

# THE CIRCULATION OF THE ATMOSPHERE.

*Mémoires originaux sur la Circulation générale de l'Atmosphère.* Annotés et Commentés par Marcel Brillouin, Maître de Conférences à l'École Normale Supérieure. Pp. xx+163. (Paris: Georges Carré et C. Naud, 1900.)

THIS may be described as a French Student's notebook of foreign memoirs upon the general circulation of the atmosphere. It contains papers upon the subject, partly translated in full, partly in extract or analysis, by Halley, Hadley, Maury, Ferrel, James Thomson, W. von Siemens, Möller, Oberbeck and von Helmholtz, with a short introduction and some critical notes to the current text.

The book may be welcomed as calling attention to a subject which greatly needs attention in this country. But little has been done for it since James Thomson, in the Bakerian lecture of 1892, revived the ideas he had originally put forward at the meeting of the British Association at Dublin in 1857. In the United States Prof. Cleveland Abbe has collected and translated the principal memoirs, but the mathematical treatment of atmospheric circulation has been neglected in England.

Contrary to the general experience of scientific books in French, the work is rather dull. The introduction makes it clear that only foreign memoirs are included, and the work of MM. Tastes and Duclaux, as well as that of M. Teisserenc de Bort and of M. Brillouin himself, particularly "Vents contigus et nuages" (*Ann. du Bur. Centr. Mët.* 1898) is only incidentally referred to, but this does not altogether account for the impression. The subject itself is difficult; indeed, in its details it is far beyond the power of mathematics. No one can suppose that it is possible to deduce the actual motion of the air at this instant at every part of the globe from its primary causes, namely the insolation of one half the globe, the radiation from the other half, the force of gravity and the rotation of the earth; and yet that is what, in a generalised manner, most of the authors quoted set out to do. Of course, a conventional atmosphere has to be used and a conventional circulation therein accounted for; and, as a matter of fact, the assumptions and conventions that a writer makes in order to bring his powers of calculation to bear are more interesting than the details of elaborate mathematics on artificial hypotheses leading to results which, to put the matter bluntly, are only true in so far as they are not new.

Von Siemens' application of the principles of conservation of momentum and of energy strikes a livelier key, but it is only when von Helmholtz's papers are reached that the reader can feel that the analysis has really become an engine of research. The mode of treatment becomes quite different. The hydrodynamics and thermodynamics of real air are the starting point, and equatorial heating becomes a secondary consideration. As each section is developed, and the dynamical effect of the scale of the problem, the equilibrium shapes of atmospheric layers, the wave phenomena that can occur between layers of different density are unfolded, it becomes possible to be enthusiastic as to the service that mathematics can render to this subject.

Von Helmholtz himself gives no general system of

atmospheric circulation, but M. Brillouin indicates the results in that direction that flow from his conclusions. He finds them in general agreement with Ferrel's distribution, and pays a tribute to Ferrel's achievement on that account.

The notes throughout are frank, appropriate and useful. It is to be feared that the book appeals to a limited class of readers, namely those who are at the same time meteorologists and mathematicians. The ordinary meteorologist will feel the want of a mathematical introduction, and the ordinary mathematician of a meteorological introduction.

W. N. S.

## OUR BOOK SHELF.

### *The Elements of the Differential and Integral Calculus.*

By J. W. A. Young, Assistant Professor of Mathematical Pedagogy in the University of Chicago, and C. E. Linebarger, Instructor in Chemistry and Physics in the Lake View High School, Chicago. Pp. xvii + 410. (London: Hirschfeld Bros., 1900.) Price 10s. 6d. net.

*Differential and Integral Calculus with Applications for Colleges, Universities, and Technical Schools.* By E. W. Nichols, Professor of Mathematics in the Virginia Military Institute. Pp. xi + 394. (Boston U.S.A.: D. C. Heath and Co., 1900.)

THE first of these books is based upon the German treatise on the differential and integral calculus with special reference to chemistry which was published by Profs. Nernst and Schönflies five or six years ago. The chief alteration in the mode of presenting the subject is that the method of limits is used throughout in the treatise before us to the exclusion of the method of differentials which was early introduced and much employed in the German text-book. But the distinctive feature of the original work, viz. the continual use of illustrative examples from chemical and physical science, has been retained in the adaptation before us, and many additional examples of the like kind have been introduced.

The treatise in its present shape forms a very convenient and serviceable text-book for English and American students of chemistry desirous of obtaining an elementary acquaintance with the principles and methods of the calculus, for here they will find a very clear presentation of the fundamental ideas of the subject, and in particular will be furnished with abundant easy exercises and applications of the mathematical processes to subjects in which they are specially interested. The book is well designed to save the time and keep up the interest of such students. Thus the first chapter contains an introduction to analytic geometry, with numerous exercises on the graphing of curves, and the last chapter is a characteristic one on the differentiation and integration of functions found empirically.

Whilst so much has been done to smooth the path and provide for the wants of the class of students specially in view, it seems matter for regret that an additional chapter on the solution of easy linear differential equations has not been furnished.

We have in Prof. Nichols' work another elementary text-book specially designed as a first book on the calculus for students of physics and engineering. It is a clear and teachable work for beginners, and contains several easy applications to mechanics and electricity. The ordinary applications of the differential calculus to geometry are brought forward earlier than usual; thus we have a chapter on tangents, normals and asymptotes to plane curves before the chapters on successive differentiation, series, illusory forms and maxima and minima. Then, after a chapter on partial and total differentiation,