The Benefits of Ventilation Visualized

The main advantage of ventilating a radiometer is the increased up-time of measurements, due to the reduction in dirt on the dome and the ability to remove or prevent dew, frost and snow. This is clearly demonstrated in the picture below. This was taken in December 2010 on the roof of the Kipp & Zonen building in Delft. The ambient temperature is just below freezing.

The picture shows three CMP 21 pyranometers mounted on a SOLYS 2 sun tracker, two of the instruments are fitted with CVF 3 ventilation units.

From the left: CMP 21 ventilated without heater, CMP 21 unventilated, CMP 21 ventilated and heated

The differences between the three pyranometers can be clearly seen. The middle CMP 21, without the CVF 3, is completely covered with snow. The CMP 21 on the left, with ventilation but the heater not switched on, has snow on the top of the dome. Only the ventilated and heated CMP 21 on the right is completely clean. Obviously, this is the only pyranometer that is able to measure the global radiation correctly.

The next picture is of the same set-up, but viewed from the opposite direction. This was taken in September 2010 and shows the effect of morning dew.

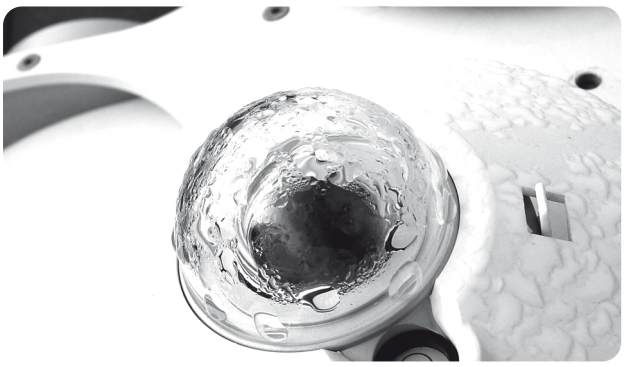
Here the dew covers the sun screen and the dome of the unventilated CMP 21 and is preventing a good measurement. The ventilated CMP 21 on the right looks better, but still has some water drops on the dome. The CMP 21 on the left, with ventilation and heating, is completely clear of dew.

Another advantage of the CVF 3, that is not visible, is reduction of the 'Zero A' offset. This offset is caused by the thermal radiation of the domes. When there is no wind the CVF 3 reduces this offset by up to 50 %. During the night, if the dome is warmer than the sky, the output of the pyranometer can be negative. During the daytime, with clear sky conditions, the offset can be hidden in the radiation signal. Also see the pyranometer FAQ section of our website, where the question of negative output during night-time is explained in detail.

A tip to improve the air flow of the CVF 3 in snowy conditions is to remove the filter from the bottom of the ventilator. The black plastic finger guard can be snapped back on without the dust filter present. This results in double the flow of air through the CVF 3 and over the dome. The filter normally blocks small leaves, dust and particles, but they will not damage the CVF 3 when going through. The interior of the CVF 3 is completely weather-proof.

Another tip, to adjust heating power to a restricted energy source, is to use the heaters in series instead of parallel. One heater consumes 5 Watts, with both heaters in parallel the consumption is 10 Watts. When the two heaters are used in series, the power is reduced to 2.5 Watts. In power-critical conditions this could just make the difference between some, or no, heating. Finally, the CVF 3 has a tacho output (5 V pulse) to show that the ventilator is actually running. This can be connected to a pulse/frequency input of a data logger.

The CVF 3 ventilation unit can be fitted to CMP 6, 11, 21 and 22, CGR 4 and CUV 5. The CVF 4 ventilation unit for the CNR 4 net radiometer does not have a tacho output, but otherwise it has the same benefits as the CVF 3 in increased availability and quality of measurements ■



Morning dew on unventilated pyranometer