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RESULTS OF BALLOON FLIGHTS
FOR COSMIC RADIATION MEASUREMENTS
AT WEISSENAU AND LINDAU
(GERMANY)

by

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H. E R B E

Max-Planck-Institut für
Aeronomie
INSTITUT FÜR STRATOSPHERENPHYSIK
Lindau / Harz

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Abstract: The results of 10 balloon flights with counter telescopes and of 24 flights with single counters are represented. It was found that a nearly unique correlation exists between the counting rate in a certain altitude and the counting rate of the neutron monitor on ground if only galactic radiation impinges at the top of the atmosphere. The counting rates of the single counter scatter in a more pronounced manner with respect to the average expectation values related to the neutron counting rates than those of the telescope do. This is considered as due to the influence of meson decay along the very extended paths traversed by particles arriving from strongly included directions. These are accepted by the single counter with its larger aperture in contrast to the telescope which responds only to particles arriving in a narrower cone centered around the vertical.

In a preceding paper ¹⁾ we could state a close correlation between the variations of the Cosmic radiation in high altitudes above Weissenau (cut off rigidity 3,2 GeV according to Quenby and Webber) and the nucleonic component on ground. After the removal of our Institute from Weissenau to Lindau near Göttingen (cut off rigidity 2,4 GeV) measurements of the same kind have been continued and supplemented by flights with other equipments.

Flights with Geiger-Müller-counter telescopes.

For the measurements above Weissenau a GM-counter-telescope described in ref. 1 was used which recorded particles arriving essentially from directions near the vertical. The counting rates were integrated by a mechanical recorder and its readings together with the air pressure telemetered to the ground station every ten seconds. The various flights covered a period of 15 months during which the counting rate of the neutron monitor at Weissenau decreased by 12 % of the initial value. Concurrently the intensity of the radiation in high altitudes decreased correspondingly.

By comparison of the different intensity versus pressure curves the following law could be established:

If only galactic radiation impinges at the top of the atmosphere, the ratio of the relative variation of the coincidence rate $K(p)$ at an air pressure p to the relative variation of the nucleonic component $N(720)$ at an air pressure of 720 Torr is a quantity which only depends on p .

$$\frac{dK(p)/K(p)}{dN(720)/N(720)} = S_t(p) \quad (1)$$

whereby the index t shall denote that the quantity $S_t(p)$ refers to the telescope actually used. It has been evaluated in ref. 1. Upon integration one gets:

$$K(p, \tau) = K(p, \tau_0) \frac{N(720, \tau)}{N(720, \tau_0)} S_t(p) \quad (2)$$

That means: If at an arbitrary time τ_0 the coincidence rate $K(p, \tau_0)$ is a known function of the air pressure p , the corresponding function $K(p, \tau)$ at any other time τ can be evaluated on the base of the counting rates of a neutron monitor at the same times. The fact that the intensity variations of the secondaries at only two different locations and levels are related to each other by only one parameter implies that also the modulation effect of the primary galactic radiation can be characterized largely by only one parameter too. An adequate possibility has been discussed by Ehmert²⁾.

In Fig. 1 the counting rates of the telescope measured during the different flights are plotted versus the air pressure. The solid lines represent the expectation curves evaluated according to equation 2. with the data of the flight on July 1, 1957 as basic values for the time τ_0 . At this flight an air pressure of 10 Torr was reached and no peculiarities were observed.

It can be seen that the measured points mostly fit well the expectation curves, except for the data on January 22, 1957 and for the deviating values during certain intervals of the flights on October 2, 1956 and on September 9, 1957. These cases have been discussed thoroughly in ref. 1.

We are still not in position to exclude a temporary malfunction of a circuit component but as sometimes very peculiar changes actually do occur we preferred to present also these results because simultaneous flights might have been carried out elsewhere which could be compared with, or geophysical events might have occurred at that date giving significance to the observed deviations.

This happened very probably in regard to the measurements on January 22, 1957. Since an excess counting rate was only measured down to an atmospheric depth of 400 g/cm² the corresponding energy of solar protons could scarcely have exceeded 1 GeV whereas the geomagnetic cut off for protons at Weissenau amounts to 2,6 GeV³⁾. At first sight this seemed contradictory to us. As however in the meantime some very clear cases could be established during magnetic storms whereby solar protons arrived at locations forbidden to them in the undisturbed magnetic field according to Störmer's theory^{4,5,6)}, the data in question are more unlikely. The following sequence of events is to be considered as relevant: A solar flare of importance 3⁺ was observed on January 20, 1957 from 0928 to 1417 UT. The plasma beam arrived at the earth on January 21 and caused a strong magnetic SSC-Storm (sudden commencement). During the night of January 21/22 unusual auroral displays were observed even over Lindau/Harz (51° effective geom. latitude). When the apparatus was aloft, three polar stations recorded cosmic noise absorption of the type indicating solar protons.*

* The author is indebted to Dr. Bailey, Boulder (Colorado), for a private communication.

It is assumed therefore that the plasma beam when approaching the earth, caused such a lowering of the cut off in Weissenau that protons with the energies in question were also admitted.

After the removal of the Institute to Lindau two additional flights were carried out with the same telescopes. Characteristic data of the flights are compiled in table 1.

Table 1.

Date	launch	appar. Nr.	appar. at sum- mit UT	lan- ding	calibr. factor	$I_{\max}$	neutrons/2 h Weissenau
19/6/58	0952	II/2	1141	1237	0,453	385	57300
3/4/59	1015	III/1	1205	1240	0,422	360	56990

The calibration factors were determined by comparing the coincidence-rates of the telescopes with the records of a stationary cubical-meson-telescope without lead absorber at Lindau, installed there among others for monitoring the cosmic radiation during and following the IGV. All data are normalized to a calibration factor of 0,430 on which all the curves in Fig. 1 are based too.

Since the neutron monitor at that time was still located at Weissenau the neutron counting rates inserted in table 1 refer yet to this station. The data represent the average counting rate during the period of the ascending flights.

Fig. 2 shows the coincidence rates measured during the flights on June 19, 1958 and April 3, 1959.

Since the intensities at the two flights and also the corresponding neutron counting rates on ground do not differ appreciably, a new derivation of $S(p)$ was not possible. If we apply however as a first approximation $S_t(p)$ evaluated for Weissenau, the solid curves in fig. 2, related to each other according to equation 2, fit satisfactorily the measured values.

Since the $S_t(p)$ relates the variation in high altitudes and on ground at the same geomagnetic latitude to each other, the variation of the neutron data at Weissenau has to be corrected for Lindau before inserting in equation (2)

On account of comparison carried out after the removal of the neutron monitor to Lindau, it turned out that the relative variations at Lindau amount to 1,26 fold the variations at Weissenau. It can be seen that by relating

the expectation values for the flight data at Weissenau corresponding to the neutron rates determined on ground to these actually measured at Lindau, the latitude effect can be evaluated for various atmospheric depths. The result is represented in table 2.

Table 2.

Pressure interval (Torr)	150 - 200	70 - 100	40 - 60	20 - 30	10 - 15
Intensity above Lindau					
Intensity above Weissenau	$1,01 \pm 0,03$	$1,06 \pm 0,03$	$1,08 \pm 0,03$	$1,14 \pm 0,03$	$1,17 \pm 0,03$

The values refer to the time interval during which the counting rate of the neutron monitor in Weissenau amounted to 57000 counts/2 h.

Flights with Single Counters.

In order to achieve the launchings of a larger number of flights at lower costs, a smaller apparatus with a single counter of the Victoreen type 1 B 85 was developed. A similar model with the same type of counter was also used by cosmic ray research groups in Berkeley and Durham (USA) (8,9). 24 successful flights with this device were performed at Lindau. The results of the different flights are plotted in Fig. 3 a and b. Fig. 4 shows counting rates averaged over different intervals of the pressure plotted versus the counting rates recorded simultaneously by the neutron monitor at Lindau.

In the bilogarithmic plot the points fit satisfactorily to straight lines as was observed also for the telescope. The lines themselves are derived after the method of least squares. At smaller pressures the points scatter considerably and the position of the regression line becomes uncertain. The straight lines for the intervals 10 - 15 Torr and 20 - 30 Torr published in ref. 6 and based on a smaller number of flights differ somewhat from those considered now as improved ones. Using however the improved reference lines only minor deviations remained which scarcely can be attributed to systematic changes. The significant deviation on July 15 which was confirmed also by measurements of several USA-groups has been thoroughly discussed elsewhere ⁶⁾.

The values for the steepness $S_z(p)$ of the straight lines in Fig. 4 are plotted in function of air pressure in Fig. 5. The curve adjusted to the points represents the best fit in the limits of the errors marked by crosses. Using the values $S_z(p)$ of this smooth curve and introducing them into equation (2), the "normal" curves for galactic radiation drawn in Fig. 3 were derived. That one of July 15 was taken basic for the time T_0 . It is situated halfway between the limits of the variations.

In general the measured values fit well the predicted curves at atmospheric depths exceeding that of the radiation maximum. This agreement is also striking in Fig. 6 where the record of the neutron monitor is shown all days when flights were carried out.

The circles with vertical bars refer to the counting rates of the single counter measured in a pressure interval between 40 - 60 Torr whereby the base of the logarithmic scale has been chosen 1,5 times of that applied for the neutron counting rate. At atmospheric depths below 40 Torr the flight data scatter in a more pronounced manner and more irregularly in regard to the neutron curve than has

been found for the coincidence rate of the telescope. This shall be discussed in detail in the following section. On account of the improved normalization the exponent of the energy spectrum of the solar protons $\gamma = 3,6$ ($f(E)dE \sim E^{-\gamma}dE$) derived for the event of July 15, 1959 in ref. 6 appears a little too **high**. Since however the deviation does not exceed the limits of errors to which the evaluation of γ is subjected, we can renounce on applying a correction.

Comparison of the intensity variations
measured with the telescope and the singel counter.

The ratio of the relative variations of the primary galactic radiation as measured with the counter telescope above Weissenau to those of the neutron counting rates on ground amounts to a little more than two. It exceeds however scarcely 1,5 if one replaces the telescope data by the single counter data. This discrepancy is due to the fact that the single counter with vertical axis is rather efficient for counting particles arriving horizontally. Consequently the average mass layer traversed by the recorded particles is considerably larger than is indicated by the measured air pressure p .

Telescope and single counter data can therefore be compared only for equivalent weighted means of mass layers traversed in the average by the recorded particles. Even then no complete agreement can be expected because the mean mass layer calculated for the single counter includes a larger variety of layer thicknesses than that for the telescope.

If we neglect the curvature of the earth, the average air layer $\bar{x}$ can be defined by

$$\bar{x} = \frac{p}{\cos \bar{\gamma}} \cdot K \text{ gcm}^{-2} \quad (3)$$

whereby $K = 1,36 \text{ gcm}^{-2} \text{ Torr}^{-1}$ and $\bar{\gamma}$ represent the weighted mean of the zenith angle distribution of the directional

intensity $I(\vartheta, p)$ per steradian, unit time, and unit area perpendicular to the direction ϑ at atmospheric depth p . If we denote by $F(\vartheta)$ the effective area at the detector, we get:

$$\bar{I}(\vartheta, p) = \frac{\int_0^{\pi/2} I(\vartheta, p) F(\vartheta) \sin \vartheta d\vartheta}{\int_0^{\pi/2} I(\vartheta, p) F(\vartheta) \sin \vartheta d\vartheta} \quad (4)$$

For a counter of cylindrical shape with length a and diameter $2r$ the effective area can be expressed by

$$F(r) = 2ra \sin \vartheta + \pi r^2 \cos \vartheta.$$

This function is represented graphically in Fig. 7. In a preceding paper ¹⁾ $L(\vartheta, p)$ has been derived from our own measurements of the vertical intensity. It agrees satisfactorily with the directional measurements of Stroud, Schenck and Winckler ¹⁰⁾ for pressures exceeding 50 Torr.

For smaller pressures and zenith angles exceeding 60° the values $I(\vartheta, p)$ introduced in equation 4 are to be considered only as rough estimates. The integration of equation 4 has been carried out graphically.

An example of the directional counting rate used in equation (4) for an atmospheric depth corresponding to 20 Torr is shown in Fig. 8. This curve represents the product of $F(\vartheta) \cdot \frac{I(\vartheta, p)}{I(0, p)}$ whereby the fraction signifies the directional intensity measured in units of the vertical intensity at the same pressure p . The area enclosed by the curve and the abscisse is divided in 4 sections (hatched and open) marking intervals of zenith angles accepting one fourth of the total counting rates each.

Fig. 9 shows for comparison the weighted mean of the zenith angle in function of air pressure for the single counter and the telescope. It is seen that the mean zenith angle of the single counter increases considerably for pressures below 100 Torr whereas that of the telescope remains essentially constant.

The ratio of the variations S_t and S_z for the telescope and the single counter respectively defined by equation (1) are plotted versus the mean air layer $\bar{x}$ in Fig. 10. The very precise point for the ratio on ground (1090 g/cm^2) has been evaluated from the records of the " μ -meson-monitor" and the neutron monitor.

S_t and S_z agree down to a mean air layer of 120 g/cm^2 at an atmospheric depth of 50 Torr. Below 120 g/cm^2 S_t increases up to a ratio of 2,2 at 20 g/cm^2 whereas in contrast to this S_z remains practically constant at a ratio of 1,5.

Since it is to be expected that any mechanism modulating the galactic Cosmic radiation will affect the low energy particles more strongly than the high energy ones, one would at first sight also expect that the variations measured with the thin walled single counter (30 mg/cm^2) are more pronounced than those measured with the telescope ($2,1 \text{ g/cm}^2$).

That this is not true arises from the transition effect which causes the intensity of secondary particles to increase with increasing air layer. Consequently in the region of atmospheric depths between the radiation maximum and the top of the atmosphere the ratio of secondary particles - produced in the average by relatively high energy primaries - to low energy primaries recorded by a detector increases with increasing zenith angle. Since the single counter predominantly responds to particles from inclined directions not accepted by the telescope, it reflects intensity variations of primaries with higher energies and weaker modulation than the telescope does. Hence $S_z(p)$ near the top of the atmosphere is also expected to be lower than $S_t(p)$.

Finally it may be pointed out that the experimental points plotted in Fig. 3 fit well the normal curves calculated on the base of S_z taken from Fig. 5.

Discussion of the scattering
of the counting rates at low air pressures.

Fig. 4 shows that the scattering of experimental points in regard to the regression lines increases with decreasing air pressure. How can this be explained?

We could infer from our measurements with the telescope and the single counter that the modulation of the galactic radiation can be described always by a unique law. Since all particles above the geomagnetic cut off at Lindau manifest themselves by secondaries detectable on ground, it is to be expected that also a unique relation between the primaries and any recorded secondary component exists. Deviations from this law indicate either that the spectrum of primaries was changed by superposition of solar radiation or by a change of the normal cut off as a consequence of magnetic storms. For most flights, there is however no evidence for that. It is furthermore improbable that the scattering of the points referring to different flights reflects differences in the efficiencies of the counters actually used because then the intensity during one entire flight should deviate systematically from the normal curve. This would also contradict to the calibrations which showed that the absolute counting rates at constant conditions of irradiations did not differ by more than 2 % from the average for all counters.

What concerns deviations possibly based on errors of the pressure data, the following can be stated:

The onset of the pressure signals was fixed with an accuracy of $\pm 0,2$ Torr. If one plots the pressure versus, the time the sequence of calibration points fits to such a smooth curve that the error of interpolation remains below 5 %. In order to adjust the pressure data precisely to the normal curves at low pressures, the calibration of the barometer would have to be changed in some cases. This is undoubtedly can be rejected. It seems to us that the ob-

served scattering is rather due to the fact that the mean air layer is not uniquely determined by the air pressure. At an air pressure of 10 Torr half of the recorded particles arrive from directions with zenith angles larger than 69° , one fourth from directions exceeding angles of 80° . Hence one fourth of the particles traverses distances in the air from 75 km up to 400 km while passing from a pressure level of 1 Torr to a level of 10 Torr. During the passage of the above mentioned geometrical distance the influence of meson instability is not negligible. This implies that variations of the distribution of temperatures in such extended regions will influence the counting rate markedly. As for the telescope the corresponding region defined by the aperture does not exceed distances of 40 km this influence is not observed.

S u m m a r y :

Between October 1956 and December 1957 eight flights with counter telescopes were carried out above Weissenau (geom. latitude eff. 47° N); two additional flights with telescopes and 24 flights with single counters were launched between June 1958 and September 1960 at Lindau/Harz (geom. latitude eff. 51° N).

The flights with the telescopes lead to a unique relation between the coincidence rates at constant pressure levels and the counting rates of the neutron monitor on ground. The same holds for the measurements with single counters below the Pfozter-Maximum. In higher altitudes the correlation is still remarkable but not so close for the telescope data.

The ratios of the relative time variations of the galactic Cosmic Radiation to those recorded by the neutron monitor on ground agree for the telescope and single counter data below the Pfozter-Maximum if plotted in function of the mean air layer calculated on the base of the detector's aperture. At small atmospheric depths (low air pressure), the relative variations of the single counter data are smaller than those of the telescope. It has to be considered that the accuracy of the ratios in the latter case is affected by a pronounced scattering of the counting rates in regard of the regression line.

It is likely that these irregular deviations are a consequence of the large aperture of the single counter which accepts mostly secondary particles arriving nearly horizontally after having traversed very extended path length in the atmosphere. If the distribution of the temperature varies irregularly along these paths the effective mean air layer is not only a function of the aperture of the detector and the atmospheric depth where the measurements

are made but also of the remote temperature distribution which is not known.

This fact has to be considered in comparing series of measurements with detectors of pronounced efficiency at large zenith angles.

I am indebted to Prof. Dr. Ehmert and Dr. G. Pfozter for numerous helpful discussions. This work was sponsored in part by the European Office of Aerospace Research of the USA Air Force.

R e f e r e n c e s

- 1) H. Erbe: Auswirkung der Variationen der primären kosmischen Strahlung auf die Mesonen- und Nukleonenkomponente am Erdboden.
Mitt. a. d. Max-Planck-Institut für Aeronomie, Nr. 2, (1959).
- 2) A. Ehmert: On the modulation of Primary Cosmic Ray Spectrum by Solar Activity.
Proc. Moscow Ray Conf. IV, 142, (1960).
- 3) I.J. Quenby, W.R. Webber: Cosmic Ray Cut-off Rigidities and the Earth's Magnetic Field.
Phil.Mag. 4, 90, (1959)
- 4) P.S. Freier, E.P. Ney, I.R. Winckler: Balloon Observations of Solar Cosmic Rays on March 26, 1958.
J. Geophys. Res. 64, 685, (1959).
- 5) E.P. Ney, I.R. Winckler, P.S. Freier: Protons from the Sun on May 12, 1959.
Phys. Rev. Let. 2, 183, (1959).
- 6) A. Ehmert, H. Erbe, G. Pfotzer, C.D. Anger, R.R. Brown: Observations of Solar Flare Radiation and Modulation Effects at Balloon Altitudes, July 1959.
J. Geophys. Res. 65, 2685, (1960).
- 7) H. Erbe: Ein Ballongerät zur Messung der kosmischen Strahlung in großen Höhen.
Elektronik (1961).
- 8) R.R. Brown: Excess Radiation at the Pfotzer-Maximum during Geophysical Disturbances.
J. Geophys. Res. 64, 323, (1959).
- 9) I.E. Henkel, I.A. Lockwood, I.H. Trainer: A Comparison of the Cosmic Ray Intensity at High Altitudes with the Nucleonic Component and Ground Elevation.
J. Geophys. Res. 64, 1427, (1959)
- 10) W.G. Stroud, I. Schenck, I.R. Winckler: A Preliminary Directional Study of Cosmic Rays at High Altitudes.
Phys. Rev. 76, 1005, (1949).
- 11) T. Obayashi, Y. Hakura, Space Research, COSPAR-Meeting Nizza 1960, p. 665.

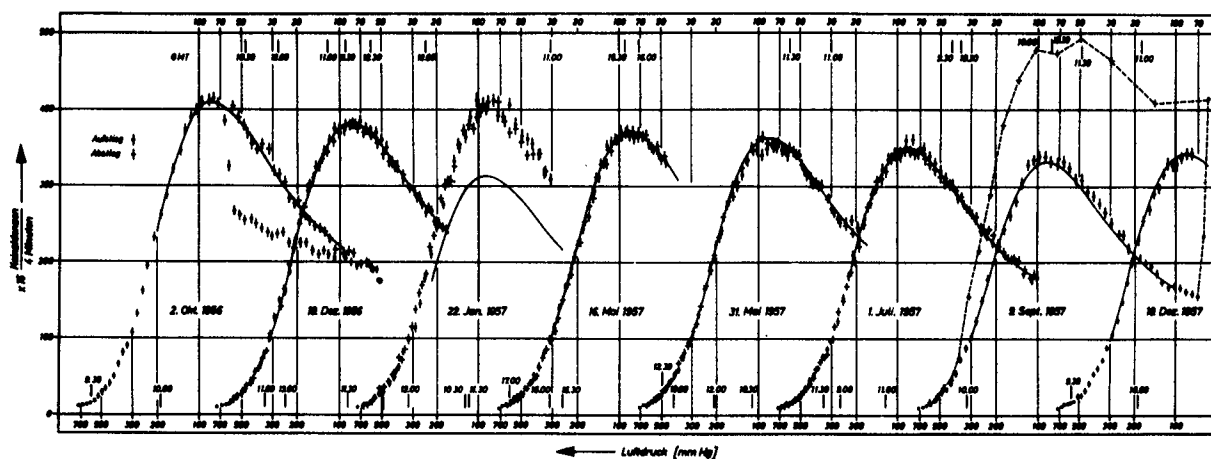


Fig. 1 Coincidence-rate of a counter telescope in function of the atmospheric depth measured by balloon flights above Weissenau

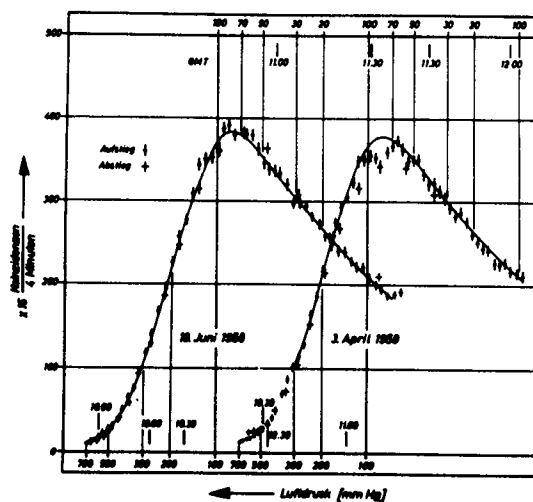


Fig. 2 Coincidence-rate of GM-counter telescope in function of the atmospheric depth above Lindau/Harz

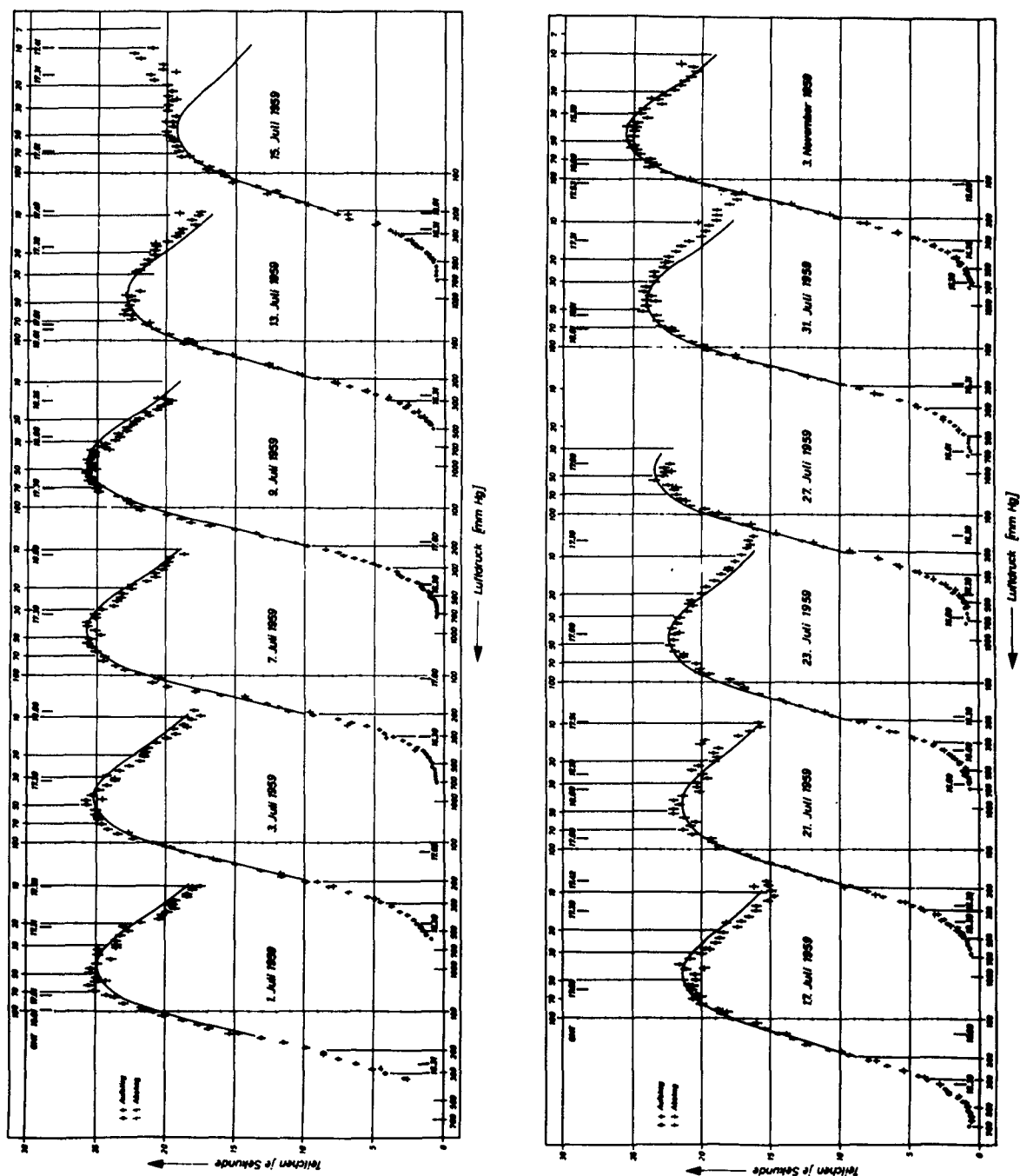


Fig. 3a Counting rates of single counters in function of the atmospheric depth above Lindau

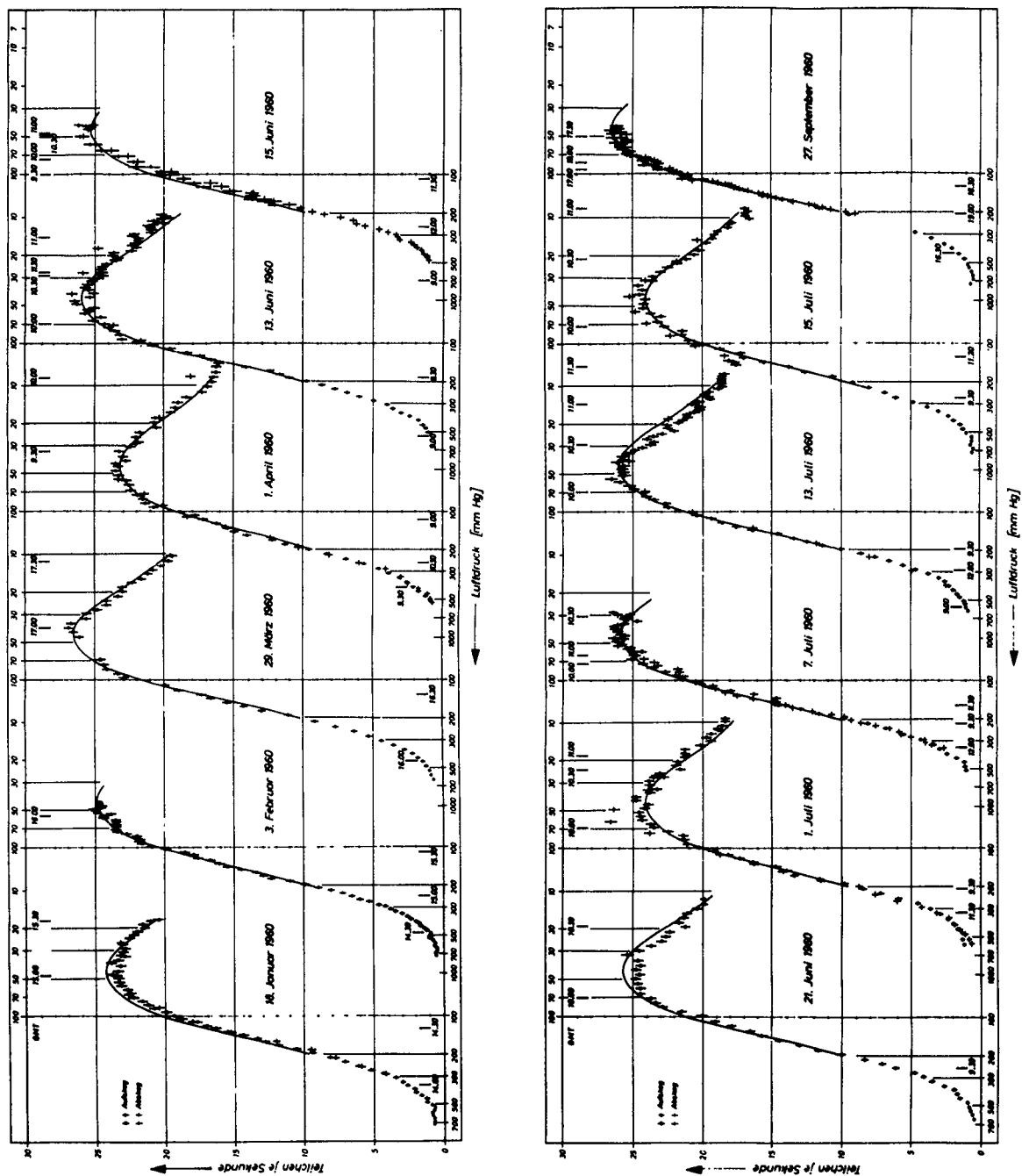


Fig. 3b Counting rates of single counters in function of the atmospheric depth above Lindau

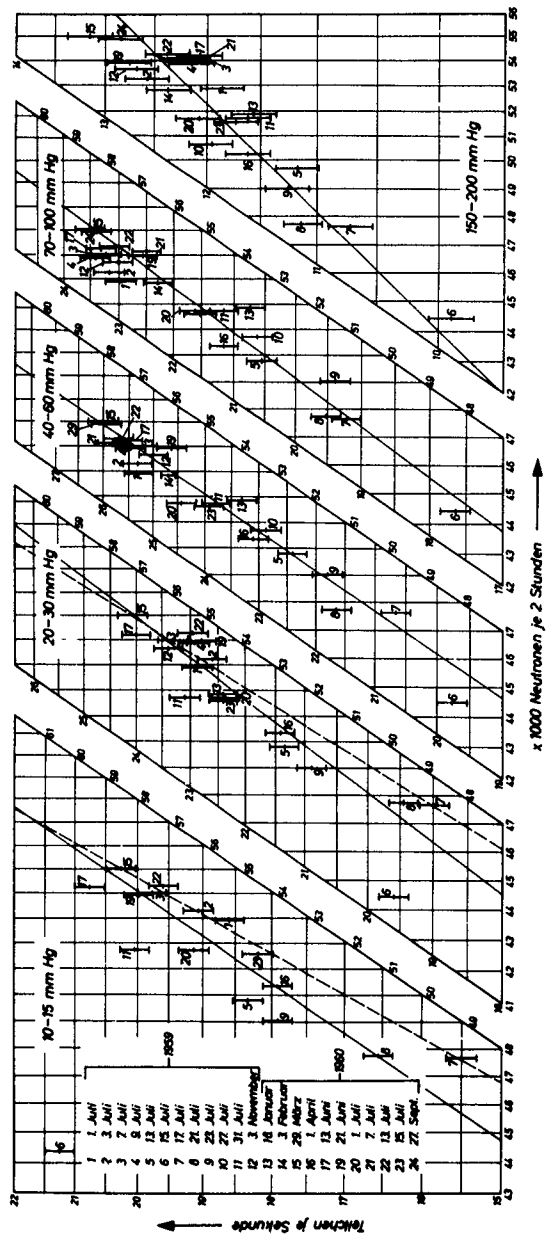


Fig. 4 Average counting rate of the single counter in different intervals of atmospheric depths in function of the neutron-counting-rate at Lindau

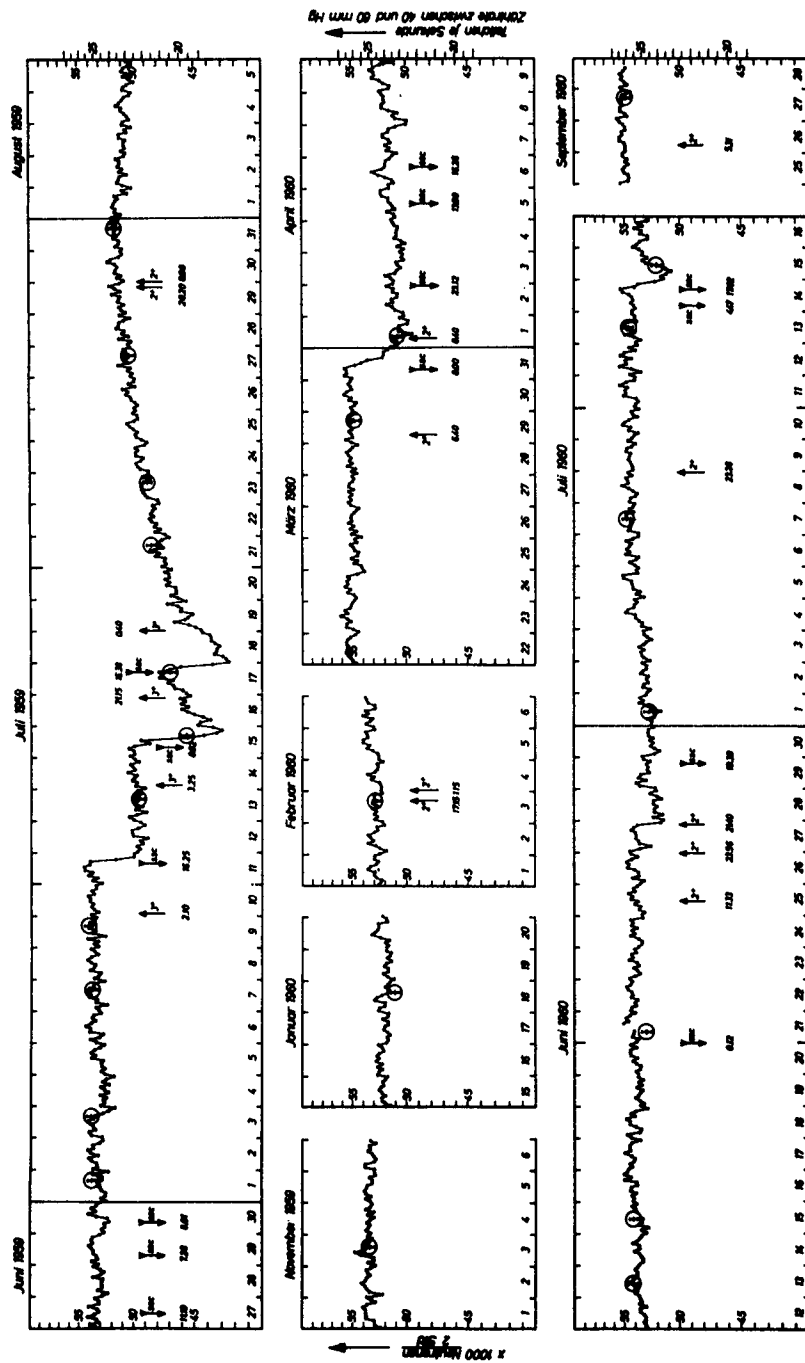


Fig. 6 Counting rate of the neutron monitor at Lindau in periods of balloon flights and counting rates of the single counter at the Pnotzer-Maximum

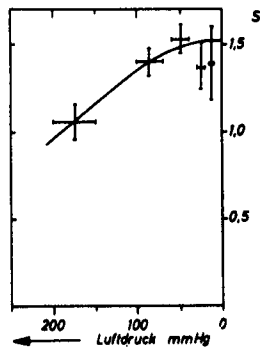


Fig. 5 Ratio S_z of the relative intensity variations in different atmospheric depths to the variations of the neutron component on ground

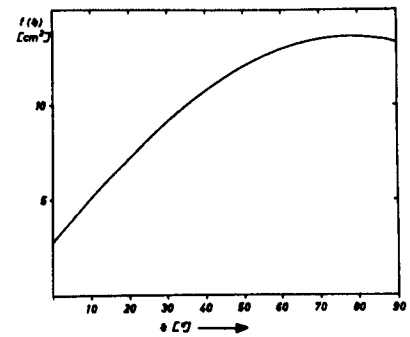


Fig. 7 Effective area of a single 1 B 85 counter versus zenith angle

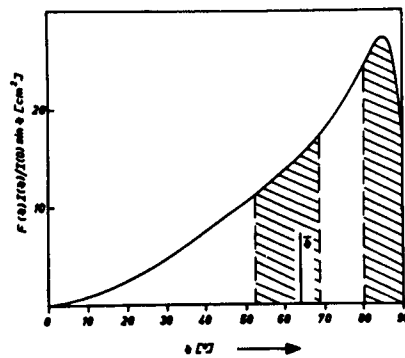


Fig. 8 Relative counting rates due to different regions of zenith angles

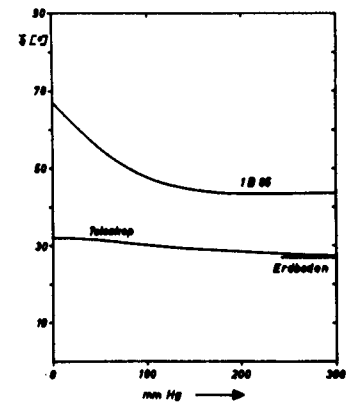


Fig. 9 Average zenith angle $\bar{\theta}$ of the single counter and the telescope

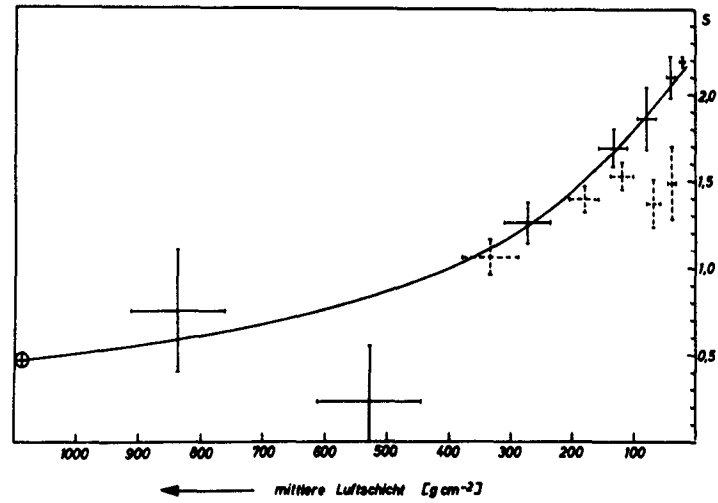


Fig. 10 Ratios $S_t(p)$ (solid crosses) for the telescope and $S_z(p)$ (dotted crosses) for the single counter in function of the average air layer traversed by the recorded particles

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ABSTRACT: The results of 10 balloon flights with counter telescopes and 24 flights with single counters covering a period from October 1956 to September 1960 are represented. - A nearly unique correlation between the counting rates of the detectors and the counting rates of the neutron monitor on ground was found in case that only galactic radiation impinges at the top of the atmosphere. Differences of the proportional factors for the single counter and the telescope are discussed.

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