Newsletter 18

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National Ecological Observatory Network

The Highest Meteo Station in the World

KIPP & ZONEN
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Content

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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

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Kipp & Zonen B.V. - 2011

Summer, UV and a Book to Read

Only three months ago I wrote "summer is here", not knowing that the summer in major parts of Western Europe had nothing to do with solar radiation and UV exposure, but almost exclusively with precipitation. And that is not our business! In the Netherlands we have had the wettest summer since 1906. But, nevertheless, the summer was fruitful with many interesting events and successes for our sales channels.

Luckily, when the Netherlands was rainy, Southern Spain wasn't. Huelva, provided a perfect setting for the inter-comparison of UV and Ozone instruments. We participated with two people and two Brewers and the report is included in this newsletter. Also included is an application note on measuring UV radiation, for which we offer a wide range of instruments.

At the EMS annual meeting in Berlin, Germany I will present the Kipp & Zonen award to Dr. Roman Nuterman. This young aspiring scientist wrote the interesting paper 'Multi-scale Meteorological and Chemical Weather Forecasting with a Downscaling Model System'.

From 16 to 23 October the annual Solar Energy Challenge will take place across Australia. Kipp & Zonen is once again sponsoring two teams; Solar Team Twente and the Nuon Solar Team of the Technical University in Delft, hoping for their fifth win. Both will use two of our CMP 6 pyranometers in their racing strategy. We wish both teams the best of luck.

By the time you read this column the second edition of 'A Guide to Solar Radiation, from sensor to application' will be available. The success of the first edition was overwhelming. After the last copy was gone the interest remained so high that we decided to go for a completely revised update, with the latest technology, developments and know-how on measuring solar radiation and with additional applications for solar energy systems.

All the best and I hope to see you during one of the many conferences where we exhibit.

Thank you and best regards,

Ben Dieterink, President
Kipp & Zonen B.V.

The Award goes to Dr. Roman Nuterman

Every year, at the annual meeting of the EMS (European Meteorological Society), we grant the Kipp & Zonen Award for Boundary Layer Research to a young aspiring scientist. This year Dr. Roman Nuterman was selected as the winner for his paper 'Multi-scale Meteorological and Chemical Weather Forecasting with a Downscaling Model System'.

Nowadays, Numerical Weather Prediction (NWP) and Atmospheric Chemistry Transport (ACT) models realise model-nesting and down-scaling from the global to the local scale and approach the necessary horizontal and vertical resolutions to provide weather and air quality forecasts for urban and local areas. However, most urban simulations of real conditions consider only a small part of the urban area in a micro-meteorological model, whilst urban heterogeneities outside the simulation domain affect the micro-scale processes.

The Danish Meteorological Institute (DMI) has provided meteorological information for 135 year. Weather forecasting today requires precise measurements, advanced modelling, powerful computers and skilled meteorologists. DMI's predictions do not limit themselves to the next few days or weeks, but look into the 22nd century as well, where scientists expect very different meteorological conditions to the ones we have today.

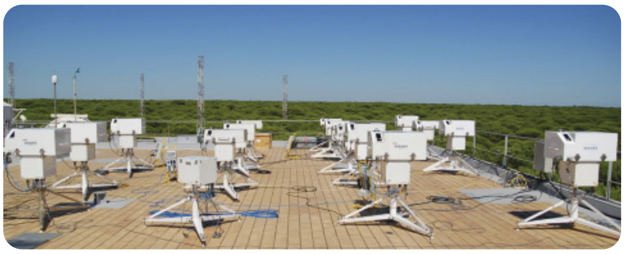
Dr. Nuterman's research at DMI is focused on the development and improvement of the down-scaling modelling chain, i.e. the coupling of regional-, urban- and street-scale models, as well as studying the heterogeneity of meteo- and chemical fields induced by urbanized areas.

The chain includes models such as the regional ACT models, the High Resolution Limited Area Model and the Comprehensive Air Quality Model. The Building Effects Parameterisation module for HIRLAM, developed by Alberto Martilli, is used to input information about the urban environment.

The complete developed system constantly performs verification of its predictions against observations. It assimilates observation data from satellites, radars, weather sensors, ceilometers, pyranometers and precipitation gauges for both nowcasting and forecasting of weather and air quality. A key input to the models is the measurement of solar radiation by Kipp & Zonen CM 11 and CM 21 pyranometers.

For more on the Monitoring Atmospheric Composition and Climate (MACC) EU Collaborative Project, of which this research forms a part, go to http://www.gmes-atmosphere.eu ■

18 Brewers come Together in Huelva



This July, Kipp & Zonen participated in the sixth Brewer inter-comparison at the El Arenosillo Atmospheric Sounding Station, near Huelva in the South of Spain. This was organized by the Regional Brewer Calibration Center Europe (RBCC-E), which is part of the Meteorological State Agency of Spain, AEMET, and is based at the Izaña Observatory on Tenerife.

The inter-comparison site is a facility of the National Institute for Aerospace Technology (INTA) and is in the middle of a national park popular with Spanish campers. Running concurrently was an inter-comparison by the Regional Dobson Calibration Center Europe (RDCC-E), and a national comparison of UV radiometers, mostly the Kipp & Zonen UVS Series.

In this campaign, 18 Brewers from Europe, Canada and Morocco participated to compare measurements and perform calibrations against one of the reference MkIII Brewers from the RBCC-E triad. UV measurements were compared to the 'Qasume' reference instrument from the world radiation center in Davos, Switzerland. As the manufacturer, we brought two Brewers ourselves, our travelling standard (BR158) and our research and development Brewer.

Southern Spain's July is hot and sunny. Although the heat was not very comfortable for the operators, the conditions were perfect for the Brewers. The campaign provided a great opportunity to meet some of the international group of Brewer operators.

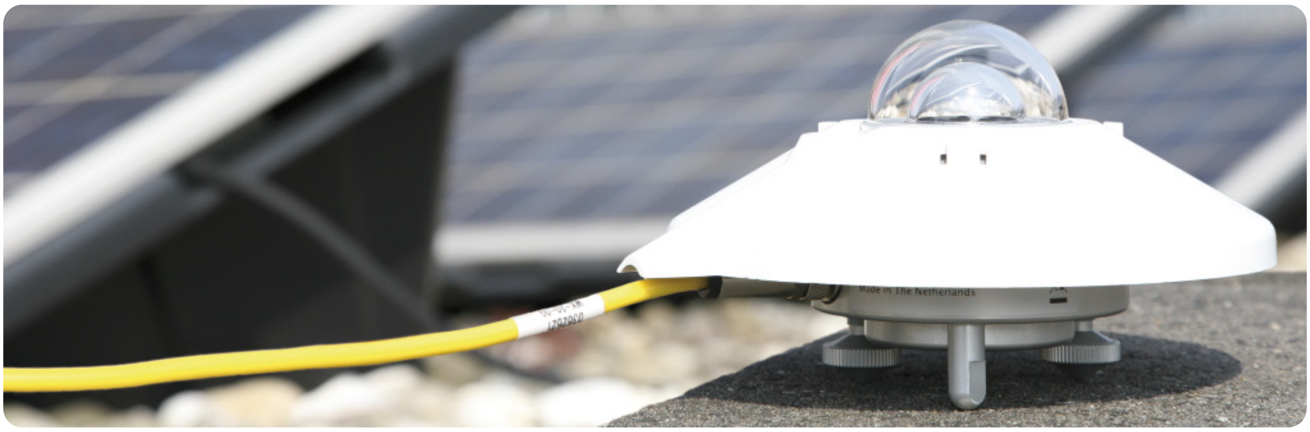
During the 10 days of the inter-comparison a lot of data was collected and several tests were done, such as UV calibrations. The campaign closed with a comparison between the Brewer and Dobson instruments. The Dobson is no longer in production, but some institutes still operate them. This predecessor of the Brewer requires manual operation, so the Dobson people had to be up at sunrise!

Our Brewers have been compared to the UV and Ozone reference instruments and the calibration constants have been adjusted, if necessary. We look forward to next year's RBCC-E campaign in Arosa, Switzerland ■

PV Monitoring for Research and Education

By Kasper Zwetsloot of the Technical University of Delft, the Netherlands

With new solar cell technologies coming onto the market, comparison between the different types gets harder and harder. This is especially the case in areas with less than optimal solar conditions, such as the Netherlands. To get a better understanding of the differences in real life conditions the Photovoltaic Materials and Devices (PVMD) group of the Delft University of Technology is building a test site.



Since the commercial introduction of the original crystalline silicone solar cells a whole new range of technologies has become available and even more are on the way. One of these technologies is thin film solar cells. In this category amorphous silicon has the biggest market share and is the main research field of the PVMD group.

All technologies have their own advantages and drawbacks. This could be in efficiency, cost, or weight, for example. The differences could also depend on the illumination condition such as direct or diffuse light, spectrum and temperature. For example, an amorphous silicon solar cell performs relatively better in diffuse light than crystalline solar cells.

For characterisation the PVMD group uses standard test conditions of 1000 W/m² irradiation with the spectrum of 1.5 Air Mass and a panel temperature of +25 °C. This makes it possible to compare the different technologies for those conditions. But in real life those conditions are seldom met. Therefore it cannot be concluded which technology is best suited for a certain application.

At the moment the PVMD test site consists of six older multi-crystalline solar arrays, from which we are monitoring the direct current and voltage. The temperature of the solar modules is also monitored. In the near future we will install different PV technologies such as micro-morph thin film modules. This will not be the last expansion. We want to create a good and comprehensive test site with as many different technologies as possible.

We are using the CMP 11 pyranometer from Kipp & Zonen to measure the global irradiance. This is our reference for the solar input since it includes all the irradiance from the total hemisphere. The specifications of the CMP 11 make it a reliable sensor to base our conclusions on. With the planned expansion of the test site more pyranometers will be added too; for example to measure the in-plane irradiance.

With all the data collected we hope to get a better insight into the differences between technologies. Hopefully, it will also give us an indication how to improve the performance of the solar modules.

The data collected from monitoring the PV modules will also be used for educational purposes. The use of sustainable energy sources also has great effects on the electricity grid. The sun is not always shinning! To give better insights into these production fluctuations we can use this data. The students, and other people that are interested, can use this data to design better PV systems. Therefore, the data is made available for everyone to use ■

For more information about the PVMD group at TUDelft please visit:
http://pvmd.ewi.tudelft.nl
And for the PV monitoring site and system visit:
http://pvmonitoring.ewi.tudelft.nl/pvmon.html

Choosing the Right UV Radiometer

The UV part of the solar spectrum covers the wavelength ranges 100 to 280 nm (UVC), 280 to 315 nm (UVB) and 315 to 400 nm (UVA). Almost all UVC from the sun, and approximately 90 % of UVB, is absorbed by the Earth's atmosphere. UVA radiation at the Earth's surface is normally 15 to 20 times greater than UVB.

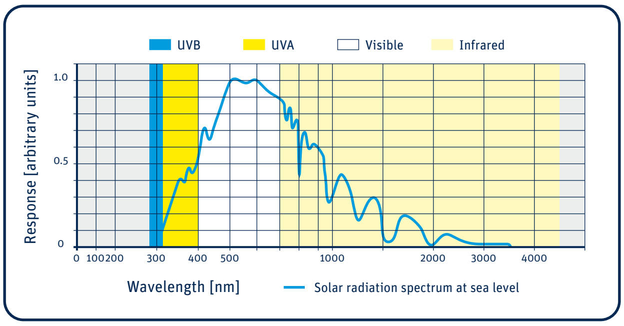
The World Meteorological Organisation and the World Health Organisation define the boundary between UVA and UVB as 315 nm. However, some other organisations, particularly in the USA, still use the older boundary definition of 320 nm. This makes a significant difference to the amount of UVB measured and must be taken into account when comparing data from different published information and from different UV sensors. Nowadays UV irradiance is always measured in W/m².

UVA and UVB measurements are mainly used to monitor and investigate the effects of solar UV radiation on plants and animals. In materials testing important issues are the ageing effects of outdoor UV exposure that cause degradation, such as brittleness and discolouration. Measurements are also carried out under controlled conditions in environmental test chambers using artificial UV light sources. For these applications the UVS-A-T, UVS-B-T and UVS-AB-T are most suitable.

UV measured with a similar response to the human skin is termed Erythemally Active UV irradiance (UVE). In the past this 'harmful UV' was measured with a number of different response functions and several countries had their own UV Index scales. Measurement terms such as 'Minimum Erythemal Dose' (MED) and exposures in MED/hr were often used but these are not well defined or standardised.

To avoid this confusion, United Nations organisations combined to produce the Global Solar UV Index (UVI). This is now accepted world-wide as the basis for public health information. The erythemal spectral response function is defined by ISO: 17166:1999 / CIE S 007/E-1998. The Global Solar UV Index can be calculated by multiplying the UVE radiation value in W/m² by 40 m²/W. For example, 0.25 W/m² of UVE represents a UV Index of 10. A UVB radiometer is not ideal for the measurement of UVE. The UVS-E-T and UVS-AE-T radiometers are specifically designed for this application.

The United Nations 'Practical Guide to the Global Solar UV Index' can be found at:
http://www.unep.org/pdf/Solar_Index_Guide.pdf



The amount of UVB and UVE radiation reaching the ground is strongly dependent upon altitude, the height of the sun in the sky, the amount of Ozone in the atmosphere and cloud cover. UVS radiometers are calibrated for a typical air-mass (solar zenith angle) and Ozone column concentration. Our unique UVIATOR software supplied with the UVS further improves the accuracy of the measurements by correcting for the amount of Ozone in the atmosphere and the solar elevation.

For many applications, such as meteorology and climatology, it is only necessary to monitor the 'Total UV' irradiance with a moderate level of accuracy, using a relatively simple and low cost instrument. For this we have the CUV 5. Although the term 'Total UV' is commonly used in meteorology, and by manufacturers, it is actually a misnomer because this type of instrument cannot match the ideal 'flat' spectral response from 280 nm to 400 nm. For accurate measurement of combined UVA and UVB the UVS-AB-T with UVIATOR should be used.

For the ultimate in spectral UV measurements there is the Brewer Mk III Spectrophotometer and this can be used as a calibration reference for network broadband UV radiometers such as the UVS Series

Consistent and Accurate PAR Data for the US National Ecological Observatory Network

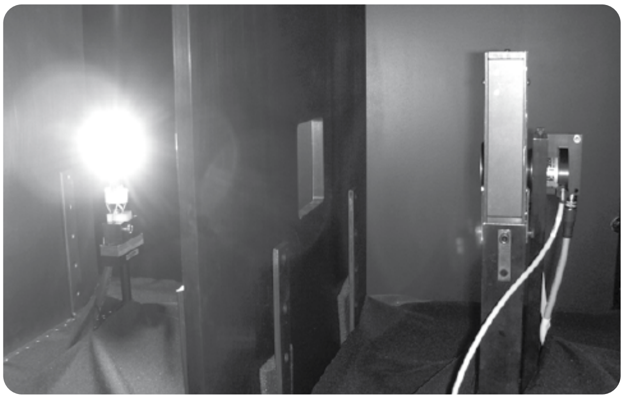
With our ever growing population and intensified land use, the biosphere, the living part of Earth, is changing. Humans depend on water, food, light, energy and air; disruptions to the biosphere affect all life on earth. As a result, changes in the way that the biosphere can provide us with our needs could alter the quality of human life in parts of the world affected.

In order to help understand these changes, the National Ecological Observatory Network (NEON) was created to collect data across the United States on the impacts of climate change, land use change, and invasive species on the biosphere. NEON will be the first observatory network of its kind designed to detect and enable forecasting of ecological change at continental scales over multiple decades. The data NEON collects will be freely and openly available to all users.

To gather ecological data in a strategic manner, NEON has partitioned the U.S.A. into 20 eco-climatic domains (see figure below), each of which represents different regions of vegetation, landforms, climate, and ecosystem performance. Division of the U.S. into domains ensures that NEON is able to systematically sample the whole country in a model objectively representing environmental variability.

NEON is funded by the National Science Foundation and has passed the planning and development stages and is now entering the construction phase of measurement stations. Soon the data will begin to come in. Constructing the entire network will take approximately five years and it is expected to be in full operation by 2016.

NEON has selected the Kipp & Zonen PQS 1 Photosynthetically Active Radiation (PAR) Quantum Sensor for use in the network. Over 1,500 PQS 1 sensors will be installed over the next 5 years, deployed at various levels of the forest canopy to accurately measure the pattern of PAR availability and utilization. To ensure consistent and accurate data NEON has developed a calibration facility traceable to the National Institute of Standards and Technology (NIST) for the PQS 1 PAR sensors, which is shown below.

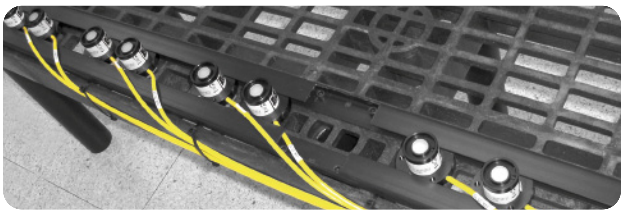


NEON plans on collecting data for the next 30 years, so this data needs to be of the highest accuracy and reliability and the collection frequencies need to remain constant.

NEON will also implement a Scientific Solar Monitoring Station from Kipp & Zonen in accordance with the guidelines of the Baseline Surface Radiation Network (BSRN) to measure direct, diffuse and global solar radiation with the highest accuracy. The station will include the SOLYS 2 sun tracker with CHP 1 Pyrheliometer, two CVF 3 ventilated CMP 22 Pyranometers and a ventilated CGR 4 Pyrgeometer.

The PQS 1 PAR Quantum Sensor is just one of many in this network. NEON scientists will use more than 11,000 sensors of 44 different types to make dozens of different kinds of measurements, from soil moisture to water temperature, to wind speed. All to understand how the biosphere is changing in response to human activities.

More information on NEON's calibration facility can be found at:
http://www.neoninc.org/news/calvallab



The Highest Meteo Station in the World

By Valeria Menichini, LSI LASTEM s.r.l., Milan, Italy

Mountain regions have been designated by the General Assembly of the United Nations as primary indicators of climatic change and as sensors of the health of the Earth. Ev-K2-CNR, a department of the Italian Council for National Research, is realizing the SHARE project (Stations at High Altitude for Research on the Environment).

Specific targets are the improvement of scientific knowledge about climate variability and the impacts of climate changes, and assuring data availability over long periods. To achieve these targets a global network of mountain observatories has been created to study atmosphere composition, meteorology, glaciology, hydrology and water resources, biodiversity and health. These observatories for climatic and environmental monitoring are located across the Alps, Asia and Africa, in collaboration with UNEP, WMO, NASA, ESA and IUCN.

The Ev-K2-CNR Committee is best represented by its Pyramid Laboratory/Observatory located at an altitude of 5050 m at the base of Mount Everest in Nepal. Starting from the Pyramid the SHARE Everest project began in 2008. Since then there has been a meteorological station located on the 'South Col' at 8000 m above sea level that, in the first 3 years, supplied very useful data to the scientific community. This is the highest operational meteorological station in the world.

This year a new automatic weather station (AWS) has been added. "At this moment we have all the standard meteorological data and some are transmitted in duplicate, due to the fact that two stations are installed." says Giampietro Verza, who is responsible for the scientific equipment of the CNR Pyramid and of the whole SHARE Everest project.

"The data collected are; air temperature (more than one probe), humidity, atmospheric pressure, and wind. This is one of the most important and more stressful parameters because winds here can reach 300-350 km/h. For this reason wind is acquired with a system of double sensors and a double recording and transmission system. Moreover, we also have radiometers measuring global and UV radiation. An interesting parameter, that has been implemented, is battery condition, because it has helped to use batteries better than those available in 2008. We will improve in the future, and add additional measurements."

You can find more information about Ev-K2-CNR and the SHARE Everest project at:
www.evk2cnr.org/cms/en/evk2cnr_committee/presentation

The Everest AWS was designed and developed by LSI LASTEM s.r.l. of Milan, Italy (**www.lsi-lastem.it**) and incorporates Kipp & Zonen solar radiation instruments. A crew of the finest Italian alpinists installed the AWS at 8000 m after extensive training by LSI Lastem. LSI LASTEM s.r.l. has been a Kipp & Zonen OEM customer for over 20 years.

Eurelettronica Icas is the dedicated distributor of Kipp & Zonen products in Italy ■

Fairs & Events

Solar Power International 11 Dallas, Texas, USA	17 - 20 October 2011
Meteorological Technology World Expo Brussels, Belgium	18 - 20 October 2011
Clean Energy Expo Asia Singapore	1 - 3 November 2011
Energy & Meteorology (ICEM) 2011 Gold Coast, Queensland, Australia	8 - 11 November 2011
AGU Fall Meeting 2011 San Francisco, California, USA	5 - 9 December 2011
Intersolar China Beijing, China	7 - 9 December 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.

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