

# WCRP REPORT

World Climate Research Programme



ICSU

International Council for Science

## **SUMMARY REPORT FROM THE**

## **TENTH SESSION OF THE BASELINE SURFACE RADIATION NETWORK (BSRN)**

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<b>V. WORKING GROUP REPORTS</b>	9
Aerosol Optical Depth Working Group	9
Pyranometer Working Group	11
Direct Beam Working Group	11
Pyrgeometer Working Group	11
Uncertainties Working Group	12
<b>VI. CLOUDS AND AEROSOLS</b>	14
Retrieved Cloud Properties from BSRN-Type Observations	14
Radiation Transfer in Stratus Clouds at BSRN Payerne	15
Observed Cirrus Cloud Radiative Effects on Surface Level Shortwave and Longwave Irradiances	15
Aerosol Radiative Effects in sub-Sahel Africa: Dust and Biomass Burning	16
Characterization of Atmospheric Aerosols and Water Vapor using Ground-Based Sun Photometry	16
Climatology and Interpretation of 11 Years of Aerosol Optical Depth Data from the U.S. BSRN Stations	16
Quantification of the Direct Aerosol Effect for Cabauw, the Netherlands	17
Aerosol Optical Depth Measurements in the Azores	17
<b>VII. NETWORK ACTIVITIES CALIBRATIONS AND SPECIAL REPORTS</b>	17
Report on the GCOS Global Surface and Upper Air Networks, GSN and GUAN, Implementation Activities	17
State of the BSRN, 2008	17
Calibration Activities at the World Radiation Center, PMOD/WRC	18
High Quality Spectral UV Measurements Used to Calculate Optimum Sun-Exposure Times	18
Radiometer Calibrations and Irradiance Measurements	18
International Workshop on Global Dimming and Brightening	19
Long-term Comparisons of Collocated Ground Irradiance Flux Measurements	19
<b>VIII. MODEL AND SATELLITE COMPARISONS AND ANALYSIS</b>	20
Importance of Surface-based, Non-radiative-flux Parameters for Validating Satellite-derived Radiative Fluxes	20
Processing of the Baseline Surface Radiation Network (BSRN) Data and its Application in Validating the NASA GEWEX SRB Data	21
Pyrheliometer Ventilation	22
Applications of BSRN Data to GCM Models and Comparisons	22

***Climatology and Interpretation of 11 Years of Aerosol Optical Depth Data from the U.S. BSRN Stations (John Augustine, NOAA R/GMDL, Earth System Research Lab)***

A series of algorithms has been developed to process spectral solar measurements for aerosol optical depth (AOD) for the National Oceanic and Atmospheric Administration's (NOAA) national Surface Radiation budget network (SURFRAD). The primary components include a calibration algorithm and an AOD algorithm. The calibration procedure automatically identifies candidate points for Langley plots using the Long and Ackerman clear-sky identification method. Extrapolated calibration points are normalized to one atomic unit, grouped into one or two-month periods, statistically reduced, and averaged. The time series of quasi-monthly calibrations and associated uncertainty are fit to functions for interpolation to individual days for AOD calculations. Daily files of spectral AOD covering the visible and near infrared have been produced for 1997 through 2007 for all seven stations. Comparisons of SURFRAD daily AOD averages to NASA's AERONET product for two of the stations were generally good. An AOD climatology for each SURFRAD station was presented as an annual time series of composite monthly means that represent a typical intra-annual AOD variation. Results are similar to previous U.S. climatologies in that the highest AOD magnitude and greatest variability occurs in summer, the lowest AOD levels are in winter, and geographically, the highest magnitude AOD is in the eastern United States. Springtime Asian dust intrusions show up as a prominent secondary maximum at the western stations, which diminishes eastward. A time series of nationwide annual means shows that 500 nm AOD has decreased over the U.S. by about 0.01 AOD units over the 11-year period. However, this decline is not statistically significant, nor geographically consistent within the country. The eastern U.S. stations and western-most station at Desert Rock, Nevada show decreasing AOD, whereas the other three western stations show an increase that is attributed to an upsurge in wildfire activity in the last half of the 11-year period. When the high-frequency wildfire years are removed from those stations, the decadal tendencies go flat, thus substantiating the link to wildfire activity.

***Quantification of the Direct Aerosol Effect for Cabauw, the Netherlands (Wouter Knap, Royal Netherlands Meteorological Institute)***

Measurements of direct and diffuse solar irradiances in combination with radiative transfer calculations for cloudless skies were used to quantify the direct aerosol effect for the BSRN station of Cabauw, the Netherlands. The radiative transfer calculations were performed for atmospheres containing all constituents except aerosols. The direct aerosol effect was then calculated as differences between the measured and simulated solar irradiances. Cloudless situations were selected using different shortwave and longwave cloud detection algorithms. For 2006 the mean direct aerosol effect for global irradiance appeared to be  $-30 \text{ W/m}^2$ . A highly linear correlation between the direct effect and the aerosol optical depth (AOD) was found with a slope of  $12 \text{ W/m}^2$  per 0.1 unit of AOD.

***Aerosol Optical Depth Measurements in the Azores (Fernanda Carvalho, Portuguese Institute of Meteorology)***

A preliminary analysis of AOD results from sun-photometer measurements collected at Jose Agostinho Observatory at Angra do Heroísmo (Terceira Island, the Azores) was presented. The observational period ranges from August 2004 to December 2007, using a SP02 sun-photometer at wavelengths 412, 500, 675, and 862 nm, coupled to a 2AXP sun-tracker. The sampling interval is 5 s and data is filtered for cloud contamination in a time window of 10 minutes. Most AOD 500 nm values are below 0.3, showing a small variation during the day; frequency distribution shows a typical right skew distribution. Alpha and beta Angstrom coefficients were also computed and analyzed in the same way. Alpha values are generally positive and lower than 4, while beta values are below 1.5. AOD results from the AERONET station at Horta Observatory (Faial Island, the Azores) were also used and compared with Angra data. AOD and Angstrom coefficients were also analyzed with wind results from the automatic weather station located at both observatories. Results show different wind distributions due to different exposures; however, systematic higher AOD values are found at Horta. The proximity of the two sites indicates that these differences are more likely due to different instruments and processing methods used.

## PARTICIPANTS

Clement Akoshile  
University of Ilorin  
Physics Department  
Ilorin, Kwara State, Nigeria  
Tel: 234-805-590-2692  
E-mail: [clemakos@unilorin.edu.ng](mailto:clemakos@unilorin.edu.ng)

Mikhail Alexandrov  
Columbia University  
NASA GISS  
2880 Broadway  
New York NY USA 10025  
Tel: 1-212-678-5548  
E-mail: [malexandrov@giss.nasa.gov](mailto:malexandrov@giss.nasa.gov)

Anthony Anuforum  
Nigerian Meteorological Agency  
33 Pope John Paul II Street  
Maitama District Abuja  
Garki, Nigeria PMB 0615  
Tel: 234-807-752-8559  
E-mail: [Tonycanuforum@yahoo.com](mailto:Tonycanuforum@yahoo.com)

John Augustine  
NOAA R/GMD2  
Earth System Research Lab  
325 Broadway  
Boulder, CO USA 80305  
Tel: 1-303-497-6415  
E-mail: [John.A.Augustine@noaa.gov](mailto:John.A.Augustine@noaa.gov)

Raquel Gastesi Barasoain  
CENER, National Renewable Energy Center  
c/ Ciudad de la Innovacion  
Sarriguren, Navarra, Spain 31621  
Tel: 34-94825-2800  
E-mail: [rgastesi@cener.com](mailto:rgastesi@cener.com)

Maria Lopez Bartolome  
Agencia Estatal de Meteorologia  
c/o Leonardo Pueto Castro 8  
28060 Navidad Spain  
Tel: 36-1-5819-773  
E-mail: [mlopez@inm.es](mailto:mlopez@inm.es)

Klaus Behrens  
Meteorologisches Obs. Lindenberg,  
DWD, Am Observatorium 12,  
Lindenberg Germany D-15848  
Tel: 49-336-776-0151  
E-mail: [klaus.behrens@dwd.de](mailto:klaus.behrens@dwd.de)

Reinout Boers  
Atmospheric Research Division  
KNMI, PO Box 201  
De Bilt, The Netherlands 3730 AE  
Tel: 31-30-220-6481  
E-mail: [boers@knmi.nl](mailto:boers@knmi.nl)

Lamine Boukelia  
National Meteorological Office  
P.O. Box 31  
Tamanrasset, Algeria 11000  
Tel: 213-29-344673  
E-mail: [l\\_boukelia@yahoo.fr](mailto:l_boukelia@yahoo.fr)

Fernanda Carvalho  
Delegacao Regional dos Acores  
Instituto de Meteorologia de Portugal  
Observatorio Afonso Chaves  
Rua Mae de Deuys  
Relvado, Ponta Delgada  
9500-321 Portugal  
Tel: 321-296-650-210  
E-mail: [fernanda.carvalho@meteo.pt](mailto:fernanda.carvalho@meteo.pt)

Steven Cooper  
NOAA/ESRL/GMD  
325 Broadway  
Boulder, Co USA 80305  
Tel: 1-303-497-4123  
E-mail: [steve.j.cooper@noaa.gov](mailto:steve.j.cooper@noaa.gov)

Frederick Denn  
Science Systems and Applications  
1 Enterprise Parkway  
Hampton, Virginia 23666 USA  
Tel: 1-757-865-7518  
E-mail: [frederick.m.denn@nasa.gov](mailto:frederick.m.denn@nasa.gov)

Jean-Charles Dupont  
Ecole Polytechnique - LMD/IPSL  
91128 Palaiseau Cedex France  
Tel: 33-016933-5145  
E-mail: [jean-charles.dupont@lmd.polytechnique.fr](mailto:jean-charles.dupont@lmd.polytechnique.fr)

Ellsworth Dutton  
NOAA Climate Mon. and Diagnostics Lab  
Mail Code R/CMDL 1  
325 Broadway Street  
Boulder CO, USA 80305  
Tel: 1-303-497-6660  
E-mail: [ells.dutton@noaa.gov](mailto:ells.dutton@noaa.gov)

Dawn Erlich  
International GEWEX Project Office,  
8403 Colesville Roads, Ste 1550  
Silver Spring, MD 20910  
Tel: 1-240-485-1855  
E-mail: [gewex@gewex.org](mailto:gewex@gewex.org)

Paulo Fialho  
Universidade dos Açores – Grupo de Química  
e Física da Atmosfera  
PT - 9701-851 Angra do Heroísmo  
Açores – Portugal  
E-mail- [paulo.fialho@angra.uac.pt](mailto:paulo.fialho@angra.uac.pt)

Patrick Fishwick  
UK Met Office, FitzRoy Road  
Exeter EX1 3PB United Kingdom  
Tel: 44-(0)-1392-885534  
E-mail: [patrick.fishwick@metoffice.gov.uk](mailto:patrick.fishwick@metoffice.gov.uk)

Julian Gröbner  
PMOD/WRC, Dorfstrasse 33  
Davos Dorf Switzerland 7260  
Tel: 41-81-417-5157  
E-mail: [julian.groebner@pmodwrc.ch](mailto:julian.groebner@pmodwrc.ch)

Hein Haak  
Director of Climate and Seismology  
KNMI, PO Box 201  
De Bilt, The Netherlands 3730 AE

Martial Haefelin  
LMD/IPSL/CNRS, Ecole Polytechnique  
Palaiseau, Cedex, France 91128  
Tel: 33-1-6933-5109  
E-mail: [martial.haefelin@ipsl.polytechnique.fr](mailto:martial.haefelin@ipsl.polytechnique.fr)

David Halliwell  
Air Quality Research Division  
Environment Canada  
PO Box 160 Wilcox SK S0G5E0  
Tel: 306-352-3818  
E-mail: [david.halliwell@ec.gc.ca](mailto:david.halliwell@ec.gc.ca)

Gary Hodges  
NOAA/ESRL/GMD  
325 Broadway St  
Boulder CO USA 80501  
Tel: 303-497-6460  
E-mail: [gary.hodges@noaa.gov](mailto:gary.hodges@noaa.gov)

Ain Kallis  
Tartu-Toravere Meteorological Station  
Estonian Met. and Hydrological Institute  
Toravere 61602 Estonia  
Tel: 372-5-118-679  
E-mail: [kallis@aai.ee](mailto:kallis@aai.ee)

Wouter Knap  
KNMI, PO Box 201  
De Bilt, The Netherlands 3730 AE  
Tel: 31-30-22064-69  
E-mail: [knap@knmi.nl](mailto:knap@knmi.nl)

Gert König -Langlo  
Meteo. Observatorien, Alfred Wegener Inst.  
Bussestrasse 24  
Bremerhaven, Germany D-27570  
Tel: 49-471-4831-1806  
E-mail: [Gert.Koenig-Langlo@awi.de](mailto:Gert.Koenig-Langlo@awi.de)

Christian Lanconelli  
ISAC-CHR, Gobetti 101  
Bologna, Italy 90125  
Tel: 39-051-6399-588  
E-mail: [c.lanconelli@isac.chr.it](mailto:c.lanconelli@isac.chr.it)

Lu Longhua  
Chinese Academy of Met. Sciences, CMA  
No. 46, Zhongguancun Nandajie  
Beijing, China 10081  
Tel: 86-10-6840-6896  
E-mail: [lulonghua@cams.cma.gov.cn](mailto:lulonghua@cams.cma.gov.cn)

Chuck Long  
Pacific Northwest National Lab  
P.O. Box 999, MSIN: K9-38  
Richland, WA 99352  
Tel: 509-372-4917  
E-mail: [Chuck.Long@pnl.gov](mailto:Chuck.Long@pnl.gov)

Alexander Los  
EKO Instruments Europe B.V.  
Los Middelstegracht 87H  
Leiden, The Netherlands 2312TT  
Tel: 31-71-514-1300  
E-mail: [alexander.los@eko-eu.com](mailto:alexander.los@eko-eu.com)

Vera Lyubansky  
Israel Meteorological Service  
Bet Dagan, Israel 25  
Tel: 972-3-9482174  
E-mail: [veralub@ims.gov.il](mailto:veralub@ims.gov.il)

Marion Maturilli  
Alfred Wegener Institute,  
Research Unit Potsdam  
Telegrafenberg A45  
D-14473 Potsdam, Germany  
Tel: 49-331-288-2166  
E-mail: [marion.maturilli@awi.de](mailto:marion.maturilli@awi.de)

- 16:20 – 16:40 Rachel Pinker and H. Wang – Characterizing the Radiation Environment of the BSRN Sites
- 16:40 – 17:00 Joseph Michalsky – Proposed Working Standard for the Measurement of Diffuse Shortwave Irradiance
- 17:00 – 17:45 Poster Viewing

**8 July, Tuesday**

**Basic Observations – Analysis and Review (continued)**

- 08:30 – 08:50 Steve Wilcox and Daryl Myers – The Effects of the Thermal Environment on the Eppley Normal Incidence Pyrheliometer (NIP)
- 08:50 – 09:10 Klaus Behrens – Responsivity of the Lindenberg BSRN Pyranometers Determined with Different Methods
- 09:10 – 09:30 David Halliwell – Pyranometer Calibration and Characterization: Comparing Results from Mix-of-Sun-and-Cloud Calculations to ISO/ASTM Alternating and Continuous Sun-and-Shade Methods
- 09:30 – 09:50 Christian Lanconelli – First Analysis on Albedo Measurements at Concordia Station and Comparison with South Pole Evaluations.
- 09:50 – 10:05 Joop Mes - A Proposed Improvement to the Laboratory Calibration of Pyranometers
- 10:05 – 10:30 Break

**Working Group Reports**

- 10:30 – 10:45 IR WG –
- 10:45 – 11:00 AOD WG – Joseph Michalsky
- 11:00 – 11:15 Pyranometer WG
- 11:15 – 11:30 Direct WG
- 11:30 – 11:45 Pyrgeometer WG – Rolf Philipona
- 11:45 – 12:00 Uncertainties WG – Klaus Behrens
- 12:00 – 13:00 Lunch

**Clouds and Aerosols**

- 13:00 – 13:20 Steve Cooper – Retrieved Cloud Properties from BSRN-type Observations
- 13:20 – 13:40 Laurent Vuilleumier and D. Nowak – Radiation Transfer in Stratus Clouds at BSRN Payerne
- 13:40 – 14:05 Jean-Charles Dupont and Martial Haeffelin – Observed Cirrus Cloud Radiative Effects on Surface-level Shortwave and Longwave Irradiances
- 14:05 – 14:25 Rachel Pinker – Aerosol Radiative Effects in the Sub-Sahel Africa: Dust and Biomass Burning
- 14:25 – 14:45 Mikhail Alexandrov – Characterization of Atmospheric Aerosols and Water Vapor using Ground-based Sun Photometry
- 14:45 – 15:05 John Augustine – Climatology and Interpretation of 11-years of Aerosol Optical Depth Data from the U.S. BSRN Stations

- 15:05 – 15:30 Break
- 15:30 – 15:50 Wouter Knap – Quantification of the Direct Aerosol Effect for Cabauw, the Netherlands

15:50 – 16:20 **Fernanda Carvalho – Aerosol Optical Measurements in the Azores**

**Network Activities, Calibrations, and Special Reports**

16:20 – 16:45 Richard Thigpen – Report on the GCOS Global surface and Upper Air Networks, GSN and GUAN, Implementation Activities

16:45 – 17:45 Poster Viewing

**9 July, Wednesday**

**Network Activities, Calibrations, and Special Reports (continued)**

08:30 – 09:00 Ellsworth Dutton – State of BSRN

09:00 – 09:30 Julian Gröbner – Calibration Activities at the World Radiation Center, PMOD/WRC

09:30 – 09:50 Richard McKenzie – High-Quality Spectral UV Measurements used to Calculate Optimal Sun-Exposure Times

09:50 – 10:10 Thomas Stoffel – Radiometer Calibrations and Irradiance Measurements

10:10 – 10:40 Break

10:40 – 12:00 General Discussions, Action Items

12:00 – 22:00 Lunch and Local Tour

**10 July, Thursday**

**Network Activities, Calibrations, and Special Reports (continued)**

08:30 – 08:55 Chuck Long – Brief Report on the International Workshop on Global Dimming and Brightening

08:55 – 09:15 Laurent Vuilleumier – Long-term Comparisons of Collocated Ground Irradiance Flux Measurements

**Model and Satellite Comparisons and Analysis**

09:15 – 09:35 Yuanchong Zhang – Importance of Surface-Based, Nonradiative-Flux Parameters for Validating Satellite-Derived Radiative Fluxes

09:35 – 09:50 Taiping Zhang – Processing of the Baseline Surface Radiation Network (BSRN) Data and its Application in Validating the NASA GEWEX SRB Data

09:50 – 10:00 Wouter Knap and Ed Worrell – Pyranometer Condensation Problem

10:00 – 10:15 Break

10:15 – 10:35 Martin Wild – Applications of BSRN Data to GCM Models and Comparisons

10:35 – 10:50 Chuck Long – MJO Detection using Manus Surface Radiation Measurements

10:50 – 11:00 Jean-Charles Dupont – Evaluation of SW and LW based Cloud Detection Algorithms

11:00 – 11:20 Ping Wang – Clear Sky Closure Study during EUCAARI Campaign