Hydro-Meteorological Multi-Hazard Systems & Climate Change Related Extreme Events

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CONTENTS

- Hazard and Disaster Menu
- Time & Space scale
- Extreme weather & climate Events
- Conclusions

Multi-Hazards

- Cyclones
- Torrential Rains / Floods
- Tsunamis
- High Waves / Storm Surge /Freak Waves
- Water Spouts
- Tornadoes (mini)
- Droughts
- Landslides
- Cold Spell
- Heat Wave
- Extreme Events (microbursts, electric storms, etc)
- Sea Level Rise

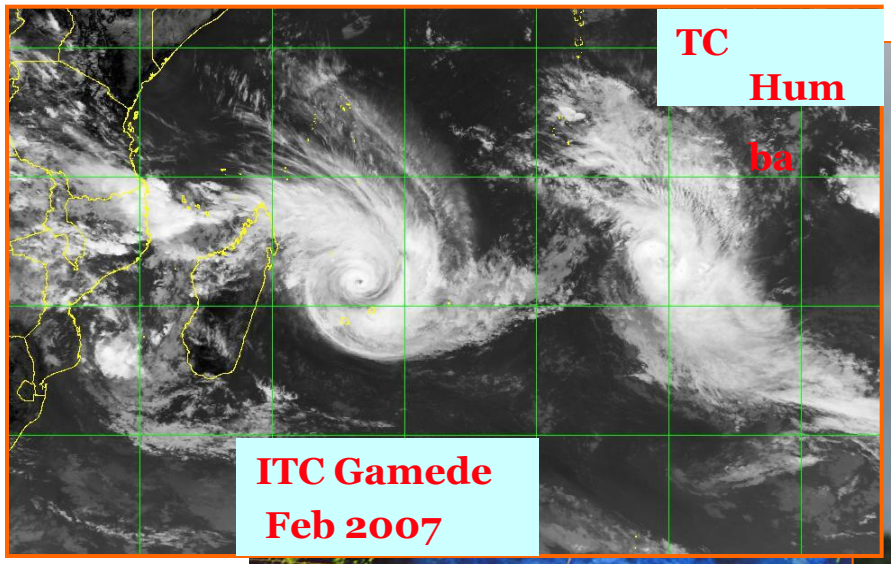
What is a Hazard?

- **A hazard** is a situation that poses a level of threat to life, health, property, or environment. Most hazards are dormant or potential, with only a theoretical risk of harm; however, once a hazard becomes "active", it can create an emergency situation. A hazard does not exist when it is happening. A hazardous situation that has come to pass is called an incident. Hazard and vulnerability interact together to create risk.

What is a Disaster?

- A **disaster** is either a natural or man-made ***hazard*** which has come to fruition, resulting in an event of substantial extent causing significant physical damage or destruction, loss of life, or drastic change to the natural environment. It is classified as either a natural disaster or a man-made disaster. A disaster can be ostensively defined as any tragic event with great loss stemming from events such as earthquakes, floods, catastrophic accidents, fires, or explosions.
- In contemporary academia, disasters are seen as the consequence of inappropriately managed risk. These risks are the product of hazards and vulnerability.

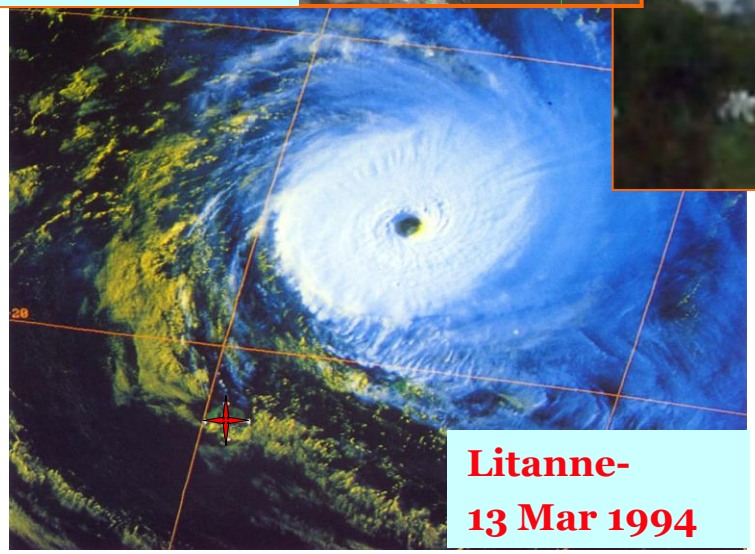
Some Snap Shots



TC Hum ba

ITC Gamede Feb 2007

Tornado observed from Vacoas Met Station

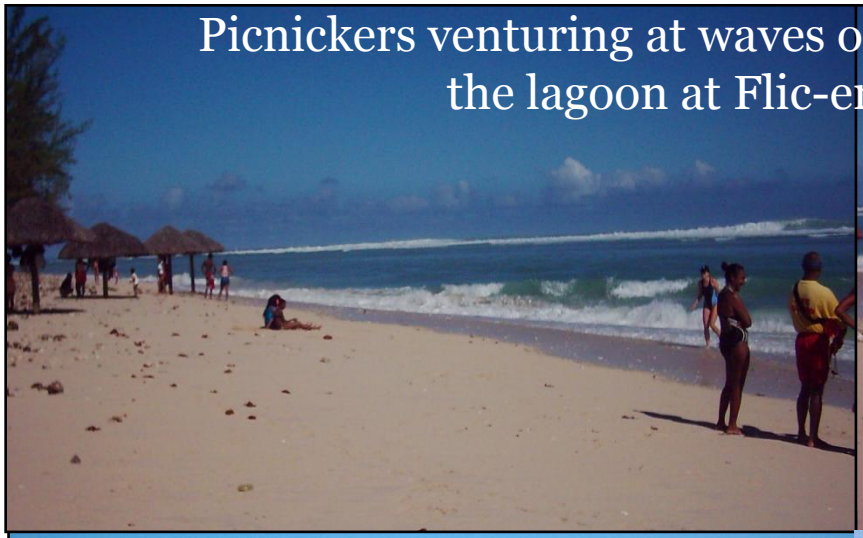


Litanne- 13 Mar 1994

Storm Surge

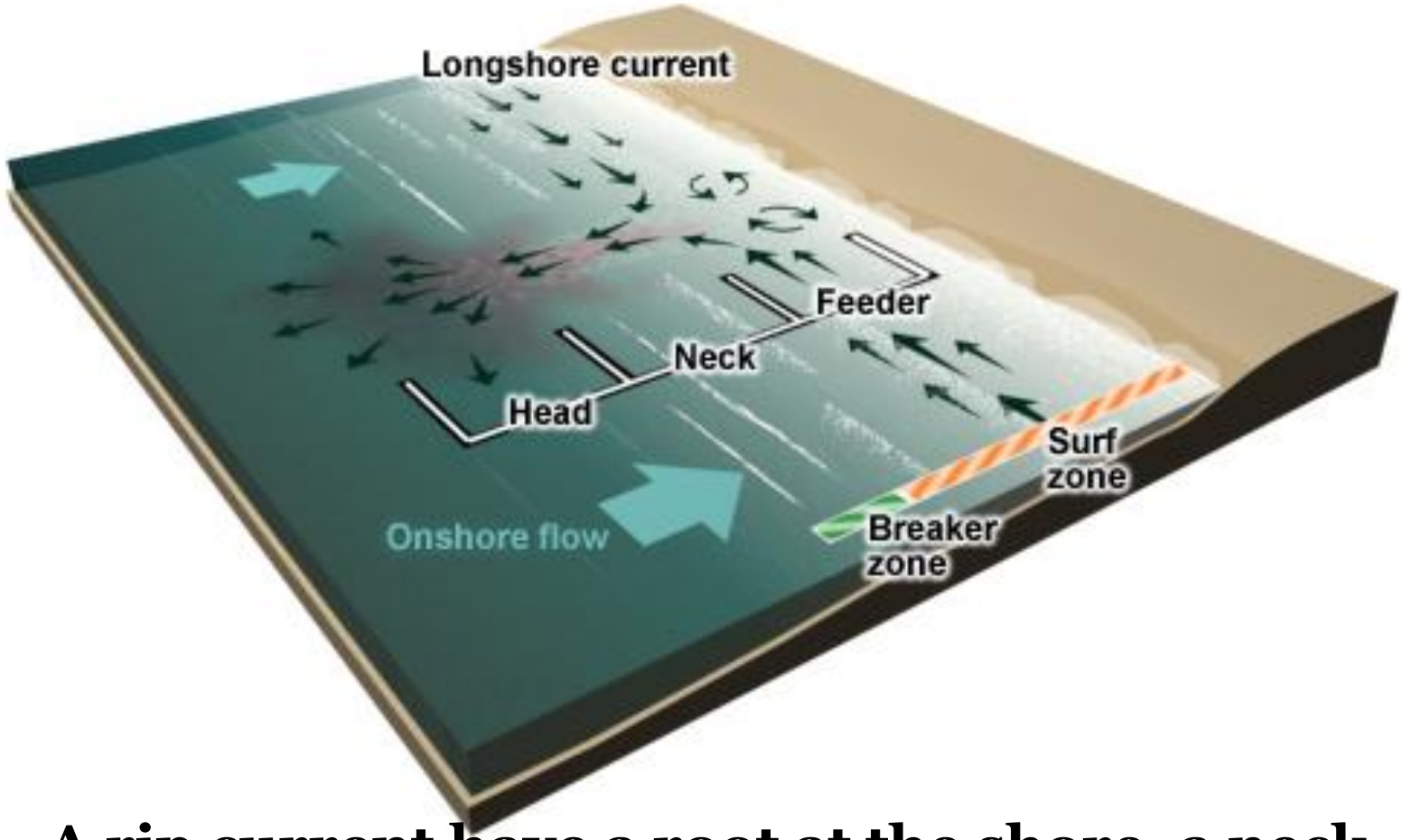
Swell Waves

Picnickers venturing at waves of the order of 2.5 metres inside the lagoon at Flic-en-Flac public beach



Lightning and Tornadoes

RIP CURRENT STRUCTURE



A rip current have a root at the shore, a neck across the breaker zone and a mushroom head.

Weather and storm patterns cause seasonal fluctuations in the beach recession and lagoonal bathymetry

SHIP WRECK AT ST BRANDON DURING TROPICAL CYCLONE GAMEDE

SEA LEVEL 7 meters over sea level

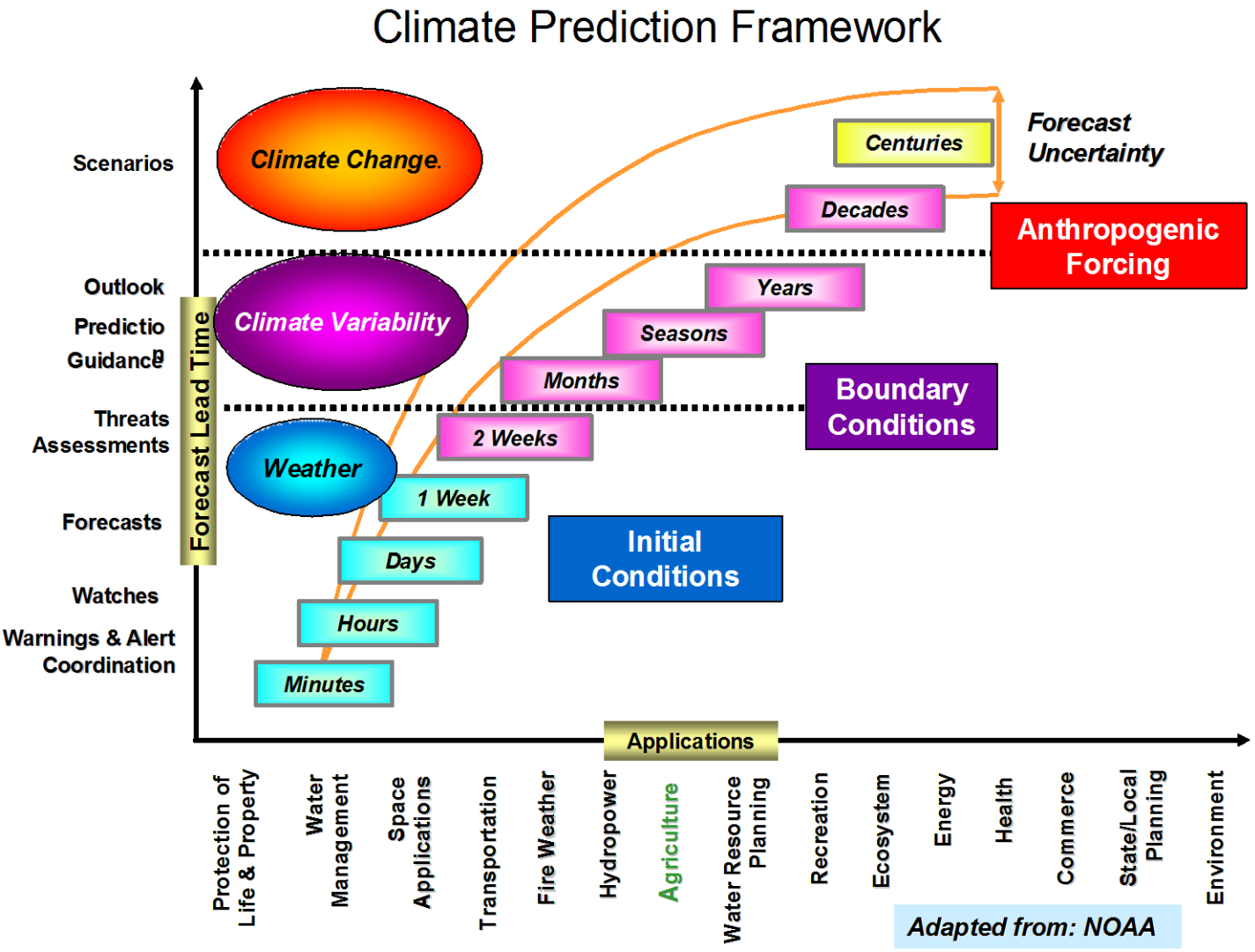
27 Febrero 2010

A sense of urgency…
Natural variations compounded by global warming may cause more damaging






Reasons and motivations



Decision-makers in sensitive sectors not equipped to use climate information for managing current and future climate risks

Scales

Dimension	40,000 - 400 km	400 - 4km	4km - 40m	40m - 40cm	40cm - 4 mm
Scale	Masoscale	Mesoscale	Misoscale	Mososcale	Musoscale
Downburts	Cyclone	Macrobursts Mesocyclone	Microburst Tornado	Dust Devil	Turbulent Eddy

Are we seeing changes in Extremes?

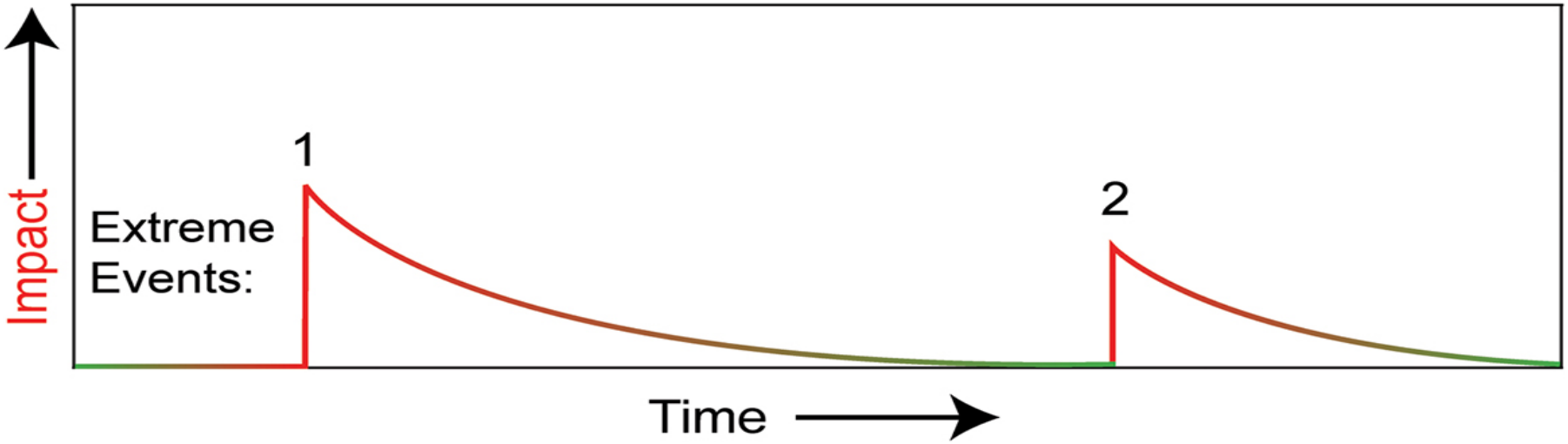
- Yes, there is evidence for observed changes in weather and climate extremes.
- Model projections suggest we will continue to see changes.
- Some changes have been attributed to human-induced climate change.

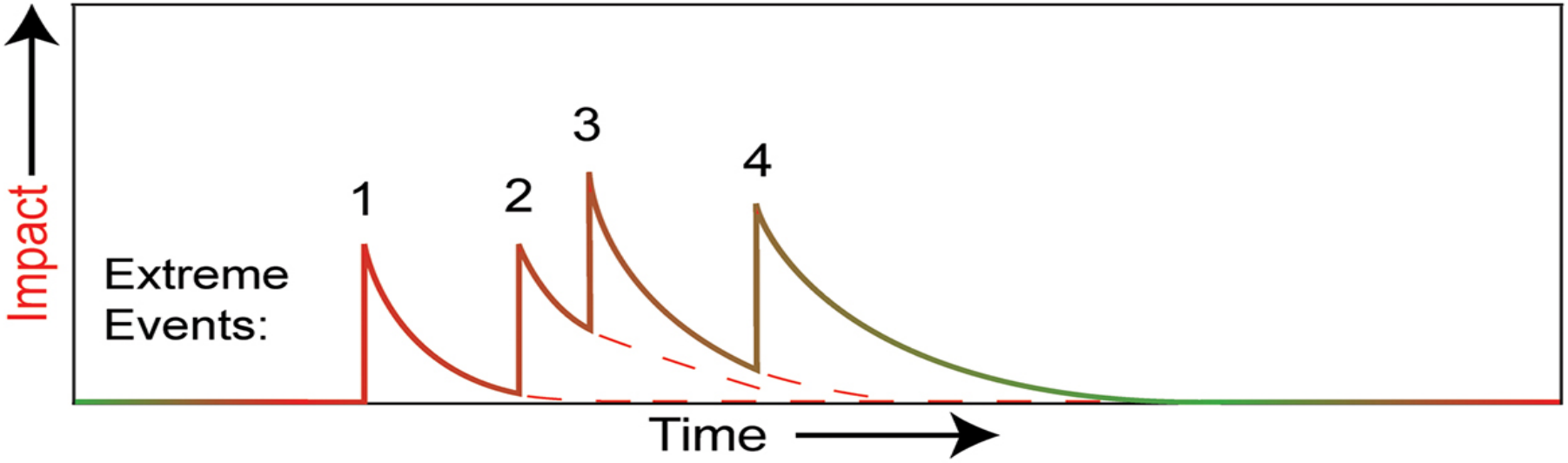
How do we define Extremes?

- IPCC AR4 Glossary: “an extreme weather event is an event that is ***rare*** at a particular place and time of year”

- “***rare***” is defined as the highest or lowest 10%.

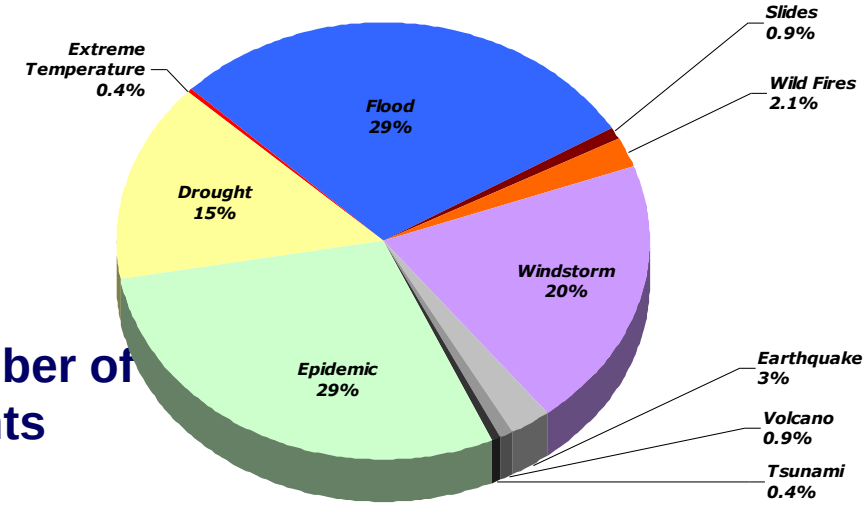
Extreme Events and Recovery of a System



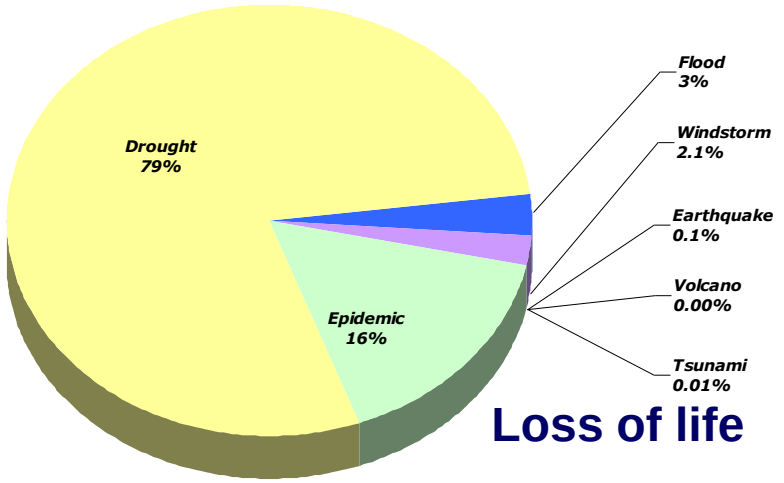


Distribution of Disasters Caused by Natural Hazards and their Impacts (1978-2007)

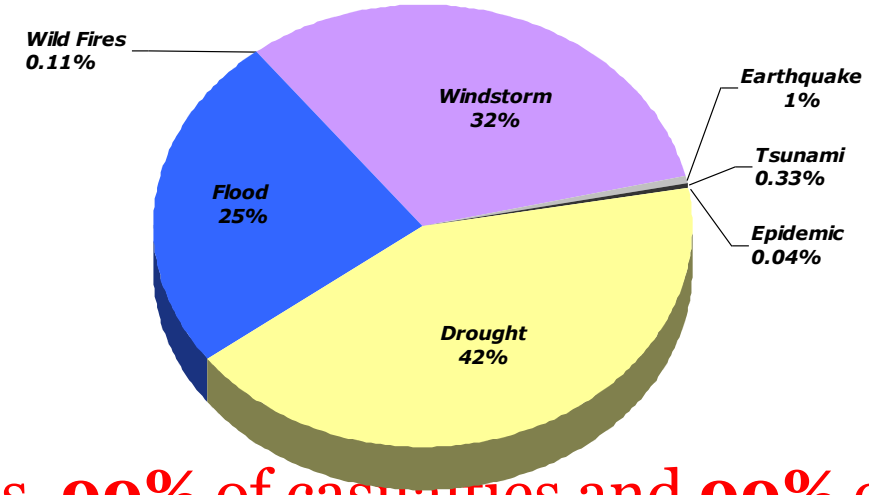
Number of events



Loss of life

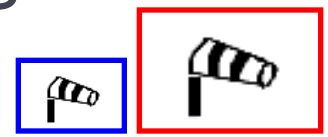


Economic losses

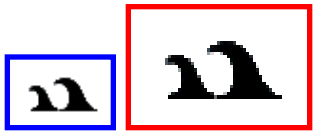


95% of events, **99%** of casualties and **99%** of economic losses are related to hydro-meteorological hazards.

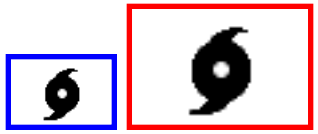
Increasing Risks under a Changing Climate



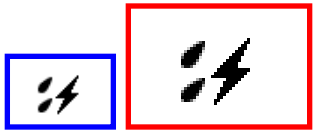
Strong Wind



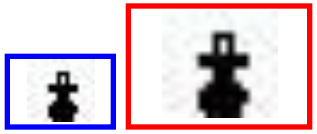
Coastal Marine Hazards



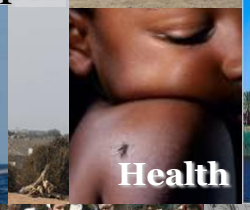
Tropical Cyclones

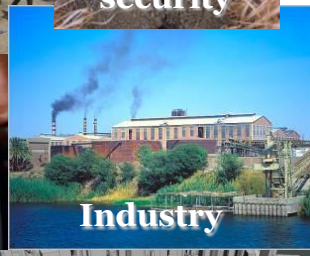


Heavy rainfall / Flood



Heatwaves





Hazards' intensity and frequency are increasing

Exposure is increa

Need for disaster risk management

How A BUTTERFLY destroyed the roof of the neighbour

DOWNBURSTS

Macroburst

•A large downburst with its outburst extending in excess of 4 km in horizontal dimension. An intense macroburst often causes widespread tornado like damage. Damaging winds, lasting 5 to 30 minutes, could be as high as 60 m/sec

Microburst

•A small outburst with its outburst, damaging winds extending only 4 km or less. In spite of its horizontal scale, an intense microburst could induce damaging winds as high as 75 m/sec

Fig. 2.1 A view of the leading edge of a macroburst on 12 August 1975 near Lake Okeechobee, Florida. The leading edge is characterized by a roll cloud, dust clouds, and a front of gusty winds (gust front). Photo by Ron Holle

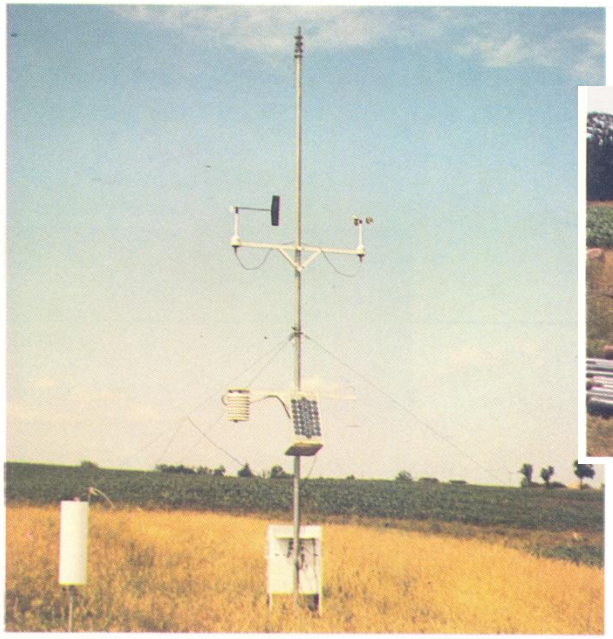


Fig. 4.4 CP-4 Doppler radar at O'Hare and a view of a PAM station.

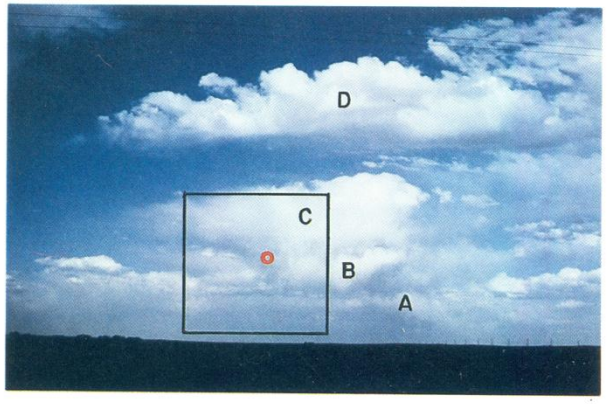


Fig. 6.36 Wide-angle and telephoto views of four giant anteater clouds at 1740 taken from CP-3 by Brian Smith. Penetration photos (right) were taken by Fujita in the King Air.

Extreme Weather & Climate Events

It has been observed that many extreme events occurred in the preceding decades over the Republic of Mauritius in the form of **heavy/torrential rainfall** leading to **flash floods**, violent **thunderstorm** or electric storm accompanied by **mini tornadoes** and **hail storm**, **micro-bursts**, **high waves** in the form of swells or freak waves, **heat wave** with uncomfortable temperature lingering for days and **explosive growth of cyclonic activities**.

Conclusions

*It is **virtually certain** that **extreme weather and climate events** will occur*

*The prevailing atmospheric conditions may lead to **severe flash floods**, **electric storms**, **high/freak waves** during storm surges and **mini tornadoes***

Thank You