

**Recommendations (draft):  
Toward the Establishment of Disaster Mitigation Strategy  
for Extreme Severe Storms over the Asian Countries**

**2<sup>nd</sup> International Workshop on Extreme Severe Storms and  
Disaster Mitigation Strategies**

**27-29 Feb. 2020, Central University of Rajasthan**

**List of Collaborating Countries: 4 (India, Japan, Nepal and Bangladesh)**

**Number of participants in the collaborative research: 30**

**Graduate students: 18**

The Southern plains of the Himalayas are prone to many types of atmospheric disasters due to extreme rain and wind storms. In order to mitigate the impacts of such calamities due to severe weather systems, the foremost requirement is to develop accurate early warning system at the scale of a village. Longer the lead time of forecasts, higher would be the chances for mitigating their impacts by the disaster management authorities. Unfortunately, the forecasting of extreme storms at precise location, time and intensity are still not so accurate even based on the latest high resolution models. This is due to the scarcity of data at the scale of the phenomena like thunderstorm, cloudburst, **inherent nonlinearity, and highly diverse land surface condition**. The problem becomes more complicated over the mountains due to presence of steep topography and rapid variations of trough & ridges. Lightening is another big hazard, which is difficult to predict. There are a lot of casualties due to lightning strikes annually in many parts of India, Nepal and Bangladesh. Thus, there is a need for a very high resolution network of meteorological observations to measure 3 dimensional profiles of the atmosphere more frequently every day.

Under these perspectives, we have defined research topics that could be developed under our

research collaboration on “Extreme Severe Storms and Disaster Mitigation Strategy in Asian Countries” as follows.

1. Strategic Theme [1]: Understanding of Extreme Severe Storms:
2. Strategic Theme [2]: Understanding Climate Change Impact on Extreme Severe Storms:
3. Strategic Theme [3]: Towards Advanced Numerical Modelling of Extreme Severe Storms:
4. Strategic Theme [4]: Mitigation strategy for Extreme Severe Storms:

The researchers from India, Japan, Nepal and Bangladesh have expressed interests in collaborations on these strategic themes. In this workshop, 20 research papers were presented, and about 50 researchers participated from different Asian countries including India, Bangladesh, Nepal and Japan. In summary, emphasis was given to establishment of dense network of observations points over the Himalayas, transparent cooperation between the collaborating institutes, and transparency of data transfer.

#### Interim Plans for 2019-2020:

Fundamental studies on rainstorms in South Himalayan area will be continued. Focus will be on discussion on implementation of near real-time rainstorm detection and early warning system (EWS) for extreme rainstorms. Strategic theme for mitigation strategy for extreme severe storms in the Agenda identifies four points;

1. Development of EWS of extreme storms for disaster mitigation,
2. Building of strong human resources for resilience against extreme storms in the changing climate scenarios,
3. Development of impact based forecasting and communication strategies to the end users.
4. Identifying better science communication techniques (technical information to layman responsive messages).

Based on these issues, we will plan for the upcoming EWS, to be implemented under this project.

1. We shall 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. Impact studies of assimilation of new available data from satellites and existing ground based observational facilities will benefit us.

2. Systematic understanding of the relationship between behavior of convective systems and convective parameterization schemes should be important.
3. We shall also 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.
4. Experimental center for the numerical forecast and early warning of extreme severe storm should be planned and implemented based on our collaboration, seeking funding agencies globally.