H32A-0542 1330h POSTER

Simulating Remediation of CO_2 Leakage from Geological Storage Sites

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One strategy to reduce net greenhouse gas emissions is to inject carbon dioxide (CO_2) deep into subsurface formations where presumably it would be stored indefinitely. Although geologic storage formations will be carefully selected, CO_2 injected into a target formation may unexpectedly migrate upwards and ultimately seep out at the ground surface, creating a potential hazard to human beings and ecosystems. In this case, CO_2 that has leaked from the geologic storage site is considered a contaminant, and remediation strategies such as passive venting and active pumping are needed. The purpose of this study is to investigate remediation strategies for CO_2 leakage from geologic storage sites. We use the integral finite-difference code TOUGH2 to simulate the remediation of CO_2 in subsurface systems. We consider the components of water, CO_2 and air, and model flow and transport in aqueous and gas phases subject to a variety of initial and boundary conditions including passive venting and active pumping. We have investigated the time it takes for a gas plume of CO_2 to be removed from the vadose zone both by natural attenuation processes and by active extraction wells. The time for removal is parameterized in terms of a CO_2 plume half-life, defined as the time required for one-half of the CO_2 mass to be removed. Initial simulations show that barometric pressure fluctuations enhance the removal of CO_2 from the vadose zone, but that CO_2 trapped near the water table is difficult to remove by either passive or active remediation approaches. This work was supported by a Cooperative Research and Development Agreement (CRADA) between BP Corporation North America, as part of the CO_2 Capture Project (CCP), and the U.S. Department of Energy (DOE) through the National Energy Technologies Laboratory (NETL), and by the U.S. Department of Energy under contract DE-AC03-76SF00098.

H32A-0543 1330h POSTER

Modeling CO_2 and Carbon-Isotope Dynamics in a Deep Unsaturated Zone Near Beatty, Nevada

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Natural unsaturated-zone gas profiles at the Amargosa Desert Research Site near Beatty, Nevada show an increase in the partial pressure of CO_2 (PCO_2) from $\sim$36 Pa at the land surface to $\sim$900 Pa at the 110-m deep water table. The CO_2 profiles show generally increasing δ^{13}C values with depth, from a time-weighted-average -18$^o/_{oo}$ in the root zone to -14$^o/_{oo}$ at the water table, and strongly decreasing ^{14}C activities, from 120 percent modern carbon (PMC) in the root zone to 20 PMC at the water table. Field data suggest the presence of two CO_2 sources, one shallow and one deep. The shallow source results from seasonally variable respiration in the root zone. The deep source is located near the water table, and is presumed to represent steady production associated with calcite precipitation. We use a geochemical gas-diffusion model to better quantify CO_2 production and partitioning between shallow and deep sources. The model was developed by coupling the geochemical equilibrium model PHREEQC with a finite-difference gas-diffusion algorithm. The individual isotopic species of CO_2 are treated as separate chemical components that diffuse and react independently. Because shallow and deep sources are isotopically distinct, the measured δ^{13}C and ^{14}C profiles help constrain model solutions. Shallow CO_2 production reflects the isotopic influence of biological processes that include root respiration and metabolism of modern soil carbon. Deep CO_2 production reflects the isotopic composition of old groundwater (20 PMC). Model simulations run to steady state indicate that the shallow CO_2 source from root and microbial respiration comprises $\sim$97% of the total CO_2 annual average production at this arid site. Despite the relatively small contribution from groundwater ($\sim$0.1 mol CO_2 m^{-2} yr^{-1}), upward diffusion from this source strongly influences the distribution of CO_2 and carbon isotopes in the deep unsaturated zone. Transient simulations for seasonally varying soil-respiration rates establish profile-perturbation depths as a function of time for PCO_2, δ^{13}C, and ^{14}C. The new model of carbon-isotopic profiles provides a quantitative understanding of isotopically distinct fluxes prerequisite for analyzing migration of $^{14}CO_2$ from radioactive waste in deep unsaturated zones.

H32A-0544 1330h POSTER

Simulating CO_2 Leakage and Seepage From Geologic Carbon Sequestration Sites: Implications for Near-Surface Monitoring

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The injection of CO_2 into deep geologic formations for the purpose of carbon sequestration entails risk that CO_2 will leak upward from the target formation and ultimately seep out of the ground surface. We have developed a coupled subsurface and atmospheric surface layer modeling capability based on TOUGH2 to simulate CO_2 leakage and seepage. Simulation results for representative subsurface and surface layer conditions are used to specify the requirements of potential near-surface monitoring strategies relevant to both health, safety, and environmental risk assessment as well as sequestration verification. The coupled model makes use of the standard multicomponent and multiphase framework of TOUGH2 and extends the model domain to include an atmospheric surface layer. In the atmospheric surface layer, we assume a logarithmic velocity profile for the time-averaged wind and make use of Pasquill-Gifford and Smagorinski dispersion coefficients to model surface layer dispersion. Results for the unsaturated zone and surface layer show that the vadose zone pore space can become filled with pure CO_2 even for small leakage fluxes, but that CO_2 concentrations above the ground surface are very low due to the strong effects of dispersion caused by surface winds. Ecological processes such as plant photosynthesis and root respiration, as well as biodegradation in soils, strongly affect near-surface CO_2 concentrations and fluxes. The challenge for geologic carbon sequestration verification is to discern the leakage and seepage signal from the ecological signal. Our simulations point to the importance of subsurface monitoring and the need for geochemical (e.g., isotopic) analyses to distinguish leaking injected fossil CO_2 from natural ecological CO_2. This work was supported by the Office of Science, U.S. Department of Energy under contract No. DE-AC03-76SF00098.

H32A-0545 1330h POSTER

Characterization of Soil Moisture Variability Along a Hillslope in a Semiarid Catchment, Dry Creek Watershed, Boise, Idaho

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The spatial and temporal distribution of soil moisture exerts significant control on hillslope hydrologic processes. Recent research has identified the need for soil moisture data collection at the point scale to assist calibration and validation of remote sensing data, to facilitate understanding of soil water fluxes, and for modeling of hillslope hydrologic processes. The objectives of this research were to describe the temporal and spatial distribution of soil moisture in a 0.02 square kilometer semiarid catchment in the headwaters of the Dry Creek basin near Boise, Idaho, and to collect soil water content data to assist the calibration and validation of a shallow soil hydrologic model for forecasting streamflow initiation and hillslope hydrologic processes along the Boise Front, Boise, Idaho. Additionally, the results of the study may be applied to the investigation of shrub encroachment in shrub-grass ecotones along the Boise Front relative to changes in soil moisture. Near-surface soil moisture data was collected using time domain reflectometry (TDR) along a 10 x 20 meter grid in a 0.02 square kilometer catchment (Upper Dry Creek study area) in the Boise Foothills. Results suggest that slope position and shape are the dominant topographic influences on soil moisture at the Upper Dry Creek site. Upper slopes were well drained, and middle to lower slopes represented a convergence of lateral subsurface flow. Soil moisture content on concave and convex slopes was greatest in the middle and lower elevations following snowmelt and in the upper and lower elevations during drydown. Results indicate that lateral unsaturated subsurface flow on steep concave and convex slopes (non-local control) is the mechanism for the distribution of soil moisture in the Upper Dry Creek study area during snowmelt.

H32B MCC: Level 1 Wednesday 1330h

Early Results From NASA's EOS Aqua Spacecraft Mission V Posters

(joint with A, OS)

Presiding: **S M Graham,** NASA Goddard Space Flight Center**; T S Pagano,** Jet Propulsion Laboratory, California Institute of Technology

H32B-0546 1330h POSTER

MODIS Albedo and Surface Reflectance Products From Combined Aqua and Terra Processing

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The combined Terra and Aqua MODIS BRDF/Albedo product (MCD43) has been operational and running in parallel with the standard Terra-only MODIS BRDF/Albedo product (MOD43) since June 2003. The same algorithm is being used to produce both sets of products (BRDF model parameters, white-sky and black-sky albedo, and Nadir BRDF-Adjusted Reflectance (NBAR)) although, in the case of the combined product (MCD43B4), two NBAR values are supplied at each location - one at the mean time of the Terra overpass and a second at the mean time of the Aqua overpass. Initial comparisons demonstrate how the addition of supplementary cloud-free surface observations from Aqua improve the sampling of the surface anisotropy and lead to a larger number of high quality full inversion retrievals across the globe. Presentation of comparisons between Terra-only and the Terra-plus-Aqua albedos and coincident field validation data from the SURFRAD/BSRN tower sites will also be made.

H32B-0547 1330h POSTER

AMSR-E Swath to Grid Toolkit

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The AMSR-E Swath to Grid Toolkit (AS2GT) is a suite of software tools to subset and grid Levels 1b and 2a AMSR-E swath data. Gridding options include control over the map projection, resolution, and dimensions of the output grid, selection of resampling method, choice of how to handle overlapping swaths, and subsetting by time or region. These tools make it easy to process data into custom grids with whatever time or spacial resolution you require. For example you could grid each individual overpass in your field study at full 5 or 10km resolution or you could create 3 day averages for the entire globe at 1/4 degree. AS2GT and its close relative, the MODIS Swath to Grid Toolkit (MS2GT), use the same configuration files to describe

the output grids making it easy to intercompare AMSR-E and MODIS data. The AS2GT package will also handle some forms of SSM/I and SMMR data. New formats are easy to add as the changes are confined to a single ingest routine at the start of processing. Current supported formats include: MSFC SSM/I Brightness Temperatures available from the Global Hydrology Resource Center at http://ghrc.msfc.nasa.gov/ and the reprocessed Level 1b SMMR Pathfinder Brightness Temperatures available from The National Snow and Ice Data Center at http://nsidc.org. These two sources of data combined with the AMSR-E form a continuous time series of freely available passive microwave observations from 1979 to the present. The package can be downloaded from http://nsidc.org/tools/

H32B-0548 1330h POSTER

Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) Validation Data Management at the National Snow and Ice Data Center (NSIDC) Distributed Active Archive Center (DAAC)

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The National Snow and Ice Data Center (NSIDC) Distributed Active Archive Center (DAAC) is supporting the Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) validation activity. NSIDC has designed and developed a web portal to data and information collected during NASA's AMSR-E Validation Program: (http://nsidc.org/data/amsr_validation/.) The AMSR-E validation experiments address three disciplines: soil moisture, rainfall and cryospheric validation campaigns. This poster describes all these experiments (past, present and future). NSIDC provides documentation, e.g., user guides, as well as metadata documents (DIFS) submitted to the Global Change Master Directory (GCMD), for all the AMSR-E validation experiments. NSIDC further supports the validation activities by collaborating with the AMSR-E Science Investigator-led Processing System (SIPS) to provide scientists in the field (e.g., Arctic and Antarctic ship and flight campaigns) with quick, easy access to AMSR-E data for their validation experiments. NSIDC provides subsets of reformatted data in a manner most convenient to the validation scientists while they conduct their experiments. The AMSR-E is a mission instrument launched aboard NASA's Aqua Satellite on 4 May 2002. The Aqua mission provides a multidisciplinary study of the Earth's atmospheric, oceanic, cryospheric, and land processes and their relationship to global change. With six instruments aboard, the Aqua Satellite will travel in a polar, sun-synchronous orbit. NSIDC will archive and distribute all AMSR-E products, including Levels 1A, 2, and 3 data. Users can order Level-1A AMSR-E data beginning 19 June 2003 and Level-2A data beginning 01 September 2003. Other products will be available in March 2004.

URL: http://nsidc.org/data/amsr_validation/

H32B-0549 1330h POSTER

Multi-Sensor Approach to Mapping Snow Cover Using Data From NASA's EOS Aqua and Terra Spacecraft

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Snow cover is an important variable for climate and hydrologic models due to its effects on energy and moisture budgets. Over the past several decades both optical and passive microwave satellite data have been utilized for snow mapping at the regional to global scale. For the period 1978 to 2002, we have shown earlier that both passive microwave and visible data sets indicate a similar pattern of inter-annual variability, although the maximum snow extents derived from the microwave data are, depending on season, less than those provided by the visible satellite data and the visible data typically show higher monthly variability. Snow mapping using optical data is based on the magnitude of the surface reflectance while microwave data can be used to identify snow cover because the microwave energy emitted by the underlying soil is scattered by the snow grains resulting in a sharp decrease in brightness temperature and a characteristic negative spectral gradient. Our previous work has defined the respective advantages and disadvantages of these two types of satellite data for snow cover mapping and it is clear that a blended product is optimal. We present a multi-sensor approach to snow mapping based both on historical data as well as data from current NASA EOS sensors. For the period 1978 to 2002 we combine data from the NOAA weekly snow charts with passive microwave data from the SMMR and SSM/I brightness temperature record. For the current and future time period we blend MODIS and AMSR-E data sets. An example of validation at the brightness temperature level is provided through the comparison of AMSR-E with data from the well-calibrated heritage SSM/I sensor over a large homogeneous snow-covered surface (Dome C, Antarctica). Prototype snow cover maps from AMSR-E compare well with maps derived from SSM/I. Our current blended product is being developed in the 25 km EASE-Grid while the MODIS data being used are in the Climate Modelers Grid (CMG) at approximately 5 km (0.05 deg.) allowing the blended product to indicate percent snow cover over the larger grid cell. Relationships between the percent area covered by snow as indicated by the MODIS data and the threshold for the appearance of snow as indicated by the passive microwave data are presented. Both MODIS and AMSR-E data have enhanced spatial resolution compared to the earlier data sources and examples of how this increased spatial resolution results in more accurate snow cover maps are presented. A wide range of validation data sets are being employed in this study including the NASA Cold Lands Processes Field Experiment undertaken in Colorado during 2002 and 2003.

H32B-0550 1330h POSTER

Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) Product Overview

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The Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) is a mission instrument launched aboard NASA's Aqua Satellite on 4 May 2002. It is a multichannel passive microwave radiometer that is capable of measuring geophysical variables in the global water cycle, such as snow, sea ice, sea surface temperature, precipitation and soil moisture, providing finer spatial resolution than previously possible with spaceborne microwave radiometers. The National Snow and Ice Data Center (NSIDC) Distributed Active Archive Center (DAAC) will archive and distribute all AMSR-E products, including Levels 1A, 2, and 3 data. Users can order Level-1A AMSR-E data beginning 19 June 2003 and Level-2A data shortly after 01 September 2003. Other products will be available in March 2004. This poster provides an overview of each of the AMSR-E data products that are or will be available from NSIDC, including sample images and a description of the processing steps that generate higher level products from the lower level products. For more information about AMSR-E data products available from NSIDC, please see http://nsidc.org/data/amsr.

URL: http://nsidc.org/data/amsr

H32B-0551 1330h POSTER

AMSR Validation Program

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AMSR and AMSR-E are passive microwave radiometers built by NASDA in Japan. AMSR flies on ADEOS II, launched December 14 2001, and AMSR-E flies on NASA's Aqua satellite, launched May 4 2001. The Science teams in both countries have developed algorithms to retrieve different atmospheric parameters from the data obtained by these radiometers. The US Science team has developed a Validation plan that involved several campaigns. In fact most of these campaign have taken place this year: 2003, nicknamed the "Golden Year" for AMSR Validation. The first campaign started in January 2003 with the Extra-tropical precipitation campaign, followed by IOP3 for Cold Lands Processes Experiment (CLPX) in Colorado. After the change out of some of the instruments, the Validation program continued with the Arctic Sea Ice campaign based in Alaska, and followed by CLPX IOP 4, back in Colorado. Soil Moisture EXperiment 03 (SMEX03) started in late June in Alabama and Georgia, and then completed in Oklahoma mid-July. The last campaign in this series is AMSR Antarctic Sea Ice (AASI)/SMEX in Brazil. The major goals of each campaign, and very preliminary data will be shown. Most of these campaigns were in collaboration with the Japanese AMSR scientists.

H32B-0552 1330h POSTER

Sea Ice Surface Temperature From the Moderate Resolution Imaging Spectroradiometer (MODIS)

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Global sea ice products are produced from the Earth Observing System (EOS) Moderate Resolution Imaging Spectroradiometer (MODIS) on board both the Terra and Aqua satellites. Daily sea ice extent and ice-surface temperature (IST) products are available at 1- and 4-km resolution. Validation activities have been undertaken to assess the accuracy of the MODIS IST product at the South Pole station in Antarctica and in the Arctic Ocean using near-surface air-temperature data from a meteorological station and drifting buoys. Results from the study areas show that under clear skies, the MODIS ISTs are very close to those of the near-surface air temperatures with a bias of -1.1 and -1.2°K, and an uncertainty of 1.6 and 1.7°K, respectively. It is shown that the uncertainties would be reduced if the actual temperature of the ice surface were reported instead of the near-surface air temperature. It is not possible to get an accurate IST from MODIS in the presence of even very thin clouds or fog, however using both the Advanced Microwave Scanning Radiometer-EOS (AMSR-E) and the MODIS on the Aqua satellite, it may be possible to develop a relationship between MODIS-derived IST and ice temperature derived from the AMSR-E. Since the AMSR-E measurements are generally unaffected by cloud cover, they may be used to complement the MODIS IST measurements.

URL: http://modis-snow-ice.gsfc.nasa.gov

H32B-0553 1330h POSTER

Above-Cloud Precipitable Water Retrievals Using the MODIS 0.94 μm Band With Applications for Multi-Layer Cloud Detection

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In order to perform satellite retrievals of cloud properties, it is important to account for the effect of the above-cloud atmosphere on the observations. The solar bands used in the operational MODIS Terra and Aqua cloud optical and microphysical algorithms (visible, NIR, and SWIR spectral windows) are primarily affected by water vapor, and to a lesser extent by well-mixed gases. For water vapor, the above-cloud column amount, or precipitable water, provides adequate information for an atmospheric correction; details of the vertical vapor distribution are not typically necessary for the level of correction required. Cloud-top pressure has a secondary effect due to pressure broadening influences. For well-mixed gases, cloud-top pressure is

also required for estimates of above-cloud abundances. We present a method for obtaining above-cloud precipitable water over dark ocean surfaces using the MODIS 0.94 μm vapor absorption band. The retrieval includes an iterative procedure for establishing cloud-top temperature and pressure, and is useful for both single layer water and ice clouds. Knowledge of cloud thermodynamic phase is fundamental in retrieving cloud optical and microphysical properties. However, in cases of optically thin cirrus overlapping lower water clouds, the concept of a single unique phase is ill-defined and depends, at least, on the spectral region of interest. We will present a method for multi-layer and multi-phase cloud detection which uses above-cloud precipitable water retrievals along with several existing MODIS operational cloud products (cloud-top pressure derived from a CO2 slicing algorithm, IR and SWIR phase retrievals). Results are catagorized by whether the radiative signature in the MODIS solar bands is primarily that of a water cloud with ice cloud contamination, or visa-versa. Examples in polar and mid-latitude regions will be shown.

H32B-0554 1330h POSTER

The Two Aerosol Products In The Terra/CERES-MODIS SSF Data: Comparison And Validation

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There are two aerosol products in the Terra/CERES-MODIS Single Satellite Footprint (SSF) data. The first is the standard MODIS aerosol product (over ocean and vegetated land) mapped to CERES footprints. The second is derived over ocean using the two-channel NOAA/NESDIS AVHRR-type aerosol retrieval algorithm with CERES/MODIS clear-sky radiance as input. These two aerosol products will be compared in the paper to help building up the connection and consistency between the advanced MODIS aerosol data and the long-term historical AVHRR aerosol data. They will also be validated against the ground-based AERONET observations. Error sources associated with cloud contamination, surface variability, and aerosol model assumptions in the two products will be evaluated.

H32B-0555 1330h POSTER

CERES Data Products at the LaRC Atmospheric Sciences Data Center (ASDC)

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The experiments on NASA's Terra and Aqua spacecraft are focused on collecting global data sets needed to study the inter-relationships inherent in the Earth's coupled atmosphere-land-ocean system. Data from these experiments will be used to address issues such as the Earth's radiant energy budget, global cloudiness, effects of atmospheric aerosols and land surfaces. This paper will provide a description of the Clouds and the Earth's Radiant Energy System (CERES) data products and associated geophysical parameters available from the Langley Research Center (LaRC) Atmospheric Sciences Data Center (ASDC). CERES uses broadband radiometric measurements in three channels to provide both solar-reflected and Earth-emitted radiation throughout the atmosphere and, in combination with simultaneous measurements from instruments such as the Moderate Resolution Imaging Spectroradiometer (MODIS), to provide new information on cloud properties. CERES data products are designed to provide the most accurately possible estimates of solar and thermal infrared radiative fluxes at the top of the atmosphere, at the surface of the Earth, and at several levels within the atmosphere. The CERES data products contain key surface and atmospheric parameters (e.g., cloud properties, aerosols, water vapor, surface temperature, surface wind speed) that affect the radiative energy. These parameters can be used to facilitate studies of water vapor, aerosol, and cloud feedbacks in the climate system. The spatial scales of the data products range from a single CERES field of view at 20km, to global view (e.g., 1 degree latitude/longitude gridded data over the globe). The time scales range from instantaneous radiative fluxes to 3hourly averages, to daily means, to monthly averages. The Langley Research Center (LaRC) Atmospheric Sciences Data Center (ASDC) playsa major role in enabling basic scientific research by merging data and documentation, thus making information (data and documentation) available to the user community. Information about all of the available CERES data products and how to obtain them can be found at the ASDC web site, http://eosweb.larc.nasa.gov

H32B-0556 1330h POSTER

Simulation of AMSR-E Brightness Temperatures During the 2002 SMEX Experiment

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Soil moisture has been shown to play a significant role in the hydrologic cycle as a boundary condition influencing infiltration, heat exchange and biogeochemical cycles. The launch of NASA's Aqua satellite on 4 May, 2002 provided the first opportunity for high temporal and large scale observation of global-wide soil moisture to be observed. The AMSR-E (Advanced Microwave Scanning Radiometer for the Earth Observing System) instrument onboard Aqua improves the spatial resolution and frequency range of earlier generations of passive microwave instruments. Brightness temperatures are simulated in an attempt to analyze heterogeneity effects and moisture retrieval methods for comparison with available observed AMSR-E data. The Ames, IA portion of the 2002 Soil Moisture Experiments (SMEX02) was successful in observing a large-scale rain event over the region. A semi-empirically-based radiative transfer model is used with the addition of surface and atmospheric parameters collected during the study. A description of the model simulation and heterogeneity effects will be given in addition to moisture retrievals and in-situ comparisons.

H32B-0557 1330h POSTER

Algorithm Refinement for Aqua/AMSR-E Soil Moisture Retrieval

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The Advanced Microwave Scanning Radiometer (AMSR-E) is one of six instruments launched in May 2002 on the Aqua spacecraft as part of NASA's Earth Observing System (EOS). The AMSR-E instrument was developed by the National Space Development Agency (NASDA) of Japan. It operates at six frequencies in the range 6.9 to 89 GHz, with coverage over a wide swath, providing global observations every 2-3 days. The low-frequency data channels provide a capability for estimating soil moisture at a spatial resolution of about 60 km, over land areas of limited vegetation cover, based on use of the 6.9 GHz frequency channels. The initial AMSR-E soil moisture algorithm emphasized use of the 6.9 GHz channels to maximize vegetation penetration while minimizing atmospheric effects. In post-launch evaluations the 6.9 GHz channel data have been found to be contaminated by radio frequency interference (RFI) over many regions, especially in the United States. Calibration biases in the processed sensor data have also hampered use of the low-frequency channel observations over land. Modifications to the soil moisture retrieval algorithm have been made that avoid the RFI problem by using 10.7 GHz and higher frequency data. A revised instrument calibration algorithm has also been imlemented recently by the AMSR-E processing team. Limitations on the soil moisture sensing capability, that result from eliminating use of the 6.9 GHz data, are a reduction of soil moisture sensitivity in vegetated areas and an increase in sensitivity to atmospheric moisture. A benefit is the improved spatial resolution available at 10.7 GHz. Updated AMSR-E soil moisture products using the revised calibration and soil moisture algorithm are currently being generated, and re-evaluations of the products are being carried out. In this paper we provide assessments of the revised products and an outlook on the utility of the AMSR-E soil moisture measurements.

H32B-0558 1330h POSTER

Improved Nighttime and Twilight Polar Cloud Detection Algorithms Using Terra and Aqua Observations

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The Arctic and Antarctic regions play important roles in the global climate system. Accurate detection of clouds over snow and ice surfaces using satellite radiance observations is a crucial first step in determining surface and top-of-atmosphere radiative fluxes. Scene identification during polar nighttime and twilight is challenging, in part, due to the lack of brightness temperature contrast between clouds and surface properties and by the sensitivity of algorithms to large reflectance uncertainties in twilight conditions. Measurements from the Moderate Resolution Imaging Spectroradiometer (MODIS) on board NASA's Terra and Aqua satellites provide valuable new spectral information and enhanced spatial and temporal resolution to study clouds and the surface energy balance at high latitudes. The Clouds and Earth's Radiant Energy System (CERES) nighttime and twilight polar cloud masks were developed and further improved using the MODIS observed Brightness Temperature Differences (BTD) of 3.7 and 11 micron, 3.7 and 12 micron, 6.7 and 11 micron, 8.5 and 11 micron, and 11 and 12 micron. The algorithms use these BTDs, which are combined with other ancillary information such as snow and ice maps from the National Snow and Ice Data Center to determine the presence of snow and ice surfaces. Special sets of tests are applied for regions with very cold surface skin temperatures (i.e., Greenland and the Antarctic plateau). MODIS frequently observes the Earth in "twilight" conditions at high latitudes, especially during spring and autumn seasons. The twilight cloud detection scheme utilizes the reflected solar components at 1.6, 2.1 and 3.75 micron in addition to the BTDs. Comparison of the results from the improved nighttime and twilight polar cloud masks with the Micropulse Lidar (MPL) observations at South Pole and Barrow, Alaska shows good agreement.

H32B-0559 1330h POSTER

Retreival of Carbon Trace Gases From AIRS Data

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Atmospheric Infrared Sounder (AIRS) onboard EOS AQUA platform has capability to retrieve carbon trace gases with particularly distinct signature in the 300-800 hPa region. The current presentation will describe the methodology, limitations and current skills of estimating total column carbon dioxide, profiles of methane and carbon monoxide from AIRS data. Analysis of the preliminary retrieval will be presented with an emphasis to study the diurnal, and zonal variation of these gases over North America and Brazil. A quick look at AIRS CO product shows that it captured some fire signature in September 2002. A brief discussion will be presented comparing the retreived products with other in-situ observation.

H32B-0560 1330h POSTER

Snow and Sea Ice Angular Distribution Model From CERES Radiance Measurements

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Clouds and the Earth's Radiant Energy System (CERES) instruments on Terra that is on a polar orbit are taking measurements of broadband shortwave,

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longwave and window radiances since March 2000. Because the CERES instruments can be operated under the rotating azimuth mode, they can take radiance measurements over snow covered surface from a wide range of viewing angles. Angular distribution models (ADM) for snow and sea ice are developed in order to estimate top-of-atmosphere broadband shortwave and longwave irradiance using measurements by CERES instruments. Because of a large difference of angular dependent radiances, ADM is divided in to three types based on surface type, permanent snow, fresh snow, and sea ice. These ADM types are further divided using MODIS-derived scene type; colocation of MODIS image with CERES footprints provides scene identification of CERES footprints such as cloud, snow, and sea ice fraction over a CERES footprint. The shortwave permanent snow ADM depends on cloud fraction and shortwave fresh snow and sea ice ADMs depend on both cloud fraction and snow and ice fraction. The longwave ADMs depends on cloud fraction, surface temperature, and temperature difference between the surface and cloud top. ADM-derived albedo indicates that albedo over clear sky permanent snow is approximately 0.65 and nearly independent of solar zenith angle. Clouds increase the albedo over permanent snow; all-sky albedo over permanent snow is approximately 0.7. As a part of an internal consistency check of ADM-derived irradiance, ADM-derived irradiances and irradiances computed by integrating measured radiances are compared.

H32B-0561 1330h POSTER

New Angular Distribution Models for Shortwave and Longwave Top-of-Atmosphere Radiative Flux Estimation From the Clouds and the Earth's Radiant Energy System Instrument

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The Clouds and the Earth's Radiant Energy System (CERES) provides highly accurate top-of-atmosphere (TOA) shortwave (SW), longwave (LW) and window (WN) radiance measurements and radiative flux estimates together with coincident cloud and aerosol properties inferred from the Moderate Resolution Imaging Spectrometer (MODIS). These data are needed to investigate the critical role that clouds and aerosols play in modulating the radiative energy flow within the Earth-atmosphere system. To estimate TOA fluxes from measured CERES radiances, one must account for the angular dependence in the radiance field, which is a strong function of the physical and optical characteristics of the scene (e.g. surface type, cloud fraction, cloud/aerosol optical depth, cloud phase), as well as the illumination angle. Because the CERES instrument can rotate in azimuth as it scans in elevation, it is acquires data over a wide range of angles. Consequently, one can construct angular distribution models (ADMs) for radiance-to-flux conversion from the CERES measurements. Furthermore, since CERES and MODIS are on the same spacecraft, the ADMs can be derived as a function of MODIS-based scene type parameters that have a strong influence on radiance anisotropy. This presentation provides a brief overview of the methodology and validation results for a new set of global CERES ADMs developed from two years of CERES measurements on the Terra spacecraft. The uncertainty in regional monthly mean SW and LW TOA fluxes from the new ADMs is less than 0.5 W m-2 based on comparisons with TOA fluxes evaluated by direct integration of the measured radiances. From multiangle CERES radiance measurements, instantaneous TOA flux errors are estimated to be $<$ 10 W m-2 in the SW and $<$ 3.5 W m-2 in the LW. Uncertainties in TOA fluxes from the new CERES ADMs are a factor of 2-5 smaller than those based on ADMs developed during the Earth Radiation Budget Experiment (ERBE). The improved accuracy in the Terra radiative fluxes is essential in studies that examine radiative forcing by cloud type and studies that combine TOA fluxes with surface measurements from specific locations.

H32B-0562 1330h POSTER

Exploring the feasibility of using the MODIS 1 km by 1 km cloud mask product to generate a lower resolution product suitable for use with other instruments (e.g AIRS) on the EOS-Aqua satellite.

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The MODIS Level-2 Cloud Mask Products MOD35_L2 (MODIS -TERRA) and MYD35_L2 (MODIS-AQUA) are available globally day and night at a pixel resolution of 1 km by 1 km. The cloud mask is based on a series of spectral cloud detection tests and estimates the probability of a pixel being clear with varying degrees of confidence (Platnick et al). We attempt to explore the possibility of adapting the MODIS Cloud Mask Product to other instruments on the Terra and Aqua Satellites that have a coarser pixel resolution as compared to the MODIS pixel. From a data center (e.g. GES-DAAC) perspective, this could potentially have a positive impact on the distribution system and better serve end users who require a lower resolution cloud mask product for their applications.

H32B-0563 1330h POSTER

Validation of AIRS Column Ozone Retrievals

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The Atmospheric Infrared Sounder (AIRS) instrument was launched May, 2002 on the EOS Aqua platform. Using cloud-cleared thermal radiance spectra observed in the nadir, global measurements of ozone profiles and column densities have been made twice-daily on a $\sim$45 km footprint using the O_3 ν_1 and ν_3 fundamental bands. We report comparisons of AIRS ozone column retrievals with EP-TOMS measurements between 40° S and 40° N using version 3.1.9 of the AIRS retrieval algorithm.

H32B-0564 1330h POSTER

Comparisons of AIRS retrieved CO & MODIS Fire Counts

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Using data from both EOS Terra and Aqua platforms, we present spatial correlations between carbon monoxide amounts and biomass burning locations. Retrieved tropospheric carbon monoxide comes to us via the Atmospheric InfaRed Sounder (AIRS) onboard Aqua. Fire locations are provided from the Moderate Resolution Imaging Spectroradiometer (MODIS) onboard Terra. Comparing these two products we can begin to quantify biomass burning vs industrial sources of carbon monoxide. Locations of coincident fire and high CO imply sources such as wild fires, where as areas of high CO and no nearby fire indicate industrial sources such as fossil fuel combustion or long range transport. For example on September 6, 2002 high CO and increased fire counts are seen in southwestern Brazil, central southern Africa, eastern Europe, and Borneo. Results for additional days will be presented.

H32B-0565 1330h POSTER

REMOTE SENSING OF SEA SURFACE TEMPERATURE FROM GROUND AND SKY

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A sea surface temperature (SST) retrieval, using a narrow region about 1305 cm^{-1} (7.6 microns), has been developed for the Baltimore Bomem Atmospheric Emitted Radiance Interferometer (BBAERI) as a part of the Atmospheric InfraRed Sounder (AIRS) BBAERI Ocean Validation Experiment (ABOVE) at the Chesapeake Light platform. The BBAERI retrievals and in situ measurements of SST by floating or moored buoys afford a source of validation for global satellite measurements, and in turn, enable a better understanding of global climate change and atmosphere/ocean coupling. Global climate models require sea surface temperatures accurate to within 0.3 K. Difficulty arises when comparing point measurements (buoys) to 2 m single spot measurements (BBAERI) to larger spatial scale observations (1 km MODIS and 13.5 km AIRS). To enable a similar mapping of SSTs around Chesapeake Light, satellite measurements over 20 km are averaged in 1 km range rings and bracketed by the maxima/minima of BBAERI measurements within 1 hour of overpass. Comparison of BBAERI/AIRS on Aqua, and BBAERI/Moderate Resolution Imaging Spectrometer (MODIS) on Aqua and Terra retrieved SSTs agree to within 0.15 K for clear sky cases during Summer/Fall 2002 and Summer 2003.

URL: http://physics.umbc.edu/~mcmillan/ABOVE/index.html

H32B-0566 1330h POSTER

The Testing of AMSR-E Snow Depth and Snow Water Equivalent Estimates in the Northern Hemisphere

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Accurate estimation of snow mass is important for effective characterization of the hydrological cycle at different space and time scales. In the global hydrological cycle, not only does snow constitute a critical seasonal and long-term storage factor but it also affects global climate mass and energy dynamics. Satellite passive microwave observations have been used to estimate global snow depth and snow water equivalent (SWE) since 1979. However, during this time the instruments available have been able to observe snow mass over spatial domains only at regional scales; finer scale observations have not been possible. The Advanced Microwave Scanning Radiometer - EOS launched in 2002 aboard NASA's Aqua platform, has improved spatial resolution capabilities compared with previous passive microwave instruments and, potentially, can be used to estimate snow depth and SWE with increased accuracy at the regional scale. This paper describes refinements to the snow water equivalent products that are being developed for AMSR-E. The baseline retrieval algorithm uses the brightness temperature difference between 18 and 36 GHz channels to estimate snow depth and SWE. Two important refinements under development are described that attempt to better constrain the retrieval algorithm with respect to the effect of grain size and forest cover. Both these factors are known to affect the naturally upwelling microwave radiation from snow. Testing of the refined approach is conducted using daily measurements of snow depth from the World Meteorological Organization (WMO) Global Telecommunications System (GTS) archive. We examine the accuracy of the snow depth estimates at the global scale and also in three regions: Colorado Rocky Mountains, USA, Canadian Prairies and Finland. Each region represents a different "snow regime" and is affected by grain size evolution and forest cover in different ways. Additionally, for each region, WMO/GTS data are augmented by locally

collected ground data to produce a more comprehensive ground test data set. The paper demonstrates the accuracy of the refined AMSR-E product and how important the need is to account for grain size and forest cover effects.

H32B-0567 1330h POSTER

Example MODIS Global Cloud Optical and Microphysical Properties: Comparisons Between Terra and Aqua

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MODIS observations from the NASA EOS Terra spacecraft (launched in December 1999, 1030 local time equatorial crossing) have provided a unique data set of Earth observations. With the launch of the NASA Aqua spacecraft in May 2002 (1330 local time), two MODIS daytime (sunlit) and nighttime observations are now available in a 24 hour period, allowing for some measure of diurnal variability. We report on an initial analysis of several operational global (Level-3) cloud products from the two platforms. The MODIS atmosphere Level-3 products, which include clear-sky and aerosol products in addition to cloud products, are available as three separate files providing daily, eight-day, and monthly aggregations; each temporal aggregation is spatially aggregated to a 1° grid. The files contain approximately 600 statisitical datasets (from simple means and standard deviations to 1- and 2-dimensional histograms). Operational cloud products include detection (cloud fraction), cloud-top properties, and daytime-only cloud optical thickness and particle effective radius for both water and ice clouds. We will compare example global Terra and Aqua cloud fraction, optical thickness, and effective radius aggregations.

H32B-0568 1330h POSTER

An Assessment of the Use of AMSR E 10 GHz Data for Soil Moisture Estimation in SMEX02

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The launch of the Advanced Microwave Scanning Radiometer (AMSR-E) on board the NASA EOS Aqua Satellite has drawn much interest from the scientific community that has been waiting for a low frequency spaceborne microwave radiometer (< 10 GHz) capable of measuring soil moisture. The AMSR-E instrument was developed by the National Space Development Agency of Japan (NASDA) and makes dual-polarized microwave measurements at six frequencies: 6.9, 10.7, 18.7, 23.8, 36.5, and 89 GHz. Early examinations of AMSR-E measurements have shown evidence of extensive Radio-Frequency Interference (RFI) in the 6.9 GHz channels, especially over the continental U.S. Due to the contamination of 6.9 GHz data by RFI, it may be necessary to use the next lowest frequency, 10.7 GHz, for soil moisture retrieval. This frequency has been available on the TRMM Microwave Imager for several years; however, the TRMM sensor only provides data between 38 N to 38 S in latitude whereas AMSR-E provides global coverage. We examined the impact of alternative frequencies on soil moisture retrieval using data from the Soil Moisture Experiments in 2002 (SMEX02). SMEX02 took place in Walnut Creek Watershed and surrounding region of Iowa from June 24 to July 12. The experiment focused on microwave remote sensing of soil moisture in an agricultural setting. Land cover in the Walnut Creek Watershed consists of a patchwork of corn and soybean fields, with some isolated forested zones. This presents a challenge to soil moisture retrieval using AMSR-E 10 GHz data. Extensive vegetation sampling was conducted during SMEX02 to provide information to estimate vegetation parameters required by retrieval algorithm. The maps of AMSR-E 10 GHz data over the SMEX02 area from July 2 to 13 show the decrease of brightness temperature (TB) due to precipitation, although the range is not as profound as expected at L band. The Normalized Difference Polarization Index (NDPI), defined as (TBv-TBh)/(TBv+TBh), computed for various frequencies can be considered as indicators of surface vegetation conditions and soil moisture. The plots of NDPI at 10.7, 18.7 and 36.5 GHz over the SMEX02 area show distinct differences between 36.5 and 10.7 and 18.7 GHz data. This study aims to explore the use NDPI at different frequencies in estimating soil moisture from a densely vegetated area at the AMSR-E 10 GHz footprint scale.

H32B-0569 1330h POSTER

Spatial-Spectral EOF analysis of AIRS data: an exploratory study

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We apply spatial-spectral EOF analysis to 14 days of AIRS (Atmospheric Infrared Sounder) calibrated radiance data collected over the tropics and subtropics (32S to 32N) from July 1 to July 14, 2003. We limit our analysis to the nadir-view (scan angle less than 5^{o}) spectra only. After the quality control procedure, we have an average of 1400 spectra over this period for each 4^{o} by 5^{o} grid box. We obtain a 14-day averaged spectrum for each grid box and apply EOF analysis to these averaged spectra to obtain principal components in spectrally resolved radiance and associated spatial patterns. The first principal component (PC1) can explain more than 90% of the total variance. With the second principal component (PC2), these two leading principal components can explain more than 99% of the total variance. The PC1 spectral features are consistent with spectral features due to the change of surface (or cloud deck) emission temperature. A couple of features can be clearly seen in the PC1 spatial map: ITCZ due to the low emission temperature of optically-thick high cloud, Sahara due to the high surface emission temperature and the clear sky. The spatial map of PC1 closely resembles that of NCEP/NCAR reanalysis of outgoing longwave radiation over the same period. It is also highly correlated with the map of high cloud amount. Both the spectral features and spatial map indicate that the PC1 is mainly due to the spatial variation of cloud emission temperature (for grid boxes with the optically thick clouds) and surface temperature. The PC2 shows spectral features similar to those due to the change of the optical depth of low clouds. Moreover, the PC2 spatial map shows maxima near the coasts of Peru, Namibia and California, as well as over the southern ocean west of Australia. All these regions are known for high frequency of marine stratus. Unlike the traditional approach of observing low clouds from the visible reflectance, these results indicate that we can actually see variations related to low clouds from AIRS infrared data. The PC2 spectral shape also shows contributions from the stratosphere. This demonstrates that AIRS data, with its good quality and dense sampling patterns, can be a useful dataset for future validation and development of general circulation models.

H32B-0570 1330h POSTER

Global Survey of 6.9 GHz Radio Frequency Interference and Implications for Future Remote Sensing

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The AMSR-E instrument on the AQUA platform affords a nearly unprecedented opportunity to monitor the Earth at the 6.9 GHz microwave band. In this respect, AMSR-E prefigures other instruments that will extend microwave remote sensing to even lower frequencies. These measurements have already proven useful for investigations of sea surface temperature and soil moisture. Unfortunately, expanding use of this band for telecommunications is increasingly leading to Radio Frequency Interference (RFI) conflicts with remote sensing needs. Drawing on an archive of more than one year of AMSR-E data, we present a global survey of RFI sources, focusing on both spatial and temporal characteristics. In many cases, RFI is easily recognizable either due to its intensity or its correlation with known population centers. While the obvious RFI, (almost all of which is over land), can be disregarded in studies of natural phenomena, the challenge is to identify RFI when the signature is not obvious. This discrimination will provide the dual benefits of salvaging data that would otherwise be discarded, while ensuring that only untainted data is used for studying natural phenomena. This paper explores several criteria that may be used for this purpose.

H32B-0571 1330h POSTER

Aqua MODIS and AIRS Products Available from NASA GES DAAC

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The Moderate Resolution Imaging Spectroradiometer (MODIS), the key instrument of the NASA Earth Observing System (EOS), and the Atmospheric Infrared Sounder (AIRS), a high-resolution infrared sounder closely coupled with the AMSU-A (Advanced Microwave Sounding Unit-A) and HSB (Humidity Sounder for Brazil), were launched aboard the Aqua satellite on May 4, 2002 (1:30 pm equator crossing time, ascending). The suite of Aqua instruments, together with those on the Terra satellite (launched on December 18, 1999), enable the global monitoring of the atmosphere, the terrestrial ecosystems, and the oceans, and will provide long-term data sets for the same geophysical parameters needed for climate and global change studies. MODIS has a 2330 km viewing swath width and provides data in 36 spectral bands between 0.415 and 14.235 micron, with spatial resolutions of 250 m (2 bands), 500 m (5 bands), and 1000 m (29 bands). Improving upon heritage sensors, MODIS provides better sensitivity, finer spatial resolution, and new channels, yielding unprecedented volume of information on Earth's atmosphere and surface. The 2378-channels AIRS, on the other hand, together with AMSU-A and HSB, constitute an innovative atmospheric sounding group of visible, infrared, and microwave sensors that measures temperature at an accuracy of 1^{o} K in layers 1 km thick, and humidity with an accuracy of 20% in layers 2 km thick in the troposphere. Thus, while the scope of MODIS is the details of the Land and Ocean surfaces and the total atmospheric column, AIRS mission is to better understand the vertical atmospheric structure. The NASA Goddard Earth Sciences Distributed Active Archive Center (GES DAAC), seen as "GSFC-ECS" in the Earth Observing System Data Gateway,currently distributes three major groups of MODIS data: Level 1 Radiometric and Geolocation, and all levels of Atmosphere and Ocean data. The MODIS Atmosphere data types are Aerosols, Water Vapor, Clouds, Profiles, and Cloud Mask. The MODIS Ocean data types include Normalized Water Leaving Radiances, Ocean Color, Sea Surface Temperatures, and Ocean Primary Productivity (OPP). The AIRS/AMSU-A/HSB products include Level 1B radiances and, and planned to be released soon, retrieved Level 2 atmospheric parameters and profiles such as temperatures, humidity, cloud, water vapor, and ozone. The MODIS and AIRS Data Support Teams were established at the GES DAAC to provide end-to-end support to users in navigating through the complex structure of MODIS and AIRS information. In spite of instrument specifics, MODIS and AIRS offer similar products in number of cases. Our goals are: to understand the similarities and differences between comparable geophysical products from the two instruments and guide Users through it; to explore the potential benefits of combined use of MODIS and AIRS data, as well as cross-instrument validation and ancillary data substitution.

URL: http://daac.gsfc.nasa.gov/MODIS/, http://daac.gsfc.nasa.gov/atmodyn/airs/index.html

H32B-0572 1330h POSTER

ABOVE03, The 2003 AIRS BBAERI Ocean Validation Experiment: AIRS Validation and Aerosols

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From May 28 to July 9, 2003, a complementary set of instruments was deployed to the United States Coast Guard (USCG) Chesapeake Light lighthouse platform to provide correlative measurements characterizing the atmosphere and sea surface over the ocean for validation of NASA's Atmospheric InfraRed Sounder (AIRS) onboard the Aqua satellite. Located 25 km due east of Virginia Beach, VA, Chesapeake Light offers a relatively convenient site for measurements over the ocean while being far enough offshore for water only AIRS fields of view. In addition to the UMBC Baltimore Bomem Atmospheric Emitted Radiance Interferometer (BBAERI), the UMBC Elastic Lidar Facility (ELF), and Vaisala RS-90 rawinsondes used during ABOVE02, we deployed in situ O_3 and CO gas analyzers and during the first three weeks, flew 18 ozonesondes in collaboration with Dr. Mike Newchurch, UAH. A total of 140 Vaisala RS-90 radiosondes were launched covering 61 Aqua and 12 Terra overpasses. Preliminary comparisons of ABOVE03 data products to AIRS observations and retrievals will be presented. Particular attention will be paid to both AIRS and ground-based aerosol observations.

URL: http://physics.umbc.edu/~mcmillan/ABOVE/index.html

H32B-0573 1330h POSTER

Validation of Aqua AMSR-E Ocean Surface Wind Speeds

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Global ocean surface wind speeds are a valuable geophysical product obtained from observations made by the Advanced Microwave Scanning Radiometer for the Earth Observing System (AMSR-E) on the Aqua spacecraft. Remote Sensing Systems also produces ocean wind speeds for SSM/I and TMI using the same physically based model. The sun asynchronous coverage of the TRMM TMI is used to obtain close collocations with AMSR-E winds. Preliminary reports of 3-month comparisons showed rms statistics of 0.5 m/s. This good agreement of AMSR-E with other radiometers is confirmed in more comprehensive radiometer and scatterometer intercomparisons reported here. In addition to these instrument validations, we report on AMSR-E wind speed validations using open-ocean NDBC, PIRATA, TAO and Canadian moored buoy data. Overall statistics and specific examples are used to demonstrate the quality of the AMSR-E winds.

H32B-0574 1330h POSTER

Infrared Atmospheric Spectroscopy using AIRS

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The high radiometric accuracy of the Atmospheric Infrared Sounder (AIRS) on AQUA, coupled with it's high spectral resolving power of $\sim$1200 has provided a very demanding dataset for testing the accuracy of clear air atmospheric radiative transfer models and their associated spectroscopy. Since AIRS uses a physical retrieval, the accuracy of the AIRS products are directly dependent on the accuracy of the forward radiative transfer algorithm (RTA). Extensive validation of the AIRS RTA using dedicated radiodsonde launches and the European Center for Medium Range Forecasting (ECMWF) model data has highlighted several shortcomings in the spectroscopy used in the AIRS RTA, especially with regard to carbon dioxide lineshape and the water vapor continuum. Reanalysis of existing laboratory spectra of carbon dioxide and a recent analysis of DOE ARM measurements of high spectral resolution down-welling radiance using the AERI radiometer largely confirm the AIRS validation results. Together these studies will provide the community with significantly improved clear air spectroscopy that will potentially impact a wide range of infrared remote sensors. A by-product of this work is the creation of a large 1-year dataset of nominally clear AIRS FOVS over ocean that may prove useful for a wide range of atmospheric studies.

H32B-0575 1330h POSTER

Multiparametric Airborne Radar observations of the melting layer during the Wakasa Bay Experiment and compairson to passive radiometric brightness temperatures

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The NASA/JPL airborne precipitation radar APR-2 (dual frequency - 14 and 35 GHz, Doppler and dual polarization) was operated on the NASA P-3 aircraft during the Wakasa Bay (Japan) experiment. The experiment conducted jointly by the U.S. AMSR-E and Japanese AMSR teams in Jan/Feb 2003, was designed to (1) validate both the AMSR and AMSR-E shallow rainfall and snowfall retrieval capabilities (2) extend the database of rainfall properties needed to implement a comprehensive physical validation scheme, and (3) extend our understanding of rainfall structures through the use of new remote sensing technology. On 12 flights, more than 30 hours worth of precipitation systems were observed, including rain and snow events, both over ocean and over land. The statistics of several melting layer parameters derived from the multiparametric radar observations of two stratiform rain events are presented and compaired to measured passive radiometric brightness temperatures.

H32B-0576 1330h POSTER

Examination of AIRS Validation Data

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Since June 2002, the Upper Air Instrumentation and Research Programs (UAIRP) group located at NASA Wallops Flight Facility, Wallops Island, Virginia has been conducting regular correlative measurements for Aqua/Atmospheric Infrared Sounder (AIRS) validation. Balloon-born instrumentation includes: electrochemical concentration cells (ECC) to determine ozone distribution, chilled mirror hygrometers to measure relative humidity, accurate temperature measurement radiosonde (ATM) for temperature measurements and accompanying standard radiosonde data. Each of these methods yields results with roughly ten meter vertical resolution. These measurements have been obtained approximately weekly at Wallops Island, Virginia, Natal, Brazil, and Ascension Island. Additional measurements have been taken during limited campaigns at Andoya, Norway and Andros Island, the Bahamas. The validation data is compared to AIRS retrieved measurements of ozone, humidity, and temperature. Differences in the data sets are examined for spatial, temporal, and seasonal dependencies.

H32B-0577 1330h POSTER

The Effects of Sea Surface Temperatures on North American Monsoon Rainfall in 2003

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Sea surface temperature (SST) is recognized as important to atmospheric circulation from decadal to seasonal scales. In this research, the effects of SSTs on rainfall from weekly to monthly are numerically tested using mesoscale model NCAR/PENN MM5 during North American monsoon (NAM) season in year of 2003. For emphasis of the relative importance on SSTs, different types of SSTs are employed as sensitivity tests. These SSTs include Reynolds 1o by 1o weekly SST, FNL 1o by 1o skin temperature, and Aqua SSTs that include mid-infrared (IR) channels and thermal IR channels retrieved SSTs. The preliminary results show that, when high-resolution MODIS SST was used, the precipitation was much improved, especially over tropical oceans and western Mexico costal. Over the US inland, precipitation was also changed when SST changed. The effect of SST on precipitation lags 3-4 days over costal area and 5-7 days over inland. It could be concluded that SST is important to weakly, monthly scales in mesoscale model.

H32B-0578 1330h POSTER

Detection of Temperature and Moisture Variability in the Planetary Boundary Layer From AIRS Observations

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The profiles of temperature and moisture in the planetary boundary layer (PBL), or that region above the surface within the scale-height of water vapor (e.g., 1 to 2 km above the surface) are extremely important to water transport and the cloud-surface energy budget. The Atmospheric Infrared Sounder (AIRS), a very precise, medium-resolution spectrometer on the Aqua spacecraft, is providing profiles of atmospheric temperature and water vapor at vertical resolution of one to two kilometers. We demonstrate that AIRS is sensitive to variability in PBL temperature and humidity structures and that the vertical structure can be quantitatively resolved. Our studies focus on the response of weak water vapor lines of varying ground state energies as well as nearby continuum regions between 800-1200 wavenumbers. Atmospheric temperature and moisture profiles derived from in situ observations are used in line-by-line radiative transfer model computations, where the spectral response functions are convolved in order to compare with the AIRS spectral radiances. We describe a capability to detect and potentially quantify variable mixed layer thickness, moisture stratification and temperature inversion through comparisons of radiative transfer calculations with AIRS observations. The results may be especially relevant for studies of the stable marine boundary, stratus evolution and frontal dynamics.