Advances in UV Ground- and Space-based Measurements and Modeling

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In late July 2001, SPIE held 3 days of UV sessions in San Diego that attracted more than 50 papers written by authors from 12 countries. We have collected 11 of those papers in this special section of *Optical Engineering*. Another 22 of the papers given at the SPIE sessions dealing with the effects of UV on plants and ecosystems will be found in a special issue of *Agricultural and Forest Meteorology*.

The papers in this special section focus on the measurement and modeling of solar ultraviolet (UV) radiation reaching the Earth's surface and penetrating into the ocean. One of the most widely used models for predicting the amount of UV radiation at the Earth's surface is the discrete ordinate model described by Stamnes et al.[1] An overview of UV modeling issues relating to both surface irradiance and irradiance penetrating into the oceans is presented by Stamnes. Vasilkov et al. present modeling results using NASA Total Ozone Mapping Spectrometer (TOMS)-derived column ozone and cloud cover to predict the amount of UV reaching various depths of the ocean. Krotkov et al. outline the improvements that have been made to the TOMS surface UV retrieval procedure. Schmalwieser et al. provide global validation of the Austrian UV Index Forecast for clear skies by comparing model results with broadband irradiances measured over four continents.

Fioletov et al. compare Canadian Brewer UV spectrometer data from 10 sites with TOMS retrievals. The authors determine that TOMS overestimates UV at all but the cleanest site. Long-term time series of UV are reported by Sasaki et al., and Chubarova et al. Sasaki et al. analyze a ten-year broadband time series from Japan and find modest positive trends in UV. Chubarova et al. document a twenty-year broadband UV-B plus UV-A (300 to 380-nm) time series from Moscow and determine a slight positive trend, which the authors attribute to decreases in cloud cover and aerosols.

In addition to ozone decreases due to chlorine and bromine free radicals causing catalytic destruction of ozone in polar regions, there have recently been many documented events of ozone poor from low latitudes air being advected to mid latitudes resulting in large increases in surface UV. Siani et al. report on such an event that occurred in Italy in November 2000. Another factor known to have a strong influence on the UV reaching the ground is the surface albebo. Schmucki and Philopona make a careful study of the influence of varying snowfields on the UV reaching several stations in the Swiss Alps.

Science moves ahead by relating measurements of the physical world made by new instrumentation using ever more comprehensive models. Harrison et al. describe the new USDA reference spectrometer that is being used to calibrate all of the 44 USDA broadband UV radiometers. Heath and Ahmad demonstrate the utility of a multichannel narrowband radiometer which, when used in conjunction with a portable scanning spectrometer, can calibrate other UV radiometric instruments and derive column ozone.

These papers represent some of the latest UV research that continues to benefit from the combination of new instrumentation, analysis of well-calibrated time series, and comparisons to radiative transfer models. The editors of this special section wish to express our thanks to SPIE, especially to Jonica Todd-Gallery, Jinxue Wang, and Karolyn Labes. Finally we wish to thank the reviewers for their time and expertise. They, as well as the authors, contributed to the high quality of the research that is presented here.

References

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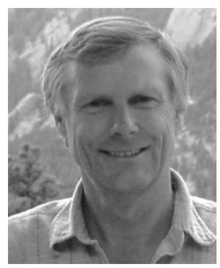
James Slusser studied physics at Western Michigan University and received his bachelor's degree in 1977 and his master's degree in 1980. The next nine years were spent in Chicago where he was the undergraduate physics laboratory director at Loyola University and later worked as a design engineer for Atlas Electric Devices, serving as a project manager for an ultraviolet outdoor radiometer and temperature probe for weathering chambers. In 1989 he returned to school to study atmospheric science and radiative transfer at the University of Alaska at Fairbanks. His dissertation involved measuring stratospheric nitrogen dioxide and exploring its relationship to ozone abundances. After earning his PhD in 1994 he spent three months at Lauder, New Zealand doing trace gases analysis using the zenith sky spectroscopy. He then took up a position as a research associate at the Center for Atmospheric Science at Cambridge University in England where he investigated the effects of volcanic aerosols on nitrogen dioxide and ozone abundances in Antarctica. In 1996 he became a research scientist at the USDA UV-B Monitoring and Research Program at Colorado State University. In 1999 he became the director of the program. His current research interests include improving the calibration accuracy and precision of UV measurements and retrievals of ozone column and aerosol properties. He is a member of the AGU, AMS, and SPIE and serves as an associate editor of the *Journal of Geophysical Research*.

Wei Gao received a BS in applied meteorology from Nanjing Institute of Meteorology, China, and a MS in agro-micrometeorology from Mississippi State University. He received his PhD in applied meteorology from Purdue University. He developed a geometric ultraviolet (UV) radiation transfer model and estimated the UV-B radiation loading on potentially UVB sensitive surface in vegetation canopies. He did his postdoctoral training at the National Center for Atmospheric Research, Boulder, Colorado, where he conducted research on climate change scenario formation, climate change impacts on the biosphere, and analysis of climate variability and extreme climate events. He is currently a research scientist at the USDA UVB Monitoring and Research Program at Colorado State University. His research interests include atmospheric/vegetation canopy radiation transfer modeling, UV radiation, UV radiation and other climate stress factors influences on plants, total ozone interactions with other atmospheric parameters, impact of climate change, and ecosystem modeling.



Richard McKenzie received a BSc Hons in physics from the University of Canterbury, NZ and a MSc in physics from the University of the South Pacific, Fiji. He earned a DPhil, in atmospheric physics from the University of Oxford, UK. He is New Zealand's National Institute of Water and Atmosphere (NIWA) Principal Scientist (Radiation), and has led NIWA's UV Radiation program since its inception. He is also involved in trace gas studies, as well as studies of the effects on radiation of aerosols and clouds. He has published widely in the above areas of research and communicated results to the public through the media, the internet, and through numerous public lectures. He has been actively involved in the WMO Scientific Assessments of Ozone Depletion (1991, 1994, 1998) as lead author of the UV Chapter (and co-author of the 2002 assessment in preparation). Since 1994 he has been a member of the UNEP Effects Panel that reports on the environmental effects of ozone depletion (the sole representative from the Southern Hemisphere).