# INVESTIGATIONS OF SELECTED EUROPEAN CYCLONES BY MEANS OF SERIAL ASCENTS

## CASE 3[1]: DECEMBER 30-31, 1930.

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(Manuscript received 21. March 1935.)

### Introduction.

During the days December 30—31, 1930 sounding balloons were released from Uccle for the purpose of exploring aerologically a fairly deep depression travelling across Southern England to the North Sea. M. Jaumotte, the Director of the Royal Meteorological Institute of Belgium, has again been so generous as to place all the records at my disposal for investigation. In presenting herewith the results, I wish to express my most sincere thanks to M. Jaumotte and to those of his assistants who have been helping with the ascents and their evaluation.

The plan of the investigation was just the same as that of the previous series of ascents described in Geofysiske Publikasjoner Vol. IX, No. 9 to which I can herewith refer. Technically this last series was less successful than those in 1928, mostly due to leaking balloons, so that many of the records had to be rejected. Even the 38 ascents retained for use in this analysis (tabulated at the end of the paper) are not very reliable, especially in the uppermost region. Furthermore, the humidity values are not trustworthy. Nevertheless the large scale features of the explored depression stand out so well, that I do not hesitate in discussing them in this paper.

[1] Case 1: March 28—30, 1928, Beiträge zur Physik der freien Atmosphäre, Band 21, Heft 1, 1933. Case 2: Dec. 26—28, 1928, Geofysiske Publikasjoner, Vol. IX, No. 9.

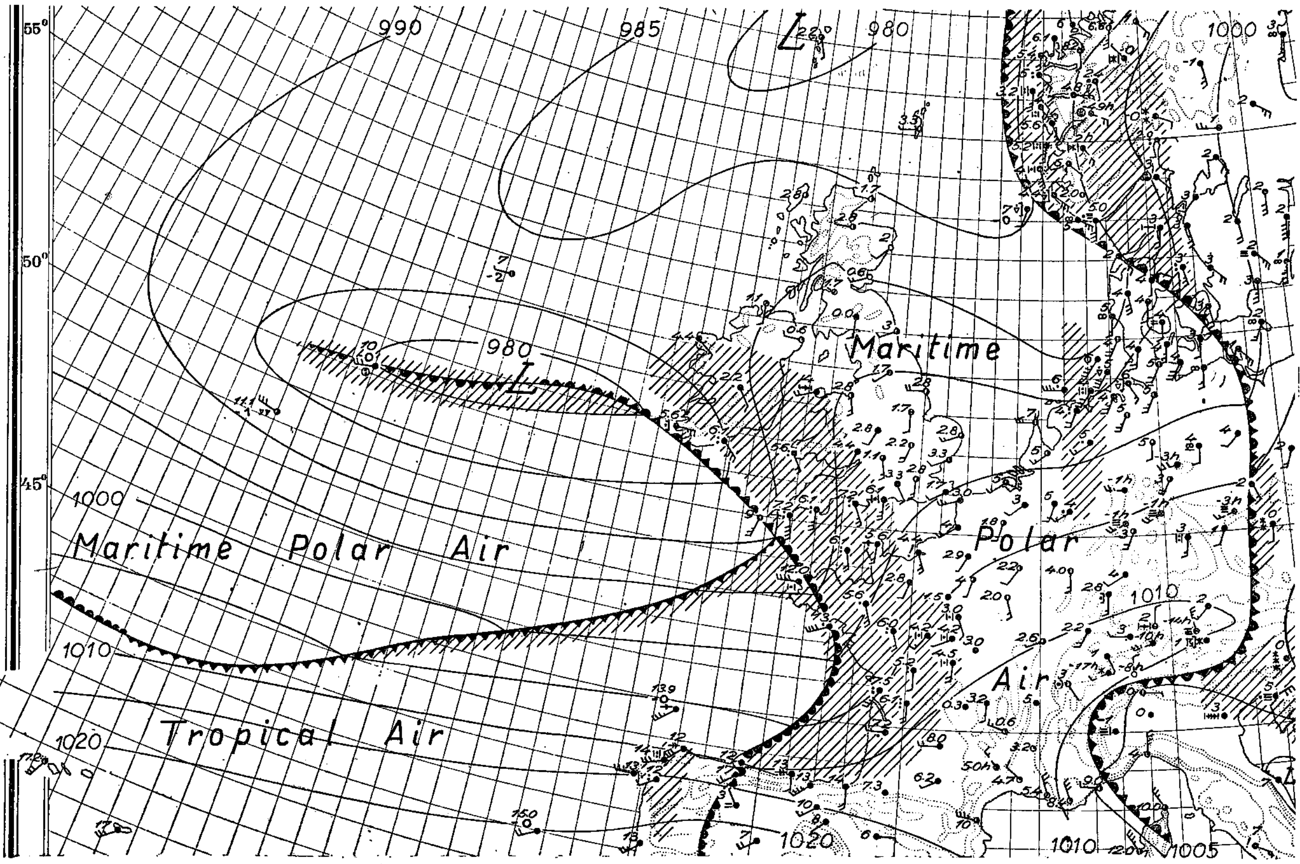
### 1. The Synoptic Situation.

(Hereto 6 maps on pages 4 and 6).

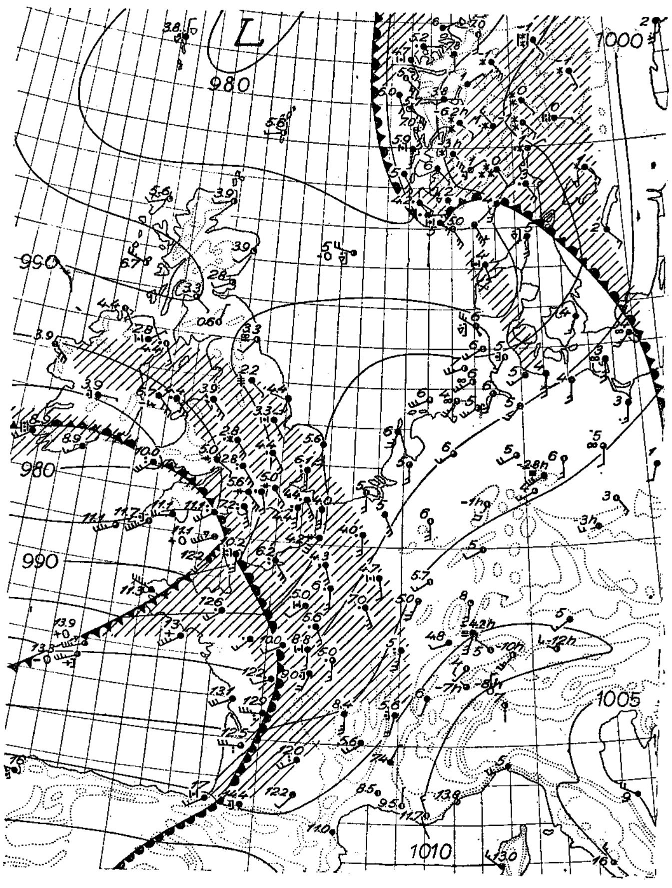
When the series of ascents was started on the morning of the 30th of December, Uccle was on a flat wedge between two troughs of low pressure. As is usual in that situation the air was of maritime polar origin. Apart from Uccle three other places within the same air mass — Soesterberg, Hamburg and Friedrichshafen — had ascents on the morning of the 30th, and show as far as they go but small differences from the temperature distribution over Uccle (fig. 1). The Uccle ascent reaches the warm sector air after passing through a transitional layer from 5.4 to 6.5 km.

A selection of Uccle ascents during the 30th of December are reproduced in fig. 2 and show the gradual downward displacement of the warm front surface of the oncoming depression. The transitional layer changes somewhat in thickness from the one ascent to the other. For instance, in the $12^h$ and $12^h41$ ascent (the latter of which appears as sounding No. 8 in the diagram) the transition was very gradual, whereas both before and after it was much sharper. The same diffuse transition between the two superjacent air masses is found in the airplane ascent in Duxford at $10^h30$ which is inserted for comparison in fig. 2.

On the morning map of the 30th of December the warm front was to be found along the pressure trough which extended SE -wards from the centre off the British Isles. It was accompanied by a




December 30. 1930. 7 GMT.

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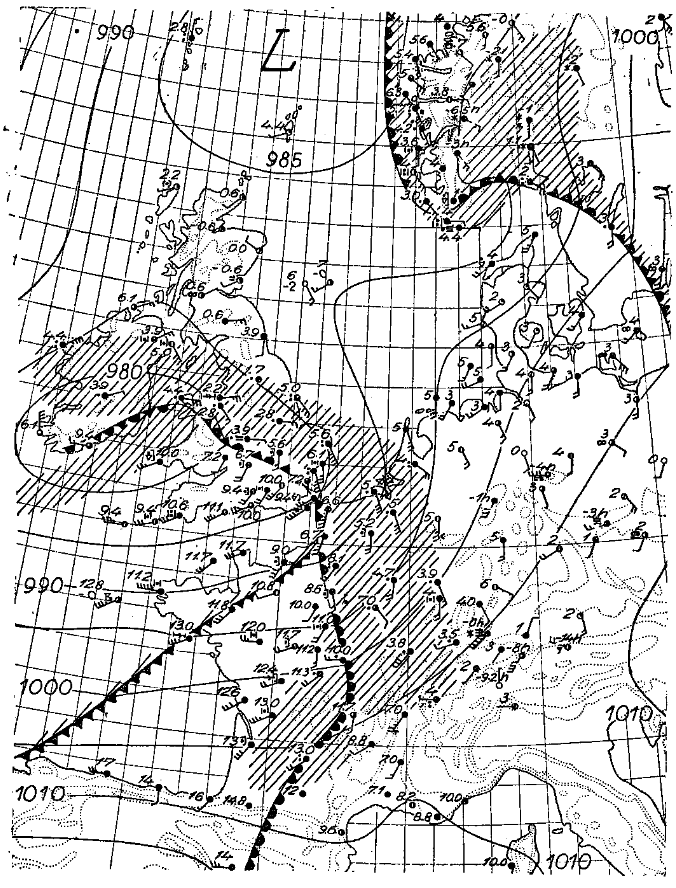



December 30. 1930. 18 GMT.

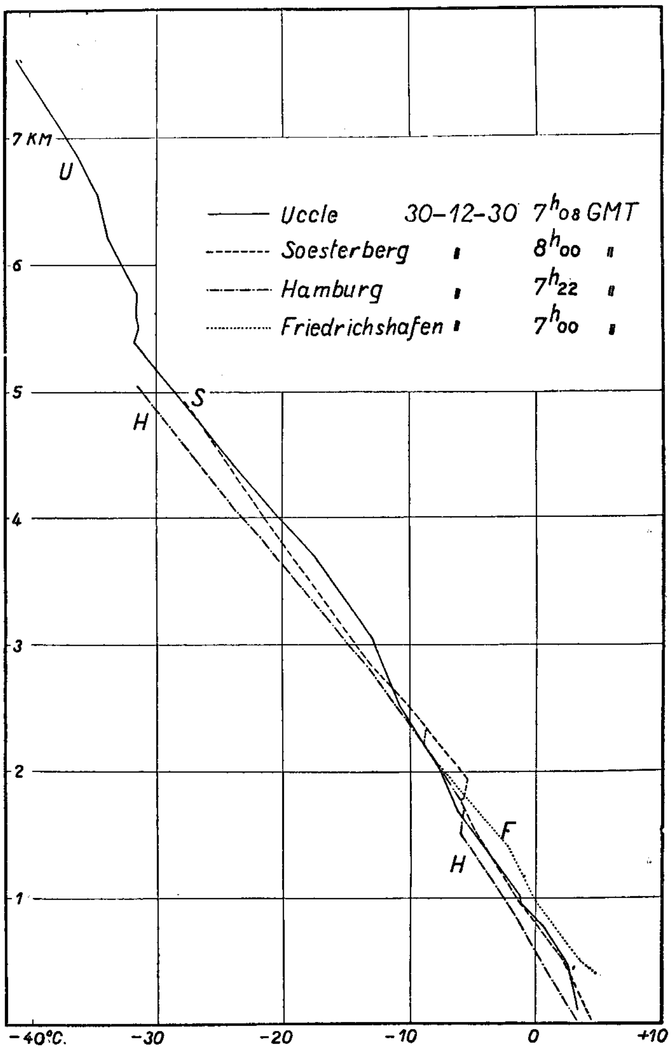



Fig. 1. Ascents through the maritime polar air. The Uccle ascent reaches the tropical air at 6.5 km.

sudden veer of wind from SE or S to W. Brest and Lorient, which have had the trough line passage, report 12 and 13° C respectively as compared with about 6° C just ahead of the same trough line. It is reasonably certain that this warm air at the extreme west of France forms part of the current of «tropical air» from the Azores to the Iberian Peninsula and the Bay of Biscay.[1]

The «warm sector» over the Bay of Biscay is limited towards NW by a cold front the existence of which is ascertained on the $13^h$ map. There the wind at Brest has veered slightly and a drop of temperature (against the normal daily variation) has taken place. Lorient is still in the mild tropical current and the same current has invaded France as far as Cherbourg—Tours—Bayonne.

The maritime polar air which has made its entrance over the Western Channel and Southern Ireland is only slightly colder than would be a tropical current, but its temperature drops off gradually with increasing distance NW-wards behind the cold front. The lack of a decided drop of temperature at the cold front itself can be considered as quite normal in depressions that are occluded at the centre. The foremost part of the cold air from the rear of the depression has always been warmed up while passing south of the centre.

The evening map of the 30th shows only the regular eastwards displacement of the aforementioned front systems, whereas the morning map of

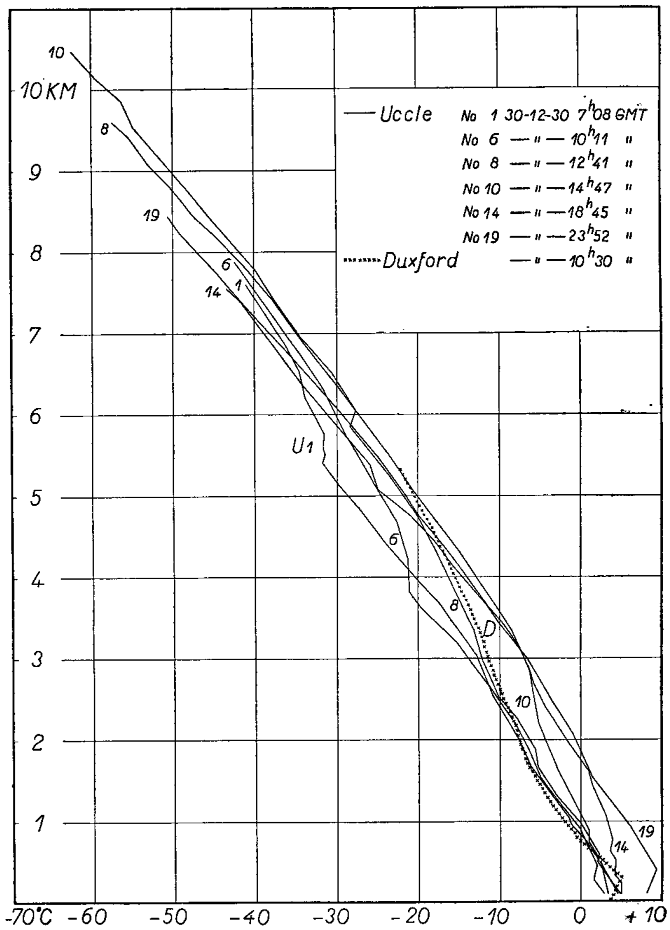
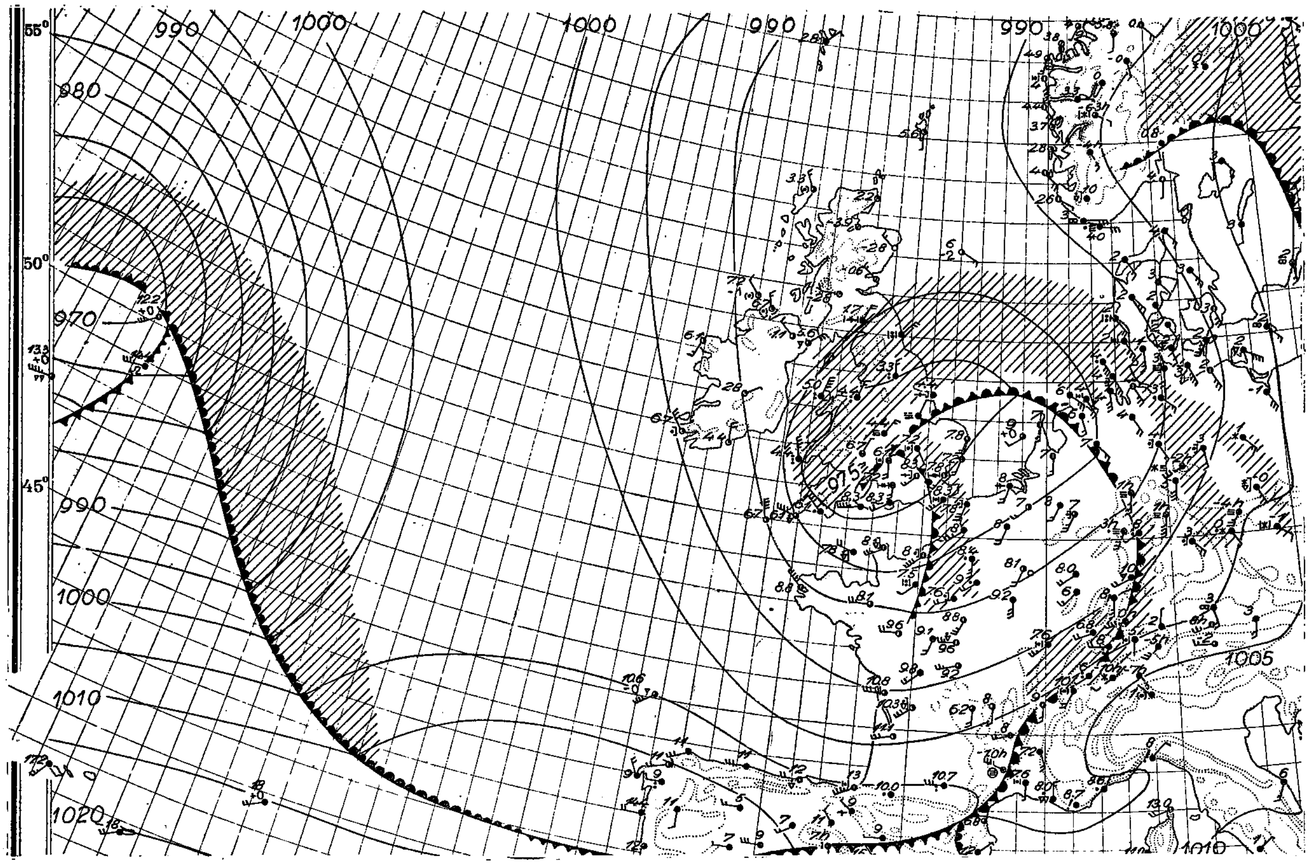
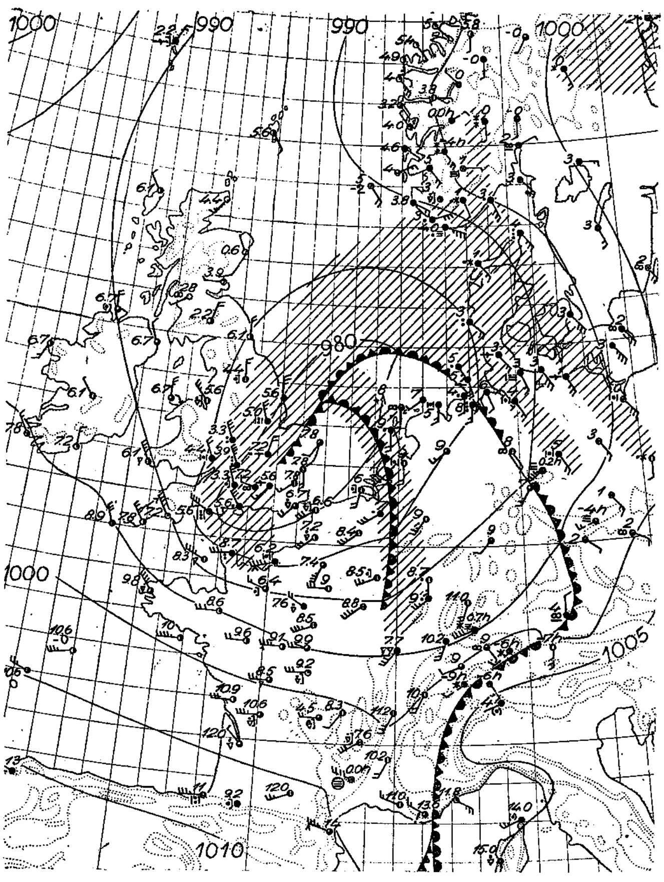



Fig. 2. Ascents through the warm front surface showing its gradual lowering during the approach of the warm front.

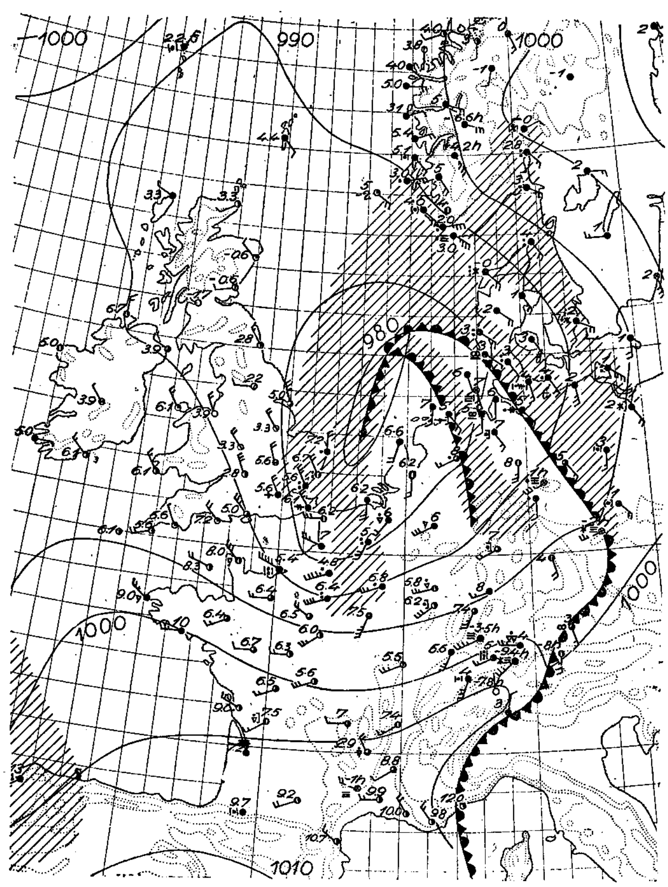
[1] The ascents show that this air is not quite as warm as the tropical air in the December ascents of 1928 and a complete analysis of its history over the Atlantic might have characterized it as very old and degenerate "maritime polar air". In spite of this uncertainty I will use the adjective "tropical" when referring later to the air that invaded France from the Bay of Biscay on the morning of the 30th of December.




December 31. 1930. 7 GMT.




December 31. 1930. 13 GMT.




December 31. 1930. 18 GMT.

the 31st brings the completed occlusion into evidence. The tropical air is no longer to be found at ground level north of the Pyrenees. East of the occluded front ascents are available from Hamburg, Lindenberg and Friedrichshafen (fig. 3). They all show the prefrontal wedge of cold air with stable stratification extending from the ground some distance upwards. A normal lapse rate is again established higher up where the ascents get up to the warm sector air (or to the maritime polar air which may have succeeded it without causing much change of temperature). The thickness of the prefrontal wedge of cold air at Hamburg at $7^h28$ GMT is 1400 m, which gives an inclination of the wedge equal to about 1/165 between Hamburg and the occluded front. At Lindenberg the $6^h$ and $9^h$ ascents do not reach the upper warm current but at $13^h00$ GMT it is reached at 1100 m. The inclination of the cold wedge in that case comes out as 1/200. (Equally small values of the inclination of the lower portion of the warm front surface result from the analysis of the Uccle ascents, as will be seen later). At Friedrichshafen the warm sector air is reached already at 900 m above sea level, this being another indication of the gentle slope of the receding cold wedge.

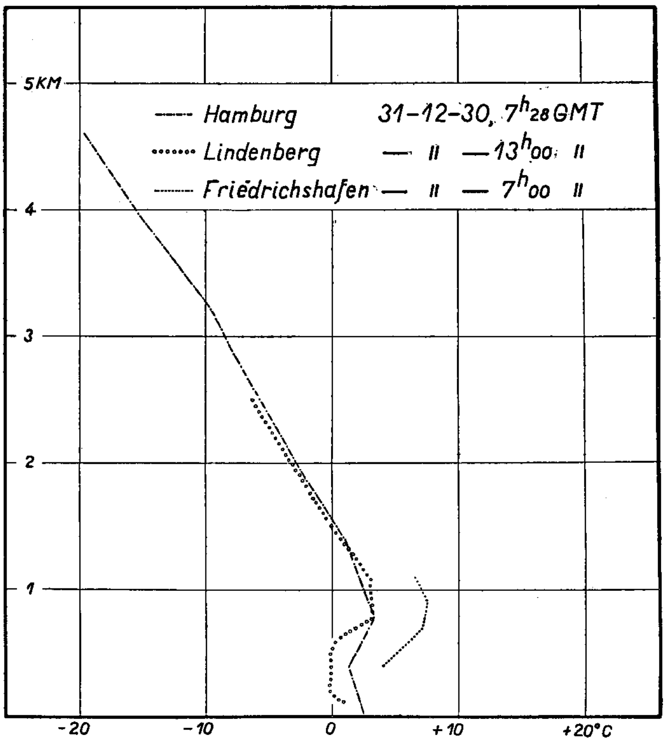



Fig. 3. Ascents through the warm front surface just ahead of the occluded front.

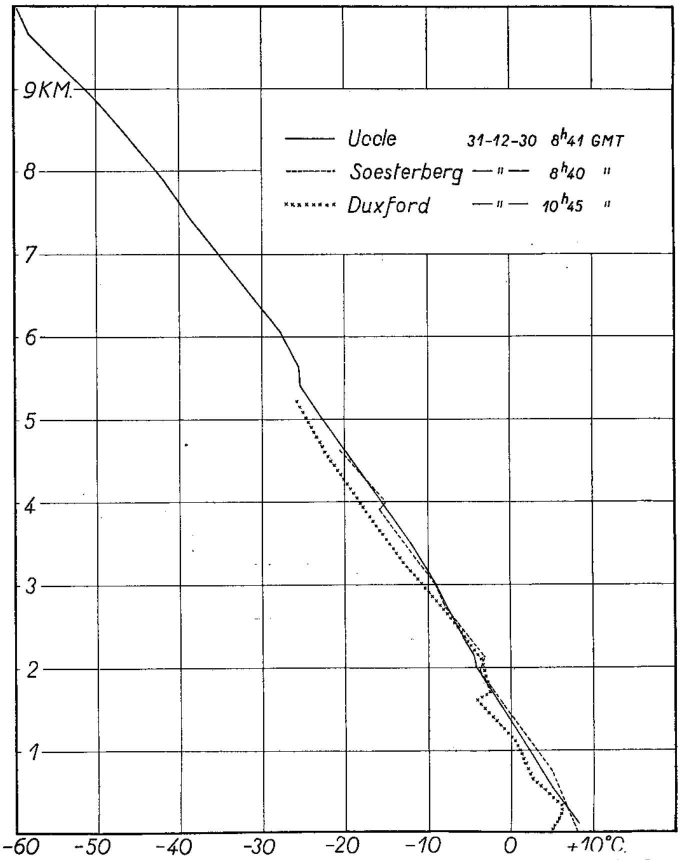



Fig. 4. Ascents through the maritime polar air behind the occluded front. The Uccle ascent reaches the tropical air at 5.6 km.

Behind the occluded front ascents are available from Soesterberg and Duxford in addition to those at Uccle. Fig 4. shows the close agreement between the ascent at Soesterberg and the simultaneous one at Uccle. All the way up to 5 km the temperature is now lower than in the Uccle warm sector ascents, but the drop of temperature has nowhere exceeded 4° C. Above the isothermalcy at about 5½ km the Uccle ascent reaches the tropical air. Duxford is a little colder than Uccle and Soesterberg, since it has been passed by the back bent occlusion, or in other words since the cold air is now reaching Duxford over a shorter track than before.

The continued ascents at Uccle are made during the passage of the back bent occlusion, which gave a good drop of temperature, and of the following pressure trough, which turns out to be devoid of any thermal front. This latter result could have been anticipated from an inspection of the weather maps alone. The pressure trough that passes from a line London—Cherbourg at $13^h$ to a line Ostende —Paris at $18^h$ has an approximate speed of 50 km/h,

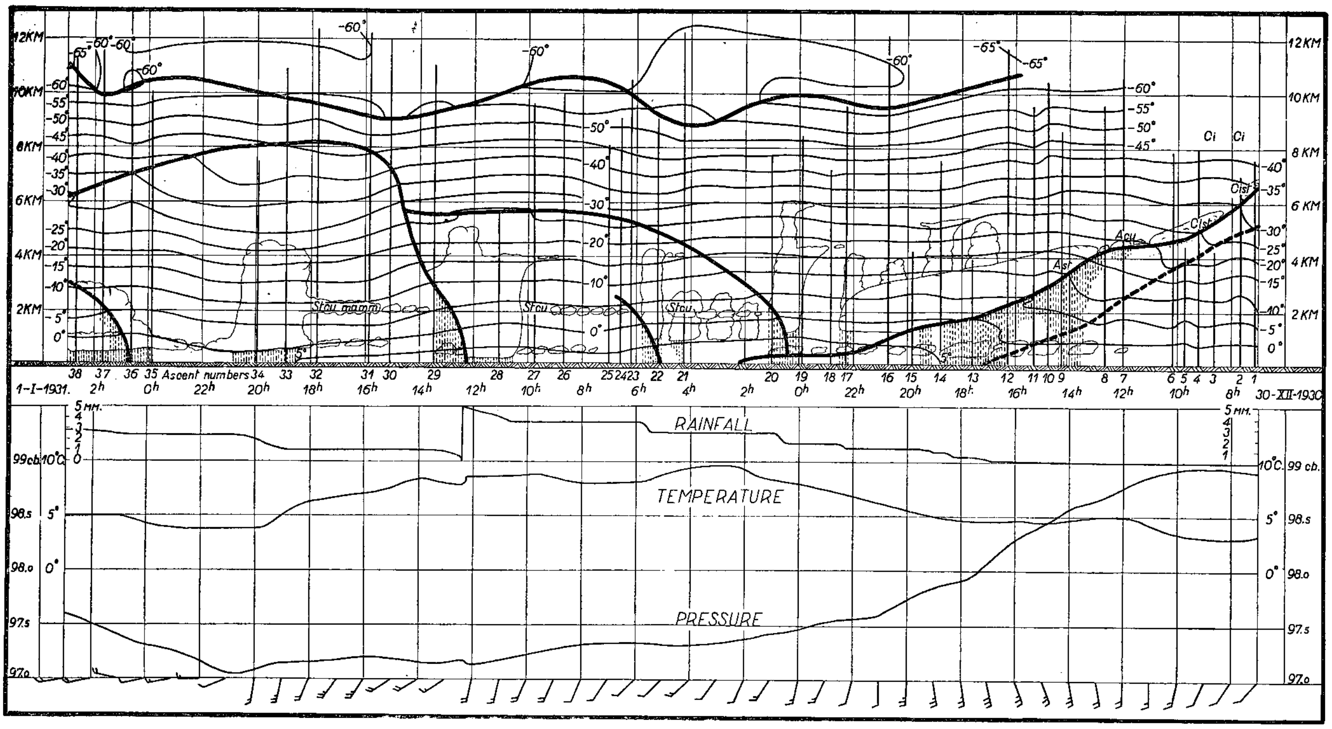



Fig. 5. Upper half: Isopleths of temperature, Frontal surfaces, Clouds and Precipitation.
Lower half: Rainfall, Temperature, Pressure and Surface wind on the same right-to-left time scale as in upper half.

but the geostrophic wind normal to the trough is far greater and attains at places 200 km/h. Then evidently the air must pass through the trough from its rear to its front side, which is incompatible with the existence of a thermal front along the pressure trough. However, at the back bent occlusion, which can be followed backwards to its original position in the westward pointing trough on the morning of the 30th, there is satisfactory agreement between the geostrophic wind component normal to the front and the speed of propagation of the front.

The last ascents of the series in the New Years night also show the influence in the higher layers of the next perturbation approaching off the mouth of the Channel.

## 2. The Field of Temperature in Vertical Cross Section.

### a. *The Structure of the Troposphere before the Occlusion Passage.*

Starting at the right end of the vertical cross section (fig. 5) we find the warm front surface well indicated by a zone of abnormally small temperature lapse rate (at places even inversions) at about 6 km above sea level. If we adhere to the rule of placing the warm front surface at the top of the layer of feeble lapse rates,[1] we get it at 6,6 km by 7 GMT. At the same time (morning map of the 30th) the warm front surface was intersecting the ground at the coast of Brittany 640 km WSW of Uccle. The average slope of the warm front surface along a line Uccle—Lorient was then about 1/97. At 13 GMT, the time of the next map, the warm front surface has descended to 4.2 km and intersects the ground 420 km WSW of Uccle, again an average slope of 1/100. At 18 GMT it is at 1.7 km above Uccle and intersects the ground 210 km to the W of the same place. The slope of this lowest part of the warm front surface is thus 1/124, which is less than its average slope higher up. This is also clearly to be seen in the vertical cross section where the cold wedge continues as a shallow layer of cold air which is not removed before $2^h$ at night.

It seems natural to ascribe this dragging behind of a film of cold air to the effect of friction. If that is correct one should expect the inclination of the warm front surface typical for the free atmosphere to continue undisturbed down to the level of about 0.5 km, whereas below that level the air

[1] For the justification of this rule see J. Bjerknes and E. Palmén: Aerologische Analyse einer Zyklone, Beiträge zur Physik der freien Atmosphäre, Band 21, Heft 1, 1933.

should be more and more retarded by friction and form the cold air film that drags behind. The change of slope is actually taking place at the height to be expected, namely about 0.5 km from the ground level.

The thermograph at the ground, the trace of which is given on the same time scale as that of the vertical cross section, records a rise of temperature during the period from about 18 GMT to 2 GMT. During that 8 hour period Uccle was within the zone of transitional temperature preceding the front passage. The transitional air, which evidently consists of heated parts of the cold air, is in the vertical cross section enclosed between the warm front surface and another surface (stippled), roughly parallel to the former, which intersects the ground at about $18^h$. This transitional air is characterized by maximum values of the horizontal temperature gradient and by minimum values of the vertical lapse rate of temperature.

It will be noticed that the transitional air occupies a rather narrow space in the uppermost portion visible on our diagram, in other words that the most clear cut warm front passage is observed at the 5 or 6 km level. Whether this is the general rule or not is of course still uncertain.

The tropical air below 4 km is almost isothermal in horizontal direction, but above that level there occur temperature variations whose magnitude reaches about 7° C in the uppermost troposphere. The most pronounced maximum of temperature of the upper tropical air occurs between $14^h$ and $15^h$, lower temperatures being recorded near the occlusion. This implies an increase of the lapse rate of the tropical air with the approach of the occluded front. The lapse rate in the tropical air over the higher part of the warm front surface is smaller than the saturated adiabatic, as can be seen from ascent 10 in fig. 6, but conditional instability is reached in some parts of the ascents nearer to the occluded front, as exemplified in fig. 6 by ascent no. 14. The character of the warm front rain also develops accordingly from slight continuous rain through moderate rain of variable intensity (showers superimposed on continuous rain) ending finally with isolated showers during the last hours preceding the occlusion passage.

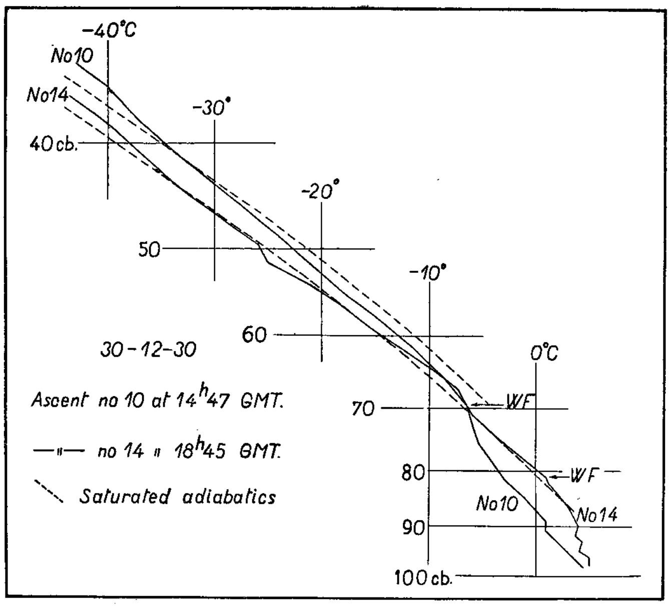



Fig. 6. Ascent No. 10 shows throughout the usual stability of the tropical air. Ascent No. 14 shows conditional instability of the tropical air from the warm front surface (1600 m) up to about 5 km with intercalated stable layer at about 3 km.

The complete evolution of the state of the sky can be seen from the following list of observations which cover the period up to the time of passage of the occluded front. The picture of the rainfall can be completed by consulting also the autographic record given underneath the vertical cross section (fig. 5).

*30th of December 1930.*

| Time | Total cloudiness | Clouds and Hydrometeors |
|---|---|---|
| $5^h15$ | 10 | Probably Ci or Cist, stars faintly visible. |
| $6^h30$ | 10 | Ci, Cist. |
| $7^h30$ | 9.9 | Ci, Cist, Acu radiatus. |
| $8^h\ 0$ | 9 | Ci. |
| $8^h30$ | 10 | Cist, at places rather dense. |
| $9^h13$ | 10 | Cist, halo. |
| $9^h45$ | 10 | Cist, halo. |
| $10^h11$ | 10 | Cist, halo. |
| $10^h48$ | 10 | Cist, halo, 1/10 Acu at SW horizon. |
| $11^h28$ | 9 | Cist 3/10 at NE horizon, Acu 6/10 moving from 270°, Scud 1/10. |
| $12^h\ 0$ | 9.9 | Acu changing into Ast with fall stripes. Ripples SE—NW. Sun faintly visible. Scud 1/10. |
| $12^h41$ | 9.9 | Layer of Acu, temporarily thinner. |
| $13^h19$ | 10 | Ast without holes, Nb 9/10 at 600 m. |
| $13^h40$ | 10 | » » » » » » » » Slight rain just starting. |
| $13^h50$ | 10 | Nb 10/10 at 600 m, slight rain. |
| $14^h19$ | 10 | Ast 10/10, Nb 3/10, slight rain. |
| $14^h47$ | 10 | Ast 10/10, Nb 5/10, the rain has just stopped. |
| $15^h19$ | 10 | Ast 10/10, Nb 8/10 at 500 m, no rain. |
| $15^h49$ | 10 | Ast 10/10, Nb 9/10 at 500 m, no rain. |
| $16^h17$ to $18^h07$ | 10 | Ast 10/10, Nb 9/10, light or moderate rain. |
| $18^h45$ to $22^h15$ | 10 | Too dark for determination of cloud forms. As for rainfall see autographic record. |

| | | |
|---|---|---|
| $22^{h}49$ | 8 | Moon-light. { Acu from SW with dark parts, some drops of rain. |
| $23^{h}17$ | 9 | Thin Ast, lower clouds in patches, some drops. |
| $23^{h}52$ | 10 | Moderate rain. |

The clouds and the precipitation observed according to the above list have been inserted on the vertical cross section. It has been assumed that all Cist, Ast and Acu were located just above the warm front surface. Height measurements of the upper clouds could not be made to prove or disprove that assumption, so that some uncertainty remains, especially as regards the location of the Cist. If it were situated just above the warm front surface it must have descended as low as 4.5 km when it was last observed overhead at about $11^{h}$. At that time the cloud veil was however dense and grey enough to be taken for an Ast, only the halo characterized it still as a Cist.

The Acu phase of the cloud evolution occurred at the place where the warm front surface is relatively ill-defined and relatively flat. This seems to indicate that the Acu of the kind observed is merely a weaker development of the up-glide cloud that usually takes the shape of a uniform and impervious Ast.

The first rain reached the ground when the warm front surface was at a height of about 3.7 km. As stated before the rain changed gradually into a more showery type with the approach of the occlusion. The Ast remained intact but must have had cumulonimboid protuberances on top.

### b. *The Structure of the Troposphere behind the Occlusion.*

On the maps the warm front was accompanied by a good contrast of temperature whereas the cold front had almost none. The same holds true for the vertical cross section. The deviation of isothermal surfaces from the horizontal is quite conspicuous where they pass through the warm front surface but much less so where they intersect the cold front surface. The indirect signs on which to locate the cold front passage have been mainly the two following:

1. the sudden veer of about 22° at $0^{h}30$ the 31st.
2. the rainfall record which also suggests the cold front passage at $0^{h}30$.

The thermogram at the ground cannot show the cold front passage at $0^{h}30$ since there is still a remainder of the receding wedge of cold air left underneath. The temperature at the ground, therefore, continues to rise until a little after $2^{h}$, when the receding cold air has been swept away. This event, which marks the passage of the occluded front, is also accompanied by a slight veer.

The exact position in space of the cold front slope is, as is usual in cases of frontolysis, rather uncertain. But from $10^{h}$ to $12^{h}$ the upper limit of the cold air (temporarily horizontal) appears again very clearly in the form of a stable layer between 5.3 and 5.7 km. Above that layer the isothermal surfaces have remained at practically the same levels as they occupied during the warmest phase of tropical air met with earlier in the series. Below the stable layer the temperature is in all levels a little lower than it was in the warm sector, but nowhere by more than 4° C.

After $14^{h}$ the stable layer disappears again and a considerable fall of temperature takes place also above 5.7 km. This must be interpreted as a further increase of the depth of the polar air up to approximately 8 km. After $20^{h}$ the thickness of the polar air again decreases and at $2^{h}39$, the end of the series of ascents, there is again tropical air as far down as 6.3 km. The temperature of this tropical air at the extreme left is almost identical with that at the extreme right of the diagram. Furthermore it is limited downwards by a warm front surface, the structure of which is very similar to the warm front surface at the right hand side of the diagram. This new warm front can be seen over the Atlantic on the morning map of the 31st. It moved fast and was over Central France the next morning (at that time as an occluded front).

After having determined the approximate outline of the body of maritime polar air we proceed to a further examination of the internal structure of the same air mass. We therefore return to the notes on the weather:

*31st of December 1930.*

| Time | Total cloudiness | Clouds and Hydrometeors |
|---|---|---|
| $0^{h}29$ | 10 | Rain. |
| $1^{h}\ 0$ | 10 | Slight rain. |
| $1^{h}\ 5$ to $2^{h}\ 0$ | 9 | |
| $2^{h}43$ to $4^{h}13$ | 10 | |
| $4^{h}30$ | 10 | Some drops of rain. |

| Time | Total cloudiness | Clouds and Hydrometeors |
|---|---|---|
| $4^{h}44$ | 10 | |
| $4^{h}47$ | 9 | |
| $5^{h}\ 5$ | 10 | Slight rain. |
| $5^{h}30$ to $5^{h}40$ | 10 | Fairly heavy rain. |
| $5^{h}43$ | 9 | |
| $6^{h}\ 0$ | 5 | Still cloudy in the E. |
| $6^{h}33$ | 9 | The segment of clear sky passes away Ewards. Elsewhere overcast. |
| $7^{h}\ 1$ | 10 | Stcu 9/10 and something above it. |
| $7^{h}29$ | 10 | Stcu 10/10, Scud 1/10. |
| $8^{h}11$ | 9 | Stcu 9/10, Scud 5/10. |
| $8^{h}41$ to $9^{h}11$ | 9 | Stcu 9/10, Scud 5/10 in 450 m. |
| $9^{h}46$ | 9 | Acu 5/10 from 260°, Scud 8/10 in 400 m. |
| $10^{h}14$ | 10 | Ast 10/10 (same layers as the Acu), Scud 6/10 in 400 m. |
| $10^{h}22$ | 10 | Nbst 10/10, Scud 6/10 in 400 m. Slight rain. |
| $10^{h}39$ | 10 | Nbst 10/10, Scud 9/10 in 250 m. Rain. |
| $11^{h}\ 8$ | 10 | Nbst 10/10, Scud 8/10 in 250 m. Rain, small drops. |
| $11^{h}45$ | 10 | Scud 10/10 in 200 m. Rain, small drops. |
| $12^{h}39$ | 10 | Nbst 10/10, Scud 5/10. Ordinary rain. |
| $13^{h}25$ | 9 | Ast 9/10, clear in the W. Slight intermittent rain. |
| $13^{h}50$ | 9 | Stcu 9/10. |
| $15^{h}\ 4$ | 9 | Stcu 9/10, Scud 3/10 at 700 m. |
| $15^{h}50$ | 10 | Stcu mammatus 10/10, Scud 9/10. |
| $16^{h}47$ | 9 | Stcu mammatus 9/10, Scud 9/10. |
| $17^{h}45$ | 10 | Stcu 10/10, Scud 9/10. Small shower. |
| $18^{h}15$ to $19^{h}58$ | 10 | Scud 10/10. Moderate rain. |
| $21^{h}\ 8$ | 10 | Slight drizzle. |
| $22^{h}\ 7$ to $23^{h}\ 0$ | 10 | St 10/10. The moon sometimes visible. |
| $23^{h}52$ | 10 | Rain, small drops. |
| | *1st of January 1931.* | |
| $0^{h}30$ | 10 | Rain and drizzle. |
| $0^{h}37$ | 10 | The rain diminishes, the drizzle persists. |
| $1^{h}40$ to $2^{h}39$ | 10 | Drizzle. |

After the cold front rain between $0^{h}$ and $1^{h}$ of the 31st a period of moderate convection followed. The clouds could not be classified because of the darkness, but most likely it was a sky of Stcu mixed with convective clouds. The only real shower (or perhaps a weak secondary cold front) came between $5^{h}$ and $6^{h}$.

Between $10^{h}$ and $14^{h}$ on the 31st another rain system passed, which was extensive enough to be identified on the maps. On the $13^{h}$ map it is of course to be found over Belgium, and it can be traced over Holland and Eastern France too. On the morning map of the same day it must have extended from SE England southwards to the W

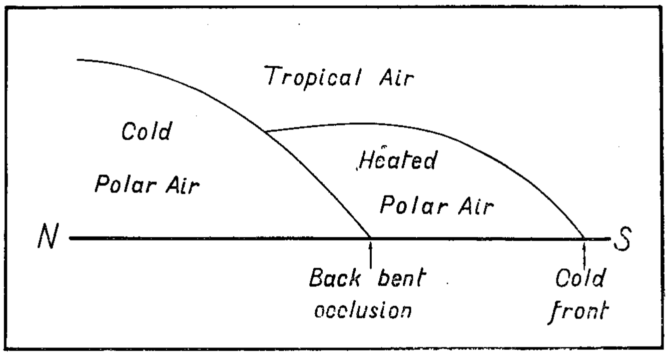



Fig. 7. The theoretical "back bent occlusion" in vertical cross section.

of Paris. At $1^{h}$ the same day it was over the western Channel having just passed Scilly and Plymouth. On the evening map of the 30th it was between Scilly and S. Ireland, and on the $13^{h}$ map of the 30th over Valentia. This backward tracing of the rain system in question leads to the conclusion that it was associated with the back bent occlusion, the position of which is well established on the maps for the 30th of December.

A vertical cross section N—S through the back bent occlusion on the morning of the 30th (see fig. 7) would have shown a front surface between the cold polar air to the north and the heated polar air to the S of the trough, and moreover some kind of limiting surface between those two polar air masses and the tropical air above. The polar air S of the trough can not extend very high up since its southern limit — the cold front — is only some 6—700 km away.

The schematical arrangement of air masses in fig. 7 is verified by the Uccle ascents. The rain system which we traced backwards as belonging to the back bent occlusion is also in Uccle (fig. 5) associated with the back bent occlusion pattern of front surfaces. The whole complex system has swung round from the W to the SE of the depression without any material change of structure. The cold front in the ground autographics of temperature, pressure and wind just after $12^{h}$ should then be identical with what is drawn as the back bent occlusion on the maps. This is also verified by the fact that the back bent occlusion, as drawn on the maps, all the time has a speed of propagation practically equal to the component of geostrophic wind perpendicular to the front.

The inclination of the occlusion surface separating the two kinds of polar air is surprisingly steep, approximately 1/20. This steep slope of the surface of discontinuity must have developed from normal conditions by an advance of the highest portion of the cold wedge relatively to the lowest portion of the same body of air. This is of course likely to happen wherever there is a considerable increase with height of the wind component normal to the front. As the ultimate result of such conditions the surface of discontinuity would reach the vertical position, but before that stage is attained some kind of overturning would have to take place.

At Uccle there were no violent manifestations of energy associated with the back bent occlusion. Winds remained moderate and the rain too, even though the slope of the wedge was so unusually steep. Perhaps this is typical for the outer end of back bent occlusions which always must fade away into continuity. In our case all perceptible signs of a front faded away about 300 km south of Uccle. A vertical cross section 300 km or a little farther S of Uccle would presumably have shown a continuous drop of temperature from E to W but no front system.

The back bent occlusion which we have now examined was on the morning of the 30th situated in the pressure trough pointing W-wards from the centre, but during the following 36 hours it gets more and more ahead of the trough. Actually the front moved, and of course had to move, with a speed approximately equal to the component of the geostrophic wind normal to the front, whereas the barometric trough had a speed of displacement that was considerably slower. This is a phenomenon commonly observed in the troughs of back bent occlusions.

At Uccle the back bent occlusion passed the 31st at $12^h$ whereas the barometric trough with which it had once been connected did not pass before $20^h30$. A rather quick veer of the wind accompanies that pressure trough but no drop of temperature either at the ground or in upper layers. The temperature was at a minimum simultaneously in all layers up to 7 km at about the time when the barometric trough passed.

There was moderate rain during the two hours preceding the passage of the trough and the rain eased off immediately afterwards. This non frontal rain must have been formed by the ascent connected with the convergence of a homogeneous air mass. It occurs just during the period of maximum negative pressure change, very well in agreement with the theory of Brunt and Douglas.[1] In this case the barometric trough was thermally symmetrical and therefore vertical. Consequently the maximum negative pressure change occurred simultaneously at all levels. Then also the maximum horizontal convergence must have occured within the same vertical column. The vertical component of velocity will then attain relatively large values, since the effect of the convergence adds up from layer to layer.

Some slight rain was experienced also towards the end of the seires of ascents, probably due to a very weak cold front.

### c. *Tropopause Waves.*

Due to the bad balloons the information about the tropopause waves is scanty and rather uncertain.

The tropopause crest over the warm front surface was not reached by any of the ascents. The lower lying tropopause over the central part of the depression is traversed by several ascents and seems to be undulating. At the time of the last ascent the tropopause is rising quickly towards the crest situated over the warm front surface of the next depression.

## 3. The Field of Pressure in Vertical Cross Section.

Barograms at different levels have been constructed in fig. 8. They show a certain variation of form with height especially during the first part of the series (right-hand side).

The rapid fall of pressure at the ground during the afternoon of the 30th occurs under the warm front slope and hence it must decrease with height. Above the warm front surface, or, more precisely, above the place where that surface passes the 3 km level, there is a crest of high pressure which is found at the same ordinate $14^h20^m$ in all barograms from 4 km upwards. This crest of high pressure certainly corresponds to a crest of the tropopause which was however not reached by any of the ascents. In two earlier series of ascents from Uccle[2] the same crest of the tropopause was found at the same position relative to the warm front surface, namely where the warm front surface passes the 3 to 4 km level. It is presumably also the same crest of the

[1] Memoirs of the Royal Meteorological Society, Vol III, No. 22, 1928.

[2] Geof. Publ. Vol. IX, No. 9, 1932 and Beitr. z. Ph. d. fr. Atm. Band 21, Heft 1, 1933.

tropopause that is visible in the results of aerological statistics.[1]

The fall of pressure at the ground continues at a reduced rate after the occlusion passage in the evening of the 30th. This fall takes place in spite of the arrival of gradually colder air, from which can be inferred that a considerable fall of pressure goes on in the layers above the cold air advection. This is clearly shown by the barograms. From 0h to 20h30 of the 31st the pressure falls

| | | | |
|---|---|---|---|
| at the ground | | by | 4 mb |
| » 1 km | ..... | » | 6 » |
| » 2 » | ..... | » | 8 » |
| » 3 » | ..... | » | 9 » |
| » 4 » | ..... | » | 11 » |
| » 5 » | ..... | » | 12 » |
| » 6 » | ..... | » | 12 » |
| » 7 » | ..... | » | 12.5 mb. |

Still higher up no quantitatvive amounts can be given, since the ascent nearest to the trough on the evening of the 31st stopped between 7 and 8 km. However, enough can be seen to show that the trough of pressure in question persists way up in the stratosphere.

All the higher barograms, furthermore, show small oscillations superimposed on the general fall from the 30th 14h to the 31st 20h30. The pressure trough on the 30th at 21h coincides with a tropopause trough. The next pressure trough, on the 31st at 6h, comes 2 hours behind a tropopause trough.

All these minor perturbations in the upper troposphere are damped out downwards so that their effect on the ground barogram is hardly perceptible.

[1] See for instance Schedler, Beitr. z. Ph. d. fr. Atm. Band IX, p. 181, 1921.

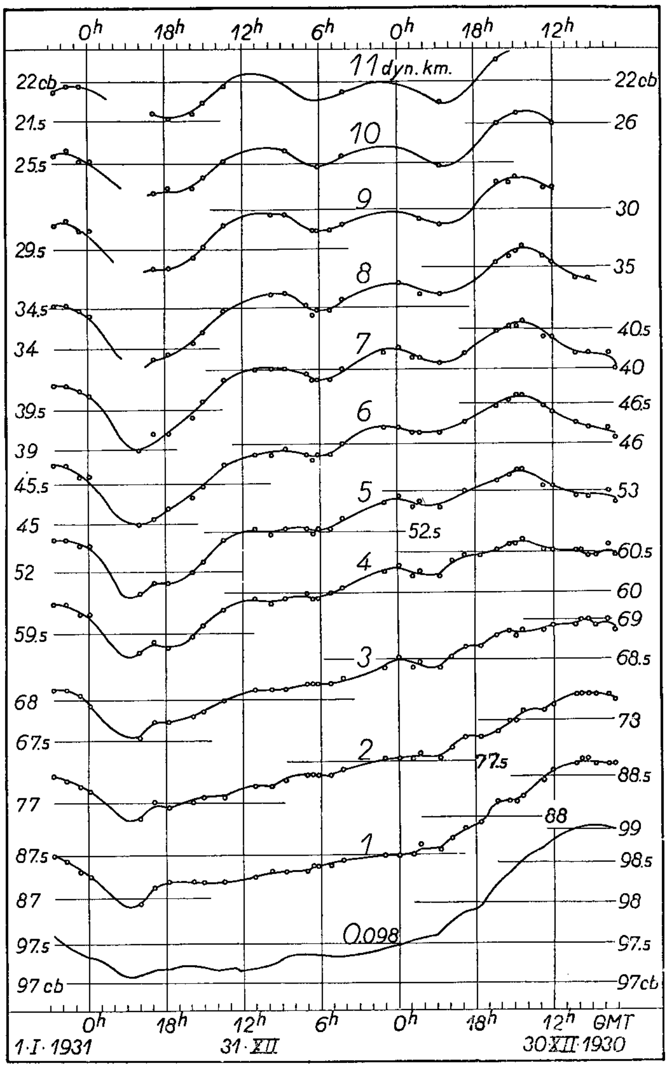



Fig. 8. Barograms at the ground (0.098 dyn. km.) and at successive levels 1, 2, 3 ..... 11 dyn. km. Pressure unit centibar, time scale from right to left.

## The Uccle Ascents.

No. 1. 30-XII-1930. 7$^{h}$08.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 742 | + 3.3 | |
| 466 | 709 | + 2.5 | |
| 778 | 682 | + 0.5 | 67 |
| 944 | 668 | — 1.1 | |
| 1028 | 661 | — 1.4 | |
| 1346 | 635 | — 3.7 | |
| 1687 | 608 | — 6.3 | |
| 1974 | 586 | — 7.5 | 69 |
| 2256 | 565 | — 9.2 | |
| 2520 | 546 | — 10.8 | |
| 2690 | 534 | — 11.6 | |
| 3026 | 511 | — 12.8 | 67 |
| 3329 | 491 | — 14.9 | |
| 3673 | 469 | — 17.4 | |
| 4030 | 447 | — 20.7 | 65 |
| 4417 | 424 | — 24.0 | |
| 4857 | 399 | — 27.3 | |
| 5112 | 385 | — 29.6 | |
| 5395 | 370 | — 31.8 | |
| 5511 | 364 | — 31.5 | 67 |
| 5589 | 360 | — 31.7 | |
| 5768 | 351 | — 31.6 | |
| 6202 | 330 | — 33.9 | |
| 6549 | 314 | — 34.7 | 65 |
| 6890 | 299 | — 36.4 | |
| 7196 | 286 | — 38.4 | |
| 7615 | 269 | — 41.1 | 64 |

No. 2. 30-XII-1930. 7$^{h}$38.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 742 | + 3.2 | |
| 265 | 727 | + 2.9 | |
| 354 | 719 | + 3.0 | 61 |
| 850 | 676 | + 0.2 | |
| 1162 | 650 | — 2.1 | |
| 1273 | 641 | — 2.4 | |
| 1729 | 605 | — 5.1 | 63 |
| 2153 | 573 | — 7.6 | |
| 2442 | 552 | — 9.4 | |
| 2755 | 530 | — 10.1 | |
| 3201 | 500 | — 13.0 | |
| 3541 | 478 | — 15.6 | 61 |
| 3846 | 459 | — 18.2 | |
| 4244 | 435 | — 21.1 | |
| 4536 | 418 | — 23.6 | |
| 4855 | 400 | — 26.6 | |
| 5129 | 385 | — 28.6 | 59 |
| 5434 | 369 | — 28.5 | |
| 5893 | 346 | — 30.0 | |
| 6018 | 340 | — 29.9 | |
| 6513 | 317 | — 32.7 | |
| 6945 | 298 | — 35.8 | 59 |

No. 3. 30-XII-1930. 8$^{h}$38.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 742 | + 3.1 | |
| 144 | 738 | + 3.2 | |
| 321 | 722 | + 1.5 | |
| 535 | 703 | + 1.8 | |
| 873 | 674 | — 0.2 | |
| 1089 | 656 | — 2.0 | |
| 1223 | 645 | — 2.7 | |
| 1522 | 621 | — 4.9 | |
| 1843 | 596 | — 7.2 | |
| 1948 | 588 | — 7.3 | |
| 2244 | 566 | — 8.5 | |
| 2535 | 545 | — 10.6 | |
| 2648 | 537 | — 10.7 | |
| 2939 | 517 | — 12.5 | |
| 3208 | 499 | — 15.0 | |
| 3499 | 480 | — 17.4 | |
| 3800 | 461 | — 19.8 | |
| 3962 | 451 | — 21.6 | |
| 4277 | 432 | — 23.9 | |

No. 4. 30-XII-1930. 9$^{h}$13.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 742 | + 3.2 | |
| 133 | 739 | + 3.0 | |
| 399 | 715 | + 1.3 | |
| 490 | 707 | + 1.8 | |
| 838 | 677 | — 0.5 | 68 |
| 1236 | 644 | — 2.6 | |
| 1510 | 622 | — 4.6 | |
| 1754 | 603 | — 6.3 | |
| 2179 | 571 | — 8.0 | |
| 2568 | 543 | — 10.3 | 66 |
| 2914 | 519 | — 12.7 | |
| 3182 | 501 | — 15.3 | |
| 3457 | 483 | — 17.4 | |
| 3885 | 456 | — 20.7 | |
| 4115 | 442 | — 22.9 | 65 |
| 4436 | 423 | — 24.3 | |
| 4681 | 409 | — 24.4 | |
| 5027 | 390 | — 25.3 | |
| 5466 | 367 | — 26.8 | |
| 5787 | 351 | — 28.6 | 64 |
| 6248 | 329 | — 31.0 | |
| 6645 | 311 | — 33.1 | |
| 6967 | 297 | — 35.3 | |
| 7302 | 283 | — 37.6 | |
| 7625 | 270 | — 39.9 | |
| 7960 | 257 | — 42.3 | 63 |

No. 5. 30-XII-1930. 9$^{h}$44.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 742 | + 3.4 | |
| 287 | 725 | + 2.5 | |
| 456 | 710 | + 3.1 | |
| 839 | 677 | + 0.8 | 49 |
| 1275 | 641 | — 2.1 | |
| 1615 | 614 | — 4.3 | |
| 1731 | 605 | — 4.7 | |
| 2101 | 577 | — 6.5 | 50 |
| 2501 | 548 | — 9.2 | |
| 2817 | 526 | — 11.6 | |
| 3157 | 503 | — 14.2 | |
| 3463 | 483 | — 16.9 | 48 |
| 3698 | 468 | — 18.9 | |
| 3891 | 456 | — 20.3 | |
| 4121 | 442 | — 20.8 | |
| 4428 | 424 | — 20.7 | |
| 4839 | 401 | — 22.4 | |
| 5252 | 379 | — 24.1 | 48 |

No. 6. 30-XII-1930. 10$^{h}$11.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 742 | + 3.4 | |
| 276 | 726 | + 1.6 | |
| 444 | 711 | + 2.0 | |
| 898 | 672 | — 0.1 | 54 |
| 1200 | 647 | — 2.5 | |
| 1511 | 622 | — 4.9 | |
| 1871 | 594 | — 6.4 | 55 |
| 2220 | 568 | — 8.2 | |
| 2525 | 546 | — 10.4 | |
| 2899 | 520 | — 13.1 | 49 |
| 3211 | 499 | — 15.4 | |
| 3440 | 484 | — 17.7 | |
| 3628 | 472 | — 19.8 | |
| 3818 | 460 | — 21.1 | 47 |
| 4214 | 436 | — 21.3 | |
| 4684 | 409 | — 22.6 | 48 |
| 5050 | 389 | — 24.9 | |
| 5511 | 365 | — 27.3 | |
| 5894 | 346 | — 29.6 | |
| 6317 | 326 | — 31.7 | 48 |
| 6761 | 306 | — 34.6 | |
| 7134 | 290 | — 37.3 | |
| 7449 | 277 | — 39.5 | |
| 7700 | 267 | — 41.2 | |
| 7880 | 260 | — 42.4 | 47 |

No. 7. 30-XII-1930. 12$^{h}$00.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 741 | + 5.0 | |
| 134 | 738 | + 4.7 | |
| 312 | 722 | + 3.0 | |
| 538 | 702 | + 1.7 | |
| 642 | 693 | + 1.9 | 70 |
| 1021 | 661 | — 0.7 | |
| 1353 | 634 | — 3.0 | |
| 1503 | 622 | — 4.1 | |
| 1786 | 600 | — 5.0 | |
| 1984 | 585 | — 4.8 | |
| 2298 | 562 | — 7.2 | 70 |
| 2607 | 540 | — 10.0 | |
| 2911 | 519 | — 12.8 | |
| 3240 | 497 | — 13.8 | |
| 3599 | 474 | — 15.1 | |
| 4039 | 447 | — 16.7 | 69 |
| 4451 | 423 | — 18.7 | |
| 4866 | 400 | — 20.8 | |
| 5242 | 380 | — 23.6 | |
| 5515 | 366 | — 25.6 | 68 |
| 5615 | 361 | — 26.6 | 68 |
| 5962 | 344 | — 26.8 | 69 |
| 6325 | 327 | — 29.4 | |
| 6636 | 313 | — 31.9 | |
| 6888 | 302 | — 33.6 | |
| 7219 | 288 | — 36.0 | |
| 7413 | 280 | — 38.2 | 68 |
| 7713 | 268 | — 40.2 | |
| 7841 | 263 | — 41.8 | |
| 8128 | 252 | — 44.0 | |
| 8480 | 239 | — 47.0 | |
| 8877 | 225 | — 50.4 | 67 |
| 9323 | 210 | — 53.4 | |
| 9603 | 201 | — 56.1 | |
| 10026 | 188 | — 58.5 | |
| 10367 | 178 | — 60.2 | |
| 10616 | 171 | — 61.5 | 67 |

No. 8. 30-XII-1930. 12$^{h}$41.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 740 | + 4.8 | |
| 111 | 739 | + 4.8 | |
| 493 | 705 | + 2.0 | |
| 597 | 696 | + 2.2 | |
| 1012 | 661 | — 0.3 | 72 |
| 1293 | 638 | — 2.8 | |
| 1660 | 609 | — 5.3 | 67 |
| 1895 | 591 | — 5.7 | 70 |
| 2274 | 563 | — 8.0 | |
| 2525 | 545 | — 10.2 | |
| 2990 | 513 | — 12.2 | 77 |
| 3371 | 488 | — 13.3 | |
| 3819 | 460 | — 15.5 | |
| 4378 | 427 | — 18.1 | |
| 4864 | 400 | — 20.8 | |
| 5241 | 380 | — 23.4 | 78 |
| 5573 | 363 | — 26.2 | |
| 5856 | 349 | — 28.3 | |
| 6044 | 340 | — 27.7 | |
| 6500 | 319 | — 30.5 | |
| 6933 | 300 | — 34.3 | 73 |
| 7436 | 279 | — 38.0 | |
| 7840 | 263 | — 41.4 | |
| 8208 | 249 | — 44.9 | |
| 8452 | 240 | — 47.6 | 71 |
| 8818 | 227 | — 50.5 | |
| 9080 | 218 | — 53.1 | |
| 9412 | 207 | — 55.5 | |
| 9598 | 201 | — 57.5 | 69 |

No. 9. 30-XII-1930. 14$^{h}$19.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 739 | + 4.6 | |
| 122 | 737 | + 4.5 | |
| 586 | 696 | + 1.9 | |
| 785 | 679 | + 1.4 | 61 |
| 1135 | 650 | — 0.6 | |
| 1537 | 618 | — 2.6 | |
| 2011 | 582 | — 4.7 | |
| 2327 | 559 | — 6.0 | |
| 2583 | 541 | — 6.8 | |
| 2832 | 524 | — 7.1 | 62 |
| 3103 | 506 | — 8.5 | |
| 3642 | 473 | — 10.9 | |
| 4057 | 448 | — 13.4 | |
| 4473 | 424 | — 16.3 | |
| 4965 | 397 | — 19.7 | |
| 5327 | 378 | — 22.6 | 60 |
| 5744 | 357 | — 25.5 | |
| 6181 | 336 | — 28.5 | |
| 6708 | 312 | — 31.9 | |
| 6983 | 300 | — 34.6 | |
| 7267 | 288 | — 37.3 | |
| 7760 | 268 | — 40.5 | 55 |
| 8097 | 255 | — 43.2 | |
| 8392 | 244 | — 45.8 | |
| 8669 | 234 | — 47.7 | 53 |

No. 10. 30-XII-1930. 14$^{h}$47.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 738 | + 4.5 | |
| 155 | 733 | + 4.2 | |
| 738 | 682 | + 1.0 | |
| 893 | 669 | + 1.0 | 55 |
| 1298 | 636 | — 1.1 | |
| 1642 | 609 | — 3.0 | |
| 2205 | 567 | — 5.3 | |
| 2515 | 545 | — 5.9 | |
| 2867 | 521 | — 6.4 | 56 |
| 3344 | 490 | — 8.6 | |
| 3798 | 462 | — 11.5 | |
| 4326 | 431 | — 15.1 | |
| 4665 | 412 | — 17.7 | |
| 5111 | 388 | — 21.0 | |
| 5560 | 365 | — 24.0 | 55 |

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 5947 | 346 | —26.9 | |
| 6417 | 324 | —30.5 | |
| 6775 | 308 | —33.3 | |
| 7291 | 286 | —37.0 | |
| 7815 | 265 | —40.2 | |
| 8129 | 253 | —42.9 | 53 |
| 8454 | 241 | —45.8 | |
| 8821 | 228 | —48.7 | |
| 9114 | 218 | —51.3 | |
| 9541 | 204 | —54.9 | |
| 9860 | 194 | —57.3 | |
| 10125 | 186 | —59.5 | |
| 10468 | 176 | —62.5 | 52 |

No. 11. 30-XII-1930. 15h19.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 738 | + 4.4 | |
| 200 | 729 | + 4.2 | |
| 426 | 709 | + 2.6 | 99 |
| 727 | 683 | + 0.8 | |
| 1051 | 656 | — 0.5 | |
| 1411 | 627 | — 1.9 | |
| 1761 | 600 | — 3.1 | |
| 2056 | 578 | — 4.3 | 100 |
| 2193 | 568 | — 5.0 | |
| 2389 | 554 | — 5.4 | |
| 2489 | 547 | — 5.0 | |
| 2737 | 530 | — 5.5 | |
| 3145 | 503 | — 7.9 | |
| 3380 | 488 | — 9.8 | 99 |
| 3587 | 475 | —11.5 | |
| 3882 | 457 | —13.1 | |
| 4309 | 432 | —15.7 | |
| 4592 | 416 | —18.2 | 100 |
| 4774 | 406 | —19.6 | |
| 5052 | 391 | —20.8 | |
| 5341 | 376 | —22.9 | |
| 5618 | 362 | —25.2 | |
| 5861 | 350 | —27.3 | |
| 6303 | 329 | —31.0 | |
| 6700 | 311 | —33.6 | 99 |
| 7068 | 295 | —36.5 | |
| 7354 | 283 | —39.4 | |
| 7624 | 272 | —41.5 | |
| 7955 | 259 | —43.8 | 99 |
| 8164 | 251 | —46.0 | |
| 8461 | 240 | —48.4 | |
| 8683 | 232 | —50.5 | |
| 8910 | 224 | —52.3 | |
| 9174 | 215 | —54.5 | |
| 9385 | 208 | —56.3 | |
| 9570 | 202 | —57.9 | 95 |

No. 12. 30-XII-1930. 16h17.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 737 | + 4.6 | |
| 166 | 731 | + 4.6 | |
| 574 | 695 | + 2.4 | |
| 1099 | 651 | — 0.7 | |
| 1424 | 625 | — 0.5 | 85 |
| 1776 | 598 | — 1.5 | |
| 1950 | 585 | — 1.8 | |
| 2338 | 557 | — 3.8 | |
| 2524 | 544 | — 4.8 | |
| 2728 | 530 | — 5.5 | 89 |
| 3059 | 508 | — 7.4 | |
| 3418 | 485 | — 9.7 | |
| 3643 | 471 | —11.5 | |
| 3823 | 460 | —13.3 | 90 |
| 4160 | 440 | —14.4 | |
| 4528 | 419 | —17.0 | |
| 4818 | 403 | —19.1 | |
| 5175 | 384 | —21.4 | |
| 5527 | 366 | —24.1 | 87 |
| 5851 | 350 | —26.6 | |
| 6251 | 331 | —29.4 | |
| 6647 | 313 | —32.7 | |
| 7037 | 296 | —35.7 | |
| 7371 | 282 | —38.3 | |
| 7744 | 267 | —41.2 | 85 |
| 8081 | 254 | —43.5 | |
| 8432 | 241 | —46.4 | |
| 8797 | 228 | —49.6 | |
| 9088 | 218 | —52.3 | |
| 9421 | 207 | —54.6 | 83 |
| 9767 | 196 | —57.3 | |
| 10198 | 183 | —59.7 | |
| 10583 | 172 | —61.8 | |
| 11145 | 157 | —63.8 | |
| 11630 | 145 | —65.2 | 82 |

No. 13. 30-XII-1930. 17h35.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 735 | + 4.7 | |
| 179 | 728 | + 5.1 | |
| 671 | 685 | + 2.1 | 98 |
| 982 | 659 | + 2.0 | |
| 1306 | 633 | + 1.9 | |
| 1799 | 595 | — 0.1 | |
| 2239 | 563 | — 2.7 | |
| 2495 | 545 | — 4.3 | 100 |
| 2924 | 516 | — 6.2 | |
| 3342 | 489 | — 8.7 | |
| 3630 | 471 | —10.7 | |
| 3895 | 455 | —12.7 | 100 |

No. 14. 30-XII-1930. 18h45.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 734 | + 5.0 | |
| 235 | 722 | + 5.0 | |
| 354 | 712 | + 4.0 | |
| 515 | 698 | + 4.3 | |
| 632 | 688 | + 3.6 | |
| 763 | 677 | + 3.9 | 75 |
| 1092 | 650 | + 3.0 | |
| 1446 | 622 | + 1.4 | |
| 1616 | 609 | + 1.0 | 80 |
| 1965 | 583 | — 1.6 | |
| 2396 | 552 | — 4.4 | |
| 2685 | 532 | — 5.9 | |
| 3061 | 507 | — 7.2 | 79 |
| 3420 | 484 | — 9.6 | |
| 3777 | 462 | —12.7 | 74 |
| 4129 | 441 | —15.7 | |
| 4441 | 423 | —18.0 | |
| 4764 | 405 | —21.0 | |
| 5077 | 388 | —24.9 | 73 |
| 5383 | 372 | —25.9 | |
| 5739 | 354 | —28.9 | |
| 6131 | 335 | —32.3 | |
| 6408 | 322 | —34.6 | |
| 6785 | 305 | —37.2 | 69 |
| 7107 | 291 | —39.5 | |
| 7394 | 279 | —41.8 | |
| 7565 | 272 | —43.5 | 68 |

No. 15. 30-XII-1930. 19h48.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 733 | + 5.4 | |
| 134 | 730 | + 5.7 | |
| 629 | 687 | + 5.9 | 90 |
| 1105 | 648 | + 4.0 | 94 |
| 1488 | 618 | + 1.9 | 94 |
| 1751 | 598 | — 0.1 | |
| 2049 | 576 | — 2.3 | |
| 2160 | 568 | — 1.8 | |
| 2401 | 551 | — 3.2 | 83 |
| 2721 | 529 | — 4.8 | |
| 2992 | 511 | — 6.9 | |
| 3349 | 488 | — 9.2 | |
| 3704 | 466 | —11.7 | 73 |
| 4020 | 447 | —14.2 | |
| 4243 | 434 | —16.2 | |

No. 16. 30-XII-1930. 20h42.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 732 | + 6.0 | |
| 631 | 686 | + 5.3 | 79 |
| 1105 | 647 | + 3.2 | |
| 1448 | 620 | + 1.0 | |
| 1966 | 581 | — 2.1 | |
| 2201 | 564 | — 2.9 | 73 |
| 2661 | 532 | — 5.5 | |
| 3066 | 505 | — 8.4 | |
| 3409 | 483 | —11.1 | |
| 3732 | 463 | —13.2 | 69 |
| 4290 | 430 | —17.3 | |
| 4698 | 407 | —21.0 | |
| 5182 | 381 | —24.2 | |
| 5533 | 363 | —27.3 | 66 |
| 6063 | 337 | —31.7 | |
| 6602 | 312 | —35.4 | |
| 7082 | 291 | —39.9 | |
| 7465 | 275 | —43.2 | 64 |
| 7890 | 258 | —47.2 | |
| 8203 | 246 | —50.4 | |
| 8498 | 235 | —53.6 | |
| 8776 | 225 | —56.4 | |
| 9033 | 216 | —58.5 | 62 |
| 9299 | 207 | —60.3 | |
| 9543 | 199 | —61.5 | |
| 9765 | 192 | —60.8 | |
| 9798 | 191 | —61.4 | |
| 10200 | 179 | —60.4 | 60 |
| 10671 | 166 | —58.8 | |
| 11221 | 152 | —60.3 | |
| 11600 | 143 | —61.3 | |
| 12189 | 130 | —62.0 | 60 |

No. 17. 30-XII-1930. 22h15.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 732 | + 7.0 | |
| 258 | 718 | + 6.8 | |
| 514 | 696 | + 7.1 | |
| 1071 | 650 | + 4.2 | |
| 1479 | 618 | + 1.5 | |
| 2013 | 578 | — 1.8 | |
| 2710 | 529 | — 6.0 | |
| 3102 | 503 | — 8.7 | |
| 3446 | 481 | —10.7 | |
| 3788 | 460 | —13.5 | |
| 4297 | 430 | —17.2 | |
| 4580 | 414 | —19.6 | |
| 4946 | 394 | —22.4 | |
| 5287 | 376 | —25.2 | |
| 5641 | 358 | —28.3 | |
| 5946 | 343 | —30.7 | |
| 6347 | 324 | —33.7 | |
| 6655 | 310 | —36.4 | |
| 6950 | 297 | —39.0 | |
| 7302 | 282 | —42.7 | |
| 7643 | 268 | —45.4 | |
| 7870 | 259 | —47.6 | |
| 8102 | 250 | —49.9 | |
| 8393 | 239 | —52.8 | |
| 8639 | 230 | —56.1 | |
| 8892 | 221 | —57.3 | |
| 9333 | 206 | —59.6 | |
| 9611 | 197 | —61.4 | |

No. 18. 30-XII-1930. 22h49.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 731 | + 7.3 | |
| 190 | 723 | + 8.0 | |
| 468 | 699 | + 7.7 | |
| 826 | 669 | + 5.4 | |
| 1148 | 643 | + 3.2 | 64 |
| 1236 | 636 | + 2.9 | |
| 1507 | 615 | + 1.3 | |
| 1692 | 601 | + 0.1 | |
| 1894 | 586 | — 0.8 | |
| 2240 | 561 | — 3.0 | |
| 2570 | 538 | — 5.1 | 73 |
| 2941 | 513 | — 7.3 | |
| 3343 | 487 | — 9.8 | |
| 3648 | 468 | —12.4 | |
| 3984 | 448 | —14.9 | 77 |
| 4288 | 430 | —17.5 | |
| 4538 | 416 | —19.5 | |
| 4791 | 402 | —21.5 | |
| 5146 | 383 | —23.5 | |
| 5496 | 365 | —26.1 | 79 |
| 5757 | 352 | —28.7 | |
| 6067 | 337 | —31.4 | |
| 6430 | 320 | —34.6 | |
| 6763 | 305 | —37.5 | |
| 7014 | 294 | —40.1 | |
| 7249 | 284 | —41.8 | 76 |

No. 19. 30-XII-1930. 23h52.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 731 | + 8.0 | |
| 398 | 705 | + 9.3 | |
| 940 | 660 | + 6.1 | |
| 1539 | 613 | + 1.4 | |
| 2051 | 575 | — 0.9 | |
| 2476 | 545 | — 3.7 | |
| 3012 | 509 | — 6.7 | |
| 3450 | 481 | —10.3 | |
| 3925 | 452 | —13.5 | |
| 4355 | 427 | —16.7 | |
| 4768 | 404 | —20.1 | |
| 5027 | 390 | —21.7 | |
| 5432 | 369 | —24.6 | |
| 5773 | 352 | —27.6 | |
| 6169 | 333 | —30.7 | |
| 6517 | 317 | —33.9 | |
| 6945 | 298 | —37.7 | |
| 7322 | 282 | —41.2 | |
| 7690 | 267 | —44.2 | |
| 7996 | 255 | —47.1 | |
| 8205 | 247 | —49.0 | |
| 8447 | 238 | —50.7 | |

No. 20. 31-XII-1930. 1h00.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 731 | + 8.4 | |
| 398 | 705 | + 9.5 | 95 |
| 779 | 673 | + 7.1 | |
| 1063 | 650 | + 4.7 | |
| 1341 | 628 | + 2.1 | |
| 1627 | 606 | + 0.4 | 98 |

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 2158 | 567 | − 1.7 | |
| 2573 | 538 | − 4.2 | 100 |
| 2991 | 510 | − 6.9 | |
| 3348 | 487 | − 9.2 | |
| 3638 | 469 | −11.0 | |
| 3988 | 448 | −13.4 | 97 |
| 4211 | 435 | −15.5 | |
| 4491 | 419 | −18.3 | |
| 4707 | 407 | −19.6 | |
| 4984 | 392 | −21.4 | |
| 5310 | 375 | −23.5 | 85 |
| 5586 | 361 | −25.9 | |
| 5829 | 349 | −28.4 | |
| 6142 | 334 | −31.6 | |
| 6400 | 322 | −32.8 | 78 |
| 6643 | 311 | −35.4 | |
| 6915 | 299 | −38.3 | |
| 7242 | 285 | −41.1 | |
| 7507 | 274 | −43.5 | |
| 7730 | 265 | −45.6 | 77 |

No. 21. 31-XII-1930. 4h13.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 730 | + 9.2 | |
| 612 | 686 | + 6.8 | |
| 1076 | 648 | + 3.4 | |
| 1654 | 603 | − 0.2 | |
| 2199 | 563 | − 3.6 | |
| 2820 | 520 | − 7.6 | |
| 3469 | 478 | −11.6 | |
| 3964 | 448 | −15.0 | |
| 4221 | 433 | −16.8 | |
| 4664 | 408 | −20.4 | |
| 5071 | 386 | −23.5 | |
| 5536 | 362 | −27.0 | |
| 6047 | 337 | −30.8 | |
| 6389 | 321 | −33.8 | |
| 6790 | 303 | −37.0 | |
| 7163 | 287 | −40.1 | |
| 7502 | 273 | −43.5 | |
| 7776 | 262 | −46.5 | |
| 8085 | 250 | −49.1 | |
| 8515 | 234 | −51.7 | |
| 8884 | 221 | −53.5 | |
| 9151 | 212 | −53.8 | |
| 9588 | 198 | −55.1 | |
| 9986 | 186 | −56.0 | |
| 10336 | 176 | −57.3 | |
| 10703 | 166 | −59.3 | |
| 11378 | 149 | −59.4 | |
| 11857 | 138 | −59.4 | |
| 12278 | 129 | −59.8 | |

No. 22. 31-XII-1930. 5h11.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 730 | + 8.6 | |
| 328 | 710 | + 7.2 | |
| 949 | 658 | + 4.2 | |
| 1442 | 619 | + 0.8 | |
| 1920 | 583 | − 2.3 | |
| 2237 | 560 | − 4.1 | |
| 2624 | 533 | − 6.9 | |
| 2906 | 514 | − 8.7 | |
| 3243 | 492 | −10.9 | |
| 3689 | 464 | −14.0 | |
| 4089 | 440 | −16.9 | |
| 4454 | 419 | −19.7 | |
| 4778 | 401 | −21.9 | |
| 5113 | 383 | −24.8 | |
| 5422 | 367 | −27.1 | |
| 5721 | 352 | −29.4 | |
| 6030 | 337 | −32.1 | |
| 6327 | 323 | −34.9 | |
| 6634 | 309 | −37.4 | |
| 6998 | 293 | −40.6 | |
| 7426 | 275 | −43.4 | |
| 7852 | 258 | −46.2 | |
| 8467 | 235 | −49.5 | |
| 9167 | 211 | −52.6 | |

No. 23. 31-XII-1930. 6h10.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 730 | + 8.0 | |
| 317 | 711 | + 7.4 | |
| 597 | 687 | + 5.2 | |
| 1009 | 653 | + 3.0 | |
| 1490 | 615 | − 0.1 | |
| 1807 | 591 | − 2.2 | |
| 2344 | 552 | − 5.1 | |
| 2766 | 523 | − 7.7 | |
| 3284 | 489 | −11.5 | |
| 3716 | 462 | −14.6 | |
| 4117 | 438 | −17.3 | |
| 4608 | 410 | −20.8 | |
| 4956 | 391 | −23.6 | |
| 5336 | 371 | −26.7 | |
| 5753 | 350 | −30.0 | |
| 6126 | 332 | −33.0 | |
| 6427 | 318 | −35.6 | |
| 6899 | 297 | −39.0 | |
| 7251 | 282 | −41.1 | |
| 7545 | 270 | −43.4 | |
| 7849 | 258 | −45.6 | |
| 8192 | 245 | −47.3 | |
| 8665 | 228 | −49.5 | |
| 9047 | 215 | −52.0 | |
| 9322 | 206 | −54.1 | |
| 9542 | 199 | −55.8 | |
| 9769 | 192 | −57.5 | |
| 10002 | 185 | −59.1 | |
| 10348 | 175 | −60.7 | |
| 10492 | 171 | −61.4 | |

No. 24. 31-XII-1930. 6h33.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 730 | + 8.0 | |
| 224 | 719 | + 7.0 | 85 |
| 727 | 676 | + 4.3 | |
| 1194 | 638 | + 1.6 | |
| 1463 | 617 | − 0.4 | |
| 1738 | 596 | − 2.6 | |
| 2118 | 568 | − 4.6 | 88 |
| 2485 | 542 | − 6.5 | |
| 2792 | 521 | − 8.8 | |
| 3048 | 504 | −10.9 | 86 |
| 3389 | 482 | −12.6 | |
| 3760 | 459 | −14.9 | |
| 4112 | 438 | −17.7 | |
| 4459 | 418 | −20.1 | |
| 4838 | 397 | −23.0 | |
| 5176 | 379 | −25.6 | 76 |
| 5507 | 362 | −28.5 | |
| 5911 | 342 | −31.4 | |
| 6226 | 327 | −34.0 | |
| 6778 | 302 | −37.7 | |
| 7151 | 286 | −40.2 | 74 |
| 7541 | 270 | −43.2 | |
| 7976 | 253 | −45.7 | |
| 8464 | 235 | −48.2 | |
| 8836 | 222 | −50.7 | |
| 9134 | 212 | −53.0 | 72 |

No. 25. 31-XII-1930. 7h01.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 730 | + 7.9 | |
| 111 | 729 | + 7.8 | |
| 527 | 693 | + 4.9 | |
| 754 | 674 | + 4.9 | 84 |
| 1237 | 635 | + 1.0 | |
| 1571 | 609 | − 1.7 | |
| 1849 | 588 | − 3.6 | |
| 1971 | 579 | − 3.5 | |
| 2361 | 551 | − 6.4 | |
| 2590 | 535 | − 8.4 | 87 |
| 2856 | 517 | − 9.0 | |
| 3316 | 487 | −11.9 | |
| 3668 | 465 | −14.7 | |
| 4016 | 444 | −17.4 | |
| 4186 | 434 | −18.2 | |
| 4500 | 418 | −20.5 | 82 |
| 4714 | 406 | −22.3 | |
| 4934 | 394 | −23.5 | |
| 5274 | 376 | −26.3 | |
| 5647 | 357 | −29.1 | |
| 6015 | 339 | −31.8 | |
| 6355 | 323 | −34.3 | 79 |
| 6891 | 299 | −37.7 | |
| 7292 | 282 | −40.2 | |
| 7663 | 267 | −42.2 | |
| 7920 | 257 | −44.2 | |
| 8104 | 250 | −45.9 | 76 |

No. 26. 31-XII-1930. 8h41.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 730 | + 8.3 | |
| 525 | 693 | + 5.2 | |
| 1019 | 652 | + 2.0 | |
| 1578 | 608 | − 1.5 | |
| 2005 | 576 | − 4.2 | |
| 2129 | 567 | − 4.4 | |
| 2439 | 545 | − 6.2 | |
| 2956 | 510 | − 8.8 | |
| 3453 | 478 | −11.8 | |
| 3845 | 454 | −14.5 | |
| 4271 | 429 | −17.5 | |
| 4699 | 405 | −20.5 | |
| 5052 | 386 | −23.0 | |
| 5399 | 368 | −25.3 | |
| 5639 | 356 | −25.5 | |
| 6056 | 336 | −27.8 | |
| 6516 | 315 | −31.4 | |
| 6883 | 299 | −34.3 | |
| 7436 | 276 | −38.7 | |
| 7895 | 258 | −41.8 | |
| 8242 | 245 | −44.7 | |
| 8604 | 232 | −47.7 | |
| 8893 | 222 | −50.3 | |
| 9191 | 212 | −53.3 | |
| 9437 | 204 | −56.0 | |
| 9658 | 197 | −58.2 | |
| 9984 | 187 | −59.7 | |

No. 27. 31-XII-1930. 9h46.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 729 | + 8.8 | |
| 213 | 719 | + 8.5 | |
| 551 | 690 | + 5.7 | 91 |
| 1123 | 643 | + 2.0 | 93 |
| 1351 | 625 | + 0.5 | |
| 1584 | 607 | − 0.5 | |
| 2000 | 576 | − 3.7 | |
| 2464 | 543 | − 5.6 | 88 |
| 2920 | 512 | − 8.8 | 90 |
| 3480 | 476 | −12.5 | 79 |
| 3856 | 453 | −15.5 | |
| 4334 | 425 | −18.8 | |
| 4726 | 403 | −22.0 | 83 |
| 4893 | 394 | −21.6 | 80 |
| 5177 | 379 | −23.7 | |
| 5431 | 366 | −25.2 | 74 |
| 5755 | 350 | −25.3 | 70 |
| 6244 | 327 | −29.2 | |
| 6714 | 306 | −32.8 | 65 |
| 7089 | 290 | −35.9 | |
| 7331 | 280 | −38.3 | |
| 7480 | 274 | −38.5 | |
| 7812 | 261 | −41.2 | |
| 8265 | 244 | −44.8 | 64 |
| 8686 | 229 | −48.0 | |
| 9008 | 218 | −50.6 | |
| 9280 | 209 | −53.3 | |
| 9625 | 198 | −56.2 | 63 |

No. 28. 31-XII-1930. 11h03.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 729 | + 8.5 | |
| 157 | 724 | + 8.1 | |
| 719 | 676 | + 4.8 | 100 |
| 1263 | 632 | + 1.5 | |
| 1772 | 593 | − 1.4 | 100 |
| 2240 | 559 | − 4.3 | |
| 2670 | 529 | − 7.3 | |
| 3107 | 500 | −10.1 | |
| 3564 | 471 | −12.9 | |
| 3860 | 453 | −15.2 | 82 |
| 4130 | 437 | −17.1 | |
| 4443 | 419 | −19.6 | |
| 4676 | 406 | −21.9 | |
| 5046 | 386 | −24.7 | 67 |
| 5315 | 372 | −23.1 | |
| 5677 | 354 | −24.5 | |
| 6034 | 337 | −26.5 | |
| 6316 | 324 | −28.4 | 71 |
| 6654 | 309 | −30.8 | |
| 6957 | 296 | −32.7 | |
| 7272 | 283 | −34.4 | |
| 7677 | 267 | −35.8 | 76 |

No. 29. 31-XII-1930. 13h26.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 729 | + 8.0 | |
| 145 | 725 | + 7.7 | |
| 513 | 693 | + 5.0 | |
| 896 | 661 | + 1.8 | 93 |
| 1194 | 637 | − 0.4 | |
| 1422 | 619 | − 1.8 | |
| 1642 | 602 | − 2.7 | |
| 1868 | 585 | − 4.2 | 95 |
| 2114 | 567 | − 5.8 | |
| 2211 | 560 | − 5.5 | |
| 2611 | 532 | − 7.8 | |
| 3060 | 502 | −10.1 | |
| 3547 | 471 | −13.2 | 84 |
| 4045 | 441 | −16.4 | |
| 4462 | 417 | −20.0 | |
| 4917 | 392 | −23.3 | |
| 5356 | 369 | −26.9 | |
| 5575 | 358 | −25.8 | |
| 6030 | 336 | −29.2 | 81 |
| 6420 | 318 | −32.2 | |
| 6828 | 300 | −35.6 | |
| 7182 | 285 | −38.5 | |

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 7626 | 267 | −41.7 | |
| 8068 | 250 | −44.9 | |
| 8591 | 231 | −48.5 | 75 |
| 8939 | 219 | −51.4 | |
| 9302 | 207 | −53.8 | |
| 9816 | 191 | −55.6 | |
| 10227 | 179 | −56.1 | |
| 10555 | 170 | −55.3 | |
| 10981 | 159 | −54.8 | 72 |

No. 30. 31-XII-1930. 15h04.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 729 | +7.5 | |
| 168 | 723 | +6.9 | |
| 514 | 693 | +3.8 | |
| 872 | 663 | +0.4 | |
| 1216 | 635 | −2.1 | 80 |
| 1560 | 608 | −4.8 | |
| 1875 | 584 | −7.3 | |
| 1942 | 579 | −6.7 | |
| 2160 | 563 | −7.5 | |
| 2484 | 540 | −9.5 | |
| 2803 | 518 | −12.0 | 78 |
| 3119 | 497 | −13.9 | |
| 3525 | 471 | −15.8 | |
| 3918 | 447 | −18.2 | |
| 4293 | 425 | −20.5 | |
| 4740 | 400 | −23.0 | |
| 5114 | 380 | −25.5 | 77 |
| 5624 | 354 | −29.4 | |
| 5745 | 348 | −29.8 | |
| 6165 | 328 | −32.6 | |
| 6560 | 310 | −35.9 | |
| 7068 | 288 | −39.2 | |
| 7507 | 270 | −42.0 | 72 |
| 7970 | 252 | −45.8 | |
| 8430 | 235 | −49.8 | |
| 8890 | 219 | −53.3 | |
| 9159 | 210 | −55.5 | |
| 9661 | 194 | −57.6 | |
| 10277 | 176 | −56.7 | |
| 10723 | 164 | −58.2 | |
| 11538 | 144 | −59.8 | |
| 11988 | 134 | −58.9 | 68 |

No. 31. 31-XII-1930. 15h50.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 729 | +7.0 | |
| 134 | 726 | +6.8 | |
| 491 | 695 | +4.0 | |
| 751 | 673 | +1.2 | 80 |
| 1029 | 650 | −1.5 | |
| 1340 | 625 | −4.0 | |
| 1846 | 586 | −6.9 | |
| 2198 | 560 | −8.9 | 93 |
| 2664 | 527 | −13.6 | |
| 3049 | 501 | −14.4 | |
| 3434 | 476 | −17.7 | |
| 3706 | 459 | −18.3 | |
| 4105 | 435 | −20.9 | 83 |
| 4486 | 413 | −23.4 | |
| 4922 | 389 | −26.2 | |
| 5167 | 376 | −27.1 | |
| 5519 | 358 | −29.7 | |
| 5926 | 338 | −32.3 | |
| 6202 | 325 | −34.9 | |
| 6574 | 308 | −38.0 | |
| 6986 | 290 | −40.9 | 75 |
| 7419 | 272 | −43.2 | |
| 7799 | 257 | −45.4 | |
| 8144 | 244 | −47.9 | |
| 8559 | 229 | −51.0 | |
| 8968 | 215 | −53.0 | 73 |
| 9211 | 207 | −54.1 | |
| 9660 | 193 | −54.3 | |
| 9930 | 185 | −56.0 | |
| 10391 | 172 | −57.9 | |
| 11004 | 156 | −59.1 | |
| 11505 | 144 | −60.1 | |
| 12241 | 128 | −59.0 | 73 |

No. 32. 31-XII-1930. 17h45.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 729 | +6.1 | |
| 465 | 697 | +3.6 | |
| 855 | 664 | −0.1 | 87 |
| 1272 | 630 | −3.7 | 80 |
| 1733 | 594 | −6.6 | |
| 2054 | 570 | −8.0 | |
| 2414 | 544 | −10.6 | |
| 2686 | 525 | −12.9 | 81 |
| 2862 | 513 | −13.5 | |
| 3254 | 487 | −16.4 | |
| 3697 | 459 | −19.4 | |
| 4059 | 437 | −22.5 | |
| 4401 | 417 | −25.5 | 77 |
| 4755 | 397 | −28.6 | |
| 5180 | 374 | −31.3 | 74 |
| 5528 | 356 | −32.1 | 70 |
| 5954 | 335 | −34.8 | |
| 6381 | 315 | −37.0 | |
| 6902 | 292 | −39.9 | |
| 7459 | 269 | −42.5 | |
| 8418 | 233 | −47.5 | 67 |
| 9100 | 210 | −50.6 | |
| 9481 | 198 | −53.2 | |
| 9986 | 183 | −55.3 | 66 |
| 10417 | 171 | −56.9 | |
| 10758 | 162 | −58.7 | |
| 11497 | 144 | −58.7 | |
| 11992 | 133 | −62.1 | |
| 12376 | 125 | −61.0 | 65 |

No. 33. 31-XII-1930. 18h53.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 729 | +5.2 | |
| 419 | 701 | +2.8 | |
| 843 | 665 | −0.5 | 96 |
| 1161 | 639 | −2.6 | |
| 1463 | 615 | −4.7 | 100 |
| 1749 | 593 | −6.6 | |
| 2235 | 557 | −9.7 | |
| 2573 | 533 | −12.0 | |
| 2791 | 518 | −13.5 | 96 |
| 3075 | 499 | −14.8 | |
| 3446 | 475 | −17.7 | |
| 3701 | 459 | −20.0 | 94 |
| 3930 | 445 | −22.6 | |
| 4231 | 427 | −25.4 | 95 |
| 4524 | 410 | −27.7 | |
| 4900 | 389 | −30.9 | |
| 5178 | 374 | −32.4 | 79 |
| 5427 | 361 | −33.3 | |
| 5847 | 340 | −34.3 | |
| 6204 | 323 | −35.9 | |
| 6600 | 305 | −38.1 | 66 |
| 6876 | 293 | −39.7 | |
| 7112 | 283 | −41.0 | |
| 7332 | 274 | −41.7 | |
| 7686 | 260 | −43.6 | |
| 8110 | 244 | −45.7 | 62 |
| 8531 | 229 | −47.9 | |
| 8854 | 218 | −50.1 | |
| 9128 | 209 | −51.9 | |
| 9476 | 198 | −53.6 | 60 |
| 9775 | 189 | −54.7 | |
| 10194 | 177 | −55.3 | |
| 10488 | 169 | −56.1 | |
| 10915 | 158 | −56.9 | 60 |

No. 34. 31-XII-1930. 19h58.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 728 | +3.8 | |
| 336 | 707 | +1.8 | |
| 707 | 675 | −0.6 | |
| 1154 | 638 | −2.9 | |
| 1822 | 586 | −6.7 | 100 |
| 2312 | 550 | −10.2 | |
| 2654 | 526 | −12.6 | |
| 3023 | 501 | −15.2 | |
| 3206 | 489 | −16.8 | 71 |
| 3376 | 478 | −17.7 | |
| 3710 | 457 | −20.7 | |
| 4022 | 438 | −23.6 | |
| 4361 | 418 | −26.2 | 69 |
| 4749 | 396 | −29.4 | |
| 5155 | 374 | −31.4 | 50 |
| 5542 | 354 | −33.7 | |
| 5948 | 334 | −35.8 | |
| 6265 | 319 | −38.1 | |
| 6595 | 304 | −39.6 | 53 |
| 6916 | 290 | −41.1 | |
| 7177 | 279 | −42.6 | |
| 7523 | 265 | −43.5 | 58 |

No. 35. 31-XII-1930. 23h52.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 730 | +4.1 | |
| 200 | 721 | +4.3 | |
| 416 | 702 | +3.7 | |
| 768 | 672 | +1.5 | |
| 1246 | 633 | −1.0 | 74 |
| 1965 | 578 | −4.7 | |
| 2382 | 548 | −7.3 | |
| 2788 | 520 | −9.9 | |
| 3228 | 491 | −13.0 | 80 |
| 3624 | 466 | −15.4 | |
| 4003 | 443 | −18.0 | |
| 4346 | 423 | −20.7 | 79 |
| 4612 | 408 | −22.9 | |
| 4903 | 392 | −25.2 | |
| 5300 | 371 | −28.2 | |
| 5676 | 352 | −30.0 | 77 |
| 5963 | 338 | −31.6 | |
| 6175 | 328 | −33.2 | |
| 6391 | 318 | −34.1 | |
| 6727 | 303 | −36.6 | |
| 7152 | 285 | −37.0 | 76 |
| 7498 | 271 | −38.9 | |
| 7807 | 259 | −41.1 | |
| 8127 | 247 | −43.5 | |
| 8460 | 235 | −46.1 | |
| 8689 | 227 | −48.3 | 73 |
| 9014 | 216 | −50.6 | |
| 9384 | 204 | −52.9 | |
| 9705 | 194 | −55.4 | |
| 10075 | 183 | −58.2 | 71 |

No. 36. 1-I-1931. 0h37.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 730 | +4.1 | |
| 348 | 708 | +4.8 | 95 |
| 843 | 666 | +2.1 | |
| 1275 | 631 | −0.6 | |
| 1636 | 603 | −2.7 | 100 |
| 2011 | 575 | −4.9 | |
| 2430 | 545 | −7.0 | 94 |
| 2735 | 524 | −9.2 | |
| 3004 | 506 | −11.3 | 97 |
| 3264 | 489 | −13.4 | |
| 3500 | 474 | −14.4 | |
| 3857 | 452 | −17.3 | 92 |
| 4212 | 431 | −20.2 | 94 |
| 4508 | 414 | −22.3 | |
| 4814 | 397 | −24.6 | |
| 5131 | 380 | −27.0 | 84 |
| 5401 | 366 | −27.3 | |
| 5700 | 351 | −28.8 | |
| 6447 | 316 | −31.5 | |
| 7026 | 291 | −34.8 | |
| 7593 | 268 | −40.9 | |
| 7982 | 253 | −44.3 | |
| 8333 | 240 | −47.3 | 61 |
| 8815 | 223 | −50.7 | |
| 9390 | 204 | −54.6 | |
| 9676 | 195 | −57.4 | |
| 10041 | 184 | −59.7 | |
| 10248 | 178 | −60.8 | |
| 10720 | 165 | −60.5 | 57 |
| 10950 | 159 | −59.5 | |
| 11483 | 146 | −60.3 | |
| 11833 | 138 | −61.2 | |
| 12858 | 117 | −61.0 | |
| 13708 | 102 | −61.6 | 55 |

No. 37. 1-I-1931. 1h40.

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|
| 100 | 731 | +4.9 | |
| 122 | 729 | +4.5 | |
| 372 | 707 | +4.0 | |
| 663 | 682 | +1.6 | |
| 1099 | 646 | −0.7 | 89 |
| 1464 | 617 | −2.7 | |
| 1818 | 590 | −4.2 | |
| 2326 | 553 | −6.8 | 84 |
| 2686 | 528 | −8.7 | |
| 3060 | 503 | −11.2 | |
| 3354 | 484 | −13.8 | |
| 3738 | 460 | −16.4 | 84 |
| 4122 | 437 | −19.0 | |
| 4381 | 422 | −21.5 | |
| 4664 | 406 | −24.1 | |
| 4993 | 388 | −26.4 | |
| 5354 | 369 | −29.1 | |
| 5711 | 351 | −30.1 | 75 |
| 6502 | 314 | −30.9 | |
| 6942 | 295 | −34.0 | |
| 7330 | 279 | −37.2 | |
| 7683 | 265 | −40.1 | |
| 8078 | 250 | −42.9 | |
| 8549 | 233 | −46.5 | |
| 8839 | 223 | −49.0 | 68 |
| 9168 | 212 | −52.0 | |
| 9479 | 202 | −54.6 | |
| 9704 | 195 | −57.3 | |
| 9900 | 189 | −59.5 | |

| Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % | Altitude geom. m | Pressure mm Hg. | Temperature °C | Relative Humidity % |
|---|---|---|---|---|---|---|---|
| 10526 | 171 | —59.4 | 65 | 4680 | 405 | —22.8 | |
| 10866 | 162 | —57.7 | | 5011 | 387 | —25.4 | |
| 11145 | 155 | —56.6 | | 5315 | 371 | —28.0 | 89 |
| 11567 | 145 | —57.6 | 66 | 5571 | 358 | —29.8 | |
| | | | | 5752 | 349 | —29.7 | |
| | | | | 5980 | 338 | —31.0 | |
| No. 38. 1-I-1931. 2h39. | | | | 6107 | 332 | —30.4 | 84 |
| 100 | 732 | + 4.9 | | 6569 | 311 | —32.4 | |
| 428 | 703 | + 3.2 | | 7010 | 292 | —35.0 | |
| 815 | 670 | + 0.8 | | 7400 | 276 | —38.0 | |
| 1281 | 632 | — 2.1 | 90 | 7808 | 260 | —41.2 | |
| 1664 | 602 | — 4.8 | | 8320 | 241 | —44.4 | 79 |
| 1956 | 580 | — 6.8 | | 8746 | 226 | —47.6 | |
| 2201 | 562 | — 8.3 | 100 | 9073 | 215 | —50.8 | |
| 2368 | 550 | — 7.8 | | 9477 | 202 | —54.0 | |
| 2728 | 525 | — 9.3 | | 9799 | 192 | —57.0 | |
| 3149 | 497 | —12.2 | | 10170 | 181 | —59.8 | 74 |
| 3366 | 483 | —14.0 | | 10522 | 171 | —62.6 | |
| 3605 | 468 | —15.0 | 98 | 10970 | 159 | —64.0 | |
| 3933 | 448 | —17.4 | | 11446 | 147 | —63.7 | |
| 4273 | 428 | —20.0 | | 11531 | 145 | —62.5 | 72 |

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