

The Finnish Radiosonde With Rolled Hair as hygrometer

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In the last years the rolled hair (also called the Frankenberger-hair or Pernix-hair) with very good response at low temperatures has been used at the humidity sensing element in the German morse-radiosonde. In two papers SCHULZE (1952) shows from measurements made at Flensburg how extremely useful the new method is in measuring humidity. The time-constant of the rolled hair hygrometer at normal temperatures is five times smaller than that of the unrolled hair and the hair is also functioning at as low temperatures as -70°C , where the time constant is about 500 sec at 100 per cent humidity.

Using the values of the time-constant obtained by Schulze the time-lag corrections are directly applicable at temperatures above -20°C , and with some computational work applicable also below -20°C . One disadvantage, according to Schulze, is that the "drying" effect of the hair causes a rise in the time-constant which depends on the time of the radiosonde passing a very dry layer in the atmosphere. As yet no simple method exists of applying the corrections in these cases.

Not all radiosondes are suitable for applying the rolled hair in the hygrometer. Especially the audiofrequency modulated types where the representation of the meteorological elements into electrical units are made by means of a resistance are as yet not suitable without using complicated mechanical constructions. The simplest mechanical mounting of the hair is obtained when mounted to move one side

of a small plate condensor elastically suspended. If the condensor is in the tank circuit of an radio-frequency oscillator, radio-frequency modulation is obtained by means of the hair and in relation to the humidity changes. This is made in the Finnish sonde. The reduced strength of the rolled hair is of no importance to the reliability of the measurements. Breaks in the hair are avoided when the sharp bends of the mounted hair are fixed with some cellulose paint.

The Finnish sonde is easily adopted for double humidity measurements. The figures show the result of a sounding made at Stockholm - Bromma, with two hygrometers, one with normal hair and one with rolled hair. The humidity are to the left in the figures (heavy line for rolled hair, thin line for normal hair). At the ground a strong inversion keeps the humidity high and equal to 80 per cent as indicated by both the hygrometers (Point 1). Half the way up in the inversion the humidity is very rapidly sinking to low values indicating a subsidence layer reaching up to 700 mb. The sounding is made in a high pressure center with cold air moving south and penetrating the lowest layers. With the normal hair this subsidence process at low temperature is not clearly shown.

Above 700 mb, humid air from south is moving northwards over western Scandinavia and according to the rolled hair, humidities above 60 per cent are shown in all layers up to the tropopause. Here the normal hair gives

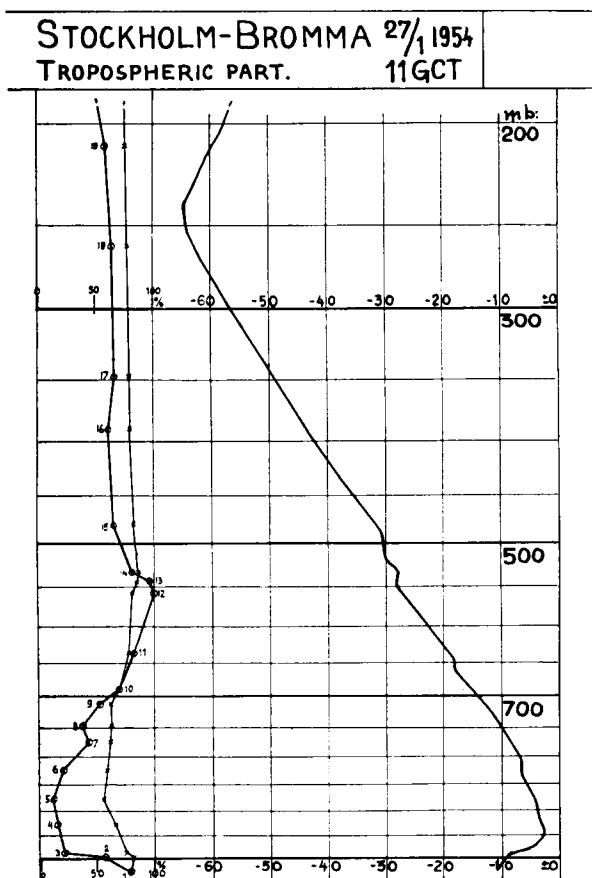


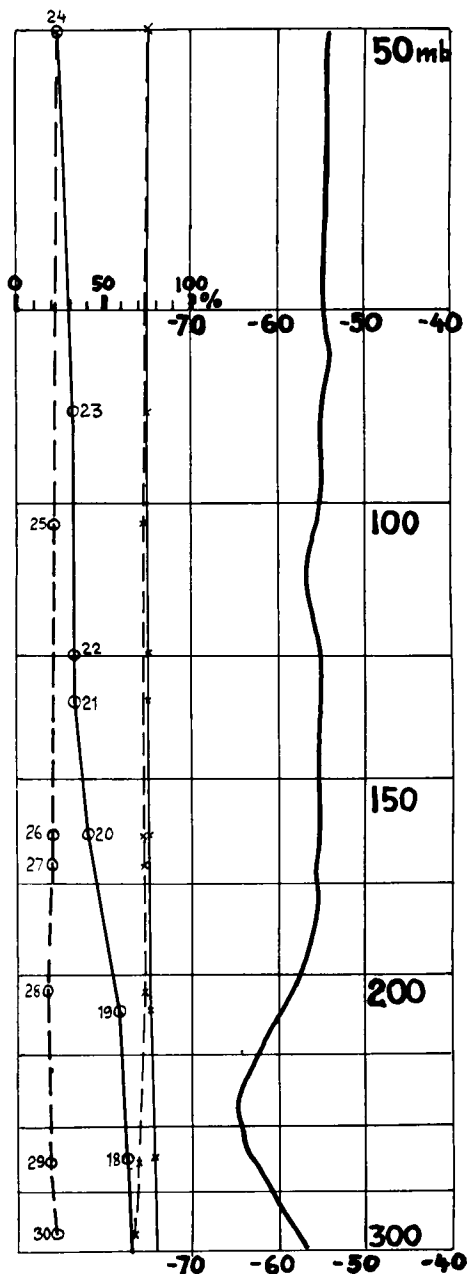
Fig. 1a and 1b: Sounding with double hygrometers. Temperature curves to the right, humidity curves to the left (heavy line rolled hair, thin line normal hair). The descent curves are indicated with dashed lines.

no information. Interesting is the marked inversion at 550 mb. The rolled hair rapidly reaches high humidities (95—100 per cent) when passing an observed altocumulus layer. From point 12 the humidity decreases but the normal hair is still indicating rising humidity (point 12—14). The normal hair in fact gives a false sign of the humidity lapse-rate.

In the stratosphere both ascent and descent (dashed lines) curves are shown. At point 18 the sonde enters the dry stratosphere with a humidity according to the descent curve being equal to 20 per cent. Between points 18 and 19 the humidity decreases at a slow rate but more rapidly between 19 and 20. This because of the increasing temperature with in-

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crease of the rate of response. Between points 22 and 23 the humidity stops falling indicating a somewhat higher humidity value (30 per cent) higher up in the stratosphere (!) than in the bottom layer just above the tropopause. The very low humidity values in the lower stratosphere may be the result of subsidence

in the meridional northward flow of air from the tropical tropopause levels.

Even if the correction methods are as yet not always useful for the stratospherical parts of the sounding, useful conclusions can be drawn from both the ascent and descent curves in this region.

REFERENCES

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