2/10 of the sky covered) would best be described as:

19% fair *17%* sunny *40%* clear *24%* bright.

Other: *2/10, cloudy bright, fairly bright, few scattered clouds, fair with good visibility.*

10. A forecast reading "Tomorrow will be partly cloudy" means to you:

49% Part of the sky will be covered by clouds all day

38% Part of the day will be clear, the remainder cloudy

2% Rain will fall intermittently during the day

6% It will be cloudy in some areas, clear in others.

7% The forecaster is only partly sure what to expect.

Other: *Intermittent sunshine.*

11. A forecast which called for "rain and sleet" would lead you to expect:

50% The formation of ice on roads and sidewalks

13% Some snowflakes to fall with the rain

35% Some ice pellets to fall with the rain

2% Rain during the morning and snow during the afternoon.

Other: *Heavy wet snow.*

New Data on the Lower Stratosphere *

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WITH the increase of flying in the stratosphere improved data on the temperature, wind, and humidity there become more important. Although the information now available will become obsolete rather soon with the increase in observations, a summary of some results is given here.

Starting with the end of March, 1947, preliminary reports on routine measurements of meteorological elements using 2000-gram balloons have been issued by the Air Weather Station, White Sands Proving Ground, Las Cruces, New Mexico (32.4° North, 106.3° West, elevation 3991 feet = 1217 m). Rawinsondes are used for transmission of the data; heights are computed from the pressure and occasionally checked by radar tracking.

Many of the measurements were made at altitudes exceeding 75,000 feet (see table below) with occasional reports for altitudes over 100,000 feet (30 km). The agreement between day and night data is good, and no large errors are indicated. These measurements provide a very important aid in attempts to solve a number of meteorological problems. A second similar station situated as far as possible to the north would be very valuable.

Average values of the observed temperature for four quarterly periods are given in FIGURE 1.[1] It seems that except for the neighborhood of the tropopause, where the lowest temperatures are recorded in summer, the temperature of the lower stratosphere is highest in summer. This agrees with findings by Dobson *et al* ([1], p. 172) for regions farther north. For an elevation of 90,000 feet (about 30 km) averages were calculated for those months for which sufficient data are available. These resulted in the following values (in degrees centigrade, with standard error, April 1947 to May 1948):

Month	Jan./Feb.	March	April	May	July	Sept.
Temperature	−48 ±2	−50 ±4	−44 ±6	−38 ±7	−37 ±6	−42 ±4
Number of observations	6	7	24	7	12	5

The yearly period is significant. For higher altitudes the results from sound data in Central Europe indicate a temperature maximum there occurring late in winter [2] (ozone effect). No reliable data are available regarding the height of the layer (probably between 30 and 40 km, likely to depend on the latitude) in which the curve giving the annual period of temperature reverses its maxima and minima or gradually changes its phase.

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[1] Data were plotted first for individual ascents by Dr. L. P. Geldart; the combining and drafting of FIGURE 1 was done by Mr. R. Gilman.

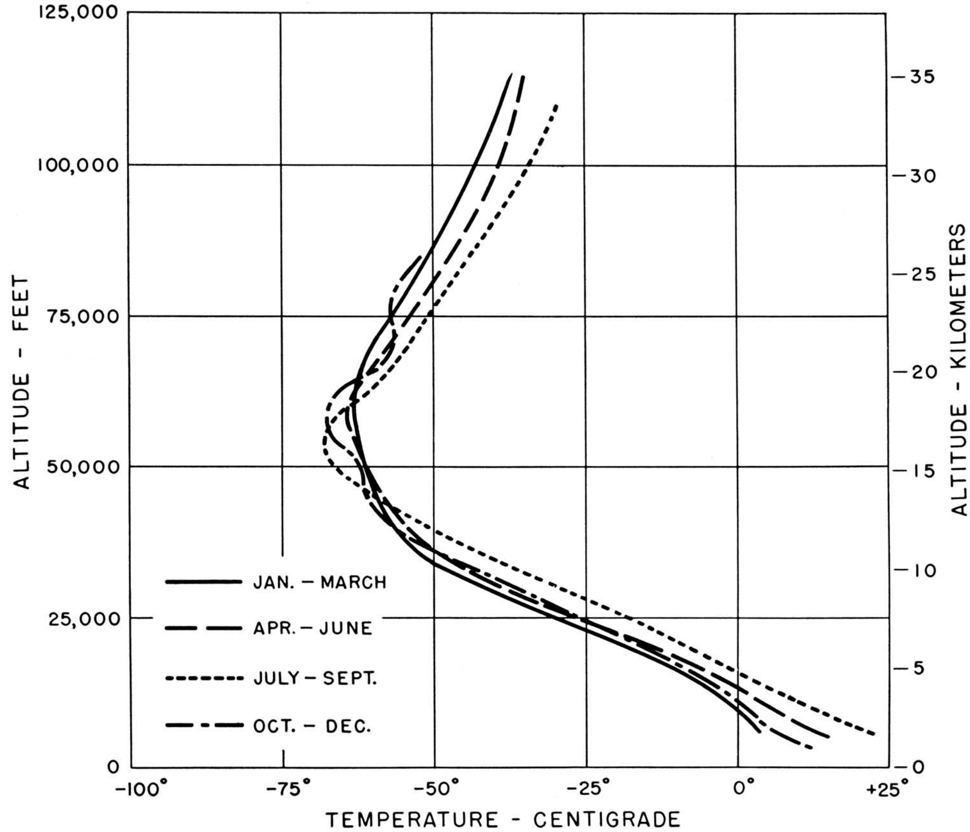

FIG. 1. Mean temperature-height curves for White Sands Proving Ground, Las Cruces, New Mexico, U. S. A., Lat. 32°N., 1947–1948.

The great majority of the wind observations show westerly wind in the higher levels of the troposphere. Investigations by Dobson [3] and others have indicated a maximum of the wind velocity near the tropopause. In the data from White Sands where the tropopause is usually at an altitude between 45,000 and 55,000 feet (15 ± km), the maximum wind velocity usually occurs well below the tropopause, roughly at 40,000 feet (12 km). Since the direction of the horizontal temperature gradient reverses from poleward to equatorward in the average near this level, the horizontal pressure gradient decreases above this altitude. The apparent difference between the earlier results and those based on data from White Sands are due to the fact that most of the earlier data on the wind velocity were obtained in higher latitudes, where the level of the tropopause more nearly agrees with the level of maximum pressure gradient.

The highest wind velocities observed in the troposphere over White Sands reached about 200 miles/hr (100 ± m/sec). Values of more than 100 miles/hr (over 50 m/sec) in the upper troposphere were recorded in almost every month.

During the winter months, occasionally a change from westerly winds (below) to easterly winds (above) was found in the lower stratosphere. Usually, however, westerly winds with velocities decreasing with altitude prevailed to the top of the ascent; rarely velocities higher than the maximum in the troposphere were observed in the lower stratosphere over White Sands. Over Norway, mother-of-pearl clouds have indicated occasionally westerly winds with velocities of about 170 miles/hr (75 m/sec) during winter (see Størmer [4]).

From May to October, easterly winds prevailed above about 60,000 feet (18 km) at White Sands, but then usually the wind velocity did not exceed 50 miles/hr (25 m/sec). The maximum was about 100 miles/hr (50 m/sec). However, it must be considered that generally in instances of higher velocities the balloon is rather far away, and observations are likely to have been lost more frequently in such instances than during ascents in calmer weather. Various kinds of observations (see, e.g., Gutenberg [2]) indicate an increase in velocity of the easterly winds with altitude, reaching or even surpassing 200 miles/hr in the upper stratosphere.

In a short note, Johnson [5] published results for wind at a level of 30 km (100,000 ft) over England. They show seasonal changes similar to the corresponding data from White Sands. Between February 1944 and May 1945, easterly winds prevailed at an altitude of 30 km over England during the summer with a mean velocity of about 25 miles/hr (12 m/sec) and westerly winds of an average of 80 miles/hr (37 m/sec) during the winter; the observed maximum was 146 miles/hr (66 m/sec).

Flohn [7] has discussed similar results for Omaha (Nebraska), Iraq and Tateno (Japan). Combining these with the fact that in the equatorial region (Batavia, Atlantic Ocean) easterly winds prevail above about 18 km (60,000 ft), he came to the conclusion that during summer easterly winds prevail in the lower stratosphere between the equator and at least the sub-polar zone. However, during winter thus far no evidence is available to locate the transition zone between the westerly winds which extend certainly as high as 25 km (80,000 ft) and the easterly winds above. Flohn points out that the unpublished results of the Schwabenland-expedition indicate that during summer in the southern Atlantic south of 35° latitude the reversal of the pressure gradient occurs above 20 km, somewhat higher than in the northern hemisphere.

According to Flohn, new calculations of the pressure and temperature distribution as a function of the latitude are being undertaken. The best data now available are those given in Hann-Süring [6]. The following tabulation is based on pressure data which have been calculated there from observed temperatures. The observed seasonal changes of the wind velocity in the lower stratosphere correspond to these calculated seasonal variations of the mean pressure gradient:

PRESSURE DIFFERENCE IN MILLIBARS

Altitude		75° N. to Equator		60° N. to 30° N.	
Km	Feet ±	Summer	Winter	Summer	Winter
6	19,700	−28	−55	−18	−30
8	26,300	−29	−55	−20	−31
10	32,800	−26	−48	−19	−26
12	39,700	−20	−38	−14	−21
14	45,900	−12	−27	− 9	−15
20	65,600	+ 2	− 5	0	− 3

Humidity observations at great altitudes are rarely accurate, and very few data are available above about 35,000 (10 ± km). At White Sands, occasionally, the relative humidity observed between 30,000 and 35,000 feet was as high as 90 percent but in the great majority of ascents it was between 20 and 35 percent at the highest points of observation. Considering, that at the average temperature there of about − 50°C the saturation pressure of water vapor is about 0.03 mm Hg, the actual pressure of water vapor there would be normally about 0.01 mm Hg, or only about 0.004 percent of the air pressure there. This is a small fraction of the corresponding ratio near the surface where it is of the order of 1 percent. In the lower stratosphere, according to Dobson *et al* ([1], pp. 152–157) the relative amount of water vapor continues to decrease. However, the existence of the mother-of-pearl clouds shows (see [4]) that saturation occasionally may be reached at elevations between 20 and 30 km (70,000 and 100,000 ft). Even then, water vapor forms a much smaller percentage of the air in the lower stratosphere than near the ground. Apparently, no explanation has been given for this rapid decrease of water vapor near the tropopause.

No new data seem to have been published concerning changes in the percentage of other constituents of the atmosphere with altitude. For discussion of ozone and carbon dioxide see, e.g., Dobson *et al* [1].

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