Newsletter 24

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KIPP & ZONEN
SINCE 1830

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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

Innovation

Innovation is a kind of a 'magic' word today. Governments are making special funding available for companies that are innovative; there are industry awards for the most innovative companies. It seems that if a company is not innovative, it is lost and there is no future for such companies.

When I started my professional career in 1992 in the Scientific Department of the Dutch Meteorological Institute (KNMI) in solar radiation research, one of the first instruments I was introduced to was the CM 11. A few years later I purchased Brewer #100 for KNMI, the first commercially built Brewer MkIII. Now working at Kipp & Zonen in 2013 we have arrived at the CMP 11 and SMP11 and the Brewer MkIII, all still in principle the same as 18 years ago.

Despite what one would expect, science is conservative. New sensors means breaking measurements series, parallel measurements, avoiding discontinuities in measurements series, etc. From the perspective that such sensors can and have to be used operationally for some two decades, it can be deduced that the highest build quality is more essential and important than innovation.

The sensors Kipp & Zonen manufactures, are not commodities. Our customers are not going to be happy if we launch new versions of sensors every year (although some of our competitors seem to think so). Over the years many innovation have been implemented, but in the form of evolutionary innovations (instead of revolutionary).

On the other hand, the investments in innovations and R&D continues and new programs will be started to expand the evolutionary innovations and to initiate more 'revolutionary' innovations for those products that need it.

Kipp & Zonen is innovative and highly values the directions from our users. We strive to accommodate innovative activities to develop new and beautiful top quality products in the years to come, without losing our well known quality.

Enjoy reading the 24th issue of our newsletter.

Foeke Kuik -
Business Development Manager
Kipp & Zonen B.V.

Improved Alignment and Testing of LAS MkII

A new alignment and calibration facility for the Large Aperture Scintillometer (LAS) has recently been commissioned on the roof of Kipp & Zonen in Delft.

A large aperture scintillometer is an instrument that consists of a transmitter and receiver, spaced from a hundred metres to sveral kilometres apart, that measures heat fluxes from the Earth's surface. Using an internal data logger the LAS MkII receiver records intensity fluctuations of the light beam emitted by the transmitter. These fluctuations are caused by refraction of the light beam as it passes through the turbulent surface layer of air.

To obtain the best quality measurements, the alignment of optical components within the transmitter and receiver to the axis of the Fresnel focussing lens must be optimised. We have now designed and installed equipment that allows new LAS MkII, and instruments returned for service, to be tested at the factory by a single operator.

A reference transmitter is located 890 m away on top of the Electrical Engineering, Mathematics and Computer Science building of the Delft University of Technology, and points at the Kipp & Zonen roof. The infra-red light beam from the transmitter spreads out slightly with distance, so we can place several test receivers alongside a reference receiver for optical alignment and we can compare the data from them for performance checks.

The university's roof also has a reference receiver with a radio data link so that the received signal strength can be monitored whilst a test transmitter on the Kipp & Zonen roof is optically aligned and the beam power checked.

This new facility enables easy and repeatable alignment and testing of our Large Aperture Scintillometers and comparison with reference instruments ■

A New Brewer for Korea

At the end of January, our Brewer specialist David Godoy visited Korea to install a new Brewer MkIII Spectrophotometer. Here he tells us about his trip.

"There is already a wide Brewer network spread around the world and South Korea is one of the countries supporting the network with several Brewers. The Korean Meteorological Administration (KMA) has recently acquired a new Brewer to be located at Anmyeon Island, which is 200 km south of Seoul.

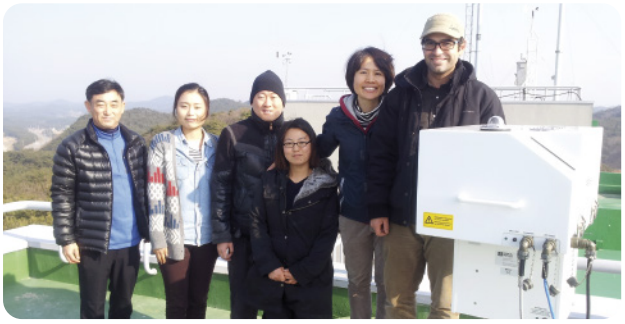
In December last year three of the staff from the Korea Global Atmosphere Watch Center (KGAWC) visited Delft to see their new Brewer and to undertake an in-depth training course about the operation and maintenance of the instrument. The next step was to visit them to install and commission it.

I flew to Korea in order to install Brewer #213 at the KGAWC Observatory, and to give training to the people involved with the Brewer. I have to say that I greatly appreciated all the support that was given to me by Danny Lee (Hanway) and Jung Mi Lee (KMA), they were willing to make my time there as comfortable as possible and they made me feel really at home.

Over the two first days, I set the new Brewer in place, checked that everything was in order and performed some final adjustments. On the third day I started the training and helped them to tackle some problems with their older Brewer #161 so that they could install it on the roof once again.

After solving the issues with #161 and making sure that the new #213 was doing well we went to Puhang City (400 km away) for the last two days, to troubleshoot Brewer #095 which was working poorly. Thanks to help from Danny, Jung and the rest of the team we managed to diagnose the problem and find a solution so that the old #095 could work again.

I left Korea exhausted but with a very good feeling, satisfied from having done a good job; I am really looking forward to returning to Korea to see such friendly people again."



With thanks to our Brewer distributor for South Korea, Hanway Trading Co. Ltd. of Seoul ■

Solar Monitoring in Qatar

Launched in 2011, QEERI is the Qatar Environment & Energy Research Institute and a member of the Qatar Foundation for Education, Science and Community Development. QEERI is conducting research in the areas of Concentrated Solar Power (CSP), Efficient PV Systems and the effect of dust on Solar Collectors. A Reference Solar Monitoring Station was installed in Doha, Qatar to obtain accurate solar radiation data for research and investigation.

The CMP 11 pyranometers and CGR 3 pyrgeometer being fitted on a CVF 3 ventilation unit before the cover is mounted

Concentrated Solar Power is used for generating electricity and for water desalination. Other points of interest are the Qatar Energy footprint and a Qatar solar atlas. Even though oil and gas are still important export products of Qatar, QEERI is looking to the future for alternatives and clean long term solutions.

In November 2012 Ruud Ringoir from Kipp & Zonen visited Doha to install and commission a Solar Monitoring Station for the Alternative Energy Group of QEERI, on the roof of a building of the Qatar Foundation. Together with Dr. Mokhtar Chmeissani, an affiliate scientist in the Alternative Energy group, Dunia A. Bachour and Dr. Daniel Perez Astudillo, both researchers at QEERI, the station was installed and operating in three days.

Dr. Daniel Perez Astudillo, Dr. Mokhtar Chmeissani and Ruud Ringoir

The basis of the station is a SOLYS 2 sun tracker with sun sensor kit and shading ball assembly. The system measures Global and Diffuse radiation with CMP 11 pyranometers. Direct radiation is measured with a CHP 1 pyrheliometer and the long-wave (FIR) radiation with a CGR 4 pyrgeometer. The three top-mounted radiometers are fitted with CVF 3 ventilation units.

Dunia A. Bachour mounting the CMP 11 pyranometers

The instruments are connected to a COMBILOG data logger with 230 VAC power supply and a 12 V battery with solar panel as backup. Communication between the data logger and a computer is via RS-232 cable. However, when the station is moved to its final location communication will be via GSM/GPRS modem. The selection of the site will be based on availability and an optimal free field of view ■

Measuring PV Performance in the Real World

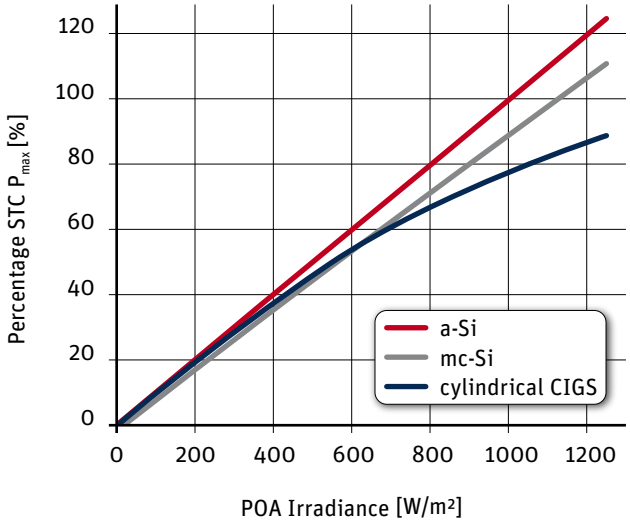
By Michael S. Buday, MS/MBA; University of Michigan, Ann Arbour

We designed and constructed a test-bed for the purpose of evaluating PV modules in real-world conditions, and the impacts of key variables that affect PV performance.

The key components of the system include a 1 kW source-meter performing IV (current/voltage) sweeps, a switching mainframe that directs the system to select a PV module to test while routing the other modules to fixed load resistors while not under test. A data acquisition system collects readings from weather-station instruments tracking irradiance, temperature (both back-of-module and ambient) and wind speed.

Current, voltage and power observations, correlated to our weather-station device readings, are collected from a total of 20 c-Si (crystalline silicon), a-Si (amorphous silicon) and CIGS (copper indium gallium (di)selenide) PV modules every ten minutes during daylight-hours when plane of array irradiance is > 20 W/m². To measure POA IRR, we use several Kipp & Zonen SP Lite2 photodiode detector pyranometers.

Secondary-standard, first-class and second class thermopile-type pyranometers measure all the available solar irradiance throughout the range 300 to 2800 nm, which more than covers the wavelengths to which PV technologies respond. However, silicon diode pyranometers only respond to a narrower range of wavelengths (400 to 1100 nm) but are still used in PV weather stations, in part because they are less expensive than thermopiles. Therefore, in March 2011, we added a secondary standard Kipp & Zonen CMP 21 to our test-bed.



Actual module power versus plane of array irradiance

Based on observations taken between July and December 2010, our PV module performance results consist of a series of graphs plotting percentage P_{max}, I_{sc}, V_{oc} and FF against POA irradiance, as well as percentage Pmax against AOI, percentage P_{max} and FF against module temperature, and FF and percentage P_{max} over time intervals. Shown on the graph below is the percentage of P_{max} under Standard Test Conditions (STC, 1000 W/m² and +25 °C) that is actually produced under real world outdoor conditions.

In accordance with IEC 61853-1, we also calculated linear and polynomial line fits for percentage Pmax versus irradiance and linear interpolations of I_{sc}, V_{oc}, V_{mp} and P_{max} with respect to temperature and irradiance as well as a polynomial interpolation of P_{max} to irradiance.

We observed that our CIGS module had a better fit with a polynomial rather than a linear equation, especially below 1000 W/m². As indicated in the graph a-Si module clearly demonstrates a better power index to irradiance performance ratio than either c-Si or CIGS. This corresponds to the equations in the table and is due to a-Si's superior temperature coefficient.

Module Material	% P_{max} Trend Line	R^2
a-Si	0.0010 Irr - 0.0740	0.986
CIGS	4×10^{-7} Irr^2 + 0.0012 Irr - 0.0187	0.974
c-Si	0.000898 Irr - 0.0138	0.994

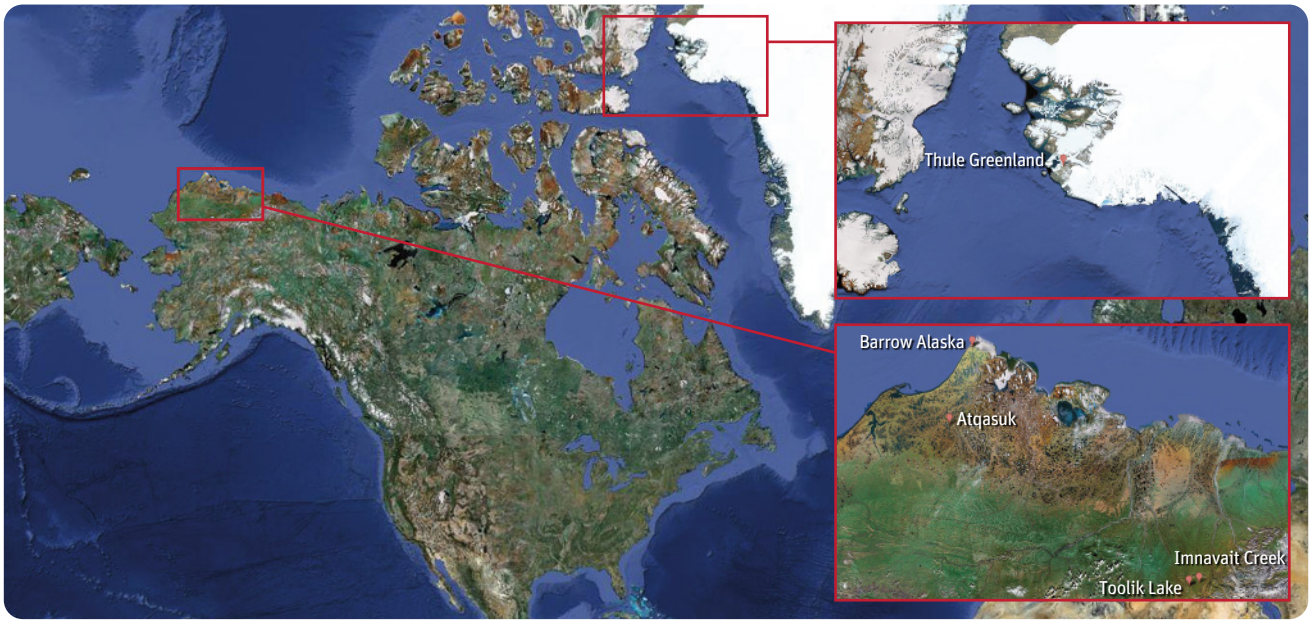
Outdoor PV module testing systems, such as the one we developed can dramatically increase an organization's capability to evaluate PV under real-world conditions. They help to highlight the limitations of STC-based PV ratings and can assist a PV manufacturer with product development or a developer with selecting PV modules for installation ■

Source: Buday, M., Keoleian, G., Marion, W., Measuring Irradiance, Temperature and Angle of Incidence Effects on Photovoltaic Modules in Auburn Hills, Michigan, Center for Sustainable Systems, Report No. CSS11-12, University of Michigan, Ann Arbor, Michigan

CNR 4 on the North Slope of Alaska

By Steven F. Oberbauer, Ph.D. and Nathan C. Healey, Ph.D. of Florida International University Department of Biological Sciences, Miami

Ecological research currently being conducted on the North Slope of Alaska has been enhanced via implementation of radiation measurements made by Kipp & Zonen products. Here, we employ CNR 4 Net Radiometers at four locations: Toolik Lake (68°37'15.78" N, 149°35'47.40" W) and Imnavait Creek (68°36'59.12" N, 149°18'22.69" W), Atqasuk (70°27'N, 157°24'W) and Barrow Alaska (71°18' N, 156°40' W).



This instrument is part of a suite of sensors on mobile platforms designed to examine Arctic ecological characteristics of vegetation through long-term observations within the Arctic Observation Network (AON) and the International Tundra Experiment (ITEX) established in the early 1990's.

We utilize the CNR 4 model at the North Slope locations so that we can analyze all incoming and outgoing long-wave and short-wave radiation among different vegetative communities including dry heath, moist acidic tundra, and shrub tundra, to name a few. At a fifth location, Thule Greenland (76°32' N, 68°49' W), we are using a CNR 2 in conjunction with a CMP 3 pyranometer.

Our daily scans span the Arctic growing season (May to September) enabling us to analyze phenomena occurring over seasonal, monthly, weekly, and daily time periods. These radiation measurements across the Arctic biome are critical for AON-ITEX in order to investigate both short-term and long-term energy, carbon, and water balance studies at the Earth's surface.

We don't only work in Alaska! We have also deployed a lightweight mobile sensor with a CNR 2 net radiometer and CMP 3 pyranometer system above the canopy of rainforest in Costa Rica. And two of our eddy covariance flux towers in the Everglades of Florida as well as the tower in Costa Rica use CNR 2's. And in the Florida Everglades Wetlands we're using a Kipp & Zonen Large Aperture Scintillometer (LAS) for sensible heat flux measurement.

Left: CNR 4 Net Radiometer at far left of sensor system on support cables at Toolik Lake, Alaska

Right: Steven F. Oberbauer (Principal Investigator) and Nathan C. Healey (Postdoctoral Research Associate) observing the mobile sensor system's support cables and towers

Find out more about the work of the Florida International University Department of Biological Sciences at **www.biology.fiu.edu**

The New French Office is at your Service

Last year the French office moved to a new facility. Now that they are settled in, it's time to turn the extra space available into an advantage for our customers in France.

Kipp & Zonen France has expanded its activities to minimize the turn-around times for maintenance, repair and calibration. Moreover, they will soon be able to perform calibrations themselves! Pierre Simonneaud, our customer support technician, and Kamal Sabra, our sales manager, are both excited about the prospect of having their own calibration facility.

Our new French office cannot be overlooked

"It will be a great benefit to all our customers to add the calibration of pyranometers, albedometers and some other instruments to our service. Once the installation is completed and validated, and we have received reference instruments calibrated at the World Radiation Centre in Davos, Switzerland, we will be ready to accept customer instruments for calibration."

The new calibration facility will be operational this summer ■

Get trained on Solar Radiation Measurement

Did you know that we offer certified training both on location and at our office? Depending on your requirements and topics of interest we can train you and your staff on the measurement of solar radiation and the installation of our instruments.

In 2 or 3 days our product managers explain the theory and let you go hands-on with our instruments. All aspects are covered and you will be ready to advise, install and work with the best radiometers in the world! ■

Fairs & Events

EGU General Assembly Vienna • Austria	7 - 12 April 2013
The Solar Show AFRICA Johannesburg • South Africa	9 & 10 April 2013
SOLAREX • Istanbul • Turkey	11 - 13 April 2013
CISOLAR • Moscow • Russia	11 & 12 April 2013
SOLAR 2013 • Baltimore • USA	16 - 20 April 2013
SOLAREXPO • Milan • Italy	8 - 10 May 2013
SNEC 2013 PV POWER EXPO Shanghai • China	14 & 15 May 2013
Renewable Energy Asia Bangkok • Thailand	5 - 8 June 2013
Intersolar EUROPE Munich • Germany	19 - 21 June 2013
ICEM • International Conference Energy & Meteorology Toulouse • France	25 - 28 June 2013

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.

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