area of irrigated land using mid-infrared and optical bands. Based on this information one can calculate the global areal extent of agricultural land irrigated from impounded water resources. A second approach involves unmixing MODIS data for sub-pixel analysis of small water bodies directly. The MODIS analysis can be "trained" by high-resolution analysis of Landsat TM data, leading to global impounded reservoir area from MODIS without the need for hydrologic land use characterization. In both approaches, water volume can be determined by impounded water area inferred from remote sensing, and typical water depths obtained from local studies. For all reservoirs (big and small) impounded ground water can be estimated using topographic databases, combined with information regarding typical porosities and dam height. Integrating this information with impounded surface water, total increases in water resources can be determined.

B21E-0762 0830h POSTER

Inter-comparison of MODIS and AVHRR NDVI Time Series for Monitoring Terrestrial Vegetation

Brad Reed[1] (605-594-6012; reed@usgs.gov)

John Dwyer[1] (605-594-6060; dwyer@usgs.gov)

[1]SAIC, USGS EROS Data Center, Sioux Falls, SD 57198, United States

The moderate resolution imaging spectroradiometer (MODIS) is NASA's primary Earth observation sensor for global change studies. With the launch of the Terra satellite in 1999 and Aqua in 2002, improved data for land studies of radiation budget, ecosystems, and land cover characteristics, as well as ocean and atmospheric data, became available to scientists. One ecosystem variable that has been extensively used for remote sensing studies of global change is the normalized difference vegetation index (NDVI), a greenness measure that is linearly related to several biophysical measures such as fraction of photosynthetically active radiation (fPAR) and leaf area index (LAI). The value of the NDVI is that it has been calculated for many years from a heritage satellite sensor, the advanced very high resolution radiometer (AVHRR), thus establishing a useful time-series of global change related data. However, due to several differences between MODIS and AVHRR, including sensor radiometery, spectral resolution, and overpass time, direct comparisons and transitions are not readily made. This poster describes a dataset that has been created by the US Geological Survey to facilitate such comparisons and to document and characterize the similarities and differences between the sensors. Early results indicate similar temporal trajectories of the two time-series, but the NDVI from MODIS has generally slightly higher values than that from AVHRR. This indicates that temporal studies between the sensors may not require extensive corrections, but studies concerned with the magnitude of the NDVI will require considerable adjustment. In addition, several metrics derived from the NDVI temporal trajectories may be used to describe and associate the phenologic state of vegetation within the context of regional climatic influences.

B21E-0763 0830h POSTER

Albedo/BRDF Retrievals from MODIS Using 8-day Clear-sky Composites

Yi Luo[1] ((613) 992-8796; yi.luo@NRCan.gc.ca)

Alexander P Trishchenko[2] ((613) 995-5787; Trichtch@nrcan.gc.ca)

Rasim Latifovic[2] (613) 947-1816; Rasim.Latifovic@nrcan.gc.ca)

Zhanqing Li[3] ((301) 405-6699; zli@atmos.umd.edu)

[1]Noetix Research Inc., 265 Carling Ave, Ottawa, ON K1S2E1, Canada

[2]Canada Centre for Remote Sensing, NRCan, 588 Booth Street, Ottawa, ON K1A0Y7, Canada

[3]University of Maryland, 2207 Computer & Space Sciences Bldg, College Park, MD 20742-2425, United States

We present results of retrievals of surface bidirectional reflectance distribution function (BRDF) and albedo properties using MODIS 8-day clear-sky composite product MOD09. The approach is based on simultaneous use of landcover classification and clear-sky composite data products. Surface anisotropic properties derived from MODIS, which is a cross track scanning instrument, are also validated against multiangular observations available from Terra/MISR data. Comparison has been made over the Atmospheric Radiation Measurement (ARM) Program Southern Great Plane (SGP) study area. In general, results compare quite favorably with MODIS BRDF/Albedo product MOD43. This indicates the possibility of surface albedo/BRDF mapping with higher temporal resolution - 8 days instead of 16 days as presently adopted in MODIS data processing. Limitations and consequences of BRDF retrievals using observations available from single sun-synchronous platform are also analyzed. Approach and results for generating 10-day surface albedo/BRDF products using MODIS MOD09 clear-sky composite data will be also discussed. This temporal resolution is required to provide compatibility with other satellite datasets, such as ones available from AVHRR and VGT sensors. This research was supported by the US Department of Energy Atmospheric Radiation Measurement (ARM) Program under grant No. DE-FG02-02ER63351.

B21E-0764 0830h POSTER

New Features of the Collection 4 MODIS LAI and FPAR Product

Tan Bin[1] (+1 617 353 8845; tanbin@crsa.bu.edu); Wenze Yang[1] (+1 617 353 8846; ywze@crsa.bu.edu); Huang Dong[1] (+1 617 353 8846; dh@crsa.bu.edu); Nikolay Shabanov[1] (+1 617 353 5985; shabanov@crsa.bu.edu); Yuri Knyazikhin[1] (jknjazi@crsa.bu.edu); Ranga Myneni[1] (+1 617 353 5742; rmyneni@crsa,bu.edu)

[1]Boston University, 675 Commonwealth Ave., #457, Boston, MA 02215, United States

An algorithm based on physics of radiative transfer in vegetation canopies for the retrieval of vegetation green leaf area index (LAI) and fraction of absorbed photosynthetically active radiation (FPAR) from MODIS surface reflectance data was developed, prototyped and is in operational production at NASA computing facilities since June 2000. This poster highlights recent changes in the operational MODIS LAI and FPAR algorithm introduced for collection 4 data reprocessing. The changes to the algorithm are targeted to improve agreement of retrieved LAI and FPAR with corresponding field measurements, improve consistency of Quality Control (QC) definitions and miscellaneous bug fixes as summarized below. * Improvement of LUTs for the main and back-up algorithms for biomes 1 and 3. Benefits: a) increase in quality of retrievals; b) non-physical peaks in the global LAI distribution have been removed; c) improved agreement with field measurements * Improved QA scheme. Benefits: a) consistency between MODLAND and SCF quality flags has been achieved; b)ambiguity in QA has been resolved * New 8-day compositing scheme. Benefits: a) compositing over best quality retrievals, instead of all retrievals; b) lowers LAI values, decreases saturation and number of pixels generated by the back-up * At-launch static IGBP land cover, input to the LAI/FPAR algorithm, was replaced with the MODIS land cover map. Benefits: a) crosswalking of 17 classes IGBP scheme to 6-biome LC has been eliminated; b) uncertainties in the MODIS LAI/FPAR product due to uncertainties in land cover map have been reduced

B21E-0765 0830h POSTER

Validation of prototype MODIS evapotranspiration (MOD16) in the eastern Asia

Kenlo Nishida (kenlo@sakura.cc.tsukuba.ac.jp)

Institute of Agricultural and Forest Engineering, University of Tsukuba, Japan 305-8572, Tsukuba 305-8572, Japan

The prototype MODIS evapotranspiration (ET) algorithm was tested with ground flux observation network. As a result, the algorithm based on a two-source model and the complementary concept gave almost same accuracy as initially obtained in the north American region on NOAA/AVHRR.

B21E-0766 0830h POSTER

Application of MODIS GPP to Forecast Risk of Hantavirus Pulmonary Syndrome Based on Fluctuations in Reservoir Population Density

Rachel Loehman[1] ((406) 243-5616; rachel@ntsg.umt.edu)

Faith Ann Heinsch[1] ((406) 243-6218; faithann@ntsg.umt.edu)

James N. Mills[2] ((404) 639-1510; jmills@cdc.gov)

Kent Wagoner[2] ((404) 639-1510; kew7@cdc.gov)

Steve Running[1] ((406) 243-6311)

[1]NTSG, College of Forestry and Conservation, University of Montana, Missoula, MT 59812, United States

[2]Special Pathogens Branch, Division of Viral and Rickettsial Diseases, Centers for Disease Control and Prevention, Atlanta, GA 30333, United States

Recent predictive models for hantavirus pulmonary syndrome (HPS) have used remotely sensed spectral reflectance data to characterize risk areas with limited success. We present an alternative method using gross primary production (GPP) from the MODIS sensor to estimate the effects of biomass accumulation on population density of *Peromyscus maniculatus* (deer mouse), the principal reservoir species for Sin Nombre virus (SNV). The majority of diagnosed HPS cases in North America are attributed to SNV, which is transmitted to humans through inhalation of excretions and secretions from infected rodents. A logistic model framework is used to evaluate MODIS GPP, temperature, and precipitation as predictors of *P. maniculatus* density at established trapping sites across the western United States. Rodent populations are estimated using monthly minimum number alive (MNA) data for 2000 through 2002. Both local meteorological data from nearby weather stations and 1.25 degree x 1 degree gridded data from the NASA DAO were used in the regression model to determine the spatial sensitivity of the response. MODIS eight-day GPP data (1-km resolution) were acquired and binned to monthly average and monthly sum GPP for 3km x 3km grids surrounding each rodent trapping site. The use of MODIS GPP to forecast HPS risk may result in a marked improvement over past reflectance-based risk area characterizations. The MODIS GPP product provides a vegetation dynamics estimate that is unique to disease models, and targets the fundamental ecological processes responsible for increased rodent density and amplified disease risk.

B21E-0767 0830h POSTER

Current Status Of MOD17 And What Influence Its Results

Maosheng Zhao[1] (zhao@ntsg.umt.edu)

Steven W. Running[1] (swr@ntsg.umt.edu)

Ramakrishna R. Nemani[1] (nemani@ntsg.umt.edu)

[1]NTSG, College of Forestry and Conservation, University of Montana, Missoula, MT 59812, United States

With the validation of collection3 MODIS data for 2001 and 2002, EOS science team is improving some MODIS algorithms and related ancillary data sets to enhance the accuracy of MODIS products. Now collection4 MODIS data sets are being reprocessed. Here we compare MOD17 collection4 with collection3 globally to see which aspects are improved and what make this happen. Changes in daily meteorological data (DAO) inputs and MOD15A2 (8-day Fpar & LAI) have great impacts on MOD17 results. Globally, latest GEOS4.02 DAO data sets have higher accuracy than previous GEO3.0, which contributes much to MOD17 improvements. Improved MOD15A2 plays an important role in MOD17 improvements for some biomes, such as grass and crop. Furthermore, we find some uncertainties in MOD17, and propose some schemes for future improvements. For example, 1) the DAO boundary lines existing in MOD17 image due to its coarse spatial resolution can be eliminated by spatial non-linear interpolation, 2) the short missing-period and cloud contaminated pixels can be filled by using temporal linear interpolation, 3) unrealistic negative NPP can be solved by using a relatively constant ratio of NPP to GPP. In the end, the improved MOD17 can enhance our abilities to monitor ecological conditions, natural resources, and environment changes.

URL: http://www.ntsg.umt.edu

B21F MCC: Level 2 Tuesday 0830h

The Impact of Dust Emission and Deposition on Biogeochemical Cycling and Ecosystem Function I Posters

(joint with A, H, OS, PP)

Presiding: **G S Okin,** University of Virginia**; N Mahowald,** National Center for Atmospheric Research

B21F-0768 0830h POSTER

Estimate of Nutrient Input to the Pacific Ocean from Long-Range Transport of Aerosols

Steven S Cliff[1] ((530)867-2037; sscliff@ucdavis.edu)

Tony VanCuren[2] ((916)327-1511; rvancure@arb.ca.gov)

[1]Universisty of California, Davis, Department of Applied Science One Shields Avenue, Davis, CA 95616, United States

[2]California Air Resources Board, 1001 I Street, Sacramento, CA 95812, United States

Dust and pollution generation and transport have increasingly become the subject of scrutiny for their impacts on global climate, the ecosystem, and human health. Several recent regional and hemispheric scale campaigns were conducted to better characterize aerosol composition and transport. These campaigns include the 2001 Aerosol Characterization Experiment in Asia (ACE-Asia) and the Intercontinental Transport and Chemical Transformation Experiment of 2002 (ITCT-2K2). In addition, long-term sampling has been conducted at National Parks and Monuments across the United States as part of the Interagency Monitoring of Protected Visual Environments (IMPROVE) program. These data provide a basis for estimating the transport and deposition of atmospheric particulate matter to the northern hemisphere oceans. Here we focus on the aerosol that is generated in Asia (i.e. compositionally distinct from North America and Europe) and transported across the Pacific Basin. The flux of aerosol from the source region from ACE-Asia data combined with data from receptor sites in North America from ACE-Asia, ITCT, and IMPROVE sampling are used to estimate oceanic deposition. A previously identified signature for Asian aerosol (VanCuren and Cahill, JGR December 2003) is used as a marker for transport. Comparison with direct deposition measurements is made.

B21F-0769 0830h POSTER

Estimates of soluble iron from observations and a global mineral aerosol model

Jenny L. Hand[1] (970-491-3699; hand@cira.colostate.edu)

Natalie M. Mahowald[2]

Ying Chen[3]

Ronald L. Siefert[3]

Chao Luo[4]

[1]Cooperative Institute for Research in the Atmosphere, Colorado State University, Fort Collins, CO 80523, United States

[2]National Center for Atmospheric Research, P.O. Box 3000, Boulder, CO 80307, United States

[3]Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science, Solomons, MD 20688, United States

[4]Bren School of Environmental Science and Management and Institute for Computational Earth System Science, University of California, Santa Barbara, Santa Barbara, CA 93106, United States

Desert dust deposition to the ocean may be a significant source of biogeochemically important elements, specifically iron. The bioavailability of iron in the oceans requires it to be in a soluble form, and because atmospheric iron in desert dust is typically insoluble, understanding the atmospheric processes that convert insoluble iron to a more soluble form is essential. Understanding these relationships is especially important in remote ocean regions where iron may be the limiting nutrient. Observations of soluble iron from 2001 cruise-based aerosol measurements in the Atlantic and Pacific Oceans ranged from 0- 49.4% in fine mode (< 3 micrometer in diameter) and 0-95.2% in the coarse mode. Correlations between percent soluble iron with other aerosol species were found for some of the cruises, suggesting iron processing in aerosol solutions may be important. We test two simple hypotheses of soluble iron enhancement using a global model of mineral aerosols. The first method assumes that iron solubility increases as iron is exposed to solar radiation, approximating photoreduction reactions that are important pathways for enhancement of soluble iron. The second process imitates cloud processing of iron by increasing the amount of soluble iron when the mineral aerosol comes into contact with a cloud. Both methods resulted in similar magnitudes of percent soluble iron compared to observations but did not capture specific events, perhaps because the model does not include aerosol interactions between species other than mineral dust.

B21F-0770 0830h POSTER

Impact of air pollution on deposition of mineral dust: Implications for ocean productivity

Song-Miao Fan[1] ((609)452-6569; snf@gfdl.noaa.gov)

Larry W Horrowitz[1] (lwh@gfdl.noaa.gov)

Hiram Levy[1] (hl@gfdl.noaa.gov)

Walter J Moxim[1] (wm@gfdl.noaa.gov)

[1]NOAA GFDL, Princeton University, Forrestal Campus, Princeton, NJ 08544, United States

Atmospheric dust aerosols originating from arid regions are simulated in an atmospheric global chemical transport model. Based on model results and observations of dust oncentration, we hypothesize that Asian dust over the North Pacific is mostly hydrophilic and removed efficiently by both ice and droplet nucleation processes. By contrast, African dust over the tropical Atlantic is mostly hydrophobic and removed by ice, but not droplet, nucleation. We suggest that Asian dust is transformed into hydrophilic aerosols by chemical reactions with air pollutants over East Asia, which produce high levels of readily soluble materials on the surface of dust particles. A model of chemical aging will be presented for the hygroscopic transformation of mineral dust in the atmosphere. The model predicts that evolving air pollution in East Asia could have caused an increase of dust deposition to the coastal oceans off Asia and a decrease by as much as 50 percent in the eastern North Pacific. Insofar as iron from dust deposition fuels diatom blooms in the North Pacific Ocean, this decrease could have potential consequences on ocean biology.

B21F-0771 0830h POSTER

Episodic Dust Passage and Phytoplankton Blooms in North Pacific Ocean

Nicholas Meskhidze[1] (404-385-4405; nmeskhidze@eas.gatech.edu)

William L Chameides[1] (404-894-1749; wcham@eas.gatech.edu)

Athanasios Nenes[1,2] (404-894-9225; nenes@eas.gatech.edu)

[1]Georgia Institute of Technology, School of Earth and Atmospheric Sciences, 311 Ferst Drive, Atlanta, GA 30332, United States

[2]Georgia Institute of Technology, School of Chemical and Biomolecular Engineering, 311 Ferst Drive, Atlanta, GA 30332, United States

Bioavailability of iron (Fe) has been hypothesized to play a key role in limiting phytoplankton productivity in much of the world's ocean, particularly in high-nitrate low-chlorophyll (HNLC) regions such as the subarctic North Pacific. The transport and deposition of mineral dust from arid and semi-arid continental regions is believed to be a major mechanism by which Fe is delivered to the surface waters of the remote ocean. This source of oceanic Fe is particularly vital for HNLC waters of subarctic North Pacific; therefore, it is an appropriate region for examining the effects of episodic dust deposition from the Asian continent on phytoplankton blooms. In this work, satellite imagery is used to identify specific mineral dust events from East Asia, track their trajectories across the Pacific Ocean and determine if the passage of these dust plumes across the North Pacific Ocean can be correlated with the occurrence of a chlorophyll a pulse. Lagrangian box model calculations are also used to estimate the likely input of bioavailable Fe to the surface waters of the North Pacific Ocean during these dust events.

B21F-0772 0830h POSTER

The Speciation and Solubility of Aerosol Iron and Aluminum in the North Atlantic Ocean: Results from the 2003 CLIVAR A16N Expedition

Clifton Stryker Buck[1] (850-644-6753; buck@ocean.fsu.edu)

William M Landing[1] (850-644-6037; landing@ocean.fsu.edu)

Joseph Resing[2] (206-526-6184; resing@pmel.noaa.gov)

Geoffrey T Lebon[2] (206-526-6184; lebon@pmel.noaa.gov)

[1]Department of Oceanography, Florida State University, Tallahassee, FL 32306-4320, United States

[2]Joint Institute for Study of the Atmosphere and Ocean, NOAA/PMEL 7600 Sandpoint Way NE, Seattle, WA 98115, United States

As part of the 2003 CLIVAR cruise in the north Atlantic, we collected 24-hour aerosol samples aboard the R/V Ronald H. Brown leaving Reykjavik, Iceland on June 19, 2003 and arriving in Natal, Brazil on August 8, 2003. The goal of this research was to measure the solubility and speciation of Fe and Al in continental dust, especially as a result of the Saharan dust plume. The cruise track passed directly through the plume as clearly shown by the deposition of red dust on the ship that persisted for several days. Four replicate samples were collected using an automatic sector-controlled aerosol sampling system that collected only when the wind was $\pm$ 90^{o} off the bow of the ship and exceeded 0.5 m/sec. The aerosols were collected on 47 mm PCTE and polypropylene filters for roughly 24-hour periods, filtering as much as 70 m^3 of air through each filter. In addition, we deployed a Multiple Orifice Uniform Deposition Impactor (MOUDI) to collect size fractionated aerosol samples. Surface seawater samples, collected every 60 naut. miles, were processed using cross-flow ultrafiltration to quantify the impacts of soluble Fe and Al deposition on the formation of colloidal species. The polypropylene filters were quickly leached with 100 mL of either freshly collected 0.2 μm filtered surface seawater at natural pH or 100 mL of unacidified ultrapure water that had equilibrated with the atmosphere. Seawater filtrates were analyzed for soluble Fe(II) using the Ferrozine colorimetric method. These samples were also analyzed for total soluble Fe using the ICP-MS isotope dilution method upon returning to FSU. The ultrapure water filtrate samples were frozen until they could be analyzed at FSU for major anions using ion chromotography. The PCTE filters were analyzed for total Fe (and other elements) using energy-dispersive X-ray fluorescence at the NOAA/PMEL laboratory.

B21F-0773 0830h POSTER

The Influence of Eolian Deposition on Dissolved Al and Fe Distributions in the North Atlantic During the CLIVAR A16N Cruise

Chris I Measures[1] (808-956-8693; chrism@soest.hawaii.edu)

William M Landing[2] (850-644-6037; wlanding@mailer.fsu.edu)

Clifton S Buck[2] (850-644-6037; cbuck@ocean.ocean.fsu.edu)

Matthew T Brown[1] (808-956-6032; mbrown@soest.hawaii.edu)

[1]University of Hawaii, Dept of Oceanography 1000 Pope Road , Honolulu, HI 96822, United States

[2]Florida State University, Dept of Oceanography, Tallahassee, FL 32306, United States

Dissolved Al and Fe were determined by shipboard FIA on samples collected from the upper 1000m at 62 stations between 62N and 5S in the Atlantic Ocean during the CLIVAR A16N expedition. Contour plots of the distributions reveal a large number of features which are well resolved by the approximately 1 degree sampling resolution. Surface water distributions show significant inputs of both elements from the deposition of Saharan dust into the waters of the equatorial Atlantic. In addition, a large region of sub-surface Al enhancement is observed between 20N and 35N. A region of enhanced deep water Fe values (up to 2nM) is observed between 20N and 5N underlying the Saharan surface water inputs and coincident with the oxygen minimum underlying the high productivity upwelling zone off NW Africa. Initial interpretations of these features and their implications for our understanding of Fe and Al inputs to the surface ocean and the biogeochemical cycles that remove and recycle them will be discussed.

B21F-0774 0830h POSTER

Characterization of Viable Fungal Spores in PM 2.5 Filter Samples Reaching the Eastern Caribbean

Yasmin Detres[1] (yasmin@cacique.uprm.edu)

Roy A Armstrong[1] (roy@cacique.uprm.edu)

[1]Department of Marine Sciences, University of Puerto Rico, PO Box 9013, Mayaguez, PR 00681

Aerosols from Africa travel across the tropical Atlantic Ocean carrying particulates, microorganisms and other contaminants into the Caribbean region. An air sampling station was installed at Castle Bruce, Dominica on March 31, 2002 and operated continuously until August 1, 2002 for the characterization of fungi species present in the Saharan dust. The sequential air sampler collected PM 2.5 samples, which were subsequently analyzed for fungal spores. The input of aerosols into this region was traced by AVHRR and SeaWiFS satellite imagery as well as by NAAPS and Hysplit models. The climatology of Aerosol Optical Thickness (AOT) data from AVHRR for the study site show higher aerosol concentrations for the period of May through July with peak values during the last week of June. Some filters were used for determination of PM 2.5 concentration by gravimetric analysis. Results ranged from 3.08 to 18.06 ug/m^3. The number of colony forming units in the sampled filters ranged from 0.08 to 2.5 m^{-3} with peak values during the last week of June. Fungal identification to gender level was based on macro and micro morphological features and species characterization was performed using molecular techniques. Among the identified species there are some plant pathogens that affect economically important crops and some human pathogens responsible of serious respiratory diseases. The relation between aerosol optical depth and fungi concentration, as well as the link between these organisms and health issues will be presented.

B21F-0775 0830h POSTER

Airborne Fungi in Sahara Dust Aerosols Reaching the Eastern Caribbean: I. Taxonomic Characterization by Morphological Features

Omayra Rivera-Denizard[1] (ordenizard@hotmail.com)

Carlos Betancourt[1] (beta@stahl.uprm.edu)

Roy A Armstrong[2] (roy@cacique.uprm.edu)

Yasmin Detres[2] (yasmin@cacique.uprm.edu)

[1]Department of Biology, University of Puerto Rico at Mayaguez, PO Box 9012, Mayaguez, PR 00681

[2]Department of Marine Sciences, University of Puerto Rico at Mayaguez, PO Box 9013, Mayaguez, PR 00681

A wide variety of microorganisms are dispersed into the Caribbean region due to the input of Saharan dust aerosols during the summer months. These microorganisms can cause diseases in plants and animals, and might be responsible for an increase incidence of asthma and respiratory diseases in this region. A PM 2.5 air sampling station was installed in Castle Bruce, Dominica from March through July of 2002. Fourteen filters were obtained by running the air sampler continuously for 24 hour periods. The samples were collected in sterile Teflon filters (47 mm in diameter, 0.2 um pore size), inoculated in Malt Extract Agar (MEA) with lactic acid and incubated at 29^{o} C. Colonies were counted, isolated and cultured on separate Petri dishes. Fungal classification to the genus level used macroscopic features and microscopic evaluation. The Nomarski light microscopy technique was used for identification of reproductive structures. A total of 105 colonies were isolated. Six genera including *Aspergillus, Penicillium, Cladosporium, Fusarium, Curvularia*,and *Nigrospora* were identified. The protocol for the molecular characterization to species level is presented as the second part of this work.

B21F-0776 0830h POSTER

Airborne Fungi in Sahara Dust Aerosols Reaching the Eastern Caribbean: II. Species Identification Using Molecular Techniques

Alina De la Mota[1] (a_delamota@yahoo.com)

Carlos Betancourt[1] (beta@stahl.uprm.edu)

Yasmin Detres[2] (yasmin@cacique.uprm.edu)

Roy Armstrong[2] (roy@cacique.uprm.edu)

[1]Department of Biology, University of Puerto Rico at Mayaguez, PO Box 9012, Mayaguez, PR 00681

[2]Department of Marine Sciences, University of Puerto Rico at Mayaguez, PO Box 9013, Mayaguez, PR 00681

Fungi samples from filters collected in Castle Bruce, Dominica from March through July 2002, were previously purified and identified to genus level using classic macroscopic and microscopic techniques. A total of 105 isolated colonies were cultured in liquid media and the mycelial mats used for DNA extraction. PCR was used to amplify the ITS region of the rDNA using the ITS1 and ITS4 primers. Both strands of the amplified products were sequenced and the final identification to species level was completed by a GenBank search. Fourteen different species and one fungal endophyte were identified from genders *Aspergillus*,*Penicillium*, *Fusarium*, *Cladosporium*, *Curvularia* and *Phanerochaete*. Some of these species such as *A. fumigatus*, *A. japonicus*, *P. citrinum* and *C. cladosporoides* are known to cause respiratory disorders in humans. *A. fumigatus* causes an aggressive pulmonary allergic response that might result in allergic bronchopulmonary aspergillosis. Other species such as *F. equiseti* and *C. brachyspora* are plant pathogens affecting economically important crops. Sahara dust is an important source of fungal spores of species that are not common in the Caribbean region.

B21F-0777 0830h POSTER

Trace-Element Evidence for an Aqueous Atmospheric Origin of Desert Varnish: implications for the aqueous atmospheric input flux into the ocean

Nivedita Thiagarajan[1] (nivedita@rice.edu)

Cin-Ty Lee[1] (ctlee@rice.edu)

[1]Rice University, Department of Earth Sciences, MS-126 6100 Main St, Houston, TX 77005, United States

Desert varnish is a slow-growing dark patina commonly found on rock surfaces in arid environments. Varnishes consist of about 30% Mn and Fe oxides accompanied by oxides of Si, Al, Mg, K and Ca, which occur primarily in the form of clays. Although it is generally agreed that varnishes have an atmospheric origin, their exact formation mechanism remains highly debated. Two endmember hypotheses are gradual accumulation of wind-blown dust followed by diagenesis, and direct chemical precipitation of dissolved elements from atmospheric aerosols. To rule out one of these hypotheses, we investigated the trace-element systematics of varnishes, in particular, focusing on those elements that have contrasting solubilities in aqueous environments. If our trace element analyses are consistent with the varnishes being derived from dissolved atmospheric constituents then the data can be used to quantify the paleofluxes of the soluble fraction of atmospheric aerosols to various depositional environments. For example, this will have implications for the transport of metals to the ocean that are immediately biologically available. We collected varnishes deposited on smooth basaltic lava flow surfaces in the Cima Volcanic Field (Mojave Desert) and in Death Valley, California. The chosen lava flows retain original flow surface structure and are topographical highs; the effects of erosion are hence minimal. Varnishes were scraped off with a quartz rod to minimize trace element contamination and the trace element compositions were then determined by ICP-MS using an external synthetic standard for calibration. Our analyses show that the rare-earth elements (REEs), Co, Ni, and Pb are enriched 1.5 to 10 times relative to the upper continental crust (UCC) and that Nb, Ti, Ta, Hf, Th, Rb and Cs are depleted to varying degrees relative to UCC and the REEs. These fractionations can be explained by their differing chemical behaviors in aqueous environments. The extreme depletion in Rb and Cs reflect their high solubilities and tendency to be progressively leached out by rain water. Nb, Ti, Ta, Hf and Th are present only in detrital concentrations, reflecting their high insolublities and their probable depletion in the Fe- and Mn-rich components of the varnish. Co, Ni, Pb and Ce are soluble but readily coprecipitate with Mn oxides hence their 10-fold enrichments. Enrichments caused by diagenesis of dust accreted on the varnish substrate cannot achieve the 10-fold enrichments of some elements observed here, indicating that the aqueous component must be derived directly from the atmosphere. Remarkably, we find that ferro-manganese crusts produced by hydrogenous processes in the marine environment have trace-element abundance patterns nearly identical to those of varnishes. Relative to the upper continental crust, they are enriched in REEs, Co, Ni, and Pb, depleted in Nb, Ti, Ta, Hf, Th, Rb and Cs and are anomalously high in Ce. These unexpected similarities provide additional evidence that desert varnishes represent the direct precipitation of aqueous components in the atmosphere. It may be possible to estimate the aqueous atmospheric input of such trace elements as the REEs into the ocean. For example, multiplying the Nd/Fe and Nd/Mn ratios of the varnishes by estimates of modern day Fe and Mn wet deposition inputs to the ocean yields an oceanic input of 4 to 15 x 107 moles of Nd/year. This is slightly larger than the amount of dissolved Nd entering the oceans each year (2.4 x 106 moles/yr) via rivers, hence, there is a significant atmospheric input of REEs into the ocean in aqueous form.

B21F-0778 0830h POSTER

Dust Deposition and Pedogenic Modification in an Arid Region: Tracing Soil Development with Strontium, Carbon, and Oxygen Isotopes

Angela A. McLain[1] (amcl@unm.edu); Leslie D. McFadden[1]; Yemane Asmerom[1]; Nicu-Viorel Atudorei[1]; Eric V. McDonald[2]; Zachary Sharp[1]

[1]Earth and Planetary Sciences, University of New Mexico, Albuquerque, NM 87131, United States

[2]Desert Research Institute, 2215 Raggio Pkwy, Reno, NV 89512, United States

Numerous studies have shown that accumulation of dust in desert soils is a primary means of pedogenesis in arid regions. Dust deposition is an important factor significantly impacting, among other processes, pavement development, soil water balance and soil infiltration rates, which, in turn, strongly influence vegetation density and distribution. Establishing linkages between the timing and degree of dust deposition and subsequent soil modification with changes in the local ecosystem aid in our understanding of ecological processes and landscape evolution. The Providence Mountains and Cima Volcanic Field in the Mojave Desert, California have been the sites of several important studies concerning the origins of desert pavements, soils, and landscape evolution. More recently we have conducted strontium, and carbon and oxygen isotopic studies of the carbonate fraction in these soils utilizing contrasting parent materials (mixed plutonic and limestone alluvium, basalt flows) and surface ages (mid to late Pleistocene and Holocene) to better understand the sources, changes in composition, and overall impacts of the incorporation of eolian dust on desert soil development. Sr data documents regional differences in dust delivered to the Eastern Mojave area as compared to Southern New Mexico. We document a strong correlation between dust, Av horizon and soil profile composition. Analysis of fine material from the collected dust samples has constrained Sr compositions of dust (87Sr/86Sr = 0.7101 to 0.7107) delivered to the fans and flow surfaces. Comparisons between older and younger surfaces and with the dust data suggest that de-vegetation and de-stabilization of fan surfaces in the Holocene has caused more local recycling of dust in the region. Carbon and oxygen isotopic compositions of soil carbonate enable us to constrain modes and depth of pedogenic carbonate accumulation, and in some cases distinguish between physically recycled carbonate and re-precipitated carbonate. The greatest variability in C and O isotopic data within a soil profile are in discrete nodules (d13C = -4 to +1 and d18O = -8 to 0) indicating a complex formation history. Av horizons (d13C = 0 to +2.5 and d18O = -4) and surficial dust samples (d13C = -4 to +2 and d18O = -7 to -3) contain physically recycled material as well as re-precipitated carbonate. Some soil samples as well as carbonate collars on surface clasts exhibit anomalously high d13C and d18O values which suggests they are forming under non-equilibrium conditions.

B21F-0779 0830h POSTER

Dust or Crust?: Surface Soil Nutrients in the Kalahari

Andrew D. Thomas[1] (+44-161-2471568; a.d.thomas@mmu.ac.uk)

Andrew J. Dougill[2] (+ 44-113-3436782; adougill@env.leeds.ac.uk)

[1]Manchester Metropolitan University, Department of Environmental and Geographical Sciences, Manchester M1 5GD, United Kingdom

[2]University of Leeds, School of the Environment, Leeds LS2 9JT, United Kingdom

The Kalahari covers 2.5 million km2 of southern Africa and consists of 95% fine sand-sized, aeolian-deposited sediment. Soils are predominantly deep, structureless and lacking in N, P and organic matter. Plant available nutrients are concentrated in the top centimetre and thus vulnerable to degradation and transportation by wind erosion. The fertility of Kalahari soils is important for nutritious grass production as livestock grazing remains the predominant livelihood throughout the region. The aim of the research was to investigate the interrelationships between dust, biological crusts, vegetation and disturbance across the Kalahari. Crust, vegetation and surface nutrient characteristics were determined at five locations of different land uses. The spatial and temporal variability of rainfall results in an incomplete vegetation cover and spatially heterogeneous soil nutrients. Our studies show that nutrient heterogeneity is controlled by various factors operating at different scales and is important for ecosystem functioning and degradation vulnerability. At a landscape scale, variability is minimal due to limited topography and a relatively uniform Kalahari Sand cover. At a smaller scale, spatial heterogeneity of soil N and P is also low (11 to 28%) compared to shrublands in the SW United States. Wind erosion is not the principal cause of nutrient heterogeneity because the amount of dust movement and associated nutrient fluxes are low. This is because of an extensive vegetation cover that reduces erodibility and coarse grain sizes, aggregation and biological crusts which reduce surface erosivity. Enrichment occurs under bush canopies due to organic inputs from the vegetation as well as fixation by biological soil crusts that develop preferentially in protected sub-canopy niches. Biological soil crusts are widespread and are able to persist in landscapes where there is a high level of disturbance. However, crust composition is largely restricted to simple Microcoleus spp. Crustal succession is limited by both breakage of crusts and burial by wind blown sediment. In a typical communal grazing area, 48% of the surface was unconsolidated, 44% was crusted and 8% buried crusts compared to up to 95% crust cover in National Parks. Bush sub-canopies are sites of preferential crust development and thus nutrient enrichment, but are also subjected to periodic burial by wind blown dust and plant litter. The overall impact on surface nutrients will depend upon the bush species composition, canopy structure and degree of disturbance.

B21F-0780 0830h POSTER

Soil Properties as Influenced by Dust Emissions

Edward L. Skidmore[1] (785-537-5530; skidmore@weru.ksu.edu)

John Tatarko[1] (785-537-5542; jt@weru.ksu.edu)

[1]USDA-Agricultural Research Service, 1515 College Avenue, Manhattan, KS 66502, United States

Wind erosion selectively removes the most fertile portion of the soil. When sediment balance from wind

erosion is negative, soil quality is impoverished. Our objective was to determine the change in selected soil properties that are measures of soil quality as influenced by dust emissions from wind erosion. We sampled saltation drifts and near surface bulk soil from several recently eroded fields, measured selected soil properties, and compared results from the eroded saltation drifts with the non-eroded bulk soil. We found that sandy loams became loamy sands and loamy sands became sands with 10 to 30% increase of sand in the saltation drift with a corresponding decrease in organic matter and cation exchange capacity. Whereas the texture, organic matter, and cation exchange is not benefited by the millions of tons of nutrient and organic matter enriched soil that is deposited in the road ditches, reservoirs, and oceans. In general, wind erosion degrades soil and lowers its capacity to produce food and fiber needed to sustain an increasing population.

B21F-0781 0830h POSTER

Dust deposition as a nutrient source for fynbos ecosystems, South Africa

Keir Soderberg[1,2] (ksoderberg@sspa.com)

John Compton[1] (compton@geology.uct.ac.za)

[1]Department of Geological Sciences, University of Cape Town, Private Bag, Rondebosch 7701, South Africa

[2]S.S. Papadopulos & Associates, 7944 Wisconsin Ave, Bethesda, MD 20814, United States

Fynbos vegetation is the main component of the Cape Floristic Region that occurs in areas of the southwestern Cape of South Africa. A major question concerning the fynbos ecosystem is how it supports abundant and diverse vegetation on generally nutrient-poor bedrock. As part of a general study of the geochemistry of fynbos ecosystems, dust deposition was found to be the likely source for clay particles in the soil and represent a significant source of nutrients (e.g. K, Al, Ca) to the ecosystem. Mountain fynbos, in particular, occurs in areas underlain by Peninsula Formation sandstone, which is a quartz arenite with greater than 98 wt% SiO2. Elandskloof is a headwater catchment in the Cederberg Mountains with a fynbos ecosystem that is entirely underlain by the Peninsula Formation. The soils in Elandskloof are sandy with an organic carbon content of 1 to 2 wt%. Analysis of the soil mineralogy by X-ray diffraction shows that sand and silt fractions are almost entirely comprised of quartz. The clay-size fraction constitutes approximately 6 wt% of the soil and is dominated by kaolinite. Elandskloof is a headwater catchment and, therefore, the kaolinite could only have come from two sources: the underlying sandstones or the deposition of dust particles. The minor amount of feldspar and clay minerals in the bedrock (0.5 wt% Al2O3) suggests an aeolian source for much of the kaolinite in the soil. In addition, the isotope composition of soluble lead indicates a mixture of terrigenous and anthropogenic sources, most likely from washout of aerosols and dust. In addition to soil mineralogy, evidence for aeolian contributions to fynbos ecosystems comes from the washout effect seen in the chemistry of rainwater samples collected in discrete time intervals throughout a given storm, as well as in the comparison of electrical conductivity with rainfall rates. Over a two-day period (19-21 May 2002), a "berg" wind event was observed in Cape Town in which visibility was reduced by wind blown dust. These winds, occurring a few times each year, originate on the elevated, semi-arid Karoo region of central South Africa, and travel southwest across the Cape Fold Belt where the mountain fynbos ecosystems thrive. The suspended dust of these berg wind events are washed out with the passing of the next winter front and thereby provide an important source of nutrients that, once introduced, the fynbos ecosystem is highly effective in retaining.

B21F-0782 0830h POSTER

The Role of Spatial Variability in Dust and Nutrient Emission in Deserts

Gregory S Okin (434-924-3324; okin@virginia.edu)

Department of Environmental Sciences, UVA, 291 McCormick Rd, Charlottesville, va 22904-4123, United States

Despite the improvement of wind erosion and dust emission models for vegetated surfaces in recent years, little is known about how spatial variability in the landscape influences their location and magnitude. As a result, most current models are highly scale-dependent. A new spatially-explicit wind erosion and dust flux model (SWEMO) allows estimation of wind erosion and dust flux across a landscape by incorporating coarse- and fine-scale spatial variability of pertinent landscape parameters. This approach provides a powerful basis for trying to understand how vegetation and soil interact in the landscape to create the most important dust sources. By explicitly incorporating fine-scale variability a Monte Carlo framework, SWEMO can accommodate the inherently nonlinear nature of wind erosion and dust flux. In particular, results from SWEMO indicate that the variance of cover and plant size parameters exerts primary control on estimates of wind erosion and dust flux. The inclusion of subgridcell variability highlights the importance of small but intense emission surfaces on landscape-scale measurements of dust and nutrient emission and indicates that accurate scale-independent model estimates of dust emission require some knowledge of landscape variability in source areas.

B21F-0783 0830h POSTER

Aerosol Deposition to Hyperarid Soils of the Atacama Desert

Stephanie A. Ewing[1] (510-643-6910; saewing@nature.berkeley.edu)

Brian W. Stewart[2] (bstewart@pitt.edu)

Carol Kendall[3] (ckendall@usgs.gov)

Christoper P. McKay[4] (cmckay@arc.nasa.gov)

Ronald G. Amundson[1] (earthy@nature.berkeley.edu)

[1]University of California at Berkeley, Ecosystem Science Division, ESPM 151 Hilgard Hall #3110, Berkeley, CA 94720, United States

[2]University of Pittsburgh, Department of Geology and Planetary Science 200 SRCC, Pittsburgh, PA 15260, United States

[3]United States Geological Survey, 345 Middlefield Road MS 434, Menlo Park, CA 94025, United States

[4]NASA-Ames, Space Science Division Mail Stop 345-2, Moffett Field, CA 94035, United States

The influence of atmospheric deposition in most soils is difficult to establish due to leaching and biogeochemical transformations. In contrast, the soils of the Atacama Desert in northern Chile reflect a long-term history of atmospheric deposition that is arguably not preserved elsewhere on Earth. In order to determine the mass and origin of salts accumulated, we present isotopic and chemical data for soils and aerosols along a climate gradient from the extreme hyperarid core of the Atacama ($<$ 5 mm y^{-1}), to sites that receive slightly more rain (up to 15 mm y^{-1}). In the driest region, accumulation of aerosol-derived salts has caused nearly 500% volumetric expansion of the soil. Here we focus on the origin of two of the most important salts: gypsum (calcium sulfate) and sodium nitrate. Water-soluble $^{87}Sr/^{86}Sr$ decreases with depth, indicating changing sources of sulfate-associated Ca. Sulfate $\delta^{34}S$ also decreases with depth, indicating either isotopic fractionation with downward transport or changing sources of sulfate with time. Water-soluble $^{87}Sr/^{86}Sr$ values are higher than those reported for local granitic rocks, as might be expected with very limited weathering, and lower than the value reported by Rech et al. (2003) for pedogenic gypsum at a nearby site. While near-surface sulfate $\delta^{34}S$ values imply a marine component, our observed $^{87}Sr/^{86}Sr$ values fall within the range observed for sulfate salts from salars to the east, suggesting that water-soluble soil Ca contains a significant continental component that may increase or vary in origin with depth in the profile (and thus distance of transport). Nitrate concentrations and nitrate $\delta^{15}N$ values increase with depth, as would be predicted by a advection/reaction model of downward nitrate transport. In soils with increasing precipitation, overall nitrate concentrations are dramatically reduced and overall sulfate concentrations decrease, occurring at greater soil depths. In aerosol samples, nitrate is present at concentrations significantly greater than in sea water or in the remote marine boundary layer of the tropical South Pacific, suggesting formation of nitrate from NO_x on sea-salt aerosol. Aerosol sulfate concentrations indicate significant non-sea-salt sulfate, thought to be produced by oxidation of dimethyl sulfide or SO_2. We consider marine upwelling as a possible source of N- and S- containing trace gases, and thus nitrate and sulfate in aerosols and soils, in this remote area.

B21F-0784 0830h POSTER

Unexpected Dominance of Parent-Material Strontium in a Tropical Forest on Highly Weathered Soils.

Carleton R Bern[1,2] (303-236-1024; Carleton.Bern@colorado.edu)

Alan R Townsend[1,2] (303-492-6865; alan.townsend@colorado.edu)

G. Lang Farmer[3] (farmer@terra.colorado.edu)

[1]Institute of Arctic and Alpine Research, Campus Box 450 University of Colorado, Boulder, CO 80309-0450, United States

[2]Dept of Ecology and Evolution, Campus Box 334 University of Colorado, Boulder, CO 80309-0334, United States

[3]Dept of Geological Sciences, Campus Box 399 University of Colorado, Boulder, CO 80309-0334, United States

Controls over nutrient supplies influence the basic structure and function of terrestrial ecosystems. Major plant nutrients supplied by mineral weathering (Ca, Mg, K) can be severely depleted in the highly weathered soils found in the tropics. Some recent studies have shown that as pools of rock-derived nutrients diminish, a transition occurs in which nutrients supplied by dust and precipitation become increasingly important. A state of near complete reliance on the atmosphere can occur on soils after as little as one million years of development. Such studies have relied heavily on strontium as a proxy for the nutrient elements of interest. We investigated sources of nutrients to a tropical forest in Costa Rica growing on a highly weathered soil derived from basaltic parent material 50-70 Ma in age. Base cations, including the strontium tracer, are severely depleted in the bulk and exchange pools of the upper soil profile. The close proximity of the ocean and rainfall in excess of 5m per year provide substantial inputs of atmospheric nutrients. Despite this, isotope ratios (87Sr/86Sr) indicate that >90% of actively cycling Sr is rock-derived. This result cannot be explained by inputs of continental dust, Central American tephra, or decoupling of Sr from the elements it is intended to trace. It places our sites on the opposite end of the transition from what previous studies would predict. Although the precise mechanisms responsible are currently unknown, our data suggest that variations in geomorphological and biological processes across systems with broadly similar climate and geology may lead to considerable variation in the dominant sources of key nutrients.

B21F-0785 0830h POSTER

Transoceanic transport of metals and deposition in the Southeastern United States

Charles W. Holmes (727-803-8747; cholmes@usgs.gov)

U.S.Geological Survey, 600 Fourth Street South, St.Petersburg, FL 33701, United States

Saharan dust is persistently being transported and deposited in ecosystems of the western Atlantic Ocean. Satellite photos reveal that this dust is transported in tropospheric low-pressure waves that cross the central Atlantic Ocean. This dust is an aggregate of clay and quartz particles cemented with iron oxides. Analysis of dust samples collected from Mali (central Africa), the Azores, the Caribbean and the Eastern United States show that metal concentrations are significantly higher than average crustal rocks. Over the past decade, there has been a significant effort to understand the cycling of mercury in south Florida, but other metals has received very little attention. Trace metal measurements on the ombrogeneous sediment formed during the last decade in south Florida indicates that metals can be correlated with aluminum, which is considered a proxy for dust. The largest available aerosol data set is provided by the IMPROVE (Interagency Monitoring of Protected Visual Environments) program. Focusing on arsenic as an example, the average concentration in aerosols collected during this program range from 17 mg/kg in the Virgin Islands to 79 mg/kg at Chassahowitzka, Florida. At Chassahowitzka, most of the arsenic appears to be associated with organic carbon. If it is assumed that the concentrations in Mali dust and in the aerosols in the Virgin Islands are indicative of soil dust, then the higher values at Chassahowitzka are most likely derived from local or regional sources. A simple calculation indicates that African dust supplies about 25 % of the arsenic deposited from aerosols in the southeastern United States. Comparison of the average yearly arsenic concentrations measured in the Virgin Islands and Everglades shows a negative relationship with the North Atlantic Oscillation Index (NAO). This relationship demonstrates the influence of climate on the transport and deposition of aerosols with associated metals to the southeastern United States.

B21F-0786 0830h POSTER

Mass Measurements of Saharan Dust Aerosols in Puerto Rico

Roy A Armstrong[1] (roy@cacique.uprm.edu)

Braulio Jimenez[2] (sailman@coqui.net)

Yasmin Detres[1] (yasmin@cacique.uprm.edu)

[1]Department of Marine Sciences, University of Puerto Rico at Mayaguez, PO Box 9013, Mayaguez, PR 00681

[2]University of Puerto Rico, Medical Sciences Campus, PO Box 365067, San Juan, PR 00936-5067

During the summer months, Saharan dust aerosols reach maximum values throughout the Caribbean Region. The respirable fraction of this dust, measured

as PM 2.5, has the potential to induce regional health impacts, such as asthma and allergic reactions in sensitive individuals. Surface measurements of dust aerosols were obtained at Fajardo, on the northeastern corner of Puerto Rico, since November 2000. The PM 2.5 and PM 10 size fractions from the filter samples were related to satellite and sunphotometer measurements of aerosol optical depth before, during, and after Saharan dust events. In 2002, PM 2.5 ranged from 2.5 to 18.4 ug/m^{-3} while PM 10 ranged from 11 to 60 ug/m^{-3}. The PM 2.5 fraction was approximately 25% of the PM 10. Saharan dust aerosols are also responsible for substantial heavy metal deposition in the tropical western Atlantic. In 2001, Iron increase from less than 4 mg/g during the first four months of the year, to a maximum of 24 mg/g in June, with relatively high values from May through September. An AVHRR 4-year climatology of aerosol optical depth for northeastern Puerto Rico shows a well-defined maximum peak during the last week of June and first week of July.

B21F-0787 0830h POSTER

Geochemical Fluxes Associated With a Long-range Dust Cloud From the Gobi Desert Region, Central Asia.

Christian M Zdanowicz[1] (613-947-5169; czdanowi@nrcan.gc.ca)

Gwendy E Hall[1] (613-992-6425; ghall@nrcan.gc.ca)

Judy E Vaive[1] (613-992-6730; jvaive@nrcan.gc.ca)

[1]Geological Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8, Canada

In early April, 2001, an exceptionally intense series of dust storms originated in the Gobi desert region of southern Mongolia and northern China. The dust cloud generated during these storms was tracked by satellite over the North Pacific Ocean and was detected all across North America. Instrumented floats deployed in the subarctic western Pacific Ocean revealed a near-doubling of the carbon biomass in the mixed layer over the 2-week period following the passage of the dust cloud, illustrating the impact of the dust on biological productivity in the surface Ocean (Bishop et al. 2002, Nature vol. 298). During its passage over northwestern America ca April 13, 2001, the Gobi dust plume deposited a widespread, distinctive layer of yellowish-red dust-laden snow, up to 5-cm thick, in the icefields of the St-Elias mountains, Yukon Territory. The dust fallout was probably enhanced by snowfall scavenging associated with orographic uplift of the moist Pacific air mass over the high mountain range (max elevation 5959 m). Samples of dust-laden snow were collected from a series of sites on the Mount Logan massif (60 N, 140 W), during a glaciological research expedition. The samples, collected between elevations of 2400 and 5340 m, contained as much as 80 ppm (mass) of dust. The dust particles were analyzed in the laboratories of the Geological Survey of Canada to characterize their physical attributes (e.g., grain size distribution) as well as their bulk mineralogical and geochemical composition. The concentrations of over 60 major, minor and trace elements were determined using ICP-MS an ICP-ES, including some important nutrients and biolimiting to biointermediate elements such as P, Si, Ba and Ca. Using these measurements, we calculated first-order estimates of the depositional fluxes for various geochemical elements associated with the Gobi dust fallout. Such detailed compositional data on far-traveled dust clouds are rarely available. We hope our findings presented here will assist researchers engaged in evaluating the potential biogeochemical impact of long-range dust transport events on marine, freshwater and terrestrial ecosystems.

B21F-0788 0830h POSTER

Numerical Modeling of Regional Windblown Dust in the Pacific Northwest:Incorporation of an Improved Dust Emission Model

Irra Sundram[1] (1-509-335-6248; irra_t-mohanasu@wsu.edu); Candis Claiborn[1] (1-509-335-6273; claiborn@wsu.edu); Tara Strand[1] (1-509-335-5738; strand@mail.wsu.edu); Brian Lamb[1] (1-509-335-7632; blamb@wsu.edu); Dave Chandler[2]; Keith Saxton[3] (1-509-335-2724; ksaxton@wsu.edu)

[1]Laboratory for Atmospheric Research, Department of Civil & Environmental Enginnering Washington State University, Pullman, WA 99164, United States

[2]Department of Plants, Soil and Biometeorology, Utah State University, Logan, UT 84322, United States

[3]USDA-ARS, L.J. Smith Hall Washington State University, Pullman, WA 99164, United States

Soil erosion by wind is a serious consequence of dryland agriculture in eastern Washington where the main adverse effects are loss of nutrient rich soil, reduced visibility during dust storms and regional air quality impacts in downwind populated areas. A multidisciplinary research effort to study windblown dust in central and eastern Washington was initiated under the Columbia Plateau PM_{10} (CP^{3}) program. As part of this study, wind erosion and windblown dust emissions were measured in impacted population centers and a transport and dispersion model was developed for the region. The modeling system includes the use of a prognostic meteorological model, Mesoscale Metorological Model Version 5 (MM5), coupled with the CALMET/CALGRID Eularian modeling pair and a new dust emission module (EMIT-PM), developed specifically for this region from extensive soil sampling, portable wind tunnel measurements and intensive field campaigns. Surface wind observations were integrated into the diagnostic meteorological model, CALMET, along with wind fields generated by MM5 for six dust storm events that occurred in November 1990, October 1991, September 1993, November 1993, August 1996 and September 1999. Area dust emissions were generated using the CALMET wind fields along with detailed soil and land use maps in the EMIT-PM model and these hourly, gridded emissions were then used in CALGRID, which calculated hourly averaged concentrations of PM10 (particulate matter of aerodynamic diameter $< 10\ \mu$ m) throughout the modeling domain. The predicted 24-hour average concentrations compared favorably to observed concentrations that were measured at selected locations within the modeling domain. For all the simulated events, with the exception of the August 1996 event, ratios of observed to predicted concentrations were within a range of 0.5 to 6.0. Because these ratios' were obtained without the need for a calibrated dust constant, it appears that the EMIT-PM provides an improved representation of PM_{10} emissions from eroding fields in the Columbia Plateau. The overall robustness of this modeling approach in terms of the computational resources utilized and the prediction accuracy range achieved is encouraging with regards to developing a predictive based system for dust emissions.

B21F-0789 0830h POSTER

Identifying Dust Sources in North Africa and Modeling Patterns of Dust Emissions From These Sources

John Andrew Ballantine[1] ((805) 893-8816; andyb@bren.ucsb.edu)

Gregory S. Okin[2] (okin@virginia.edu)

Dar A. Roberts[1] (dar@geog.ucsb.edu)

[1]University of California, Santa Barbara, Department of Geography University of California, Santa Barbara, CA 93106-4060

[2]University of Virginia, Department of Environmental Sciences 921 McCormick Rd. University of Virginia, Charlottesville, VA 22904-4123

Atmospheric models are requiring more accurate representations of the surface in modeling emissions of dust from the surface and the nutrients attached to fine mineral particles. Regional to continental scale characterization of surface landforms that are susceptible to erosion has become possible with the advent of satellites that monitor the land surface at moderate spectral and spatial resolution (e.g. MODIS). The most productive dust sources in the world are in the Sahara Desert and the Sahel, in areas where human pressures may be making the landscape more susceptible to wind erosion. This project seeks to model dust emissions in the Sahara and Sahel with estimates of surface parameters from satellite imagery and ancillary data. A map of landforms for Africa, north of 10 degrees, was constructed using a multiple endmember spectral mixture analysis (MESMA) of the MODIS 500 meter, 7 band, reflectance product. The magnitude of surface winds acting on the landforms was determined from forecast models. Surface parameters (vegetation characteristics, threshold wind velocity, and grain size distribution) were estimated for the imagery. Estimates of nutrient concentration on Saharan/Sahelian dust were used to estimate nutrient emissions. The results highlight patterns of dust emission from sources in North Africa and are compared with modeled and observed sources in the literature.

B21G MCC: 3014 Tuesday 1020h

Impacts of Biomineralization on Earth Environments II *(joint with A, OS, PP, V, GC, MR)*

Presiding: **L Wasylenki,** Virginia Polytechnic Institute and State University**; P Dove,** Virginia Polytechnic Institute and State University

B21G-01 1020h INVITED

Diatom Production of Opal and the Evolution of Nitrate to Silicic Acid Ratios in the Ocean

Christina L De La Rocha (44 1223 333 479; christina00@esc.cam.ac.uk)

Department of Earth Sciences, University of Cambrdige, Downing Street, Cambridge CB2 3EQ, United Kingdom

Diatoms are highly successful phytoplankton and over the course of appearing and radiating are thought to have caused a drop in marine concentrations of silicic acid on the order of about 1000 μM (Siever 1991). Diatoms deposit opal in their cell wall and so require Si in what is a roughly equal proportion to N. Such a great need for Si should not hamper diatom growth in a Si-rich environment, such as the modern ocean with its average N/Si ratio of 0.6 (tabulated from the >17,000 WOCE stations), well below the 1:1 boundary between eventual N- and eventual Si-limitation. But the deeper pumping of Si than N prior to remineralization from biogenic particles produced in surface waters has pushed the average nitrate to silicic acid ratio (N/Si) of the upper kilometer to 1.4. Values peak around 300 m, and decline both above and below this depth. Average N/Si ratios do not drop below 1 until 800 m, suggesting that, in the absence of nitrate-utilization by non-siliceous phytoplankton, most waters upwelling into the euphotic zone of the modern day ocean contain N and Si in proportions that should be Si-limiting to diatom growth. The average ratio of utilization of N/Si appears to be 1.9, which could correspond to the uptake ratio of Fe-limited diatoms or to a significant proportion of the nitrate being taken up by non-siliceous phytoplankton. This high utilization ratio causes the drop in N/Si above 300 m, but the drop in N/Si below 300 m is due to the more efficient remineralization of N than Si from sinking particles. Despite the high N/Si ratio of surface waters, diatoms are not necessarily faced with Si-limitation as much of the N is taken up instead by non-siliceous phytoplankton. Marine N/Si ratios have been high probably only in the last third of the existence of the diatoms. Prior to the appearance and radiation of the diatoms surface ocean N/Si ratios were likely on the order of 0.02 and from that time have probably risen by a factor of 30 to 70. Now that the N/Si ratio of surface waters exceeds the value of 1, the total amount of Si input to the euphotic zone limits the proportion of available N that can be acquired by diatoms and diatoms may at times experience Si-limitation despite the competition with other phytoplankton for N stocks.

B21G-02 1035h

Relative Impact of Biologically versus Physiochemically Dominated Modes of Mineralization on the Earth's Environment

Brent R Constantz (650-723-8177; brentc@stanford.edu)

Stanford University, Biomechanical Engineering Division, 217 Durand, Stanford, CA 94305, United States

Taxonomic groups forming biominerals that have had the largest impact on the earth's environment may have common styles of mineralization processes. Lowenstam recognized that organisms utilize two principal modes in biomineralization: "biologically-dominated" and "physiochemically-dominated" mineralization. The most prolific mineralizing taxa are: (1) reef framework builders, (2) reef sediment formers, (3) pelagic carbonate formers, and (4) planktonic mineralizers associated with upwelling. Taxa that have had the least impact on the earth's environment are mobile organisms with non-massive, often exceptionally strong skeletons. The prolifically mineralizing taxa (1 -4) have modes of mineralization dominated by physiochemical mineralization processes. The least prolific mineralizers have modes of mineralization dominated by biologically-controlled processes. Examples of biologically-dominated modes of mineralization are the skeletons of mobile echinoderms, mollusks, and arthropods. There are less common sessile examples of these