THE FIELD PERFORMANCE OF TEN BELLANI RADIATION INTEGRATORS¹

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The Bellani-type radiation integrators (pyranometers) are considered by some workers (Shaw and McComb 1959, MacHattie 1961, Vézina 1961) as useful and reliable instruments in forest research for measuring total solar radiation. One of these, the Davos Observatory Model, has a spherical metal-coated glass radiation receiver a distillation system with very low residual air pressure using alcohol as a liquid. These instruments are not mass-produced and the alcohol content varies slightly from one to another, making individual calibration by the manufacturer necessary.

Courvoisier and Wierzejewski (1954), in their description of the instrument, stated that its sensitivity may be taken as unchanged for 20 years. This is a tentative indication based on the results of artificial ageing of some instruments by means of an intensive ultraviolet light source (quartz lamp). In fact, according to Dr. Mörikofer³, no experience has yet been gained with the durability of this new model of Bellani, because it has been in use only for a few years. A break in the glass of the receiver may at any time cause a decrease in the vacuum between the spheres, or the metal-glass contact of the receiver may deteriorate (Pereira 1959) after some years of field use.

The object of the test reported here was to learn how ten Bellani radiation integrators which had been in use for one year under different forest conditions would compare with each other when exposed under identical conditions.

The daily solar radiation measured by the ten Bellani pyranometers was compared during 47 days in the spring and summer of 1962. The pyranometers used in the test were manufactured at the Davos Observatory, and calibrated between March and August 1960 by means of a standard spherical pyranometer calibrated in absolute units. All the instruments were mounted roughly 5.5 feet above the ground in an open field at the Valcartier Forest Experiment Station near Quebec City. The amount of alcohol distilled was normally read daily at 8.00 a.m., and the instruments were then reset. After correcting for ambient temperature, the daily amounts of distilled liquid, in cubic centimetres, were converted, by means of the individual calibration curves, into gram calories per square centimetre (langley).

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The daily totals of radiation integrated by all ten pyranometers were very similar. The differences between instruments, for various degrees of cloudiness and for all days as well, were slight. Moreover, there was no differential response to varying meteorological conditions for the various instruments. Correlation of any instrument with a "standard" one was highly significant, $r > 0.992$ ($P.01 = .372$). The differences between the responses of the "standard" and any other Bellani for the whole observation period never reached the level of significance ($t < 0.210$; $P.05 = 1.99$). It was therefore concluded that the daily response of all ten instruments tested to changing meteorological conditions was essentially the same.

RESUME

Le fonctionnement sur le terrain de dix pyranomètres de Bellani, modèle de l'observatoire de Davos, a été étudié pendant 47 jours à l'été de 1962. Cet appareil mesure le rayonnement solaire reçu sur une surface sphérique et est sensible même à des doses de radiation très faibles comme on en rencontre souvent en forêt. Puisque l'appareil n'est pas fabriqué en série, ses dimensions peuvent varier légèrement d'un appareil à l'autre. C'est pourquoi chaque pyranomètre est calibré individuellement par le manufacturier. Un des dix appareils a été utilisé comme étalon. On a trouvé que le fonctionnement des dix appareils placés dans les mêmes conditions, après un an d'usage, était essentiellement le même malgré les changements journaliers dans les conditions climatiques.

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