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AN APPEAL FOR AN AERO-PHYSICAL OBSERVATORY IN JAPAN.

By S. TETSU TAMURA, Ph. D. Dated Washington, D. C., March 9, 1906.

It is well known that the progress of meteorology has seemed very slow. Within the past century the world has seen electricity, chemistry, and other special branches of science emerge from their previous uncertain and indefinite condition, but dynamic meteorology is still wandering in fog and darkness. Thousands upon thousands of observations at the earth's surface have told us much, but still the fundamental mechanical problems have not yet been solved. Although the importance of the exploration of the upper atmosphere has been recognized ever since the days of Pascal, yet very little is known of this vast mysterious ocean of air. Meteorologists are now fully convinced that the atmospheric phenomena at the earth's surface depend, in great measure, upon the thermal and electrical as well as the dynamic conditions of the upper atmosphere. So long as this upper region remains unexplored meteorology will not only be unable to enter into the group of exact sciences but will fail to do its full service for the promotion of human welfare. Hence, a number of mountain observatories have been established in Europe and elsewhere and many balloon and kite ascensions have been made for sounding the depths of the upper atmosphere. The balloon ascensions of Gay Lussac and Biot in 1804, of Barral and Bixio in 1850, of Glaisher in 1862, and Berson in 1894 furnished many important facts relative to the physics of the atmosphere. Since this last date unmanned balloons, carrying only very light self-registering apparatus, have been brought to great perfection, and extreme heights of eleven or twelve miles have been reached that would otherwise have been inaccessible. By this mode of research Hermite, Besançon, and Teisserenc de Bort in France, and Assmann, Berson, and Hergesell in Germany, have done a great service to meteorology. Beginning with October, 1902, daily balloon and kite ascensions were made by Assmann and his associates at the Prussian Aeronautic Observatory, while Teisserenc de Bort's great work in his famous observatory at Trappes, near Paris, dates back to 1890.

The kite experiments in atmospheric electricity made in America by Benjamin Franklin in 1753, and by Joseph Henry in 1840, are now classic. Most important contributions to meteorology by kite flying have been made by Messrs. Rotch, Fergusson, and Clayton, of Blue Hill Observatory. The United States Weather Bureau in 1898 temporarily maintained seventeen kite stations, and is now completing the Mount Weather Research Observatory, where the temperature, moisture, and movement of the air at great heights will be ascertained by means of balloons and kites, while other researches on the sun's heat, atmospheric absorption, atmospheric electricity, terrestrial magnetism, and seismic phenomena will be conducted.

In Japan, too, the importance of the study of the upper air was recognized soon after the organization of our meteorological service in 1875. Since that time the specialists at the Central Meteorological Observatory at Tokyo and at provincial stations have undertaken many technical expeditions to high mountains in order to investigate the phenomena of the higher strata of the atmosphere. For the establishment of the first Japanese mountain observatory we are indebted to our illustrious Prince Yamashina. For the site of this observatory his imperial highness chose Mount Tsukuba, that remarkable mountain which stands alone on an extensive plain, and which, moreover, lies in the tracks of the cyclones of very intense character. Since its opening, in 1902, it has been of great service to observational meteorology in Japan.

It is evident, however, that the atmospheric data observed at mountain stations are very much affected by the local topography and the disturbing elements of the mountain mass and surface. A discussion of the observations made in the free upper air during balloon ascents from Munich, and those made simultaneously at neighboring mountain stations, shows important differences between them. Hence, it becomes vitally important for each civilized country or nation to establish on its own soil an aero-physical observatory, like those at Trappes, Blue Hill, Berlin, Lindenberg, and Mount Weather.

The scientific problems to be investigated at such a research observatory are manifold, and include the following:

(1) The distribution of temperature in the upper atmosphere; the thermal conditions in cyclones and anticyclones; the distribution and condensation of atmospheric moisture; the distribution of pressure in the upper and lower atmosphere: these are problems of paramount importance, and must be investigated by ascensions of balloons and kites.

(2) The absorption of solar heat by the atmosphere, which must be measured by means of the pyrheliometer and actinometer; the dissipation of solar light and heat as determined by the polariscope; the detailed analysis of the sunbeams as carried out by means of the bolometer and spectrometer. To all these there should be added apparatus for studying the conductivity and emissivity of the land and water, the snowfields and the forests of the earth's surface.

(3) The discovery of the remarkable properties of radium has opened up a field of research relative to the ionization of gases, and this has led to a complete revolution in our ideas relative to atmospheric electricity. By means of an Exner's electrometer and Benndorf's self-registering apparatus the potential should be measured. To make systematic observations of dissipation and radio-activity of the air under ground, we need the Elster and Geitel instruments. Corresponding measurements of the ionization should be made with the Ebert ion-counter, and the Gerdien conductivity apparatus.

Japan feels the direct influences of the Pacific Ocean and the Asiatic Continent, and also those of the tropical and polar ocean currents, so that meteorological as well as climatic conditions in Japan are very complex. Very often a continental cyclone, which appears to originate in the Asiatic Continent, and a typhoon, which comes from the Tropics by way of the Philippines and Formosa, pass over Japan simultaneously, bringing great complexities in the weather. In spite of all