

TIDAL DATA IN THE NORTH AMERICAN ARCTIC

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KNOWLEDGE of tidal conditions in North American arctic waters is meagre when the vast area of these waters and the great extent of the coastal shorelines are considered. Tidal observations are difficult to obtain due to the prevalence of ice, scarcity of inhabited areas, and the inaccessibility of the region. Available data are inadequate, sometimes of dubious quality, and frequently insufficiently distributed to permit a proper study of the tidal regime. In many areas the range of the tide is small and therefore long periods of observations are necessary to separate comparatively large variations due to meteorological conditions from true tidal fluctuations.

Prior to 1945 the tide had been observed at only a few places along the Arctic Ocean coast of Alaska and Canada. In the last ten years observations have been obtained at about twenty additional places. These additional observations are sufficient to establish that the range of tide along the arctic coast of Alaska, east of Cape Lisburne, is only about one-half foot. The limited durations of the observations do not provide data for long-period investigations of sea level variation. Tidal harmonic constants have been derived for Cape Columbia and Cape Sheridan, Ellesmere Island. They are based on a 29-day series in 1908 and 220 days in 1905 to 1908 respectively.

Tidal observations in the numerous channels between the islands of the Canadian Arctic ordinarily supply local information only and inferences on tidal conditions in nearby channels would in general be unreliable. The observations at Winter Harbour, Port Kennedy, Port Leopold, Beechey Island, Penny Strait, and Discovery Harbour are of sufficient length for harmonic analysis and the tidal constants necessary for predictions are available. Shorter periods of tidal observations are being obtained at an increasing number of other stations in the area, particularly the far northern weather stations.

In Hudson Bay and Hudson Strait there is a reasonable coverage of tidal observations, except for the southern and eastern parts of the bay. More stations are still required, particularly in Hudson Strait where the exceptionally large range of the tide makes a greater than normal density of tidal stations necessary. Harmonic constants are available for Churchill and Diana Bay, and sufficient data have been obtained for harmonic analysis from Port Nelson, Rankin Inlet, Chesterfield Inlet, Coral Harbour, Koksoak River, Leaf Basin, and Leaf Bay.

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For the waters of Baffin Bay and Davis Strait the consistency of the available data permits a fairly satisfactory interpretation of the tides although the coverage is inadequate. Along the western coastline of these waters, harmonic constants are available for Kingua Fiord, Cumberland Sound, from a 41-day series in 1883 and for Frobisher's Farthest, Frobisher Bay, from a 29-day series in 1951. The coast of Greenland fronting these waters is more adequately covered in the southern portion. There are harmonic constants for eight stations: Nanortalik, Julianehaab, Ivigtut, Godthaab, Godhavn, Rifkol Ø, Kronprinsens Ejland, and Ingnerit.

Along the northwest coast of Greenland from Port Foulke northward, there are five tidal stations including two facing the Arctic Ocean. Harmonic constants are available for all five: Port Foulke, Rensselaer Bugt, Thank God Harbour, Kap Bryant, and Kap Morris Jesup. On the east coast of Greenland tidal data are available for ten places, seven of which are clustered between latitudes 70° and 77° N. Harmonic constants are available for four stations: Danmarks Havn, Lille Finsch Ø, Danmark Ø, and Finnsbu.

There are indications of varying types of tides in all these waters. It would appear that Bering Sea has little effect on the tide in the Arctic Ocean; in the waters about the islands of the Canadian Arctic there is a semi-diurnal tide with a moderate inequality; different types of tide exist along the coasts of Greenland as indicated by the harmonic constants; there is a substantial diurnal tide in the Arctic Ocean north of Greenland as opposed to a less complex semi-diurnal tide in the nearby North Atlantic waters.

The establishment of additional tidal stations is necessary and series of observations must be made over longer periods before a complete study can be made of the tidal regime of the arctic waters. Additional observations, if made over a sufficient period, will show regional tidal characteristics in various places. Whenever facilities and opportunities are available, observations should be made in the offshore areas of the extensive Arctic Ocean basin. Depth soundings should usually be made at these locations.

New techniques will be necessary to obtain the improved observations in arctic regions. A series of at least three bench marks should be established and connected by levels to the datum of the observation at each station. Proper procedure for subsequent observations at the same station would provide correlated data over a longer period and would enhance the value of any limited observation.

Geophysical changes have been noted by secular variations in sea level along other coasts of North America, where systematic tidal observations have furnished data on the slow changes which have taken place in the relative elevation of the land to the sea. There is little or no basic data now available for detecting geophysical changes in the arctic region of North America.