

miles of the localities where tidal influence in the current was most distinctly detected.

In addition to the regular observations of the currents, the density of the water and its temperature were taken at regular intervals along all the courses which there was occasion to run. In this way an extensive series of densities and temperatures were obtained; and some of the same lines were run twice at different dates for comparison. This method has often been found useful in tracing the direction of the movement of the water. Also, at anchorage stations where the current was found to veer widely in its direction, the temperature of the water was taken every half hour in the hope of finding some difference to accord with the varying direction of the current itself.

The depth at which it was necessary to anchor at the various stations, ranged from 30 to 150 fathoms; and the holding ground was often very poor; as the bottom was sometimes flat rock lying horizontally, or soft mud. This mud was usually met with at the greater depths. The steamer itself is too heavy for the purpose, and difficult to hold. Its sides are so high, especially towards the bow, that the wind pressure alone is often enough to make it drag anchor on such bottom; especially when the current holds it broadside to the wind. In many cases the rough weather only lasted a few hours, as the sea fills very quickly in the Gulf; and if the vessel could have been held while it lasted, much time would have been saved. On one occasion in endeavouring to do so, the mooring hawser of steel wire one inch in diameter was parted, and the best anchor for holding was lost. The available shelter was so far distant, it was usually more advantageous to "lie to" in the open and keep in the vicinity of the station, even if the heavy weather lasted a day or two. The anchorage appliances used, which are of a special character, have been described in previous reports. They were improved and re-inforced as much as possible for this season's work.

#### METHOD OF OBSERVING THE CURRENTS.

It soon became evident that the methods employed in previous seasons would require much modification, owing to the difference in the character of the currents. The currents examined in former seasons had considerable strength, from one to three knots, and generally a uniform direction for at least some hours at a time. Their chief variation was in velocity, which fluctuated with the tide, or fell off with the depth. But the currents in the region examined this season varied chiefly in their direction. They usually veered in direction from hour to hour, often going completely round the compass, and the direction at any depth was often different from the surface direction. Their speed was always low, seldom exceeding one knot per hour. Hence the direction of the current, both at the surface and below, was of much more importance relatively, than the accurate determination of velocity. At the first station occupied, where the depth was 155 fathoms, a number of careful measurements of the velocity were made, with a current meter, as far down as 80 fathoms. The velocity was found to vary very irregularly at different depths, and as the meter did not indicate direction, these observations proved of little value. To understand these currents, it was found quite as necessary to examine the undercurrent as the surface current itself, as will be more fully explained when the influences that affect them are discussed. The methods adopted to arrive at their nature were, therefore, as follows:—

The direction of the current on the surface was obtained by a float attached by a line to the stern. This float was made of a board painted white, with short pieces standing out vertically from its under side to give it a good hold in the water; and weighted with lead to bring it even with the water and prevent the wind from having any hold upon it. The direction of the current was read by taking its bearing on a dumb compass at the stern; which was set to the heading of the ship at each observation. The direction of the surface current was thus obtained every half hour, continuously, day and night. The velocity of the current was measured by a current meter, registering electrically by means of a counter on board. This meter

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