

oxygenous and nitrogenous contents of their swimming bladders.

As fresh and salt water do not attain the maximum of their density at the same degree of temperature, and as the saltness of the sea lowers the thermometrical degree corresponding to this point, we can understand how the water drawn from great depths of the sea during the voyages of Kotzebue and Dupetit-Thouars could have been found to have only the temperature of 37° and $36^{\circ}.5$. This icy temperature of sea water, which is likewise manifested at the depths of tropical seas, first led to a study of the lower polar currents, which move from both poles toward the equator. Without these submarine currents, the tropical seas at those depths could only have a temperature equal to the local maximum of cold possessed by the falling particles of water at the radiating and cooled surface of the tropical sea. In the Mediterranean, the cause of the absence of such a refrigeration of the lower strata is ingeniously explained by Arago, on the assumption that the entrance of the deeper polar currents into the Straits of Gibraltar, where the water at the surface flows in from the Atlantic Ocean from west to east, is hindered by the submarine counter-currents which move from east to west, from the Mediterranean into the Atlantic.

The ocean, which acts as a general equalizer and moderator of climates, exhibits a most remarkable uniformity and constancy of temperature, especially between 10° north and 10° south latitude,* over spaces of many thousands of square miles, at a distance from land where it is not penetrated by currents of cold and heated water. It has, therefore, been justly observed, that an exact and long-continued investigation of these thermic relations of the tropical seas might most easily afford a solution to the great and much-contested problem of the permanence of climates and terrestrial temperatures.† Great changes in the luminous disk of the sun would,

* See the series of observations made by me in the South Sea, from $0^{\circ} 5'$ to $13^{\circ} 16'$ N. lat., in my *Asie Centrale*, t. iii., p. 234.

† "We might (by means of the temperature of the ocean under the tropics) enter into the consideration of a question which has hitherto remained unanswered, namely, that of the constancy of terrestrial temperatures, without taking into account the very circumscribed local influences arising from the diminution of wood in the plains and on mountains, and the drying up of lakes and marshes. Each age might easily transmit to the succeeding one some few data, which would perhaps furnish the most simple, exact, and direct means of deciding whether the sun, which is almost the sole and exclusive source of the heat of