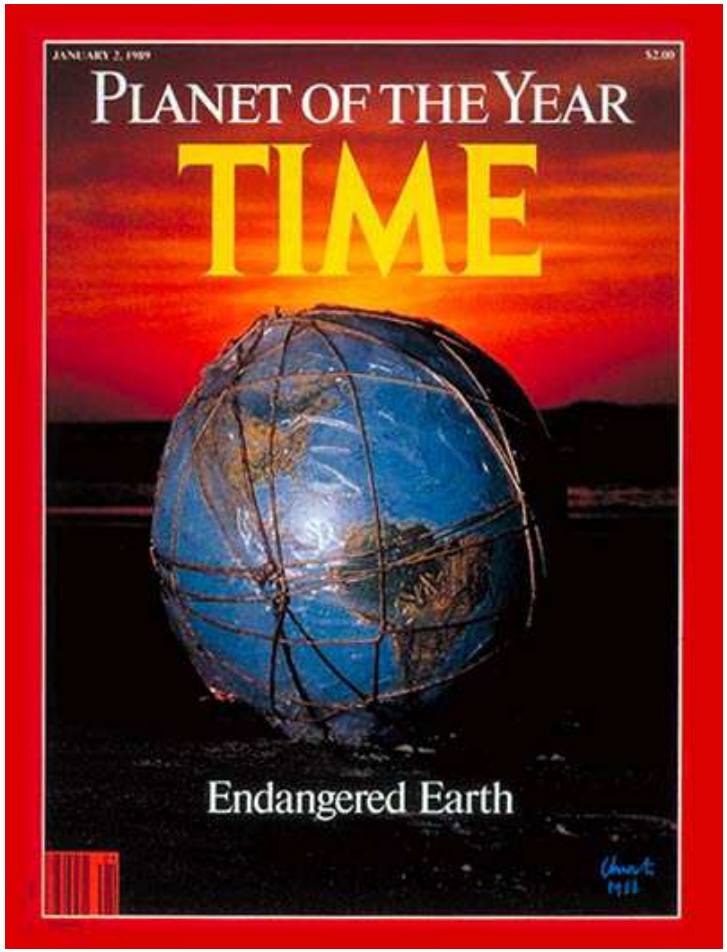
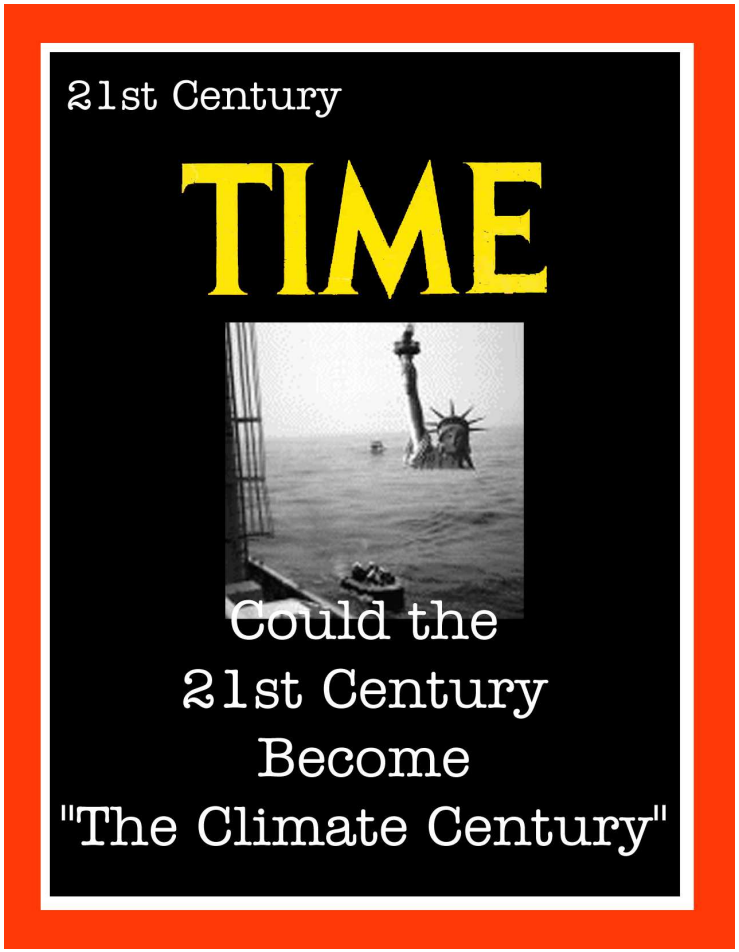
We need Nature more than Nature needs us

The planet in 1988



The climate system in 2020?



A Few Key Points

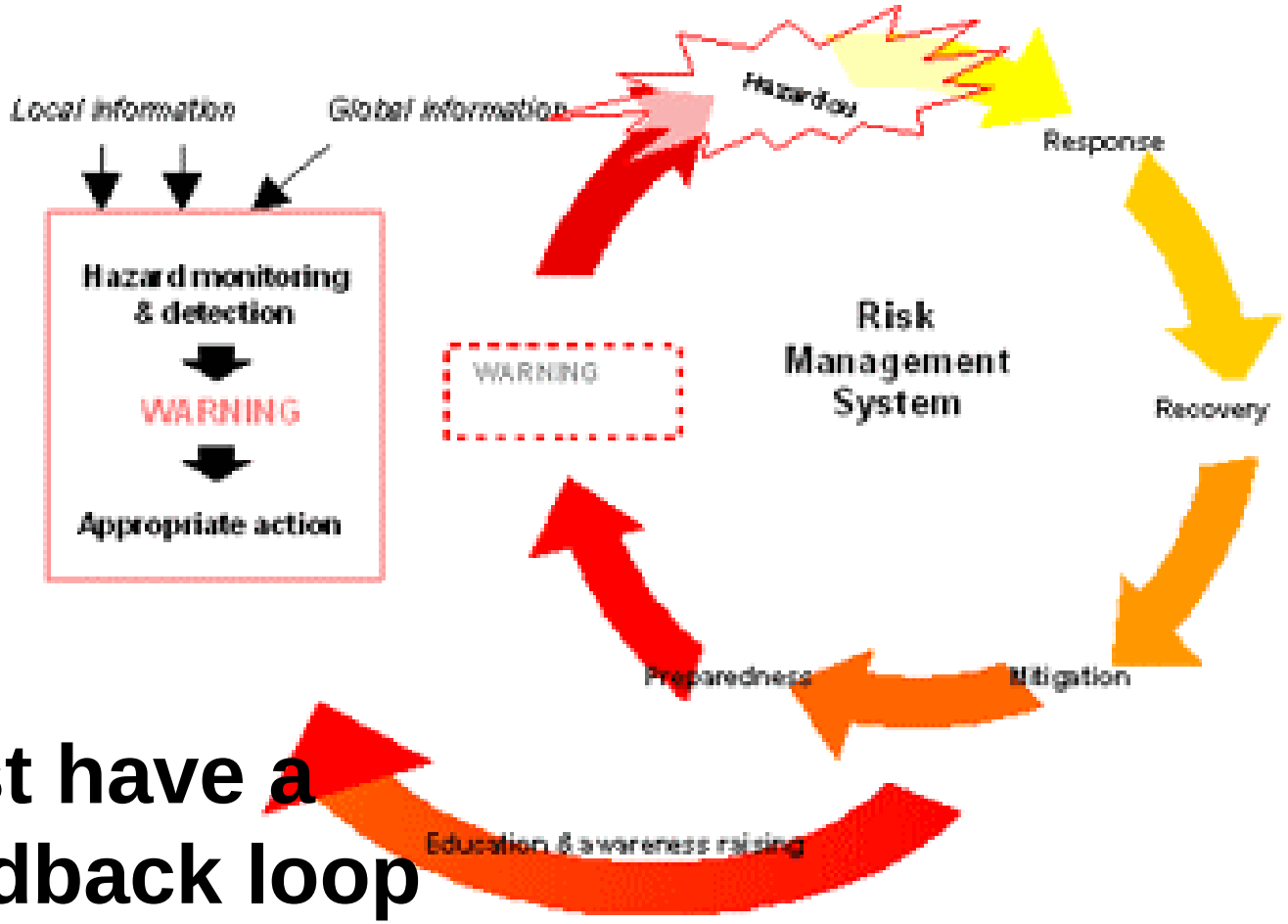
1. People are now an integral part of the climate system
2. Need to forecast changes at interface on climate-society-environment interactions
3. Creeping environmental change is as important as quick onset
4. Governments do not like to pay for monitoring, often seen as low priority
5. Late lessons from early warnings
6. early warning systems compete for attention, confusing the public
7. Weather and climate forecast value depend on how they are used

Forecast is not “end-to-end” !

Timely, accurate, unambiguous & credible

WARNING

And reliable as well



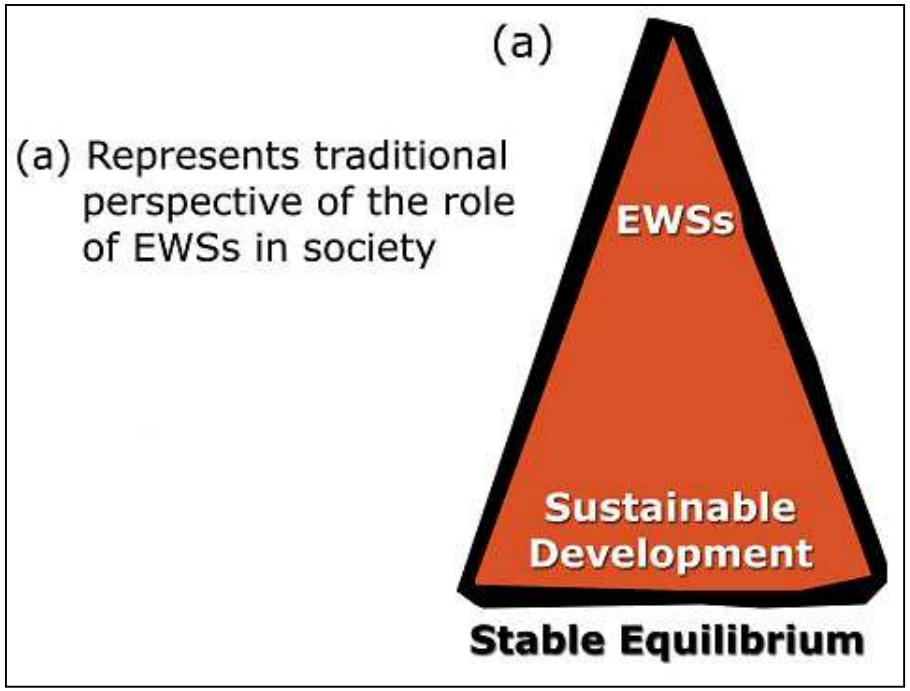
Must have a Feedback loop

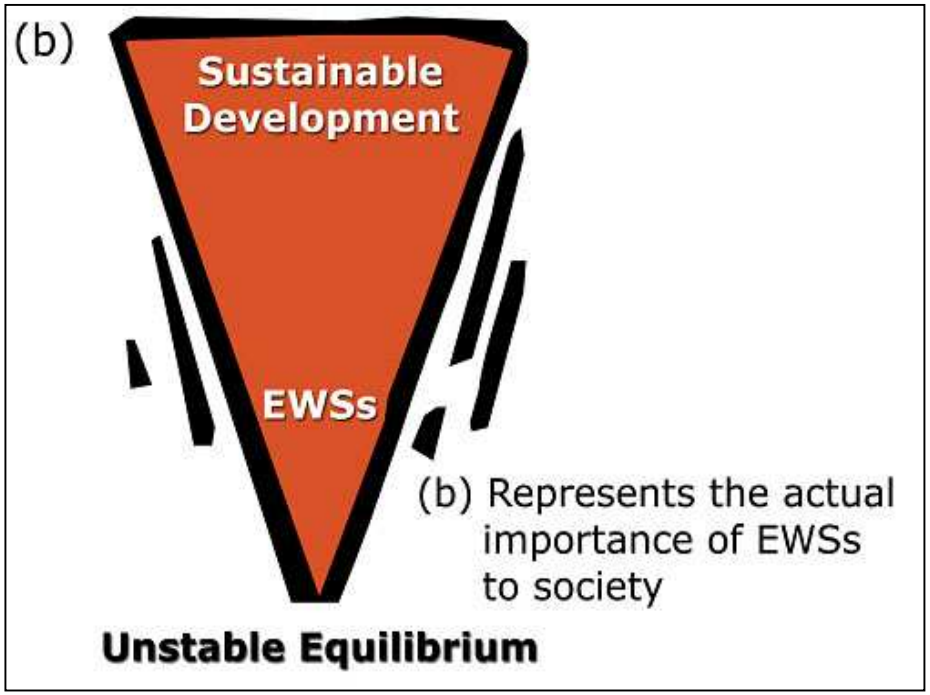
http://www.lirneasia.net/wp-content/newssl.gif

EWS is essential for security

- **Political**
- **Environmental**
- **Economic**
- **Cultural**
- **Hazards**
- **Resources**
- **Public safety**

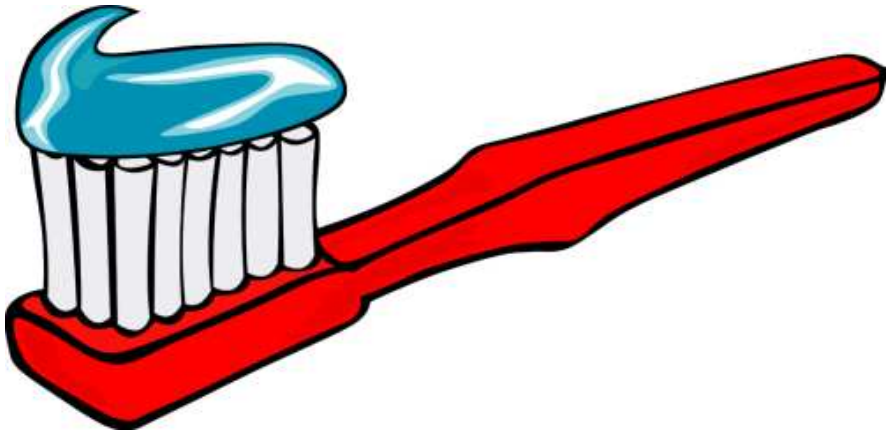
EWSs are more important than governments might realize





Societal needs from early warnings

- **Adaptation responses to climate variability, extremes, fluctuations and change require effective EWS**
- **Adaptation is a process that will require a society to prioritize to "adapt in parts" …**



Climate is one thing but …
what does “Climate-related” mean?

- Food
- Agriculture
- Energy
- Health
- Disasters
- Commerce
  - Manufacturing
  - Trade
  - Aid

•Climate-related, water-related and weather-related are common terms.

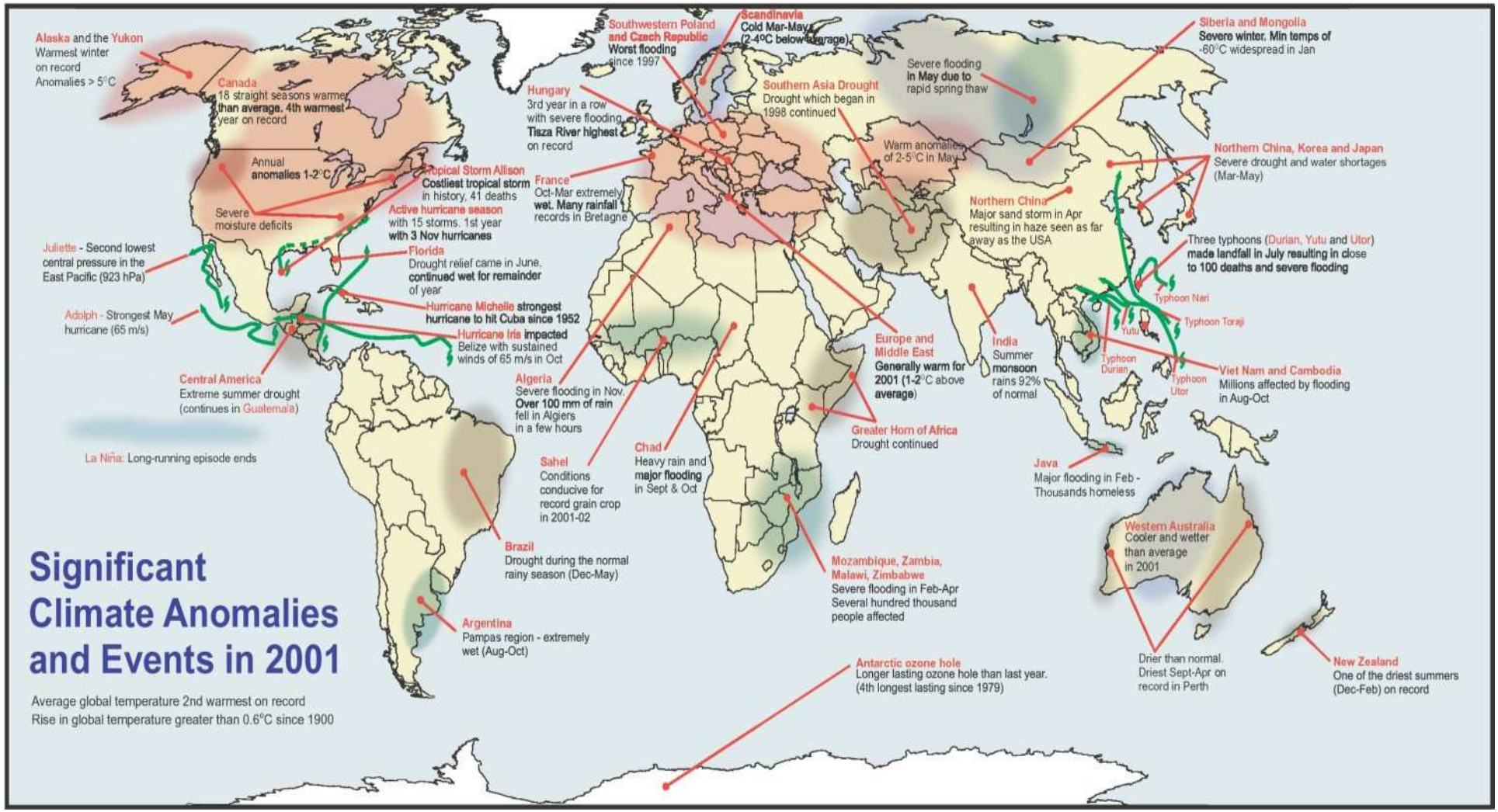
•Each one expands awareness of the influence of climate, water and weather processes and impacts on ecosystems and societies.

•The value of climate, water and weather knowledge is hidden below the surface as with an iceberg.

Perceptions about Climate

1. Climate as a hazard
2. Climate as a boundary constraint
3. Climate as a resource

Graph 2


Alaska and the Yukon
Warmest winter on record
Anomalies > 5°C
Canada
18 straight seasons warmer than average. 4th warmest year on record
Annual anomalies 1-2°C
Severe moisture deficits
Tropical Storm Allison
Costliest tropical storm in history, 41 deaths
Active hurricane season
with 15 storms. 1st year with 3 Nov hurricanes
Juliette - Second lowest central pressure in the East Pacific (923 hPa)
Florida
Drought relief came in June, continued wet for remainder of year
Adolph - Strongest May hurricane (65 m/s)
Hurricane Michelle strongest hurricane to hit Cuba since 1952
Hurricane Iris impacted
Belize with sustained winds of 65 m/s in Oct
Central America
Extreme summer drought (continues in Guatemala)
La Niña: Long-running episode ends
Southwestern Poland and Czech Republic
Worst flooding since 1997
Scandinavia
Cold Mar-May (2-4ºC below average)
Hungary
3rd year in a row with severe flooding
Tisza River highest on record
France
Oct-Mar extremely wet. Many rainfall records in Bretagne
Algeria
Severe flooding in Nov.
Over 100 mm of rain fell in Algiers in a few hours
Sahel
Conditions conducive for record grain crop in 2001-02
Chad
Heavy rain and major flooding in Sept & Oct
Brazil
Drought during the normal rainy season (Dec-May)
Argentina
Pampas region - extremely wet (Aug-Oct)
Southern Asia Drought
Drought which began in 1998 continued
Severe flooding in May due to rapid spring thaw
Warm anomalies of 2-5°C in May
Siberia and Mongolia
Severe winter. Min temps of -60°C widespread in Jan
Northern China, Korea and Japan
Severe drought and water shortages (Mar-May)
Northern China
Major sand storm in Apr resulting in haze seen as far away as the USA
Three typhoons (Durian, Yutu and Utor) made landfall in July resulting in close to 100 deaths and severe flooding
Typhoon Nari
Typhoon Toraji
Yutu
Typhoon Durian
Typhoon Utor
Viet Nam and Cambodia
Millions affected by flooding in Aug-Oct
Europe and Middle East
Generally warm for 2001 (1-2°C above average)
India
Summer monsoon rains 92% of normal
Greater Horn of Africa
Drought continued
Java
Major flooding in Feb - Thousands homeless
Mozambique, Zambia, Malawi, Zimbabwe
Severe flooding in Feb-Apr
Several hundred thousand people affected
Western Australia
Cooler and wetter than average in 2001
Drier than normal. Driest Sept-Apr on record in Perth
New Zealand
One of the driest summers (Dec-Feb) on record
Antarctic ozone hole
Longer lasting ozone hole than last year. (4th longest lasting since 1979)
Significant Climate Anomalies and Events in 2001
Average global temperature 2nd warmest on record
Rise in global temperature greater than 0.6°C since 1900

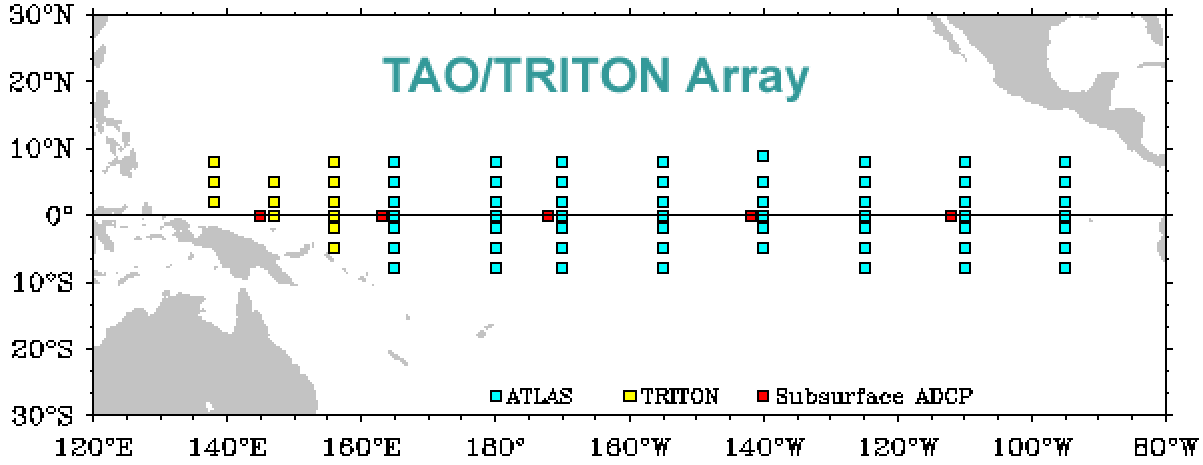
Types of hazards

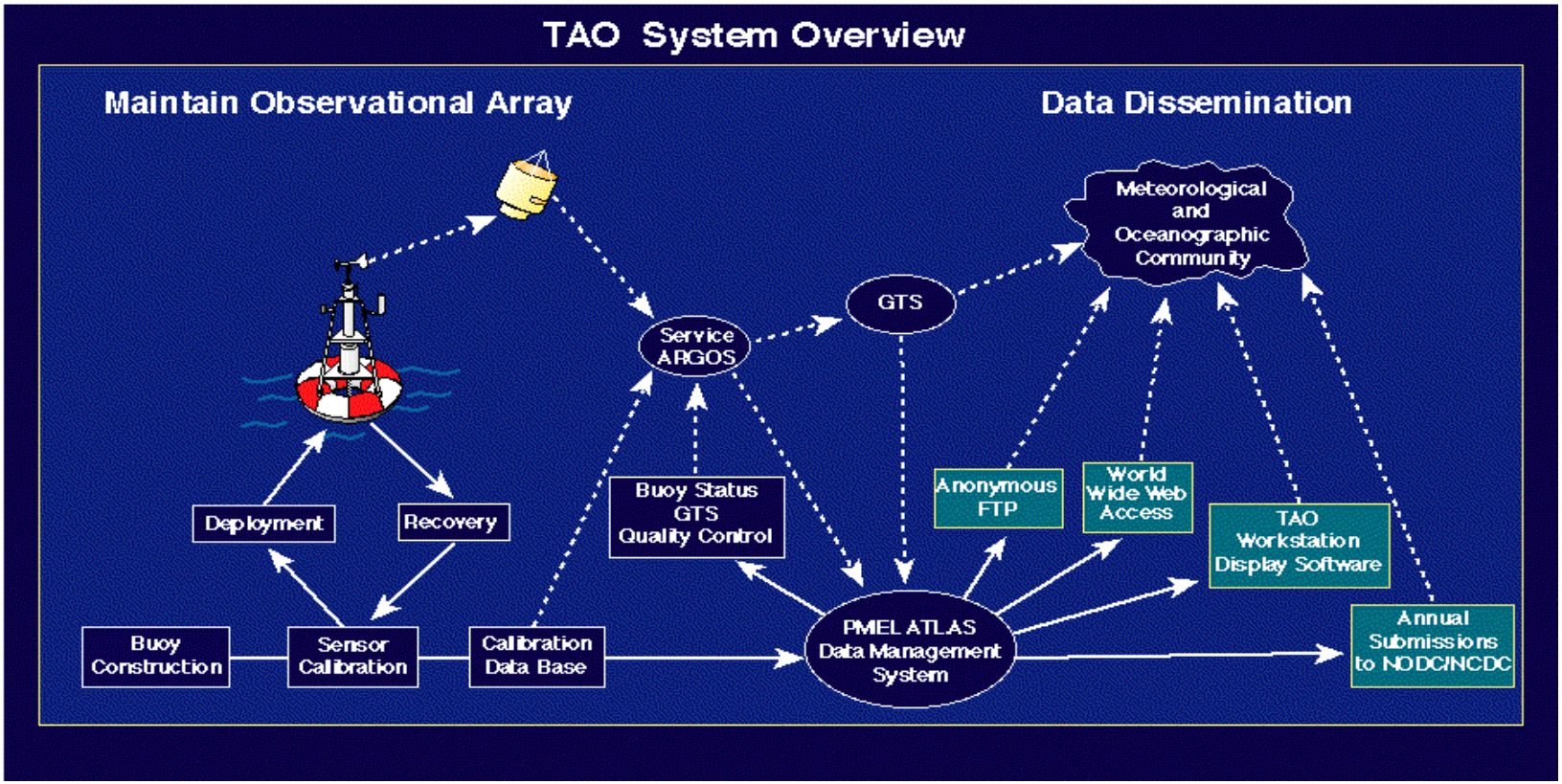
- **Quick onset**
  - **Hi threat, crisis**
  - **Short time to respond**
  - **Hi cost of impacts**
- **Creeping (CEPs)**
  - **Long-term**
  - **Low grade**
  - **Cumulative**
  - **Incremental cost of impacts**
  - **Deal with it later**

Governments have great difficulty focusing on CEPs

Monitoring for El Nino:

Part of an EWS






El Nino
No El Nino
Not sure, yet
El Niño Forecast
Olympic Trials

And then there is …
Abrupt climate change!

Early warning affairs:
An education and training opportunity

- **The “affairs” notion refers to multi-issue aspects related to warnings about hazards.**
  - **Aspects include:**
    - **EW science**
    - **EW & society**
    - **EW & environment**
    - **EW policy and law**
    - **EW politics**
    - **EW economics**
    - **EW technology & techynique**
    - **EW ethics& equity**
      - **Who provides EW to people in zones in conflict?**

EW science

- **What is needed:**
- **Time series (qualitative and quantitative)**
  - **For the threat(s) of concern**
- **Monitoring**
  - **Identification of critical thresholds**
- **Models**
- **Experience**
- **Hazards research**
  - **EWs vary for different threats**

Foreseeability

- **Scientists tend to rely on probabilities**
  - **For hazard occurrence**
  - **For potential impacts**

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

EW impacts

- **Excellent EWS**
- **Good EWS**
- **Poor EWS**

- **EWS Success depends on:**
  - **Track record of warnings**
  - **Accurate warning**
  - **Timeliness**
  - **Dissemination**
  - **Understanding**
  - **Response**

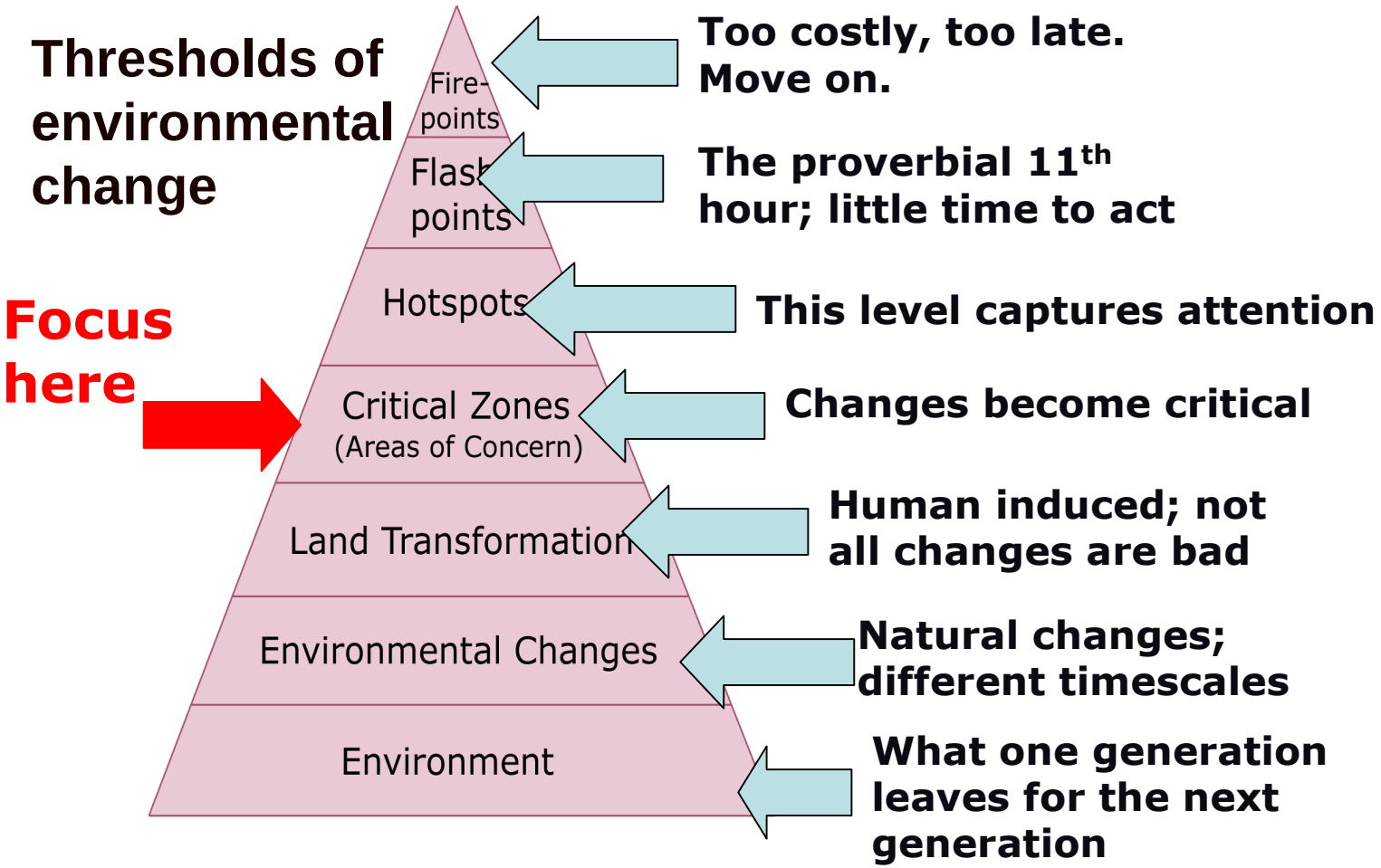
EW Policy & Law

- **Every country has a number of EWSs for climate, water and weather related hazards**
- **Some are formal and official**
- **Some are informal and indigenous**

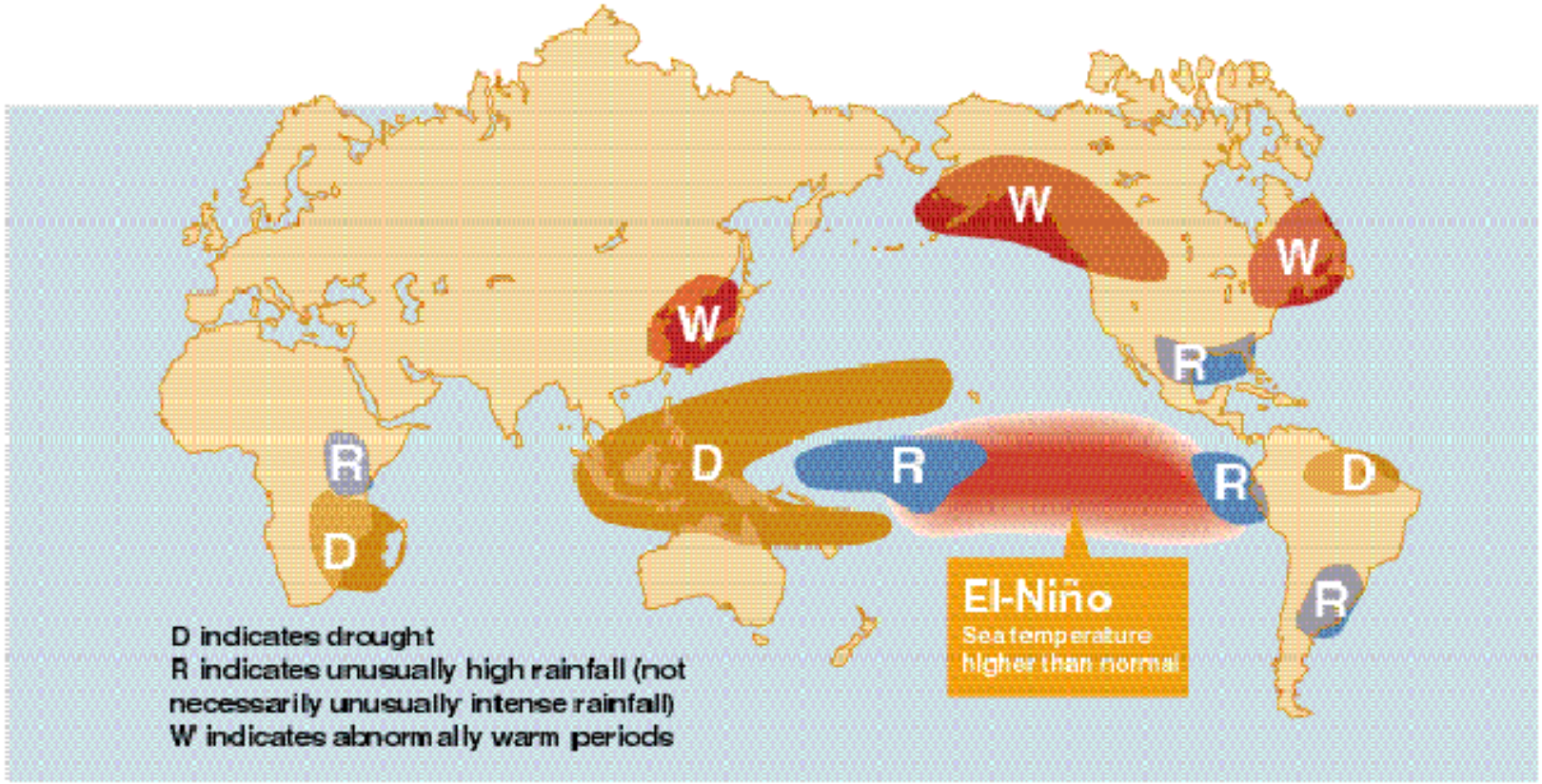
- **I found 11 EWSs for famine in the Sudan !!!**

EW Politics

- **Political issues surround all facets of an EWS**
  - **Who is to be warned first, and when?**
- **Competing EWSs**
  - **Government agencies, NGO, private sector, Media**
- **Competing political, economic and cultural interests**


Thresholds of environmental change
Focus here
Fire-points
Flash points
Hotspots
Critical Zones
(Areas of Concern)
Land Transformation
Environmental Changes
Environment
Too costly, too late. Move on.
The proverbial 11th hour; little time to act
This level captures attention
Changes become critical
Human induced; not all changes are bad
Natural changes; different timescales
What one generation leaves for the next generation

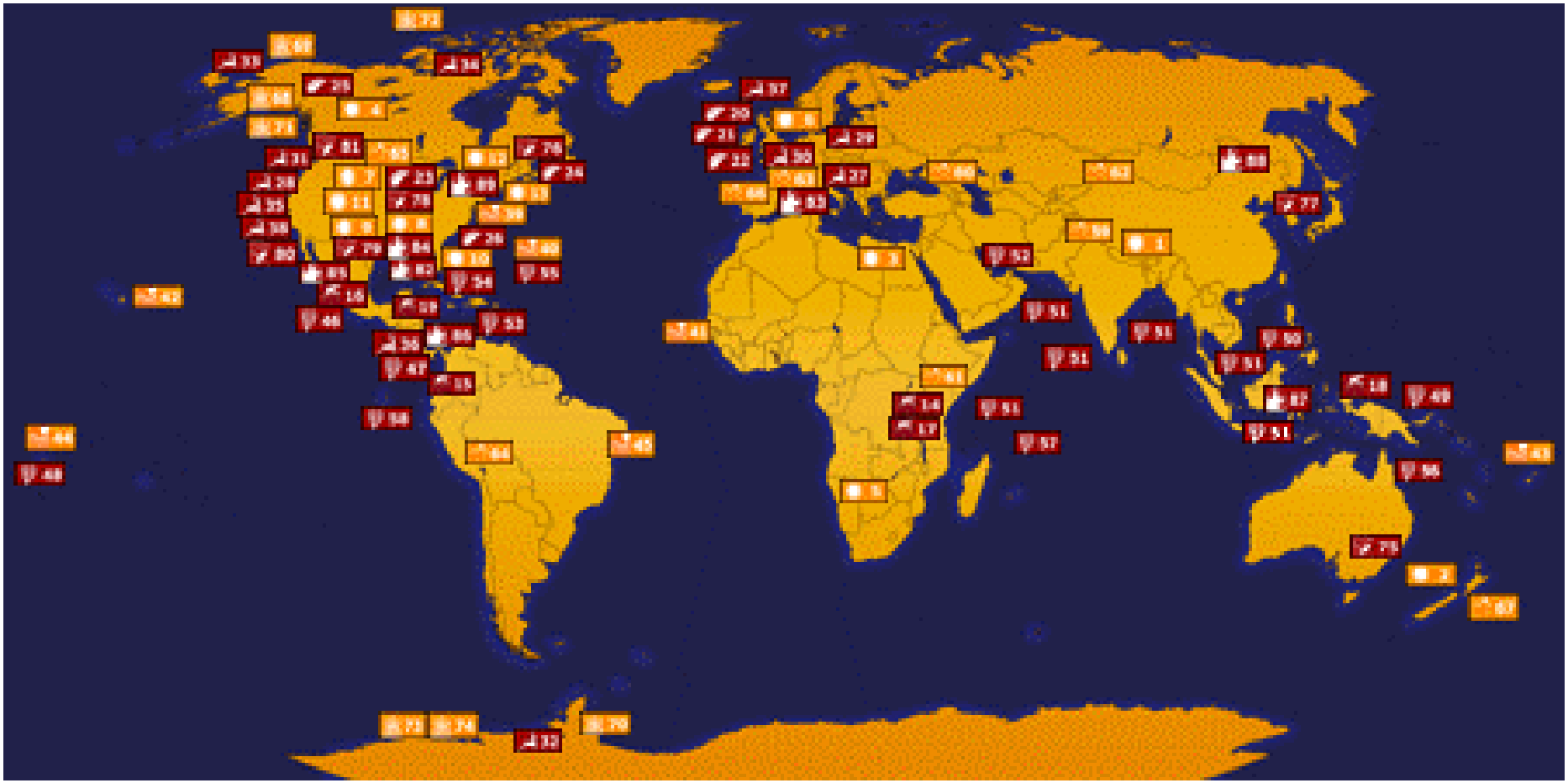
El Nino Hotspots??



Great Map (circa 1986) ! Put this in the home for the aged.

RE-DO this with new scientific information.

Global Warming hotspots



Climate Tipping Points ("hotspots")

A "Place" as Early Warning

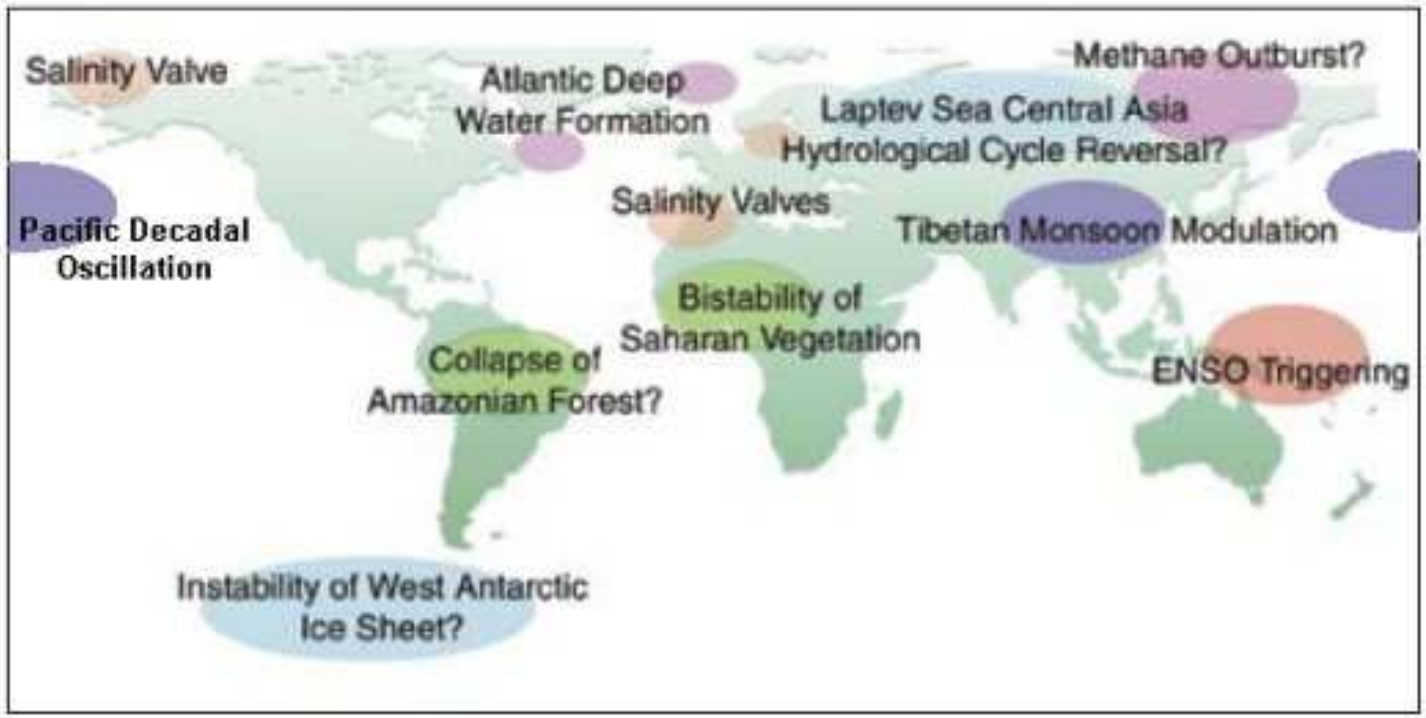


Figure 17. Critical region analysis of hot spots or switch and choke points: an early attempt at identifying parts of the Earth where changes at the regional scale can cause significant changes in the functioning of the Earth System as a whole.

Source: Schellnhuber (2002) In Steffen et al., Challenges of a Changing Earth, Springer.

EW Economics

- Who is paying for EWS? Who is warned?
- Cost for an EWS
- Benefits from an EWS
- Cost/benefits
  - For monitoring the hazard(s)
  - For constructing the warning
  - For disseminating the warning
  - For educating the public about, hazard, warning, required response
- How do you put a cost on “misery”?
- What is the benefits from no misery?

EW Ethics & Equity

- **Who is involved in the EW System?**
- **Who get the warning? Who won't?**
- **Who gets the warning first?**
- **In what languages are the warnings issued?**
  - **Scientific jargon or street language?**
- **How is the warning delivered?**
- **Who issues the warning?**
- **Which early warning to listen to?**
- **Government's role in EWS for hazards?**

EWSs technologies & techniques

- **Monitoring**
  - **from space**
  - **on the ground**
  - **From Internet**
- **New indicators**
  - **Qualitative, quantitative, folkwisdom, anecdotal**
- **New methods of detection**
- **Scientific breakthroughs**
- **Analogues & History**

What do we want an EWS to address?

- Vulnerability reduction
- Resilience enhancement
- Instability avoidance
- Sustainability
- Adaptation to, mitigation or prevention of adverse environmental changes
- Reduction of uncertainty
- Minimize the possibility of surprise
- Inform decision makers

mhg

One EWS does not (cannot) meet all needs

- **Frequency of different hazards play a major role in the differences in …**
  - **Perceived reliability of warnings**
  - **Sustained interest in an EWS**
  - **Sustained financial support for an EWS**
  - **Discounting the past (a tendency)**
    - **e.g., I do not know the hazards my grandfather witnessed**

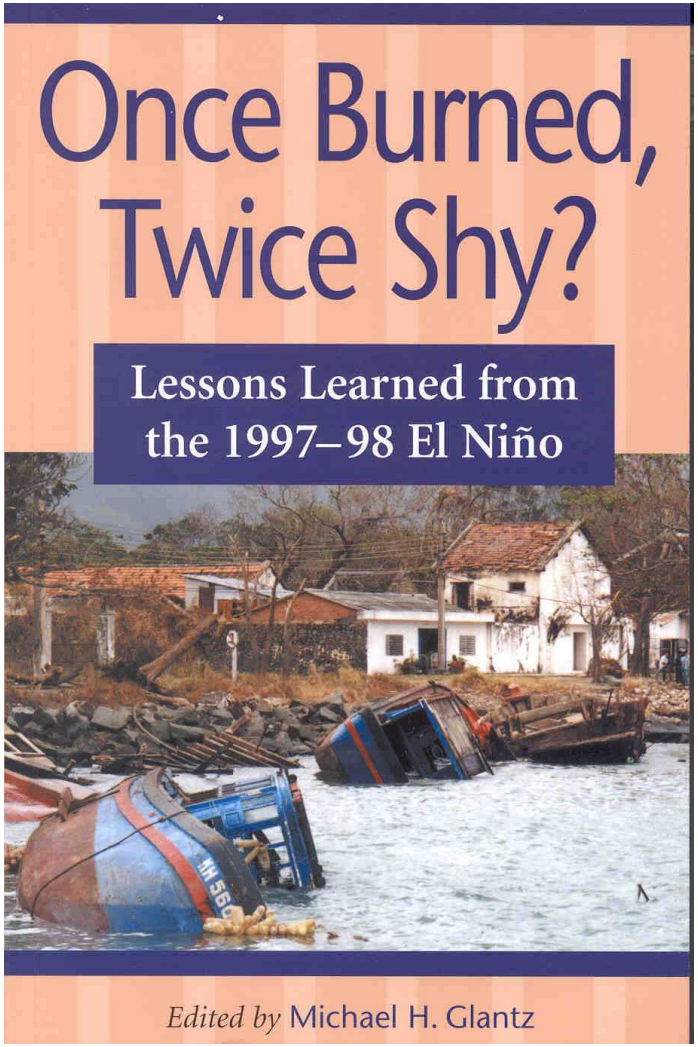
One forecast: three perceptions

- **1997-98 El Nino forecast: NOAA June 1997**

- **Kenya**
- **Costa Rica**
- **Peru**

- **Because there is a forecast or warning does not mean it will be perceived in the same way**

“Once Burned, Twice Shy” 2000 (UNU Press)



Knowledge: an El Nino example

- El Nino knowledge encompasses
  - Time series
  - physical and biological parameters
  - Historical documents, records & stories
  - Traditional knowledge
- Along with …
  - Forecasts
  - A Super El Nino was forecast for 2006
    - Usually there are competing forecasts
    - Whose to believe?

A foreseeability example:
Zimbabwe 2002-03 El Nino

- **1997-98 El Nino Forecast**
- **The historical record of droughts and their consequences in the region**
- **Zimbabwe's role as regional food source**
- **Internal politics**
- **Global community concerns**

- **Food insecurity was a likely result and did occur**

Defining hotspots

- What do we mean by hotspots?
- How does it relate to other concepts?
  - Environmental changes
  - Early warning
  - Critical zones (Areas of concern, AOCs)
  - Flashpoints
  - Firepoints

Types of hotspots

- Groundwater contamination hotspots (agr)
- Dirty water hotspots (Johannesburg)
- Hotspots for dengue fever (New Zealand)
- Regional weather and climate hotspots
- Tuberculosis (TB) hotspots
- Disaster hotspots
- “hottest of hotspots” (e.g., Madagascar)
- Forest (Guinea) & forest fire (Canada) hotspots
- Point source vs. area source for hotspots

What about climate-related hotspots?

- **These would involve the usual list of climate anomalies or extremes.**
  - **El Nino or La Nina events**
  - **Prolonged drought (year to year)**
  - **Floods**
  - **Fires**
  - **Shifting locations of vectors, locust, other**
  - **Severe storms (rain, wind)**
  - **Dust storms**