Cover story

Impact of Changing Weather Patterns

Climate of Sri Lanka is tropical with monsoonal rainfall patterns. Since it is located in Asian monsoon region, it has a tropical monsoonal climate. Sri Lanka is located just south of the southern tip of Indian sub continent between 6° and 10° north of equator surrounded by the Indian Ocean having an aerial extent of about 65,625 square kilometers.

There is marked variation in climate due to the central highland region being surrounded by an extensive lowland area. The regional difference in temperature is due to the altitude. There is no temperature variation due to latitude. The mean monthly temperature differs slightly, depending on the seasonal movement of sun, with some influence exerted by the rainfall.

Keeping track of global warming, rising sea-level, air and water pollution and extreme weather events is necessary to achieve sustainable development. While no one can control the weather, accurate observations and predictions with a high accuracy and lead time can radically improve our chance of living in relative safety.

The mean annual rainfall in Sri Lanka varies from 900 to 6000 mm. The higher values are experienced on the western slopes of the central hill country (see figure 1). In the southwest of the island, the annual rainfall varies from 2500 to over 5000 mm. In the northwest and the southeast, the annual means are less than 1250 mm.

The island is influenced by two wind regimes. The southwest monsoon (summer monsoon) is from mid May to September, and the northeast monsoon (winter monsoon) is from December to February. The seasons in between these two monsoons are called the inter-monsoon seasons where the winds are light and variable.

The rainfall during the two inter-monsoon periods, March-April and October-November is mainly convectional.

Southwest Monsoon (May to September)
The Southwest quarter of the island receive 500 - 4000 mm of rain during this season, higher falls over the western slopes of the central hills).

Northeast Monsoon (December to February)
The eastern half of the island including Rakwana hills receives 500 - 2000 mm of rain during this season. The higher rainfalls are experienced over Rangala range of hills.

First Inter Monsoon period (March to April)
The rainfall is mainly convective and ranges from 5-30% of the annual rainfall. The higher contributions to total annual rainfall are from inland areas.

Second Inter-Monsoon Period (October to November)
The rainfall is fairly widespread and is mainly due to disturbances (low-pressure systems, depressions and cyclones) in the southwest Bay of Bengal and in the southeast Arabian Sea. These disturbances generally form on the ITCZ, which lies across the latitude of Sri Lanka during October and November. The rainfall varies from 17% to 51% of the annual total.

Weather Related Natural Disasters

Majority of natural disasters experienced in Sri Lanka are weather related. Some of these are cyclones, heavy rainfalls leading to floods and landslides, lightening, tornadoes, coastal inundation due to high sea waves and tsunami. The frequency of occurrence of some disasters is extremely rare.

Frequent	heavy rain and floods, landslides, lightning, tornadoes, droughts
Intermediate	cyclones and storm surges, coastal inundation
Rare	earthquakes, tsunami

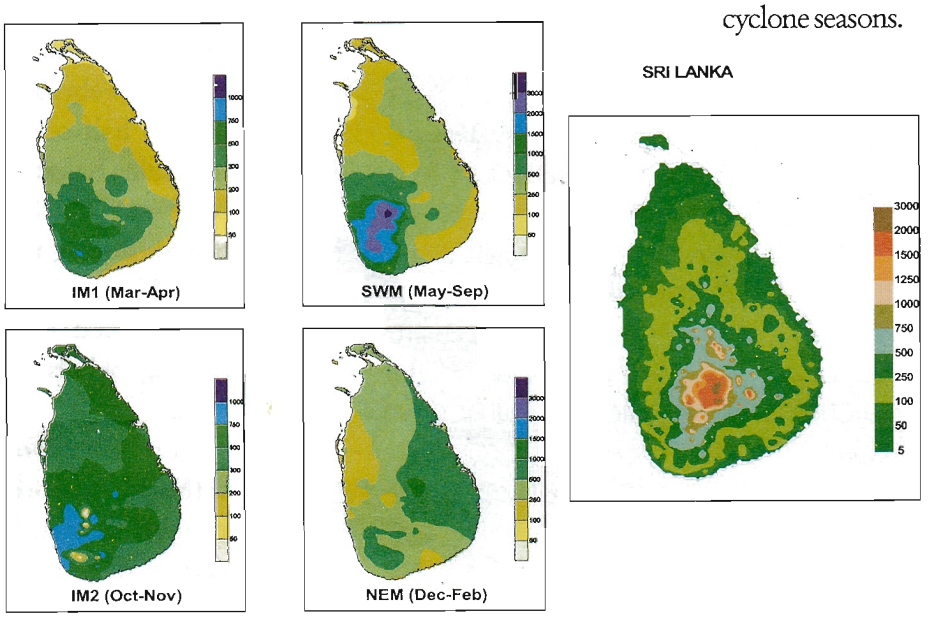


Figure 1 Seasonal rain fall patterns

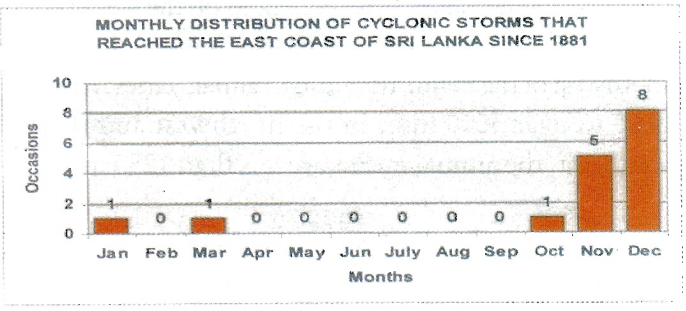
Tropical Cyclones

Hurricanes, typhoons or intense vertical storms, no matter what you call them, tropical cyclones are the most devastating of all the natural hazards. Every year cyclones wreak havoc when they move inland from the sea, their fierce winds and heavy rainfall blazing a trail of destruction.

Tropical cyclones are areas of low atmospheric pressure that form over warm tropical or sub-tropical waters, eventually building up into huge, circulating mass of wind and thunderstorms up to hundreds of kilometers in diameter. Surface winds can reach speeds of 200 km an hour, although the 'eye' at the centre, usually just a few dozen kilometers in diameter, is relatively calm.

On average, about 80 storms or cyclones form over the globe annually. Of these, about 4 occur in the Bay of Bengal and one in the Arabian sea. Although a large number of cyclonic disturbances had either formed or passed close to Sri Lanka, only 15 cyclonic storms had crossed the coast during the period 1881 - 2001. Out of the 35 systems which crossed Sri Lanka during the above period, 26 systems had crossed the coast during November and December (see figure 2). Therefore in Sri Lanka, November - December is reckoned as the cyclone seasons.

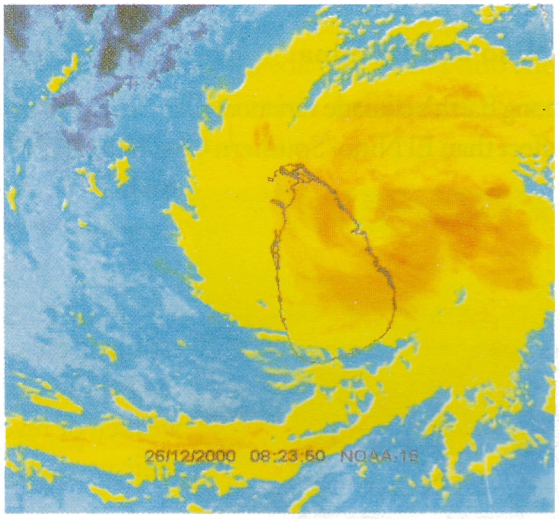
The Department of Meteorology issues cyclone alert warning when a depression or a cyclonic storm is about 550 km off the coast. When the storm is 300 km off the coast a cyclone warning is issued every 6 hours. Point of probable landfall and likely areas to be affected are also given. When the tropical storm is 200 km off the coast and if the landfall is indicated, a bulletin is issued every 3 hours.



JANUARY	- 1906
MARCH	- 1907
OCTOBER	- 1967
NOVEMBER	- 1912, 1922, 1966, 1978, 1992
DECEMBER	- 1908, 1912, 1913, 1919, 1931, 1964, 1967, 2000

Figure 2 Cyclones that have hit Sri Lanka

Measures to limit the impact of tropical cyclones can range from community awareness campaigns on how to deal with disasters to building levees against flooding. All such measures are important, as they not only reduce the cost of disasters to the community, but also help save lives.



Trincomalee Cyclone 26.12.2000

Beyond a good early warning system, a preparedness plan should cover the protection of buildings, emergency shelter, secure and reliable communications, evacuation and transport arrangements. It should also include safety, security measures and coordination between various agencies. Getting the warnings out in time to a population aware of danger and poised to act makes a real contribution to a cyclone disaster mitigation system.

Storm Surges

Storm surges, a result of tropical cyclones, can be just as lethal as cyclones. If this 'wall of water' reaches land, sea water flows in with immense force washing away everything in their path. One of the most dramatic example on record was in 1970, when a massive storm surge left 300,000 people dead after it swept in over the coastal wetland of Bangladesh. A storm surge forms when tropical cyclones move over a continental shelf. A combination of strong onshore winds and low atmospheric pressure creates the surge-a giant dome of seawater some 60 to 80 kilometers across and 2 to 5 metres high. If the cyclone reaches the coast, the strong winds whip up the sea and push the dome of water inland, usually to extremely destrction. Providing timely early warning of storm surges and publicizing evacuation plans as widely as possible are both crucial to reducing risk. Early warning of surges will depend heavily on early warning of cyclones.

Thunderstorms and Tornadoes

Thunderstorms and tornadoes are considered most destructive weather systems during intermonsoon periods. These phenomena occur under specific conditions, where lower atmospheric wind changes the speed and direction vertically, with an optimal shear in a moist environment. All thunderstorms and tornadoes have the potential to produce lightning. The cloud to ground stroke is the most destructive and hazardous. General public should take precautionary measures during this period.

Floods

Flooding occurs when rainwater accumulates at a rate faster than soils can absorb it or rivers can carry it away. Floods come in all sorts of forms, from small flash floods to sheets of water covering huge areas of land, and can be triggered by severe thunderstorms, tornadoes, tropical cyclones and monsoons. In coastal areas, storm surges caused by tropical cyclones, tsunamis, or even rivers swollen by exceptionally high tides can cause flooding.

Forecasting floods can be tricky and depends on the type and nature of the phenomenon that triggers the flooding. For example, widespread flash floods are often started off by heavy rain falling in one area within a large area of lighter rain, to eveyone's confusion. Forecasting floods caused by the heavy rain or storm surges that can sweep inland as part of a tropical cyclone can also be a complex job.

To make predictions as accurate as possible, the National Hydrological Services and the National Meteorological Services should undertake flood forecasting based on quantitative precipitation forecasts.

Landslides and mudflows

Landslides happen when heavy rains send large amounts of earth, rock, sand and mud flowing swiftly down mountain slopes. This happens partcularly on slopes that are bare or burnt by forest or brush fires.

Mudflows and the coarser debri flows are wet, fast-moving landslides. They form when masses of loose, wet debris become unstable due to saturation from rainfall or an overflowing lake. Landslides and mudflows can bury, crush or carry away people, objects and even buildings. Landslide prone areas need highly effective disaster management strategies. Hazard maps are one of the first steps towards formulating such strategies. These are essential topographic maps showing potential level of danger from landslides.

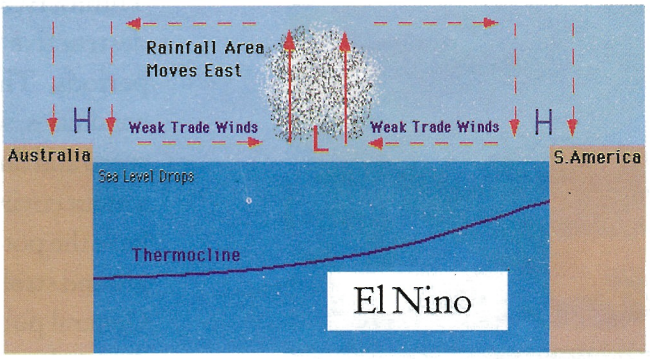
Drought

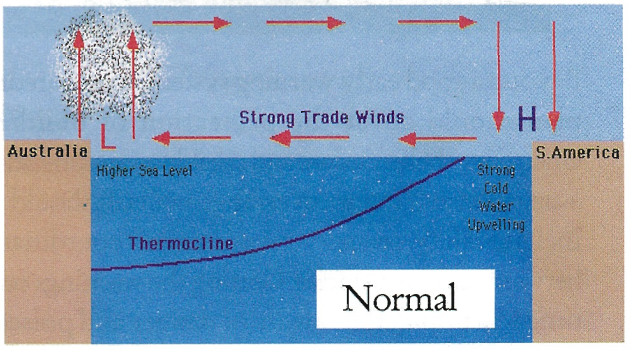
Drought, stands alone among other water related disasters. It is caused by too little water, not too much. Drought takes place over a relatively long time, not in few minutes or hours like other water related disasters. It can happen almost anywhere.

Drought is, in fact, a normal periodic feature of climate, the result of a natural reduction in precipitation over time. When rainfall becomes relatively scant or infrequent, the normal balance between precipitation and the evaporation process gets disrupted. Drought is the result. It can be highly destructive, particularly when accompanied by high temperature, strong winds and low relative humidity.

El Nino and La Nina

Among Earth's climatic variation, none is more dramatic in effect than El Nino/Southern Oscillation (ENSO). An El Nino strikes every three to seven years, when trade winds in the tropical parts of the Pacific Ocean weaken or reverse their usual route.





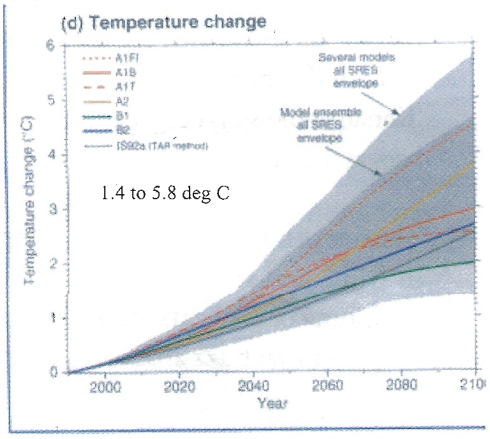
The winds then blow surface water warmed by the tropical Sun to the eastern Pacific Ocean and the equatorial west coast of South America. Rain follows the current, and eastern South America may then experience flooding,

Drought in Hambanthota, 2001

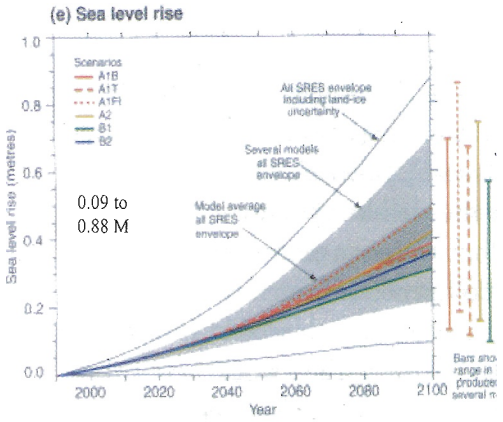
while Australia, southern Africa and Indonesia may have droughts. A La Nina events is the opposite, with warmer waters in the western Pacific and cooler waters off the west coast of South America. The weather brought by El Nino events is often so extreme that its prediction is now a top priority for National Meteorological and Hydrological Services around the world. Careful monitoring of the sea-surface temperatures of the Pacific Ocean enables prediction of El Nino and La Nina events and their impacts in all parts of the world up to several months ahead.

The Implication of Climate Change

Climate change is a huge challenge to the adapability of humans. Shifts in the global climate have triggered some of the extreme weather conditions we are now seeing. Even in a stable climate, the temperature, wind, cloudiness and precipitation are in a constantly changing state. Floods, droughts, storms, heat waves and cold snaps, as well as related events such as bush fires, avalanches and landslides, are all natural facets of climate variability. Impacts from above extreme events can be costly in both human and environmental terms. The IPCC's three-volume Third Assessment Report was finalized in early 2001. Its message is clear: intensive climate research and monitoring give scientists much greater confidence in their understanding of the causes and consequences of global warming. The Assessment Report presents a snapshot of what the earth will probably look like in the 21st century, when global warming of 1.4 - 5.8°C will influence weather patterns, water resources, the cycling of the seasons, ecosystems and extreme climate events. Even greater changes are expected in the more distant future.



The average sea level is predicted to rise by 9 to 88 cm by the year 2100. This could cause mainly by the thermal expansion of the upper layers of the ocean as they warm, with some contribution from melting glaciers. The uncertainty range is large, and changing ocean currents, local land movement and other factors will cause local and regional sea level rise much more or much less than the global average.



Effective Early Warning Systems

Keeping track of global warming, rising sea-level, air and water pollution, extreme weather events and other processes facing the world is necessary for achieving sustainable development. While no one can control the weather, accurate observations and predictions with a higher level of accuracy and lead time can radically improve people's chances of living in relative safety, and protecting precious natural resources. Millions of people worldwide owe their lives and livelihoods to effective early warning systems. People-centred early warning systems empower communities to prepare for and confront the power of natural hazards. They bring safety, security and peace of mind. Early warning systems provide resilience to natural hazards, and protect economic asserts and development gains. They help the society adapt to and defend against the uncertainties of climate change.

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