

have the same effect as the application of heat to the bottom, and in either case we should have an instance of simple convection, the warmer under-water rising through a colder upper layer; but that is not what we have in the polar sea; for the temperature of the arctic sea gradually sinks from a few fathoms beneath the surface to a minimum temperature, and consequent maximum density, at the bottom. Therefore in this case the application of cold at the surface is not equivalent to the application of heat to the bottom in a hot-water heating apparatus, and Dr. Carpenter has shown that he is aware of this by requiring the backward propagation of a *surface-current*.

That a certain effect in increase of specific gravity must be produced by the cooling of the surface film of the arctic ocean there seems to be little doubt; but the area of maximum effect is very limited, and during the long arctic winter the greater part of that area is protected by a thick layer of ice, one of the worst possible conductors.

It certainly appears to me that this cause is totally inadequate to induce a powerful current of great depth, six thousand miles long and several thousand miles in width, the effect which Dr. Carpenter attributes to it.

During the summer of 1870, and afterwards in 1871, Dr. Carpenter made a series of observations on the current in the Strait of Gibraltar. The existence of an under-current out of the Mediterranean was considered to be established by these observations, and the conclusions arrived at as to its cause did not differ materially from those already very generally