydro-climatic changes (especially extreme events) in the mountainous region of Pakistan Assessment of the impacts of projected climate change on stream flows (including riverine/flash/glacier outburst flood flows) in the selected river streams of Pakistan using different simulation models;
- Adaptation measures to cope with (a) the flood and drought situations, (b) reduced water availability, (c) the intrusion of sea water in the coastal areas of Pakistan.

III. Agriculture Section

- Assessment of the impacts of projected climate change on productivity of various agricultural crops in different climatic zones of the country using crop growth simulation models;
- Study of climate change impacts on land degradation and deforestation;
- Study of insect-pest infestation dynamics in the wake of climate change;
- Food security in the wake of climate change and reduced availability of irrigation water;
- Assessment of climate change impacts on livestock;
- Adaptation measures to counter negative impacts of climate change on Agriculture, Livestock and Forestry.

d) Achievements and Progress of GCISC:

Since its inception, GCISC has produced over 100 scientific papers and official reports, collaborated with national and international institutions, contributed to the work of prestigious international scientific panels, and provided advice to the government on national policies as well as international commitments. The following is a summary of the accomplishments in 2015. In case of joint authorship, the name of the GCISC researcher is in **bold** script.

Publications:

International / National Papers: 9

1. N. Forsythe, A.J. Hardy, H.J. Fowler, S. Blenkinsop, C.G. Kilsby, D.R. Archer and **M. Z. Hashmi** (2015) A detailed cloud fraction climatology of the Upper Indus Basin and its implications for near surface air temperature. *Journal of Climate*, 28, 3537–3556. doi: <http://dx.doi.org/10.1175/JCLI-D-14-00505.1>.
2. N. Pepin, R. S. Bradley, H. F. Diaz, M. Baraer, E. B. Caceres, N. Forsythe, H. Fowler, G. Greenwood, **M. Z. Hashmi**, X. D. Liu, J. R. Miller, L. Ning, A. Ohmura, E. Palazzi, I. Rangwala, W. Schöner, I. Severskiy, M. Shahgedanova, M. B. Wang, S. N. Williamson, and D. Q. Yang (2015). Elevation-dependent warming in mountain regions of the world. *Nature- Climate Change* 5,424–430(2015) doi:10.1038/nclimate2563.
3. M. Aamer, **M. Arif Goheer**, and Muhammad Nasim (2015) Distribution and Indexation of Plant Available Nutrients of Soils in the District Bahawalpur, Pakistan. *Journal of Biology, Agriculture and Healthcare*. ISSN 2224-3208 (Paper) ISSN 2225-093X (Online) Vol.5, No.21, 23-30.
4. M. Aamer, and **Aftab A. Khan** (2015) Evaluation of Ground Water Quality for Irrigation Purpose of the Areas of District Bahawalnagar, Pakistan. *Journal of Natural Sciences Research*, www.iiste.org ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online) Vol.5, No.19, 23-26.
5. **M. Adnan, N. Rehman, S. Ali, S. Mehmood, K.A. Mir, A.A. Khan**, and B. Khalid (2015) Prediction of Pakistan Summer Rainfall from Global SST and SLP. *International Journal of Weather*, Manuscript ID: WEA-16-0039 (Accepted)
6. M. Aamer, **Aftab Khan**, and Sobia Khan (2015) Assessment and Characterization of Irrigation Quality of Ground Water in Bahawalpur District, Pakistan. *Developing Country Studies*, www.iiste.org ISSN 2224-607X (Paper) ISSN 2225-0565 (Online) Vol.5, No.20,39-42.
7. A. Kamran, **M. A. Goheer**, K. Saifullah, and S. Amir (2016) Pak-India Cooperation for Harnessing Benefits of Transboundary Water in Indus Basin: A policy brief prepared under Cohort-18 on transboundary water cooperation and published by LEAD-Pakistan.
8. Kashif Majeed Salik, **M. Zia-ur-Rahman Hashmi**, Waheed-ul-Zafar Zahdi, and Sadia Ishfaq (2016) Ecological Assessment of the Indus Delta in Pakistan: A Desktop Analysis of Environmental Flow Requirements, in Imrana Niazi, Sarah S. Aneel, and Uzma T. Haroon, eds. *Pathways to Sustainable Development*. pp. 133-150. Sang-e-Meel Publications.

9. Kashif Majeed Salik, **M. Zia-ur-Rahman Hashmi**, Sadia Ishfaq, and Waheed-ul-Zafar Zahdi (2016) Environmental flow requirements and impacts of climate change-induced river flow changes on ecology of the Indus Delta, Pakistan. *Regional Studies in Marine Science*, vol. 7 (September 2016): 185-195. ISSN 2352-4855, <http://dx.doi.org/10.1016/j.rsma.2016.06.008>.

Research Reports: 5

1. **M. Zia ur Rahman Hashmi, Amjad Masood, Qurat ul Ain Ahmad and Shahbaz Mehmood** (2015) Technical Report of APN Project "Runoff Scenarios and Water Based Adaptation Strategies in South Asia" (ARCP2013-20NMY-Shrestha).
2. Chaudhry, Qamar uz Zaman, Ghulam Rasul, Ahmad Kamal, Munir Ahmad Mangrio, and **Shahbaz Mahmood** (2015) Severe Heat Wave over Southern Parts of Pakistan Focusing Karachi in June 2015. Ministry of Climate Change.
3. **M. Adnan, Nadia Rehman, Javeria Ashraf, M. Munir Sheikh, and Arshad M. Khan**, (2015) Seasonal Predictability of Monsoon Rains in Pakistan. *GCISC Research Report RR-18* (Interim).
4. **Kaleem Anwar Mir, and M. Ijaz** (2016) Greenhouse Gas Emission Inventory of Pakistan for the Year 2011-2012.
5. Balakrishnan, Malini, S. R. Bajracharya, V. S. Batra, **M. Z. Hashmi**, and A. B. Shrestha (2016) Freshwater, in *GEO6: Regional Assessment for Asia and the Pacific*. UNEP

Books, Monographs and Conference Proceedings (2)

1. **Qurat ul Ain Ahmed, M. Zia ur Rahman Hashmi, and M. Arif Goheer** (2015). Proceedings of the Regional Training Workshop on "The Application of UBC Watershed Model for Hydrological Studies". APN Project "Runoff Scenarios and Water Based Adaptation Strategies in South Asia" (ARCP2013-20NMY-Shrestha).
2. **Nuzba Shaheen, and M. Arif Goheer** (2016) Proceedings of the Regional Inception Workshop organized under APN Project on "Climate Smart Agriculture through sustainable water use management" (CAF2015-RR12-NMY-Shaheen), 10-12 November 2015, Islamabad, Pakistan.

Presentations at Workshops/ Seminars/ Conferences/ Symposia

International: 8

1. M. Arif Goheer (2015) Climate Change Threats to Agriculture in Pakistan: Impacts and Adaptation Prospects. Lecture delivered in a Seminar on *Climate Change: Issues, Challenges and Opportunities for Landless farmers and Peasants of Sind*, organized by Sindh Agriculture University, Tandojam, and ILO. September 09, 2015.
2. M. Amjad (2015) Energy Situation in Pakistan. *2015 Wind Power Generation for Developing Countries*, 14 August – 8 October 2015, Lanzhou, China. Organized by the government of China.
3. M. Zia-ur-Rahman Hashmi (2015) GLOFs: Learning and Way Forward, presentation at the *International GLOF Conference*, 14-15 October 2015, Islamabad
4. Nadia Rehman and M. Adnan (2015) Seasonal Prediction of Summer Rains over Monsoon Region of Pakistan, presentation in the Advanced School and Workshop on Sub-seasonal to Seasonal (S2S) Prediction and Application to Drought Prediction, 23 November–04 December 2015, ICTP, Trieste, Italy.

5. Nuzba Shaheen Generation of Weather Data using Stochastic Weather Generator for Upper Indus Basin of Pakistan, presentation at APCC Training Program, 11 December 2015, Busan, Korea
6. Nadia Rehman (2015) Case Study-Forecast Analysis of Heat Wave Event of Southern Pakistan by Using ECMWF-S2S Data Portal, presentation at the Advanced School and Workshop on Sub-seasonal to Seasonal (S2S) Prediction and Application to Drought Prediction, 23 November–04 December 2015, ICTP, Trieste, Italy.
7. Qudsia Zafar (2015) Downscaling of Regional Climate Data Derived from Statistical Downscaling Techniques over Pakistan, presentation at APCC Training Program, Busan, South Korea, 12 December 2015.
8. Shaukat Ali, Shahbaz Mehmood and M. Arif Goheer (2016) CORDEX data application for mountainous regions. Poster Presentation at Stockholm, Sweden, 17-20 May 2016.

National: 19

1. M. Arif Goheer and M. Mohsin Iqbal (2015) From Sustainable Production to Sustainable Consumption: Climate Change Challenges to Food Security in Pakistan, Presentation at the World Environment Day-2015, organized by the Pakistan Engineering Congress (PEC), on Seven Billion Dreams: One Planet: Consume with Care., 6 June 2015, Lahore
2. Kaleem Anwar Mir and Muhammad Ijaz (2015) GHG Emission Inventory of Pakistan for the Year 2011-2012, presentation to FAO Islamabad, 25 August 2015, Islamabad.
3. M. Ijaz (2015) Greenhouse Gas (GHG) Emission Inventory of Pakistan for the Year 2011-12, presentation to FAO Pakistan, 28 August 2015.
4. Syed Mehmood Nasir (2015) Wetlands Management, presentation at 4th Learning Session on Hydro-Diplomacy and Negotiation for Shared Waters, under Cohort-18 of the Transboundary Water Management Workshop, 24-28 August 2015.
5. M. Arif Goheer (2015) Negotiations and Agreements between Ganges River Basin Riparians, presentation at 4th Learning Session on Hydro-Diplomacy and Negotiation for Shared Waters, under Cohort-18 of the Transboundary Water Management Workshop, 24-28 August 2015.
6. M. Arif Goheer (2015) Overview of INDC's submitted to UNFCCC and Pakistan's stance, presentation to the Secretary, Ministry of Climate Change, 07 October 2015
7. M. Arif Goheer (2015) Climate Change and Agriculture: Context and Challenges, presentation at 3-day Workshop on Climate Risk Management, jointly organized by GCISC and the National Institute of Disaster Management (NIDM), 27-29 October 2015, Islamabad.
8. M. Zia-ur-Rahman Hashmi (2015) GLOFs, presentation at NIDM Training Workshop on Climate Change Management, 27-29 October 2015.
9. Shahbaz Mehmood (2015) Science of Climate Change: Simulating the future, Invited Lecture at NIDM Training Workshop on Climate Change Management, 27–29 October 2015, Islamabad
10. M. Arif Goheer (2015) Climate Change Negotiating Text, presentation to Honorable Minister for Climate Change, 17 November 2015.
11. M. Ijaz (2015) Responses to Climate Change: Adaptation and Mitigation, presentation at NCRD Workshop, December 2015, Islamabad.

12. M. Zia-ur-Rahman Hashmi (2015) Glaciers, presentation at NCRD Training Course on Climate Change: Implications and Adaptations, 17 December 2015.
13. Shahbaz Mehmood (2015) Science of Climate Change: An Overview, Invited Lecture at Training Course on Climate Change: Implications & Adaptations, 14–18 December 2015, NCRD, Islamabad.
14. Shahbaz Mehmood (2015) Pakistan's Major Climate Change-Related Concerns and Vulnerabilities. Invited Lecture at NCRD Training Course on Climate Change: Implications and Adaptations, 14–18 December 2015, Islamabad.
15. Shaukat Ali (2015) Presentation, at Conference on Challenges in Water Security to Meet Growing Food Requirements, organized by AASSA (Association of Academies and Societies of Sciences in Asia) and PAS (Pakistan Academy of Sciences)
16. Shaukat Ali (2015) Future Earth and CORDEX Applications for Asia, seminar presentation at COMSATS IIT, Islamabad, 12 April 2016.
17. M. Arif Goheer (2015) UNFCCC Guidelines for Preparing National Communications, presentation at the Inception Workshop of 2nd National Communication (SNC), 11 May 2016, Islamabad.
18. M. Arif Goheer (2015) Paris Agreement and Aspects of Adaptation and Agriculture, presentation at Journalists Training Workshop on What does Paris Agreement mean for Pakistan, organized by the Heinrich Boll Stiftung, 22 December 2016, Islamabad.
19. Syed Mehmood Nasir (2015) Forests and Snow Leopards, presentation at Journalists Training Workshop on What does Paris Agreement mean for Pakistan, organized by the Heinrich Boll Stiftung, 22 December 2016, Islamabad.

Presentations at Project Workshops (9)

1. M. Arif Goheer (2015) Ensuring Food Security under Climate Change: A Simulation Modeling Perspective, presentation in *APN Project Inception Workshop: Climate Smart Agriculture through Sustainable Water Use Management: Exploring New Approaches and Devising Strategies for Climate Change Adaptation in South Asia*, 10-12 November 2015, Islamabad.
2. M. Arif Goheer (2015) Developing Common Research Framework for Project Studies, session moderator in Regional Inception Workshop under APN Project Climate Smart Agriculture through Sustainable Water Use Management: Exploring New Approaches and Devising Strategies for Climate Change Adaptation in South Asia, 10-12 November 2015, Islamabad.
3. M. Arif Goheer (2015) Research Problems/ Limitations and Way Forward, session moderator in Regional Inception Workshop under APN Project Climate Smart Agriculture through Sustainable Water Use Management: Exploring New Approaches and Devising Strategies for Climate Change Adaptation in South Asia, 10-12 November 2015, Islamabad.
4. Shahbaz Mehmood, Nadia Rehman, and Shaukat Ali (2015) Climate Change: Projecting the Future Climate for Impact Assessment Studies, presentation at Regional Inception Workshop under APN project Climate smart agriculture through sustainable water use management: Exploring new approaches and devising strategies for climate change adaptation in South Asia (Ref: CAF2014-RR12-NMY-Shaheen), 10-12 November, 2015, Islamabad.

5. Shaukat Ali, Shahbaz Mehmood, and Nadia Rehman (2015) Twenty-first Century Climatic and Hydrological Changes over North Pakistan, presentation at Regional inception Workshop under APN project, Climate smart agriculture through sustainable water use management: Exploring new approaches and devising strategies for climate change adaptation in South Asia (Ref: CAF2014-RR12-NMY-Shaheen), 10-12 November 2015, Islamabad.
6. Zia-ur-Rahman Hashmi (2015) Climate Change Threat to Pakistan's Water Resources and Impact modeling needs, presentation at the Regional Inception Workshop under APN project Climate smart agriculture through sustainable water use management: Exploring new approaches and devising strategies for climate change adaptation in South Asia (Ref: CAF2014-RR12-NMY-Shaheen), 10-12 November 2015, Islamabad.
7. Nuzba Shaheen (2015) Project Overview: Climate Smart Agriculture Through Sustainable Water Use Management, at Regional Inception Workshop under APN Project CAF2015-RR12-NMY-Shaheen, 10 November 2015, Islamabad.
8. Nuzba Shaheen (2015) Project Plan and Research Framework, presentation at Regional Inception Workshop under APN Project CAF2015-RR12-NMY-Shaheen, 11 November 2015, Islamabad.
9. Nuzba Shaheen (2015) APN Project Overview and Progress, presentation at Regional Training Workshop, Use of Statistical Downscaling and AquaCrop Simulation Modeling Tools for Climate Change Impact Studies, under APN Project CAF2015-RR12-NMY-Shaheen, 30-04 June 2016, Kandy, Sri Lanka.

Organization of Scientific Activities (3)

1. *Climate Risk Management*, 3-day Workshop in collaboration with National Institute of Disaster Management, 27-29 October 2015, Islamabad
2. *Regional Inception Workshop*, APN Project Climate Smart Agriculture through Sustainable Water Use Management (CAF2015-RR12-NMY-Shaheen), 10 November 2015, Islamabad, Pakistan.
3. *Use of Statistical Downscaling and AquaCrop Simulation Modeling Tools for Climate Change Impact Studies*. Regional training workshop organized under APN Project CAF2015-RR12-NMY-Shaheen, 30 May-04 June 2016, Kandy, Sri Lanka.

Contributions to Research Projects (4)

1. UNEP Project on Preparation of Intended Nationally Determined Contributions (INDC) to the 2015 Agreement under the United Nations Framework Convention on Climate Change (GFL-5070-2724-4F36-2207)
2. APN Project on Climate Smart Agriculture through Sustainable Water Use Management: Exploring New Approaches and Devising Strategies for Climate Change Adaptation in South Asia.
3. APN Project on Assessing Spatio-temporal Vulnerabilities of NPP (Net Primary Productivity) and NEP (Net Ecosystems Productivity) of Grassland Ecosystems in response to Climate Change.
4. APN project on Runoff Scenarios and Water Based Adaptation Strategies in South Asia (ARCP2013-20NMY-Shrestha).

Mass Awareness / Media Appearance (3)

1. M. Arif Goheer appeared in Radio Pakistan live programme "Raabta", 10:05-11:00 am, April 13, 2016.
2. M. Zia ur Rahman Hashmi appeared in Radio Pakistan live programme "Raabta", 10:05-11:00 am, April 14, 2016.
3. M. Arif Goheer appeared in Radio Pakistan programme, "Mahool Zindgi Hai", 15:15-16:00, April 18, 2016.

Contributions to International/ National Efforts (UNFCCC, IPCC, GEO & Others) (6)

1. One GCISC Scientist (Mr. Muhamamd Arif Goheer) participated in UNFCCC COP-21, Paris, France, as Government of Pakistan Delegate. 30 November to 12 December 2015.
2. One GCISC Scientist (Dr. M. Zia Hashmi) participated as a technical expert from Pakistan in the IPCC Workshop on Regional Climate Projections and their Use in Impacts and Risk Analysis Studies, 15-18 September 2015, São José dos Campos, Brazil.
3. Five GCISC Scientists contributed to various chapters of UNEP Global Environment Outlook (GEO-6) Asia and Pacific Component.
4. One GCISC Scientist (Mr. Muhamamd Amjad) participated as Fellow in LEAD-Pakistan Fellowship Programme on Urban Resilience and Sustainable Cities.
5. One GCISC Scientist (Dr. Shaukat Ali) participated in Young Scientist Summer Program, APEC Climate Centre, Busan Korea.
6. One GCISC Scientist (Dr. M. Zia Hashmi) participated as a climate change expert from Pakistan in the Special Session of the SAARC Programming Committee to decide on the location of SAARC Environment and Disaster Management Centre (SEDMC). Dec 2015.

e) Other

- Processing of Draft GCISC Employees Service Rules through the Establishment Division.
- Selection of new office premises for GCISC.
- Advertisement for the various technical and administrative posts in GCISC.
- Procurement of IT Equipment through standard government procedures.
- Provision of advice to Ministry of Climate Change and other Government entities on climate-related issues.
- Regular in-house seminars and trainings events.
- Draft Replies to National Assembly/Senate's Starred/Un-starred Questions and Motions on climate-related topics.