VISIBILITY OF DISTANT OBJECTS

Among the atmospheric phenomena which are of interest to the seaman, visibility of distant objects, whether at sea or on land, takes a prominent place. All data obtained from the study of this question are of help towards perfecting the Art and methods of navigation.

Several articles have been published in the *Hydrographic Review* on the question of the visibility of lights at sea and on observations concerning the visibility of light, particularly in Volume VIII, N° 1, May, 1931, pages 144 to 149. In this article reference is made to the numerical notations used in meteorological messages to designate the degree of visibility at sea. These data give a concrete idea of the evaluations which the navigator can make for himself on this subject. Also, certain Meteorological Observatories take daily observations of visibility, generally of terrestrial objects, such as distant summits, prominent objects situated at varying distances, and even of the sea horizon, which, when tabulated for one or more years, provide a certain measure of information regarding the transparency of the atmosphere.

Thus the Meteorological Section of the FABRA Observatory, in its various annual bulletins published by the Barcelona Academy of Arts and Science, gives tables of visibility for each day of the year, using a special scale from 0 to 4 to designate the visibility of distant objects, 0 corresponding to invisibility and 4 to the clearest visibility.

More accurate tests of visibility, by highly scientific methods, have been carried out for some time past at Danzig, by Professor Dr. H. KOSCHMIEDER. The results were published in the *Forschungsarbeiten des Staatlichen Observatoriums, Danzig - Heft* 2 and *Heft* 3 of 1930. The *Monthly Weather Review* for November 1930 (published at Washington by the *Weather Bureau* of the United States of America) gives an analysis in English of these observations, and describes the methods used and the results obtained up to the present. These experiments deal with the visibility of a black object, *i. e.* the distance of perception by daylight — the maximum distance at which the observer can still discern the object. Whilst at night a light becomes gradually less visible as its source moves further away from the observer, a black object becomes lighter coloured by daylight as it recedes from the observer, as can be proved by observing a departing train with the eye, on a misty day. At first it appears black against the light background, and then, as it gets farther away, its silhouette fades gradually until it merges into the background and finally disappears. The author has established a formula for calculating the distance at which a black surface is visible by day. Observations were first taken over the sea from the Eastern mole of Danzig with of a telephotometer, a range-finder and a theodolite, using a towed target composed of two pieces of canvas, one black and the other white, joined together, the black surface measuring 6 metres by 6 metres. Photometric measurements of the brightness of the two surfaces and of the horizon were made with a ROSENBERG astrophotometer constructed by the Askania-Werke of Berlin. The target was towed round the observation point in a circle, so that observations could be taken with the sun at various relative bearings. These observations demonstrated that the lighting of the black surface varies as does that of the horizon, and that, immediately in line with the sun, the lighting is greater than in the opposite direction and that, at a certain distance from the observer, the black surface, when in direct line with the sun, may appear as brilliant as a white surface of high albedo. These investigations showed also that in a wind blowing from the sea and to leeward of a large town the air is not optically homogeneous.

Supplementary observations were carried out in the neighbourhood of Rostau, both in summer and in winter; here the influence of refraction due to sunlight was much more pronounced than over the sea.