

SVSD

THE NETHERLANDS

STORMSURGE WARNING SERVICE



The Organization of The Storm-surge Warning Service of The Netherlands

1. Introduction

The western part of The Netherlands, that forms part of the delta of the rivers Rhine, Meuse and Scheldt Lies, with the exception of the narrow ridges of dunes bounding the coast, below mean sea-level (MSL). This means that more than half of the population of The Netherlands lives and works up to 6 meters below this elevation. The part of the Netherlands with an elevation of less than 2 meters above MSL, which in the absence of dikes would submerge during a high tide is of about the same size as the part with an elevation of more than 2 meters above MSL. (see fig. 1).

To protect the land against inundation, hundreds of kilometers of dikes have been built in past centuries and some dike and barrier-building continues to this day. In 1986 the East-Scheldt-Barrier is put into use, and within a few years time there will be a barrier in the New Waterway to protect the Rhine Delta against very high Stormsurges. Unceasingly, the foundations of dikes are threatened by the scouring action of strong tidal currents and the stability of their crowns is endangered by water splashing over during severe stormsurges. Needless to say, that the coastal defence system is checked frequently to ensure its reliability. A separate Government organization has been given the task to perform this duty. The organization has a melodious and enlightening name in the dutch language, namely "Rijkswaterstaat" (in English it would be called something like 'Governmentwaterstate'), meaning water control and public worksdepartment. Besides the task mentioned above, this organization is also responsible for the administration and maintenance of roads and waterways.

2. The tide in the North Sea

The astronomical tide in the North Sea is semi-diurnal. That means that two tidal cycles occur during a day, producing twice daily high water and twice daily low water. The average time interval between two high c.q. two low watertides amounts to 12 hours 25 minutes.

The main tidal wave enters the North Sea from the North Atlantic along the coast of Scotland. It is supplemented by a small subsidiary tide which enters the North Sea basin via the English Channel. The character of the tide varies in different parts of the North Sea. For instance, the average change in height between high and low water at the coast is a maximum at Flushing and amounts to 3.80 meters. Going from here to the north along the coast of The Netherlands, the tidal difference decreases to approximately 1.40 m at Den Helder. From here to the East (Eems estuary) the tidal difference increases again to 3.00 m (see fig. 2).

3. The influence of meteorological effects on the lapse of the tidal curve

The tide resulting from astronomical factors can be affected strongly in height and slightly in time by meteorological conditions.

The main meteorological affect is:

windset-up: strong winds blowing from the sea, especially the notorious north-westerlies (see fig. 3), cause the water in the North Sea to bank-up.

The extent to which this occurs, depends mainly on the strength, the direction and the duration of the gale.

4. The height and profile of dikes, dams and embankments along the coast of The Netherlands

At present, as a consequence of the Delta-Plan (prepared after the flood disaster of 1953), reconstruction of dikes is in progress and to a large extent already finalized, so that they will be able to withstand stormsurges of such severity, that their heights have a probability of exceedance only of 1 to 2½ % in a century (e.g. a frequency of 1 to 4 x 10⁻⁴ per year).

Nevertheless, stormsurges will always occur, during which the dikes will be seriously affected by breaking waves, strong currents or other dangers.

5. The storm-surge warning service (in dutch abbr. SVSD)

The storm-surge warning service has the task to inform the organizations responsible for the adequate functioning of watercontrolling dikes and barriers, in particular the waterboards and also other institutions charged with water control and public health, if the height of water is expected to reach or to exceed dangerous levels. The SVSD forms part of "Rijkswaterstaat". It is ready to come into action at any time 24 hours a day throughout the year.

Its main task consists of monitoring closely the situation at the coast during severe gales, to prepare forecasts of the expected highest water-levels, and to issue warnings to the authorities in charge of dikes when conditions are expected that constitute a danger to the continued well-functioning of the coastal defence system. When warning telegrams have been issued to the agencies concerned, it is for them to take such measures as they consider necessary for the fulfillment of their duties.

6. Warnings-warning levels

Until the storm-surge season of 1987-1988 two types of warningtelegrams used to be issued by the SVSD-organization in The Netherlands and were to be distinguished as.

- I. a proposal for a limited dike watch : if a water level was predicted at which some relatively minor precautionary action was required.
- II. a proposal for an extensive dike watch: if a waterlevel was forecast that calls for a number of security measures.

As a result of the Delta-plan the reconstruction of dikes and the construction of barriers have made the hinterland safer from flooding and from the storm-surge season 1988-1989 warning-telegrams are replaced by warnings by telephone and may be distinguished.

- I. a warning to some agencies at which relatively minor precautionary action is required.
- II. a warning with a proposal for dike watch to all agencies.

As was stated earlier, the heights of HW along the Netherlands coast vary significantly. For this reason its coastal zone for the purpose of the SVSD is divided into five sectors (see fig. 4).

Taking into account these factors, it is possible to prepare a table indicating the threshold at which a warning needs to be issued.

Sector	Schelde	West Holland	Den Helder	Harlingen	Delfzijl
reference station	Flushing	Hook of Holland	Den Helder	Harlingen	Delfzijl
warning	3.30	2.20	1.90	2.70	3.00
dike watch proposal	3.70	2.80	2.60	3.30	3.80

(Levels are in meters above mean sea level).

The levels serve as a guide. Deviations are admissible if justified by circumstances (dike conditions).

7. Co-operation between the SVSD of "Rijkswaterstaat" in The Hague and the Royal Netherlands Meteorological Institute

It is the responsibility of the meteorological service to prepare forecasts of the effort of meteorological conditions (c.q. gales) on the astronomical tides. For this purpose, a limited number of the meteorologists with an extensive experience in weather forecasting have received a special training.

In case the expected increase at high water at one of the reference stations exceeds the information level (= about 40 or 50 cm below the lowest warning level), the Meteorological Service will alert the SVSD in The Hague, preferably at least 10 hours prior to the actual time of HW.

The staff of the SVSD in The Hague, a service manned by specialists with a long experience of the behaviour of water in the coastal zone, have normal working hours.

They are rostered for SVSD-duty by means of a time-schedule. When scheduled for duty, they must be on call at home by telephone during off-office hours.

When the officer in charge of the SVSD rostered for duty is informed that the information level at high tide is expected to be exceeded, he decides on account of general information weather or not the SVSD will become operational. However, no warnings will be issued unless this clearly becomes necessary.

The time remaining until the occurrence of high water is of critical importance. Let us presume that the weather conditions deteriorate to such an extent that after consultation with the specialist meteorologist at the met. Office (via a "hot"line) the officer in charge of the SVSD concludes that the tidal height in a sector will exceed one of the threshold values in table 1. In such a situation, the SVSD specialist in The Hague will

(provided the head of his department does agree) forward warnings to the agencies concerned.

In general, the warnings with or without a dike watch proposal are received by these agencies about 6 hours prior to the time of high water leaving a reasonable period of time to take the required action.

The agencies concerned are:

1. The polder-boards in the coastal provinces.
2. The bureaus of "Rijkswaterstaat" in the coastal provinces.
3. The Queen's Commissioners of the coastal provinces.
4. The Ministry of Home Affairs (Directorate Firebrigade).

8. Deterioration of the weather developments

Let us now presume that the weather situation develops in such a way that the meteorologist expects a tidal rise at HW which warrants the establishment of a dike watch.

He will inform immediately his colleague of the SVSD in The Hague of the situation via the "hot line" telephone. The SVSD specialist will then consider the conditions prevailing, and if necessary issue a warning for the establishment of a dike-watch.

Such a dike watch proposal is dispatched to more agencies as are on the list for a warning only.

The actions which these agencies may wish to take, are more drastic now. Examples of those actions are :

1. Rijkswaterstaat and polder boards will summon their personal and call out auxiliaries, recruited from local inhabitants : emergency building and other material (predominantly sandbags) is made ready and trucks are loaded; sea-ward dikes are continuously patrolled by personal equipped with walkie-talkies.
2. The Directorate Firebrigade will summon personal; telephone and teletype centres are manned; emergency columns (ambulances, rolling kitchens, hospitals, etc.) are made ready for instant departure. And in some cases Military commanders of army, navy and airforce are requested by the Queens Commissioner (Provincial Governor) to consign soldiers, sailors and other service personnel to barracks. Helicopters, coastal small boats etc. do receive special emergency equipment on board.
3. Gutterings in dikes, where roads or railroads traverse an embankment, have to be closed.

In addition, burgomasters and police and fire brigade commanders in the treated areas are informed. They have received prior instructions on which roads will have to be used in case of flooding. It is their task to keep traffic on the move.

9. Information to the people via radio

During radio newsbulletins, the following announcement is made immediately after the weatherforecast :

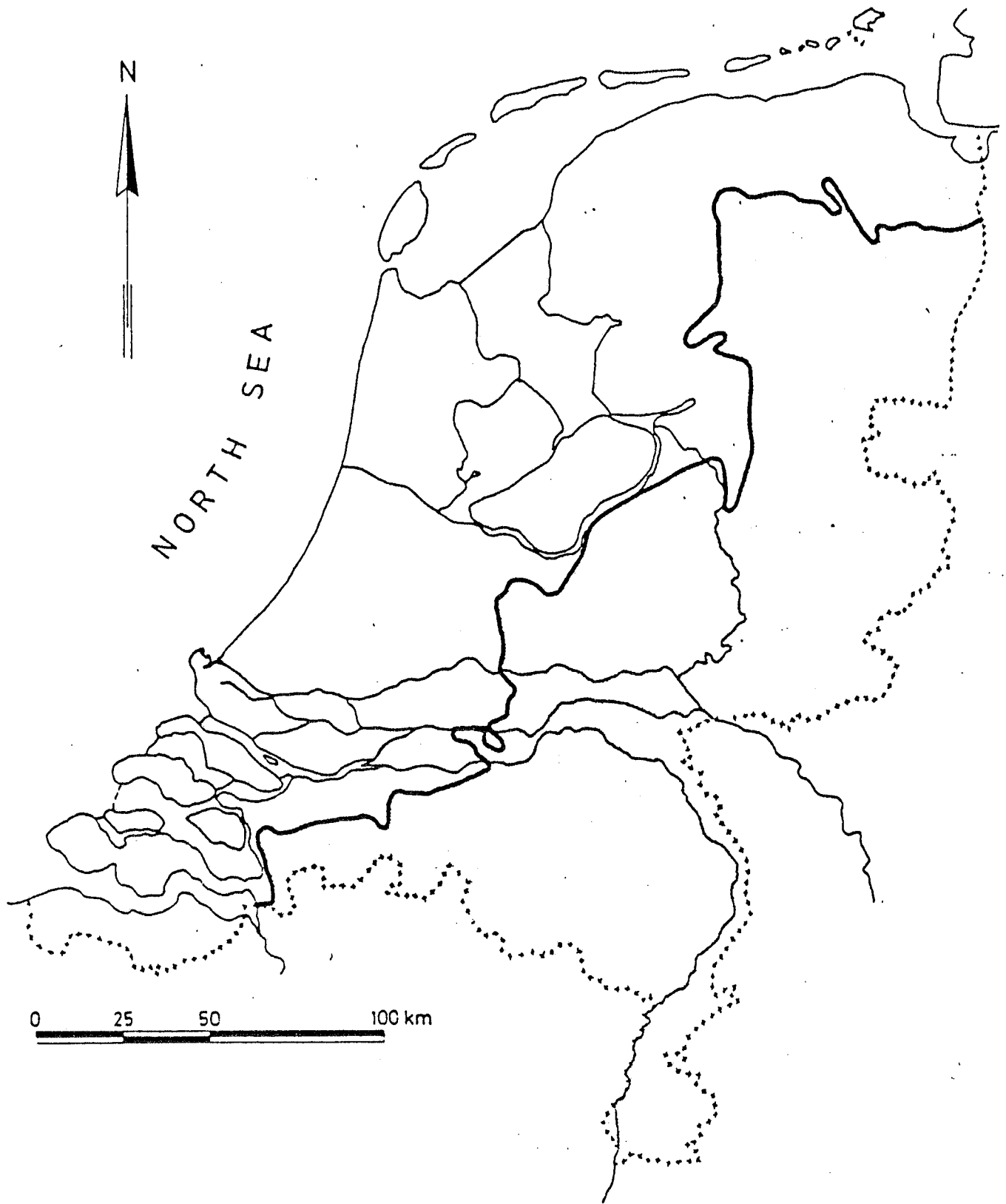
"Excepted increases of high water this afternoon : at Flushing ... meters etc. On the basis of these water levels, "Rijkswaterstaat" has suggested the establishment of dike watch for the following sector ...".

This "dike watch" is interpreted by the population living in the lower parts of the country as an indication that one should be alert. While it lasts, people in the regions concerned will listen regularly to the radio. They know that if necessary further information will be distributed by radio. Should an emergency arise, messages for immediate evacuation will be announced by radio and TV.

After the serious flooding on 31 januari 1953 the SVSD has been reorganized. Until now, it has not been necessary to take measures for evacuation due to the breakthrough of dams or dikes. Nevertheless, people, especially elderly ones, do feel greatly relieved when the announcement is made that the dike watch has been cancelled.

Third edition

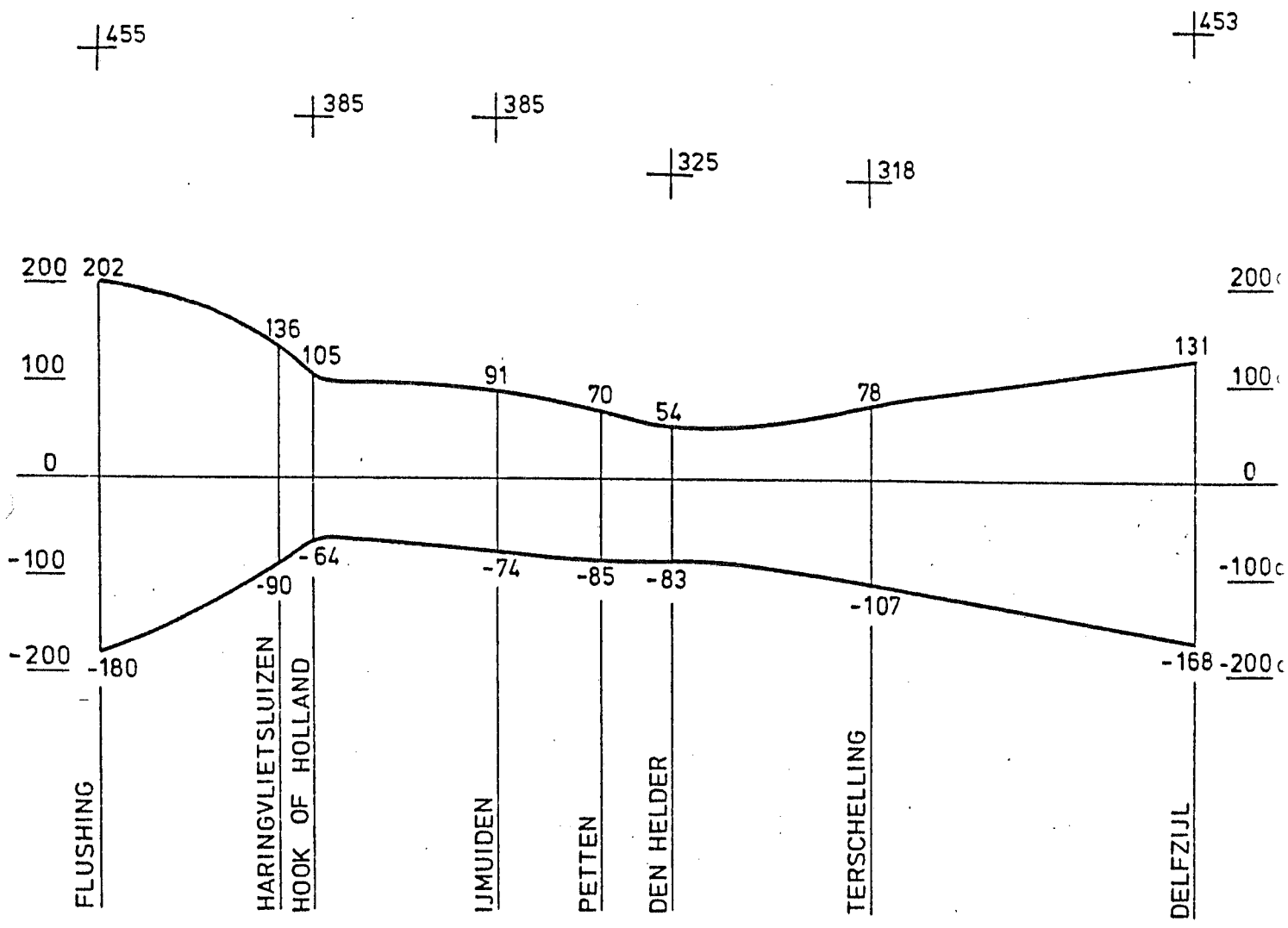
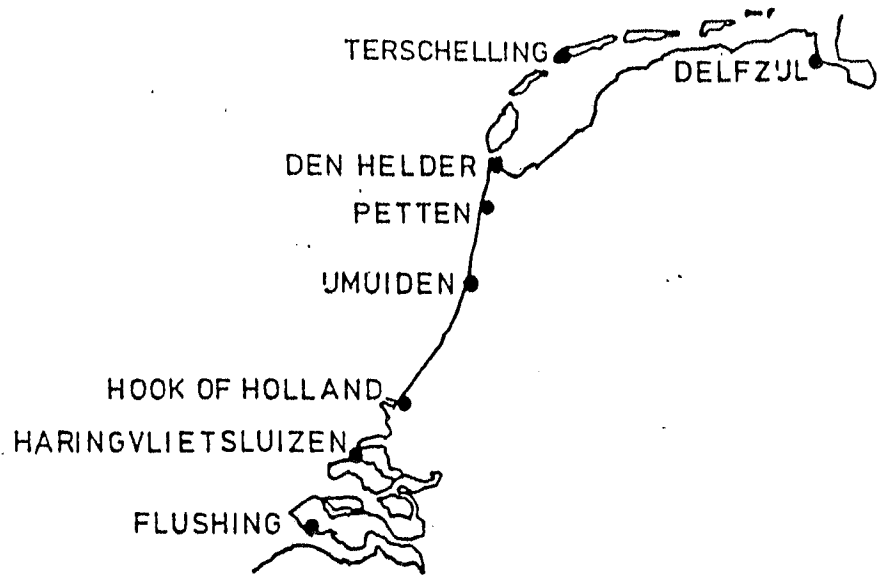
februari 1989



PART OF THE NETHERLANDS WITH ELEVATION OF MORE THAN 2 METERS ABOVE MEAN SEA LEVEL.

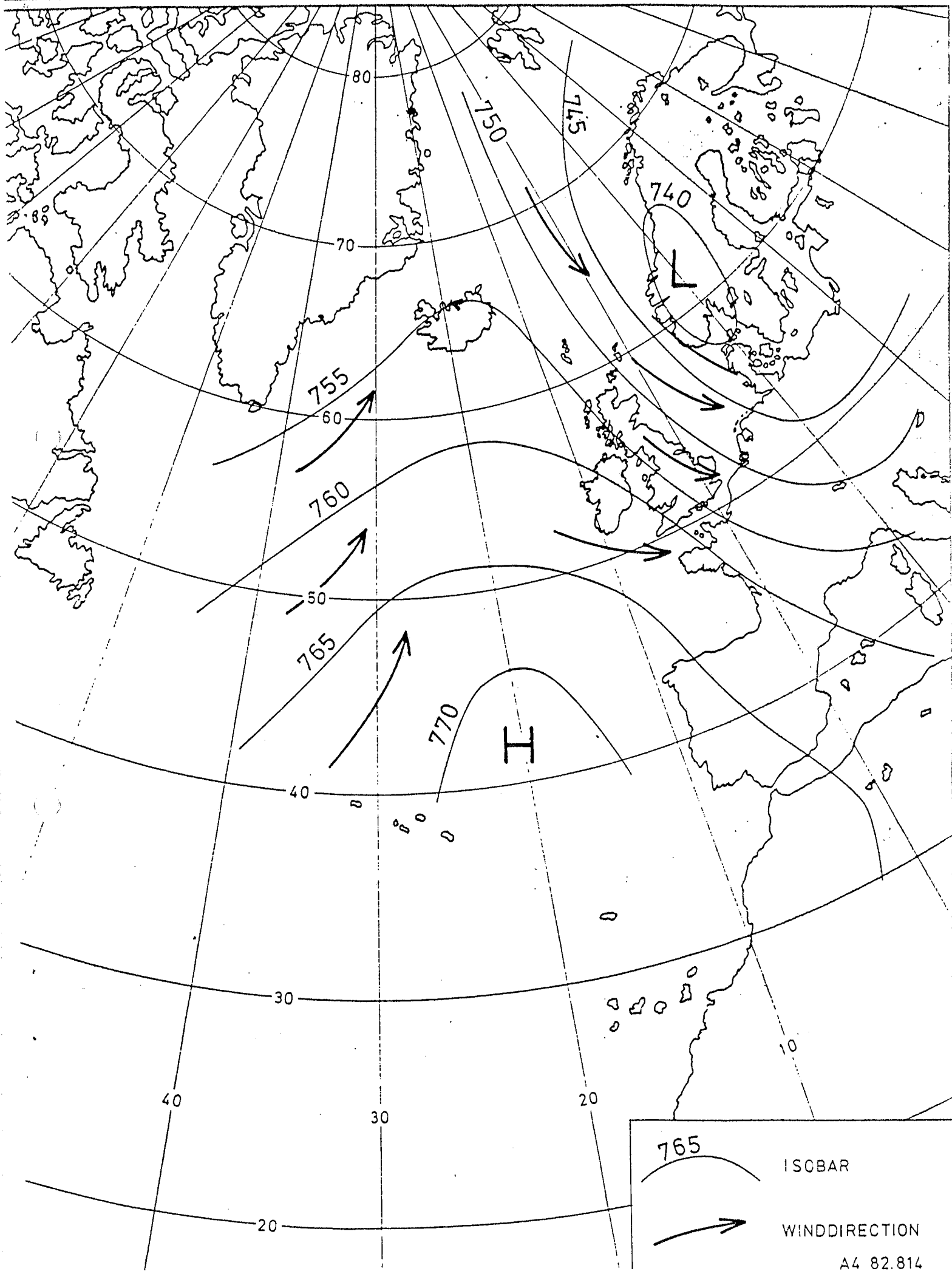


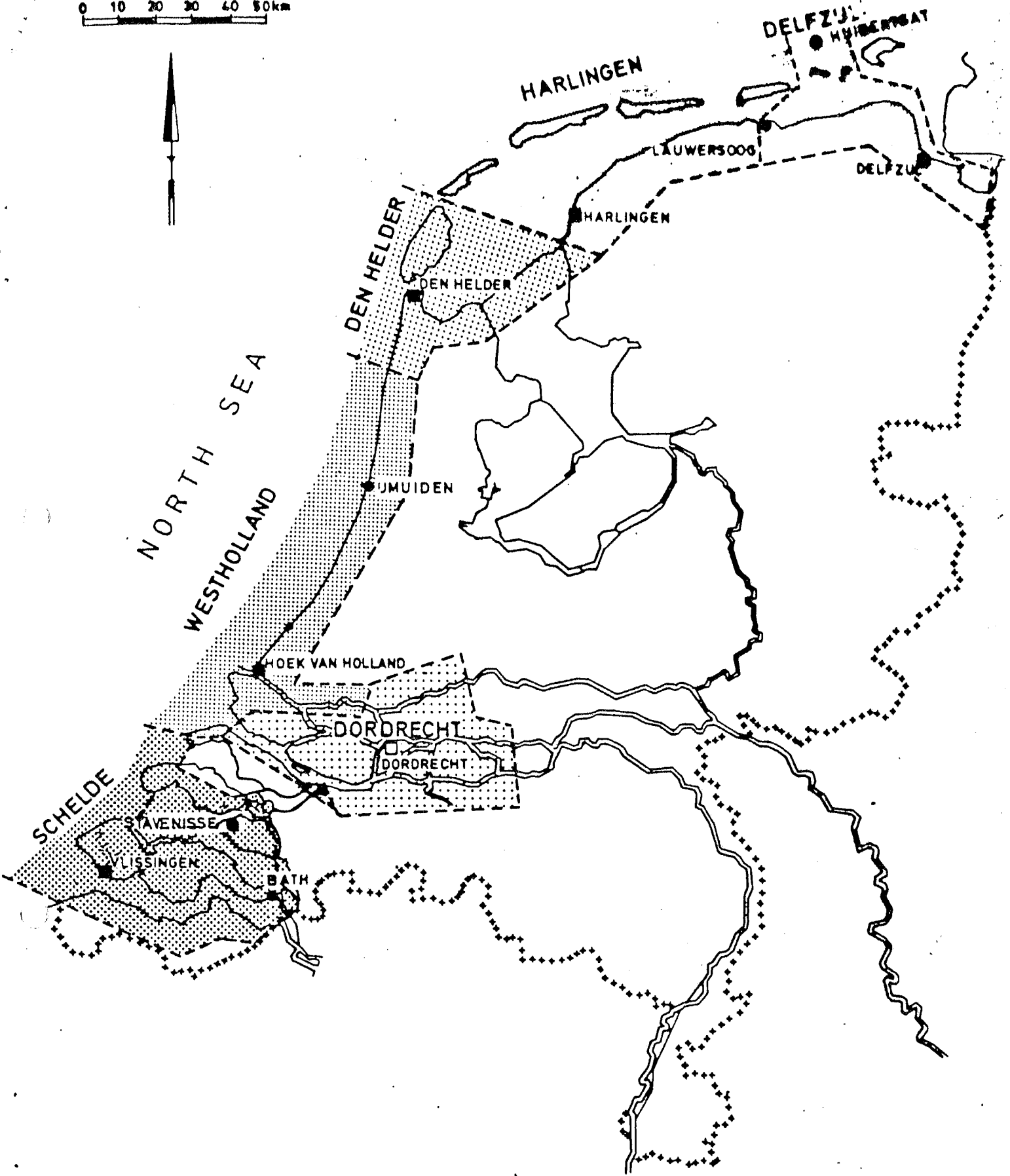
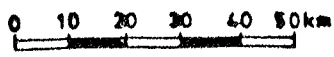
PART OF THE NETHERLANDS WITH ELEVATION OF LESS THAN 2 METERS ABOVE MEAN SEA LEVEL.



MEAN TIDAL DIFFERENCES ALONG THE COAST OF THE NETHERLANDS
 †³¹⁸ HIGHEST LEVEL SINCE 1900

SCHEME OF AIR PRESSURE SITUATION CAUSING THE NOTORIOUS NORTH WESTERLIES OVER THE NORTH SEA AREA





SVSD - SECTORS

rijkswaterstaat
 dienst getijdewateren
 hoofdafdeling informatie en ontwikkeling
 afdeling informatie systemen