

Supplementary File 1 for: Wyszyński P. & Przybylak R. 2014. Variability of humidity conditions in the Arctic during the first International Polar Year, 1882-83. *Polar Research* 33.

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Excerpt from a report of the Swedish expedition to Kapp Thordsen, Spitsbergen

The following is an excerpt from a scientific report of the Swedish polar expedition to Kapp Thordsen, Spitsbergen, 1882–83 (Ekholm 1890). The description by Nils Ekholm, the leader of the expedition, concerns the methodology of humidity measurements in polar regions during the first International Polar Year and problems with the use of hygrometers in low air temperatures.

According to the recommendation of the “International Polar Expedition Programme,” hourly observations were made using a psychrometer and a hair hygrometer, placed side by side in a thermometer shelter. In the summer (June – August), when the temperature—with few exceptions—remained above zero, the air was usually quite humid, and deviations in the humidity values were very small, these two instruments demonstrated a very reassuring conformity. Thus, in that season of the year there were not any difficulties following the recommendation of Mr Wild, accepted at the 4th International Polar Conference, namely “When using a hair hygrometer and a psychrometer at the same time, one ought to refer to the readings of the latter only from the temperature of 0.5°C and up on the dry-bulb thermometer; for lower temperatures, however, the relative humidity—whose adjustment shall be determined by simultaneous observation at higher temperatures, mentioned above—ought to be deducted from the readings of the hair hygrometer; subsequently, the absolute humidity shall be calculated using the relative humidity and the temperature of air.” Then again, everything changed during the cold time of the year. The psychrometer and the hair hygrometer developed a discrepancy which occasionally reached as much as 70%. From 18 October to 18 February, the wet-bulb thermometer never showed a temperature above 0°C, and the indications of the hair

hygrometer were evidently disturbed, therefore on numerous occasions and for prolonged time it could not be used at all. ... Unfortunately, the hygrometers proved useless during the cold season, just when we needed them the most. Apparently, the cold blocked the bearings of the rotational axis, which did not move for many days on which the humidity varied the most, and then suddenly their indicators moved far on the scale for no obvious reason. Moreover, frost and snow made them often stuck and disturbed their functioning. (Ekholm 1890: 10-12 translated by Cezary Kuzdrzał)

Excerpt from a report of the Dutch expedition in the Kara Sea

The following is an excerpt from a report from the Dutch polar expedition that wintered in the Kara Sea in 1882–83. The description by Henri Ekama concerns the methodology of humidity measurements in polar regions during the first International Polar Year and the introduction of appropriate corrections into hygrometer readings.

As long as the indications of a wet-bulb thermometer kept above 0.5° , the relative and absolute humidity were determined using Mr Wild's psychrometric charts, as proposed by Mr Jelinek. At lower temperatures, the relative humidity was established on the basis of the indications of a hair hygrometer, and then the absolute humidity was calculated, using the above-mentioned charts, for air temperatures that we registered at that time. The hair hygrometer was graduated for May, June and July of 1883, comparing its readings – as recommended by the Commission—with the readings of the psychrometer as long as the temperatures on the wet-bulb thermometer remained above 0.5°C ... In other months, the lowest reading when we found the hair covered with dew was assumed as the saturation point. We also attributed the same values as observed in May, June and July, to the degree lines on the scale ... Furthermore, we often found the hair of the hygrometer covered with tiny ice crystals when the state continues for some time; the needle indicated higher and higher values up to the point where it could not move any higher and the hair started to stretch. As soon as frost emerged on the hair we assumed the air had to be saturated with water vapour; also, whenever this happened, we accepted the lowest position indicated by the hygrometer needle as the saturation point, whereas other lines on the scale were assigned values concluded from the above-mentioned charts for May, June and July, increasing or decreasing the numbers as required by the

saturation point. The nature itself suggested this kind of graduation and the process was as consistent with the requirements of the International Polar Commission as possible.

After long periods of high humidity of the air, the saturation point sometimes changed prominently. In October 1882, its value was established at 81, the next month it was 82, and in December it was 79. When we resumed observations in January 1883, the instrument indicated 70 as the saturation point ... I shall leave it to the reader to conclude whether these [humidity measurements] are of any value, however a knowledgeable reader will certainly notice a considerable homogeneity; the determination of the hygrometric state of air is clearly an unrewarding task when the site is a surface of frozen water which spreads around the observer as far as the eye can see ...

...The experiences gathered during the observations convinced me that one can use a hair hygrometer in polar regions one has is a reliable measure to control it. (Ekama, in Snellen & Ekama 1910: 75-76, translated by Cezary Kuzdrzał)

References

- Ekholm N.G. 1890. *Observations faites au Cap Thorsden, Spitzberg, par l'expédition suédoise. Tome I: 3. Observations météorologiques. (Observations made at Cape Thorsden, Spitsbergen, by a Swedish expedition. Vol. I: 3. Meteorological observations.)* Stockholm: Royal Printing Office.
- Snellen M. & Ekama H. 1910. *Rapport sur l'Expédition Néerlandaise qui a hiverné dans la Mer de Kara en 1882/1883. (Report on the Dutch expedition that wintered in the Kara Sea in 1882/1883.)* Utrecht: J. Van Boekhoven.