EARLY WARNING SYSTEM FOR TROPICAL CYCLONES IN THE REPUBLIC OF CUBA

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Training Workshop on
MultiHazard
Early Warning Systems
with focus on Institutional Coordination and Cooperation
1-3 October 2009
Pula, Croatia

"Hazards should not be watched upon when they are already over us, but when they could be avoided"

" To place Science in everybody's language, that is a goodness than only a few people do".

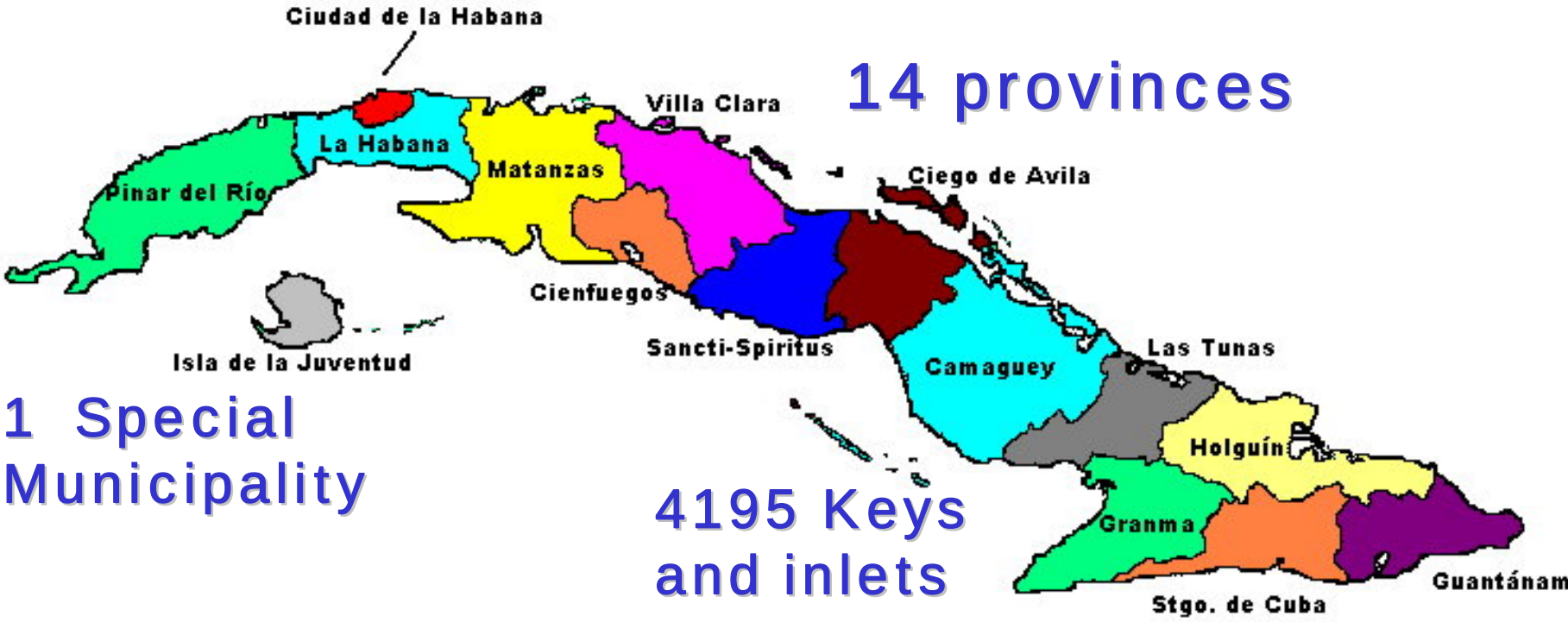
José Martí
National Hero of Cuba

(1853 – 1895)

CUBA, THE CARIBBEAN SEA AND CENTRAL AMERICA:

HAVE THE SAME SCENARY OF HAZARDS

Overview on Cuba



14 provinces

1 Special Municipality

4195 Keys and inlets

Area : 110 922 km² Coastline: 5 746 km

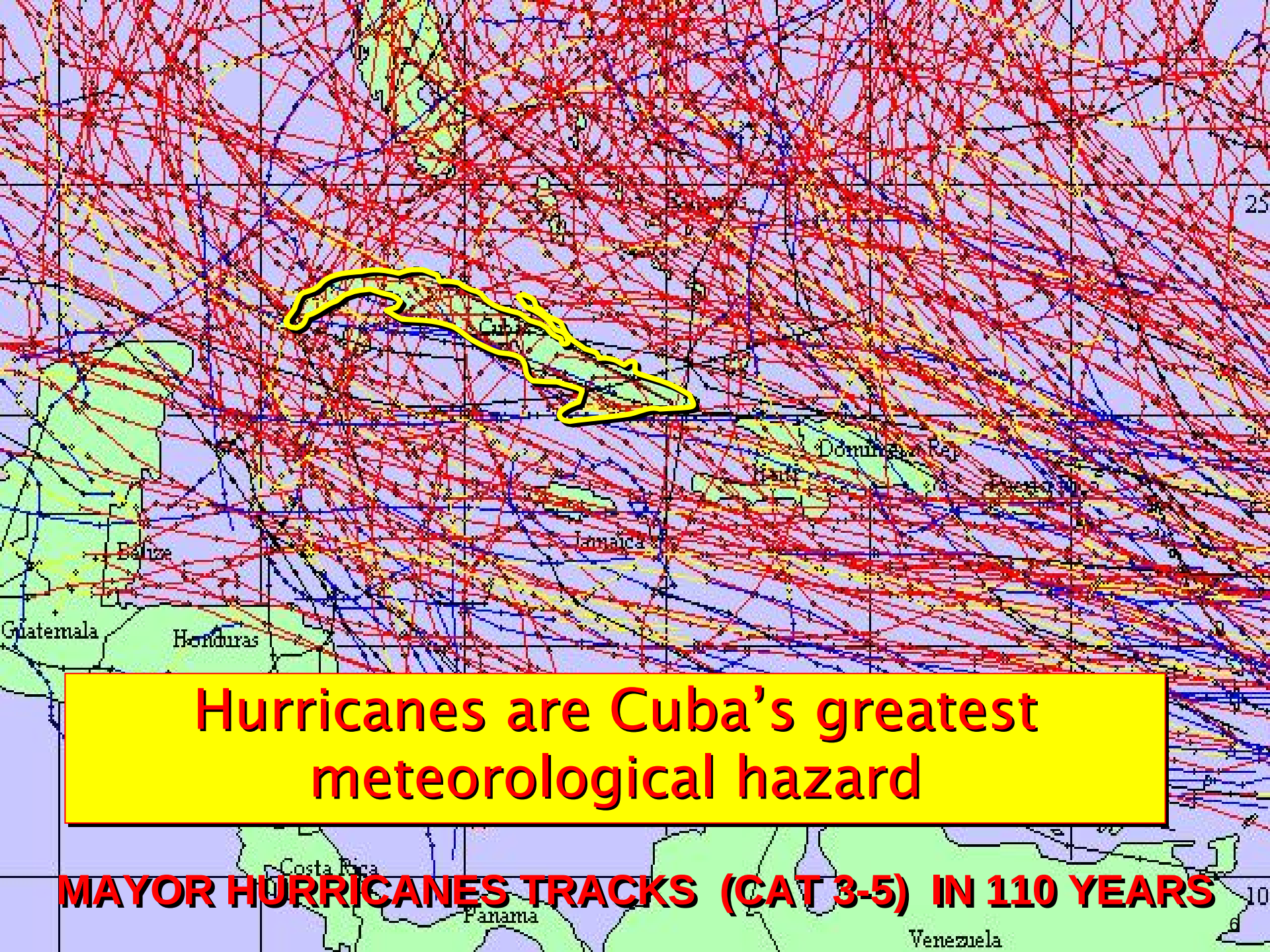
Population: 11 millon

Hidrometeorological Hazards

Tropical Cyclones

Torrential Rains

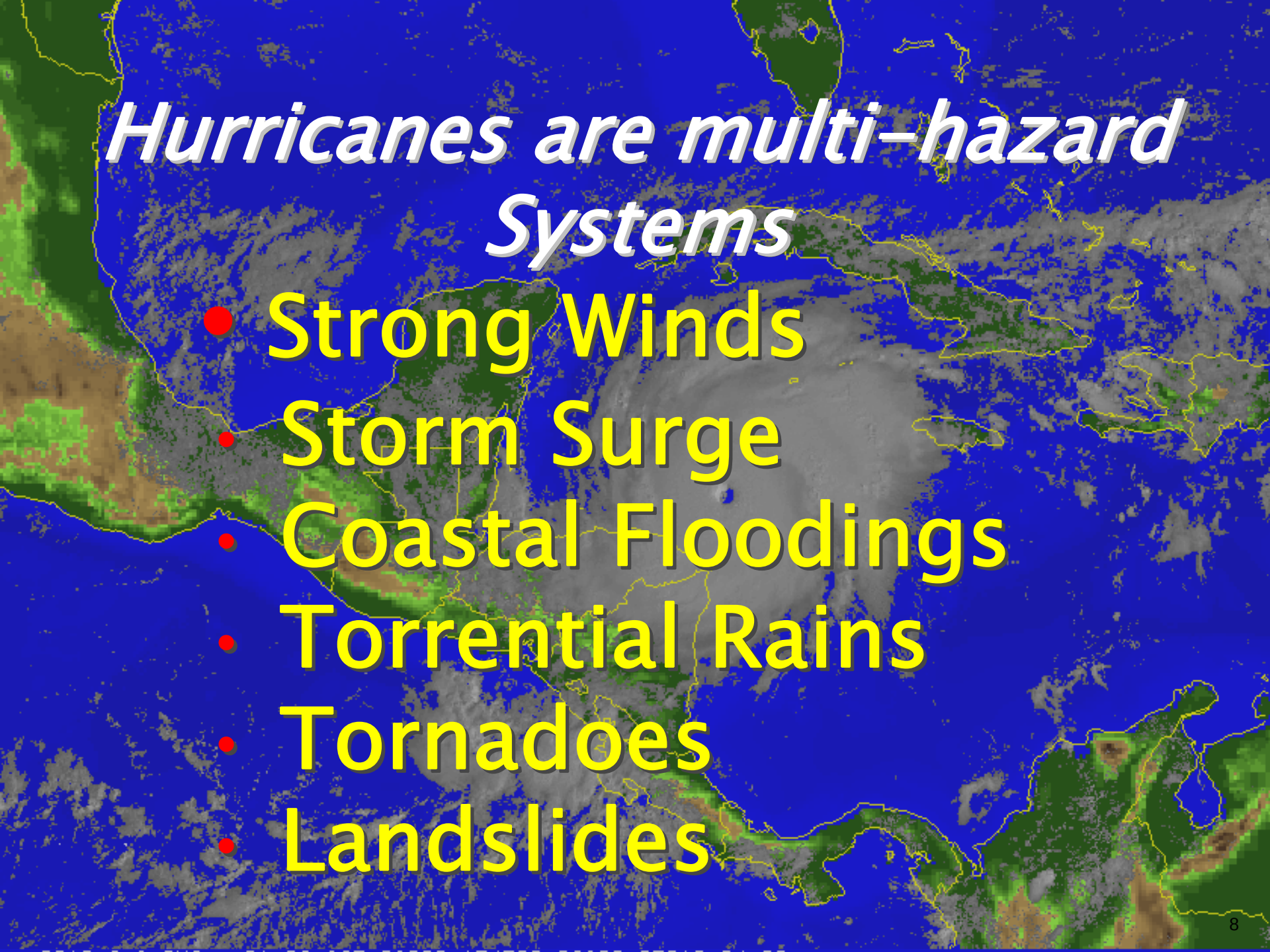
Coastal Floodings and Lowland Floodings



Hurricanes are Cuba's greatest meteorological hazard

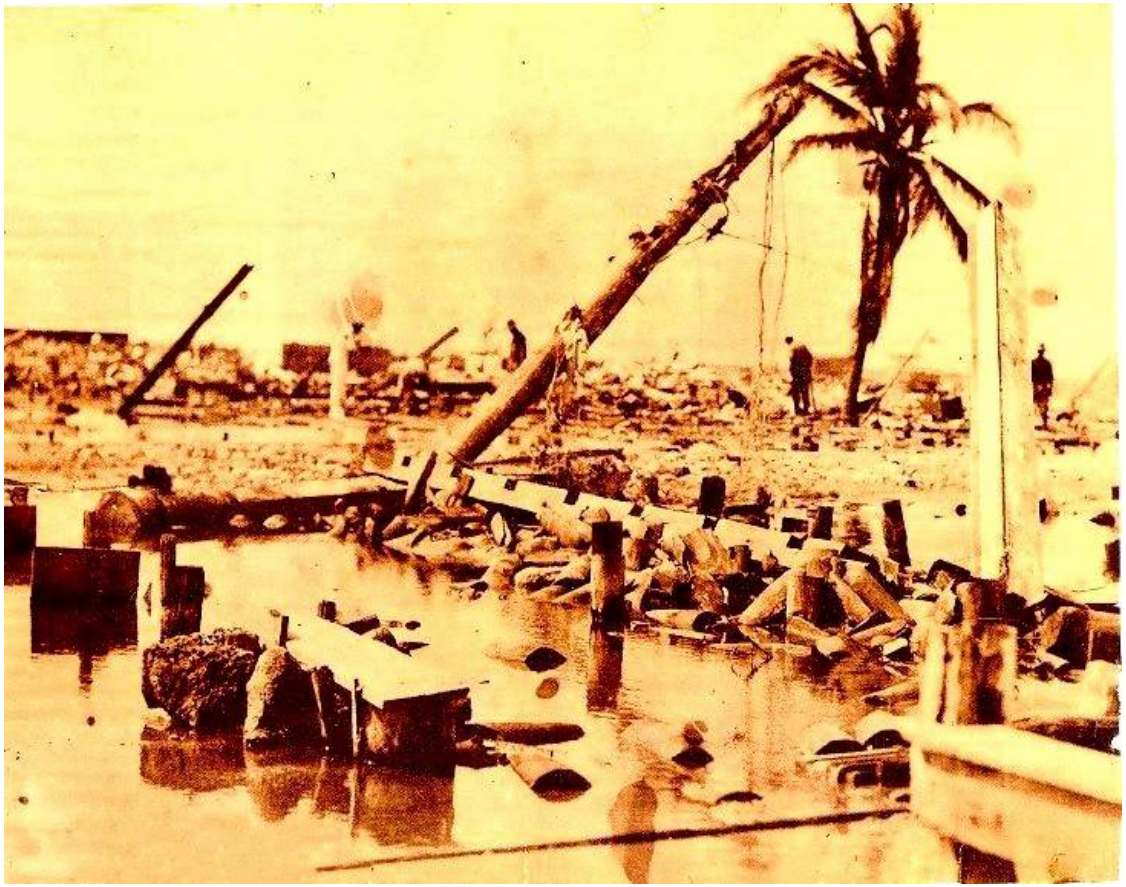
MAYOR HURRICANES TRACKS (CAT 3-5) IN 110 YEARS

Hurricanes are multi-hazard Systems



Hurricanes are multi-hazard Systems

- Strong Winds
- Storm Surge
- Coastal Floodings
- Torrential Rains
- Tornadoes
- Landslides



SANTA CRUZ DEL SUR NOVEMBER 1932

Mayor Catastrophe in Cuban History

Storm Surge in a Major Hurricane.

Casualties: 3033

The whole city dissapeared under the 6.5 meters high Storm Surge

HURRICANE FLORA
OCTOBER 1963

Casualties: 1200

Great Material Losses,

US $300 000 000
(1963 value)

Total amount of rain:
1 800 mm in 72 hours
over mountainous terrain
where the largest Cuban
river cross lowlands

ORIGIN OF THE EARLY WARNING SYSTEM IN CUBA

- Triumph of Cuban Revolution in 1959.
- The Great Disaster in Hurricane “Flora” (1963).
- The specific need for organization and preparedness to face the threat of disasters.

LEAD TO:

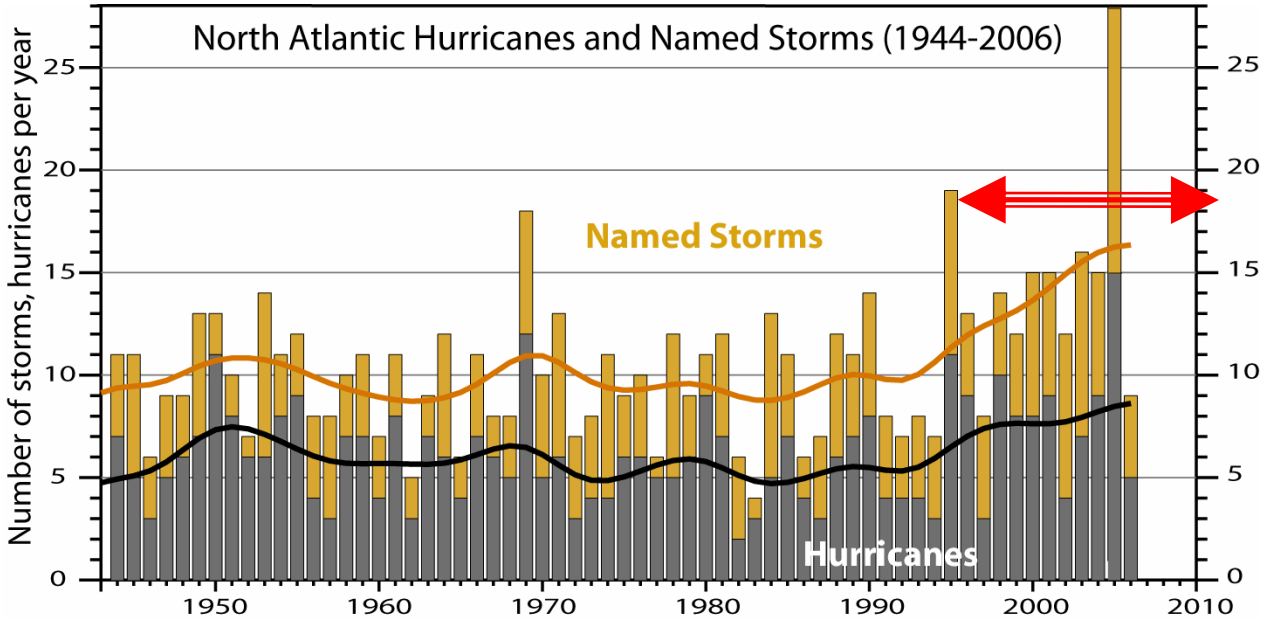
✓THE MODERNIZATION OF THE CIVIL DEFENSE (CREATED IN 1962)

✓THE METEOROLOGICAL SERVICE (FOUNDED IN 1856, BUT ALMOST WITH NO CHANGE UNTIL THEN),

✓THE BUILDING OF A SYSTEM OF DAMS TO PREVENT LARGE FLOODINGS.

BACKGROUND OF THE ESTABLISHMENT OF EWS

An active Tropical Cyclone period began in 1995 Cuban National Meteorological Service foresaw the need to have an early alert on tropical cyclones



The first Early Warning Message was issued on October 14, 1996, several days before hurricane "Lili" crossed over the central provinces of Cuba

A wide legal basis regulating the functioning of EWS

- Law No. 75 of National Defense
- Decree-law No. 170 on the Civil Defense system
- Guideline No. 1 of the Vice President of the National Defense Council
- Law No. 81 / 97 on the Environment
- Resolution 106 /99 of the Ministry of Science, Technology and Environment
- Ordinance Law No. 279 of 2007 "On General Principles, Organization, Preparation and Provisions of the Hydrometeorological System of Cuba for Exceptional Situations

THE CIVIL DEFENSE IN CUBA IS

AN INTEGRATED SYSTEM OF ALL SOCIETAL AND STATE FORCES AND RESOURSES.

MISSION: TO PROTECT PERSONS, GOODS, SOCIETAL STRUCTURES, THE NATIONAL ECONOMY AS WELL AS NATURAL RESOURCES.

PRINCIPLES OF THE EARLY WARNING SYSTEM IN CUBA

- ✓ NATIONAL AND INSTITUTIONAL REACH
- ✓ DIRECTION OF THE SYSTEM AT HIGHEST LEVEL
- ✓ OVERALL PROTECTION
- ✓ DIFFERENTIAL WAY OF PLANNING AND ORGANIZING PROTECTION.
- ✓ EFFECTIVE COOPERATION WITH THE METEOROLOGICAL SERVICE, THE MEDIA, THE ARMED FORCES AND THE MINISTRY OF THE INTERIOR, AS WELL AS OTHER SPECIALIZED FORCES, FOR THEIR SUPPORT IN CASE OF NATURAL DISASTER SITUATIONS.

NATIONAL AND INSTITUTIONAL REACH

The system of Civil Defense in Cuba exists in the whole Country and is organized at all levels, taking into account the political and administrative divisions and the corresponding structure of the State.

It is supported by the use of all human and materials resources that belong to the State, economic and societal organizations.

DIRECTION AT THE HIGHEST LEVEL

THE PRESIDENT OF THE STATE COUNCIL IS THE HEAD OF THE CIVIL DEFENSE

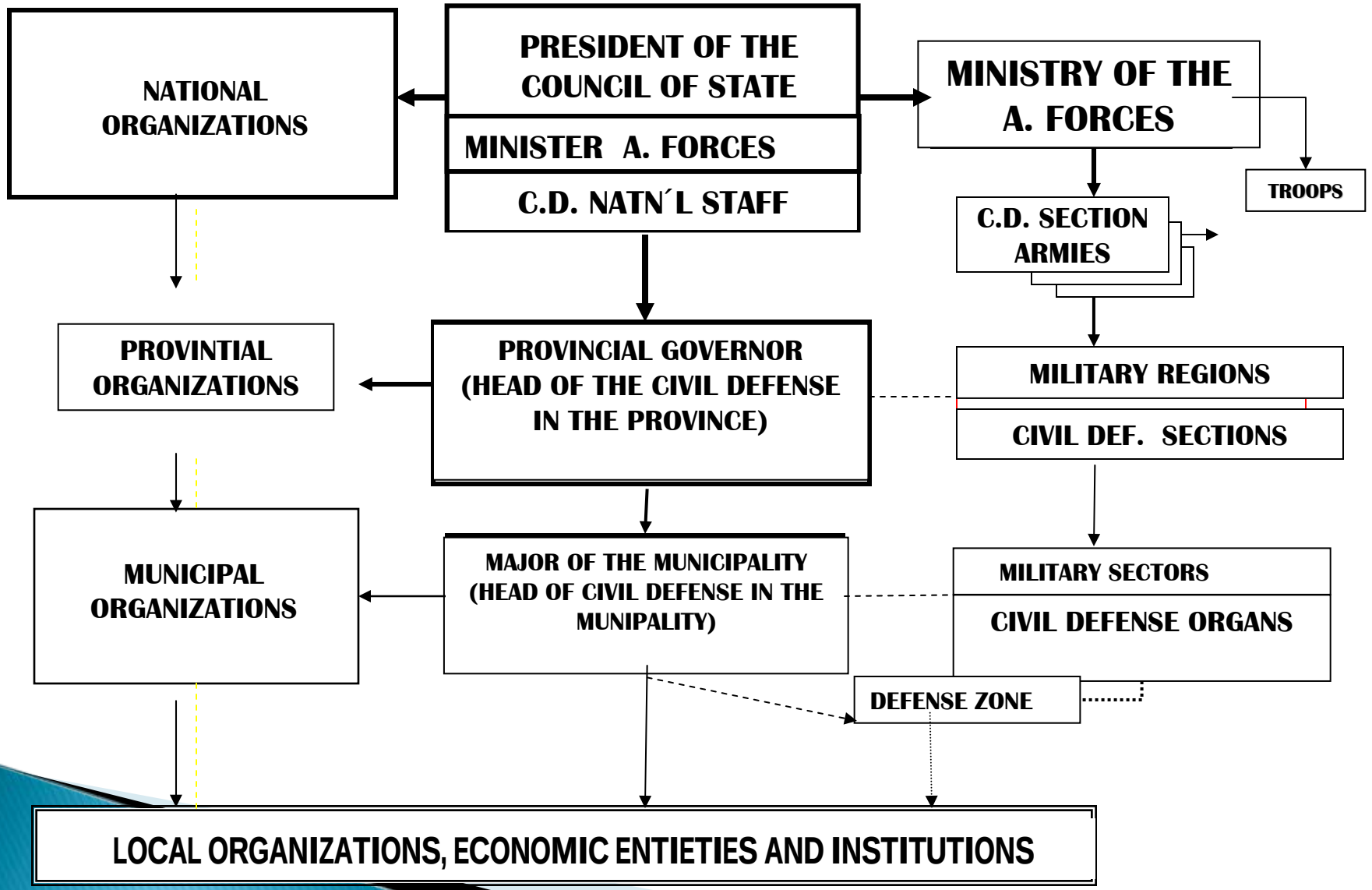
THE MINISTER OF THE ARMED FORCES HAS:

THE CIVIL DEFENSE NATIONAL STAFF

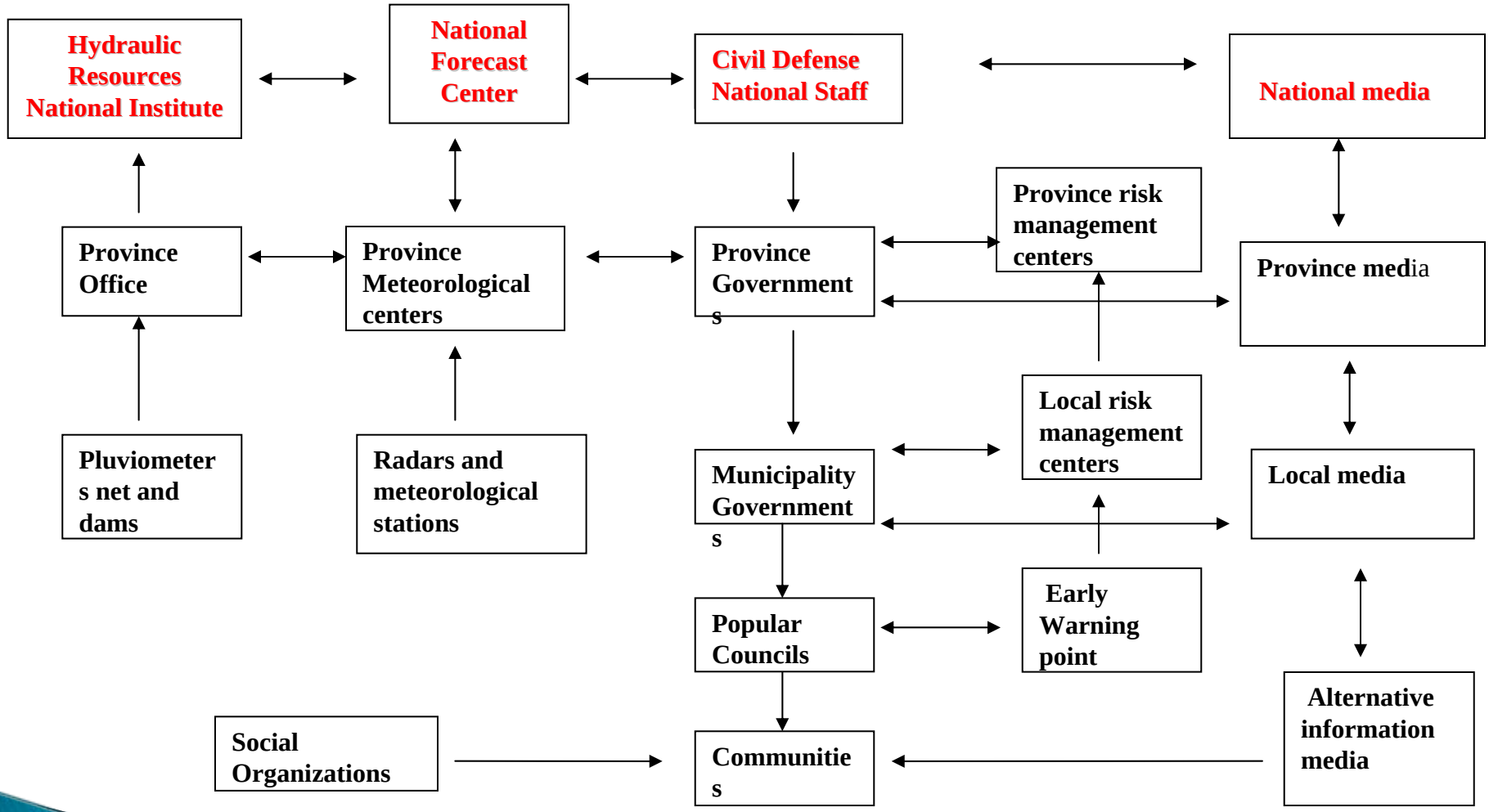
THE GOVERNORS AND MAYORS IN PROVINCES AND MUNICIPALITIES ARE THE HEADS OF THE CIVIL DEFENSE IN THEIR TERRITORIES

THE DIRECTORS OF STATE ORGANIZATIONS, AND THOSE OF ECONOMICAL ENTIETIES AND SOCIAL INSTITUTIONS ARE AT THE SAME TIME THE HEADS OF THE CIVIL DEFENSE AND ARE RESPONSIBLE FOR THE CIVIL DEFENSE SYSTEM IN THEIR AREAS OF INTEREST.

ORGANIZATION OF THE CUBAN CIVIL DEFENSE SYSTEM



FUNCTIONAL STRUCTURE OF EARLY WARNING SYSTEM FOR TROPICAL CYCLONE IN CUBA



THE PROTECTION IS PLANNED, ORGANIZED AND EXECUTED TAKING INTO ACCOUNT THE RESPONSABILITIES AND FIELD OF ACTION OF EVERY OFFICIAL AT ALL LEVELS, AS WELL AS THE HAZARDS TO WHICH EVERY COMMUNITY IS EXPOSED TO.

AN IMPORTANT ELEMENT IS THE ACTIVE PARTICIPATION OF ALL INSTITUTIONS THAT HAVE FORCES AND SPECIALIZED TECHNICAL ELEMENTS WHICH HAVE BEEN TRAINED AND ORGANIZED FOR A QUICK RESPONSE, SUCH AS:

ARMED FORCES, MINISTRY OF SCIENCE, TECHNOLOGY AND THE ENVIRONMENT, MINISTRY OF HEALTH, INSTITUTE OF WATER RESOURCES, MINISTRY OF INFORMATICS AND COMMUNICATIONS, ETC.

The development of this Legislative framework for Civil Defense and the mandatory inclusion of measures for Disaster Reduction and Mitigation in the process of planning the development of the Country and new projects and investments, acts as a strong policy that has already yielded good benefits to Cuban Society

GENERAL STEPS IN THE EARLY WARNING PROCESS

- PREVENTION
- PREPAREDNESS
- RESPONSE: PHASES, ACTIONS AND MEASURES
- RECUPERATION, REHABILITATION AND RECONSTRUCTION

Training Program for officials, workers and all people includes:

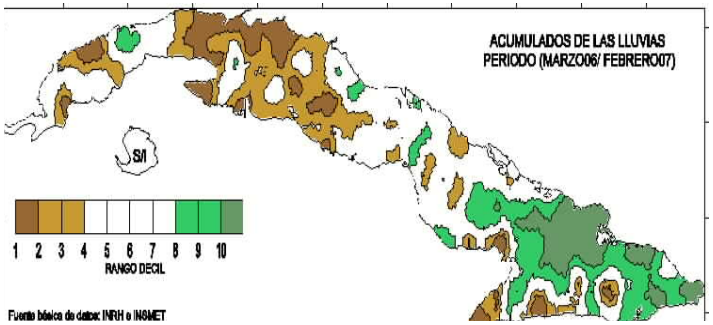
Talks and Conference,
Radio and TV programs,
Short Courses through the Educational TV Channels,
School Curriculae in Primary, Secondary and University levels.

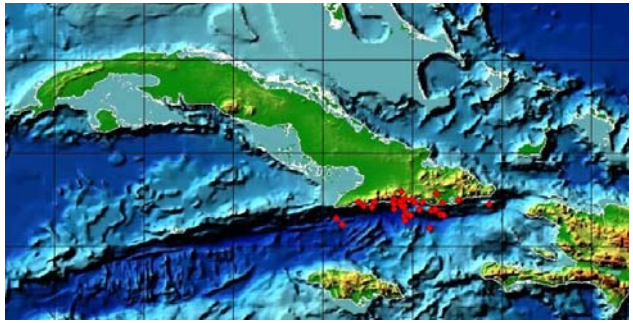
A set of institutions guarantee surveillance against all events threatening the country. They have branches in all provinces, and some have municipal representations

Hydrometeorological events

floods

forest fires





drought

earthquakes

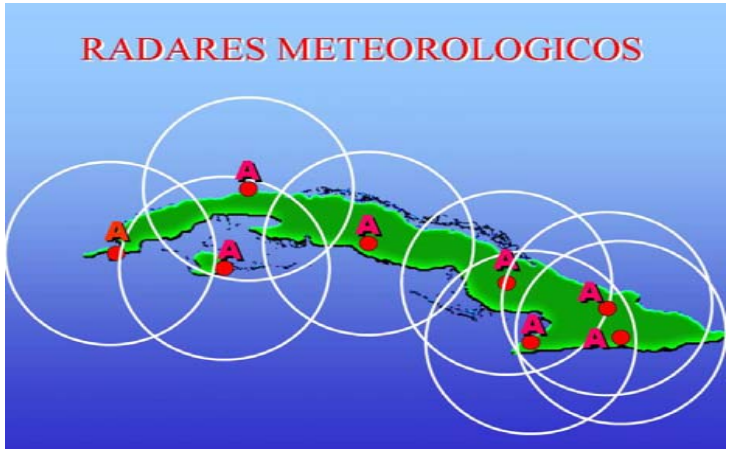
This surveillance network makes up the base of Cuba's Early Warning System and is part of its Civil Defense System

Main elements of the EWS for TC

- Central surveillance entities in charge of monitoring the hazards and their territorial branches.
- Authorities at the different levels, entrusted implementing the relevant protection measures, advised by officials and experts of the Civil Defense.
- The media and mass and social organizations at the local level, which help disseminate information.
- The people, who are well organized and prepared.

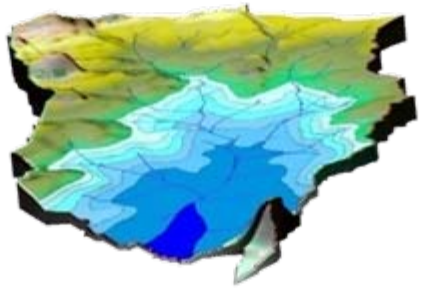
Elements including in EWS for tropical cyclones

- An effective meteorological and hydrologic surveillance and communication systems between these services and Civil Defense institutions, both at the national and local levels.
- An effective network for transmitting information
- The use of all the mass media for spreading warning messages.
- Plans designed for different situations



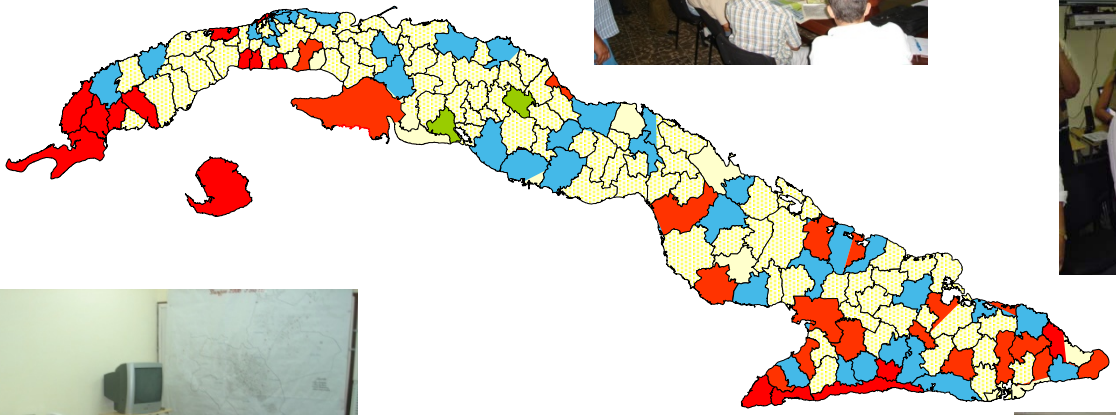
Utilization of risk information in emergency planning and warnings

- The Environment Agency of the Ministry of Science, Technology and the Environment was assigned the responsibility, to organize, lead and conduct disaster risk studies.



- There is a group of specialists that elaborated a methodology to assess the risk from national to local level

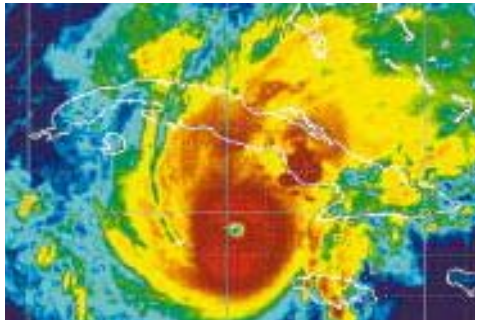
- Databases of risk for are properly stored at the risk management centers of each municipality
- Plans are updated every year based on risk estimation
- The results of the upgrade are informed to the provincial and national levels.



Hazard monitoring, forecasting, and mandates for warning development

National Forecast Center

river flooding



wildfires

National Institute of Hydraulic Resources

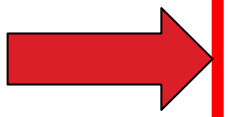
Forest Keeper Body

Role of the NMHS in the EWS

- To constantly monitor weather
- To issue timely Early Warnings to the Government, the Civil Defense, and the people on any hazardous weather system that could affect any part of the Country.
- To transmit Early Warnings and warnings through the Media, mainly TV and radio, updating the information.
- To participate in awareness and educational activities

Hazard monitoring, forecasting, and mandates for warning development

The National Meteorological Service has the sole mandate for issuing meteorological warnings on thunderstorm, tropical cyclone, flash flood, strong winds, landslide, tornado, coastal flooding and storm surge



National Staff of the Civil Defense issues a warning note

threatened areas

A true partnership as part of a sole National System in which all efforts are put into action for the protection of life and material resources as well

Cuban Meteorological Service has the organizational responsibility for monitoring, forecasting and developing the hazard warning and communicating it to the public from the scientific and operational point of view

National Civil Defense is responsible for the development of the warning in terms of the mobilization of all national and local resources, including all logistics for protective measures and evacuations

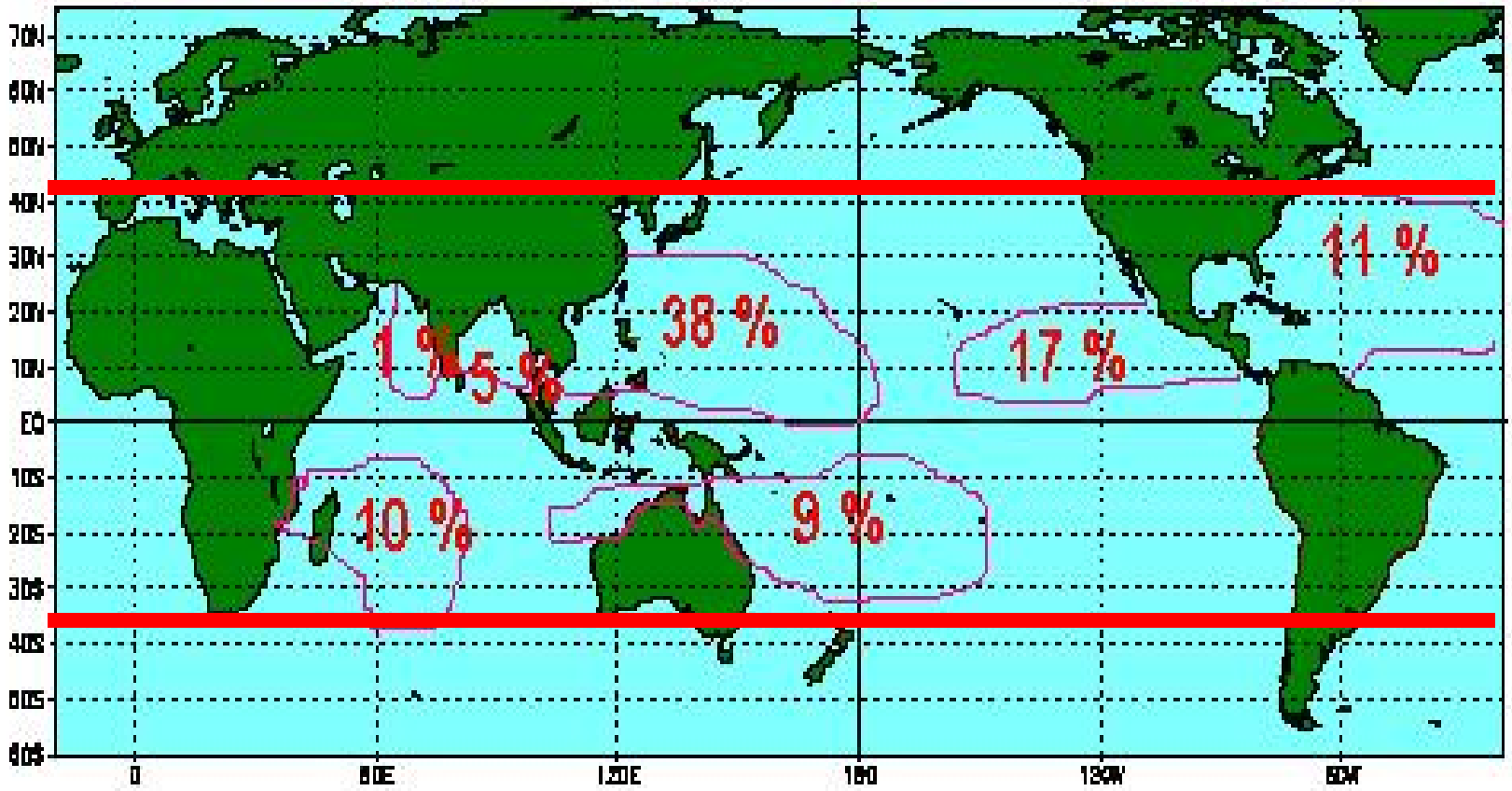
THE LEADERS OF THE COUNTRY ARE ALWAYS AT THE FIRST LINE

POLITICAL WILL AND COMMITMENT

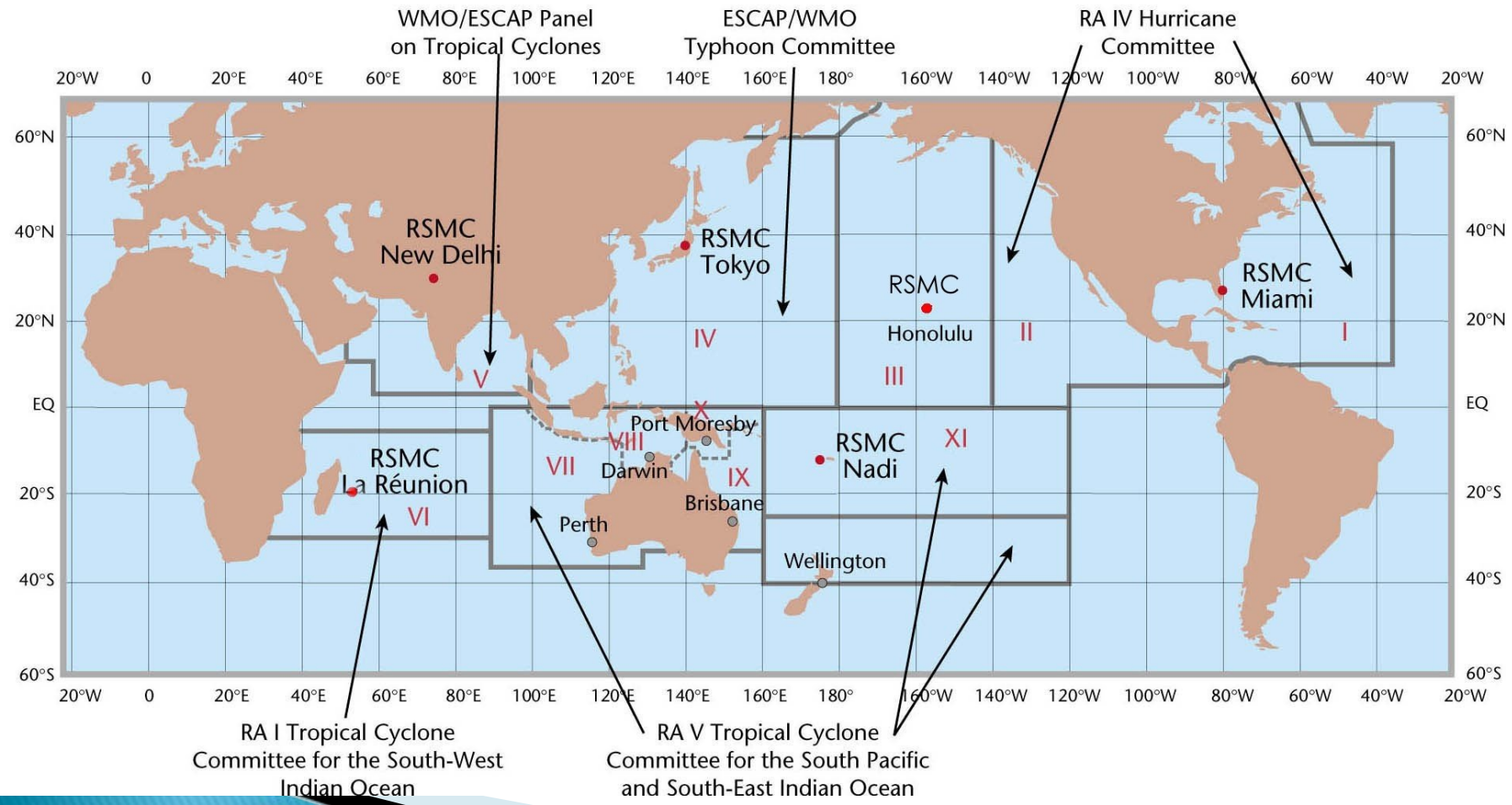
VISITING THE NATIONAL FORECASTING CENTER, GIVING GUIDELINES FOR ACTION THROUGH TV AND RADIO, OR VISITING AFFECTED AREAS WHEN TROPICAL CYCLONE WINDS ARE STILL BLOWING

Tropical Cyclones monitoring and Forecasting

WORLD DISTRIBUTION OF TROPICAL CYCLONES



WMO TROPICAL CYCLONE RSMC REGIONS



CLASIFICATION OF TROPICAL CYCLONES IN WMO RA IV HURRICANE COMMITTE COUNTRIES

Tropical Depression	< 63 km/h
Tropical Storm	63 – 117 km/h
Hurricane	> = 118 km/h

CLASSIFICATION SCALE FOR HURRICANES IN WMO RA–IV
THE SAFFIR–SIMPSON SCALE

Category	*Maximum Sustained Winds (km/h)*	*Potential Damage*
1	118-153	Minimal
2	154-177	Moderate
3	178-209	Extensive
4	210-250	Extreme
5	> 250	Catastrophic

MAJOR HURRICANES

WORLD TROPICAL CYCLONE SYSTEM

WMO WORLD WEATHER WATCH

Global Observations --- Global Telecommunications

WORLD METEOROLOGICAL SPECIALIZED CENTERS

Global Numerical Models

WMO REGIONAL & TC SPECIALIZED CENTERS

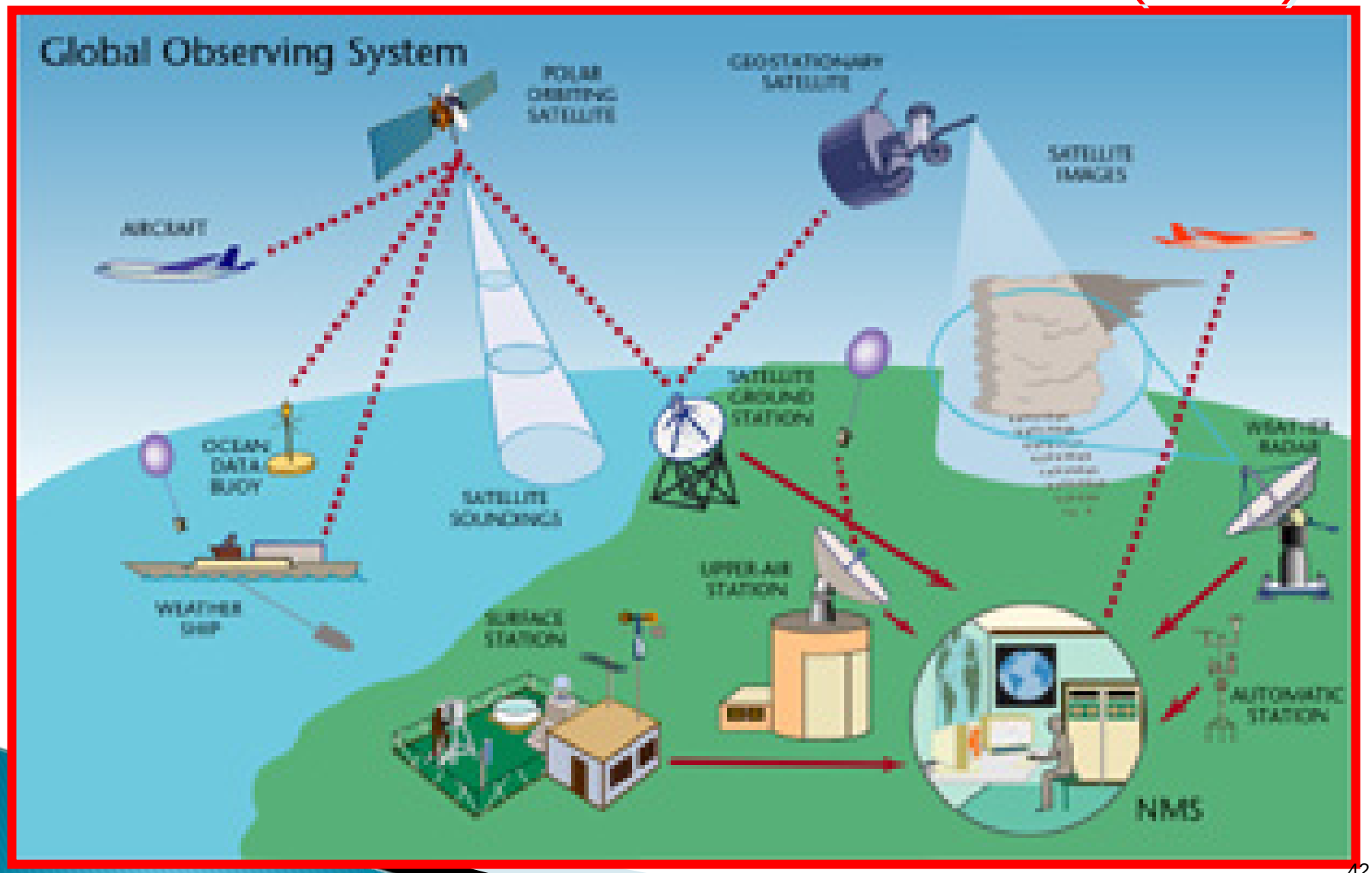
Regional Models and TC Models

NATIONAL METEOROLOGICAL CENTERS

National Weather Watch, Forecasts & Warnings for the Country

PUBLIC | GOVERNMENT | CIVIL DEFENSE | MEDIA

WMO GLOBAL OBSERVING SYSTEM (GOS)



Cuba:

METEOROLOGICAL SERVICE

1 National Forecasting Center

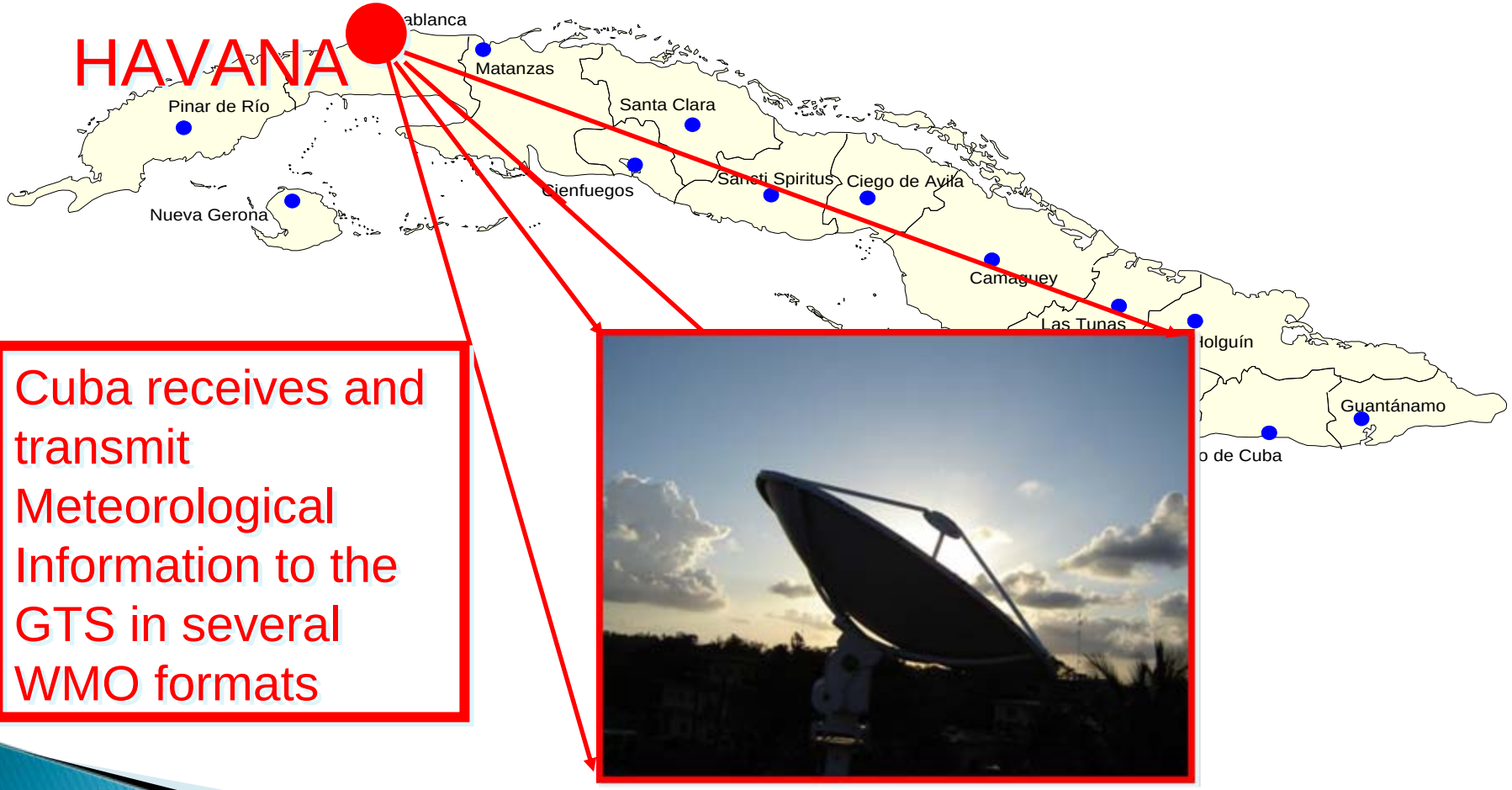
15 Provincial Forecasting Departments

67 Meteorological Stations

8 Meteorological Radars

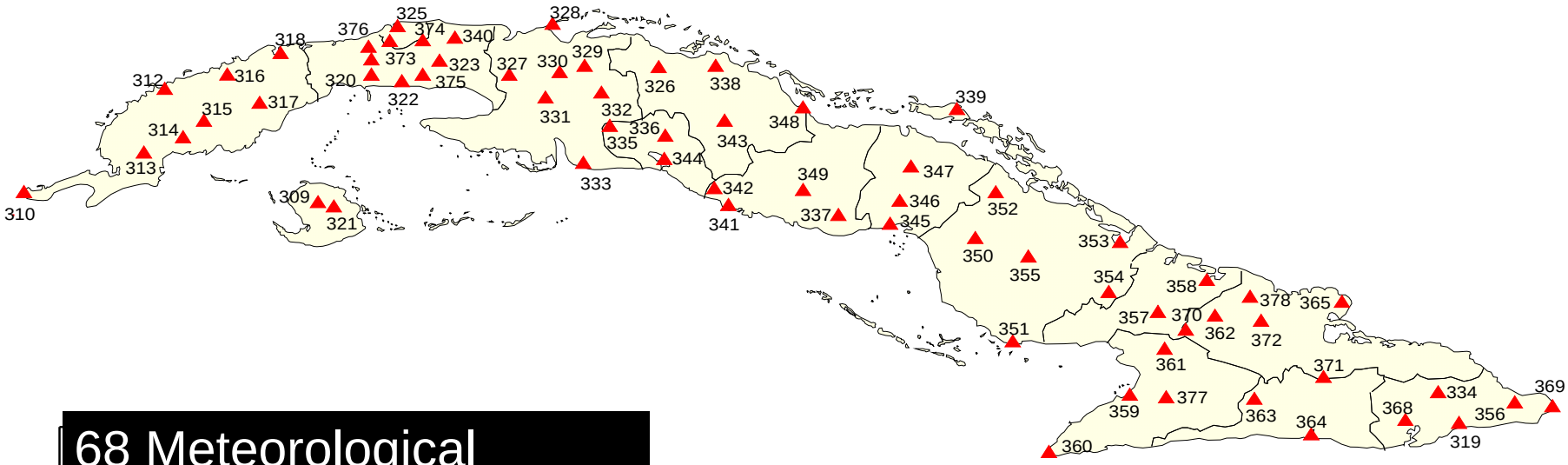
3 Meteorological Satellite Ground Stations

WMO GTS link at the Cuban National Meteorological Center in Havana



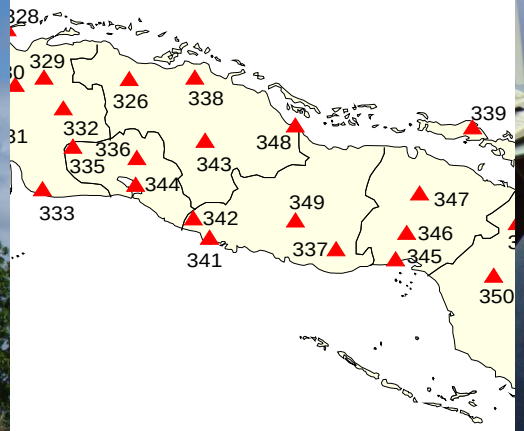
Cuba receives and transmit Meteorological Information to the GTS in several WMO formats

NATIONAL METEOROLOGICAL OBSERVING SYSTEM IN CUBA



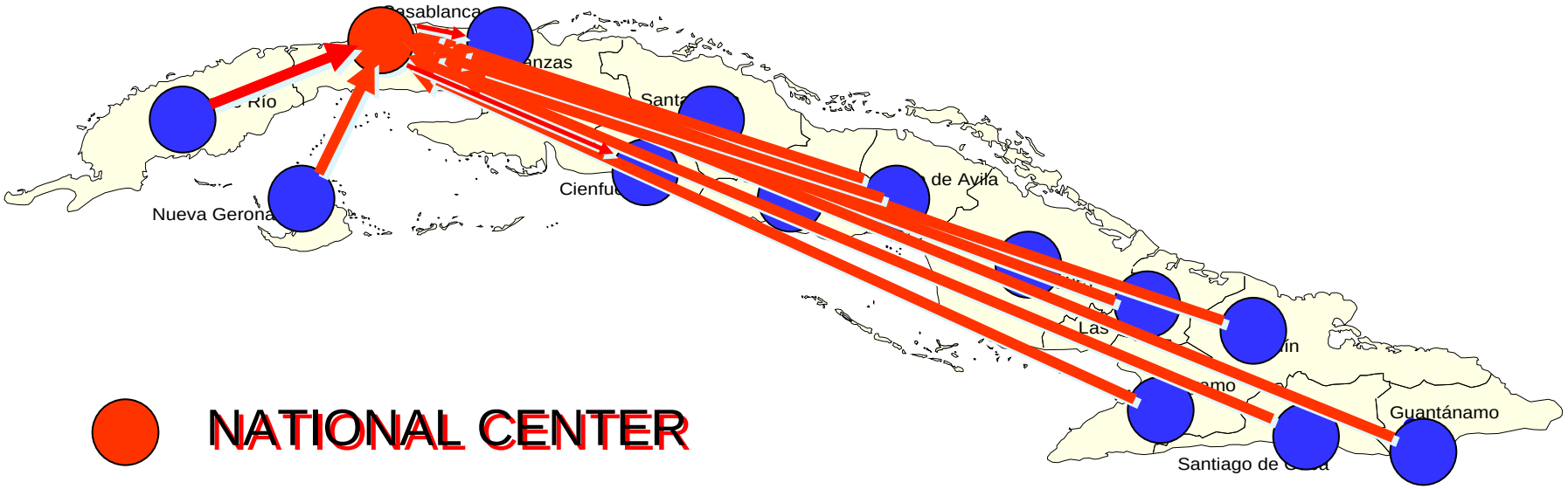
68 Meteorological Stations
1 Upper Air Sounding Station
1 High Resolution Satellite Earth Station

NATIONAL METEOROLOGICAL OBSERVING SYSTEM IN CUBA



68 Meteorological Stations
1 Upper Air Sounding Station
1 High Resolution Satellite Earth Station

NATIONAL METEOROLOGICAL TELECOMMUNICATION NETWORK IN CUBA



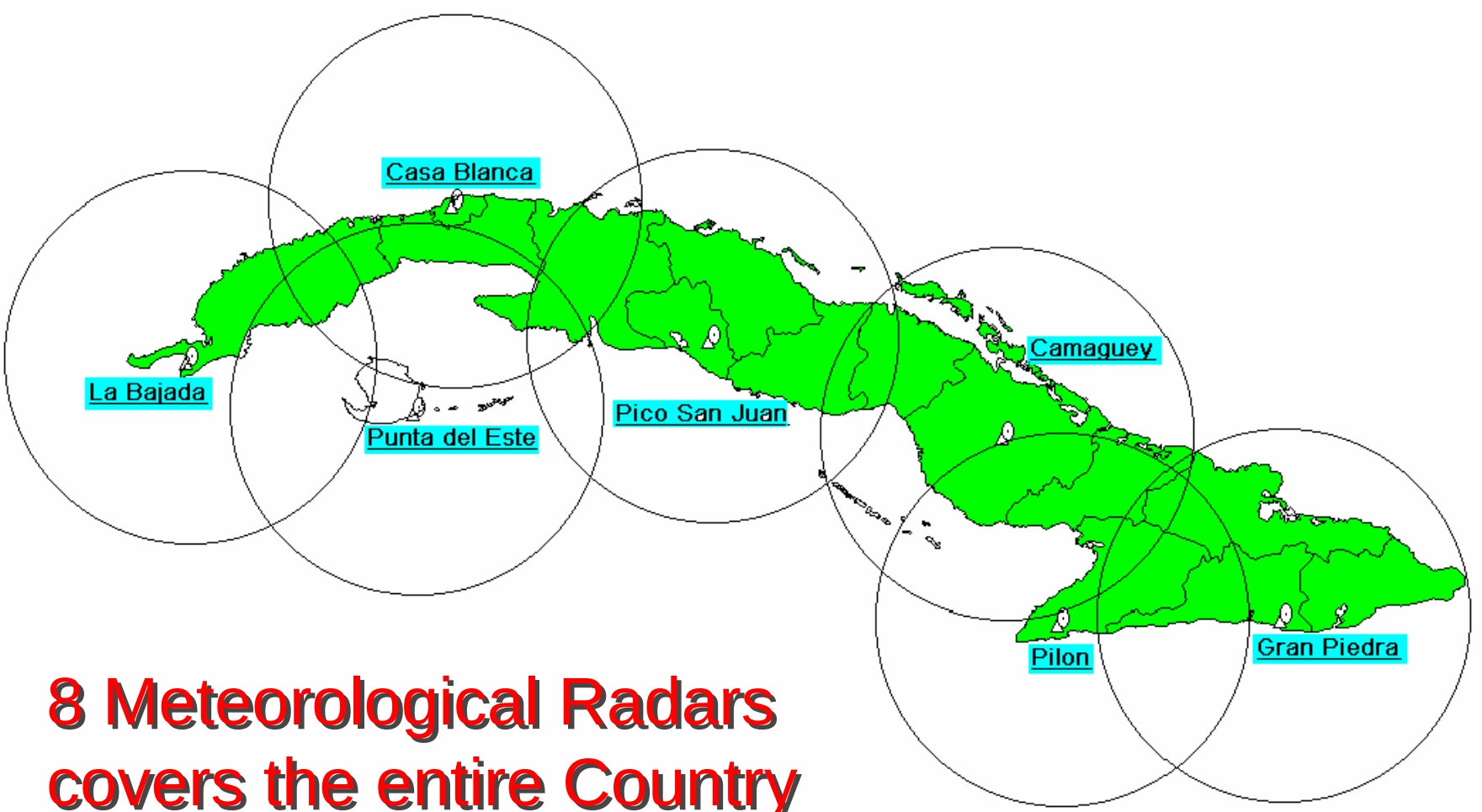
NATIONAL CENTER

PROVINCIAL CENTER

TCP / IP LINK

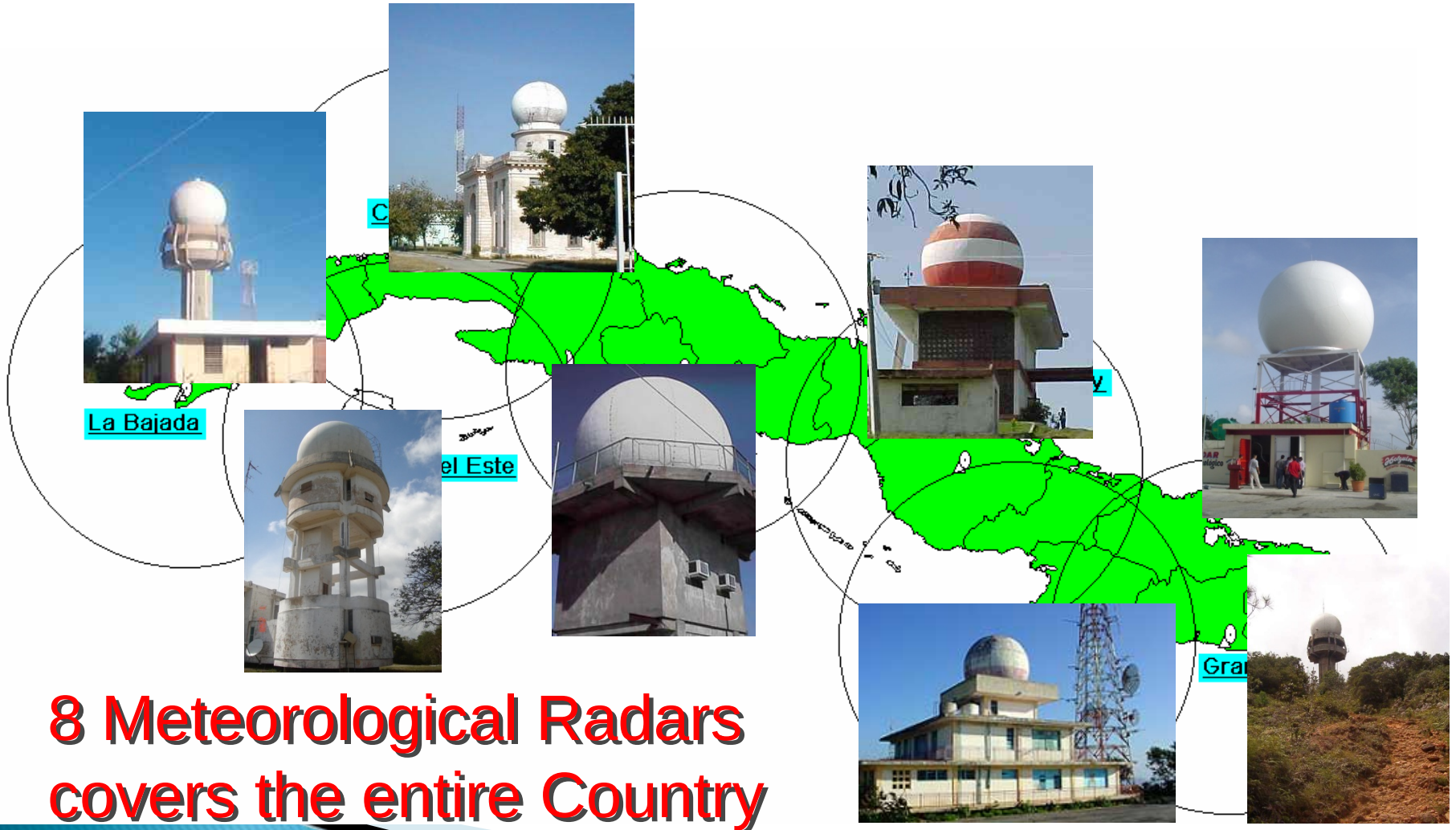
NMTN digitally provides all relevant exchange of meteorological information in the Country

WEATHER RADAR NETWORK COVERAGE IN CUBA



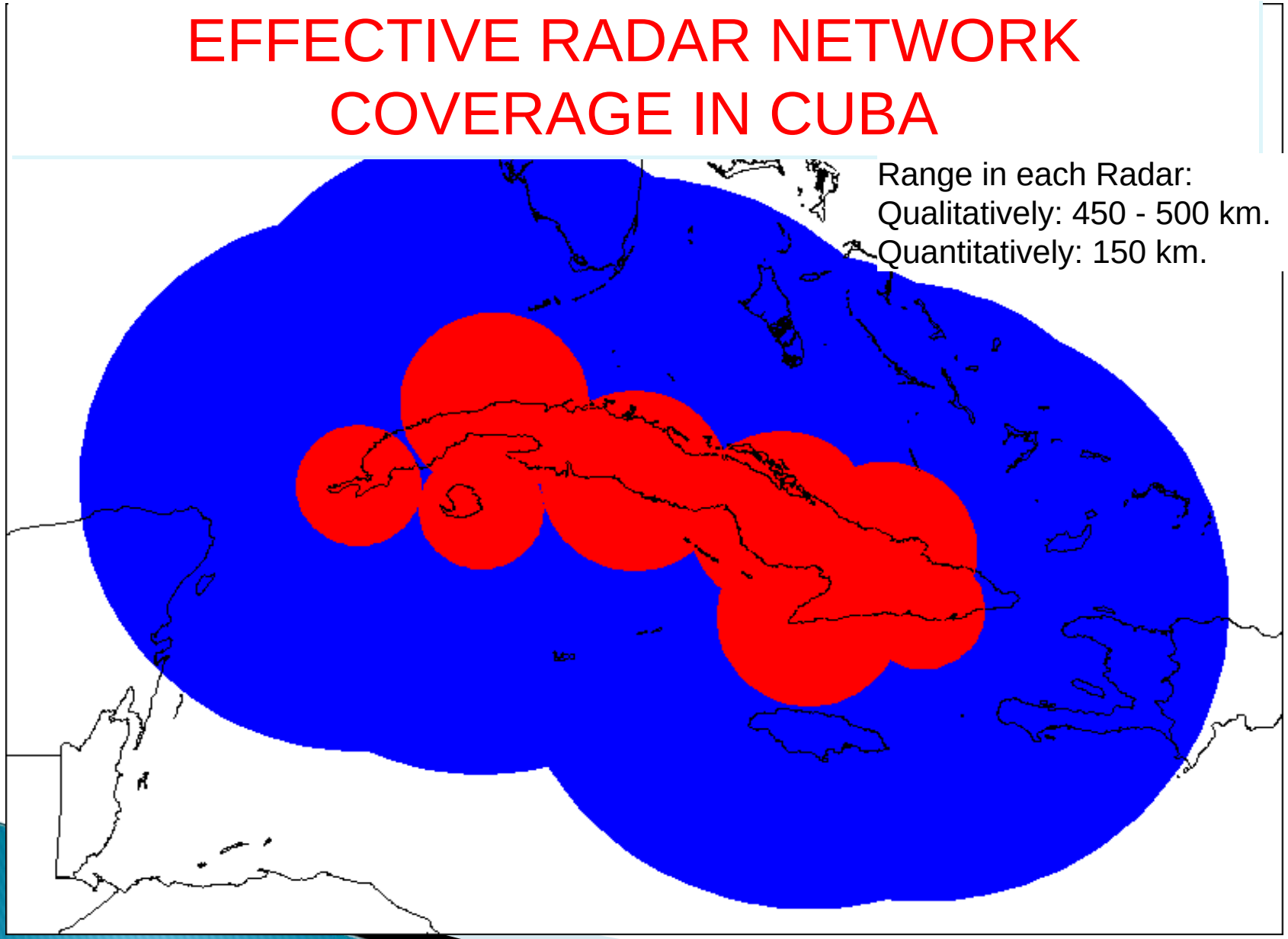
8 Meteorological Radars covers the entire Country

WEATHER RADAR NETWORK COVERAGE IN CUBA



8 Meteorological Radars covers the entire Country

EFFECTIVE RADAR NETWORK COVERAGE IN CUBA



DATA INPUT

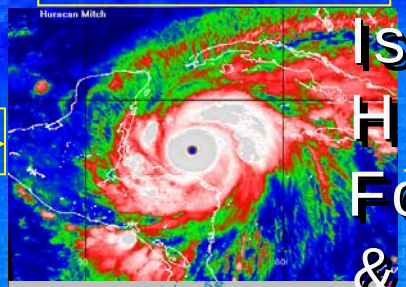
ANALYSIS AND NUMERICAL MODELS

DIFUSSION OF WARNINGS

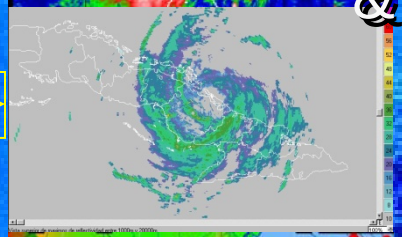
RESPONSE ACTIONS

GOVERNMENT,CIVIL DEFENSE, RESIDENTS

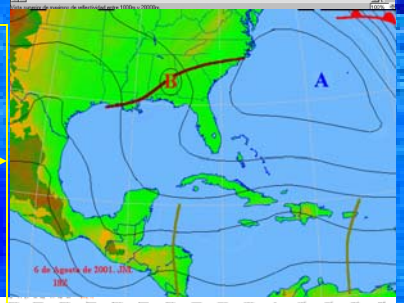
SATELLITES



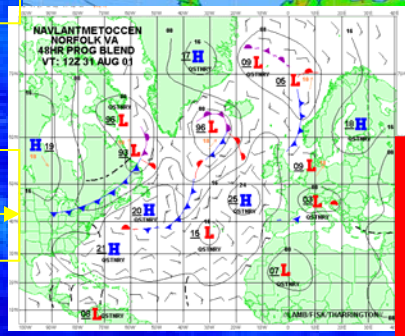
RADARS



WEATHER STATIONS
UA SOUNDINGS
SHIPS
BUOYS
AIRCRAFTS

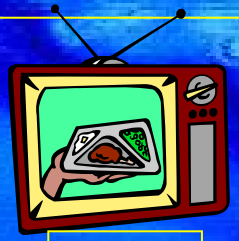


NUMERICAL MODELS



Issues Official Hurricane Forecasts & Warnings

FORECASTERS

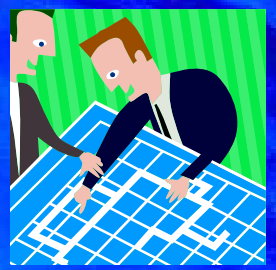


TV

RADIO

PHONE - FAX

INTERNET



NATIONAL FORECASTING CENTER

ERRORS ARE GREATER WHEN FORECAST RANGE INCREASES….. UNCERTAINTIES EXIST AND MUST BE ADDRESSED

	FORECAST RANGE (hr); ERROR (km)				
MODEL	12	24	36	48	72
CLIPER	51	103	161	220	351
BAMS	61	114	168	222	336
BAMN	49	91	133	177	268
BAMD	47	88	132	183	293
LBAR	41	75	111	159	284
GFDI	42	69	98	128	200
AVN	56	98	139	178	248
NOGAPS	57	81	107	126	193
UKMET	57	92	136	165	244
GFDL	44	70	96	120	178

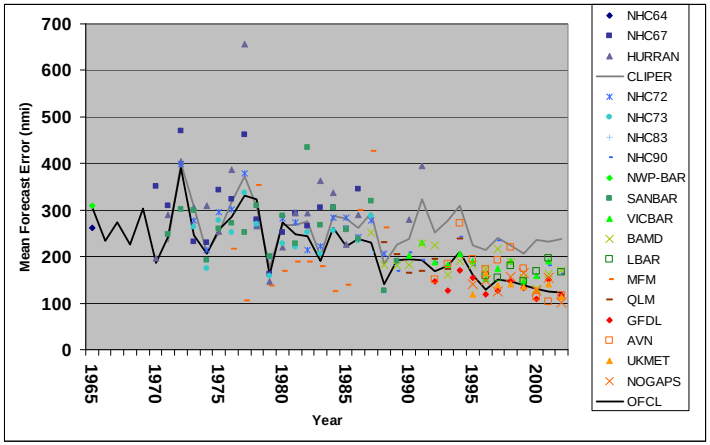
TRACK FORECAST MODELS

TRACK FORECASTS ARE MUCH BETTER THAT INTENSITY FORECASTS

	FORECAST RANGE (hr); ERROR (km/h)				
MODEL	12	24	36	48	72
SHIFOR	8.2	11.4	14.0	16.9	21.1
SHIPS	8.1	11.0	13.0	15.7	20.5
GFDI	9.3	11.6	13.9	16.6	19.0
CT91CI	10.0	13.2	16.0	17.8	20.6

INTENSITY FORECAST MODELS

HOWEVER, ERRORS ARE DIMINISHING IN ALL TIME RANGES DUE TO IMPROVEMENT IN DATA ASSIMILATION AND MODEL PHYSICS.



OPTIONS TO REDUCE FORECAST UNCERTAINTY?

More accurate and numerous observations with greater coverage.

Improved analysis (data assimilation) methods.

Faster computers and more complex models.

Probabilistic forecasting with ENSAMBLES and a CONSENSUS FORECAST

Model Forecasting Definitions

Deterministic - single forecast from a single initialization

Ensemble - collection of forecasts verifying at the same time and created from different but equally viable initial conditions, forecasting methods, and/or models that (ideally) statistically represent nearly all forecast possibilities

Consensus - average of multiple forecasts verifying at same time

Lagged Average - average of forecasts with different initial times and all verifying at the same time

Superensemble - multiple models and multiple initializations, adjusted for biases

"*WARNING*" AND "*EARLY WARNING*" HAS DIFFERENT MEANINGS WHEN DEALING WITH TROPICAL CYCLONES;

WARNING:

- Usually means that inmmediate actions have to be taken to protect lives and properties, generally in a 24 hr time frame.

EARLY WARNING:

- Means that there is some likelihood that hurricane conditions might be expected in 3, 4 or 5 days and, because of it, the level of information and awareness should be increased, without taking, for the moment, any further action. This information is given with time enough, so that everyone could be well informed.

- Heavily depends on a previous education and preparation of the users of this information (i.e. Government, Civil Defense, the Media people, residents, etc.).
- Increases awareness on the likelihood of the hurricane threat and prepares everybody to take actions in the near future, if it becomes necessary.

THE CHALLENGE OF AN EARLY WARNING IN HURRICANES

MEAN 5-DAY TRACK FORECAST ERRORS FOR THE ATLANTIC BASIN

24 HR....147 km

48 HR....257 km

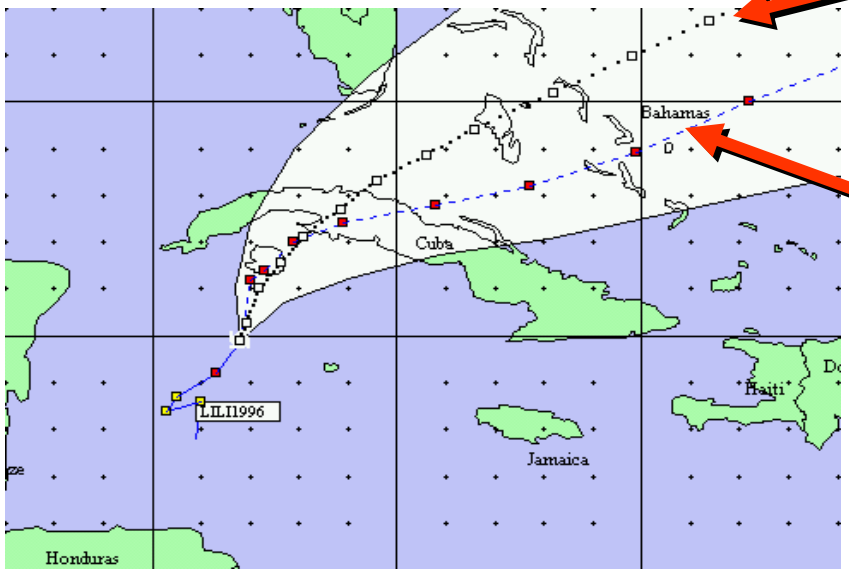
72 HR....388 km

96 HR....505 km

120 HR...688 km

ERROR CONE GRAPHICS

Forecast track + mean error = "Risk area"

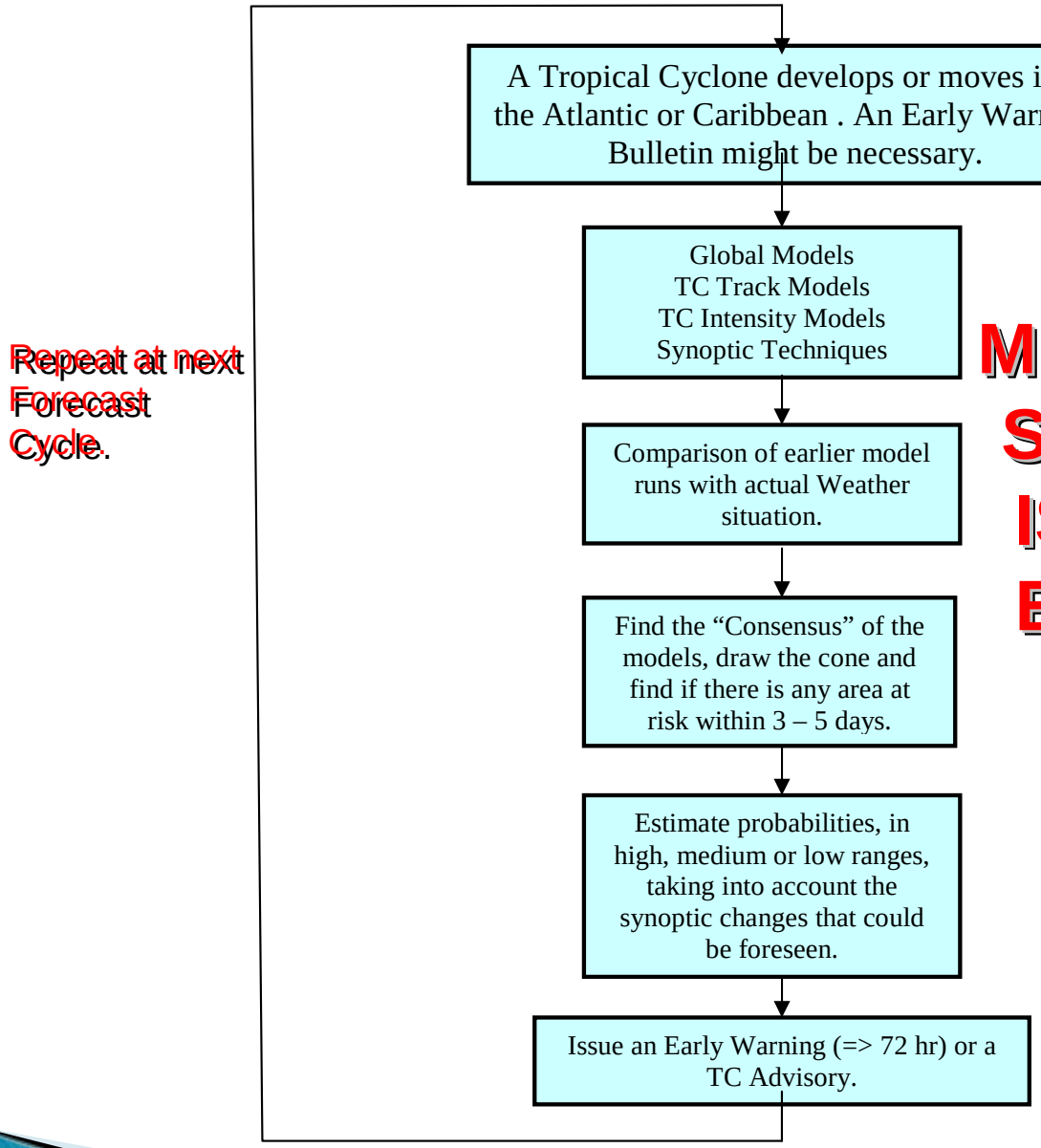


Forecasted mean track in the middle of the cone

Actual Track

(60 to 70 % of actual tracks will be inside the cone area)

Main Application in Early Warning:
To make users aware of the uncertainty of the forecast track and to discourage users from focusing only on a single forecast track, but at the same time ASSESSING THAT THEY ARE IN AN AREA AT RISK.



METHODOLOGICAL SCHEME FOR THE ISSUANCE OF AN EARLY WARNING AT CUBAN NATIONAL FORECASTING CENTER.

EXAMPLE OF AN EARLY WARNING BULLETIN

- Havana, Thursday, November 1, 2001 2:30 pm
  National Forecasting Center, Institute of Meteorology.

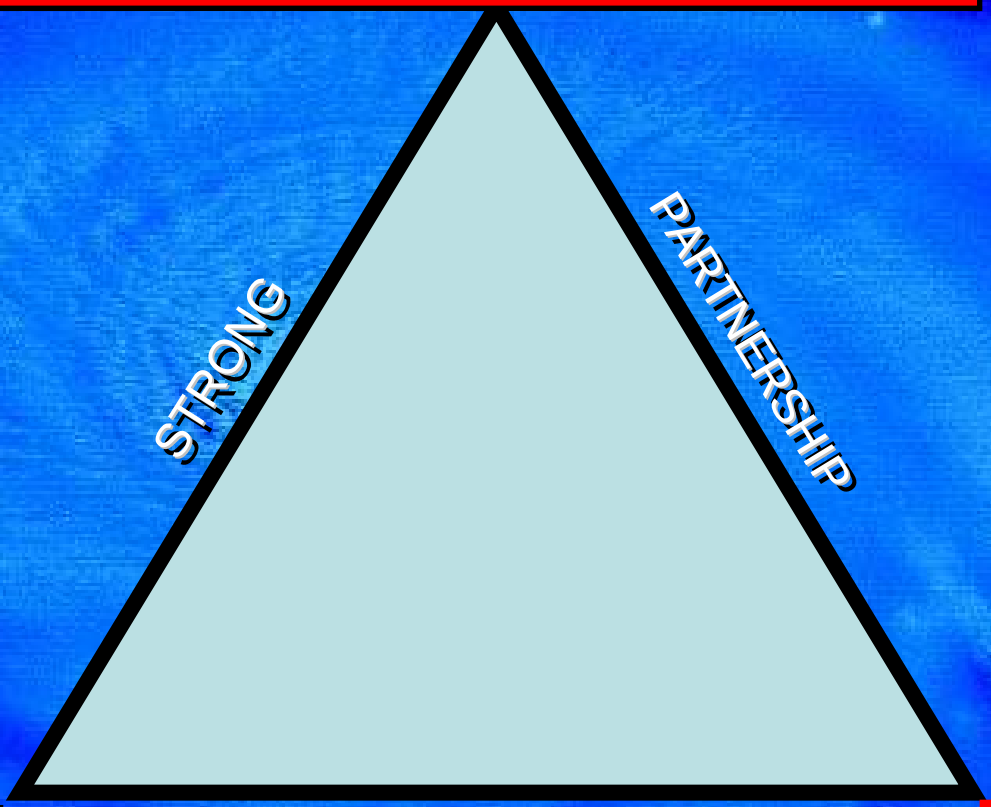
- EARLY WARNING BULLETIN

  Synopsis: Tropical Depression No. 15 was upgraded to Tropical Storm "Michelle" last night and is now over water in the NW Caribbean Sea. The Tropical Storm is located 490 km South of Cabo Corrientes, Pinar del Río province. Maximum Sustained Winds are 110 km/h, near Hurricane strengh. It is expected to become a Hurricane this afternoon. It is moving Northnorthwest ay 11 km/h.

- Outlook: Conditions favor further development of this tropical system. Within 72 hours, "Michelle" could already be a Major Hurricane over an area very near Cuba. A Northnortheast or Northeast movement is likely to occur by then, which would make "Michelle" cross directly over Cuba. The most threatened areas are the Western and Central provinces. The greatest likelihood is for a hit from Sunday to Monday. This will depend on the storm movement, for there could be periods of stalling or slow movement before "Michelle" speeds up in a near Northeast direction.
  All interests should very carefully follow further information on "Michelle" issued by the National Forecasting Center.

- Dissemination of Warnings
- Cooperation with Media
- Disaster risk management Agency and Local Authorities
- Actions from National to Local levels and role of the Met Service
- Training of Authorities and population

National Forecast Center



The Media

Civil Defense

TO FACE THE HURRICANE HAZARD, THERE IS A STRONG PARTNERSHIP AMONG THE NFC,THE CIVIL DEFENSE AND THE MEDIA

Cuba:

RADIO & TELEVISION

Radio:
5 Natl. Networks
15 Prov. Networks
63 Municipal Radio Stations

Coverage: 99.3 % of Cuban territory

Television:
4 Natl. Networks
15 Prov.TV Stations

Coverage: 96 % of Cuban territory

NATIONAL FORECASTING CENTER (NMS)

- Cuban NMS uses an user-oriented philosophy, as emphasized by WMO PWS Program.
- Cuban NMS has a reputation of accuracy, reliability and timeliness.
- Early Warnings and Warnings are issued with a clear, concise wording, with a wide use of graphics and the introduction of probabilities to address incertitude.

CIVIL DEFENSE

The Civil Defense receive a clear message so that they can take protective measures such as evacuation, well ahead of the impact.

MEDIA

The Media is an effective link between the NMS, the Civil Defense and the community, having a strong influence in how a warning is received

"*EARLY WARNINGS*"

- **Are issued by the NMS whenever there is some likelihood that hurricane conditions might be expected in the next 3, 4 or 5 days.**

- **Increases awareness on the hurricane threat and prepares everybody to take actions in the near future, if it becomes necessary.**

- **Heavily depends on a previous education and preparation of the users of this information (i.e. Government, Civil Defense, the Media people, residents, etc.).**

Regular Warnings are issued every 6 hours or less from 72 hours before any forecasted strike

PUBLIC INFORMATION

- Is more frequent as the Tropical Cyclone becomes closer.

- National Radio & TV broadcast “live” from the National Forecasting Center and the Civil Defense Headquarters from 48 – 24 hours before the storm strikes.

- Local Radio & TV stations do the same for their localities from the Provintial Forecasting Departments and Local Civil.

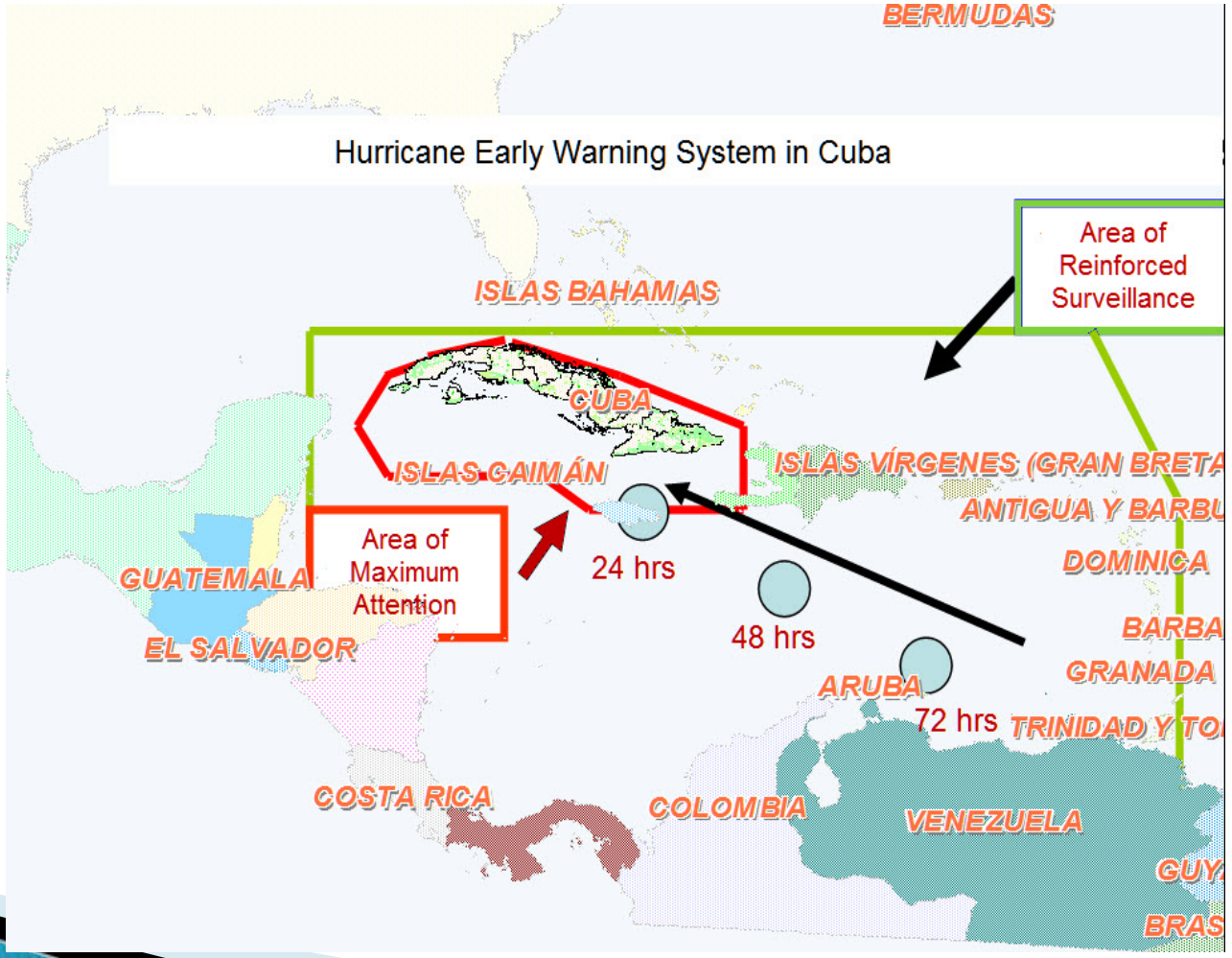
- **The Perception of Danger is gradually being created!!.**

Warning message development cycle

The Early Warning System for tropical hurricanes is organized and works along the following sequence:

The National Forecast Center of the Institute of Meteorology permanently monitors the formation and development of tropical cyclones from their formation in the West African coast and during their traveling across the Atlantic towards the Caribbean

1



2

The National Staff of the Civil Defense evaluates the warning and issues a notice for the governments of the threatened provinces and for the state organizations whose resources might be affected

The governments of the threatened provinces, take measures based on the risk level of each community, and the assessment of the local meteorological and hydrological services

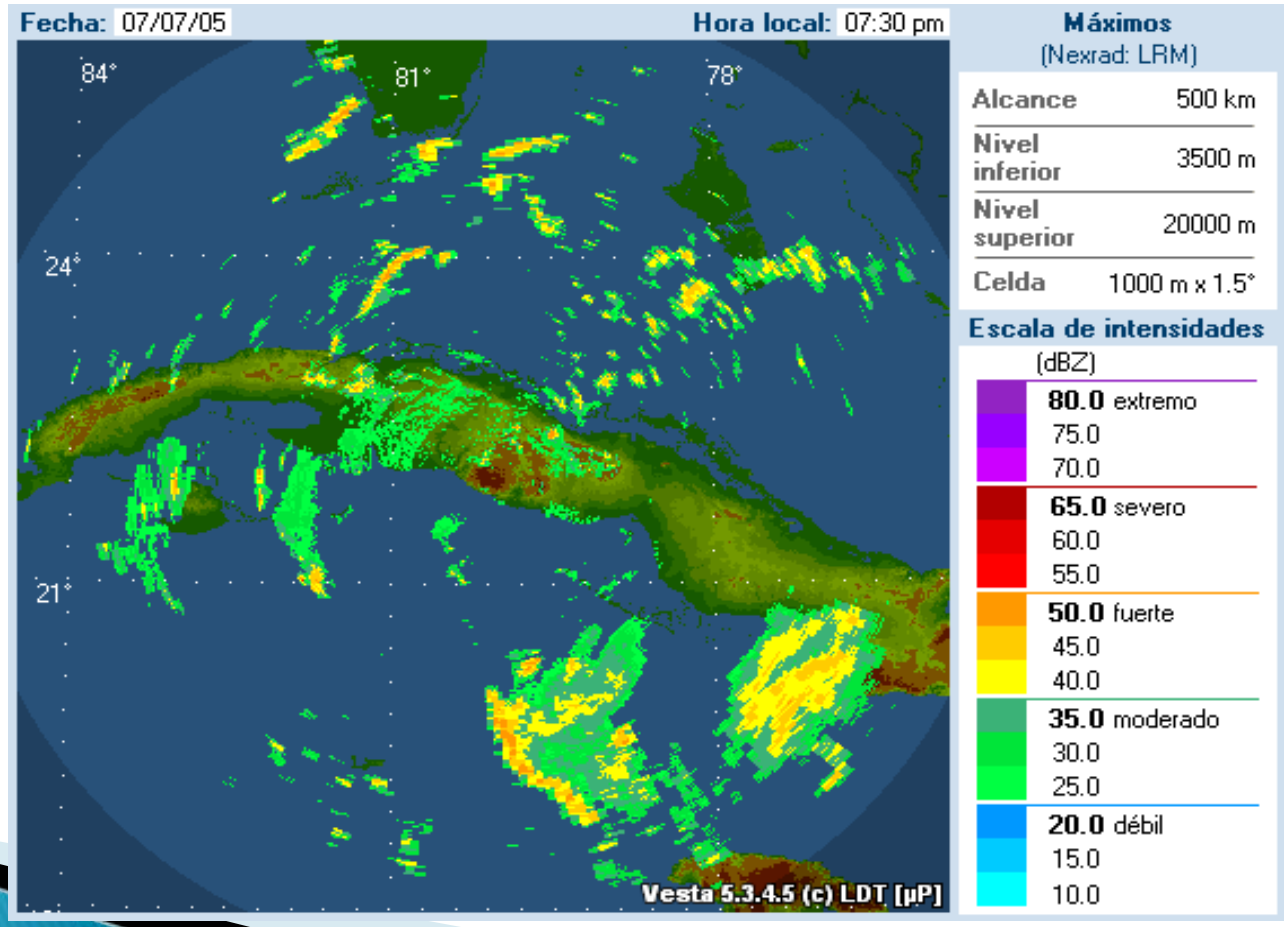
3

As the tropical cyclone continues to approach Cuba, the Meteorological Institute's Forecast Center increases the number of warnings describing in detail the future track and intensity of the hurricane, as well as the expected impact of winds, rains, storm surge and waves.

4

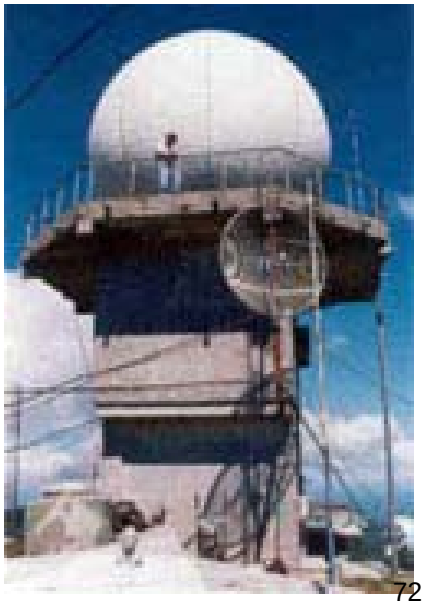
When it is estimated that the tropical cyclone could be affecting within the following 72 hours, the phases foreseen in the response stage are announced (Informative Phase (72 hours), Alert Phase (48 hours), and Alarm Phase (24hours)) by means of bulletins issued by the Civil Defense National Staff and broadcast over national and local radio and television.

5



6

The provincial meteorological centers evaluate the probable local impact of the precipitations and send the information to the hydrological service in the territory, which in turn estimates the potential for floods based on the situation of the water resources (level of water in the reservoirs, the canalization and drainage conditions, the soil saturation, and the hydrological condition of rivers.)



7

An assessment of the likely impact of winds and waves is conducted along similar lines, taking into consideration the structural vulnerabilities of housing, economic facilities and coastal settlements, which receive protection in accordance with their level of exposure and risk.

After the tropical cyclone stops being a hazard for the country, the recovery stage is declared, and the restoration of the damaged infrastructure and services begins, for which there are territorial and national plans.

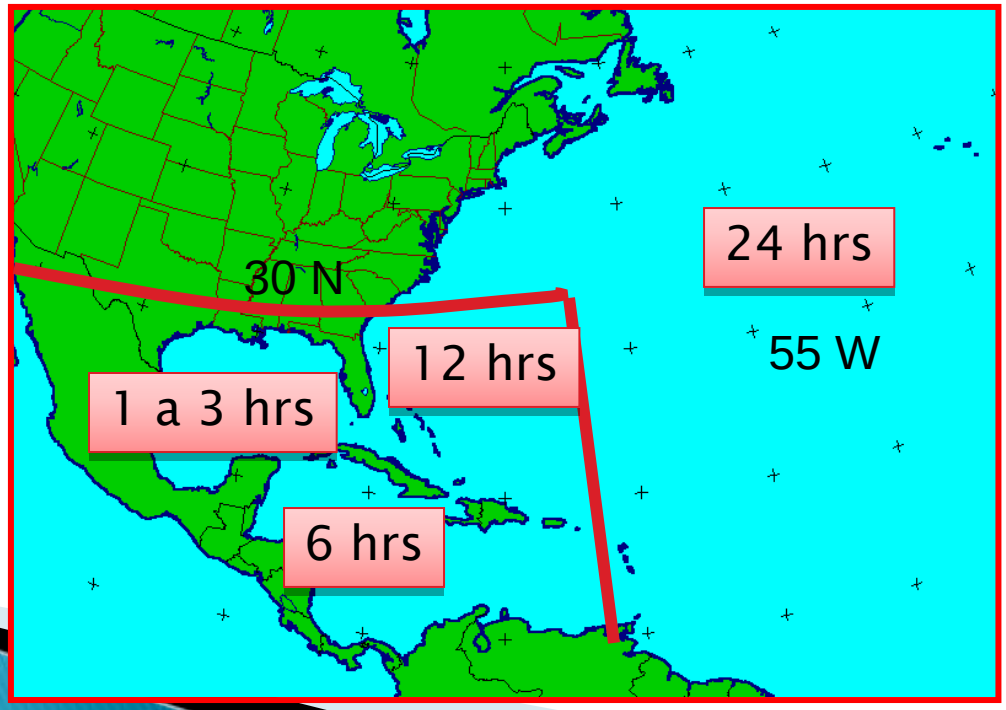
8

Warning dissemination mechanisms

•The Early Warning messages begin to be issued by the National Forecast Center with 120 hours in advance of a possible impact, repeating them every 24 hours.

•When the Hurricane penetrates inside the area of surveillance of the Caribbean Sea, warnings are issued every 12 hours, and when the Hurricane ends up being a potential threat to Cuban territory in 72 hours or less, warnings begin to be issued every 6 hours.

•When the hurricane is very n**e**ar the territory of the country, warnings are issued continually every 3 hours or less.



Warning dissemination mechanisms

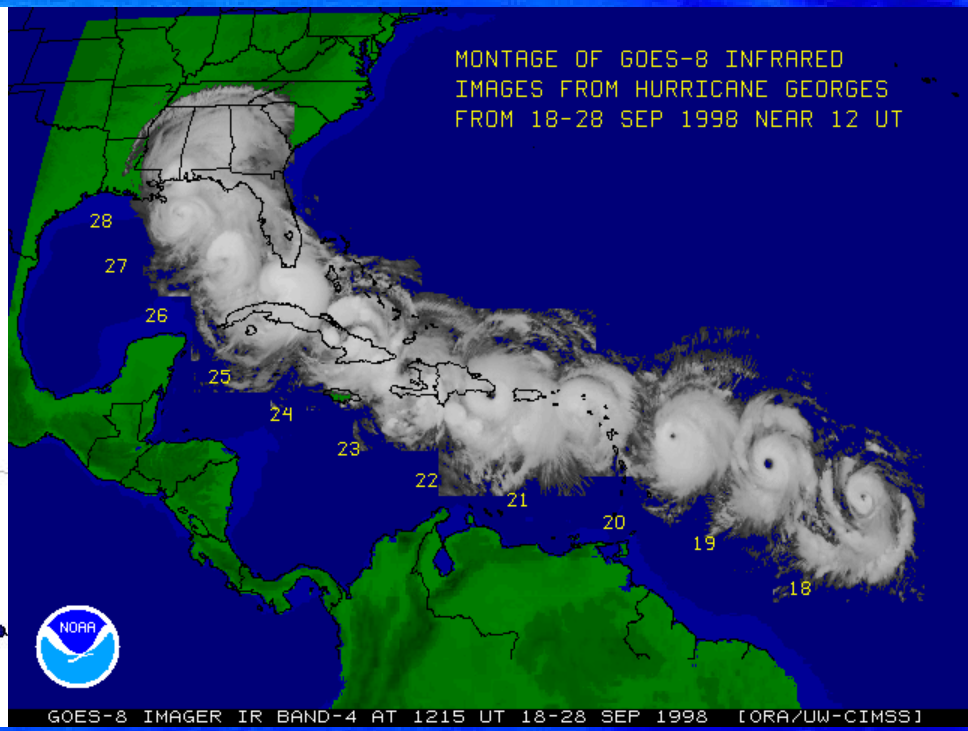
Radio, and very especially television, is a very important tool for warnings.

The country counts with more than a television set for home and the TV signal arrives to 98% of the national territory, and almost to all of the population. This results in building a great awareness and interest among everybody, with frequent live direct broadcasts by meteorologists from the National Forecast Center.

Plain language is used, and also many details are given

A call is made for everyone's past experiences with hurricanes

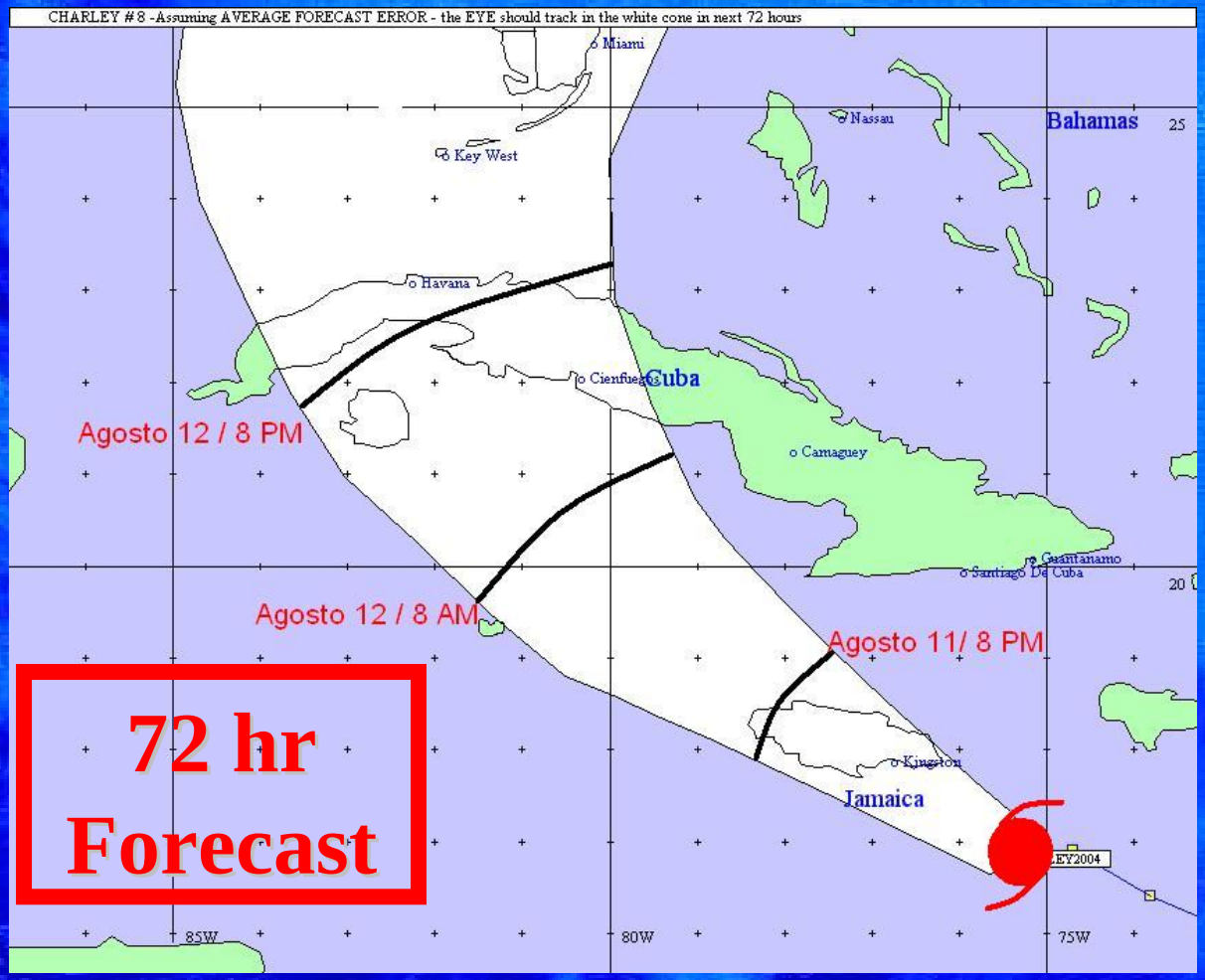
People is warned about some details that could drive to confusion, i.e. the hurricane is NOT a point.



And also that the main dangers are WINDS, FLOODINGS and STORM SURGE

The Use of Radar and Satellite Imagery in TV is very helpful to show the movement and the area covered by the Hurricane.

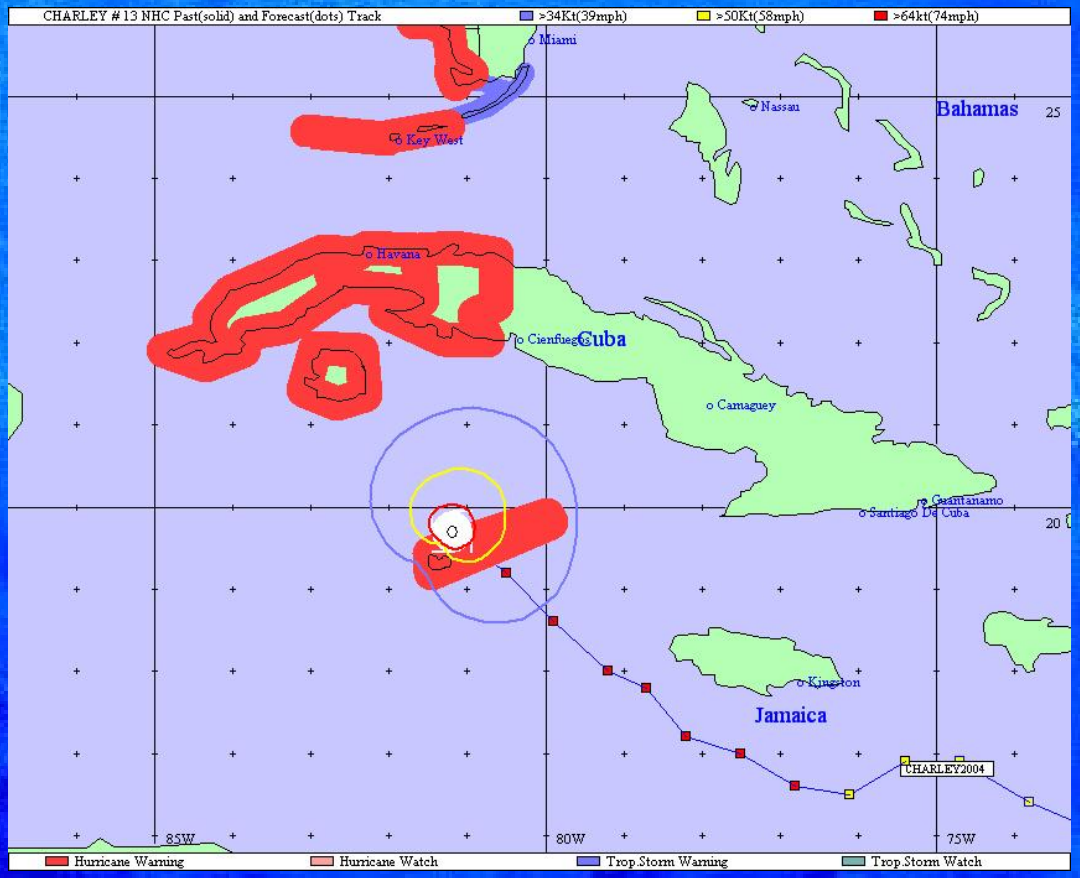
The Use of Probabilistic Cones to Address Uncertainties



Tropical Storm CHARLEY

Initial Pos.
Aug 11 / 12 noon
16.5 N 76.1 W 175 km SE Kinsgton, JAM 860 km SE Isle of Youth
Max.Sust.Winds: 110 km/h

The Areas under Warnings are clearly shown



Several entities participate in the issuance and distribution process of the Early Warning messages

- The National Forecast Center of the Institute of Meteorology issues Early Warning and Warnings on the tropical cyclone for the National Staff of the Civil Defense, and meteorologists give the meteorological information through national radio and TV, both national and local.
- The National Staff of the Civil Defense issues informative notes with guidance and recommendations from an approach on the protection of lives and material goods, which are sent to all levels of government as well as to the radio and TV, both national and local.
- Television channels and radio stations, both national and local, transmit in a special program 24 hours round with reports, interviews to specialists and authorities and also reports related with the evolution of the hurricane, the protective measures being adopted in each place and guidance on measures to be completed. The International Press Center disseminates information for the foreign press agencies and coordinates interviews with forecasters and specialists

Disasters Reduction Plans in Cuba are drafted at all levels, from the very basic People's Council to the provincial governments and from local to national economic entities and organizations, based on an assessment of the risk at each level

Main elements of response

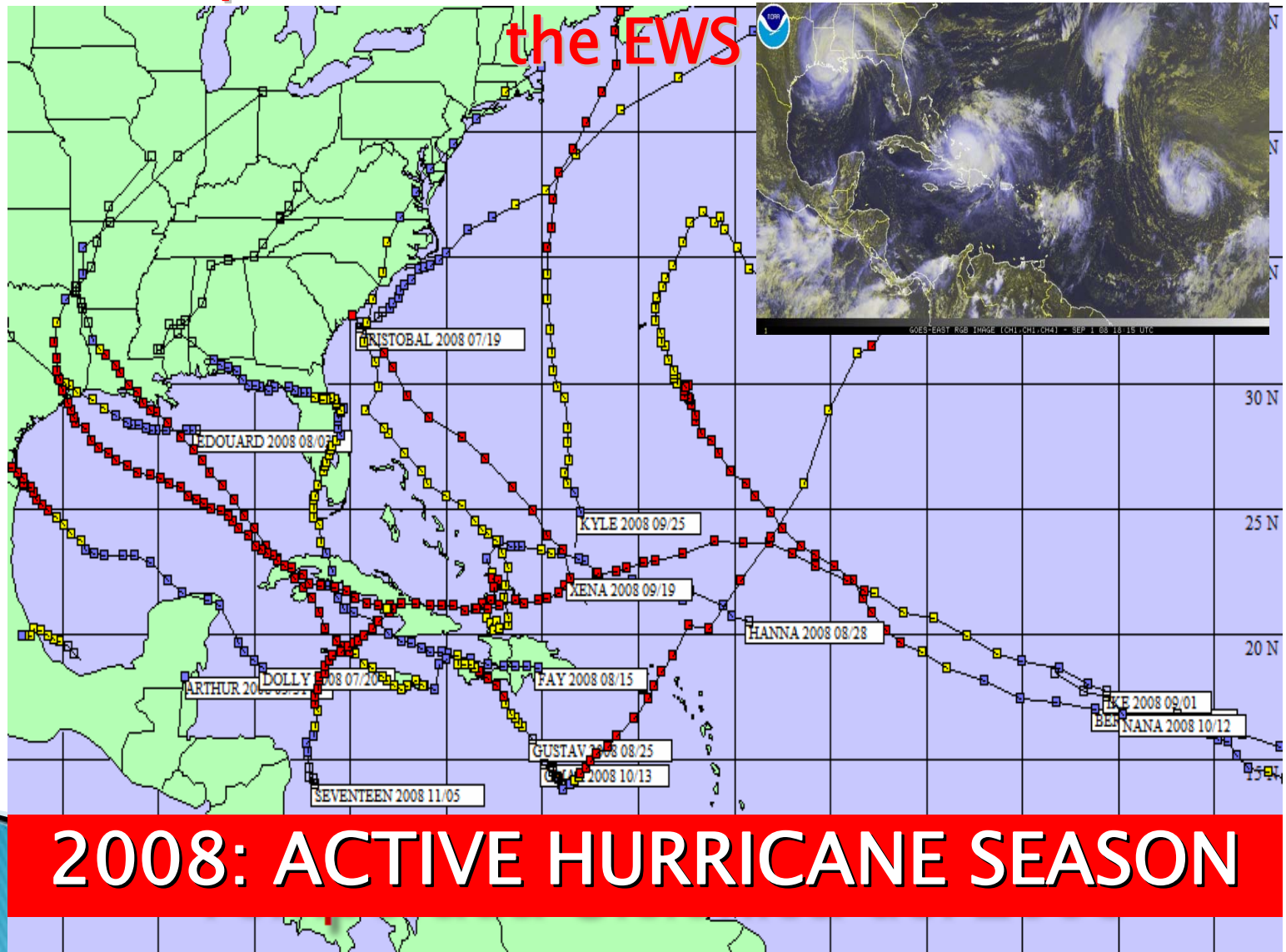
- An adecuate apreciation of the event's main features and the level of risk for persons and the economical goods exposed
- A step by step implementation of all protective measures
- Timely protection of the population as well as their personal belongings.
- Permanent public information Información on the evolution of the hazards and the measures to take in each situation.
- A centralized System of Direction

Improvement of overall operational framework of EWS

- The feedback mechanisms that the NMS has been utilizing is the direct dialog with users, being these special users like the government and Civil Defense, or other users as Ministries, the Media, etc. Sometimes, written suggestions are also received. All suggestions are taken into consideration and they help to improve the forecast and warning service.

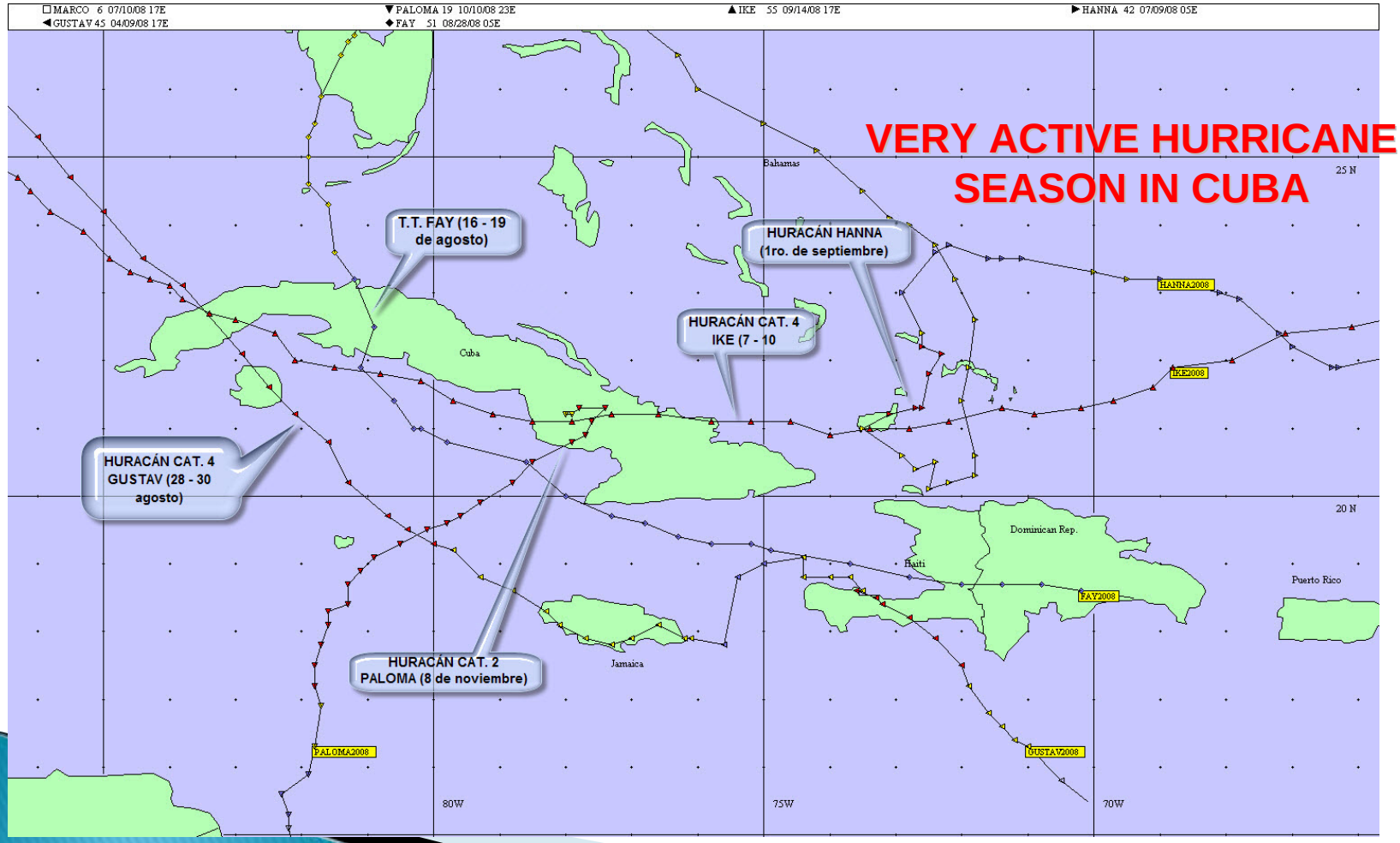
- Congratulations messages from many people and organizations, including Government, are received after each hurricane impact, for forecasts and warnings are generally successful.

Examples of events where the EWS has led to improvements in preparedness and prevention Role of the NMHS in the EWS



2008: ACTIVE HURRICANE SEASON

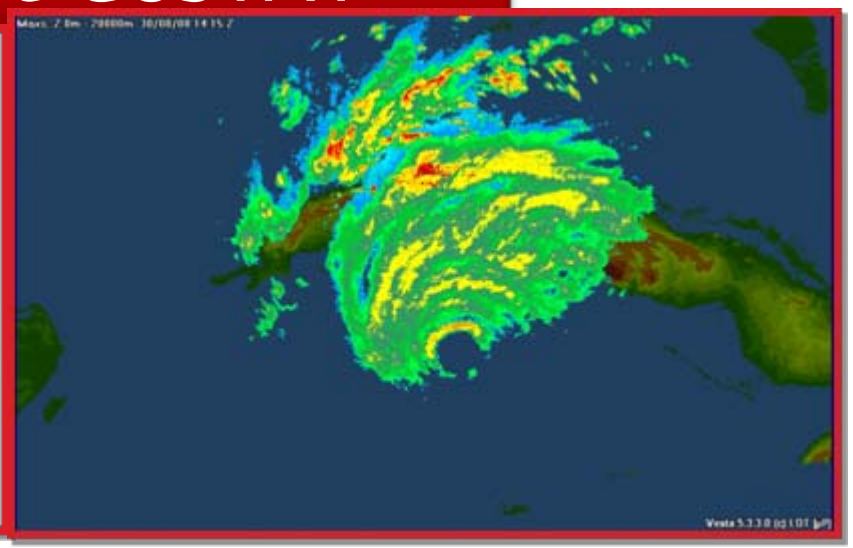
Examples of events where the EWS has led to improvements in preparedness and prevention Role of the NMHS in the EWS



Examples of events where the EWS has led to improvements in preparedness and prevention Role of the NMHS in the EWS

Hurricane GUSTAV

Gustav Official Track

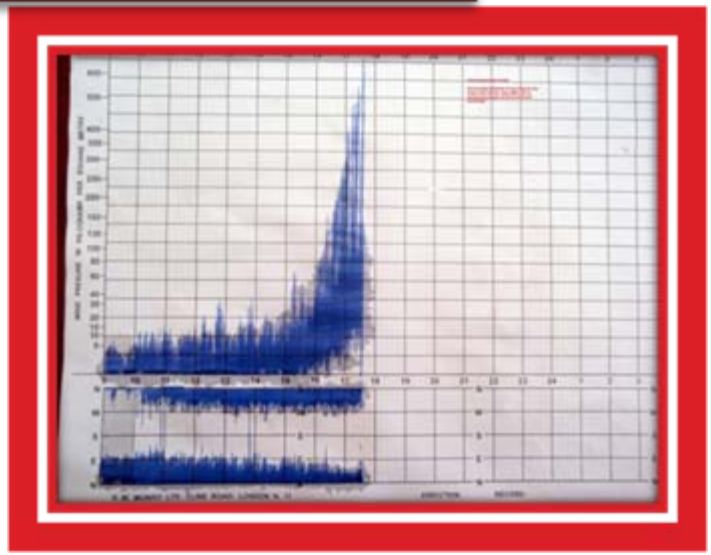


Havana Radar loop

Examples of events where the EWS has led to improvements in preparedness and prevention Role of the NMHS in the EWS

Hurricane GUSTAV

A maximum wind gust of 340 km/h was recorded at Paso Real de San Diego Meteorological Station, a new World Record Wind Gust in Tropical Cyclones.



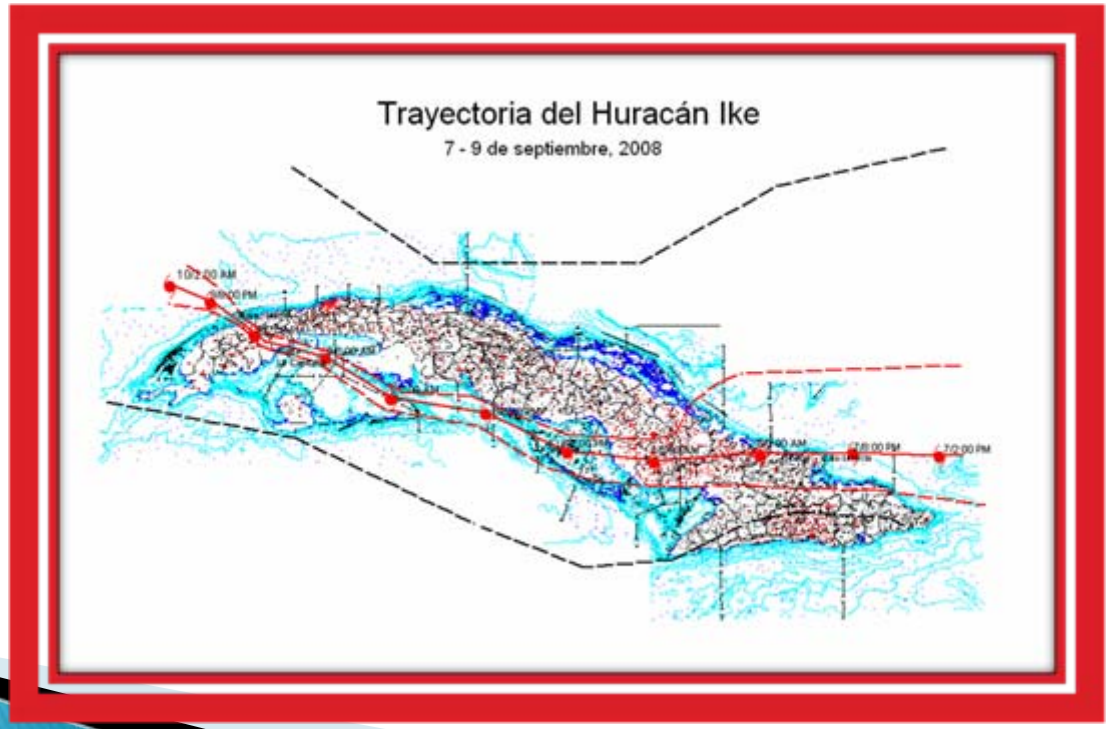
Examples of events where the EWS has led to improvements in preparedness and prevention Role of the NMHS in the EWS

Meteorologist explained the main features of this deadly hurricane along with the track and intensity forecasts.

People were well prepared and the Civil Defense made a superb job. The amount of material losses was great, however, not a single life was lost.

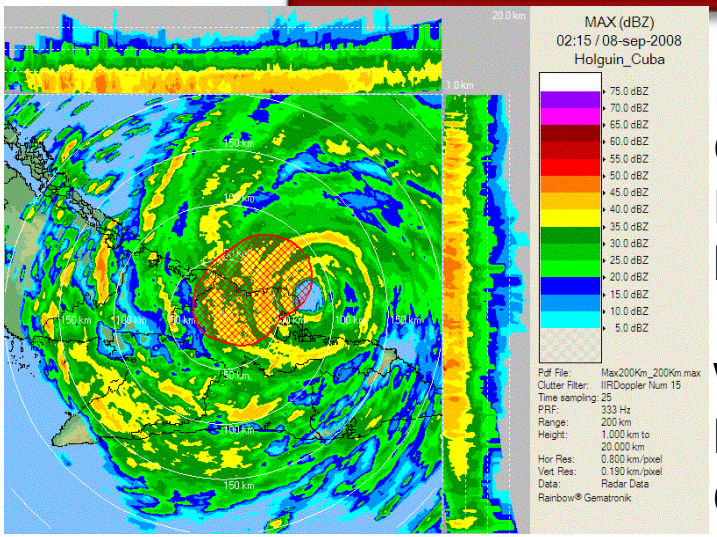
Examples of events where the EWS has led to improvements in preparedness and prevention Role of the NMHS in the EWS

Just 10 days later came major hurricane “IKE” and affected the whole Country.



Examples of events where the EWS has led to improvements in preparedness and prevention Role of the NMHS in the EWS

Huracán IKE



Doppler radar at Holguín showing the eye at landfall, 10:15 PM (02:15 UTC,Sept.8, 2008)

It was the first time ever that the Cuban Eastern provinces of Holguin and Las Tunas were hit by a major category 4 Hurricane

Wind speed at landfall is not known, for anemometers were destroyed

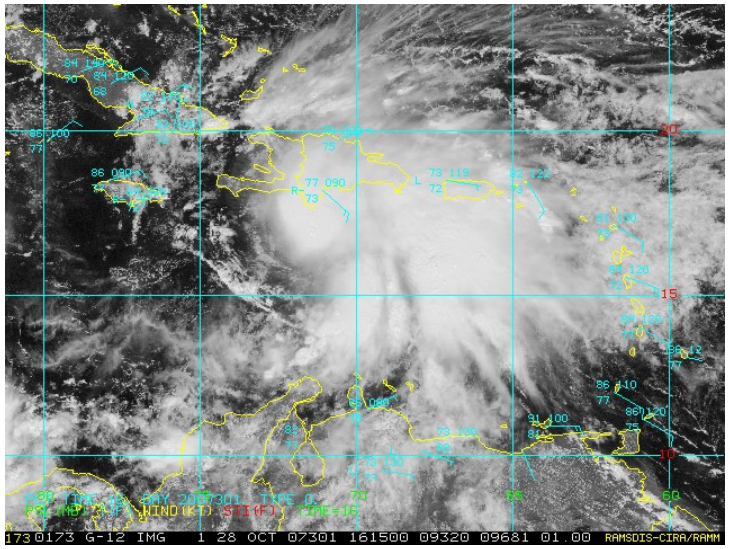
Examples of events where the EWS has led to improvements in preparedness and prevention Role of the NMHS in the EWS

There were 7 deaths with “Ike”, the majority of them provoked by negligence of the victims, sometimes without anything to do directly with the hurricane.

The lesson is that it is needed to warn even more not to do things that people in the affected area or areas under some type of warning are not suppose to do.

A few weeks later, came Hurricane Paloma and there were a great insistence on the Media that people should not go out in a hurricane, nor do things that are hazardous and they are not suppose to do in a storm. No casualties were reported.

Examples of events where the EWS has led to improvements in preparedness and prevention Role of the NMHS in the EWS



- Meteorologists stressed that rain was the important factor: forget the track and winds
- There was a timely Early Warning
- Great Material losses: $499 millions USD

Rainfall totals in 24 hours were between 200 and 300 mm over Eastern Cuba. The soil was already saturated because of heavy rainfall during the previous month. Large areas were completely flooded and a massive evacuation took place well before that it happened.

There were big losses to agriculture and economy, but nobody was dead during the event.

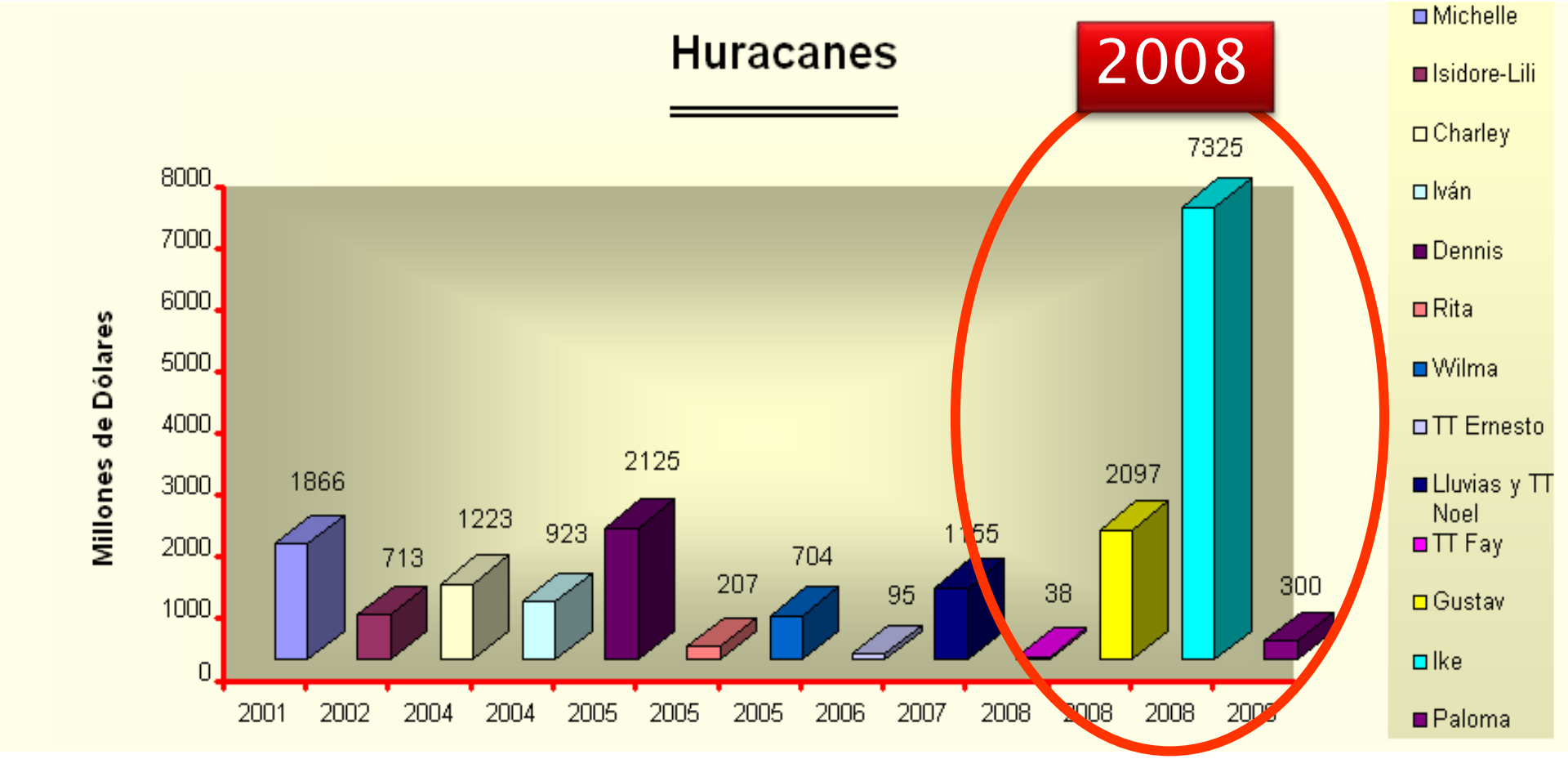
TROPICAL STORMS AND HURRICANES THAT HAVE AFFECTED CUBA SINCE 1995

NAME	YEAR	CATEGORY	DEATHS
Lili	1996	H2	0
Georges	1998	H1	6
Irene	1999	TT	2
Michelle	2001	H4	5
Isidore	2002	H1	0
Lili	2002	H2	1
Charley	2004	H3	4
Ivan	2004	H5	0
Dennis	2005	H4	16
Alberto	2006	TT	0
Ernesto	2006	TT	0
Noel	2007	TT	0

HURRICANE SEASON 2008 WAS ONE OF THE MOST ACTIVE EVER IN CUBAN HISTORY

NAME	YEAR	CATEGORY	DEATHS
Fay	2008	TT	0
Hanna (Indir.)	2008	TT	0
Gustav	2008	H4	0
Ike	2008	H3	7
Paloma	2008	H2	0

BUT ONLY 7 PEOPLE LOST THEIR LIV ES, MAINLY BECAUSE OF THE VICTIMS THEMSELVES, FOR SOME OF THEM DID NOT FOLLOW ACCORDINGLY THE ORIENTATIONS GIVEN BY THE CIVIL DEFENSE



ECONOMIC DAMAGES ARE GREAT

Overall lessons learnt and future steps for improving the system

- The NMS needs human resources and a good infrastructure as well
- Full coordination among the NMS, Civil Defense and the Media is needed
- People's education is an important factor.

Overall lessons learnt and future steps for improving the system

- Full discussion after any event lead to makes things better next time
- Increase even more people's education, mainly in aspects such as individual responsibility and discipline
- Continue improving infrastructure of the NMS as far as economic factor permits

Thank you !

¡ Gracias !

Hvala !

QUESTIONS?

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