



SECOND INTERNATIONAL CONFERENCE ON
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LONG PERIOD OSCILLATIONS
AT GUFUNES, ICELAND

Thorbjörn Karlsson
Research Engineer

Science Institute
University of Iceland

Reykjavík
Iceland

INTRODUCTION

At Gufunes peninsula, just outside of Reykjavík, Iceland, a pier has been built to handle cargo to and from a fertilizer plant which is located on the peninsula (see Figure 1). The pier is located at the end of a small bay (Eiðsvík) formed by two islands, the Viðey and the Geldinganes, where the straits between the Viðey and the shore are very shallow and the Geldinganes actually becomes connected to land during low tide (as indicated by the name since nes means a peninsula). No protection against incoming waves is provided for the pier other than that offered by these two nearby islands.

The fertilizer plant pier has become notorious among sea captains due to the presence of heavy surge at the pier, especially during westerly winds. Ships berthed at the pier have frequently encountered considerable difficulties due to this surge and have had to be removed from the pier until the sea quiets down.

The harbour authorities in Reykjavík were interested in studying this surge problem, with possible expansion of the harbour into the Eiðsvík area in mind, and in 1971 a tidal gage was installed on the pier. This paper describes the measurement equipment and presents a discussion of the results obtained.

MEASURING EQUIPMENT

The tidal gage was made by Leupold and Stevens Instruments Inc., Portland, Oregon, Type A35B. The paper velocity was set at 18 inches /hour, with vertical scale set at 1:10. The float was in a square duct, 35 x 35 cm, with an adjustable hole in bottom, 1 1/4 inches in diameter when fully open. After some trials the hole was set at

half closed which provided an area ratio between hole and duct of 1 to 300. This ratio reduces a 50 cm high wind wave of 10 sec period to approximately 1.5 cm inside the duct, but lets through a 10 cm high wave of 200 sec period with only a reduction of 1 cm (see References 1 and 2). The long period waves will therefore show up very clearly on the record.

DISCUSSION OF RESULTS

Records were made at the Gufunes pier off and on during 1971-1972 but a bad storm resulting in heavy surge at the pier was long coming. Finally, on 21-22 October 1972 a rather bad storm was experienced, which gave records with very clear surge characteristics. The weather maps from 21-23 October are shown in Fig. 2 and Table I gives the wind speed and direction recorded at the Reykjavík Airport during those three days.

Samples of records obtained during this storm are shown in Fig. 3. The same figure shows also high tide times in Reykjavík on the same days. The records show heavy surge just before high tide in the afternoon of 21 October (record from 15:00) and again at high

Table I

Wind speed and wind direction recorded at Reykjavík airport on 21-23 October 1972. Directions from which wind blows are given in terms of degrees measured clockwise from north.

Date	21. Oct. 1972		22. Oct. 1972		23. Oct. 1972	
Time	Direction	Speed knots	Direction	Speed knots	Direction	Speed knots
03	24	20	25	20	33	25
06	23	23	23	11	32	17
09	23	28	20	10	11	03
12	25	42	20	12	18	07
15	25	28	23	07	18	06
18	25	32	27	23	09	06
21	26	29	29	24	09	09
24	24	22	31	22	08	13

tide the following morning (record from 06:00 on 22 Oct.). The surge is considerably reduced at low tide which occurred near midnight between 21 and 22 October although it is still present. This indicates that the surge is more pronounced during high tide than during

low tide, a fact which seems to be confirmed by sailors' experience in the area. The records from the latter part of 22 October until early on 23 October do not show much surge motion even though a rather strong wind was still blowing. The wind, however, had by that time shifted in direction from southwesterly or westerly wind to northwesterly wind. This is also in agreement with experience.

Spectral analysis was performed on the records from 12:40 to 16:40 on 21 October 1972, the period during which some of the heaviest surge was recorded. The results are presented in Fig. 4, showing very distinct peaks at periods of 300 and 200 seconds and a somewhat less pronounced peak at 120 seconds.

CONCLUSION

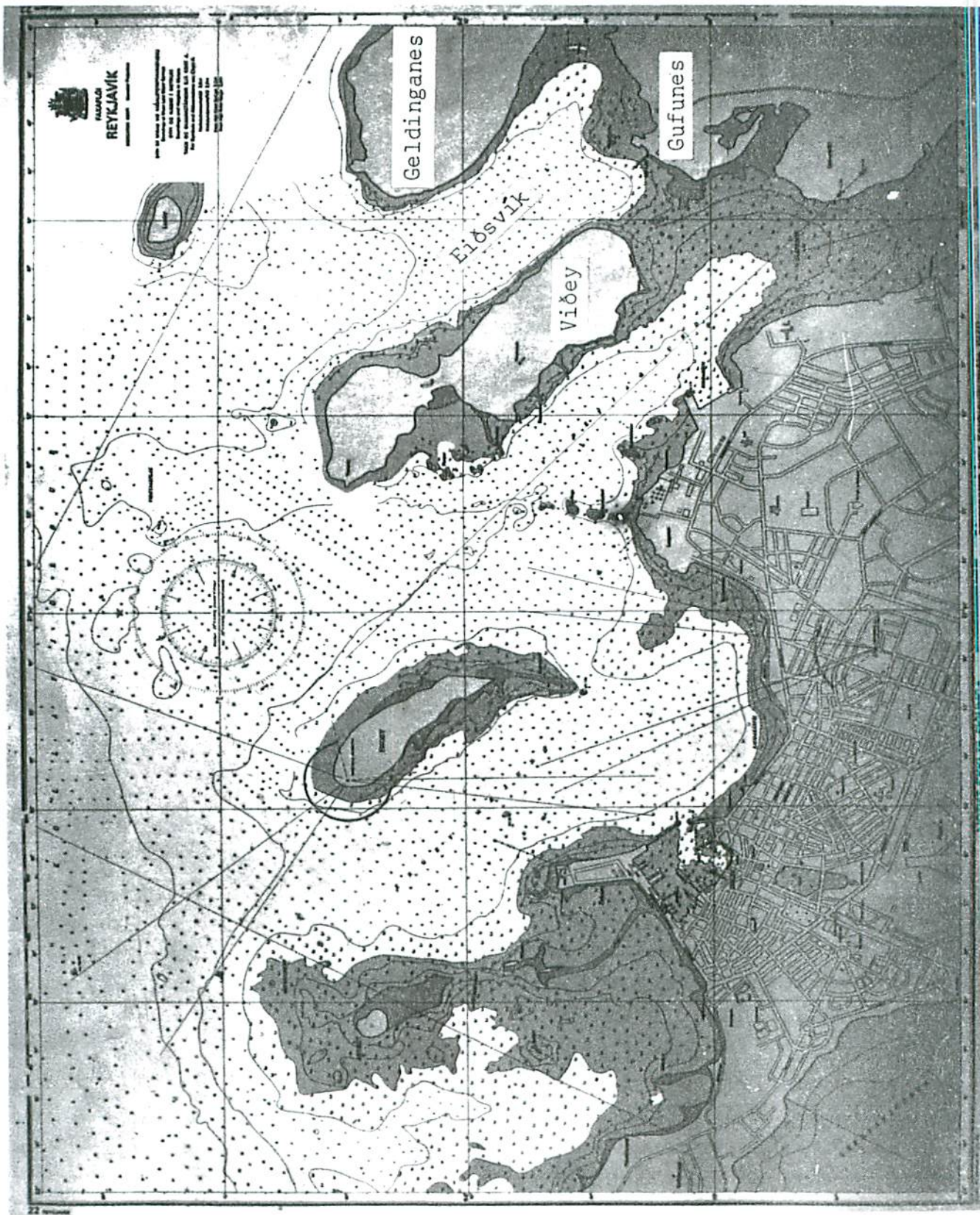
The results presented in this paper are all obtained during one storm and are therefore hardly conclusive as far as surge in the Eiðsvík area are concerned. The results, however, seem to agree well with actual experience in the following points:

1. The surge is a problem mainly during southwesterly to westerly winds.
2. The problem is more pronounced during high tide than during low tide.

No attempt will be made here to determine the origin or the nature of the motion in the Eiðsvík, but the dominant frequencies of 300, 200 and 120 seconds might suggest a coupling of longitudinal and transversal oscillations. A more detailed observational and analytical investigation is, however, needed before any firm conclusions can be drawn on this point.

REFERENCES

1. Cross Ralph H.: Tide gage frequency response. Journal of the Waterways and Harbor Division, Proceedings of the ASCE, Vol. 94, No. WW3, August 1968.
2. Jonsson, Ivar G., and H. Lundgren: Måling af seiching i Vestmannaeyjahöfn. Report no. 1 for Iceland State Harbour Authority. Coastal Engineering Laboratory, Technical University of Denmark. Copenhagen, July 1960.



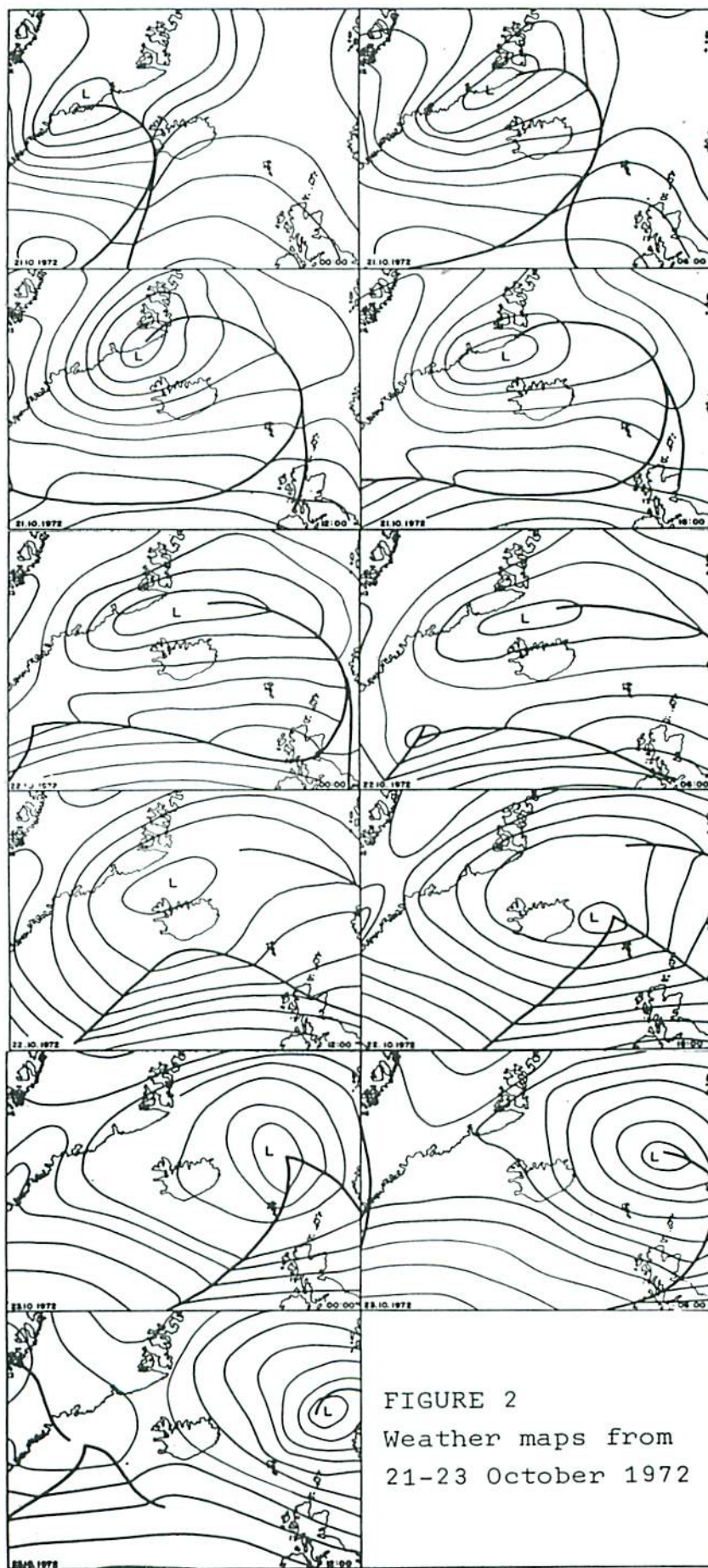


FIGURE 2
Weather maps from
21-23 October 1972

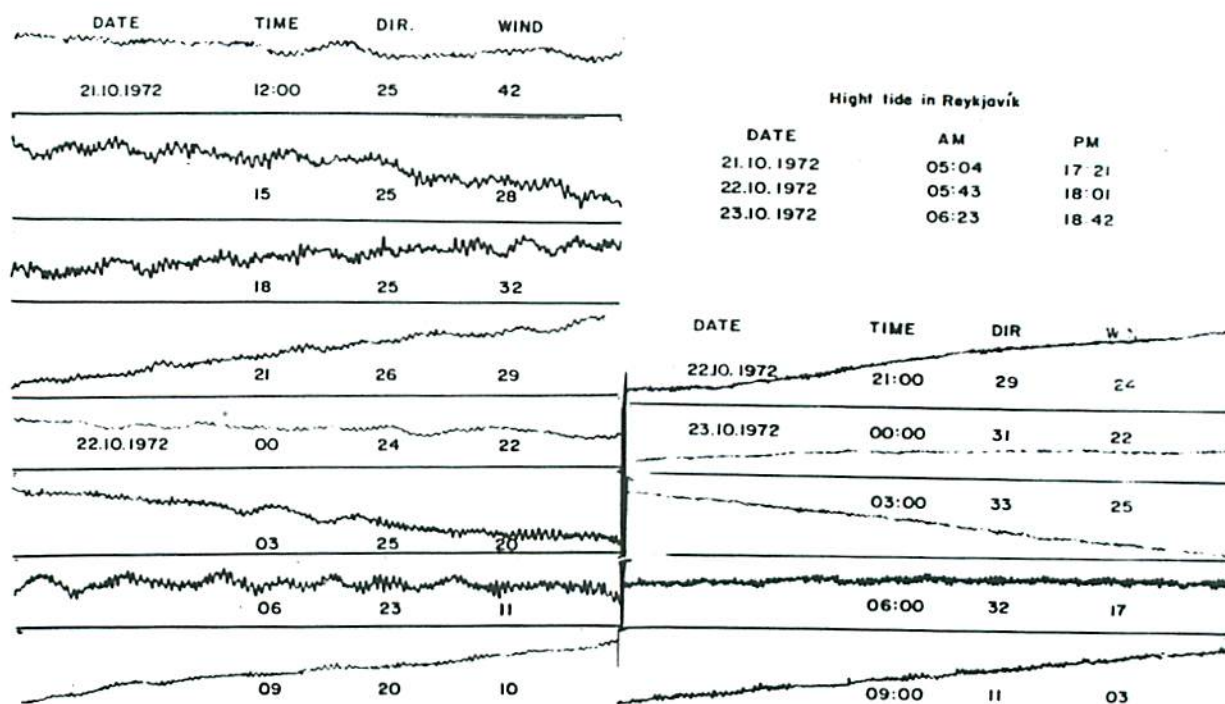


FIGURE 3. Samples of tidal gage records from Gufunes

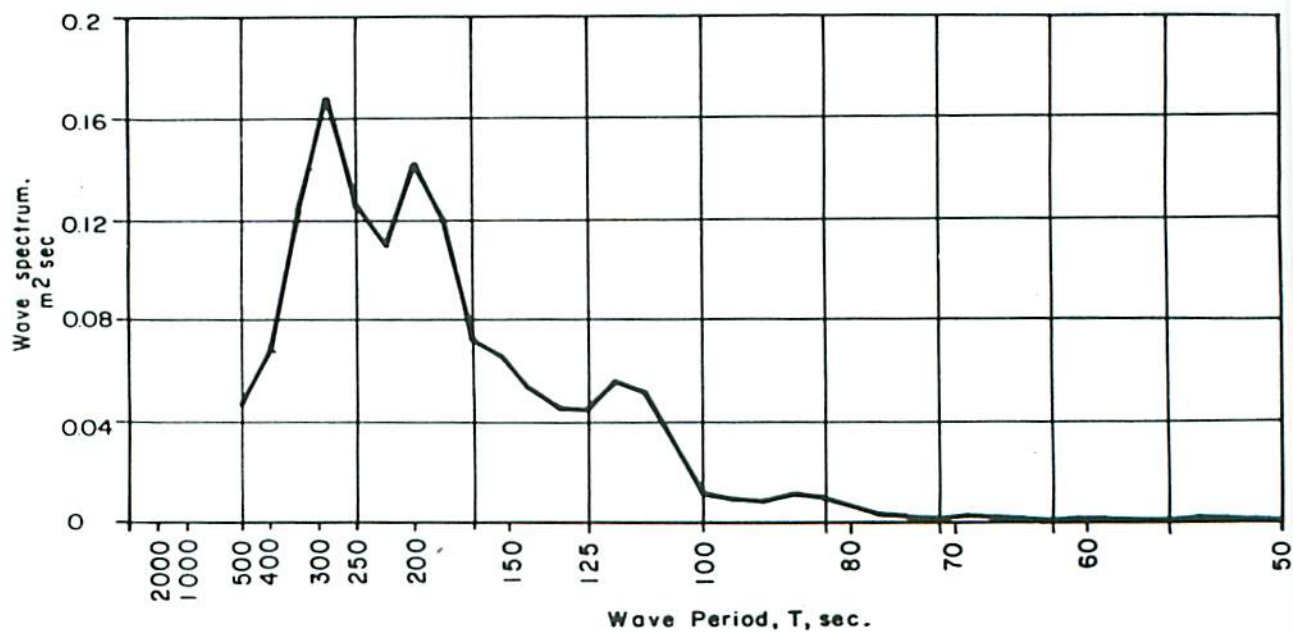


FIGURE 4. Energy spectrum for surge motion at Gufunes