

Prototype performance and preliminary trial results from an evaluation of the Sunshine Pyranometer (SPN1) - a new instrument for the measurement of global radiation, diffuse radiation and sunshine duration.

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The **Sunshine Pyranometer (SPN1)** from **Delta-T Devices Ltd** has a unique and patented design consisting of seven thermopile sensors beneath a shade mask. (**Figure 1**)

This design allows the measurement of three parameters (**global & diffuse radiation and sunshine status**) in a single instrument without any moving parts. The shade mask pattern ensures that one thermopile is fully exposed to the solar beam, while at least one thermopile is also completely shaded from it.

This poster describes the performance of the SPN1 during in-house testing, and also preliminary results from a trial conducted by MeteoSwiss at two of their monitoring sites.



Fig 1 Sunshine Pyranometer

Sunshine Duration

The SPN1 calculates sunshine state (defined by the WMO as $>120\text{W}\cdot\text{m}^{-2}$) using an algorithm based on the values and the ratio of direct & diffuse radiation.

Figure 4 shows a comparison between the BF3 (the predecessor to the SPN1 which uses the same algorithm) and a Campbell-Stokes

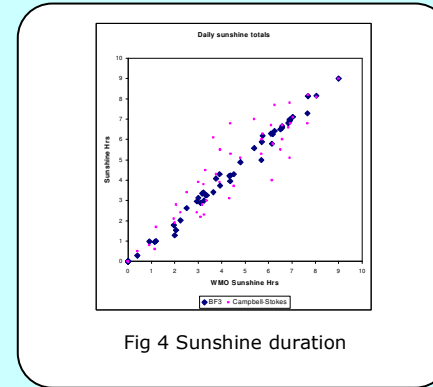


Fig 4 Sunshine duration

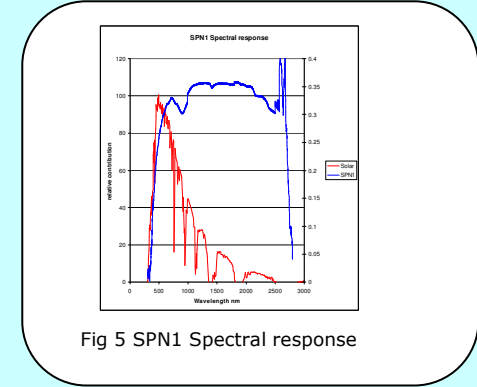


Fig 5 SPN1 Spectral response

Global & Diffuse radiation

Figure 2 shows a comparison between a Kipp & Zonen CM6B with a tracking disc and an SPN1 instrument.

There is an excellent correlation between the two sensors in the measurement of global and diffuse radiation

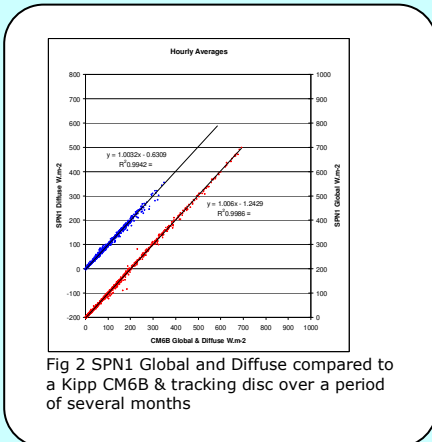


Fig 2 SPN1 Global and Diffuse compared to a Kipp CM6B & tracking disc over a period of several months

Figure 3 shows the performance of the SPN1 during tests at Payerne in Switzerland.

Measurements recorded using the SPN1 were compared to those obtained using nearby Kipp & Zonen CM21 pyranometers for a period of 24 hours (**Fig 3a**) and hourly averages over a period of several days (**Fig 3b**).

The two instruments displayed excellent correlation in their respective measurements of global radiation.

It should be noted that one of the CM21 pyranometers was situated some way from the SPN1

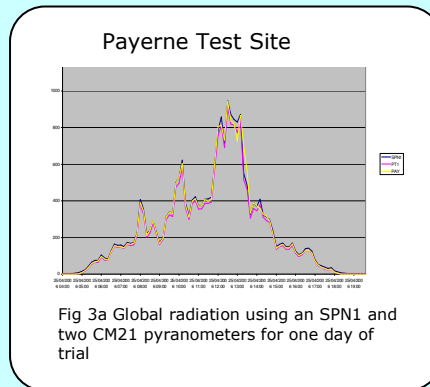


Fig 3a Global radiation using an SPN1 and two CM21 pyranometers for one day of trial

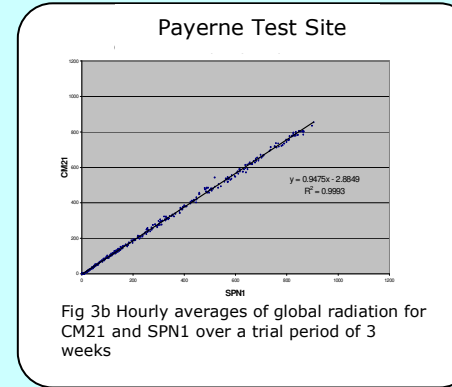


Fig 3b Hourly averages of global radiation for CM21 and SPN1 over a trial period of 3 weeks

Figure 5 Shows the spectral response of a prototype SPN1, combining the response for the thermopile sensors, diffusers and glass dome. The solar spectrum at ground level is shown for comparison.

Key Features:

- Direct & Diffuse radiation with Sunshine Duration in a single instrument
- No moving parts or tracking
- No routine adjustment or alignment
- Works at any latitude
- Internal thermostatic heater

Conclusions

The SPN1 provides accurate measurements of global and diffuse radiation and sunshine duration.

Its design lends itself to inclusion in a weather station network as it is able to provide these three measurements, in a single cost effective instrument requiring little routine maintenance.

Further applications where the SPN1 might be used would include atmospheric research requiring the measurement of diffuse solar radiation.

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