

## **ECONOMIC AND SOCIETAL IMPACTS OF VERY SHORT RANGE FORECASTING IN DEVELOPING COUNTRIES AND USER CONCERNS; PAKISTAN PERSPECTIVE**

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### **Abstract:**

In this study, economic and societal impacts of very short range forecasting have been studied in qualitative and quantitative terms based on various case studies. It depicts that economies of developing countries are more vulnerable to weather related hazards due to weak infrastructure, less public & institutional awareness in coping extreme weather events, non-coordinated mitigation strategies and poor responses to hazardous weather warnings.

Flight operations in national routes are mostly of short duration (at the most three hours) in most of developing countries. Very short range reliable forecasts can play vital role in economic prosperity of aviation sector and in turn, positive impact on aviation users in terms of commitment / satisfaction. PIA; national carrier of Pakistan suffered a loss of rupees 5 million just in one month (January 2005) in lieu of non operation of flights for northern areas due to bad weather. Out of 48 scheduled flights, only twelve could be operated. This situation caused problem for more than four thousand families.

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Analysis of past extreme weather events in relation to societal response depicts a positive trend; public response to weather warnings is improving. Involvement of NGOs and community representatives has increased manifold in mitigation activities.

Aviation users stressed the need for tailored made weather information to the specific needs of aviation sector comprising a) More frequent update of detailed wind profile of atmosphere, b) reliable forecasting of in-route convective storms/intense lightning, c) improved access to real-time instrumental weather data (visibility, precipitation, weather phenomena etc). Progressive growers and operators of public services industries demanded elaborated short range forecasts of extreme temperatures, snow/fog conditions, wind, heavy rains and other more useful products.

### **INTRODUCTION**

South Asia is vulnerable to a variety of natural hazards. These hazards in combination with the vulnerabilities of response systems and communities have in the last decade caused severe disasters costing loss of lives, property and the socio-economic development to countries. During the last decade (1995-2004), damage associated with floods, drought and windstorms in South and Southeast Asia alone amounted to over US\$ 33 billion, with more than 25,000 deaths (EM-DAT, [http://www.em\\_dat.net](http://www.em_dat.net)). More than 8,500 deaths were recorded in Pakistan from natural disasters. 26.202 million people were affected from natural disasters.

The scientific advancements in now-casting and monitoring of extreme weather events needs to be complemented with improved strategies for communicating risk. Detailed forecast information must be supplied keeping in view the capabilities of targeted audience if this scientific skill is to be applied in mitigating disasters.

In South Asia, real-time automated and/or manned weather observations, radar echo maps, satellite imageries, wind profilers, lightning detection systems, and real-time weather maps and meso-scale numerical guidance products are used by National Meteorological Services (NMSs) in generating very short range weather forecasts. Users like caterers, aviation sector, transporters, livestock traders and other operators of public service industries prefer to get updated weather forecast through television channels or by calling the weather office and having a detailed briefing from a forecaster. Print media information is generally considered old.

### DATA AND METHODS

Following segments were covered in this study.

- A number of extreme events when very short range forecasts were provided to vulnerable communities and mitigation agencies. The impacts were qualitatively analyzed on the basis of response recorded by mitigation workers.
- Aviation sector statistics and response of users in flight operation and sufferings. Economic aspects were analyzed from the statistics provided by PIA.
- Public response when disastrous event repeated to a particular area. Disaster management agency workers views considered more important.

### CASE STUDIES

Devastating floods in Indus delta in Pakistan in 1992 and 1997 provided considerable lead time. However, the scope and intensity of the 1992 floods came as a surprise to the PMD experts. Learning from this experience, they made proper use of the lead time granted by the gradual flood onset in 1997.

In 1992 event, a wide variety of means of communication were used to warn the public with a lead time of 8-12 hours. The difficult part was convincing the people of the genuine nature of impending danger. In some areas, the high frequency of flooding made the population believe in their own intimate knowledge of risks and dangers. However, people were inclined to judge the flood warnings in accordance with earlier river flood experiences, which had been less severe. The 1992 floods, however, had a larger scope and impact, now estimated to be of once in a century frequency. It was therefore difficult to convince the population of the magnitude and severity of the coming flood.

Many people were not eager to evacuate. Public shelter facilities remained almost empty. Some refused to evacuate because they felt adequately protected in the upper floors of their houses, as in previous events. Still, the governments were blamed for not taking necessary precautionary measures, and people demanded for damage compensation.

Though Pakistan has good quality flood detection and forecasting systems, problems with the translation of forecasts and deficiencies in forecast communication were experienced. Many emergency services and authorities complained about the content and the timing of flood announcements, and the technical and non-transparent vocabulary used by meteorological and hydrological services. This eventually produced inter-

organizational tensions between agencies responsible for the communication of river levels, and the responsible authorities and emergency services (GoP 1993).

### SOCIETAL IMPACTS:

1992 experience resulted in a positive societal response in relation to awareness and mitigation based on weather warnings. 1997 flood was the 2<sup>nd</sup> highest on record but the loss of lives was minimal due to effective warnings and positive response of peoples en-route to flood waters.

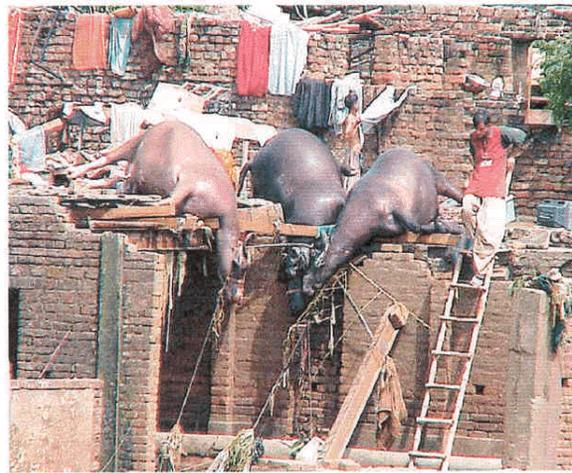
### CLOUD BURST OF JULY 23, 2001

On 23rd July 2001, after 10 hours of continuous downpour from 0600-1600 PST, in somewhat cloudburst proportion, the local stream "called Nulla Lai" and all of its contributory streams, rose to such heights that the phenomenon will be remembered as the "2001 Flood."

The Nulla Lai made a clean sweep of all surrounding buildings and some road bridges which crossed it. It was the worst flash flood ever experienced in the twin cities. There were other flash floods in the past. But most of old timers say that those were "insignificant" compared to the current one.

Flash Floods warnings started from 0300GMT on news media(TV Radio) and local authorities arranged announcements through speakers as well( 5 hours lead-time and a maximum of half hour is required to walk away from the area). The police force was also used to evacuate public from danger zone. However, due to non-cooperation of encroachers, 61 people dead mainly women & children. 601 houses were completely destroyed whereas 1378 houses were partially damaged.

### LESSON LEARNED



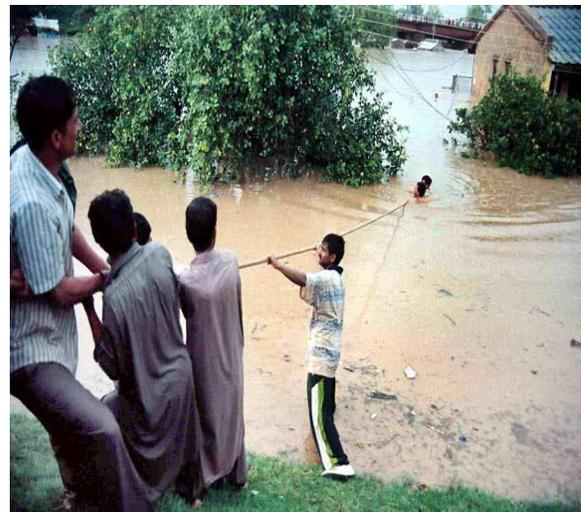
Public is sensitized after this tragic event. In case of any severe weather, public calls to weather office increases many fold.

### Overall Economic Impact of Weather Events for Pakistan and neighboring Countries

|          | <u>Overall Economic Impact</u> | <u>Cumulative total</u> |
|----------|--------------------------------|-------------------------|
|          | (Working lives/m)              | (Working lives/m)       |
| Pakistan | 3.0                            | 18.7                    |
| Nepal    | 2.7                            | 12.9                    |
| Oman     | 5.9                            | 28.1                    |

Source: WMO Bulletin vol 53 No 3

Despite the fact very short range forecasts are reasonably good and early warnings are



issued to help general public evacuate from areas of potential threat from severe weather, losses due to flash floods during last 3 years were towards higher side.

| <b>Losses due to flash floods in Pakistan</b> |            |                     |
|---|------------|---------------------|
|   | Lives Lost | Population Affected |
| 2003  | 230        | 1.3 million         |
| 2004  | 25         | 0.05 million        |
| 2005  | 832        | 5 million           |

## BANGLADESH

The Flood Forecasting and Warning Center (FFWC) of the Bangladesh Water Development Board (BWDB) is responsible for monitoring flooding in the country in a unified and multipurpose manner. A daily bulletin, based on observed data and results of forecast models, is prepared, and distributed at around 12:00 noon to various administrative tiers. Flood warning messages are issued that display trends of water levels if it is close to or exceeds the danger levels, at which flooding becomes a serious threat. The evacuation time for peoples living in areas of potential threat is 6-10 hours

However, the danger level nomenclature used by the FFWC may not be easily understood by potential users, the agriculture community as it does not relate the potential threat of floods on a specific crop at a specific stage and at a specific location, particularly in areas away from the main flood forecasting stations. The current flood forecasting arrangements do not provide any support for modifying cropping practices to minimize agricultural losses due to floods. The warning time of floods at the time of harvest leave little time to complete harvest operations or to store the harvest in proper areas.

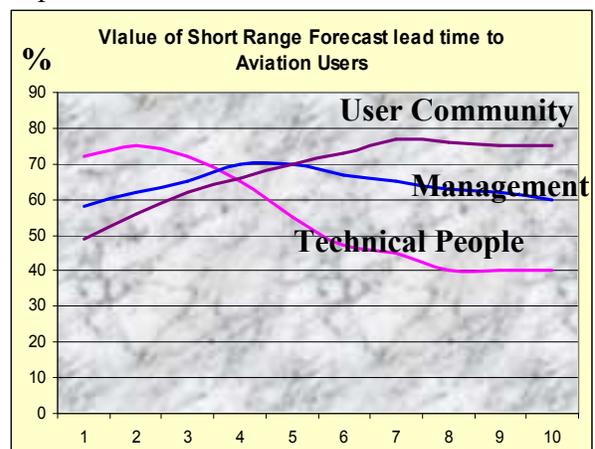
This led to a loss of 2 million tons of rice during the 1998 floods. The FFWC is currently implementing a pilot project, with NGO involvement, to evolve community-based flood forecast dissemination procedures that will meet user's needs.

## AVIATION USERS CONCERNS

High impact weather phenomena like thunderstorms which cause lightning, high winds, hail, tornadoes and heavy precipitation, pose significant threats to life and property and have large negative impacts on aviation and commerce industry in Pakistan. Reliable forecasts of thunderstorms are a high priority for many agencies whose missions and operations are affected due to such conditions. These include the Civil Aviation Authority (CAA), the National Highway Authority (NHA), the Federal Emergency Relief Cell (FERC), Defence Ministry, and of course, the Airlines. Defence Ministry and National flight carrier PIA supported thunderstorm research and development activities to help meet their operational needs and improve operational services for the general public.

## USERS CONCERNS

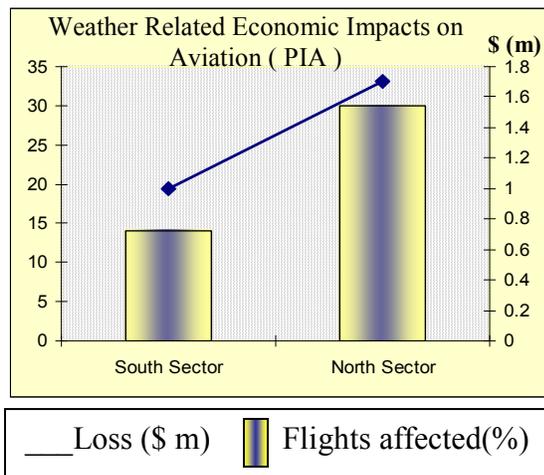
Flight crew ranked now-casting as the most effective tool for scheduled flight operations.



General public preferred reliable short range forecast of more value to them. Management of airlines recommended reliable very short range forecasts to make the industry a leisure for users.

However, the scientific jargon used in forecast information is not understandable by users. Users do not know how to deal with the uncertainties in the forecasts.

There is no institutional mechanism for communicating high impact weather phenomena forecasts to various user departments and agencies. Short-range forecasts are of most significance to livestock dealers, members of public service industries, communication and aviation sectors and small industries like bricks manufacturing industry. In developing countries where road infrastructure is very sparse and mobility is restricted substantially in rainy conditions,



foreknowledge of the likely pattern of precipitation could imply substantial improvements to food security as well as profits to larger-scale producers.

### LESSON LEARNED

The accuracy of forecasts depends on effective measurement of known predictors, model quality and local interpretation. These technical failures have had the effect of enforcing more humility on meteorologists and called into question

the utility of widespread dissemination of forecast material. Like earthquakes, with which it shares a number of structural features, intensity of high impact weather in quantitative terms is not easily second-guessed.

### TOURISM

There is a dire need to provide very short term forecast and warnings of thunderstorms because they have proven to be destructive to human as well as too many sectors of life due to lightning, high rainfall intensity, hail, and also strong winds. A hilly station Bhurban/Murree is a tourist spot in summer and receives 10-12 ft snow during winter. It is just one hour drive from the capital Islamabad and thousands of people drive to Murree to enjoy snowfall during winter and to get a sigh of relief in case of heat wave in summer. The very short range forecast regarding snowfall in winter/ heat wave in summer is of prime importance to users / dwellers of twin cities of Rawalpindi-Islamabad. Special advisory of high impact weather like thunderstorms for the safety of public is also the most wanted parameter of callers.

### CONCLUSION:

The scientific advancements in now-casting and monitoring of extreme weather events needs to be complemented with improved strategies for communicating risk. Detailed forecast information must be supplied keeping in view the capabilities of targeted audience if this scientific skill is to be applied in mitigating disasters.

Moreover, the human and economic costs of badly wrong forecasts can be considerable. Even forecasts from the most reliable models still deal in probabilities, and this remains their weakest feature. Can a probabilistic forecast really be transmitted in a format that is useful to vulnerable communities? What calculus do through

models, daily users of weather information already make. Users of now-casting and very short range forecasting desire that, indigenous strategies be combined with external knowledge to improve economic aspects of weather advisories.

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