

maticians as to prepare the way fully for this work. The formula for the times given by Professor Avery in his "Tides and Waves," when compared with the observed times, differs remarkably in certain parts of the lunar month. A diagram shows the general form of the curve of interval between the moon's transit and high water. Advantage is taken of the part of the curve which changes but little in ordinate to obtain an average luni-tidal interval corresponding in kind with the number for semi-diurnal tides, known at the establishment. These tides occur about the period of greatest declination of the moon. These intervals, at greatest declination, vary greatly during the year; and the form of curve showing the annual change is presented, as deduced from observations at Key West, Fort Morgan (Mobile entrance), and Galveston, as well as from San Francisco, on the Western coast, where the results are remarkably regular. These annual curves are used to deduce the average number for the interval of the daily tides from the short series of observations; the limits of uncertainty of the process are pointed out. These intervals are next turned into cotidal hours by the usual process of correcting for the difference of longitude, for transit, for depth, and by the process just described for the annual change. A table of cotidal hours for the various stations is then given. By it the cotidal lines are traced, the tide waves entering the Straits of Florida, passing through them, crossing to the entrance of the Mississippi, and passing laterally to the western coast of the peninsula of Florida from south to north, and along the southern coast of Upper Florida, along the eastern coast of Louisiana from the Southwest Pass northward, and along the coast of Mississippi. Also, into the Gulf between Southwest pass and the Rio Grande, in such a way that Galveston has, as the head of the Gulf, the latest cotidal hour. By forming groups of stations, the direction of the cotidal lines, the mean cotidal hour, and the velocity of the wave's movement are roughly determined. The difficulties of forming the groups are explained, and the general character of the results given by them are shown in a table and upon a diagram map. Upon the map also are given the cotidal hours of the stations, and the results of the grouping. Finally, from the study of the groups and their connection, the cotidal lines or the daily tides are drawn upon the map. The main cotidal hour of the northern shore of the Gulf is twenty-six hours, twenty seven, occurring at the head of the bight in which Galveston lies. The twenty-five hour line appears at Cedar Keys, and touches the coast again at Brazos Santiago. Twenty-three is at the Tortugas and Key West, and nineteen at Cape Florida.

A similar course to that just described is followed in the discussion of the semi-diurnal tides. The table of stations, their positions, and the other data necessary to obtain cotidal hours is given. The progress of the semi-diurnal wave as indicated by three hours is also shown. The general motion of the wave is like that of the diurnal wave, with very characteristic peculiarities. From the line of deep water joining the Tortugas and Southwest Pass at the entrance of the Mississippi the semi-diurnal wave reaches the stations on the western coast of the Florida peninsula in this order, from south to north and west. The movement west of St. George's appears to be in the order of Pensacola, Fort Morgan and Cat Island, while for the diurnal wave it was Cat Island, Fort Morgan, Pensacola. To the westward of Southwest Pass there is a sudden increase of establishment, as if another semi-diurnal wave brought the tides there. The mean cotidal hour of the five sections west of Southwest Pass is 20 h. 6 m., while that of Southwest Pass and three east of it is 16 h. 17 m., a difference of about four hours. This taken with