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Versuch zur Niederschlagsmessung aus treibendem Nebel

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An attempt to measure precipitation from drifting fog

A visit for several weeks at the Mt. Brocken Observatory provided an opportunity to supplement previous investigations regarding amounts of precipitation which, as experience showed, were not measured by a standard rain gauge. The considerable excess amounts when the gauge was set up in a forest (F. LINKE, Meteorol. Zeitschr. 1916, p. 140; 1921, p. 277) should probably be attributed also to the circumstance that although only a receiver without special preparations was available, drops of water from other parts of the tree had converged to the point from which water dripped into the gauge. Thus, the measurements on the gauge were no longer calibrated to the area ratio of the receiving surface to the container dispensing the water. It is precisely characteristic of plants that they conduct the water which they recieve to central points. Thus, for example, more water drips from a tree trunk than hits the trunk directly from the air. It is not surprising that a small rain gauge set up on the Feldberg [Hill] and filled with loose wood to 30 cm above the top of the receiver gave readings many times

higher than a mountain rain gauge even with a Nipher shield. While the excess during fog was by a factor of ten to twenty, no inference can be drawn regarding the amount representing the fog, because details are lacking (W. HARTMANN, Das Wetter ['The weather'], 1920, p. 77 ff.). Hitherto the most advanced measurements of precipitation from fog alone were obtained by MARLOTH, whose findings are reported in detail together with previous knowledge by J. VON HANN (Meteorol. Zeitschr. 1906, p. 547 ff.). During foggy drizzle, when an open rain gauge measured ca. 0.01 to 0.1 inches of precipitation, MARLOTH's fogmeter, which was set up in the south-east trade-wind area on Tafelberg [Hill] near Kapstadt, gave a reading about ten to twelve times higher-- in striking correspondence with the measurements obtained on the Feldberg. It is not yet clear how much precipitation is yielded by fog when no rain is falling at the same time. In our experience, during fog the measuring tube usually remains dry. Always only the funnel becomes wet. MARLOTH caught the horizontal precipitation (as it is designated by R. SUERING; cf. LINKE) on a wire frame with individual bunches of reed grass attached, along which the water ran into the gauge.

The experiments at Mt. Brocken were intended only as a spot check at answering the question: How much precipitation exclusively from fog falls on a surface which can be related to the measurements on a rain gauge, especially when the

wind velocity is taken into account? It would probably be of interest in connection with future measurements to compare the amounts actually measured with the water content of the fog, e.g., as determined by H. KOEHLER's method (Meteorol. Zeitschr. 1929, p. 76, abstract). A fine wire mesh, as used in window screens, was cut to exact measurements, rolled into the shape of a cylinder, and fitted into a rain gauge so that the upper edge of the mesh projected ca. 35 cm above the edge of the gauge. Its diameter was 1/3 smaller than that of the rain gauge. The mesh was wound in four coils. We used a mountain rain gauge and a small Hellmann gauge with receiving areas of 500 and 200 cm^2 respectively, and total heights of ca. 85 and 80 cm respectively from the ground to the top edge of the wire cylinder, which would probably be many times the height of the vegetation. The circular shape of the mesh surface was valuable for assessing differences in the amounts of moisture on the luff and the lee. Previous tests had shown that the forward side of stands of vegetation exhibited three times as much moisture as the inner portions. The weather in May and early June allowed only sufficient measurements to indicate whether it would be worthwhile for Miss GROBE to continue the measurements at Mt. Brocken. For the same reason also no measurements were taken with loose wood, as had been suggested by Prof. HENZE.

(1) Nr.	Tag (2)	Zeit (3)	g	Windrichtung (4) Geschw. in m/sec	Bemerkungen (5)
1	4. Mai 1931	11.00—12.45	0.0	WSW 7	≡¹, (6)
2	5. (12) „ 1931	18.40—19.50	> 1.0	ENE 1.5	≡², vorübergehend ≡¹ und Gipfel frei von ≡.
3	6. „ 1931	8.55—11.35	7.0	ENE—ESE 8	durchweg ≡¹, vorübergehend ≡², minutenlang aufreißend. (7)
4	7. „ 1931	9.15— 9.50	20.0	ENE 9	≡² Boden des Trichters durch abgelaufenes, unmeßbares Wasser benetzt. (8)
5	9. „ 1931	9.00—11.30	79.0	WSW—SW 11	≡², gleichförmig, Boden des Trichters auch befeuchtet. (9)
6	18. „ 1931	9.57—10.57	8.0	WSW 12	≡² vorübergehend minutenlang (10) ≡¹.
7	21. „ 1931	19.55—20.55	82.0	N 6	≡², sehr nässend, kein Regen. (11)

1- no. 2- date 3- time 4- wind direction, velocity
5- remarks 6- periods of...[1] and peaks free of...
7- steady... , periods of... , clearing for a number of minutes 8- bottom of funnel moistened by unmeasurable amounts of dripping water 9- uniform, bottom of funnel moistened 10- periods of... for several minutes
11- very wet, no rain 12- May

The results of our measurements with the mountain rain gauge are compiled in the chart above. Next to the date, the period for which the gauge was set up in fog is shown, followed by the weight of the precipitation on the wire mesh (in grams), the wind direction and velocity, and under 'Remarks', some notes on the behaviour of the fog during the measurements. During each test, the station rain gauge remained completely dry with the exception of a light film of moisture in isolated cases, so that only the precipitation originating from the drifting fog was measured in the mesh. Ten grams, in relation to the 500 cm^2 surface area of the receiver, represents 0.17 mm of precipitation. The circumstances explaining the different results are probably

[1] [Translator's note] A key to meteorological symbols was not available.

indicated by the wind velocity and the intensity of the fog. The amounts measured were very small as long as there was only moderate fog or fog of varying intensity with interruptions, even though the velocity was the same as in cases with large amounts of precipitation (no. 1 to 3 and 6). No. 7 gave a large amount with relatively low wind velocity because this measurement was taken in very wet fog. The measurements for no. 4 and 5 in fog of uniform intensity (visibility 1) were about equal at approximately the same wind velocity, if converted to periods of equal duration: viz., ca. 0.5 mm per hour. In view of the average of more than two hundred days of fog in the Mt. Brocken area, the role of fog in the water cycle here must be considerable. Simultaneous measurements with a small rain gauge likewise fitted with wire mesh showed similar amounts. In every case, the moisture on the mesh was greater on the luff. At low wind velocities, the lee side even remained dry. This difference was observed even with a mesh-cylinder diameter of only ca. 17 cm. This supports the previous observation that the interior of a level stand of vegetation receives much less of this horizontal precipitation than the edge. If the continuation of these experiments permits any general inference concerning the amounts of water condensed from drifting fog at a given wind velocity, then it will only be necessary to ascertain the duration of the fog in order to estimate the amount of moisture precipitated by the

vegetation on a given surface area, e.g., on a hillside. It remains an open question whether it would be more expedient to calculate the amount of precipitation for the entire circumference of the wire-mesh cylinder, as in the present case, or only for half of the surface. A. DIECKMANN