GEWEX WCRP

Global Energy and Water Cycle Experiment

NEWS

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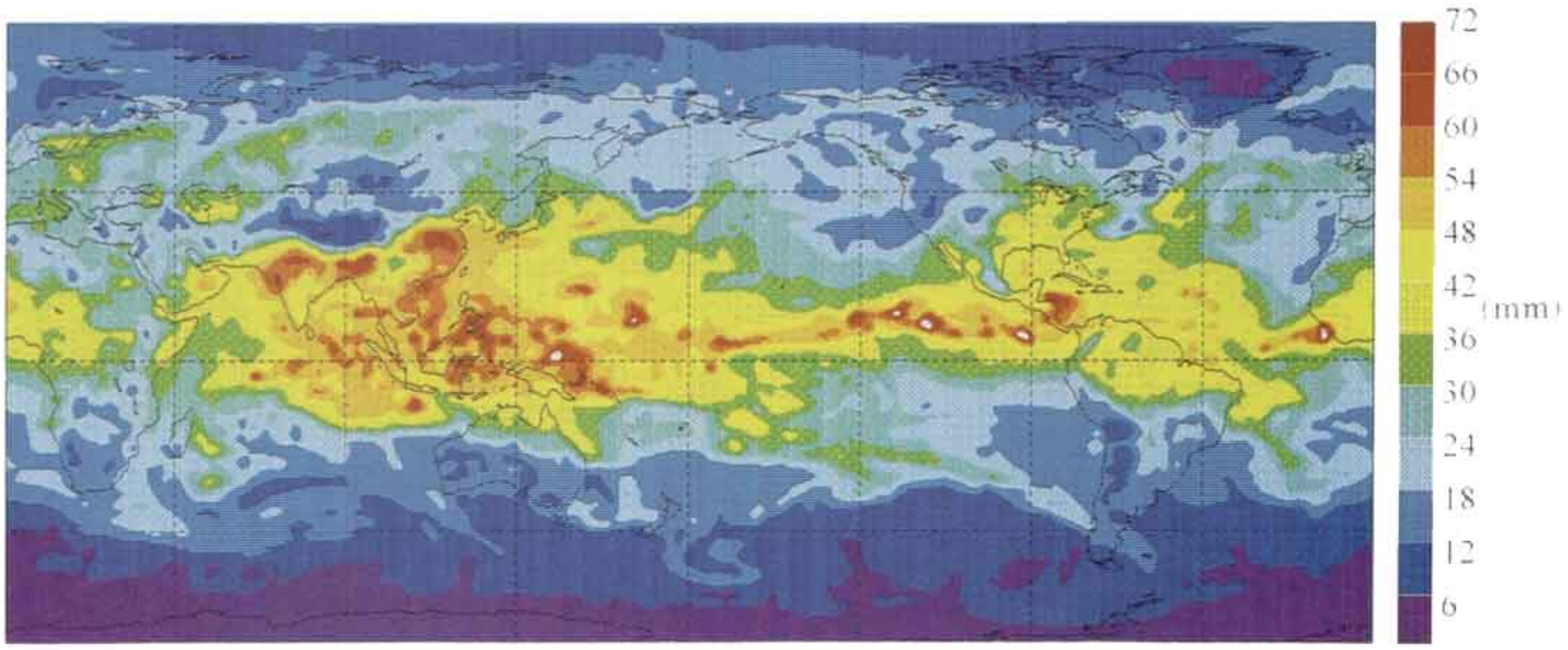
World Climate Research Programme–WCRP



New global water vapor data set of total precipitable water now available based on combined radiosonde, microwave (SSM/I), and infrared satellite (TOVS) data (example is for 10 July 1989, see article page 8). Five-year total and three-layer data sets due by summer 1995. The significant vertical and temporal variation in water vapor measured by Raman lidar is illustrated on page 20.

BALTEX
The Baltic Sea Experiment

Lennart Bengtsson
Max-Planck-Institut für Meteorologie

Introduction

The Baltic Sea region covers an area of 2.1 x 10^6 km^2 including the drainage basin of 1.7 x 10^6 km^2. The annual net drainage discharge is 470 km^3/yr, with an interannual variation of some 25%. The total discharge from the Baltic Sea through the Danish Straits is about the same as for the Mississippi River.

The large scale hydrological balance for the Baltic Sea was investigated in the early 1960s by means of aerological observations by Erik Palmen and Alf Nyberg and their coworkers in Finland and Sweden. The net accumulated precipitation was validated by hydrological measurements of river runoff and precipitation measurements.

(Continued on page 7)

WHAT'S NEW IN GEWEX

- New Global Water Vapor Data Set Available
- Prof. H. Grassl New WCRP Director
- Over 200 Attend European GEWEX Conference
- ISCCP II (1995-2000) Planning Underway
- Cloud Profiling Radar Gains Support (Workshop Report Published)
- BALTEX Science Steering Group Constituted

In This Issue

NEW WORLD CLIMATE RESEARCH PROGRAMME DIRECTOR SELECTED

Professor Hartmut Grassl will succeed Prof. Pierre Morel as Director of the World Climate Research Programme (WCRP) on 1 October 1994. Prof. Grassl's scientific background includes research in atmospheric radiative transfer and the radiative impact of aerosols. In addition he has contributed to the modeling of land-ocean-ice atmosphere-coupled systems and also to the development of spaceborne measuring systems.

Prof. Harmut Grassl appointed new director of WCRP.

For the past 6 years, Prof. Grassl has been head of the Experimental Meteorology Department at the University of Hamburg and also a director of the Max-Planck-Institute for Meteorology. Previously he was head of the Department of Physics at the GKSS Research Center, Geesthacht, and on the Meteorology Department faculty at the University of Kiel.

In recent years, Prof. Grassl has been active in communicating global change science issues to the general public and government bodies at national and international levels. He is chairman of the Global Change Advisory Board of the German Government and a vice chairman of the Inter-Governmental Panel for Climate Change.

World Meteorological Organization (WMO) President Zou Jingmeng, with Prof. G.O.P. Obasi, Secretary General of the WMO, presenting International Meteorological Organization Prize Medal to Prof. V. Suomi. (Photograph courtesy of University of Wisconsin-Madison)

PROF. VERNER E. SUOMI HONORED

On 13 May 1994, at the University of Wisconsin-Madison, the World Meteorological Organization's 38th International Meteorological Organization Prize was presented to Prof. Verner Suomi. The scroll for the prize read

> "In recognition of his pioneering contributions as the father of weather satellites, establishing the field of satellite meteorology, inventing numerous instruments to measure the Earth's heat budget, enabling geostationary weather observation by inventing the spin-scan camera, and fostering international cooperation by his leadership in cooperative weather endeavors."

The activities began on the morning of 14 May 1994, with the 1994 Suomi Lecture presented by David S. Johnson of the U.S. National Research Council on the evolution of the meteorological satellite. His focus was on the United States role, with frequent reference to Prof. Suomi's contribution. The recollections presented by David Johnson began with the U.S. Navy's Vanguard program and then proceeded to the accelerated efforts following the 1957 "Sputnik" event. The productivity of the 1960s cooperative efforts between the then newly formed National Aeronautics and Space Administration and the U.S Weather Bureau (and the successor

organizations in the 1970s) was very good when key decisions were made in hours or days. Those informed decisions were made by scientists, engineers, and operational meteorologists. This policy led to the rapid, successful, and economic development of the operational meteorological satellite.

David Johnson recalled many important facts not generally known that contributed to the development of meteorological satellites. For example, Prof. Sean Twomey's solution of a satellite stability problem by applying his knowledge of atmospheric electricity. David also noted that with the passing of the years, the advances slowed and costs soared as the policy of "decision by committee" grew, and then about 15 years ago, there was a crippling decision to abandon the program to test fly experimental instruments on NASA satellites. He concluded his talk with a plea to correct the present sluggish, costly procedures hindering the advancement of meteorological satellites.

During the discussion Prof. Pierre Morel was identified as the leader in the development of environmental satellites in Europe. He replied that he has similar concerns to those presented by David about today's lack of innovation and creativity in satellite meteorology, in contrast to the Suomi legend.

The highlight of the day was the formal presentation ceremony of the 38th International Meteorological Organization Prize to Prof. Verner Suomi. Following a "welcome" by David Ward, Chancellor of the University of Wisconsin-Madison, Dr. E. W. (Joe) Friday, Jr., Permanent Representative of the United States to the World Meteorological Organization (WMO) introduced Prof. G.O.P. Obasi, Secretary-General of the WMO. Prof. Obasi reviewed the history of the prize and many of Prof. Suomi's accomplishments. Following Prof. Obasi's informative address, the formal three-part presentation of a gold medal, scroll, and check was made by the President of the WMO, Zou Jingmeng.

The acceptance speech by Prof. Suomi was brief. He specifically mentioned the role of GEWEX in combining advances in technology and science to improve the understanding of the processes that will lead to better climate and weather predictions. In the Suomi tradition, he introduced in his talk a new idea on how to use technological advances outside of meteorology, specifically the use of cellular communication satellites to provide atmospheric soundings.

BALTEX Science Steering Group Constituted

In May 1994, the BALTEX Science Steering Group (BSSG) held its first meeting. The composition of BSSG is aimed at representing the principal disciplines and the 10 countries currently active in BALTEX.

BSSG Membership

Prof. L. Bengtsson (Chair)	Germany
Prof. S. Bergstrom	Sweden
Prof. J. Dera	Poland
Prof. E. Holopainen	Finland
Prof. Z. Kaczmarek (Vice-Chair)	Poland
Dr. P. Karing	Estonia
Dr. P. Korkutis	Lithuania
Prof. W. Krauss	Germany
Mr. L. Laursen	Denmark
Dr. P. Mälkki	Finland
Prof. E. Müller	Germany
Prof. E. Raschke (Vice-Chair)	Germany
Prof. G.A. Schultz	Germany
Dr. I.M. Skouratovich	Belarus
Prof. A. Stigebrand	Sweden
Prof. H. Sundquist	Sweden
Prof. V.S. Vuglinsky	Russia
Dr. E. Zaharchenko	Latvia
Ex-Officio:	
Dr. H.-J. Isemer	Germany

To support the work of the BSSG, three BALTEX working groups, Data Management and Data Studies (chaired by Mr. L. Laursen, Denmark), Numerical Experimentation (chaired by Prof. J. Willebrand, Germany), and Process Studies (chaired by Prof. E. Ruprecht, Germany) were established in 1993. All of the working groups met earlier this year with the main task to prepare input for the BALTEX Implementation Plan.

The national BALTEX committees are preparing proposals or programs for contributions to BALTEX. The German BALTEX contributions are funded for the period 1994–96 by the German Federal Ministry of Research and Technology (BMFT) within the special national research category Water Cycles. Additional funds from the BMFT were obtained to support initial scientific projects in the eastern countries. (See related workshop summary, page 12).

Prof. Pierre Morel and Prof. Verner Suomi at the University of Wisconsin-Madison, 13 May 1994.
(Photograph courtesy of University of Wisconsin-Madison)

CONVERSATION

in

Madison, Wisconsin, U.S.A.

with

Prof. Pierre Morel, Director, World Climate Research Programme
Prof. Emeritus, Verner Suomi, University of Wisconsin-Madison

and

Dr. Paul F. Twitchell, *GEWEX News*

I am honored to have the opportunity to speak with two distinguished leaders in science. You are both people of action.

GEWEX: First, may I extend my congratulations to Prof. Suomi for receiving the 38th International Meteorological Organization Prize, presented yesterday, by Zou Jingmeng, the President of the World Meteorological Organization (WMO).

SUOMI: I would like to thank Prof. Morel and you for coming.

GEWEX: I understand that following a symposium in May 1986, on the Impacts of Satellites on Atmospheric and Oceanic Science, that both of you and Dr. Lennart Bengtsson, Max-Planck-Institut für Meteorologie, met to discuss the scientific basis for global climate change with a focus on the energy and water cycle. Let's start with the meeting of both of you and Dr. Bengtsson. How did you happen to get together?

MOREL: Well, we were all here in Madison for the symposium held in honor of Prof. Suomi on the occasion of his retirement.

SUOMI: Yes, it was the Friday following the talks; Pierre, Lennart, and I met here in Madison. We were discussing what we had heard earlier about the plans promoting satellite measurements for global change research.

MOREL: The speakers advocating satellite programs and instruments had an obvious lack of recognition for the need to combine in an optimal fashion satellite data with other sources of information.

SUOMI: Pierre spoke at the 1986 symposium about the need to expand upon the results that accrued from the Global Atmospheric Research Programme (GARP), that is, a better understanding of the dynamics of the atmospheric circulation for developing improved operational weather prediction.

MOREL: However, GARP was deficient as it was essentially an exercise in "dry" fluid dynamics. It was not possible at that time to obtain adequate observations from satellites for determining global energy, water exchange, and transport.

SUOMI: Water is very important for the heat budget. For example, over the prairie grass in Nebraska on a long June summer day, the grass soaked up the sun. While the albedo was only 12% and the sun very strong, the diurnal temperature range was 15 °C. However, in September when the grass had dried the albedo was 30%, and yet the diurnal temperature range was 30 °C because there was little or no moisture to evaporate. So land processes are important, but the oceans are a major controlling factor in global heat flux.

MOREL: What do we do about the oceans? We can now measure ocean surface temperatures from satellites and compute fluxes.

SUOMI: In the 1960s at a Numerical Weather Prediction Conference in Tokyo, I had a discussion with Yale Mintz. At that time, modelers treated the ocean as a solid silver mirror and land as dry styrofoam. Well, land when wet acts like the ocean, that is, like wet styrofoam. However, it is not that simple. Climate is controlled by a great variety of processes, but there was no systematic approach to study the processes. Obviously, a global thermodynamic experiment was needed similar to GARP that includes water and radiation processes. When Pierre became director of the World Climate Research Programme (WCRP), he implemented a strategy to organize the existing disjointed array of process studies into the logical scientific strategy that we call GEWEX.

MOREL: Getting scientists from different disciplines to focus their research on global change, not just talk about working together, but to *do it*, is a painstaking process. It is not easy for good scientists from different disciplines to develop common goals and language to address interdisciplinary problems. The GEWEX science teams are genuinely doing it.

GEWEX: It is clear from this conversation that when both of you met here in Madison with Lennart Bengtsson that the scientific foundation for GEWEX was a major theme. Was the acronym GEWEX created at this meeting?

SUOMI: Pierre already had some ideas, and I think that we were calling this GARP-like program GEWAC. Maybe Pierre can recall when the "AC" was replaced by an "EX".

MOREL: I believe the acronym GEWEX emerged at our get-together in 1986 after your retirement symposium. As I recall we were discussing the science in the context of a global experiment. There were prior acronyms for GEWEX, but none quite captured the imagination of the science managers.

GEWEX: Possibly one of you, or both of you, would like to comment on the role that environmental satellites will play in global change studies.

MOREL: GEWEX provides the scientific basis and the perspective to think about how satellites will contribute to climate prediction. The processes that govern climate change, annual variations, or control the equilibrium of climate have some form of memory. To develop improved models using four-dimensional data analysis and to introduce better parameterization and physics will require satellites to provide global data. Also, to validate these models will require data over long periods of time. For example, there is a need for a cloud radar on one or more future satellites. Cloud radar will be essential for GEWEX and important for advancing operational weather prediction. If we are to provide the best input data for climate and weather prediction models it will be necessary to assimilate merged information derived from existing and planned satellite instruments in combination with surface-based observations.

SUOMI: I agree, a problem today is that instrument developers oversell their device assuming that it can do more by itself than it can. We need to consider using instruments in combination with each other to measure water in the atmosphere and its transport. For example, over the ocean the water molecules leaving the surface vary with sea surface temperature, but the molecules going back in depend upon atmospheric conditions. This flux of water molecules over the ocean is a combination of oceanic and atmospheric processes. To measure these requires a combination of instruments, which is very difficult from satellites. I use this as an example of the need to use instruments in combination with each other.

MOREL: The international satellite community has lost a good deal of its momentum for developing new instruments. Making opportunities to test new instruments on NASA platforms so rare and difficult has jeopardized innovative ideas. We might not have weather satellites today if decisions thirty or more years ago had been made by committee rule. The novel ideas Prof. Suomi introduced might never have been realized. The slow progress we see today in testing new instrument ideas is not only a problem in the United States. For example, in Europe, METEOSAT took only 3 years to define from its 1968 beginnings and was launched 10 years later.

Present-day managers and their committees are simply too well organized to consider any risk, while politicians think mainly in 2-year timeframes. One did not build a railroad across this country on a 2-year time scale.

SUOMI: You mentioned building railroads. Yesterday I used the analogy of the telegraph network built by commercial railroads giving weather forecasters information on a synoptic scale for the first time, and now, with the advent of cellular communication satellites, we have another opportunity to use a commercial enterprise to advance our science. I introduced in my talk the idea of using changes in signal propagation between global positioning satellites and the low orbiting cellular communication satellites (occultation scheme) to deduce "soundings" of the atmospheric density profile.

There are plans for a new generation of platforms and there are new ideas, but how do we get government to act on them? Today the long planning process within government agencies is hindering progress.

GEWEX: Thanks to both of you for this opportunity to discuss the concept of GEWEX and for your enlightened thoughts on the future.

BALTEX Sea Experiment

(Continued from page 1)

The Baltic Sea area is a very suitable region for a major geophysical experiment and will no doubt contribute significantly to the scientific objectives of GEWEX. It will primarily be a cage experiment including process studies, numerical modeling, long term data analysis, and application of remote sensing. The preparatory stage has started, including planning work and preparatory numerical modeling. The BALTEX project will be actively supported by meteorological services in the area, several of them operating advanced limited area models and data assimilation systems.

BALTEX will have a strong oceanographic component, including studies of water exchange processes and detailed studies of sea-ice processes in the Baltic Sea. Other areas of interest include investigations of intense cyclogenesis over the Baltic Sea. An improved understanding of the hydrological and energy cycle for the Baltic region will not only be of considerable benefit for the region itself but for weather and climate modeling in general and will create a sound scientific basis for environmental investigations. Several aspects of the BALTEX program would be transferable to other areas such as hydrological investigations of large Russian rivers and the Canadian Mackenzie GEWEX Study (MAGS).

A successful research program will provide benefits within a large number of areas. Some of them are discussed below.

Short Range Weather Prediction

The Baltic Sea plays a central role for trade and shipping. Shipping requires more reliable forecasts, particularly for adverse weather conditions, for the state of the sea, and for the status of the sea ice. A particularly serious problem is icing on ships, which can develop rapidly in stormy conditions at low temperatures.

Severe storm surges occur particularly at the inner parts and end of bays. These are most serious in rapidly moving systems when the water level can change critically in a few hours. In many cases casualties have been reported.

The Baltic Sea is also playing an increasingly important role for leisure activities. Accidents due to the sudden development of small scale weather systems causing loss of life and property are not unusual. Improved monitoring of the weather through satellite observations and radar, *in situ* observations, and more realistic and reliable numerical modeling will be necessary for improvement of weather prediction services.

Many deficiencies in the weather information are due to insufficient knowledge of the hydrological cycle and many intense small scale weather systems driven by the release of latent heat and strong surface fluxes. It is anticipated that the BALTEX program will provide increased understanding of the physical mechanisms of intense mesoscale systems and contribute to more reliable forecasts of such features in the future. Similarly a more systematic use of satellite and other remote sensing data, explored under the BALTEX program, will contribute by providing a better specified initial state.

Longer Term Prediction

The sea surface temperature, sea ice, and the thermal stratification of the Baltic Sea require, together with good forecasts for the state of the atmosphere, improvements in the numerical modeling for the ocean component. Some important phenomena to predict are (1) the massive influx of salt water from the North Sea, which takes place under certain but rare meteorological conditions; (2) catastrophic increase in algae blooming; and (3) serious and rapid sea ice development. Accurate and detailed ocean modeling requiring high resolution is essential here since the vertical stratification of temperature and salt, particularly in the mixed layer, must be well described. It is expected that the ocean component of BALTEX will make a major contribution toward improved handling of these important processes.

Climate Monitoring and Impact

The BALTEX program will provide increased understanding of energy and water fluxes over a large and climatologically significant high latitude region of the Northern Hemisphere. In particular the interaction with a huge inland sea and surrounding land areas will be explored, including intense mesoscale features. Other aspects are the huge river runoff, totaling that of the Mississippi River, and occasionally occurrences of very forceful ice and air sea interaction during the winter, similar to what happens in Arctic and Antarctic waters. Development of climate monitoring methods,

including the development of satellite and radar observing and processing systems, will contribute to a better understanding of climate relevant processes of the Baltic region.

Environmental Aspects

The increase in environmental pollution in the Baltic region has reached critical levels that already have led to the destruction of aquatic life in some areas. Of particular concern is industrial waste, including discharge from nuclear power stations along the Baltic Sea and leakage of low and medium active waste dumps. In recent years, several environmental studies on the Baltic region have addressed issues mainly emphasizing chemical and biological measurements. It is clear from these investigations that the physical and dynamical processes in the Baltic region and associated interactions and feedbacks with the atmosphere and surrounding land areas are very complex. Such an example is the enforced upwelling from the huge reservoir of nutrients below the primary halocline leading to a rapid increase in both the primary and secondary biological activity. It is thus difficult to draw any general conclusions from such observational programs without a strong supportive modeling program of the physical system. Consequently, a program like BALTEX that incorporates comprehensive three-dimensional data assimilation and modeling both in the ocean and the atmosphere will provide a solid framework for environmental investigations and will make it possible for more realistic environmental predictions and scenario calculations.

Importance for Other WCRP Programs

Several aspects of the BALTEX observational programs are unique. The integration of atmospheric, hydrological, and oceanographic observations in both operational and research modes will provide important experience in future data handling and data assimilation systems for World Climate Research Programme activities. The BALTEX program will provide assistance to the GEWEX program including the GEWEX Continental-Scale International Project (GCIP), the GEWEX Cloud System Study (GCSS), and the new Climate Variability and Predictability (CLIVAR) Program.

Ice observation and ice modeling in the Baltic Sea are presently being done with advanced methods, and further such advancements will be an important part of the BALTEX program. These developments will be most beneficial for the Arctic Climate System Study (ACSYS), in particular for ice dynamics investigations in narrow straits, which will have to be treated on scales typical for the Baltic region. Future hydrological studies, particularly of arctic conditions where water flow interacts with the ice processes, such as for the large Russian rivers, will no doubt benefit from similar aspects of the BALTEX program.

A NEW TOTAL AND LAYERED GLOBAL WATER VAPOR DATA SET

Thomas H. Vonder Haar
David L. Randel
Mark A. Ringerud
Graeme L. Stephens
STC-METSAT

The development of a complete and accurate global water vapor data set is critical to an adequate understanding of the Earth's climate system and is a vital first component of the GEWEX Water Vapor Project (GVaP). Accurate global water vapor data are essential to many GEWEX related studies including poleward energy transport, radiation budget studies, general circulation model verification, and global change baseline measurements. During the next decade, many GEWEX programs and experiments will utilize present and future data sets to expand our knowledge and understanding of the role of moisture in climate and its interaction with other variables such as clouds and radiation.

The need for improved knowledge of the global water vapor distribution is well documented. The majority of large scale water vapor climatological studies have, to date, relied wholly upon analysis of radiosonde data (Bannon and Steele, 1960; Oort, 1983). There are a number of new projects currently ongoing to define more accurately the global water vapor climatology from both infrared and microwave space-based retrievals. Satellite-based observations are critical to this climatological effort because the data collected at each radiosonde site may not be representative of the surrounding atmospheric conditions as significant humidity gradients exist between the limited resolution of stations. Data gaps over the oceans and even some land areas limit the extent from which inferences may be made about the nature of the global water vapor distribution. Additional data sources, such

as infrared and microwave satellite data sets, greatly enhance the global coverage on a daily basis.

To satisfy these needs, STC-METSAT is producing, under a NASA-sponsored project, a 5-yr, 1° x 1° degree resolution, global water vapor data set. This data set covers the time period from 1988–92 and includes daily composites from a combination of ground-based radiosonde data and infrared and microwave satellite retrievals. The challenge has been to combine these data from quite different measurement systems into the most accurate data "collage."

Input Data Sources and Data Processing

The total integrated water vapor product, or precipitable water content (PWC), is a weighted merging of Defense Meteorological Satellite Program (DMSP) Special Sensor Microwave/ Imager (SSM/I) microwave retrievals, NOAA TIROS Operational Vertical Sounder (TOVS) infrared retrievals, and quality controlled radiosonde retrievals (Elliott and Gaffen, 1991). Each of these measurement systems has limited data coverage. The radiosonde coverage is widely spaced and primarily over land, while TOVS retrievals are performed in the absence of thick precipitating clouds. The SSM/I retrievals are made only over the oceans. In both satellite data sets there are also missing orbital swaths.

The final integrated PWC product is created by combining all three of the input data sets, using a hierarchical weighting scheme. This algorithm uses radiosonde data, when available as truth, and then applies a weighting scheme to the TOVS and SSM/I. Finally, linear and temporal interpolation routines are run to fill missing data points. Included as part of the PWC data set is a data source code map that describes the origin of each point in the merged product. In addition, the data source codes are ordered by the estimated data error in the merged field.

To study the important energy transport processes, layered information as well as the total integrated water is needed. For the total PWC merged product described above, three input data sources are used: TOVS, radiosonde, and SSM/I retrievals. Two of these contain level information that can be used for multilayer water vapor processing. Operational TOVS retrievals are reported at three layers: Surface–700 mb, 700 mb–500 mb, and 500 mb–300 mb. The radiosonde data PWC calculation is performed at these matching layers. For each day, three global grids are formed of the percent-of-the-total (POT) PWC in each of the three layers. Spatial and temporal interpolations are used to fill in missing data points. The assumption used in this method is that while the total and layered PWC can change rapidly, the POT in each layer is much more stable. The variability in the POT is a strong function of latitude and season and does not vary spatially as fast as the PWC. These POT fields are multiplied by the total PWC created in the SSM/I, TOVS, and radiosonde-merged process, and output as layered PWC global grids.

Results

On the cover is an example of the daily merged total precipitable water for 10 July 1989. The values range from an average of 4 mm in the tropics to less than 1 mm near the poles. During July the Indian monsoon is fully developed and the gradient in the PWC across the Himalayas is easily seen.

Figure 1 presents the global and hemispheric averages of the daily fields for the total PWC in 1988, the first year in the data set. The seasonal variation of the global water vapor and some of the hemispheric differences are very evident. These variations were first reported by Wittmeyer and Vonder Haar (1994) using only the TOVS data.

It is seen that the global PWC averages have a sinusoidal maximum during June-July-August (JJA). The Northern Hemisphere (NH) values have a maximum during the summer months (JJA) and a minimum in the winter. The difference of the NH

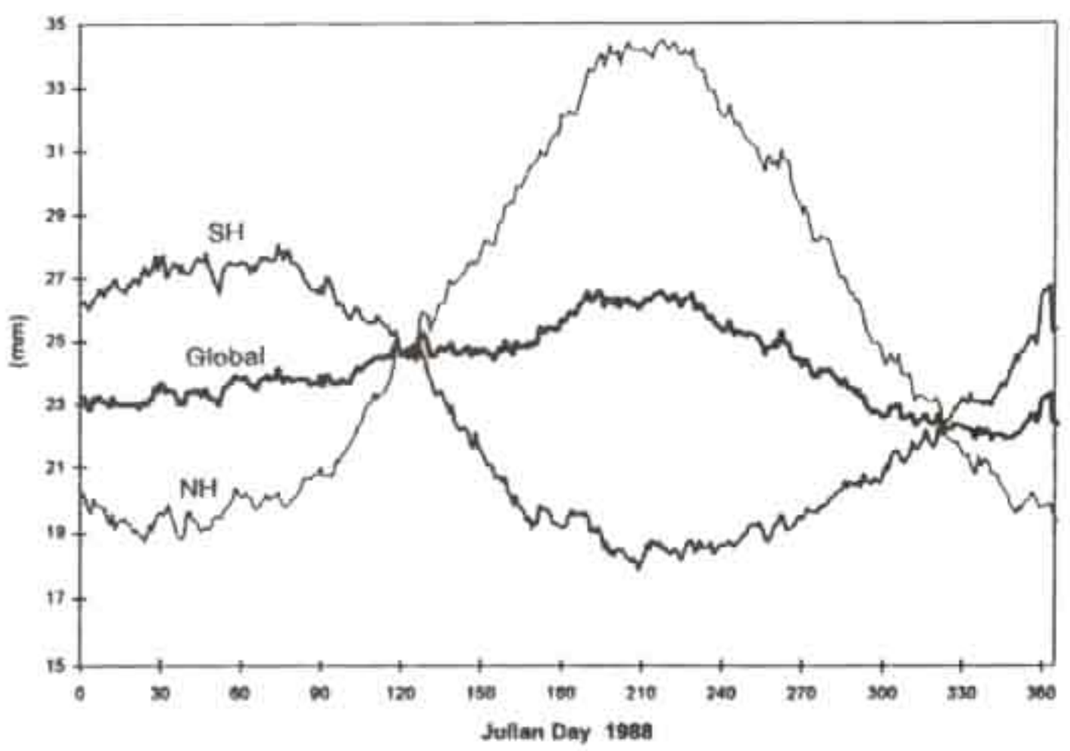


Figure 1. Annual cycles of global and hemispheric averaged precipitable water for 1988.

versus the Southern Hemisphere (SH) is significant. The range of NH averages is twice that of the SH, the summer maximum being much greater for the NH. This variation is due mainly to land-ocean differences—the NH contains most of the Earth's land area. The large NH land areas produce much more of a seasonal temperature range than the oceans. The amount of water vapor in the air is directly proportional to the temperature, and in combination with the strong summer convective maximum it causes the larger NH seasonal range. Other factors include the severe summer monsoon season in India (NH) and the lower water vapor concentrations in the SH contributed by the cold and elevated Antarctic.

In Figure 2 the global average total PWC is combined with the three layered global averages. The plot shows that more than 75% of the total PWC is below 700 mb and more than 90% is below 500 mb. The highest level shows more seasonal variability in the NH than the SH, as does the midlevel. Again, this would be largely due to the NH and SH differences mentioned above.

In Table 1 are listed the estimates of global and hemispheric averaged PWC from previous studies. The present study includes data for 1989 and is in agreement with previously published TOVS results. It is generally accepted that including the European Centre for Medium Range Weather Forecasting PWC in the results makes the values too high (Wittmeyer and Vonder Haar, 1994).

Summary

An extensive data set of global water vapor has been produced from three independent data sources. These products include total column integrated values and vertical layered values at three levels. Each of the individual input data sets has significant limitations: microwave retrievals are presently feasible only over oceans; infrared satellite techniques only work in the absence of significant cloud cover; and radiosonde measurements are made primarily over land and are distant points, not showing small scale water vapor variations. A comprehensive global data set must draw upon the strengths of each of these methods and utilize the advantages of each for all meteorological and geographical scenarios. The result is a combined product far better than any one single input data set. A method had been derived using the layered PWC from radiosondes and TOVS retrievals to create a three-layer global PWC data set. By using this information along with the SSM/I PWC retrievals over ocean areas, we have produced an extensive global three-layer data set. The complete 5-yr data set is scheduled for completion and use by climate researchers in the summer of 1995.

Table 1. Historic Estimates of Global Precipitable Water Content Including the Present Study

Investigator	Data	Time Period	NH	SH	GL
Present Study	3 sources	1989	24.8	22.4	23.6
Wittmeyer and Vonder Haar (1994)	TOVS	1983–89	24.3	22.5	23.4
Wittmeyer (1990)*	ECMWF	1983–88	28.7	26.1	27.4
Rosen et al. (1979)*	MIT	1958–63, 1968	25.7		
Starr et al. (1969)*	IGY	1957–58			26.0
Trenberth (1991)*	6 sources	1957–78			25.3
Trenberth (1987)*	EMCWF	1978–85			28.6

*For additional data and complete references on these studies, see Wittmeyer and Vonder Haar (1994).

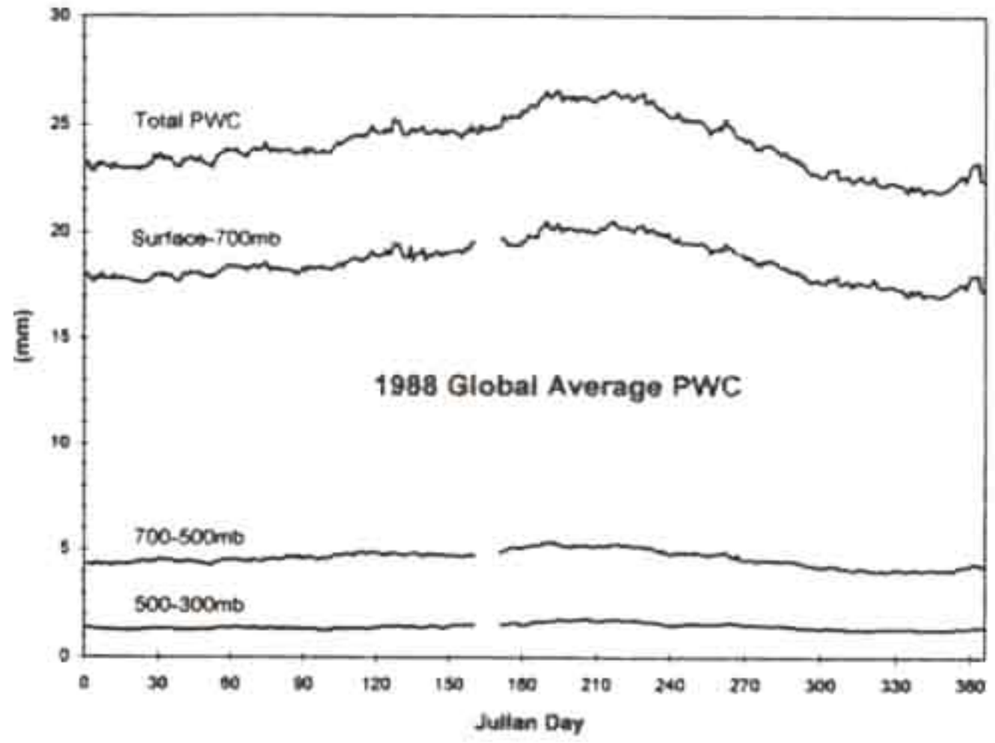


Figure 2. Annual cycle of the total and layered global averaged PWC for 1988.

Acknowledgments

Data collection and processing for this project is sponsored by the NASA, administered by J. Dodge (Contract NASW-4715). Other researchers who are an integral part of the project team include Ian L. Wittmeyer, Thomas J. Greenwald, Cynthia L. Combs, and Donald L. Reinke.

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CANADIAN GEWEX NEWS

Prof. Han-Ru Cho of the University of Toronto, Dept. of Physics, has been appointed chairman of the Canadian GEWEX Science Committee. The former chairman, Dr. Gordon McBean, will continue to follow with interest and support GEWEX in his new position as Assistant Deputy Minister of the Atmospheric Environment Service (AES) of Environment Canada.

Members of the Canadian GEWEX Science Committee met on 16 March 1994 at AES Headquarters in Toronto to complete the review of the proposals that had been submitted by government researchers for Green Plan funding for FY 1994/95. In attendance were H. R. Cho (Univ. Toronto, Chairman), D. Gray (Univ. Saskatchewan) W. Rouse (McMaster Univ.), R. Soulis (Univ. Waterloo), P. Marsh (NHRI, Saskatoon), R. Stewart (AES, Downsview), D. Verseghy (AES, Downsview), L. Welsh (AES, Saskatoon), and T. Krauss (Canadian GEWEX Secretariat).

Allocation for 20 projects was approved on the following topics:

- Satellite observations, real time mesoscale modeling, special research aircraft flights, and radar observations, during the Beaufort and Arctic Storms Experiment (BASE) to be conducted during Sept.–Oct. 1994.
- Implementation of improved precipitation measurement methodologies and application of satellite evapotranspiration studies.
- Further development of cloud-precipitation-temperature relationships for the Mackenzie GEWEX Study (MAGS).
- Moisture budget analyses and mesoscale distributed precipitation modeling for MAGS.
- Hydrological modeling with the Mackenzie Basin and Mackenzie mainstream and delta simulations.
- Hydrological process studies involving snowcover removal and development in boreal and tundra ecosystems, hydrologic responses of discontinuous permafrost and wetland zones, and glacial runoff contributions.
- Remote sensing studies of evapotranspiration and monitoring of snowmelt in northern watersheds.

For further information about the Canadian GEWEX program contact Dr. Terry Krauss, National Hydrology Research Centre, 11 Innovation Boulevard, Saskatoon, SK S7N 3H5, Tel: 306–975–4215; Fax: 306–975–5143; Internet e-mail: krausst@nhrisv.nhrc.sk.doe.ca.

MEETING AND WORKSHOP SUMMARIES

International Satellite Cloud Climatology Project (ISCCP) *Ad Hoc* Panel for Scientific Aspects of ISSCP Phase II New York City, New York 26–28 May 1994

S. Benedict
World Climate Research Programme

The International Satellite Cloud Climatology Project (ISCCP) was established in 1983 to collect and analyze satellite radiance measurements to infer the global distribution of cloud radiative properties and their diurnal and seasonal variations. As a major component of the WCRP GEWEX program, primary focus is on the determination of the role of clouds in the radiation balance (top of the atmosphere and surface) leading to greater knowledge of the global hydrological cycle. Cloud cover fraction, cloud height, and cloud optical thickness are the principal derived parameters of the ISCCP cloud climatology that relate closely to the energy available to the climate system and to the partitioning of that energy between the atmosphere and the surface. Over 8 years of global data are currently available via CD-ROM and internet FTP, and an updated 10-yr data set will be available by the end of 1995. These ISCCP data and analysis products are extensively being used now to improve the understanding and modeling of the effects of clouds on climate.

Recognizing that changes to the existing blend of research and operational practices must be considered in the context of future observing systems, the GEWEX Science Steering Group recommended that an *ad hoc* panel be appointed to look into improvements and additions to ISCCP that could be incorporated into a Phase II product in the 1995–2000 timeframe.

The panel was constituted under the auspices of the GEWEX Working Group on Radiative Fluxes (WGRF). At the New York meeting the panel chairman made the following observations in relation to potential additions to ISCCP that would benefit the modeling community:

(i) New products such as effective particle size or the phase discrimination would expand the value of the data.

(ii) Higher time and spatial resolutions for at least some representative regions, such as those that describe the GEWEX continental scale regional projects (e.g., Mississippi River basin, BALTEX, LAMBADA, MAGS).

(iii) More detailed and descriptive analyses of errors and ranges of error associated with all ISCCP products.

(iv) More direct interaction with all elements of the ISCCP and the modeling community to further the understanding and value of the ISCCP database in modeling studies.

Discussions by the panel members expanded on these topics and opened other related subjects. It was agreed at the meeting that two important quantities in obtaining radiative surface fluxes are surface temperature and surface albedo. A scheme that accounts for angular and spectral dependencies in the current data could provide a first order improvement in estimations of these values, while more ambitious analyses would require combining ISCCP data with information from other instruments. The GEWEX International Satellite Land Surface Climatology Project (ISLSCP) management has been asked to evaluate the various approaches for producing the data sets. These discussions led to the conclusion that new research methods expanding on ISCCP in the 1995–2000 timeframe should include a range of spectral measurements from additional sources not considered in the previous analyses.

It was also recommended that the specific research should consider thin cloud identification, cloud particle size, improved surface temperature and albedo products (in concert with ISLSCP), application of IR sounder and microwave imager results, and exploitation of improved conventional meteorological observations and related improvements in ground validation measurements. The panel will prepare a report for the WGRF by 1 January 1995 so that the final recommendations can be made to the GEWEX Scientific Steering Group the week of 30 January–3 February 1995.

ISCCP Phase II participants at New York City meeting in May 1994.

BALTEX Workshop
Lithuanian Board for Hydrometeorology
Vilnius, Lithuania
6–8 June 1994

Participants from Belarus, Russia, Estonia, Latvia, Lithuania, Poland, Sweden, and Germany met in Vilnius to discuss future BALTEX projects to be performed in the six eastern BALTEX countries and coordinated and partially funded by the International BALTEX Secretariat (through a grant of the German Federal Ministry of Research and Technology, BMFT). These projects have been defined to provide necessary data input for BALTEX modeling activities and to review and investigate parameterizations for physical parameters needed as input to hydrological and meteorological modeling in the BALTEX area. Participants from Sweden and Germany reviewed data requirements for the Swedish and German BALTEX modeling activities. Data sources and availability of required data as well as BALTEX-related modeling activities in the eastern countries were identified. Especially noted were data that currently are not available or are difficult to access at national or international data centers or services.

The terms of conditions for the research contracts between the BALTEX Secretariat and individual institutes in the eastern countries had been drafted and were intensively discussed in the workshop. These contracts regulate that part of the projects to be funded by the BMFT. After fine-tuning, the contracts are planned to be signed in July of this year; the start of the funded project work is scheduled for 1 July 1994.

The workshop participants pointed out that funding by the BMFT should initialize BALTEX-related research in the eastern countries and should integrate this scientific work into the overall strategy of BALTEX. The purpose of this initiative is to stimulate further funding of BALTEX-related research by national agencies in the eastern countries.

A series of biannual workshops will follow as part of the coordination efforts to review and identify the needs for future work in these BALTEX projects. The next workshop, scheduled for November of this year, will be hosted by the Belarussian Administration of Hydrometeorology in Minsk, Belarus.

Report of Fifth European Polar Lows Meeting
Paris, France
20–23 June 1994

C. Claud
Laboratoire de Météorologie Dynamique (LMD)/CNRS

The theme of this meeting was "an intercomparison of Arctic and Antarctic mesocyclones." There were 19 participants, mostly from Europe, but also from Canada, Australia, and the United States. The meeting was formally opened by Dr. A. Chedin, on leave from the Laboratoire de Météorologie Dynamique, adviser to the French Minister for Research and Higher Education.

Talks were given on case studies undertaken in both hemispheres (e.g., Bear Island, Labrador Sea, north of Scotland, and Sea of Okhotsk in the Northern, and the Antarctic Peninsula, Weddel Sea, and Marie Byrd Land in the Southern). Both observational (mostly satellite) and numerical aspects were covered. A paper related the occurrence of polar lows to the North Atlantic Oscillation and another one addressed ocean processes and atmospheric mesocyclone interaction in relation to climate change issues.

Three future experiments were presented: FASTEX (Fronts and Atlantic Storm Track Experiment), FROST (First Regional Study of the Troposphere) and BASE (Beaufort and Arctic Storm Experiment). These campaigns, though not specifically intended for the observation of polar lows, should, however, offer the opportunity to better understand them through the assembling of comprehensive data sets of *in situ* observations. The FASTEX effort is related to the GEWEX Cloud System Study and BASE is part of the Canadian GEWEX programme.

The last day, the meeting broke into two working groups. One group discussed a polar low that occurred in the Norwegian Sea in October 1993, and for which a number of conventional observations are available. It was decided that this would be a reference case, and several participants agreed to work on it. In the other group, the definition of the term "polar low" was discussed. When the groups' findings were reported, an agreement was found on the following definition:

> The term "polar mesoscale cyclones" (polar mesocyclone) is the generic term for all meso-α-scale and meso-β-scale cyclonic vortices poleward of the main polar front). The term polar low should be used for intense maritime mesocyclones with scales up to about 1000 km with a near-surface wind exceeding 15 m/s.

The tradition of the European Polar Lows Working Group is to report in the scientific literature on advances discussed; for the Paris meeting the scientific papers will be submitted to *The Atmosphere Ocean System*. A summary of the Paris Workshop was presented by R.W. Stewart, July 1994, at the GEWEX European Conference.

Workshop on a Spaceborne Millimeter Wave Radar for the Study of Clouds
Luneburg, Germany
4 July 1994

A series of three GEWEX workshops was conducted to investigate the application of data from a spaceborne cloud profiling radar to provide the basis for determining the vertical distribution of cloud properties, atmospheric radiative heating, and the surface radiation budget. These workshops culminated in the publication of a report that provides both a scientific and a preliminary technical basis for a spaceborne cloud and radiation mission including a millimeter wave radar.

It was agreed at the Luneburg workshop that the current level of understanding about the ice particle size distributions in clouds was insufficient. Data from the proposed mission would fill a major observational gap necessary for deriving the ice water content of clouds for climate research.

The issue of frequency allocation for a spaceborne radar was discussed. The frequency of 94 GHz is currently used by a growing number of surface and aircraft systems but has not been allocated to the Earth sciences community. At the time of the workshop, it was felt that a request for allocation of 94/95 GHz to spaceborne cloud radar was unlikely to result in a positive response in the timeframe needed to implement this program; specifically, the earliest would be 1997. The frequency of 78/79 GHz is available, and it was recommended that this frequency be used for the spaceborne Cloud Profiling Radar (CPR). The full impact of this change of frequency on both science applications and system development must be addressed. In the meantime, a formal proposal is being made to acquire 94/95 GHz for the spaceborne radar.

GEWEX Working Group on Radiative Fluxes Meeting
Luneburg, Germany
5–8 July 1994

The Working Group on Radiative Fluxes (WGRF) has the responsibility for climate-related radiation issues in the WCRP. Studies of radiative processes, surface radiation fluxes, radiative flux divergence in the atmospheric column, cloud optical properties, and cloud-radiation interaction are fundamental to the implementation of GEWEX, and the working group, therefore, serves as the Radiation Science Panel for GEWEX. The objective of the meeting was to review progress in several major areas of scientific activity including the development of the cloud profiling mission, continuation of the International Satellite Cloud Climatology Project (ISCCP) through the end of the decade and beyond (ISCCP-Phase II), implementation of the Surface Radiation Budget Climatology Project, development of cloud fields and radiative heating and cooling profiles for GEWEX continental-scale regional experiments, implementation plans for the GEWEX Water Vapor Pilot Project (GVaP), progress on the Baseline Surface Radiation Network (BSRN) radiation measurement program, and other related radiation science issues.

The WGRF reaffirmed its support of the scientific basis of the Cloud Profiling Radar (CPR) mission as proposed at the CPR Workshop. The working group also plans to recommend that the Microwave Humidity Sounder (MHS) fly as planned or to enter into negotiations with the U.K. Meteorology Office to accommodate the Advance Microwave Sounder Unit (AMSU-B) engineering model in order to ensure that the vertical distribution of water vapor can be effectively measured from the EOS-PM platform. The WGRF further recommended that additional priority be given to the timely delivery of the BSRN data to an appropriate electronic archive.

The ISCCP was reviewed and the WGRF endorsed plans by the Global Processing Center to complete, by the end of 1995, a reanalysis of an entire 10-yr data set with previously approved improvements to the current processing scheme and algorithms. This effort will keep the project responsive to the community's needs as GEWEX enters its intensive observational phase at the end of the decade.

The meeting also included discussions on the need for coordinated data management of observational data sets from regional experiments. These data sets will be made easily accessible to the modeling community.

GEWEX Radiation Science Panel Meeting Participants, Luneburg, Germany, 5-8 July 1994.

The WGRF endorsed the continued development of the GVaP pilot study with the understanding that one of the thrusts of the project, which emphasizes development of a reference station network, should proceed in phases. It was recommended that the Atmospheric Radiation Measurement (ARM) Cloud and Radiation Testbed (CART) site in the Mississippi Valley region should be used as an initial verification of the GVaP reference station concept and that other existing and planned sites should be considered in the evaluation phase even though they may not initially be configured with the complete complement of desired equipment (e.g., including Raman lidars). It was felt that a proposed concept by project leaders to certify and test a reference station in the tropics (Christmas Island) should be considered a separate initiative.

The ISCCP Global Processing Center reported plans to produce tailored subsets of the pixel level satellite data, representing areas about 4–7 km across and sampled at intervals of about 30 km every 3 hours. The subsets will generally cover the geographical boundaries of each of the GEWEX continental-scale regional projects and a few other selected experimental regions and will be generated from the ISCCP Phase I reanalysis data set designated as "DX" data. The reanalyzed globally merged data at 3-hourly and 250-km temporal and spacial resolution ("D1") will also be used in further verification of the current surface radiation budget algorithms for computing surface fluxes.

The WGRF has taken under consideration an offer by the Colorado State University to host the next meeting in or near Boulder, Colorado, in July 1995, in the same timeframe as the International Union of Geodesy and Geophysics meeting in Boulder.

Working Group on Data Management for WCRP Radiation Projects
Budapest, Hungary
11–14 July 1994

The objectives of the Working Group on Data Management (WGDM) meeting were to review the operations and resolve programmatic issues with each of the WCRP radiation projects. Plans were reviewed for extending the collection and processing of all related radiation data and products.

Specific topics discussed included the following:

(1) The changes and additions to ISCCP that will constitute the second phase of the project in the timeframe 1995–2000. It was recommended that the current use of 6250 bps tapes be maintained only until a more efficient system can be investigated and implemented as a standard ISCCP data media (e.g., exabyte tapes, cartridge tapes).

(2) The ESA and EUMETSAT representatives agreed to keep the WGDM chairman advised of the transition process that will see EUMETSAT take over responsibility of the ISCCP data processing from the METEOSAT series of satellites beginning in December 1995.

(3) The working group chairman accepted responsibility to investigate and report to the group on the status of NASA ER-2 aircraft calibration campaigns that have provided good correlation data in the past but have recently been suspended.

(4) Presentations by satellite center representatives:

- The Chinese representative indicated willingness to the Satellite Meteorological Center in Beijing to participate in ISCCP and other WCRP GEWEX projects.
- The Hungarian Meteorological Service representative reviewed the status of the processing capabilities that exist for processing satellite data at the Satellite Research Laboratory in Budapest.
- The ESA European Space Operations Centre representative presented a status of the current support of ISCCP and distributed a CD-ROM containing the operational satellite radiance data.

The next meeting will be held in September 1996.

European Conference on the Global Energy and Water Cycle
London, England
18–22 July 1994

The European Conference on the Global Energy and Water Cycle held in London, England, from 18 to 22 July 1994, was a great success. Organized under the auspices of the UK GEWEX Forum, chaired by Prof. Keith Browning, the conference was housed in the rooms of The Royal Society, Britain's National Academy of Science.

The conference, with almost 300 registrants from over 20 countries, was fully subscribed. Among the keynote speakers, Prof. Pierre Morel gave his last lecture as Director of WCRP, on the science issues underlying GEWEX. General background on impacts was provided by Prof. Martin Parry and former ambassador, Sir Crispin Tickell. The main body of the conference was divided into six sessions. These dealt with atmospheric processes, precipitation measurement and analysis, land-atmosphere interactions, ocean-atmosphere interaction, continental-scale water budgets and, to knit them all together, global modeling.

A feature of the conference was its posters. There were about 200 altogether, but this was not as daunting as it might seem. Liberal time was allowed for viewing subsets of posters during long refreshment breaks that followed poster introduction plenary sessions. For each of these sessions all the appropriate poster presenters were seated on the platform and each talked about five key words or phrases that the chairman displayed for one minute. The standard of the posters and their presentation were generally quite high.

The after dinner speaker, Prof Jim Dooge, President of the International Council of Scientific Unions, stressed in his talk that an important ingredient of the conference was the way in which the different disciplines were coming together. There were no parallel sessions, and it was gratifying that hydrologists, oceanographers, and meteorologists sat through one another's lectures.

The essence of the Global Energy and Water Cycle is the coupling between the various components and processes. This was amply brought out by the presentations and will be systematized in a book to be published in the next year or two. Based on contributions from a small subset of conference participants, this heavily-edited volume will aim to

provide a balanced picture of the state of the art, while at the same time emphasizing the fundamental principles in a manner amenable to those unfamiliar with the subject. One light-hearted suggestion was that it should be entitled "Coupling for Beginners."

MEETING ANNOUNCEMENTS AND CALL FOR PAPERS

The World Climate Research Programme (WCRP) Conference on the Dynamics of the Arctic Climate System, 7–10 November 1994, Göteborg, Sweden

The purpose of this conference is to present contemporary understanding of the interaction of the Arctic with global change and to discuss implementation plans for the Arctic Climate System Study (ACSYS) of WCRP. The conference will have four sessions: Hydrological Cycle, Atmosphere, Sea Ice, and Ocean.

For additional information, contact Conference Chairman Peter Lemke, Alfred-Wegener-Institute, D-27515 Bremerhaven, Germany; Tel: +49–471–4831–512; Fax: +49–471–4831–425.

The 75th Annual Meeting of the American Meteorological Society (AMS), 15–20 January 1995, Dallas, Texas

As part of the 75th AMS Annual Meeting, there will be several symposia on climate topics. For further information on the Sixth Symposium on Global Change Studies contact Eric J. Barron, Earth System Science Center, 248 Deike Bldg., Pennsylvania State University, University Park, PA 16802; Tel: 814–865–1619; Fax: 814–865–3191; Omnet: E.Barron; Internet: eric@essc.psu.edu.

For Conference on Hydrology contact Dara Entekhabi, Dept. Civil and Environmental Engineering, Building 48-331, Massachusetts Institute of Technology, Cambridge, Massachusetts; Tel: 617–253–9698; Fax: 617–258–8850; E-Mail: dara@alborz.mit.edu.

Additional information on other symposia and registration can be found in recent issues of the Bulletin of the American Meteorological Society. Abstracts are due by 1 September 1994 for the many symposia scheduled for the 75th AMS Annual Meeting.

The Second International Study Conference on GEWEX in Asia and GAME, 6–10 March 1995, Pattaya, Thailand

The conference 6–10 March 1995 aims to discuss the scientific issues related to the water and energy cycles in monsoon Asia and its relation to the global climate system. Another important aim of this conference is to discuss and coordinate the international cooperation related to GAME (GEWEX Asian Monsoon Experiment).

To obtain the first circular attached with the registration form contact Prof. T. Yasunari, Chairman of the Second International Study Conference on GEWEX in Asia and GAME, c/o Institute of Geoscience, University of Tsukuba, Tsukuba, Ibaraki 305, Japan, Tel: +81 298 53 4399; Fax: +81 298 51 9764; E-Mail: yasunari@atm. geo.tsukuba.ac.jp; or contact Prof. K. Musiake, Secretariat of the Second International Study Conference on GEWEX in Asia and GAME, c/o Institute of Industrial Science, University of Tokyo, 7-22-1 Roppongi, Minato-ku, Tokyo 106, Japan, Tel: +81 3 3402 6231, ext. 2525; Fax: +81 3 3402 2597; E-Mail: prof@hydro.iis.u-tokyo.ac.jp

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NATO Advanced Study Institute on Remote Sensing of Processes Governing Energy and Water Cycles in the Climate System, 1–12 May 1995, Plön, Germany

This NATO–Advanced Study Institute (ASI) will cover all aspects—and wavelength regions—to measure indirectly from satellites, aircraft, or ground the atmosphere or ground properties, which allow studies of those processes that govern energy and water cycles in the climate system. Three additional lectures reflect the state of the art of climatology and modeling. All lectures are of basic interest for many climate research issues, in particular for the projects within GEWEX. One day will be spent at a "Remote Sensing Park" with various lidar, radar, rass, and passive sounding capabilities.

Students with a graduate or undergraduate degree in engineering, or in disciplines ranging from physics to geosciences, are invited to submit their first application to the ASI-Director, Prof. E. Raschke, as soon as possible. Some financial support is available. Contact Professor Raschke, GKSS Research Center, D-21502 Geesthacht, Germany, Tel: +49 4152 871833; Fax: +49 4152 872020; E-mail: raschke@dvmc10.gkss.de.

International GEWEX Workshop on Cold-Season/ Region Hydrometeorology, 22–26 May 1995, Banff, Alberta, Canada

An international GEWEX workshop focusing on cold-season/region hydrometeorological scientific issues will be held in Banff, Alberta, Canada, during the period 22–26 May 1995. The workshop is being held in conjunction with the annual general meeting of the Canadian Geophysical Union. The major workshop sponsors include the International and Canadian GEWEX project offices, NOAA, and the Canadian Atmospheric Environment Service. The objectives of the workshop are to review the current state of knowledge of cold-season hydrology and land-atmosphere interactions, and to identify and address the most crucial problems facing the modeling community. Workshop themes will include all aspects of snow and ice hydrology, surface-atmosphere, and surface-subsurface interactions and modeling, as well as hydrologic, GCM, and land surface process parameterizations, scaling, and modeling. Call For Papers pamphlets and announcements will be distributed in September with a deadline for abstracts due on 1 December 1994. More information concerning this workshop can be obtained by contacting the workshop organizing committee chairman, Dr. Tom Carroll, at Tel: 612–725–3039; Fax: 612–725–3338; Internet: tcarroll@ snow.nohrsc.nws.gov OR Dr. Terry Krauss at Tel: 306–975–4215; Fax: 306–975–5143; Internet: krausst@nhrisv.nhrc.sk.doe.ca.

XVIII Pacific Science Congress, 5–12 June 1995, Beijing, China

The 18th Quadrennial Congress held by the Pacific Science Association will include 6 symposia and about 20 scientific sessions, including the following topics: (1) Global Climate and Environment Change, and (2) Asia-Pacific Monsoon Meteorology.

For abstract and registration forms, contact the XVIII Pacific Science Congress Secretariat, Laboratory of Climate Research, Institute of Atmospheric Physics, Chinese Academy of Sciences, P.O. Box 2718, Beijing, 100080, China; Tel: +86–1–2575034; Fax: +86–1–2562458; E-Mail: fucb%bepc2@scs.slac.stanford.edu.

First Study Conference on BALTEX, 28 August–1 September 1995, Visby, Sweden

The First Study Conference on BALTEX is being organized by the BALTEX Science Steering Group (BSSG), the Swedish National Committee for the IGBP, the WCRP of the Royal Swedish Academy of Sciences, and the Swedish Meteorological and Hydrological Institute (SMHI). The conference is designed to offer first opportunities to review the present state-of-the-art in modeling and measuring energy and water cycles in the Baltic Sea drainage basin. It will cover recent research in hydrology, meteorology, and physical oceanography. The conference is scheduled to take place in Visby on the island of Gotland. The provisional program comprises invited lectures on research related to BALTEX, reports from the BSSG and BALTEX working groups on the progress of BALTEX, and presentation of scientific papers on results and ideas relevant for BALTEX.

The first circular for this conference has been delivered by the local organizing committee. The deadline for preregistration and indication of provisional titles of contributions is 31 October 1994. A second circular will follow at the end of this year. Extended abstracts, one page long, should be submitted not later than 28 February 1995. After the conference, manuscripts will be submitted to TELLUS and peer reviewed for a special issue. For further information and submittance of registration contact Prof. Anders Omstedt, SMHI, S-60176 Norrkoping, Sweden, Tel: +46 11 15 80 00; Telex: 64400 smhis; Fax: +46 11 17 02 07; E-mail; aomstedt@smhi.se.

WCRP/GEWEX MEETINGS CALENDAR

12–16 September 1994—BSRN SCIENTIFIC WORKSHOP, Zurich, Switzerland. For information contact Dr. DeLuisi, the BSRN Project Manager, at Air Resources Laboratory, Surface Radiation Research Branch, 325 Broadway, Boulder, CO 80303-3328; Tel.: 303–497–6824; Fax: 303–497–6546; or Professor A. Ohmura ETHZ, Geographisches Institut, Winterhurstrasse 190, CH-8057 Zurich; Tel: +41–1–257–5220; Fax: +41–1–362–5197.

19–20 September 1994—SECOND MEETING OF BALTEX WORKING GROUP ON PROCESS STUDIES, Copenhagen, Denmark.

19–23 September 1994—INTERNATIONAL GCIP/MAGS WORKSHOP ON SCALING IN HYDROMETEOROLOGICAL/ HYDROLOGICAL PROCESSES AND MODELS, Victoria British Columbia, Canada.

28–30 September 1994—EIGHTH SESSION OF THE GPCP WGDM, Offenbach, Germany.

4–6 October 1994—ISLSCP SOIL WETNESS INDEX MEETING, Boulder, Colorado (invitation only).

25–28 October 1994—WATER VAPOR CLIMATE SYSTEM, Jekyll Island, Georgia, U.S.A. For information contact William Elliot or Dian Gaffen, NOAA Air Resources Laboratory, 1315 East-West Highway, Silver Spring, MD, 20910; Tel:: 301–713–0295.

31 October–2 November 1994—ISLSCP SCIENCE PANEL MEETING, Boulder, Colorado, Joint session with GCIP on 2 November (invitation only).

31 October–4 November 1994—ECMWF/GCSS WORKSHOP ON MODELLING, VALIDATION, AND ASSIMILATION OF CLOUDS, Reading, UK.

1–4 November 1994—Meeting of BALTEX IMPLEMENTATION PLAN DRAFTING GROUP, Island of Bornholm, Denmark.

2–4 November 1994—FIFTH GCIP SCIENCE PANEL MEETING, Boulder, CO (invitation only).

2–4 November 1994—GEWEX NUMERICAL EXPERIMENTATION PANEL MEETING, Boulder, Colorado (by invitation only).

7–10 November 1994—DYNAMICS OF THE ARCTIC CLIMATE SYSTEM, Göteborg, Sweden. See announcement page 16.

13–16 December 1994—GCSS SCIENCE PANEL MEETING, Victoria, BC, Canada.

15–20 January 1995 — AMERICAN METEOROLOGICAL SOCIETY ANNUAL MEETING, Dallas, Texas. See announcement page 16.

25–27 January 1995—SECOND BALTEX SCIENCE STEERING GROUP MEETING, Helsinki, Finland.

30 January–3 February 1995—GEWEX SSG, Melborne, Australia (invitation only).

6–7 February 1995—JOINT WCRP/IGBP WORKING GROUP ON LAND SURFACE EXPERIMENT, Sydney, Australia (invitation only).

6–10 March 1995—SECOND INTERNATIONAL STUDY CONFERENCE ON GEWEX IN ASIA AND GAME, Pattaya, Thailand. See announcement page 16.

12–14 April 1995—GPCP THIRD ALGORITHM INTERCOMPARISON PROGRAMME (AIP-3) WORKSHOP. Melbourne, Australia (tentative dates).

1–12 May 1995—NATO–ADVANCED STUDY INSTITUTE on Remote Sensing of Processes Governing Energy and Water Cycles in the Climate System, Plön, Germany. Applicants should contact Prof. Erhardt Raschke, ASI-Director, GKSS Research Center, Max Planck Str., D-21502 Geesthacht Germany, Tel: +49 4152 871833; Fax: +49 4152 872020; E-mail: raschke@dvmc10.gkss.de. See announcement page 16.

15–19 May 1995—ATMOSPHERE MODEL INTERCOMPARISON PROJECT (AMIP) CONFERENCE, Monterey, California.

22–26 May 1995—INTERNATIONAL GEWEX WORKSHOP ON COLD-SEASON/REGION HYDROMETEOROLOGY, Banff, Alberta, Canada. See announcement page 17.

5–12 June 1995—XVIII PACIFIC SCIENCE CONGRESS, Beijing, China. For information contact Congress Secretariat, Laboratory of Climate Research, Institute of Atmospheric Physics, Chinese Academy of Sciences, P.O. Box 2718, Beijing 100080, China; Tel: +86–1–2575034; Fax: +86–1–2562458. See announcement page 17.

28 August–1 September 1995—FIRST STUDY CONFERENCE ON BALTEX. See Call for Papers in this issue for further information, contact Prof. Anders Omstedt, SMHI, S-60176 Noorkoping, Sweden, Tel: +46 11 15 80 00; Telex: 64400 smhis; Fax: +46 11 17 02 07; E-mail: aomstedt@smhi.se.

GEWEX REPORTS AND DOCUMENTS

(Available from IGPO)

GEWEX CLOUD SYSTEM STUDY (GCSS) SCIENCE PLAN. May 1994, IGPO Publication Series No. 11.

GEWEX PAMPHLET (fivefold glossy)

IMPLEMENTATION PLAN FOR GEWEX CONTINENTAL-SCALE PROJECT (GCIP), VOLUME III: Strategic Plan for Data Management. March 1994, IGPO Series No. 9.

UTILITY AND FEASIBILITY OF A CLOUD PROFILING RADAR, Report of the GEWEX Topical Workshop, 29 June–1 July 1993, Pasadena, California. April 1994, IGPO Series No. 10.

IMPLEMENTATION PLAN FOR GEWEX CONTINENTAL-SCALE PROJECT (GCIP) VOLUME II: Research. June 1994, IGPO Publication Series No. 8.

PROJECT FOR INTERCOMPARISON OF LAND-SURFACE PARAMETERIZATION SCHEMES (PILPS): Results from Off-line Control Simulations (Phase 1A). December 1993, IGPO Publication Series No. 7.

GCIP PAMPHLET (trifold glossy)

IMPLEMENTATION PLAN FOR THE GEWEX CONTINENTAL-SCALE INTERNATIONAL PROJECT (GCIP), VOLUME I: Data Collection and Operational Model Upgrade. May 1993, IGPO Publication Series No. 6.

PROJECT FOR INTERCOMPARISON OF LAND-SURFACE PARAMETERIZATION SCHEMES (PILPS): Report on PILPS Workshop, 24–26 June 1992, Columbia, Maryland and First Science Plan. September 1992, IGPO Publication Series No. 5

INTERNATIONAL SATELLITE LAND SURFACE CLIMATOLOGY (ISLSCP) WORKSHOP REPORT, 23–26 June 1992, Columbia, Maryland, U.S.A.

A PRELIMINARY SCIENCE PLAN FOR A LARGE-SCALE BIOSPHERE-ATMOSPHERE FIELD EXPERIMENT IN AMAZON BASIN, Report on Workshop convened 18–20 June 1992 at NASA Goddard Space Flight Center, Greenbelt, Maryland, U.S.A.

GEWEX CONTINENTAL-SCALE INTERNATIONAL PROJECT (GCIP) DATA WORKSHOP: Summary report on 5–8 May 1992 Workshop. June 1992, IGPO Publication Series No. 4.

GEWEX CONTINENTAL-SCALE INTERNATIONAL PROJECT (GCIP) ATMOSPHERIC SCIENCE COMPONENT; Report on Atmospheric Subpanel Workshop, 18–19 March 1992. May 1992, IGPO Publication Series No. 3.

IMPLEMENTATION PLAN FOR THE PILOT PHASE OF THE GEWEX WATER VAPOR PROJECT (GVaP). March 1992, IGPO Publication Series No. 2.

SCIENTIFIC PLAN FOR THE GEWEX CONTINENTAL-SCALE INTERNATIONAL PROJECT (GCIP)-WCRP-67, February 1992 (WMO/TD/No. 461). (Second printing now available)

THE ROLE OF WATER VAPOR IN CLIMATE, A STRATEGIC RESEARCH PLAN FOR THE PROPOSED GEWEX WATER VAPOR PROJECT (GVaP), REPORT OF WORKSHOP, EASTON, MD, U.S.A., 30 October–1 November 1990. NASA Conf. Pub. 3210.

GLOBAL ENERGY AND WATER CYCLE EXPERIMENT (GEWEX)—REPORT OF THE FIRST GEWEX TEMPERATURE/HUMIDITY RETRIEVAL WORKSHOP, WCRP-XX, Greenbelt, MD, U.S.A., 23–26 October 1990.

GEWEX CONTINENTAL-SCALE INTERNATIONAL PROJECT (GCIP). REPORT OF THE FIRST GCIP PLANNING WORKSHOP, RESTON, VIRGINIA, U.S.A., 8–10 October 1990. April 1991, IGPO Publication Series No. 1.

SCIENTIFIC PLAN FOR THE GLOBAL ENERGY AND WATER CYCLE EXPERIMENT—WCRP-40, AUGUST 1990. (WMO/TD–No. 376).

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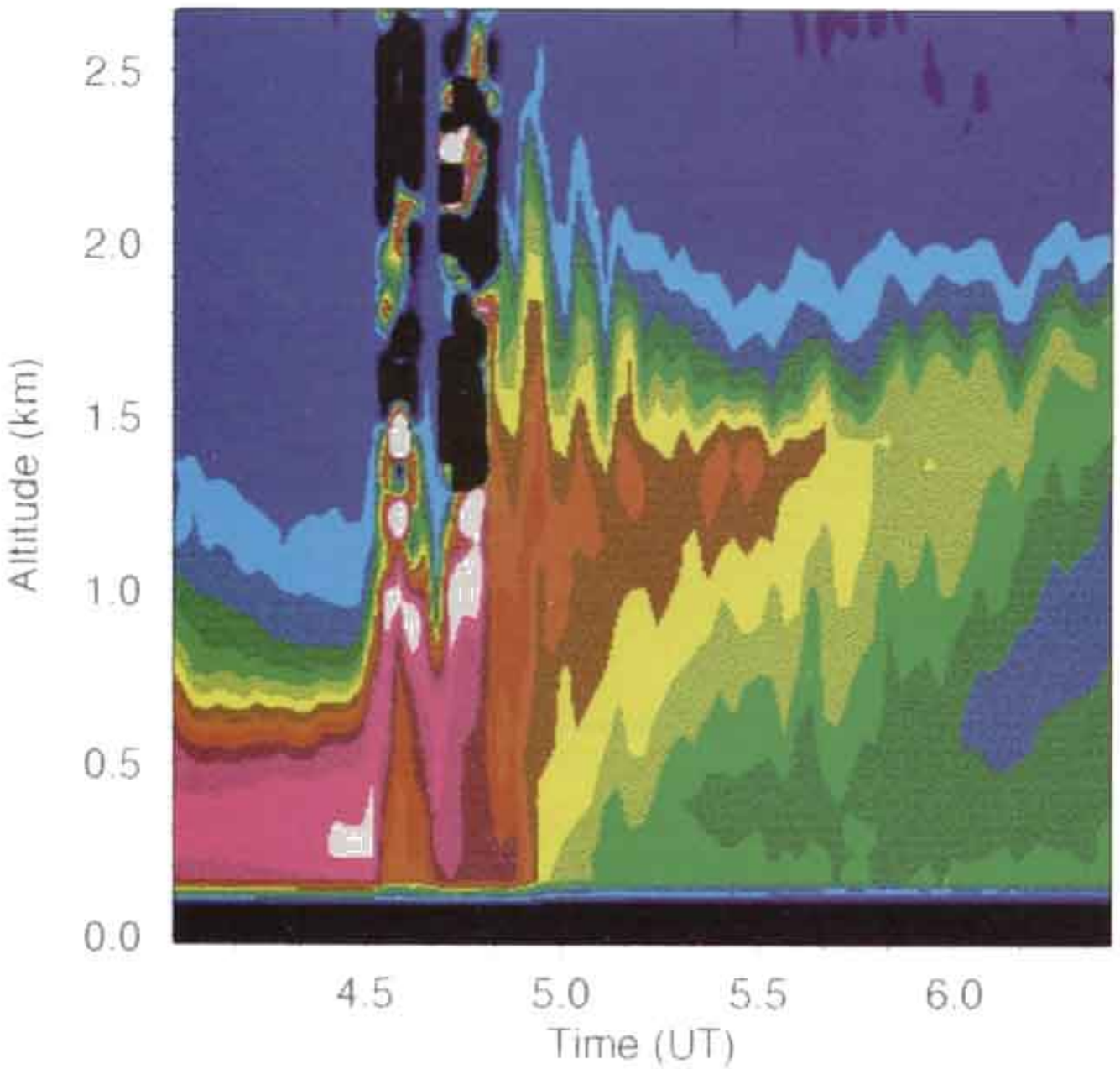

WATER VAPOR VARIATION DURING A COLD FRONT PASSAGE

The adjoining figure depicts water vapor as measured by the NASA Goddard Space Flight Center Raman lidar during a cold front passage on 15 April 1994 over the multi-instrumented Atmospheric Radiation Measurement Cloud and Radiation Testbed site near Lamont, Oklahoma, in the southwestern United States. The image shows a strong vertical oscillation associated with cold dry air behind the front undercutting warm moist air in advance of the front. The Raman lidar is a GEWEX Water Vapor Project (GVaP) instrument.

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