by the aquatic plants must be considered in order to explain the unusually low DGM levels and related observations. Further study on the driving forces and mechanism for Hg biogeochemodynamics in the ecosystem is highly of interest.

A31D-0081 0830h POSTER

Core Atmospheric Measurements at the Summit, Greenland Environmental Observatory: GEOSummit

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A program is being implemented for long-term measurements of the Arctic atmosphere, snow and other Earth system components at the Summit, Greenland Environmental Observatory (GEOSummit), located at an elevation of 3100 m on the Greenland ice sheet. GEOSummit was the site of the Greenland Ice Sheet Project 2 (GISP2) ice core studies, completed in 1993, and has been a site of atmospheric, snow, and other geophysical measurements ever since. It is currently the only high-altitude site for atmospheric and related measurements in the Arctic. Many of these measurements, previously made intermittently at GEOSummit, resumed on a continuous basis beginning in summer 2003 and will be made publicly available. Core atmospheric and snow measurements provide a baseline for the continued operation of GEOSummit as a long-term site for year-round disciplinary and interdisciplinary measurements and research. Because changes in Arctic atmospheric circulation are cyclic over 4-5 year or longer times, long-duration measurements are being made available to understand circulation and to place observed changes in a long-term perspective. The availability of the GEOSummit measurements encourages and facilitates multi-disciplinary research by providing a high-quality core of baseline observations. The current program continues and expands the core baseline measurements at GEOSummit for a five-year period, beginning in summer 2003. GEOSummit is currently a partnership between NSF-OPP, NOAA-CMDL, and investigators from Denmark, Germany and Switzerland. Baseline measurements include meteorology, radiation, tropospheric and aerosol chemistry, snow properties and snow chemistry as well as carbon cycle compounds, chlorofluorocarbons, radiation, and ozone. Average water accumulation at GEOSummit is 21 g cm2 y-1, with annual patterns varying significantly from year to year. The mean annual temperature is -30 oC, varying between -70 and 0 oC. Near-surface summertime ozone averages 55 ppbv. Aerosol fluxes and atmospheric gas concentrations (e.g., O3, CO, CO2, CH4) exhibit characteristic annual cycling.

URL: http://www.geosummit.org

A31D-0082 0830h POSTER

Seasonal differences in snow chemistry from the vicinity of Mt. Everest, central Himalayas

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During August and September, 1998, fresh snow samples were collected in the East Rongbuk (ER) Glacier on the northern slope of Mt. Everest over an elevation range 5800-6500 m. Three snowpits were sampled in the ER glacier at an elevation of 6400m, 6500m, and 6500 m in August 1998, May 2000, and October 2002, respectively. Snow chemical data from fresh snow and snowpit samples from the ER Glacier are shown to be consistent with earlier results reported by other researches from the vicinity of Mt. Everest. Among major ions, calcium has the most striking seasonal differences: non-monsoon snow calcium concentration is one order of magnitude higher than monsoon value. A large seasonal difference characterizes fresh snow sulfate but does not seem to persist in snowpit samples probably as a consequence of post-depositional ion elution. Non-monsoon snow sodium, potassium, and chloride are close to two times higher than monsoon snow for both fresh snow and snowpit samples. Magnesium has distinct seasonal variations in snowpit samples and a four fold higher concentration in non-monsoon snow than that in monsoon snow. Seasonal differences in major chemical composition in snow over the Mt. Everest region provide a definitive indicator for precisely dating ice cores and as a consequence are essential in reconstructing the history of climate change and atmospheric chemistry in this region.

A31D-0083 0830h POSTER

Linkage Issues Between Global Tropospheric Chemistry Model and Regional Air Quality Model

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One of key problems of regional air quality models, such as U.S. EPA's CMAQ, is finding accurate initial and boundary conditions for the simulations. Most popular method for this is running a regional air quality model at a coarser resolution with seasonal profile data and surface emissions input for a long-enough period of time for the spin-up process. However, the procedure is not able to account for the change in the boundary conditions due to certain air pollution long-range transport events. For this reason, we attempt to use outputs of global tropospheric chemistry model simulations to provide the reasonable boundary conditions for the regional air quality simulations. To provide the initial and boundary conditions for regional modeling, we have used the GEOS-CHEM model to link with CMAQ. To link the GEOS-CHEM output in the Latitude-Longitude coordinates at 2°X2.5 of horizontal resolution and 48 vertical layers to the CMAQ in the Lambert-Conformal coordinate at 36kmX36km horizontal resolution over the US-continental domain and 23 vertical layers, it is necessary to perform the horizontal and vertical interpolations. Chemical species mapping is needed because of the different chemistry reaction mechanisms are used such as the O3-NOx-hydrocarbon chemistry in GEOS-CHEM and CB4 and SAPRC99 in CMAQ. In this study we discuss issues in liking the global and regional scale models, such as compatibility of model dynamics, differences in emissions data used and effects of different chemical mechanisms between GEOS-CHEM and CMAQ. To investigate the effects of using GEOS-CHEM output as initial and boundary conditions instead of the profile data on regional CMAQ simulations we have conducted 4 sensitivity CMAQ simulations for the combination of using GEOS-CHEM output and profile data for the boundary conditions and with the CB4 and SAPRC99 as the chemical mechanisms. Analysis shows that there were no significant differences in wind fields and O3 distributions between the GEOS of the NASA DAO in GEOS-CHEM and MM5 in CMAQ. We also compared emissions inputs used for the GEOS-CHEM and CMAQ, in particular for the NOx and VOC species. To verify the CMAQ results after liking with GEOS-CHEM, we have compared the CMAQ results of each simulated cases with AIRS data.

A31D-0084 0830h POSTER

Relationships between crustal records from three ice cores in West Antarctica and atmospheric circulation

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Using NCEP/NCAR Reanalysis data, we investigate the relationships between crustal ion (nssCa2+: non sea-salt Ca2+) concentrations from three West Antarctica ice cores: Siple Dome (SD), ITASE00-1 (IT001) and ITASE01-5 (IT015), and the climatic factors: air pressure/geopotential height, zonal (u) and meridional (v) wind strength. Linear correlation analyses between nssCa2+ concentrations and air pressure, wind fields for the recent 50 years indicate that the SD nssCa2+ variation is positively correlated with spring (SON) circumpolar zonal wind, while the IT001 nssCa2+ has positive correlation with circumpolar zonal wind during the whole year (r> 0.3, p< 0.01). Intensified Southern Westerlies circulation is conducive to transport more crustal aerosols to both sites. Further correlation analyses between nssCa2+ concentrations and atmospheric circulation for SD and IT001 suggest that the high inland plateau (e.g. IT001) is largely influenced by the transport from the upper troposphere. The IT015 nssCa2+ is negative correlated with westerly wind in October and November, suggesting that the stronger westerly circulation may weaken the transport of crustal species to IT015. Results of correlation of nssCa2+ in three ice cores with Antarctic Oscillation (AAO) index are agreed well with those of winds. NssCa2+ concentrations are also related to ENSO variability in which higher crustal species corresponds with stronger ENSO event.

A31E MCC: Level 1 Wednesday 0830h

Climate II Posters *(joint with GC)*

Presiding: **M Herzog,** University of Michigan**; M J Prather,** University of California, Irvine

A31E-0085 0830h POSTER

Modes of Climate Variability Under Climate Change Scenarios

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This combined observational and modeling study concerns how patterns of variability including the El Niño Southern Oscillation (ENSO), the Arctic Oscillation- North Atlantic Oscillation (AO-NAO), the Pacific North American Pattern (PNA) and the Western Pacific Pattern (WP) may be modified by climate change. Possible modifications to these teleconnection patterns, including changes in amplitude, frequency, duration, and spatial pattern, are analyzed. The signature and influence of these teleconnection patterns on diagnostics including surface air temperature, precipitation, zonal and meridional wind, geopotential height, storms, and the fluxes of heat and momentum are also explored. Analytical techniques include correlation and compositing of NCEP reanalysis data from two periods: 1) 1958-1998, and 2) 1979-1998. Model data from the Goddard Institute for Space Studies (GISS) AGCM, driven with 1) current and 2) enhanced greenhouse forcing are compared as well.

A31E-0086 0830h POSTER

A New Approach to Global Surface Temperature Study

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A new approach to global surface temperature study was investigated. A complete set of non-orthogonal Thermal Decay Modes of Climate (TDM) was derived from a two dimensional linear Energy Balance Climate Model (EBCM). This EBCM includes the distribution of land and sea surface characteristics explicitly and was solved in two dimensions on the sphere as a series of time (or frequency) dependent mode amplitudes. The amplitudes of these modes have temporal characteristics which are purely decaying exponential with time constants that are proportional to the sensitivity of an individual mode to external perturbations. Experiments, such as the reconstruction of the geographical distributions of seasonal cycle and variance, suggest that the TDM of 2D EBCM fit the present climate very well. The decomposition may provide a new way of analyzing surface temperature data. The new analyses should make it possible to infer the sensitivity of the real climate to external perturbations.

A31E-0087 0830h POSTER

Improved Precipitation Simulations using Spectral (bin) Microphysics in a Mesoscale Atmospheric Model.

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A new, faster, spectral (bin) microphysics model, SBM Fast, has been developed and coupled to the mesoscale model, MM5. The SBM Fast, which is based on the micro-physical package of the Hebrew University, solves a system of equations for size distribution functions for water drops, three types of ice crystals (plates, columns, and dendrites) as well as snowflakes, graupel, and hail/frozen drops. A budget for aerosols is used to obtain the spectrum of condensation nuclei, which is used to obtain the initial drop spectrum. The coupling of SBM Fast to the three-dimensional mesoscale model, MM5, allows SBM Fast to simulate microphysics within a realistic, time-varying mesoscale environment. Thus, the SBM Fast model can be used, potentially, to improve precipitation forecasts during warm rain or mixed convective, and/or cold-season snow events. This work describes results from high resolution simulations of a convective, mesoscale precipitating system that developed over Florida 27th July 1991. The focus is on the evolution of sea-breeze fronts into a convective squall line, that includes stratiform cloud development. Analysis suggests that the MM5 SBM reproduces well cloud structure, cloud type, winds, and precipitation amounts. Results further show the importance of initial aerosol concentration on vertical velocity, cloud structure, and rainfall.

A31E-0088 0830h POSTER

Initialization of the Purdue Mesoscale Model with the Land Data Assimilation System

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Analysis data derived from the Finite Volume Data Assimilation System (FVDAS, NASA Global Modeling and Assimilation Office) and Land Data Assimilation System (LDAS, NASA Hydrological Sciences Branch) have been successfully implemented in a meso-scale model and are tested to provide initial conditions and lateral boundary forcings. Initialization of the Purdue Mesoscale Model's precipitation forecast with FVDAS and LDAS high-resolution land surface and soil moisture data are compared with ECMWF data. Initial conditions of the land surface provided by FVDAS/LDAS show significant differences in both soil moisture and ground temperature compared to ECMWF, which results in a much different prediction of atmospheric state and weather variables. The simulation result shows that significant changes to the forecasted weather system are due to such differences, especially for the atmospheric state over the land surface. Comparison of precipitation, moisture budgets, and surface energy shows that, not only the intensity and location of precipitation over the Midwest is in better agreement with FVDAS/LDAS run, but also the temperature forecast is in better agreement when compared to ECMWF data. However, the precipitation over the Rockies is too large due to the cumulus parameterization scheme used in the model. The RMS errors and biases of FVDAS/LDAS are smaller than the control run and show statistical significance supporting the conclusion that use of LDAS improves the precipitation and temperature forecast for the case of Midwestern flood which occurred during May 21 23, 1998. The implementation of FVDAS/LDAS data to a mesoscale model is the first case experiment to date, and more case studies will be conducted in the near future.

A31E-0089 0830h POSTER

Global Temporal Trends in Surface and Free-Air Equivalent Temperatures at High Elevations

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Reconciling differences between temporal trends in surface (land station) and free-air (radiosonde and satellite) temperature data concerns the international scientific community. This paper examines the differences between temporal trends in surface temperature observations at high elevation and interpolated free-air equivalent temperatures from both NCEP/NCAR reanalyses and CARDS (radiosonde data) for recent decades. Preliminary analysis of screen maxima and minima from a range of high elevation SNOTEL (Snow-Telemetry) sites in the western U.S. vs free-air equivalent temperatures interpolated from the NCAR/NCEP reanalysis yielded systematic diurnal and annual signals in the free-air/surface temperature differences. Long-term trends in such differences over the last 20 years are significant at many locations, but vary by magnitude and sign, and are dependent on topography and elevation. Such temporal trends indicate that the Earth's surface may be responding to climate change in a contrasting way to the free atmosphere over this time horizon. Possible mechanisms for such decoupling are discussed.

A31E-0090 0830h POSTER

The ENSO Signal on Tropospheric and Stratospheric MSU Temperatures

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The ENSO signal on tropospheric and stratospheric temperatures has been investigated using Microwave Sounding Unit (MSU) data for the period 1979-2000.Monthly mean T2lt and T4 MSU temperatures have been analysed in terms of emphirical orthogonal functions in the Tropics. This study has been extended to extratropical regions by multiple regression of the data onto the principal components of the tropical EOFs. In order to produce a clearer description of ENSO, EOF analysis have been carried out separately to the zonal mean temperature field and to the deviations from the zonal mean both in troposphere and lower stratosphere.

In the tropical troposphere, ENSO is the main source of variability, it accounts for 68% of the variance and it is related to three different EOFs. The first one accounts for almost 50% of the tropical variability. It is a zonal mean pattern and lags the Niño3.4 index by 3 or 4 months. The remaining ENSO variability, is explained by two independent wavelike signals. The former, in phase with Niño3.4, seems to be the atmospheric response to the warming of the Eastern Pacific SSTs. The second one leads N3.4 by 10,12 months and shows the atmospheric tropical disturbances near the date line. It might be considered as a precursor of ENSO.

In the lower stratosphere, 89% of the variance is explained by two zonal mean patterns not related to ENSO. The first one explains 77% of the variance and it is strongly influenced by the volcanic eruptions of El Chinchón and Mt. Pinatubo. The second one is closely related to the behaviour of the QBO. ENSO accounts for 6% of the tropical variability and it is a wave phenomeno in the lower stratosphere. There is no indication of any ENSO related zonal mean response, but there are two ENSO related eddy EOFs almost perfectly correlated with the eddy tropospheric EOFs. They reflect the vertical structure of internal equatorial waves in the tropics and quasi-geostrophic wavetrains in extratropical latitudes.

A31E-0091 0830h POSTER

Micro- and Meso-topographic Temperature Regimes in Mountainous Terrain, Niwot Ridge, Colorado

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Air temperatures recorded along and across topographic transects on Niwot Ridge over a multi-year period and through all seasons, vary by aspect and slope gradient, and are related to synoptic atmospheric conditions. The extent of cold air ponding (much colder temperatures at the low topographic points) and temperature differences associated with north or south facing slopes, are examined for three north/south transects of contrasting gradients. Synoptic conditions, as expressed through quantitative circulation indices, influence both within and between transect variation. On a slightly larger spatial scale, we compare lower and higher ridge-top sites. Inversions occur even at these sites, their occurrence and magnitude strongly related to synoptic flow patterns. At both mico- and meso-scale, cold air ponding is greatest on clear, calm nights.

A31E-0092 0830h POSTER

Extreme Temperature and Precipitation Events in Alaska

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While much emphasis has been placed on changes in temperature and precipitation means, events at the tails of the frequency distribution, or extreme events, are lesser known. However it is generally these events that generate the most detrimental societal impacts. Daily temperature and precipitation observations were investigated for the period 1950 to 2001 at locations representative of arctic, continental, and maritime climate regimes in Alaska. Extreme minimum temperatures showed an increase that was generally almost twice the magnitude as that for extreme maxima. These trends are on the order of 1 to 2°C for the winter and spring months, whereas trends for summer are almost negligible, and the autumn months show a negative tendency, or decrease. These changes are fairly uniform across Alaska's climate regions. Changes in mean temperatures show similar seasonal dependency with the strongest warming in winter and spring and a slight cooling in the fall, and all regions show a warming for the annual average that is in the range of 0.5 to 2.0]$degC$. For all regions except the arctic, precipitation shows a general increase on the order of 6% to 23% for the annual total, in which the autumn and winter months show the largest increase. The change in extreme precipitation events was found to be greater than the corresponding change in the mean daily total. The arctic has shown a precipitation decrease that is seasonally uniform, with a strong decrease in the mean daily total.

A31E-0093 0830h POSTER

Composite Evolution of the Northern Hemisphere Stratospheric Sudden Warming

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This study examines the evolution of the atmospheric flow and wave fluxes during the composite life cycle of a stratospheric sudden warming (SSW) in the Northern Hemisphere. Previous studies of SSWs have focused on the evolution of the flow and wave fluxes at stratospheric levels. Motivated by recent evidence of strong coupling between the circulations of the stratosphere and troposphere during the Northern Hemisphere winter, we provide here a comprehensive analysis of the evolution of the flow and wave fluxes during a SSW at levels throughout the depth of the stratosphere and troposphere. During the onset of a SSW, the polar stratosphere is disturbed by poleward heat and momentum flux anomalies associated mainly with waves of zonal wavenumber one and two. When the waves break in the lower stratosphere, they act to weaken the strength of the circumpolar flow there, and drive an anomalous mean meridional circulation that gives rise to anomalously high polar stratospheric temperatures. As the SSW progresses, the induced stratospheric circulation anomalies descend to the lower stratosphere, where they coincide with the growth of anomalous equatorward momentum fluxes by waves in the upper troposphere centered near 50N, and by anomalous equatorward heat fluxes by waves in the lower troposphere centered near 60N. The anomalies in tropospheric wave activity are mainly associated with waves of zonal wavenumber four and higher, and are concentrated over the Atlantic half of the hemisphere. The anomalous upper tropospheric momentum fluxes drive anomalies in the tropospheric mean meridional circulation that transport easterly zonal wind anomalies from the upper troposphere to the surface where they compose negative polarity of the Northern Hemisphere Annular Mode (NAM).

A31E-0094 0830h POSTER

Retrieval and Validation of Surface Long Wave Radiation Budget From CERES

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Parameterizations that produce surface radiation fluxes directly from the top of atmosphere fluxes and other meteorological variables are presented. In particular, the techniques employ the top-of-atmosphere measurements made by the CERES instrument on board the TRMM and other EOS satellites (TERRA and AQUA) in combination with other meteorological variables to analyze the energetics of the tropospheric column and surface. The analysis is separated into land and ocean regions. The key parameters derived include, 1) the atmospheric greenhouse effect, in both broadband and window (8 - 12 micron), which is the reduction in the clear-sky outgoing long-wave radiation representing the radiative heating of the surface-atmospheric column, and 2) the back-radiation from the atmosphere to the surface, again in broadband and window, representing the radiative heating of the surface by the atmosphere. The latter parameter is archived in the EOS data base and accessible from the NASA Langley Research Center CERES data archives. The results reported here constitute long-wave model A in the Single Satellite Footprint (SSF) data set. Both the parameters referred to above represent a measure of the atmospheric greenhouse effect. Instantaneous/footprint scale broadband fluxes have been validated against in situ measurements made at the Atmospheric Radiation Program (ARM) Central and extended facilities and at the other surface sites of the Baseline Surface Radiation Network (BSRN) and the Climate Monitoring and Diagnostics Laboratory (CMDL). The agreement is within the stipulated objectives of the broad EOS program. Further analysis of the seasonal and geographical distribution of the surface radiation flux components in the continuum and broadband channels provides observational support for the key role played by the water vapor continuum in modulating the energy balance of the surface and the atmospheric column. Regions with enhanced moisture levels experience a sharp increase in emissions to the surface, especially in the window region which contributes in large part to the enhanced radiative cooling of the surface and the atmospheric column.

A31E-0095 0830h POSTER

Observed Global Cloud and Radiation Flux Changes Since 1952

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Gridded 72-day surface-observed cloud cover anomalies are converted to top-of-atmosphere radiation flux anomalies by scaling by climatological cloud radiative forcing measured by the ERBE scanner. The resulting cloud-estimated radiation anomalies are well-correlated with measured ERBS non-scanner radiation anomalies during the overlapping period of record (1985-1997). The surface-observed cloud dataset independently reproduces the large change in tropical LW and SW radiation flux in the early 1990's previously documented by ERBS. This agreement provides confidence that surface observations of clouds provide reliable information about cloud-related radiation changes during the pre-satellite era. Analysis of a surface-observed cloud cover and estimated radiation flux indicates upper-level cloud cover has decreased and outgoing LW radiation had increased over much of the tropical and extratropical oceans during the past several decades. Low-level stratiform cloud cover and SW reflection have increased over extratropical oceans during the past several decades. The spatial pattern of cloud trends suggests that they are in part related to warming of the central and eastern tropical Pacific since the mid 1970's. These results indicate that changes in cloudiness over the past fifty years have acted to slow the rate of global warming, but it is not yet known whether cloud trends will continue in the same direction in the future.

A31E-0096 0830h POSTER

Solar Ultraviolet Radiation Received in an Urban Area

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Urban air chemistry is driven by solar UV radiation. Therefore, it is important to understand the variability in UV radiation at the ground and the physical mechanisms behind this variability. This study seeks to analyze measurements of UV spectral irradiance made by a Brewer Spectrophotometer in Chicago. The Brewer Spectrophotometer is a single-grating instrument for measuring ozone and UV research, and is operating at the University of Chicago as part of the USEPA UV monitoring network. Instrumental measurements are benchmarked to a radiative transfer model under clear sky conditions over the air pollution season. Comparisons between measured irradiances and calculations based on column ozone obtained from satellite-based sensors, allow an interpretation of observed variability in terms of cause and effect. In addition, spectral weightings are applied to measurements and model results based on dissociation cross sections of NO_2 and O_3. This produces quantities that are useful indicators of the UV radiation that drives air chemistry.

A31E-0097 0830h POSTER

Observations and Stochastic Modeling of Shortwave Radiative Transfer at the ARM CART Sites

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Preliminary single-column model (SCM) studies have indicated that the SCM often predicts clear sky conditions when low-level scattered cloudiness actually occurs. Stochastic modeling is a promising technique for representing shortwave radiative transfer through broken cloud fields. Results from the stochastic model may be used to improve the performance of the SCM. To this end, one year of continuously sampled data from the Atmospheric Radiation Measurement (ARM) Programs Clouds and Radiative Testbed (CART) sites (Southern Great Plains, Tropical Western Pacific and North Slopes of Alaska) have been analyzed for input to the stochastic radiative transfer model. The cloud optical and geometric properties were determined using the techniques detailed in Lane, Goris and Somerville (2002). The resulting climatology for all three sites, including cloud height, thickness, fraction and optical properties, will be discussed and results will be compared to similar studies where appropriate (e.g. Lazarus et al. 2000). The output domain-averaged, shortwave radiation fields from the stochastic model will be evaluated using both observations and parallel plane model results to determine appropriateness of this technique as a correction to current shortwave cloud and radiation parameterizations.

A31E-0098 0830h POSTER

Raman Lasing and Cavity Resonances in Water Micro-Droplets: Possible Effects on Shortwave Cloud Forcing

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The influence of narrow optical resonances, which result from trapping of light rays via total internal reflection in water droplets, on the absorption of shortwave (SW) solar radiation has been characterized through high resolution Mie scattering calculations. Our results indicate that these resonances engender an increase in absorption of solar radiation by cloud droplets by several W/m^2 above the linear direct absorption process in the range 0.3-1.1 μm. This work suggests that Mie scattering calculations performed at the 0.1x ($x = 2\pi r/\lambda$) resolution typically implemented in cloudy sky radiative transfer models may not be sufficient to correctly model SW absorption, consistent with the recent finding of Nussenveig [2003]. Stimulated Raman scattering experiments on pure water microdroplets yield cavity enhancements in general agreement with the Mie theory results.

A31E-0099 0830h POSTER

On-orbit SI Traceability of the Calibration of a Spectrally Resolved Measurement of Atmospheric Thermal Radiances

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The Climate Change Research Initiative (CCRI) prioritizes the development of specialized observational datasets intended to improve the quality of high-end model forecasts of future climate. Because of the evolution of climate change signals over periods of years to decades, distinct from the synoptic timescales characteristic of the meteorological observing network, measurement accuracy is prioritized over measurement precision. This accuracy must be demonstrable to future investigators from any agency or country for all time. This demanding standard for accuracy requires the measurement to be traceable to the Système International d'Unités (SI). The SI provides an internationally recognized and reproducible standard that makes the measurement results intrinsically comparable between scientists and across instruments. With the development of new calibration facilities in collaboration with standards laboratories such as NIST (Rice and Johnson 2001), the traceability of space-based remote sensing measurements to the SI can be clearly demonstrated in the pre-launch. It is another challenge altogether to maintain this traceability on-orbit, as these remote sensing instruments are typically not recovered after the mission terminates. On-orbit calibration systems provide some information about the radiometric stability, but the question of absolute drift from the SI value is a vexing question. One solution under consideration is the development of the moon and certain stars as space-based SI standards. For infrared instruments with large viewing apertures, this solution still contains intolerable uncertainties. Here we describe a second solution: to include a redundant calibration system that provides an on-orbit measurement of every significant component uncertainty in the instrument error budget. We present preliminary lab results from a prototype spectrally resolved infrared radiometer designed to measure the earth's thermal radiation spectrum to an SI-traceable accuracy of 0.1 K. These results simulate the on-orbit tests to verify the instrument's native infrared radiance scale, derived from blackbody sources.

A31E-0100 0830h POSTER

The Effect of Aerosol and Ozone on Surface Spectral UV Radiation

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To investigate the effects of ozone and aerosol on surface spectral UV radiation(SUV), SUV and total ozone are measured by Brewer spectrophotometer(MK-IV, #148) located at Yonsei University, Seoul from October, 1997 to September, 1998. AOD was calculated by using a rotating shadowband radiometer data at the same site and time of total ozone and SUV measurements. The ozone and aerosol effects obtained from measurement and calculation were compared with those of TUV model. RAF for ozone depends on reference total ozone difference as well as wavelength. With the larger difference in total ozone, RAF went up. RAFs for aerosol depend on wavelength and reference AOD difference. When AOD difference is higher, RAF is higher. After aerosol effect was applied to TUV model, accuracy was improved better than that with no calibration.

A31E-0101 0830h POSTER

Modified Instrument ARUV for Automated Registration of Ultraviolet Radiation

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The automated instrument ARUV to measure the solar ultraviolet radiation (UV) was developed and built as a component of the multi-purpose monitoring system at the Division of Cosmic Rays of IZMIRAN. ARUV includes modules: (1) optical; (2) dispersion forming (grate and prizm); (3) guidance; (4) conversion of light to electronic signal; (5) registration. Modules 1 and 3 (celostat, astrosensor, photoelectrical unit, beam guidance) retain the light over the slit of the spectrometer. The optical system provides amplification by a factor of 400-500. The dispersion-forming block is installed on the industrially manufactured spectrometer STE-1 with the crossed dispersion (grate plus prizm). The inverse linear dispersion in wavelengths 350-450 nm is 0.47 - 0.64 nm/mm and the resolution is 0.01 nm. Registration is carried out by scanning over the spectrum with NMOS Linear Image sensors. The scanning covers two wavebands: 304.4 to 316.3 nm and 324.0 to 336.0 nm. The duration of scanning is less than 0.01 s, which allows us to neglect the time shift of processes with periods greater than 0.1 s. All microchips (guidance of the light beam, feedback, signal conversion, forming of the output signal, and data storage) are set up on a single plate together with NMOS Linear Image sensors. The plate is installed in the cassette of the spectrometer. ARUV can be used both in ground-based observatories and on moving vehicles (ship, aircraft). Reference. Steblova, R.S., A.V. Kulikov, V.G. Yanke, and V.G. Kartashev, The automated instrument to measure ultraviolet radiation (ARUV), EOS Trans. AGU, 76(46), F101, 1995.

A31E-0102 0830h POSTER

Using Environmental Variables to Distribute Human Populations Spatially With an Evaluation in California

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Climate change research, which focuses on anthropogenic factors, may be hampered by the lack of population data available at high spatial resolutions, particularly for developing countries or historical time periods. A refined model that distributes human populations spatially is developed and tested using California as the test case. The model is based on the concept of “habitability”. Habitability is the propensity for a place to sustain a fixed human population. Habitability is forced by environmental factors, specifically elevation, topographic accessibility, river proximity, and annual water surplus. Model-estimated population distributions are compared to 1990 California census data at the block-group level to evaluate the efficacy of the habitability model. Results show that the model can realistically distribute California's total population based on the spatial distributions of a few environmental variables. Adding annual water surplus actually degraded the model's performance, which implies that it may not require a hydroclimatic variable. The model does not resolve well the very-high urban densities. Although further refinement is necessary to adequately represent the urban populations, the habitability model performance suggests that it is a promising approach to population mapping, as well as to quantifying population-environment variables.

A31E-0103 0830h POSTER

Prediction of Significant Wave Heights in Extreme Storms Affecting Far North Alaska

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Barrow, Alaska is located at the northernmost point of the United States on the shore of the Arctic Ocean. The area surrounding Barrow is low lying and is thus vulnerable to coastal flooding via waves and storm surges. Previous modeling of flooding resulting from a storm that affected Barrow and the rest of the North Slope coast region in October 1963 did not reproduce observed flooding, which was substantially greater than modeled. It is hypothesized that because this model only incorporated storm surge and not waves, the model was unable to simulate the total amount of flooding. The current study examines a recent storm that affected the North Slope of Alaska on July 28-30, 2003, and includes prediction of wave height using the SWAN (Simulating WAves Nearshore) model. In addition this study considers the formation and development, climatological context, and community responses for this storm. Results from the wave modeling portion of this study will be incorporated into a coastal flooding model in order to better simulate the coastal environment under extreme conditions in this area.

A31E-0104 0830h POSTER

Climate Response to Large-Scale Wind Farms

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Enhanced reliance on wind energy is one of the possible ways to solve the greenhouse gas problem. However, because wind farms modify the interaction between atmosphere and surface, there is a possibility that wind energy might also change the global climate if developed on a scale large enough to make material reductions in greenhouse emissions. To investigate possible effect of large wind farm arrays on climate, we used a version of GFDL AGCM with prescribed climatological SST and ice extent. A series of 20-year integration included a range of spatial coverage and several different parameterizations for wind farms, as well as controls. Presented here are the results of the experiments with the largest wind farm arrays considered, where significant parts of Europe,North America, and-Chinaare covered. The total wind farm area in this case is about 10% of land surface; the resulting dissipation of kinetic energy on wind farms ranges from 12 to 19 TW (compared to current global primary energy consumption of 12 TW). The results of the simulations show similar effects on climate despite differences in parameterization for the wind farms. The global-average climate reaction is negligible, but regional effects are not. The effect of wind farms on annual mean surface air temperature reaches a regional maximum of the order of 1 degree, which is smaller than the 2XCO2 signal. The temperature response is strongest inEurasia, where it is characterized by cooling in northern mid-latitudes of entire continent and warming in the South in all seasons except JJA, when the pattern is much weaker. The response of precipitation does not show an obvious large-scale pattern and is likely to be statistically not significant.

A31F MCC: 3001-3003 Wednesday 1020h

Bjerknes Lecture *(joint with B, OS, GC)*

A31F-01 1025h INVITED

What atmospheric oxygen measurements are telling us about the carbon cycle

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Direct observations of changes in the oxygen content of the atmosphere have now been underway for more than a decade. The data reveal a rich spectrum of variabilty on seasonal and interannual time scales that are diagnostic of rates of photosynthesis and respiration in the land and marine biospheres and of rates of mixing and transport in the ocean and atmosphere. This paper will discuss how the oxygen data can be utilized, together with atmospheric CO2 data, to help separate land and oceanic contributions to CO2 variability and to provide a new window for resolving secular changes in ocean biogeochemistry. The paper will also highlight the expanding experimental capabilities for measurements of oxygen and related tracers.

A31G MCC: 3018 Wednesday 1020h

Chemistry and Dynamics of the Upper Troposphere and Lower Stratosphere II *(joint with SA, AE)*

Presiding: **M Ross,** Aerospace Corp.; **M Zondlo,** Southwest Sciences

A

A31G-01 1020h

Evidence of the Effect of Summertime Midlatitude Convection on the Subtropical Lower Stratosphere: An Analysis of Tracer Measurements From the CRYSTAL-FACE Mission

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Correlations of long-lived trace gases measured during the CRYSTAL-FACE mission are used to examine mixing in the summer subtropical lower stratosphere. A large number of particles produced by biomass burning were measured in the lower stratosphere up to potential temperatures of 390 K. The particle measurements, combined with the large scale circulation, suggests recent injection of midlatitude tropospheric air into the lower stratosphere. Fractions of midlatitude tropospheric air in the lower stratosphere are calculated based on consistency between all of the tracer-tracer correlations. The tropospheric endpoints to the mixing estimates give an indication of midlatitude continental convective input into the lower stratosphere. Radiative heating rates in the summer subtropical stratosphere above roughly 360 K are positive which suggests that this region will rise and thus, the midlatitude convective input will have an effect on the composition of the stratosphere as a whole.

A31G-02 1035h

Stratospheric Water Vapor and the Asian Monsoon: An Adjoint Model Investigation

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