National Report to the Eighteenth Session of the Group of Experts for the Global Sea Level Observing System (GLOSS)

Current status of the Argentinian Sea Level Network

The tide gauge network in Argentina is managed by the Naval Hydrographic Service (SHN) and includes the four tide gauges that are part of the GLOSS network: Mar del Plata, Puerto Madryn, Puerto Deseado and Ushuaia. It also comprises tide gauges in San Fernando, Buenos Aires, La Plata, Atalaya, Santa Teresita, Mar del Plata, and Puerto Belgrano (Figure 1). Besides these stations, the SHN processes water level observations from tide gauges installed and maintained by other national or binational organizations, such as the Comisión Administradora del Río de la Plata (CARP) and the Administración General de Puertos (AGP), as well as private ports like Puerto Quequén, Puerto Bahía Blanca, and Puerto Punta Loyola (Figure 1).

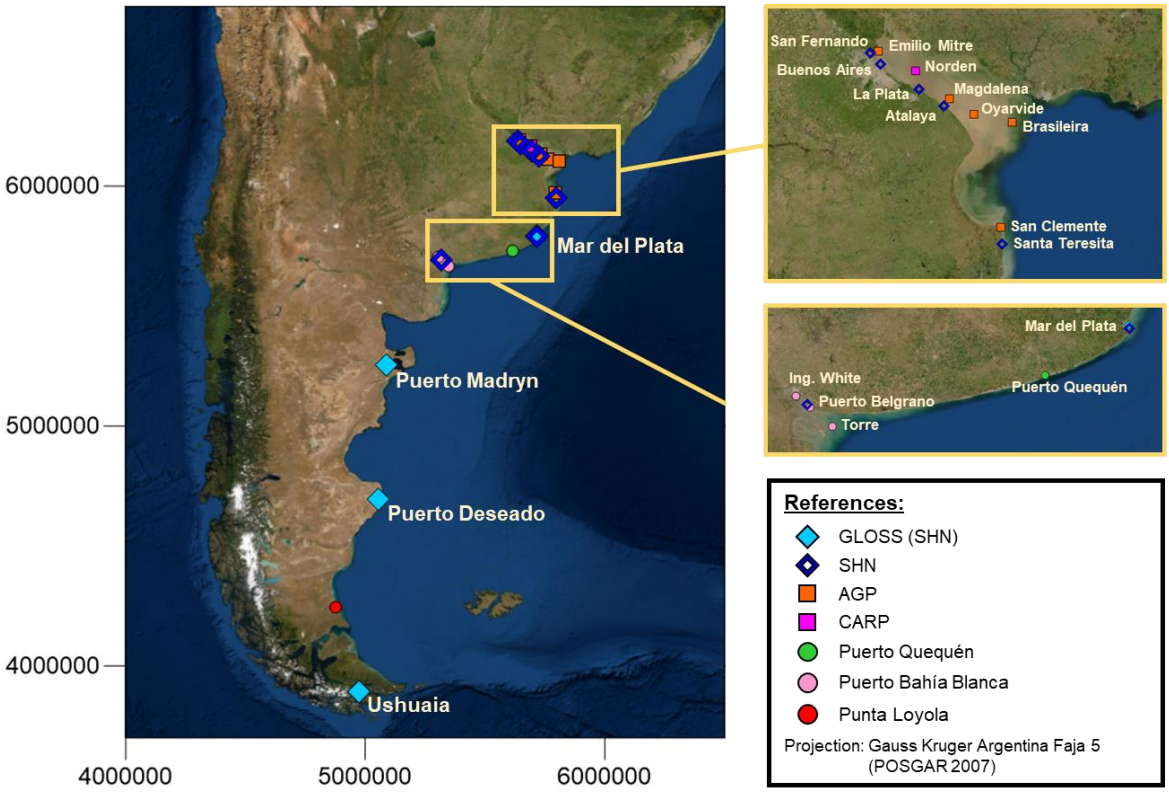


Figure 1. Location of tide gauges.

These tide gauges are also used to identify, in real time, phenomena that may pose a threat to nautical safety, such as extreme storm surges events, which frequently occur in the Río de la Plata. Observations from SHN tide gauges, as well as those from other agencies, are available on their respective websites.

The Argentinian GLOSS tide gauges are jointly maintained with the University of Hawaii Sea Level Center, and their observations can be accessed in near real time through the IOC Sea Level Station Monitoring Facility website. Table 1 provides the coordinates, ID numbers and sensors types of these GLOSS stations.

Station	Coordinates	PSMSL ID	GLOSS ID	UHSLC ID	Sensor (sampling rate)		
					1	2	3
Mar del Plata	38°.00015278 S 57°.53850556 W	819	192	729	R (1)	R (3)	F (5)
Puerto Madryn	42°.76265 S 65°.03068611 W	2305	191	731	P (1)	R (3)	R (3)
Puerto Deseado	47°.75357778 S 65°.91469444 W	185	190	286	P (1)	R (3)	F (5)
Ushuaia	54°.817 S 68°.217 W	1850	181	600	R (1)	R (5)	-

Table 1. Characteristics of the Argentinian GLOSS Stations. Type of gauges: R: Radar, P: Pressure, F: Floater.

Since November 2022, the stations at Mar del Plata, Puerto Madryn, and Puerto Deseado have recorded observations with a data availability rate higher than 95% for at least one of the installed sensors.

The radar sensor (rad) at Mar del Plata exhibited erratic behavior and was removed from publication in May 2024. The float sensor (enc) showed variations in the measurement reference and later began displaying frequent spikes and prolonged periods of constant values. The radar sensor (ra2), although it presents some spikes and outliers, has recorded data for more than 97% of the time.

At Puerto Deseado, no data is available from the float sensor (enc), but the two additional sensors have recorded more than 99% of the observations. These sensors, along with the three sensors at Puerto Madryn, have provided continuous observations with few gaps and minimal outliers or spikes.

The sensors at Ushuaia have experienced frequent outages since mid-2024, likely due to a battery issue, as low voltage readings were recorded before each interruption. An inspection of the station was carried out earlier this year, revealing infrastructure problems (Figure 2),

which has led to an evaluation of the station's possible relocation. The SHN is currently in contact with personnel from the University of Hawaii Sea Level Center regarding the replacement of equipment at Mar del Plata and Ushuaia, as well as the selection of a potential new location.

At the beginning of 2025, water level measurements were conducted at the naval dock in Ushuaia for sounding reduction purposes. The recorded heights were compared with the available observations from the GLOSS station, showing good agreement between both datasets (standard deviation of the differences < 0.013m), making this a potential site for the station's relocation (Figure 3).

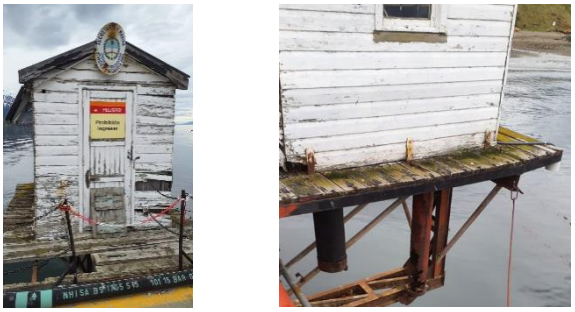


Figure 2. Condition of the Tide Gauge House in Ushuaia.

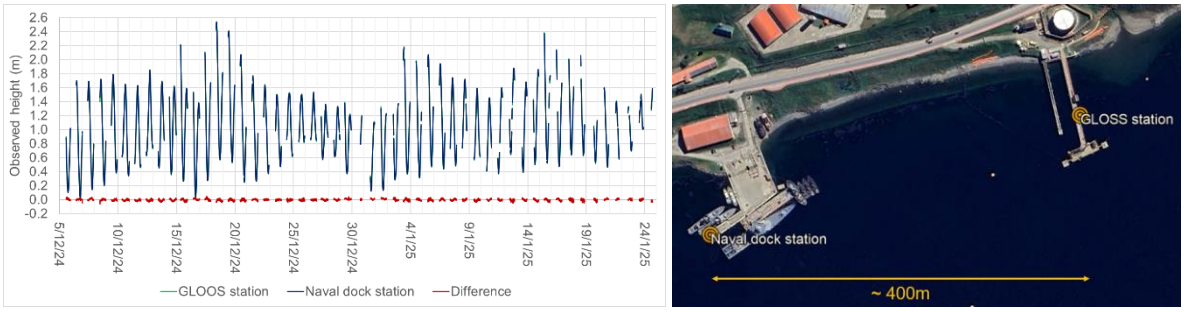
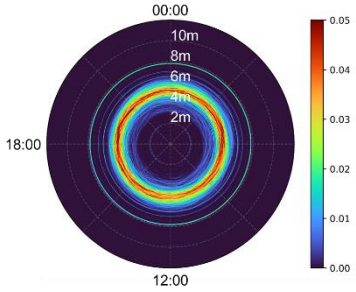


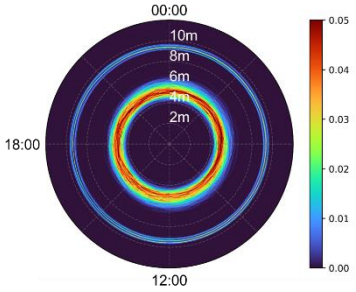
Figure 3. Comparison of Observed Water Levels in Ushuaia Between GLOSS Sensors and the Pressure Tide Gauge Located at the Naval Dock.

Figure 4 shows the observed water levels from each sensor along with the astronomical tide prediction, referenced to the Chart Datum, for the period from December 2024 to January 2025. Figure 5 displays the heat maps of the observed heights for each station and sensor for the period from November 2022 to January 2025, calculated from a bidimensional histogram defined radially by the observed height and angularly by the time and minute of observation (0° = 00:00; 180° = 12:00).

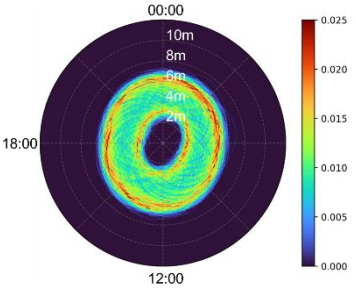
Figure 4. Observed water levels from each sensor along with the astronomical tide prediction, referenced to the Char Datum.



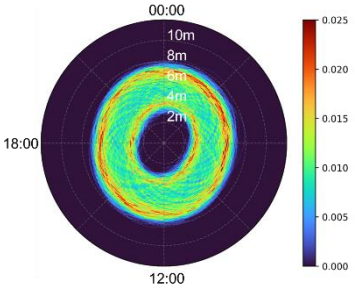
Mar del Plata (plat2) – enc



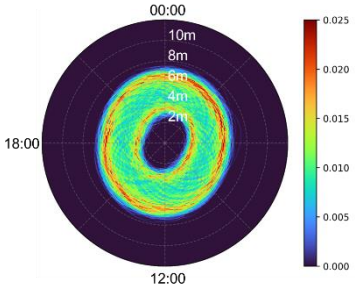
Mar del Plata (plat2) – ra2



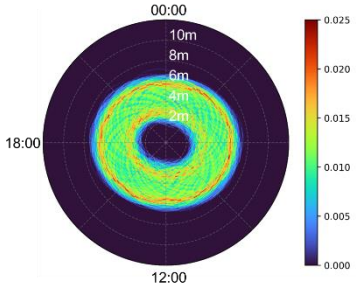
Puerto Madryn (madry) – prs



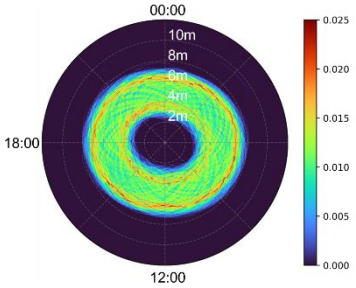
Puerto Madryn (madry) – rad



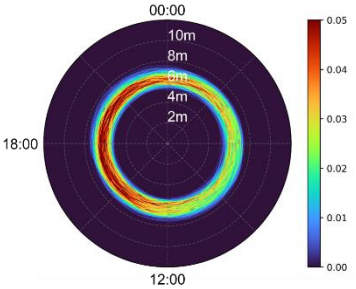
Puerto Madryn (madry) – ra2



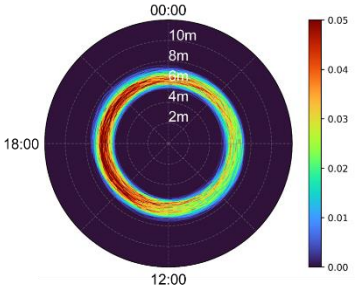
Puerto Deseado (dese) – prs



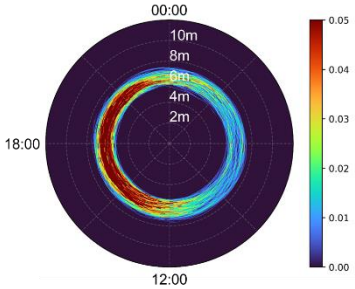
Puerto Deseado (dese) – rad



Ushuaia (ushu) – rad



Ushuaia (ushu) – ra2



Ushuaia – (ushu) rad (2024-2025)

Figure 5. Heat maps of the observed heights for each station and sensor.

Between Figures 4 and 5, it is noteworthy that the sensors at Puerto Madryn and Puerto Deseado show few spurious data, and despite the differences in the measurement reference of each sensor, the areas with the highest frequency of heights coincide at each station. The sensors at Mar del Plata frequently present observations outside the tidal amplitude range, corresponding to spikes or constant data observed by the sensor that do not correspond to actual water level observations. In the figure for Ushuaia, frequent outages are identified between 00:00 and 12:00, mainly for the period from January 2024 to January 2025.

Figure 6 shows the comparison of the relative monthly mean sea levels of the GLOSS station sensors after applying spike and outlier filtering processing. Ushuaia is not shown because of frequent missing data

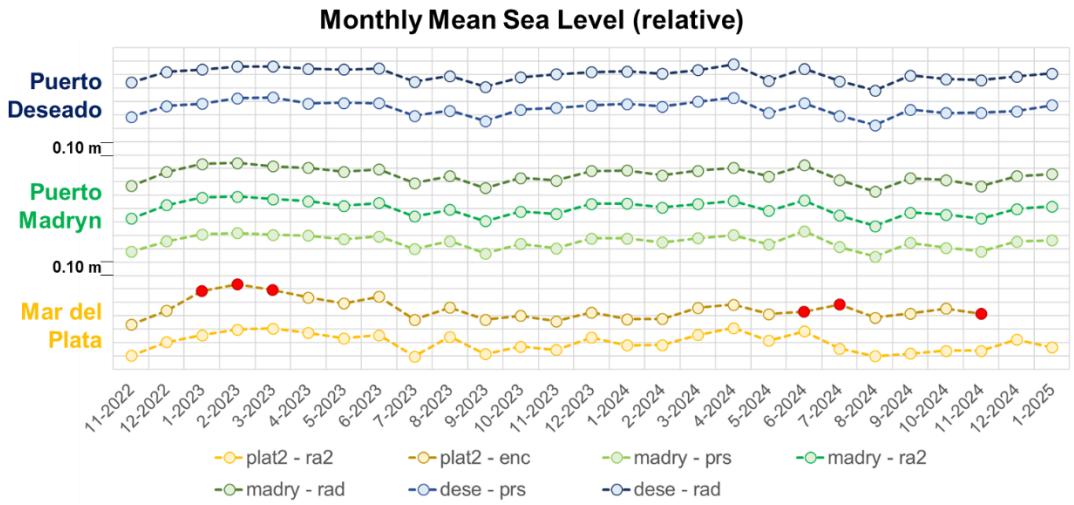


Figure 6. Relative monthly mean sea Level of GLOSS stations Mar del Plata, Puerto Madryn and Puerto Deseado. The red dots indicate possible changes in the measurement reference.

Observations from both the SHN's own tide gauges and external tide gauges are processed in delayed mode to obtain or update tidal harmonic constants, characterize phenomena such as meteotsunamis and storm surges, and to calculate and analyze mean sea level changes. The results of this processing are published in technical reports and research papers, and mean sea level data from GLOSS stations is submitted to the PSMSL.

In addition to the stations mentioned above, the SHN continues to work on upgrading and installing new sensors to measure water levels. Currently, the verification and calibration of 5 radar sensors and 5 pressure sensors are being carried out at the Buenos Aires tide gauge

station. These sensors will be used to provide coverage of the Atlantic coast or, if necessary, to replace the sensors at GLOSS stations experiencing failures. Possible locations for the new sensors are near the cities of San Antonio Este, Camarones, Comodoro Rivadavia, Punta Loyola, and Río Grande (Figure 7).

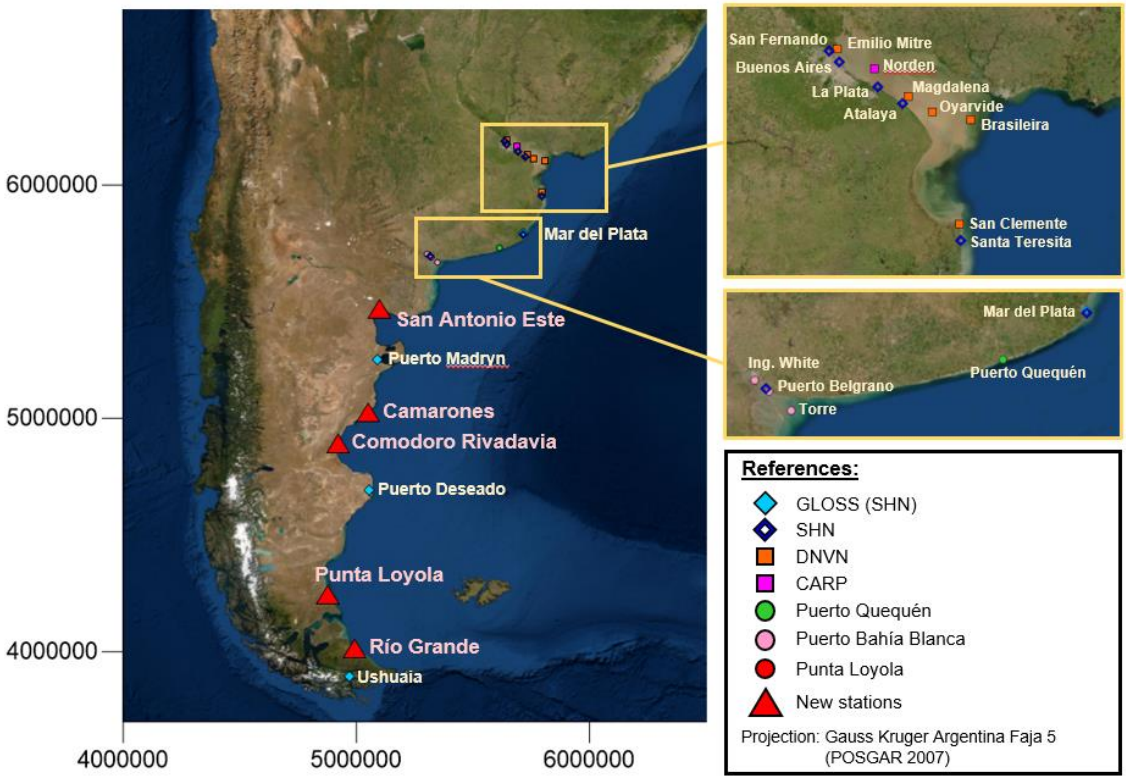


Figure 7. Locations of planned SHN stations.