IMPACT OF SATELLITE INFORMATION RECEPTION IN MONITORING EXTREME HYDROMETEOROLOGICAL EVENTS

The use of satellite imaging in Cuba dates back to March 23, 1969. Images came from three satellites over the Atlantic and Pacific oceans, whose cameras responded only to the visible spectrum. Although the procedure for the images was troublesome, this important tool for monitoring weather hazardous phenomena and other applications was available.

After that, other receivers were acquired with various technologies but, for some years, the Meteorological service did not have direct access to satellite data, but only through the Internet.

This situation explains the importance of the acquisition by the Project for Improvement hydrometeorological Early Warning System (EWS) in the provinces affected by Hurricane Sandy, with support from the European Commission and UNDP, of a LRIT receiving station.

Two other stations were also purchased: EUMETSAT and GEONETCAST using satellite technology for TV images and products that complement the LRIT station. In addition, licenses were purchased to install the processing software in the eastern provinces benefited by the project. A WiFi link was established between the receiving station and the Forecast Center to ensure information traffic in case of interruption of the network cable.

Thus, INSMET has 3 receptor satellites associated to LRIT, EUMETCast and GEONETCast services at present, which form a system of high performance satellite reception.

Satellite reception system located at the Meteorological Institute

The system has the necessary equipment for reception of information coming from geostationary meteorological satellites, among which are the following:

- Antennas of various sizes, aligned with the corresponding satellites.
- A specific receptor for transmissions in LRIT format from the GOES satellite.
- DVB-type reception cards for EUMETCast and GEONETCast broadcasting.
- Computers for controlling the reception and software of product management which increase availability of services in real time.
- Computers for image processing and product generation.
- UPS to avoid operation losses because of blackout.

LRIT System

Station receiving data from GOES geostationary meteorological satellite accompanied by software that generates products to meteorological needs. This allows updating the information from Cuba surrounding areas every 15 minutes, with a resolution of 4 km in the visible, infrared and water steam bands, which is a valuable tool for monitoring hazardous weather phenomena.

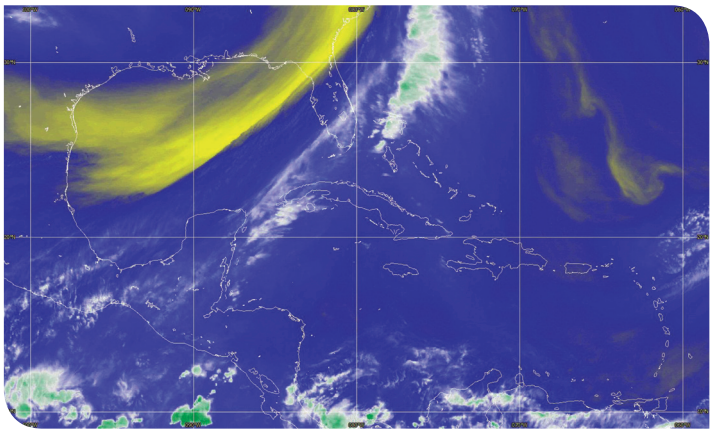
GEONETCast System

It is a satellite-based system for the dissemination of meteorological products in near real time, easy to use and inexpensive. It aims to provide global information for correct decision-making in critical areas such as public health, energy, agriculture, climate, water, natural disasters and ecosystems.

EUMETCast System

EUMETCast includes meteorological data from Meteosat and GOES satellites, and also from different meteorological programs. It is a system of multiple services based on standard technology of digital video broadcasting (DVB). It simultaneously uses geostationary satellites of commercial multi-files telecommunications (data and products) for a wide community of users.

Post-processed image of water vapor



This material has been made in the framework of the project: **"Improvement of the hydro-meteorological Early Warning Systems to increase disaster preparedness and to reduce vulnerability of the population living in the affected provinces by Hurricane Sandy (Cuba)"**; implemented by the United Nations Development Programme (UNDP); under the Action Plan for the Caribbean from the European Commission's Disaster-Preparedness Programme (DIPECHO).

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Advantages of these systems:

- It works with original numerical data allowing its processing for customized products.
- The information is obtained almost in real time (with a delay of up to 10 minutes) and an update period of up to 15 minutes.
- The quality and image resolution (4 km) and other data obtained in this way are practically impossible to obtain via Internet unless a high bandwidth is available.
- The images are complemented by reports, advertisements, monitoring of phenomena, variables behavior analysis, among many other products in binary formats, ascii, tables, graphs and maps.

Capturing information directly from a meteorological satellite requires a costly technology, that is why less expensive services have been being developed from original raw received from different satellites. Thus, while the information received by the LRIT station come from a weather satellite, GEONETCast and EUMETCast services are derived from spatial devices not specifically dedicated to meteorology.

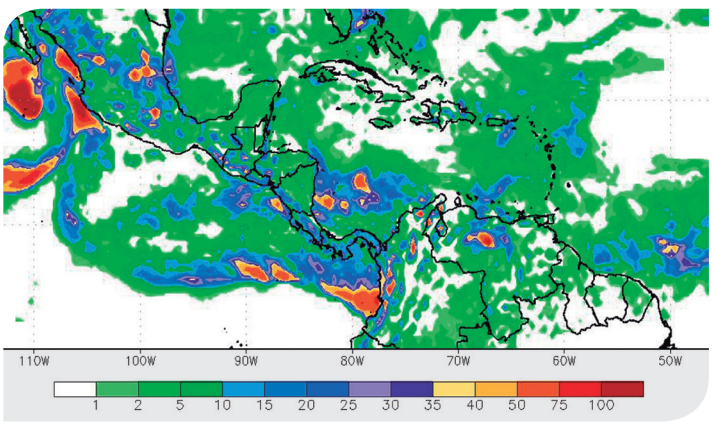
The transmission of information from low speed (LRIT, for its English acronym) is an international standard for data transfer developed by the Coordination Group for Meteorological Satellites (CGMS) of the National Oceanic and Atmospheric Administration (NOAA) in response to a recommendation on satellite digital weather broadcasts.

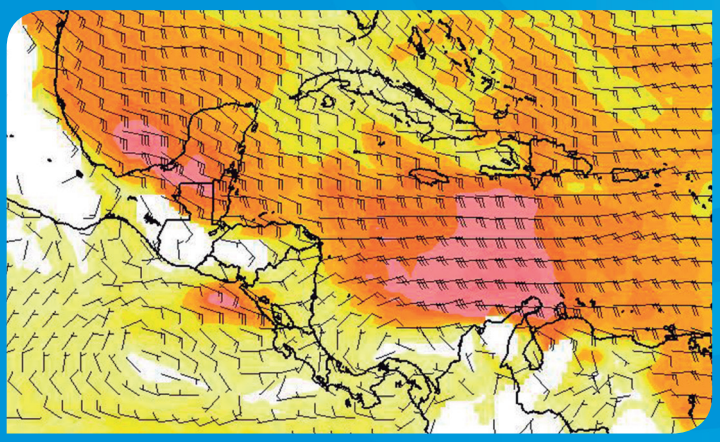
In addition, images are accompanied by texts and tables to complement the information. These services also provide additional information on other topics such as:

- Rain and wind Forecasts
- Outputs of global and regional runs of numerical models
- Streamlines
- Vegetation Index
- Sea surface temperature
- Information of tracking of tropical cyclones
- Wildfires

To facilitate user access to all this information a website that compiles and classifies information of these services by shared access in the meteorology network was made.

24 hours rain Forecast





Output of the WRF regional model

The data exchange platform being developed as part of the project aims to make available this large volume of information to all users.

Besides its use in monitoring hazardous meteorological phenomena, these services have an important application in tracking other extreme events such as drought, which so far were only supported by the obtaining of terrestrial data from rainfall, weather and conventional hydrometric stations.

The GOES LRIT station enables access, store and process, progressively, the huge volume of information and satellite data already available, which would expand markedly operational capacity for monitoring.

From the images of channels 0.6, 6.75 and 10.7, offered by GOES 13 satellite with a spatial resolution of 16 square km and a temporal resolution of up to 15 minutes in the Caribbean area, rainfall data (mm / t) permanently available for the throughout area, may be calculated and used.

All this new information, previously requires to be calibrated, to the effects of different purposes and temporal and spatial scales to use, for which there are different methods and means that each country applies according to their own experiences and interests.

Although the strategic importance of installing these satellite receivers are evident for the monitoring of extreme disaster events, the reduced bandwidth between the INSMET and provincial meteorological centers limits the possibility so that, in that instance, it can have a part of the information so they can play the role in the Early Warning System. As an alternative solution, the networks from ICRT and INRH are used for a determined transmission of a meteorological information packet.

For this reason it is also necessary to define the information sent to provincial meteorological centers, which must include both processed meteorological products in the INSMET, as well as original data received by the satellite receiver so that it can process them with the use of licenses acquired by the project and to get their own products.