in PM 2.5 in air masses transported from the ocean during the day. Sulphate from ocean biogenic sources contributed between 0.07 and 0.5 mg/m3 (average 0.3 mg/m3) to atmospheric sulphate concentrations in the Fraser Valley during the Pacific 2001 field campaign from August 16 - 30. Significantly, nitrate at an inland site, Langley, was related to the amount of biogenic sulphate present. Higher nitrate concentrations corresponded to air masses that were more oxidized and contained a larger proportion of biogenic sulphate, while lower concentrations were associated with well-mixed but more polluted airmasses over the Strait of Georgia.

A31A-09 0830h POSTER

Bioaersols at snow-air interface

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Bioaersols, airborne living or products of biological activities, can impact the chemical composition of snow at the atmosphere-snow interface. In this talk, we will present three-year observation data on selected chemical species and biological entities of snow in an urban, two sub-urban, and an Arctic site. We will also present a conceptual model of snow-air chemical interactions in presence of micro-organisms.

A31B CC: 220 C-E Wednesday 0830h

Constraining the Global Mass Distribution of Mineral Dust Aerosol III Posters *(joint with B, GC)*

Presiding: **R L Miller,** NASA Goddard Institute for Space Studies**; C S Zender,** University of California, Irvine

A31B-01 0830h POSTER

Natural and Anthropogenic Mineral Dust: Systematic Terminology and Current Mass Budget Estimates

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The Second International Workshop on Mineral Dust convened in Paris September 10–12, 2003. During discussion of how best to improve estimates of dust loading and radiative forcing, we recognized that the binary division of dust into "natural" and "anthropogenic" emissions is inadequate for many purposes. While natural dust sources like deserts are easily visualized, anthropogenic dust sources come in many forms. A consensus terminology is necessary to objectively define, attribute, and intercompare dust mass budgets and forcings. Policymakers request an objective definition and distinction of "natural" and "anthropogenic" dust. Models may simulate various types or species of anthropogenic dust that are impossible to discriminate in observations. Our dust taxonomy is based on these requests and limitations. Dust is classified as either Natural Dust (DN), Direct Anthropogenic Dust (DA1), Passive Anthropogenic Dust (DA2), or Indirect Anthropogenic Dust (DA3). We illustrate this taxonomy by applying it to most extent mineral dust mass budget estimates. We find that the range in Natural Dust estimates is about a factor of four. Few studies provide any Anthropogenic Dust (DA) estimates. Of those, none fully distinguish between anthropogenically mobilized dust (DA1), Naturally mobilized dust from anthropogenic sources (DA2), and changes in emissions from natural source regions due to anthropogenically induced climate change (DA3). The causes and potential for remediation of each DA subclass are significantly different. Apportioning modeled and observed estimates into these dust classes would therefore be valuable to policymakers while simultaneously facilitating model inter-comparisons.

A31B-02 0830h POSTER

Testing MODIS Dust Detection Capabilities Over the Ocean Using Visible and IR Channels

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Remote sensing from space offers the best opportunity to detect and track the mineral dust, especially over the oceans where data are extremely limited. Global transport models rely on satellite retrievals of dust to constrain the spatial distribution of aerosol optical depth as well as radiative forcing predicted by models. Several recent studies have attempted to assimilate satellite aerosol products into the transport models seeking a better model performance. Given the importance of the subject in climate change studies, there is a great need for reliable and accurate dust data from satellites. In this study we examine how well the Moderate Resolution Imaging Spectroradiometer (MODIS) can detect dust, especially in the presence of clouds. Since clouds frequently occur in the regions affected by dust transport, reliable discrimination of dust from clouds would be a required first step in any aerosol retrievals. For our analysis we use the MODIS Level 1B data containing calibrated and geolocated reflectances and radiances from seven spectral channels for the period of February 24th 2000 - January 31st 2004 over various geographical regions. The granules with dust, cloud and clear sky pixels over the oceans were identified using the true color images. Thirty granules were selected for a detailed analysis. For each case, we tested MODIS cloud mask as well as aerosol and cloud products. We found that MODIS cloud mask fail to differentiate between dusty and cloudy pixels. Dust was mistakenly identified as clouds in many circumstances. To address this issue, we investigated whether a combination of visible reflectances, local standard deviations, visible to infrared reflectance ratio and brightness temperature differences can be used to uniquely detect mineral dust plumes over the oceans. The results will be presented and implications for model validation and dust-cloud interaction studies will be discussed.

A31B-03 0830h POSTER

A Japan-Sino joint project, ADEC - Aeolian Dust Experiment on Climate Impact

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In recent years, aeolian dust has been thought to be an important factor of the climate system on the earth by the radiative forcing effect in the atmosphere and by the influence on the carbon dioxide cycle because deposited dust supplies nutrient salts for the phytoplankton on the ocean surface. Among them, radiative forcing direct and/or indirect effects are important factors of the global warming. Nevertheless, the reliability of the evaluation regarding the radiative forcing impact of aeolian dust is very low. [IPCC, 2001]. This is because the understanding and the model representations of dust entrainment, spatial and temporal distribution of dust, and optical properties of dust particles are not so accurate. Based on this background, Aeolian Dust Experiment on Climate Impact (ADEC) was started in April 2000 as a Japan-Sino Joint Project. The goal of this project is to evaluate the global dust supply to the atmosphere and its radiative forcing direct effect. For this purpose, we have made: 1) in situ observations at desert areas in China for wind erosion processes, 2) network observations from China to Japan, ranging from 80 to 140 East, for understanding spatial-size distribution, chemical, and optical properties of dust particles, and 3) numerical simulation by GCM dust model for evaluation of dust impact on the global climate over the past 50 years. This was planned as a five-year project and two intensive observations, IOP-1, April 12-25 2002, and IOP-2, March 15-26 2003, were put into practice. Intensive observations were made at 6 sites in China (Qira, Aksu, Dunhuang, Shapotou, Beijing, and Qingdao) and 4 sites in Japan (Naha, Fukuoka, Nagoya, and Tsukuba). Preliminary results show that 1) saltation flux at a gobi desert monitored by a newly developed sand particle counter was around 10 times larger than that of a sand dune, which will be caused by the difference of the parent soil size distribution of each ground condition, 2) the background of KOSA events were found in the atmosphere over Japan, 3) based on the Asian dust mineral components, evaluated radiative forcing of the Asian dust is weaker than OPAC3.1 dust model, 4) GCM dust model represented the global distribution of dust which shows reasonable agreement with the observational results. In the presentation, a brief summary of the two IOPs and preliminary results of 2004 spring field campaign will be shown.

URL: http://www.aeoliandust.com/

A31B-04 0830h POSTER

Modeling Arabian Dust Mobilization During the Asian Summer Monsoon: the effect of Prescribed Versus Calculated Sea Surface Temperatures.

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Mobilization of dust over the Arabian Penisula during the Northern Hemisphere summer monsoon is strongly sensitive to radiative scattering by dust particles. In an experiment with prescribed SST, emission increases with the particle absorptivity and is up to 40% larger compared to an experiment that omits dust radiative forcing. Radiative heating within the dust layer acts as an elevated heat source, driving low-level convergence and reinforcing the monsoon circulation. In contrast, dust radiative forcing reduces Arabian emission by 20% if SST is calculated. This discrepency results from the absence of a surface energy constraint in the prescribed SST experiments. With calculated SST, the reduction of sunlight incident upon the surface is balanced by a reduction in the turbulent fluxes of latent and sensible heat into the atmosphere. This represents a cooling of the atmosphere which almost precisely cancels radiative heating within the dust layer. The contrasting effect of dust radiative forcing in the two experiments shows the importance of the surface energy budget to the climate response to dust, which is absent in prescribed SST experiments.

A31B-05 0830h POSTER

Radiative-Induced Climate Feedbacks of the Present Mineral Dust Cycle - Results From a Global Modeling Study

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Mineral dust may modify the interplay of the various components of the Earth system, atmosphere, land and ocean, in different ways. One of its key effects is altering the radiative balance of the atmosphere by an increased aerosol loading. The strength of this radiative effect and of possible feedback mechanisms on both the Earth's climate and the mineral dust cycle itself, are poorly understood on a global scale, yet. Here, we present first results of a new model approach to enhance our knowledge of the mineral dust cycle, changes of the radiative forcing and potential feedback mechanisms within the Earth system. A recently developed dust emission model (including a prognostic vegetation-phenology scheme) was incorporated into a new aerosol scheme (HAM) of the latest version of the Hamburg General Circulation Model ECHAM5. Coupled to a slab ocean model, this set-up allows simultaneously studying of vegetation-dust feedbacks, changes in surface temperatures both over land and ocean, and large-scale variations of the atmospheric circulation, all induced by radiative effects attributable to mineral dust aerosol loading. Performing several ECHAM5 simulations prescribing appropriate present-day boundary conditions enables us to focus on the following aspects: (1) How strong is the disturbance of the atmosphere's radiative balance by mineral aerosol loading? (2) How does this radiative disturbance translate into surface temperature changes? (3) What are the main dust-induced changes of the atmospheric circulation? (4) Do radiative effects of mineral aerosol increase or decrease the strength the dust cycle itself? (5) Are the simulation results substantially altered by small variations of the computed size-distribution, and the prescribed refractive indices of the dust particles?

A31B-06 0830h POSTER

Distribution of Threshold Velocities in East Asia

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An aeolian dust outbreak occurs when a wind velocity exceeds a threshold. In simpler dust models, threshold wind velocities of dust outbreak are set as a constant, 6.5 m/sec, although they should exhibit various values with differing land surface conditions. In more complex models, estimated threshold velocities are given with differing land surface conditions. However, it is not clear whether threshold velocities are correctly estimated or not. This study presents threshold velocities on maps of East Asia (30N-60N, 75E-145E), which are obtained through a statistical analysis using data of present weathers and wind velocities from surface meteorological observatories in the dust season (March, April and May) from 1988 - 2003. Two kinds of threshold velocity are defined from frequency distributions of wind velocities with and without dust outbreaks for each observatory. They are the minimum threshold velocity ($u_{t5\%}$) and the practical threshold velocity ($u_{t50\%}$). The former ($u_{t5\%}$) and the latter ($u_{t50\%}$) correspond to 5 percentile and 50 percentile (i.e., the median) of threshold velocities at such observatory for the analysis period. The minimum threshold velocity ($u_{t5\%}$) should be obtained when the land surface is in nearly the most favorable condition for dust outbreak at such observatory. The practical threshold velocity ($u_{t50\%}$) should be obtained when the land surface is in a normal condition at such observatory. The difference between minimum and practical threshold velocities ($\Delta u_t = u_{t50\%} - u_{t5\%}$) indicates the variation of threshold velocities and this can be an index of the variation of land surface conditions. Major results are summarized as follows: (1) Both kinds of threshold velocities (i.e., $u_{t5\%}$ and $u_{t50\%}$) are the largest in northern Mongolia. On the other hand, they are the smallest in the Taklimakan Desert.; (2) From the viewpoint of land cover type, both kinds of threshold velocities are the largest in the Grass/Shrub region (northern Mongolia), the next largest in the Semi Desert Shrubs region (Gobi Desert) and the smallest in the Bare Desert region (Taklimakan Desert); (3) The practical threshold velocities ($u_{t50\%}$) are conspicuously larger than those used in simple dust models, which are 6.5 m/sec, in the regions except for the Taklimakan Desert. (4) Differences between threshold velocities (Δu_t) are large in Mongolia and small in the Taklimakan Desert. This result indicates that land surface conditions are largely variable in Mongolia and almost constant in the Taklimakan Desert.

A31B-07 0830h POSTER

A simulation of the Transpacific Transport of Mineral Dust from Asia During Spring 2001: Evaluation of Results from GEOS-CHEM with Ground-based, Aircraft and Satellite Measurements

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Global simulations of the mobilization, transport, and deposition of mineral dust have been conducted using the GEOS-CHEM tropospheric chemistry and aerosol transport model. The simulations are focused on spring 2001, when a major transpacific transport of mineral dust from Asia occurred. The model is used to determine the impact of the Asian dust on aerosol concentrations over North America, and to distinguish the Asian impact from that due to local sources. Results of simulations using alternative dust mobilization schemes are compared and contrasted. The model results are assessed using data from the IMPROVE surface aerosol network over North America, together with in-situ bulk aerosol measurements made over the western Pacific during the 2001 TRACE-P and ACE-Asia aircraft campaigns. In addition, estimates of aerosol optical depth (AOD), diagnosed from the model, are compared with measurements of AOD from the MODIS satellite instrument. The observations provide important constraints to assess the fidelity of model processes. Comparisons with data near source regions focus on estimates of dust mobilization, and on deposition immediately downstream of the source. Comparisons with data at remote locations highlight transport and accumulated deposition processes in the model. The model captures the timing of observed dust mobilization episodes over Asia in Spring 2001 and subsequent transpacific transport. The model shows skill in representing the timing, geographic distribution, and longevity of large localized increases in aerosol concentrations observed at IMPROVE surface sites during April and May 2001. In addition, the model shows skill in capturing mineral dust concentrations measured from aircraft during the TRACE-P and ACE-Asia missions. Comparison with IMPROVE observations also shows simulated features with no apparent basis in the observations, and observed features not captured by the model. These anomalies highlight model limitations, and the attributes that underpin the dust mobilization calculations.

A31C CC: 220 C-E Wednesday 0830h

Atmospheric Chemistry and Aerosol Processes in West Africa: Saharan Dust, Biomass Burning, and Measured Tropospheric Ozone II Posters *(joint with U)*

Presiding: **G S Jenkins,** Howard University**; V Morris,** Howard University**; R Martin,** Dalhousie University

A31C-01 0830h POSTER

Seasonal variation of tropospheric ozone and lightning over the Tropical Atlantic

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The influence of the natural source, 'lightning', on the seasonal variation of the tropical tropospheric ozone over the Atlantic is examined. Most TOMS-derived tropospheric ozone data show that the high value of ozone is found over the Atlantic ocean in the southern hemisphere during DJF, while the low value near West Africa in the northern hemisphere where the biomass burning is widespread during that period. On the other hand, during JJA when the biomass burning region is shifted to the southern hemisphere, the high value of ozone is observed over the Atlantic ocean near the West Africa in the northern hemisphere as well as off the coast of the central Africa. The Empirical Orthogonal Function analysis is applied to the TOMS CCD tropospheric column ozone (1998 $\sim$ 2001), the lightning (1995 $\sim$ 2000) and the aerosol index (1998 $\sim$ 2001) as an alternative data of the biomass burning. The first two EOF modes of the ozone, explaining 82 % of total variance, show the variation related with the tropical ozone maximum during SON and the high value in the southern (northern) hemisphere during winter (summer) season. Moreover, these modes are highly correlated with the first two EOF modes of the lightning, which account for 72 % of total variance. On the other hand, the first EOF mode of the aerosol index, capturing 51 % of total variance, is related with the high aerosol index off the coast of the central Africa (5 $^{\circ}$ S $\sim$ 15 $^{\circ}$ S) during July through October. Also, this mode shows the high aerosol index near the West Africa during December through March, which is the Tropical Ozone Paradox. Furthermore, we found that the horizontal and vertical circulations near the tropical Atlantic are more favorable to lightning than biomass burning for the enhanced tropospheric column ozone.

A31C-02 0830h POSTER

Absorbing aerosol on precipitation: Dynamic aspects in association with CAPE and convective parameterization closure, and dependence on aerosol heating profile

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The Indian Ocean Experiment (INDOEX), conducted from 1995 to 2000 to document aerosols in South Asia during winter monsoon season, revealed the existence of a layer of highly absorbing haze in the lower troposphere. The observed haze has one of the two distinctly different vertical distributions: 1) concentrated in the planetary boundary layer (PBL) below 1.5 km, and 2) elevated profile peaking around 3km. Here, we provide the dynamical basis for understanding the direct effects of absorbing aerosols on the large-scale precipitation and the role of the aerosol vertical distribution. This was done through a series of the South Asian haze experiments with the NCAR Community Climate Model (CCM3), CCM3 with a new convection closure, and the Community Atmospheric Model (CAM2). All of the models have interactive atmosphere and land components, with prescribed sea surface temperatures. As far as the underlying land surface temperature is concerned, the lifted profile creates as much cooling as the vertically uniform haze (i.e., lifted haze extrapolated to the surface), while the PBL profile makes very little cooling. This is well explained by the balance between the near-surface warming effect and the surface cooling effect. The mechanism of the aerosol effect on precipitation distribution is investigated by examining the correspondence between aerosol profile, changes of precipitation and the atmospheric convective instability. The direct heating of the near-surface air in the PBL profile case increases CAPE significantly, and the lifted profile decreases CAPE marginally. On the other hand, the low-level heating of any profile would cause a large-scale rising motion over time, and then increase the CAPE by decreasing the mid-level temperature. Expectedly, the precipitation averaged over the haze area increases a few times more by the PBL profile than by the lifted profile in the CCM3 that uses a CAPE-based closure for the convective parameterization scheme. In the PBL profile case, the maximum precipitation increase area coincides with the maximum of the immediate CAPE increase by the PBL haze heating. As for the lifted profile, the precipitation increase maximum is located somewhat away from the immediate CAPE decrease maximum and the overall precipitation increase is very small. A new closure tries to preserve the environmental CAPE (CAPEe), and in this new closure the haze heating regardless of the vertical profile decreases the CAPEe and creates the precipitation increase maximum away from the maximum of this immediate CAPEe decrease, as does the lifted profile in the traditional closure. Using the traditional closure and the ECMWF reanalyses, we estimate the CAPE change due to the INDOEX haze and thus the precipitation change.

A31C-03 0830h POSTER

Heterogeneous Chemistry on Mineral Dust Surfaces

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Mineral aerosol can affect gas phase chemistry in the troposphere by providing reactive sites for heterogeneous reactions. The influence of mineral dust on the tropospheric photochemical cycle is the subject of our modelling study, carried out with a global general circulation model, which includes modules for aerosols and atmospheric chemistry. The simulations include the reactions between mineral dust aerosols and the gas-phase species, O3, HNO3, NO3, N2O5 and SO2. Furthermore, the sensitivity of this simulation on the range of uncertainty of the single uptake coefficients are tested. The model simulates a decrease in global tropospheric ozone mass by about 5% due to the heterogeneous reactions on dust aerosols. The strongest influence is seen over North Africa, where ozone can decrease locally up to 10 ppbv near the surface. The most important heterogeneous reaction is the uptake of HNO3 on the dust surface. The comparison of the model results to observations indicates that the model simulates well the aerosol mass transported into the Mediterranean during the dust events, and the arrival of all major dust events that have been observed during a 7 month period. The decreases in ozone concentration during dust events is better simulated by the model when the heterogeneous reactions are included.

A31C-04 0830h POSTER

How does African dust influence radiative fluxes over the African Continent and the Atlantic Ocean?

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Under previous effort in the framework of the NOAA/NASA PATHFINDER and EOS Validation in sub-Sahel Africa, work was done that can enable to assess the impact of dust on the radiative fluxes over the African continent and the Atlantic Ocean. Specifically, radiative fluxes at 0.5 degree resolution were derived from the ISCCP DX data, based on METEOSAT and GOES-E observations. Time series that cover at least one decade of satellite based estimates are now