BOOK REVIEWS

FRANZ BAUR: Einführung in die Grosswetterkunde, Wiesbaden 1948, 165. pp. Dieterich'sche Verlagsbuchhandlung.

This small volume by Franz Baur is as interesting for the author's philosophical approach to the problem of the longer-period variation of the weather and its forecasting as for the weather facts which are presented. In his introduction Baur defines his basic concepts and justifies the recognition of the *Grosswetterkunde* as an important branch, in its own right, of the science of meteorology.

By the term, *Grosswetter*, Baur refers to the large-scale weather pattern over one sector, predominantly continental or maritime, of either hemisphere. He divides the northern and the southern hemispheres each into five such sectors, and defines the *Welt-Grosswetter* in terms of the ten individual sector weather patterns. This division of the general circulation pattern into a number of individual sectors in either hemisphere is useful as a basis for analog classification of the circulation patterns, but Baur does not combine the sector patterns into any single integrated hemisphere pattern or hemisphere circulation indices. He deals with the significant features of the regional (usually the European sector from 30° W to 45° E) weather patterns which are persistent (*gleichbleibend*) over a period of days (*Grosswetterlage*), the *Grosswetterlage* largely determining the local day-to-day sequence of weather in each locality.

Baur recognizes that the first (and minor) problem of *Grosswetter* research is to establish the fact that there actually exists a real *Grosswetter* in the sense that the probability of occurrence of specific weather phenomena over long periods of time is determined by changing external weather-conditioning causes, rather than merely by the superposition of persistence and internal "chance" occurrences on the climatologically normal pattern. An example of an internal "chance" occurrence is the deposit of the precipitation of one heavy storm just on the snow side, rather than on the rain side of the freezing temperature, to furnish an extensive snow cover. Baur admits that without the presence of external (i.e., external to the weather pattern itself, not necessarily extra-terrestrial) superposed weather controls, *Grosswetter* research reduces to a study of the comparative morphology of weather patterns which has only limited forecasting significance. But once the existence of a real *Grosswetter* is established, then the principal problem of *Grosswetter* research is to determine the terrestrial or extra-terrestrial influences which condition the time-and-space variations of the general circulation pattern. It is primarily this problem to which Baur addresses himself.

In the appendix to this volume, as a subject which is too technical for the average lay reader, Baur proves to his own satisfaction, by a statistical technique which is unfamiliar to this reviewer and too elaborate for complete reproduction in this brief review, that a real *Grosswetter* does exist. For this purpose, he selects arbitrarily some nineteen individual measurements of weather elements, the occurrence or non-occurrence of which can be taken readily each day from the weather map. For each element, for each of the past 50 years, he forms a series of the daily occurrence or non-occurrence of the selected value during a fifty-day period. For eleven of these weather elements, the 50 yearly series run from July 1 through August 19, and for eight of them the series runs from January 1 through February 19. For each of these nineteen sets of 50 annual fifty-day series of values, Baur computes the average "divergence coefficient", which is the ratio of the empirical scattering to the "Markoff" scattering (the "Markoff" scattering being the Bernoullian scattering corrected to eliminate the effect of serial correlation). The 50 series averages of each of these nineteen divergence coefficients ranges from 1.03 to 1.40, average 1.24. A value of D = 100 is to be expected if these series represent only the operation of persistence and chance occurrences. According to Baur, this result lies far beyond the limits of any chance occurrence, and proves that there exist superposed changeable complexes of conditions by reason of which the probability of the occurrence of characteristic weather features over longer periods of time is different from year to year, i.e., there exists a real *Grosswetter* in the sense originally defined.

Accepting the existence of a real Grosswetter, Baur procedes to investigate its nature and physical controls. He discusses first the *Grosswetter* patterns of the European sector of the northern hemisphere, indicating how the other weather elements are related to the circulation (pressure pattern), both current and past. Baur emphasizes in particular the relationship of the pressure pattern at the tropopause level to the temperature field and sea level pressure pattern, and the dominant role of upper level steering in the movement of isallobaric centers at sea level. He completes this section with a rather elaborate classification of sea level circulation patterns in the European sector, and some interpretation of the climatology or seasonal distribution of these circulation patterns. There is little in this section of the book which will be new or surprising to any meteorologist who has worked with daily and mean circulation patterns over large areas of the earth's surface.

In the second section, Baur extends his discussion of *Grosswetter* patterns to the northern hemisphere. He discusses the heat balance of the atmosphere and the necessary meridional transport of heat in the usual terms (after BAUR and PHILIPPS). He derives the form of the general circulation in the widely accepted pattern of a thermally direct circulation which is impressed into zonal cells by the fact of the earth's rotation. The pattern of meridional cells is determined in the mean primarily by the seasonal monsoon effects of continents and oceans. The necessary meridional heat transport is effected in part by the latitudinal *austausch* of these large semipermanent seasonal cells, and in part by that of the irregularly migratory pressure centers of middle latitudes. The irregular (non-seasonal) fluctuations of the general circulation pattern Baur sees essentially as fluctuations about a normal seasonal heat balance and heat transport, any disturbance or unbalance in one direction being compensated by a swing off balance in the other direction. He offers no comment on nor interpretation of the mechanics of the widely varying cellular patterns of the general circulation which occur from week to week. His following classification of *Welt-Grosswetterlagen* consists merely of setting side by side the five sector pattern designators for the northern hemisphere above the corresponding five designators for the southern hemisphere, with the latitude of the heat equator being indicated between the two hemispheres. This classification of world weather patterns, which is capable of almost infinite variation, is sadly lacking in any unifying mechanical or dynamic principle, or in any unified expression in terms of simple indices of the state of the general circulation as a whole.

With respect to the determination of the terrestrial and extra-terrestrial influences that affect his *Grosswetter* patterns, Baur does not have much evidence to offer which is essentially new or finally conclusive. Among the terrestrial influences which he discusses briefly are volcanic outbreaks (Humphrey's theory of the reduction of insolational heating by volcanic ash), the fluctuation of the temperature and strength of the ocean currents, ice conditions in the Polar seas, and minor oscillations of the inclination of the axis of rotation of the earth. The amount of this latter variation is utterly small and must be insignificant in effect. With respect to the significance of the other three factors, there is statistical evidence pro and con, but Baur has no new evidence to add to previous investigations which have led to inconclusive or negative results. Particularly with regard to ocean currents and polar ice, the statistical and synoptic evidence favors the point of view that the ice and current conditions are predominantly, if not exclusively, results rather than causes of the general circulation patterns. Ocean temperature or ice conditions at times may be indicators of future weather patterns, but not in themselves be the physical causes.

In the fourth section of his book, Baur reviews briefly the question of periodicity in the *Grosswetter*. The daily and seasonal periods find almost an infinite variety of expression in weather phenomena, the seasonal periodicity finding expression in the monthly and seasonal frequency distribution of Baur's *Grosswetter* types. He continues with a discussion of the periodic analysis of pressure waves or rhythmic variation of pressure, including the computation of correlation coefficients for pressure values paired on opposite sides of symmetry points as defined by Weickmann. Baur says that two years' work spent on statistical analysis of this type at the Long-range Weather Forecasting Institute failed to produce enough results of forecasting significance to justify its continuance. In an interesting section in the Appendix he shows by actual experiment that by the drawing of numbers in a manner which imposed a moderate degree of serial correlation more or less corresponding to that in weather data, he obtains series which contain periodic variations and even symmetry points and symmetry correlations that are almost identical with those found in series of daily pressure observations. In other words, Baur attributes the great variety of periodicity and symmetry patterns which may be derived from pressure

series to be primarily the incidental result of serial correlation in the data, and as such to have no greater forecasting significance than the persistence itself. With this conclusion this reviewer is in hearty agreement!

In his discussion of the extra-terrestrial influences on the *Grosswetter* patterns (Section V), Baur considers the effects of the moon and the planets, and of solar radiation and sunspots. Except for the minute tidal effect of the moon on atmospheric pressure, he concludes that empirical experience (synoptic and statistical) has been able to detect no definite evidence of any effect either of the phase of the moon or of the planets on terrestrial weather. Most meteorologists today are in agreement with this conclusion.

In his discussion of solar variability Baur assumes that the final revised monthly mean values of the solar constant published by the Smithsonian Institution actually express true solar variability, an assumption which the statistical work of PAGE[1] opens to serious question. Using monthly mean solar constant values from 1919—1937, Baur produces some evidence for a double solar constant period within the sunspot cycle, with solar constant minima occurring at sunspot maximum and at sunspot minimum. He accounts for the solar constant minimum at sunspot maximum by the increased absorption of the outgoing solar radiation in the higher solar atmosphere at time of maximum, because of the increased amount of absorbing material which is driven into the higher atmosphere at time of maximum solar disturbance. Baur also produces some impressive statistical-synoptic evidence (by correlation), for the same 1919—1937 period, of increased zonal westerly circulation over northern Europe in midwinter (January-February) with increased solar constant, but in view of the shortness of the period (two sunspot cycles) and the serious doubt concerning the reality of the solar constant variation, this reviewer would be very hesitant to accept these results at their face value.

Baur agrees with most other investigators when he says that the eleven-year sunspot cycle is reflected beyond much doubt in meteorological data only in the tropics, but even there his evidence is not really conclusive. He extends some of the older correlations of KÖPPEN and C. E. P. BROOKS to more recent data with appreciable deterioration of the earlier correlations. He finds statistical evidence in the analysis of 200 years of Central European temperature data and 100 years of precipitation data for a double weather cycle, within the sunspot cycle, corresponding to his double cycle of the solar constant, and likewise for a corresponding cycle of the interseasonal monsoonal pressure contrast in Central Asia. However, the amplitudes and regularity of these long-period fluctuations are not impressive. Certainly further statistical verification of their significance than that given here by Baur would be desirable. By and large, Baur does not add much to the previous inconclusive evidence as to the degree of the dependence of world weather patterns on irregular solar activity. He recognizes the present unsatisfactory state of this evidence by his rather cautious general conclusion on the topic, with which this reviewer is in full accord, that at least certain portions of the solar radiation are subject to fluctuations to which the changes of the *Grosswetter* are definitely related, but that the many problems which are posed by this relationship can be solved only by close co-ordination of further research in atmospheric and solar physics.

In the final section of his book Baur discusses briefly his methods of extended (three to five days) and long range (ten-day, monthly and seasonal) weather forecasting. The five and ten-day forecasts are based on synoptic (the evolution from past to current and future daily and average *Grosswetter* patterns, use of analogs) and statistical (by correlation and periodic analysis) techniques. The longer period forecasts are based more on the statistical, and less on the synoptic, techniques. Baur does not, in this discussion, elaborate on the details of his forecasting techniques more than he has in the past, nor does he furnish any systematic verification evidence as to the success or skill of the forecasts. Consequently there is little point in reviewing this section further. From the impressions which the reviewer has obtained of Baur's forecasts and forecasting techniques, including the results of an earlier attempt at an objective statistical verification of two years of his five- and ten-day forecasts[2], there is no evidence that his results are significantly better than those obtained by similar forecasts prepared by other agencies.

In the appendix, Baur summarizes in one brief three-point statement the essential conclusions which he draws from the material treated in this volume, as follows: "Es existiert ein Grosswetter. Dieses wird von der Sonne gelenkt, von dem vorausgegangenen Gross- und Weltwetter geformt." (There

[1] *Monthly Weather Review*, Supplement 39, pp. 118—120.

[2] See Supplement No. 39, *Monthly Weather Review*, pp. 88—91.

exists a *Gross*-wetter. This is controlled by the sun, moulded by the preceding *Gross*- and world weather.) This reviewer is in complete agreement with this statement, and in general with the author's philosophical approach to the forecast problem, but he does not feel that other than by some statistical refinement the author has contributed much that is essentially new or significant to the proof of these hypotheses. Particularly notable is the lack of any integrating principle or unifying approach in his synoptic expression of the state or change of state of the general circulation pattern (*Gross-Weltwetterlage*).

On the other hand, there is no question but that Baur's efforts in the field of longer-range forecasting, which form the basis of this volume, constitute pioneer work in this field. The difficulties which the investigator has to face in this field are evident from the present unsatisfactory status of long-range forecasting as a science. Baur certainly deserves credit for making the effort to present a very subjective and technically esoteric yet most important branch of meteorology in a form which is comprehensible to the average intelligent reader.

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R. SCHERHAG: Neue Methoden der Wetteranalyse und Wetterprognose. Berlin-Göttingen-Heidelberg, 1948. 424 pp., 213 figures. Springer-Verlag.

During the 1930's, the publication "Täglicher Wetterbericht der Deutschen Seewarte" was an important source of information for those who were interested in current weather and current aerological observations. It was more than that: it actually gave, in figures and text, day after day an instructive picture of the working methods employed by the meteorological service of the Seewarte. The comprehensive use of aerological material gave this weather service the character of a pioneer team and the descriptive text of the bulletins often witnessed of the authors' deep personal interest in the problems. The present writer recalls with special pleasure the comments by Dr Scherhag which gave much valuable information, pointing out significant details which easily enough might have been overlooked, apostrophizing extreme conditions in a language which called things by their right name, and, above all, introducing the reader into the workshop of those German meteorologists who tried to find new laws and rules by studying three-dimensional weather.

Much has happened since these days. For a few years the second world war brought an immense increase of the aerological material in Germany and countries under German control, and an equally great increase of the need for detailed and reliable forecasts of surface weather and upper air conditions. We do not know with what feelings the German meteorologists followed their orders in pursuing their work under these conditions, so favourable and so desperate at the same time, but we may suppose that many of them, with the international view which is natural to the scientists of a truly international science, received some inspiration from the conviction that their work should prove valuable in a future of peaceful, world-wide cooperation. If this assumption is correct, it is possible to understand that German meteorologists who were helped to continue their scientific work after the war ended, have been able to produce very valuable articles and books in spite of the hard times they have experienced.

The most comprehensive monography which has, until now, resulted from this scientific activity, is the work of RICHARD SCHERHAG on *New Methods of Weather Analysis and Weather Forecasting*. This book contains 424 pages in big size, and 213 figures most of which are original and of a very high class.

The work consists of five parts entitled as follows:

(1) Development and Fundaments of Synoptic Meteorology,
(2) General Circulation of Troposphere and Stratosphere,
(3) Weather and Weather Analysis,
(4) Weather Forecasting,
(5) Long-Range Forecasting.

In the first part the author gives an interesting survey of the development of synoptic meteorology.

The German schools are, for natural reasons, treated more completely than others, and little is said e.g. about the great development which has taken place within this branch of meteorology in the United States during the last decade, but on the whole Scherhag's statements seem to be deliberate and as objective as one might claim in view of the fact that the author has a personal opinion and is ready to stand for it.

In his treatment of the development of synoptic aerology, Scherhag gives good arguments for the choice of standard isobaric surfaces made by German meteorologists, i.e. the 700, 500, 225, 96 and 41 mb levels. It certainly ought to be discussed whether this set of standard levels should not be adopted by an international convention.

"The fundaments of synoptic meteorology" is the heading of a rather short chapter (13 pp.) which contains the greater part of the very few and elementary mathematical equations of Scherhag's work. This brief treatment, of course, adds little to the generally accepted dynamical theories but may be justified as a recapitulation of theoretical ideas which are, in the author's opinion, essential for the synoptician. A theoretical meteorologist would probably, after reading this section, feel discouraged once more by the contrast between the magnificent building of theory itself and the modest, almost crippled part of it which is thought to be applicable in the weather service. — Although the treatment of the problem is very elementary, a few statements and formulations are open to criticism. It is too plain language to say, for instance, that the coriolis acceleration, being the only force acting on a straight-moving air mass, must be compensated by the gradient force if the wind should not change its direction (p. 21); and it is not convincing when one of the fundamental findings of synoptic aerology: high pressure over warm air, low pressure over cold air in the upper troposphere, is said to be *caused* by ground friction (p. 29).

Part 2, dealing with the general circulation, is of much greater value. The many tables of new aerological mean values (mainly concerning localities in Europe), and the extremely instructive charts based on these and other (partly unpublished) new means, represent no doubt years of hard work, especially hard because so many factors act together to impede a statistical treatment of aerological observations. Scherhag and others who have shared the task with him seem to have spared no effort to secure the best possible result for the greatest possible area in space and time. Nevertheless, the charts must, of course, for vast areas be considered merely as an indication of the probable general picture, the revision of which may be possible and necessary in a very short time. In fact, the German weather service in Bad Kissingen is already publishing new charts showing seasonal mean values which are, for some areas, based on a material that was not accessible for the construction of Scherhag's maps.

The most outstanding new information that can be gathered from these latter maps is perhaps the reversal of the pressure gradient which, during summer, is taking place in latitudes north of 30° N somewhere between the levels of 96 and 41 mbs. The strong easterly current at the 300 mb level over India in summer is shown to be the lowest-dipping part of a tropical stratospherical ringshaped stream which during that time of the year winds around the earth in latitudes between 10 and 25° N.[1] This is an interesting counterpart to the polar stream which in winter does not reach its maximum at the tropopause, as generally believed, but, at latitudes north of 50°, continues to increase — on the mean charts, at least — up to the highest levels from which information could be obtained by the aid of radiosondes.

The last chapter of part 2 gives a survey of the so-called stratospheric compensation, that is to say the well-known rule that the stratosphere is cold, when the troposphere is warm, and vice versa. The treatment which Scherhag gives of this question is rather comprehensive — 24 p. — and very interesting. It is pointed out that although the rule quoted above is confirmed with few exceptions by the material for any single station and month, it is *not* valid when the annual variation is considered, the stratosphere in middle and, to a much higher degree, in high latitudes being considerably warmer in summer than in winter. A detailed study of stratospheric compensation has revealed that, besides, in winter there are variations in the degree of compensation from day to day which must be connected somehow with different circulation types; the main periods seem to be of the order of magnitude of 20 days or more. Some outstanding cases of deviations from the normal compensation are given, with an interesting account of relationship to tropospherical conditions and the geographical distribution of the said anomaly. The idea of taking deviations from

[1] Scherhag suggests that this equatorial ring stream prevents any appreciable outflow ("einen stärkeren Abfluss") from the summer to the winter hemisphere, but gives no reasons for his suggestion.

an empirically determined "normal" compensation (which is a function of the season and the geographical coordinates) is favourable in several respects; the applicability is, of course, limited to such areas and seasons where compensation is the normal thing, but in middle latitudes this condition is fulfilled. In addition to his empirical results, Scherhag gives a short outline of the theory concerned. Finally, the behaviour of the wind in the compensation layer is illustrated by figures which are based on a rather great number of radar wind measurements at Berlin and show the normal changes of wind velocity and wind direction between 11,000 and 16,000 m as a function of wind velocity and wind direction, respectively, at 11,000 m. It ought to be stressed, however, that each of the dots in these figures (55—58, p. 106—107) does not represent an individual case but rather a group of cases. One additional diagram, at least, showing the scattering of observed individual values within a month or a season, would have been of considerable interest.

The third part, which deals with weather and weather analysis, is the bulk of the whole book, containing nearly 200 pages. It consists of three chapters, entitled Elements of the weather map, Analysis of the weather map, and Typical weather situations (Wetterlagen) in Europe. The disposition of the great variety of facts and thoughts given in the first of these chapters may at the first glance seem puzzling, but a closer study will make the reader understand and, quite probably, accept the reasons for the untraditional order of presentation. The dynamical anticyclone is treated at first, followed by the cold anticyclone, the air-masses, the frontal zone, the cyclones and their fronts, the hurricanes, high-tropospherical processes, the cold pool ("Kaltlufttropfen") and, at last, stratospheric weather processes.

The general description of air-masses, fronts, cyclones, and anticyclones is, of course, on the whole in good agreement with the treatment given in other text-books of later years. Nevertheless, it can be gathered from almost every page how deeply the author is personally engaged in the problems which he is discussing. Scherhag is equally far from a dogmatism which is inclined to reproach Nature with its poor fitting to theory, and a nihilism which finds everything diffuse and turbid and nebulous.

For some practical purposes, one might have wished that the author should have chosen his examples, or at least a great part of them, from weather phenomena of moderate intensity, from the everyday problems of analysis and forecasting. No doubt, a collection of such examples might have been useful, too, for students of meteorology, but it is not difficult to understand that Scherhag has preferred to select situations of special interest, thus making his book something of a catalogue of the most outstanding weather events in Europe and adjacent parts of the Atlantic during more than 50 years. This should not be considered as a kind of journalistic record-hunting; in fact, the circumstances under which meteorological extremes occur deserve serious consideration and are well worth a description, provided this description includes an account of the physics of the case that is treated.

Some of the definitions and statements in this section are open to criticism. A front is (p. 248) defined as a narrow boundary zone, where air masses of different origin and different character are moved towards one another; it seems doubtful whether this definition accounts for e.g. a fast moving cold front. — The rules given by GUILBERT in his "Nouvelle Méthode de prévision du temps" are treated with a remarkable esteem; one might suppose that Scherhag feels indebted to Guilbert whose work may with some reservation be said to anticipate the modern prognostic chart and Scherhag's own divergence theory. In the opinion of the present writer, however, Guilbert's often quoted rule of succession of pressure ridges and troughs with 24 hours interval is in lack of every theoretical support and of little or no practical value. — Referring to v. FICKER's so called primary and secondary waves, Scherhag writes that a phase difference of $^1/_4$ wave length between the ground level and the upper troposphere can be brought about by a horizontal temperature gradient in the layer between. This, of course, is true, but if so, the lowest mean temperature of the troposphere must be found more than $^1/_4$ wave length behind the pressure minimum at the ground, or, in other words, the highs must on an average be colder than the lows, and this is, in fact, an exception rather than the rule. The phase difference between high-tropospheric and low-tropospheric pressure waves is less than the phase difference between temperature and low-tropospheric pressure waves, and even the latter is in most cases less than $^1/_4$ wave length.

It shall not be concealed that besides these points there are some other passages in Scherhag's book where one may have reasons to put a question mark on the margin. The book is, on the whole, written in such a way that the reader has no chance to fall asleep, and some of the weak points may, indirectly, be useful as incitements to new research work; with

a few exceptions, the weak points are not simply errors.

The main value of Scherhag's work lies, no doubt, in the straightforward and skilful analysis of a great number of charts, including upper air charts and mean charts (but, curiously enough, no cross-section of the type which is so frequent in aerological literature), and the accompanying text with its multitude of important remarks on general problems. Nearly all situations described are of great interest, either for illustrating well-known facts or for the discussion of new or intricate problems. Some of the examples may be briefly mentioned here: the great anticyclone over the arctic in the middle of Jan. 1940 (p. 124), the famous anticyclone over Europe about Jan. 23, 1907 (p. 134), the instructive case of cyclogenesis in a frontal zone over eastern North America about Febr. 8, 1933 (p. 157), the extremely deep cyclones of Dec. 8, 1886 (p. 179) and Jan. 2, 1933 (p. 187), the unprecedented outbreak of Siberean arctic air to Europe about Jan. 25, 1942 (p. 233), and the severe gale over the Baltic region on July 9, 1931 (p. 280).

The fourth part, called Weather Forecasting, attaches to the third part by continuing the description of weather situations; the situations described in this section are all of them complicated and difficult from a prognostic point of view, except one (p. 326) which has been inserted to illustrate the construction method of prognostic charts. It is true that this method stands out quite clearly just because of the uncomplicated situation to which it is applied but it might have been more natural to start with some examples of this type and proceed to more intricate prognostic problems. It should have been of considerable interest to see a detailed description of the construction of prognostic charts in a few really difficult cases: one should exemplify the striking successes which are sometimes achieved; one or two should demonstrate the equally striking failures which remind us of the imperfection of this (and, probably, any other) approach to a solution of the problem of forecasting weather.

As in the whole book, the casuistic treatment of the subject is much fuller and much more valuable than the deductive passages. It must be acknowledged, though, that the author has made an effort to compile some rules which, presumably, are of prognostic value; these rules, most of which are formulated by Scherhag or RODEWALD, no doubt deserve the attention of forecasters, but no final judgment as to their practical value or theoretical foundation can be given as yet. — In a section concerning forecasting of individual weather elements the author renders much valuable advice. Some principal remarks upon the formulation of forecasts are brillantly written and ought to be studied thoroughly by all weather forecasters. The warnings against "Gummiprognosen" and "a deadly levelling" of the wording of a forecast are not only of much need but also characteristic for the spirit of the author.

The last few pages of the text deal with the problem of long-range forecasting. The method of using analogous situations is briefly described, and the difficulties in finding sufficiently close analogies are discussed. Scherhag's pessimism on this point, as well as concerning the method of multiple correlations, may be justified, but it stands out in marked contrast to the benevolence with which he presents such items as symmetry points, reflexion points, "singularities", and sun spot cycles in the atmosphere. As far as the so called wave phenomena studied by the Leipzic school are concerned, there may be some reason to suppose that they are not merely accidental in character, but when Dr. Scherhag, evidently, believes that long-range forecasts may well be based on these theories it is difficult to follow him. As for the singularities, Scherhag bases his discussion upon the works of SCHMAUSS, FLOHN and other German meteorologists. It is true that he warns against an exaggerate use of the singularities, and his statement that an increased probability ("eine besondere Bereitschaft") for a certain weather type is present at certain times is not incorrect in itself, if the term *at certain times* is understood to mean during periods of the duration of several weeks; but one gets the impression that Scherhag is ready to accept a good deal of the results which the singularity specialists claim to have arrived at. After the book was written, professor J. BARTELS has given a very clear, sceptical and convincing survey of the whole problem from a statistical point of view in articles published in "Annalen der Meteorologie", and it may be hoped that, on account of this survey, the whole discussion of the singularities may in a following edition of Scherhag's book be replaced by a mainly historical treatment of the singularity epoch in German meteorology.

The literature list given at the end of the book is unusually comprehensive (897 numbers) and seems to have been compiled with great care. Among the articles mentioned in the list, some have been issued in periodicals or series which are not familiar to meteorologists in general, a fact which increases the value of the list for the research worker.

The make-up of the book is of a high standard. The figures have been drawn with great care, and the reproduction is remarkably fine. But it should not be concealed that this high technical standard must have been an important cause for the high price of Scherhag's book (75 Reichsmark!). It must be hoped that the book will be translated into English and French and issued in a number of specimens sufficiently great to reduce to price considerably. If such a translation is made, there will be an opportunity to correct a few errors, some of which have been mentioned above, but this will not and should not change the general character or the personal note of Scherhag's great work.

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Table of contents and index to Tellus Vol. I will be distributed with Vol. II, No 1, which is scheduled to appear in February 1950.