Climatic Continentality and Oceanity.

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NOT much less important among the geographical factors which determine climate than latitude and altitude, is the relative distribution of land and sea, or, in short, continentality *versus* oceanity, and in view of the somewhat large class of students who encounter this aspect of climatology it seems desirable to direct attention to a couple of German maps which have recently appeared indicating the distribution of continentality over the globe as a whole and over Europe in detail (*Petermanns Mitteilungen*, June 1922, R. Spitaler after G. Swobodna).

It is possible to represent the mean or normal temperature of a particular latitude at any time of the year in an equation involving, also, the intensity of insolation and the relative distribution of land and water in the neighbourhood; and therefore it comes about that there is a means of seeing how the temperature of a given point in summer, winter, or the year as a whole, compares, on one hand, with full "continentality" such as would uniformly prevail over a hemisphere covered entirely with land, or, on the other hand, with full "oceanity" such as would characterise an entire water hemisphere. The maps in question are based upon the annual range of air temperature between January and July, but are not quite the same thing as simple maps of equal annual range would be, because the annual range is to some extent affected by differences of latitude which are allowed for in the relationship just referred to. Taking full "continentality" as 100, and full "oceanity" as 0 (zero "continentality"), lines of equal percentage value are drawn across the entire map of the world except the inter-tropical belt, uncertainty for which attaches to the fact that the significance of the seasons is not the same as it is in extra-tropical latitudes.

There is a large area in the interior of North America with 90 per cent. continentality, the Sahara region and much of Western Asia with 100, and a considerable portion of Eastern Asia suffering from a super-continentality amounting to as much as 130. This is explained by the abnormal winter cold of Central Asia, due to a certain type of atmospheric circulation set up over this great land-mass, which results in a local degree of continentality greater than that proper to a uniform land hemisphere. A high degree of continentality also prevails over the land-locked North Polar basin where the ice-covering raises the percentage of the Arctic Ocean to near 100. At the other end of the scale we find 5 per cent. (95 per cent. oceanity) over that part of the North Atlantic between Iceland and Norway, and 0 (full oceanity) over much of the oceanic areas in the Southern Hemisphere, while local regions in the South Pacific and the Southern Ocean, under a special trend of sea and air currents, experience a slight degree of super-oceanity amounting to −5 per cent. on the continentality scale (105 oceanity). In consequence of the circulation of the atmosphere there are regions where continentality trespasses upon the sea, *e.g.* the Yellow Sea and Sea of Okhotsk with 70 per cent., and where oceanity invades the land, *e.g.* England and France with 20 to 45 per cent., values actually lower than that of the land-locked Mediterranean Sea, which averages about 45 per cent.

It is clear, therefore, that these maps show something more than the simple effect of local land and sea influences upon the annual range of temperature, and it would have been instructive to have a cartographical representation of this effect as well, uncomplicated by the effect due to the transference of continental and oceanic conditions beyond their respective domains. If one turns, for example, to the more detailed map of Europe, there is 10 per cent. continentality along the west coasts of Ireland and Scotland, and the 50 per cent. line, marking the boundary between the "continental" and "oceanic" parts of the continent, driven back by the prevailing Atlantic winds to the longitude of eastern Germany except for outliers around Spain, Switzerland and Sweden. Even the neighbourhood of London, the most continental portion of the United Kingdom, has a percentage no higher than 27, and the generally low value, about 25 per cent. for England as a whole with a position fairly well balanced as between land and sea, unmistakably reflects the dominating influence of the prevailing oceanic winds. There can be little doubt, indeed, that if the south-east of England were normally controlled by a stagnant contracyclonic system of circulation allowing more local temperature controls to gain the ascendant, the continentality would rise to near 50 per cent., and to near 75 per cent. if the prevailing winds were continental east winds instead of the actual oceanic west winds. This conclusion is strongly supported by the high degree of continentality, about 70 per cent., which prevails on the east coast of the United States in consequence of the westerly circulation from the interior of the continent.

Instructive as these German maps are, they do no more than touch the fringe of the subject inasmuch as there are other criteria by which thermal continentality may be judged, namely, diurnal range of temperature and the magnitude of irregular deviations from the normal, both of which run roughly, but not exactly, parallel with the seasonal or annual range above considered. It could be shown, for example, that in relation to the inland parts of England the east coast is somewhat more "continental" according to annual range than according to diurnal range of temperature. This is because the short-period range between day and night is more definitely influenced in the long run by local distance from the sea, whereas the seasonal range of temperature is more markedly affected by continental types of weather, transporting summer heat or winter cold, on the east coast than it is farther west.

Interesting, too, is the study of continentality from the point of view of deviations of particular seasons from the normal, and here a striking lesson is afforded by the climates of London and Paris. The French capital on the average of a long series of years is 2° F. colder than the English in January and 3° F. hotter in July, the greater difference in summer being apparently due to the more southerly latitude, which would work with the continentality difference in the warm season but against it in the cold. Yet it is during occasional periods of severe cold that the more violent continentality of Paris is so emphatically demonstrated. The month of December, 1879, was, on the continental mainland, one of unparalleled rigour, the mean temperature day and night for the entire month in Paris being so low as 18° F., or some 20° below the normal. But the coldest December ever recorded in London, that of 1890, a month of appalling gloom and as cold as any winter month that has occurred since the establishment of records, had a mean temperature not lower than 29° F., or only 10° below normal, while the same month in Paris was 12° below, or only less cold than 1879. There are many similar instances of wider departures from the normal on the other side of the Channel.

Facts of this kind constitute an obtrusive aspect of climate, but they are apt to be eclipsed in the common practice of limiting one's studies to means and averages.