

# BOOK REVIEWS

## Predicting the Weather

*Weather Forecasting as a Problem in Physics.* By Andrei S. Monin. Translated by Paul Superak. Pp. x+199. (MIT: Cambridge, Massachusetts and London, December 1972.) \$12.50.

MOST readers of *Nature* will be aware that weather forecasting has recently been undergoing very substantial changes in technique. The older empirical and partly subjective methods (not lacking physics but unable to exploit it numerically to any great extent) have become largely, though by no means wholly, replaceable by quantitative methods deriving from direct application of the basic laws of physics. The problem posed is to observe the 3-D atmosphere, or some part of it, in regard to weather-significant properties like pressure, temperature, humidity at a given initial instant and then to calculate its evolution by using dynamical and thermodynamical equations and boundary conditions (a model) thought to represent, more or less adequately for the particular kind of forecast required, the physics of the evolutionary process. (For experimental purposes initial data may also be invented.) Because of the non-linearity of the equations the numerical solutions are only to be obtained by finite-difference methods on high speed, large capacity computers, so that massive computational as well as physical problems are involved.

The intensive development of the new techniques has been an important concern of atmospheric dynamical research since the Second World War and has involved academic as much as or more than weather-service scientists. (This research is blessedly almost free from categorization as "pure" or "applied".) But the only textual literature in English specifically on the subject has been that provided back in 1961 by P. D. Thompson's *Numerical Weather Analysis and Prediction* (Macmillan) so that great interest should be aroused by the appearance now of a second volume and that from a Soviet scientist who is very distinguished for his research on turbulence theory but had not perhaps been thought of in the West as greatly concerned with large-scale atmospheric dynamics. Dr Monin shows here that he is as familiar with our literature in this field as with his own to which he has indeed contributed significantly.

Monin's book is in four sections. A short introduction deals with the history of the subject and with the scales and spectra of atmospheric processes. This is followed by a chapter on the theory of short-range weather prediction which in physical terms is to use an adiabatic model and in practical terms a model useful for two or three days since the run-down time of the atmosphere is a week or so. The use of quasi-geostrophic, quasi-solenoidal approximations which filter out the "non weather producing" motions from the system is fully discussed and advocated against the current tendency to use the more complete ("primitive") equations.

The author then passes to problems of long-range prediction, global climate and climatic change, for which non-adiabatic processes—radiation, friction and turbulent fluxes—are very much at the heart of the matter. These latter, strangely enough for Monin, are not given much attention except for radiative heating and cooling. There are discussions of a global system of observation such as will be used for the Global Atmospheric Research Programme, of predictability, and of possible mechanisms for climatic change. A final section deals with laboratory modelling using differentially heated rotating liquids, with the atmospheres of the planets out to Jupiter and with the utilization of forecasts.

This is a scholarly work in which few words are wasted. There is indeed such compression, in parts describing the construction of models, that some familiarity with the field by the reader is desirable but at least he does not have to face large amounts of intricate mathematics. The writing is engagingly fresh with the author ready to express controversial views both about the science and its uses which will raise some eyebrows. Yet it also has a somewhat pedagogic quality with here and there a lack of balance, as if the writer were passing on received knowledge rather than the results of work with which he has been much concerned. The practising forecaster might thus find the presentation occasionally irksome and he would mainly seek in vain for examples of the applications of the techniques described, except in long term, global models. But the scope of the treatment is admirable and will most certainly be enjoyed by all with some knowledge of the subject. The book

should also be an excellent means of informing physicists who would like to be made aware without needless complication of the way in which the subject is heading.

The translation is reasonably idiomatic but one remains pleasantly aware that the work was originally written in Russian.

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## Visual Physiology

*Physiology of Photoreceptor Organs.* Edited by M. G. F. Fuortes. Pp. x+765. (Springer: Berlin and New York, 1972.) 244 DM ; \$77.40.

"VISUAL science has undergone remarkable development in the past two decades. A generation of competent, vigorous workers, skilled in the use of the latest biophysical and biochemical techniques, has built a structure of new understanding on older foundations that puts this branch of science in the very forefront of neurophysiology." Thus aptly, H. K. Hartline, who so very appropriately contributes the introduction as well as an article with F. Ratliff, summarizes the significance of this new volume of the *Handbook of Sensory Physiology*. What more can a reviewer reasonably say in a short space, to show that all the essays are welcome and many of them thoughtful summaries of a busy subject? Fuortes has picked his topics and contributors well. The literature up to about 1970 is discussed and, of course, one can hear the voices and read the reviewers commenting on how dated some of the articles are already. That may be so for the specialist reading the essay of his specialty. But I do not find this especially disturbing. The requirements of a handbook such as this are that the bibliographies shall be accurate and extensive and the articles readable. Thus it is possible to find out what is going on in specialities adjacent to one's own.

For example essays such as that by A. Kropf on the structure and reactions of visual pigments and W. R. Levick on the receptive fields of retinal ganglion cells are welcome not so much to the specialist but for their readability by those primarily interested in the structure of the compound eye of insects (O. Trujillo-Cenoz) or retinal metabolism (W. Sickel).