

Most of the forty-two elements that can readily be determined by the ICP-MS method were below detection limits in the majority of the aerosol samples. The notable exception was mercury, which was present in concentrations from  $< 0.1$  to approximately  $1 \text{ ng m}^{-3}$ . These values of particulate Hg are comparable to or slightly higher than those observed in recent studies in the Arctic, and they are much higher than generally found in more temperate regions. While the cause for the high particulate Hg concentrations has not been determined, it is likely that the oxidation of gas-phase Hg is involved.

**A51B-0066 0830h POSTER**

**Measurements of Sulfuric Acid and Methanesulfonic Acid During ISCAT 2000**

Fred L. Eisele<sup>1,2</sup> (303 497 1483; eisele@ucar.edu)

Roy L. Mauldin III<sup>1</sup> (303 497 1861; mauldin@ucar.edu)

Edward Kosciuch<sup>1</sup> (303 497 1410; kosciuch@ucar.edu)

<sup>1</sup> Atmospheric Chemistry Division, National Center for Atmospheric Research, 1850 Table Mesa Dr., Boulder, CO 80303, United States

<sup>2</sup> Earth and Atmospheric Sciences, Georgia Institute of Technology, 221 Bobby Dod Way, Atlanta, GA 30332, United States

Gas phase sulfuric and methanesulfonic acid (MSA) were measured at the South Pole using a selected ion chemical ionization mass spectrometric technique during ISCAT 2000. Both compounds were typically quite low. Upon only a few occasions did sulfuric acid increase briefly into the  $1 \times 10^6$  molecules  $\text{cm}^{-3}$  range and MSA increase into the mid  $10^5$  molecules  $\text{cm}^{-3}$  range. While MSA was typically close to its detection limit at about  $1 \times 10^5$  molecules  $\text{cm}^{-3}$ , sulfuric acid was typically only a few times higher at 2 or  $3 \times 10^5$  molecules  $\text{cm}^{-3}$ . Despite the consistently high OH concentrations measured at this site, the low observed gas phase sulfuric acid suggests that average local sulfur dioxide concentrations are probably fairly low.

Methanesulfonic acid remained low throughout the campaign, also suggesting that DMS was probably not being oxidized locally. Thus, the MS observed in aerosols is believed to have been transported in the particle phase from areas closer to the coast.

**A51C MC: Hall D Friday 0830h Sampling Issues in Observing the Atmosphere I**

**Presiding:** I Astin, University of Reading; G R North, Texas AM University

**A51C-0067 0830h POSTER**

**Enhancing the West Antarctic Meteorological Record With Artificial Neural Networks**

David B Reusch<sup>1</sup> (814-865-9319; dbr@geosc.psu.edu)

Richard B Alley<sup>1</sup> (ralley@essc.psu.edu)

<sup>1</sup> The Pennsylvania State University, Department of Geosciences and EMS Environment Institute, 517 Deike Building, University Park, PA 16802, United States

Improved interpretation of the ever growing body of ice-core-based paleoclimate records from Antarctica requires a deeper understanding of Antarctic meteorology. New field campaigns and improved numerical forecasting models will ultimately provide long-term benefits but neither addresses the existing observational archive. In contrast, our work with automatic weather station (AWS) data addresses this issue directly. AWS currently provide the only year-round, continuous direct measurements of weather on the ice sheet. As the spatial coverage of the network has expanded year to year (thanks to C. Stearns and his University of Wisconsin AWS group), so has our meteorological database. Unfortunately, many of the records are relatively short (less than 10 years) and/or incomplete (to varying degrees) due to the vagaries of the harsh environment. Climate downscaling results in temperate latitudes suggest it is possible to use GCM-scale meteorological data sets (e.g., ECMWF reanalysis products) to both fill gaps in the AWS records and extend them back in time to create a uniform and complete database of West Antarctic surface meteorology (at AWS sites). Such records are highly relevant to

the improved interpretation of the expanding library of snow-pit and ice-core data sets.

Our solution uses artificial neural network (ANN) techniques to predict the near-surface meteorology recorded by AWS instruments (e.g., temperature, pressure) using large-scale features of the atmosphere (e.g., 500 mb geopotential height) from a region around the AWS. ANNs are trained to predict observed AWS data from the corresponding GCM-scale data. Intra-year prediction (of observations in the training year) has been very successful (e.g., RMS errors  $< 2$  mbar for pressure). Inter-year prediction (of observations not in the training year) remains a work-in-progress (e.g., RMS errors are 4-5 mbar). Three ANN architectures yield similar results suggesting our approach is valid but our training methodology needs refinement.

These results support high confidence in the ANN-based predictions from the GCM-scale data for periods where AWS data are unavailable, e.g., before installation. ANNs thus provide a means to expand our surface meteorological records significantly in West Antarctica.

**A51C-0068 0830h POSTER**

**Long-term accuracy of surface spectroradiometry in the UV, Visible, and near IR domains, and Impacts on Derived Products**

Lee Harrison (518 437 8741; lee@asrc.cestm.albany.edu)

Piotr Kiedron<sup>1</sup> (518 437 8737; kiedron@asrc.cestm.albany.edu)

Jerry Berndt<sup>1</sup> (518 437 8738; jerry@asrc.cestm.albany.edu)

Joseph J. Michalsky<sup>1</sup> (518 437 8755; joe@asrc.cestm.albany.edu)

Qilong Min<sup>1</sup> (518 437 8742; min@asrc.cestm.albany.edu)

<sup>1</sup> Atmospheric Sciences Research Center, State University of New York, Albany, 251 Fuller Rd, Albany, NY 12203, United States

The Rotating Shadowband Spectroradiometer (RSS) is a medium-resolution field spectroradiometer developed for continuous long term field deployment. Successive improvements to the instrument have been operating for the ARM Program and elsewhere since 1997, and provide the large majority of spectral observations taken by ARM within its wavelength domain of 360 - 1100 nm. We also operate the US reference UV spectroradiometric network, consisting of 3 sites with high resolution double monochromators measuring from 280 to 400 nm at higher resolution.

We describe the long term maintenance of irradiance scales, congruence tests with solar spectra via Langley regression, and the impact of calibration uncertainties on derived products including aerosol and cloud optical depths, common trace-gas retrievals, and mean photon pathlength from O2 A-band.

**A51C-0069 0830h POSTER**

**AMORE: Atmospheric Modeling Of Radiation Experiment**

James Slusser<sup>1</sup> (970 491 3623; sluss@nrel.colostate.edu)

Lee Harrison<sup>2</sup> (518 437 8741; lee@asrc.cestm.albany.edu)

Wei Gao<sup>1</sup> (970 491 3623)

<sup>1</sup> UV-B Program Office, Colorado State University, 419 Canyon Road, Fort Collins, CO 80523, United States

<sup>2</sup> Atmospheric Sciences Research Center, State University of New York, Albany, 251 Fuller Rd, Albany, NY 12203, United States

The purpose of this talk is to present a comparison of modeled and measured clear-sky erythemal UV irradiances. Are the various models in reasonable agreement with the various measurements? Measurements were made with the USDA Reference Spectroradiometer, New Zealand's NIWA Spectroradiometer, a USEPA Brewer, and a Yankee UV-RSS. Modeling groups were given a list of clear days between June 5 and August 5, 2001. The average measured morning and afternoon aerosol optical depths at 368 nm and 332 nm were measured with a UV-MFRSR. The estimated wavelength independent aerosol asymmetry parameter and single scattering albedo, surface pressure and albedo, total column ozone, extraterrestrial solar spectrum, erythemal weighting function were supplied. Modeling groups submitted erythemal weight irradiances for every half hour. Comparisons of measurements to models showed good agreement to within 10% for SZAs out to 60 degrees. Reasons for discrepancies will be discussed.

**A51C-0070 0830h POSTER**

**Direct Measurements of the Absorption of Solar Radiation in Clouds**

Robert W. Portmann<sup>1</sup> (303-497-7083; portmann@al.noaa.gov)

Susan Solomon<sup>1</sup> (solomon@al.noaa.gov)

John S. Daniel<sup>1</sup> (jdaniel@al.noaa.gov)

Andy O. Langford<sup>1</sup> (langford@al.noaa.gov)

Henry L. Miller<sup>1</sup> (miller@al.noaa.gov)

<sup>1</sup> NOAA Aeronomy Lab, 325 Broadway R/ALS, Boulder, CO 80305, United States

Several techniques to directly measure the absorption of solar radiation in clouds in the visible and near-IR spectral regions are discussed. Ground based and airborne measurements taken with several spectrographs covering 400-1000 nm are used. The fact that the cloud scattering properties are nearly constant over this spectral interval is exploited to estimate the absorption in clouds. No evidence is found for any unexplained absorption with an optical depth greater than 1% (across the cloud) over the spectral region studied. In addition, it is shown that optical path lengths measured using O<sub>2</sub> absorption bands are usually modeled accurately using a plane-parallel radiative transfer model when cloud cover is not broken. These results are discussed in the context of the "anomalous absorption" debate.

**A51C-0071 0830h POSTER**

**Experiments in Cloudy-Sky Shortwave Flux Closure in the Tropical Western Pacific**

Sally A McFarlane<sup>1</sup> (303-735-2650; mcfarlan@candela.colorado.edu)

K. Franklin Evans<sup>1</sup> (evans@nit.colorado.edu)

<sup>1</sup> University of Colorado, PAOS CB 311, Boulder, CO 80309-0311, United States

Datasets from the Atmospheric Radiation Measurement (ARM) Program's Tropical Western Pacific sites at Nauru and Manus are used to perform broadband shortwave flux closure experiments under cloudy skies. Vertical profiles of liquid cloud microphysical properties are retrieved from millimeter wave radar and microwave radiometer data using a new retrieval algorithm based on Bayes' theorem of conditional probability. Ice cloud properties are parameterized based on radar reflectivity and temperature. Independent pixel and plane-parallel calculations are performed using the SHDOM radiative transfer model with the RRTM shortwave k-distribution.

Differences in modeled and observed surface fluxes are analyzed in terms of cloud height, cloud fraction, and cloud variability. Due to the variability of the broken trade cumulus clouds seen in the tropics, averaging over long time periods is required to reduce rms errors between modeled and observed surface fluxes.

**A51C-0072 0830h POSTER**

**Atmospheric Sounding by Occultation Technique using the Atmospheric Sounding by Occultation Technique using the Regional Atmospheric Model HIRHAM of the Arctic**

Vyacheslav Kunitsyn<sup>1</sup> (++7 095 939 3806;

kunitsyn@phys.msu.ru); Victor Zakharov<sup>1</sup>; Antje Weisheimer<sup>2</sup>; Michael Gerding<sup>2</sup>; Roland Neuber<sup>2</sup>; Klaus Dethloff<sup>2</sup> (++49 331 288 2104; dethloff@awi-potsdam.de); Annette Rinke<sup>2</sup>

<sup>1</sup> Lomonosov State University, Vorbivjov Gory, Moscow 119899, Russian Federation

<sup>2</sup> Alfred-Wegener Institute for Polar and Marine Research, Telegrafenberg A43, Potsdam 14473, Germany

It is important to use experimental satellite data about the space-time distribution of meteorological parameters for validation and estimation of meteorological and climate models of the atmosphere. Particularly important is the Arctic region where there are only few meteorological stations. Low orbital satellites with GPS receivers like GPS/MET, CHAMP, Orsted give the possibility to reconstruct profiles of meteorological values by the occultation technique. But in many cases there is no sense to compare these experimental meteorological profiles with local profiles from atmospheric climate models. The reconstruction of meteorological profiles based on the assumption of a quasi-spherical atmosphere. The reconstructed meteorological profiles of a nonspherical atmosphere will be distorted ("averaged" by the irregular atmosphere), therefore it is not allowed to compare these profiles with model local

profiles. Instead it makes sense to compare experimental profiles with those, calculated in connection with an atmospheric model. These profiles are also "averaged" by the model of an irregular atmosphere. Such "averaged-weighted" profiles will be calculated taking into account the probing ray tracing in the model of an irregular atmosphere. If the model of the irregular atmosphere is close to the real atmosphere then the calculated model profiles will be close to experimental profiles. Such comparison of "weighted" model profiles with experimental profiles allows to compare different atmosphere models and to validate these models in data sparse regions like the Arctic.

The paper discusses the methods and results of modeling the solution of the forward and inverse problems of atmosphere diagnostics. Modeling is based on comparing the given model distribution of the atmospheric parameters and the distribution obtained by solving the inverse problem by means of the occultation technique using GPS radiosignals. The data for solving the inverse problem are obtained by solving the forward problem of radiosignal propagation in a non-homogeneous medium. The spatial 3D distribution of the refraction index for the atmosphere is produced as a result of recalculating the fields of meteorological parameters (pressure, temperature and humidity) obtained from simulations with the regional model of the Arctic atmosphere HIRHAM4 for altitudes up to 25 km. For higher altitudes the CIRA model of the atmosphere and the model distribution of the ionosphere electron density were used. The error in the forward problem solution was, as recalculated with respect to satellite position, less than 2 cm, which reduces the error in reconstructing the profiles of meteorological parameters to less than 0.1% in the case of a spherically symmetrical medium.

A distribution of the errors and biases in reconstructing meteorological parameters at the levels defined by the HIRHAM4 model for an Arctic integration area were obtained. The regions where the error are greater than the "background" ones have been determined and the positions of these regions were compared with the distribution of meteorological parameters gradients. These results allow the diagnostics of model errors and biases. The possibility of validating models using also the data from ground-based GPS receivers was established. The results of comparing the experimental profiles reconstructed by the occultation technique with those calculated for the same region using the "weighted" regional atmospheric model profiles are discussed.

URL: <http://www.awi-potsdam.de>

#### A51C-0073 0830h POSTER

##### The Impact of NPOESS on Mesoscale Forecasts

Joel B Mozer<sup>1</sup> (505 434-7037; jmozer@nso.edu)

Susan Triantafillou<sup>2</sup> (781 377-4069; susan.triantafillou@hanscom.af.mil)

Sheryl F Thorpe<sup>3</sup> (781 377-3033; sheryl.thorpe@hanscom.af.mil)

<sup>1</sup>US Air Force Research Laboratory, Space Vehicles Directorate Sac Peak / National Solar Observatory, Sunspot, NM 88349

<sup>2</sup>Radex, Inc., 3 Preston Court, Bedford, MA 01730

<sup>3</sup>Titan Corp, 3 Preston Court, Bedford, MA 01730

Environmental Data Records (EDRs) from the future National Polar-orbiting Operational Environmental Satellite System (NPOESS) represent a significant improvement in both the quantity and quality of satellite data available to operational weather forecast centers. The availability of these EDRs potentially affects many aspects of military and civilian operations. Our objective is to assess the influence of NPOESS on the accuracy of mesoscale numerical weather prediction model forecasts over a region where conventional data are limited. This is accomplished by conducting an NPOESS Mesoscale Observing System Simulation Experiment (OSSE), in which, the observing system data is simulated by appropriate quantities derived from the results of a numerical weather prediction model that functions as the nature run. An independent forecast model is selected to make weather predictions both with and without the simulated observations. The results are compared to assess the overall impact of the new observing system.

The simulated observations in this study are based on the Mesoscale Atmospheric Simulation System (MASS). The model results pertaining to a 30-day period in 1982 over the Korean peninsula are sampled to simulate NPOESS data and soundings at World Meteorological Organization (WMO) locations. The MM5 version 3 is used to generate forecasts using National Centers for Environmental Prediction (NCEP) analyses with and without the enhancement of NPOESS simulated data. Two assimilation runs are created to produce fields enhanced by just WMO data and a combination of WMO and NPOESS data. In both cases, the simulated observations influence the calculations through the initial and boundary conditions and the four dimensional data assimilation (FDDA). These results are used to initialize 6-, 12- and 24-h forecasts that are compared to the nature run.

As expected, a comparison of the assimilation runs and nature run shows the addition of simulated NPOESS data brings the fields closer to the nature run. However, the differences between the two assimilation runs are small in comparison to the differences between the nature run and either assimilation run. When forecast accuracy is compared, the inclusion of NPOESS simulated data is shown to reduce errors in certain quantities. For example, the mid-level temperature forecasts are significantly improved for the short-term forecast period in contrast to the moisture quantities that are not improved over any period.

Ongoing research is focused on improving the nature run to remove unrealistic effects and biases. This is expected to result in greater improvements in accuracy attributable to NPOESS simulated observations. Future work involves changing the time and the location to avoid large-scale events and changing the assimilation approach to give more weight to the observations.

#### A51C-0074 0830h POSTER

##### Investigation of liquid water path retrieval techniques using ship-based microwave radiometers

Dana E. Lane<sup>1</sup> ((732)932-9081; lane@envsci.rutgers.edu)

Chris Fairall<sup>2</sup> (Chris.Fairall@noaa.gov)

Ed Westwater<sup>2</sup> (Ed.Westwater@noaa.gov)

Duane Hazen<sup>2</sup> (Duane.Hazen@noaa.gov)

Brad Orr<sup>2</sup> (Brad.Orr@noaa.gov)

<sup>1</sup>Rutgers University, 14 College Farm Road, New Brunswick, NJ 08901-8551

<sup>2</sup>NOAA/ETL, 325 Broadway R/ET7, Boulder, CO 80305, United States

Investigation of ship-based microwave radiometer observations from the equatorial Pacific during four EPIC cruises indicates nonphysical values of liquid water path during clear sky conditions. These data are evaluated using measurements taken at the Atmospheric Radiation Measurement Program's Tropical Western Pacific (TWP) site during the Nauru99 experiment. Ship-based observations from the RV Ron Brown and the Mirai taken near the TWP site are employed for instrumentation evaluation. Liquid water path inferred by several remote-sensing instruments, ship- and island-based, are compared with each other and with values modeled from sonde data. In general, the modeled brightness temperatures from the sondes are greater than those determined by the radiometers. However, it is unclear whether this indicates a problem with the radiometer or with the aging sondes. The microwave radiometer on the RV Ron Brown compared favorably with a similar instrument located on the island. Retrieval techniques which combine radiometer data with ceilometer data are promising under clear sky or stratus cloud conditions. New techniques for retrieving liquid water path information under broken cloud conditions are being developed.

#### A51C-0075 0830h POSTER

##### In-situ Crystallization of Gypsum on a Beta-Gauge Filter

Ralf Kaegi (+41 1 823 43 79; ralf.kaegi@empa.ch)

Swiss Federal Laboratories for Materials Testing and Research, Ueberlandstrasse 129, Duebendorf, CH 8600

Beta gauges are frequently used for continuous mass monitoring of ambient air particles. In the Anderson FH 62 I-R a quartz fiber particle filter is exposed to beta particles from a Kr-85 source. The absorption of beta radiation is then a measure of the mass of particles deposited on the filter. In our setup, condensation was avoided by keeping the sampling tube at 50°C, which lead to a filter temperature of 35°C. Sampling was performed through a PM1 inlet for periods of 24h at a flow rate of 1m<sup>3</sup> per h. After sampling, the filters were analyzed using a high resolution scanning electron microscope (HR-SEM, XL30, FEG). A thorough inspection of the filter surface revealed idiomorphically shaped crystals which were identified as gypsum. The idiomorphic shape is rather unusual for airborne particles, indicating that these crystals grew on the filter surface during sampling. Two pathways may be invoked: i) reaction of atmospheric sulfur dioxide (SO<sub>2</sub>), possibly after (surface bound) oxidation to sulfate (SO<sub>4</sub><sup>2-</sup>), with calcareous particulate matter trapped on the filter or ii) chemical reaction between ammonium sulfate ((NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>) and calcareous particulate matter, with or without intermediate dissolution of these substances. In both cases, the in-situ formation of gypsum on the filter surface is probably coupled to a change in mass, as well as a change in absorption of beta radiation that must be considered when interpreting results obtained by a beta gauge. Such processes may also be important for morphological studies of ambient particulate matter. Our further work will focus on the crystallization

of gypsum on a filter surface using synthetic mixtures of N<sub>2</sub>, O<sub>2</sub>, SO<sub>2</sub>, and H<sub>2</sub>O to test the mentioned crystallization pathways.

#### A51D MC: Hall D Friday 0830h

##### Predictability of the North American Monsoon System II

Presiding: K Arsenault, NASA  
Goddard Space Flight Center

#### A51D-0076 0830h POSTER

##### Synoptic Patterns and Frequency Analysis of the North American Monsoon System

Eileen A. Hall-McKim<sup>1</sup> (303-449-1683; mckim@ucsub.colorado.edu)

Anne Nolin<sup>1</sup> (nolin@kryos.colorado.edu)

Fiona Lo<sup>1</sup> (Fiona@kryos.colorado.edu)

Mark Serreze<sup>1</sup> (serreze@kryos.colorado.edu)

Martyn Clark<sup>1</sup> (mpclark@kryos.colorado.edu)

<sup>1</sup>University of Colorado, Campus Box 449, Boulder, CO 80309, United States

This study investigates the hypothesis that the evolution of the North American Monsoon System (NAMS) is modulated by intraseasonal fluctuations in atmospheric circulation. The monsoon phenomenon undergoes considerable intraseasonal variability with alternating periods of widespread, heavy thunderstorms (bursts) and drier periods (breaks). The monsoon bursts (breaks) occur on time scales of days (weeks) and appear to be modulated by synoptic patterns that help organize convectively favorable (unfavorable) environments. For this two-part investigation, we first analyze composite synoptic pressure patterns and identify atmospheric configurations that enhance or stifle convective activity. Precipitation data from stations in Arizona and New Mexico are ranked by total July-August precipitation (1958-1998) to identify monsoon seasons by strength. Significant precipitation events are chosen from high/low monsoon seasons. The NCEP-NCAR Reanalysis Data are used to identify regional atmospheric features preceding and following each of the significant events. We examine the 500 mb geopotential height, focusing on midlatitude upper level trough features, easterly flow from the Gulf of Mexico, moisture surges from the Gulf of California, and latitudinal position of the Bermuda and Pacific Subtropical Highs. Secondly, intraseasonal fluctuations of observed summer precipitation for Arizona and New Mexico are analyzed to ascertain their spatial/temporal coherence. Spectral characteristics of intraseasonal burst/break activity are examined using a 41-year data set of July-August average daily precipitation for regions in Arizona and New Mexico. Wavelet analysis is used to explore both the dominant modes of variability and how those modes vary in time. This work represents a step in a broader investigation that will examine interactions between the land surface and atmospheric circulation as they relate to the North American Monsoon System. Further analysis will examine comparison to indices of large-scale atmospheric features i.e., ENSO, PNA, and MJO, and possible land surface forcing of anomalous snow extent over North America.

#### A51D-0077 0830h POSTER

##### Effects of a Revised Cumulus Parameterization Scheme on CCM3 Simulations of the North American Monsoon

Raymond W. Arritt (1-515-294-9870;

rwarritt@iastate.edu)

Iowa State University, 3010 Agronomy Hall, Ames, IA 50011-1010, United States

Monsoon circulations involve feedback between atmospheric dynamics and diabatic heating. We thus expect that simulations of the North American monsoon in a GCM could be affected by details of the convective parameterization. CCM3 version 3.6.16 is being run for the AMIP-II period (1979-1996) using identical configurations except for the cumulus parameterization. A simulation with the original Zhang and McFarlane scheme is compared to a revised version in which the closure responds to large-scale forcing rather than being determined exclusively by boundary-layer CAPE. Simulated precipitation over the North American monsoon region shows monsoon-like signals in some years but not in others. When the monsoon-like signal does occur, onset of precipitation is about a month earlier