when the wind velocity was lowest and that turbulence was a small factor here.

Mr. BYERS stated that turbulence does carry particles upward and that in this case these were salt particles. He also stated that there was an optimum wind velocity for cloud formation. During a high wind turbulence was too great and there was no stability and therefore no clouds. Turbulence is necessary to carry the cooling and moisture to higher levels.

Mr. JONES cited from his experience on Mount Tamalpais and stated that with the more pronounced inversion there was an influx of insect life which must have come from the interior valleys and indicated an air draft from the interior at those levels.

Mr. WELLS called attention to the carrying of dust and smoke from the Pacific northwest several hundred miles over the ocean during the summer months.

Major BOWIE said we must have a logical explanation of these local phenomena for use in forecasting and stated that turbulence effects were not the cause. Turbulence is the result of super-adiabatic lapse rate. Major BOWIE in answering Mr. BYERS stated that high fog starts in the evening at an elevation of several hundred feet and builds down to the surface at the time of least wind in the morning.

Mr. VARNEY said in his opinion there were two stages in formation of fog: first, a building up of a moist air layer in the afternoon, and second, a cooling and building down in the night during a period of decreasing wind velocity.

## Structure and Temperature of the Stratosphere

By B. GUTENBERG

Investigations on the structure of the stratosphere during the last year have completely changed our view. Observations have shown that in the lower parts of the stratosphere temperature is increasing very slowly. Lindemann and Dobson used observations on meteors to get results on the density of higher parts. New theoretical values of temperature were found by utilizing the fact that there is a layer of ozone at a height of 40 to 50 km. Investigations of the aurora polaris have shown a difference between rays observed in the layers of the atmosphere in the shadow of the earth and those in sunlight. The spectrum of both kinds of aurorae shows lines of nitrogen but the green line of oxygen seems to decrease between the lower aurorae in the shadow of the earth and the higher ones in the lighted layers. So nitrogen and oxygen must be present up to heights of some hundred km.; the latter may be in a decreasing amount. No lines of helium or hydrogen have been observed. Maris and Epstein found by calculations that the lower parts of the stratosphere up to heights of more than 100 km. need a very long time to restore diffusion equilibrium if mixed. So we can suppose that at least in the lower 100 km. of the stratosphere the composition does not change very much with height. Finally Peterson calculated that a gas originating at the bottom of the atmosphere and leaving it at the top,—

for example, according to the results of Jeans, if these parts are too hot,—form at great heights a considerably less amount of the atmosphere than in the case of diffusion equilibrium. The idea of a warm stratosphere at great heights is supported by the observations of sound waves through the stratosphere. Using these facts and the observations of meteors we can calculate the density of the stratosphere with different assumptions. The general result of all methods is that we have very probably an increasing temperature in the stratosphere beginning at a height between 30 and 40 km., no change of composition at least until a height of 150 km., no hydrogen at any height, a slowly decreasing amount of oxygen at heights of some hundred km., and, probably a small amount of helium or water vapor or neon at very great heights. The principal gas at any height is nitrogen.—*Author's Abstract.*

*Discussion:* Col. HERSEY remarked he was glad to see that the Pasadena Institute of Technology had taken up work in Meteorology and Aerology. Major BOWIE thanked Dr. GUTENBERG for a very interesting paper and said that the older meteorologists were seeing many changes in their concepts of meteorology.

Mr. BREESE asked concerning the data taken in the recent Picard flight. Dr. GUTENBERG replied that this flight had been too low to yield any data to compare with the thirty kilometer balloon flights.

Col. HERSEY turned the chair back to Major BOWIE at 4:45 p. m.

## A Brief Study of Oregon Temperatures

By EDWARD LANSING WELLS, U. S. Weather Bureau

The Japan Current has been given unwarranted credit for the mild climate of western Oregon, but nearness to the ocean is an important factor in the control of Oregon temperature; altitude and local topography are also very important. The Columbia River Gorge, which cuts through the Cascade Mountains nearly to sea level, forms an interesting meteorological laboratory.

The normal annual temperature in Oregon ranges from 56° in the Snake River Canyon to 38° in the high Cascades. This is a range greater than that between Mobile, Ala., and Boston, Mass.

The daily and seasonal ranges in temperature differ more widely than the normal annual temperature. There is a difference of more than 28° in the normal minimum temperature for January, and of more than 30° in the normal maximum for July. The latter is greater than the range over the entire United States east of the Rocky Mountains.

Under certain conditions the differences in temperature over the state at a given time may be extreme. On January 21, 1930, one of the coldest days ever experienced in the state, the minimum temperature was 38° on the coast and —52° at one point in the interior, a range of 90°.

Hot periods are short, particularly in the Northwest and near the coast. On the immediate coast there is seldom any hot weather. At Portland the average duration of hot spells is two days, and they seldom exceed three days in length.