COAA 2004 Annual Meeting – Scientific Presentations

Introduction

Dear Participants:

On behalf of the organizing committee, we would like to welcome you to the COAA 2004 annual meeting. 10 papers will be presented, covering data analysis, modeling, remote sensing and algorithm development of atmospheric, oceanic and research and applications.

The committee member have worked hard to produce a balance program, negotiated a good menu for the conference dinner, and most of all, have worked collegial and coming up to the challenge whenever needs arise, making the organizing of this meeting a truly enjoyable experience.

We thank the Department of Meteorology of University of Maryland for hosting this meeting and Yixiang Nie for producing the conference program in its present form.

This annual meeting also concludes Xiaofeng Li's 2-year term as COAA board program director. He wishes the best luck to future COAA program.

Have a good meeting!
Xiaofeng Li and Zhanqing Li

Abstracts

1. Validation of TRMM PR Measurements and Estimates

Liang Liao. Goddard Earth Sciences & Technology Center/Caelum, Greenbelt, MD 20771
Robert Meneghini Code 975, NASA/GSFC, Greenbelt, MD 20771

The TRMM Precipitation Radar (PR), which operates at a frequency of 13.8 GHz and measures rain from space, is subject to attenuation while propagating in rain, partially melted hydrometeors and water clouds. The correction for attenuation is a crucial procedure in order to accurately estimate rain rate. Validating the TRMM PR measurements and estimates and examining some of TRMM standard algorithms require comparisons with well-calibrated non-attenuated ground-based radar measurements. The relative calibration accuracy of the radars is evaluated by checking the reflectivities at the storm top, where the PR attenuation is negligible. Near the surface, where the PR attenuation effects can be significant, the data are used to assess the performance of the PR attenuation correction algorithm. In this study the ground-based measurements are taken from the S-band WSR-88D radar during the TRMM satellite overpasses over the Melbourne, Florida site during times when significant precipitation was present in the overlap region of the PR and WSR-88D. Resampling the PR and WSR-88D data sets to a common high-resolution grid provides a means by which the radar reflectivity factor can be compared at different heights and for different rain types over ocean and land. The comparisons are also made for the surface rain, area-averaged rain and classification of storm types. The statistical parameters of mean and standard deviation will be given for the evaluation of the PR products. In this study the version 5 and 6 data of the PR are used while the version 5 WSR-88D data are available for all the comparisons.

Email: lliao@neptune.gsfc.nasa.gov
EDUCATION: 1987-1993: Ph.D. in Meteorology, University of Utah, Utah.
1982-1985: M.S. in Space Physics, Wuhan University, P.R.China.
1978-1982: B.S. in Electrical Engineering, Wuhan University, P.R.China.

EMPLOYMENT: 1994-present:Goddard Earth Sciences and Technology Center/Caelum Research Corp. Senior Scientist/Team Leader
1987-1993:University of Utah, Salt Lake City, Utah, Department of Meteorology, Graduate Research Assistant
1985-1987:Wuhan University, Wuhan, China, Department of Space Physics, Assistant Professor
PROFESSIONAL ASSOCIATIONS: Member of the American Meteorological Society, American Geophysical Union, and IEEE.
RESEARCH INTERESTS: Simulations of the microwave propagation and scattering through atmospheric precipitation and hydrometers for the study of the radar measurements of precipitation and cloud. Development of algorithms of microwave radar for retrievals of hydrometer profiles. Modeling of radar bright band signatures associated with the melting region of hydrometers to understand the microphysical properties of the melting particles and their influences on wave propagation.

2. Origin and Structures of a Major Turbid Water Plume in the East China Sea

Dongliang Yuan. GES DAAC, NASA Goddard Space Flight Center, Greenbelt, Maryland
Jianrong Zhu. State Key Laboratory of Estuary and Coastal studies, East ChinaNormal University
Chunyan Li, Skidaway Institute of Oceanography, Savannah, Georgia
Dunxin Hu. Institute of Oceanology, Academia Sinica, Qingdao, China.

A significant turbid water plume in the East China Sea is observed by the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument on board of Terra satellite. The plume is found to originate from the shallow waters along the coast of China north of the Yangtze River mouth and is not related to the discharge of the Yangtze River. In situ hydrography and flow measurements have confirmed that the Yangtze River water did not feed into the plume in winter 2001. A strong seasonal cycle of the plume evolution is observed. The plume expands in fall, maximizes in winter, shrinks in spring, and becomes coastally bonded in summer. Substantial interannual variations are indicated by the satellite observations as well. The large area of coverage in winter and the significant annual and interannual variations suggest that the plume has significant implications to the regional circulation and ecosystem.

Email : dyuan@daacmail.gsfc.nasa.gov
Dr. Yuan, Dongliang graduated from Beijing University Department of Mechanics in 1988 and received his M.S. degree in oceanography from Institute of Oceanology, Chinese Academy of Science in Qingdao, China. He got his Ph. D. degree from the Florida State University in 1995. His past experience includes studies of ocean circulation in the Asian marginal seas, in the Gulf of Mexico, off the east coast of the United States, and in the equatorial Pacific and Indian Oceans. His research interests are the dynamics and thermodynamics that control the variations of ocean circulation and sea surface temperature. His past position includes a postdoctoral position at Florida State University, a visiting scientist position at University Space Research Association, and an assistant research scientist position at University of Maryland, Baltimore County. He is currently holding a scientist position at Goddard GES DISC to support the scientific use of MODIS data.

3. Raising the Environmental I.Q. of Public

Yixiang Nie. StormCenter Communications, Inc.

StormCenter is focusing on applying environmental science in such a way as to engage the public and to increase their understanding of the environment. It is a challenge to better utilize science information as a tool for improved public and agency decision making, to directly relate science to societal benefits, and to increase public environmental awareness so better decision making can be made in times of crisis.

In this presentation, I will briefly introduce how we process and deliver environmental issue related satellite imagery and stories to media and public. In addition, RealTrack^{TM} will be further discussed. StormCenter Communications, Inc. and Accurate Environmental Forecasting, Inc. have teamed up to deliver this new hurricane

forecast model that has been used at the National Hurricane Center and in some selected private industry locations for more than 5 years to public.

Email: eric@stormcenter.com

EDUCATION: Ph.D. student, Remote Sensing, George Mason University, 2000 – present
M.S., Computational Sciences, George Mason University, 2003.
B.S., Computer Science, Dalian University of Technology, China, 2000

POSITION: Scientist, Geo-Information and Remote Sensing, StormCenter Communications, Inc.

EMPLOYMENT: Research assistant, Center for Earth Observing and Space Research, George Mason University, 2000 – 2004
Research assistant, Natural Language Processing Lab, Dept. of Computer Science, Dalian University of Technology, 1997 -- 2000

RESEARCH INTERESTS: Hyperspectral imaging, Nonlinear data analysis, Remote sensing of ocean pigments, Vegetation and climate change

4. Simulation of Diurnal Patterns of Summer Precipitation in the North American Monsoon: An Assessment Using TRMM

Cheng-Zhi Zou and Weizhong Zheng. NOAA/NESDIS/Office of Research and Applications

The North American monsoon is an important climate feature of the southwestern U.S. and northwestern Mexico. Its particular precipitation characteristics have received great attention from both meteorologists and climatologists. The North American monsoon typically begins in early July and persists through the end of September, during which a belt of heavy rainfall occurs along the western slopes of Sierra Madre Occidental with an averaged rain rate exceeding 200 mm per month. The rainfall of this three-month period accounts for 60% to 80% of the annual total in the northwestern Mexico. The precipitation patterns over a large portion of the southwestern U.S. are affected by the North American monsoon. One of the major challenges in the current studies is to successfully simulate the diurnal cycle of precipitation in the North American monsoon. The diurnal cycle of precipitation is important since, in most cases, the diurnal amplitude of precipitation exceeds its daily mean during summer. In addition, the diurnal cycle of precipitation has large effects on surface hydrology and surface energy balance.

Recently, Zhang et al. (2003) have conducted a one-month continuous integration over Large-Scale-Area-East (LSA-E) using the Pennsylvania State University/National Center for Atmospheric Research (PSU/NCAR) Mesoscale Model Version 5 (MM5) coupled with the Simplified Simple Biosphere (SSiB) land surface model. During the integration, many daily characteristics of the weather evolution and diurnal cycle of precipitation over LSA-E were reasonably reproduced. Encouraged by these findings, this study simulates the diurnal pattern of the July 2002 precipitation in the North American monsoon in a continuous one-month integration using the coupled MM5-SSiB model.

The simulation is conducted in a two-way, nested grid with a resolution of 45 km for the coarse domain and 15 km for the fine domain and only the fine domain that covers the core region of the North American monsoon is analyzed. Comparisons with the conventional gauge-based observations show that the coupled model successfully simulates the strength, position, and orientation of the monthly mean heavy rainbelt along the western slopes of Sierra Madre Occidental. In addition, the spatial pattern and phasing of the diurnal cycle of precipitation in this region agrees fairly well with the satellite observations from the Tropical Rainfall Measuring Mission (TRMM).

Email: Cheng-Zhi.Zou@noaa.gov

POSITION (2001-present): Physical Scientist, Office of Research and Applications (ORA), NOAA/NESDIS
EMPLOYMENT (1997-2000): Senior Scientist, QSS Group, Inc.
EDUCATION: PhD, 1995: School of Meteorology, University of Oklahoma
RESEARCH INTEREST: Climate studies using satellite and modeling

5. Response of Precipitation to Soil Moisture Constraints in the NCEP Global Model Simulations

Cheng-Hsuan Lu. RS Information Systems, Inc., McLean, VA,
and NOAA/NWS/NCEP EMC, Camp Springs, MD

This study presents the model results using the NCEP Global Forecast System (GFS). The NCEP EMC is among a dozen AGCM groups participating in the Global Land-Atmosphere Coupling Experiment (GLACE), an AGCM inter comparison study aimed to examine the degree to which the atmosphere responds to anomalies in land surface states. A total of three ensembles of GFS simulations are conducted for the 1994 boreal summer using observed SST throughout the integration. The first set is a typical AMIP runs. For the second set, each member is forced to maintain the same time series of surface prognostic variables. The third set is same as the second set except only deep soil moisture time series is forced to be identical among the member simulations.

The impact of prescribed land states on near surface fields is evident, e.g., latent heat flux time series shows great coherence among the members. However, the evolution of precipitation among the members shows a broad disparity and only a small fraction of the precipitation variance can be explained by soil moisture anomalies. In fact, the NCEP GFS is among these AGCMs that show very weak response of precipitation to prescribed land states. The lack of sensitivity of precipitation to soil moisture constraints is likely due to how the boundary layer mixing and moisture convection are formulated in the GFS

Email: Sarah.Lu@noaa.gov

EDUCATION: Ph.D., Atmospheric Science, State University of New York at Albany
MS, Atmospheric Sciences, State University of New York at Albany
BS, Atmospheric Physics, National Central University, Taiwan

EMPLOYMENT: Nov 2001 - present. Science/Programmer Analyst III, RSIS, McLean, VA, Work as a contract scientist for NCEP EMC
Sep 2000 - Sep 2001, Atmospheric Scientist, DSTI/RDC, Greenbelt, MD, Work as a contract scientist for NCEP CPC
May 1998 - Aug 2000, postdoctoral associate, Atmospheric Sciences Research Center, State University of New York at Albany, Albany, NY
January 1991 - May 1998, Graduate research associate, Atmospheric Sciences Research Center, State University of New York at Albany, Albany, NY

6. Recent Improvements to the Fast Transmittance Model, OPTRAN, for NOAA Data Assimilation

Xiaozhen Xiong, QSS Group Inc., 4500 Forbes Blvd, Lanham, MD 20706, USA

Larry M. McMillin, Yong Han, Fuzhong Weng, Thomas J. Kleespies. Office of Research and Application, National Environmental Satellite, Data, and Information Service, NOAA, Camp Springs, MD 20746, USA
Paul Van Delst. CIMSS, University of Wisconsin-Madison

Here presented the most recent improvements to the fast and accurate transmittance-calculation procedure, Optical Path TRANsmittance (OPTRAN), which is used for satellite data assimilation in NOAA and used in physical retrievals by many users. One of the most important improvements is the introduction of a correction term to account for the polychromatic effect of the channel transmittance. This replaces the effective transmittance widely used in many current fast models. Use of the correction term solves some numerical problems that are associated with the use of effective transmittances, and greatly reduces the line-by-line computational burden, while allowing for the efficient inclusion of multiple gases. Other improvements include additional predictors, changes to the absorber space, treating the water continuum absorption separate from the water line absorption, as well as some procedures to reduce the number of coefficients for its implementation for data assimilation. Significant improvements are found in the ozone channels and the atmospheric window regions. Results of OPTRAN for High-resolution Infrared Radiation Sounders (HIRS), Atmospheric Infrared Sounder (AIRS), as well as other microwave sensors like SSMIS, AMSU are demonstrated.

Email: Xiaozhen.Xiong@noaa.gov
POSITION: Research Scientist, Jan 2001 to present NOAA/NESDIS/ORA (QSS Group Inc.)
EDUCATION: Ph.D. Atmospheric Sciences, 2000. Geophysical Institute, University of Alaska Fairbanks, AK, USA
M.S. Atmospheric Physics, 1991. Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China
B.S. Atmospheric Sounding, 1988. Radar remote sensing and meteorological instruments, Chengdu Institute of Meteorology, Sichuan, China
AREAS OF EXPERIENCES AND RESEARCH INTEREST: Radiative transfer modeling; polar remote sensing; satellite retrieval of cloud and surface properties; retrieval of CO2, CH4 and CO from satellite; greenhouse gases and climate change

7. Dynamics in Planetary Atmospheric Physics: Comparative Studies of Equatorial Superrotation for Venus, Titan and Earth

Xun Zhu. The Johns Hopkins University Applied Physics Laboratory
11100 Johns Hopkins Road, Laurel, MD 20723-6099

A long-standing problem of the existence of equatorial superrotation in a rotating planetary atmosphere has been solved recently. The momentum budget that maintains stable superrotational winds in a given planetary atmosphere is examined systematically, comprehensively, and analytically. After reviewing general approaches of modeling studies of comparative planetary atmospheres, we describe the major dynamical processes that maintain stable equatorial superrotation for the atmospheres of Venus, Titan and Earth. Under appropriate conditions, all three planets could have equatorial superrotational winds greater than 100 m/s. Venus' equatorial superrotation of 118 m/s is maintained at its cloud-top level around 65 km. To have an equatorial superrotational jet stream for Titan's stratosphere, its main haze layer that absorbs solar radiation needs to be lifted to 0.1 mb. Strong equatorial superrotational winds for the Earth's atmosphere could be induced by optically thick dust clouds, following an asteroid impact. The Earth's superrotation can enhance meridional transport of the atmosphere, which could have accelerated the globalization of an environment unfavorable to the survival of the dinosaurs.

Email: Xun.Zhu@jhuapl.edu
POSITION: Senior Professional Staff (Atmospheric Physicist) Space Department The Johns Hopkins University Applied Physics Laboratory
EDUCATION: Ph.D. Atmospheric Science, University of Washington, USA (1987)
B.S. Meteorology, Nanjing Institute of Meteorology, China (1982)
EMPLOYMENT: 1997 - present: Senior professional staff, JHU/APL - Space Department

8. The NCEP Flexible Global Atmospheric Model: Design and Preliminary Results

Hann-Ming Henry Juang. Environmental Modeling Center, NCEP

A flexible modeling framework has been developed, it will be easily implemented in any elements of model codes, not also physics but also dynamics. Current NCEP global model has been separated into several elements and plugged into the framework to form a flexible global model (FGM). Further development to plug in other global models is planned. The elements of the model design and the concept of the model framework happens to be approximated to ESMF (Earth System Modeling Framework), though ESMF and FGM are developed independently.

Instead of fixed and detail rules and/or packages for users or modelers to follow. The FGM provides a concept and a method to build model super-structure. There is a simple rule to form a component of model. Each component comprises three calls: In ESMF terms, they are initialized, run, and finalized. In practical use, they can be named any. In FGM, we use compound words for names, so we will know the relationship among calls, and the sequences etc. The main purpose of forming this kind of super-structure is to have capability to couple with other models or components.

However, in order to communicate among three calls, a structured data type with pointer to pass through is designed. In this design, it is easy to change dynamics core and/or remove/add variables to the dynamics or physics package without to modify passing arguments. The structure data can be as a pointer without dimension in compiler, then the dimension is given by running time, for example, through FORTRAN namelist. Thus, one executable code can be used for different model resolution.

FGM has most capability of current global model, including MPI and reduced Gaussian grid structure. However, it has 2-D as well as 1-D decomposition for MPI, and a reduced spectral computation (Juang, 2004). It is so flexible that it can be run with any resolution and any MPI decomposition without re-compilation. The hybrid vertical coordinates to have flexible options for testing sigma, sigma-pressure, sigma-theta, and/or sigma-theta-pressure coordinates are under development.

Email: Henry.Juang@noaa.gov

EDUCATION: 1988 Ph.D. in Atmospheric Sciences, University of Illinois at Champaign-Urbana
1978 BA, in Atmospheric Physics, National Central University, Chongli, Taiwan

POSITIONS: Research Meteorologist, Environmental Modeling Center, National Centers for Environmental Prediction

9. A Grid-free Element Method for Gas Dynamics Simulation

Jun Shen and Peter Bernard. University of Maryland College Park, Department of Mechanical Engineering

A new grid-free Lagrangian dilatation element method for compressible flow has been developed in this research as an extension of incompressible vortex methods. It differs from grid-based numerical methods in a number of ways. The discretization is represented by a group of Lagrangian particles that are convected with the fluid flow velocities instead of a fixed spatial grid system. The velocities of the flow field, necessary in each time step to move the computational elements, are recovered from the dilatation distribution similar to the 'Biot-Savart' law used in incompressible vortex methods. The Fast Multi-pole Method (FMM) is used to speed up the process and reduce the cost from O(N^2) down to O(N log N). Each computational particle carries physical properties such as dilatation, temperature, density and geometric volume. These properties are governed by the Lagrangian governing equations derived from the Navier-Stokes equations. While the computational elements are convected in the flow, their properties are updated by integrating their corresponding governing equations. The spatial derivatives appeared in the Lagrangian governing equations are evaluated by using moving least-square fitting. The implementation of several different boundary conditions has been developed in this research. The results of applying the new grid-free dilatation method several compressible flow problems are compared with the solutions given by other proven numerical schemes. Good agreement of these results helps to establish the correctness of the present method.

Email: shen@umd.edu

EDUCATION: Ph.D., University of Maryland College Park, Dec. 2004
M.S., Jilin University China, Mar. 2001
B.S., Jilin University China, July 1998

RESEARCH INTEREST: Computational fluid dynamics, turbulence modeling and simulation, heat transfer and thermal management, scientific computing, and micro/nano-fluidics.

10. Modelling Cross-shore Sediment Transport Processes With A Time Domain Boussinesq Model

Wen Long. Center for Applied Coastal Research, Univ. of Delaware

A phase-resolving sediment transport model is proposed by incorporating a time domain Boussinesq model and a wave boundary layer model for the purpose of looking for detailed cross-shore sediment transport mechanisms. The work is essentially to model sediment transport rate using instantaneous bed shear stress predicted from a detailed wave boundary layer model following Hsu et al (2004) and Justesen (1988) with free stream velocities obtained from Boussinesq model. Model is utilized to reproduce on shore sand bar migration events observed in DUCK94 field experiments. Relatively good agreement is achieved.

Email: longmtm@dune.coastal.udel.edu
POSITION: Ph.D Candidate, Civil Engineering
AFFILATION: Center for Applied Coastal Research , University of Delaware
EDUCATION: Master: Fluid Mechanics, Tianjin University, 2000
Bachelor: Engineering Mechanics, Tianjin University, 1997
RESEARCH INTEREST: Coastal/Ocean Engineering, Computational Fluid Dynamics, Sediment Transport, Waves and Currents, Environmental Fluid Mechanics