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Aerial Navigation and Meteorology.

METEOROLOGY has been international ever since it became a science. From the first congress of directors of meteorological institutes at Vienna in 1873, meteorologists have been engaged in standardising methods of observation and exposure of instruments, and in devising codes for the transmission of observations by telegraph in order to compress as much valuable information as possible in the small space available for transmission at moderate cost. So the introduction of upper-air data, though strongly recommended by those who wanted to substitute calculation for "rule of thumb," had to fight its way against other useful and more easily accessible information of the older kind. The last international code, fixed at Rome in 1913 after long correspondence and discussion, kept the morning message at four groups of five figures, and allotted only one figure to upper-air data—direction of high cloud—in addition to the customary figure for weather or state of the sky. For the benefit of aerial navigation, the results of pilot-balloon ascents were telegraphed by many European observatories to the central station at Lindenberg. Funds for the telegraphic distribution of these data and of those of soundings of the atmosphere by means of kites or cable balloons were usually lacking.

The great war has changed all this; aerial navigation demanded quick and detailed information, especially about low cloud, visibility, and wind velocity in free air. Many reporting stations were erected and connected to central offices by telephone or wireless. Meteorologists sprang up from the ground, the observational hours were multiplied, and no one considered the cost.

The result lies before us in the form of Annexe G of the Convention for the Regulation of Aerial Navigation,[1] the object of which is to substitute legal regulation for free international co-operation. The prominent features are:—

(1) Regulation of the collection and dissemination of meteorological information—introduction of four observational hours instead of two or three; of short-period (three to four hours) and route forecasts (six hours) on one hand, and of long-period forecasts (two or three days) on the other, besides the normal forecasts (twenty to thirty hours).

(2) Extension of the number of groups in the reports from individual stations to a central office from four to six for all stations, and from four to any number between twelve and forty-four for stations observing upper-air wind, temperature, and humidity.

(3) Introduction of new codes for the new information and several of the customary data.

Annexe G has been discussed at a meeting in London of members of the pre-war International Meteorological Committee, and again at the Conference of Directors of Meteorological Institutes at Paris in October, 1919; but definite resolutions were postponed. We have reason to think, however, that the following remarks express the opinion of a large majority of Continental meteorologists and several of their British colleagues.

There is practically no difference of opinion about the necessity of reorganisation and centralisation of the collection and dissemination of meteorological information. Standard observational hours, quick transmission of the reports to the national centre, exchange of collective reports between centres with a maximum distance of 1500 km. within an hour and a half of the observation, followed by selections from these reports sent out over world-wide ranges by a few high-power wireless stations within three hours of the observation, is a good, but not altogether new, scheme. Its complete realisation will be hampered only by the unsatisfactory state of communication by telegraph or telephone in some countries. The proposed simultaneous transmission of several of the national collective reports may cause the receiving stations to miss part of them; successive transmission may take more time than the convention grants; but these are only technical details: the principle is all right. Differentiation of forecasts also is necessary, but it has to be adapted to local circumstances.

[1] "Air Ministry. Convention portant Réglementation de la Navigation Aérienne (13 Octobre, 1919). Convention for the Regulation of Aerial Navigation (October 13, 1919)." Pp. 48. (London: H.M. Stationery Office, 1920.) Cmd. 670. Price 1s. net.

Appendix III. mentions, in addition to the observations of physical quantities like wind, pressure, temperature, and humidity, no fewer than seven kinds of weather phenomena (fog, clouds, precipitation, visibility, etc.), and only as additional and facultative do we find wind, temperature, and humidity in the upper air, in spite of the fact that knowledge of the latter data is essential for a real prediction of weather phenomena, whereas the most minute description of present weather does not form a guarantee against sudden changes. Some years ago it might have been urged that sufficiently recent upper-air data were not available—we have shown, however, in Holland that the aeroplane is an excellent substitute for the kite or the cable balloon in almost any weather, and hence this excuse is no longer permissible. In this respect Appendix III. almost looks like a step backwards.

Certainly the multitude of codes introduced by European meteorological institutes since the war is a nuisance, but it may be taken as a symptom of the general dislike of the codes prescribed in Appendix IV. These include units, like the millibar, unfamiliar to the majority of Continental meteorologists (unless in purely scientific work), and change codes for the transmission of the usual elements without any real gain for practical purposes, and they do not use sufficient economy with the room available in the telegrams. A few specimens may illustrate this. Wind direction is given in two figures as usual, but in a scale of 1 to 72 instead of 1 to 32; this means that an accuracy of 5° is claimed. Every meteorologist knows that such accuracy is imaginary—the exposure of the anemometer, the turbulence of the winds, etc., cause larger variations with space and time. No fewer than four figures are allotted to past and present weather. The result is that the observer is puzzled as to the number he is to choose out of 50 or 100, five or six numbers applying equally well, or he gets into the habit of reporting some favourite phenomenon —the very slightest degree of haze, for instance. The multitude of phenomena reported makes one lose sight of the distribution of any particular class.

In our view, Appendix IV. is a mistake, and ought to be deleted as soon as possible; it may prevent some States from joining the convention, Article 34 of which allows a minority of one-fourth or even less to prevent any modification of the annexes. General rules ought to be given in the convention, details being left to a competent body like the "Comité Météorologique International," reconstituted at Paris in October, 1919, which certainly is fully aware of the need for reforms, and will choose the best way to ensure general approval.

In the meantime, reforms are not being postponed; the majority of the Continental countries have already their wireless collective reports, and others will soon follow—special route reports for flying purposes are being exchanged, for example, between England, France, Belgium, and Holland. Meteorologists are thankful for the stimulus which aerial navigation has given to their weather services; they admire the desire for organisation and centralisation apparent in the convention; but they cannot overlook the fact that meteorology has other important applications. Theoretically it might be argued that these may look after themselves; practically it is impossible to maintain an independent system of information, say for agricultural purposes. In following up the historical line, the Comité International will try to serve *all* purposes equally well.

E. VAN EVERDINGEN.

Child Physiology.

The Principles of Ante-Natal and Post-Natal Child Physiology: Pure and Applied. By W. M. Feldman. Pp. xxvii+694+6 plates. (London: Longmans, Green, and Co., 1920.) Price 30s. net.

DR. FELDMAN'S work is a notable addition to the books which deal with physiology. As in them, so in this volume, the reader is impressed by the great change which the past decade has wrought in the content of physiological science, and especially in the predominance of physics, of mathematics, and of chemistry which is so noticeable. Here and there one comes upon pages occupied almost entirely with mathematical formulæ. Dr. Feldman's book has all these characters; but it has also another feature, which is novel: it brings to the study of the physiology of the child (up to puberty) a consideration of the conditions of life which exist before birth, and an evaluation of the effect which the process of birth itself has upon these conditions. It has in this respect and for this reason what one might term a fructifying novelty. It sweeps into the scope of child physiology not only the vital processes of fœtal life, which differ merely in details from those which prevail after birth, but also those of embryonic life, which are so manifestly unlike physiology that we commonly call them "embryology," as if they were something apart; and it travels still further back towards the origins of