Environment Canada Imaging Cover Page

Report N.: 

SKP Box Number: 672672428

ATMOSPHERIC ENVIRONMENT SERVICE
DEPARTMENT OF THE ENVIRONMENT – CANADA

Technical Memoranda

AN AID TO RADIATION MEASUREMENTS IN WINTER

by
D. STORR

U.D.C. 551.508.2

TEC 771
12 JULY 1972

ENVIRONMENT CANADA - ATMOSPHERIC ENVIRONMENT SERVICE
4905 Dufferin Street
Downsview, Ontario

AN AID TO RADIATION MEASUREMENTS IN WINTER

by

D. Storr

ABSTRACT

Snow accumulation on the dome of a radiometer may result in serious data loss, especially where daily inspection is not possible. A method which prevents the accumulation by means of a blower is described.

UNE AIDE POUR LA MESURE DU RAYONNEMENT EN HIVER

par

D. Storr

RÉSUMÉ

L'accumulation de neige sur le dôme d'un radiomètre pourrait occasionner une grande perte dans les données, surtout où l'inspection quotidienne n'est pas possible. Une méthode qui prévient l'accumulation au moyen d'une souffleuse est décrite ici.

AN AID TO RADIATION MEASUREMENTS IN WINTER

by

D. Storr

(Manuscript received July 7, 1972)

1. The Problem

Geiger (1965) has stated that "radiation is undoubtedly the most important of all meteorologic elements". It is used by scientists in agriculture, oceanography, hydrology, glaciology and other fields besides meteorology. It is therefore very important to eliminate all possible sources of error in its measurement.

It is noted in Radiation (Anon., 1970) and in Guide to Meteorological Instruments and Observing Practices (World Meteorological Organization, 1961) that any accumulation of snow, frost, dew or dust on the dome of the CSIRO, Kipp, or Eppley radiometers can give rise to serious errors, and the domes should be cleaned daily. However, even where this practice is possible it does not provide continuous protection, e.g. when snow is falling. At sites where daily inspection is impossible, an accumulation of snow on the dome can render worthless the data for several days.

At the Marmot Creek Experimental Watershed, Alberta, (Jeffrey, 1965) inspection of the Kipp and CSIRO radiometers is only possible once a month in winter, and snow accumulation on the domes has been a significant cause of data loss.

2. Theory

The installation of a heating ring around the sensor was considered but rejected because of doubt that it would be sufficient to remove snow in cold weather, and also from concern that the radiant energy from the ring would be reflected to the thermopile from snow on the dome.

It was therefore decided to try an artificial airstream to prevent snow accumulating on the Kipp radiometer. The Kipp was chosen for the test because the wide guard disc made the problem more serious than with the relatively smooth surfaced CSIRO net radiometer. Latimer (1962) reported that the response of the Kipp and CSIRO radiometers is insensitive to wind speed, so it was assumed that a constant

flow of air would prevent snow accumulation on the dome without affecting data quality. If the airstream is in the same plane as the thermopile and guard disc, snow would tend to accumulate on the lee side of the dome, so the airstream must be directed from an angle above the sensor. The fan cannot be directly over the sensor because of its obvious effects on the data.

3. Installation and Results

In December, 1970, a centifugal type blower fan with a 2 1/2 inch circular outlet, powered by a continuous-duty, completely enclosed motor, was installed about 12 inches to the side and at an angle of about 30 degrees above the Kipp sensor. The sensor is on a short boom extending southward at the 125-foot level on a 150-foot mast. The fan was mounted as close to the tower as possible to reduce reflection of insolation to the sensor to a minimum. Figure 1 is a photo of the installation from below, somewhat distorted by foreshortening. Figure 2 illustrates the relative positions of the sensor and fan more adequately.

Because the site is visited only once a month in winter, the fan operates continuously.

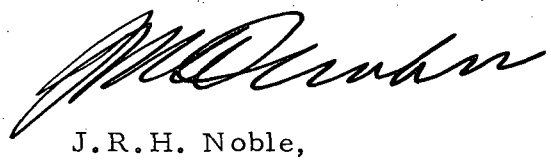
Results for the 1970-71 winter have been excellent. On several occasions a comparison of the recorded traces from the Kipp and net radiometers has shown the Kipp to be operating normally while the net was partially or completely snow-covered. Figures 3 and 4 show simultaneous traces from the two sensors under normal conditions (No. 3) and when the net is covered with snow (No. 4). Because the calibration factors of the two sensors are different, the absolute values of the radiation intensities are not comparable. A rapid and large increase in net radiation is noted about 1130 MST March 5, when the snow fell off the dome. The sharp increase in global radiation between 0700 and 0800 is caused by the sun coming over the eastern mountain range. Shutting off the fan produces no visible change in the record, thus uppporting Latimer's report that the sensor is insensitive to wind speed.

Before the next snow season, the two sensors will be placed side by side to determine if one airstream can keep both free of snow without adversely affecting the readings of either. If not, another fan will be installed to keep the net radiometer clear.

4. Summary and Conclusions

The airstream from the fan prevents snow accumulation on the Kipp radiometer, so should be equally effective for the net radiometer. Dew on the sensor has not been a problem at this height above ground, but the fan should be of value in dew prevention at ground-level sites. In some situations the airstream could also assist in inhibiting frost formation and dust accumulation on the domes.

APPROVED,



J.R.H. Noble,
Assistant Deputy Minister,
Atmospheric Environment Service.

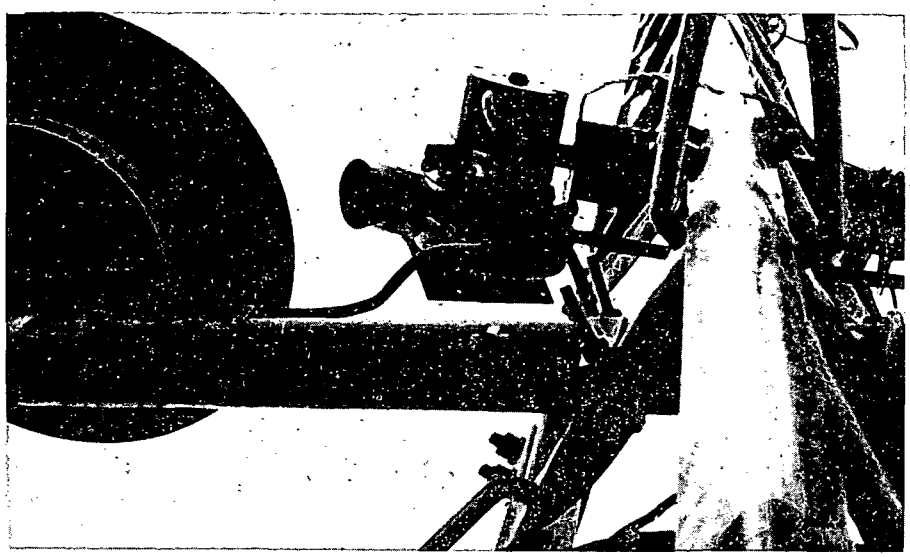


Figure 1.

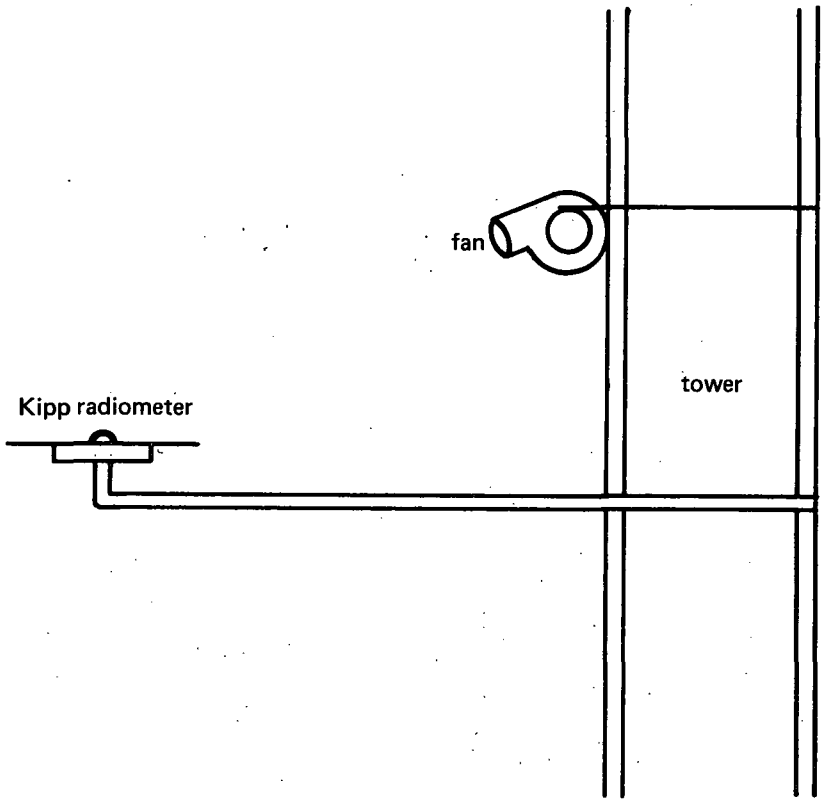


Figure 2.
Relative Positions of Sensor and Fan on Tower

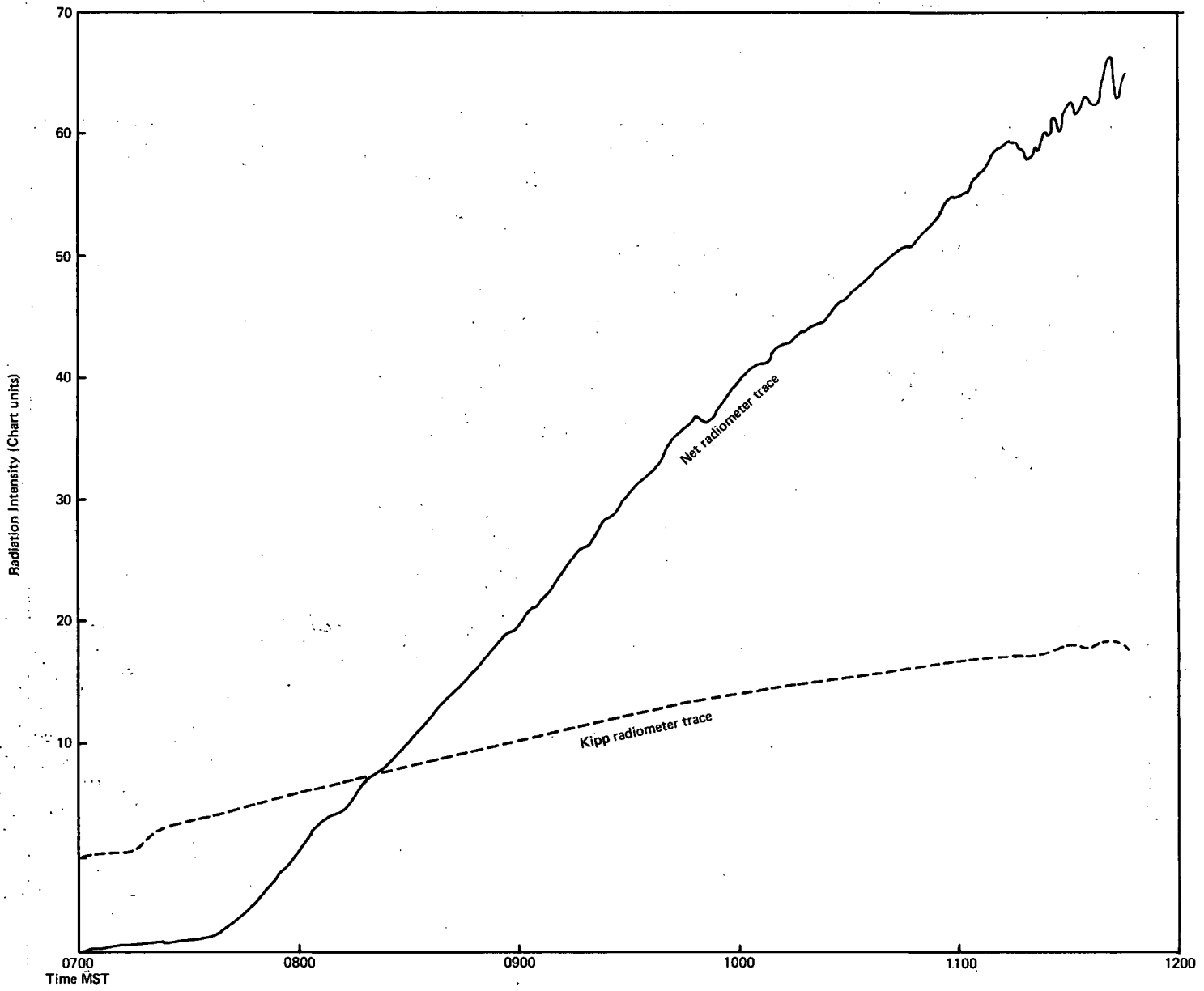


Figure 3.
Recorder Traces by Kipp and Net Radiometers Under Normal Conditions
March 14, 1971, Marmot Creek, Alta.

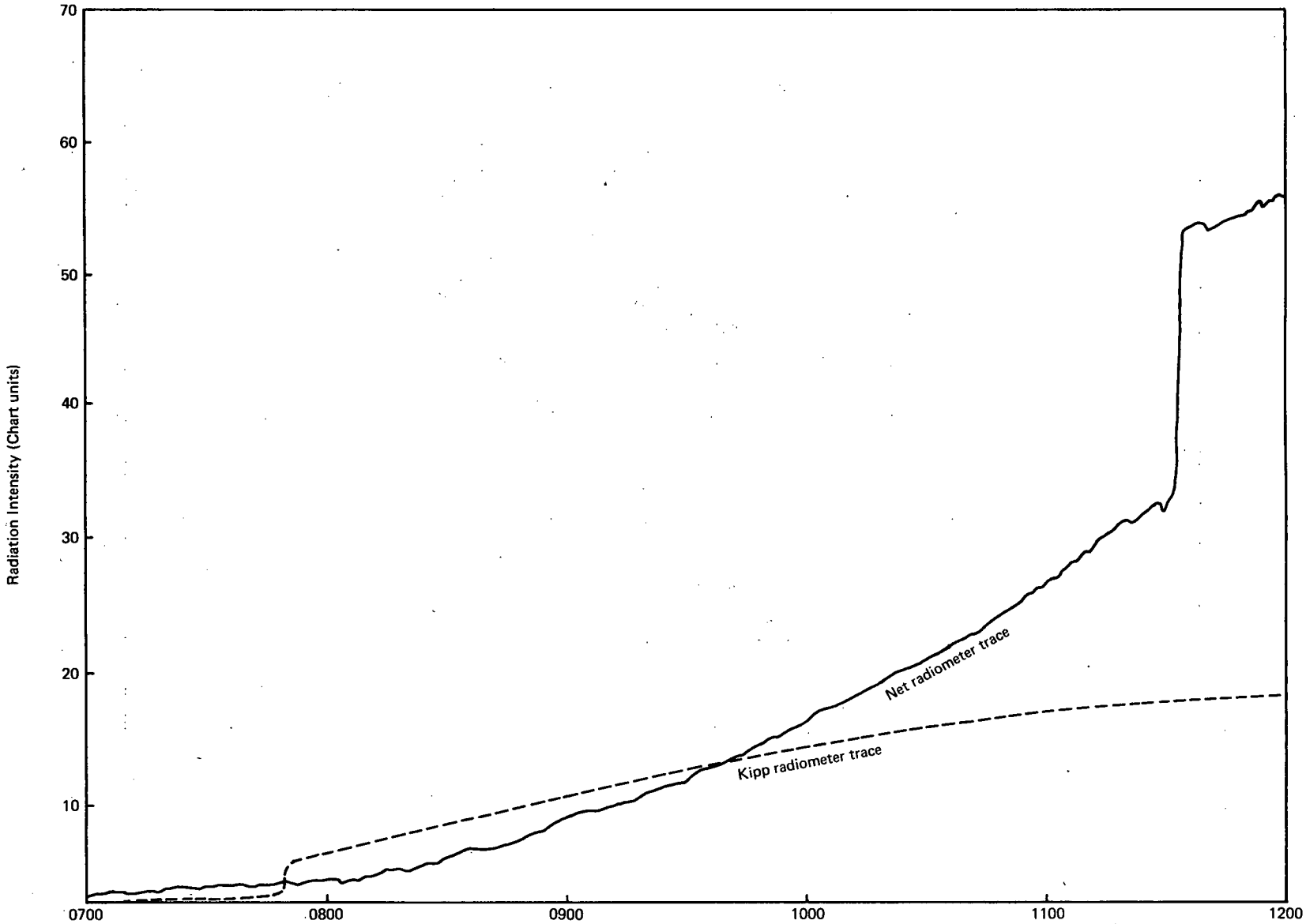


Figure 4.

Traces by Net and Kipp Radiometers with Snow on the Dome of the Former Until 1130 MST. March 5, 1971

References

1. Anon., 1970: Radiation. Meteorological Branch, Canada Department of Transport, Toronto, UDC: 551.508.2.

2. Geiger, R., 1965: The Climate Near the Ground. English translation by Harvard Univ. Press, Cambridge, Mass., p. 5.

3. Jeffrey, W.W., 1965: Experimental Watersheds in the Rocky Mountains, Alberta, Canada. Publ. 66, Symposium of Budapest of I.A.S.H.

4. Latimer, J.R., 1962: Laboratory and Field Studies of the Properties of Radiation Instruments. Meteorological Branch, Canada Department of Transport, Toronto, Circ. 3672 TEC-414.

4. World Meteorological Organization, 1961: Guide to Meteorological Instruments and Observing Practices, W.M.O., No. 8, TP 3.

TEC-771 UDC: 551.508.2
12 July 1972

CANADA
Environment - Atmospheric Environment Service
4905 Dufferin Street, Downsview, Ontario

An Aid to Radiation Measurements in Winter
by D. Storr

3 pps. 4 figs. 4 refs.

Subject Reference: 1. Radiation Instruments

TEC-771 UDC: 551.508.2
12 July 1972

CANADA
Environment - Atmospheric Environment Service
4905 Dufferin Street, Downsview, Ontario

An Aid to Radiation Measurements in Winter
by D. Storr

3 pps. 4 figs. 4 refs.

Subject Reference: 1. Radiation Instruments

TEC-771 UDC: 551.508.2
12 July 1972

CANADA
Environment - Atmospheric Environment Service
4905 Dufferin Street, Downsview, Ontario

An Aid to Radiation Measurements in Winter
by D. Storr

3 pps. 4 figs. 4 refs.

Subject Reference: 1. Radiation Instruments

TEC-771 UDC: 551.508.2
12 July 1972

CANADA
Environment - Atmospheric Environment Service
4905 Dufferin Street, Downsview, Ontario

An Aid to Radiation Measurements in Winter
by D. Storr

3 pps. 4 figs. 4 refs.

Subject Reference: 1. Radiation Instruments

ABSTRACT: Snow accumulation on the dome of a radiometer may result in serious data loss, especially when daily inspection is not possible. A method which prevents the accumulation by means of a blower is described.

ABSTRACT: Snow accumulation on the dome of a radiometer may result in serious data loss, especially when daily inspection is not possible. A method which prevents the accumulation by means of a blower is described.

ABSTRACT: Snow accumulation on the dome of a radiometer may result in serious data loss, especially when daily inspection is not possible. A method which prevents the accumulation by means of a blower is described.

ABSTRACT: Snow accumulation on the dome of a radiometer may result in serious data loss, especially when daily inspection is not possible. A method which prevents the accumulation by means of a blower is described.