sion of temperature in the stratosphere. The mean value of the height of the tropopause is 16.5 geodynamic kilometers, and its mean temperature 194.5° A. The period of activity of the monsoon in northern India is July to September.

(2) *November to middle of May.*—In this period, Types III and IV are more frequent. Even here there is almost always an inversion of temperature above 17 geodynamic kilometers. The mean values of H_c and T_c during this period are 16.2 gkm. and 201° A. if we take the values corresponding to the higher value of H_c on occasions when the transitions were of type IV, and 14.9 gkm. and 203.5° A. if we take values corresponding to the lower values of H_c.

A significant feature shown by the results of the monsoon period is the comparatively high temperature between 4 and 13 gkm. and the close agreement of the height-temperature lines between these limits with those of saturation adiabatics.

In Figure 2 are shown the values of T_c plotted against the corresponding values of H_c. The values obtained by Van Bemmelen from ascents at Batavia are also plotted for comparison. The general tendency of H_c to approach a limiting value of about 17.5 gkm. with decreasing T_c is very suggestive.—*K. R. Ramanathan, Meteorological Office Poona, October 12.*

Cours de Physique, Troisième Partie, Aérologie et Aérodynamique. By E. Rothé (Gauthier-Villars, Paris, 1928).—This book is an elementary treatment of the sciences of aerology and aerodynamics based largely on the lectures of Professor Rothé at the Aerodynamic Institute of the Faculty of Sciences at Nancy and at the Geophysical Institute at Strasbourg. The publication of the part on aerodynamics was interrupted by the war in 1914 and although the original manuscript was revised, the revision appears to have consisted mainly of the addition of the Strasbourg lectures on aerology. There are exceedingly few references to work in aerodynamics carried out after 1914. Unfortunately, aerodynamics has advanced so rapidly that experiments made prior to 1910 are obsolete, because models were too large, the interference of supports was excessive, the airstreams were nonuniform and turbulent, and instruments and experimental technique were, according to present day standards, primitive. The book of Professor Rothé represents in general the state of the science in 1914 rather than in 1928. Dimensional coefficients are used instead of the nondimensional coefficients which have been in use almost universally for several years. The value given as the result of the most precise "modern" experiments on the resistance of flat plates is about 20 per cent too high. The only aerodynamic balance described is the obsolete Eiffel balance. Such examples could be multiplied.

An entire chapter is devoted to the so-called paradox of Dubuat. In 1786 Dubuat published an account of experiments on plates towed in still water and immersed in running water, in which a difference of about 30 per cent was found, depending on whether the plate or the water was moving. Notwithstanding the fact that both results are considerably in error because of the use of an inaccurate anemometer for the measurement of the speed of the flowing water, because of the interference of large supports, and of an inaccurate method of obtaining the total force from pressure measurements, this "paradox" and its many "explanations" are often quoted by engineers as showing that the forces on bodies in fluids depend on whether body or fluid is moving. Professor Rothé quotes an "explanation" given by Joukowski in 1916 that the difference was due to turbulence in the flowing water, and describes confirming experiments in which plates are moved in a tube just a little larger than the plate. According to the best of our knowledge, the flow around a thin flat plate in a large stream is not very sensitive to the amount of turbulence present, and turbulence has no place in an "explanation" of the Dubuat "paradox." The effects of turbulence are felt only in bodies of curved outlines such as spheres, cylinders, ellipsoids, airship hulls, etc.

Notwithstanding the fact that Professor Rothé's book is not suitable for beginning the study of aerodynamics, the advanced student will find a number of the older experiments brought together in a convenient place and will find much of historical interest in the book.—*H. L. Dryden, Physicist.*

The diurnal variability of humidity in northwestern Washington (by George W. Alexander).—Author's Abstract: An attempt was made to discover whether or not there is any consistent relationship between relative or absolute humidity, as indicated at the morning (5 a.m. Pacific time) observation and the percentage of relative humidity (degree of fire hazard) during the afternoon of the same day. The results were altogether negative.

Over a total of 8,268 dates it was found that low relative humidity in the afternoon was preceeded by normal relative humidity in the morning in 67 per cent of the cases and by near normal conditions in an additional 21 per cent. Greatly subnormal relative humidity at morning observation was of rare occurrence, and usually marked the culmination rather than the beginning of a period of "fire weather." Even the lowest percentages in the afternoon frequently followed abnormally high morning percentages.

The absolute humidity, as represented by the temperature of the dew point, was normal or near normal on 88 per cent of days with subnormal relative humidity in the afternoon. There is a tendency for variation in the absolute humidity, the dew-point temperature and the relative humidity each decreasing in 38 per cent of these days. In April, May, and September east winds cause abnormally low absolute and relative humidities simultaneously three or four times each year; in midsummer most cases of low relative humidity are due to increases in temperature.

The conclusion is expressed that, for this section at least, morning humidities can not be used effectively as arguments in the development of empiric formulæ for determining the percentage of relative humidity during the following afternoon, and that the determination of the nature and extent of changes in humidity must be based on a proper interpretation of the weather map.

Arctic exploration.—Sir Hubert Wilkins, speaking before the British Empire Chamber of Commerce, in the Whitehall Club in New York on March 20, 1929, outlined a 10-year plan to establish 12 weather-observing stations in the Antarctic and sub-Antarctic for the betterment of weather forecasting. Sir Hubert, it may be remembered, made an airplane flight from Point Barrow, Alaska, to Spitzbergen in April, 1928.

According to the report of the luncheon as printed in the New York Times of March 21, 1929, Sir Hubert is reported as saying:

> The plan that has been before the Meteorological Society now for a number of years is this: We shall lay down in the Arctic some

30 more stations than there are at present and that work is now in the hands of a society known as the Aero-Arctic Society with headquarters at Berlin and subscribed to by every Government in the Northern Hemisphere without exception. * * * The plan for investigation at the polar regions is not going to open the way in itself to accurate meteorological forecasting, but it is going to help if we can collect our information and correlate it with that which has already been gathered from other parts of the world.—(*Excerpted from the New York Times of March 21, 1929.*)

Flying weather over Greenland.—Prof. William H. Hobbs, director of the University of Michigan Greenland expeditions, is a strong advocate of the Greenland air route between America and Europe, which offers the great advantage of avoiding the long "hops" of more southerly routes and also of passing to the northward of the fog-ridden Newfoundland Banks. The route he recommends starts at Chicago, crosses British America to Cape Chidley, spans the relatively narrow Baffin Bay to to the west coast of Greenland, crosses the inland ice of Greenland to Angmagsalik, on the east coast, continues thence to Reykiavik, Iceland, and then crosses to any desired point in northwestern Europe. Concerning certain climatic features of this route he says:

Over Greenland, and particularly over the great dome of inland ice, fogs are exceedingly rare, if we except the shallow near-surface stratum of the remote Greenland interior. This zone of mist and fine snow may constitute a serious handicap, in that ice may form on the fuselage. It is believed, however, that this dangerous zone can be avoided by flying at a height of a few hundred feet above the flat surface of the dome, which is at a level of about 9,000 feet.

The glacial anticyclone located permanently over the inland ice consists of upper currents moving in toward the center, there settling to the ice surface, and passing out centrifugally toward all margins. It is therefore only necessary for the pilot to ascend a few thousand meters so as to enter the upper currents and proceed to the center with a tail wind, and, after crossing the central region, to descend into the surface current and go out with a tail wind. This circulation can be used as well on the westward as on the eastward journey.

The surface of the inland ice, except near its margin, is nearly as level as a ballroom floor and is also hard enough for landing with wheels or skis within broad zones on either side.—*C. F. Talman, in Why the Weather?, Science Service, March 19, 1929.*

551.5 (44).

French meteorological activity, 1928.—In the Finance Committees' report to the 1929 Air Budget, General Hirschner outlines the work of the meteorological service for 1928, as follows:

The requests for regular meteorological reports pertaining to air navigation have steadily increased during 1928. The information desired pertained particularly to long-distance flights, thus complicating the gathering and dissemination of information. During the period from May to August, for example, the number of reports to various meteorological stations averaged from 50 to 60 per day and required messages aggregating some 2,500 words.

Meteorological information was divided into three general classes—that for civilian air lines, flights undertaken by either the military or naval air services, and long-distance flights.

CIVILIAN AIR LINES

Nine civilian air lines were organized during 1928 * * *. To cover completely this increasing number of air lines it was necessary to create auxiliary posts (gendarmerie, airdrome caretakers, etc.) for simple observations which, nevertheless, required careful checking. On certain lines, the service starts very early in the morning, necessitating observations during the night and at daybreak. It was necessary to arrange with the various departments, particularly the auxiliary services, and to obtain permission to use personnel for gathering and transmitting the information. The situation is particularly complicated since our regular lines are practically all international in character. This requires close liaison between meteorological services of the interested countries.

MILITARY FLIGHTS

These may be classified as follows: Individual flights, formation cross-country flights, and night flights. The protection of individual flights is assured by the normal system of information. Usually the pilots on such individual flights are experienced men who are capable of coping with difficult meteorological situations.

Formation cross-country flights necessitate a much closer control and the information furnished must be more complete. Additional means of transmission are thus necessary and in preparation for such flights rather complicated orders may be required. The importance of meteorological information can not be too greatly stressed. In spite of the great progress which has been made, two serious accidents occurred during 1928 which might have been evaded. A pilot left an eastern airdrome during local clear weather but became lost in a fog which covered a great part of France. He was forced down and in landing his plane turned over. A squadron flying in formation left an eastern airdrome under good local weather conditions but met with a series of violent storms which had been forecast and reported by the Meteorological Bureau. The squadron was dispersed and partly destroyed.

NIGHT FLIGHTS

Until 1927 night flying was restricted to the areas over Chartres and Nancy where the night bombarding regiments are stationed. During 1928, however, individual and formation night flights took place over the whole of France. This necessitated in many cases a special meteorological organization, since the last information received, in the normal network, is at 6 p. m. It was impossible to exact too much night work of personnel required to make early morning observations.

Since training in night flying will continue, it will be necessary to provide adequate funds to make the night meteorological service effective.

LONG-DISTANCE FLIGHTS

These flights generally pass beyond the limits of France and sometimes those of Europe. They usually begin early in the morning and are often postposed from day to day. This imposed a great responsibility upon the meteorological service. * * *

SCIENTIFIC STUDIES

The method of forecasting weather conditions has undergone very marked improvement, thanks to the work of our meteorologists and those abroad. Meteorological studies in connection with trans-Atlantic flights have had an important effect on the study of the atmosphere over the ocean. * * *

HIGH ATMOSPHERE

The Trappes Observatory continued its work on the temperature, pressure, and hygrometry of the high atmosphere. Balloon observations were made, either in conjunction with international soundings, or at favorable times and in connection with special studies. As a general rule, twin balloons were used since they are easier to locate after landing, and in addition will carry more complete equipment consisting of the baro-thermo-hygro, and other apparatus.

INTERNATIONAL RELATIONS

International collaboration is essential in meteorology. Numerous conferences and international congresses have taken place during 1928. These may be divided into three groups: Conferences on purely meteorological subjects; Air conferences with meteorological commissions; radio conferences.

Meteorological conferences.—Certain of these are scientific and pertain to the unification of methods which are essential to the development of the science. (Commission for the exploration of the high atmosphere which met in 1927 at Leipzig; Session of the International Geodetical and Geophysical Union which met in Prague in 1927.) Others concern the organization necessary for the transmission of radiograms. (Commission for the radiometeorological organization over the sea which met in London in 1928).

The first of these conferences, presided over by the Director of the National Meteorological Bureau, began a complete organization for radiometeorological observations at sea and particularly over the Northern Atlantic. The second treated of the problems incident to the functioning of the world's radiometeorological network and prepared a new code for the transmission of meteorological observations. These two conferences were the first to be attended by representatives of the American meteorological service since the war.

Aeronautical conferences.—The proper functioning of international air lines necessitates periodical conferences which deal with