BALTEX Newsletter

No. 3 **June 2002**

World Climate Research Programme / Global Energy and Water Cycle Experiment
WCRP GEWEX

Enlarging the Scope of BALTEX

Hartmut Graßl
Chairman BALTEX SSG; Max-Planck-Institute for Meteorology, Hamburg, Germany
Anders Omstedt
Vice-chairman BALTEX SSG; University of Göteborg, Sweden

Phase I of BALTEX (1993 to 2002) has brought major results in both scientific results and infrastructure at the European level. Examples include coupled regional models for the Baltic Sea basin with new detailed water budget estimates established and new data sets assimilated. An ongoing data assimilation project is focussing on parts of the BALTEX/*BRIDGE* period 1999 to 2002 (see page 8), and many BALTEX projects are ongoing in different countries funded by both national and European sources. Results of the BALTEX programme are documented in more than 100 peer-reviewed journal articles including several dedicated BALTEX journal issues and overview publications (see page 2). Four dedicated BALTEX data centres for meteorological, hydrological, oceanographic and radar data are being operated by the Swedish and German national weather services. The radar data originate from the Nordic weather radar network BALTRAD (see page 6), which has been implemented in close relation to the BALTEX programme.

As the present co-chairs of the BALTEX SSG we are proud and happy with the ongoing development of BALTEX as a European research programme and we would like to thank all researchers and institutions contributing to BALTEX, as well as members of the BALTEX SSG, Working Groups and other bodies for their continuous support and leadership. It is our particular pleasure in this context to appreciate the leadership and engagement of the earlier BALTEX SSG co-chairs Lennart Bengtsson, Ehrhard Raschke and Zdzislaw Kaczmarek.

The BALTEX Community is now making plans for enlarging the scientific scope and thus strengthening the outreach of BALTEX. The numerous achievements of BALTEX call for an intensive application to other fields where knowledge on the water and energy cycle is of fundamental importance: Climate variability and climate change studies including scenarios of potential future climate, and environmental investigations related to nutrients and pollutants. Impact studies - responding to social needs and supporting decision makers in a broader context of

Contents

Global Change issues related to the Baltic Sea basin - are envisaged to accompany the research efforts during BALTEX phase II. Activities will more closely be discussed with and ñ hopefully - applied by the larger user communities, even beyond the World Climate Research Programmeís (WCRP) science community, including e.g. hydropower companies, water resource managers and intergovernmental bodies for the Baltic Sea and its catchments.

In addition to the present BALTEX objectives the following issues are suggested and presently discussed to become part of the enlarged scope of BALTEX phase II (2003 and onwards):

- to perform climate variability studies for 1800 – 2100, including assessments of climate change and climate change scenarios;

- to use coupled models and analysis tools developed in BALTEX to investigate transport and deposition of nutrients and pollutants both in air and water;

- to conduct impact studies in order to respond to society's needs in the broader context of Global Change issues related to the Baltic Sea basin.

As a first step towards creating a discussion forum for BALTEX phase II some 50 institutions from 14 countries in Europe, including not only ìtraditionalî representatives of the BALTEX Community, but also important institutions representing other relevant themes, established a thematic network BAATNET, and, recently, an expression of interest for an Integrated Project in the 6th European Framework Programme entitled ìObserved and future water cycle variability and changes in the Baltic Sea basin, BALTIC WATERî originated from the BAATNET network and was submitted to the European Commission. A workshop on ìClimate variability and change in the Baltic Sea areaî was held together with the 12th BALTEX SSG meeting in De Bilt, The Netherlands in November 2001, and another workshop on ìEutrophication and pollution in the Baltic Sea basinî is scheduled to take place prior to the forthcoming 13th SSG meeting in Tallinn, Estonia, on 17 June 2002. All these mentioned activities are important steps towards defining updated science and implementation plans for BALTEX phase II, and we like to encourage interested scientists and institutions to participate in this process and join activities for implementing the second phase of BALTEX.

BALTEX Special Issues and Overview Papers

Tellus, 1996, Vol 48A, No 5, 607-793 *Selected papers presented at "First Study Conference on BALTEX"*, 15 articles.

Meteor. Zeitschrift., 2000, Vol 9, No 1+2, 1-134 *Selected papers presented at "Second Study Conference on BALTEX"*, 14 articles

Met. Atm. Phys., 2001, Vol 77, No 1-4, 1-204 *Scientific Results of the European NEWBALTIC Project,* 14 articles

Raschke, E. and 8 co-authors, 1998: *The Baltic Sea Experiment: A brief overview and some selected results of the authors.*
Surv. Geophys., Vol 19, 1-22

Raschke, E. and 36 co-authors, 2001: *BALTEX (Baltic Sea Experiment): A European contribution to investigate the Energy and Water Cycle over a Large Drainage Basin.*
Bull. Am. Met. Soc., Vol 82, No 11, 2389-2414

A special BALTEX issue of **Boreal Environmental Research** with selected papers presented at "*Third Study Conference on BALTEX*" will appear later in 2002.

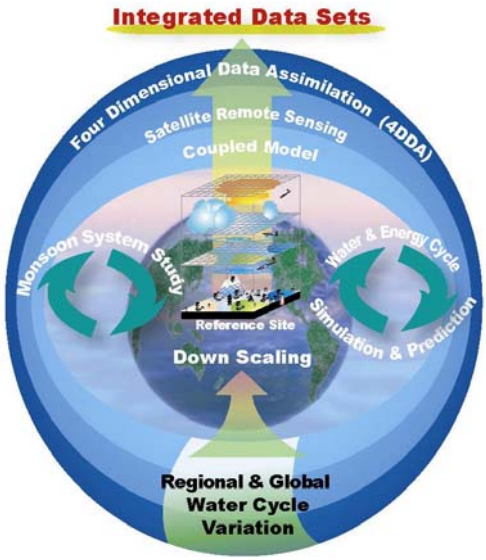
Co-ordination of the BALTEX programme and particular initiating and implementing steps towards BALTEX phase II require continuous and strengthened management activities. It is our pleasure to indicate that Dr. Hans-Jˆrg Isemer has been appointed again as the head of the International BALTEX Secretariat (IBS), effective October 2001. He had already been in this position during 1994 to 1999. IBS will continue to be established at GKSS Research Centre, Geesthacht, Germany, and we like to appreciate GKSSís financial support for the IBS, where Silke Kˆppen continuous to work on a half-day secretary position, and, as of June 2002, Dr. Sigrid Schˆttle has joined the IBS staff.

Information on BALTEX is available on the Internet at
http://w3.gkss.de/baltex/

The Coordinated Enhanced Observing Period (CEOP)

Toshio Koike
CEOP Lead Scientist; University of Tokyo, Japan

To achieve a more accurate determination of the water cycle in association with climate variability and change, as well as baseline data on the impacts of this variability on water resources, the Coordinated Enhanced Observing Period (CEOP) was launched on July 1, 2001. CEOP is now in the build-up phase after the preliminary data period from July to September 2001 and will have the two annual cycle periods from October 2002 to September 2004. CEOP is seeking to achieve a database of common measurements from both in situ and satellite remote sensing measurements, as well as matching model output that includes Model Output Location Time Series (MOLTS) data along with fourdimensional data analyses (4DDA; including global and regional reanalysis) for each specified period.

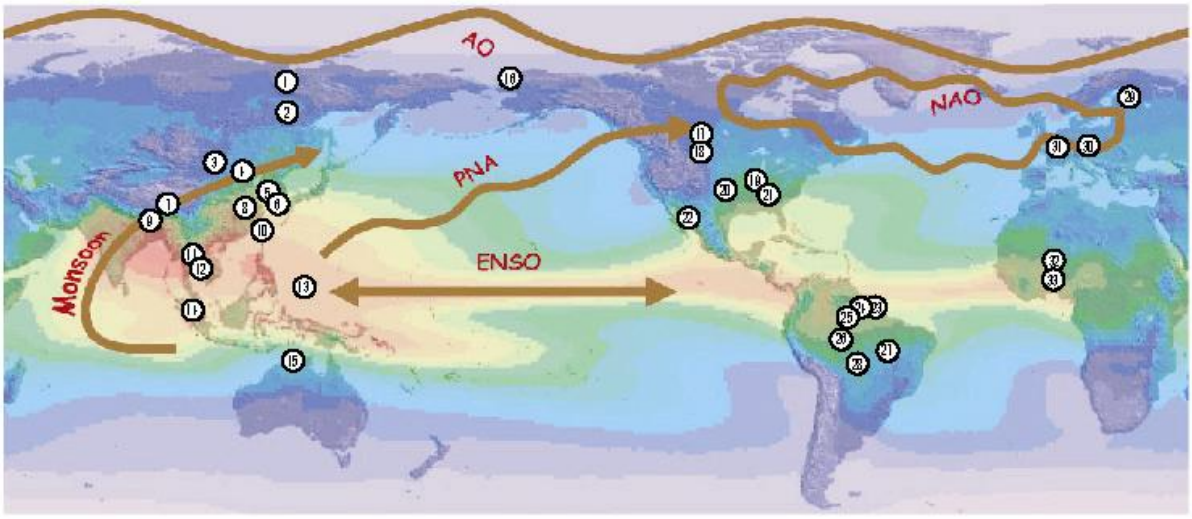


In this context, a number of carefully selected reference stations (see figure and article by Williams et al. on page 4) are linked closely with the existing network of observing sites involved in the GEWEX Continental Scale Experiments, which are distributed around the world. The initial step of CEOP is to develop a pilot global hydroclimatological dataset with global consistency that can be used to help validate satellite hydrology products and evaluate, develop and eventually predict water and energy cycle processes through global and regional models. Based on the collective dataset, we will address studies on the regional water and energy budget and both inter-comparison and inter-connectivity studies of the monsoon systems around the world. CEOP will also address defining a path to down-scale from global climate to local water resource application as a next step.

CEOP homepage on the Internet at
http://monsoon.t.u-tokyo.ac.jp/ceop/index.html

CEOP implementation plan available at
http://www.gewex.org/ceop/ceop_ip.pdf

CEOP activities are progressing as planned. The Implementation Plan was published in May 2001, and was finalized following recommendations formulated at a CEOP Implementation Workshop held at the Goddard Space Flight Center (GSFC) in March 2001.
An Initial International Implementation Planning Meeting, organized with the support of the National Space Development Agency (NASDA) of Japan, took place in Tokyo on 6-8 March 2002, at the Earth Observation Research Center of NASDA. The meeting stressed the importance of the continuity of measurements from operational earth observation satellites and the benefit expected from a coordinated use of present and soon to be launched research satellites. A key component of CEOP will, therefore, address the compilation and integration of a significant portion of the extremely high volume of new satellite data into coherent, related data sets focused on the CEOP science issues, to facilitate research in water and energy cycles, improved weather and climate predictions, and applications for water resource management. The CEOP Satellite Data Integration Working Group has been organized and is now making progress on the satellite data integration issues for CEOP. A CEOP Monsoon Systems Working Group has been organized to address the accomplishment of one of the main CEOP aims associated with the documenting of the seasonal march of the monsoon systems, assessing the monsoon systems driving mechanisms, and investigating the possible physical connections between such systems. The CEOP Data Management Working Group and reference site managers from the majority of the CEOP reference sites provided comprehensive information on the reference site data and a CEOP reference site data exchange policy was approved by the CEOP Science Steering Committee (SSC). A



1) Eastern Siberian Tundra
2) Eastern Siberian Taiga
3) Mongolian
4) Inner Mongolia
5) Korean Peninsula
6) Korean Jeju
7) Tibet
8) Yangtze River
9) Himalayas
10) Northern South China Sea- Southern Japan
11) Chao-Phraya River
12) North-East Thailand
13) Western Pacific Ocean
14) Equatorial Island
15) TWP
16) NSA
17) BERMS
18) Fort Peck
19) Bondville
20) SGP
21) Oak Ridge
22) AZ
23) Flona
24) Santarem
25) Manaus
26) Rondonia
27) Brasilia
28) Pantanal
29) Sodankyla
30) Lindenberg
31) Cabauw
32) Niamey
33) Oueme

CEOP Reference Sites

(see articles by T. Koike and S. Williams et al.)

draft report of the meeting is available at the CEOP homepage.

CEOP is continuing to evolve as an element of the World Climate Research Programme (WCRP) initiated by the Global Energy and Water Cycle Experiment (GEWEX) and encompassing the new endeavours being undertaken by its Climate Variability and Predictability (CLIVAR), Climate and Cryosphere (CliC) and other core projects. CEOP has gained the interest of a broad range of international organizations, as evidenced by the proposal for an Integrated Global Water Cycle Observations (IGWCO) theme within the framework of the IGOS Partnership (IGOS-P), which has re-affirmed CEOP as 'the first element of the IGWCO'. IGOS is a partnership between international bodies concerned with global environmental issues, including, among others, space agencies belonging to the Committee on Earth Observation Satellites (CEOS). The member agencies of CEOS are also expected to use their best efforts to contribute to CEOP and in particular, to cooperate with the integration of satellite data and the field campaigns data from reference sites.

CEOP Reference Sites

Steve Williams
Chair CEOP Data Management Working Group; UCAR/Joint Office for Science Support (JOSS), Boulder, CO, USA
Sam Benedict
CEOP International Coordinator; Coronado, CA, USA
Hans-Jörg Isemer
Head International BALTEX Secretariat; GKSS Research Centre, Geesthacht, Germany

A key aspect of CEOP is to coordinate the regional observations by the different GEWEX Continental Scale Experiments (CSEs) that have been established within the framework of the GEWEX Hydrometeorological Panel (GHP) to facilitate global and transferability studies. The science that motivates GEWEX, CLIVAR, and other WCRP programs is driving the coordinated data set, which can satisfy the numerical modelling and observational analysis needs of these projects and the climate research community at large.

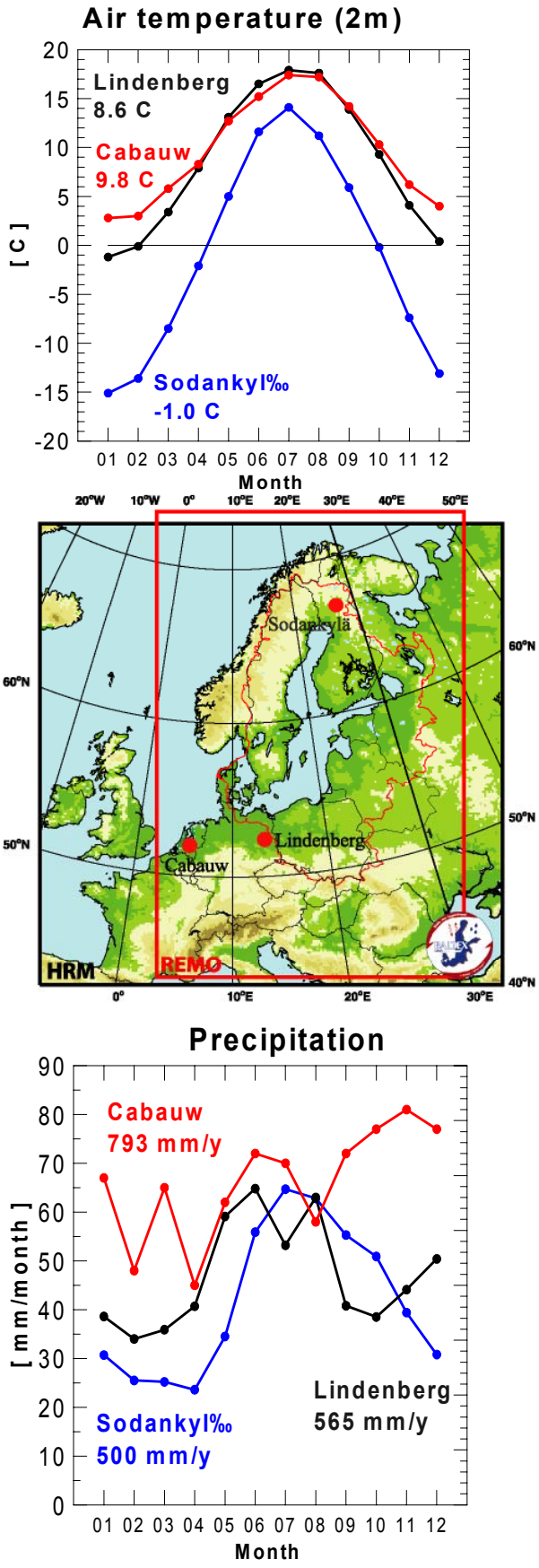


Figure 1: *Locations of and climate at the BALTEX reference sites for CEOP. Numbers in climate diagrams give mean annual 2 meter air temperature (top) and annual precipitation (bottom).*

Therefore, a critical facet of CEOP is its data collection and organization to support advanced climate research. Of the three types of data (in situ, satellite and model output) that are the basis of CEOP, the in situ data gathered from the reference sites and reference hydrological basins from the CSE regions around the world is the most fundamental component of the CEOP strategy. The CEOP reference sites located in the six most comprehensive GEWEX CSEs namely, GAPP (Mississippi River Basin), BALTEX (Baltic Sea Basin), MAGS (Canadian Mackenzie River Basin), LBA (Amazon region), CAMP (Asian monsoon region) and CATCH (Western African Monsoon Region), are being provided, through multi-national commitments, to improve the collective contribution of the CSEs to the global requirements of CEOP. The enhanced observations of sub-surface (soil), surface (radiation and precipitation), near surface (flux tower), atmospheric soundings (raob and profiler), and 3D (radar and aircraft) made at these sites will provide CEOP with the basic resources necessary to achieve its main scientific objectives.

The CSEs, in turn, stand to benefit, along with other stakeholders, from the outcomes of CEOP that will be associated with better prediction of water and energy fluxes and reservoirs over land on temporal scales up to seasonal for water resource applications and with a better assessment of the driving mechanisms, physical connections and march of the monsoon systems.

Details on Reference Sites on Internet at
http://www.joss.ucar.edu/ghp/ceopdm/rsite.html

More than 30 reference sites with quite some differences in their status and spectrum of data to be delivered are presently confirmed for CEOP. Three of them are located in Europe and their contribution to CEOP has been initiated and is being coordinated through BALTEX, specifically the International BALTEX Secretariat. At present, the BALTEX reference sites for CEOP include: 1) the Sodankylä Observatory in Finland, operated by the Finnish Meteorological Institute (FMI), 2) the Meteorological Observatory Lindenberg in Germany, operated by the German Weather Service (DWD), and 3) the Experimental Atmospheric Boundary Layer Measurement Site at Cabauw in The Netherlands, operated by the Royal Netherlands Meteorological Institute (KNMI). The responsible site managers for

CEOP are Bengt Tammelin (FMI), Frank Beyrich (DWD), and Fred Bosveld (KNMI). All three sites will deliver high-resolution radiosonde, flux tower, various modern ground based remote sensing, surface radiation and turbulent flux, standard surface meteorology, and soil data, thus meeting requirements for a CEOP 1-D site. The European CEOP sites have a long tradition in performing and contributing to national and international experiments and monitoring activities providing for outstanding experience in various modern tropospheric and soil measurement techniques, data quality measures and storage. The three sites encompass different climate regimes in Northern and Central Europe (see figure 1 on page 5).

Sample data of all sites were delivered to the CEOP Data Archive (CDA) in early 2002 and, presently, data for the CEOP preliminary data period, 1 July to 30 September 2001, are prepared for delivery to CDA. The national weather services involved (FMI, DWD, KNMI) have committed themselves to provide data to CDA for the complete two annual cycle periods, October 2002 to December 2004. A detailed description of the European reference sites and their data for CEOP is planned to be included in forthcoming issues of the BALTEX *Newsletter*.

BALTEX Radar Data Centre

Jarmo Koistinen
Chair BALTEX Working Group on Radar;
Finnish Meteorological Institute, Helsinki, Finland
Daniel B. Michelson
Head BALTEX Radar Data Centre;
Swedish Meteorological and Hydrological Institute, Norrköping, Sweden

Accurate precipitation measurements are essential to improve scientific understanding of energy and water cycles, and to develop forecasting systems to both warn of hazards and enable the optimisation of management procedures. Satellite remote sensing techniques alone cannot provide reliable precipitation observations, especially at high latitudes. Rain gauges with sufficient spatial and temporal resolution are almost unavailable over the sea. Weather radars are the only sensors which are able to provide precipitation observations, with high spatial and temporal resolutions, simultaneously over both land and sea. The activities of the BALTEX Working Group on Radar have lead to the establishment and operation of the BALTEX Radar Data Centre (BRDC), designed to collect data from those radars in and proximate to the Baltic Sea and it's drainage basin, to process these data into series of homogeneous products, to disseminate these products to BALTEX data users, and to archive all data and products. These activities are a major contribution to the BALTEX Main Experiment (*BRIDGE*), starting on October 1, 1999, which merges into the GEWEX Coordinated Enhanced Observing Period (CEOP).

The BALTEX Radar Network (BALTRAD) consists of around 30 C-band, almost all Doppler, weather radars in Norway, Sweden, Finland, Denmark, Germany, and Poland (see figure 2 on page 7). The potential to expand BALTRAD in conjunction with CEOP is excellent, as data from many existing radars are becoming increasingly available and new radars are being installed continuously in BALTEX countries.

BALTRAD provides BALTEX with composite images of radar reflectivity factor every 15 minutes with 2 km horizontal resolution. Three and 12 hour radar-based accumulated precipitation products are also produced at the same horizontal resolution using an adjustment technique employing gauge observations which have been systematically corrected. Vertical profiles of horizontal winds with a vertical resolution of 200 m are available every 15 minutes from Swedish and Finnish radars. BALTRAD products are available to BALTEX data users on CD-ROM.

BALTEX Radar Data Centre
on the Internet at
http://www.smhi.se/brdc

When it comes to the qualities and accuracies of the BALTRAD products, the use of multisource temperature information from satellite and objective analysis systems has been demonstrated as being able to identify and remove non - precipitation echoes effectively in BALTRAD composites. The gauge adjustment technique has also been shown to effectively minimize the radar data's bias as a function of distance from the radar. In most cases, this average bias is reduced to being within around 20%. In the most extreme case (distances exceeding 200 km during winter) the average bias is reduced to around 60% from being over 3000%! Research and development activities being conducted by members of the BALTEX Working Group on Radar (WGR) are now focussing on deriving methods whereby lo-

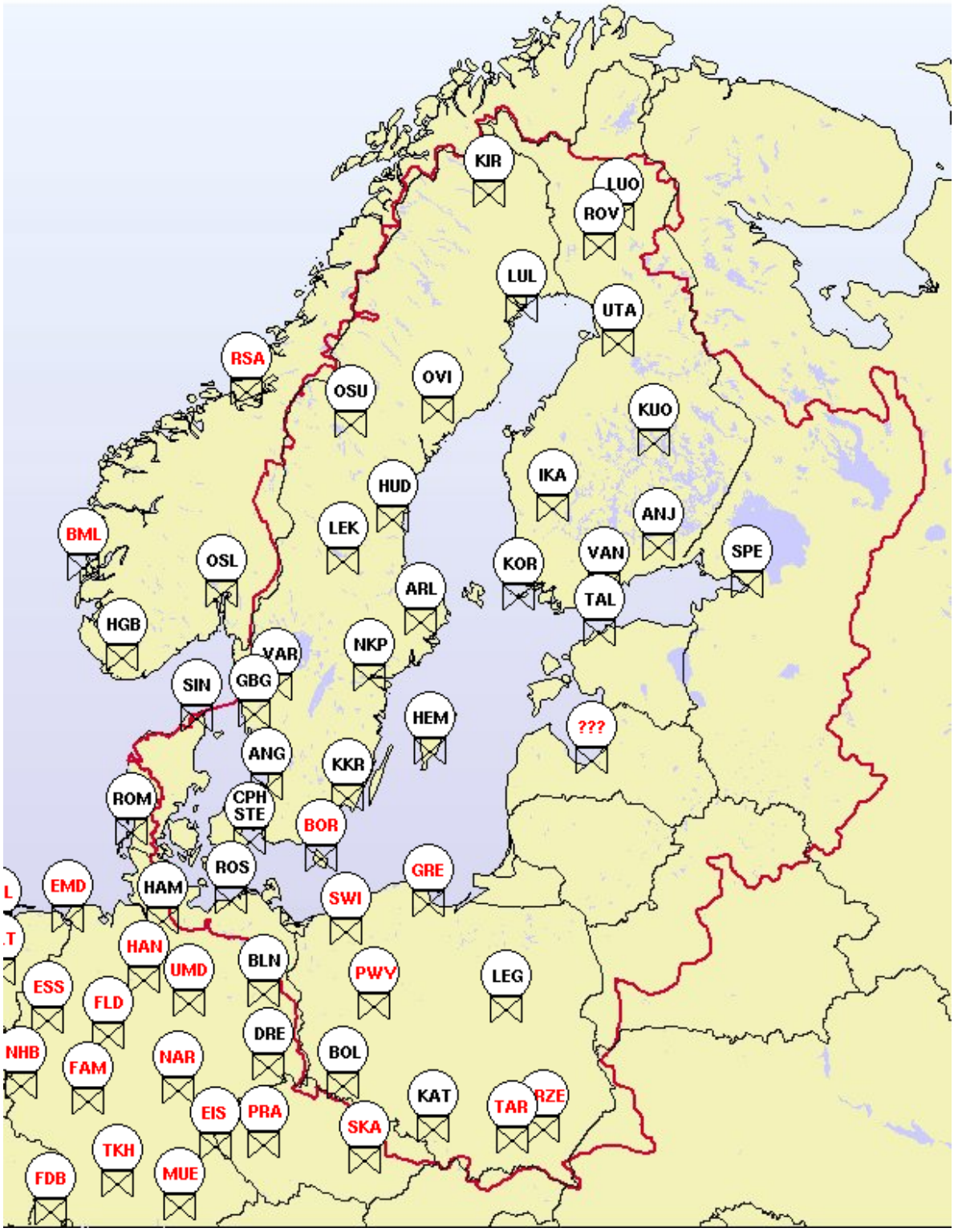


Figure 2: *Existing BALTRAD radars in black. Potential BALTRAD radars in red. The Baltic Sea's drain basin is outlined by a red polygon. Background map courtesy of UNEP GRID-Arendal.*

cal atmospheric conditions may be taken into account, thereby leading to more accurate radar-based precipitation estimates.

There is increasing interest in the use of BALTRAD datasets for various applications. For example, BALTRAD composites have been comprehensively used in the development of the precipitation analysis algorithm within the framework of the Eumetsat Satellite Application Facility to support Nowcasting and Very Short Range Forecasting applications. Validation of precipitation-related variables derived from NASA/AQUA is an area where data from the

BRDC during CEOP will be exploited. Such activities demonstrate the utility of BALTRAD infrastructure for studying precipitation in various ways at high latitudes and cold climates.

Within the numerical weather prediction (NWP) community, gauge-adjusted BALTRAD products have been used in validation exercises using several model systems. For example, comparisons between BALTRAD and HIRLAM precipitation estimates have showed high degrees of correspondence both in terms of amounts and spatial distributions. The development of new methods of variational assimilation of wind information from Doppler radars is another area where BALTRAD infrastructure has proven itself valuable to NWP.

The WGR is now in the process of preparing for CEOP, where new and exciting challenges, both in terms of radar hydrometeorology and the use of datasets in various meteorological and hydrological applications, await.

References

Michelson D.B., Andersson T., Koistinen J., Collier C.G., Riedl J., Szturc J., Gjertsen U., Nielsen A., and Overgaard S., 2000: *BALTEX Radar Data Centre Products and their Methodologies*. Reports Meteorology and Climatology RMK Nr. 90., SMHI, SE-601 76, Norrköping, Sweden. 76 pp.

Koistinen J. and Michelson D.B., 2002: *BALTEX Weather Radar-Based Precipitation Products and their Accuracies.* Boreal Environmental Research (in press).

BALTEX Regional Re-Assimilation Completed

Carl Fortelius *(carl.fortelius@fmi.fi)*
Finnish Meteorological Institute, Helsinki, Finland
Ulf Andræ *(ulf.andrae@smhi.se)*
Swedish Meteorological and Hydrological Institute, Norrköping, Sweden

The BALTEX regional re-assimilation project uses meteorological data assimilation for quantifying the climatic energy and water cycles over the catchment basin of the Baltic Sea during the course of one annual cycle, September 1999 to October 2000. The project is a joint undertaking of the Finnish (FMI) and Swedish (SMHI) National Meteorological Services, organised as an ECMWF (European Centre for Medium Range Weather Forecast) special project. The assimilation system used is a specially designed version of the HIRLAM numerical weather prediction system maintained by the international HIRLAM project, consisting of the National Meteorological Services in 9 European countries. A specific objective is to produce gridded fields of all components needed to close the energy and water cycles of the entire Baltic Sea Basin, with a spatial resolution of 22 km and a temporal resolution of 6 hours. The assessment of these products using available independent measurements constitutes a significant part of the project. The assimilation runs for this period are now completed and the analysis of the results is in progress. The project is described at the BALTEX website (*w3.gkss.de/baltex/*) and in Fortelius et al. (2002). Surface fluxes of energy and water and other pertinent fields are available to researchers, who are encouraged to participate in the assessment and utilization of the data.

As a preliminary example, Figure 3 shows areal precipitation amounts for southern Finland from the re-assimilation model compared to gridded precipitation totals obtained from the BALTEX Radar Data Centre for the same region. The correspondence between the two completely independent estimates is good in all seasons.

Reference

Fortelius, C., U. Andræ, and M. Forsblom, 2002: *The BALTEX regional reanalysis project.* Boreal Environmental Research (accepted).

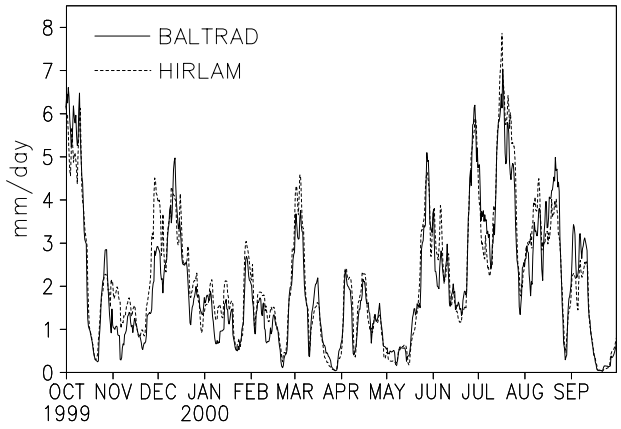


Figure 3: *Areal precipitation amounts for southern Finland. The dashed lines show 5-day running averages as given by the re-assimilation model, while the solid lines are based on 12-hourly gridded precipitation totals from the BALTEX Radar Data Centre.*

Challenges for the Baltic Regional Environmental Research: Reconstruction of Changing Climate and Changing Pollution Patterns

Hans von Storch *(storch@gkss.de)*
Director Institute for Coastal Research, GKSS Research Centre, Geesthacht, Germany

General

Environmental research has grown out of a broad range of *natural sciences*, such as physics, oceanography, hydrology and ecology. Originally its goal was mostly oriented towards identification and understanding of relevant processes in the various environmental systems. BALTEX is and was a prominent and particularly successful example of these efforts. In the course of time, the focus is changing towards a more holistic view of the environmental system in its entirety, and that includes people. People, who use and change the "services" of the environment, exploit the environment as a utility, and sometimes consider it as a threat or risk. There is a gradual transformation of research programs from fundamental to applied dealing with

- current state and ongoing change of the regional environment,
- short-term forecasting,
- perspectives of future change,
- options for future (sustainable) use in e.g., agriculture, forestry, fishery, traffic,energy, tourism, and deposition of substances.

In fact, IGBP programs such as LOICZ are beginning to embrace and incorporate the human dimension and the application of scientific knowledge about the regional environment for guiding adaptation, mitigation and management in general as goals and integral components.

Applied Baltic Regional Environmental Research

In case of Baltic regional environmental research, the science has matured so that it may be used to advise society and policy about how to deal with the resource "environment" and how to respond to ongoing or expected environmental change. Physical science has made sufficient progress to allow for the application of the knowledge constructed during BALTEX. This does not imply that all problems would have been solved, but that uncertainties have been reduced considerably by BALTEX. Lack of complete knowledge must be dealt with by making the remaining uncertainties explicit. It should not prevent from applying the available knowledge.

The extension of BALTEX to more applied research components may include the physical / dynamical, chemical / ecological, historical / geological, economical / political and sociological "dimensions", supporting science / policy discourse mechanisms such as IPCC or HELCOM. Such an extended BALTEX program will also contribute to LOICZ as well as continuingly to GEWEX.

The knowledge collected and constructed during the BALTEX program has resulted in powerful quasi-realistic models of the regional atmosphere, of the hydrology of the Baltic sea catchment and of the hydrography of the Baltic Sea, where the coupling of models has been a focus of the program since its beginning. Also quality-controlled and homogeneous data sets indicative of changing climatic and environmental conditions have been assembled. It is suggested that these models and data sets should, among others, be used for

- assessing the state of pollution, the pattern and speed of climate change, and the discrimination between anthropogenic and natural climate change; and
- providing scenarios of mitigation of pollution, adaptation to environmental regional change, and of the optimal use of the resource „regional environment".

Examples

Two examples are very briefly shown in the following.

The *first example* concerns the temporal evolution of salinity in the Baltic Sea. Salinity is a crucial ecological parameter in this brackish, geologically young sea, where it establishes precarious conditions where few marine (high-salinity) or freshwater (low-salinity) species can survive, determines stratification and limited oxygenation through the halocline, and affects the speciation and toxicity of metals. Salinity has been monitored since about 1960 at a variety of locations, but prior to that only episodical data exist. Zorita and Laine (2000) constructed a statistical regression model relating salinity and air pressure fields, using the salinity data available since the 1960s and homogeneous regional air pressure analyses. Air pressure analyses of homogeneous quality and sufficient accuracy are available since the beginning of the 20th century, so that this link may be used for estimating the development of salinity in the Baltic sea since the beginning of the 20th

century. The episodically available observations from the first half of the 20th century are used for validation of the method.

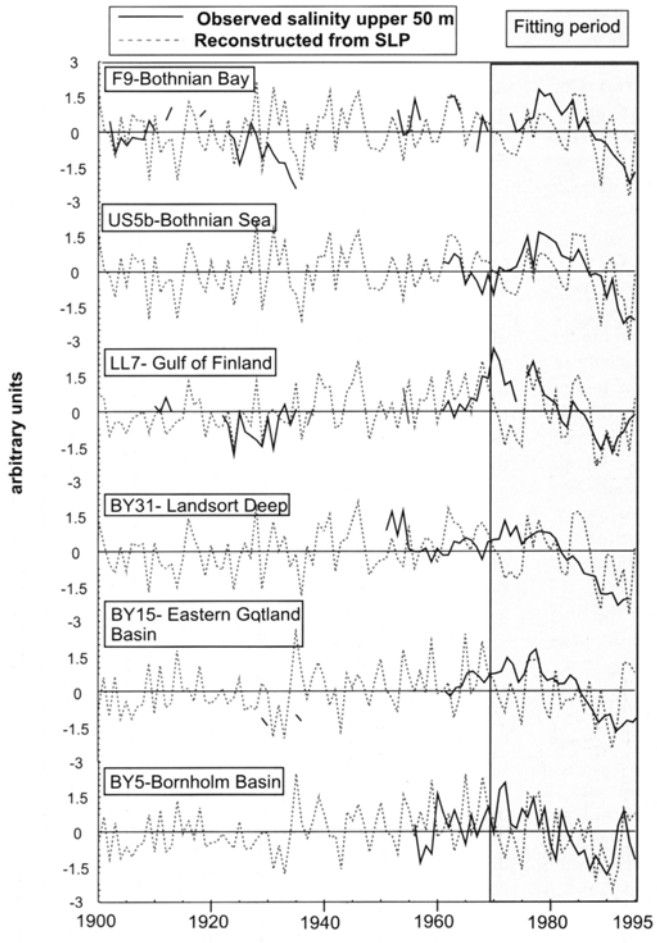


Figure 4: *Observed (solid) and reconstructed (dashed) salinity in the upper 50 m of the Baltic Sea at a series of locations. Reconstruction regressing the wintertime SLP field (Zorita and Laine, 2000).*

The result of the exercise is shown in Figure 4. Obviously, the reconstruction is successful, as is demonstrated by the similarity between the reconstructed and episodical data prior to 1960. Furthermore, the decline in salinity seen in the past few years is beyond the range of normal variation in the preceding decades. It remains to be analysed if the identified change is continuing and whether it is consistent with the expected changes related to anthropogenic climate change. Also, the ecological implications need to be analysed.

The *second example* is related to the regional pollution with anthropogenic substances – in this case lead added to gasoline to prevent knocking (von Storch et al., 2002). The emission of lead rose almost unabated since the revitalization of the European economy after World War II, until the first regulation measures were introduced in the early and mid 1970s. In the mid and late 1980s leaded gas was mostly phased out in Europe. The regulation was undoubtedly successful in terms of diminishing the ecological threat and improving the general air quality. At the same time, it did not have the adverse economic effects which had been predicted by some stakeholders (Hagner, 2001, 2002). However, even if the emission of lead by traffic is no longer one of the pressing environmental problems in Europe, the questions remains of what is the current distribution of the large amount of lead that was previously emitted.

In order to quantitatively describe the fate of the gasoline-lead, spatially disaggregated emissions were estimated (Pacyna and Pacyna, 2000) and fed into a 40-year detailed regional weather reconstruction extending from 1958 to 1997 (Feser et al., 2001). In this way, a temporally and spatially high-resolution description of the air concentrations of lead, and of the depositions were obtained. With this data set, budgets can be calculated of how much lead is deposited in certain regions, and where it came from (Costa-Cabral, 2001).

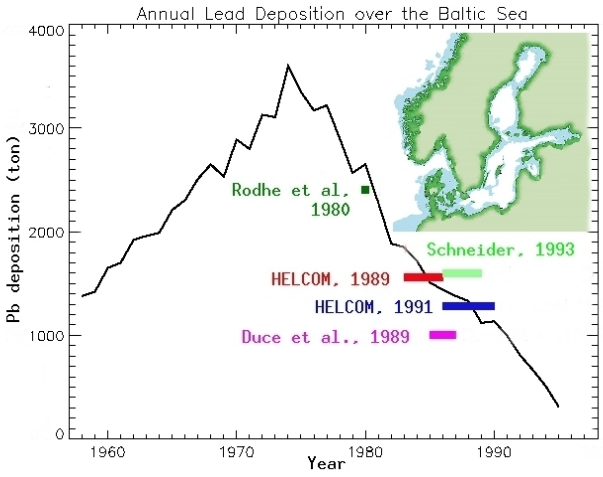


Figure 5: *Observed (colored bars) and reconstructed (line) annual atmospheric deposition of lead into the Baltic Sea (von Storch et al., 2002).*

The annual deposition of lead into the Baltic sea, shown in Figure 5, follows a pattern similar to the emissions, increasing until the middle of the 1970s, and decreasing thereafter. Maximum depositions are estimated to have surpassed 3,500 tons in 1974, while by 1995 they were likely only of a few hundred tons. In the 1980s several attempts were made to estimate the depositions over the entire Baltic Sea based on point observations. These estimates, which were provided as an average value over a time window of a few years,

are represented by color bars in the diagram. Interestingly, the reconstructions based on the modelling and on the observed data are consistent, adding credibility to the modelling approach.

The example demonstrates that it is possible to subject a political regulation to an a-posteriori analysis about costs and benefits. Lead has served as an example because of its relatively simplicity and the well documented strongly changing emissions. The methodology may be used for other substances, such as Persistent Organic Pollutants, and for the a-priori assessment of proposed regulations (scenarios). For that purpose, the existing models and data of the dynamics of substances in the atmosphere, and in the catchment and the Baltic Sea, need to be extended.

References

Costa-Cabral, M. C., 2001: *Reconstruction of atmospheric lead fluxes in Europe over four decades (1958-1995). Part II: Results.* (submitted)

Feser, F., R. Weisse and H. von Storch, 2001: *Multidecadal atmospheric modelling for Europe yields multi-purpose data*. EOS 82, 305-310.

Hagner, C., 2000: *European regulations to reduce lead emissions from automobiles - did they have an economic impact on the German gasoline and automobile markets?* Reg. Environ. Change 1: 135-151.

Hagner, C., 2002: *Regional and Long-Term Patterns of Lead Concentrations in Riverine, Marine and Terrestrial Systems and Humans in Northwest Europe.* Water, Air and Soil Pollution 134,1-40.

Pacyna, J. M. and E. G. Pacyna, 2000: *Atmospheric emissions of anthropogenic lead in Europe: improvements, updates, historical data and projections.* GKSS Report 2000/3

von Storch, H., M. Costa-Cabral, C. Hagner, F. Feser, J. Pacyna and E. Pacyna, 2002: *Four Decades of Gasoline Lead Emissions and Control Policies in Europe: A Retrospective Assessment*. (submitted to STOTEN, the Science of the Total Environment).

Zorita, E., and A. Laine, 2000: *Dependence of salinity and oxygen concentrations in the Baltic Sea on the large-scale atmospheric circulation.* Clim. Res. 14, 25-41.

German Contributions to BALTEX within the National Climate Research Programme DEKLIM

Daniela Jacob *(jacob@dkrz.de)*
Coordinator DEKLIM projects; Max-Planck-Institute for Meteorology, Hamburg, Germany

More than 30 national groups in Germany are presently involved in regional processes studies in the Baltic Sea drainage basin. This work is a major part of the Climate Research Programme (DEKLIM) in Germany defined for the years 2001 to 2006. DEKLIM is funded by the national Ministry for Education and Research (BMBF). The total financial support amounts to some 8.3 million Euro – a substantial contribution to the international BALTEX research. The DEKLIM / BALTEX studies are organized in eight clusters addressing the following topics:

Access to DEKLIM project websites on the Internet through
http://www.deklim.de

1) **IBSEN**: Integrated Baltic Sea Environment Study: Analysis and Simulation of Hydrological and Ecological Variability in the last 1000 years (3 groups); 2) **EVA-GRIPS**: Regional Evaporation at Grid/Pixel Scale over heterogeneous Land Surfaces (8 groups); 3) **BASEWECS**: Baltic Sea Water and Energy Cycle Study (3 groups); 4) **BALTIMOS**: Development and Validation of a Coupled Model System in the Baltic Region (8 groups); 5) **APOLAS**: More Accurate Areal Precipitation Measurements over Land and Sea (4 groups); 6) **BOBA**: Soil frost and snow metamorphism simulations for the BALTEX-region with a complex hydro-thermodynamic soil-vegetation scheme (2 groups); 7) **CANIBALT**: Influence of carbon and nitrogen fluxes on the water and energy budget of the terrestrial biosphere in the Baltic Sea drainage basin (1 group); 8) **Hyper SatAn**: Hyperspectral satellite data analysis over land surfaces for climate modelling applications (1 group).
Each of these clusters has established an individual website which may be accessed e.g. through *www.deklim.de.* You may also contact one of the national DEKLIM representatives:
Dr. Daniela Jacob or Dr. Joachim Dippner at Institute for Baltic Sea Research Warnemünde, IOW (*dippner@bio-19.io-warnemuende.de*).

BBC-Workshop, Leipzig, Germany, May 2002

Clemens Simmer
Coordinator 4D-CLOUDS project and BALTEX SSG member;
Susanne Crewell
Scientific Coordinator CLIWA-NET project; both at Meteorological Institute, University of Bonn (MIUB), Germany

A workshop devoted to the first results of airborne and ground-based cloud measurements of microphysical and radiation parameters during the BALTEX *BRIDGE* Campaign (BBC) took place in Leipzig, Germany, on May 13/14, 2002. The BBC campaign conducted in August/Septemper 2001 marked the largest experimental effort within the EU funded project CLIWA-NET (BALTEX Cloud Liquid Water Network). The German 4D-Clouds project (with eight national partners) joined its experimental efforts with CLIWA-NET. Additional aircraft measurements were possible through a CAATER initiative. Further ground-based measurements were provided by several other research groups including more than 100 radio soundings by United Kingdom's Metoffice and the Dutch Army. The first two weeks of August 2001 the microwave intercomparison campaign (MICAM) took place at the central facility in Cabauw at the Experimental Atmospheric Boundary Layer measurement site operated by the Dutch national weather service (KNMI) in order to better characterize the accuracy of microwave radiometer estimates of liquid water path (LWP) – the central parameter in CLIWA-NET. After the campaign the microwave radiometer were distributed within a regional network consisting of six stations. At the central site Cabauw measurements were made, amongst others, with radars, lidars, radiometers, lidar ceilometers, a 200 m meteorological mast, and a wide range of radiation measurement.

The workshop featured 23 presentations within the different sessions: aircraft and balloon measurements, satellites, ground-based remote sensing measurements and modelling. Data analysis had proceeded impressingly for all instruments since the end of the campaign and first attempts to integrate different data sources were already made. Basically, all data are now available to the BBC participants and the general public (on request) from the central BBC server at KNMI.

The aircraft measurements included, amongst others, imaging spectrometer measurements (Cessna, FUB Berlin), combined radiances and microphysical properties (Partenavia, IfT Leipzig) and detailed microphysics and turbulence (Merlin, Meteo France). From these measurements and a lifting fog layer probed by a tethered balloon (IfT Leipzig) with microphysical instrumentation some case studies were identified for future integrated studies. Ground-based remote sensing measurements provided time series measurements of cloud water which are currently used in CLIWA-NET for systematic model evaluations. Statistical properties provided from these measurements can also be used to generate synthetic clouds (MIUB) – with similar statistical properties – which are suited as input for 3D radiative transfer models to study the effect of inhomogeneous clouds.

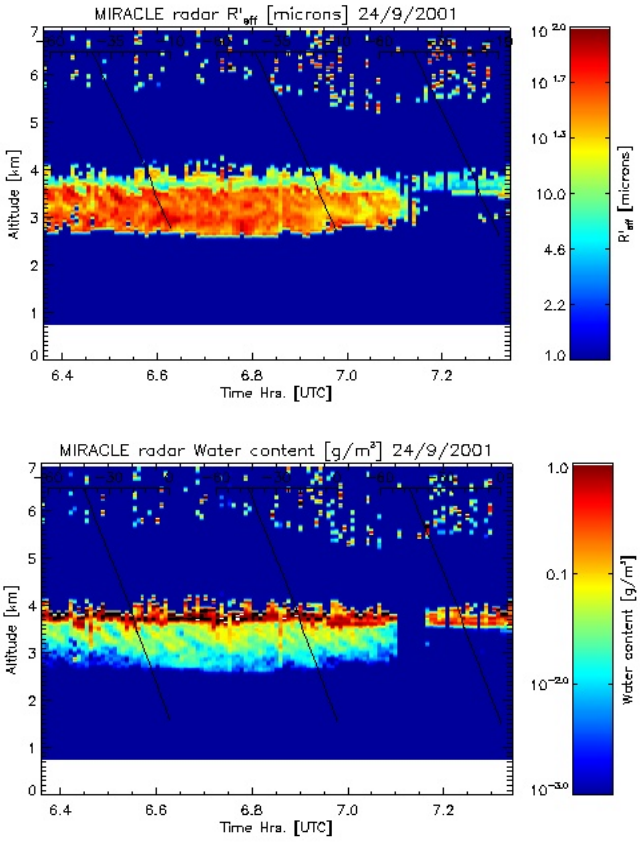


Figure 6: *Time series of effective radius' and liquid water content derived from collocated lidar and radar (GKSS cloud radar MIRACLE) measurements using the algorithm by Donovan and van Lammeren (2001). Obviously large ice crystals fall out of a thin layer consisting of super-cooled water with LWP ~30 g m^{-2} .*

An example of the results (Figure 6) are statistics about super-cooled cloud layers. The ground-based measurements showed that these layers existed at about 12 % of the time (KNMI). Be-

sides their potential risk for aviation these layers have a strong effect on the radiative transfer. The measurements within the regional network could – for the first time – prove that theses layers can exist over more than 100 km and persist for several hours.

New International BALTEX Secretariat Staff Member

Hans-Jörg Isemer
Head International BALTEX Secretariat;
GKSS Research Centre, Geesthacht, Germany

As of June 2002, Dr. Sigrid Schöttle is a new staff member at the International BALTEX Secretariat (IBS) at GKSS Research Centre, Geesthacht, Germany. She is a physical oceanographer by education and got her diploma degree at the University of Hamburg with a diploma thesis on sea surface height variability of the tropical oceans. She took part in several research ship cruises to the Greenland Sea and to the eastern North Atlantic Ocean where she gained experience in experimental oceanography and meteorology. She has recently got her PhD at the Max Planck Institute for Meteorology in Hamburg, Germany, where she worked in the group of natural climate variability and predictability headed by Mojib Latif. Dr. Schöttle's PhD thesis concentrated on the impact of satellite altimeter data assimilation on El Nino forecasts, dealing with Topex/Poseidon altimeter data, ocean and atmosphere modelling and atmospheric forcing fields from various sources. She will strengthen the IBS by bringing new competences to the IBS in the fields of physical oceanography, climate variability and remote sensing. The photo (Figure 7) demonstrates that she already now has nicely integrated into the IBS staff forming a "Stairway to BALTEX" together with Silke Köppen and myself, and we are very much looking forward to working together with Sigrid Schöttle in the future.

It is my particular pleasure to acknowledge the financial support of GKSS Research Centre Geesthacht for the IBS. I would like to stress that, since January 2002, GKSS is the only sponsor of the IBS covering not only salaries for Silke Köppen, Sigrid Schöttle and myself, but also substantial infrastructure and travel support. The IBS is embedded in GKSS's European and International Project Department (SEP) with close cooperation and interaction with the GKSS Institute for Coastal Research.

Figure 7: *A "Stairway to BALTEX" formed by the International BALTEX Secretariat's staff members Silke Köppen (right) , Sigrid Schöttle (middle) and Hans-Jörg Isemer.*

BALTEX *Newsletter* Revival

Hans-Jörg Isemer
Head International BALTEX Secretariat;
GKSS Research Centre, Geesthacht, Germany

After a long break of the BALTEX *Newsletter's* publication, this issue is published following suggestions of the 12th BALTEX SSG meeting held November 2001 in De Bilt, The Netherlands. A major motivation for revitalisation of the *Newsletter* is the particular period of time BALTEX is now entering: The transition to and preparation of phase 2 of BALTEX with an increased necessity for rapid information and discussion means at the international level. The plan now is to publish the BALTEX *Newsletter* regularly in 3 to 4 months intervals; or less, if sufficient material is submitted to the editor. It is hoped that the BALTEX *Newsletter* may be widely and regularly used in the future for information on results of running and past projects and studies, as well as ideas and plans for future contributions to phase 2 of BALTEX.

Next issue of the BALTEX *Newsletter* (# 4)
Please, send articles to be published to
isemer@gkss.de* or *baltex@gkss.de
before
30 September 2002

BALTEX is the European continental-scale experiment within the Global Energy and Water Cycle Experiment (GEWEX). It constitutes a research programme focussing on water and energy cycles in the climate system of the entire Baltic Sea basin with contributions of more than 10 countries. GEWEX has been launched by the World Meteorological Organisation (WMO), the International Council of Scientific Union (ICSU) and the Intergovernmental Oceanographic Commission (IOC), as part of the World Climate Research Programme (WCRP). The scientific planning of BALTEX is under the guidance of the BALTEX Science Steering Group, chaired by Professor Hartmut Graßl, Max-Planck-Institute for Meteorology, Hamburg, Germany. The BALTEX *Newsletter* is edited and printed at the International BALTEX Secretariat with financial support through the GKSS Research Centre Geesthacht, Germany. It is the hope, that the BALTEX *Newsletter* is accepted as a means of reporting on plans, meetings and work in progress, which are relevant to the goals of BALTEX, as outlined in the Scientific and Initial Implementation Plans for BALTEX.
The editor invites the scientific community to submit BALTEX - related contributions to be published in this *Newsletter*. Submitted contributions will not be *peer-reviewed* and do not necessarily reflect the majority's view of the BALTEX research community. Scientific material published in this *Newsletter* should not be used without permission of the authors.
Please, send contributions to the BALTEX *Newsletter*, requests for BALTEX-related documents, suggestions or questions to the International BALTEX Secretariat via

GKSS Forschungszentrum Geesthacht GmbH
International BALTEX Secretariat
c/o Dr. Hans-Jörg Isemer
Max-Planck-Straße 1
D - 21502 Geesthacht
Germany
Phone: +49-4152-871661
Fax: +49-4152-871730
e-mail: baltex@gkss.de *and* isemer@gkss.de

Order Form

☐ **Change of address:**

☐ **Please send the BALTEX *Newsletter* to the following address:**

Name: _____

Organization: _____

Mailing Address: _____

City: _____

Country: _____

Telephone: _____ **Fax:** _____

Electronic Mail: _____