A72A-0156 1330h POSTER

Analysis of NO/NO_2 Exchange and the Evolution of $ClO/ClONO_2/NO_2$ During SOLVE

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In situ measurements of NO_x, Cl_x and $ClONO_2$ in the polar vortex during SOLVE are used to study the $ClO/ClONO_2/NO_2$ subset and NO/NO_2 exchange over a very large dynamic range of ClO (75-1400 ppt). This extremely large dynamic range of measurements over a three month period together with a reanalysis of NO_2 mixing ratios following post-flight lab calibration measurements allowed us to study the above systems quantitatively. Observations of extremely low levels of NO_x within the vortex during the Arctic winter are reported and the observations are used to test models designed to calculate chlorine recovery. The measured NO_2 values agree well with those calculated from NO using a steady-state approximation. Analysis of $ClONO_2$ calculated from NO_2 using a steady-state approximation indicate that $J[ClONO_2]/k[ClO+NO_2$ is ca. 25% too small. Gradual reemergence of NO_2 and $ClONO_2$ in chemically processed air during the second phase of SOLVE is consistent with photochemical production of NO_2 from reaction of OH with HNO_3 and photolysis of HNO_3. Measurements of NO_2, ClO, and $ClONO_2$ are used to examine transport related increase of NO_2 levels at the edge of the vortex.

A72A-0157 1330h POSTER

Temperature and Precipitation Trends and Variability in Alaska Since 1950

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The northern hemisphere has experienced a general warming trend in recent decades that is most pronounced at high latitudes. For Alaska, the mean annual temperature has increased approximately 1.4°C for the most recent climate normal (1971-2000). However, it is important to note that the increase is nonlinear and exhibits seasonal and spatial variability. In this investigation, climate records for first-order observing stations in Alaska were examined for the period 1950 to 2001. Spatial coverage is such that the three climate regimes in the state (arctic, continental, and maritime) are represented. Seasonal temperature trends show that the greatest warming has occurred in winter. Furthermore, the trend is greater for minimum temperatures than maximum. Although most locations show an increase in snowfall, there is also a coincident decrease in total annual precipitation, the former largely due to an increase in autumn snowfall total.

A72B MCC: Hall D Sunday 1330h

Regional Climate Modeling II Posters

(joint with NG, B, H, OS, GC)

Presiding: **A Robock,** Rutgers University**; G Stenchikov,** Rutgers University

A72B-0158 1330h POSTER

Regional Changes in Extreme Climatic Events

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This study focuses on California as a climatically complex region that is vulnerable to changes in water supply and delivery. A regional climate model is employed to assess changes in the frequency and intensity of extreme temperatures and precipitation. Significant increases in daily minimum and maximum temperatures occur with a doubling of atmospheric carbon dioxide concentration. Increases in daily temperatures lead to increases in prolonged heat waves and length of the growing season. Changes in total and extreme precipitation vary by geographic region.

A72B-0159 1330h POSTER

Verification and Skills of a Multi Model Ensemble Forecasting System Using a Kernel based Numerical Weather Prediction Model

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The quality of deterministic weather forecasts varies significantly from day to day. The most significant errors on a daily basis are often a factor 2 or 3 stronger than the monthly averaged error. In regional climate simulations it also has been shown that differences between the control and sensitivity simulation is not only due to the initial conditions, but also due to the approximations in the model's configuration. This points to the use of an ensemble of forecasts each generated with different model configurations. In this paper we want to demonstrate, verify and quatify the skill of such an approach to get a more constant and better forecast quality for realtime and climatic applications. In our system 50 ensemble members start from the same large scale weather pattern taken from an analysis of a global model. Each member differs from the other in the choice of the numerical solution of the fast atmospheric processes.

A72B-0160 1330h POSTER

A Multianalysis Ensemble Modeling of Uncertainties In A Regional Climate System Model

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A multianalysis ensemble of monthly integrations was conducted to examine the response of the internal variability of a regional climate system model to initial and lateral boundary conditions. This study demonstrates that internal variability of the regional model is sensitive to the uncertainties associated with the global analyses and interpolation procedures used. The former is a dominant source to contributions to the model's internal variability, but the latter is not negligible. Simulated surface energy fluxes and precipitation display significant variability in response to the differences between forcing datasets.

A72B-0161 1330h POSTER

Analysis of a long term Regional Model Simulation

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The use of regional climate models in studying atmospheric dynamics is on the increase in southern Africa, where the MM5 regional model has been used for a range of experiments. Such work has led to the start of a 15-year climatology simulation for the model so that more accurate evaluation of the model can be made. This paper will look at some of the results obtained from this experiment.

The increasing use of model output necessitates a deeper analysis of the data than is conventionally undertaken. Therefore in addition to comparing time averaged climatic fields from the model to observed station data, the output has been compared to other statistics such as total number of rain days, and indices of wet and dry spell duration. Initial analysis of one year of the long term simulation has shown that the model produces a large positive rainfall anomaly along the eastern escarpment of South Africa. Although positive rainfall anomalies are also present in the interior of the region, these are not as high. The comparison of the number of rain days above 20mm with those of observed data show that although the model produces more rain events, the magnitudes of these events are not high enough to change the actual 80th percentile of the model output drastically. This initial finding has been encouraging and the analysis of the complete long term simulation using these different statistics will be useful in assessing the biases of the model as well as the errors that exist in it. Such analysis will also be of great relevance to the end users of model output.

A72B-0162 1330h POSTER

Testing the Effects of Increased Horizontal Resolution in a Regional Climate Model for a Climatically Vulnerable Region

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The need for high-resolution simulations of modern and future climates has driven the use of regional climate models in recent years. Regional climate models use a much higher horizontal resolution than global climate models, allowing more detailed investigations of climate at scales of importance to a wider range of parties. Here we explore the effects of increased horizontal resolution on the simulation of climate over the Western U. S. We performed three experiments of modern day climate, using the same boundary conditions, at three different horizontal resolutions, 20 km, 30 km, and 40 km. We compared the experiments with observations of climate and with each other in order to evaluate any improvement or lack of improvement in using the higher resolution. Initial comparisons suggest that a 20 km resolution produces more accurate snow and precipitation results, with temperature results being more similar and accurate between the 20 and 30 km cases.

A72B-0163 1330h POSTER

Toward 10-km mesh global climate simulations

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An atmospheric general circulation model (AGCM) that runs very efficiently on the Earth Simulator (ES) was developed. The ES is a gigantic vector-parallel computer with the peak performance of 40 Tflops. The AGCM, named AFES (AGCM for ES), was based on the version 5.4.02 of an AGCM developed jointly by the Center for Climate System Research, the University of Tokyo and the Japanese National Institute for Environmental Sciences. The AFES was, however, totally rewritten in FORTRAN90 and MPI while the original AGCM was written in FORTRAN77 and not capable of parallel computing. The AFES achieved 26 Tflops (about 65 % of the peak performance of the ES) at resolution of T1279L96 (10-km horizontal resolution and 500-m vertical resolution in middle troposphere to lower stratosphere).

Some results of 10- to 20-day global simulations will be presented. At this moment, only short-term simulations are possible due to data storage limitation. As ten tera flops computing is achieved, peta byte data storage are necessary to conduct climate-type simulations at this super-high resolution global simulations. Some possibilities for future research topics in global super-high resolution climate simulations will be discussed.

Some target topics are mesoscale structures and self-organization of the Baiu-Meiyu front over Japan, cyclogenecsis over the North Pacific and typhoons around the Japan area. Also improvement in local precipitation with increasing horizontal resolution will be demonstrated.

A72B-0164 1330h POSTER

Regional Atmospheric Modeling of Caribbean Climate

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We use the Regional Atmospheric Modeling System (RAMS) to simulate climatic pattern on the island of Puerto Rico. We hope our analyses will be used to determine the effects of climate change on other Caribbean and tropical islands. Our first experiments were to simulate the precipitation patterns on the island and the urban heat island effect. The main model configuration consists of two grids. Grid 1 covers the entire Caribbean area and has a horizontal resolution of 20 km; it was used mainly for downscaling the large-scale observational data and for boundary nudging. Grid 2 has a horizontal resolution of 5 km and covers the island of Puerto Rico and surrounding waters with the full microphysical parameterization. RAMS was configured to use a vegetation index based on AVHRR data from NOAA 12 and NOAA 14 satellites. From these images we show that the vegetation for the month of January is more abundant than in March. Mean diameters for cloud droplets and raindrops where specified as 35 micrometers and 100 micrometers, respectively. We minimized errors due to clouds by combining data into a monthly composites. We found that experimentation with the microphysical parameterization had a significant impact in the total precipitation amount over the island. RAMS robustly simulated the total accumulated precipitation for the month of April 1998 as well the dependence of the precipitation pattern on the local topography over the island of Puerto Rico. To test the urban heat island effect RAMS was configured using only infrared emission and absorption of water vapor and carbon dioxide without treating clouds or condensate. A soil model was used with ten layers 5 cm thick. The model clearly shows that because of the urban heat island effect San Juan is 5° warmer than the surrounding area. The model results were validated using an extensive network of environmental monitoring instruments from various agencies covering the island of Puerto Rico. The data was converted to a common format using the Java application and made available over the internet using Java Server Pages. Statistical analysis and neural network techniques were employed to improve resolution of sparse lower atmospheric data.

URL: http://www.ece.uprm.edu/cmg/

A72B-0165 1330h POSTER

Investigation of Surface Hydrology Simulated by the Canadian Regional Climate Model over the Quebec/Labrador Territory

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The Canadian Regional Climate Model (CRCM) can be used in a simulation mode where it is driven by objective analyses. In such mode, the model can be validated using various observational datasets. We present an investigation of the CRCM's surface hydrology from a three-year simulation conducted over the Quebec/Labrador territory. In the experiment, the CRCM was run at a 30 km horizontal grid-point spacing on a 100X100 point domain and driven by NCEP (National Center for Environmental Protection) atmospheric objective analyses for the period from June 1992 to May 1995. The CRCM's regional hydrologic budget over a series of catchment basins is investigated and validated through comparison with observations of precipitation, screen temperature, snow cover and runoff data. The model's output is also compared to evaporation data. Spatial analysis of the CRCM's annual runoff shows that the model is in good agreement with basin observations although its precipitation and surface evaporation during summer months are generally too important. On the seasonal scale, the CRCM captures the main features of the annual cycle, and in particular the snow cover accumulation, which is a major element of the hydrologic cycle with its spring melt reaching up to 50% of the annual runoff. Furthermore, investigation of the CRCM's daily precipitation characteristics and comparison with observations provides a more detailed picture of the model's precipitation behavior. Finally, results presented from sensitivity tests in regards to the model's resolution and its domain location help define the set-up for the next CRCM experiment.

A72B-0166 1330h POSTER

On the Development of a Regional Climate Model for the Central Europe with Emphasis to Climate Change Study on the Territory of the Czech Republic

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The project has been launched in 2001 in the Czech Republic with the aim to develop a regional climate model (RCM) for the territory of central Europe, which has been overlooked by regional climate modeling studies until now. The RCM is being developed by modifications of the numerical weather prediction (NWP) model ALADIN, run operationally at the Regional Centre of LACE (Limited-Area Modeling in Central Europe) in Prague. It concentrates on the area of central Europe and is intended in close future to serve as a source of climate change scenarios on a regional and local scales for countries in that region. The uniqueness of the RCM is in its very fine horizontal resolution of about 20 km, which is at the high end of current RCMs.

The ALADIN model proves to be integrable for month-long time periods, far beyond its current operational use (up to 48 hours), after only minor modifications of rather a technical nature are implemented. The presentation will summarize validation of recent experimental runs of the RCM, nested in the operational assimilations by the ARPEGE NWP global model, representing observed conditions. Several one-month long integrations have been conducted for July 1998, with the aim to investigate, among others, the influence of a treatment of lower boundary conditions, interpolation at lateral boundaries, and the effects of repeated restarts of the RCM. The validation concerns (i) the upper-air fields, (ii) surface temperature and precipitation at the dense station network in the Czech Republic, as well as against continental-scale gridded climatologies, and (iii) vertical cross-sections.

During the development, supporting tests were completed with the RegCM2 concerning the modeling sensitivity to geometry of the model area. Moreover, we use the RegCM2 to test the methodology for planning and organizing the experiments.

Future activities in the development of the RCM will also be outlined in the presentation.

A72B-0167 1330h POSTER

Impact of Deforestation on the Climate of West-central Africa

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Numerous logging concessions covering significant parts of the Congo rainforest in West-central Africa have been awarded recently. A regional atmopheric model (RAMS) was used to investigate the potential impact of this proposed deforestation. Results show that intensive logging can have significant impacts on the surface temperature and precipitation on a regional scale.

A72B-0168 1330h POSTER

Simulation of the Climate of South-West Asia with a Regional Model

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The ability of the regional model RegCM2 to simulate the climate of South-West Asia is examined. The climate of the region displays high spatial, seasonal and interannual variability, providing a strong test of climate model capabilities. RegCM2 captures the spatial variability of temperature and precipitation despite cold biases being present in the model. RegCM2 does not capture the annual cycle of precipitation on the Black and Caspian Sea coasts where very steep topography exists, nor on the eastern Mediterranean coast where the coastal mountains are not resolvable. RegCM2 does capture the seasonal cycle in the Fertile Crescent and Zagros mountains, where it is strongly influenced by a plateau circulation above the Iranian plateau. It is shown that accurate simulation of precipitation in these regions, including the inter-annual variability, requires the correct simulation of both storm tracks and topographic interactions. Through the use of regional climate models the concentration and transport pathways of water vapor through the Middle East can be explored. The results demonstrate that short lived 'events' have little impact on monthly mean atmospheric fields yet provide a significant amount of the precipitated water which flows in the Tigris river.

A72B-0169 1330h POSTER

Greenland ice sheet ablation modeling using a high resolution atmospheric model

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This study focuses on the application of the Polar MM5 mesoscale atmospheric circulation model to Greenland ice sheet ablation processes. Model simulations include three domains, one running at 20-40 km over the whole of Greenland, including surrounding areas and two increasingly higher resolution nested domains over a western Greenland test bed, the Jakobshavn Ablation Region (JAR). Improved parameterizations of albedo, water vapor exchange, meltwater production, and blowing snow are applied to the period extending from pre-onset of melt through the end of the 2001 melt season. Analysis focuses on validation of the Polar MM5 ablation simulations with Automatic Weather Station data from the Greenland Climate Network. 2001 melt season ablation components are presented for JAR. This study makes possible future extension of the Polar MM5 to multi-year total ice sheet ablation modeling.

A72B-0170 1330h POSTER

Effect of Coastal Upwelling on Circulation and Climate in Coastal Regions

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Upwelling due to synoptic scale southwesterly winds can cause sea surface temperatures to decrease by about 5°C along the New Jersey coast. The decrease in surface ocean temperatures impacts the overlying atmosphere, which then can be transported inland during sea breeze development. This effect could strongly impact coastal climate.

Numerical simulations using the Regional Atmospheric Modeling System (RAMS) were done to examine coastal upwelling effect on sea breeze development along the New Jersey coast. Model runs were made using actual sea surface temperatures from the AVHRR satellite showing strong upwelling as well as with a representative sea surface temperature map with no upwelling present. This was done to isolate the effect of sea surface temperature on the sea breeze, by keeping all other parameters constant. RAMS was run using 3 nested grids, with the highest horizontal resolution being 2 km, over a 48-hour period. Vertical resolution of 45 layers was used, with almost half of them below 2 km, an area which is most crucial in sea breeze development.

Model simulations showed that the largest impact was on temperatures within the sea breeze circulation, where temperature differences of up to 5°C were noted. This difference was greatest along the barrier islands reaching 4°C and decreased to 1°C about 50 km inland. The dynamical affects of coastal upwelling should be included in climate models in order to account for their effect on coastal temperatures. By using fixed or climatological sea surface temperatures their impact on coastal locations could be missed. Changes in inland propagation and wind speed intensity were also seen in the simulations although their impacts were not as large.

A72B-0171 1330h POSTER

STABILIZATION OF REGIONAL COLUMN MODELS BY PARAMETERIZED DYNAMICAL TENDENCIES

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Atmospheric Single Column Models (SCMs) provide an efficient modeling framework for regional studies. In these models, vertical profiles of temperature and humidity evolve in response to diabatic interactions within the column and adiabatic tendencies produced by by the large scale circulation. The adiabatic tendencies are either prescribed or neglected and,thus, decoupled from the diabatic tendencies. This decoupling can lead to the rapid development of unrealistic atmospheric states. In particular, the temperature profiles from a SCM can become unrealistic enough within just a few hours to render any meaningful diagnosis difficult, if not impossible.

We have implemented an SCM framework in which the adiabatic tendencies are coupled to the column physics through a formula that links vertical temperature advection to the time-history of diabatic heating rates. The parameters in any such coupling formula should depend in principle depend upon the zonal, meridional, vertical and temporal scales of the heating. In practice, however, we find that the dependence is weak over a wide range of zonal and meridional scales; the vertical dependence is accounted for in the formula itself, as is also the temporal dependence by considering the time history of the diabatic forcing rather than just instantaneous values.

The effect of this dynamical coupling on the behavior of an SCM extracted from the NCAR CCM is investigated here. Because of the coupling, only the mean temperature and humidity profiles for the environment in which the column is embedded need to be explicitly specified; all other quantities are generated by the model. The coupled SCM is tested in tropical conditions during the TOGA COARE period. Control runs and 100-member ensembles, in which initial temperature and humidity profiles are perturbed, are run for environmental conditions taken from 85 sets of observed temperature and humidity profiles. The same data are also used to force the original, dynamically uncoupled, SCM.

Coupling substantially reduces the bias and variability of the SCM. Temperature and humidity profiles for each of the 85 sets of runs are maintained within realistic values in the coupled SCM, whereas in the uncoupled SCM the bias often exceeds 10 K. However, the sensitivity to initial perturbations in the two models is similar. Perhaps the most important benefit of the coupling is that it allows us to diagnose error growth in the SCM while maintaining a realistic atmospheric state.

A72B-0172 1330h POSTER

A DYNAMICALLY INTERACTIVE COLUMN PHYSICS MODEL SUITABLE FOR DIAGNOSING REGIONAL CLIMATE VARIABILITY AND GCM ERRORS

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Climate diagnosis increasingly involves understanding the evolution of relatively weak signals in a high-order chaotic system of strongly interacting components. Assessing the sensitivity of the full system to perturbations (or errors) is problematic: forward "brute force" calculations are too expensive, and backward "adjoint" calculations assume linearity. Fortunately, for many specific problems it is not necessary to consider the full complexity of climate interactions; diagnosis with simpler models can be very useful. The simplification usually involves restricting the focus to component subsystems (atmosphere, ocean, land, cryosphere etc) or using models that emphasize "dynamics" over "physics" or vice versa. In growing recognition of climate sensitivity to the details of atmospheric physics, attention is increasingly turning toward diagnostic models with complex physics and simplified dynamics. Single column models (SCMs) that consider complex diabatic interactions within a single atmospheric column are the best and most extreme examples of these, and the focus of this study.

For regional studies, the use of SCMs is problematic because, in part, advection by the large-scale circulation is typically decoupled from diabatic interactions. This decoupling, while apparently necessary to make an SCM workable at all, can nevertheless lead to rapid spurious error growth in SCM experiments, especially in the tropics.

An SCM framework that couples the vertical advective tendencies to the column physics is developed here. Conceptually, the column is viewed as being embedded in a region of uniform background winds, temperature and humidity, which allows all fluctuating advection terms to be specified in terms of vertical velocity, temperature, and humidity. The vertical velocity at any instant is given by a formula that links the vertical temperature advection to the history of the SCM-generated diabatic heating rates up to that instant. The parameters in this coupling formula are obtained empirically from a separate dry linear Primitive Equation (PE) model forced by steady idealized diabatic heating.

The ability of this dynamical coupling formula to determine local vertical velocities from the history of local diabatic heating rates is tested in a linear PE model forced by oscillating 3-dimensional heating fields. The formula works surprisingly well over a wide range of spatial and temporal heating scales, even passing the hard test of correctly reproducing the phase shift and amplication of the response for near-resonant heating. This success suggests that to obtain the correct advective tendencies, detailed knowledge of the vertical and temporal structure of the diabatic forcing is necessary, but that of its horizontal structure is not.

The single column model with vertical velocities coupled to the local temperature and humidity in this manner effectively eliminates the spurious SCM instabilities alluded to above. Such a dynamically interactive SCM would be useful in increasing the realism of simple "Box"-type models of regional climate variability. It is also argued that future SCM diagnoses of GCM physics would benefit from such a coupling.

A72B-0173 1330h POSTER

Climate simulation for typhoongenesis by high resolution AGCM

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Each year, about 30 typhoons develop on the Western North Pacific basin. Some of them approach to or make landfall onto Japan. One of our concerns is how the ongoing global climate change will influence behavior of tropical cyclones. For example, how will the frequency and intensity of typhoons be modified and how the track of storms altered?

Numerical simulation studies have been conducted to obtain hint of answer to the above kind of questions. Ideally, spatial resolution of the models used should be sufficiently fine so that the simulated storms exhibit realistic scale and structure.

A new supercomputer called Earth Simulator (ES) is a powerful tool to study various kinds of meso-scale phenomena. It is a vector-parallel computer composed of 640 nodes with each having 8 processors. It enables us to run the atmospheric general circulation model (AGCM) with horizontal resolution of a few tens kilometers. In other words, the model can be regarded as a global meso-scale model. It is considered appropriate to use such a model in investigation of impact of the global change on meso-system as well as on regional climate.

The AGCM for ES (AFES) is constructed through inter- and inter-node parallelization and vectorization. The model is based on the AGCM version 5.4.02 of CCSR/NIES. In the present talk, we show the results from the AFES with T319L24, i.e., T319 horizontal resolution and 24 vertical layers.

As the first step of simulation of typhoon response to climate change, it is appropriate to study climatological field producing typhoons during northern summer. Time integration of the model started from the condition corresponding to January 1, 1979, in the NCEP/NCAR reanalysis and ran for 5 years with the use of seasonally varying climatological SST. It is found that frequency and intensity of typhoons vary year to year even though seasonally cyclic SST does not vary. Global circulation in an active typhoon year will be composed against that in an inactive year.

A72B-0174 1330h POSTER

Western North Pacific Tropical Cyclones in the Regional Spectral Model

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The ability of the NCEP Regional Spectral Model (RSM) to simulate typhoons in the Western North Pacific basin is examined. The 50km resolution RSM is forced by the T42 ECHAM4.5 Atmospheric General Circulation Model (AGCM). The AGCM simulates well the annual cycle of tropical cyclone (typhoon) frequency in the Western North Pacific and also has some skill in simulating the interannual variability in this basin. However, the intensity of AGCM tropical cyclones is weaker and the spatial scale larger than observed due to low model resolution. Additionally, there are systematic spatial biases with the AGCM tending to form too many tropical cyclones in the Central Pacific and too few in the South China Sea compared to observations. The effect of higher resolution in the RSM on model tropical cyclone intensity and spatial scale is investigated.

The representation of the tropical cyclones is much improved compared to the low-resolution forcing AGCM, with a well defined eye, eye wall and rain bainds, however the tropical cyclones are not as intense as observed ones. The tracks of the RSM tropical cyclones are smoother and more similar to observed ones than the AGCM tropical cyclones tracks, especially far from the coast. Other properties, such as tropical cyclones first positions, tropical cyclone activity are also analysed.

A72B-0175 1330h POSTER

Sensitivity of Vegetation in the Western United States to Global Anthropogenic Changes in Atmospheric Carbon Dioxide Concentration: Forcing and Feedbacks in an RCM-EVM Coupling

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Anthropogenic increases in atmospheric carbon dioxide (CO_2) concentrations may affect vegetation distribution both directly through changes in photosynthesis and water-use efficiency, and indirectly through CO_2 induced climate change. Additionally, changes in vegetation distribution due to these direct and indirect effects may induce land surface-atmosphere feedbacks that create further change in both regional climate and regional vegetation distribution. Using a regional climate model (RegCM2.5) coupled to an equilibrium vegetation model (BIOME4), we quantitatively tested the sensitivity of climate and vegetation in the western United States to both the direct and indirect effects of doubled pre-Industrial atmospheric CO_2 concentrations and to land surface-atmospheric feedbacks induced by the initial vegetation sensitivities. In assessing regional vegetation responses to the initial effects of elevated CO_2 levels, vegetation in the western United States was sensitive to changes in photosynthesis and water use efficiency caused by increased CO_2 availability, with woody biome types replacing less woody types throughout the domain. Vegetation was also sensitive to the initial climatic effects of increased CO_2 concentrations, particularly at high elevations, both due to warming throughout the domain and to decreased precipitation in key mountain regions such as the Sierra Nevada and the Cascade and Blue Mountains of Oregon. Additionally, these patterns changed when the initial climatic and non-climatic effects of CO_2 on vegetation were tested in combination, creating sensitivities not seen in either of the individual cases and indicating that climatic and non-climatic effects must be considered in tandem when assessing the potential impacts of elevated CO_2 levels. Finally, asynchronous coupling of RegCM2.5 and BIOME4 tested the role of land surface-atmosphere feedbacks in shaping the regional response to elevated global atmospheric CO_2 concentrations. The initial regional vegetation responses to elevated atmospheric CO_2 levels resulted in regional land surface-atmosphere feedbacks that further altered regional climate and vegetation distribution, particularly along ecotones. Because the asynchronous coupling of RegCM2.5 and BIOME4 represents a new regional climate model application, further work is required to constrain the model sensitivity to choice in methodological variables such as length and number of iterations and domain size and placement.

A72B-0176 1330h POSTER

Using MISR/Terra Products to Support Regional Climate Modeling

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The MISR instrument on NASA's Terra platform routinely acquires spectro-directional measurements of the solar radiation reflected by the planet. These measurements, obtained at a spatial resolution of up to 275 m, provide a unique opportunity to improve regional climate models and forecasts, by delivering reliable and accurate descriptions of the observed geophysical environments. These can be used either to initialize surface, cloud and aerosol fields, or to evaluate RCM simulations. Examples of products delivered from MISR and currently available operationally will be exhibited.

A72B-0177 1330h POSTER

Comparison of Future Air Femperature Changes in six AOGCMs With Focus Over Scandinavia

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Predictions of near-surface air temperatures by six AOGCMs (CGCM2, ECHAM4, GFDL, HADCM3, MRI2, NCAR DOE PCM) included in the latest IPCC assessment are intercompared focussing over the land areas of northern Europe and its subdomain Scandinavia. Monthly data from transient runs under the A2- and B2- draft marker emission scenarios are analysed with respect to annual and monthly areal averaged temperature changes during the coming century and their geographical patterns.

Predicted temperature changes tend to increase when moving from the global to the regional scale of Scandinavia, although the GFDL B2-experiment projects lower sensitivities for northern Europe and Scandinavia than for global scales. The MRI-model simulates considerably lower sensitivities than the other models. Disregarding this model, results are in close agreement for global scales, while considerable intermodel variability arises for the regional scales. In contrast to global averages considerable month-to-month variation can be observed for Scandinavia, however the pattern varies between models. While some models lack a regular pattern in projected monthly temperature changes (e.g. GFDL, MRI), other models project a pronounced seasonal cycle with lowest sensitivites in summer and largest in winter (e.g. CGCM, HadCM). Most models predict an increase in warming towards the north over the Scandinavian area. Together with increased winter sensitivities this points to a coupling with Arctic sea ice processes. We find that there is a large model-to-model variability in Arctic sea ice change and the modelling of Arctic sea-ice appears to be crucial in determining high latitude response to global climate change.

A72B-0178 1330h POSTER

GCIP Water and Energy Budget Synthesis (WEBS)

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As part of the World Climate Research Program's (WCRP's) Global Energy and Water-Cycle Experiment (GEWEX) Continental-scale International Project (GCIP), a water and energy budget synthesis (WEBS) has been developed from the "best available" observations and models for the period 1996-1999. This WEBS includes a general description of the Mississippi River Basin climate, physiographic characteristics, available observations, representative types of models used for GCIP investigations, and a comparison of water and energy variables and budgets from models and observations. Besides this summary paper, a companion CD-ROM with more extensive discussion, figures, tables, and raw data is also available to the interested researcher.

Observations cannot adequately "close" budgets since too many fundamental processes are missing. Models that properly represent the many complicated atmospheric and near-surface interactions are required for overall descriptions of the budgets. Models will also be needed for eventual predictions of these water and energy processes. Therefore, different classes of models have also been compared with available observations. The comparison includes a representative global general circulation model, regional climate model, and a macroscale hydrologic model. There does appear to be a clear advantage to using a regional analysis over a global analysis or a regional simulation over a global simulation to describe the Mississippi River Basin budgets. There also appears to be some advantage to using a macroscale hydrologic model for at least the surface water budgets.

A72B-0179 1330h POSTER

The Impact of Historical Land-use Changes on the Short-term Mesoscale Climate: A Modeling Case Study

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In the second half of the 19th century land use and land cover in the three-lakes region on the Swiss Plateau was dramatically modified. Most of the formerly marshy and frequently inundated plains were drained and replaced by nowadays intensively used agricultural land with predominantly crops and vegetables.

This case study investigates the effects of these historical land-use and land-cover changes on the short-term climate of typical clear-sky summer days in July. In order to evaluate the influences, a mesoscale dynamical non-hydrostatic model was used with a very high horizontal resolution of $1\times1\,km^2$ nested in a coarser grid of $10\times10\,km^2$ with one-way interactions. The same atmospheric data were used for initial and boundary conditions for both simulations of historical and present conditions. Six sensitivity experiments were conducted in order to assess the importance of changes in the physiological, morphological, and soil properties for the changes in the short-term summer climate.

In the area of land-use changes, the daily average temperature was 0.25°C cooler for the present land-use conditions. During the day, heterogeneous changes in temperature were observed depending on the type of land-use conversion. In areas where afforestation took place over the last 150 years, an average warming of more than 1.0°C could be observed. In contrast, deforestation resulted in a cooling of up to 2.0°C. Furthermore, changes in the average water vapor mixing ratio are most pronounced during the day, with an average increase of 0.2 g/kg. During the night, the average temperature was up to 0.6°C cooler for the present land-use conditions. Due to topographical effects, the nighttime cooling is mainly restricted to low-lying areas on the formerly frequently inundated plains. The diurnal temperature range in the area of land-use changes increased by 0.1–0.3°C. Changes in the state of the atmosphere extended up to 40 km downstream of the area of land-use changes. Due to the ascending topography in the downstream area, the altered air masses were transported up to a height of ca. 2,500 m a.s.l.

With the sensitivity experiments, it could be shown that the daytime temperature decrease caused by morphological changes dominated the temperature increase due to changed physiological properties while changes in the mixing ratio during the day were mainly caused by changes in the physiological properties. In contrast, the altered physiological properties are the dominant factor for the nighttime cooling.

A72C MCC: Hall D Sunday 1330h

Atmospheric Chemistry: Trace Gases and Radical Chemistry Posters

Presiding: **J H Butler,** NOAA Climate Monitoring and Diagnostics Laboratory

A72C-0180 1330h POSTER

Methyl Halide Distributions and Fluxes in the Southern Ocean

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Methyl bromide and methyl chloride together constitute about one-quarter of the equivalent chlorine that participates in stratospheric ozone depletion. The primary sources for these compounds are natural, yet the atmospheric budgets are poorly constrained. The oceans are an important component of the methyl halide budgets, acting both as a source and a sink of these gases. As climate changes, the net oceanic fluxes of these gases are likely to change in response. Estimating the magnitude or direction of these changes will require an understanding of the cycling of methyl bromide and methyl chloride within specific regions, of which the Southern Ocean may be significant.

Air and water concentrations of methyl bromide, methyl chloride, and methyl iodide in and over the Southern Ocean were measured during the November-December 2001 CLIVAR SR3 transect between Australia and Antarctica, which was a reoccupation of the WOCE SR3 line. While methyl iodide was supersaturated throughout the cruise, methyl bromide and methyl chloride were significantly undersaturated over most of the cruise track, consistent with other studies suggesting that polar waters are a net sink for these