

7<sup>TH</sup> IHO TIDE AND WATER LEVEL WORKING GROUP MEETING  
21 - 24 APRIL 2015, SILVER SPRING, MD, UNITED STATES OF AMERICA



# CHILEAN SEA LEVEL NETWORK

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SERVICIO HIDROGRÁFICO Y OCEANOGRÁFICO DE LA ARMADA DE CHILE

*Siempre queda mucho por hacer...*

# Presentation Structure

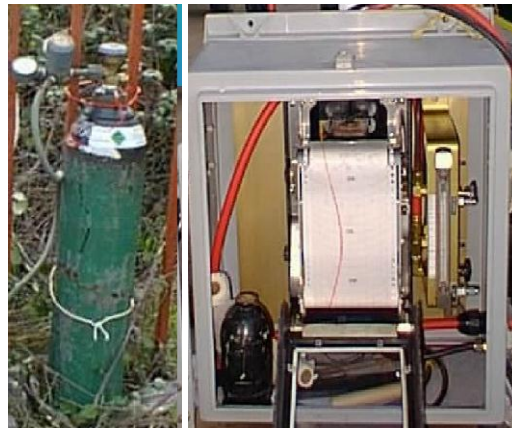
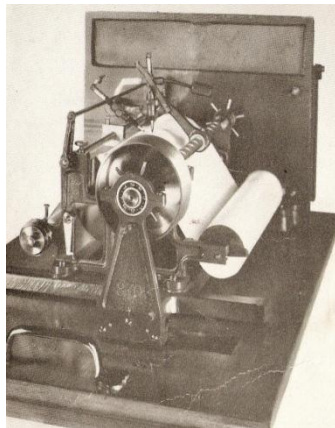
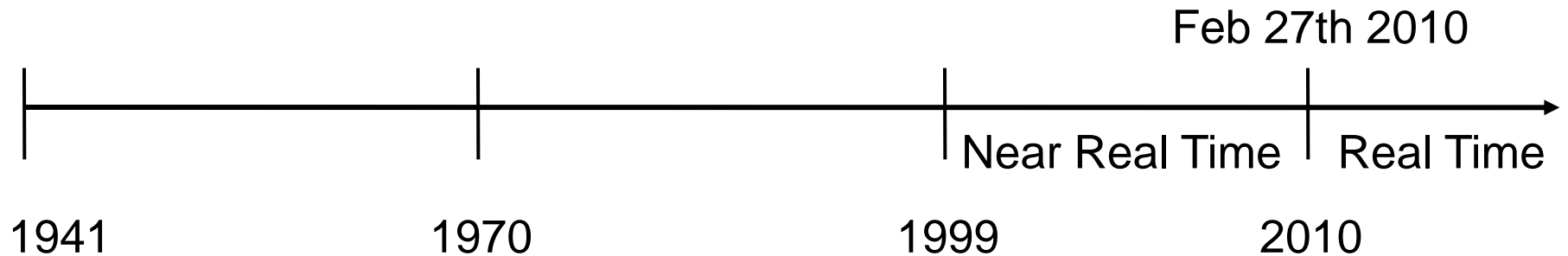
- Current state
- Sea level station components
- Data transmission
- Tides at SHOA website
- Radar – Pressure sensor comparison
- Conclusions



# Current State



# Chilean Sea Level Network Hardware Upgrade process



dry purged recording  
tide gauge



Data collecting  
platforms

A reinforced upgrade

- Improving telemetry
- New platforms and sensors

Mechanical devices

Digital equipments



# Chilean Sea Level Stations Network 2010 - 2015

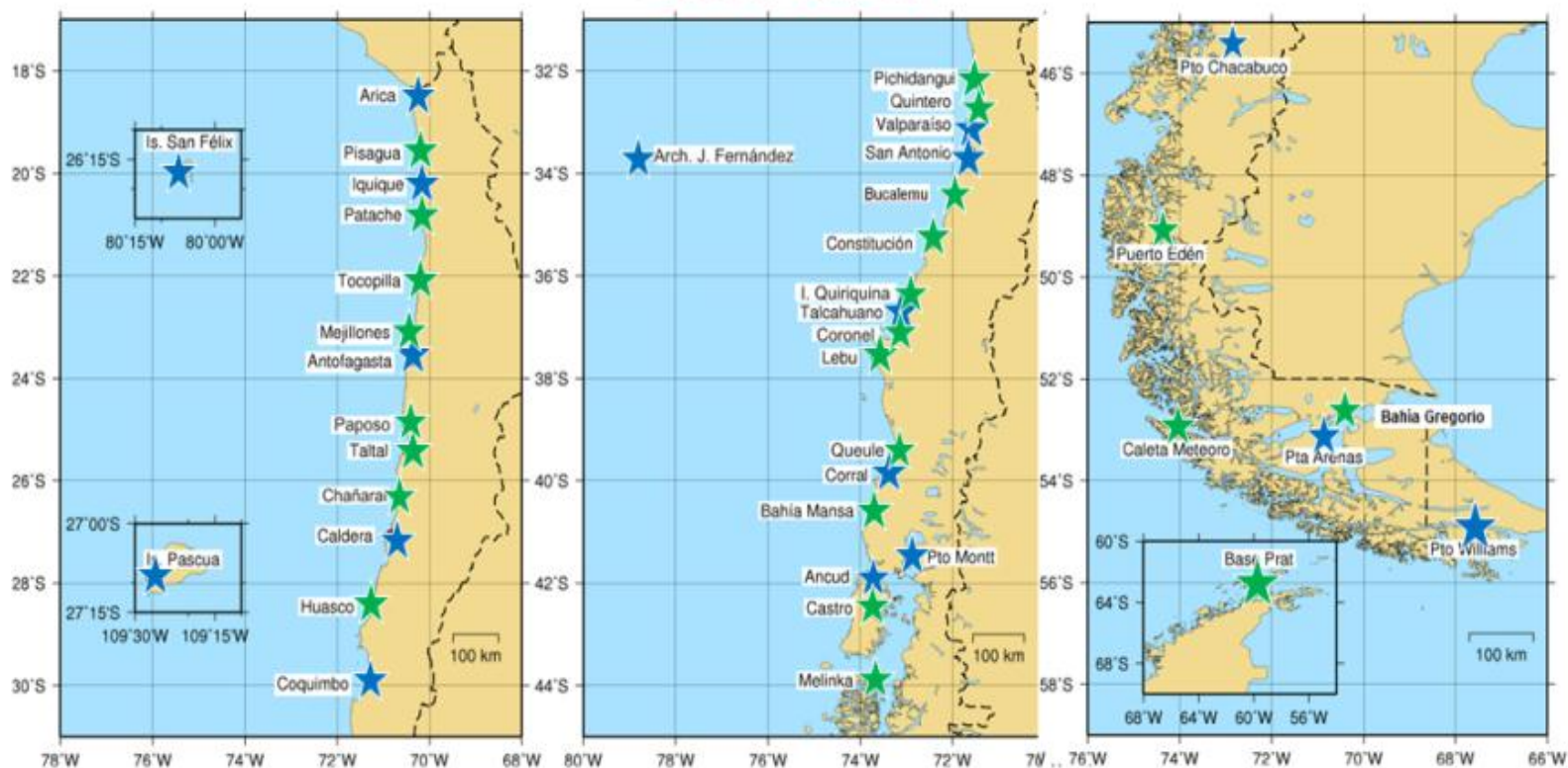
- 17 Station Upgrades

17



40

- 24 New Stations





# Chilean Sea Level Stations Network

- **40 Stations with real time transmission:**

**Sampling interval: 1 minute**

**Tx transmission: 1, 5, 10, 15 min**

**Sensor Standard configuration**

Sea Level

Water Temperature

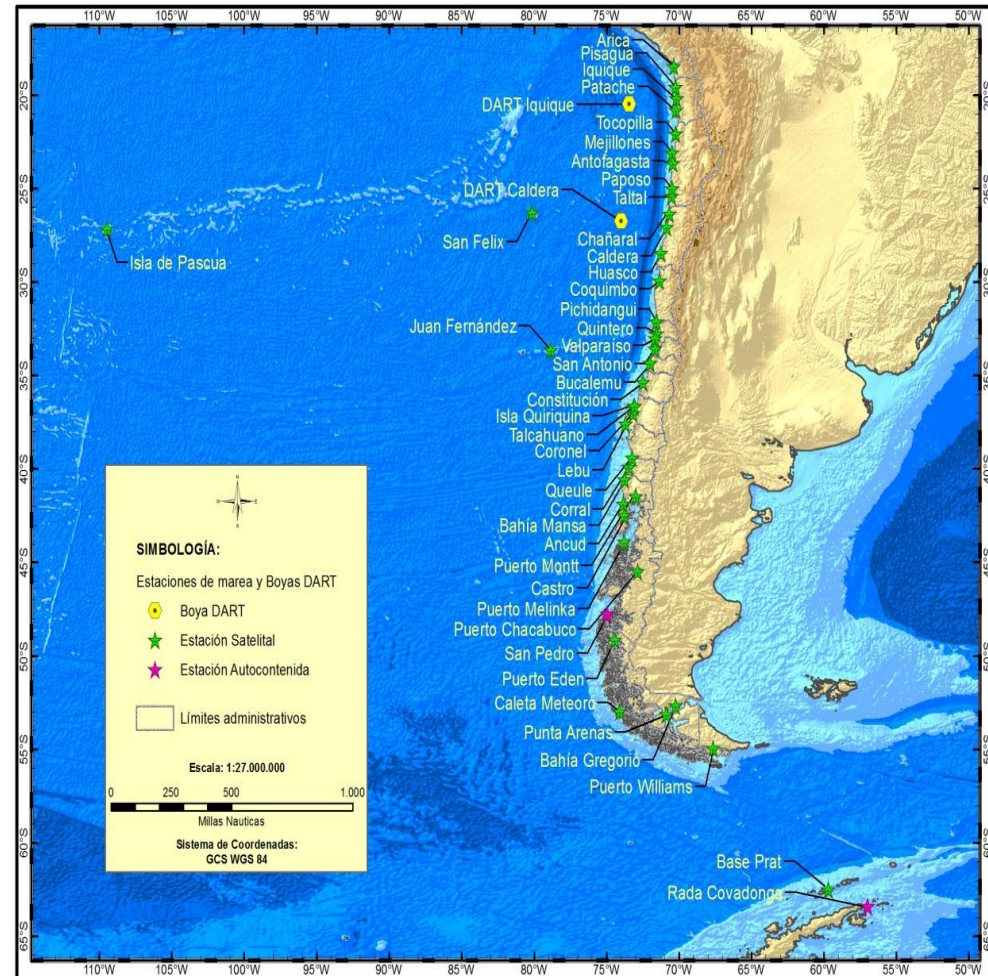
Combined Air Temp and humidity

Atmospheric pressure

- **2 Self contained platforms:**

San Pedro

Rada Covadonga

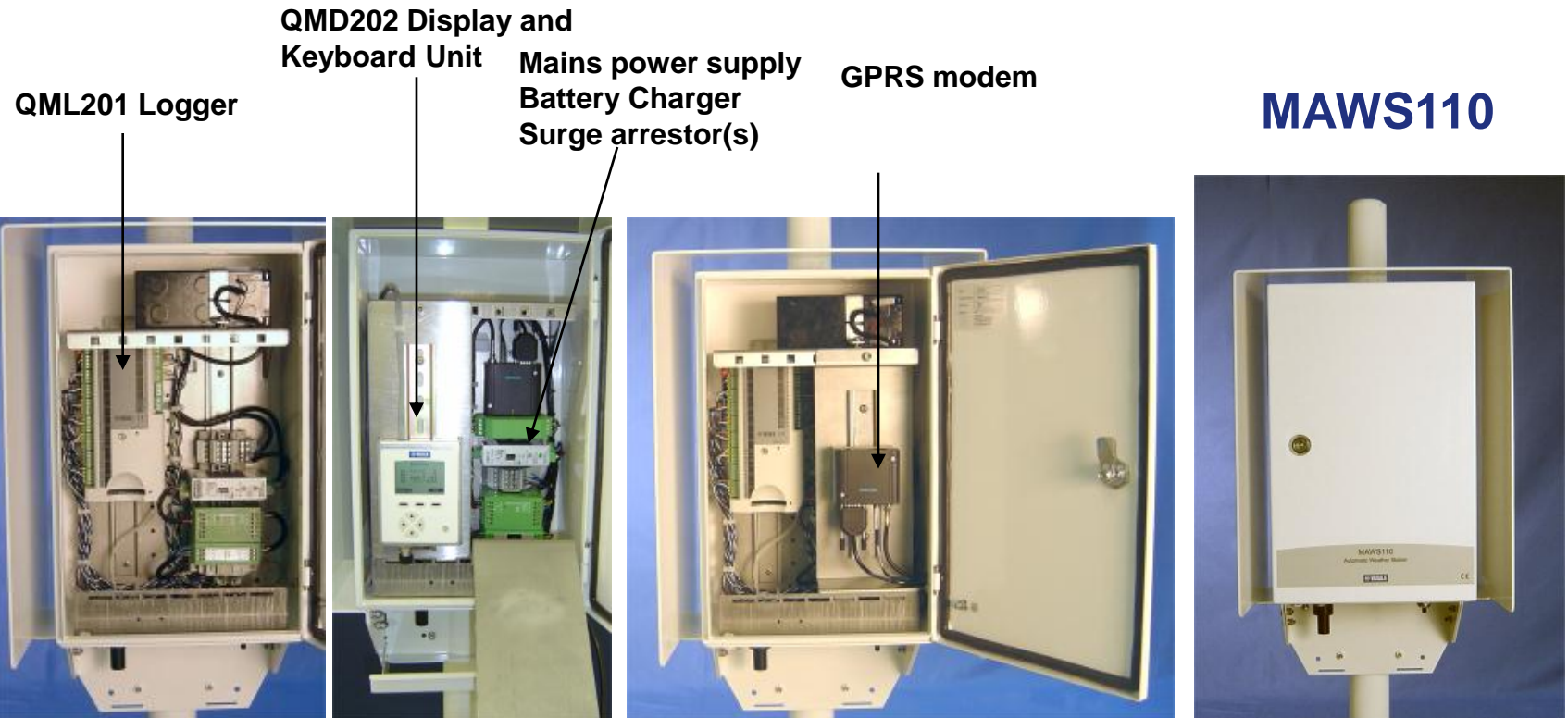


# Sea Level Station Components



# VAISALA HydroMet SYSTEM MAWS110

## Medium Sized Systems





# Submersible Water Level Sensor Druck PTX1830

## Specifications

- Operating Range : 10 m
- Accuracy :  $\pm 0.1$  % F.S.
- Operating Temperature Range : -20 to 60 °C
- Full welded titanium construction
- Backed by 5 year corrosion warranty
- Vented polyurethane cable
- Cable Termination STE 110



**Silicon Sensing element within the all-titanium pressure module**



# Radar Water Level Sensor Vegapulse 62

- **CONTACT FREE WATER LEVEL MEASUREMENTS(26GHz TECHNOLOGY)**

- **INSENSITIVE TO MUD, DRIFT WOOD, LEAVES, ETC**
- **MINIMUM CONSTRUCTION WORK**
- **INSENSITIVE TO FOG, TEMPERATURE FLUCTUATION**
- **NO OR LITTLE ZERO DRIFT**

**AIR**

- **MEASURING RANGE 0 - 35 M**
- **ACCURACY:  $\pm 2$  MM**
- **OPERATING TEMP: - 20 TO +70° C**
- **LOW POWER CONSUMPTION**



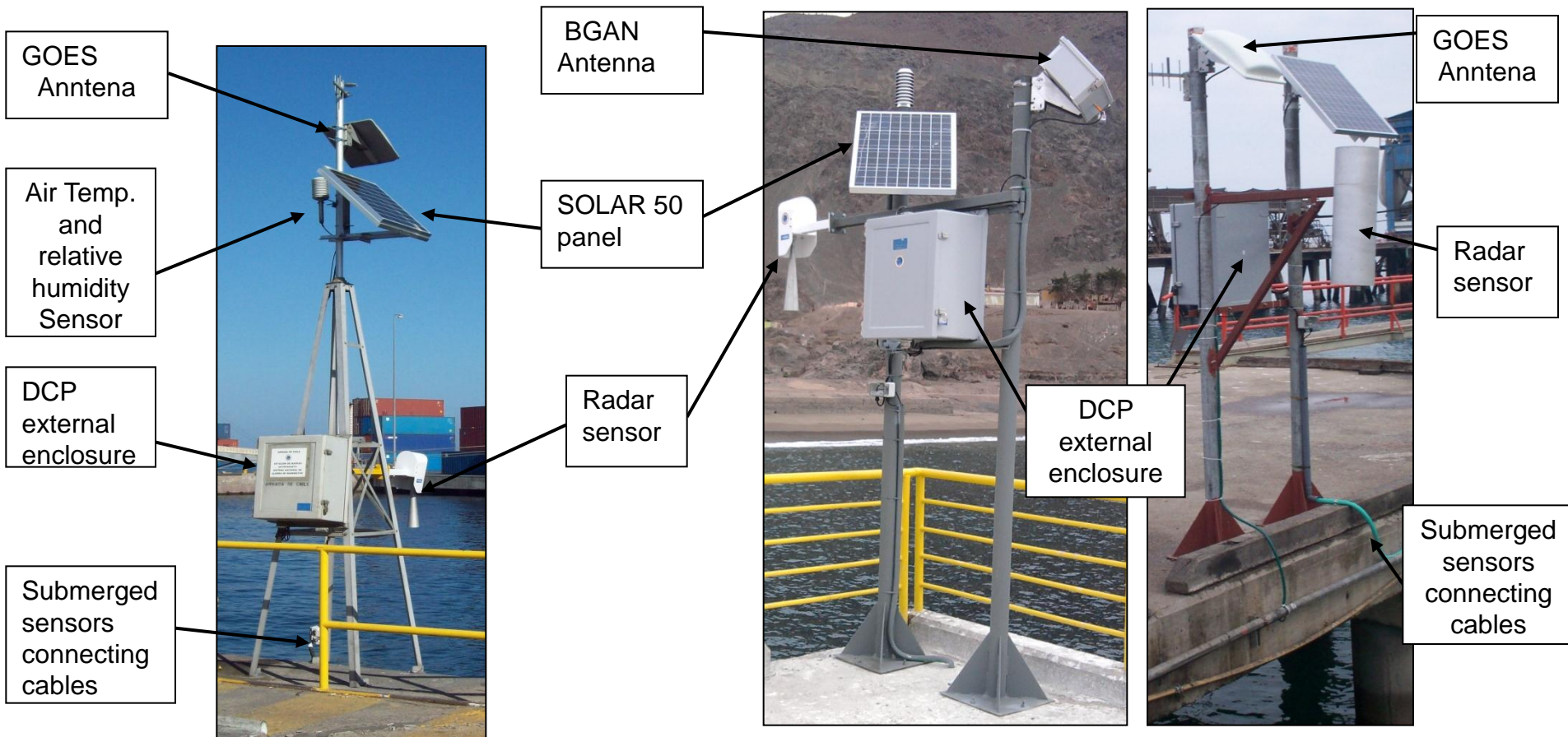
# Radar Water Level Sensor Vegapulse 62





# Sea Level Station Components

## Mounting Configuration



Pyramidal structure

Type «H» structure

Aluminum equal leg angles

Galvanized steel masts

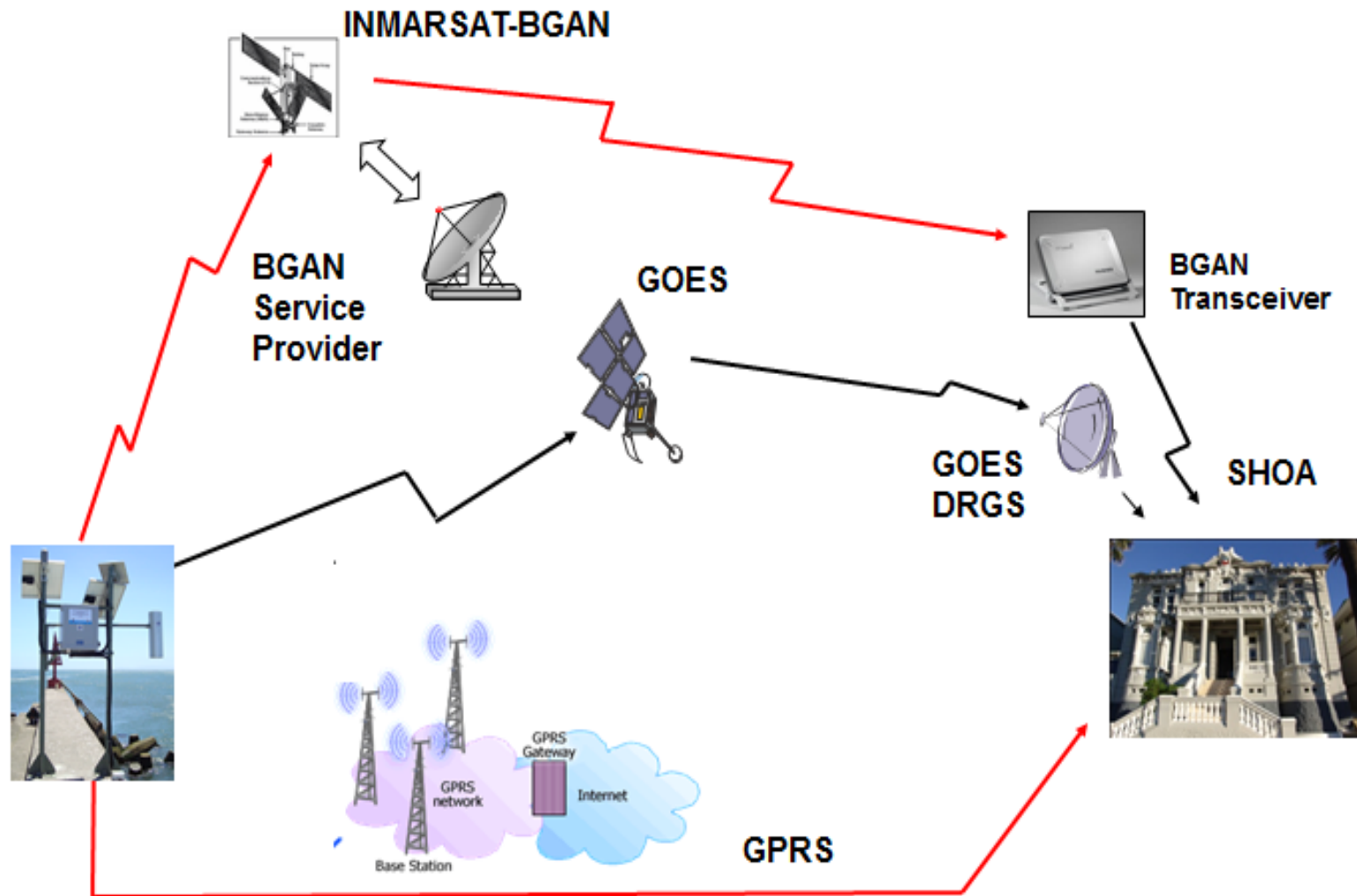


# Data Transmission



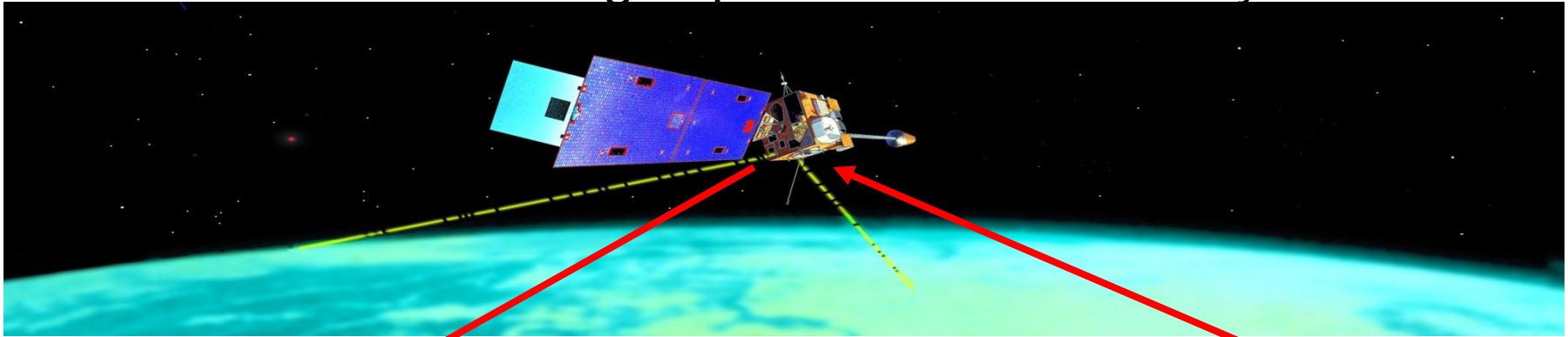


# SHOA Operational Data Acquisition



# Direct Readout Ground Station (DGRS)

Provides ability to directly receive data from GOES satellites without being dependent on secondary links



Receiver/Demodulator  
4 Channel HDR:

- Supports 100 / 300 / 1200 BAUD Transmissions Simultaneously
- Supports auto BAUD detection as recently approved by NESDIS



# BGAN transceiver

- T&T300 requires data input using Ethernet protocol and a Digi® PortServer TS HMEI converter Ethernet/RS232 (solved previous troubles using Lantronics® DXE421) to transform the data supplied by the DCP.
- A Vaisala iBoot module was installed in support of automating BGAN transceiver reset.
  - Periodically, the rooftop BGAN transceiver has lost satellite lock and has required a reboot to regain operation.
  - The iBoot along with a Metman script will support recognition of this condition and automatic reboot of the transceiver.



# Telemetry Protocols

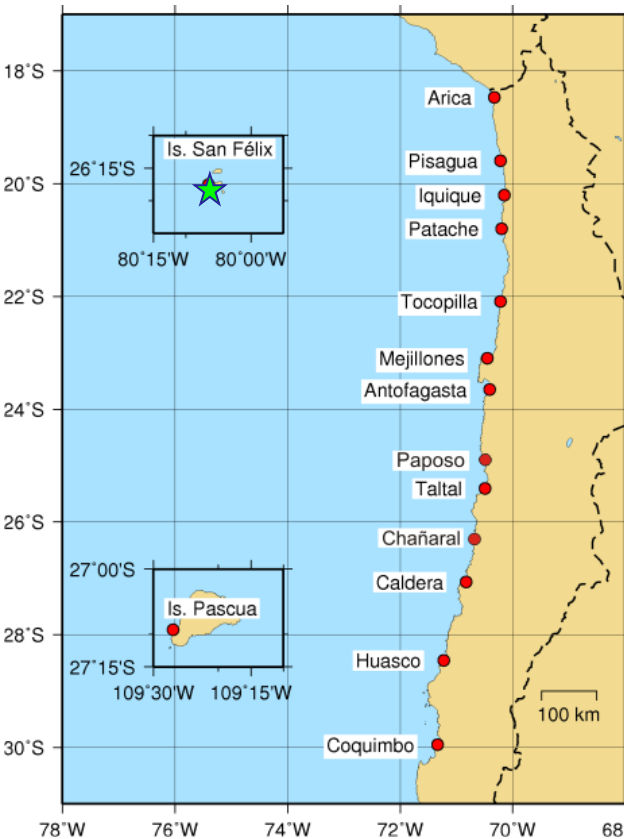
- Sea level stations with dual telemetry capabilities
  - Primary : GOES or BGAN/Inmarsat Satellite
  - Secondary : GPRS
- Available Combinations
  - GOES – BGAN: 03 Stations



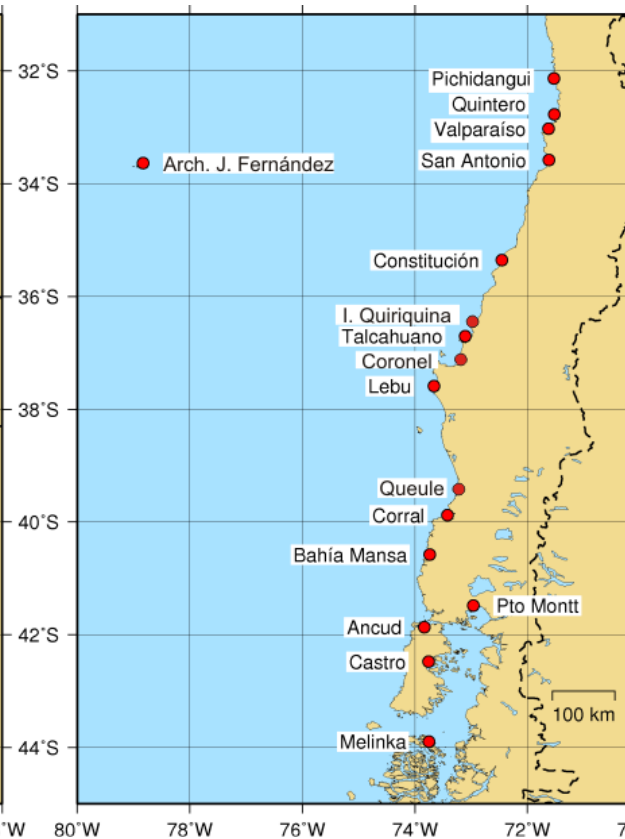
# Telemetry Protocols



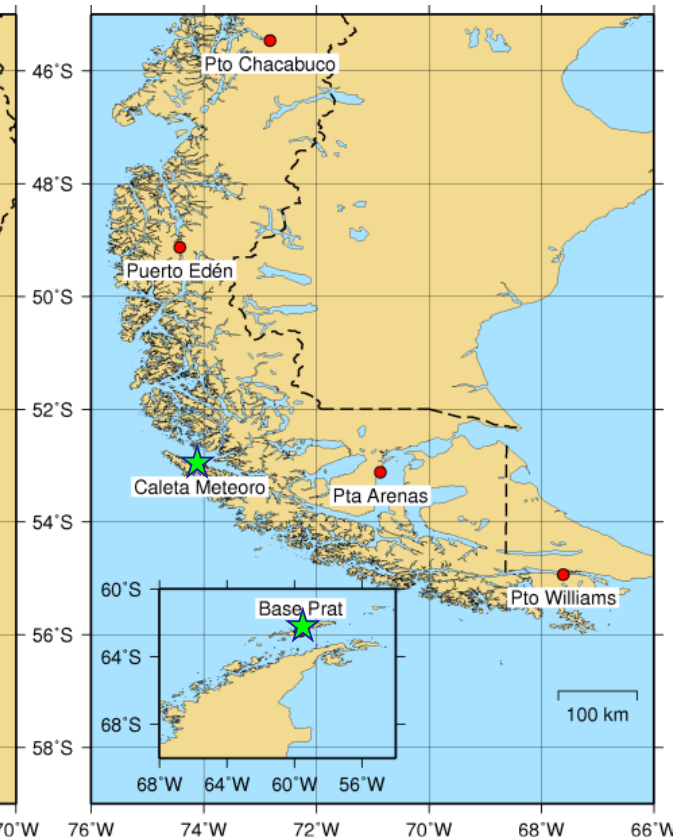
*GOES - BGAN*



*GOES - GPRS*



*BGAN - GPRS*





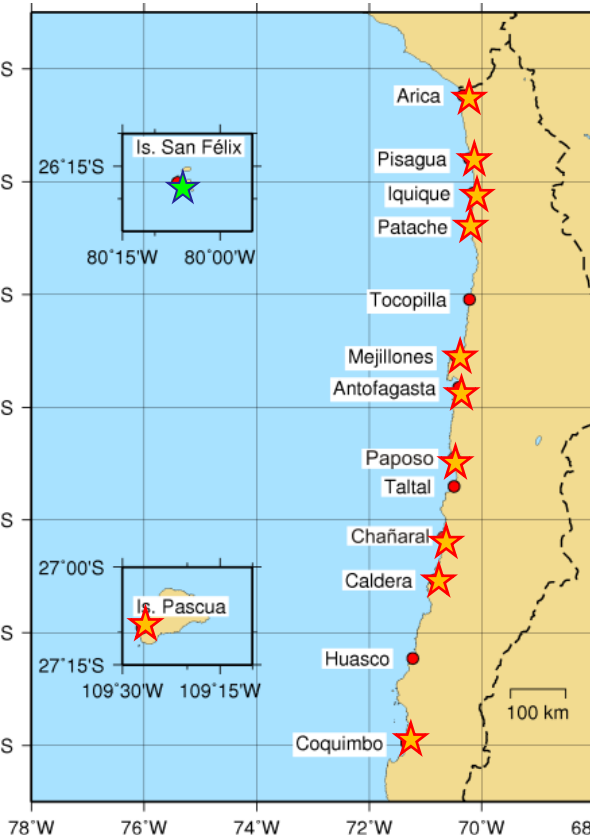
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- Available Combinations
  - GOES – BGAN: 03 Stations
  - GOES – GPRS: 32 Stations



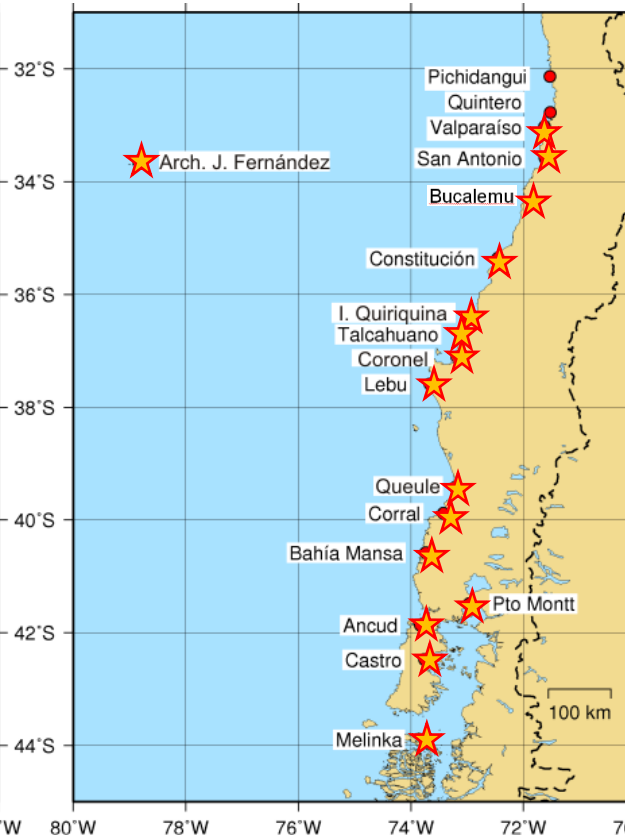
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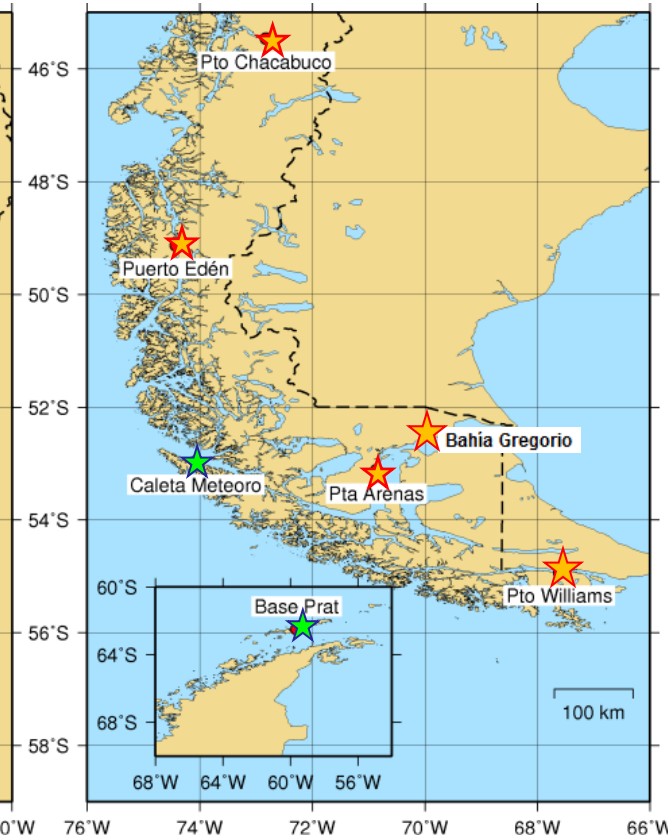
*GOES - BGAN*



*GOES - GPRS*



*BGAN - GPRS*



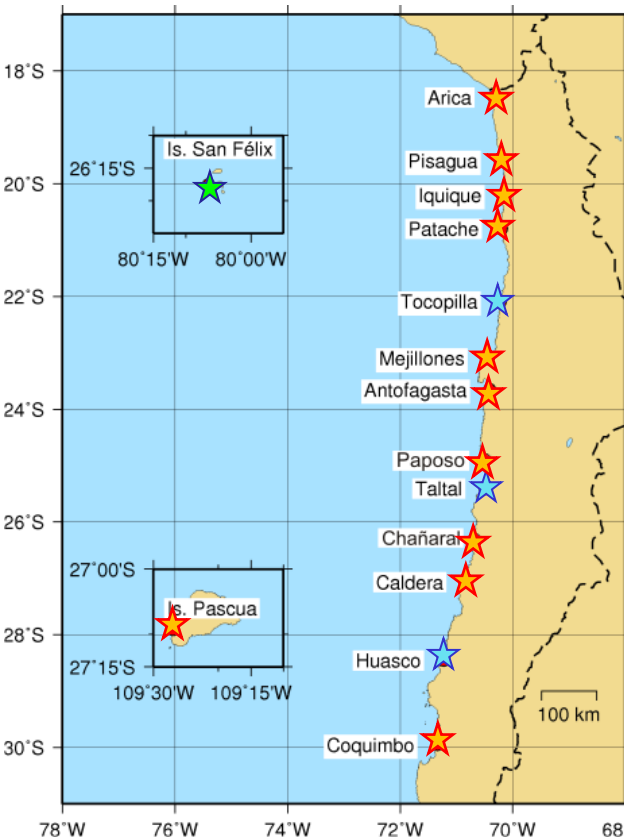
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  - GOES – GPRS: 32 Stations
  - BGAN – GPRS 05 Stations



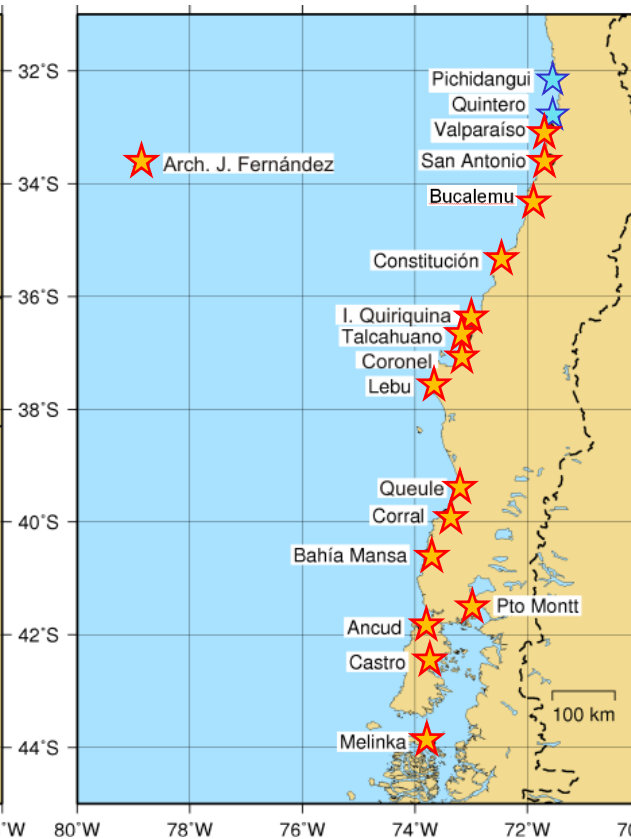
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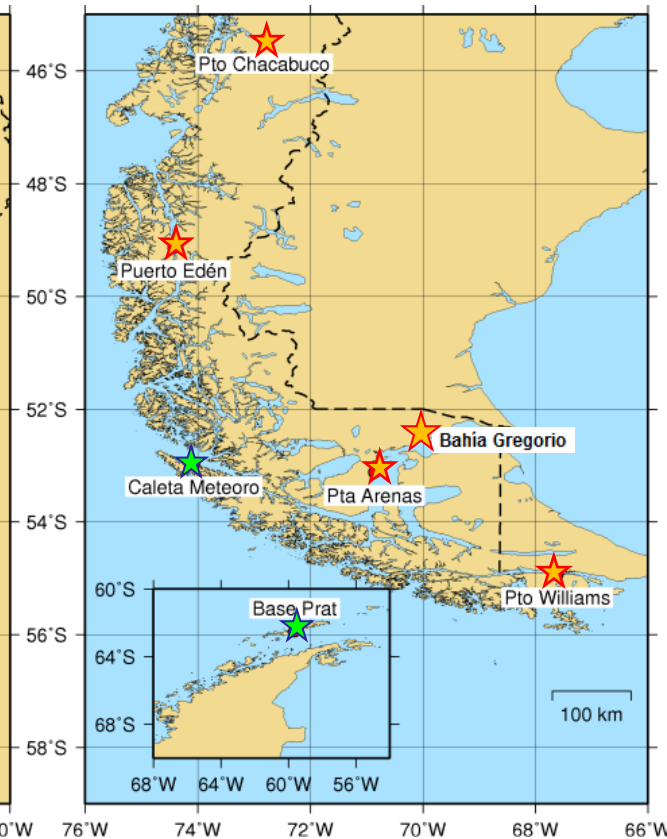
*GOES - BGAN*



*GOES - GPRS*



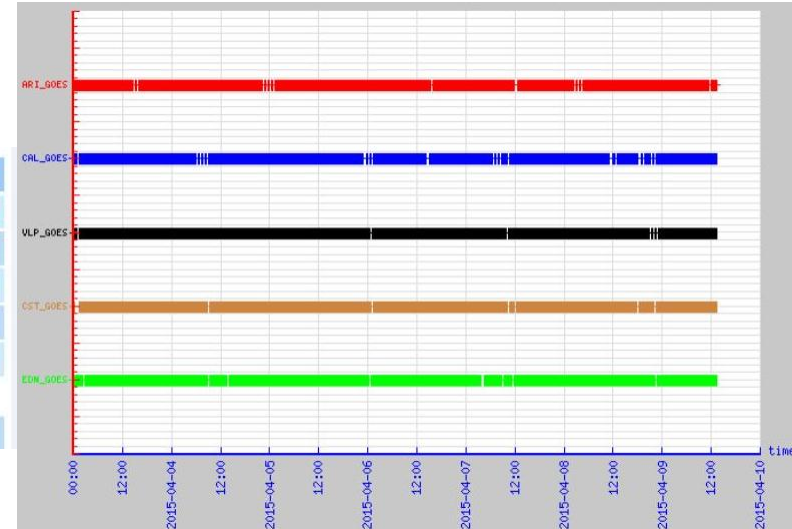
*BGAN - GPRS*



# Current GOES and BGAN Status

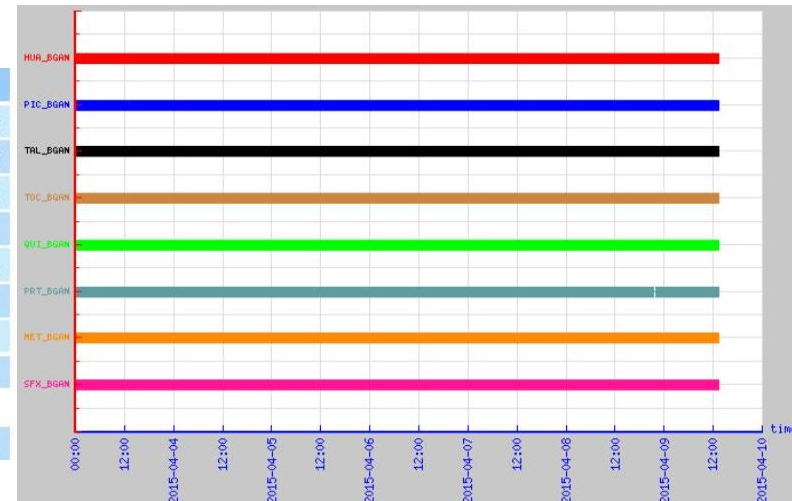
## GOES

Station	2015-04-03		2015-04-04		2015-04-05		2015-04-06		2015-04-07		2015-04-08		2015-04-09 !
ARI_GOES	1319	92 %	1367	95 %	1387	96 %	1279	89 %	1350	94 %	1269	88 %	707 87 %
CAL_GOES	1384	96 %	1286	89 %	1365	95 %	1274	88 %	1186	82 %	1220	85 %	753 93 %
VLP_GOES	1354	94 %	1335	93 %	1408	98 %	1364	95 %	1345	93 %	1349	94 %	770 95 %
CST_GOES	1384	96 %	1390	97 %	1429	99 %	1299	90 %	1335	93 %	1294	90 %	771 95 %
EDN_GOES	1334	93 %	1260	88 %	1394	97 %	1304	91 %	1230	85 %	1214	84 %	744 92 %
<b>Sum/Average</b>	6775	94 %	6638	92 %	6983	97 %	6520	91 %	6446	90 %	6346	88 %	3745 93 %



## BGAN

Station	2015-04-03		2015-04-04		2015-04-05		2015-04-06		2015-04-07		2015-04-08		2015-04-09 !
HUA_BGAN	1434	100 %	1440	100 %	1440	100 %	1440	100 %	1436	100 %	1435	100 %	796 100 %
PIC_BGAN	1433	100 %	1436	100 %	1440	100 %	1440	100 %	1440	100 %	1440	100 %	796 100 %
TAL_BGAN	1432	99 %	1440	100 %	1437	100 %	1440	100 %	1440	100 %	1440	100 %	796 100 %
TOC_BGAN	1432	99 %	1440	100 %	1440	100 %	1440	100 %	1440	100 %	1440	100 %	794 99 %
QUI_BGAN	1431	99 %	1440	100 %	1436	100 %	1440	100 %	1436	100 %	1437	100 %	796 100 %
PRT_BGAN	1433	100 %	1440	100 %	1440	100 %	1439	100 %	1440	100 %	1419	99 %	795 99 %
MET_BGAN	1433	100 %	1440	100 %	1440	100 %	1440	100 %	1439	100 %	1440	100 %	794 99 %
SFX_BGAN	1436	100 %	1435	100 %	1436	100 %	1436	100 %	1436	100 %	1437	100 %	790 99 %
<b>Sum/Average</b>	11464	100 %	11511	100 %	11509	100 %	11515	100 %	11507	100 %	11488	100 %	6357 99 %





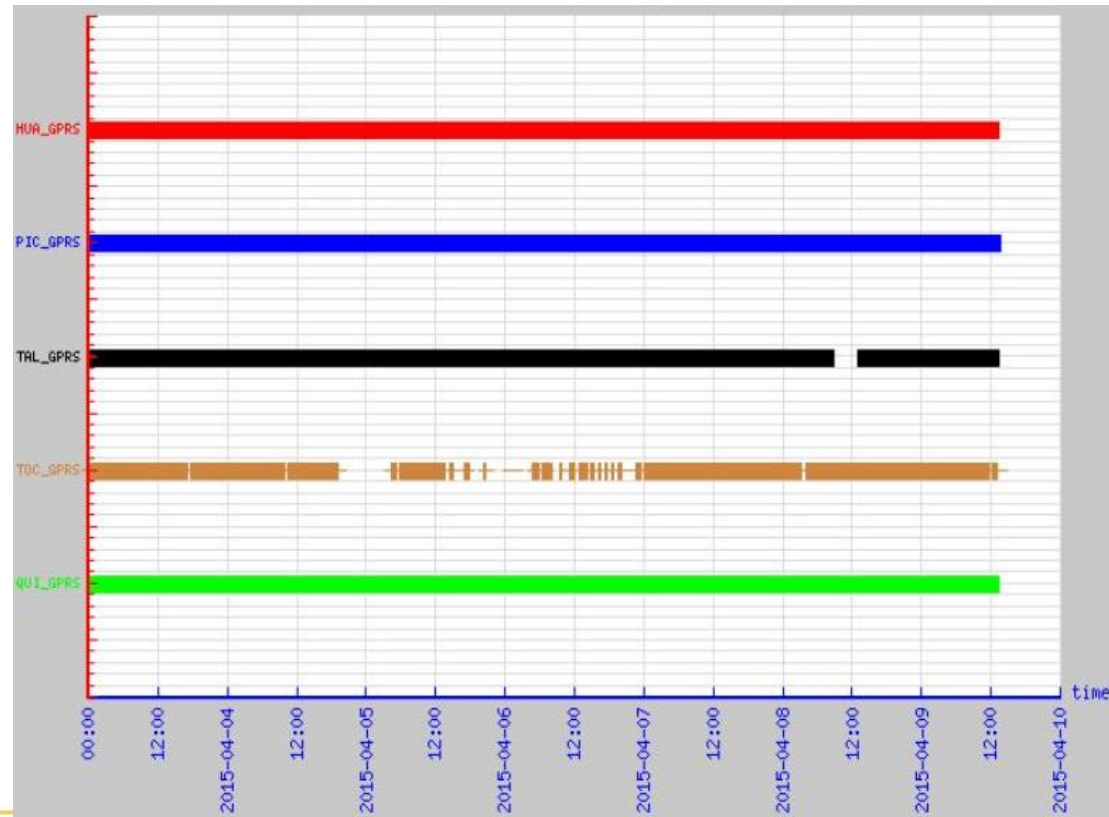
# Current GPRS Status

Station	2015-04-03		2015-04-04		2015-04-05		2015-04-06		2015-04-07		2015-04-08		2015-04-09 !	
HUA_GPRS	1440	100 %	1440	100 %	1440	100 %	1440	100 %	1440	100 %	1440	100 %	805	100 %
PIC_GPRS	1440	100 %	1440	100 %	1440	100 %	1440	100 %	1440	100 %	1440	100 %	806	100 %
TAL_GPRS	1440	100 %	1440	100 %	1440	100 %	1440	100 %	1440	100 %	1195	83 %	805	100 %
TOC_GPRS	1324	92 %	1046	73 %	545	38 %	437	30 %	1319	92 %	1284	89 %	738	92 %
QUI_GPRS	1440	100 %	1440	100 %	1440	100 %	1440	100 %	1440	100 %	1440	100 %	805	100 %

Sum/Average	7084	98 %	6806	95 %	6305	88 %	6197	86 %	7079	98 %	6799	94 %	3959	98 %
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Station

- Huasco
- Pichidanguí
- Taltal
- Tocopilla
- Quintero



# Daily Operative Report

N°	ESTACION	TRANSMISION			SENSOR MAREA		OPERATIVIDAD ESTACION
		GPRS	BGAN	GOES	PRS (mm)	VEGA (mm)	
1	ARICA	OPE		OPE	OPE	OPE	OPE
2	PISAGUA	OPE		OPE	OPE	OPE	OPE
3	IQUIQUE	OPE		OPE	OPE	OPE	OPE
4	PATACHE	OPE		OPE	OPE	OPE	OPE
5	TOCOPILLA	OPE	OPE		OPE	OPE	OPE
6	BAHÍA MEJILLONES	OPE		OPE	OPE	OPE	OPE
7	ANTOFAGASTA	OPE		OPE	OPE	OPE	OPE
8	PAPOSO	OPE		OPE	OPE	OPE	OPE
9	TALTAL	OPE	OPE		OPE	OPE	OPE
10	CHAÑARAL	OPE		OPE	OPE	OPE	OPE
11	CALDERA	OPE		OPE	OPE	OPE	OPE
12	HUASCO	OPE	OPE		OPE	OPE	OPE
13	COQUIMBO	OPE		OPE	OPE	OPE	OPE
14	PICHIDANGUI	OPE	OPE		OPE	OPE	OPE
15	QUINTERO	OPE	OPE		OPE	OPE	OPE
16	VALPARAISO	OPE		OPE	OPE	OPE	OPE
17	SAN ANTONIO	OPE		OPE	OPE	OPE	OPE
18	BUCALEMU	OPE		OPE	OPE <sup>3</sup>		OPE
19	CONSTITUCION	OPE		OPE	OPE	OPE	OPE
20	ISLA QUIRIQUINA	OPE		OPE	OPE	OPE	OPE
21	TALCAHUANO	OPE		OPE	OPE	OPE	OPE
22	CORONEL	OPE		OPE	OPE	OPE	OPE
23	LEBU	OPE		OPE	OPE	OPE	OPE
24	QUEULE	OPE		OPE	OPE	OPE	OPE
25	CORRAL	OPE		OPE	OPE	OPE	OPE
26	BAHÍA MANSA	OPE		OPE	OPE	OPE	OPE
27	PUERTO MONTT	OPE		OPE	OPE	OPE	OPE
28	ANCUD	OPE		OPE	OPE	OPE	OPE
29	CASTRO	NO OPE		NO OPE	OPE	OPE	NO OPE
30	MELINKA	OPE		OPE	OPE	OPE	OPE
31	PUERTO CHACABUCO	OPE		OPE	OPE	OPE	OPE
32	PUERTO EDEN	OPE		OPE	OPE	OPE	OPE
33	CALETA METEORO		OPE	OPE	OPE <sup>3</sup>		OPE
34	PUNTA ARENAS	OPE		OPE	OPE	OPE	OPE
35	BAHIA GREGORIO	OPE		OPE	OPE	OPE	OPE
36	PUERTO WILLIAMS	OPE		OPE	OPE	OPE	OPE
37	ANTARTICA (BASE PRAT)		OPE	OPE	OPE <sup>3</sup>		OPE
38	SAN FELIX		OPE	OPE	OPE	OPE	OPE
39	JUAN FERNANDEZ	OPE		OPE	OPE	OPE	OPE
40	ISLA DE PASCUA	OPE		OPE	OPE	OPE	OPE

# Tides at SHOA website



# Links to access Tide Table Predictions

[http://www.shoa.cl/mareas/tablademarea\\_ing.html](http://www.shoa.cl/mareas/tablademarea_ing.html)



CHILEAN NAVY HYDROGRAPHIC AND OCEANOGRAPHIC SERVICE

**Tides**

PRODUCTS ORGANIZATION INFORMATION FREE DOWNLOADS

SHOA ACTIVITIES

INFORMATIVOS

NAVAL ATTACHÉS OF OFFICER STUDENTS TAKING THEIR SPECIALTY COURSE VISIT THE HYDROGRAPHIC AND OCEANOGRAPHIC SERVICE OF THE NAVY (SHOA)

more activities

Info / bulletins

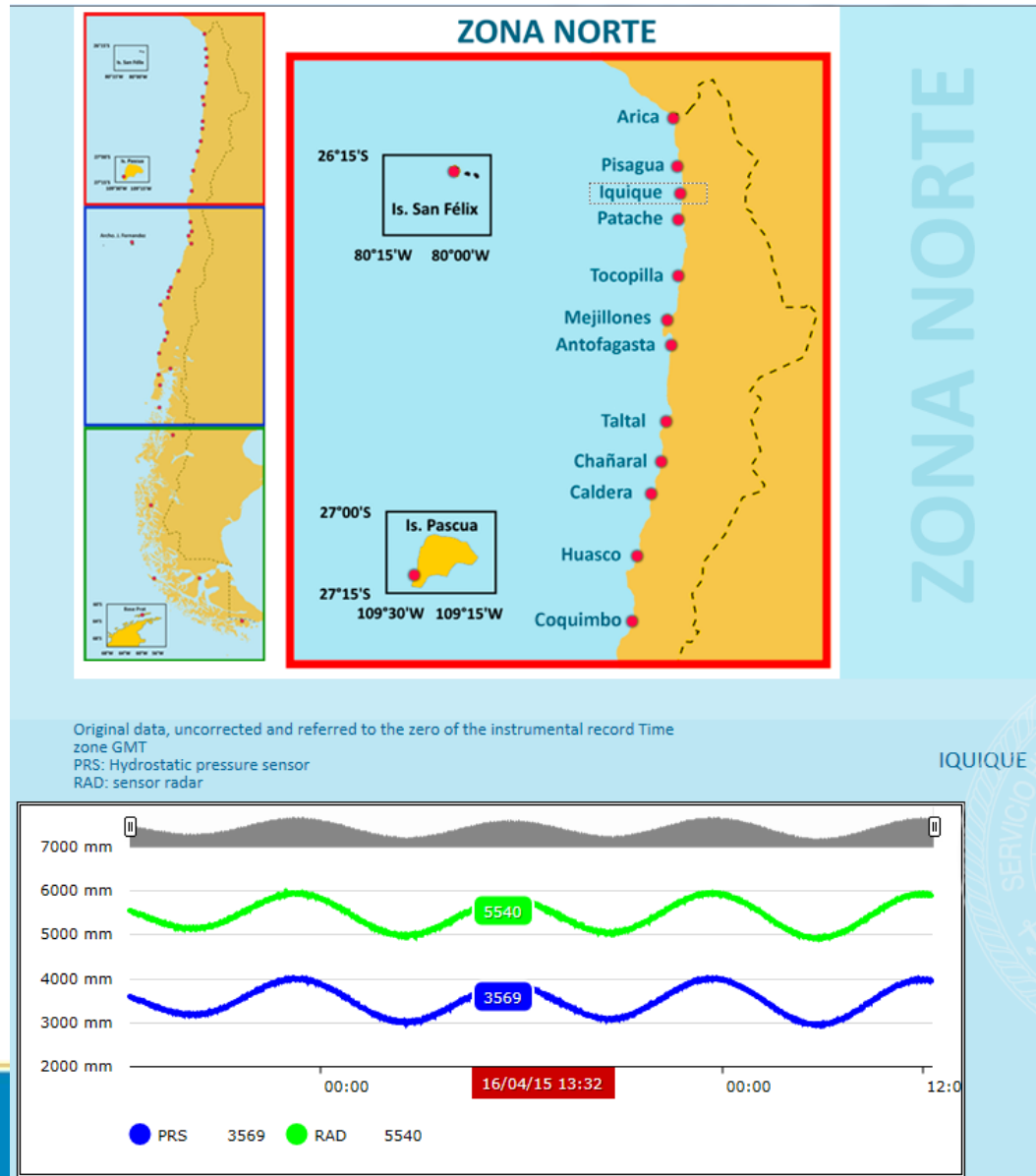
OIRS consultas técnicas

ISO 9001 Quality Certification since 2008 for production processes of nautical charts and Publications.

Errázuriz Echaurren 254 Playa Ancha - Valparaíso - Chile - Teléfono (32) 2266666 - Fax (32) 2266542

# Links to access data in real time

[http://www.shoa.cl/mareas/mapa\\_ing.php](http://www.shoa.cl/mareas/mapa_ing.php)

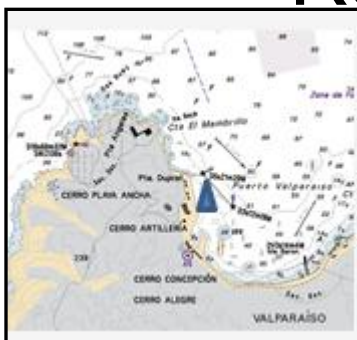




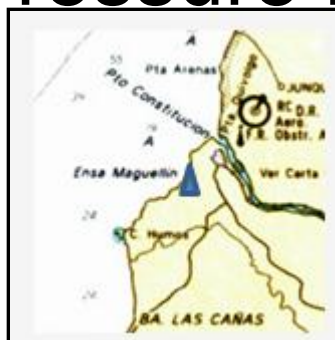
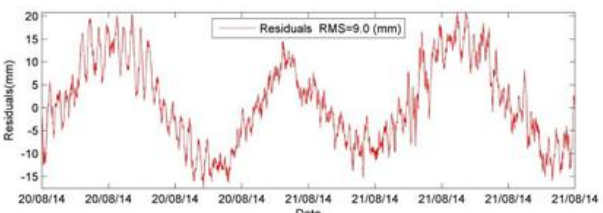
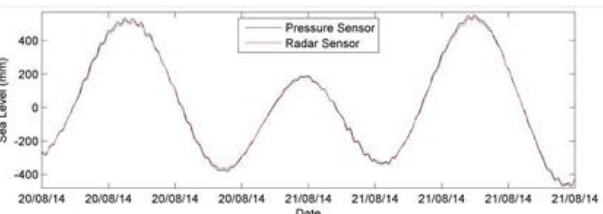
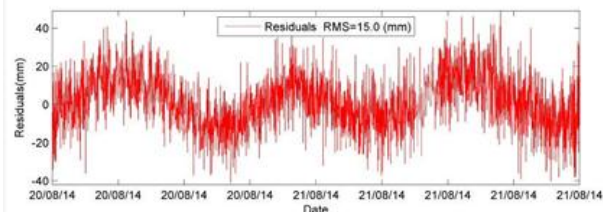
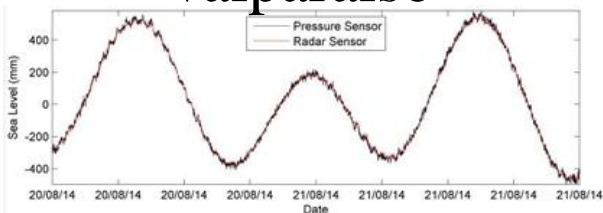
# Radar - Pressure Sensor comparison



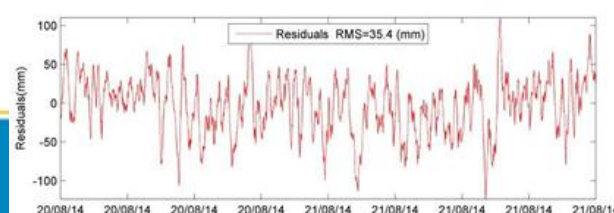
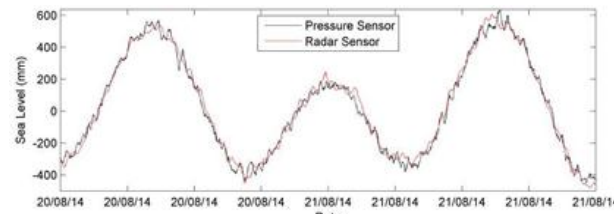
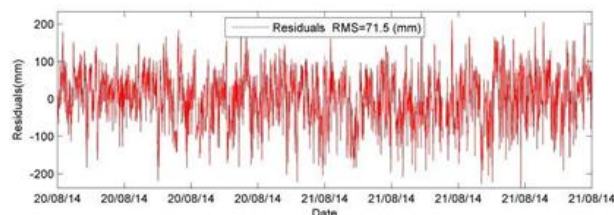
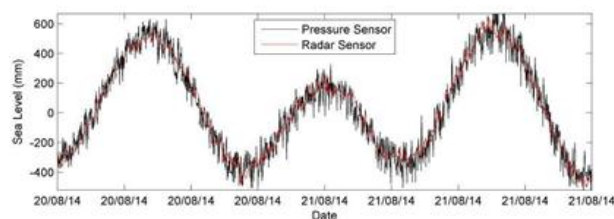
# Radar – Pressure Residuals



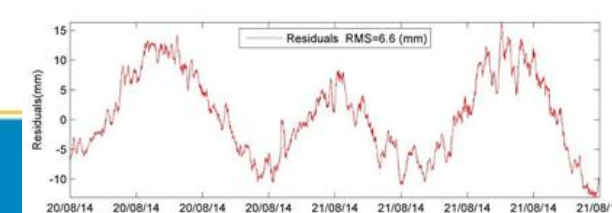
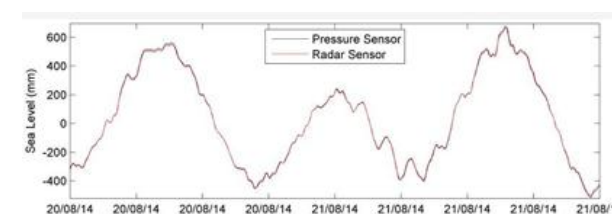
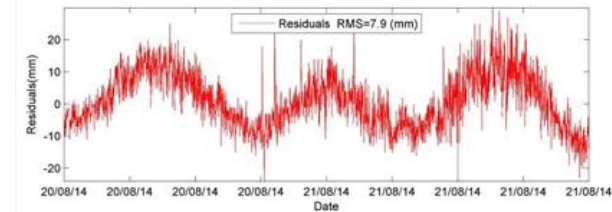
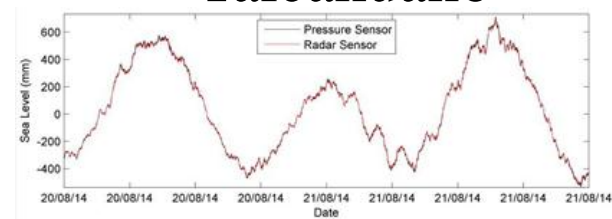
Valparaíso



Constitución



Talcahuano



# Conclusions

- Alternative systems for real time data transmission using several telemetry options (GOES, BGAN, GPRS) has given powerful support to the National Tsunami Alarm System operation.
- VEGA radar sensor has demonstrate high reliability in several sea conditions (Moderate and small wave heights) as a redundant sea level sensor (potencially primary sensor).
- Upgrade and densification of stations have improved the sea level data collecting network for operational and scientific purposes.



# THANKS



# Bgan Data Flow

