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Sea-Level Observation in the Antarctic Region by the Republica Oriental del Uruguay
Ⅱ. Harmonic Analysis

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Abstract : A tide heights programme has been performed during the antarctic summers since December 1987 by SOHMA and IAU. Tidal observation periods and tidal statistics are presented. Harmonic analysis was applied for the first and second tidal series and the weighed average for each harmonic constant was obtained.

Key words : tides, harmonic analysis, Antarctica, Base "Artigas"

The Servicio de Oceanografia, Hidrografia y Meteorologia de la Armada (SOHMA) and the Instituto Antartico Uruguayo (IAU) has been performing a tide heights programme during the antarctic summers since December 1987. Observations are being carried out at the Scientific Antarctic Base "ARTIGAS" (BCAA) environs, 62° 11'.1 S, 58° 52'.1 W (Fig. 1). This programme also supports the bathimetric surveys for a nautical chart of the zone.

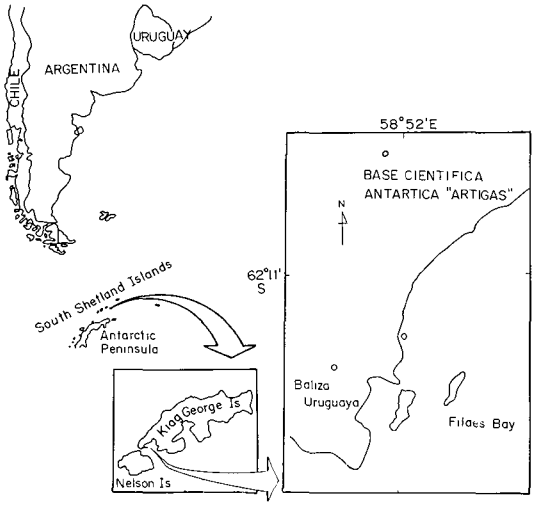

Fig. 1. Tide gauges location.

Table 1 shows the measuring periods. Conductivity and temperature series were also obtained from the Aanderaa WLR-7. The pressure gauge's solid state memory records were read with the VTERM communication utilitary. The algorithms proposed in the Aanderaa Manual were applied to calculate the elevations of the sea surface using the barometric pressure series obtained at the BCAA weather station and the equipment's temperature data. The tide pole corresponding to the first measuring period was refered to the SGM-4 Servicio Geografico Militar bench mark (Fig. 2). A first report of these data (Forbes, 1989), related tide heights to a plane 12.38 m below the SGM-4 (Fig. 3), obtaining a mean sea level of 6.5 cm for January 1988 using the X0-Filter (COI-UNESCO, 1985).

Table 1. Tidal Observation Periods(BCAA)

Instrument	Period	Interval
Tide pole	16/12/87 to 09/02/88	hourly
AANDERAA WLR-7	28/12/88 to 23/02/89	10 minutes
AANDERAA WLR-7	15/02/90 to 15/03/90	10 minutes

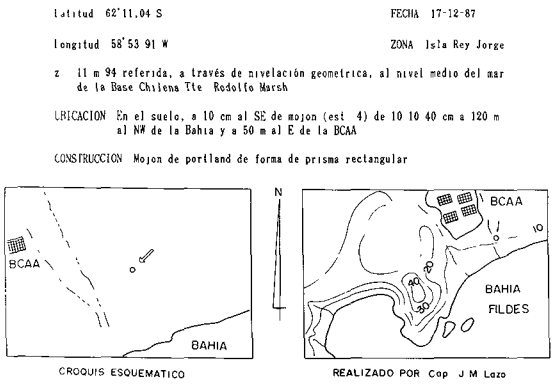

Fig. 2. Bench Mark location.

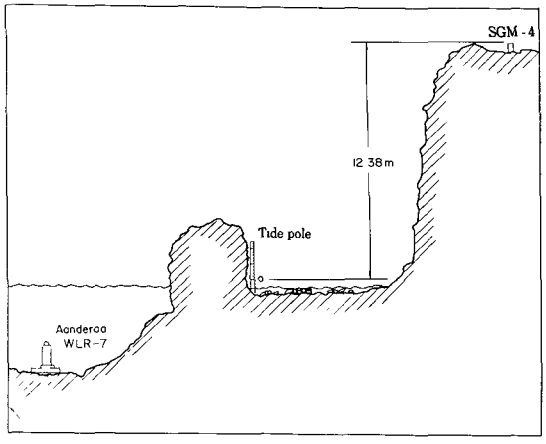

Fig. 3. Arrangement of equipments in the survey area

In order to calibrate the Aanderaa's zero, the tide gauges and the tide pole records were correlated. Although a 0.90 correlation coefficient (N = 52) was obtained, data dispersion is great (Fig. 4). Forbes (in press) adopted a same base level substracting the mean level of each observation period to the obtained series.

Table 2 reports the tidal statistics (Forbes, in press) and since differences between two low-tides for the same day can reach 150 cm, the values corresponding to the lowest low-tide are shown between brackets. The word "ordinary" belongs to the mean level of high/low tides, while "extraordinary" refers to the records above and below the ordinary. These statistics contribute to the knowledge of tide behaviour at BCAA approaches.

Harmonic analysis was applied for the first and second tidal series and the weighed average for each harmonic constant was obtained. Figure 5 shows the real and predicted tidal curve

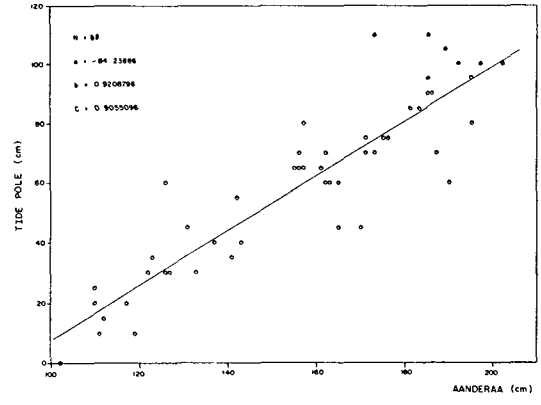

Fig. 4. Regresion and correlation between AANDERAA and tide pole

Table 2. Tidal Statistics(BCAA)

	87/88	88/89	90	Summary
Maximum height	101	90	96	101
Minimum height	−154	−138	−123	−154
Mean level	0	0	0	0
Ordinary high-tide	56	57	63	59
Ordinary low-tide	−51(−88)	−55(−89)	−64(−88)	−57(−88)
Ordinary tide amplitude	107(144)	113(146)	127(151)	116(147)
Extraordinary high-tide	68	70	77	72
Extraordinary low-tide	−90(−113)	−92(−114)	−91(−105)	−91(−111)
Extraordinary tide amplitude	158(181)	161(183)	167(181)	169(182)

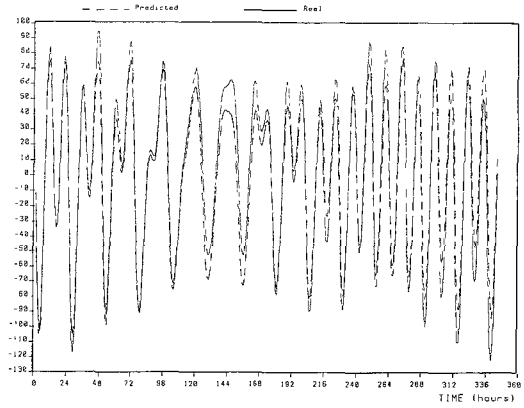

Fig. 5. Predicted and real tides heights - March 1990.

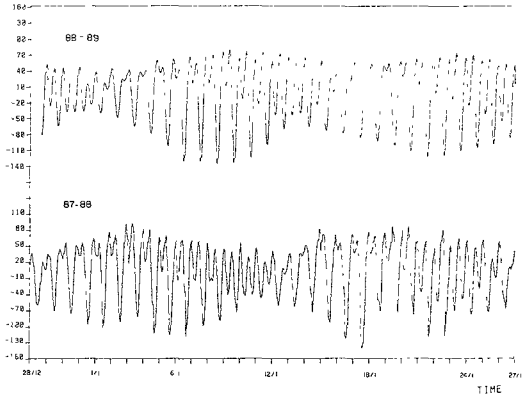

Fig. 6. Tide heights.

for the third stage. The relationship is highly significant ($r = 0.97$), but many times, when the high and low water occurs the predicted heights values are lowest (in absolute terms) than the real ones.

The relation between semiamplitudes of diurnal components (K1 and O1) and semidiurnal (M2 and S2) is $F = 0.84$. According to Defant (1961) and IHA (1981), this regime is mixed, mainly semidiurnal (Forbes, in press) (Fig. 6).

The SOHMA attempts to deploy and maintain at least one permanent station for measurements in order to contribute some programms (GLOSS, PEMSL, WOCE).

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