W/m^2 from models presented in the IPCC 2001 report. A comparison of the measured surface forcing with the corresponding radiative trapping is also conducted; the radiative trapping was calculated with MODTRAN 4 . The average of the measured radiative trapping fluxes from 30 days at 45 N is about 0.57 W/m^2 ; this is close to the global forcing estimate of 0.7 W/m^2 for tropospheric ozone in summer reported in the 2001 IPCC report. Our measurements have been made at 44N over all four seasons. The same technique yields measurements of the average boundary layer ozone concentrations; comparisons with surface monitors show significant errors in the surface measurements. This presents a problem for model comparisons with surface monitoring ozone measurements. In order to decrease the uncertainty of the tropospheric ozone forcing measurements further, many more measurements need to be made at different latitudes and climates.

A33B-04 1430h

Changes in Tropospheric Chemistry at 2100

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We have performed simulations of the response of tropospheric composition to climate and emissions changes a century hence. The simulations use the newly developed state-of-the-art GISS modelE GCM in a fully coupled climate-chemistry-aerosol mode. Results are presented showing the effects of climate changes alone and of climate and emissions together. We focus on the responses of stratosphere-troposphere exchange (+ 71 Tg/yr O3), for which a wide range of predictions currently exist, and of lightning, and on the impact of changes in the hydrologic cycle. Ozone changes are compared with the CTM studies of the last IPCC assessment. Additional simulations incorporating stratospheric chemical changes and climate-induced changes in methane emissions from wetlands are also discussed

A33B-05 1445h

On the Effects of Using On-line Versus Off-line Chemical Input Fields in a Global Tropospheric Chemistry-Aerosol General Circulation Model.

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Our previous global modeling approach has been to use off-line sulfate aerosol fields for the tropospheric chemistry simulations and off-line oxidant fields for the sulfate aerosol simulations. This presents inadequacies, not least because the aerosol-chemistry coupling processes occur on short time scales. We have implemented a flexible model interface between the existing tropospheric chemistry and sulfate aerosol modules within the new generation 'modelE' Goddard Institute for Space Studies general circulation model (GISS GCM), allowing us to perform simulations in either coupled (on-line) or uncoupled (off-line) mode. We use this flexible code architecture to isolate the effects of on-line versus off-line chemical input fields on the ozone and sulfate simulations. Although, on annual and global scales, the differences between the coupled and uncoupled simulations are small, significant deviations do occur on regional and seasonal scales. For example, the coupled (on-line) simulation predicts increased sulfate surface mixing ratio over central Europe in summer, (about 0.5 ppbv or 20%), relative to the uncoupled (off-line) simulation. The difference is driven by greater gas-phase oxidation of sulfur dioxide in the on-line simulation as a result of exposure to higher daytime oxidant concentrations when running in coupled mode. Similarly, the coupled model predicts significantly higher summer time hydroxyl radical levels (up to 40%) over the northeastern United States and central Europe compared to the uncoupled simulation, for reasons yet to be determined. The effect of using on-line versus off-line sulfate fields on the ozone simulation appears to be less significant. An analysis using preindustrial emissions will also be conducted. Model output, including sulfur dioxide, sulfate and ozone concentrations, from both coupled and uncoupled simulations, will be evaluated using surface observations from several networks.

A34A CC: 520 D Wednesday 1530h

Frontiers in Atmospheric Observations and Their Impacts: AIRS, AVHRR, HIAPER

Presiding: **K H Rosenlof,** NOAA Aeronomy Laboratory**; H H Aumann,** Jet Propulsion Laboratory, California Institute of Technology

A34A-01 1530h

Infrared Remote Sensing Through Clouds With the AIRS-AMSU-HSB Sounding System on Aqua: An Update

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The Atmospheric Infrared Sounder (AIRS) experiment on NASA's Earth Observing System Aqua spacecraft is a combination of infrared and microwave instruments designed for remote sensing of the atmosphere in the presence of clouds. The instruments and associated ground-based processing system have been in near full-time operation since September 2002, and have generated over 300,000 retrievals daily. The primary retrieved products are daily global fields of surface temperature, cloud height and fraction, and height-resolved humidity, temperature and minor gases. These observations are relevant to altitudes from the surface to the upper stratosphere. Central to the AIRS retrieval process is cloud-cleared radiance –the emission from the cloud-free part of a scene– generated from a combination of infrared and microwave observations. We present instantaneous and time-averaged observations of cloud-cleared radiances, cloud properties, temperature, humidity and minor gases. We describe progress toward the central objectives of uncertainties of 1 K / km for atmospheric temperature profiles, 5% for total precipitable water vapor, 20% for relative humidity profiles, 0.5 C for sea surface temperatures, and 1.0 K for land surface temperatures. Some examples of how these observations are being used to answer important outstanding questions in the atmospheric sciences are also described.

URL: http://www.jpl.nasa.gov/airs

A34A-02 1545h

First Evaluation of AIRS Data for Climate Trending

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The Advanced Infrared Temperature Sounder, AIRS, is a high spectral resolution radiometer with spectral coverage from 3.7 to 15.4 microns, which was launched in May 2002 by NASA into polar orbit on the EOS Aqua satellite. Monitoring the sea surface temperature using the AIRS 2616cm-1 window channel relative to the NCEP provided RTG-SST shows measurement stability at better than the 8mK/year level. Eighteen months of clear night tropical ocean AIRS data have been used for the initial evaluate of mid-tropospheric temperature, lapse rate and water vapor variation for time trending and potential climate signatures using 3.7 micron and 4.3 micron CO2 R-branch channels. The Southern Oscillation during 2003 is evident in the data as a strong temperature variation with a 2.5K amplitude. This variation is tracked essentially in phase by the temperature at the 300 - 400 mbar level and the lapse rate, but with a factor of five smaller amplitude, and a 10% variation in the precipitable water. With the lifetime of AIRS expected to be seven year, the analysis of many cycles of the southern oscillation and correlation with El Nino events promises to be the start of climate monitoring from space with unprecedented accuracy. This effort can be continue by future high spectral resolution polar sounders, startimg with ISAI in 2006, followed by high spectral resolution NPOES operational sounders starting in 2008.

A34A-03 1600h

AIRS Data Mining Service at the Goddard Earth Sciences (GES) DISC DAAC

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The Atmospheric Infrared Sounder (AIRS) is a high-resolution infrared (IR) sounder with 2378 spectral channels flying on the EOS Aqua platform with two operational microwave sounders, the Advanced Microwave Sounding Unit (AMSU) and the Humidity Sounder for Brazil (HSB). Measurements from the three instruments are analyzed jointly to filter out the effects of clouds from the IR data in order to derive clear-column air-temperature profiles and surface temperatures with high vertical resolution and accuracy. Together, these three instruments constitute an advanced operational sounding data system that have contributed to improve global modeling efforts and numerical weather prediction; enhance studies of the global energy and water cycles, the effects of greenhouse gases, and atmosphere-surface interactions; and facilitate monitoring of climate variations and trends. The NASA Goddard Earth Sciences Data and Information Services Center/Distributed Active Archive Center (GES DISC DAAC) provides long-term archive and distribution services for AIRS/AMSU/HSB data products as well science support to assist users in understanding, accessing and using the AIRS data products. However, the high data volume generated by the AIRS/AMSU/HSB instruments and the complexity of its data format (Hierarchical Data Format, HDF) are barriers to AIRS data use. Although many researchers are interested in only a fraction of the data they receive or request, they are forced to run their algorithms on a much larger data set to extract the information of interest. In order to address this problem, the GES DAAC is expanding its data mining system to accept AIRS user's algorithms by providing online tools for spectral channels and value added product sub-settings, as well as spatial, temporal and user defined profile sub-settings. This presentation will show details of the AIRS components of the GES DAAC data mining system including technical description, input data and returning products, advantages and capabilities plus algorithm examples.

A34A-04 1615h

Impact of real-time vegetation fraction from AVHRR on Eta model

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Vegetation plays a significant role in determining the partition of surface sensible and latent heat flux, so vegetation must be represented adequately in numerical weather prediction models. The NCEP operational Eta model uses the NESDIS 0.144 degree (about 14km) monthly green vegetation fraction database, which is based upon a 5-year NDVI climatology from AVHRR data observed from the NOAA's polar-orbiting satellites (1986 to 1991). In reality, vegetation fraction

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changes from year to year and can have a different seasonal evolution from climatology, e.g. due to an advance or delay in spring 'green-up', changes in temperature and precipitation patterns, different irrigation or crop harvesting, forest fires, deforestation, desertification, hailstorm, flooding or drought affected vegetation. Recently, NESDIS has produced 'real-time' weekly green vegetation fraction from the remote sensor AVHRR. In this study, this new data set is tested in the Noah land-surface model coupled with the 12-km mesoscale Eta model to make 0-3 day simulations for the growing seasons. Resulting surface fluxes, and 2-meter dew-point and air temperature will be compared to those predicted by the operational Eta model, and to observations including data from various mesoscale observing networks

A34A-05 1630h

UPDATE ON HIGH-PERFORMANCE INSTRUMENTED AIRBORNE PLATFORM FOR ENVIRONMENTAL RESEARCH (HIAPER)

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The High-Performance Instrumented Airborne Platform for Environmental Research (HIAPER) will be a medium sized jet aircraft capable of operating in the upper troposphere to lower stratosphere, highly modified to carry a substantial scientific research payload. The vision for this project emerged from the community in the 1980s, reviewed and approval by the National Science Board starting 1997, and received its first funding in FY 2000. HIAPER is being designed to serve a broad cross-section of the geosciences community. Because of its long duration and downward and upward looking ports as well as other aspects of the platform, HIAPER will significantly enhance capabilities available to the ocean sciences community. The continued involvements of the community in the design of this research platform as well as on-board instrumentation are hallmarks of the project. Rationale for HIAPER, a project overview, and the science needs it will fulfill are discussed. Particular attention will be given to current status of the project and the opportunities for community input instrumentations to be carried by HIAPER.

URL: http://www.hiaper.ucar.edu/

A41A CC: 220 C-E Thursday 0830h

Ice Cores: Contributions to Climate Variability and Dynamics I Posters

(joint with B, OS, C, GC, PP)

Presiding: **C A Shuman,** NASA Goddard Space Flight Center

A41A-01 0830h POSTER

Reconstruction of interannual Antarctic climate variability from ice cores

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Antarctica represents a significant gap in efforts to achieve reliable reconstructions of interannual to century-scale climate variability. A reliable reconstruction of Antarctic climate on these timescales requires obtaining precisely dated ice cores at high temporal resolution, and with sufficient spatial coverage to adequately capture large-scale climate variability. Ice cores retrieved by the International TransAntarctic Scientific Expedition (ITASE) program are a major step towards this goal. As part of US ITASE, ice cores were obtained from twenty-three sites that are widely distributed across the West Antarctic Ice Sheet, providing continuous records of snow chemistry covering at least 200 years. These cores have been dated at better-than-annual resolution, primarily though the identification of summer peaks in non-sea-salt sulfate (nss-SO_4). Validation of the timescales was achieved through independent identification of other seasonal variations and marker horizons. Dating precision to within 1-2 months is demonstrated by the occurrence of spring-time nitrate peaks 3 months before the nss-SO_4 maxima, by the identification of distinct mid-winter warming in some years in both instrumental temperature records and stable isotope ratios, and by the timing of hydrogen peroxide maxima. Dating accuracy to within ±1 one year is demonstrated by volcanic marker horizons, Tambora (1815-1816) being the most prominent. Additional validation of the ±1 year accuracy is provided by the tracing of isochronal layers from site to site using high-frequency ice penetrating radar observations. Reconstruction of climate variability from the ice core data is achieved in three stages. First, satellite-derived anomalies are used to define characteristic patterns of Antarctic temperature variability by conventional EOF analysis; this provides approximately 20 years of monthly data. Using instrumental weather station data (largely from the Antarctic coastline)] as predictor variables, we obtain a reconstruction of the principal components of Antarctic temperatures, with coverage over the entire continent back to 1961. Finally, the resulting 40+ years of spatiotemporal variations in Antarctic temperatures are used as a calibration target for the ice core data. Our current reconstruction uses five stable isotope records from West Antarctica, plus data from Talos Dome and Law Dome. The results show an overall warming of Antarctica since at least the early 1960s, but with cooling in the summer months. Preliminary results also suggest overall warming since the mid 1800s, with significant multi-decadal scale variations. These results, if further validated, will have important implications for the interpretation of recent observed trends in the Southern Annular Mode/Antarctic Oscillation. Major contributors to this work, in addition to this listed authors, include D. Dixon, G. Hamilton, S. Kaspari, A. Kurbatov, P. Mayewski, B. Spikes (University of Maine), M. Albert, S. Arcone, A. Gow, D. Meese (CRREL), C. Shuman (NASA/Goddard), M. Frey (University of Arizona), M. Wumkes (Glacier Data) and T. van Ommen (Antarctic CRC).

A41A-02 0830h POSTER

8 Glacial-Interglacial Cycles high Resolution Record of Chloride, Nitrate and Sulphate from EPICA-Dome C ice-core (Antarctica).

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Fast Ion Chromatographic measurements of chloride, nitrate and sulphate were carried out in a continuous way and high depth resolution (up to 2.0 cm) along the EDC96 and EDC99 ice cores, drilled at Dome C (East Antarctica, 75° 06' S; 123° 23' E; 3233 m a.s.l.) in the framework of the EPICA (European Project for Ice Coring in Antarctica) program. The deeper ice core (EDC99) reached the depth of 3200 m (about 100 m above the bedrock) during the 2002-2003 Antarctic Campaign. The EDC99 ice core (present time accumulation at Dome C: around 25 kg m-2 yr-1) is expected to cover about 900 kyrs. The continuous measurements of chloride, nitrate and sulphate, carried out directly on site, show sharp concentration changes in the glacial-interglacial transitions and during the interstadial periods. The comparison between chemistry, dust, ice-isotopic and marine-isotopic profiles enlightens source, atmospheric-circulation and snow-composition changes able to affect the load and persistency of the components in the snow layers. In particular, changes in snow acidity and in accumulation rates drive post-depositional processes affecting the snow concentration of chloride and nitrate. On the other hand, sulphate fluxes seem to be quite constant along several glacial-interglacial cycles, allowing the use of the inverse concentration as a proxy of the snow accumulation rate (dry deposition is dominant at Dome C). The inverse-concentration profile of sulphate is compared to a preliminary accumulation.rate trend, carried out on the basis of the dD profile, and to the dD profile obtained by marine-sediment cores. A very sharp similarity was shown by the different record and the anomalous pattern of the isotopic-marine stage 13 is fully confirmed by the inverse sulphate record.

A41A-03 0830h POSTER

Interactions Between Solar Forcing And Decadal To Centennial Scale Climate Dynamics 1700-2000

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Annually resolved Pacific ice core and coral records are shown to contain variability on decadal to centennial timescales resulting from internal dynamics and solar forcing. The maximum correlation occurs at a lag of three years with respect to the solar forcing suggesting an oceanic link in the response. In addition, a reversal in the sign of the correlation between the ice core record, a proxy for temperatures in the North Pacific, and the solar forcing occurred around the start of the 20th century. We argue that this behaviour is the result of a non-linear resonant interaction between the solar forcing and internal dynamics of the climate system.

A41A-04 0830h POSTER

Ice core records of Late Holocene climate variability in the Dry Valleys, Antarctica

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The Dry Valleys region of Antarctica represents a unique transition environment between coastal and interior portions of the continent. Previously developed paleoclimate records from the surrounding area, including shallow and deep ice cores, lake cores, and glacial deposits, indicate a complex evolution of Holocene climate dynamics, however the resolution of available records is usually not sufficient to resolve interannual to decadal processes. In particular, the interaction of various ocean/atmosphere phenomena (e.g., ENSO, Antarctic Oscillation, Antarctic Circumpolar Wave) that may be responsible for regional and/or larger scale climate events during the late Holocene (e.g., Little Ice Age) remains unresolved. Over the next two Antarctic field seasons, we plan to recover intermediate length (200-350 m) ice cores from several sites in the Dry Valleys, with the goal of producing annually-dated paleoclimate records for at least the last 2000 years. As part of site selection activities during the 2004/04 season, snowpit sample profiles, shallow (20 m) firn cores, and GPS and ground penetrating radar data were collected from three glacier accumulation zones in the Dry Valleys (Clark, Commonwealth, and Blue Glaciers). Calibration of isotope, major ion, and trace element data from the snowpits and shallow cores with available meteorological data from automatic weather stations in the Dry Valleys will be presented and discussed.

A41A-05 0830h POSTER

Creep of Granular Ice With and Without Dispersed Particles

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The effects of dispersed particles on creep and related phenomena have been studied in polycrystalline laboratory-grown ice. The importance of the dislocation density during creep has been analyzed using a dislocation-based model of anelasticity to estimate the