

International Research (Project No.: 30W-02)

Project name: Towards the International Collaboration to the Implementation of the Early Warning System for the South Himalayan Cloudburst Disaster

Principal Investigator: Someshwar Das, Professor

Affiliation: Department of Atmospheric Science, School of Earth sciences, Central University of Rajasthan

Name of DPRI collaborative researcher: Hirohiko ISHIKAWA, Professor

Research period: April 1, 2018 ~ March 31, 2020

Research location: India, Japan

Number of participants in the collaborative research: 71 (DPRI staff: 1, non-DPRI staff: 70)

- Number of graduate students: 30 (Master students: 20, Doctor students: 10)

- Participation role of graduate students

[They attended an international workshops on “Extreme Severe Storms and Disaster Mitigation Strategy (ESSDMS)” organized at Central University of Rajasthan. They are engaged in different project works related to severe storms and cloudbursts over the Himalayas.]

Anticipated impact for research and education

1. Establishment of new international linkage and collaboration among interdisciplinary researchers, students in South Asian countries and Japan.
2. Emission of strategic plan of the early warning system in different time scales for the South Himalayan severe rainstorm disasters including the experimental center for the numerical forecast and early warning of extreme severe storm.

Research report

(1) Purpose

Over the South Himalayan range, many severe atmospheric mega-disasters due to the extreme rainstorm events are taking place. Recently In June 2013 in Uttarakhand Himalayan region in India, severe rainstorm (also known as cloudburst) caused more than 4000 death because of flooding and landslides. Mega-floods hit northeastern part of Indian subcontinent in recent successive two years in 2016-17, that affected millions of people. Such atmospheric mega-disasters in this area are expected to increase in number rapidly. The atmospheric warming will increase extreme rainstorms, and is creating a huge number of glacier lakes, significantly increasing the potential of atmospheric mega-disasters. The economic development in South Asian countries on the other hand results in the unplanned human intervention in nature, raising disaster vulnerabilities in these areas. Extreme rainfall events are now catching new interests of wide research communities in South Asia.

Therefore, we intended to facilitate implementation of the early warning system in different time scales for the South Himalayan severe rainstorm disasters. The purpose of the present study was to foster the international linkage and collaboration among interdisciplinary researchers, and to emit an agenda for the implementation of early warning system of severe rainstorm disaster in South Himalayan region.

(2) Summary of research progress

We launched a new international research platform, the Extreme Severe Storm and Disaster Mitigation Strategy (ESSDMS) project, which combined researchers in currently five countries, India, Bangladesh, Nepal, Myanmar and Japan. Under this project, we conducted two international workshops in December 2018 and February 2020 at the Central University of Rajasthan (CURAJ), in India. The first ESSDMS workshop was held with 27 research papers and more than 50 participated

researchers. It emitted a recommendation that summarizes our challenges to mitigate disasters associated with extreme severe storms. The second ESSDMS workshop, with 20 research papers and more than 30 participated researchers, further concluded that the focus will be on implementation of near real-time rainstorm detection and early warning system (EWS) for extreme rainstorms. We also sent three researchers from ESSDMS project to an international conference AOGS (Asia Oceania Geosciences Society) 2019 held in Singapore during 28 Jul. to 2 Aug. 2019.

Another important activity conducted under this project was the organization of a workshop on AsiaPEX / South Asia. The AsiaPEX (Asian Precipitation Experiment), is a new international hydroclimatological research project, which is the main international hydroclimate research initiative for the Asian monsoon under GEWEX Hydroclimate Panel (GHP) in GEWEX. It was launched in FY2019. The ESSDMS community discussed about the South Asian part of the AsiaPEX project, and conducted a workshop on the AsiaPEX/ South Asia during 1-2 March 2020 at CURAJ. A panel discussion was held at the end of the workshop including all the participants. A recommendation draft has been made based on the panel discussions. For all these workshops, many graduate students contributed in conducting the sessions and participated in discussions. They also learned international level research.

(3) Summary of research findings

We summarize major research findings based on these activities above. Firstly, our emphasis on strategic themes are (1) understanding of extreme severe storms, (2) understanding climate change impact on extreme severe storms, (3) advanced numerical modelling of extreme severe storms, and (4) mitigation strategy for extreme severe storms. We will proceed to research plans for the upcoming early warning system as follows: (1) to design a coordinated numerical experiment for the simulations of some selected extreme severe storms over the Himalayas and request all the collaborators to conduct the experiments in a systematic way for better inter-comparison of the results of the selected cases, (2) to understand the relationship between behavior of convective systems and convective parameterization schemes, (3) to survey the vulnerable areas over the western and central Himalayas, which are prone to frequent cloudbursts and assess the ground realities for the need of special observations and field experiments (if any) for improving the EWS in future, and (4) to launch experimental center for the numerical forecast and early warning of extreme severe storm, which should be planned and implemented based on our collaboration.

(4) Publications of research findings

1. Das Someshwar, 2020: Cloudbursts and Rainstorms over Southern Plains of the Himalayas. *International workshop on AsiaPEX-SA, Central University of Rajasthan, India, 1-2 March 2020.*
2. Das Someshwar, S. K. Panda, J. Meandad, K.M.G. Rabbani, S. Sabarina Sultana, and Towhida Rashid, 2020: Simulation of Severe Storms over southern plains of the Himalayas. *2nd International workshop on "Extreme Severe Storms and Disaster Mitigation Strategy (ESSDMS2)", Central University of Rajasthan, India, 27-29 Feb 2020.*
3. Das Someshwar, S. K. Panda, J. Meandad, K.M.G. Rabbani, S. Sabarina Sultana, and Towhida Rashid, 2020: Simulation of Severe Storms over southern plains of the Central and Eastern Himalayas. *International Conference on Earth & Environmental Sciences and Technology (ICEEST), University of Dhaka, Bangladesh, 25-30 Jan 2020.*
4. Panda S.K., Archana Tripathy and Someshwar Das, 2020: Impact of Dust on Tropical Cyclone Ockhi as Simulated by WRF Model. *International Conference on Earth & Environmental Sciences and Technology (ICEEST), University of Dhaka, Bangladesh, 25-30 Jan 2020.*

5. Rabbani, K.M.G., Someshwar Das, M.A.K. Mallik, S.K. Panda, and A. Kabir, 2020: A comprehensive analysis of the Nor'westers over Bangladesh based on observations and simulations by the WRF Model: Sensitivity of physical processes and verification using Model Evaluation Tools. *Submitted to Meteorology & Atmospheric Physics.*
6. Javed Meandad, Towhida Rashid, Someshwar Das, and Subrat Kumar Panda, 2020: Study on the Relationship between Lightning Flash Rate and Cloud Microphysical Parameters Derived Through WRF Model. *Under preparation for submission in a Journal.*
7. Archana Tripathy, Subrat Kumar Panda and Someshwar Das, 2020: Impact of dust on tropical cyclone Ockhi: a case study simulated by WRF-Chem. *Under preparation for journal.*
8. Fumie Murata, Toru Terao, Kaustav Chakravarty, Hiambok Jones Syiemlieh, Laitpharlang Cajee, 2020: Characteristics of Orographic Rain Drop-Size Distribution at Cherrapunji, Northeast India. Submitted to Atmosphere.
9. Toru Terao, 2020: New Analysis Framework of Asian Summer Monsoon Variability: Production and Transportation of High Equivalent Potential Temperature Airmass. *Under preparation for journal.*