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China's second PV Pioneer Project
Pyranometer and satellite, how to combine the data



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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

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Kipp & Zonen B.V. - 2018

Improving the customer experience

December 2017 was an important month for Kipp & Zonen, as the company was acquired by the Hach/OTT group of companies, part of the Danaher Corporation. This group has a long history of serving customers in water quality management, meteorology and environment; which means that Kipp & Zonen will be embedded in a business ecosystem that will certainly improve the customer experience.

Within this new context we will be able to tap into the group R&D resources, for example in the field of sensor data integration. This will help us to rapidly respond to customers needing integrated or customized instrument technology, enabling us to better explore your needs and to respond with optimised solutions.

Using the expanded group sales network, Kipp & Zonen will also be offering an improved capacity to provide support locally for our international customers. This applies initially to providing information and logistics in the local language and over time will lead to the wider availability of local instrument services; such as installation, maintenance and calibration.

Integrated systems will continue to be provided by our business partners, but they will be able to rely on one company to supply and support a wider range of instruments, arrange warranties and support data integration. This means for our end-users a faster, more comprehensive service and less compatibility issues.

The Kipp & Zonen family is very pleased to be working with our new group of colleagues and we will be maintaining our own operations and identity. It allows us to bring new opportunities to our customers whilst maintaining the trusted high standard of Kipp & Zonen products and services.

We look forward to introducing you to our expanded and enhanced customer experience.



Erik Valks
CEO Kipp & Zonen



rt1 update

The first RT1 systems have left our factory and are now installed in the field. RT1 can play a crucial role in monitoring the efficiency of commercial-scale rooftop solar panel installations. It provides the real-time local irradiance and PV panel temperature measurements that you need to derive the performance ratio, and thus the return on investment, of the project.

RT1 is designed to make the monitoring of rooftop PV as easy as possible, but at the level of accuracy Kipp & Zonen is known for. The biggest benefit is, of course, the combination of two sensors; a silicon pyranometer and a panel temperature sensor. But, there are more clever things about RT1:

- It is very easy to mount because you don't need any tools or screws
- The solar irradiance measurement is in the exact plane of array of the PV panels because RT1 is fixed directly on a panel
- The cables and waterproof connectors are high quality
- The temperature sensor is very robust and is thermally isolated from the air
- The temperature sensor will stay firmly fixed, thanks to the special heat-conducting 3M™ tape
- RT1 comes with cable ties and self-adhesive mounting pads, to properly secure the sensor cable to the panel

Feedback from one of the first customers

The first customer to buy an RT1 in India is Kalpa Power. Rounak Muthiyan (Director) and Rohidas Hiray (Assistant Manager) explain how and why they were the first to do so.

“At Intersolar 2017 Europe in June, I stumbled upon this great utility product which was a perfect fit for the Indian rooftop solar market. Till date we're always using the SMP3 product which is primarily designed for ground mount/utility-scale installations.

Kipp & Zonen is an industry leader when it comes to sensors for renewable energy solar applications. The SMP3 and CMP3 pyranometers have been the only products available in the Indian market to fit the rooftop industry in the past. We were convinced about the benefits and the accuracy of Kipp &

Zonen very early, when we installed the products at our commercial and industrial rooftop projects.

The new RT1 however, has great advantages over the Second Class SMP3 and CMP3; its price position, the ease of mounting it on variable tilt roofs as well as the added advantage of a module temperature sensor.

When we were introduced to the RT1 sensor with all its added benefits, like a simple mounting fixture, integrated module sensor and the high quality that all Kipp & Zonen products are known for, it was a no-brainer for us to go ahead and select the RT1 device” ■

Rounak Muthiyan



Kalpa Power Pvt. Ltd. specializes in designing, building and implementing systems for generating solar power. In just a few years, it has commissioned close to 5 MW of solar power capacity. Kalpa Power was born out of the motto: “Making power more reliable, affordable and environment friendly”

A pyranometer to support **Solar Racing Groningen** in their World Solar Challenge 2017

By Ray Blokker, Solar Racing Groningen



Pyranometer supporting Solar Racing Groningen

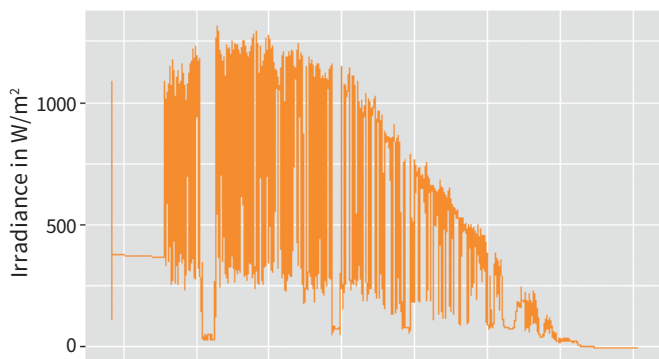
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The Solar Racing Groningen team attended the Bridgestone World Solar Challenge 2017, not as competitors but as observers. Since the team is going to participate in the 2019 race, it is crucial to get as much knowledge as possible before heading to this race. We brought a SMP11-V pyranometer with us to Australia to prepare for 2019.

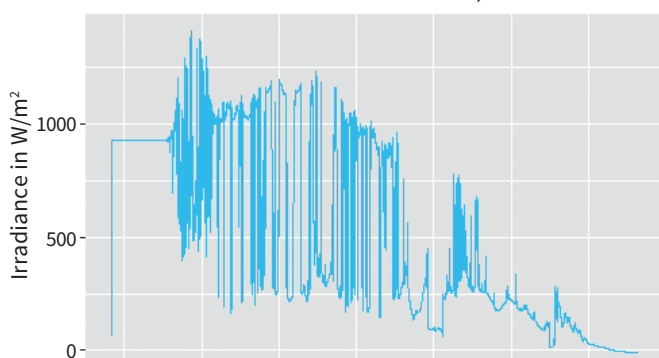
The Groningen team is not the first Dutch team to use a pyranometer from Kipp & Zonen. When our team members, Ray and Danny, were driving around Darwin, they saw the same device on top of other Dutch team support cars. These teams

directed the pyranometers towards the sun when they stopped in order to make final adjustments and to validate the model. In our experience, we used the pyranometer for getting data which will help us at several stages when designing the car.

Irradiance on October 8th, 2017



Irradiance on October 9th, 2017



While Ray and Danny drove through the Australian outback, the logging unit was on. This means that all the data collected by the sensors was stored on the SD cards located in the logger. The data was stored during the day and in the evening they were extracted from the SD cards and sent to the rest of the team in the Netherlands for further study. Our modelling and software engineer, Jussi, later plotted the data (as shown left) in order to analyse the information. This helped us visualize the trip in many ways.

Additionally, the collected irradiance data during the race is of critical value for our building process, it will help us determine which type of solar panels to use and at which angles to place the individual cells. Analysis of the data revealed that the average solar irradiance during this race was around 480 W/m^2 and peaked on the third race day at a maximum irradiance of 1410 W/m^2 .

This year's race was not the sunniest one, daily averages during the race day did not exceed 500 W/m^2 , except for the

last day when the observed average was around 700 W/m^2 , interestingly the irradiance peak still did not exceed the third day. Finally, after some analysis, we were able to determine what was the average irradiance fluctuation during the race and this gave us a number to consider when choosing optimal solar panels.

We would like to specially thank Kipp & Zonen for supporting us in our Bridgestone World Solar Challenge project ■



The students Ray and Danny rented a camper to travel through the Outback and mounted the SMP11-V on top of the roof

Energy balance studies in India with LAS MkII

By Vinay Sehgal, Professor & Principal Scientist, Division of Agricultural Physics, Indian Agricultural Research Institute, New Delhi & Keith Wilson, Atmospheric Scientist, Kipp & Zonen



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3 years ago the Indian Institute of Remote Sciences (IIRS), Dehradun in collaboration with the Indian Agricultural Research Institute (IARI), New Delhi chose the Kipp & Zonen LAS MkII to conduct studies in Energy Balance. Now their research results have been published in the Journal of Earth System Science⁽¹⁾.

A large aperture scintillometer (LAS) is an open-path optical device for monitoring fluctuations in refractive index of the turbulent atmosphere. The infrared light beam is transmitted to the receiver over path lengths up to 4.5 km that represent a relatively large area.

The LAS MkII receiver can calculate the real-time sensible heat flux (H) with the accessory meteorological sensor kit. The data can be stored in its internal memory. When combined with net radiation (NR Lite2) and other meteorological data, the spatially averaged evapotranspiration (ET) can be derived by the Kipp & Zonen EVATION software package.

The surface heat fluxes measured by the LAS are linked to latent heat flux (LvE) and evapotranspiration (ET), and can contribute to energy balance and water balance studies. Compared to traditional point measurement systems, the LAS

MkII operates at spatial scales comparable to the grid box size of numerical models and the pixel size of satellite images used in meteorology, hydrology and water management studies.

The LAS MkII has been installed at the agricultural experimental farm of the Indian Agricultural Research Institute in New Delhi. The path length is 990 m over an irrigated and cultivated agricultural landscape. The paper discusses the patterns of energy flux on diurnal and seasonal bases at the scintillometer path. The area was mainly covered by maize in the Kharif (monsoon crop) and wheat in the Rabi (winter) season during the crop growing seasons of 2014-2015.

The biophysical parameters (leaf area, soil moisture, crop height) were recorded at a two-weekly temporal resolution along the path length, at regular sampling distances. The Bowen ratio value for Kharif and Rabi seasons was 0.76 and 0.88

respectively for the scintillometer. Leaf area index had a significantly positive correlation with latent heat flux ($R^2 = 0.80$) while a significantly negative correlation with sensible heat flux ($R^2 = -0.79$). Soil moisture had a significant negative correlation with sensible heat flux ($R^2 = -0.68$).

The average evapotranspiration from cropland was 1.58 mm of water depth per day and total evapotranspiration was 543 mm over the twelve months study period, most of this falling during the monsoon period (July to September).



Solar powered LAS MkII transmitter



LAS MkII receiver

This study shows that the LAS MkII is a robust instrument, which can evaluate energy flux over a large area, and for long periods. Further studies could lead to use in crop simulation modelling, development of new models with calibration by LAS, validation of remote sensing energy balance algorithms, and the optimum utilization of water for irrigation.

Experiments with LAS over large and relatively homogeneous agroecosystems are critical for accurate and large-area representative measurements of ET, and also useful in the calibration and validation programmes of polar and geostationary satellite instruments. Additionally, it can be used in development of crop simulation models, new remote sensing energy balance algorithms, and their calibration and validation.

LAS has a major advantage to evaluate remote sensing flux with large spatial coverage that is more reliable, considering the satellite pixel sizes, than other flux estimation methods like Lysimetry or Eddy Covariance.

For more information, visit the Division of Agricultural Physics at:

bit.ly/2nTPIXC

The paper is available from: bit.ly/2AfEFcO ■



India invests in bankable **solar energy projects**

By Robin Sharma, MeaTech Solutions

With a rapidly growing need for power in India and the development of new technologies, solar energy has become the fastest expanding form of new energy production. The Jawaharlal Nehru National Solar Mission, an initiative of the Indian Government, has targeted 100 GW of the country's national power to be through solar sources by the year 2022.



The importance of solar radiation measurement

Accurate solar radiation measurements for the PV energy industry and for scientific research study are major bankable assets. To know and understand the available resource helps to monitor the performance of a solar plant in every stage: from preconstruction, prospecting and bankability, to the day-to-day operation and decision making of the plant during its lifetime.

MeaTech (Measurement Technologies) Solutions LLP is focused on providing professional, friendly, and reliable service in the supply of high quality equipment, services and consultancy or advice to clients in the solar industry and beyond, including environmental data. They offer full Kipp & Zonen solutions for the measurement of solar irradiance.

Site Prospecting and Operation Monitoring

Accurate solar measurements start with initial site prospecting. This process involves using a combination of satellite and ground-based data, in order to choose the best location for a solar site. Instrument selection, along with well-planned operation and maintenance, play an important role in understanding and maximizing the output of the plant based on the availability of the resource.

A typical installation that MeaTech offers includes standard meteorological parameters such as air temperature and relative humidity, wind speed and direction, and rainfall; as well as back of module temperature. It can also include either wireless or SCADA connected communications custom-made to suit the customer needs.

When selecting a sensor suite, it is important to consider the required accuracy to achieve the objectives of the monitoring system, which may depend on size or other criteria. Most PV plants use Global Horizontal Irradiance (GHI) and/or Plane of

Array (POA) Irradiance, along with other parameters, to calculate performance ratio, power loss, or to validate the historical satellite or modelled data sets.

Pyranometers have different accuracy and specification classes, as defined by International Standards (such as ISO 9060). It is important to understand the various classes and what is best suited for a site. The main objective of the user for selecting any of the ISO standard pyranometers for the solar power system is to ensure the accuracy of their data.

MeaTech Solutions, as a proud partner of Kipp & Zonen for Solar Radiation products and Campbell Scientific, Canada for data acquisition and meteorological measurements, offers turnkey monitoring solutions for any PV monitoring plant size.

Pyranometers are recommended to be calibrated every two years. After equipment installation in July 2017, MeaTech Solutions now offers calibration services for Kipp & Zonen pyranometers from its headquarters in Gurugram, India. The team has been trained and is authorized to operate the Kipp & Zonen facility to perform calibrations in India, to factory standards and minimise downtime in measurements due to shipping back to the factory or the calibration facility in Singapore ■





China's second PV Pioneer Project

China's solar energy capacity continues to grow explosively. In 2017 about 54 GW was planned to be put in place. The forecast for 2018 is said to be 55 GW. One of the largest solar power plants is in Datong with a capacity of 1,000 MW so far and will grow to 3 GW in the next coming phases. Already, they have 13 Kipp & Zonen solar monitoring stations running in Datong, installed by Beijing Solarsky Technology, to maximize the efficiency of the energy yield of this PV Pioneer Project. In 2017 a second PV Pioneer Project was deployed in Ruicheng and again monitored with Kipp & Zonen quality instruments.

About Ruicheng

Ruicheng is a small city located in the south-west of Shanxi province with a population of 410,000. The Ruicheng PV pioneer project has two stages. The first stage is 500 MW, and the second could be 520 MW. The investment in this project reaches 4.2 billion Chinese Yuan, the site covers an area of 14 square kilometers and there are six PV plant companies participating in the first stage.

7 solar monitoring stations

Thanks to the success of the Datong project, Solarsky has installed 7 high performance solar monitoring stations at Ruicheng; one for each PV site and one for comparison. Each station is based on a SOLYS2 sun tracker to monitor GHI, DHI and DNI with two CMP10 pyranometers and a CHP1 pyrliometer. An additional CMP11 pyranometer monitors tilted irradiance.

Due to the Ruicheng landscape it was inevitable to have many different tilt angles of the PV panels. Therefore SolarSky also installed a row of 14 CMP11 pyranometers at a variety of tilt angles at one of the sites.

You can read more about the installation by SolarSky on the Kipp & Zonen blog:

blog.kippzonen.com/inside-the-ruicheng-pv-pioneer-project

To see the video that was captured of this gigantic solar power plant please go to www.youtube.com/kippzonen.

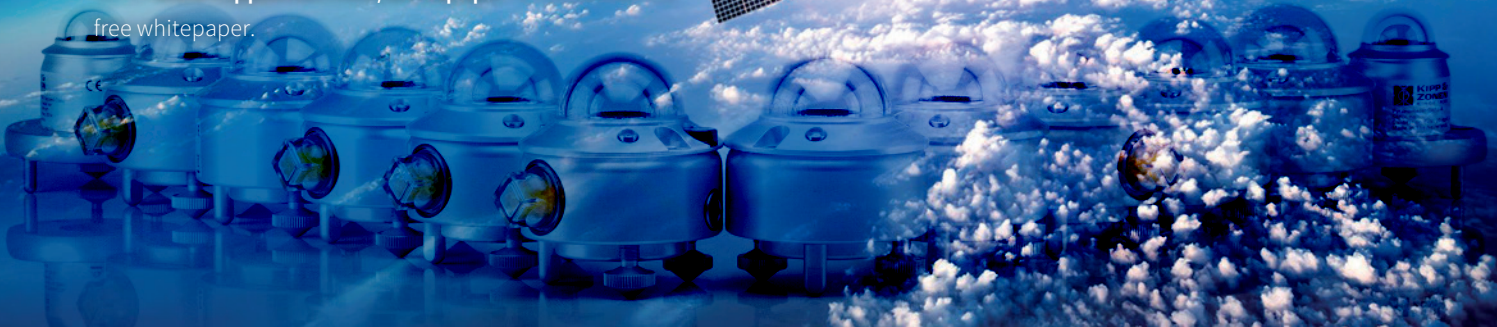
In Newsletter 39 you can read the details about the Datong project. Newsletter 39 is available at the download center of www.kippzonen.com ■

Pyranometer and satellite, how to combine the data

As the leading manufacturer of pyranometers we know our instruments are highly accurate and reliable and the best way to measure solar irradiance. However, we do get questions about satellite data and its quality. To be honest, satellite data can be very good. But, which to choose? Or even better; why choose?

Together with 3E we have written a whitepaper to discuss the differences between ground measurements with pyranometers and satellite derived solar irradiance data.

Go to www.kippzonen.com/whitepaper to download the free whitepaper.



A new sales manager for the US team: welcome Damon!

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We are happy to introduce you to our new colleague Damon Nitzel. As the new sales manager, Damon will be part of Kipp & Zonen's US office. With his technical background and experience in the environmental market, we are confident that he makes a great addition to the US team.

"I am grateful to join Kipp & Zonen as the Sales Manager for the US office where I get to support our amazing customers. I earned a Master's degree in Biochemistry at Utah State University and have applied this scientific background to manage a worldwide distributor network for an environmental measurement company.

Working from Logan, Utah I will be focusing on further developing Kipp & Zonen's leading role in the solar energy market. I am looking forward to introducing the RT1 commercial rooftop duo sensor and the upcoming DustIQ soiling monitoring system early in 2018 to solar power providers to help them keep their installations running at maximum performance.

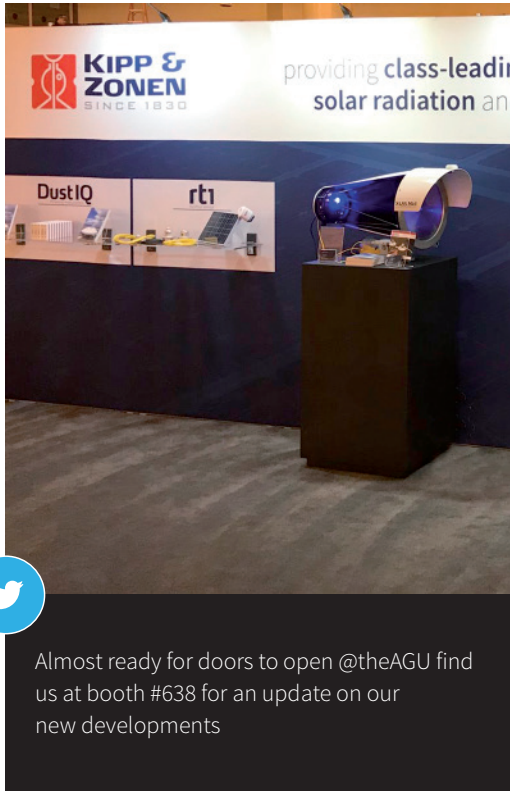
I am excited to get to know our partners and I'm looking forward to meeting everyone over the next few months. Later in 2018 I will be representing Kipp & Zonen at Intersolar North America and Solar Power International" ■



Fairs & Events

WFES (World Future Energy Summit) • Abu Dhabi • UAE	15 - 18 January
PV Operations Europe • Munich • Germany	13 - 14 February
CSP Focus China • Beijing • China	22 - 23 March
Solar Power Expo • Beijing • China	27 - 29 March
InterMET Asia • Singapore • Singapore	11 - 12 April

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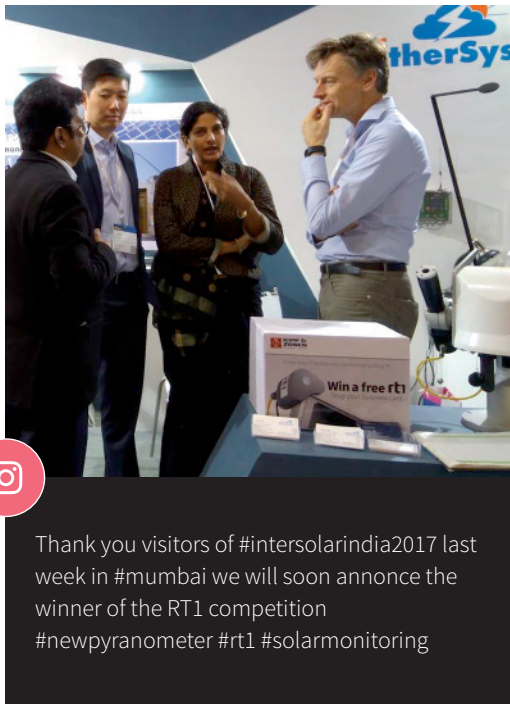
Almost ready for doors to open @theAGU find us at booth #638 for an update on our new developments



Irradiance measurements for PV plants: satellite or pyranometer? A new blog with a link to download a white paper about this frequently asked question that we developed together with 3E. <https://hubs.ly/H09qf040>



Stop by one of our partners this week @IntersolarIndia and win a free RT1 rooftop PV monitoring solution



Thank you visitors of #intersolarindia2017 last week in #mumbai we will soon announce the winner of the RT1 competition #newpyranometer #rt1 #solarmonitoring



Solar Monitoring for the O&M of Ruicheng PV Pioneer Project, China

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