

one or more rain-makers in a local group who either confine their magical activities to this sphere or are fully initiated medicine-men. In most tribes women cannot witness the rites; in others they participate in some methods or perform a simple type of magical act themselves.

The methods employed by the rain-makers are surprisingly varied, originating as they do in a dream, as a traditional rite performed by the dream-people, or from an incident in daily life which has been followed by rain. Many of the methods are imitative of clouds and falling rain, and of aquatic animals; others seek to persuade the ancestral beings to release the rain, and some medicine-men believe they can go up to the sky to open the clouds.

The Dieri and other tribes of the Lake Eyre district believe that the mura-mura, their spiritual ancestors who made and inhabited the earth in the dream-time prior to man's occupation, now live in the sky, and some of them have to be influenced by ceremonies to release the rain from the clouds.

In south-east Australia storms of wind and rain, and also floods, were believed to be sent by enemies to disturb hunting and fishing activities. The Kurnai of Gippsland squirted water from the mouth in the direction from which rain usually came, and sang magical rain chants acquired in dreams by both men and women.

In Arnhem Land pounded bark (used for poisoning fish) is wrapped in grass, weighted in stones, and taken out into either salt or fresh water by a man until his shoulders are covered; here he drops the bundle, sings a song about falling rain, and pushes the water with his hands to represent the rain splashing on its surface. He expects the clouds to form in about three days and the rain to come on the fourth day after this rite. Here, too, a large bundle of green grass fashioned into a human image is buried and when it swells up rain is expected to fall. The rain is stopped by taking the grass out of the water or ground and spreading it out to dry.

AIR MASS CLIMATOLOGY OF THE BRITISH ISLES

SOME simple facts about the air mass climatology of the British Isles, such as the difference between the relative coldness of east and the relative warmth of south-west winds in winter, have been common knowledge for ages. In the second and third decades of this century the Norwegian school of meteorologists, led by V. and J. Bjerknes, elaborated the ideas of Shaw, Lempfert and others to depict the atmosphere as 'organized' not only into cyclonic and anticyclonic systems but also into warm and cold air masses (often referred to respectively as tropical and polar air) with different life-histories. The interplay of different air masses was shown to produce the day-to-day weather changes of the temperate and polar regions.

In a recent Air Ministry/Meteorological Office* memoir, which is a contribution to synoptic climatology, Dr. J. E. Belasco has investigated the more important physical properties of the atmosphere over the British Isles in twenty-one subdivisions of

tropical and polar air, using surface and upper-air data for the period 1931-45. The generalized tracks over which the air masses reach the British Isles are shown by maps, and the frequency of occurrence of the air masses and the average temperature and humidity of the atmosphere in them at the surface at Kew Observatory and in the upper air up to 450 mb. (about 6 km.) over the British Isles are set out in tables and thermodynamic diagrams. There is also a discussion of the changes of temperature and humidity which maritime tropical and direct polar air masses undergo as, on their way to the British Isles, they pass over a surface respectively colder and warmer than their lowest layers. With the aid of this memoir, it has now become possible for the first time to explain some aspects of the climate of the British Isles in terms of the incidence and of the physical properties of different air masses instead of describing them statistically by the usual presentation of means and extremes.

The discussion shows that the correspondence between air mass and wind direction is quite rough and far from unique. Thus, north-west winds usually bring a cold air mass with a large fall of temperature with height and associated showery weather; but when an anticyclone remains stationary westward of Ireland, such winds can bring air originating over the sub-tropical Atlantic which has been cooled from below on its way. Again, polar air of a particularly unstable type can come with a south wind having travelled around a stationary depression centred south-west of Ireland. Quite the coldest air mass is, as is well known, the one which comes in winter from Russia and reaches the British Isles from the east or south-east. This air mass has in January a mean maximum temperature of 31° F. at Kew. The warmest air mass in January comes from the Madeira area and has a mean maximum of 53° F. at Kew. In July the temperature differences between the coldest and warmest air masses are nearly as great as in January. Air of west Mediterranean origin has at Kew in July a mean maximum of 82° F. and air direct from the sea north of Norway a mean maximum of 64°. The differences of temperature between air masses in the upper air are larger than at the surface because the primary heating and cooling occur at the surface.

Dr. Belasco's memoir will be of value not only to those seeking a physical explanation of British climate, but also to the weather forecaster in stating the weather to be expected in an air mass the arrival of which he has foretold.

PAPER PULP RESEARCH AT THE DEHRA DUN RESEARCH INSTITUTE

INVESTIGATIONS on the pulping of *illuk* grass (*Imperata arundinacea*) by the soda and the mono-sulphite processes* have been undertaken at the Forest Research Institute, Dehra Dun, at the request of the Ceylon Government, which forwarded samples for the purpose, with the view of ascertaining the respective economics and suitability of the two

* Air Ministry: Meteorological Office. Geophysical Memoir No. 87: Characteristics of Air Masses over the British Isles (M.O. 5306). By Dr. J. E. Belasco. Pp. 34. (London: H.M.S.O., 1952.) 2s. 6d. net.

* Indian Forest Bulletin No. 145: Pulping of Illuk Grass (*Imperata arundinacea*) by Soda and Mono-Sulphite Processes. By Chattar Singh and Dr. S. R. D. Guha. Pp. ii+10. (Delhi: Manager of Publications, 1951.) Annas 8; 9d.