CHAPTER XXIX.

SAND-CURRENTS — RIPPLE-MARKS, WAVES, AND DUNES.

As the atmosphere possesses its regular, uniform currents, and the hydrosphere its similar currents, so also the lithosphere, or solid crust of the earth, exhibits its real currents. It sounds paradoxical to say, that not only the gaseous and the fluid envelopes of the earth, but also its solid envelope, is able to form currents; and yet so it is. Mass-transportations on the earth's surface take place of course under countless different conditions, and in intimate connection with denudation, the levelling of the surface, disintegration, sedimentation, the formation of alluvium, the heaping up of æolian matter in immense deposits, volcanic phenomena etc. etc. Yet it is not of these I desire to speak, but of the mass-transportations of drift-sand which take place in regular currents on a stupendous scale, currents that are equivalent to the regional and horizontal currents of the atmosphere and the ocean. These three species of current in different aggregational conditions are of course initiated by different impelling forces. Atmospheric currents are set up by differences of atmospheric pressure; oceanic currents by the retarding friction of the atmospheric currents as they pass over the surface of the water; and drift-sand currents likewise by the mechanical lifting force of the currents of the atmosphere. The limits or bounds within which these three species of current flow are very unlike one another. Those of the atmosphere are extremely faintly defined, and their geographical positions are very changeable. The limits of the oceanic currents are far more sharply defined, and their boundaries fluctuate far less. But it is the limits of the sand-streams that are the most sharply defined of all; in most cases they admit of being delineated, even on large scale maps, with the greatest distinctness of outline. An oceanic current that is maintained by a wind blowing from a constant direction is influenced but little or not at all, and in any case only superficially, by a local change of wind. This holds good also of the sand-currents, as we saw in the Desert of Tschertschen. In the former case we have over-pouring waves going over in a direction contrary to the current; in the latter case the dune-accumulations maintain their usual position and form, but of the individuals composing them those that are uppermost and on the extreme outside are compelled to turn their steep leeward faces towards the direction from which the prevailing wind generally comes. On the other