

World Meteorological Organization

Role of WMO and National Meteorological and Hydrological Services in Developing More Disaster Resilient Communities

By

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Agenda

- Disaster Risk Management (DRM)
- Role of World Meteorological Organization (WMO) and National Meteorological and Hydrological Services (NMHSs) in DRM
- Effective Early Warning Systems



- **Disaster Risk Management (DRM)**

- Role of World Meteorological Organization (WMO) and National Meteorological and Hydrological Services (NMHSs) in DRM
- Effective Early Warning Systems

We cannot avoid hazards



...but we can Prevent Them from Becoming Disasters



One Dollar spent on disaster preparedness can prevent 5 - 10 Dollar of disaster-related losses

Source: World Resources Institute

When a Disaster Happens, it Impacts Across Various Economic Sectors



Agriculture & Food Security

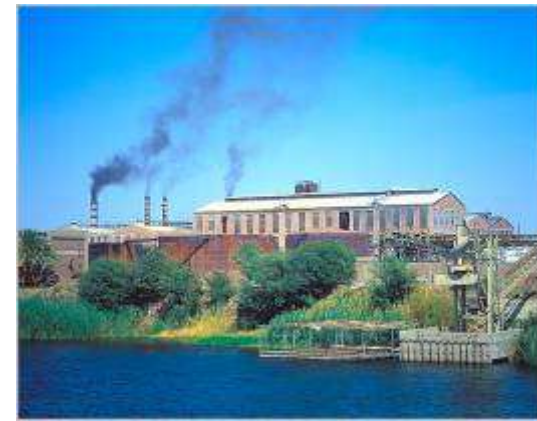


Water Resource Management

Health



Industry & infrastructure



Disaster Risk Management Involves a Wide Range of Decisions and Actions

Disaster Risk Management

Risk Identification

- Historical hazard data and analysis
- Changing hazard trends
- Vulnerability assessment
- Risk quantification

Risk Reduction

- Sectoral planning
- Early Warning Systems
- Emergency Preparedness planning
- Education and training

Risk Transfer

- Financial tools
 - Insurance
 - Weather derivatives
 - Cat bonds

Need for **Partnerships** and **Coordination** Among Different Players

Governance, Organizations, Operations

**Scientific, Technical,
Research,
Operational Services**

(Hazard Observing & Forecasting,
Risk Identification)

Financial

(Risk Transfer)

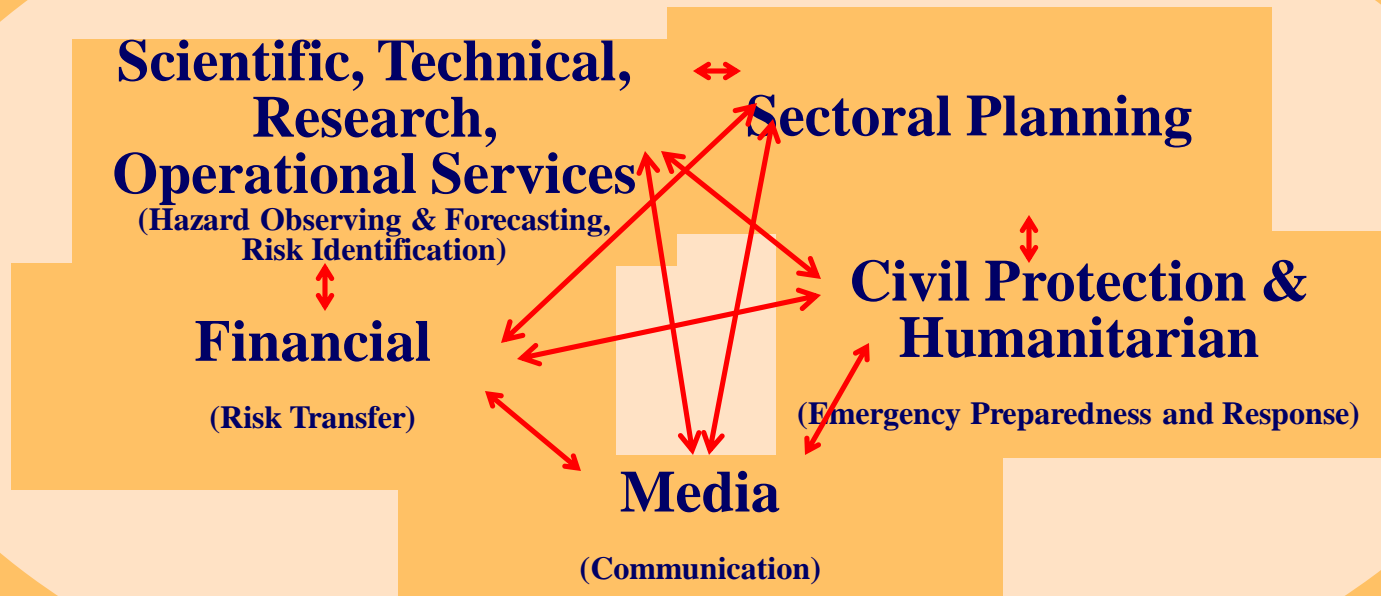
Sectoral Planning

**Civil Protection &
Humanitarian**

(Emergency Preparedness and Response)

Media

(Communication)



Need for Effective and Harmonized Governance, Institutional and Operational Mechanisms

Disaster Risk Management

Governance

- Strong political will and commitment
- Disaster management plans
- Legislation and policies (all levels)
- Legal frameworks

Operational

- Processes and mechanisms
- Integration of information in decision process
- Preparedness and drills
- Training
- Effective response
- Feedback

Organizational

- Clarity of roles and responsibilities
- Coordination and partnerships
- Integrated planning

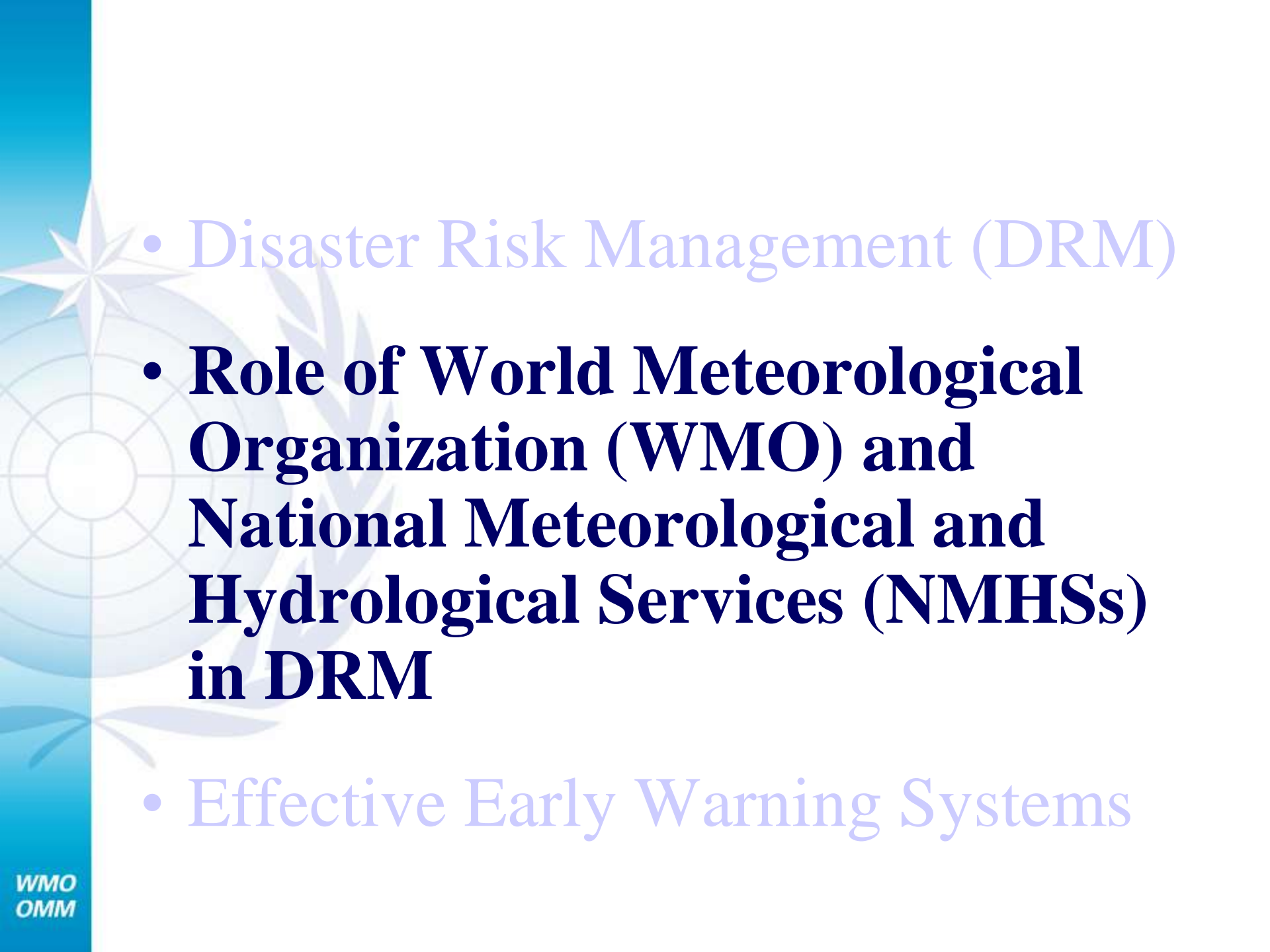
International Movement for Strengthening National Disaster Risk Management

- **World Conference on Disaster Reduction**
(Kobe, Japan, January 2005)
 - **Hyogo Framework for Action, providing coherent international and regional support for strengthening national disaster risk management capacities.**
- **G8 Summit and UN General Assembly (2005)**
- **Reform of the International Strategy for Disaster Reduction (ISDR) System**
 - **Will ensure stronger coordination and collaborations at the international and regional agencies in support of national capacities.**
- **Third International Early Warning Conference**
 - **Global Early Warning Survey**

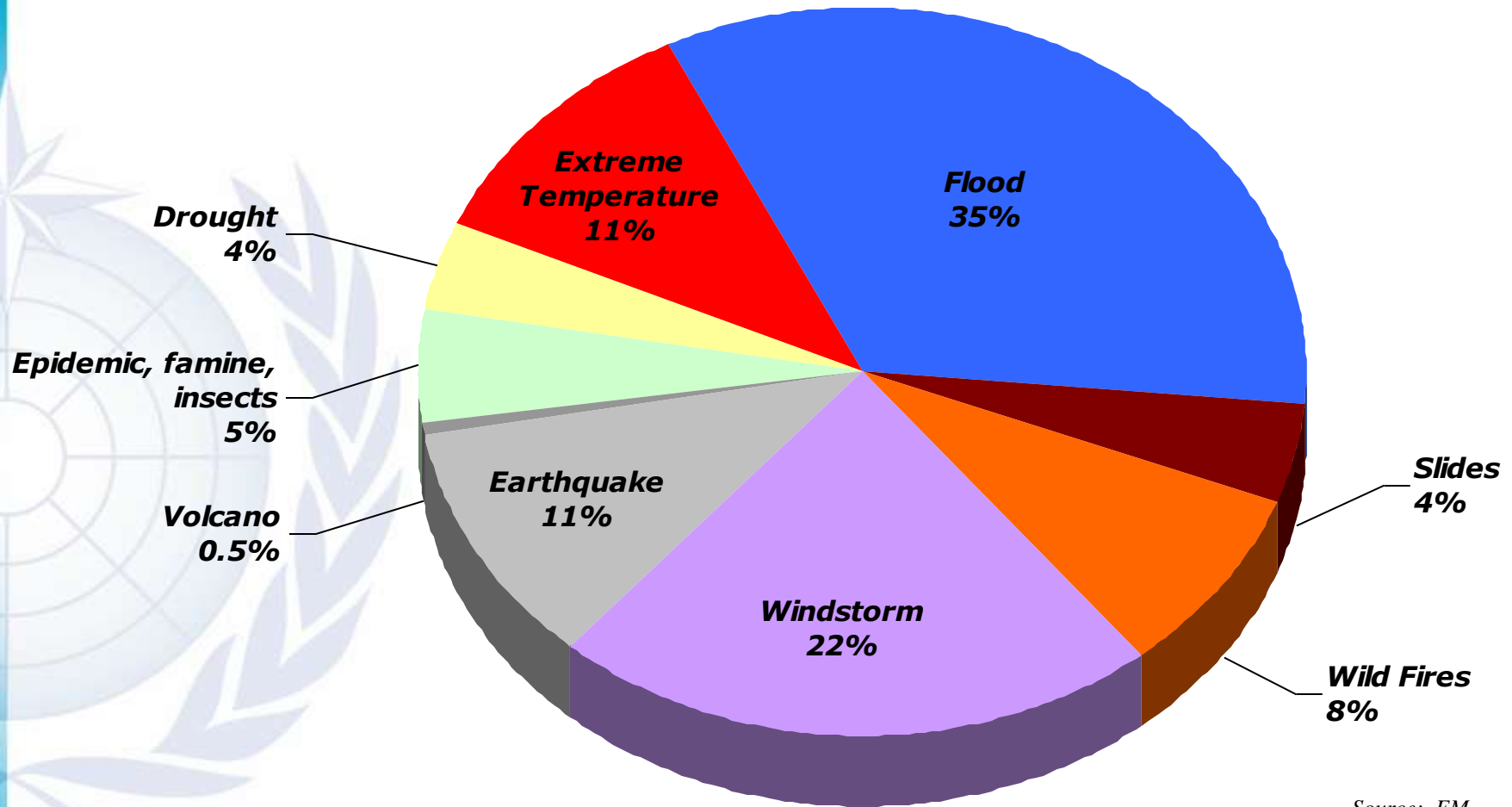
Linking Disaster Risk Management with the Development Agenda ...

Hyogo Framework for Action (5 priority areas):

- 1) Governance: organizational, legal and policy frameworks
- 2) Risk identification, assessment, monitoring and early warning
- 3) Knowledge management and education
- 4) Reducing underlying risk factors
- 5) Preparedness for effective response and recovery

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- Disaster Risk Management (DRM)
 - **Role of World Meteorological Organization (WMO) and National Meteorological and Hydrological Services (NMHSs) in DRM**
 - Effective Early Warning Systems

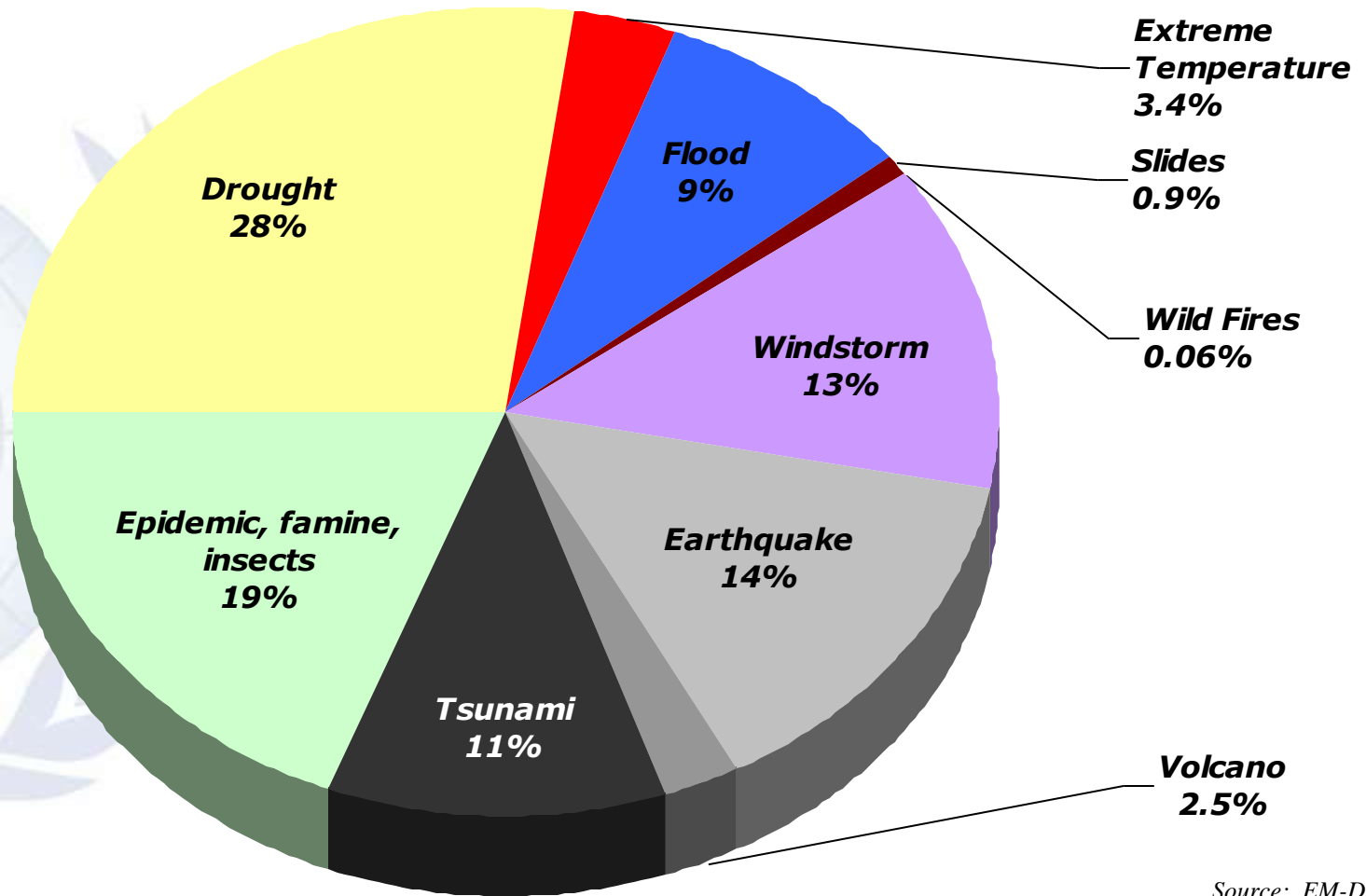
Number of Disasters (1980-2019)



Nearly **90%** of disasters are related to hydro-meteorological factors.

Source: EM-DAT: The OFDA/CRED International Disaster Database
- www.em-dat.net
- Université Catholique de Louvain - Brussels
- Belgium

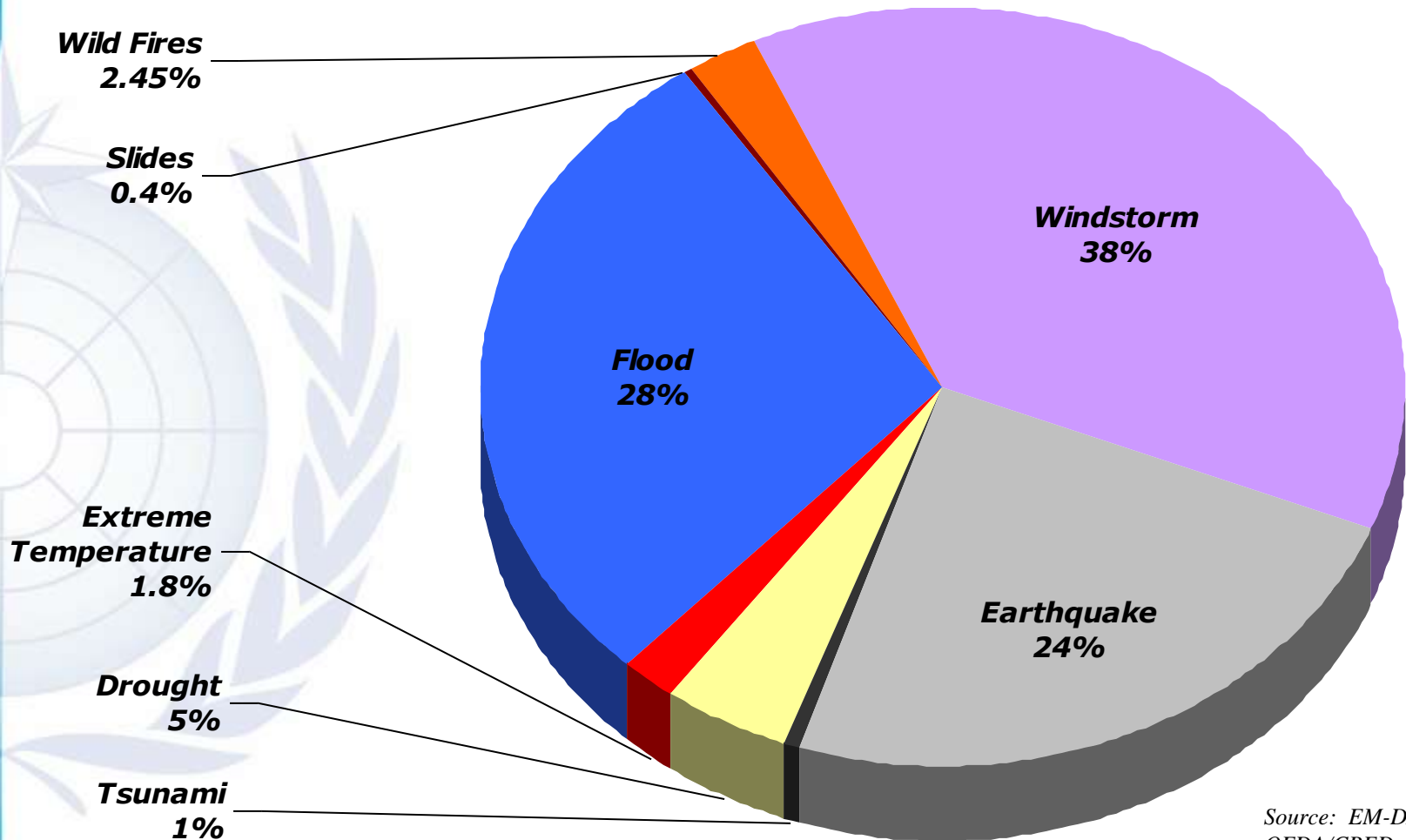
Loss of Human Life (1980-2019)



Nearly **70%** of loss of life are related to hydro-meteorological factors

Source: EM-DAT: The OFDA/CRED International Disaster Database - www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium

Economic Losses (1980-2005)

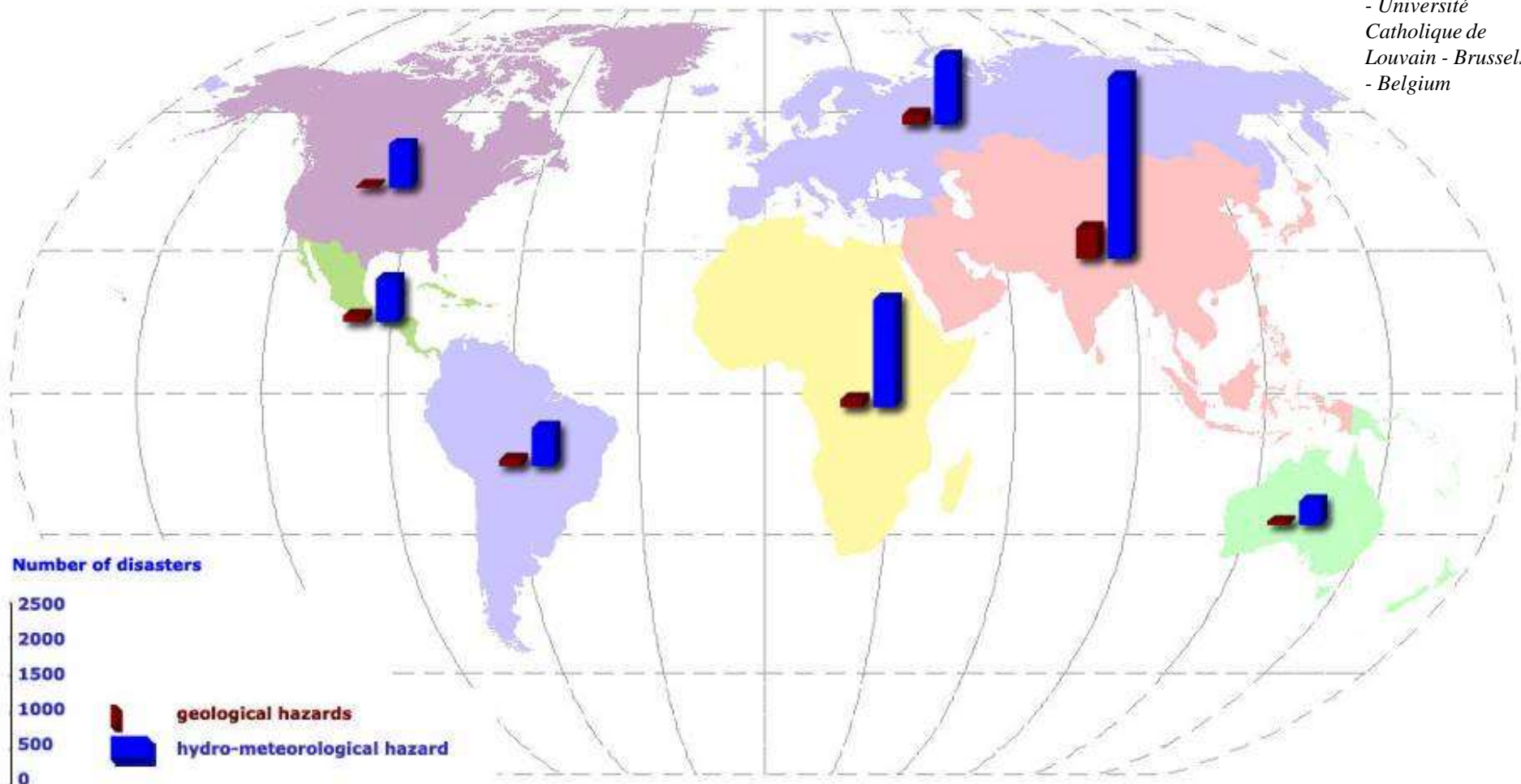


Nearly **75%** of economic losses are related to hydro-meteorological factors

Source: EM-DAT: The OFDA/CRED International Disaster Database - www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium

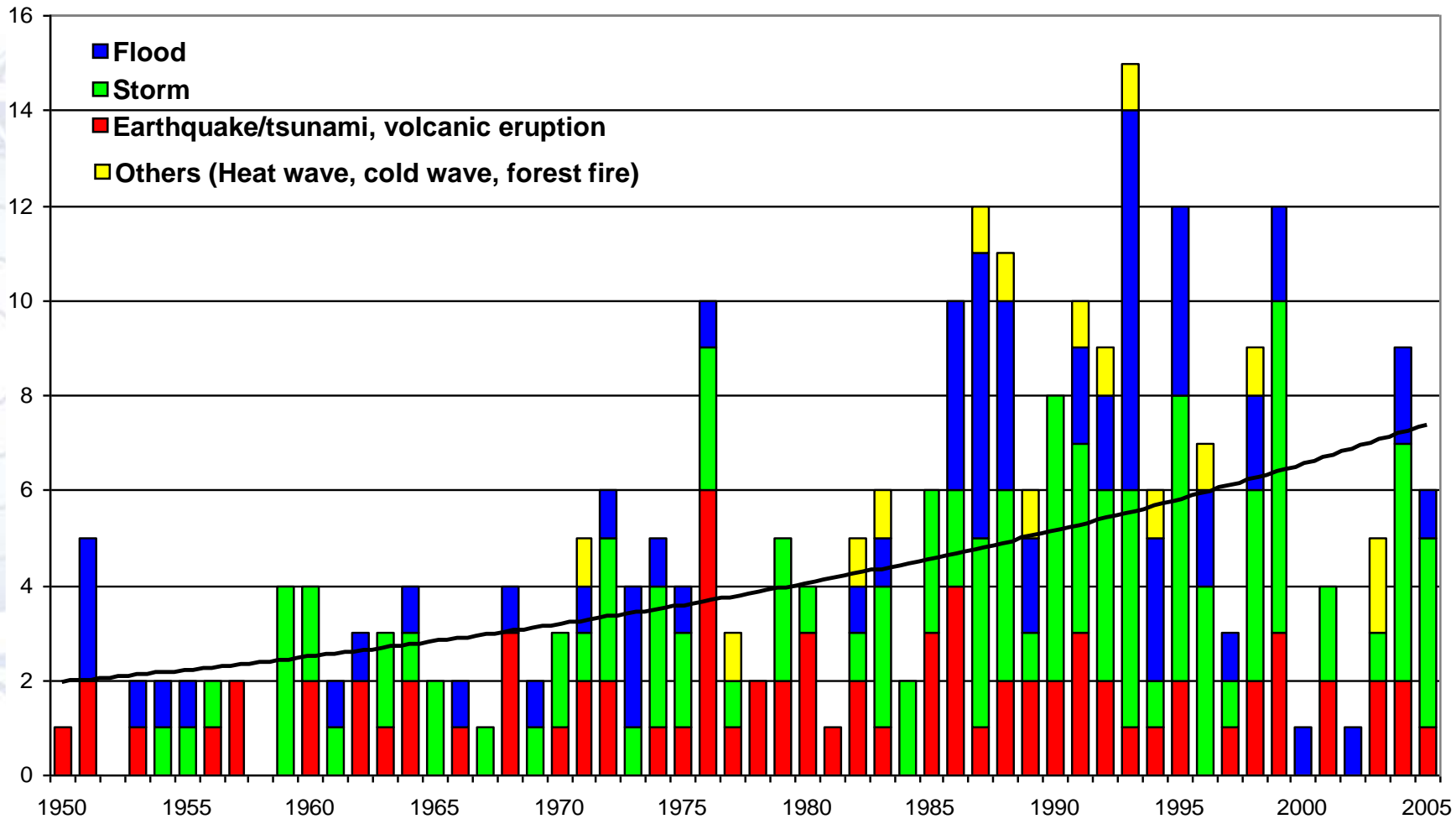
Regional Distribution of Natural Disasters (Number of Events, 1980-2005)

Source: EM-DAT: The OFDA/CRED International Disaster Database
- www.em-dat.net
- Université Catholique de Louvain - Brussels
- Belgium



Great Natural Disasters 1950 – 2005

Number of events

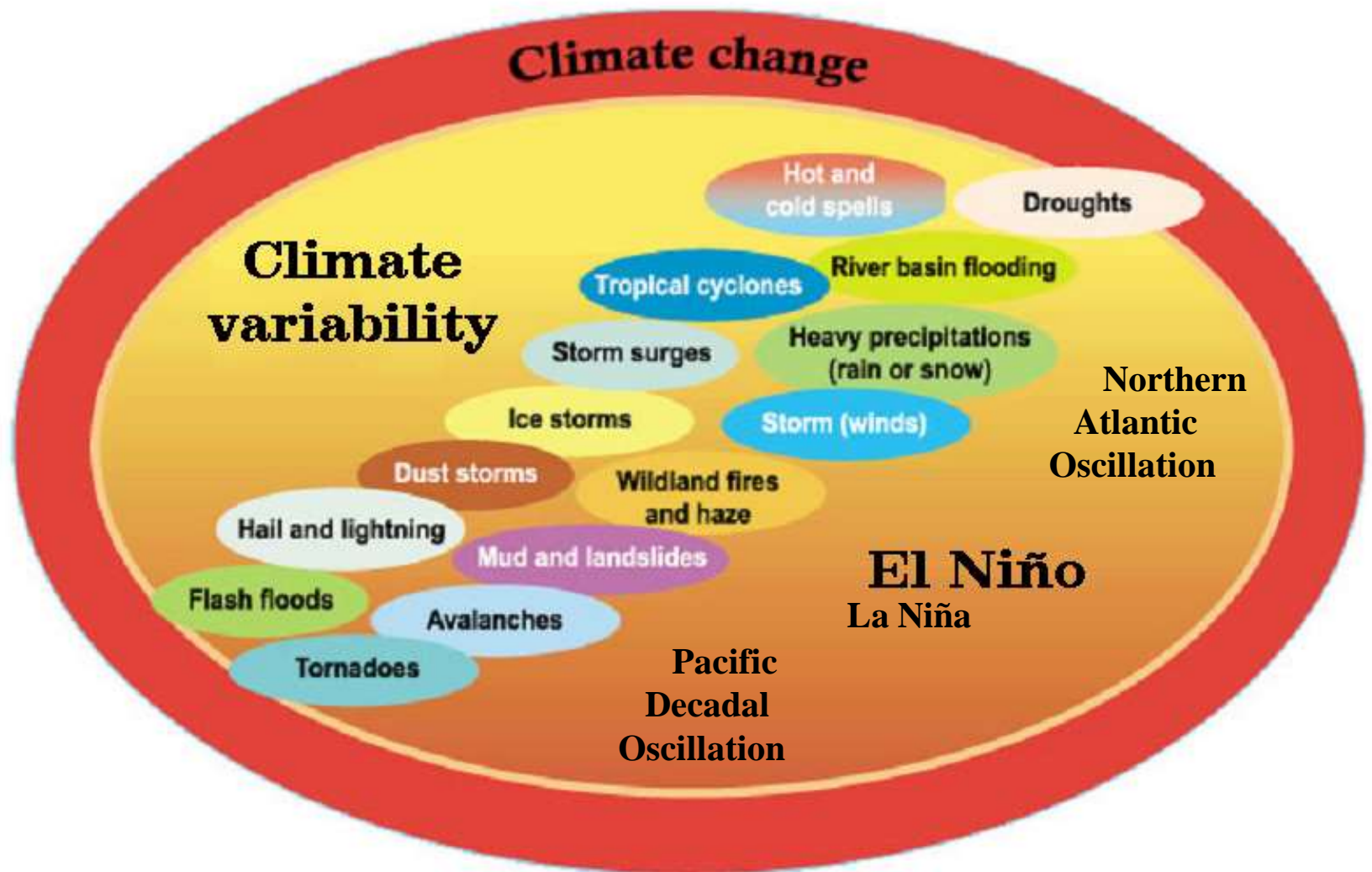


World Meteorological Organization

**133 years of
international and regional
cooperation in support of
national capacities for
meteorological, climate and
hydrological services for socio-
economic development**



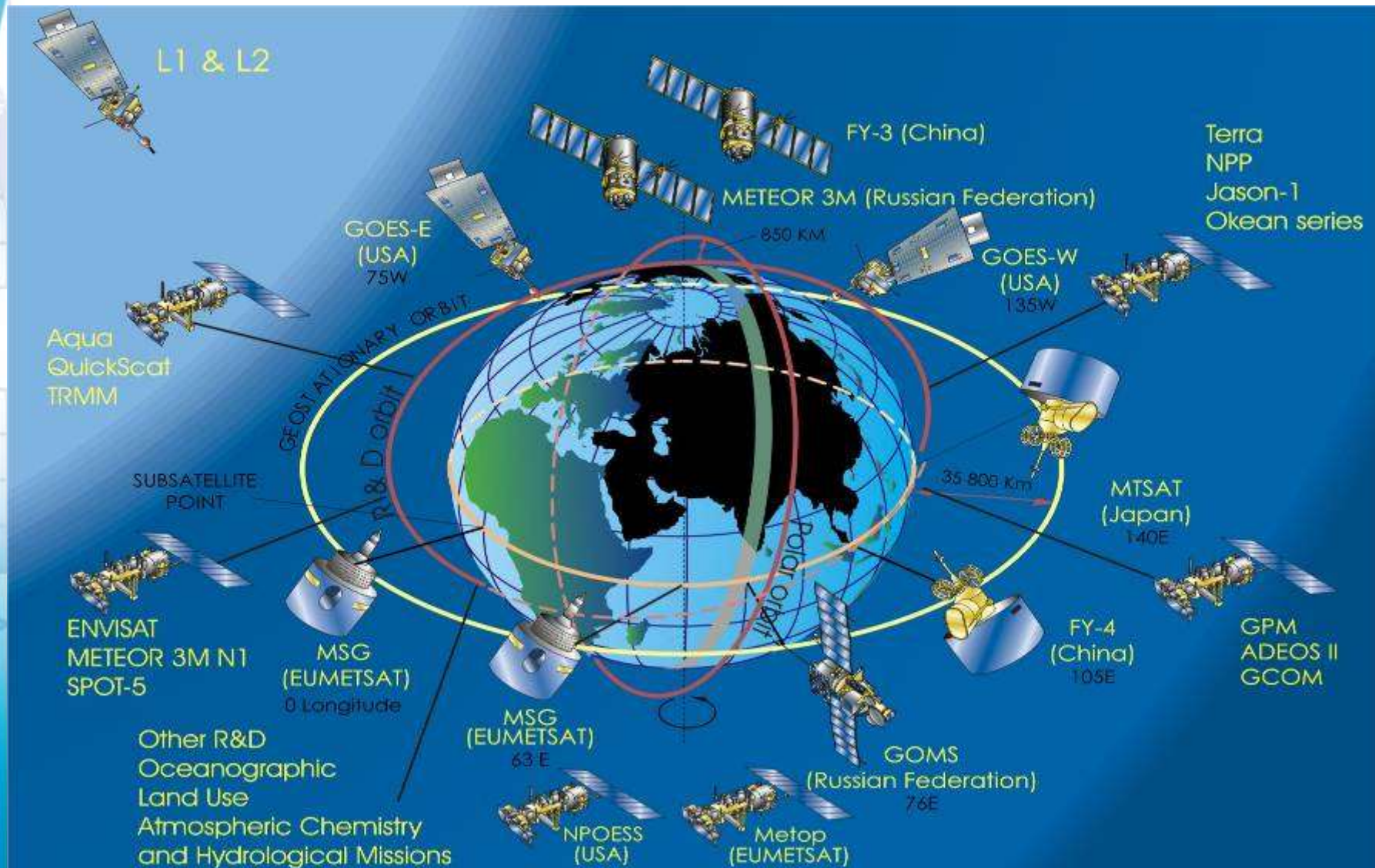
WMO Scientific and international research Programmes - Advancing the knowledge of natural hazards and their changing patterns



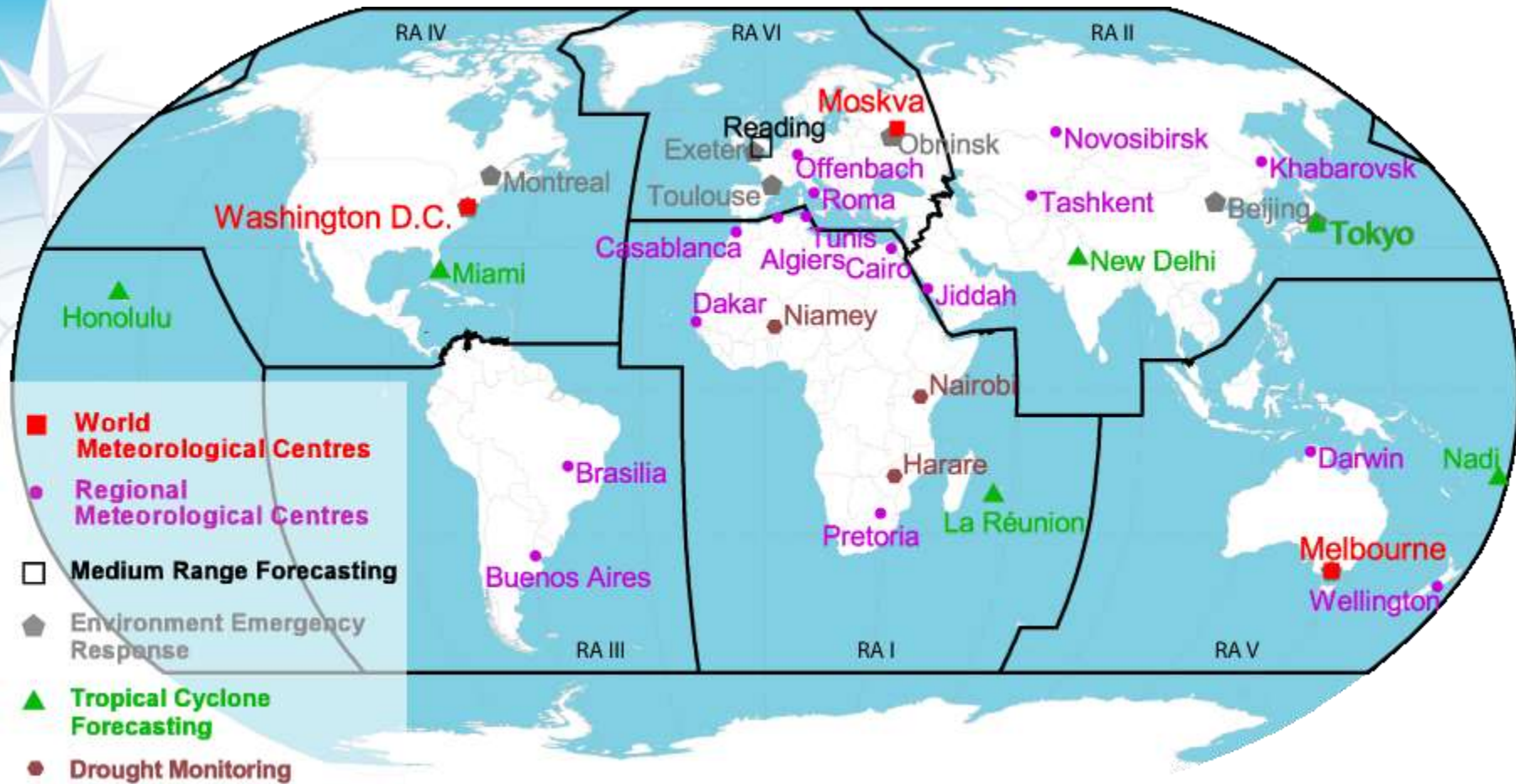
WMO Global Observing System



Coordinated Space System for Monitoring Weather, Climate & Water Conditions

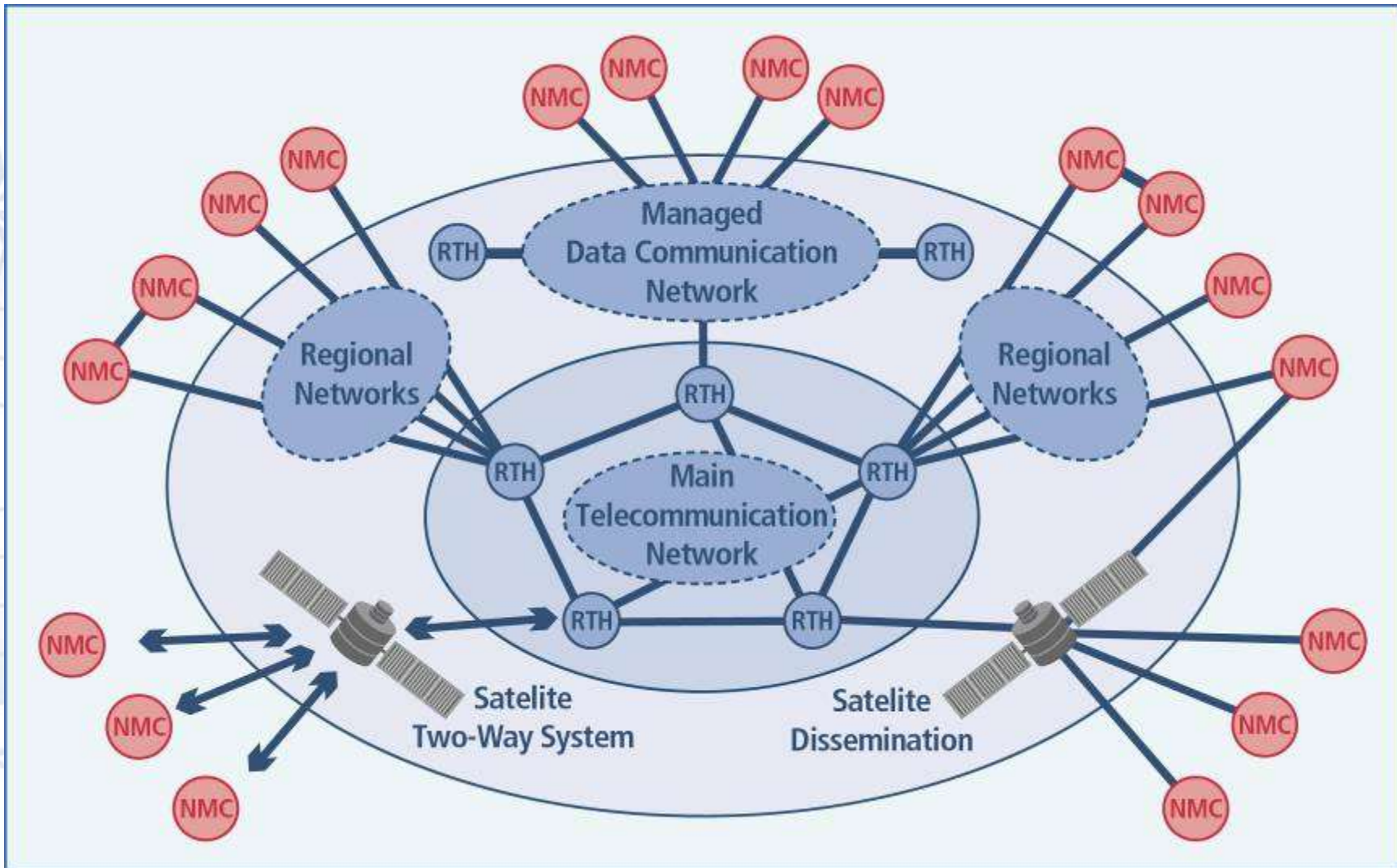


WMO's Global Data Processing and Forecasting Centres



Providing technical support for analysis and forecasting

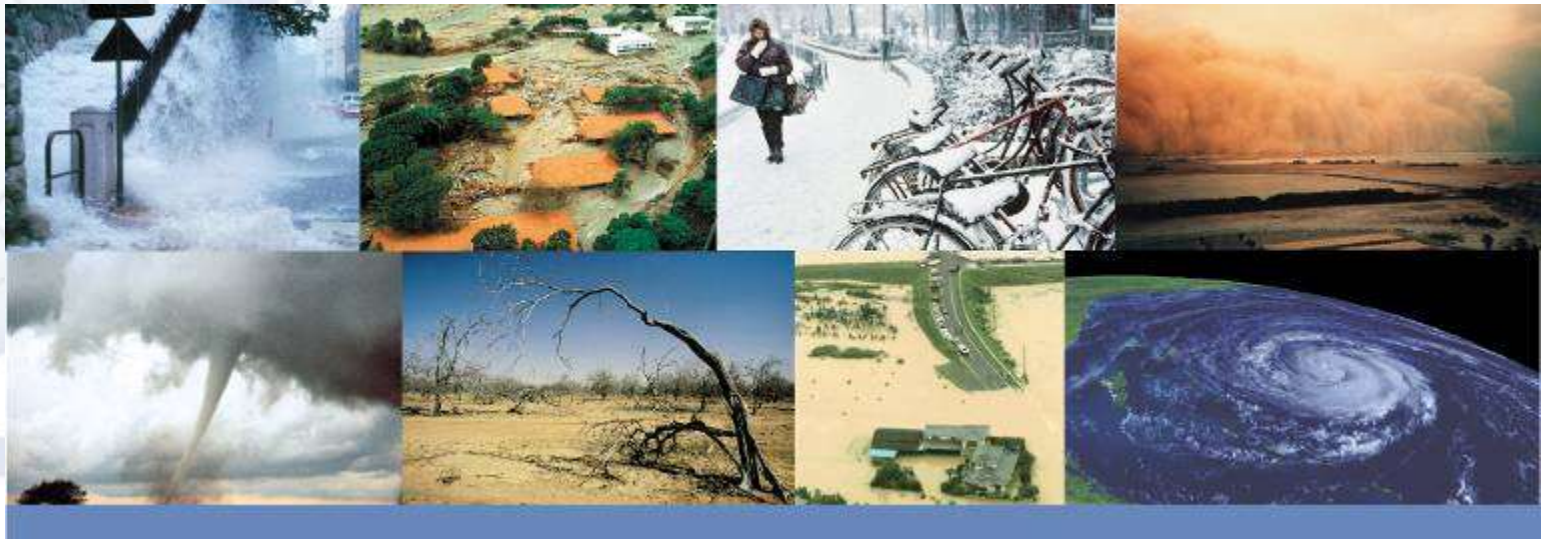
WMO Global Telecommunication System (GTS)



Enabling exchanges of data, forecasts, and analysis among 187 WMO Member countries and territories.

National Meteorological and Hydrological Services

- **Operational 24/7 organizations**
- **Provide products and services for**
 - **Hazard data analysis**
 - **Forecasts and predictions (next hour to climate time scales)**
 - **Warnings ...**



Severe storms, tropical cyclones (hurricanes and typhoons), storm surges, floods, cold spells, heat waves, droughts, forest fires, locust swarms, etc...

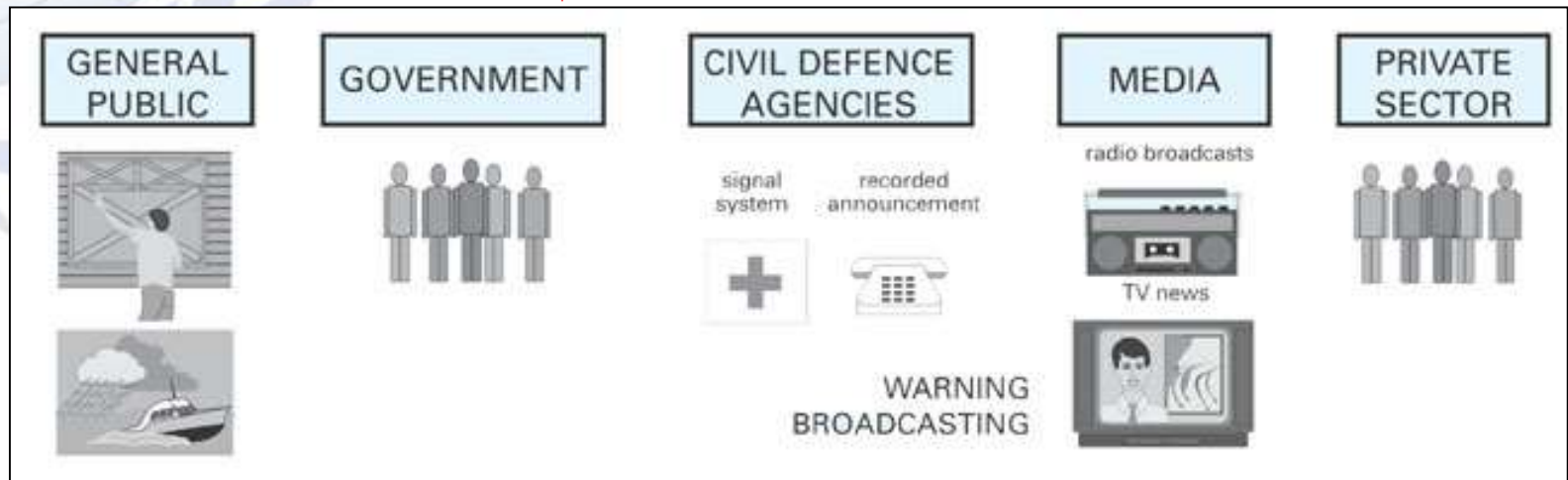
Supporting National Capacities for Disaster Risk Management

24 hours a day, everyday of the year, in every country

**National Meteorological
and Hydrological Services**

Products and Services

**Needs, requirements,
Feedback**



Services of Meteorological and Hydrological Services in support of Disaster Risk Management

1. Mainstreaming technical services in national disaster risk management plans supported by legislation
2. Hazard monitoring, databases and analysis
=> Risk analysis (historical and forward looking analysis of trends)
3. Operational hazard early detection and warnings
(next hour to longer climate timeframes)
4. Meteorological services for pre- and post-disaster response and relief operations
5. Education and training programmes with stakeholders (authorities, emergency operators, media)
6. Public outreach programmes and materials

Contributions of National Meteorological and Hydrological Services **to Risk Identification**

- Availability of historical and real-time hazard databases
- Hazard analysis and mapping methodologies
 - Severity , Frequency, Location, Timing
 - Statistical analysis of historical data
 - GIS/GPS mapping
 - Probabilistic climate models – Forward looking trend analysis
 - Emerging technologies (factors in changing patterns due to climate variability and change)

At National Level Many Challenges Remain

- Political recognition for benefits of investing in observing networks
- Institutional capacity
 - Operations and sustainability of observing networks
 - Data collection and management systems
 - Data rescue to translate massive amount of paper-based records into digital records
 - Quality control to ensure consistency and completeness
 - Capacity to archive large databases
- Availability of data to users
 - National data policies (commercial vs. public good)

Development of these capacities should be considered as an investment for enhanced risk management.

Contribution of National Meteorological and Hydrological Services **to Risk Reduction**


- Input into sectoral planning (zoning, development, etc)
- Early warning systems
 - Probabilistic forecasting and warnings from next hour to longer climate timescales
 - Integration of risk information into warning messages
 - Communication and dissemination
 - Partnerships, joint planning and joint training with national agencies responsible of emergency preparedness and response
- Meteorological Services in support of pre- and post-disaster response and relief operations

Contribution of National Meteorological and Hydrological Services to Risk Transfer

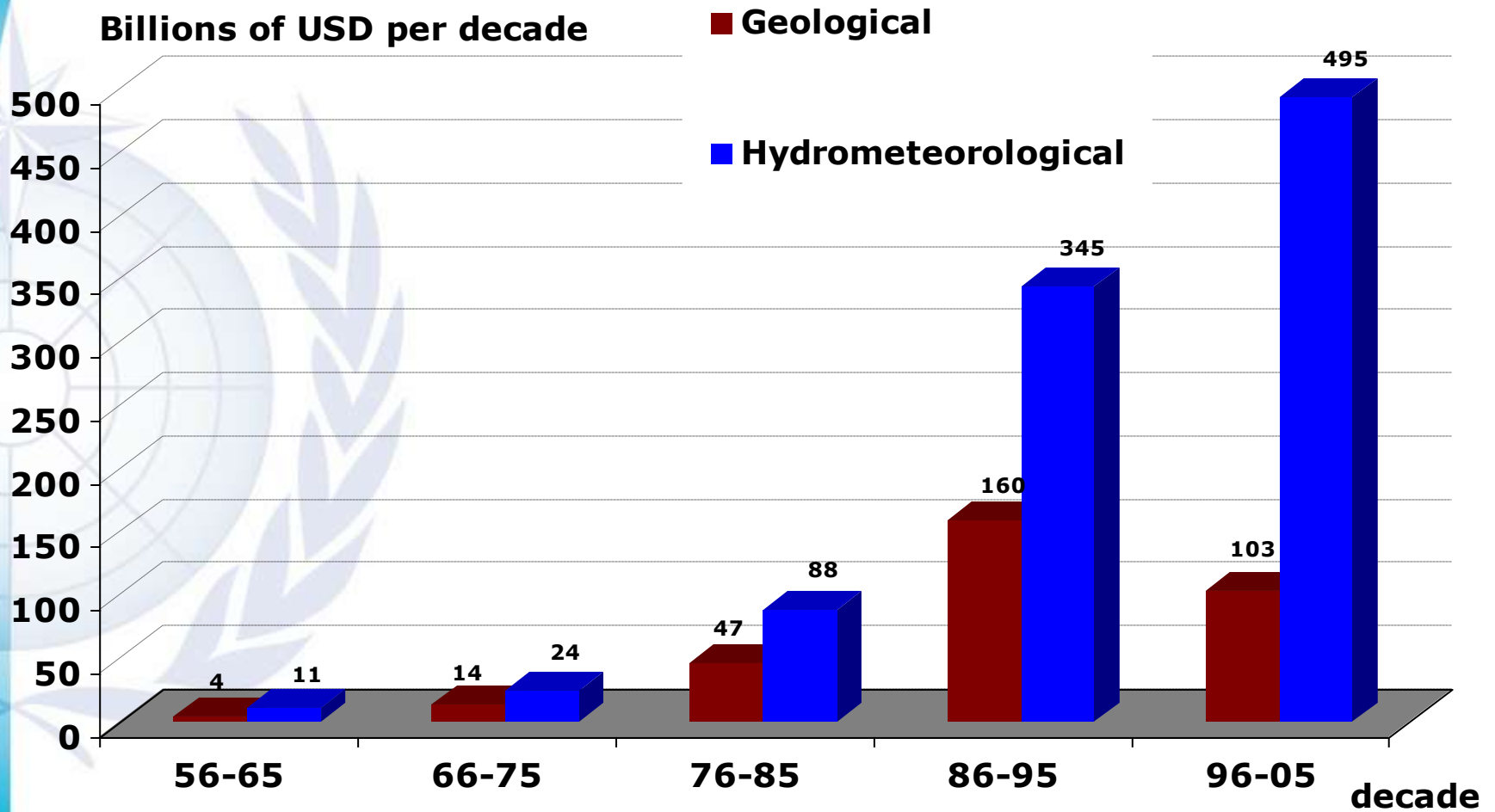
| products | provider | example |
|----------------------------|-----------------------|--|
| Insurance | Government | <ul style="list-style-type: none">– Crop / flood insurance– Agricultural and drought derivatives |
| Weather derivatives | Private sector | <ul style="list-style-type: none">– Insurance for property and casualty– Micro-insurance– Weather derivatives– Catastrophe bonds for hurricanes |
| Catastrophe bonds | | |

Contribution of National Meteorological and Hydrological Services to Design and Settlement of **Risk Transfer Tools**

- Availability and accessibility of historical meteorological and hydrological databases
- Technical support for data homogenization and analysis
- Reliable authoritative data for contract settlement
- Forecasts products for risk portfolio management

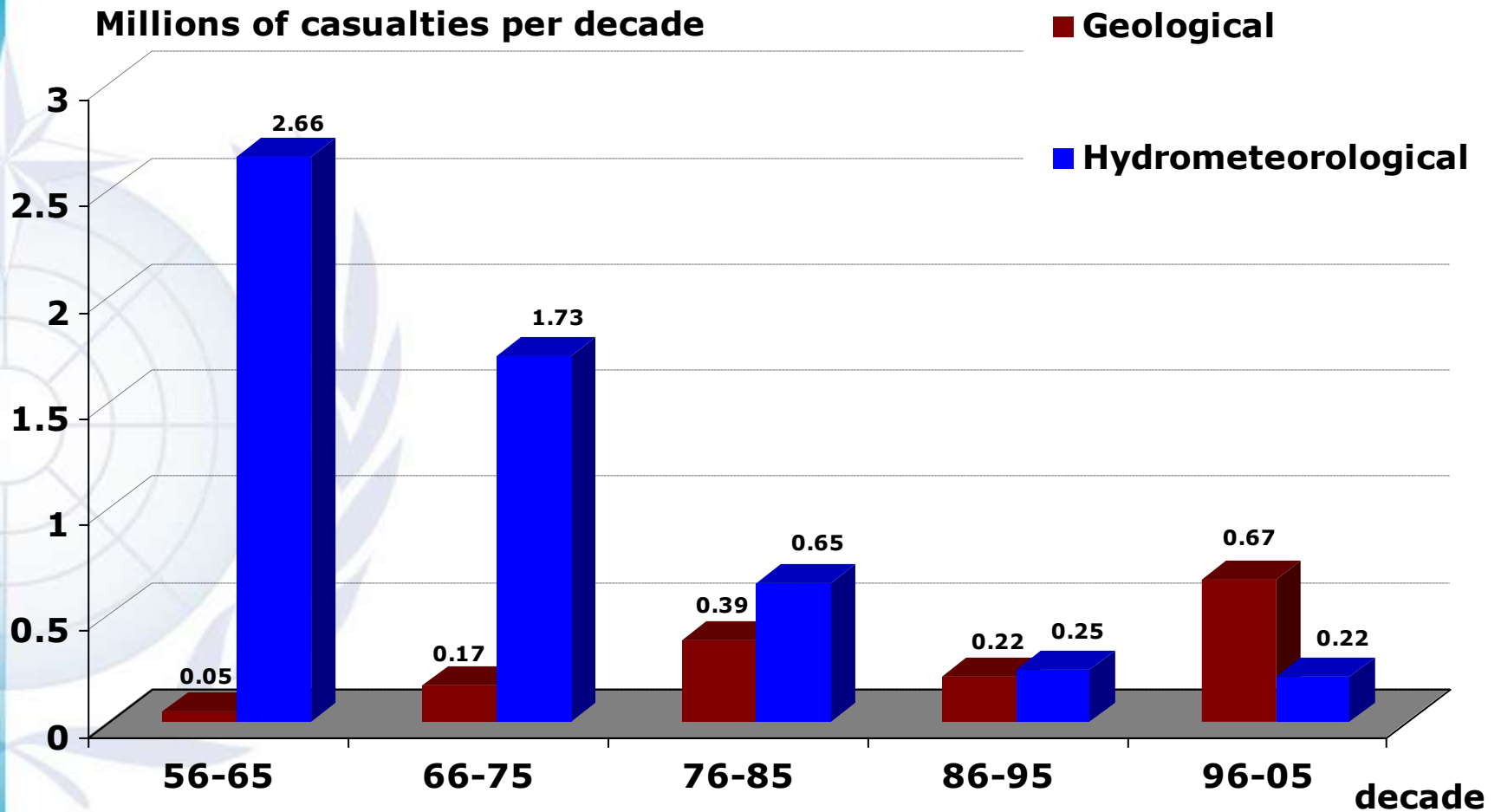
- 
- Disaster Risk Management (DRM)
 - Role of World Meteorological Organization (WMO) and National Meteorological and Hydrological Services (NMHSs) in DRM
 - **Effective Early Warning Systems**

Natural Disaster trends



Source: EM-DAT:
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Natural Disaster trends



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Ongoing Progress to Improve Hazard Forecast and Warnings Quality and Lead Times

Short- to
Medium-Range
Weather

Hours to days

Seasonal Forecasts
Short-Term Climate

Weeks

Months

Long-Term
Climate

Years



Emergency
Response

Preparedness

Prevention

Components of Effective Early Warning Systems

Governance, Organization and Operations

**Observing, detecting
& Forecasting of
Hazards**

**“Authoritative”
Understandable
Warnings &
Dissemination
Mechanism**

**Risk
Identification and
Integration in
Warning Messages**

**Integration in
Emergency
Preparedness, and
Response**

Symposium on Multi-Hazard EWS for Integrated Disaster Management (WMO Headquarters, 23-24 May 2006)

- **Issues:** Governance, institutional, technical, operational, resource challenges, benefits and synergies, along the four components of EWS
- **Participants:** 99 experts and practitioners from 18 agencies working in different components of early warning system

Challenges for Effective Early Warning Systems

Risk Identification

- **Data gaps, quality, accessibility, sharing**
 - Hazard
 - Vulnerability (e.g. socio-economic, topographic...)
- **Standardized methodologies and expertise** (e.g. hazard analysis, risk modelling)
- **Understanding of the changing patterns of risk** (e.g. hazard, vulnerabilities)
- **Local capacities**

Observing, Detecting, Forecasting

- **Strengthen observation systems**
 - coverage
 - sustainability
 - inter-operability
 - multi-use of networks (where practical)
 - built on "system of systems" concept
 - data policies
- **Prediction and forecasting**
 - methodologies, accuracy and lead time
 - multi-disciplinary

Coordination and partnerships across components !

Communication and Dissemination

- **Effective warning messages:**
 - Incorporation of information about risks in warning messages
 - Understandable warning messages
 - “Authoritative” warnings (Authentication of sources)
- **Dissemination networks:**
 - Interoperability (use of international standards)
 - Redundancy and resilience of networks
 - Same distribution channels for warnings of different hazards (cost efficiency, reliability and effectiveness)
- **Standard warning terminologies**
 - Nationwide and across borders
 - Traffic light concept

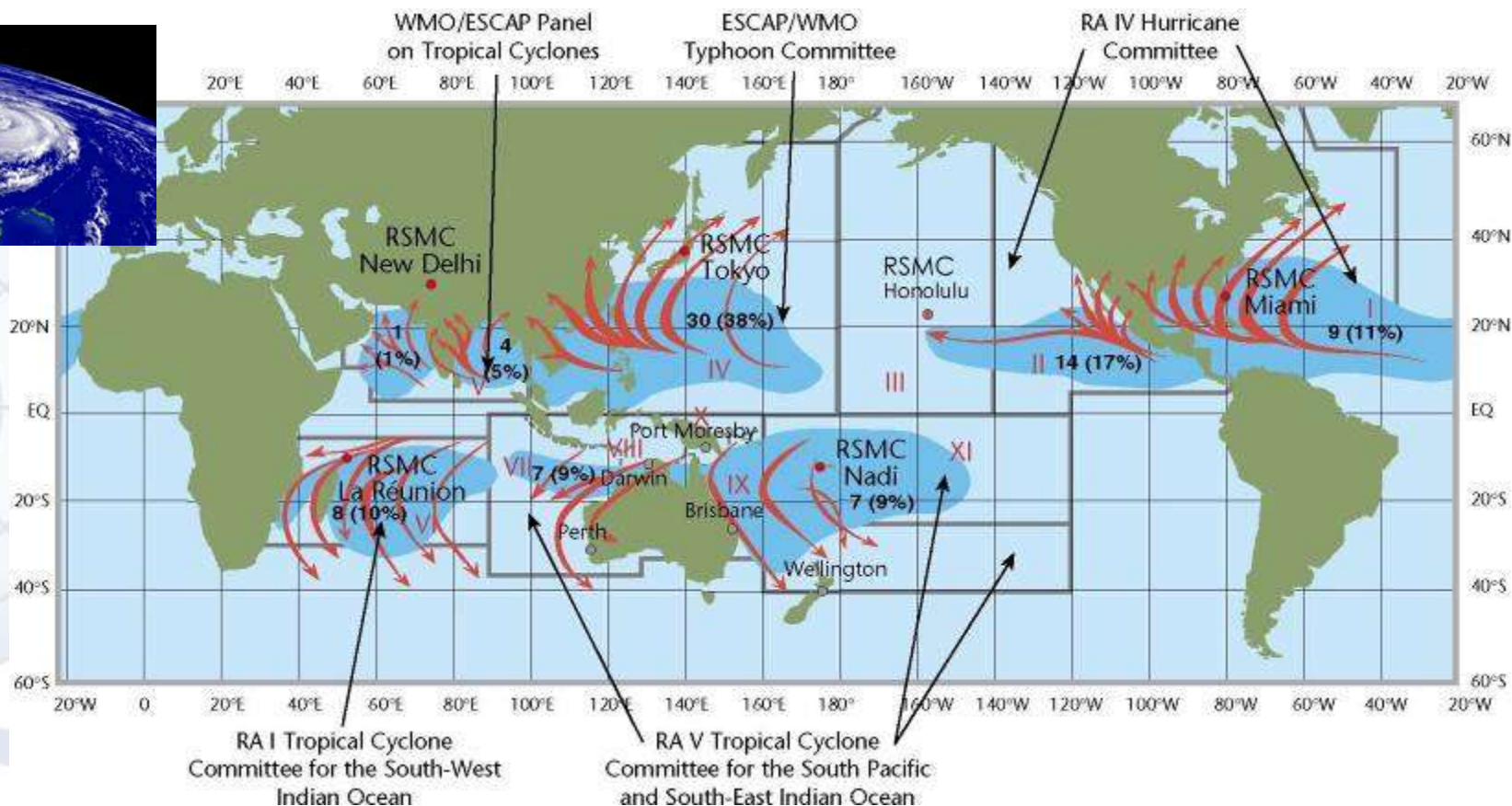
Emergency Planning, Preparedness and Response

- **Education and awareness** (emergency responders, authorities, risk managers, emergency responders, media, public...):
 - Understanding of warnings and uncertainties
 - Awareness of less frequent events
 - Cross-training of operational agencies and media
- **Operational planning**
 - Drills
 - Community preparedness and programmes



Examples: Connecting authoritative warnings to effective preparedness and Response at the Community level

WMO Global Tropical Cyclone Early Warning System



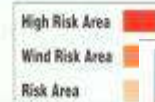
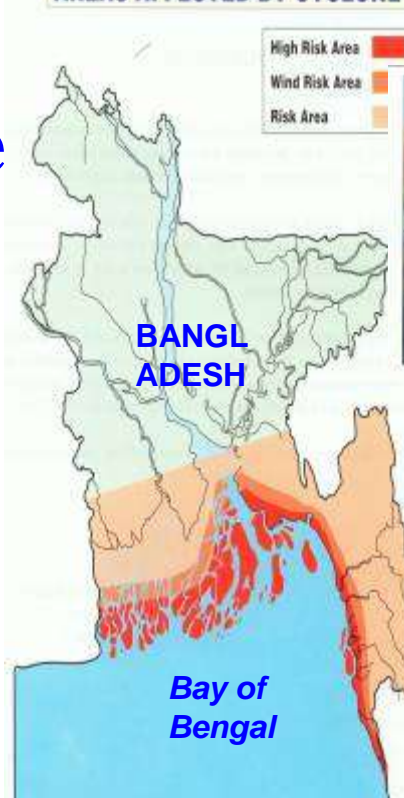
Regional cooperation (6 Regional Centres) in support of national tropical cyclone early warning systems

Bangladesh: Cyclone Preparedness Programme

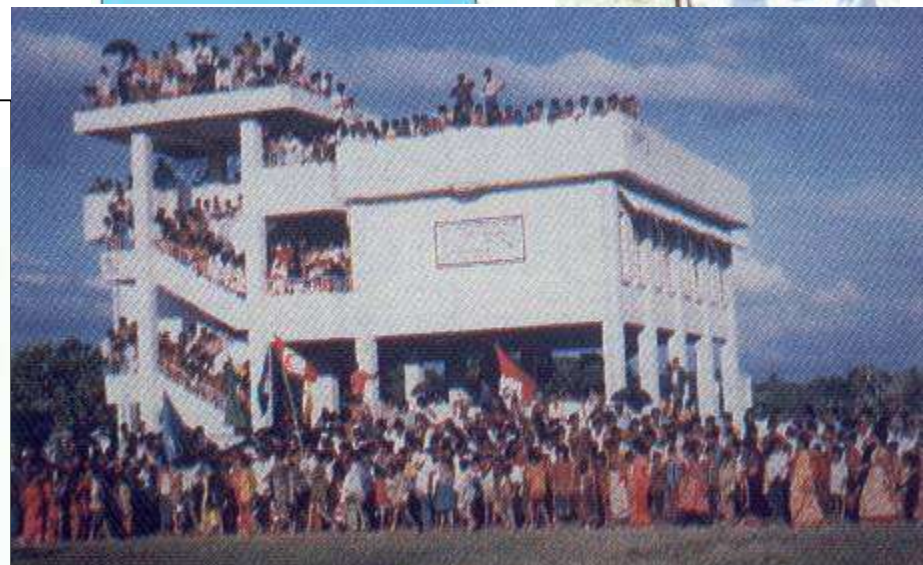
Low investments, high efficiency

- **GOVERNANCE:** legislative framework
- **OPERATIONAL:** community-based approach with a network of volunteers, trained and trainers, and infrastructures (shelters)
- **ORGANISATIONAL:** strong partnership among agencies
- **Authoritative warnings**

AREAS AFFECTED BY CYCLONE



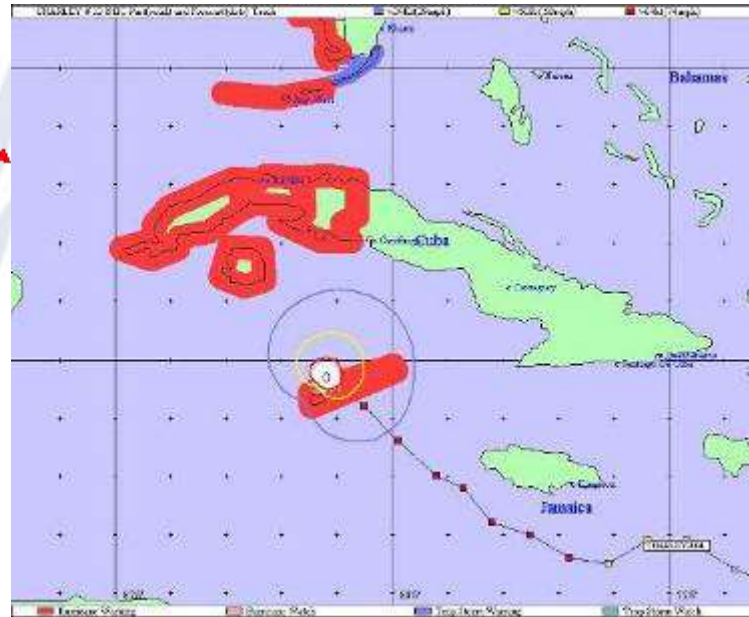
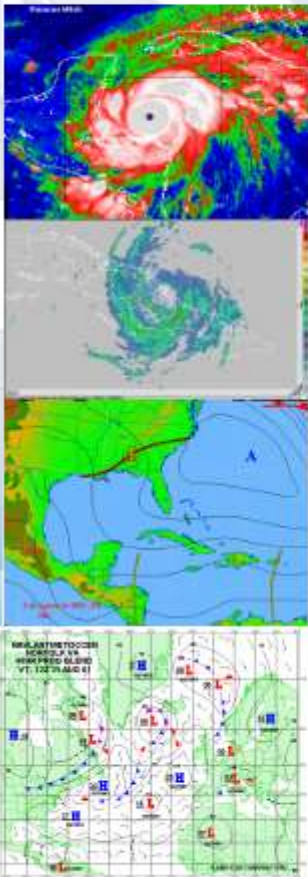
Warning categories:



Cuba: Cyclone Early Warning

Small country, 99% access to media (radio & TV),
coordinated top-down warning and response mechanisms

ANALYSIS AND NUMERICAL MODELS



Warning

DIFUSSION OF WARNINGS



TV



RADIO



PHONE - FAX



INTERNET

RESPONSE ACTIONS

**GOVERNMENT,
CIVIL DEFENSE,
RESIDENTS**



France: "Vigilance" Strategy

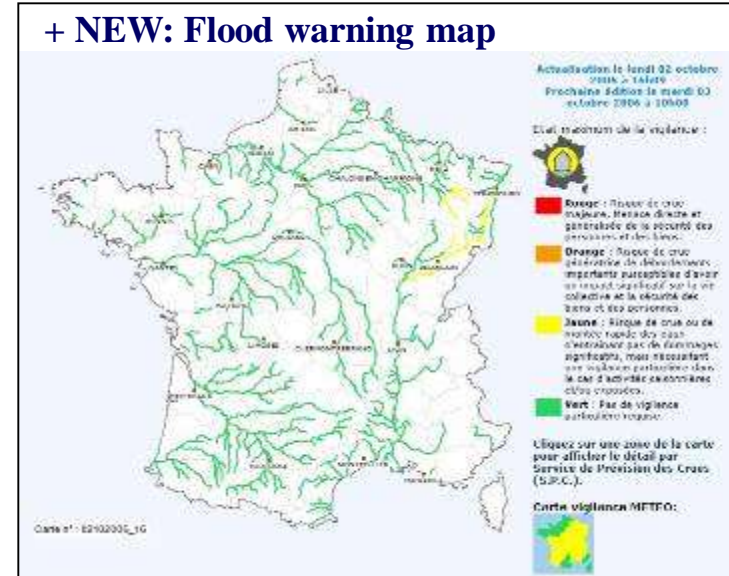
Hazards

-  Strong wind
-  Strong rainfall
-  Thunderstorm
-  Snow/Ice
-  Avalanches
-  Heat waves

Level of warning

-  Level 4
-  Level 3
-  Level 2
-  Level 1




+ NEW: Flood warning map



METEO FRANCE Guide vigilance

Carte de vigilance météorologique
Diffusée le mercredi 03 décembre 2003 à 10h32
Valable jusqu'au jeudi 04 décembre 2003 à 06h00

Actualisation de la carte diffusée le 03 décembre 2003 à 08h25

-  Vent violent
-  Fortes précipitations
-  Orages
-  Neige-Verges
-  Avalanches

- Niveau 4** : Une vigilance absolue s'impose, des phénomènes météorologiques dangereux d'intensité exceptionnelle sont prévus, tenus sous régulièrement au courant de l'évolution météorologique et contactez vous aux services de secours avec les pouvoirs publics.
- Niveau 3** : Soyez très vigilant, des phénomènes météorologiques dangereux sont prévus, tenus sous au courant de l'évolution météorologique et contactez vous aux services de secours avec les pouvoirs publics.
- Niveau 2** : Soyez attentif, vous pouvez être affectés au risque météorologique, des phénomènes météorologiques dangereux sont occasionnellement dans la région, les évènements sont en alerte, contactez vous au service de l'évolution météorologique.
- Niveau 1** : Pas de vigilance particulière.

Les cartes de vigilance météo paraissent 2 fois par jour à 08h et à 18h.

En cas de vigilance orange (niveau 2) ou rouge (niveau 4), des bulletins de suivi sont disponibles.

Commentaires Météo-France

Sur la région de Montpellier la situation est potentiellement catastrophique aujourd'hui. Le vent d'Est violent souffle en Méditerranée.

Conseils des pouvoirs publics

Vent/orange

- Limitez vos déplacements et renseignez vous avant de les entreprendre.
- Prenez garde aux chutes d'arbres ou d'objets.
- N'intervenez pas sur les toitures.
- Rangez les objets exposés au vent.

Précipitations/orange

- Renseignez vous avant d'entreprendre un déplacement et soyez vigilants. Evitez le réseau routier secondaire.
- Soyez prudents face aux conditions de circulation pouvant être difficiles.
- Si vous habitez en zone habituellement inondable, prenez les précautions d'usage.

Carte n°1: 62102002_04_03

Warnings activate cascades of preventive and response plans, actions and responsibilities

Legislation

Planning

Authoritative Warnings

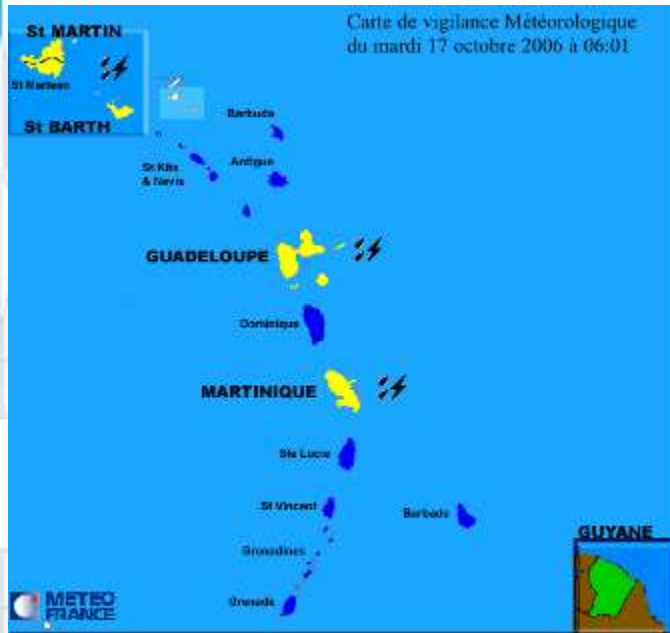
Organizational linkages

Training and feedback

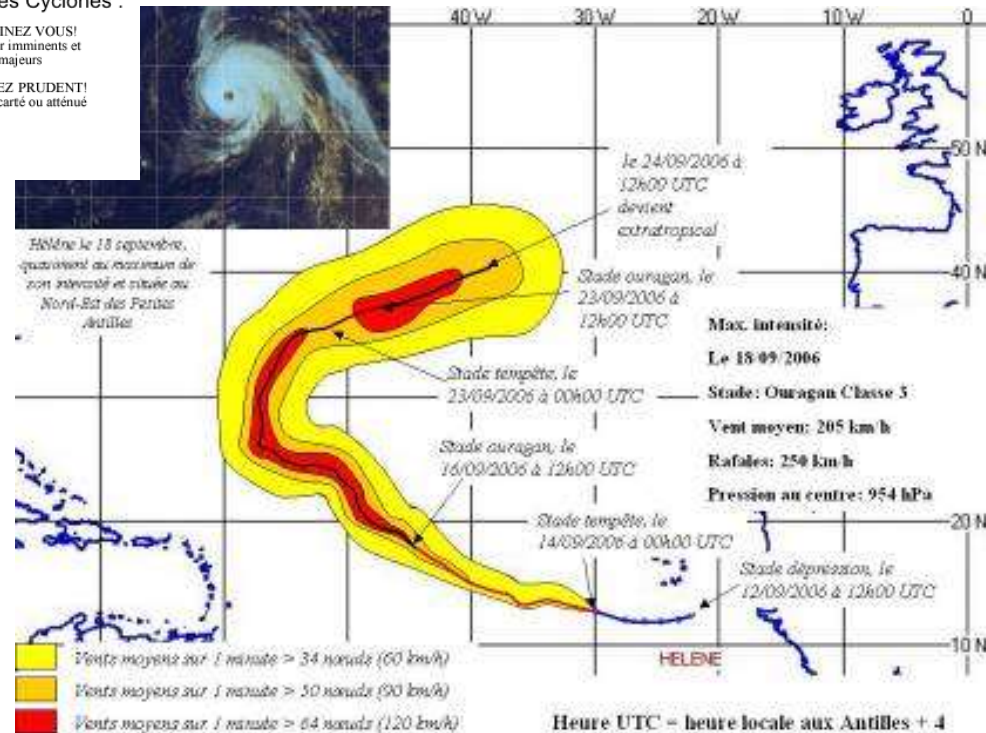
5 levels from national to local authorities

France: "Vigilance" Strategy

Distinct approach on tropical areas



- Vent violent
 - Mer Dangereuse
 - Fortes précipitations Orages
 - Cyclone
 - PAS DE PREVISION
 - PAS DE VIGILANCE PARTICULIERE
 - SOYEZ ATTENTIF
Danger imprécis ou effets limités
 - PREPAREZ VOUS!
Danger probable ou effets modérés
 - PROTEGEZ VOUS!
Danger très probable et effets importants
- En + pour les Cyclones :
- CONFINEZ VOUS!
Danger imminents et effets majeurs
 - RESTEZ PRUDENT!
Danger écarté ou atténué



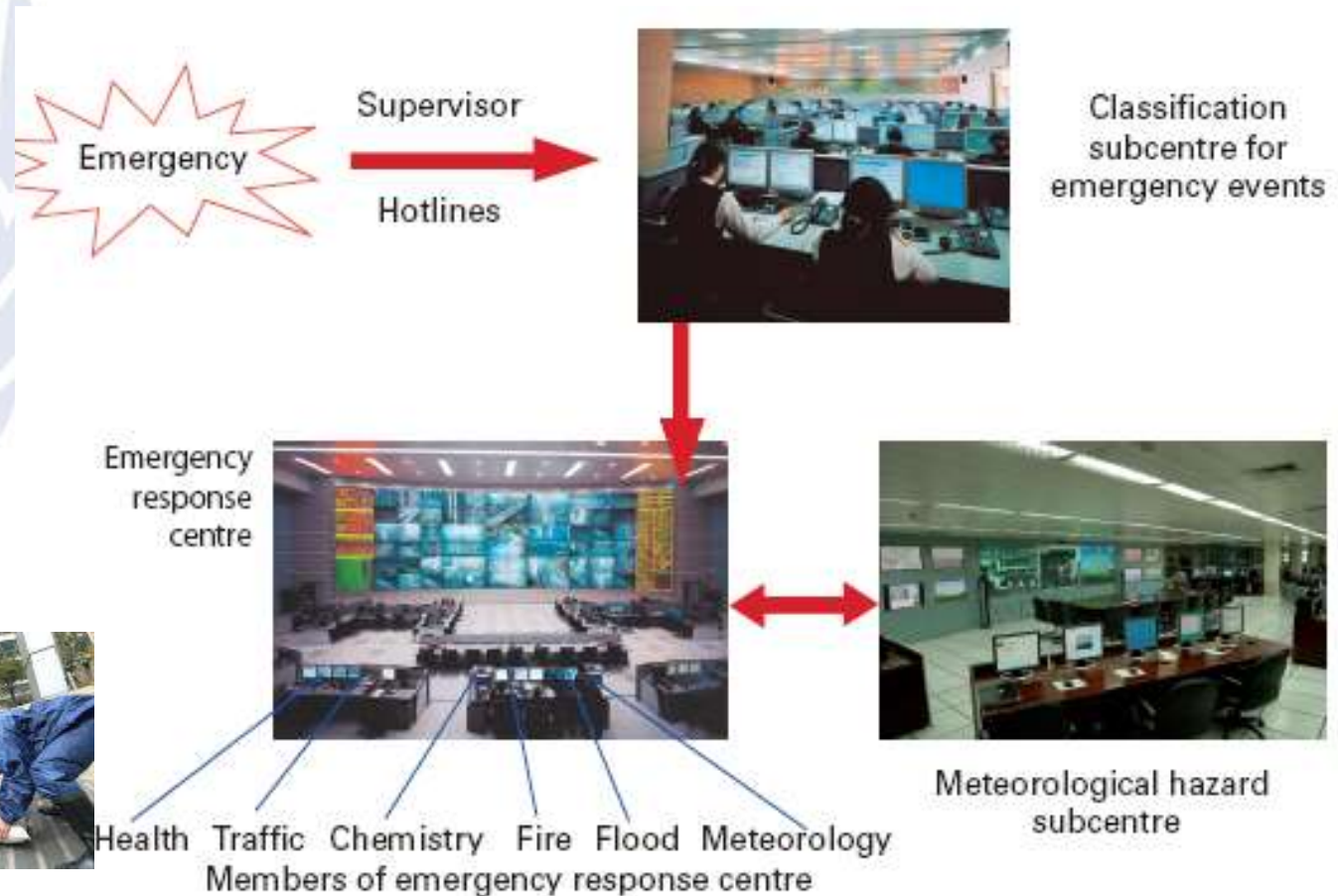
Shanghai City: Multi-Hazard Early Warning and Emergency Response Programme

Governance : (mega) city-level.

Organisational: Top-down (monitoring, forecasting, warning) and bottom-up

Operational: Community-based + high tech monitoring and alerting tools

Multi-Hazard Approach: Services are specialized but shared for alert dissemination and response mechanisms.



将网格监督员、12311的问题信息转发到各区平台

Common Aspects of Four Cases Discussed

- Political commitment and legislation
 - Complete DRR cycle: prevention, preparedness, response, recovery
- Coordination and partnerships among different government agencies
 - Roles and responsibilities
 - Linking national to local levels (Top-down, Bottom-up)
- Authoritative, understandable warnings
 - Combine hazard, risk and response information
- Dissemination Mechanism match culture/resources
 - Sustainability, interoperability, reliability
- Warning categories – Integration with emergency preparedness and response actions
- Community-based programmes
- Feedback

Thank You

For more information please contact:

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<http://www.wmo.int/disasters>

