below. As a consequence, these regions would exhibit westerly zonal winds which may be considered to be downward and poleward extensions of the high-level stream in the equatorial belt. The westerly zonal winds would extend down to ground level but their speeds would diminish in the lower levels. The winds would evidently be strongest in latitudes between 30° and 45° (north or south) and become weaker as we proceed further polewards.

7. The Easterly Surface-Winds

The void in the atmosphere left by the streaming upwards of heated air from near the equator has, of necessity, to be filled up by air moving in towards the equator at various levels. Some of this replacement may be effected in the equatorial belt by an inflow in the marginal regions at various levels. But a substantial part of the air needed must come in at and near the ground level. Admixture of air from the higher latitudes with the atmosphere nearer the equator would reduce the speed of rotation of the atmosphere in the lower levels. Hence, at these levels, zonal easterly winds would be perceived.

8. Winds in the Polar Belt

The difference between the heating effect of solar radiation in the belt of mid-latitudes and in the polar belt is sufficiently great to allow of a circuit of convection being established in these areas. Warm air goes up into the troposphere from the belt of middle latitudes. Its replacement has to be effected by colder air moving in from the polar regions. Since the surface speeds of movement are very low near the poles, the air drifting away from the poles would result in reducing the surface-speeds of the atmosphere with which it mixes. Hence, we would have a regime of easterly surface-winds in the polar belt. The warm air going up from mid-latitudes has necessarily to find its way back into the polar belts. This can be achieved by its going to the tropopause level and then drifting polewards and then slowly subsiding into the polar area. As the air thus going up is derived from the mid-latitudes where the surface speeds are much higher than in the polar belt, it follows that westerly winds with considerable speeds would be perceived as blowing over the polar areas at high levels.

HERMANN VON HELMHOLTZ *

THIS is an unabridged, unaltered reprinting of the 1st (1906) edition.

This present work, prepared by a lifelong friend of Helmholtz's, is the definitive biography in English of this remarkable man. It tells of the unusual family background that directed Helmholtz's development, the philosophical background that helped form Helmholtz's method of working. It also reveals Helmholtz's personality: his mental gifts, his occasional lacunæ, his buoyant hopes, and his occasional moments of sadness. One of the great scientific biographies of all time, it reveals Helmholtz both as one of the creators of modern science and as a human being.

An unusual feature about Koenigsberger's book is that it does not stop at enumerating individual pieces of work that Helmholtz undertook. It explains each of his discoveries (as far as this is possible) in clear verbal statements that are easily followed. As you read through this book, you will understand just what Helmholtz really contributed in optics, acoustics, electrodynamics, mathematics, and the many other areas in which he worked.

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* *Hermann von Helmholtz.* By Leo Koenigsberger. Translated by Frances A. Welby. (Dover Publications, Inc., New York), 1965. Pp. xix + 440. Price $ 2.25.