

Michael H. Glantz, Director

Center for Capacity Building
Senior Scientist, NCAR

Societal Aspects of High-Impact Weather and Climate: The need for early warnings in Asia and the Pacific (and everywhere else)

UNU Global Seminar

“Interactions: People & the Environment”

Okinawa

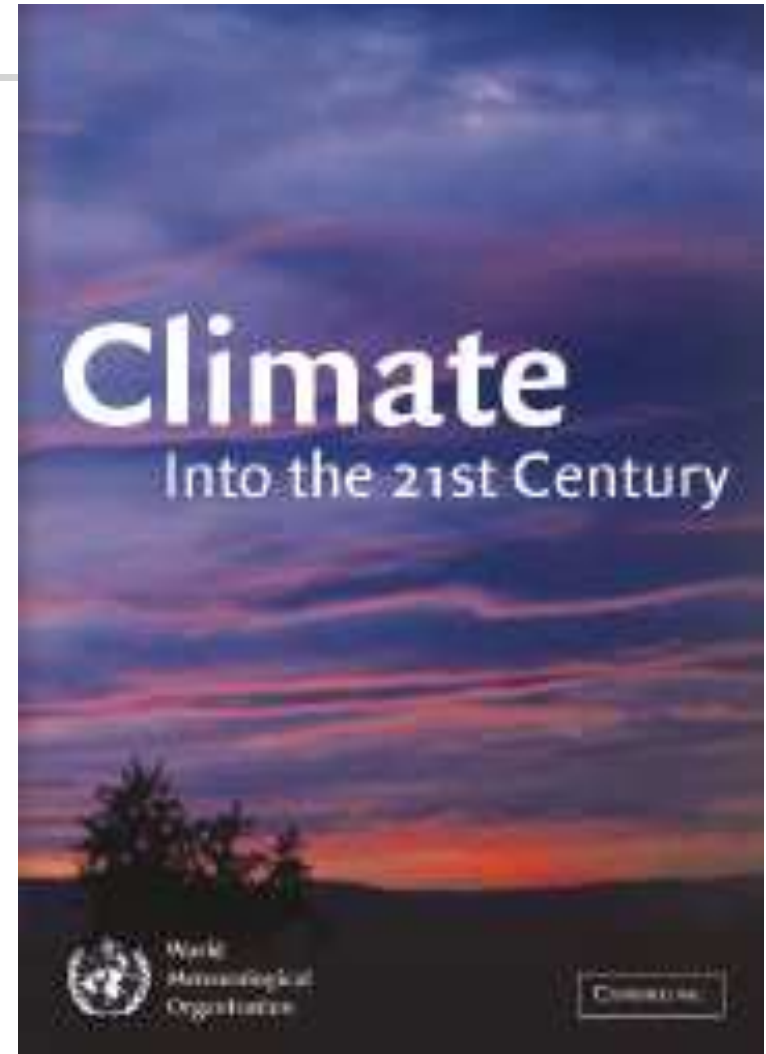
19-22 December 2007





Aspects of Climate

- **Climate variability**
- **Climate fluctuations**
- **Climate change**
 - **New global climate state**
- **Extreme events**
 - **Seasonality**



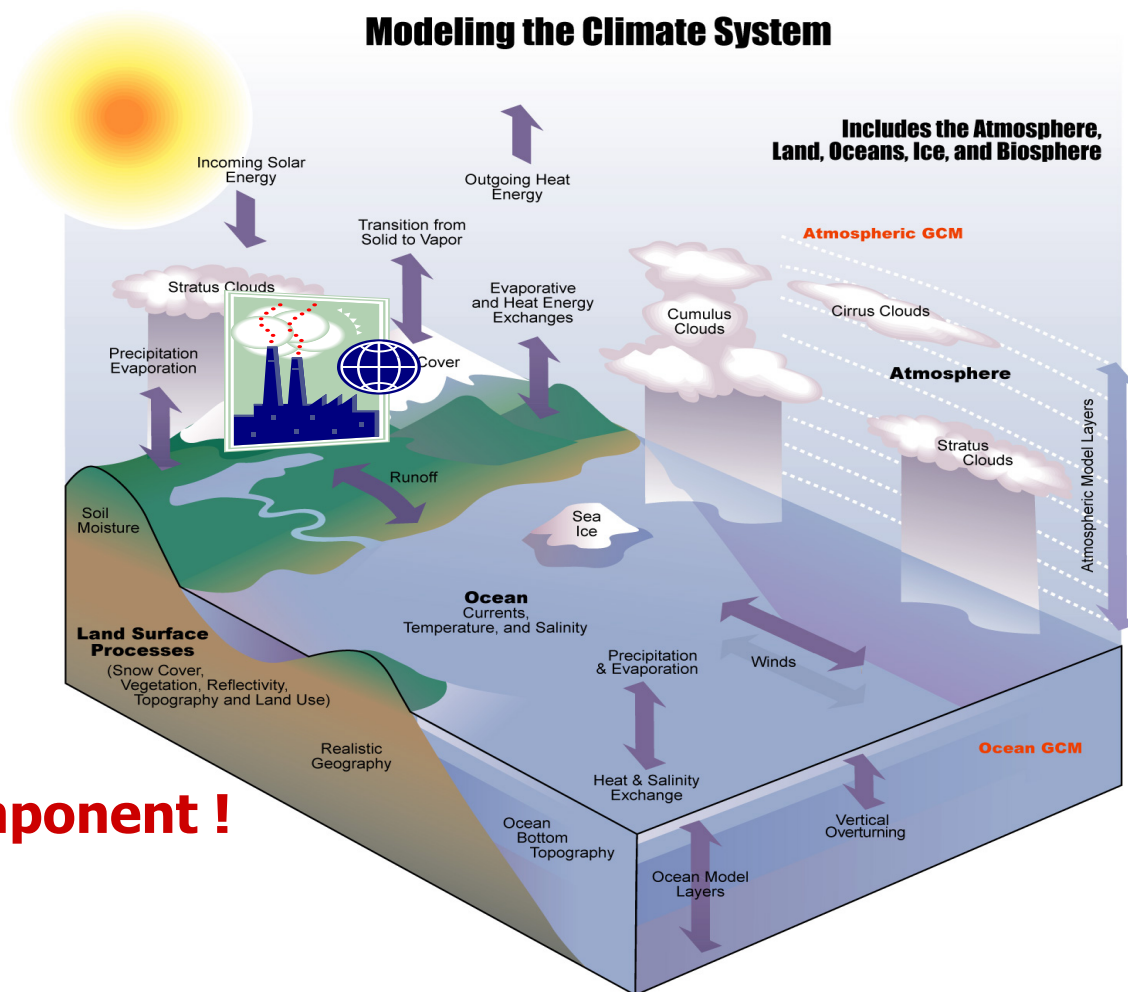
The Global Climate System



Understanding the
physical Climate
System

Understanding its
components

Society is NOW a component !



Explaining Climate Science

- Understand the climate system
- Understand its components
- Society is a component



**IT DOES NOT HAVE TO BE
SO DIFFICULT**



- **Every part of globe can be affected**
- **Frequency, location, impacts and timing vary**
- **Impacts have a cascade effect**





Superstorms, a new extreme?

- **Superstorm 1993 (North America)**
- **Hurricane Mitch 1998 (Central America)**
- **SuperTyphoon Maemi 2003 (Korea)**
- **Super Dust Storm 2002 (China)**
- **Super-cyclone Sidr 2007 (Bangladesh)**
- **SuperTyphoon Wipha 2007 (China)**
- **“El Nino of the Century” 1997-98 (Global)**



No definition of “Superstorms”

- Storm could be ***SUPER***,
because of ...
 - the level of death and destruction
 - the impact on the economy
 - perceived as opposed to actual severity
 - an exaggerated forecast
 - media hype

Something new to worry about?

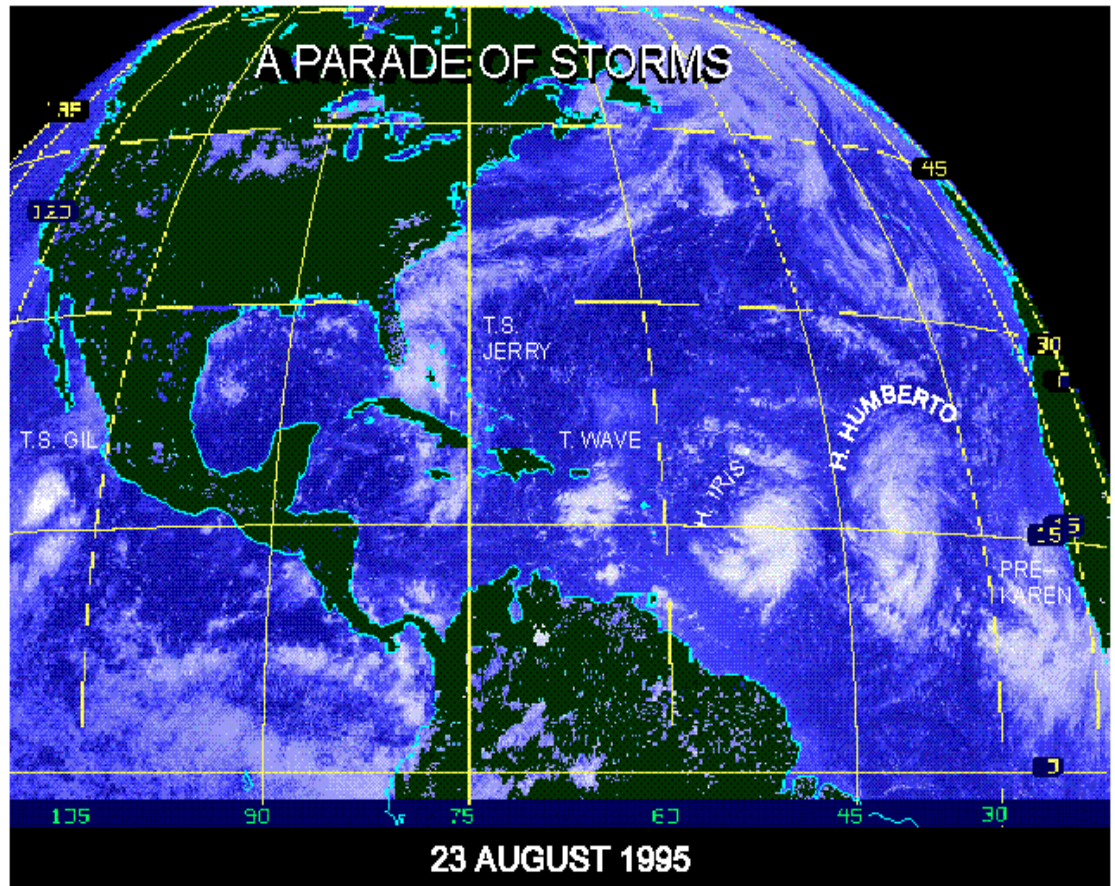
A season of “Superstorms”

- The 2005 tropical storm season
- The 2004 tropical storm season
 - **In the Atlantic**
 - 4 hurricanes in Florida
 - **In the Pacific**
 - 10 typhoons in Japan



Foreseeability

- Consider the concept of **foreseeability**
- A qualitative version of probability
 - Borrowed from legal profession



Foreseeability of **superstorms**

**SuperStorm '93:
storm of the century**

The Superstorms of
1993 and 1949

Mars Superstorm:
Aug. 14th & 15th?

Superstorm Sweeps Over England

**The 10-12 November 2001
Balearic Superstorm**

*Was there a supercyclone
in Orissa? Yes*

Worst storm in a century
leaves damaging scar
(Australia 2003)

**Supercyclone
in Orissa**

Global Warming and
the Superstorm

**Mega Cyclone in
Orissa (1999)**

**Hypercane: Hurricane
from Hell**

Increase in Extreme
Weather events -
mega hailstorms

*Superstorm: Winds hit
225 mph*

**Supercyclone narrowly
misses northern
Australia**

The coming global
Superstorm

Geophysical Activity
During Two
Superstorms

**The 1993 Superstorm Cold
Surge: Frontal Structure,
Gap Flow, and...**

**Jupiter: 300-year
old "Hypercane"**

The March 1993 Superstorm
Cyclogenesis: Incipient Phase Synoptic

Super-intense hurricanes

**Supercane
Isabel**

*Massive storm called
a "Hypercane"*

January 1988 Ice Storm
of the century devastates northcountry

*Superstorm: Isabel strengthens
into second major hurricane of
the year*

Re-thinking high impact weather and climate

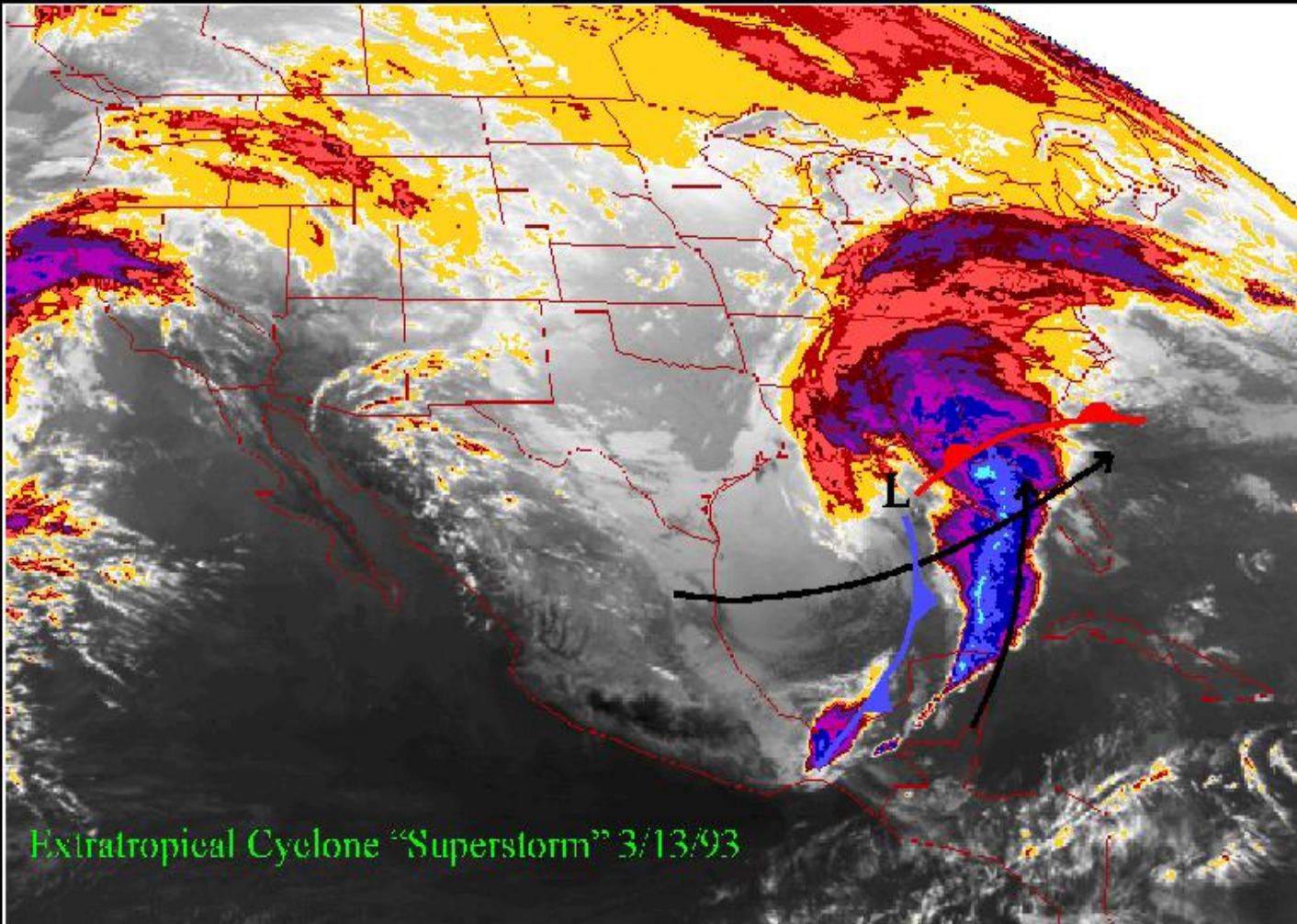
- **More high impacts with a warmer atmosphere?**
- **Successive storms close in time can have the same damage as a single superstorm**
- **It is possible to have a season of “superstorms”**



Characteristics of Superstorm '93

AAA-VSI TO IR16-S IN REAL TIME

0201Z 13 MAR 1993



Extratropical Cyclone "Superstorm" 3/13/93

ENHANCE: CH12

SuperCyclone Orissa 1999 (India)



100km

ORISSA

Jaipur

Bay of Bengal

Bhubaneswar

Puri

Latest Indian government estimates put the death toll over 7,000. The Red Cross/Red Crescent put the figure nearer 10,000 with another 10 million homeless or otherwise affected.

Jagatsinhpur

Worst hit district of Orissa. Indian government estimates over 2,000 dead.

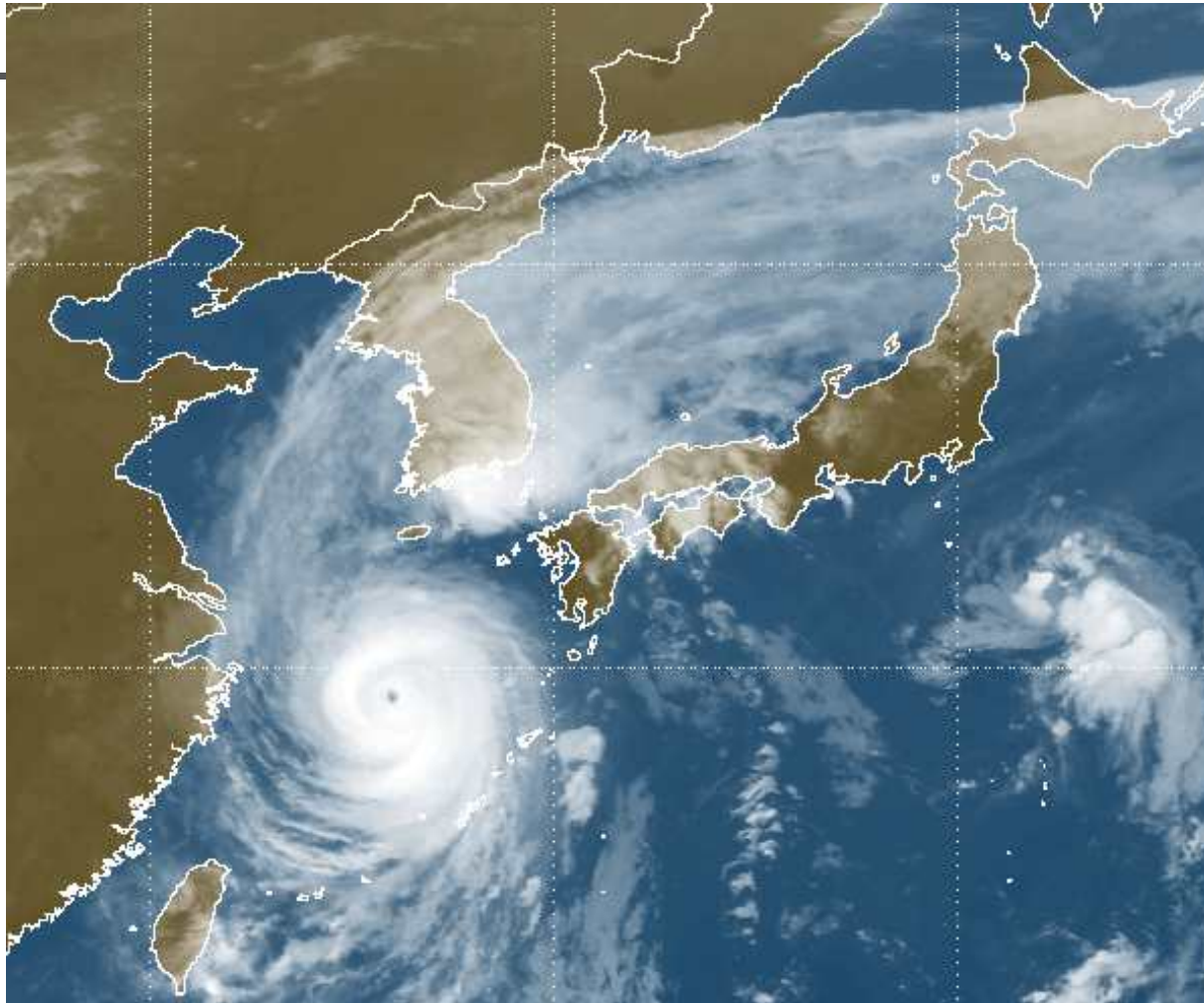


Orissa cyclone devastation '99

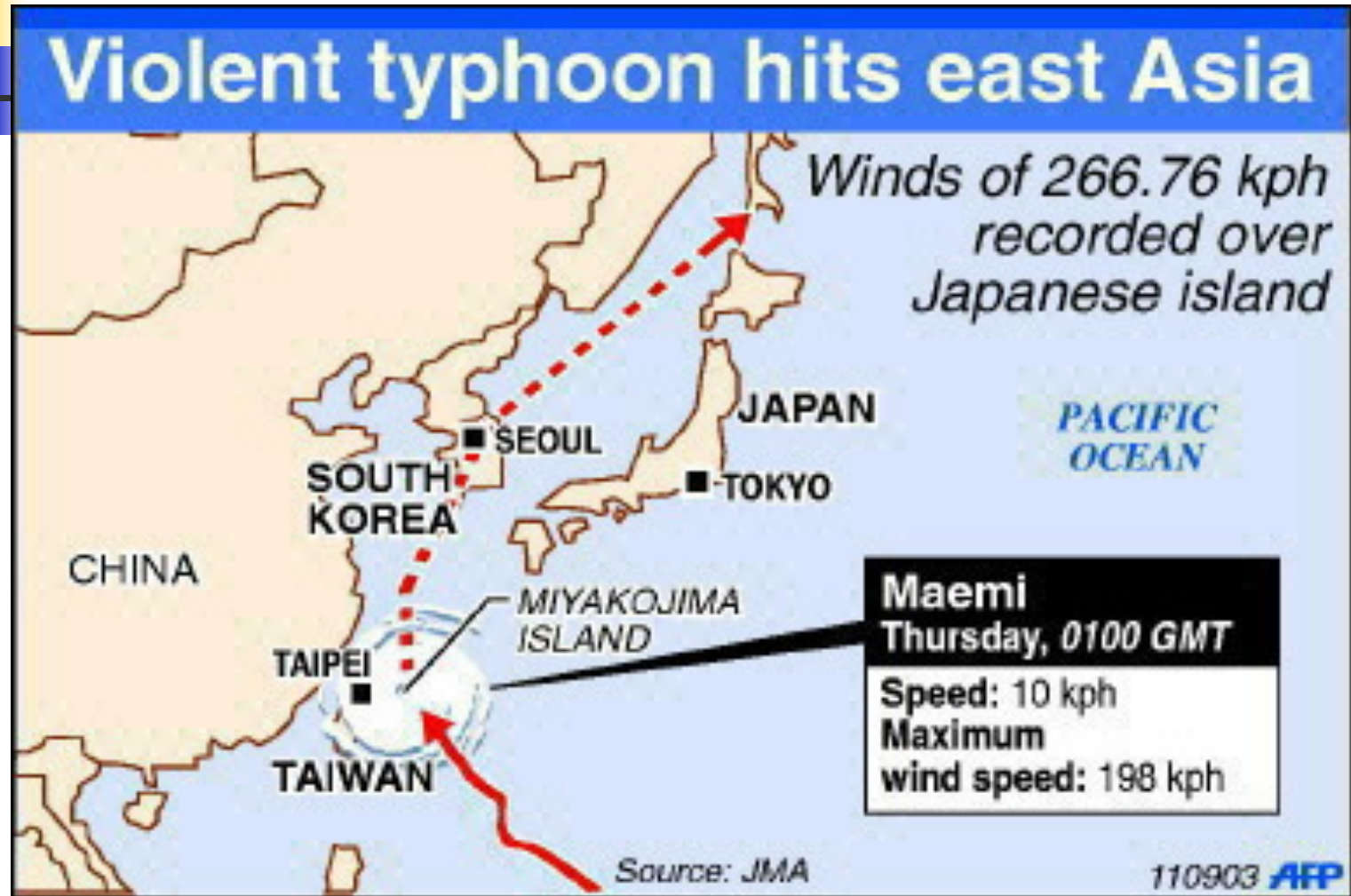


Super Typhoon Maemi

September 3-13, 2003



Super Typhoon Maemi



Weblines for Super-Typhoon Maemi

**Maemi could
cost 1.2 billion USD**

Typhoon Maemi devastates
parts of South Korea

Life after typhoon Maemi

Typhoon Maemi produces
major destruction in
South Korea

**78 dead, thousands homeless
in typhoon fury**

**Most powerful typhoon since 1904:
causes 4.1 billion USD in damage**

Typhoon Slams Pusan,
South Korea

**Maemi ravages South Korea,
at least 110 dead**

Maemi leaves 110 dead

**Typhoon Maemi kills
at least 72**

Typhoon Maemi slams
South Korea: a fury
unseen in a century

**Maemi kills 1, injures 93
in southwestern Japan**

**Debris washed onto shore after
typhoon Maemi hits S. Korea**

33 dead as typhoon
Maemi pounds
south Korea

**Massive Typhoon Maemi
pounds South Korea**

South Korea battered
by Maemi

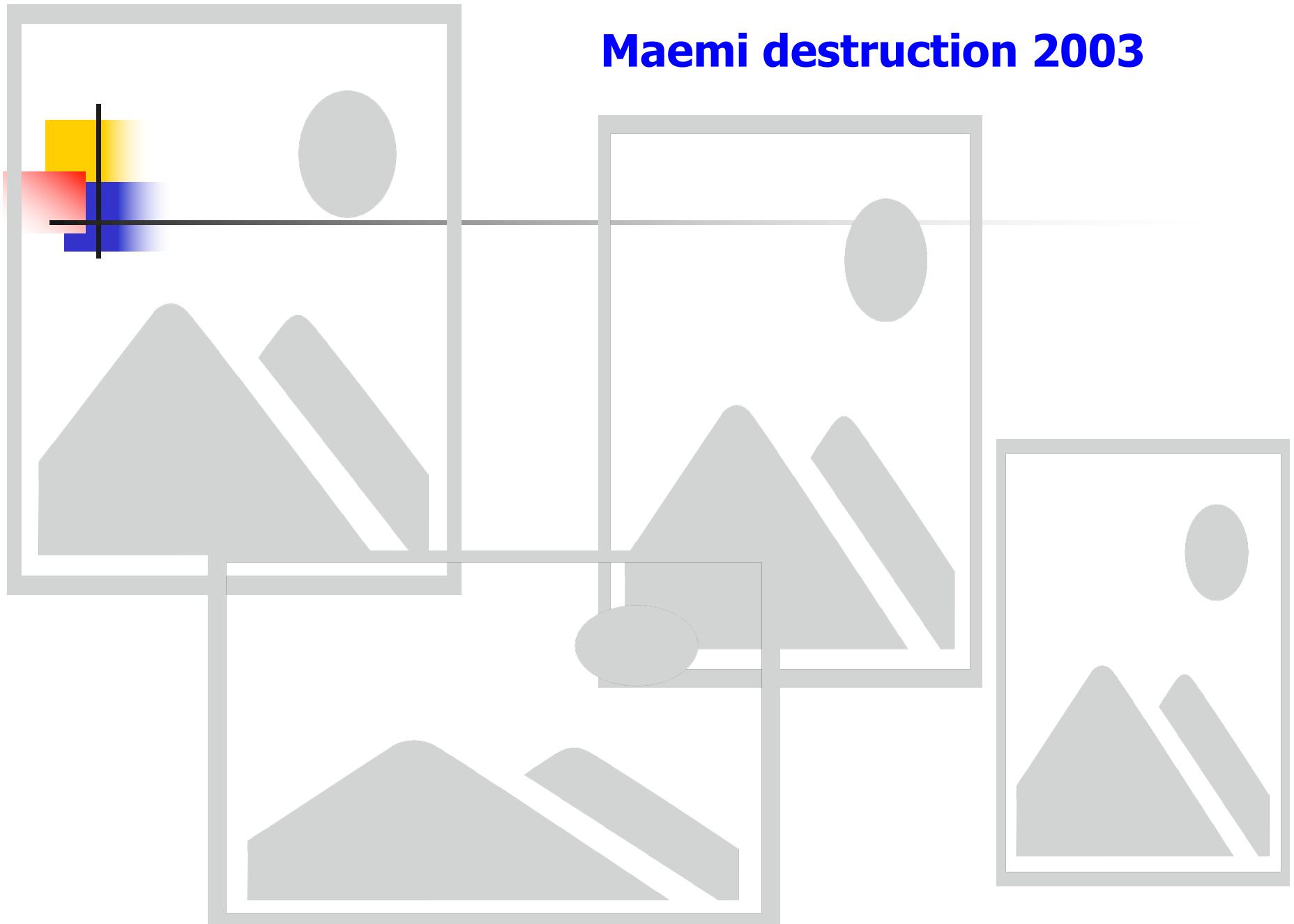
**Maemi cuts through Jeju
into Korean peninsula**

**Typhoon Maemi to
bring torrential rains to
Taiwan Thursday**

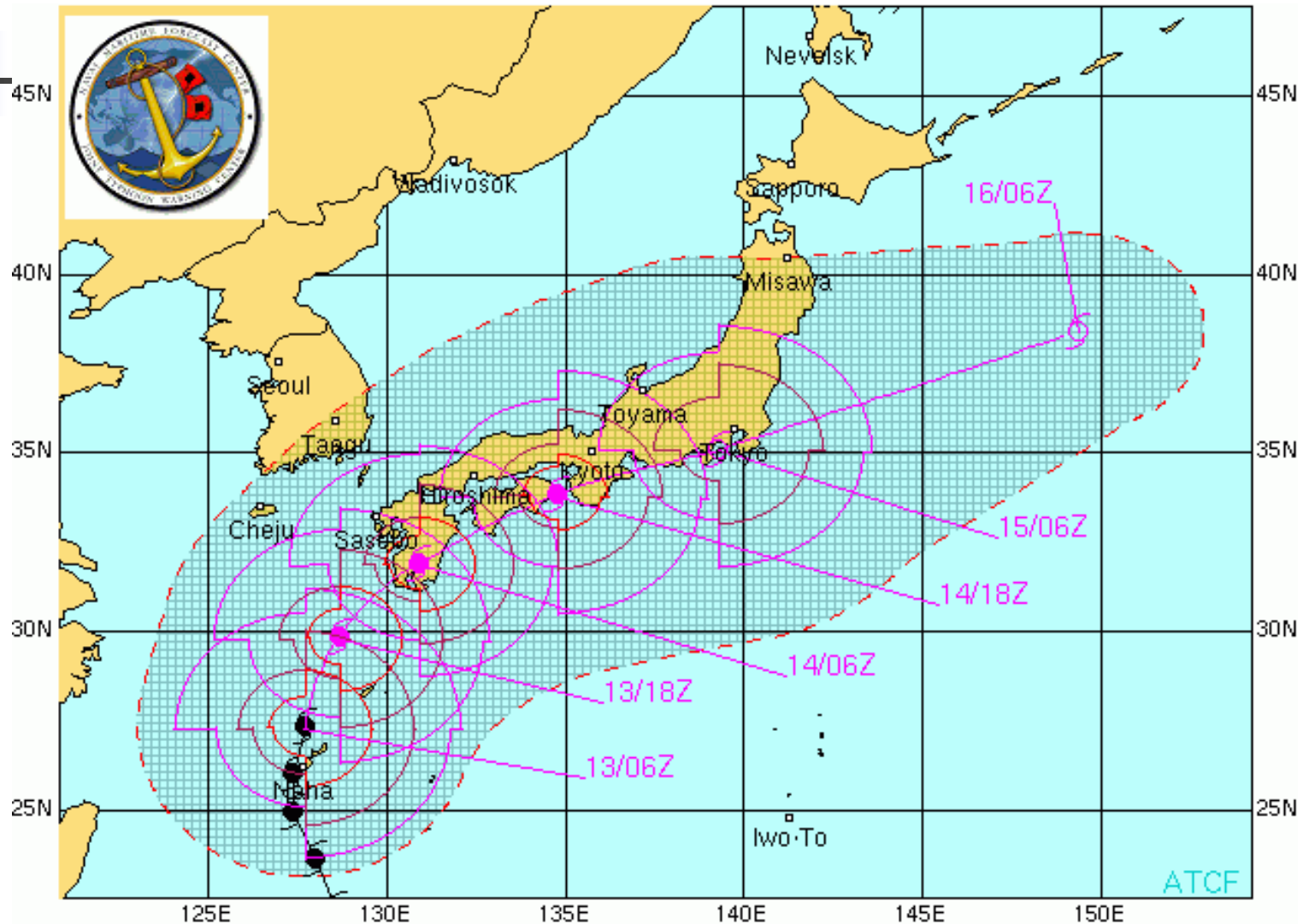
**NGO to assist typhoon
Maemi victims**

Maemi inflicts heavy damage,
capsizing fishing vessels,
toppling cranes

Maemi destruction 2003



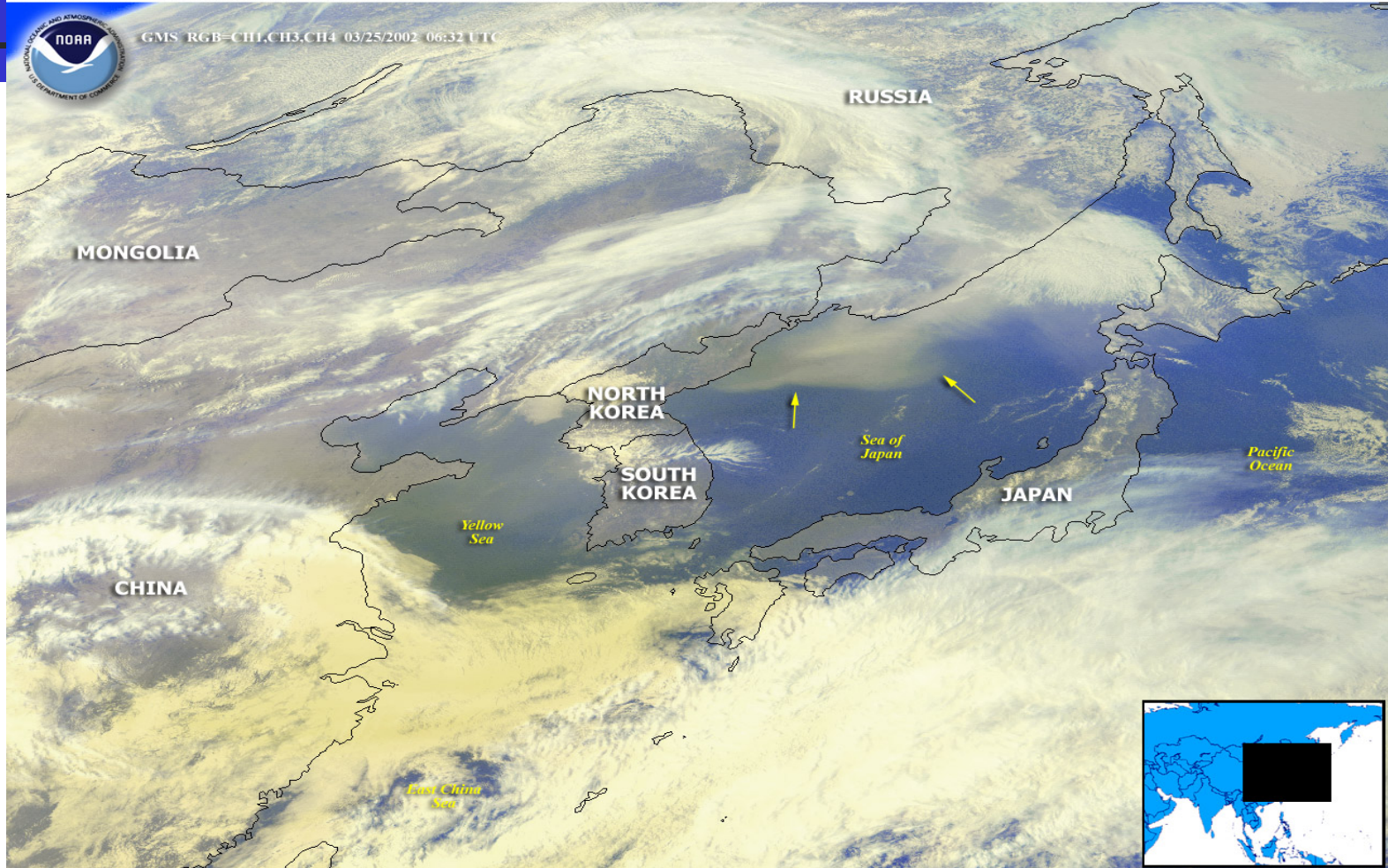
Typhoon Man-Yi (July 13, 2007)



Super Sandstorm 2002 (in Northern China)

Airborne dust and possible smog (indicated by the yellow arrows) is visible blowing over the Yellow Sea and the Sea of Japan.

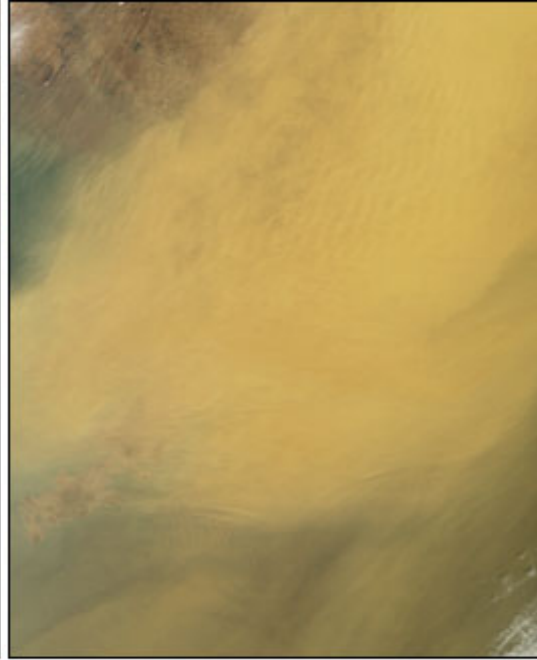
CREDIT: NOAA



Liaoning Peninsular before and after sandstorm



March 23, 2002



April 8, 2002

Beijing, Forbidden City

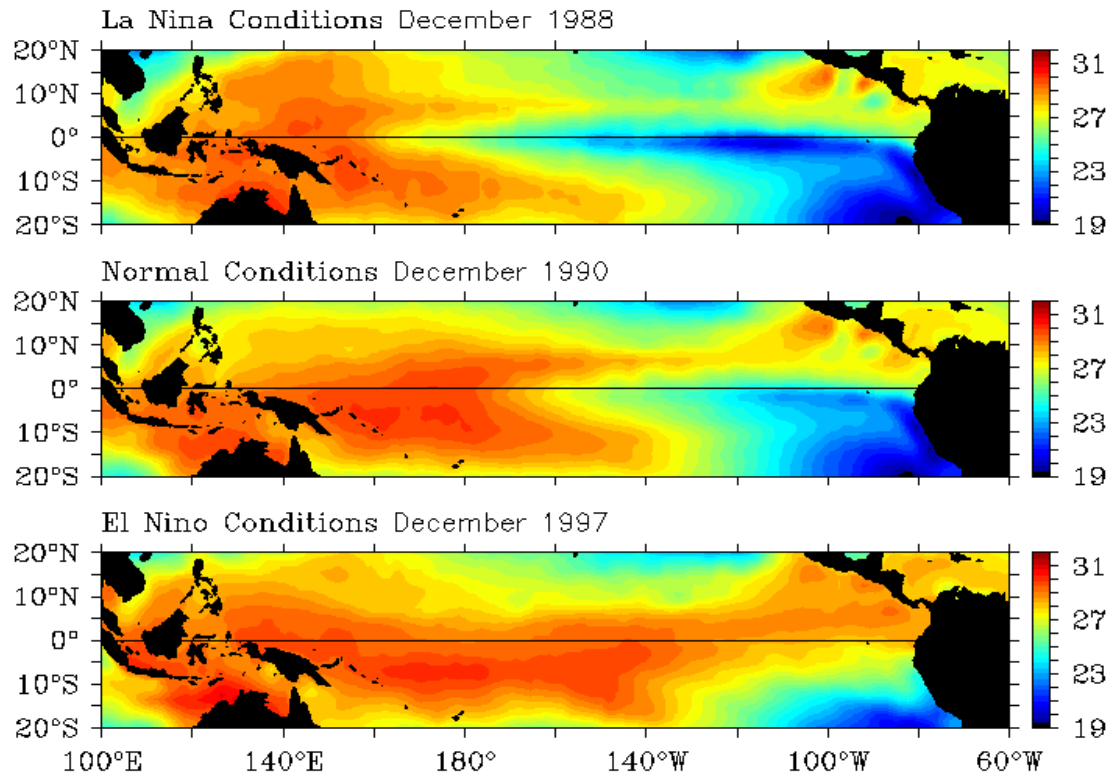


Beijing commuters



High Impact Climate: 1997-98 El Niño of the 20th Century

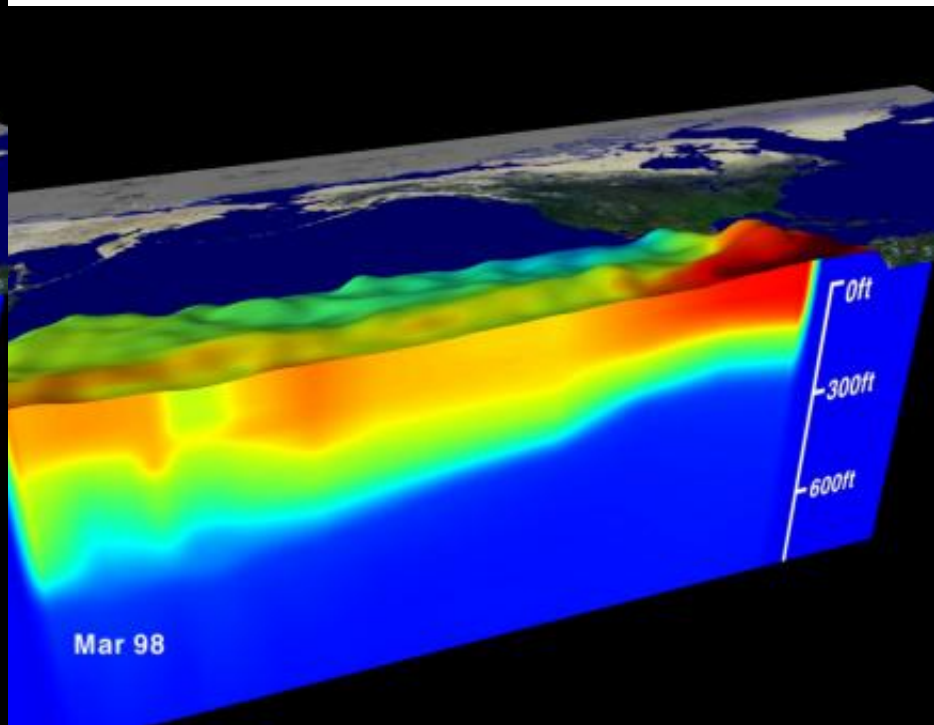
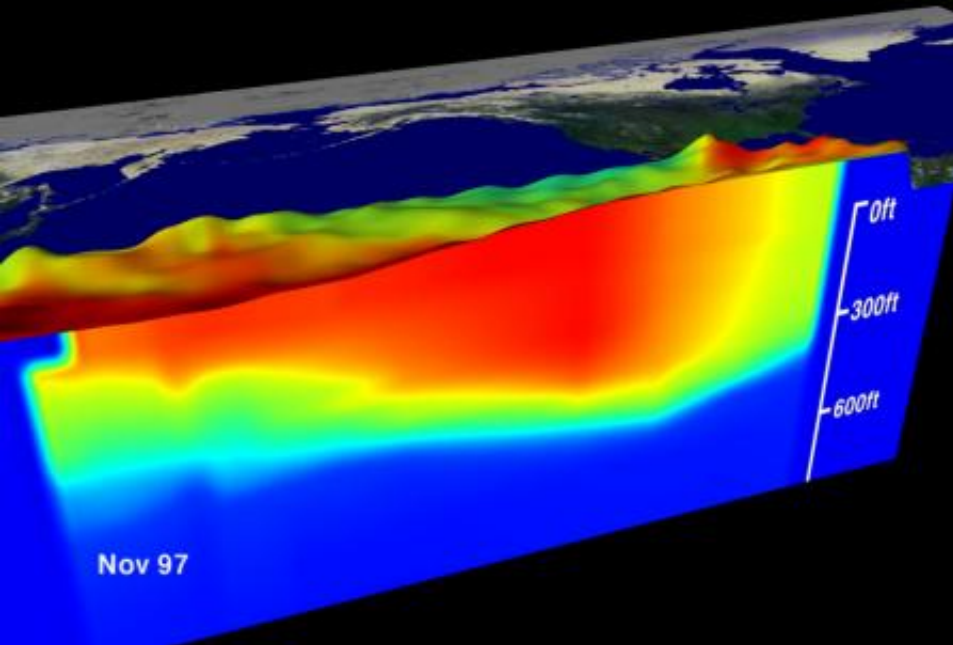
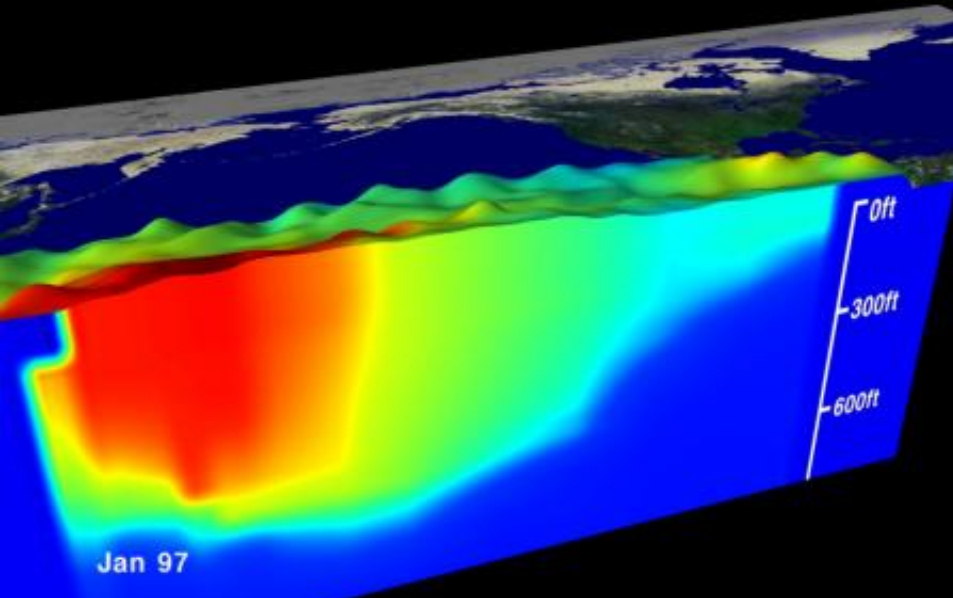
Reynolds Monthly SST ($^{\circ}\text{C}$)



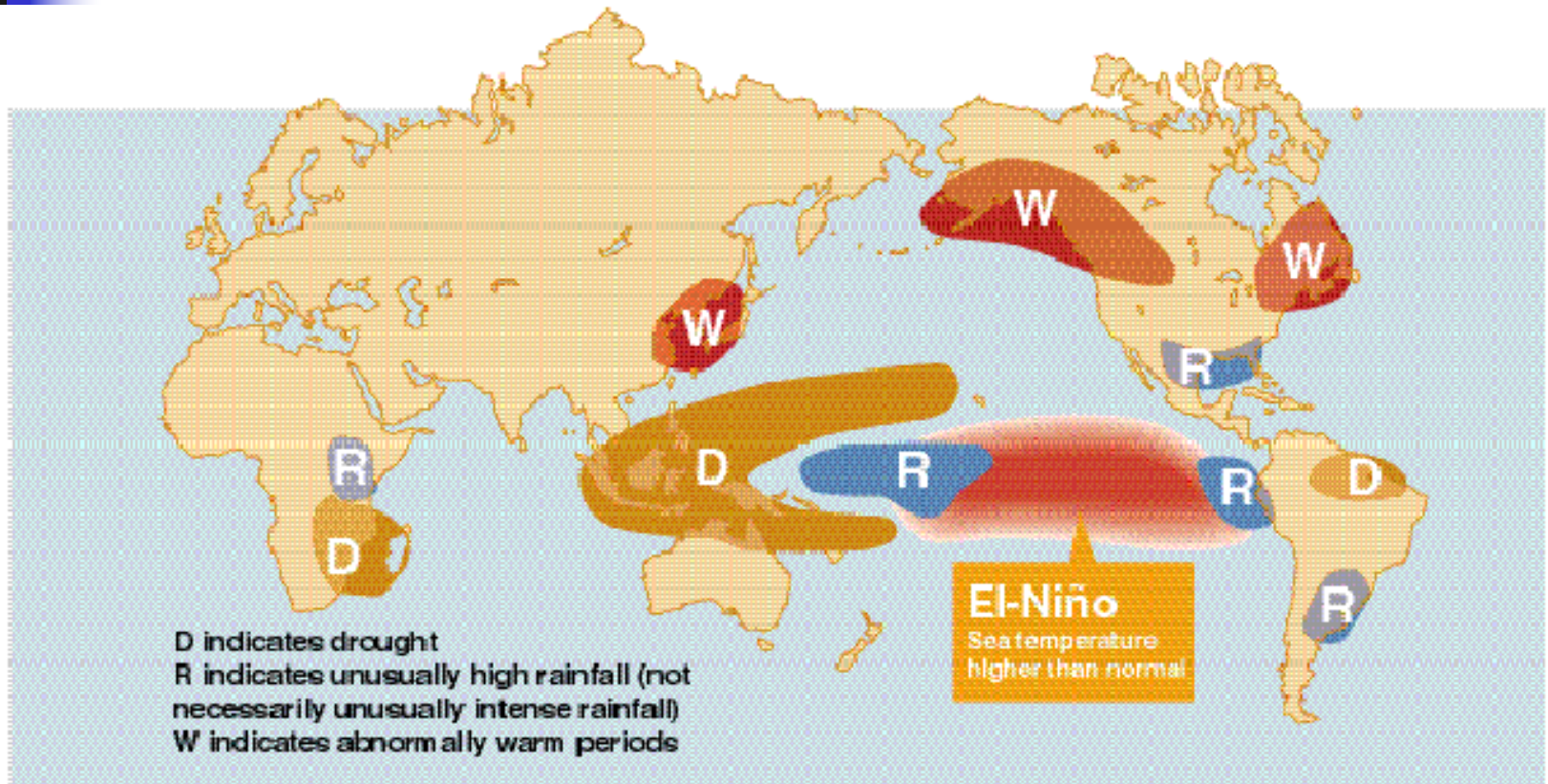
TAO Project Office/PMEL/NOAA

El Niño is a High Impact Climate episode that catalyzes the onset
of High Impact Weather events

Ocean temperature profile, equatorial Pacific during the 1997-98 El Niño of the century



Impacts That Generally Accompany El Niño Events

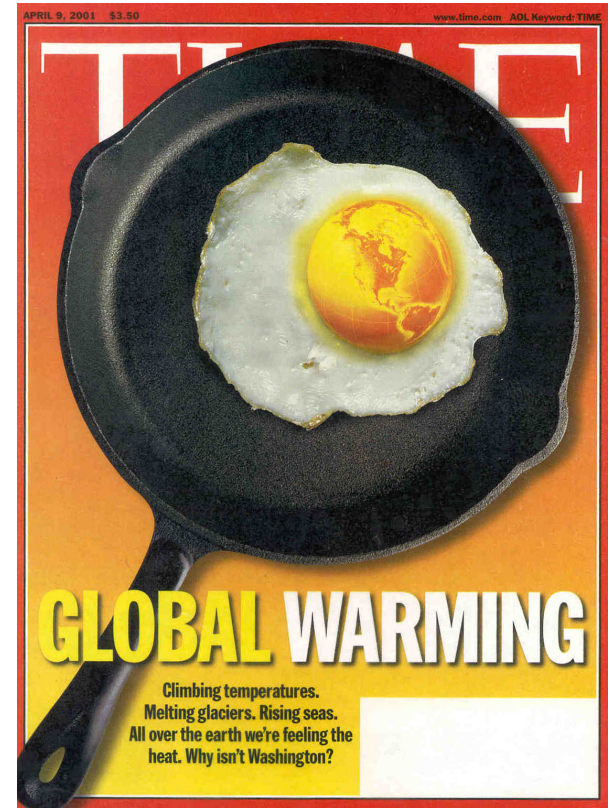


El Niño-related fires & haze 1997-98



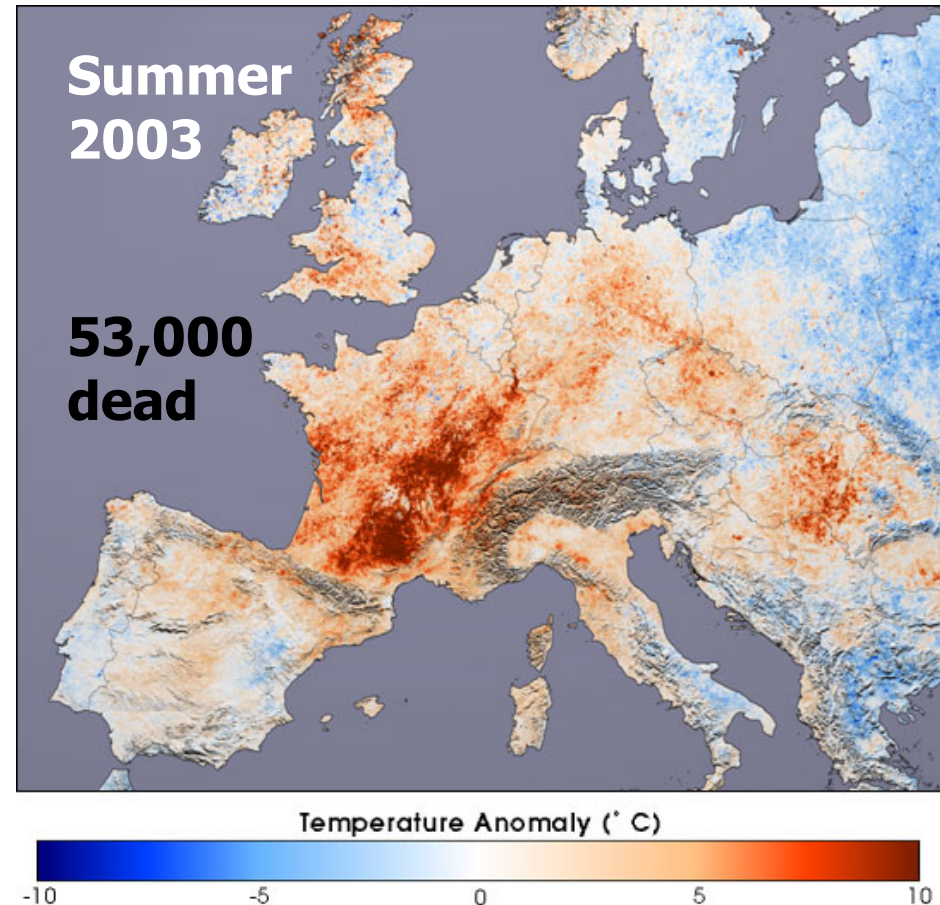
Concerns About Climate Change

- Some Changes Can Be Expected
- Others Cannot Be Anticipated
- ***Types of surprises:***
 - Expectable, unexpected
 - Timing
 - Location
- ***Surprises***
 - Climate
 - “Superstorms”
 - Climate-related
 - Droughts, floods, fires, infectious disease outbreaks, e.g., “events of the century”
 - Antarctic ice disintegration
 - Widespread food shortages



Extremes will change in a **WARMER** climate

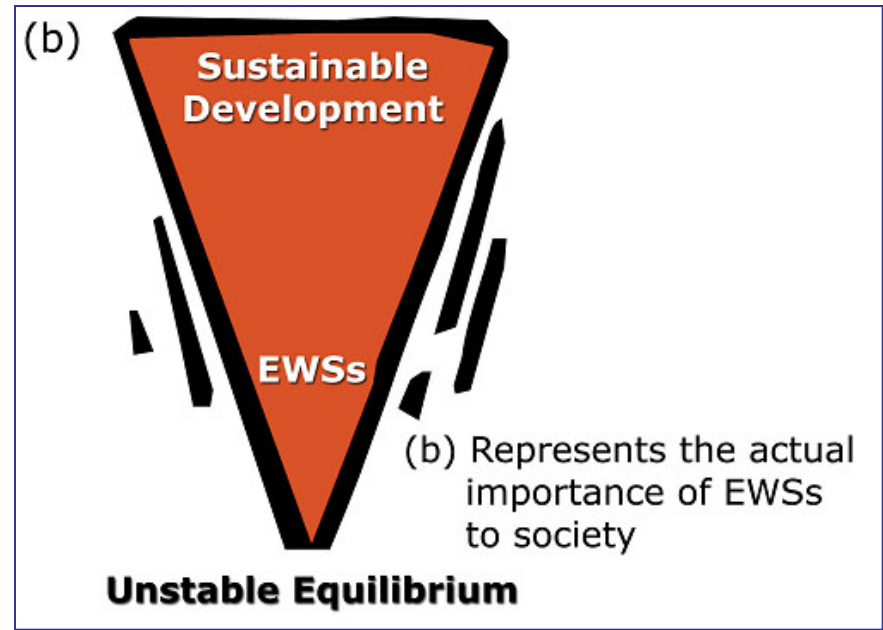
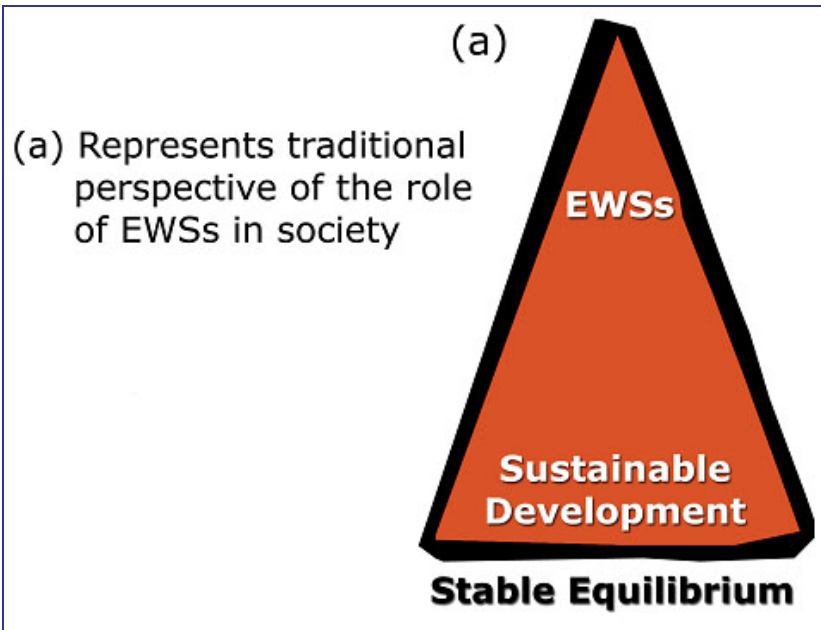
Extremes such as typhoons, floods, droughts, fires, heat waves and disease outbreaks



Demographic Changes affect severity of climate impacts



EWSs more important than some governments might realize





Highlights about early warning systems

EWS are more important than most governments realize

- **People disagree about each word in EWS**
 - **(early, warning, system)**
- **Early warnings are politically sensitive**
- **One EWS does not fit all users' needs**
- **EW is a risky as well as a thankless job**
 - **“Success has many fathers. Failure is an orphan”**
 - **People recall failed warnings more than successful ones**



Highlights about High Impact Events & Superstorms

- **“Superstorms” is an emerging category of high impact events.**
- **Decision makers need to realize the value to society of early warnings of high-impact hydro-meteorological events.**
- **Share experiences of coping with high impact events across political borders, cultures and continents.**



21st Century

TIME

Could the
21st Century
Become
"The Climate Century"

?