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World Climate Research Programme



ICSU

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SUMMARY REPORT FROM THE

TENTH SESSION OF THE BASELINE SURFACE RADIATION NETWORK (BSRN)

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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 W/m^2 . A highly linear correlation between the direct effect and the aerosol optical depth (AOD) was found with a slope of 12 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.

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- 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