



# Tides, Water Level and Currents Working Group – TWCWG1

## Niterói, Brazil, 25-29 April 2016

“Peruvian Sea Level Network”

*Captain José Tejeda*



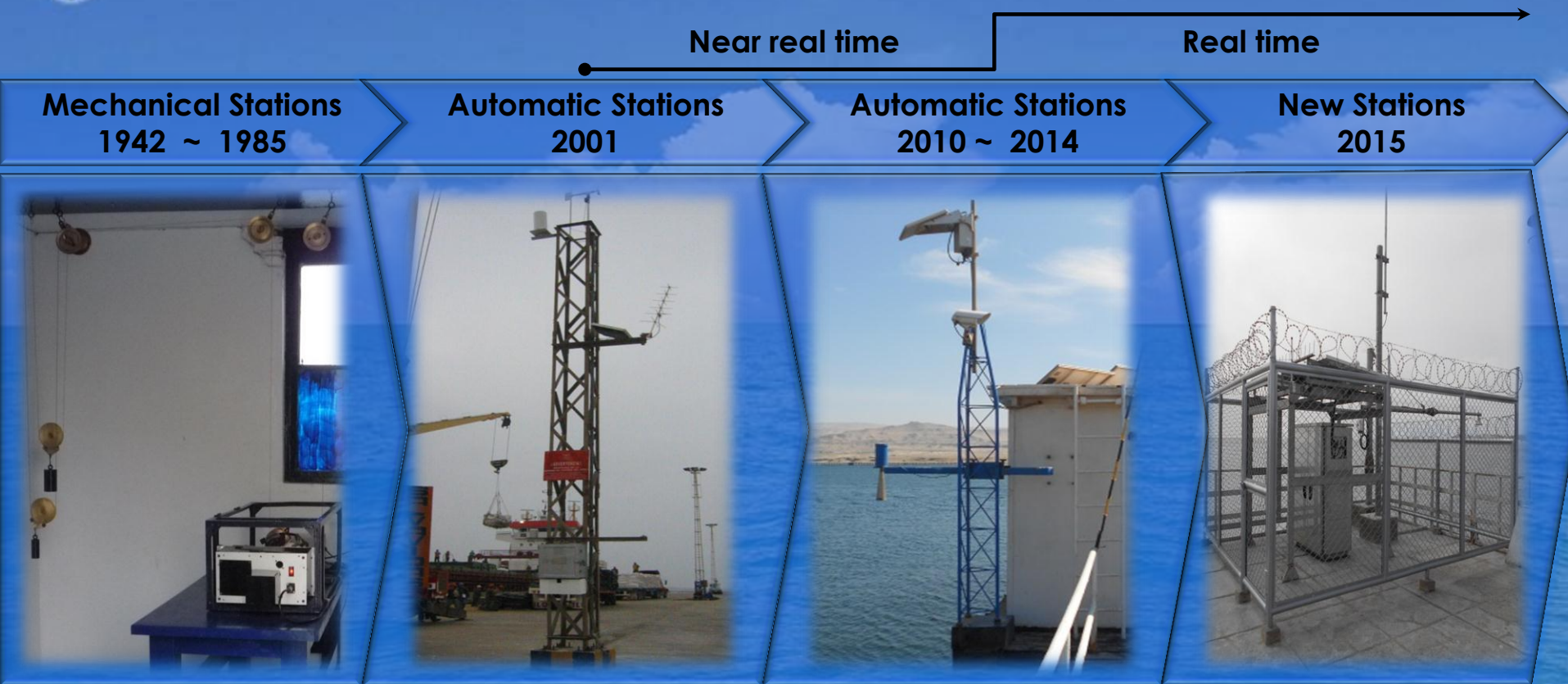


# Content

- Sea level measurements
- Data transmission
- Peruvian sea level station network
- Components of Sea level station network
- Tides at Website
- Operational and scientific purposes
- Radar – Pressure sensor comparison
- Conclusions



# Sea Level Measurements



08 •

Upgrade process

→ 19

Permanents  
Stations

Tsunami Warning System

National Network



# Data Transmission

~ 2000

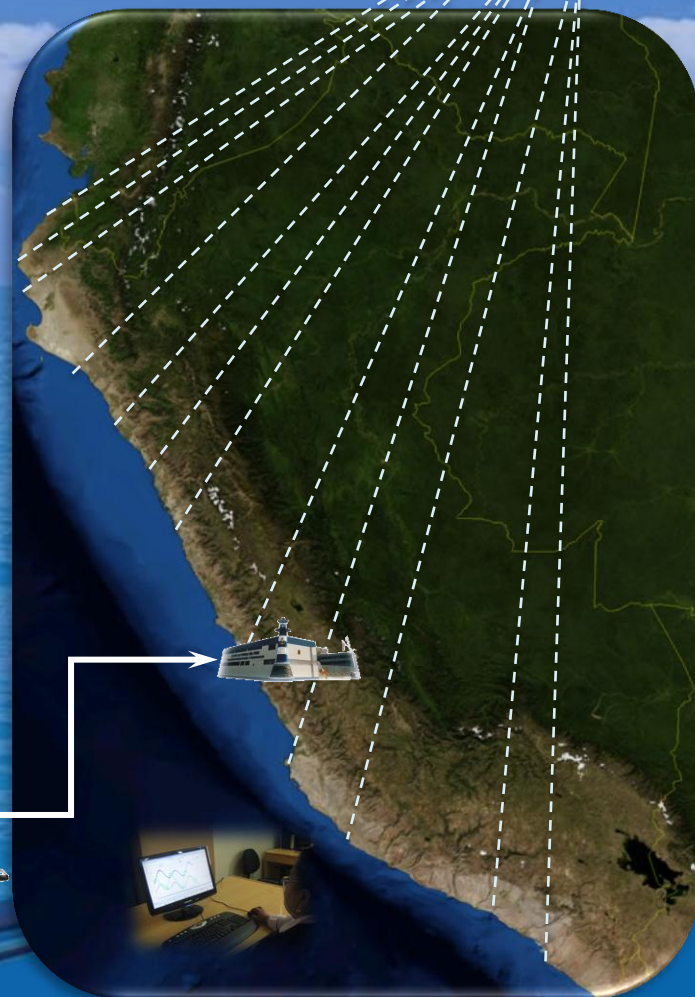
- Monthly via terrestrial
- Radio link every minute

2010

- Satellite GOES 8 every 3 hours
- GPRS (1 - 10 minutes)

2011 ~

- GPRS (1 - 10 minutes)
- IRIDIUM (1 - 5 minutes)
- GOES (1 - 5 minutes)





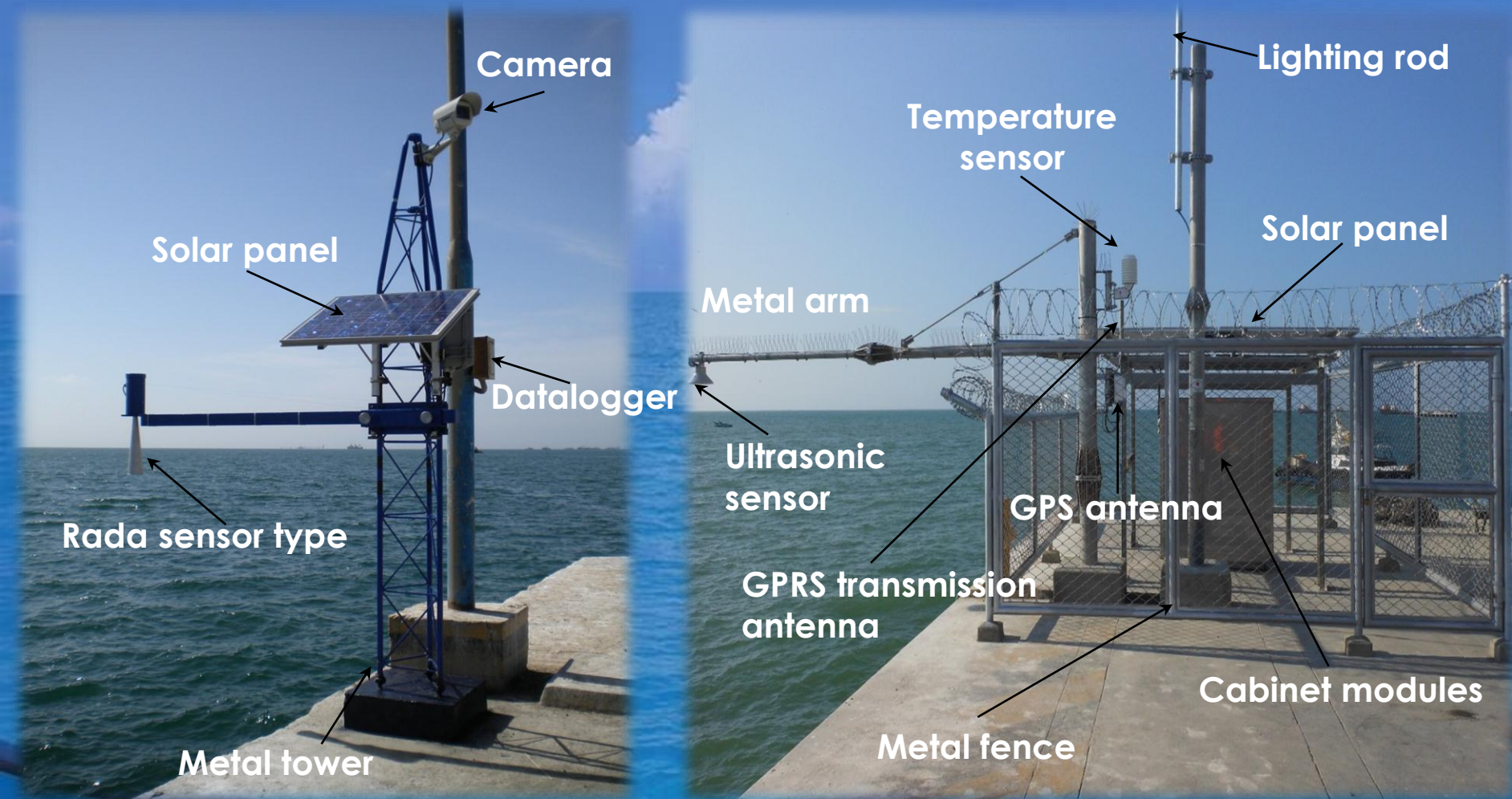
# Peruvian Sea Level Stations Network

Zone	Station	Location	
		Latitud °S	Longitud °W
North	<i>La Cruz</i>	03°38'01"	080°35'15"
	<i>Talara</i>	04°34'30"	081°16'57"
	<i>Paita</i>	05°05'01"	081°06'27"
	<i>Bayóvar</i>	05°47'38"	081°03'16"
	<i>Lobos de Afuera</i>	06°56'06"	080°43'19"
Central	<i>Salaverry</i>	08°13'40"	078°58'54"
	<i>Chimbote</i>	09°04'34"	078°36'45"
	<i>Huarmey</i>	10°05'57"	078°10'54"
	<i>Huacho</i>	11°07'18"	077°36'58"
	<i>Callao</i>	12°04'08"	077°10'00"
	<i>Cerro Azul</i>	13°01'33"	076°29'07"
	<i>Pisco</i>	13°49'10"	076°15'07"
South	<i>San Juan</i>	15°21'19"	075°09'37"
	<i>Chala</i>	15°51'58"	074°14'53"
	<i>La Planchada</i>	16°13'52"	073°41'39"
	<i>Atico</i>	16°24'17"	073°13'15"
	<i>Matarani</i>	17°00'03"	072°06'31"
	<i>Ilo</i>	17°38'40"	071°20'54"
	<i>Caleta Grau</i>	17°59'36"	070°53'03"





# Components of the Sea Level Stations



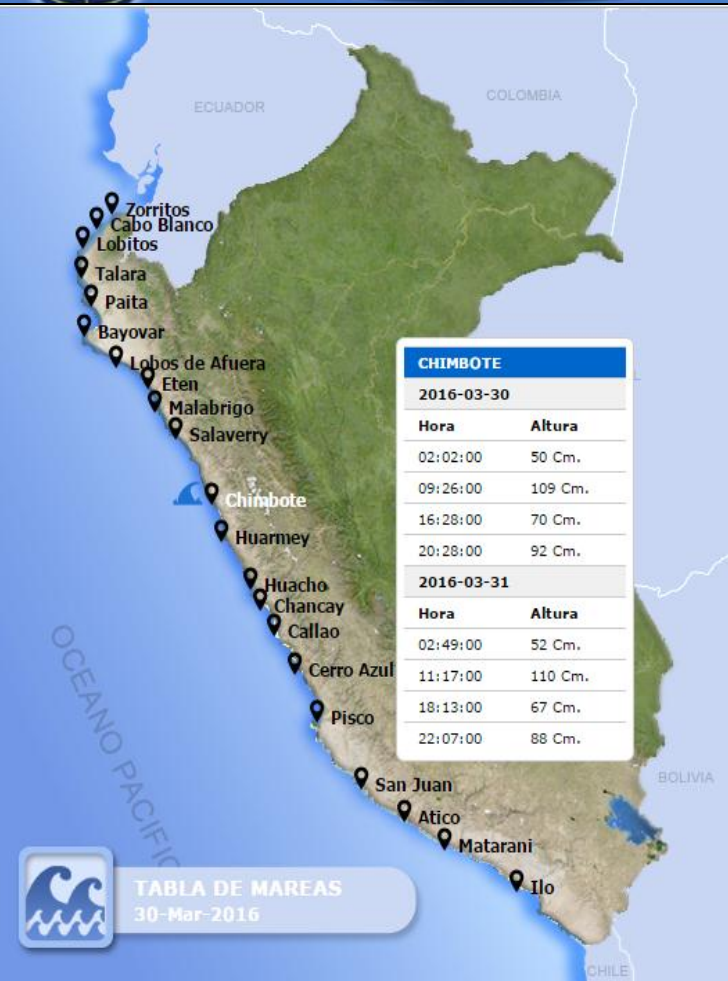


# Tide at Website





# Tide Table Predictions



## TABLA DE MAREAS

La presente información muestra las predicciones de las horas, alturas de las pleamares y bajamares de los Puertos del Perú las que se basan principalmente en la información proveniente de la Red de Estaciones Mareográficas referidas al Nivel Medio de Bajamares de Sicigias Ordinarias (NMBSO), establecidas por la Dirección de Hidrografía y Navegación (DHN) en el Litoral Peruano.

### Definiciones

- **Marea:** movimientos periódicos y alternativos de ascenso y descenso del nivel del mar producidos por la atracción gravitacional que ejercen sobre la tierra la Luna y el Sol principalmente.
- **Pleamar:** nivel máximo alcanzado por una MAREA CRECIENTE.
- **Bajamar:** nivel mínimo alcanzado por una MAREA VACIANTE.
- **Marea creciente:** periodo de la MAREA entre la BAJAMAR y la PLEAMAR consecutiva.
- **Marea vaciante:** periodo de la MAREA entre la PLEAMAR y la BAJAMAR consecutiva.

### Niveles de Referencia:

- **Nivel Medio del Mar:** es el promedio de la serie de observaciones.
- **Nivel Medio de Bajamares de Sicigias Ordinarias:** ocurren un día o dos después de la luna nueva.

### Descargar la tabla de mareas del m

#### Nombre del Puerto

ANCON

ATICO

Descargar PDF

Descargar PDF



Links to access

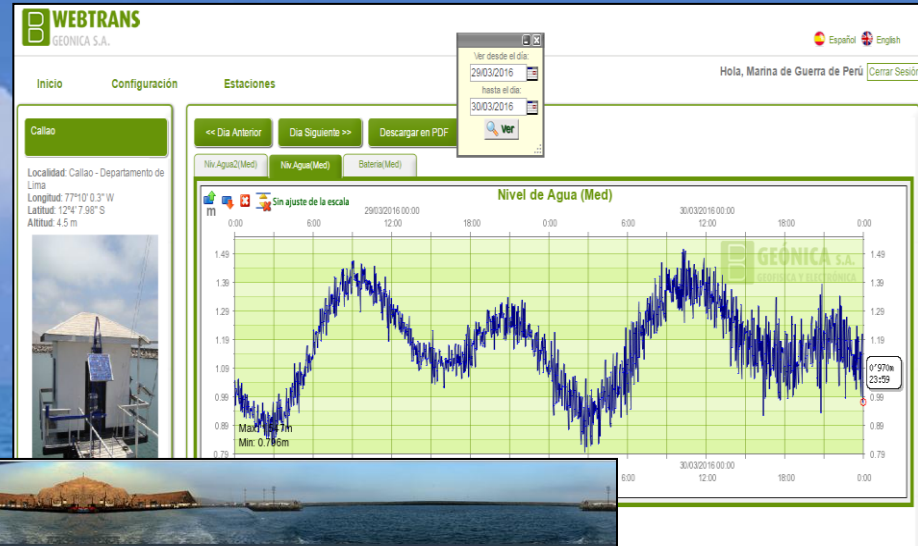
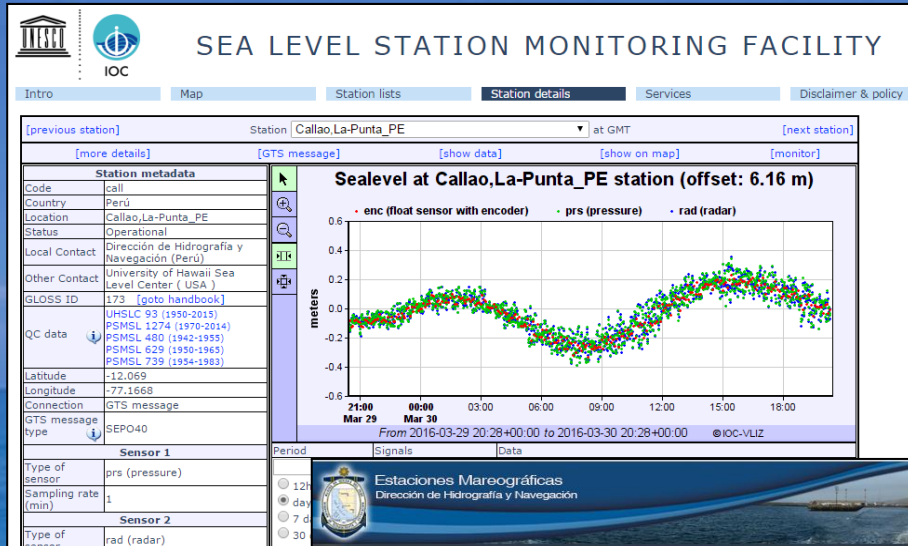
<https://www.dhn.mil.pe/secciones/mareas/index.php?f=2016-03-30>



# Tidal Data in Real Time

<http://www.ioc-sealevelmonitoring.org/>

<http://webtrans.geonica.com/index.php>



[https://www.dhn.mil.pe/secciones/departamentos/oceanografia/apps/est\\_mareograficas/](https://www.dhn.mil.pe/secciones/departamentos/oceanografia/apps/est_mareograficas/)

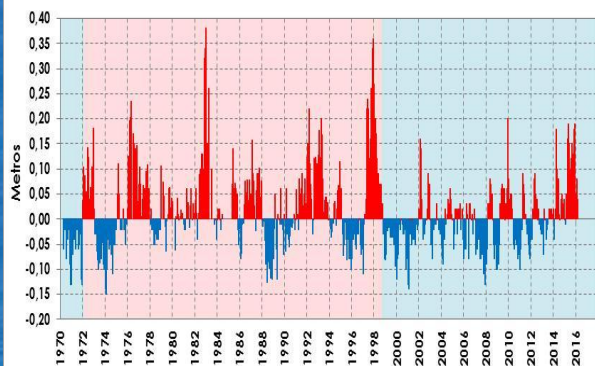


# Operational and Scientific purposes



## Monitoreo del Fenómeno El Niño

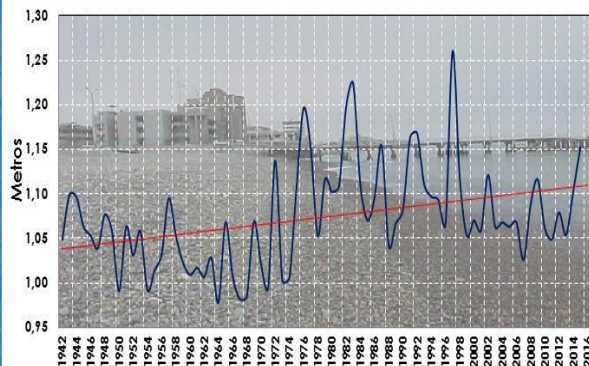
Anomalías del NMM de Talara



COP 20

## EVIDENCIAS DEL CAMBIO CLIMÁTICO EN LOS NIVELES DEL MAR FRENTA A LA COSTA PERUANA

Promedios Anuales del Nivel del Mar - Callao



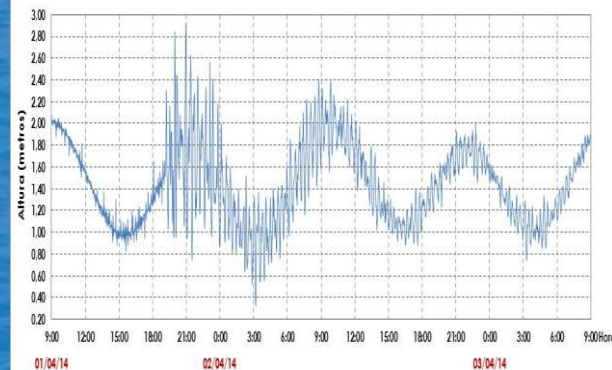
REPÚBLICA DEL PERÚ  
MINISTERIO DE DEFENSA  
MARINA DE GUERRA DEL PERÚ  
DIRECCIÓN DE HIDROGRAFÍA Y NAVEGACIÓN



DEPARTAMENTO DE OCEANOGRAFÍA  
DIVISIÓN DE GEOFÍSICA-OCEANOGRAFÍA

INFORME POST-TSUNAMI DEL SISMO DE  
IQUIQUE-CHILE (8.2 Mw) DEL 01 DE ABRIL 2014

Registro Mareográfico de Ilo





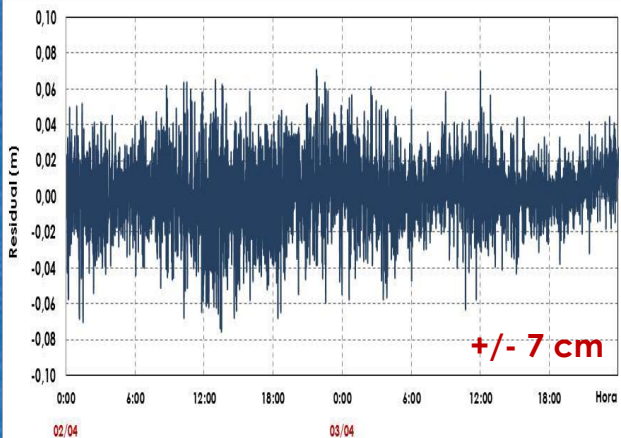
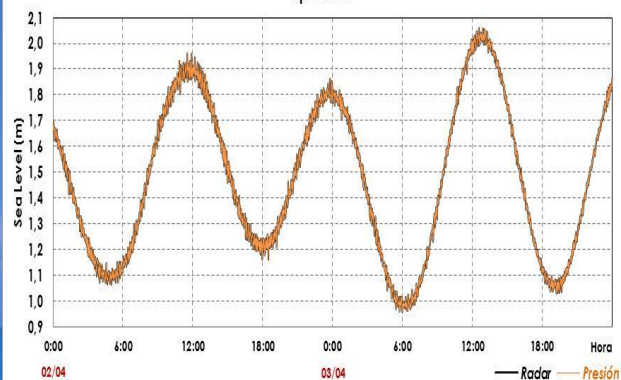
# Comparison between Radar and Pressure Sensor



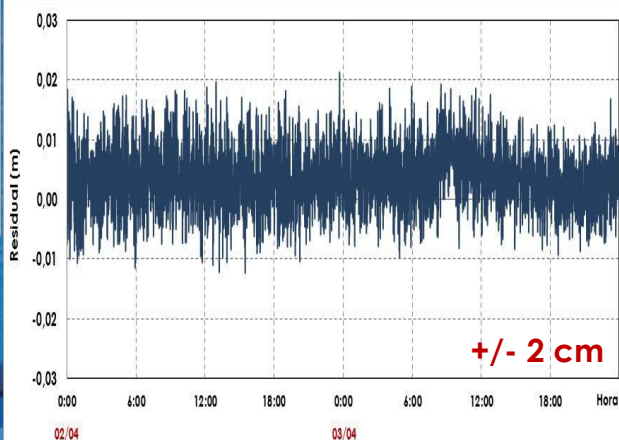
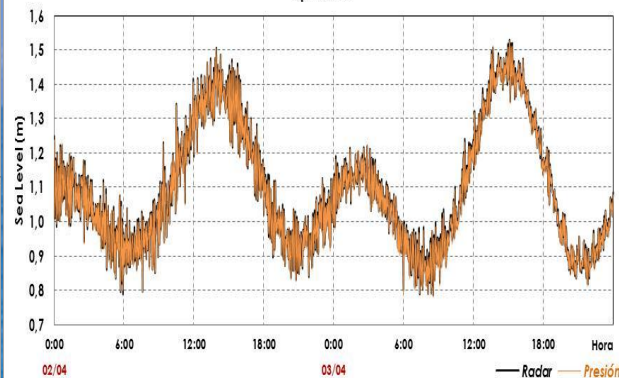


# Comparison between Radar and Pressure Sensor

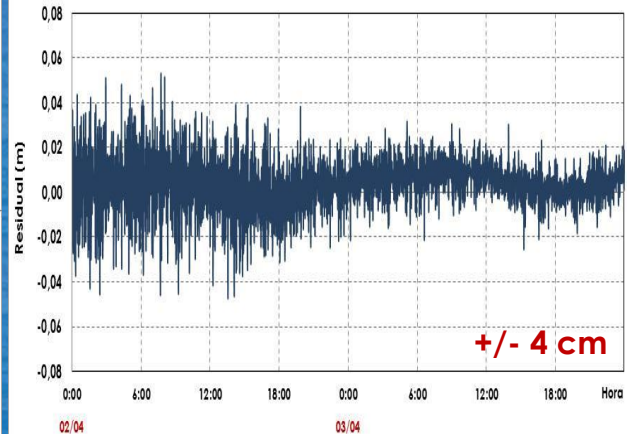
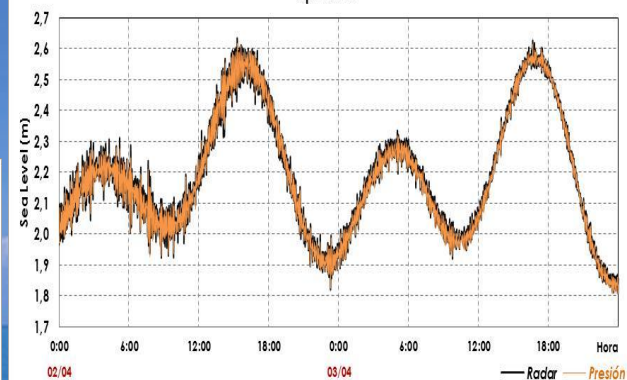
Talara  
April 2016



Callao  
April 2016



Matarani  
April 2016





## Conclusions

- ✓ Tidal stations are, at present, composed of radar and pressure sensor, secondary and main sea level sensors and a camera that allows to check changes and/or waves abnormalities from headquarters.
- ✓ The use of redundant systems (radar/pressure) and real-time transmission (satellite/telephony) will improve the work of the DHN as responsible body before the National tsunami Warning System.
- ✓ Upgrading and densification of sea level stations have improved reception of information for operational and acientific purposes. Among the principal scientific research are: the monitoring of El Niño and La Niña, the study of sea level rise related to the climate change, detection and monitoring of tsunamis and flood forecasting by rough seas.



## Conclusions

- ✓ Based on the comparisons made in the sea level measuring sensors (radar vs pressure), we note that both equipments are reliable and similar. However, the sensor type radar is very sensibly to the turbulence generated by waves and local winds in areas of open beach,; otherwise, occurs in protected areas of the marine dynamics and winds (calm (seas) in which sensors are useful.
- ✓ It is important to consider the willingness and participation in courses and/or workshops on tides for hydrography. In this case, we require specifically expand our knowledge on tidal currents.



**Thanks**