Aerosol studies were begun on Barbados in 1965 and continue to this day. Over much of this record there was a strong correlation between dust concentrations in Barbados and rainfall in the Sahel-Soudano (SS) region of North Africa. In retrospect this correlation was largely driven by three distinct periods in the early record: the period of high rainfall and low dust transport in the mid-to-late 1960s; the first drought in the early 1970s; and the extremely intense drought of the early 1980s. During this period transport showed promising relationships to various climate indices: e.g., El Niño, NAO, AMO. However, since the early 1990s there have been large year-to-year changes in SS rainfall but there is no consistent relationship to dust on Barbados or between dust and common climate indices. Furthermore, over the entire record there is a strong shift in seasonal dust transport, most notably, a great increase in winter and spring transport compared to the pre-drought and early drought period. These trends seem to suggest that there have been profound long-term changes in dust emissions and transport. A possible contributing factor could be increased population and land use in the SS region. As to the future, the IPCC 2007 multi-model projections of rainfall in Africa show drier conditions in the North but they could not produce a consensus in the SS region. The absence of a clear relationship between dust transport and African-Atlantic climate and the uncertainties in climate projections make it impossible to anticipate how transport to the Caribbean might change in the future.
Being one of the major aerosol types on a global scale, Saharan mineral dust received an increasing amount of attention in the research community during the last decade. This is reflected in a number of large field campaigns performed between Africa and America with different foci. During these campaigns, the mineral dust composition was investigated by a range of techniques, bulk ones as well as single particle measurements.

Three interdependent stages – emission, transport and deposition – affect the composition of the dust. At the emission stage, the composition is dependent on the geological basement, the surface morphological features (depression, glacis) and weathering history. On top of that, even “single” sources like the Bodélé depression may exhibit a significant heterogeneity.

During transport, the composition is modified according to the environmental conditions, but this modification depends additionally on the primary composition. For example calcitic dust is more prone to nitrification than to sulfate processing. The deposition finally may depend on these modifications and the emitted composition. Particularly, the wet deposition may be modified by dust chemistry.

For the dust impact on the atmosphere, as of today iron (direct radiative effects) and soluble matter (cloud effects) are the most important constituents. With respect to the biosphere, mostly contents and availability of iron, phosphorus and calcium are currently discussed. This availability, however, is also dependent on the environmental conditions and may be modified by processing during transport.

This presentation will try to summarize the respective key results during the last decade (e. g., from PRIDE, SHADE, AMMA, SAMUM, GERBILS, amongst others) and try to pinpoint needs for future research.
Atmospheric dust is an important vector for micronutrient addition to the oceans. In the tropical North Atlantic, which receives very large dust inputs from the Sahara, the stimulation of nitrogen fixing organisms may be the most important effect, but elsewhere dust inputs are important for the supply of nutrients for primary productivity. Estimating the magnitude of dust fluxes is therefore an important step in understanding the impact of dust on marine productivity and the associated drawdown of atmospheric CO₂.

Remote islands and coastal stations provide ideal sites for the monitoring of atmospheric dust concentrations over the ocean, with the University of Miami site at Barbados providing the longest such record. These sites can deliver excellent temporal records, but there are very few sites in operation and their distribution is very uneven, so that our understanding of the spatial distribution of dust is very poor indeed in some ocean basins (e.g. the South Atlantic and Indian Oceans).

This presentation will give examples of attempts to estimate dust fluxes over the remote Atlantic from the discontinuous atmospheric measurements available from research ships. Ships can access remote areas and provide much better spatial distribution than land-based sites, but will never yield continuous dust records for a given location. Mechanisms to account for the discontinuous nature of data obtained from ships will be described and their limitations discussed.

Other major uncertainties in this area (estimation of the atmospheric input of soluble iron to the oceans and the difficulties of estimating aerosol deposition rates) will also be considered.
CHEMICAL MODIFICATION OF AIRBORNE MINERAL DUST

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Mineral dust aerosol, i.e. suspended soil particles, can impact a wide range of global processes including the chemistry of the Earth's atmosphere and the Earth's climate. Atmospheric processing of mineral dust through heterogeneous chemical and photochemical reactions can modify the properties of dust particles and thus alter how these particles impact global processes. Using a combined approach of applying state-of-the-art surface sensitive probes, aerosol instrumentation, nanoparticle probes and reactivity studies provides for an understanding of reactions on dust particles and how these reactions can alter the global impacts of mineral dust aerosol. These laboratory studies can provide a conceptual framework from which to understand the details of chemical processes that modify the properties of Saharan mineral dust aerosol as these particles are transported through the atmosphere. In particular, the importance of mineralogy, the link between interfacial chemistry and climate and the specificity of mineral dust aerosol chemistry will be discussed. Examples will be shown that clearly provide evidence to show that mineral dust modifies the chemical balance of the atmosphere through heterogeneous reactions and that heterogeneous reactions modifies the physicochemical properties of mineral dust particles.
REGIONAL MODELLING OF SAHARAN DUST TRANSPORT
TOWARDS THE TROPICAL ATLANTIC

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In the past years the modelling of dust aerosol transport and its climate impact at global and regional scales received considerable attention. However, many aspects of the variability of atmospheric dust loads remain poorly understood. While the physical processes that are responsible for dust emission and deposition are reasonably well known, and parameterizations of soil surface properties controlling dust emissions progressed since the first dust models were published, models of modern atmospheric dust still often show considerable deviations from observations. One cause can be inadequacies in simulated meteorological fields that are used to compute dust emission fluxes. In contrast to global-scale dust models, regional dust models are expected to better reproduce individual dust events due to their higher grid resolution. Still, the representation of dust emission events that are related to precipitation events (haboobs, density currents) is problematic at grid resolutions that require parameterization of wet convection processes. New remote sensing products, together with observations from recent field studies promise an improved understanding of dust regimes and are expected to lead to considerably improved dust models.
THE INFLUENCE OF AFRICAN DUST OUTBREAKS ON ATLANTIC HURRICANES

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Hurricanes are one of the most destructive forces in nature, and an average of eight hurricanes form during each North Atlantic hurricane season, oftentimes making landfall in populated regions. Substantial property damage and loss of life can result from a single landfalling storm, therefore it is not surprising that much effort has gone into the improvement of hurricane intensity forecasts, and the prediction of hurricane activity in a changing climate. As such, understanding how these storms respond, in terms of genesis, track, and intensity, to their local environment is a priority. At the same time it is well known that dust outbreaks from West Africa are a persistent feature of the tropical North Atlantic, and there is a large body of work demonstrating that these mineral aerosols actively shape the structure of the atmosphere through interaction with radiation and as cloud condensation or ice nuclei. Given the sensitivity of hurricanes to—and the influence of African dust on—the environment of the tropical North Atlantic, it is not surprising that there is a growing number of studies suggesting that these mineral aerosols play an active role in directly influencing individual storms, and in indirectly shaping seasonal hurricane frequency and intensity. In this presentation I will review the mechanisms by which African dust may be affecting Atlantic hurricanes, covering processes that operate on time scales of hours, to those that are of decades and longer. I will end with a discussion of work to help quantify the relevance of dust to understanding future hurricane activity.
The air we breathe can contain complex, temporally variable mixtures of airborne particulate mineral matter (PMM) from diverse local and distant sources. In order to understand better the potential health implications of intercontinental dusts transported from distant sources, it is useful to understand their characteristics of potential toxicological concern compared to those of PMM from many other sources. In collaboration with public health scientists, our USGS project has measured toxicologically relevant mineralogical, geochemical, biosolubility, bioaccessibility, and bioreactivity characteristics of diverse geogenic (produced from the Earth by natural processes), geoanthropogenic, and anthropogenic PMM. Many PMM types (desert, intercontinental dusts; wildfire ash; volcanic ash; urban PMM) have abundant respirable particles (<2.5 µm) that can cause respiratory and related cardiovascular health problems. Caustic bioreactive PMM (urban PMM, concrete/cement dusts, ash from fires) can cause acute tissue irritation or damage. Potentially toxic elements (e.g. Cr[VI], Pb, Hg, As, Fe, Mn, etc.) in some PMM types (urban PMM, fossil fuel combustion PMM, fugitive mine dusts, smelter PMM) can be bioaccessible in simulated gastrointestinal and(or) respiratory fluids, and therefore may be taken up by the body. Oxidative stress and lung toxicity may result from release of bioaccessible redox-active elements, or from the body’s reactions to biodurable mineral particles (asbestos, crystalline silica, erionite) that persist in the lungs for decades. African PMM from Mali fine downwind to become predominantly <2.5 µm in Trinidad-Tobago (T-T) and US Virgin Islands (USVI), and contain clays, quartz, Fe-Ti oxides, aluminosilicates, carbonates, and sulfates. Arsenic, cadmium, iron, manganese, and other potentially toxic or redox-active elements show enhanced bioaccessibility in the finer PMM collected in T-T and USVI.
RESPIRATORY HEALTH EFFECTS OF GLOBAL TRANSPORT
OF AFRICAN DUST

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While there has been substantial investigation of how global climate change impacts our ecosystem, there has been less attention to the impact on human health. Over the past several decades, excessively dry conditions and severe dust storms in Africa have resulted in transport of large amounts of dust to North Africa, Europe and the Americas, including the Caribbean. It is estimated that over 20 million tons of dust particles arrive in the Caribbean annually and Barbados, as the easternmost Caribbean island, is among those most affected. This session aims to describe what is known about human health effects of African dust with a focus on respiratory health effects, using research in the Caribbean as a model. Asthma is a major public health problem in Barbados and asthma-related morbidity has been increasing over the last several decades. The rise in asthma prevalence in Barbados has paralleled the increasing particle concentrations from African dust events during this time period. Findings from work in Barbados investigating the impact of African dust on childhood asthma will be shared. Future directions needed to better understand the respiratory health effects of African dust will also be explored.
MIXING STATES OF AFRICAN DUST TRANSPORTED ACROSS THE NORTH ATLANTIC

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Climate forcing properties of African dust during transport in the troposphere, including light scattering and absorption, cloud droplet nucleation and ice nucleation, are dependent on the mixing state of the aerosol. Single particle results from aircraft-based sampling (the recent ICE-T project based in St. Croix as well as PELTI from St. Croix and RICO from Antigua) and from ground-based sampling from Barbados, Bermuda and Antigua show a wide range of mixing states which appear to depend upon multiple factors. These factors are interpreted to include source region, height of transport and degree of mixing with polluted air masses. Aircraft-based observations tend to have a clear advantage over coastal site observations in the well-mixed zone of the MBL where dust can readily aggregate with sea salt. However, aircraft aerosol inlets can at times produce artifact aggregates of sea salt and dust (data from PELTI illustrate this effect). Aggregation of mineral particles varies in different samples and is probably a source effect. Aggregation with sulfate, with or without partial reaction of calcite with sulfate, is common but highly variable and depends upon air mass history. An unusual mixing state observed at a site in Barbados is the presence of Br on dust particles, possibly indicating high altitude transport. The methods used, low dose scanning and transmission electron microscopy, are well suited to analyzing dust mixing states with inorganic species other than nitrate (although TEM can be used for some nitrate species).
SINGLE SCATTERING ALBEDO OF FINE MINERAL DUST AEROSOLS CONTROLLED BY IRON CONCENTRATION

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This paper presents results on the mineralogical and optical properties of suspended fine desert dust samples from Africa, and the Middle East. Optical properties of mineral dust are needed for the modeling of visibility impairment and radiative transfer as input for global and regional climate models. Specifically, single scattering albedo (SSA) is the key parameter determining, in connection with the albedo of the underlying scene, if aerosols contribute to direct radiative cooling or heating. Samples from multiple sources are suspended in the laboratory and their fine portion (i.e., PM$_{2.5}$) is selected by a cyclone with a cut-off of 2.5 μm. The resulting fine dust, relevant for long-range transport, is characterized by real-time instruments and filter sampling. Absorption and scattering coefficients and SSA are measured with dual-wavelength (i.e., 405 and 870 nm) photoacoustic spectroscopy and reciprocal nephelometry. In addition, particle size distribution is characterized with an optical aerosol spectrometer and filter samples are analyzed for elemental composition. The SSA is shown to have a strong linear correlation with the iron content of the sample. This correlation is useful to relate optical and chemical measurement and to contribute to source apportionment and radiative transfer calculations. Specifically, if these results hold in general, satellite measurements of SSA, as planned for NASA’s ill-fated GLORY mission, could yield aerosol iron mass fraction, or in reverse analysis of filter samples with x-ray fluorescence could yield information on aerosol SSA. Results on Ångström coefficients of absorption, scattering, and extinction coefficient and SSA are also presented.
IMPACT OF AFRICAN DUST EVENTS IN THE CHEMICAL COMPOSITION OF CLOUD WATER SAMPLED AT PICO ESTE, PUERTO RICO

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Cloud water samples were collected at Pico del Este (PE) during African dust events. Pico del Este is located in a tropical rainforest called El Yunque National Forest (18°16’ N 65°45’ W), Puerto Rico, at an altitude of 1050 masl. The site is mainly influenced by northeasterly trade winds, bringing clean air from the North Atlantic Ocean. However, it is also impacted by the long-range transport of pollutants from Africa in the summertime. In this study, fog/cloud water was sampled using a compact aluminum version of the Caltech Active Strand Cloudwater Collector (Al-CASCC2). Total and dissolved organic carbon (TOC, DOC), total nitrogen (TN), anions and some metals were quantified. Conductivity and pH was measured in the field. For cloud water the average pH was 5.5, but during dust events pH values were higher (6.5) probably due to higher calcium concentrations. Conductivity measurements ranged from 20 to 70 μs/cm; being higher on dust events. Cloud water, under background conditions, showed average concentrations of all species similar to other remote sites. Nevertheless, changes in the concentrations of some species (e.g. Ca²⁺, Fe, Al) were observed in periods under the influence of long-range transport of pollutants. Air masses bringing dust from Africa enhanced the concentrations from 2 to 4 times compared to periods under the influence of the trade winds. Results suggest that a significant fraction of metals in clouds are associated to airborne particulate matter. Additional results for chemical composition obtained for clouds will be presented.
A-14

UPDATED DUST-IRON DISSOLUTION MECHANISM: EFFECTS OF ORGANIC ACIDS, PHOTOLYSIS, AND DUST MINERALOGY

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Aeolian dust deposition to remote oceanic regions is a major atmospheric supply pathway of essential nutrients (e.g., iron (Fe) and phosphorus (P)) which have a controlling effect on marine primary productivity in nutrient deprived surface ocean waters. Nutrient mobilization from mineral dust is a complex process; in the atmosphere it is thought to be controlled by dust mineralogy, atmospheric chemical composition, and meteorological variables. Here we present results for the global distribution of bioavailable Fe and P concentrations and deposition fluxes using the global 3-D chemistry transport model GEOS-Chem. The model has been updated to include, for the first time, source-specific dust-mineralogy, organic ligand-promoted Fe dissolution, the photolytic redox cycling of Fe(II)/Fe(III), and acid-based P dissolution. Preliminary results indicate that Fe bound in clay minerals and the presence of oxalate can significantly increases soluble Fe production in mineral dust. Photolysis can further increase the amount of soluble Fe by converting Fe(III)-species into the more bioavailable Fe(II) form. Our presentation will cover the potential impact of model-predicted African dust transport and deposition on oceanic primary productivity and ocean-atmosphere feedback processes.
THE EVOLUTION OF THE NORTH AFRICAN DUST PLUME OVER THE PAST 20,000 YEARS

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Seafloor sediments along the northwest African margin record dramatic changes in the North African dust plume since the last glacial period, including large increases in dust emissions during cold events in the North Atlantic and a substantial decrease in emissions associated with the African Humid Period (AHP), a period of enhanced monsoon precipitation from approximately 11,000 to 5,000 years ago. Sedimentary records also suggest that dust emissions are able to change rapidly, even in response to gradual changes in climate forcings. The limited spatial extent of existing data does not allow us to determine whether changes in dust emissions occurred with similar magnitude and throughout northwest Africa; additionally, many records include only dust concentrations in sediments rather than fluxes. Here we present new dust flux records from a meridional transect of cores stretching from 27°N to 19°S along the northwest African margin. By combining grain size endmember modeling with ²³⁰Th-normalized fluxes in these cores, we are able to document spatial and temporal changes in dust loads and grain size distributions within the North African dust plume throughout the last 20,000 years. Our results provide a robust target for modeling efforts aimed at understanding past dust emission changes and quantifying past dust-related climate and biogeochemical impacts.
Quantification of the impacts of African dust on air quality and deposition in the Americas relies heavily on model and satellite-based estimates. We use a suite of satellite observations (MODIS, MISR, CALIOP) to investigate the processes of long range transport of dust represented in the global GEOS-Chem model from source to receptor. The suite of observations is used to develop a climatology of African dust transport, spatially, diurnally, seasonally and interannually and to test the representation of this variability in the model. We particularly focus our investigation on the simulated (and highly uncertain) deposition efficiency of dust across the Atlantic, and the impact of the size distribution of dust on simulated aerosol optical depth (AOD). Finally, we compare simulated dust transported to Barbados with observations and estimate seasonal deposition of African dust to the Amazon.
A-32

LONG-RANGE DUST TRANSPORT AND ITS IMPACT ON US AIR QUALITY

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A module for tropospheric aerosols (the Goddard Chemistry, Aerosol, Radiation, and Transport model, GOCART) has been implemented into Global Forecast System (GFS) at National Centers for Environmental Prediction (NCEP). This new in-line aerosol forecast system (NOAA Environmental Modeling System GFS Aerosol Component, NGAC) is currently being evaluated (the pre-operational experimental phase) and a dust-only NGAC is targeted for operational implementation in early 2012. The new aerosol capability will enable NCEP to produce global short-range aerosol forecasts, provide lateral boundary conditions for regional air quality forecast system, and create aerosol information needed for atmospheric corrections in satellite retrievals. In addition, the inclusion of prognostic aerosols in GFS provides a first step toward an aerosol data assimilation capability at NCEP. Dust-only NGAC experiments for summer 2010 were conducted and provide dynamic lateral boundary conditions (LBCs) for the National Air Quality Forecast Capability (NAQFC). This presentation will give a brief overview on NGAC, present the NGAC simulations of long range transport of Asian dust to the US west coast and trans-Atlantic transport of African dust to the Caribbean and south-eastern US, and discuss the impact of static versus dynamic LBCs on the NAQFC PM predictions over the continental US.
A-34

SAHARAN DUST ANALYSES AND FORECASTS FOR THE AMERICAS

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The Naval Research Laboratory has developed the Navy Aerosol Analysis and Prediction System (NAAPS) which, since 1999, has produced global analyses and 6-day forecasts of sulfate, smoke, dust and sea salt aerosols and visibility. The analysis for initialization is produced by the NRL Atmospheric Variational Data Assimilation System for aerosol optical depth (NAVDAS-AOD), the only operational aerosol data assimilation system. Together, NAAPS and NAVDAS-AOD provide an efficient method for assimilating satellite data (MODIS, Deep Blue, MISR, and CALIPSO) to produce consistent 3-D analyses with significant value to scientists and Air Quality (AQ) decision-makers. The global coverage directly provides quantitative information on the impact of international aerosol particles on the Americas. We describe examples of providing NAAPS analyses to the community via the Federated Data System (DataFed) and the Visibility Information Exchange Web System (VIEWS). Example applications include the interpretation of observations of Saharan dust over N. America and the impact of dust on SST retrievals.
SAHARAN DUST INCURSIONS IN THE CARIBBEAN AND VISITS TO EMERGENCY ROOMS FROM CONGESTIVE HEART FAILURE IN PUERTO RICO

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The Caribbean island of Puerto Rico periodically receives long-range transport of airborne contaminants from desert regions in northern Africa that add to local sources of air pollution. Typically referred to as ‘Saharan dusts’, these natural dust incursions bring extensive plumes of mineral aerosols that raise concerns of public health significance. While most evidence of association between particulate matter and adverse cardiovascular and respiratory health relates to anthropogenic sources of air pollutants less is known about the effects of pollutants from natural phenomena. This study focuses on the cardiovascular effects of such natural episodes. We used a case-crossover design to assess the association between Saharan dust episodes and congestive heart failure events requiring visits to hospital emergency rooms in Puerto Rico. We found an increase in the odds for congestive heart failure events up to three days after the exposure to Saharan dust incursions. In particular, the older age group (over 74 years) showed a higher risk of cardiovascular events requiring a hospital visit (IOR: 1.32; 95% CI= 1.01-1.71) after exposure to Saharan dust incursions. The results of this study suggest that Saharan dust episodes may contribute to the increased risk of visits to hospital emergency rooms due to congestive heart failure in susceptible subgroups of the population. Since dust episodes can be forecast with reasonable accuracy and observed using satellite imagery, alert mechanisms can be issued to warn the population of the possible health effects of these natural events.
For countries in and downwind of arid regions, airborne sand and dust present serious risks to the environment, property and human health. A considerable body of useful atmospheric dust information that is available today and the increased interest of a community at global scale to use such products motivated the World Meteorological Organization (WMO) to launch the Dust Storm Warning Advisory and Assessment System (SDS-WAS) on international scale to develop and implement a system of dust-related research, observations, numerical dust prediction and services. Recent examples of such cooperation are a study of meningitis outbreaks suspected to be driven by dusty weather in Sahel, research related to 4-dimensional assimilation of dust-related observations in numerical models and intercomparison of model results based on observations. The partnerships in SDS-WAS are based on an ‘open-club’ principle. SDS-WAS realizes its goals by networking research institutions, operational centres and users organized through regional nodes assisted by associated regional centres. To coordinate activities at regional levels, regional SDS-WAS centres have been established by now for North Africa/Middle East/Europe and for Asia in Spain and China respectively. Following growing interest and needs of communities in the Americas for better prediction of the dust processes and more accurate assessment of dust impacts on society, environment and climate, an initiative, coordinated by Chapman University, for establishing a Pan-American SDS-WAS centre has been recently launched. This centre is considered to play a role as an information clearinghouse and to facilitate collaboration that will lead to faster transition of dust-related research to applications.
AEROSOL AND OCEAN SCIENCE EXPEDITIONS (AEROSE): ANALYSIS OF DUST OPTICAL PROPERTIES AND THEIR IMPACT ON THE THERMODYNAMICS OF THE SAHARAN AIR_LAYER

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Results from the ongoing PIRATA Northeast Extension (PNE) Aerosol and Ocean Science Expeditions (PNE/AEROSE) – intensive campaigns conducted by the National Oceanic and Atmospheric Administration (NOAA) onboard the NOAA Ship Ronald H. Brown, in collaboration with the Howard University NOAA Center for Atmospheric Sciences (NCAS) will be discussed. AEROSE has acquired one of the most extensive collections of in situ shipboard measurements of the Saharan air layer (SAL) and associated African dust and smoke outflows over the tropical Atlantic Ocean (Nalli et al., 2011 and Morris et al., 2007). Results are presented of the optical and physical properties of mineral dust and their radiative impacts observed during encountered SAL outbreaks. In particular, the extent to which dust aerosols influence the thermodynamic properties of the SAL will be evaluated. The coupled dynamical and thermodynamical properties of the SAL help to determine how it evolves temporally and spatially across the Atlantic. Moreover they determine the SAL’s impacts on tropical weather systems. Consequently, this research may have particular relevance on improving the representation of the SAL and its impact in numerical weather prediction.
TRANSPORT AND PROCESSING OF AFRICAN DUST OBSERVED OVER THE EASTERN CARIBBEAN

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The Barbados Aerosol Cloud Experiment (BACEX) was carried out from 15 March to 15 April 2010 to observe cloud-aerosol interactions associated with precipitating and non-precipitating cumuli over the eastern Caribbean. The principal observing platform for the experiment was the CIRPAS Twin Otter that was equipped with aerosol, cloud, and precipitation probes and standard meteorological instrumentation for observing the mean and turbulent thermodynamic and wind structure. The vertical/horizontal distributions of aerosols observed on the 15 flights show a wide range of aerosol conditions that includes a characterization of the most intense African dust event observed at the Barbados Ragged Point surface site during all of 2010. In this study, we focus on two days of the intense African dust event (1-2 April) when no clouds were observed. The vertical profiles of CCN and CN indicate three layers with distinct aerosol and thermodynamic characteristics. A layer above the trade wind boundary layer (at around 2 km ± 300 m) has the characteristic thermodynamic structure of Saharan Air Layer (SAL) with well mixed potential temperature and mixing ratio. A layer extending from the surface to the about 500 m is well mixed and capped by a stable layer. A third layer extended between the top and bottom layer displays the greatest thermodynamic and aerosol variability. Mixing diagrams using CCN and CN concentrations and conserved thermodynamic parameters provide insight into the vertical transports and mixing processes giving the observed aerosol and thermodynamic variability in each layer.
LONG-RANGE DUST TRANSPORT AND ITS IMPACT ON US AIR QUALITY

Sarah Lu¹,², Youhua Tang¹,², Ho-Chun Huang¹,², Jeff McQueen¹, Arlindo da Silva³, and Mian Chin³

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A module for tropospheric aerosols (the Goddard Chemistry, Aerosol, Radiation, and Transport model, GOCART) has been implemented into Global Forecast System (GFS) at National Centers for Environmental Prediction (NCEP). This new in-line aerosol forecast system (NOAA Environmental Modeling System GFS Aerosol Component, NGAC) is currently being evaluated (the pre-operational experimental phase) and a dust-only NGAC is targeted for operational implementation in early 2012. The new aerosol capability will enable NCEP to produce global short-range aerosol forecasts, provide lateral boundary conditions for regional air quality forecast system, and create aerosol information needed for atmospheric corrections in satellite retrievals. In addition, the inclusion of prognostic aerosols in GFS provides a first step toward an aerosol data assimilation capability at NCEP. Dust-only NGAC experiments for summer 2010 were conducted and provide dynamic lateral boundary conditions (LBCs) for the National Air Quality Forecast Capability (NAQFC). This presentation will give a brief overview on NGAC, present the NGAC simulations of long range transport of Asian dust to the US west coast and trans-Atlantic transport of African dust to the Caribbean and south eastern US, and discuss the impact of static versus dynamic LBCs on the NAQFC PM predictions over the continental US.