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Contributions to the Hydrography of the Waters of the
Scotian Shelf.

Hydrodynamics of the Waters - - 1935.

Author

H. B. Hachey.

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Contributions to the Hydrography of the Waters
of the Scotian Shelf

Hydrodynamics of the Waters -- 1935

by

H. B. Hachey

(with four figures)

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Introduction:

The hydrographic data, obtained during the spring (May) and summer (August) cruises over a portion of the Scotian shelf during 1935, have been subjected to the usual hydrodynamic analysis (see series of reports under the above title). These analyses are proving to be of considerable interest. This is particularly evident when the contrasting conditions in 1934 and 1935 are considered. Definitely a westward tendency of the waters over the Scotian shelf is an outstanding feature of the area. Imposed upon this westward tendency is a complicated system of movements which may or may not play a predominating part in controlling the hydrographical features of the waters of the area in any given year.

The aim of this hydrodynamical analysis is to work out the topography of the various isobaric surfaces as indicative of the water movements in the various isobaric sheets. The methods are those developed by Bjerknes and outlined rather fully by Smith (Bull. 14, U.S. Coast Guard) and modified for inshore waters by Jacobsen and Jensen (Rapp. Cons. Explor. Mer., 39, 31-84, 1926). In the present case the topography of the surface sheet as well as that of the isobaric surface of 50 decibars is determined for the spring

and summer cruises (May and August). The topography in each case is indicated (figures 1, 2, 3, and 4) by plotting the dynamic height (in dynamic centimetres) of each point of observation relative to a chosen base. Isobars are then drawn for each dynamic centimetre of gradient, and these isobars aid in visualizing the topography of a particular isobaric surface. The data concerned is furnished in tables 1 and 2.

The Spring Cruise:

(a) the topography of the surface of the sea in May.

The topography of the surface of the sea in May is indicated in figure 1. The dynamic heights of all points of observation are expressed in dynamic centimetres and are referred to station 129 as base. Inshore, and particularly in the extreme east, the elevation of the sea's surface is greater than that offshore, with the result that an intense offshore movement (to the south) exists in the western half of the area. In the eastern portion, a coastwise movement (to the southeast) predominates. This coastwise movement is swung sharply offshore when it conflicts with the general southerly movement in the western portion of the area. Between stations 127 and 128, the maximum surface movement is found, amounting to 0.2 knots or 4.5 nautical miles per day.

(b) The topography of the isobaric surface of 50 decibars in May.

The topography of the isobaric surface of 50 decibars in May is shown in figure 2. The dynamic heights of all points of observation are expressed in dynamic centimetres and are referred to station 132 as base. In the eastern portion of the area, a southwest tendency prevails, while to the west of Halifax, this

southwesterly tendency conflicts with an offshore movement and with the result that a comparatively intensive offshore movement is in evidence in the western portion of the area. This is offset to some extent in the extreme west by a tendency for a counter-clockwise movement around La Have bank (station 124). The maximum calculated movement amounts to 0.2 knots or 4.8 nautical miles per day (between stations 125 and 50).

The August Cruise:

(a) topography of the surface of the sea in August.

The topography of the surface of the sea in August is indicated in figure 3. The dynamic heights of all points of observation are expressed in dynamic centimetres and are referred to station 58 as base. The greatest elevation of the sea's surface are to be noted in the extreme east and in the extreme west with the minimum elevation inshore in the vicinity of Halifax harbour. Such a topography indicates a complicated system of currents as is indicated by the arrow-heads. A west to east coastwise movement exists in the vicinity of Halifax. In the eastern portion of the area, an onshore (northwesterly) movement predominates. An onshore movement in the central portion of the area seemingly conflicts with the west to east movement with the result that both are turned into an offshore movement amounting to 0.2 knots or 4.8 nautical miles per day. These surface movements are of particular interest as the survey was made when tropical cyclones were in formation. Just what the distribution of atmospheric pressure was at the time is not known at present but this will be a matter of further interest and possible correlation.

(b) the topography of the isobaric surface of 50 decibars in August.

The topography of the isobaric surface of 50 decibars in August is shown in figure 4. The dynamic heights of all points of observation are expressed in dynamic centimetres and referred to station 128 as base. Comparatively little movement is indicated, a maximum of 0.4 knots or 1.0 nautical miles per day being calculated between stations 122 and 58. A shoreward tendency predominated in the eastern portion of the area, and an offshore tendency in the western portion. The central portion seemingly exhibits a slight tendency towards an anticlockwise circulation.

Summary:

1. In May, the predominating movement was a comparatively strong coastwise one to the southwest which swung offshore to the west of Halifax harbour. These movements extended to depths as great as fifty metres.

2. In August, a complicated system of surface currents were in evidence with no definite resultant trend. The feature was probably a west to east movement which was evident inshore over a considerable portion of the coast. At a depth of approximately fifty metres, the movements tend toward an anticlockwise circulation over the shelf.

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cm.)
121	0 m.	24.28	97630	00.000	2.5
"	25 m.	25.17	97534	24.396	
122	0 m.	23.03	97749	00.000	4.0
"	25 m.	25.14	97536	24.411	
"	50 m.	25.63	97478	48.788	3.1
123	0 m.	22.89	97762	00.000	3.7
"	25 m.	25.04	97546	24.414	
"	50 m.	25.74	97467	48.791	2.5
"	75 m.	25.92	97440	73.155	
"	100 m.	26.22	97401	97.510	
"	150 m.	25.98	97401	146.211	
124	0 m.	23.06	97746	00.000	3.7
"	25 m.	24.76	97573	24.415	
"	50 m.	25.75	97466	48.795	2.1
"	75 m.	26.04	97428	73.157	
125	0 m.	22.82	97769	00.000	3.3
"	25 m.	24.93	97556	24.416	
"	50 m.	25.80	97462	48.793	1.9
"	75 m.	26.747	97425	73.154	
"	100 m.	26.47	97387	97.506	
"	150 m.	26.77	97327	146.185	
"	200 m.	-----	-----		
50	0 m.	22.85	97766	00.000	0.2
"	25 m.	25.57	97496	24.408	
"	50 m.	25.94	97448	48.776	0.5
"	75 m.	26.23	97410	73.133	
126	0 m.	22.47	97805	00.000	2.9
"	25 m.	24.82	97567	24.421	
"	50 m.	25.74	97467	48.800	0.8
"	75 m.	26.22	97411	73.160	
"	100 m.	26.59	97366	97.507	
127	0 m.	22.40	97809	00.000	1.2
"	25 m.	25.53	97499	24.414	
"	50 m.	25.76	97466	48.785	0.6
128	0 m.	22.42	97807	00.000	1.9
"	25 m.	24.86	97563	24.421	
"	50 m.	25.87	97455	48.798	0.0
"	75 m.	26.29	97404	73.156	
"	100 m.	26.51	97373	97.503	
"	150 m.	26.80	97324	146.178	
52	0 m.	23.04	97748	00.000	0.0
"	25 m.	25.54	97498	24.406	
"	50 m.	25.92	97450	48.775	0.4
"	75 m.	26.30	97403	73.132	

Table 2 (continued)

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
129	0 m.	22.91	97760	00.000	2.9
"	25 m.	24.44	97603	24.421	
"	50 m.	25.79	97463	48.804	0.4
130	0 m.	22.63	97787	00.000	3.5
"	25 m.	24.57	97591	24.422	
"	50 m.	25.31	97508	48.810	0.4
131	0 m.	22.57	97793	00.000	3.0
"	25 m.	24.83	97566	24.420	
132	0 m.	22.13	97835	00.000	4.3
"	25 m.	24.75	97574	24.426	
"	50 m.	25.77	97465	48.806	1.6
"	75 m.	25.96	97436	73.169	
"	100 m.	26.02	97419	97.526	
"	150 m.	26.13	97384	146.227	
"	200 m.	26.22	97355	194.912	
133	0 m.	22.15	97833	00.000	3.9
"	25 m.	24.96	97554	24.426	
"	50 m.	25.78	97464	48.803	1.5
134	0 m.	22.15	97833	00.000	5.2
"	25 m.	24.77	97572	24.426	
"	50 m.	25.49	97491	48.809	2.2
"	75 m.	25.91	97440	73.176	
"	100 m.	26.22	97400	97.531	

Table 2 (concluded)

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
129	0 m.	25.47	97516	00.000	0.0
"	25 m.	25.63	97490	24.376	
"	50 m.	25.96	97447	48.743	0.3
130	0 m.	25.40	97523	00.000	0.9
"	25 m.	25.41	97511	24.379	
"	50 m.	25.73	97468	48.752	0.3
131	0 m.	25.39	97524	00.000	1.0
"	25 m.	25.38	97514	24.380	
132	0 m.	24.98	97563	00.000	1.3
"	25 m.	25.40	97512	24.385	
"	50 m.	25.66	97475	48.759	0.0
"	75 m.	25.88	97443	73.124	
"	100 m.	26.01	97420	97.482	
"	150 m.	26.04	97393	146.186	
"	200 m.	26.13	97362	194.873	
133	0 m.	24.52	97607	00.000	2.2
"	25 m.	25.27	97524	24.392	
"	50 m.	25.87	97455	48.765	
134	0 m.	24.03	97653	00.000	4.6
"	25 m.	23.21	97530	24.398	
"	50 m.	25.39	97501	48.777	1.5
"	75 m.	25.73	97457	73.147	
"	100 m.	26.04	97417	97.506	

Table 1 (concluded)

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
121	0 m.	24.91	97569	00.000	8.4
"	25m.	25.26	97525	24.587	
122	0 m.	24.93	97567	00.000	6.0
"	25 m.	-----	97527	24.587	
"	50 m.	25.54	97486	48.764	4.2
123	0 m.	24.97	97564	00.000	5.2
"	25 m.	25.38	97514	24.585	
"	50 m.	25.61	97480	48.759	3.9
"	75 m.	25.59	97471	73.128	
"	100 m.	25.95	97425	97.490	
"	150 m.	26.67	97336	146.181	
124	0 m.	25.62	97559	00.000	3.6
"	25 m.	25.38	97514	24.584	
"	50 m.	25.66	97475	48.758	2.4
"	75 m.	25.88	97443	73.123	
125	0 m.	25.33	97529	00.000	3.7
"	25 m.	25.57	97496	24.578	
"	50 m.	25.82	97460	48.748	3.5
"	75 m.	26.03	97429	73.109	
"	100 m.	26.61	97364	97.438	
"	150 m.	26.89	97316	146.128	
"	200 m.	27.06	97280	194.777	
50	0 m.	25.33	97529	00.000	0.4
"	25 m.	25.52	97500	24.579	
"	50 m.	25.86	97456	48.749	0.1
"	75 m.	26.51	97384	73.104	
126	0 m.	24.98	97563	00.000	2.2
"	25 m.	25.60	97493	24.582	
"	50 m.	25.72	97469	48.752	1.4
"	75 m.	25.94	97437	73.115	
"	100 m.	26.08	97414	97.472	
58	0 m.	24.76	97584	00.000	3.0
"	25 m.	25.62	97491	24.585	
"	50 m.	25.71	97470	48.755	2.1
"	75 m.	25.74	97456	73.121	
127	0 m.	24.46	97613	00.000	4.7
"	25 m.	25.20	97531	24.593	
"	50 m.	25.56	97485	48.770	2.3
128	0 m.	25.35	97527	00.000	0.6
"	25 m.	25.65	97488	24.577	
"	50 m.	25.88	97454	48.745	0.7
"	75 m.	26.20	97413	73.104	
"	100 m.	26.64	97361	97.451	
"	150 m.	27.00	97305	146.118	

Table 1 (continued)