Engelmann spruce type to timber line there is a noticeable increase in range, due to the exposed situation of the timber line station.

2. Precipitation increases rapidly with altitude up to the Douglas fir type. From the Douglas fir to the Engelmann spruce type it remains almost stationary, but at timber line there appears to be a substantial increase.

3. Wind movement is normally greatest in the higher altitudes, but this relation is not always indicated for the reason that some of the stations are located in the forest while others are in the open. The highest records are obtained at timber line, and the lowest in the spruce forest.

4. Evaporation records show no constant relation to altitude, because wind movement and exposure to sunshine, two of the strongest factors influencing evaporation, vary at the different stations according to density of cover. The highest records obtained are in the pinon-juniper type and the lowest in the Engelmann spruce type.

5. On the basis of origin there are several general soil types in this region. Those in the pinon-juniper type are derived from sandstone, limestone, and basalt. In the yellow pine type local areas of limestone and sandstone occur near the lower limits, but basaltic soils predominate over the type as a whole. Above the yellow pine type all the soils are derived from volcanic rocks.

Probably the most important soil character to be dealt with in this region is the capacity for absorbing and delivering moisture as determined by permeability, water-holding capacity, and willing coefficient. From this standpoint the heavy clay soils common through the yellow pine type present the least favorable conditions for growth, particularly with respect to natural reproduction. Although these soils have a high water-holding capacity, they also have a high wilting coefficient, and unless mixed with a large proportion of stone and gravel they are exceedingly impervious. High precipitating, low evaporation, and a high degree of permeability tend to create a large moisture supply in the Douglas fir and Engelmann spruce and alpine types.

Soil temperature is of importance mainly through its indirect effects. When the soil temperature falls to 32° F. or even a few degrees above 32°, the soil moisture ceases to be available to plant roots. If this condition persists continuously over long periods during which transpiration is favored by sunshine and wind the result may be fatal to a tree which is unable to endure extreme desiccation.

6. The data obtained indicate that the upper limits of all the forest types are determined primarily by low temperature as related to photosynthesis, and that the lower limits are determined primarily by deficient moisture supply. Low soil temperature, by rendering the soil moisture unavailable to the roots, may under certain conditions, as at timber line, become the upper control; but, at least as far as reproduction is concerned, this is not believed to be a prevalent factor in this region, for the reason that in the high altitudes, the only places where long periods of continuously low soil temperature occur, transpiration in seedlings is reduced to a negligible quantity by a deep snow cover. Deficient moisture rather than high temperature is regarded as the lower control because observations supported by experimental data on nearly all of the species in this region indicate that when adequately supplied with moisture they are capable of enduring high temperature far in excess of those which occur at the lower limits of their natural range.

BIBLIOGRAPHY.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

C. FITZHUGH TALMAN, Professor in Charge of Library.

The following have been selected from among the titles of books recently received as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies:

Batavia. K. Magnetisch en meteorologisch observatorium.
Results of pilot balloon observations at and near Batavia in the years 1911–1918. Batavia. 1920. 104 p. 28 cm. (Verhandelingen no. 6.)

Bergman, H. F.
The effects of cloudiness on the oxygen content of water, and its significance in cranberry culture. Brooklyn. 1921. p. 50-58. 25½ cm. [Excerpted from American journal of botany, vol. 8, no. 1.]

Brotherus, Hj. V.
Bericht über die meteorologische Expedition der Finnischen meteorologischen Zentralanstalt nach Kumlinge zur Beobachtung der totalen Sonnenfinsternis am 21. August 1914. Helsingfors. 1915. 33 p. 24 cm. (Suomen Valtion meteorologisen Keskuslaitoksen toimituksia, no. 4.)

Brotherus, Hj. V.
Die Ergebnisse der ersten aerologischen Beobachtungen in Finnland 1911–1914. Helsingfors. 1920. 115 p. 24 cm. (Suomen Valtion meteorologisen Keskuslaitoksen toimituksia, no. 5.)

Carrick, D. B.
Resistance of the roots of some fruit species to low temperature. Ithaca. 1920. p. 609–661. 24 cm. (Cornell university. Agricultural experiment station. Memoir 36.)

Connor, A. J.
Temperature and precipitation of Alberta, Saskatchewan and Manitoba. Ottawa. 1920. 170 p. 29 cm. [Plates and maps in separate portfolio.] (Meteorological service of Canada. Dept. of marine and fisheries.)

Eichstädt, Franz.
Die Eisverhältnisse im Kaiser Wilhelm-Kanal. Kiel. 1919. 49 p. 32 cm. (Inaug.-Diss. Kiel.)

Exner, Felix M.
Anschauungen über kalte und warme Luftströmungen nahe der Erdoberfläche und ihre Rolle in den niedrigen Zyklonen. Stockholm. 1920. p. 225–236. 24 cm. (Reprint from Geografiska annaler 1920, H. 3.) [Abstract in later REVIEW.]

Gates, Frank C., & Hurd, Ruth E.
Meteorological data, Douglas Lake, Michigan, 1912–1918. [Excerpted from 21st Michigan academy of science report, p. 373–378.]

Gex, F.
Les intempéries de l'année 1919 en Savoie et leurs répercussions agricoles et pastorales. Grenoble. 1920. 32 p. 25 cm. (Reprint from Revue de géographie alpine.)

Hintikka, E. A.
Observations magnétiques faites à Kumlinge à l'occasion de l'èclipse totale du soleil le 21 août 1914. Helsingfors. 1915. 18 p. 24 cm. (Suomen Valtion meteorologisen Keskuslaitoksen toimituksia, no. 3.)

Keidel, Juan.
Sobre la nieve penitente de los Andes argentinos. Buenos Aires. 1918. 84 p. 27 cm. (Argentina. Anales del ministero de agric. Sec. geol., mineral., y minería, tomo 12, núm. 4. Contributión al conocimiento geologico de la Rep. 2. Monografías.)

Korhonen, W. W.
Die Ausdehnung und Höhe der Schneedecke. Helsingfors. 1915. 184 p. 33 maps. 24 cm. (Suomen Valtion meteorologisen Keskuslaitoksen toimituksia, no. 2. Untersuchungen über die Schnee- und Eisverhältnisse in Finnland. 1). [Abstract in later REVIEW.]

Lammert, Luise.
Der mittlere Zustand der Atmosphäre bei Südföhn. Leipzig. 1920. p. 261–322. 24½ cm. (Veröffentlichungen des Geophys. Instituts der Univ. Leipzig, 2. Serie. Spezialarbeiten aus dem Geophys. Inst., Bd. 2, H. 7.)

Lehmann-Tegel, Kurt.
Regenkarten des Königreichs Dänemark. Berlin. 1919. 26 p. Folded maps. 32 cm.

K. Nederlandsch meteorologisch instituut.
Opstellen op oceanografisch en maritiem-meteorologisch gebied. Utrecht. 1920. 56 p. 24 cm. (Overgedrukt uit det Tijdschrift "De Zee".)

Niemeyer, Albert.
Beitrag zur Physik der Müritz. Temperatur-Beobachtungen. Rostock. 1919. 35, [21] p. 22 cm. (Inaug.-Diss. Rostock.)

Plauson, Hermann.
Gewinnung und Verwertung der atmosphärischen Elektrizität. Beitrag zur Kenntnis ihrer Sammlung, Unwandlung und Verwendung. 2. Auflage. Hamburg. 1920. 96 p. 22 charts. 25 cm.

Re, José.
El clima de Punta Arenas a través de 31 años de observationes. Punta Arenas. 1920. 121 p. Folded charts. 27 cm.

Rempp, G., & Wagner, A.
Meteorologische Terminbeobachtungen und Stundenwerte 1911–1912. Deutsches geophysikalisches Observatorium Spitzbergen, Adventbai. Vienna. 1920. 38 p. 30½ cm. (Sonderabdruck aus den Jahrbüchern der Zentralanstalt f. Meteorologie u. Geodynamik, 1917.)

Sarnetsky, Heinrich.
Der Refraktionskoeffizient in unmittelbarer Erdnähe. Giessen. 1915. 63 p. 7 folded charts. 22½ cm. (Inaug.-Diss. Giessen.)

Schulze, Franz.
Luft- und Meeresströmungen. 2. Auflage. Berlin u. Leipzig. 1920. 157 p. 16 cm.

Uibe, Martin.
Über die Helligkeitsverteilung des diffusen Sonnenlichts am klaren Himmel. Leipzig. 1918. p. 319–365. 28½ cm. (Abh. der mathem.-phys. Klasse der K. Sächsischen Gesellsch. der Wissenschaften, Bd. 35, No. 6.)

Voss, Andreas.
Wettertaschenbüchlein 1920 zum praktischen Gebrauch der einfachen, bewährten Vossschen Wetterlehre. Berlin. 1920. 18 p. 15 cm.

RECENT PAPERS BEARING ON METEOROLOGY AND SEISMOLOGY.

C. F. TALMAN, Professor in Charge of Library.

The following titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers and other communications bearing on meteorology and cognate branches of science. This is not a complete index of all the journals from which it has been complied. It shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau.

Aerial age weekly. New York. v. 12. Jan. 17, 1921.
Weather bureau nephoscope. p. 487–489.

Aeronautical journal. London. v. 25. Feb., 1921.
Scott, G. H. Airship piloting. p. 47–71. [Discusses meteorological factors.]

Aeronautics. London. v. 20. Feb. 17, 1921.
Dobson, G. Meteorology in the service of aviation. p. 113–116.

American meteorological society. Bulletin. Washington, D. C. v. 2. Feb., 1921.
Van Cleef, Eugene. Weather, climate, and advertising. p. 17–20.

American society of heating and ventilating engineers. Journal. New York. v. 27. Mar., 1921.
Fieldner, A. C., & others. Efficiency of the sugar-tube method for determining dust in air. p. 119–123.

Annalen der Hydrographie und maritimen Meteorologie. Berlin. 49 Jahrg. H. 2. 1921.
Castens, Gerhard. Laminare und turbulente Luftströmung. p. 48–54.
Peppler, W. Ergebnisse von Temperaturregistrierungen in Flandern. p. 65–68.
Thurn, H. Funktelegraphie und Wetterdienst. p. 54–65.

Annalen der Physik. Leipzig. Bd. 63. 1920.
Müller, Wilhelm. Messungen der Deformation des elektrostatischen Erdfeldes durch Luftfahrzeuge. p. 585–620. (no. 23.)
Schweidler, E. Die Aufrechterhaltung der negativen Erdladung, das Grundproblem der luftelektrischen Forschung. (Bemerkungen zur gleichbetitelten Arbeit des Hrn. R. Seeliger.) p. 726–738. (no. 24.)

Annales de géographie. Paris. 30. année. 15 jan., 1921.
Angot, Alfred. Régime pluviométrique de la France. 4me. pte. Région du sud-est. p. 32–49.

Archives des sciences physiques et naturelles. Genève. v. 2. Nov.-déc., 1920.
Dorno, C. Quel profit les mesures de la polarisation et du rayonnement solaire et céleste apportent-elles à la météorologie, la géophysique et l'astronomie? p. 501–502. [Abstract.]
Gockel, Albert. La couleur du ciel et des nuages. p. 502–504. [Abstract.]
Gockel, Albert. Transparence de l'atmosphère et prévision du temps. p. 510–511. [Abstract.]
Huber, P. B. Untersuchungen über Bodenluft. p. 508–510. [Abstract.]
Mercanton, P. L. Anémomètre à maximum simple. p. 511–513. [Abstract.]
Mercanton, P. L. Quelques cas historiques de réfraction atmosphérique excessive. p. 513–515. [Abstract.]

Astronomie. Paris. 35. année. Jan., 1921.
Des Gachons, André. Curieux halos solaires. p. 35–37.

Aviation and aircraft journal. New York. v. 10. Mar. 14, 1921.
Reihle, John A. Flying weather in the southern plains states. p. 339–340. [From MO. WEATHER REV.]

Bulletin de la société d'horticulture. Cherbourg. v. 50. 1919.
Corbière, L. L'hiver de 1916–1917 à Cherbourg. p. 30–33.
Letullier, A. Les vents d'est, cause des dégats pour certains végétaux. p. 34–35.

Ciel et terre. Bruxelles. 37. année. Jan.-fév., 1921.
Jaumotte, J. Les paratonnerres. p. 7–13.
Jaumotte, J. La série de Fourier en météorologie. p. 27–29.
Navarro [Neumann], Manuel-Maria S. Un appareil pratique de sismologie appliquée. p. 14–20.

Discovery. London. v. 2. Jan., 1921.
Horner, Donald W. Up-to-date meteorological equipment. I. p. 19–22.

Ecology. Brooklyn. v. 2. Jan., 1921.
Korstian, Clarence F. Effect of a late spring frost upon forest vegetation in the Wasatch mountains of Utah. p. 47–52.

Engineering news-record. New York. v. 86. 1921.
Early measurements of rainfall and stream flow. p. 379. (Mar. 3.) [French measurements of the 17th century.]
Machines in snow removal work. p. 411. (Mar. 10.)
Mechanical equipment speeds snow removal. Fall of 12½ inches in New York city attacked with caterpillar tractors, blade graders and motor trucks. p. 415–417. (Mar. 10.)

Experiment station record. Washington. v. 44. Jan., 1921.
Krogh, A. Composition of the atmosphere. p. 16. [Abstract.]

France. Académie des sciences. Comptes rendus. Paris. Tome 172. 1921.
Besson, Louis. Influence de la température sur le nombre de décès par diarrhée infantile, à Paris. p. 401–404. (14. fév.) [Abstract in later REVIEW.]
Glangeaud, Ph. Sur le tremblement de terre qui à affecté, le 3 octobre 1920, une notable partie des régions volcaniques du Massif Central. p. 462–465. (21. fév.)
Guilbert, Gabriel. Sur un cas d'anéantissement d'une bourrasque. p. 542–544. (28. fév.)
Mengel, Octave. Relations de sismicité et de géotectonique dans les Pyrénées. p. 540–542. (28. fév.)

Géographie. Paris. Tome 35. Fév., 1921.
Gex, F. Les inondations en Maurienne et dans les Alpes occidentales. 24 septembre 1920. p. 147–164.

Great Britain. Meteorological office. Monthly meteorological charts. East Indian seas. London. Apr., 1921.
Smith, L. A. Brooke-. Laws of tropical cyclones abbreviated.