# Newsletter 16

## The Benefits of Ventilation Visualized
## High Precision Measurement in PV Power Plants
## Chile, High Potential but Little Solar Data

KIPP & ZONEN
SINCE 1830

# Content

April 2011





## Contact

If you have a news item for the newsletter or want to share your experiences with Kipp & Zonen applications and contribute to our next issues, please e-mail the editor: kelly.dalu@kippzonen.com



# The future is bright

It is already April and Spring is here! We are getting ready for important upcoming events such as MeteoHydex in Geneva and Intersolar in Munich. Two different worlds, Meteorology/Hydrology and Renewable Energy, but both very relevant to Kipp & Zonen because they involve solar radiation. And that is our speciality!

Meeting with the different communities is a great inspiration for all facets of our business. For example, take the annual AMS (American Meteorological Society) Meeting in Seattle, USA earlier this year. The HMEI (Hydro-Meteorological Equipment Industry), of which I am chairman, organized a members meeting. The World Meteorological Organization was invited to make a presentation and the outcome was very interesting.

There are great advances being made in global and regional weather forecasting, moving from 3 day forecasts via 5 and 7 days to the target of 10 day forecasts. This is being achieved through implementation of specific programs under the umbrella of GCOS, the Global Climate Observing System of WMO. However, as most people have experienced, the weather is becoming more extreme and more difficult to predict accurately. This requires greater global coverage by real-time measurements of higher quality.

What does this mean for us? More funding for enhancements to existing national networks. More funding for new opportunities such as ocean observations. More funding for networks in parts of the world where none currently exist. The addition of measurements, such as PAR and UV, is increasing.

Public safety, protection of food and water resources and local economies, are priorities on the agenda of many countries. Expectations are that research will be intensified, requiring more and better measurement equipment.

Throughout the year we will have exciting new product launches. It is our commitment to stay on top of the technology and to live up to our Passion for Precision.

Thank you and best regards,

Ben Dieterink, President
Kipp & Zonen B.V.

# Making Brewer 100 Ready for the Antarctic

**The Brewer spectrophotometer is used to measure Ozone and Ultraviolet radiation all around the world. One very interesting location is in Antarctica. Because of the Ozone 'hole' over this continent, many Brewers are positioned there. Last year we carried out a special project for the new Belgian 'Princess Elisabeth' Antarctic Station.**

The Royal Meteorological Institute of Belgium (KMI/IRM) was given a Brewer by their counterparts in the Netherlands, KNMI. Brewer Mk III, serial number 100 has been measuring Ozone and UV for many years at the KNMI headquarters in De Bilt, since 2006 alongside their more recent Brewer Mk III number 189.

Before it was shipped off to the Antarctic, Brewer 100 received an extensive factory check and service. Although 17 years old, it was still in a very good shape. In fact, the Brewer is known for its durability and many of the first Brewers built are still up and running with consistent performance; thanks to good and regular maintenance and service.

To be fully Antarctic-ready, a heater and a cold weather cover were installed. The Brewer was also put in the environmental chamber to determine its temperature coefficients, so that the data will not be affected by temperature changes.

KMI/IRM also operates Brewers 016 and 178 in Brussels. Kipp & Zonen delivered Brewer 100 and our reference Brewer 158 to Brussels, to calibrate all three Brewers at the same time. Brewer 100 was shipped to Antarctica in October 2010, when the summer measurement season started, and was installed by Alexander Mangold of KMI/RMI early in 2011. It is now making high quality Ozone and UV measurements.

Princess Elisabeth Antarctica is the first "Zero Emission" polar station, run entirely on renewable energy sources. It is located at 71°57' South and 23°20' East, on the Utsteinen Ridge, North of the Utsteinen Nunatak, Dronning Maud Land, East-Antarctica. The altitude is 1300 m and it is 190 km from the coast.

You can view Alexander's weblog at http://belatmos.blogspot.com
Visit Princess Elisabeth Antarctica at www.antarcticstation.org ■

© International Polar Foundation - René Robert

# Improving Solar Radiation Data in Brazil

**The Instituto Nacional de Pesquisas Espaciais (INPE) is part of the Ministério da Ciência e Tecnologia of Brazil and one of their key projects is SONDA (Sistema de Organização Nacional de Dados Ambientais). Among the goals of SONDA is the collection of meteorological and radiation data at several selected sites across Brazil. This network of stations provides a basis for the publicly available data necessary for the validation of climate models and for the assessment of renewable energy resources, mainly solar and wind power.**

The Laboratory for Meteorological Instrumentation (LIM) develops robust and cost effective technologies relevant to the Brazilian National Institute for Space Science (INPE) missions. LIM supports the logistics for several research projects, including SONDA. High precision instruments from Kipp & Zonen provide the solar radiation data. The measurement sites include instruments such as the CMP 11 pyranometer, CHP 1 pyrheliometer, CGR 4 pyrgeometer and the 2AP sun tracker.

SONDA follows international standards, which makes some of these stations suitable to join the Baseline Surface Radiation Network (BSRN), part of the World Climate Research Program (WCRP) of the World Meteorological Organization (WMO). The goals of BSRN are; to provide high accuracy data for calibrating satellite-based estimates of the surface radiation budget and radiation transfer through the atmosphere; and to monitor long-term regional trends at the Earth's surface for climate change research.

Previously, new investment in the wide-scale intensive application of renewable energy technologies in Brazil has been inhibited by the lack of adequate solar and wind resource data and by the lack of tools to evaluate these data for energy planning. The necessary database is now available and will make an important contribution, not only to slowing down the growth in greenhouse gas emissions associated with the increasing Brazilian energy demand, but also to the guarantee of national energy security.

You can find out more about SONDA at:
http://sonda.ccst.inpe.br ■

# 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.

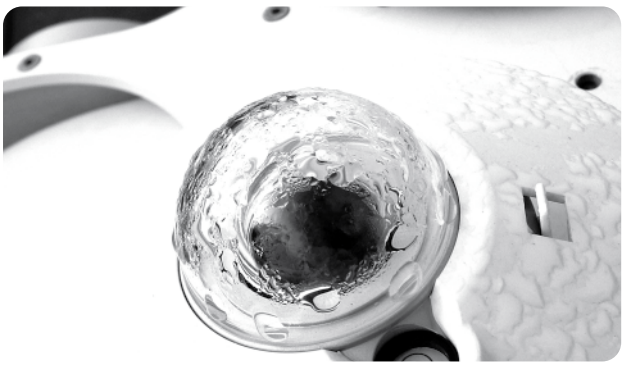
Here the dew covers the sun screen and the dome of the unventilated CMP 21 and is preventing a good measurement. The ventilated CMP 21 on the right looks better, but still has some water drops on the dome. The CMP 21 on the left, with ventilation and heating, is completely clear of dew.

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*

# High Precision Irradiation Measurement in Photovoltaic Power Plants

**Investors in utility-scale photovoltaic installations base their decision for or against such an investment project on detailed yield and performance ratio prognoses for the plant to be built. Once up and running, the plant's performance and yield are continuously monitored, analysed, and compared with the expected values.**

High precision irradiation measurements in Photovoltaic Power Plants form an essential information base for yield and performance ratio assessment.

Solar irradiation conditions in the photovoltaic (PV) generator field are at the basis of such performance ratio (PR) analyses. The higher the precision and reliability of irradiation measurement in the field, the more accurate is the actual performance and yield information provided to the plant operator and the investor.

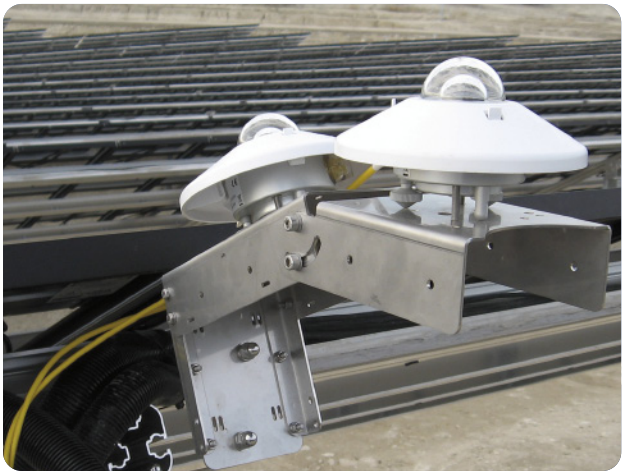
skytron® energy GmbH of Berlin develops and manufactures high-precision measurement, monitoring and control systems for the photovoltaic sector and offer solutions for the entire energy conversion chain in PV solar power plants.

The skyCONNi sensor and monitoring system, which collects the irradiation data in the PV generator field, is extremely accurate and measures at high temporal resolutions of up to 100 ms.

skytron® energy always strongly recommends its clients to opt for Kipp & Zonen pyranometers for their irradiation measurement. The steeper price compared to reference cells is offset by their high precision over a larger spectral range, their reliable linear response and negligible directional error at large angles of radiation incidence.

skyCONNi-Pyrano has inputs for two pyranometers, to measure horizontal and tilted global solar radiation, and sensors for ambient temperature and PV module temperature. Control and data transfer is by CAN Bus. skyCONNi-PyranoPro has additional facilities to power and control two Kipp & Zonen CVF 3 ventilation units to further improve the availability and quality of the measurements.





*The horizontal and tilted pyranometers*

Only such high-precision measurement data collected in the field leads, in the end, to meaningful and realistic conclusions about the performance of a photovoltaic power plant.

For more information about skytron® energy and their capabilities go to www.skytron-energy.com where you can also download the skyCONNi system brochure ■

# Chile, High Potential but Little Solar Data

**Chile is a country that heavily depends on imports to provide its energy needs. Fossil fuels provide a large percentage of the primary energy consumption, whilst renewable energy sources are still very limited. Therefore, the Chilean government has adopted renewable energy quotas for electricity production, creating interest in wind, geothermal and biomass power plants.**

*SOLYS 2 sun stracker at the PUC station, installed in 2010 at San Pedro de Atacama, in the Chilean desert*

Strangely enough, solar energy is not yet part of the discussion. You would assume that there is a lot of solar radiation available, especially in the Northern part of the country. The climatic conditions are perceived to be better than in many other locations around the world where solar energy conversion systems are in use today.

Mr. Alberto Ortega, assistant researcher and advisor in Scientific and Technical Management, and Rodrigo Escobar, Mechanical Engineering professor, both of the Pontificia Universidad Católica de Chile, are the project leaders in the Solar Resource Assessment for Chile.

Ortega says that “A proper atlas of solar energy, with actual data of low uncertainty is not available to the public or to planning authorities. This is part of the reason why solar energy has not been considered in Chile as a major energy source. There is no bankable data that could help gather the required financing that large-scale projects need.”

They have reviewed and analyzed the available solar energy data of ground stations from several sources and compared them to satellite derived measurements obtained by the Brazilian National Institute of space research, INPE, and weather simulations from Universidad de Chile.

The available ground-station information comes from three different sources:
A database of measurements from 89 stations throughout Chilean territory from 1961-1983; Data from the Chilean Meteorological Service from 1989; A network of stations at Pozo Almonte, San Pedro de Atacama and Crucero that collect data for the Chilean Comisión Nacional de Energía (CNE).

Each CNE station utilises three Kipp & Zonen CMP 11 pyranometers, a data logger, wind speed and temperature probes. One pyranometer measures global horizontal irradiance and the remaining two are mounted on a simple solar tracker. The first measures the tilted global irradiance and the second

measures the tilted diffuse irradiance by being covered with a shadow ring. Although this set-up is non-standard, and the data requires extensive post-processing, it nevertheless allows an estimate of the direct normal irradiance (DNI) with a reasonable degree of uncertainty, which is useful to assess solar energy potential.

There are locations in Chile for which data is available, but of varying quality and with interrupted periods of time. However, large regions of the Atacama Desert (in the Northern part of Chile) have no ground-station coverage and no solar radiation measurements. This is right where it is supposed, and widely discussed, that the best solar energy potential is located.

The team led by Ortega and Escobar is focusing on the development of a remote measurement technique based on satellite image processing. “The methodology works with a radiative energy transfer model in the atmosphere, utilizing climatic parameters (temperature, relative humidity, visibility, ground albedo and topography) to determine the aerosol profiles in the atmosphere.

Satellite images in the visible and infrared channels are processed as an indication of how much radiative energy is leaving the atmosphere. A special treatment allows us to detect and classify the optical properties of clouds, and the final product is an estimation of global horizontal, diffuse horizontal, and direct normal irradiance at the earth´s surface”, explains Escobar. This work, developed in collaboration with INPE, Abengoa Solar NT, the Chilean Meteorological Service and the Military Geographical Institute, aims to produce solar radiation maps for the whole country which will be published in an atlas by 2012.

The satellite-derived data needs to be validated by accurate ground station measurements. The team is deploying several Kipp & Zonen stations around the country, all of which are


composed of SOLYS 2 sun trackers, CMP 11 Pyranometers, CHP 1 pyrheliometers, CGR 4 pyrgeometers and CUV 5 Ultraviolet radiometers. “The ground measurements are used to validate the satellite estimation model, and also provide valuable data in proper temporal resolution. We have chosen Kipp & Zonen as it offers accuracy and reliability”, explains Ortega, while mentioning that several of the ground stations are deployed in hostile environments such as the Atacama Desert - the driest in the world.

Mr. Ortega believes that the adoption of a proper solar atlas will result in an enhanced ability for the analysis and design of solar energy systems, thus allowing accurate project estimations. This is perceived as the first step towards the large-scale utilisation of solar energy in Chile for power generation, industrial, commercial and residential heat supply, and solar-assisted cooling ■



# Fairs & Events

| | |
|---|---|
| EGU General Assembly 2011<br>Vienna, Austria | 3 - 8 April 2011 |
| 40th National Solar Conference<br>Raleigh, North Carolina, USA | 17 - 21 May 2011 |
| Meteohydex 2011<br>Geneva, Switzerland | 23 - 25 May 2011 |
| Intersolar Europe 2011<br>Munich, Germany | 8 - 10 June 2011 |

# Passion for Precision

Kipp & Zonen is the leading company in measuring solar radiation and atmospheric properties. Our passion for precision has led to the development of a large range of high quality instruments, from all weather radiometers to complete measurement systems.

We promise our customers guaranteed performance and quality in: Meteorology, Climatology, Hydrology, Industry, Renewable Energy, Agriculture and Public Health.

We hope you will join our passion for precision.

## HEAD OFFICE


**Kipp & Zonen B.V.**
Delftechpark 36, 2628 XH Delft
P.O. Box 507, 2600 AM Delft
The Netherlands

T: +31 (0) 15 2755 210
F: +31 (0) 15 2620 351
info@kippzonen.com


## SALES OFFICES


**Kipp & Zonen France S.A.R.L.**
7 Avenue Clément Ader
ZA Ponroy - Bâtiment M
94420 Le Plessis Trévise
France

T: +33 (0) 1 49 62 41 04
F: +33 (0) 1 49 62 41 02
kipp.france@kippzonen.com

**Kipp & Zonen Asia Pacific Pte. Ltd.**
81 Clemenceau Avenue
#04-15/16 UE Square
Singapore 239917

T: +65 (0) 6735 5033
F: +65 (0) 6735 8019
kipp.singapore@kippzonen.com

**Kipp & Zonen USA Inc.**
125 Wilbur Place
Bohemia
NY 11716
United States of America

T: +1 (0) 631 589 2065
F: +1 (0) 631 589 2068
kipp.usa@kippzonen.com


Go to www.kippzonen.com for your local distributor or contact your local sales office

KIPP & ZONEN
SINCE 1830

4414116-1104