

# The Mexican Navy's Tide Network

The DIRECCION GENERAL ADJUNTA DE HIDROGRAFIA Y CARTOGRAFIA (DIGADHICAR) has a national tide and meteorology network. Transmission of data is done both by satellite communication and by telephone links to a central processing unit at a department of the DIGADHICAR specialised in tidal data collection and analysis. This information is used not only for support of safety of navigation but also forms part of the system for timely obtaining, indicating and promulgation of meteorological and tidal information. This might concern, for example, severe storm warnings for the protection of human life at sea and amongst populations living in coastal areas.

For hydrographic surveyors the most used function of the tidal network is the day-to-day supply of tidal information, both forecasts and actual measurements, to enable them to plan their surveys and correct their measurements for tidal movements. The promulgation of warnings in relation to severe storms is closely related to tides, which are affected not only by the natural behaviour of the sea predictable by the harmonic constituents, but also by local aspects, for example the morphology of shores, rivers and harbours. Taking all these aspects into account, the department also produces Graphical tables of Tides, Calendars of tide predictions and the Tides Book, which material and information is available to the general public.

## Tidal Monitoring Project

Up until 1998 the Mexican Navy National Tide Network had only five mechanical, tide stations. The density of spacing of the stations and range of tide data produced were insufficient to be relied on in certain circumstances. The DIGADHICAR tidal department had thus sometimes to resort to requesting information from other institutions, such as the UNAM (Universidad Nacional Autonoma de Mexico), to complement their tidal information.

To support national projects for the development of coastal areas and to be better able to fulfil the functions of both forecasting (e.g. in case of severe storms) and supporting surveyors, a tidal monitoring project was started. This project carried out in close relationship to the national port scheme and other organisations and initiatives important to Mexican shores required the four-phase installation of 41 tide stations.

As actualised so far, the tidal network has thirty automatic tide stations with an operating system based on difference between atmospheric and hydrostatic pressure.

## Operational Description

Data is collected every six minutes, although the equipment has the capacity to collect at intervals from 0.5 to 120 minutes. The collected data undergoes analysis, is processed to the mean interval time, and displayed. It is also stored in the internal memory (the data unit) of the tide register station, from which the data is handled in one of two ways depending upon the nature of the station of origin, telemetric or non-telemetric.

Five of the presently operational stations transmit data by telemetric means via the Mexican satellite *Solidaridad II*™ to the department for processing and analysis of tides in Mexico City. Data from the other 25 (non-telemetric) stations are accessed via the data unit, which stores data internally for a period of up to two months. The normal operating procedure is that local personnel download the internal data unit via notebook and a software program, after which the data is sent to the department for processing and analysis of tides in Mexico City.

The telemetric stations of the network work in the following way. A station sends data via the Mexican satellite *Solidaridad II*™ to TELECOMM Movisat, a Mexican telecom provider, which stores the information in an electronic box (DNID). This *electronic storage box*™ is questioned by telephone with programmed telephone calls at twelve hourly intervals from the Center of Control and Processing of Data (CECOPROD) located in the Mexican Navy building in Mexico City. This centre stores received data in provisional files for post-analysis.

After post-analysis, data is stored in the databank, which is also used as a back-up. Tide stations can also be questioned and instructed from the CECOPROD. These instructions can modify the settings of the tidal stations: e.g. coefficients, frequency of collecting interval, operation hours or by increasing the quantity of programmed data to be transmitted.

The Center of Control and Processing Data (CECOPROD) constitutes three computers installed in a net, the characteristics of which are new technology. The software processes and calculates tidal data into and from seven to 107 harmonics with periods that can involve two months or one year of continuous data. The graphics forecast, (tide-table etc.) include moon phases and also the hour when the event occurs.

Rigid quality control is, of course, a normally applied procedure in the processing of data, from acquisition to its recording in the CECOPROD. Included in this quality control are aspects of incorrect data, filters, data time acquisition, high sea-level and low sea-level calculations, monthly and yearly means, harmonic analysis and, finally, the forecast.

## The Future

During the third phase of the Mexican Navy National Tide Network project, installation of a telemetry satellite is being considered, as is an increase the total number of tidal stations in the fourth phase. This latter phase will also include the Mexican islands in the Gulf of Mexico and Caribbean Sea. Nine tidal stations are already projected in detail.

During the installation of tide stations, benchmarks have been built and linked with other stations previously built and carrying a long tidal history. It is hoped in the future to actualise the elevation of these benchmarks with the aim of providing users with information useful for

the projection and control of sea port constructions.

#### To Conclude

The information produced by the new system is available in datasets for universities and people involved in tidal matters through an official request to the Mexican Hydrographic Office (DIGADHICAR). The tidal data information is also accessible to the public via [www.semar.gob.mx](http://www.semar.gob.mx).

The tidal network is a big step forward towards the final project goal and accuracy and operational usage has been greatly enhanced, not only for surveyors. It is vital for the safety of coastal habitation and mariners alike.

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<https://www.hydro-international.com/content/article/the-mexican-navy-s-tide-network>

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