Climate Change and Health:

Extreme Weather Events - Flooding

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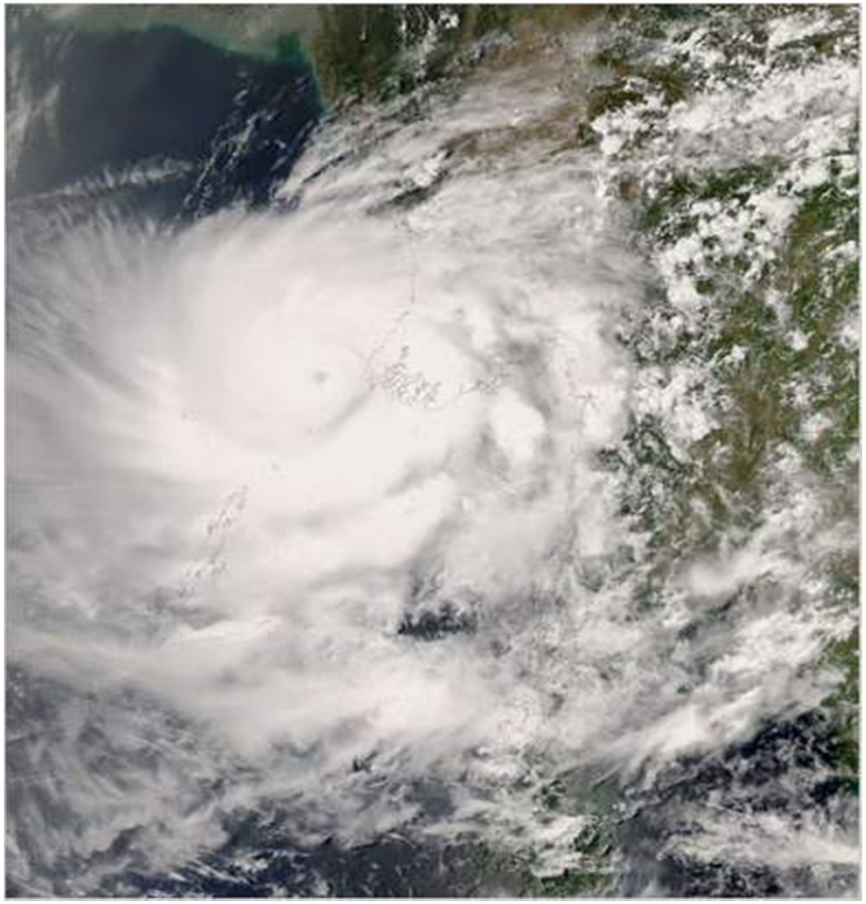
Overview

- Categories of extreme weather events considered
- How extreme weather events threaten public health
- Nature of public health impacts with extreme weather events
- Current health risks and impacts from extreme weather events in the region
- Future risks and potential health impacts from climate change

Extreme Weather Events Considered

- All extreme weather events currently experienced in countries of SEAR and IOR *could* be affected by climate change
  - Typhoons
  - Floods
  - Precipitation extremes
  - Wildfires
  - Temperature extremes
  - Others (windstorms, etc.)

Example: Cyclone Nargis Hits Myanmar, 2008



New York Times, 2008

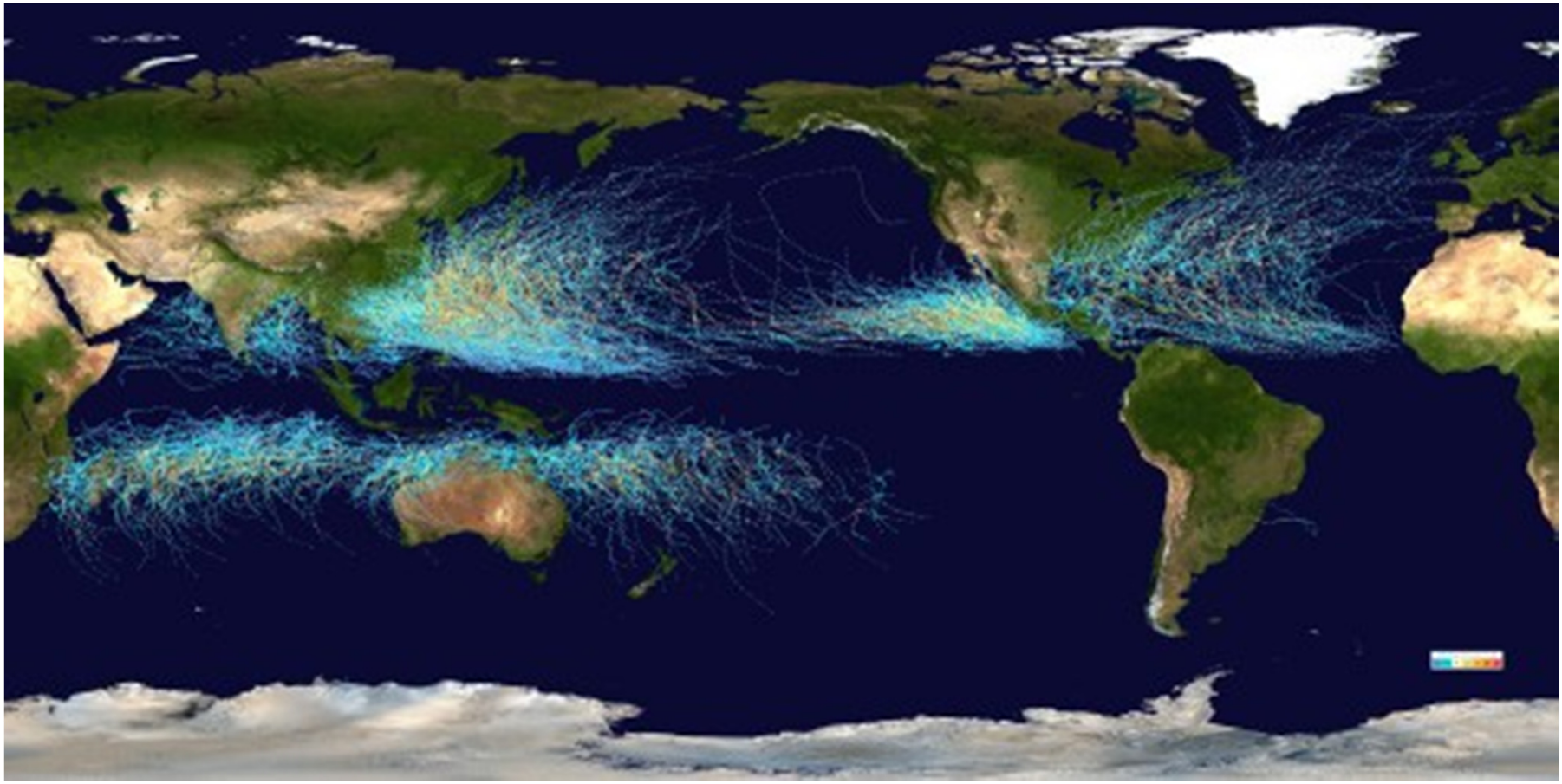
The Guardian, 2008

Example of Flooding: Bangladesh 2004

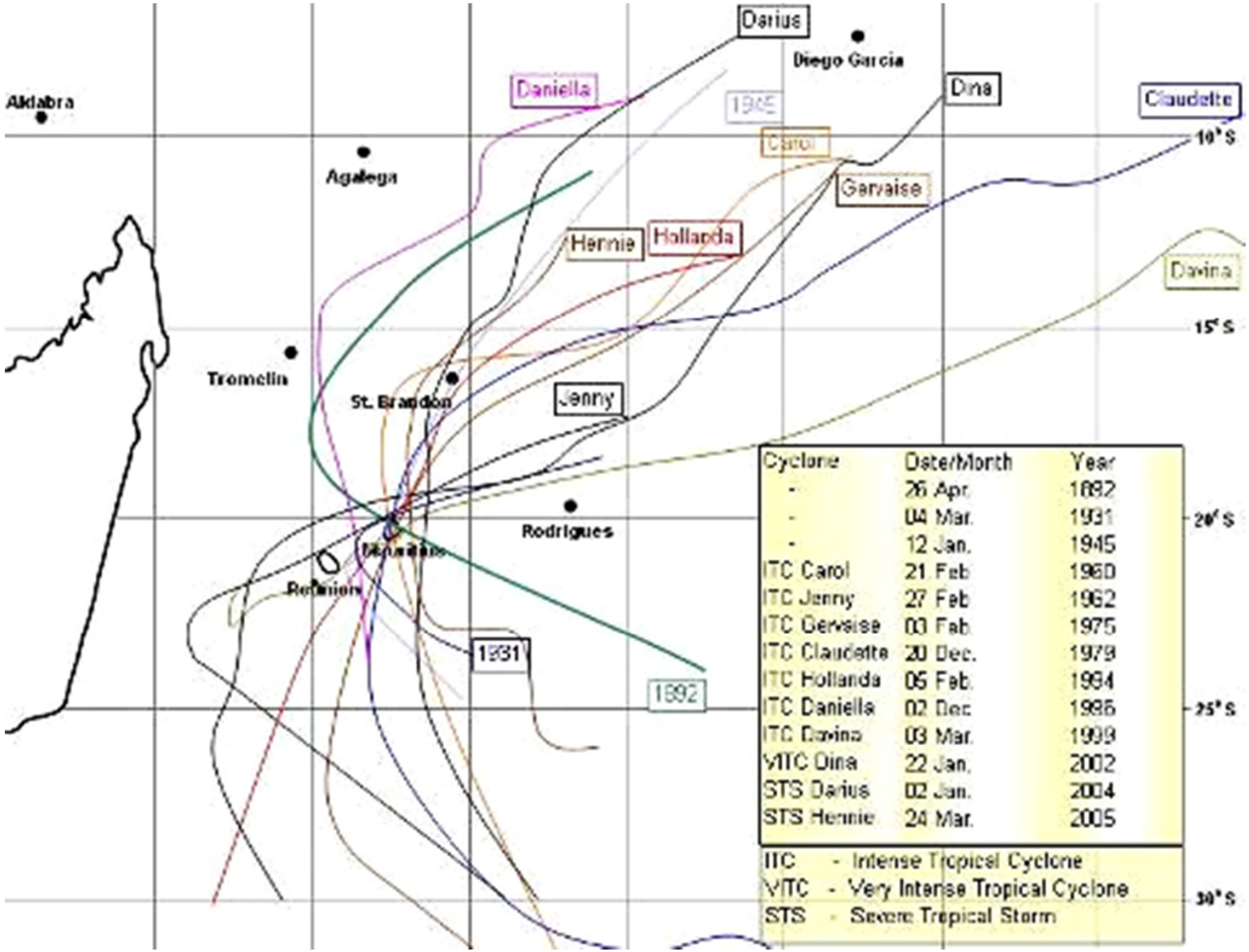
Residents fleeing with food during a 2004 flood, Bangladesh

BSA-UA, 2004

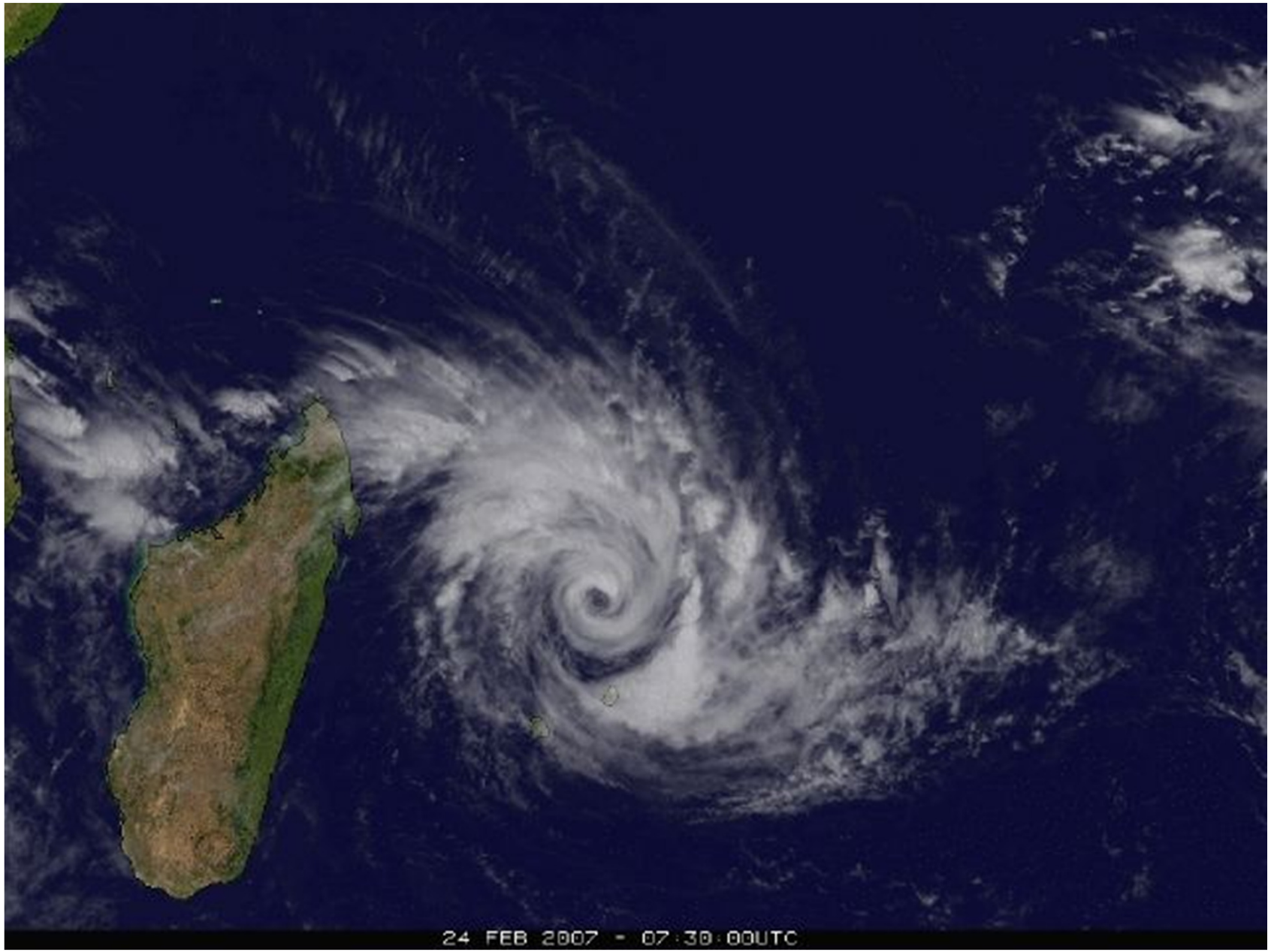
Global Cyclone Tracks



Worst Cyclone Tracks: Republic of Mauritius



Cyclone 24 Feb 2007: Republic of Mauritius



http://imageshack.us/f/90/visir15s24uc1.jpg/

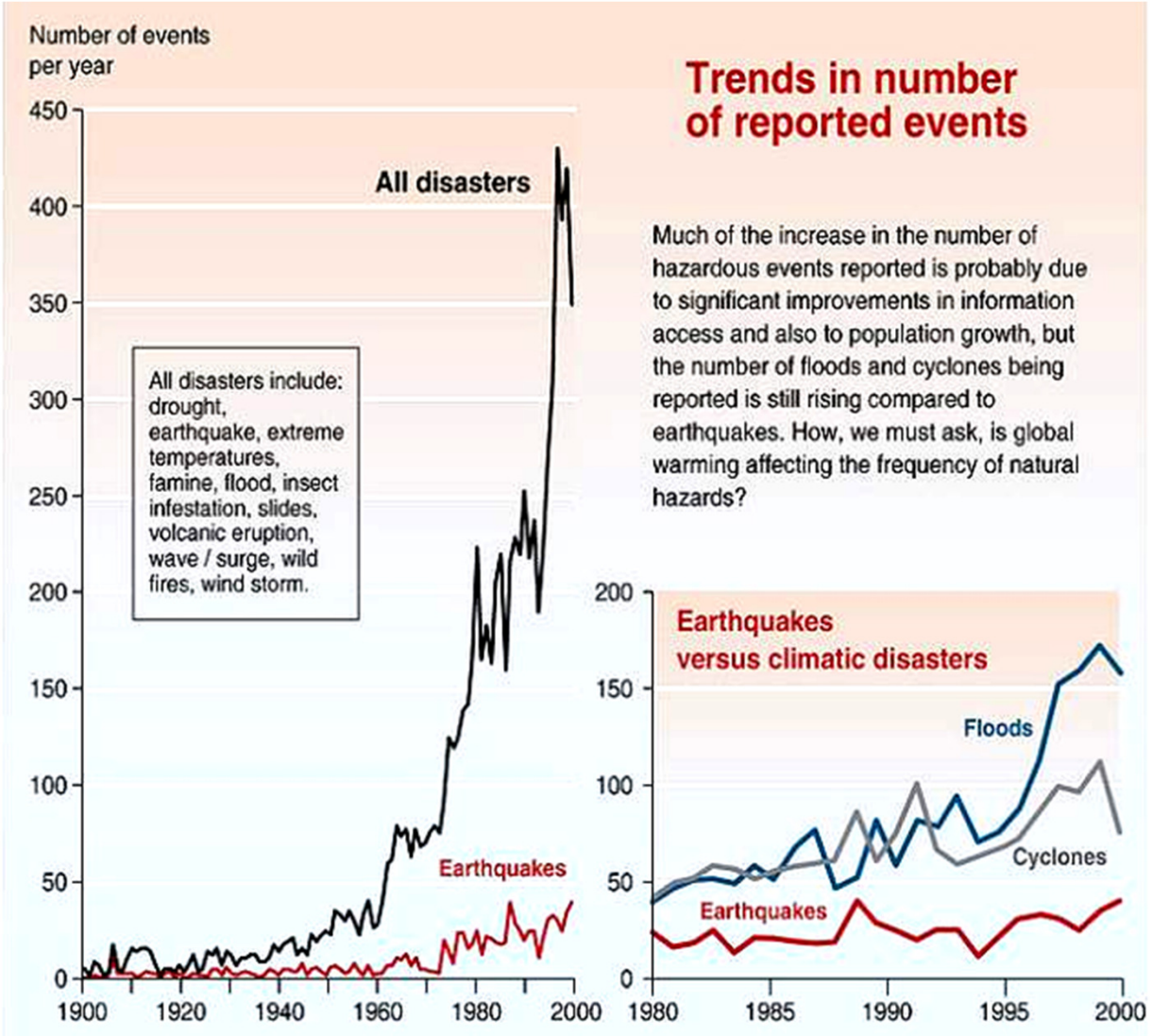
Extreme Weather Events Considered

- **Focus on typhoons/cyclones, extreme precipitation/floods, & wildfires because they:**
  - Pose a significant health risks
  - Have a long history of substantial adverse health impacts
  - Represent considerable climate change-related research
  - Comprise many current adaptation efforts

How Extreme Weather Events Threaten Public Health

- Health risks/impacts of an extreme weather event are a function of:
  - Severity: how challenging are the event's conditions (e.g., cyclone winds over 120 mph)
  - Duration: how long are the extreme conditions experienced
  - Surprise: how much advance warning was available for the event (e.g., days, hours, minutes)
- There are differences in categories of events
- There will be differences between individual events within a category

Global Warming is Increasing the Risk of Extreme Weather Events



WHO 2009

Population Characteristics Affect Risks/Impacts of Extreme Weather

- Population factors affecting the risks/impacts of extreme weather events include
  - **Size**: how many people does the event affect
  - **Age**: the young and old are less able to help themselves in an extreme weather event
  - **Health status**: poor health limits individuals' response ability
  - **Wealth**: poverty can limit the types of preparation actions and responses that can be considered, it can also affect exposure (e.g., housing stock)

Types of Public Health Impacts from Extreme Weather Events

- **Direct health impacts**
  - Morbidity
  - Mortality
    - Both are observable and clearly attributable to the physical impacts of the event:
  - Mental health impacts (Post Traumatic Stress Disorder-PTSD, depression)
    - Delayed onset and recognition can lead to impacts being missed in an event summary
    - Potential to adversely affect productivity
    - Potential for severe health and quality of life impacts

Nature of Public Health Impacts with Extreme Weather Events

- **Indirect health impacts**
  - Can be less observable
  - Can take time to develop
  - May reflect a loss of access to critical resources: clean water, shelter
  - Can result from disruption to routines:
    - Restricted access to, or supply of, medicine, caregivers, medical facilities

Deaths from Extreme Weather Events 1970-2008: Example South East Asia

SEARO country	Drought	Extreme temperature	Flood	Storm	Wildfire	Total
Bangladesh	18	2,171	41,759	474,098	-	***518,046***
Bhutan (no pre-1990 data)	-	-	222	17	-	***239***
India	320	11,710	46,185	49,029	6	***107,250***
Indonesia	1,329	-	5,227	1,692	300	***8,548***
Korea Dem P Rep	-	-	1,820	55	-	***1,875***
Korea Rep	-	40	2,274	2,186	2	***4,502***
Maldives	-	-	-	-	-	***-***
Myanmar	-	-	364	138,864	8	***139,236***
Nepal	-	108	5,481	97	88	***5,774***
Sri Lanka	-	-	941	754	-	***1,695***
Thailand	-	-	2,648	927	-	***3,575***
Timor-Leste (no pre-1990 data)	-	-	1	-	-	***1***
Total	**1,667**	**14,029**	**106,922**	**667,719**	**404**	**790,741**

Impacts not equally distributed by country or type of extreme event. Nearly 800,000 reported deaths. Storm mortality 84% of total.

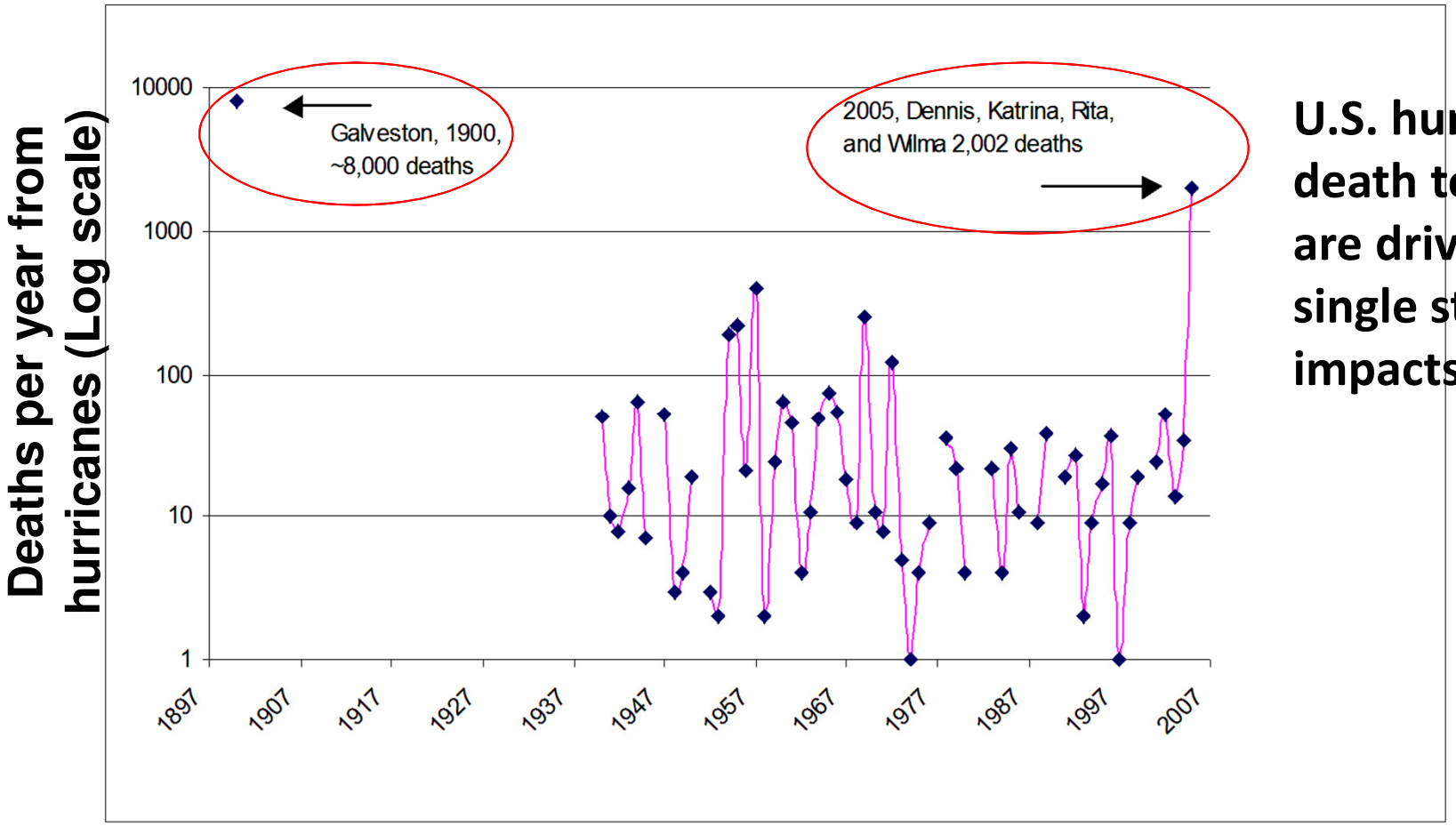
EMDAT, 2008

WHO 2009

Importance of Single Events in Health Impacts of Extreme Weather Events

- While appropriate to summarize health impacts of extreme weather events it is ***inappropriate*** to try and convey a sense of "**average**" impacts over time
- These events have **extremely variable health impacts**
- Totals are driven by a few events
- The strongest events **may not** have the **greatest health impact**

Distribution of Health Impacts by Event: U.S. Hurricane Deaths



U.S. hurricane death totals are driven by single storm impacts

Mills, 2009

Importance of Single Extreme Weather Events in South East Asia

- 73% of all reported extreme weather event deaths, roughly 77,000, in countries of South East Asia from 1970-2008 are from three cyclones:
  - November, 1970 (unnamed): 300,000 killed in Bangladesh
  - April, 1991 (Gorky): 139,000 killed in Bangladesh
  - May, 2008 (Nargis): 137,500 killed in Myanmar

EMDAT, 2008

Climate Change and Future Health Impacts of Extreme Weather Events

- Increase in risk **may or may not result in increased health impacts** from future extreme weather events
  - **Sensitivity** of health impact totals to single events means marginal impacts could have either a minimal or significant health impact
  - **Socio-demographic changes** in population location, size, health, wealth likely as significant as impact of climate change on event's future health impact
  - **Adaptation**, in the form of hazard planning, preparation, and response, will play a critical role in determining the magnitude of future health impacts from extreme weather events

WHO 2009

Cavaets to Climate Change and Extreme Weather Events

- The impact of climate change on extreme weather events will best be measured in terms of **changes in frequency and intensity of events**
- These are likely to be **marginal changes**
- **Extremely unlikely** that a **single event** can ever be attributed, in its entirety, to climate change

Examples of Adaptation to Extreme Weather Events

Following devastating cyclones Bangladesh has begun constructing cyclone shelters to keep vulnerable residents safe

Pitchford, 2008

Goals for Extreme Weather Event Notification and Response Plans (cont.)

- Develop hypothetical scenarios and practice (i.e., tabletop exercises)
- Draw on past experience
- Be flexible in response to unanticipated constraints and opportunities during actual events
- Be open to outside assistance that has the potential to improve public health

Extreme Weather Event Response: Providing/Receiving Assistance

The Guardian, 2008

Conclusions

- Extreme weather events already present a significant health risk to countries in the region based on a history of significant impacts
- Climate change may increase the frequency and/or severity of many of those events,
  - Storms/cyclones
  - Flooding
- Detecting the climate change signal or marginal impact in any given event may be impossible given natural variation

Conclusions (cont.)

- Ultimate health impact of extreme events with climate change is uncertain
  - Totals driven mainly by a limited number of individual events
- Changes in factors other than climate change will also be critical in determining the nature and extent of future health impacts
  - Population size, health, wealth, location
- Effective adaptation (e.g., education, notification, and response plans) could limit future adverse health impacts

Conclusions (cont.)

- Uncertainty over future arguments ***is not*** an argument for doing nothing
- Uncertainty with anticipated increase in risk from the nature of the events argues for ***increased efforts to prepare*** for future extreme weather events

Discussion

Questions?

Thoughts?

Concerns?

Suggestions?

http://upload.wikimedia.org/wikipedia/commons/thumb/a/a5/2007-09-09_Mauritius_24.jpg/1024px-2007-09-09_Mauritius_24.jpg

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