

# Understanding The 2007 Floods in South Asia

- Disasters: Where do they Occur?
- The Monsoon in South Asia has Begun: Floods in 2007
- Focussing in: Gujarat State
- Floods and Water Management: Experience of the Netherlands



From an Effort to Turn Local Tsunami Recovery into Regional Disaster Risk Reduction for the Poor



[southasiadisasters.net](http://southasiadisasters.net)



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This special issue of *southasiadisasters.net* is the first of a series of three on flooding in South Asia. The main argument of this series is to provide—in addition a social and economic approach—a technical perspective to help understand this recurring problem. In literature on natural disasters and vulnerability, there is a tendency to see and analyse vulnerability mainly as a social problem. Though the concept of vulnerability is often split into social, economical, physical and environmental aspects, most authors do not go into the *technical* details or causes of vulnerability. The technical or environmental aspects are only touched on briefly. Of course, the social aspects—whether one calls them political, cultural, organisational and more—are very important. Let us not forget the possibly even more important technical and physical details and describe them. These details will add to our understanding and will allow us to deal with flooding in a better way.

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Cover page photographs from [bostonnow.com](http://bostonnow.com) and [mdmu.maharashtra.gov.in](http://mdmu.maharashtra.gov.in)

## KEY IDEA

# Floods, A Social and Technical Problem?

This issue of *southasiadisasters.net* aims to provide an overview of the current flood situation in South Asia and the situation at the beginning of the monsoon season. It also sheds light on technical aspects of monsoons in South Asia and related problems of flooding. The second and third issues will go into the activities of international organisations, local governments and communities in dealing with floods, and more.

Asia is one of the most disaster-prone areas in the world. Prevalent poverty and vulnerability in Asia combine with natural hazards, affecting a large number of people. Within Asia, India is prone to disasters to a large extent and it is hit by many natural hazards: windstorm—cyclones, hurricanes, tornadoes—earthquakes, tsunamis, droughts, landslides and floods. India is only spared of volcanic eruptions. In this issue, the focus will be on the annual recurring event of floods in India and South Asia. After a short description of the contents of this issue of *southasiadisasters.net*, an overview of the situation in South-Asia in the beginning of August 2007 is given in order to give scope to the current situation. This is compared to the situation in South Asia at the beginning of the monsoon season, as described in the first article. This issue of *southasiadisasters.net* is the first in a series of three issues about flooding in South Asia.

The first article describes the situation in South Asia just after the start of the monsoon. The second article explains the current situation in Gujarat based on fieldwork of AIDMI, newspaper articles and sources of international organisations. In the third article, the situation in Jamnagar district is detailed, followed by a description of the flood situation in Rajasthan. Both articles are based on intensive fieldwork of AIDMI.

Then, in the fifth article, meteorological aspects of the monsoon in India are explored in order to have more understanding in the physical causes and characteristics of the monsoon. Also, monsoon weather systems in other parts of the world will be mentioned. In article six, an example will be given of a country in Europe that has to deal also with problems of flooding: the Netherlands.

In the final article, an example is given of an application that is used by AIDMI for flood prevention. An easy-to-use public programme is used to make an elevation map on a relatively small scale (1:16,000) in order to estimate which areas are prone to floods and which path the water will possibly follow in case of flooding.

### South Asia in August 2007

Several organisations report that the floods of this year are the worst in many years in South Asia. Tens of millions of people are affected and over 2000 people are killed.

In the first week of August, heavy rains fell on the states of West-Bengal, Orissa, northern parts of Uttar Pradesh, Assam, Arunachal Pradesh and also on coastal regions of Kerala. Further, northern parts of Bihar State

are heavily affected with over 1.1 million hectares (11,000 km<sup>2</sup>) of farmland inundated and millions of people affected. State government responses to the floods vary as can be seen in Orissa and Bihar, the state of Orissa has more resources to use in dealing with the floods.

Since the third week of July 2007, rains have caused serious flooding in the North Bihar plains, affecting as many as 19 of the 38 districts in the state causing extensive damage to infrastructure, human lives, livestock, crops and other property and assets. According to initial estimates made by the disaster management department of the state government, about 11.5 million people are affected. Assistance from the government was delayed; though currently the authorities have undertaken action. Also the army has been deployed in rescue actions.

This is also due to the experience people gained after the 1999 cyclone in Orissa. Additionally, Gujarat State was hit by floods in Jamnagar, Junagadh and Surendranagar Districts. Over 8000 people have been evacuated after water overflowed a dam. AIDMI teams are currently visiting the affected areas in Bihar and Gujarat. The heavy flooding of this monsoon season will affect agricultural harvests; this will possibly result in increasing future vulnerability. Also, drinking water, health and other essential needs are affected by the floods. The monsoon rains and floods out of it affected over 30 million people and claimed 1250 deaths in India alone, so far.

In Bangladesh, floods-affected over tens of millions of people, displacing eight million people and over 340 reported deaths. About half of the country is inundated. The floods are

caused by the heavy rains in the beginning of August and water coming from rivers. Additionally, many people suffered from snakebites in the floodwaters. Myanmar has also been hit by floods, especially areas around the City of Mandalay. Outbreaks of diseases in the 2<sup>nd</sup> week of July have been reported. Further data on affected and/or people killed by floods or other natural disasters is unfortunately unavailable.

In Nepal, flash floods and landslides-affected over 330,000 and killed over 90 people. Floods mainly affect the southern part of the country; landslides mainly affect the north. ■

Jaap Vuijk,

All India Disaster Mitigation Institute  
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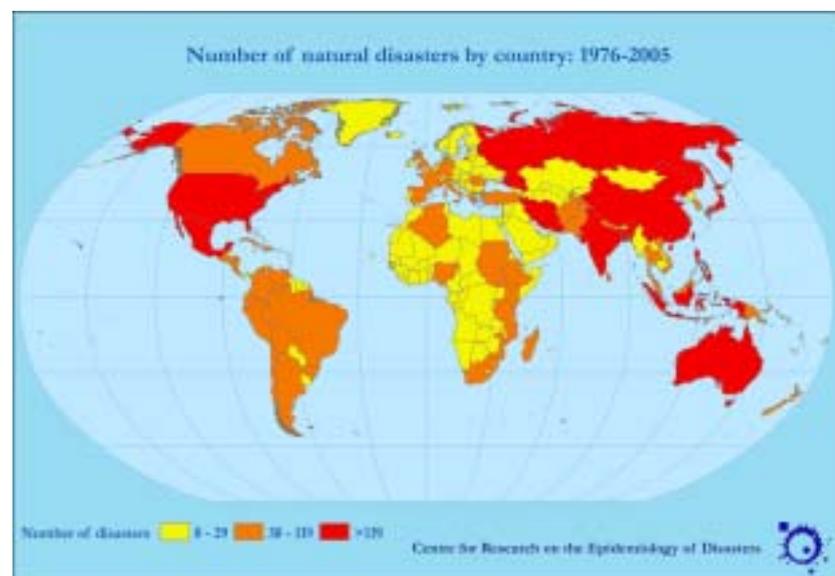
Sources:

1. [www.reliefweb.org](http://www.reliefweb.org)
2. [www.alertnet.org](http://www.alertnet.org)
3. The Times of India

## Disasters: Where do they Occur?

Of all continents, Asia is hit by natural disasters the most frequently and intensely. While floods are the most frequent of these disasters, earthquakes claim the highest number of victims. As seen from statistical data of EM-DAT, Asia is hit the most frequently and the most floods occur in Asia.

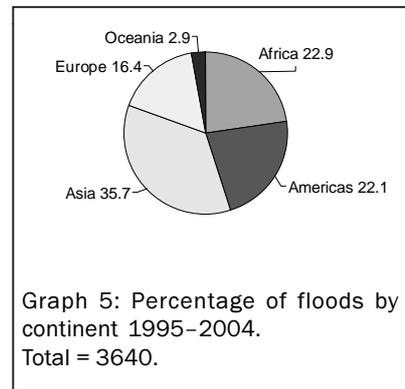
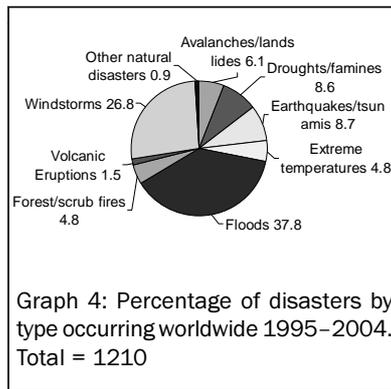
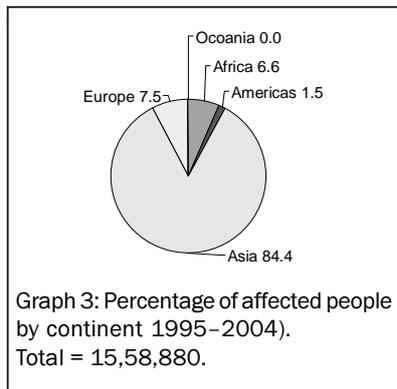
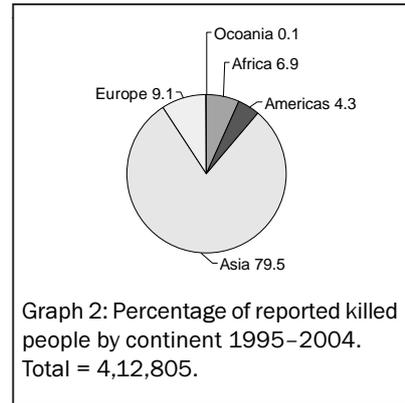
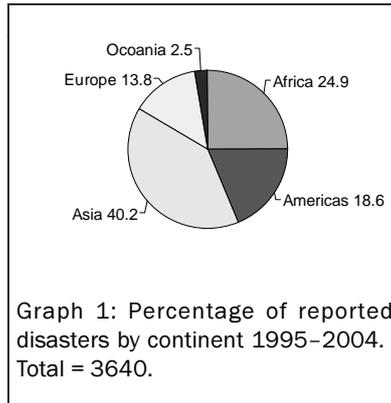
The most significant disasters are caused by droughts, famines, earthquakes and floods, though during the last 10 years the number of windstorms has increased significantly. From data of EM-DAT and ICRC, it follows that floods are by far the most frequent occurring event. Asia is hit the most by disasters in terms of occurrence and the number of people who are affected. Examples of disaster in Asia are the tsunami of 2004 and the earthquakes in Pakistan, Afghanistan and India in the last years.



From statistical data it follows that around 35% of all floods worldwide occur in Asia, see the graphs. Therefore, the problem of flooding needs special attention. In this issue of *southasiadisasters.net*, the problem

of flooding will be highlighted, with special focus on the situation in India and Gujarat State in 2007. The monsoon has started and many floods already have occurred mainly in the southern parts of Gujarat and

other states in India. When looking at the graphs it is important to realise that the definition of a "disaster" by EM-DAT is an event whereby more than 10 people die, more than 100 people are affected, a declaration of emergency is declared and outside assistance is called for. Though there are different sets of criteria to classify a situation as a "disaster", the data provided in this article gives us an indication about disaster occurrence and distribution worldwide. ■



**Sources:**

1. Centre for Research on the Epidemiology of Disasters
2. Frerks, G., D.J.M. Hilhorst, and A. Moreyra. 1999. "Local actors and the interface of interventions." Pp. 16–24 in *Natural disasters; a framework for analysis and action; Report for MSF*. Wageningen: Disaster Studies
3. AIDMI research report

## The Monsoon in South Asia has Begun: Floods in 2007

### Bangladesh and Myanmar

As early as the 15<sup>th</sup> of May, Bangladesh was hit by a tidal surge storm. Fifteen thousand people in hazardous areas were affected. In the second week of June, heavy rains caused landslides and affected many regions in the southeast of the country. In the second week of June, many locations in the country received 300–500 mm of water in just a few days. The heavy rains further resulted in mudslides in the hillsides surrounding the port city of Chittagong and were accompanied by a tornado. As we can learn from this situation, felled trees lying on hills can result in severe

mudslides and landslides. Layers of mud as thick as 9ft were common.

The floods: At the end of the second week, the floods covered approximately 20% of the country. More than 120 people died and over 100,000 people were affected by the rains, mudslides and tornadoes. During times of heavy monsoon, more than 60% of the country will be inundated. The main cause of flooding in Bangladesh is its unique geographical location and topography. The country forms the drainage basin for many large rivers that originate in Tibet, Nepal, Bhutan

and India. These include the Ganges, Brahmaputra, and Teesta rivers and over 250 smaller rivers that flow into the Bay of Bengal. This location combined with heavy rains during the monsoon inevitably results in flooding. Apart from these characteristics weather scientist claim that the monsoon of this year is unusually strong. Melting water from the Himalayan Mountains, global warming and silted water are seen as significant causes of heavier flooding.

The government responded to the situation reserving a large amount of money for relief activities and

providing thousands of metric tons of rice to affected regions. In addition, Action Aid responded to the floods as well as UNICEF, WFP, WHO, UNDP, UNCTAD and OCHA. Floods also hit Myanmar, to the capital of Rangoon and the surrounding areas in the south of the country. Heavy rain resulted in the overflowing of the Mayu River and landslides.

### **Pakistan**

In the first week of June it seemed evident that cyclone Gonu—which was forming over the Arabian Sea—would hit parts of Pakistan and India. However, the cyclone changed its track to the northwest and headed for Iran and Oman where it caused considerable damage and destruction. This cyclone influenced the southwestern monsoon weather system. In the second week of June Pakistan was hit by heavy storms and a cyclone bringing wind and rain and therefore causing floods. Especially in the south of the country, many people died and the city of Karachi was heavily damaged. After the cyclone, again heavy floods affected almost all districts in southern Pakistan. After a week of relative weather stability, flash floods hit Pakistan because of heavy monsoon rains. After months of extreme heat, by mid-July the situation in Pakistan had not improved much and the death toll due to floods was around 700. In the north of Pakistan, high temperatures are becoming a threat for people. International relief operations are underway and the key parties in providing relief are the Pakistan Army and Air Force. In addition, the Navy participates in rescue operations at sea.

### **Nepal**

On the 17<sup>th</sup> of June, hundreds of people were forced to flee from their homes as flash floods triggered by heavy monsoon rains affected areas in the south plains of the country. No deaths were reported, however many crops were destroyed by the fast flowing floodwater. Flash floods are



*Relief being provided in the north of Bihar state from helicopter.*

*Source: telegraph.co.uk*

common across the southern regions of Nepal during the monsoon season as rivers overflow during or after heavy rains. Through mid-July, no further incidents were reported.

### **India**

The southwest monsoon arrived approximately ten days earlier than the expected. It reached Kerala on the 28<sup>th</sup> of May and the interior of south Karnataka and southern Tamil Nadu on the 29<sup>th</sup>. After this progress, there was a delay in the advancement of the monsoon due to the formation of super-cyclone "Gonu" over the Arabian Sea, mentioned above. This cyclone created an area of low pressure over the Arabian Sea, thereby delaying the southwest monsoon. Thereafter, the monsoon made some progress between the 8<sup>th</sup> and 18<sup>th</sup> of June, however it was far behind schedule in many parts of the country. Heavy rains also occurred on the 18<sup>th</sup> of June in the northeast of the country, particularly in the state of Assam where more than 150,000 people had to move to schools, government offices, and other public places. In addition, the states of Maharashtra and Goa have been heavily affected. After the 18<sup>th</sup> of June, there was another halt of nine days

to the progress of the monsoon. Only after the 26<sup>th</sup> of June, it continued to other states and arrived in Delhi on the 28<sup>th</sup>, one day earlier than expected. On the 30<sup>th</sup> of June, Mumbai received heavy rains and almost the whole city was flooded for two days. The rains also covered other parts of the country where the monsoon is typically moderate or not even present at all. Areas include Barmer, Jodhpur, Ajmer, Jaipur, Narnaul in Rajasthan; Rohtak in Haryana; and Ludhiana and Amritsar in Punjab. These states are located in the northwest and have a very hot climate. In the first weeks of July, also Rajasthan and Orissa were heavily affected by floods leaving more than one million people homeless and killing more than 120 people. The central and state governments responded to the floods though there is a shortage of rescue personnel and material. In addition, local and international organisations respond to the floods such as the IFRC and Church World Service. ■

### *Sources:*

1. [www.reliefweb.org](http://www.reliefweb.org)
2. Newspapers and websites of: Indian Express, The Times of India
3. Natural Hazards division of NASA
4. Reuters AlertNet



### Infrastructure Damage

- Road services badly affected, 242 major roads including 61 state highways being flooded or damaged.
- Damage to roads and buildings is estimated at Rs. 1500 crores (375 million US\$).
- 1402 villages in the state suffering problems of drinking water due to the damage to the water supply structures.

### Livelihood Damage

- The highest levels of damage are to the energy sector (Rs. 150 crores = 38 million US\$), agriculture sector (Rs. 4000 crores), and animal husbandry (Rs. 500 crores = 130 million US\$).
- Adverse effects on trade and business, and banks.
- Huge losses of around 8 crores for salt manufacturing industries

in south Gujarat as rains submerged machinery and washed out raw and finished salt.

- Rs. 800–1000 crores (= 200–250 million US\$) of damage in business in Saurashtra including Rs. 300 crore (= 75 million US\$) damage in Rajkot.
- Rs. 2000–2500 crores (= 500–630 million US\$) damage to small-scale industries. ■

## Gujarat: Initial Response and Needs

The information related to relief and response is taken from several national and local newspapers. The response is clustered into three parts: 1) from the central government, 2) from the state government, and 3) from other states or organisations. This assessment has been finished in the 2<sup>nd</sup> week of July.

- Central government released around Rs. 400 crores (= 100 million US\$) for relief and rescue
- State Government response:
  - Compensation of Rs. 100,000 (= 2500 US\$) to the kin of victims
  - Compensation of Rs. 25,000 (= 625 US\$) for destruction of *pacca* building. (*Pacca* houses are those constructed of rigid materials, i.e. bricks and cement.)
  - Highly subsidised fodder to the state's farmers for Rs. 1 per kg for one week
  - 1300 people rescued by National Disaster Response Force (NDRF), State Reserve Police (SRP) and local community
  - Around 43,000 people of 6300 families in 11 districts shifted to safe places by district government
- Other States or Organisations:
  - Voluntary organisations, Religious institutes and groups such as the Rashtriya Swayamsevak Sangh (RSS) distributed food packets to affected people.

### Need:

The following needs have come out from the communication with our local contacts and the chief officers of the respected nagarpalikas. The AIDMI team conducted a damage and needs assessment in regions in Gujarat State, notably in the state of Jamnagar. The outcomes are the following:

- **Overall:**
  - Basic necessities: communication, milk, water, food, electricity
  - School materials, medicines and food grains
  - Temporary shelter
- **Specific:**
  - Food grains for 800 families of three slums—Santram Bhagol, Slums of Gujarat Housing Board, Sandhya Bhagol—in Padra Nagarpalika of Vadodara District and for 400 families of 10 slums in Bharuch Nagarpalika;
  - Food packets and household items for four villages—Gadhda, Botad, Valbhipur, and Umralla—in Bhavnagar District;
  - Food packets and household items for slums of Kumbharvad area of Bhavnagar City;
  - Food packets, household items, and medicines in Vanthli and Una Villages of Junagadh District
  - Household items in Dhrol, Jodia, and Lalpur Talukas of Jamnagar District;
  - Shelter repairing support to 200 families and livelihood support to 400 families in Vanja Vas/Gulabnagar slum of Jamnagar. Household items and food grains to all 800 affected households in this slum;
  - Shelter and livelihood support to 120 families in Ghanchi ni Khadki slum of Jamnagar; and
  - Livelihood support to 150 families and shelter repairing support to 10 families in Bachunagar slum of Jamnagar. ■

### Sources:

1. Financial express – website, India
2. Khaleej Times Online, Nepal
3. Situation Report on Gujarat Floods 2007, AIDMI, July 6, 2007.
4. www.reliefweb.org
5. Newspapers: Indian Express, The Times of India, Sandesh, Divya Bhaskar, Gujarat Samachar, and Jansatta.

# Cause and Impact of Flooding in Jamnagar District



Sometimes the only place to build is near the river.

## Cause of Flooding:

Jamnagar District is located in Saurashtra in the southwest of Gujarat State. During the recent heavy rains in the Gujarat, the heaviest rainfall in Jamnagar District was recorded in Jamnagar Taluka. The Jamnagar Taluka normally receives over

735 mm rains in a year during the whole monsoon season. However, in this year's monsoon season, it has already recorded a rainfall of 594 mm between just the first and fourth of July. This was 81% of the district's average annual rainfall in four days. The main reason for the flood

situation in Jamnagar district was that the district is around 22 Kilometers away from the Arabian Sea, and heavy rainfall coincided with high tide. Due to high tide, the sea was not accepting the water of heavy rains and the flood situation was the result. Moreover, the whole district has an open drainage system.

## Impact of Floods:

### (a) Impact on Human and Cattle Life:

Heavy rainfall resulted in flash floods and caused significant damage in Jamnagar (rural), Jodiya, Bhanvad (urban), and Jamjodhpur (urban) areas. According to the government, 16 people died—out of which two were identified as children below the age of 15. Overall around 12 villages and 2300 people were affected in the above-mentioned areas and all 2300 families were evacuated for three days from July 2, 2007 to July 4, 2007. Besides this, around 48 cattle were washed away.

## Flooding in Rajasthan: Causes and Effects

### Flooding

From July 3, 2007, heavy rainfall started in Rajasthan State, especially in Jodhpur, Bilada, Pali, and Barmer districts. It rained heavily during two days and caused a flood situation in the whole area, which lasted five or six days. The water came up five feet; but in most regions, it was not more than two feet.

Rajasthan is a dry state with bush land and desert characteristics. Only a few years ago, it did not rain much the whole year and people were waiting for the monsoon season to receive water for their fields since a

large share of the population are farmers or cattle holders. However, for the last two to three years, changes in weather conditions have begun to affect this part of India, bringing more and heavy rainfall during the monsoon season. As the sandy soil is not able to absorb a huge amount of water, heavy rainfall can cause flooding.

### Effects of Floods

In Rajasthan, the landscape is open and plain on many locations. Due to these geographic characteristics, the rainwater spreads over the surface of the land. These open spaces make the water flow and prevents the water

from accumulating at one place. This may indicate why the villages and the cities have not been badly affected. The heavy rains caused flooding for about five days, with water in the streets, isolating villages and making roads impassable; but after a week, the water receded.

### (a) Infrastructure Damage:

This year, heavy rainfall also caused damage to dams, which made the situation worse for some roads, but did not affect buildings. Around Jodhpur, the Jasvantsagar Dam at Bilada Taluka—more than 100 years old—collapsed and damaged the road and a military

**(b) Impact on Infrastructure:** Public and private infrastructure was damaged or affected in such a way that they cannot be used again. As per the government survey, 16 state-owned main highways and buildings suffered damage worth of Rs. 36.50 lakh. It was also found that a significant damage had occurred to *gram panchayat*-owned roads and buildings; this totalled worth of Rs. 51.60 lakh. The irrigation department of the state also passed through the same condition and experienced damage to its irrigation channels; in monetary terms, this damage is estimated at Rs. 3 crores.

Apart from this infrastructural damage, electrical power supplies did not work for five days in 304 of the 640 villages of Jamnagar District. The damage done to this infrastructure totalled Rs. 14 million.

**Government and Civil Society Response:** Government and civil society organisations started rescue and relief operations on July 2. Relief and rescue work was conducted by government officers with help of the military and around 155 people were saved from

## GHANCHI NI KHADKI, JAMNAGAR, GUJARAT

AIDMI teams have visited several flood-affected slums and collected information individually. Given below is a slum profile of "*Ghanchi ni Khadki*". This slum in Jamnagar City was heavily affected by the floods.



Ghanchi ni Khadi – recovering through a flood in a Jamnagar city.

*Ghanchi ni Khadki* slum is located near Chhatan Shah Kabrastan in Jamnagar City; it was established 35 years ago. The area has 150 households: 80% of the houses are semi-*pacca* and 20% are *pacca*. The majority comprise of the Muslims with 97% residently and remaining Hindus. The main occupation of the community is selling used cloths, fishing, and selling snacks; some are daily wage earners. This average monthly income ranges from Rs. 1200 to Rs. 1500 per family.

In the recent flooding, *Ghanchi ni Khadki* has been severely affected and has incurred huge losses and damage. Floodwater reached up to 15 feet in some of the areas and affected around 120 houses in the area. Most of the houses (78%) needs repairing, while 2% of the houses collapsed. As most of those affected sell used cloths, snacks, and fish for a living, these are significant losses and threats to livelihoods. Utensils and other household items were badly damaged or washed away in the flooding.

The location of the slum on the bank of the Nagmati River combined with the presence of two other water sources: Ranjit Sagar Canal and Swa Sain Dam is the main cause of flooding in this area. The AIDMI team has met the flood-affected people and carried out damage and needs assessments. The team also made a photo series of the flood-affected areas ([www.southasiadisasters.net](http://www.southasiadisasters.net)). It is concluded that 120 families need shelter and livelihood support. ■

post and caused the water to flow into the fields. Railway tracks were under water for several days, and trains were halted or diverted.

**(b) Shelter Damage:** Urban areas are more affected than rural areas in Rajasthan. In villages, the houses are mostly *pacca* houses and thus made of stones, cement, and a solid foundation. Therefore, these houses could endure the floods. However, the situation was different in slum areas of the cities and towns. In Pali, for example, *kachcha* houses—constructed of bricks and mud—collapsed. Furthermore, the poor people in cities are obliged to build their shelter on low-lying areas that

are prone to flooding. In addition, these people lack proper construction materials and cement, needed to build resilient houses.

**(c) Agriculture and Animal Loss:** The floods-affected farmers; most of them have lost seeds and cattle due to the floods. These villagers mainly depend on farming and animal husbandry for making a livelihood.

**(d) Other Damages:** Apart from the above-mentioned damage and losses, people face many difficulties as drinking water and power supplies were cut off for three to five days. This underlines the importance of infrastructure preparation for

disasters as infrastructure provides for many basic needs.

### Government Response:

Local authorities have responded rapidly during flooding and provided drinking water via tankers. Government authorities also visited the affected villages/areas and carried out damage assessments. The government has promised to provide the compensation as soon as possible, said Mr. T. R. Meghaved, Executive Engineer, Pali.

Overall, the government was well informed in advance so that they could control the situation and did not allow worsening in flood-affected districts. ■

six areas. At the same time, around 2300 people were evacuated to municipal schools and various community halls of various castes. During three days, 31,500 food packets had been distributed by the Jamnagar Municipal Corporation.

Various community organisations and some religious organisations have helped government to provide food packets and establishing relief camps for the affected people. Local corporators have also helped families and community groups with food, drinking water tanks, and more.

**Compensation and Rehabilitation:**

Around 15 rehabilitation camps were established for 2300 people who were badly affected by floods. Government also started assessment to provide cash dole of Rs. 1250/- per affected family.

**Current Issues:**

Apart from the above response, there is still more demand or need from flood-affected communities. They feel that government should announce the permanent rehabilitation policy for the affected people as early as possible. A damage assessment is under way; people feel that it should be completed soon so that the affected will get the compensation and they

**PATHAN COLONY, PALI, RAJASTHAN**

Fersana Imamuddin Zula, 32 years widow, living alone in Pathan Colony, Navagam near Pali City.



*Fersana Imamuddin Zula in front of her collapsed house.*

Her *Kachha* house was not strong enough to resist the forces of the floodwater. Fersana explained that water came from outside the city and flooded the area with water levels of 3 to 5 feet high. In her house, the water level was about two feet high and made the roof and the walls collapse. Debris fell on the ground but fortunately did not injure anyone. "I'm very worried about the rebuilding of the house. As I'm a widow and living on my own, I don't know who can help me. To build this house, my father supported me but he died. At the moment, I'm living with my brother and he provides me food and shelter." She is working in a factory to put diamonds in bangles. For finishing 100 bangles, she earns Rs. 10. As she can make around 300 to 400 bangles a day, she gets Rs. 30 to 40. But since the flood, she did not go to work because she was worried about her house and had to move her goods away from the collapsed house. The government spoke to her and noted her situation in the need survey. But no compensation is given yet. ■

will soon begin repatriations. It has also been observed that many flood-affected slums were not on the government's list.

**Recommendations:**

The AIDMI team visited the flood-affected areas of Jamnagar City and villages the district. The team has met the flood-affected slum communities and carried out damage assessments. Based on the observation and

discussion, the team has recommended the following:

- Develop a long-term rehabilitation policy on permanent shelter and livelihood,
- Develop early recovery support for agriculture and animal husbandry,
- Repair damaged houses,
- Provide special support to livelihoods in women-headed families;
- Raise awareness on the construction of safer building among the poor community;
- Raise awareness of the community on community-based disaster risk management;
- Raise awareness on health and hygiene among the community should be a priority for looking into malaria and other diseases.
- Raise awareness on food security among community.
- Transfer the disaster risk from poor communities to commercial insurance providers.
- Educate children, teachers and school administrators about risk and reduction opportunities. ■



*How many times will they rebuild the wall ? Flood impact in Gulabnagar, Jamnagar.*

# Understanding the Monsoon: "mausam" in South Asia

Every year the monsoon season comes. But where is it actually coming from? How is this huge weather system formed at the beginning of the season and what are its characteristics? In this article, we will go into the meteorological, geographical and physical aspects of the causes and effects of the monsoon in South Asia to provide some insights.

## Context

The monsoon not only occurs in South Asia, it is also present in North America, Sub-Saharan Africa and Brazil, though the monsoon in Asia is by far the most intense in terms of wind speed and precipitation. The English word "monsoon" is derived from the Hindi word "mausam" meaning weather, and was first associated with winds blowing into India during the British rule in India.

## The Process

A monsoon weather system is created by characteristics of topography and meteorology. The basic principle holds that water and land have a different capacity to store heat. In oceans, atmospheric temperature is



Flooded slum area in Nadiad, July 2007. People living in this area are able to live in an alternative location during the monsoon season; a public market with a roof serves as their refuge.

stored in a layer of about 50m deep; on land, heat is stored in a layer of only 1 meter thick. This means that oceans are able to store heat in a much better way; however, it needs a longer time to heat up or cool down in adapting to changing atmospheric temperatures. During summer, the land heats up more quickly than the ocean and a difference in temperature

will be created. Since warm air rises, in moving to higher altitudes it causes the air pressure just above the land to drop. Hence, also, a difference in atmospheric pressure is created between ocean; the pressure land and the above the ocean will be higher than above land. This will cause steady and strong winds to blow from the ocean to the land thereby picking up

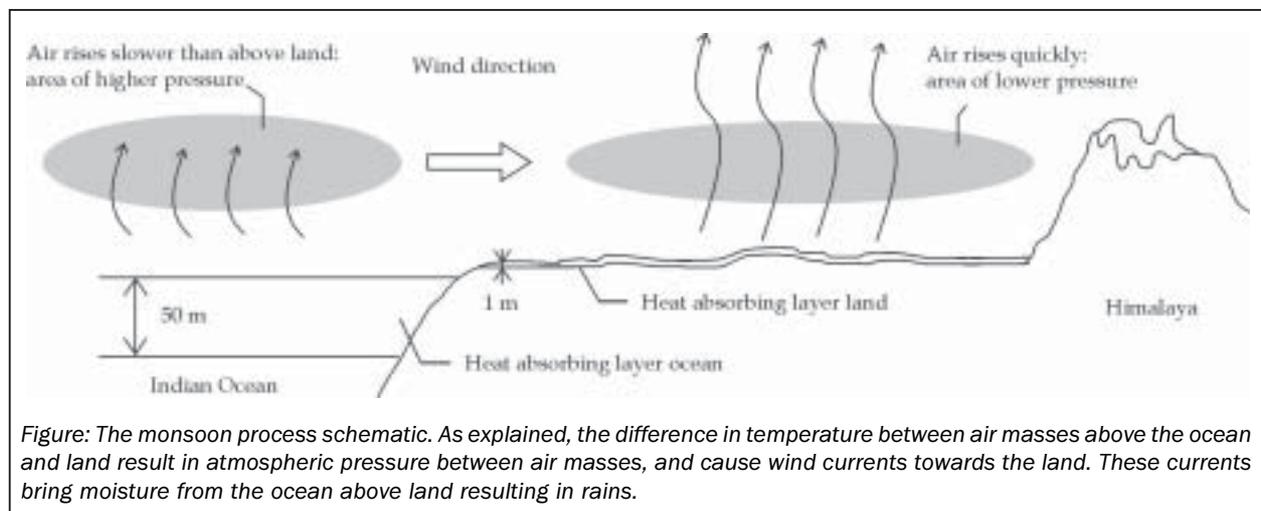


Figure: The monsoon process schematic. As explained, the difference in temperature between air masses above the ocean and land result in atmospheric pressure between air masses, and cause wind currents towards the land. These currents bring moisture from the ocean above land resulting in rains.

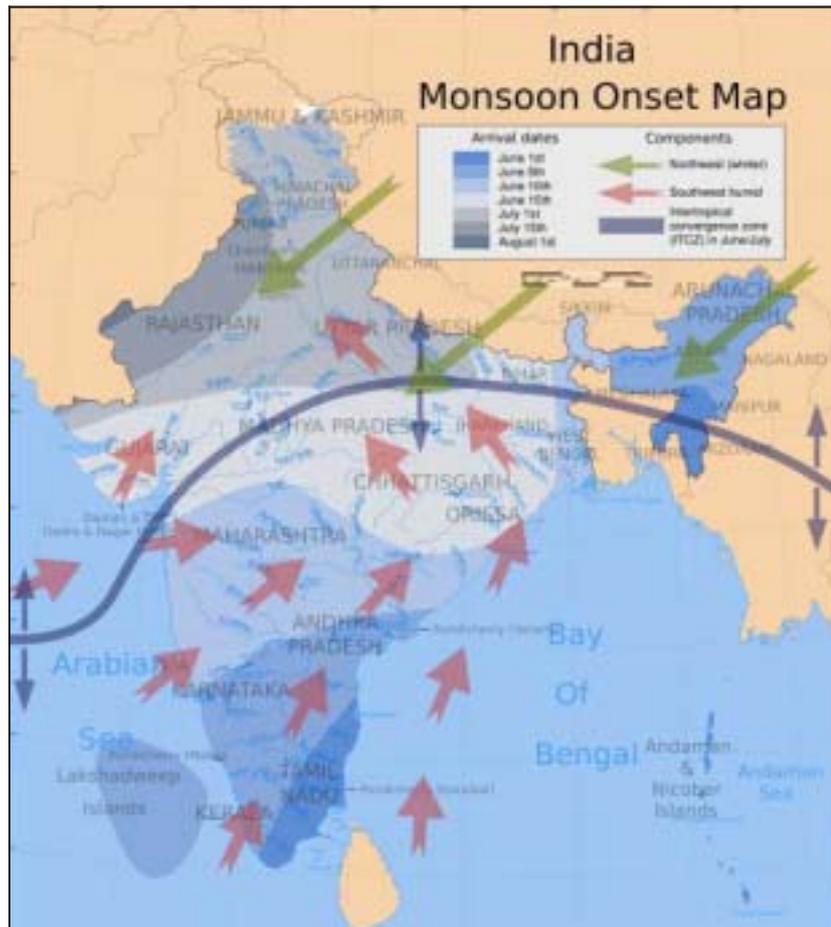
moisture from the ocean resulting in cloud formation above land. Above the land, the air will rise even more and at higher altitudes condensation-cloud formation-will occur resulting in rain.

**India: The Southwest monsoon**

In India, the Great Thar Desert and regions in the north of India heat up to high temperatures. As explained, this will cause a large area of low pressure that attracts air and moisture from high pressure areas above the Indian Ocean. Then, conditions for the monsoon are met. The monsoon travels from the southwest over India during 3-4 months and is blocked by the Himalaya mountain range. This blockage forces the air to rise, drop in temperature, condensate and again will result in rains. When the monsoon makes its journey from the Indian Ocean, the wind current is split into a branch that travels over the Indian subcontinent towards the northeast. The second branch passes the Bay of Bengal and heads for the northeastern regions. See also the figure on the right.

**India: The Northwest monsoon**

At the end of the monsoon season, the land cools off quickly, thereby creating higher air pressures above land while the ocean is heated up and therefore creates an area of lower pressure. This will cause the monsoon to retreat. During this retreating monsoon, the east branch of the retreating monsoon will pick up considerable amounts of water and moisture from the Bay of Bengal and release it over the eastern states of India; this is known as the northwest monsoon. Some eastern states receive some 30% of the total seasonal rain from the northwestern monsoon; hence, the Southwest monsoon brings around three times more rain than the Northwest monsoon. ■



**Average precipitation in various Indian cities (mm)**

City	Winter (Jan - Feb)		Summer (Mar - May)			Monsoon (Jun - Sep)			Post-monsoon (Oct - Dec)			Year-round Total	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov		Dec
Bangalore	-	-	10	30	110	70	100	130	170	150	60	10	900
Chennai	36	10	8	15	25	48	91	117	119	305	356	140	1,270
Guwahati	8	21	47	181	226	309	377	227	199	92	25	10	1,722
Kolkata	10	31	36	43	140	297	325	328	252	114	20	5	1,601
Mumbai	3	3	3	0	18	485	617	340	264	64	13	3	1,813
Nagpur	16	22	15	8	18	168	290	291	157	73	17	19	1,094
New Delhi	23	18	13	8	13	74	180	173	117	10	3	10	642
Port Blair	40	20	10	60	360	480	400	400	460	290	220	150	2,890
Srinagar	74	71	91	94	61	36	58	61	36	31	10	33	658

Figure and Table: Around the 1<sup>st</sup> of June, the first monsoon rains will reach the southern coastal states of Kerala and Tamil Nadu. By the 10<sup>th</sup> of June, the state of Maharashtra will be entirely covered, followed by Gujarat, Madhya Pradesh, Chhattisgarh, Orissa and Bengal around the 15<sup>th</sup> of June. The northern states of Rajasthan and Uttar Pradesh will be reached in July and the upper northern states and the northwest part of Rajasthan will be reached by the 1<sup>st</sup> of August. As mentioned in the first article of this issue, since last few years, some states are heavily affected by monsoon which used to be very dry, for example the state of Rajasthan. (Source: wikipedia.org.)

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# Floods and Water Management: Experience of the Netherlands

The Indian subcontinent is one of the most disaster prone areas of the world. People in South Asia are heavily affected by frequent flooding. In the Netherlands, at the northwestern edge of the Eurasian continent, people face more moderate weather conditions. Although, the weather conditions in the Netherlands are more moderate, the risks are more permanent due to its elevation, compared to many other countries. What follows is an introduction to the way people in the Netherlands deal with these risks.

## The Lowlands

The saying "God created the World, but the Dutch created the Netherlands" hints at the special relation the Dutch maintain with water that runs through and encircles a large part of the country. About 26% of the land area is below sea level, and the remaining areas are just above sea level. Hence, the meaning of the word 'the Netherlands' is 'lowlands'. During the past centuries, dikes were constructed not only to protect the land from flooding but also to conquer new land from the sea. The Netherlands have one of the

highest population densities in the world. Hence, demand for land, whether it is for agriculture or housing, has always been high. Windmills were used to drain the newly conquered land below sea level. Nowadays the windmills are replaced by motorised drainage systems.

## Waterschappen

Protecting the land from flooding and turning sea into land requires an enormous level of sustained effort. To realise this task, co-operation between communities is necessary. In the Middle Ages, people joined forces to build and maintain canals, dikes and bridges in order to regulate the different water flow. Gradually the co-operation between towns and villages to manage the ever-present water institutionalised. Today these institutions are known as a *waterschappen* (water councils). These councils are governed based on democratic principles. In the Netherlands, the *waterschappen* came into being long before the elected parliament was established. Accordingly, they represent the oldest form of democratic governance in the

Netherlands. Some authors argue that the 'identity' of Dutch society and its organisation are for a significant part determined by efforts to drain low-lying land areas.

## 1953: Disaster strikes the Netherlands

However, the Dutch have not always been successful in protecting the land behind the dikes from flooding. During the night of January 31<sup>st</sup> and February 1<sup>st</sup>, a combination of high wind speeds from the northwest and high tide pushed the sea level to exceptional heights. That night dikes in the southwest of the Netherlands that protected the interior from flooding, were smashed by the forces of nature. Almost 2000 people died and a large part of the coastal region was flooded. For almost thirty years, it had been acknowledged that the dikes in the affected area needed a refurbishment. Nevertheless, other infrastructural projects along the coastal regions were given priority. That night the meteorological services issued a warning. However, in those days there were no radiobroadcast during the nights. Hence, these warnings did not reach the people in the areas that were to be affected.

## International Aid and Long-term Recovery

Within a week, 30,000 people volunteered to help restore the dikes that were broken. Regional, national and international agents provided aid to the affected region. Today you can still find Scandinavian designed houses in the affected areas. Prefabricated homes were supplied by Denmark, Finland, Norway and Sweden to replace the destroyed houses. The disaster provoked a generous funding response. The total



Flooding after the dikes collapsed in 1953.

Source: [geocities.com/watersnoodramp.htm](http://geocities.com/watersnoodramp.htm)

aid budget amounted around 60 million Euros, which was a large amount of money at that time. In November 1953, the last holes in the dikes were repaired. In the meantime, policymakers and engineers were working on a plan that would protect the coastal areas in the Netherlands in the future. In the following decades, existing dikes were upgraded and dams—some with movable parts for temporary closings—were built to close off parts of the delta. This coastal infrastructure is known as the *Deltawerken* (Delta constructions).



A Part of the Deltawerken; a dam with openings that can be closed during a storm surge.  
Source: margriethof.nl

### Climate change

In January 1995, the water levels in the main rivers that run through the Netherlands were extremely high. Around 2,50,000 people were evacuated due to the threat of flooding in case the dikes would break. Fortunately, it appeared that the dikes were strong enough to withhold the water. In the aftermath of the threat, plans were initiated to reinforce the dikes alongside the rivers that protected the interior. However, just shortly after most of

the reinforcements were carried out new prognoses of future water levels were presented. These prognoses were based on climate scenarios that not only forecast rising sea levels but also periods with intense rainfall. This implies that new measures are necessary to prevent future flooding.

However, the authorities realised that simply making dikes higher every time presents new dangers. The

solution was not sustainable. Hence, new ideas on water management emerged. To accommodate the increasing amount of water that will run through the rivers, experts and policymakers initiated a plan to create more space for water. Accordingly, space for the water that flows towards the sea should be created not by building higher dikes but by broadening the course of the river. In addition areas are pinpointed that can be used as temporary places for flooding in case of extreme water levels. In this way, undesired flooding of densely populated areas can be prevented. Therefore, even after 1000 years of experience with keeping water in the right places, new ways of thinking on how to cope with the ever presence of water in and around the Netherlands are emerging. ■

## Before 1953: the "Afsluitdijk"

Prior to the 19<sup>th</sup> century, the Dutch Government had made plans for extensive reform of water management in the Netherlands. Plans were made to close off a complete sea: the South-Sea, "Zuiderzee" in Dutch. This would prevent many areas in the Netherlands from flooding as happened frequently at the end of the 19<sup>th</sup> century. In 1916, parts of northern Netherlands were hit by a serious flood. Several laws were issued and a special service was established to take care of the construction of new dikes and to accomplish an enormous infrastructural project, the Afsluitdijk, for flood-prone areas. The dike is 30 km in length closing of the *Zuiderzee*. Construction of the *Afsluitdijk* was finished in 1932. It was designed and build based on thorough research without the availability of computers and simulation models. Later, this dyke was built very efficiently. Additionally, a lot of experience on new materials and techniques also emerged. This experience was of great value in the construction of the "Deltatwerken" starting 20 years later. For underwater reinforcements, special plant-species were needed, providing strong branches of which construction material could be made. In other parts of the Netherlands, special plantations for these plants were established to meet the need for construction works. ■

Sources: [www.rijkswaterstaat.nl](http://www.rijkswaterstaat.nl), [www.huubmous.nl](http://www.huubmous.nl)

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2. [www.deltawerken.com](http://www.deltawerken.com)
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## Floods in Gujarat, South Asia and Other Parts of the World



AIDMI team conducting damage and needs assessment, Jamnagar, Gujarat.



Rubble and mud after receded water, Jamnagar, Gujarat.



A woman showing the level of water in her house during the floods.



Semi-pacca house collapsed due to floodwaters damaging households as well.



Enormous amounts of mud and rubble are left by over by the receded floodwaters.



Getting rid of water from the houses Mumbai.

Source: [expressindia.com](http://expressindia.com)



A poor family trying to find a safer place if any using a boat, Bhakatpur.

Source: [smh.com](http://smh.com)



Flood victims searching for refuge in Chibuto, Mozambique.

Source: [unep.org](http://unep.org)



Technology helps Draining water faster in Dhaka, Bangladesh.

Source: [alertnet.org](http://alertnet.org)



A 'Not' for peace to key water out from entering into the house in a flooded street in Bentley, near Doncaster, Yorkshire.

Source: [telegraph.co.uk](http://telegraph.co.uk)



Residential buildings are flooded as a rainstorm hits Lianzhou, south China's Guangdong Province, June 7, 2007.

Source: [smh.com.au](http://smh.com.au)



Flood hit north eastern state of Assam, India Millions were affected like the family.

Source: [northeastflash.com](http://northeastflash.com)

Until unless specified all photographs of this publication are by AIDMI.

## Elevation Map of Kheda, Gujarat

By using maps and satellite images it is possible to create layers of equal elevation in a given area. By using several layers on different levels of elevation, it becomes possible to draw an elevation map. Note that the contour lines are not completely accurate. First, the programme does not take into account the current level of water in bodies of water, e.g. rivers and ponds. It only takes into account the bottom of the rivers and ponds. Second, the edges and turns of the lines are sharper than in reality. The maps have the following advantages:

- An indication of the possible track of floodwaters can be given for hazardous and low-lying areas. However, it should be noted that influences of drainage systems (whether working or not), and water falling from terraces and thereby damaging the roads and influencing water run-off cannot be displayed.
- This information can be used for prevention activities and plans for protection measures.
- The maps can give actors involved in Disaster Risk Reduction an overview of the situation.
- With scales below 1:20000, maps of this quality can be made in a relatively easy way. ■



Figure: This map of Kheda is based on maps from Google Earth. The scale of the map is 1:16000 (1 cm = 160 m = 525 ft). The purpose of this map is to show which areas in the city are in danger during high water. Though the map is not 100% accurate, it can give a good indication of the areas where the water will go in case of heavy rainfall or floods. The floods of 2006 confirm this; one low-lying slum area became one of the first areas to be flooded, almost exactly according the elevation line of 24 meters. AIDMI has been active in the slum area as well as in a slum area on the north side of Kheda City.

Source of satellite image: Google Earth version 4.1.7087.5048 (beta)

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Note: This issue of southasiadisasters.net is prepared by AIDMI with major contributions from Jaap Vuijk, Michiel de Voogt and Manish Patel.

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