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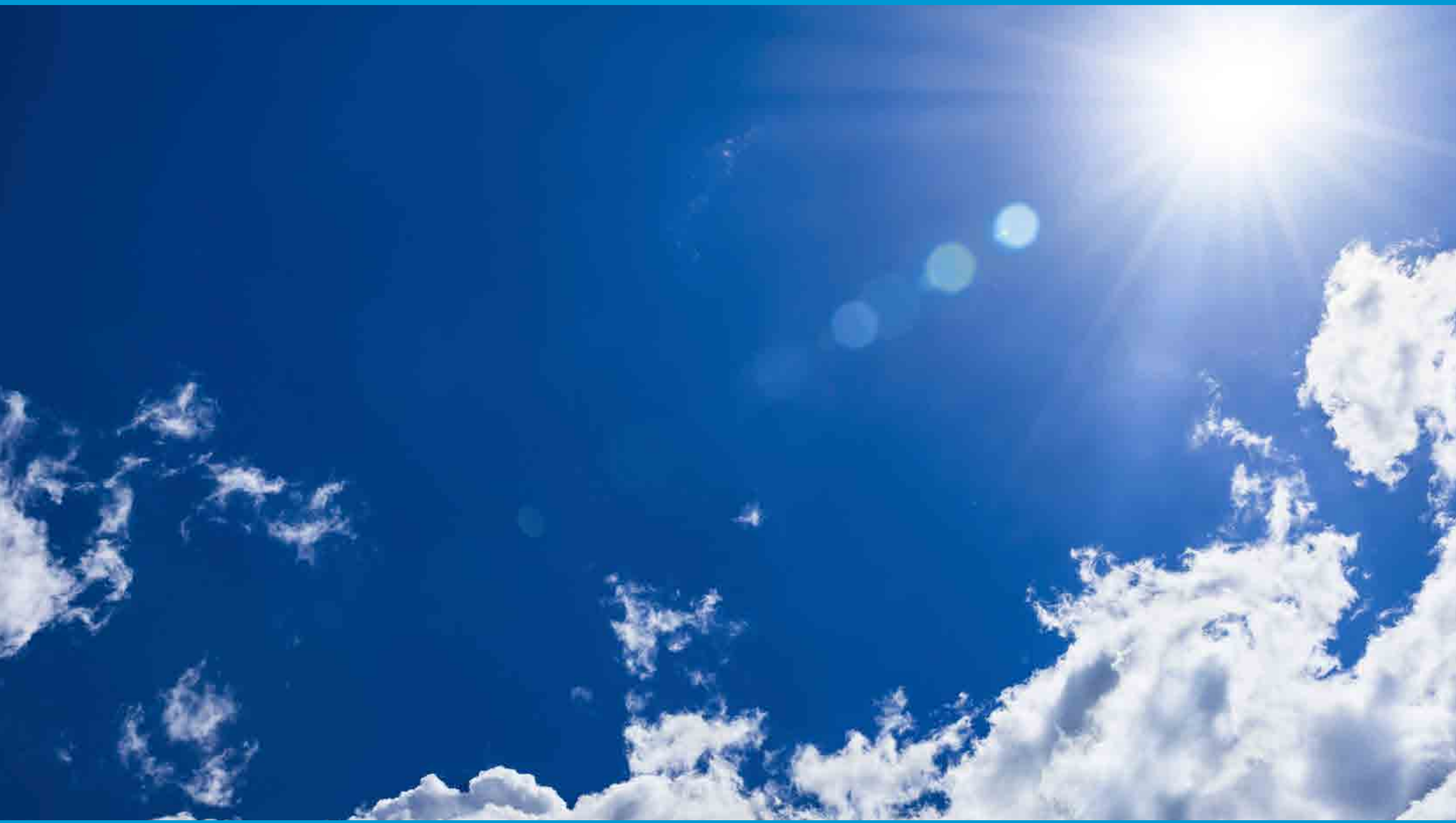

Better optics for UV monitoring

The ozone layer protects us from the harmful effects of solar ultraviolet (UV) radiation, such as increased incidences of skin cancer and cataracts. International treaties such as the Montreal Protocol have been put in place to reduce the use of ozone depleting chemicals such as CFCs. Changes in ozone and UV radiation are monitored across Europe to improve understanding of the recovery of the ozone layer and the effects of UV exposure.

Europe's National Measurement Institutes working together

The European Metrology Research Programme (EMRP) brings together National Measurement Institutes in 23 countries to address key measurement challenges at a European level. It supports collaborative research to ensure that measurement science meets the future needs of industry and wider society.

Challenge

Brewer spectrophotometers are among the most sophisticated instruments currently used to measure stratospheric ozone and solar UV radiation. Global solar UV radiation entering the spectrophotometer is sampled by a diffusion plate to measure its intensity. The diffusion characteristics of this entrance optic is one of the most important components of these complex measurement systems and currently the most suitable available material is Teflon. However Teflon presents a number of problems. The material distorts with temperature change and is damaged over time by the UV radiation that falls onto it, requiring the introduction of time-consuming corrections. The accuracy of Teflon-based instruments is significantly affected by the position of the Sun in the sky – by as much as 10% between the Sun is at its maximum height and the low angles at sunrise, sunset and during the winter months. To increase the accuracy and comparability of UV radiation measurements, the research community needs improved instrumentation, capable of providing accurate measurements regardless of the time of day or year.

Solution

The EMRP project *Traceability for surface spectral solar ultraviolet radiation* developed improved calibration methods, instruments and procedures to enable better comparability of UV radiation measurements. These research outputs were used to improve the measurement performance of the world's primary spectrophotometer, QASUME to which all other measurements are linked.

Impact

Project partner, Aalto University, working with industrial partners, Kipp & Zonen and CMS Ing.Dr.Schreder GmbH, designed new diffusion plates for Brewer spectrophotometers using novel quartz-based materials. The new quartz materials can be more easily formed into complex shapes and improve the accuracy of low angle solar UV measurements. Simulations performed by Aalto University were used to optimise the new design and prototype optics were validated using QASUME. Products incorporating the new optics will soon be commercially-available to customers requiring highly-accurate measurements of solar UV for ozone studies.

CMS Ing.Dr.Schreder GmbH, an Austrian instrumentation company, is marketing the system for research institutes and companies that already have UV spectrophotometers, enabling them to upgrade their instruments to make improved low angle measurements.

Kipp & Zonen, a leading manufacturer of solar radiation measurement instruments, will introduce upgraded optics in its commercially-available spectrophotometers as a result of interactions with the project and will also launch a kit to enable installation of the improved optics system on customers' existing instruments.

The incorporation of the quartz optics into new and existing spectrophotometers is giving the UV community greater confidence in the accuracy of the solar UV measurements and helping atmospheric researchers and health protection agencies to reliably assess long-term changes in the Earth's protective ozone layer.

Traceable UV measurements

The EMRP project *Traceability for surface spectral solar ultraviolet radiation* aimed to significantly improve the reliability of solar UV radiation measurements made from the Earth's surface, to support health protection agencies and atmospheric research. The project accomplished this through a number of major achievements: the reduced uncertainty of the world reference spectroradiometer; the improved characterization of array spectroradiometers; the establishment of a new portable UV reference spectroradiometer; and the development of new technologies, methods and software for applications in the solar UV end-user community responsible for environmental and human health protection.

EMRP
European Metrology Research Programme
Programme of EURAMET

The EMRP is jointly funded by the EMRP participating countries within EURAMET and the European Union

www.euramet.org/project-ENV03

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11326/0516 - ENV03 15050