



**SNAM**Chile

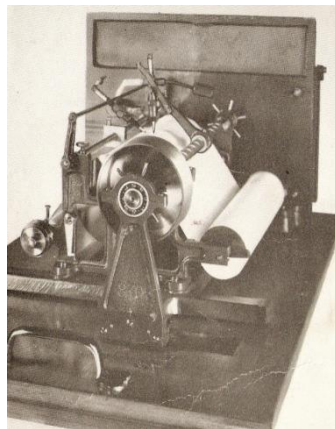
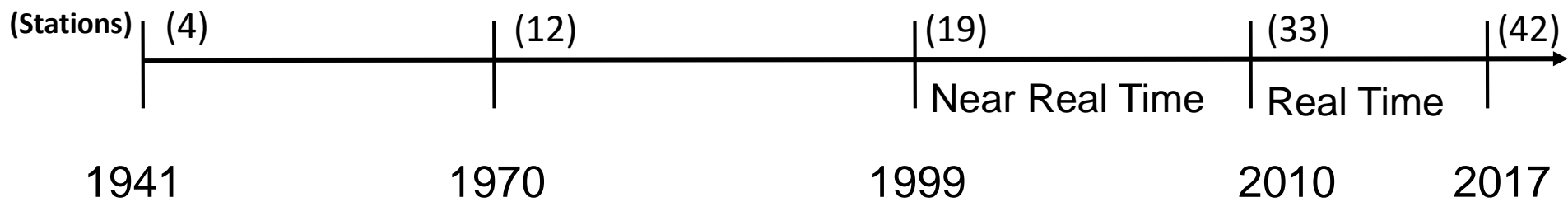
# Tide Gauges Network

Jorge Gaete V.

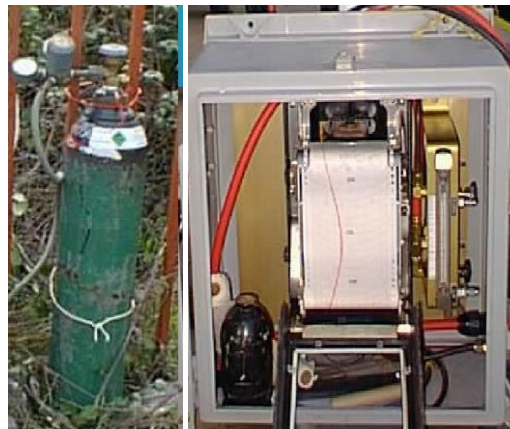
National Tsunami Warning Center Division

Oceanography Department

# Tide Gauges Network Evolution



Float Systems



Bubbler Systems



Data Collecting  
Platforms

Mechanical Devices

Digital Devices





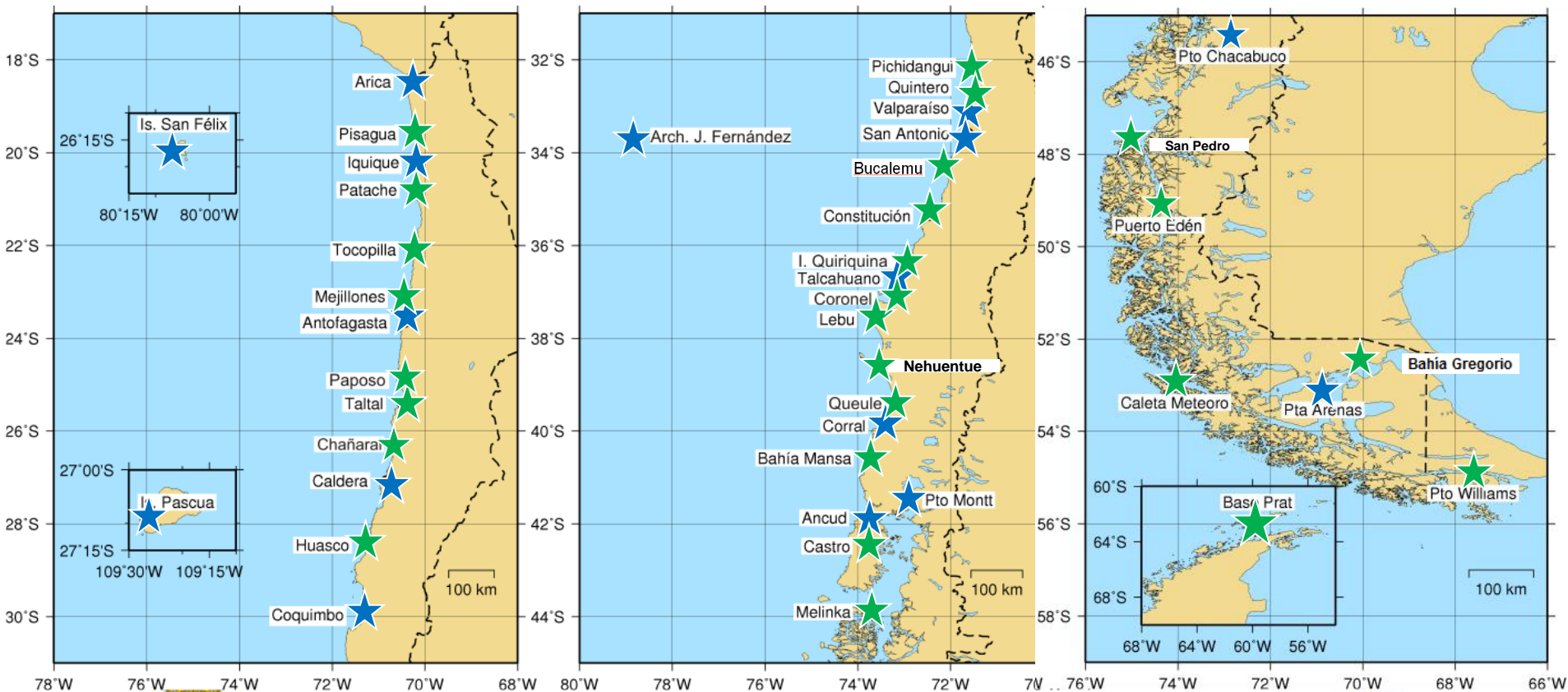
# 2010-2017

# 16

- 16 Upgrades

# 42

- 26 New Installations



# *Transmission Protocols*



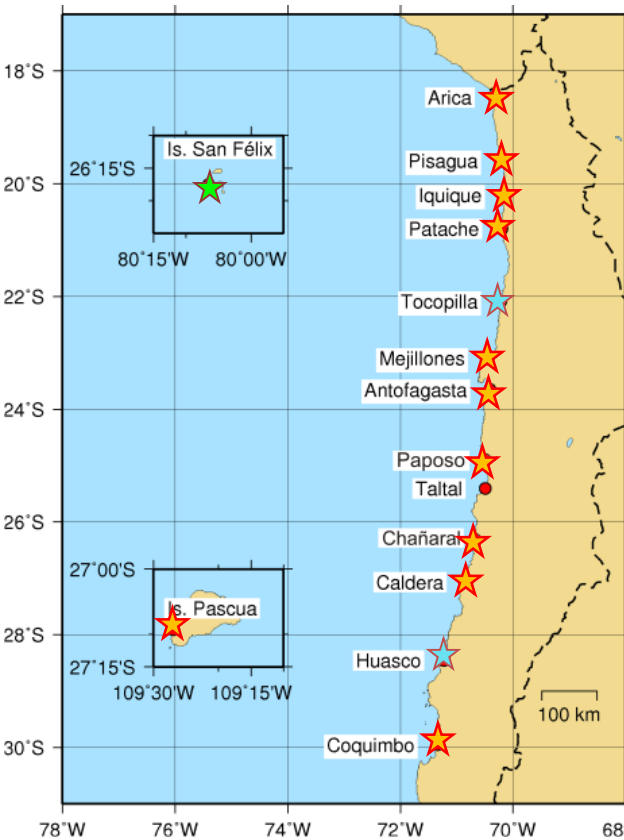
- Tide Gauges with dual communication options
  - Primary: GOES or BGAN/Inmarsat
  - Secondary: GPRS
- Available Combinations
  - GOES – BGAN: 05 Stations
  - GOES – GPRS: 34 Stations
  - BGAN – GPRS 03 Stations



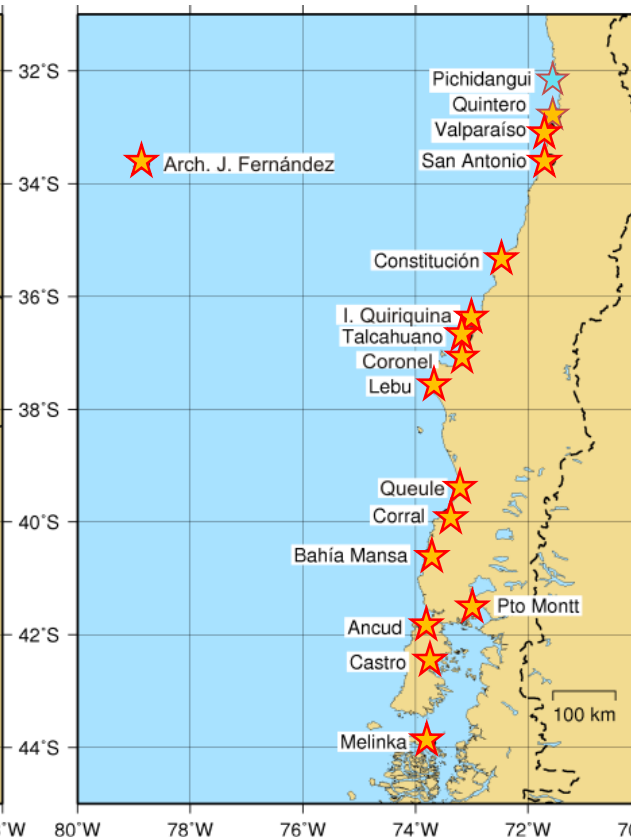
# Transmission Protocols



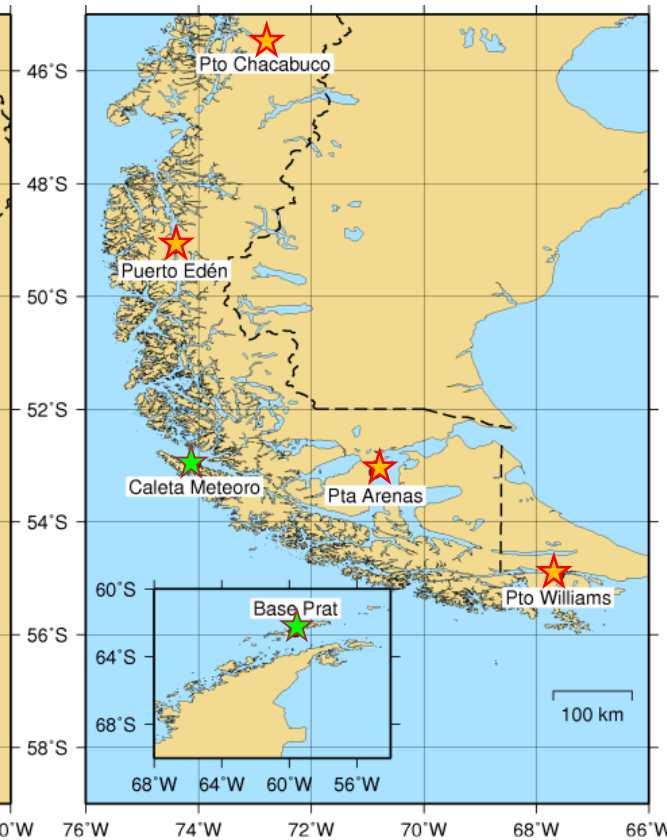
GOES - BGAN



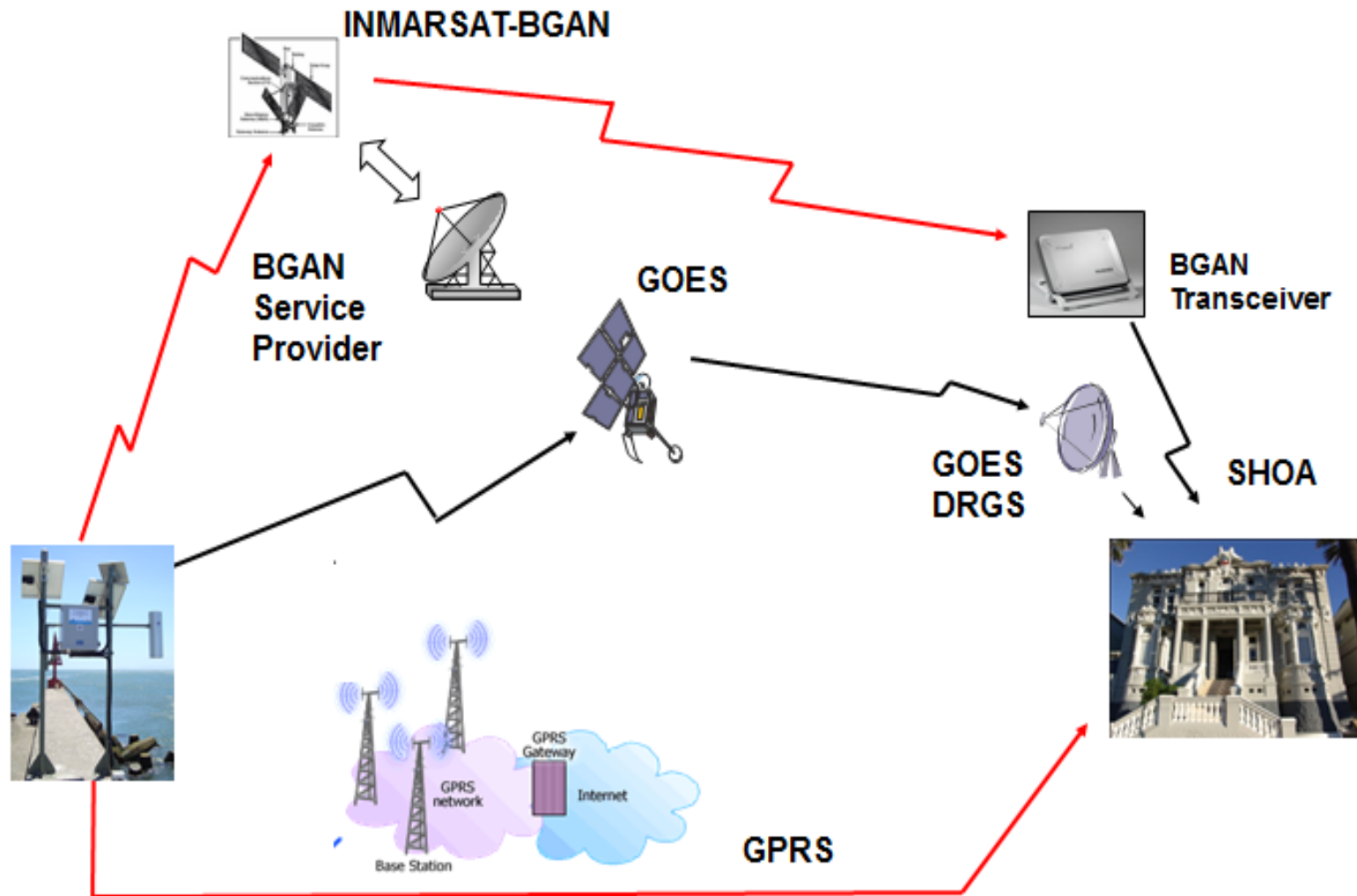
GOES - GPRS



BGAN - GPRS



# SHOA Operational Data Acquisition

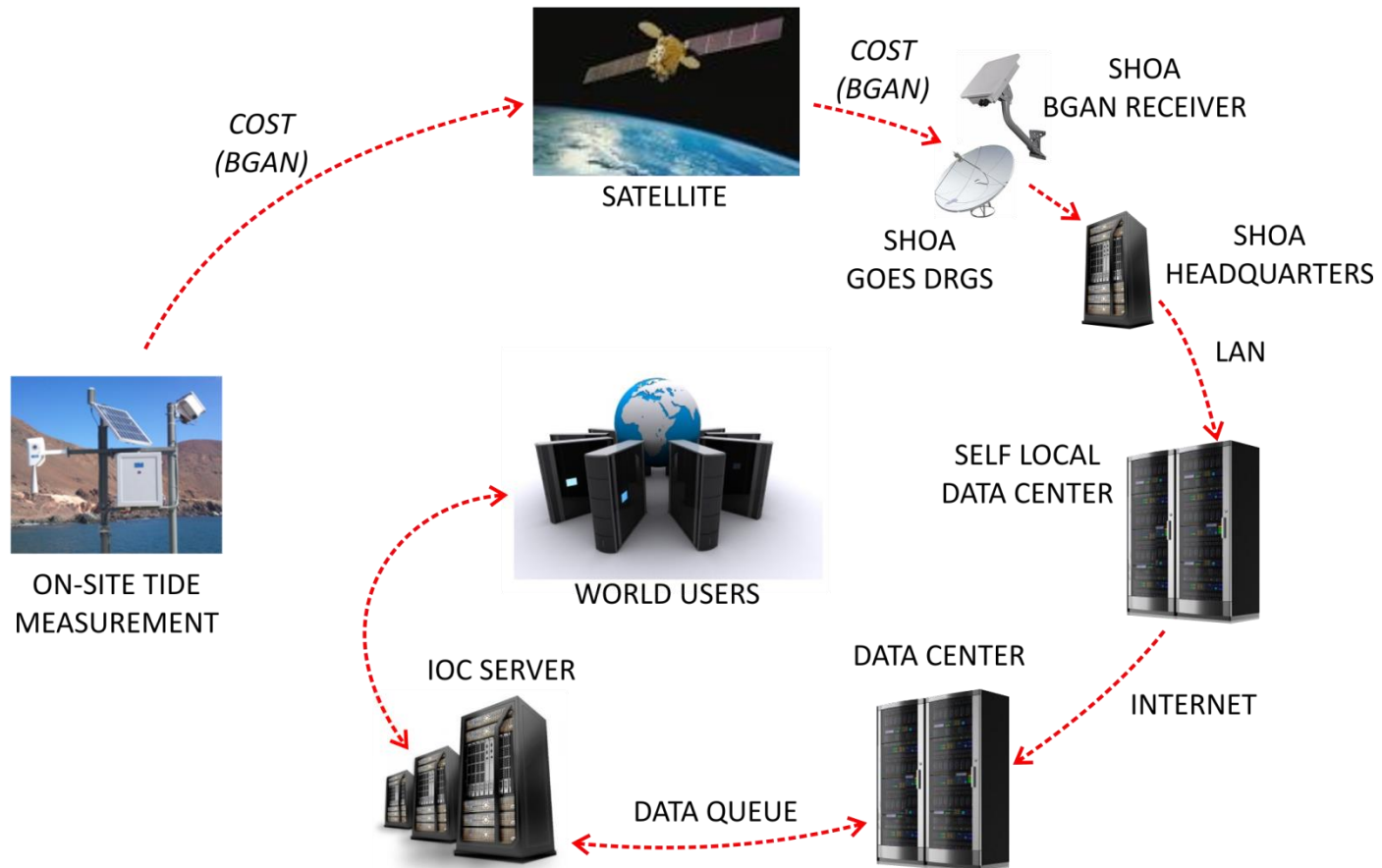


# BGAN NORMAL

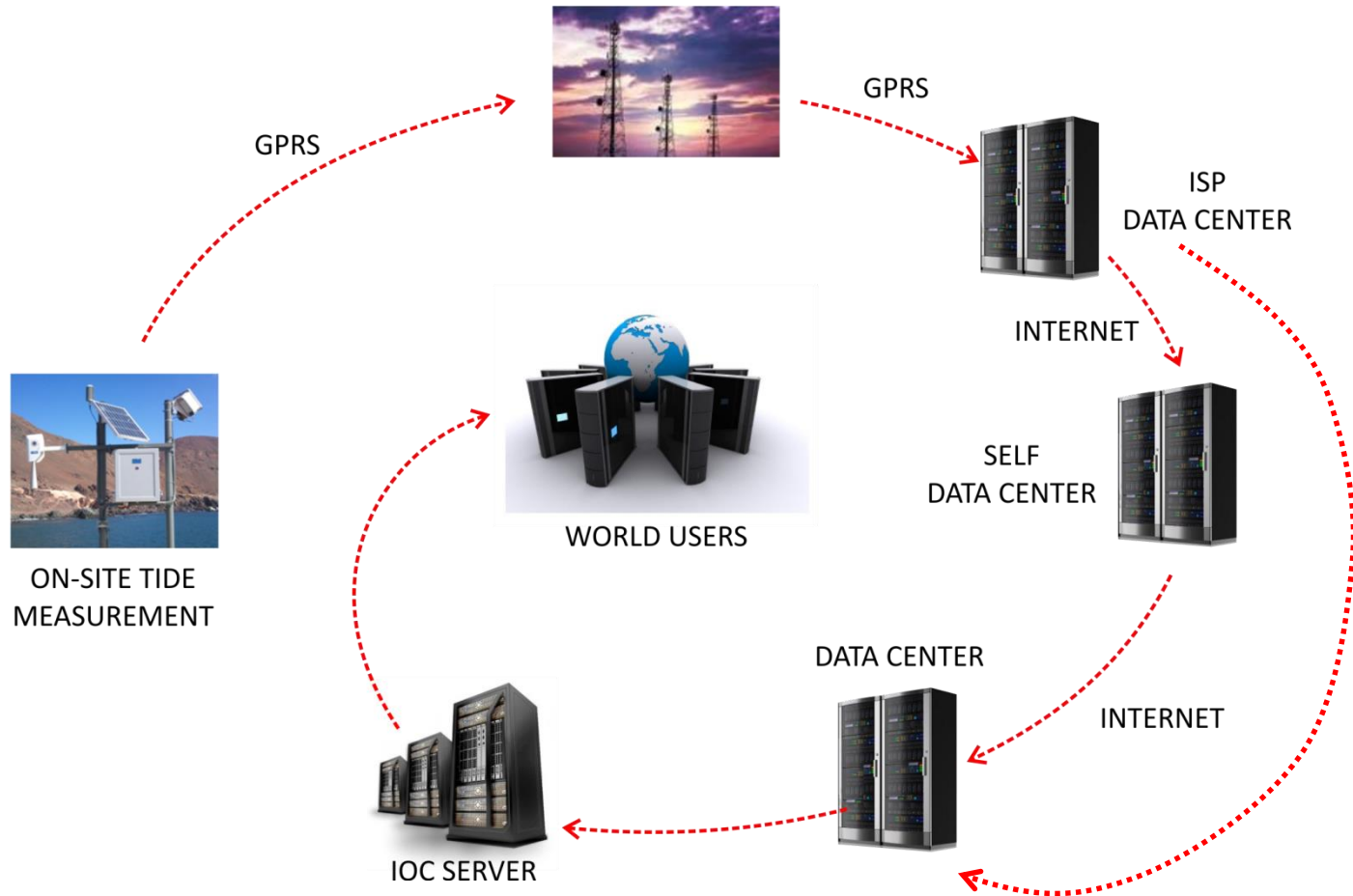




# BGAN AND GOES



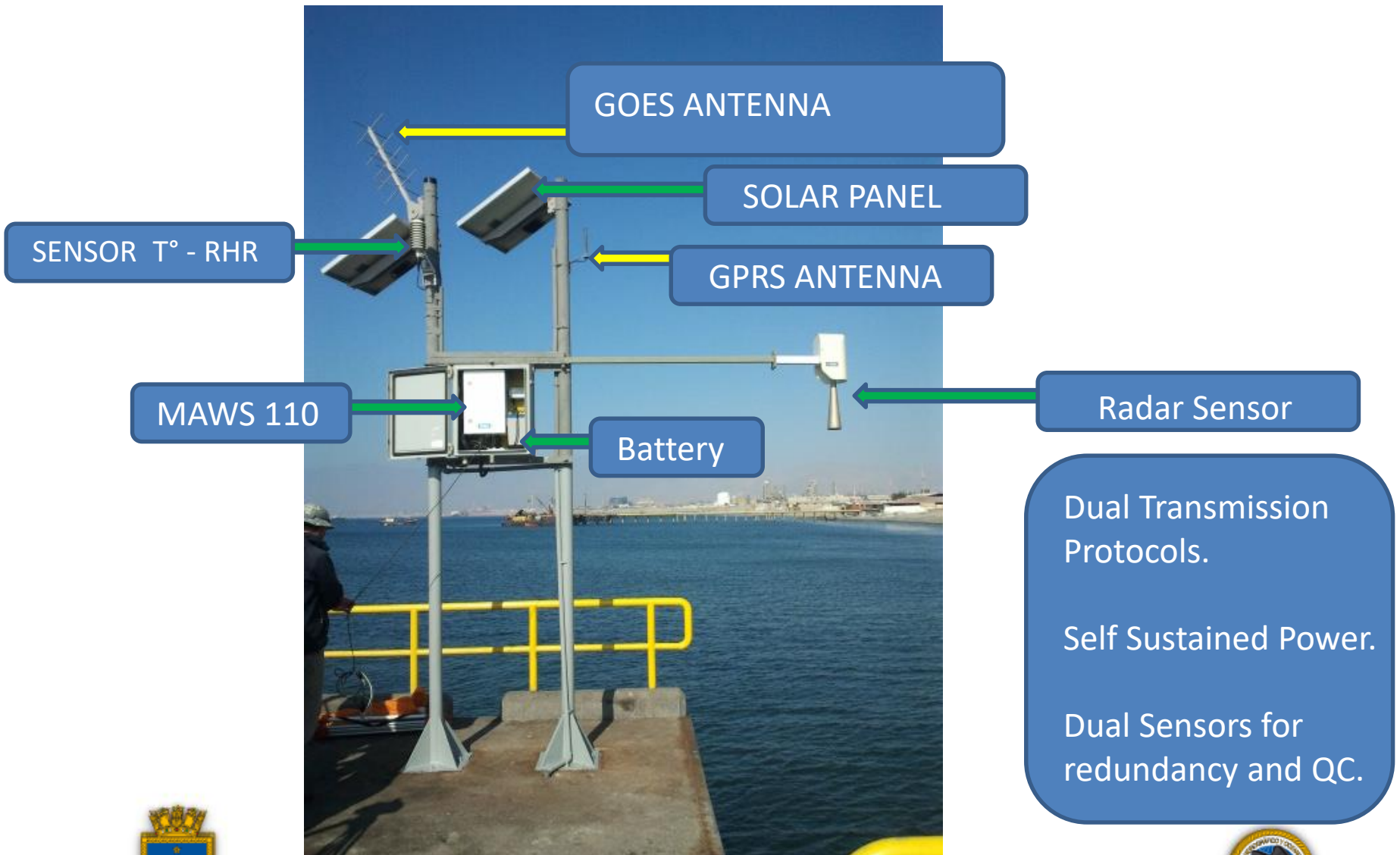
# GPRS SHOA



# *Operational Capabilities*



# Tide Gauge Components





# Sea Level Relative Pressure sensor Druck PTX1830

## Specifications



- Operational Range: 10 m
- Precision :  $\pm 15$  mm
- Operational Temp Range: -20 a 60 °C
- Molded Titanium body
- Corrosion resistant



# Sensor de Nivel del Mar

## Radar Vegapulse 62

- **Operation Frequency de 26 GHz.**

- No direct contact with water.
- Not affected by sediments.
- Not affected by humidity or air temperature variations.
- Minimal Maintenance, easy to install.
- Operational Range : 0 - 35 M
- Precision:  $\pm 2$  mm
- Low power requirement

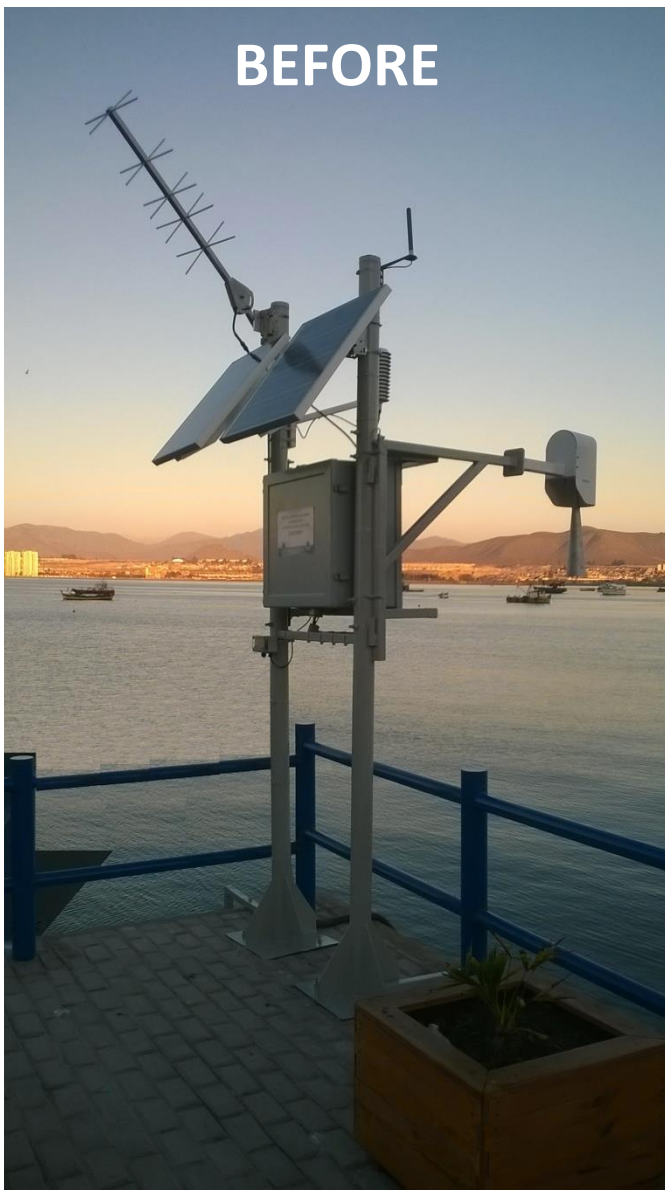


# TIDE GAUGE STATIONS WITH A PERMANENT MAINTENANCE PROGRAM





**BEFORE**



COQUIMBO  
STATION

MAXIMUM  
HEIGHT OF  
TSUNAMI WAVE  
FOR ILLAPEL  
EVENT  
16 /09/2015

**4.7  
METERS**

**DESPUES**





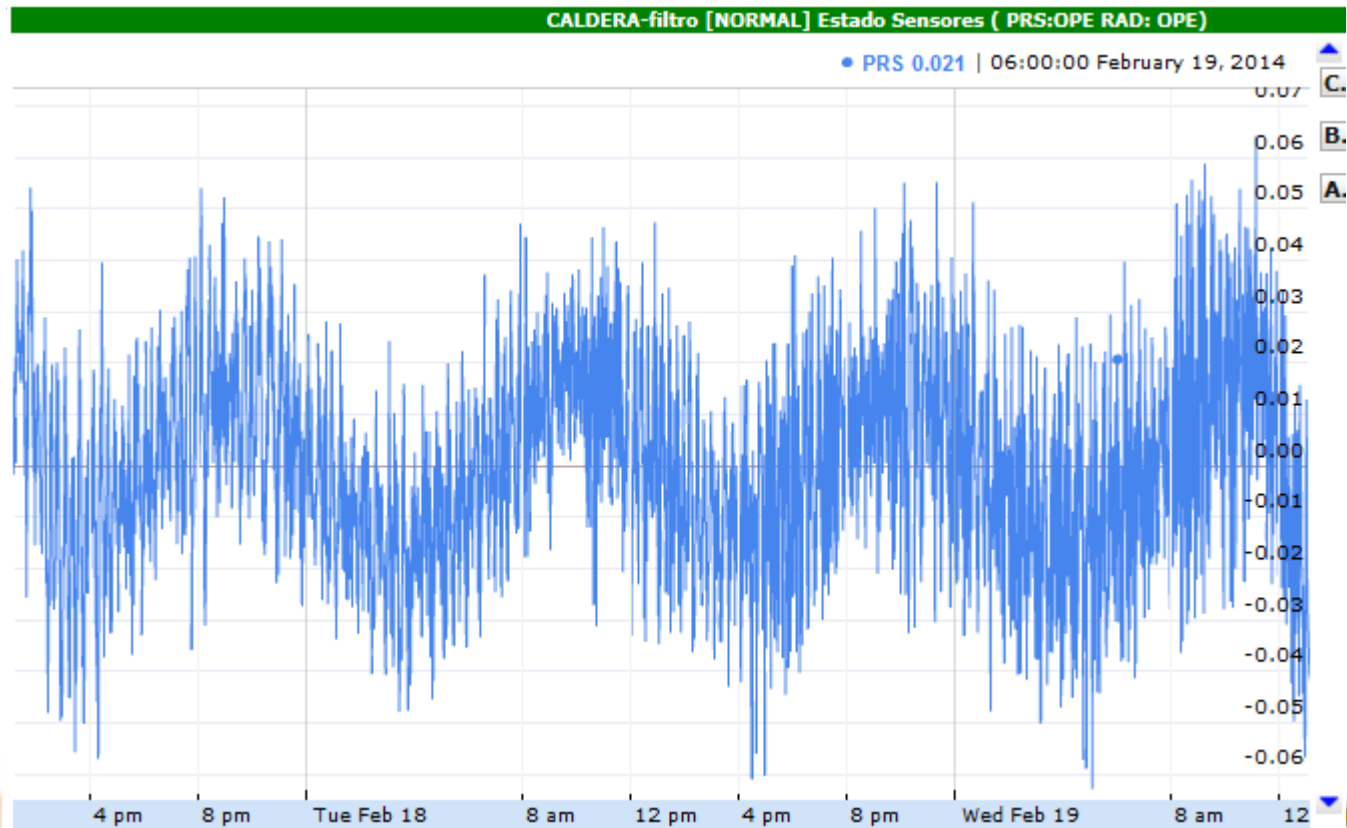
## Monitoraggio per ENM



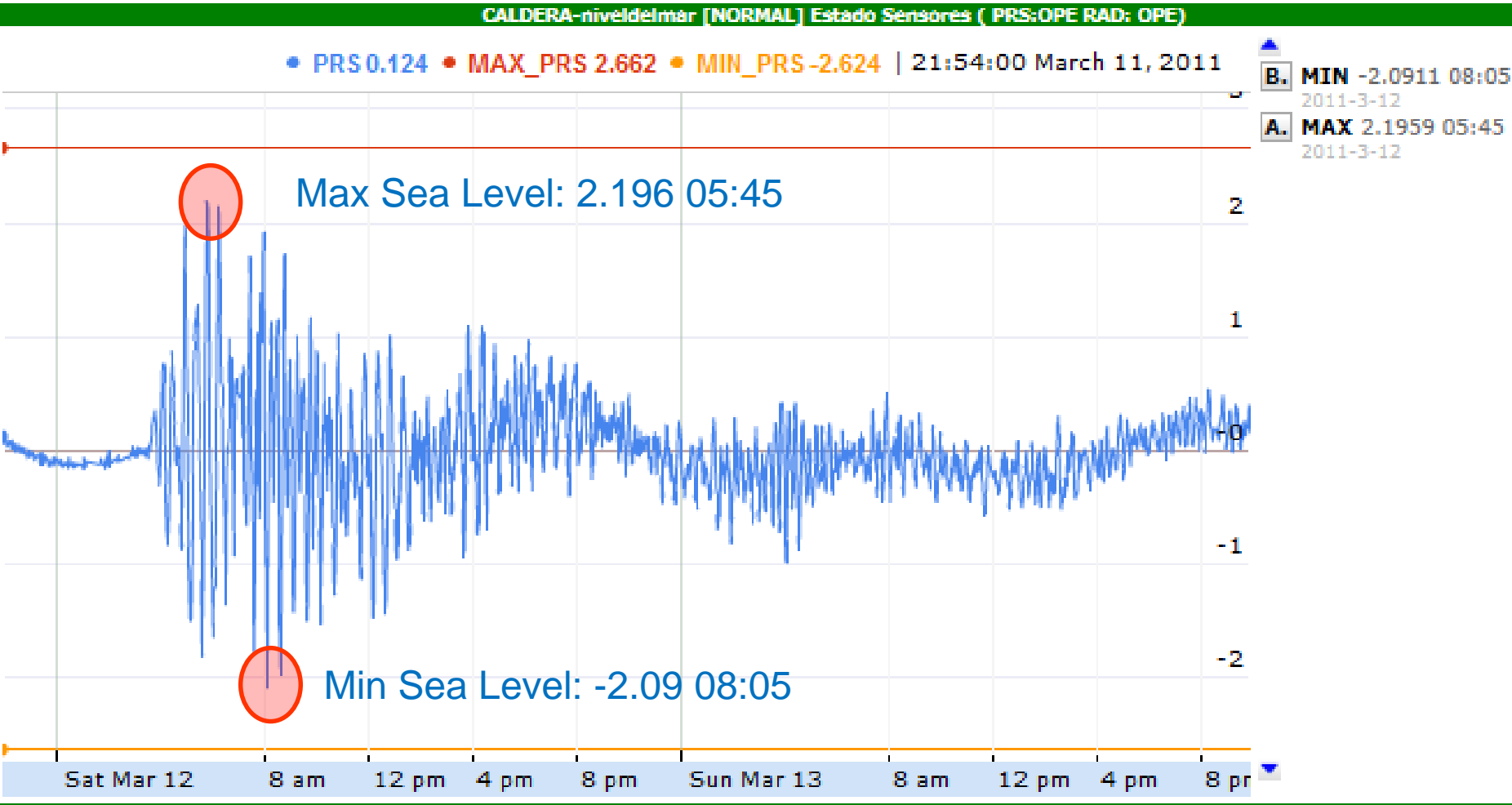
# *Data Processing for Tsunami Monitoring*



- Raw data referred to zero level
- MSL reference
- De -Tided Signal



- Tsunami Amplitude Max and Min Logging

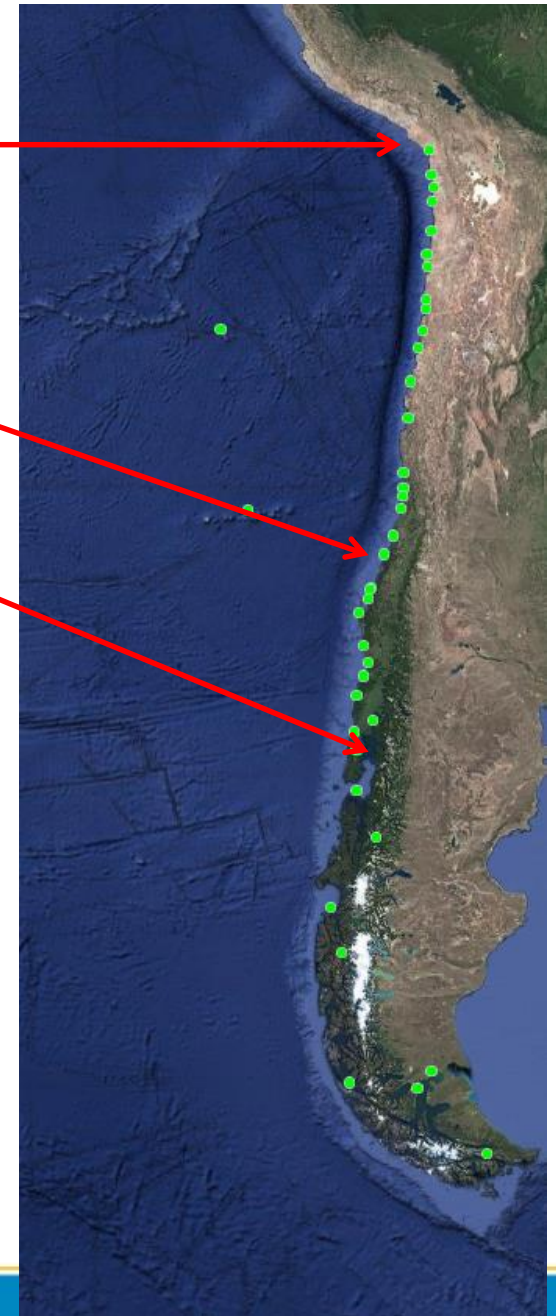


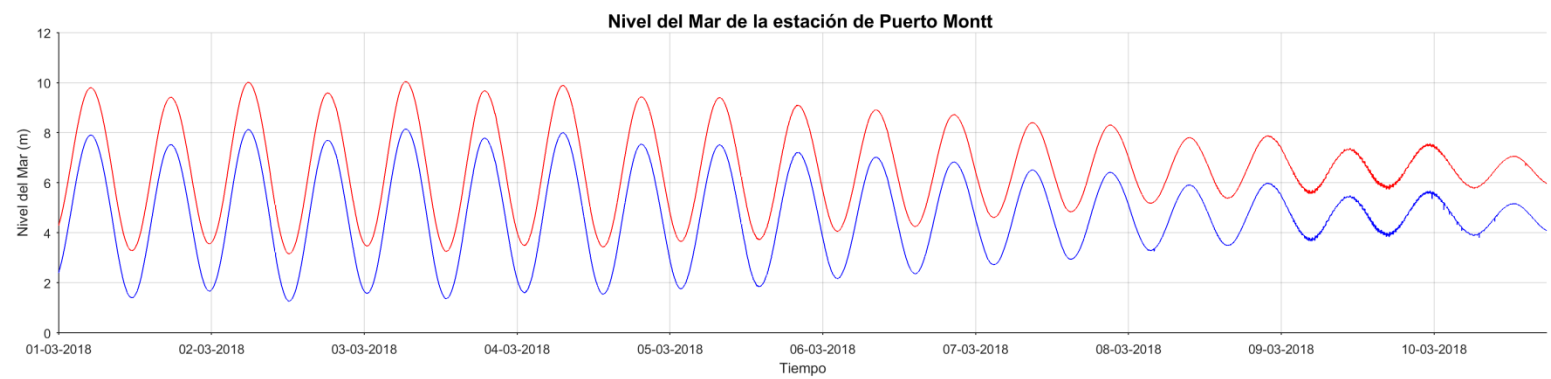
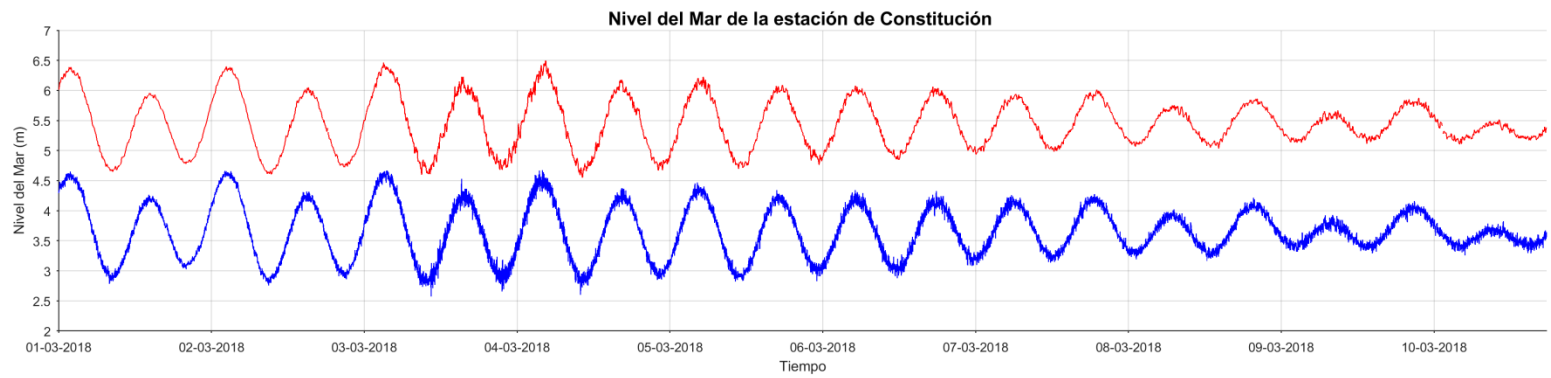
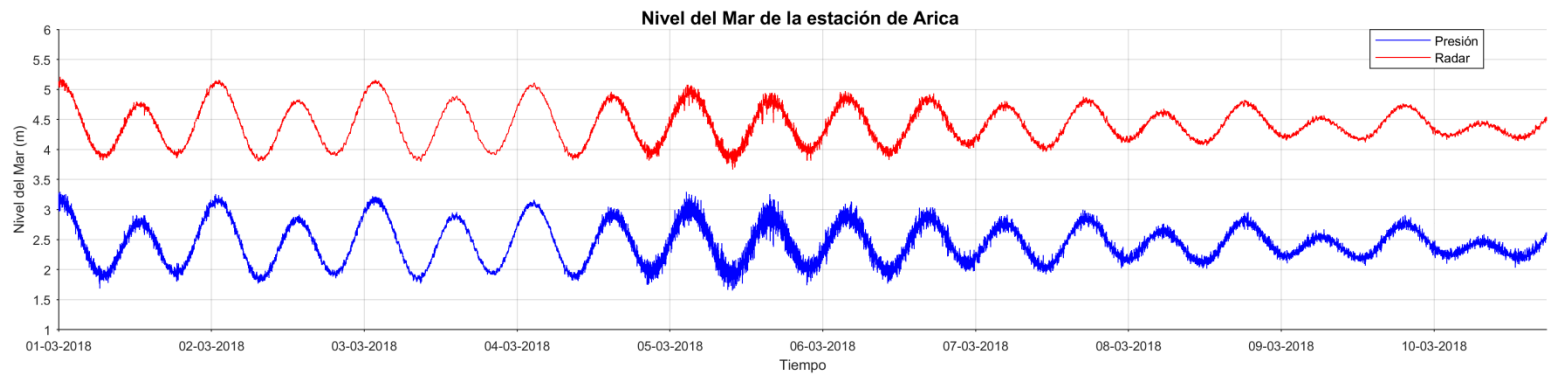


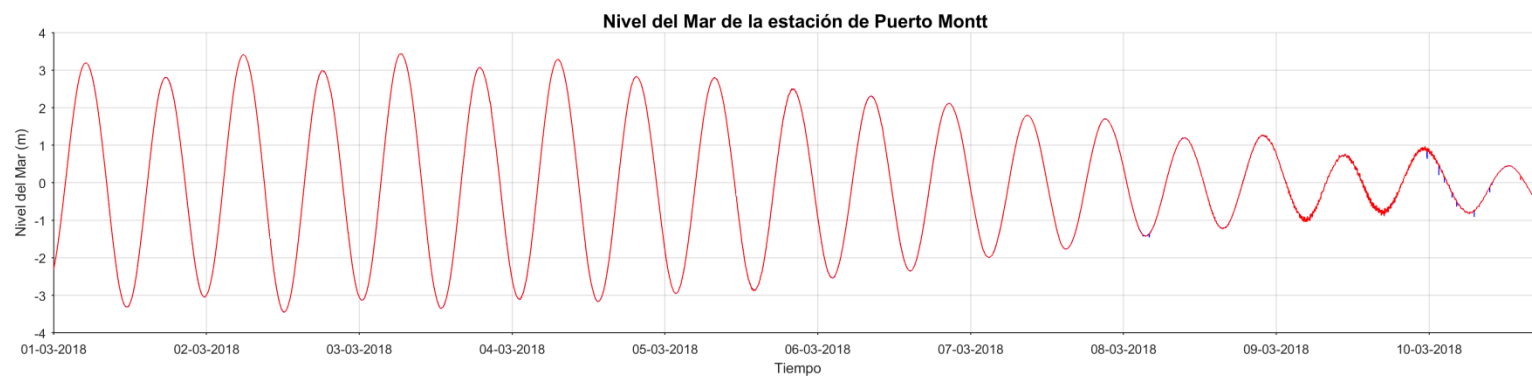
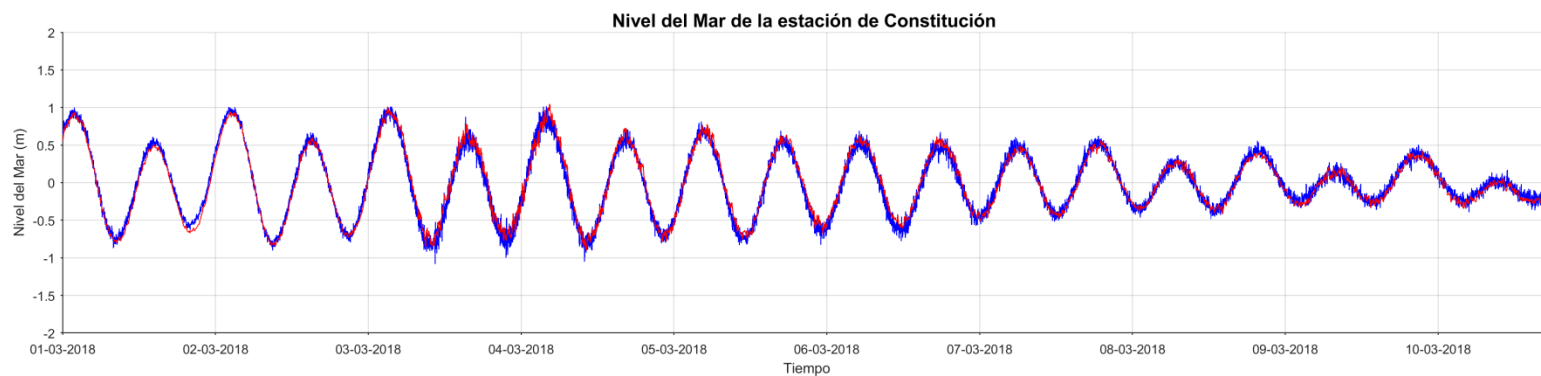
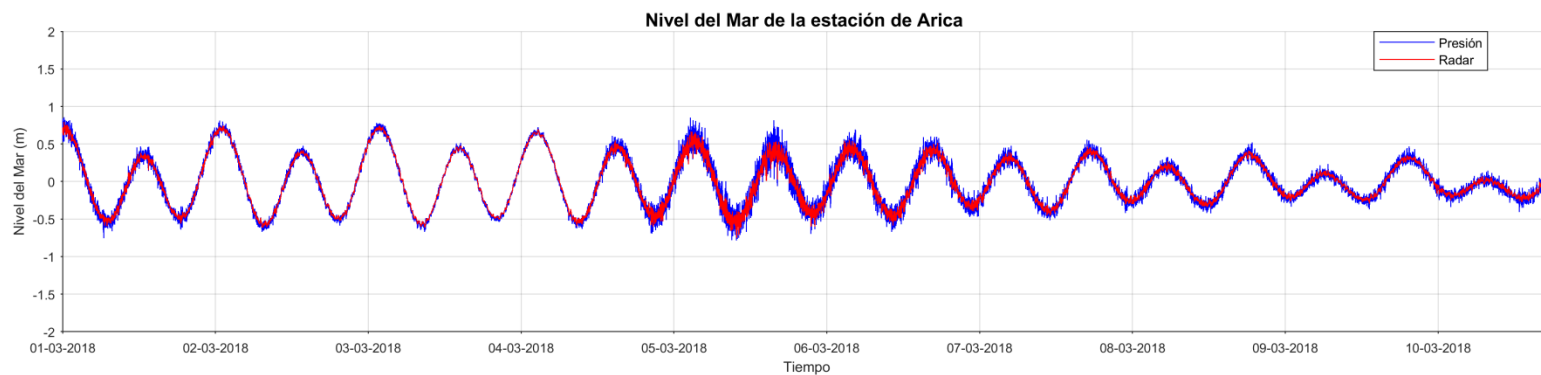
# *Radar Sensor Performance*



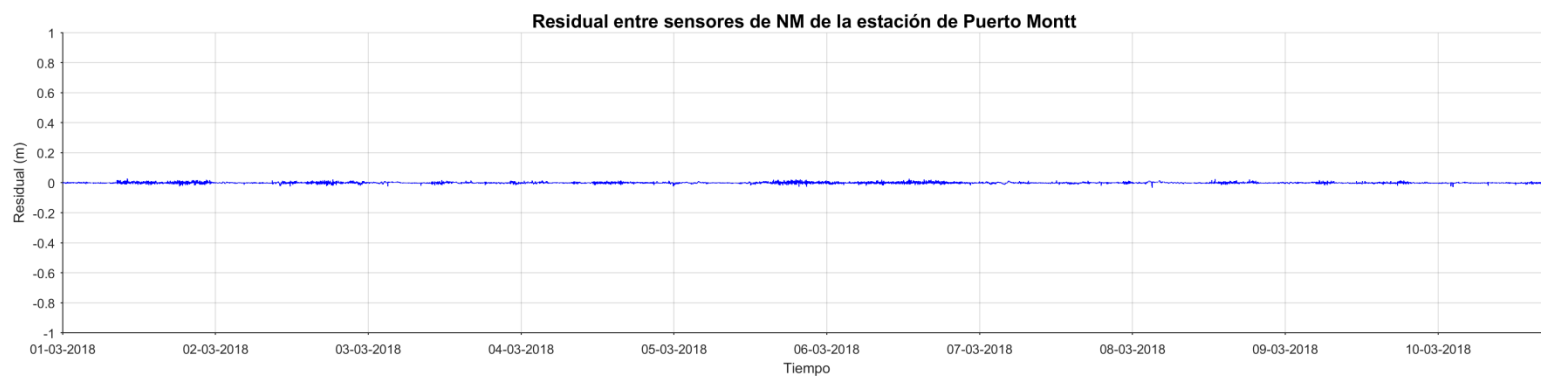
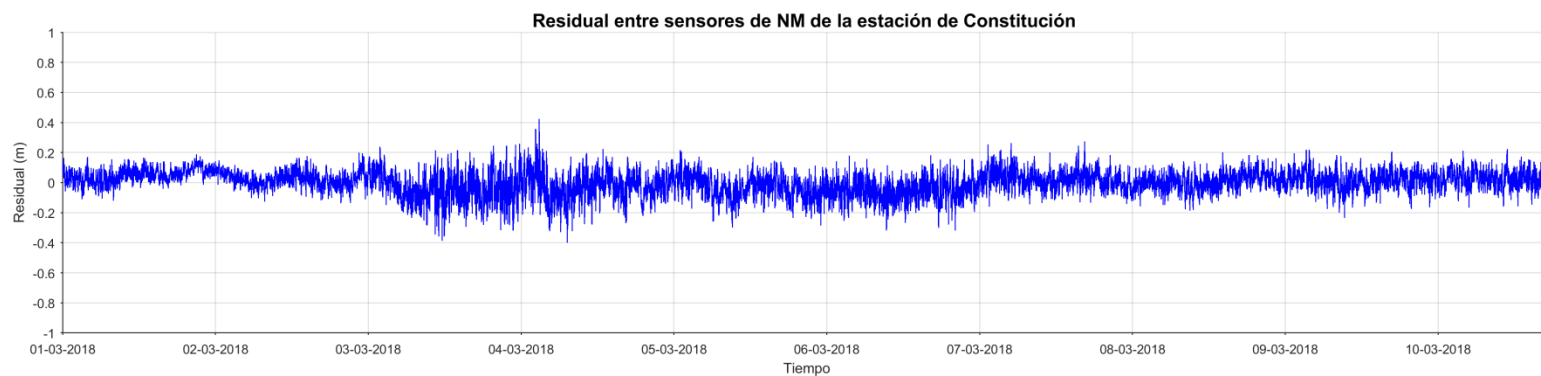
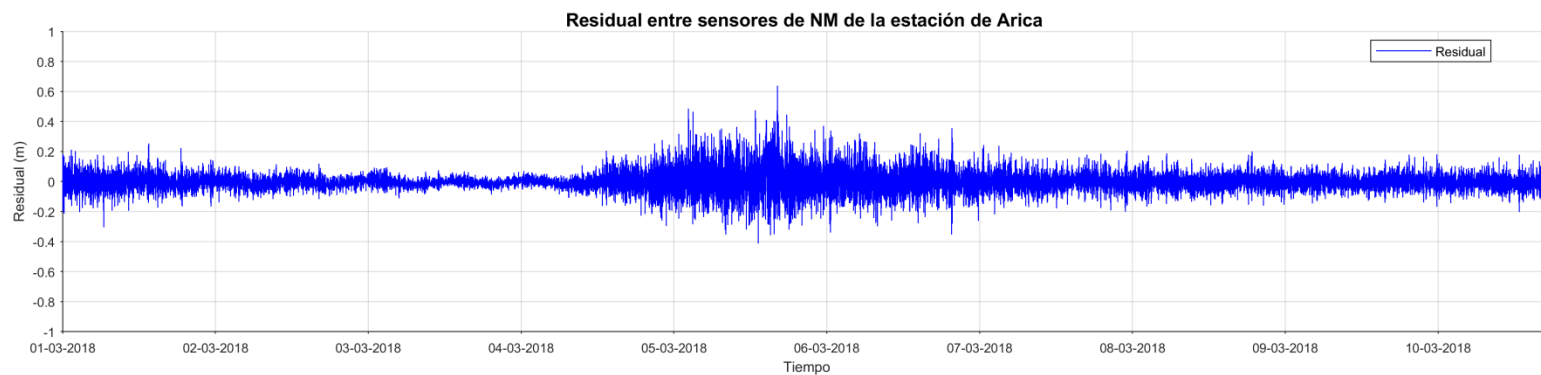
- Residuals Analysis
  - Semi Protected bay: Arica
  - Open Coast: Constitución
  - Inner Waters: Puerto Montt
- Radar sensor Settings can be adapted to different conditions.
- High frequency noise supression will reduce accuracy for Tsunami measurements.
- Compromise according to desired task.











# Conclusions

- *Wider range of available communication protocols increase Network reliability.*
- *Higher Transmission frequency allows real time monitoring.*
- *Radar Sensor has shown a strong reliability and excellent data quality.*
- *Radar sensor can be used for a wider range of applications.*
- *Sensor setting allows to cope with different sea state conditions*
- *Sensor performance will be compromise between data quality and data objectives.*

