Appendix 1: Workshop agenda

CLIMATE VARIABILITY AND CHANGE IN THE BALTIC SEA AREA

A Workshop prior to the 12th BALTEX-SSG Meeting
Buys Ballot Meeting Room, KNMI, De Bilt, The Netherlands
Monday, 12 November 2001

Chair: Aad van Ulden, KNMI

14.00 ***Introduction***
Hartmut Graßl, Max-Planck-Institute for Meteorology, Hamburg, Germany

14.10 ***Challenges for the Baltic regional environment: Reconstruction of changing climate and changing pollution patterns***
Hans von Storch, GKSS Research Centre, Geesthacht, Germany

14.35 ***Changes and impacts in the Baltic Sea basin – Evidence from the IPCC report***
Zbigniew Kundzewicz, Research Centre of Agricultur and Forest Environment, Polish Academy of Sciences, Poznan, Poland

15.00 ***The relationship between global and local temperatures in Europe over the last century***
Geert Jan van Oldenborgh, KNMI, De Bilt, The Netherlands

15.25 ***Variability and change in precipitation and run-off to the Baltic Sea***
Sten Bergström, SMHI, Norrköping, Sweden

15.50 *Break*

16.15 ***Clouds over the BALTEX area***
Karl-Göran Karlsson, SMHI, Norrköping, Sweden

16.40 ***Climate Parameter Trends in Estonia***
Sirje Keevallik, Tartu Observatory, Estonia

17.05 ***The Baltic Sea ocean climate***
Anders Omstedt, Gothenburg University, Sweden

17.30 ***PRUDENCE (Prediction of Regional scenarios and Uncertainties for Defining EuropeaN Climate change risks and Effects) aims and objectives relevant for BALTEX***
Jens Hesselbjerg Christensen, DMI, Copenhagen, Denmark

17.55 Concluding discussion and closing of the workshop

Appendix 2: Workshop presentations abstracts

Challenges for the Baltic regional environment: Reconstruction of changing climate and changing pollution patterns

Hans von Storch
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Geesthacht, Germany
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Summary

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 following “dimensions”:
•Physical /dynamical
•Chemical / ecological
•Historical /geological
•Economical / political, and
•Sociological.

Applied research shall include advising society and policy about the state of the regional environment, short-term and long-term changes, perspectives of future change, and options of future (sustainable) use (e.g., agriculture, forestry, fishery, traffic, tourism, deposition of substances). The application of knowledge about the Baltic Sea basin environment shall in particular extend to
<u>1. Assessing the</u>
•State of pollution
•Speed of climate change
•Discrimination between anthropogenic and natural climate change;
and
<u>2. Providing scenarios of</u>
•Mitigation of pollution
•Adaptation to change
•Optimal use of the resource „regional environment“.

The presentation will give several examples and illustrations.

The relationship between global and local temperature in Europe over the last century

Geert Jan van Oldenborgh, KNMI

1 Central England vs global temperature

Like most temperature records in northwestern Europe, the Central England Temperature time series over the twentieth century shows a striking similarity with the world average: a rise until about 1945, a slight decrease, and a rise again from 1970 until now. This relationship is analysed under the assumption that the natural rise in 1900–1945 had the same effects on the local weather as the mainly anthropogenic rise of 1970–2000, which is too short to be considered separately.

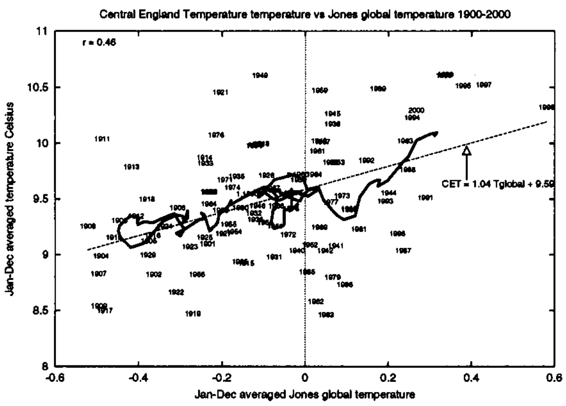

Figure 1: The Central England Temperature as a function of the Jones global temperature. The dashed line is a 10-year running mean.

The correlation between the yearly averaged Central England temperature and the global temperature is $r = 0.46$. This is not only due to the trend; detrended it still is $r = 0.30$. Obviously the correlations for 10-year averages are higher still: $r = 0.80$, detrendend $r = 0.76$. However, due to serial correlations the significance is not easy to assess.

Another approach is to consider two models for the local temperature

$$\mathrm{CET} = \mathrm{constant} + \mathrm{noise} \quad (1)$$

$$\mathrm{CET} = T'_{\mathrm{global}} + \mathrm{constant} + \mathrm{noise} \quad (2)$$

The noise characteristics are quite different for these models.

n	$\sigma\langle\mathrm{CET}\rangle_n$	$\sigma\langle\ldots\rangle_1/\sqrt{n}$	$\sigma\langle\mathrm{CET}-T'_{\mathrm{global}}\rangle_n$	$\sigma\langle\ldots\rangle_1/\sqrt{n}$
[yr]	[K]	[K]	[K]	[K]
1	0.53	0.53	0.47	0.47
5	0.30	0.24	0.19	0.21
10	0.28	0.17	0.13	0.15
20	0.25	0.12	0.08	0.11

So, model (1) is less likely then model (2), as one needs more noise with a higher autocorrelation in (1). In fact, in model (2) the noise is white to a good approximation. The same relationship is visible in spring, summer and fall, but not in winter.

2 European vs global temperature

The analysis was repeated for all GHCN temperature stations with >80 years of data in Europe. The regression coefficients are often around one. Again, this is not only the trend. Over the whole world, a regression with the Parker & Jones dataset shows that the warming has been remarkably uniform, with a regression coefficient between 0.5 and 2 over 75% of the surface. Of course the average of this map is one by definition.

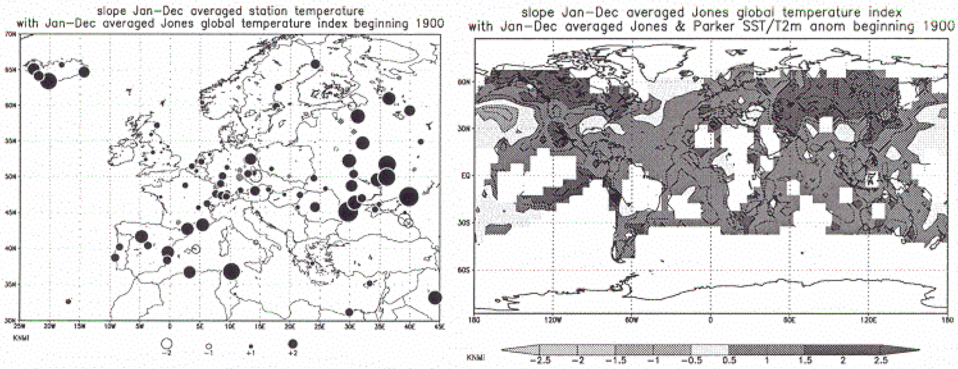

Figure 2: Regression coefficients of the relationship between local and global temperature over the twentieth century. Left: Europe for GHCN v2b stations with at least 80 years of data. Right: whole world using the Jones & Parker dataset.

3 Precipitation

Precipitation is much harder to analyse this way, as there is no a priori relationship with gobal warming and the signal/noise ratio is much poorer. There seem to be an increase in winter precipitation in central and northern Europe.

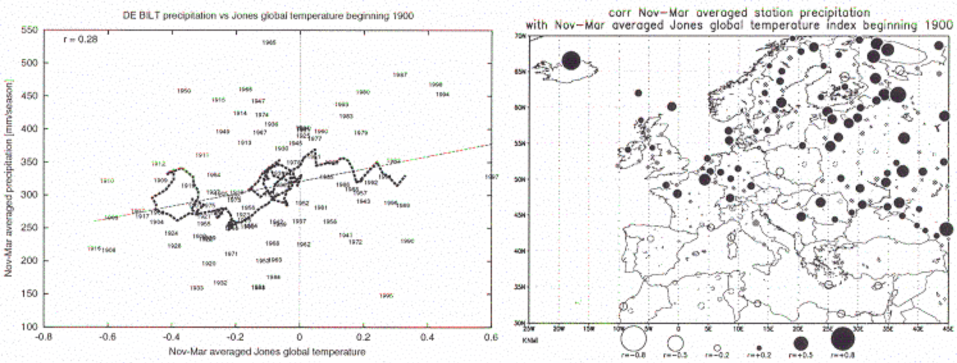

Figure 3: Left: De Bilt winter (Nov–Mar) precipitation as a function of globally averaged temperature, the dashed line indicates a 10-year running mean. Right: the correlation between local precipitation and globally averaged temperature over Europe.

Changes and impacts in the Baltic Sea basin: Evidence from IPCC TAR report

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The IPCC Third Assessment Report is there

In spring 2001, the Third Assessment Report of the Intergovernmental Panel on Climate Change was published. The volume prepared by the Working Group 2, devoted to impacts, adaptation and vulnerability, consists, among others, of sectorial and regional chapters. Chapter 13, produced by two Coordinating Lead Authors (*Kundzewicz* and *Parry,* 2001), eight Lead Authors, 37 Contributing Authors and two Review Editors, deals with the region of Europe.

Disaggregation of the TAR's findings for the Baltic region

An attempt will be made to disaggregate some of the TAR's findings, primarily contained in the European chapter (*Kundzewicz* and *Parry,* 2001), to a sub-region of the Baltic Sea basin. Discussion of climate change impacts within the Baltic region, in the light of the findings of the IPCC TAR is offered, extending to such areas as observed changes in climate, physical and biological systems, and scenarios for the future, water resources, soils, ecosystems, coastal zones, agriculture, forestry, health, insurance, and weather extremes. The European chapter of the IPCC TAR (*Kundzewicz* and *Parry,* 2001) draws extensively from the ACACIA Report of the European Union Project (*Parry,* 2000).

Examples of possible climate change impacts in the Baltic region

Studies discussed in (*Kundzewicz* and *Parry,* 2001), deal with observed and projected consequences of regional climate change, in a range of sectors.

Despite the overall warming in the region in the 20th century, in Fennoscandia, cooling in both mean maximum and mean minimum temperature in winter has been observed, but warming in summer. Annual precipitation within the 20th century has increased, particularly in the northern part of the Baltic region, and especially in winter.

Changes in timing of the hydrological cycle has been observed and further changes are projected for the future warmer world: delayed river freeze-up and earlier ice break-up, changed flow regimes, high flows coming earlier, shifting from spring towards winter.
Among observed effects in biological systems are: increases in growing season's length, poleward and upward altitudinal range shifts of plants and animals, phenology changes – earlier spring flowering of plants and egg-lying in birds, earlier emergence of insects, earlier arrival and later departure of migratory animals.

Scenario analyses for seasonal (June – July – August and December – January – February) temperature and precipitation in 2020s, 2050s and 2080s, based on a number of GCMs, are presented, following the work of Dr Tim Carter of the Finnish Environmental Institute for the ACACIA Project (*Parry,* 2000).
The Baltic region is likely to experience overall positive agricultural effects, whereas, in some production systems in Central and Eastern Europe, a decrease of productivity can be observed, due to water deficits. Changes in water-limited yield for wheat are likely to be gener-

ally positive in the region. The possibility of expansion of grapevine into the Southern part of the Baltic region has been projected.
A significant increase in exposure to coastal flooding is foreseen in the Baltic Coast. By the 2080s, the increase of the number of people experiencing flooding may increase by up to 3000%, and the range of coastal wetland losses can be as high as 84 to 98%. Adaptation costs in the Polish Coast depend largely on the magnitude of the sea-level rise; for a 1 m rise they can be as high as 14.5% of GNP.
Changes in frequency and intensity of extreme events are uncertain. Yet, a number of extreme hydrological events have occurred recently in the region and there are several mechanisms indicating possible increase of the risk in the future.

Occurrence of higher temperatures and more frequent heat waves in Southern Europe may change traditional summer tourist destinations (e. g. the Mediterranean), rendering the Baltic Sea region an even more attractive tourist destination.

Adaptive capacity and vulnerability

As in several other regions in mid and high latitudes, a moderate warming can have generally positive aggregate impacts, which can turn negative with a stronger increase in temperature. The regional vulnerability in the Baltic Sea basin is relatively lower than in some other sub-regions of Europe, and in particular, far lower than in the highly vulnerable south. Yet, despite of generally high adaptive capacity, some systems within the sub-region are vulnerable and losses cannot be avoided. For instance, adaptability of biota to a fast climate change is limited, and traditional life style of some societies is in jeopardy.

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Variability and change in precipitation and runoff to the Baltic Sea

Sten Bergström
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The variability in precipitation is great in the Baltic Sea drainage basin. This is reflected in river runoff as pictured by data from the BALTEX Hydrological Data Centre (Fig 1). The figure shows that the recent wet period may not be so outstanding as it may seem in the light of the recent flooding problems in Poland, Germany, Sweden and Norway. The 1920s was another wet period.

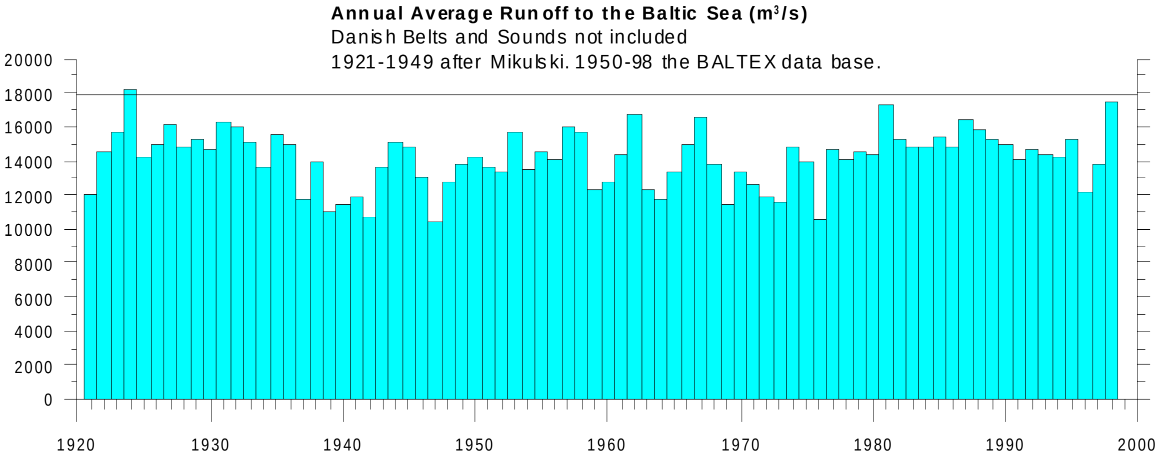

Figure 1. Mean annual river runoff to the Baltic Sea

A closer look at flood risks in Sweden has just been carried out. Objective statistical analyses do not confirm any significant trends in extreme precipitation or extreme floods in general although summer and autumn floods have increased in a 50-year perspective. This trend flattens out if records are expanded to 100 years. This increase in frequency in the 50-year perspective has generated a heated debate on possible impacts of global warming, hydropower development and land use. A growing conflict between physical planning, reservoir operation and natural variability in water levels has also been identified.

Trend analysis of precipitation suffers from severe homogeneity problems due to undercatch and a growing awareness of the need for wind-sheltered measuring sites. This has led to a fictitious upward trend in observed precipitation, which is disclosed if the relationship between runoff and precipitation is plotted. Therefore it is safer to look at long runoff records than long precipitation records. Some of the longest runoff records in the Baltic basin show a declining trend rather than increasing and indicate that there must have been a number of spectacular floods during the 19th century. These are often confirmed by proxy data.

Conclusions

Even though there has been some very wet years and several spectacular flood events in recent years in the Baltic basin, it would be premature to regard this as the final confirmation of global warming. This is not a trivial problem. Long records tell us that the we easily underestimate the natural variability and there are always question marks about data quality, in particular as concerns precipitation. Thanks to the existence of long records and co-operation between national services and research organisations the BALTEX scientific network has a strong potential to help detecting the true trends.

CLOUD CLIMATE INVESTIGATIONS IN SCANDINAVIA DURING THE LAST DECADE USING HIGH-RESOLUTION NOAA AVHRR DATA

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1 INTRODUCTION

The task to monitor the regional and global cloud climate has become increasingly depending on the existence of appropriate cloud data sets derived from satellite measurements. Many satellite-based cloud retrieval algorithms have now reached a maturity to permit the compilation of cloud climatologies with an acceptable quality. This paper describes a method for compilation of a ten-year high-resolution regional cloud climatology based on a systematic cloud classification of NOAA AVHRR scenes over the Scandinavian region. The paper also includes a comparison of results with cloud climatologies based on surface observations and other satellite data sets (e.g. ISCCP).

2 METHODOLOGY

The used approach for compilation of cloud climatologies has been to use archived results from the SCANDIA (SMHI Cloud ANalysis model using DIgital AVHRR data) cloud classification model (described in detail by Karlsson, 1996 and Karlsson, 1997) covering the period 1991-2000. SCANDIA uses the full fivechannel NOAA AVHRR data set at maximum horizontal resolution. However, the cloud climatology results presented here have been utilizing a data set with a reduced resolution of 4 km.

SCANDIA results from four daily overpasses over the area (observing approximately at night, in the morning, in the afternoon and in the evening) have been used to define a daily mean of cloud cover over the area. Results have then been accumulated to define monthly, seasonal and yearly climatologies for the studied time period. Since SCANDIA makes a separation of many different cloud types, the data set permitted also studies of different cloud groups in addition to the central parameter total fractional cloud cover. Karlsson (2001) gives a full description of these results whereas this paper only reports on some results for the parameter total fractional cloud cover.

3 THE SATELLITE DATA SET

The studied NOAA AVHRR data set is composed by data from the satellites NOAA-10, NOAA-11, NOAA-12, NOAA-14 and NOAA-15. Consequently, except for a few months of data from NOAA-10, the data set consists entirely of data from the AVHRR/2 instrument. Due to technical constraints and problems (e.g., HRPT reception problems, tape failures and data gaps due to failures of the operational satellites NOAA-11 and NOAA-15), a complete satellite coverage during the period could not be achieved. The entire satellite data set consists of 12 470 satellite scenes which is 87 % of the theoretical maximum of useful scenes during the period.

4 RESULTS

4.1 SCANDIA climatologies

Figure 1 shows the period mean of cloud occurrence (cloud frequency in 4-km horizontal resolution) over the area for the selected months of January, April, July and October. Notice here that the vertical discontinuity in some of the result pictures is due to the use of different cloud detection thresholds in two different processing areas (see Karlsson, 2001). Cloud conditions are shown to vary substantially according to season in Figure 1. Much higher cloud frequencies are found in the winter season than in the summer season for most places (except the Scandinavian mountain range and over the visible part of the Norwegian Sea). Over the Baltic Sea and over adjacent land areas, a substantial annual cycle in cloudiness is found. This is further illustrated in Figure 3 showing the annual course of cloud cover (estimated within a 36-by-36 km sub-area) at a position in the southern part of the Baltic Sea (at latitude 56N and longitude 18.5E). The yearly amplitude is estimated to approximately 40 % (40 % cloud frequency in summer and 80 % in winter). More detailed results (e.g., concerning the diurnal cycle of cloud cover and the contribution from ice and water clouds) are presented by Karlsson (2001).

4.2 Comparison with other cloud data sets

In order to validate the results of the SCANDIA cloud climatologies, a comparison with a corresponding cloud climatology based on surface observations (SYNOP) was carried out. Mean values of monthly cloud cover were compiled by use of SYNOP observations made at 00 UTC, 06 UTC, 12 UTC and 18 UTC for 28 Swedish SYNOP stations. The observations of total cloud cover from each SYNOP station were compared to corresponding estimations of SCANDIA cloud cover computed in 36-by-36 km subareas centered at the geographic location of each station. In total, more than 250 000 SYNOP observations were used and compared to corresponding satellite scenes.

Figure 4 shows an overall summary of validation results month by month in the period. Notice the sinusoidal variation in the bias error varying between +5-10 % in the winter season and –5-10 % in the summer season. Particular problems are indicated in the winter season having high positive bias errors, high RMS errors and low correlation coefficients. The low correlation coefficient in winter indicates that error structures are very complex. Several error sources seem to have importance, largely caused by the lack of useful visible information and the problematic temperature conditions near the surface with frequent temperature inversions making the use of infrared channels risky for cloud detection.

The indicated underestimation of cloudiness in summer was concluded to emanate entirely from deficiencies in the SYNOP observations. The relatively high correlation coefficient and the good experience from using the SCANDIA cloud classification in summer in operational weather forecasting support this conclusion.

The SCANDIA climatologies were also compared to two international cloud data sets: CRU (New et al., 2000) and ISCCP (D2 series – described by Rossow and Schiffer, 1999). However, since the SYNOP based CRU data set is only available over land areas and since the ISCCP D2 series is not available yet for the entire ten-year period, the comparison here is limited to the years 1991-1993 only over land areas. Figure 5 shows the comparison of monthly mean of cloud cover over land areas in the Scandinavian area of SCANDIA and the two other data sets. Noticeable is the larger dynamic range of cloud cover values for SCANDIA compared to the other two data sets. Especially the minimum values of cloud cover in the summer season are lower for SCANDIA. It can also be noticed that the agreement between SCANDIA and CRU is quite good in the beginning of the studied period. Basically the same pattern as previously found in the comparison with Swedish SYNOP stations (i.e., summertime SCANDIA underestimation and wintertime SCANDIA overestimation) were found. However, for the second half of the period deviations are very large. This is largely caused by lack of available SYNOP observations over the area in the CRU data set (basically now only giving a climatological mean of cloud cover over the area). The higher values of the the summertime minimum of cloudiness for the ISCCP data set were verified to exist also over sea areas in the region (see Karlsson, 2001).

5 DISCUSSION

The ten-year NOAA AVHRR cloud climatology shows that Scandinavian cloud conditions are largely influenced by the existence of the Baltic Sea. Conceptually, the Baltic Sea could be described as acting like a heat sink in the summer season (mainly caused by the springtime supply and accumulation of cold fresh water from melting snow in spring) suppressing convective clouds from forming over sea areas and adjacent land areas. However, the northern

part of the region does not show a similar annual cycle of cloudiness. Here, cloud conditions remain practically the same throughout the year.
The NOAA AVHRR cloud climatology over the Scandinavian region was found to reproduce surface observed cloud climatology within +/- 5 % during all seasons except in winter. As for the SYNOP climatology, no particular trend in cloudiness could be seen over the period. A minimum in cloudiness was indicated in the middle of the period but this was partly exaggerated in the satellite data set due to problems with an inadequate compensation for the degradation of the visible AVHRR channels on the NOAA-12 satellite.
Comparisons with the CRU and ISCCP D2 data sets gave good agreement but SCANDIA showed generally lower cloud amounts in the summer season than the other data sets.
The future use of the SCANDIA cloud climatology will mainly be as a tool for validation of cloud information in climate simulation models (see Jones and Willén, 2001). The data set could be a valuable contribution to the BALTEX (Rashcke et al., 2001) and CLIWANET projects aimed for studies of the water and energy cycle of the Baltic Sea. Results from an improved cloud classification model have recently been compiled within the CLIWANET project (Dybbroe, 2001) and some preliminary results over the entire Baltic Sea drainage area are shown in Figure 2.

6 ACKNOWLEDGEMENTS

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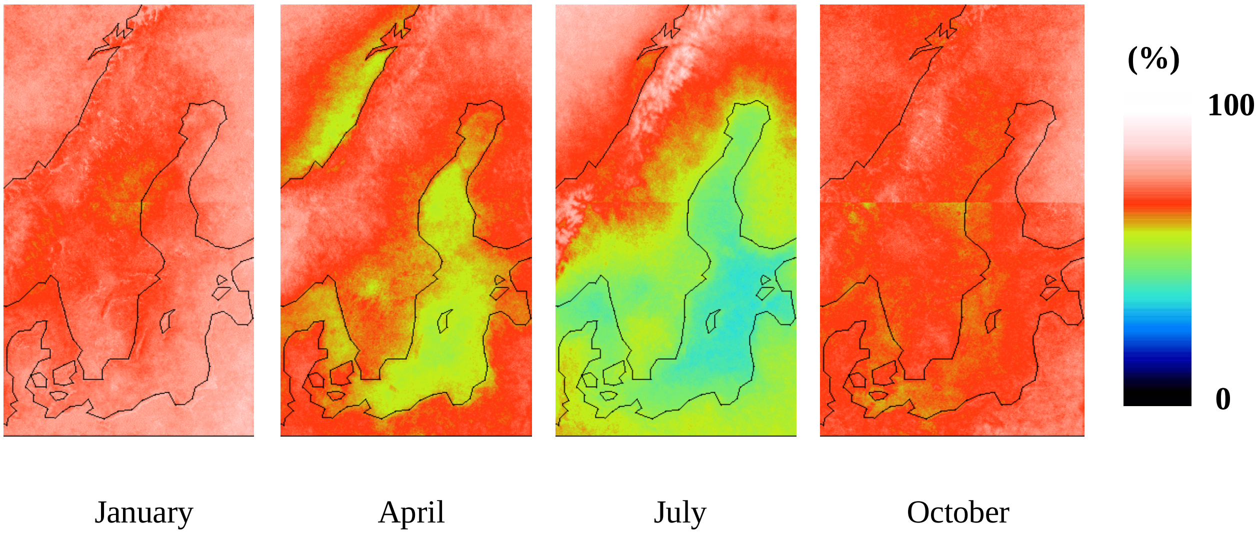

Figure 1 *Period mean (1991-2000) of cloud frequency in the Scandinavian area with 4 km horizontal resolution for the months of January, April, July and October.*

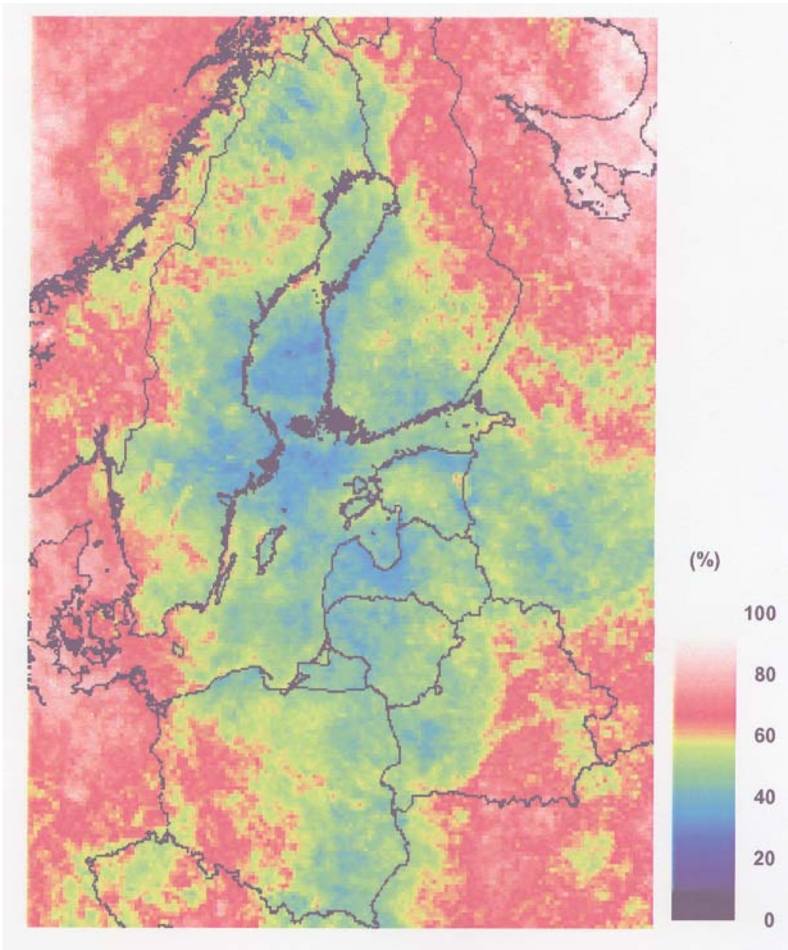

Figure 2 *Mean cloud frequencies in 10 km resolution over the Baltic Sea drainage basin derived from NOAA AVHRR afternoon passages in September 2000. See text for details.*

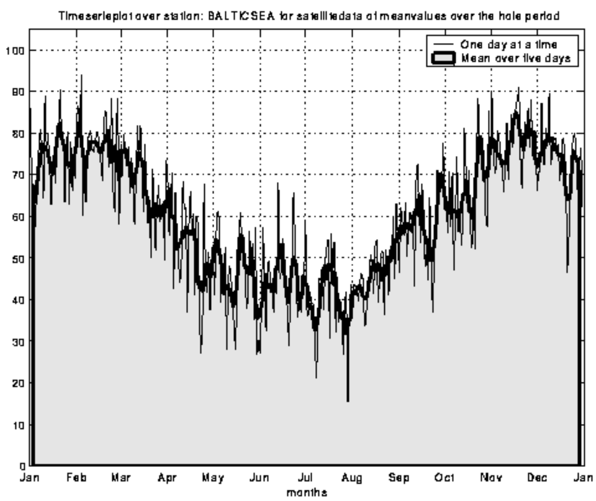

Figure 3 *The annual course of cloud cover (% -estimated in one-day and five-day intervals) for a position in the southern part of the Baltic Sea (56N,18.5E).*

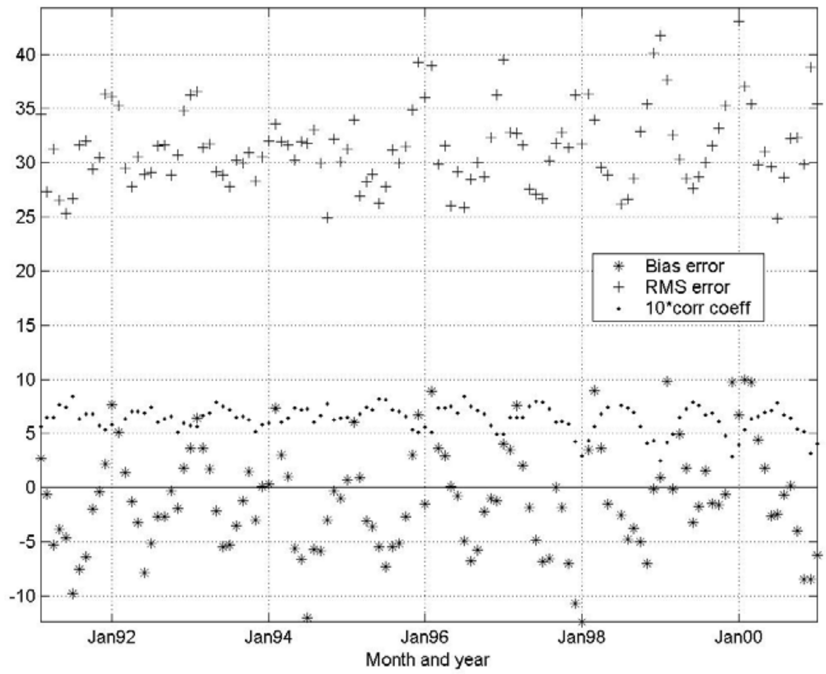

Figure 4 *Monthly averages of bias errors, RMS errors and correlation coefficients for the entire validation data set in the period 1991-2000.*

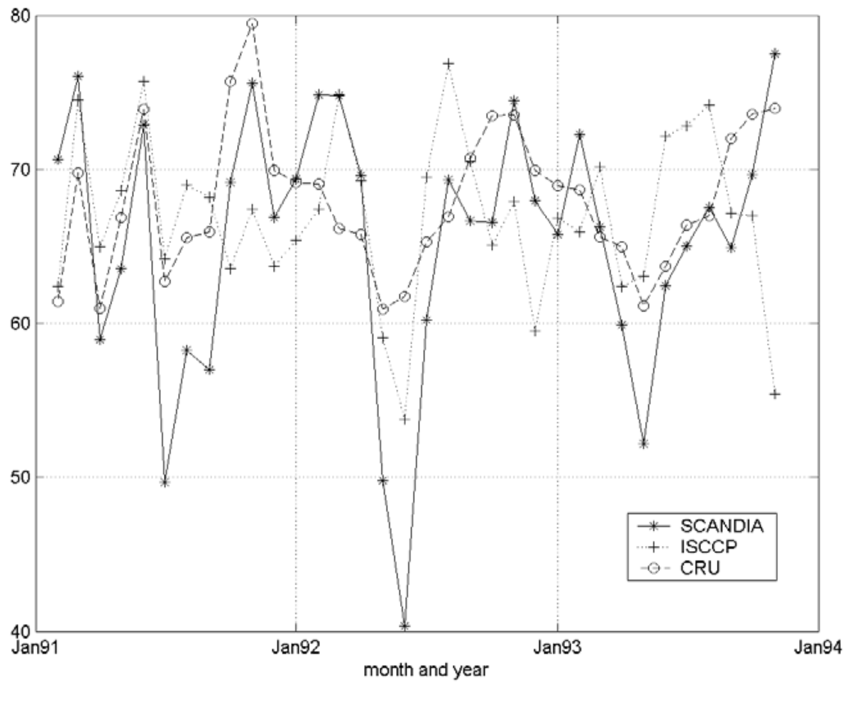

Figure 5 *Plot of monthly mean of cloud cover (%) over SCANDIA land points for SCANDIA (solid), the ISCCP D2 dataset (dotted) and the CRU data set (dashed) for the period February 1991 until November 1993.*

Climate Parameter Trends in Estonia

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In Estonia it has been noticed that during the last decades

- the weather in late winter and spring has become warmer, whereas no significant tendency can be noticed during other seasons;
- the amount of low clouds in March has increased by 1.2…3.2 tenths; this increase is statistically related to the changes in atmospheric circulation;
- the duration of snow cover has shortened.

An extensive analysis has been undertaken to investigate changes in the main weather elements in late winter and spring at Tiirikoja Meteorological Station (58.87ºN, 26.95ºE) during 1955-1995 and to relate the changes to the trends in the atmospheric circulation. The latter was estimated from wind speed and direction data at two isobaric levels (500 hPa and 850 hPa) recorded at Tallinn Aerological Station. These data permitted to calculate the zonal (u) and meridional (v) components of wind velocity at both levels. It should be reminded that the zonal velocity component u is positive when directed to the east and the meridional component v – when directed to the north.

Linear trends were fitted to time-series of monthly averages of all parameters under consideration. Along the trend lines it was possible to estimate the changes that have taken place during the observation period. These changes and the probability of significance of the respective trend are shown in Table 1 where only these trends have been used which probability of significance is less than 0.1.

Table 1. Average changes in the meteorological and aerological parameters during 1955-1995 and probability of significance of the trends (P)

Parameter	February		March		April	
	Change	P	Change	P	Change	P
Temperature	-		5.3 K	0.00	2.9 K	0.00
Monthly precipitation	-		20.5 mm	0.00	-	
Amount of low clouds	-		2.2 tenths	0.01	-	
Snow cover duration (1962-1995)	-8 days	0.01	-10 days	0.05	-	
u(850)	4.2 m/s	0.05	3.2 m/s	0.07	-	
v(850)	-		3.9 m/s	0.01	-	
u(500)	-		-		-	
v(500)	-		6.6 m/s	0.01	-	

Table 1 indicates that the most serious changes in meteorological parameters have taken place in March. March has become warmer during the last four decades. Additionally, the amount of precipitation has nearly doubled during the same period and the amount of low clouds has increased by 50%. Besides, data on the ice cover on Lake Peipsi show that during the period of 1921-1975 the average date was April 10 when the ice started to break on the lake. During the period of 1976-1996 this date was approximately two weeks earlier – on March 25.

These changes are statistically related to the changes in the average airflow in the free atmosphere above Estonia. In March the wind speed at the 500 hPa and 850 hPa isobaric levels has increased during the observation period and the average airflow has turned from NWW or NW to SW or SWW. It should be added that such changes in atmospheric circulation above Estonia can be attributed to the intensification of the NAO during the period under consideration only partly.

The Baltic Sea Ocean Climate System

By

Anders Omstedt

Earth Science Centre-Oceanography, Göteborg University, Sweden

1. Introduction

The objective of the presentation is to highlight the Baltic Sea ocean climate system. The climate system in this connection is defined as the statistical properties of salinity, ice, temperature, sea levels, in- and out-flows to and from the Baltic Sea. Calculations of these parameters will include seasonal and inter-annual means as well as extremes. The number of relevant publications in the area is large and only references to some recent studies will be given.

2. Salinity

The present climate of the Baltic Sea with regard to the salinity and the freshwater budget was analysed by Winsor et al. (2001). In Figure 1, the Baltic Sea mean salinity is shown as 5-year running mean together with the surface salinity in the Bornholm Basin. We notice that the mean salinity of the Baltic Sea has varied between about 5.5 and 6.5 $^{o}/_{oo}$ during the 20th century, with a typical time scale of thirty years. The surface salinity in the southern part of the Baltic Sea is well correlated with the mean salinity of the Baltic Sea (calculated using data from the Gotland Deep). There is no long-term trend found during the century. The figure illustrates that climate control runs must cover several decades, probably up to 100 years, to catch the natural variability of today's climate.

3. Ice and temperature

Some interesting long-term sea ice and temperature time series are available in the Baltic Sea. Jevrejva (2001) has recently presented an analysis of the severity of winter seasons in the northern Baltic Sea based on data from 1529 to 1990. Koslowski and Glaser (1999) presented results from the western Baltic Sea based on a time series from 1501 to 1995. Annual maximum ice extent data for the Baltic Sea are collected by the Finnish Institute of Marine Research and is available from 1720 to present. The influence of atmospheric circulation on the maximum ice extent in the Baltic Sea was recently analysed by Omstedt and Chen (2001). Figure 2 shows the anomaly from the long-term mean, which indicates that the significant trend earlier identified may be a result of a sudden change in the means. This change can be indicated by a “change point” in the mean of the ice extent series. The change point divides the total series into two periods of approximately equal length, with the transition corresponding to the end of little ice age and the beginning of industrialisation. Any studies of the long-term change need to consider the little ice period, a period which also can be found in other parameters as for example the in the Stockholm sea level time series (Ekman, 1999).

4. Sea levels

The countries around the Baltic Sea are still adjusting to the latest glaciation, which ended about 10 000 years ago. The postglacial uplift from the southern to the northern Baltic varies today between -1 to 8 mm/year (Ekman, 1996).Due to the salinity distribution in the Baltic Sea the mean sea level drops from the Bothnian Bay to the Skagerrak by about 35-40 cm (Ekman and Mäkinen, 1996 and Carlsson, 1998). Added on these mean sea level states large regional, seasonal and inter-annual variations are observed.

The water exchange through the Baltic Sea entrance area is mainly forced by the sea level differences between the Kattegat and the Baltic Sea and is strongly reduced due to friction. For time scales of months and larger the zonal wind and the basin mean sea level of the North Sea are the driving mechanisms for the Baltic Sea mean level (Wroblewski, 1998, Gustafsson and Andersson, 2001). The strong coupling between large scale atmospheric circulation and Baltic Sea levels has recently been analysed by Andersson (2001) and is illustrated in Figure 3.

5. In- and out-flows

From sea level, runoff and net-precipitation data one can calculate the instantaneous barotropic transports through the Danish Straits. Other methods exists such as direct measurements of the flows but for longer time series one need to use sea level variations across the Baltic entrance area to calculate the through flows. This method has been applied by Winsor et al (2001) when studying the in and out-flows during the last century. In Figure 4 the estimated yearly means of the outflow from the Baltic Sea together with a 5-year running mean are shown. The mean value of this flow, 80×10^3 m^3s^{-1}, is about 5 times larger than the river runoff, which is 14×10^3 m^3s^{-1}. The standard deviation is 3500 m^3s^{-1}, which is about twice that for the river runoff. Variations over a few years dominate but there are also variations over several decades. There is no significant trend, when looking at the whole period, though there is a general decrease from the mid 1940s to the mid 1970s.

Figure 5 shows the estimated volume transport during all inflow events. The average inflow-event transport is indicated. We see a rather even distribution with time. The frequency distribution related to this is shown in Figure 6. The events with the largest inflow volumes can be expected to have carried extra ordinary high salinity and thus have been responsible for renewal of the deepest basin water. An, at the moment, arbitrary chosen limit of 160 km^3 defining extreme inflows is inserted in Figure 5 (dashed line). Matthaus and Franck(1992) presented other ways to characterise major Baltic Sea inflows.

Acknowledgements

This work is a part of the GEWEX/BALTEX programme and has been financed by the Swedish Research Council under the contract G 600-335/2001.

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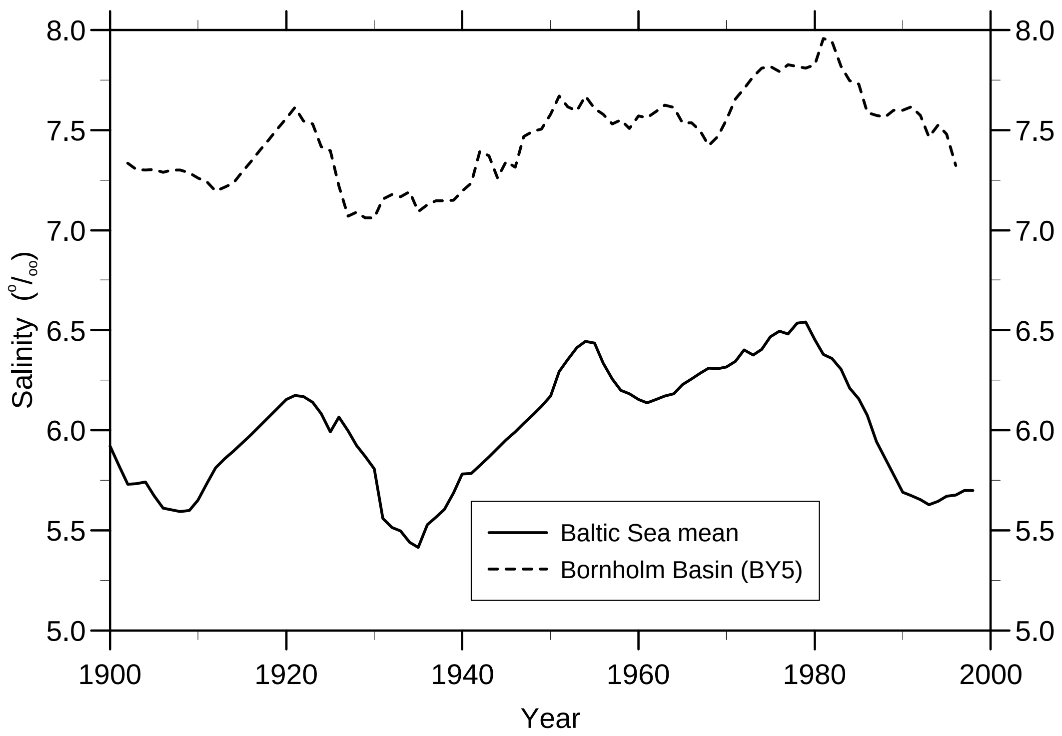

Figure 1. Surface salinity in the Bornholm Basin (BY5) together with the mean salinity of the Baltic Sea calculated from the freshwater content. Both series are 5-year running means. From Winsor et al (2001)

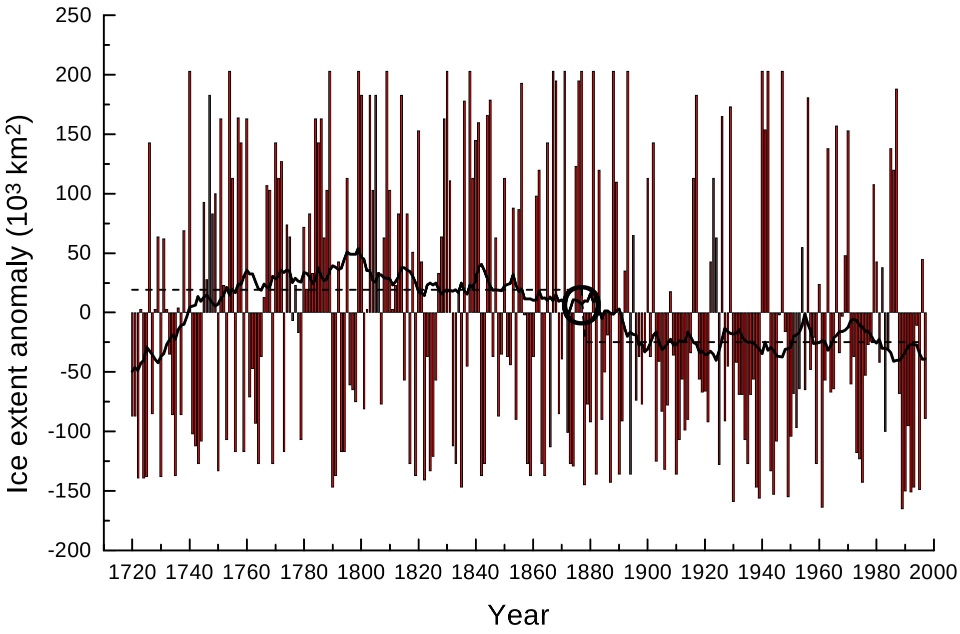

Figure 2. The anomaly (A_i-A_{mean}) of the maximum ice extent, with the change point (circle), 30-years running mean (thick line), and the means of the two subintervals divided by the change point (dashed lines). From Omstedt and Chen (2001).

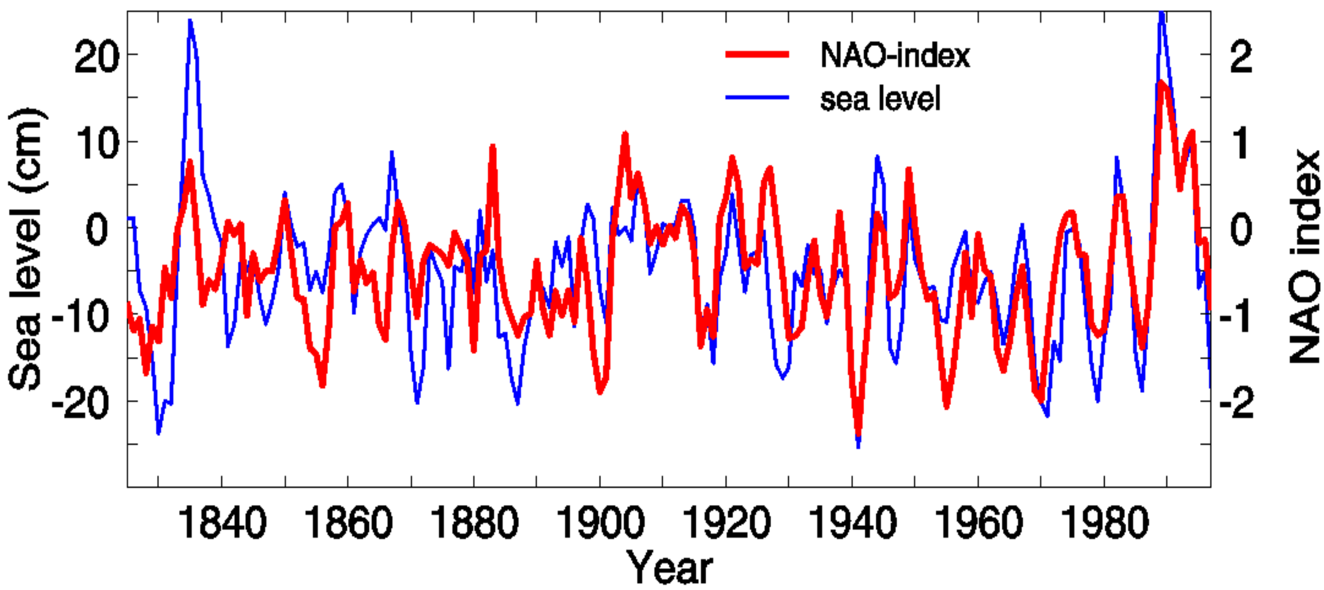

Figure 3. The winter (JFM) mean of the Baltic sea level and the NAO index for the period 1825-1997, smoothed with a 3-year running mean. From Andersson (2001).

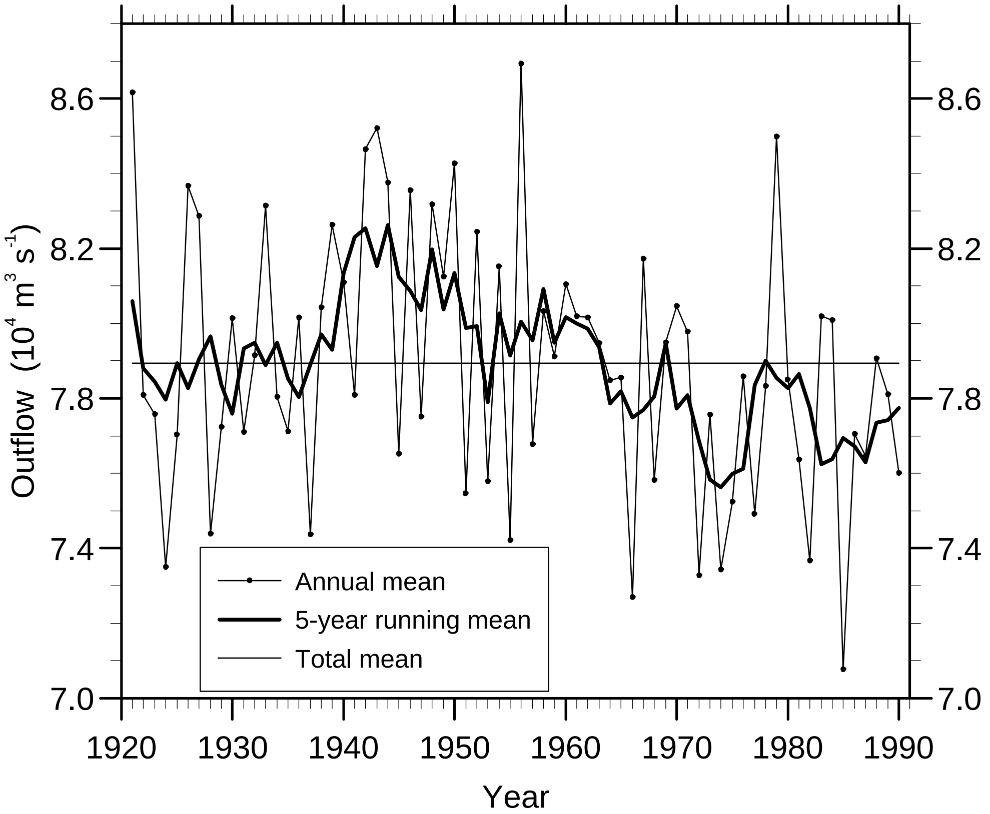

Figure 4. Calculated annual mean outflow from the Baltic Sea. From Winsor et al.(2001).

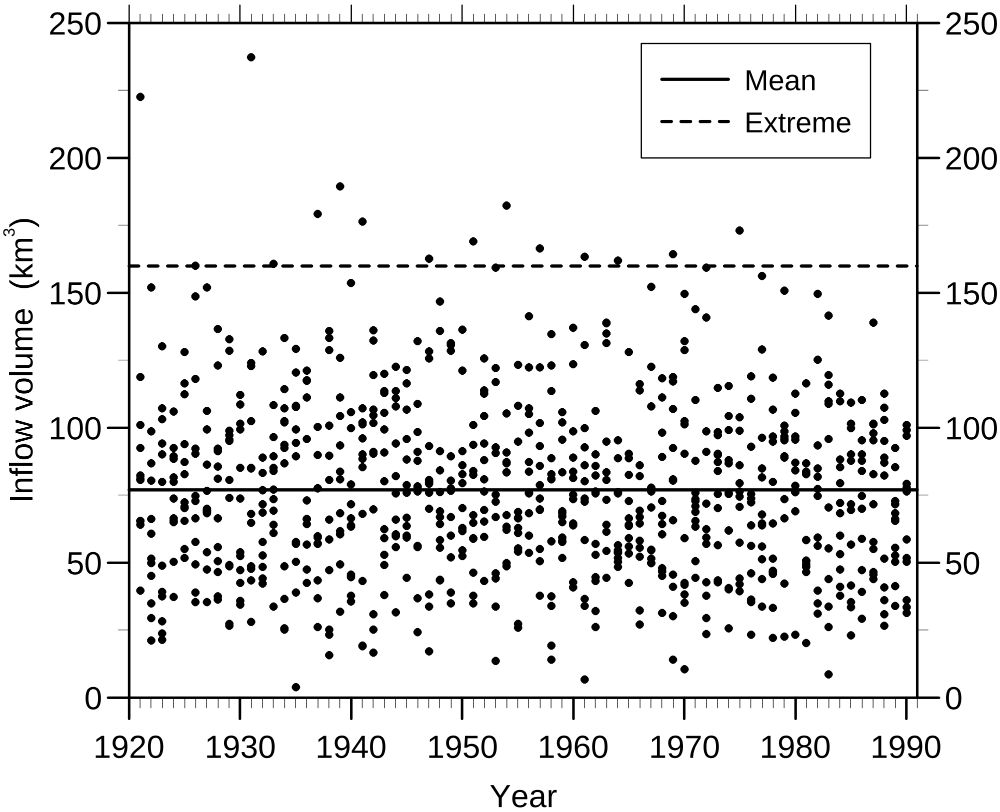

Figure 5. Scatter plot of all modelled consecutive inflow events. From Winsor et al. (2001).

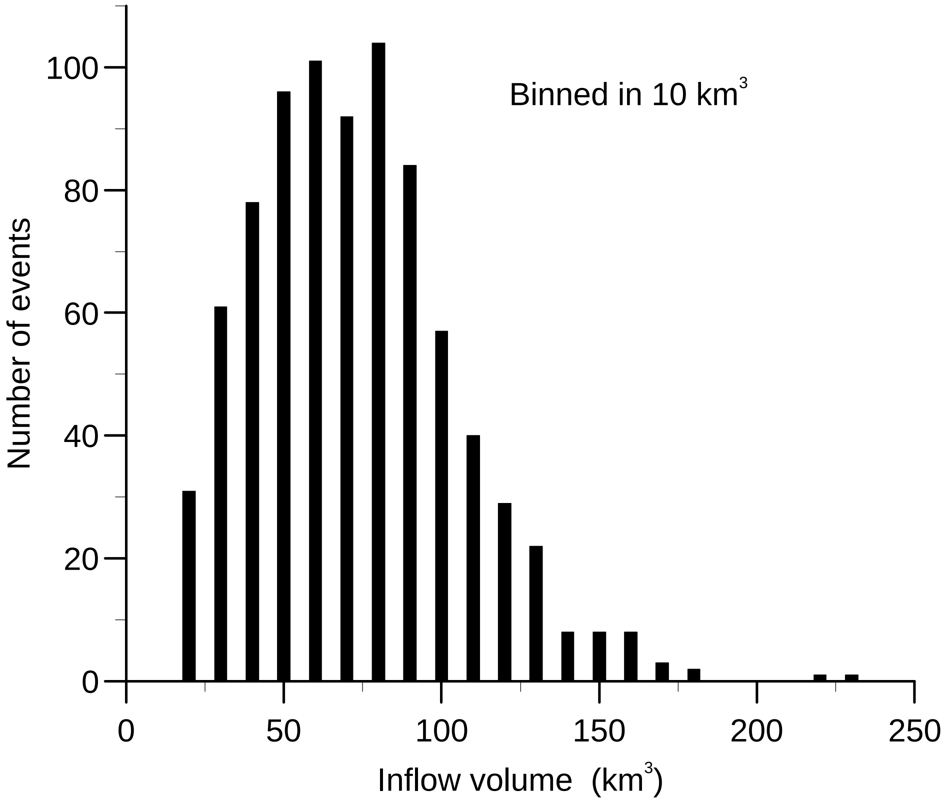

Figure 6. Distribution of inflow events. From Winsor et al. (2001).

Prediction of Regional scenarios and Uncertainties for Defining EuropeaN Climate change risks and Effects – PRUDENCE
by
Jens Hesselbjerg Christensen, DMI, Copenhagen, Denmark

Problem to be solved:
European decision-makers in government, non-governmental organisations (NGOs), and industry as well as the general public need detailed information on future climate. In this way it becomes possible to evaluate the risks of climate change due to anthropogenic emissions of greenhouse gases. Projections of future climate change already exist, but are deficient both in terms of the characterisation of their uncertainties and in terms of their regional detail. To date, the assessment of potential impacts of climate change has generally relied on projections from simple climate models or coarse resolution Atmospheric-Ocean General Circulation Models (AOGCMs), neither capable of resolving spatial scales of less than ~300km. This coarse resolution precludes the simulation of realistic extreme events and the detailed spatial structure of variables like temperature and precipitation over heterogeneous surfaces e.g. the Alps, the Mediterranean or Scandinavia. Simple models include, at best, a limited physical representation of the climate system.

Scientific objectives and approach:
PRUDENCE is a European-scale investigation with the following objectives:
a) to address and reduce the above-mentioned deficiencies in projections;
b) to quantify our confidence and the uncertainties in predictions of future climate and its impacts, using an array of climate models and impact models and expert judgement on their performance;
c) to interpret these results in relation to European policies for adapting to or mitigating climate change.

Climate change is expected to affect the frequency and magnitude of extreme weather events, due to higher temperatures, an intensified hydrological cycle or more vigorous atmospheric motions. A major limitation in previous studies of extremes has been the lack of: appropriate computational resolution - obscures or precludes analysis of the events;
long-term climate model integrations - drastically reduces their statistical significance;
co-ordination between modelling groups - limits the ability to compare different studies.
These three issues are all thoroughly addressed in PRUDENCE, by using state-of-the-art high resolution climate models, by co-ordinating the project goals to address critical aspects of uncertainty, and by applying impact models and impact assessment methodologies to provide the link between the provision of climate information and its likely application to serve the needs of European society and economy.

Expected impacts:
PRUDENCE will provide a series of high-resolution climate change scenarios for 2071-2100 for Europe, characterising the variability and level of confidence in these scenarios as a function of uncertainties in model formulation, natural/internal climate variability, and alternative scenarios of future atmospheric composition. The project will provide a quantitative assessment of the risks arising from changes in regional weather and climate in different parts of Europe, by estimating future changes in extreme events such as flooding and windstorms and by providing a robust estimation of the likelihood and magnitude of such changes. The project will also examine the uncertainties in potential impacts induced by the range of climate scenarios developed from the climate modelling results. This will provide useful information for climate modellers on the levels of accuracy in climate scenarios required by impact analysts. Furthermore, a better appreciation of the uncertainty range in calculations of future impacts

from climate change may offer new insights into the scope for adaptation and mitigation responses to climate change. In order to facilitate this exchange of new information, the PRUDENCE workplan places emphasis on the wide dissemination of results and preparation of a non-technical project summary aimed at policy makers and other interested parties.

Appendix 3: BSSG meeting agenda

12th BALTEX SSG Meeting

at

The Royal Netherlands Meteorological Institute - KNMI
DeBilt, The Netherlands
12 – 14 November 2001
Buys Ballot Meeting Room

Monday, 12 November 2001

14.00 Workshop on „Climate Variability and Change in the Baltic Sea Area"
See separate workshop agenda

18.00 Closing of the workshop

Tuesday, 13 November 2001

9.00

Item 1:
Welcome by the Host and the Chairman (Komen, van Ulden, Graßl)
Item 2:
Amendment and Approval of the Agenda
Item 3:
Approval of the Minutes of the 11th SSG Meeting and the informal SSG meeting held in Mariehamn, 5 July 2001
Item 4:
Reports from the SSG chairman and the head of the BALTEX Secretariat (IBS) on intersessional events (Graßl, Isemer)
Item 5:
BALTEX special issue for 'Boreal Environmental Research': Approval of a candidate list of journal articles on the 3rd Study Conference presentations (all)

10.00

Item 6:
Analysis of BALTEX mid-term review, initiation of necessary actions (all)

Break

11.30

Item 7: *BRIDGE*
- CLIWA-NET activities during EOP1, EOP3 and EOP4 (van Lammeren)
- The ocean part of *BRIDGE* (Omstedt)
- Consequences for forthcoming EOPs (all)
- Data Handling Policies (all)
- Evaluation Plans (all)

Lunch break

Tuesday, 13 November 2001 *(continued)*

14.00 **Item 8:**
The Co-ordinated Enhanced Observing Period of GEWEX (CEOP)
- Presentation of CEOP Goals and Objectives (Graßl)
- The BALTEX Contribution to CEOP (all)
- Establishment of a BALTEX CEOP Task Force (all)

Break

15.30 **Item 9:**
BALTNET and the Revision of the BALTEX Science Plan
- Report by the Director of IBS (Isemer)
- Discussion of Workshop Themes and Schedules (all)
- Designation of Workshop Directors (all)
- Science Plan Outline (all)
- Designation of Lead Authors for Chapters of the Science Plan (all)

Item 10:
Composition and Size of the BALTEX SSG
- Introduction (Graßl)
- Strategy for a Change (all)
- SSG, executive ? (all)

18.30 *Closing of Tuesday's session*

Wednesday, 14 November 2001

9.00 **Item 11:** Working Group reports
- Radar WG (Alestalo)
- WG on Energy and Water Cycles, WGEWC (Omstedt, Jacob)
- Tasks for the WGs [Radar, *BRIDGE*, EWC] (all)

Item 12: Data Centre reports
- BMDC (Hafner)
- BHDC (Bergström)
- BODC (Alenius)
- BRDC (Bergström)

Break

11.30 **Item 13:** Reports by country
Review on ongoing national BALTEX projects and funding situation (short, 5 minutes each at maximum): Denmark (Rosbjerg), Sweden (Omstedt), Finland (Alestalo), Estonia (Keevallik), Latvia (Leitass), Lithuania (Korkutis), Russia (Vuglinsky), Belarus (Skuratovich), Poland (Piechura), Germany (Graßl)

Wednesday, 14 November 2001 *(continued)*

Item 14: Date and Place of the Next Meeting

Item 15: Any other Business

13.00 Closing of the BSSG meeting

Appendix 4: Meeting participants

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Appendix 5: Minutes of the informal BSSG meeting, held 5 July 2001

Informal meeting of the BALTEX Science Steering Group during the Third Study Conference on BALTEX Mariehamn, Finland Wednesday, 5 July 2001, 16:00-17:30

Participants (in order of seating):
Anders Omstedt, Jouko Launiainen, Jarmo Koistinen, Mikko Alestalo, Frank Beyrich, Sabine Hafner, Angela Lehmann, Andreas Lehmann, Clemens Simmer, Hans-Jürgen Donath, Aad von Ulden, Jan Piechura, Zbigniew Kundzewicz, Piotr Kowalczak, Ann-Sofi Smedman, Andre van Lammeren, Sven-Erik Gryning, Inese Jauja, Dan Rosbjerg, Daniela Jacob, Ehrhard Raschke, Sten Bergström, Brian Wilkinson, John Roads, Pekka Alenius, Valery Vuglinsky, Daniel Michelson.

Anders Omstedt chaired the meeting, Jens Meywerk took the notes

Agenda

- Review Process during the conference
- Report of the Secretariat
- CEOP Activities
- Report of the Working Group on Energy and Water Cycles.
- Summer School
- 6th Framework Program of EU
- Miscellaneous

Review Process at the conference

Ehrhard Raschke gave a brief introduction on why a review process has been initiated for the conference. The most important reason is to have external specialists help the Science Steering Group keep BALTEX on track, to shape the program and to find possible gaps in BALTEX according to its scientific objectives. A brief written report is expected from a consortium of 4 volunteers from outside the BALTEX community consisting of Brian Wilkinson, Ronald Stewart, John Roads and Christian Mätzler. A copy of the Scientific Plan, BRIDGE Implementation Plan, Proceedings of the Second and Third Study Conference and the most recent accepted BALTEX overview paper in the Bulletin of the American Meteorological Society has been given to the reviewers as material for the review process.
Brian Wilkinson gave a brief, preliminary view of what the reviewers have found so far and whether the original objectives have been reached so far.

The reviewers found the following strength in the BALTEX program:

- It is a multidiscipline program with many activities closely bound together
- It is built on capacity with new science and products
- It exhibits a significant contribution to the World Climate Research Program
- It includes many numerical models
- It is part of international programs like GEWEX and CEOP
- It exhibits a great opportunity to share data within the community of meteorologists, hydrologists and oceanographers.

Major weaknesses were found to be:

- The Science Plan is not up to date.
- Some projects are only marginally relevant to the BALTEX science.
- There is a reduction in focus in some projects.

Recommendations from the reviewers for the future

There is a need to develop strategic plan objectives and applications need to be defined. The big issues to attract decision makers. Also, a science manager is needed if a proposal is send to the 6th Framework Program of EU. EU will explicitly call for programs on water cycle issues. 6FP is looking for big programs with 25-40 participants and a financial volume of 30-35 million Euros. BALTEX has the potential for such big programs, since the infrastructure is already in place, like an international secretariat, data centers, co-operations between about 50 institutions.

To prepare for a big program proposal during 6FP they recommend to send a Thematic Network proposal to EU by 15 October this year. This would already draw attention to BALTEX at the Commission and if successful would perhaps flatten the road for the big proposal to 6FP. Many parts of BALTEX are fully in line with EC wishes.

The reviewers also recommended to look through the Interim Memorandum of Understanding (ImoU) signed in 1998 by 50 participants from 14 countries whether all of the contributions are focused enough and to avoid a diversion from the scientific objectives. Rejecting single projects, however, might be a very difficult task due to political reasons.

The links regarding transferability studies with other Continental Scale Experiments in the frame of GEWEX needs to be intensified. A better connection to European areas like the Mediterranean should be established a s well.

The BALTEX Oceanographic Data Center needs to be improved.

The first phase of BALTEX should be concluded now with a legacy for that first phase including all conferences, papers etc.

Report of the secretariat

Jens Meywerk will leave the secretariat for another research position at GKSS starting in August. We need a replacement urgently. Graßl promised to seek funding and needs to advertise the secretariat to the GKSS bosses. As a backup Graßl could be able to establish the secretariat at MPI if GKSS is not willing to continue.

CEOP

For the Coordinated Enhanced Observing Period of the GEWEX CSEs BALTEX would need a new representative in the GEWEX Hydrometeorology Panel (GHP). We would need suggestions by the BALTEX Science Steering Group meeting in November.

1st Meeting of the WGEW

During the first meeting of the newly formed Working Group on Energy and Water Cycles it has been agreed upon to write up a text book containing a summary of major BALTEX project outcomes. Major achievements from PIDCAP, BASIS, PEP, DIAMIX and NEWBALTIC are planned to be integrated. Even NOPEX, not being part of BALTEX should be integrated into that textbook. The book is planned to be on the Ph.D. student level. A network proposal (15 October) could serve as funding source for this task. The first version of the book could be tested at a summer school. Timetable: a 1. Version should be drafted in fall 2002. Daniela Jacob will take the lead.

Summer school in Riga

A BALTEX summer school in Riga could be held in 2002/2003. Money could be applied for from NATO as done before. Dan Rosbjerg is member of a NATO committee deciding about founds for summer schools. The next meeting will be in October 2001. He will raise this issue at that time.

6FP

The presentation by Isemer on Monday morning clearly showed that there are golden opportunities for BALTEX within the 6FP of EU. Since the needed infrastructure is already in place and there are numerous participants from all over the Baltic Sea drainage basin are taking part this would be a great opportunity for that big program.
It has been decided to follow this strategy but first prepare a Concerted Action/Thematic Network Proposal and send it to EU by 15 October 2001 to flatten the way for ‘the big 6FP shot’. Not all of the ImoU contributions will go into that network proposal. Graßl agreed (even though not attending) to take the lead for the Concerted Action Proposal in October.

Appendix 6: BALTEX Mid-term Review Panel Members

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Appendix 7: BALTEX Mid-term Review Document

BALTEX Mid Term Review: Review Panel Report

Background

The Baltic Sea Experiment [BALTEX] was established in 1992 to measure and model the energy and water cycles over the Baltic Sea and its associated land drainage basin. Its purpose is to provide an improved understanding of the processes controlling the fluxes of water and energy into and out of the entire basin and to use such knowledge in coupled atmospheric, hydrological and ocean models for better weather forecasting and climate prediction. Such scientific progress is also applicable to other issues such as the fluxes of carbon, flood forecasting and pollution studies. BALTEX is one of five Continental Scale Experiments [CSEs] of the World Climate Research Programme's [WCRP] Global Energy and Water Cycle Experiment [GEWEX]. There are 14 European countries participating in BALTEX, involving 50 research groups.

The BALTEX Scientific Steering Group considered that an independent mid-term review of BALTEX was necessary. The Third Study Conference on BALTEX was to be held at Mariehamn, Aland, Finland between 2 and 6 July 2001. Many of the research results were to be presented at the Conference so the four independent scientists undertaking the Review were invited by the Steering Group to attend and to offer a brief report. Mikko Alestalo of the Finnish Meteorological Institute was also part of the Review Panel. During the Conference, the Panel held discussions with members of the Scientific Steering Group, the Secretariat and participating scientists. Following these discussions the Panel met to consolidate their views and presented their preliminary findings to the meeting of the Scientific Steering Group on 4 July. A number of documents had also been provided to assist the Panel eg. BALTEX Initial Implementation Plan 1995; BRIDGE Strategic Plan 1997 etc.

Objectives and Achievements

The primary scientific objectives of BALTEX are to:

- develop and validate coupled atmospheric/ocean/land numerical models for the Baltic Sea but which also have applicability to other regions;
- improve understanding of the controlling physical processes;
- examine the regional climate and its dependence on global climate systems.

The Review Panel considers that the BALTEX community has made significant progress in addressing these objectives. They noted that all GEWEX programmes, including BALTEX, have been successful in contributing to significant improvements to the ECMWF models. Without such combined efforts in these large scale experiments the progress of numerical weather prediction would not have reached its present capability. A paper by Raschke et al. [2001] in the Bulletin of the American Meteorological Society identifies the many achievements of BALTEX. It also offers a first water budget estimate for the basin for the period August to October 1995. Other annual water budget estimates were presented during the Conference [eg. by Hennemuth & Jacob] which gave large error bars on the estimates. Clearly there is a need for continuation of all the elements of the BALTEX project [ie. process studies, data collection, modelling] if such uncertainties are to be reduced.

Strengths

The Panel considers that BALTEX has made many scientific advances but these have only been possible through:

- establishment of a multi-disciplinary approach to address the scientific issues - oceanographers, atmospheric scientists, hydrologists etc are now working very actively together. Achieving this has not been easy since with 14 countries involved and there have been financial, cultural, political and language barriers to overcome.
- building new capacity - the existence of the project has facilitated acquisition of new scientific infrastructure [e.g GPS, radar systems etc]. Many examples of this, particularly in relation to process studies, were presented at the Conference.
- the involvement of the marine science community - this is the only CSE with a major marine element. The interaction of oceanographers with atmospheric and hydrological scientists has relevance in a wider context.
- the availability of a wide range of atmospheric, oceanographic and hydrological models - the atmospheric models [HIRLAM/Nordic countries and HRM/GKSS] are in wide use, under constant development and well tested for weather prediction. The principal hydrological model, the SMHI model, is well known and is used operationally. The area distributed hydrologic model, developed by Lohmann, is used for complementary studies by German researchers. There are several Baltic Sea oceanographic models in use. There have been a number of initiatives which couple the atmosphere, ocean, land [hydrological] models.
- willingness to exchange data and the opportunity to create data bases

Because of these and other strengths BALTEX is now making a major contribution to WCRP. The Panel was also pleased that the BALTEX Science Committee will be (a) bringing together a variety of researchers to address specific topics with well defined end products and (b) producing additional synthesis articles to describe progress in meeting the BALTEX scientific goals.

Weaknesses

While the Panel fully recognizes the achievements of BALTEX and its many strengths they perceive a number of weaknesses which need to be addressed.

The objectives of the Science Plan are clearly defined but are at a high level and are not always uppermost for Institutions which have been carrying out projects to which a BALTEX 'label' has been attached. This is understandable in that an individual Institution may have to offer some projects with objectives not always fully compatible with those of BALTEX in order to secure acceptability within its own or its national portfolio. The net effect of this for BALTEX has been that project drift has occurred. The science strategy therefore needs to be reconsidered and the knowns, unknowns and strategic research priorities identified. All existing and future projects which are relevant to BALTEX could then be positioned clearly by the Scientific Steering Group or its Working Groups either as 'core' or 'supporting' projects. This should help to focus the science and avoid inclusion of projects which may be excellent scientifically but peripheral to BALTEX themes.

Recommendations:

With respect to specific areas of the Science Programme:

- a good start has been made in comparing a number of hydrological models as part of a GEWEX PILPS study. This approach needs to be extended to both the atmospheric and, in particular, the oceanographic models.

- some excellent atmospheric, oceanographic and hydrological process field experiments have and are being undertaken within BALTEX but the results from these are not being taken up sufficiently quickly by the modelling community.

- due to internal agreements within the BALTEX programme there is good availability of some but not all data. The Panel recognizes that there are certain commercial restrictions to data output but ways to provide a free and open exchange within the international research community are needed to take full advantage of BALTEX. It is understood that, because there is no centralized marine data base, knowledge of the availability of and access to such data sets is not always easy. The arrangements need to be improved.

- In spite of these difficulties with data the synergy achieved through collaboration between disciplines has been remarkable. Remote sensing data, on the other hand, appears to be problematic in terms of quantitative assessments for the majority of BALTEX scientists. Nevertheless good progress has been achieved in precipitation measurements over the entire Baltic region through the use of a well coordinated radar network supported by complementary information from satellite data etc. More quantitative use of remote sensing data is needed in assessing dynamic processes, cloud water, temperature [especially land and sea surfaces], snow cover and aerosols. All of these are relevant for the determination of water and energy budgets.

The Future

The Review Panel considers that the original scientific objectives are still valid but may need extending so as to reflect more explicitly the needs of user groups beyond the WCRP science community. In this regard it is encouraging to note that the Helsinki Commission HELCOM is showing an interest in BALTEX. The Commission is well placed to provide guidance which would be helpful in identifying end-user benefits and societal relevance.

In the Panel's opinion one important legacy of BALTEX would be the future use of its data bases by the international research community to further develop models and gain additional insight into water and energy processes and the development of hydro-climatological models. Another legacy would be the transfer of the regional hydro-climatic modelling knowledge to other European and global regions [possibly to other climatically similar and/or different CSE regions]; some model exchange experience has already been gained with MAGS. BALTEX is in an excellent position to do this. An initial step could be an invitation to other CSEs to test their modelling capability over the BALTEX area during a well documented period such as PIDCAP or BRIDGE.

All of these activities would be important steps towards increasing the reliability of global water and energy budgets.

It is further suggested that the Scientific Steering Group identifies two or three 'big issues' relevant to users i.e. those issues which should attract the attention of national governments, the European Union, commercial interests and the general public. Such big issues may be concerned with water resources, flooding, water quality etc. However it is not the Panel's role to make firm recommendations - this is the task for the BALTEX community, possibly in collaboration with the GEWEX and WCRP Committees.

Management and Funding

The Panel noted that over the next few weeks there are to be changes in membership of the Scientific Steering Group and the Secretariat. Such changes will be occurring at a particularly critical time for BALTEX. The Committee and the Secretariat are to be complimented on the excellent progress made over the last five years and it is essential for this multi-national programme that their strong coordinating role is maintained. The Panel suggests that any changes are effected quickly. With respect to the Secretariat, a Project Manager and a Chief Scientist should be appointed on a full- time basis as soon as possible.

Funding for BALTEX to date has come predominantly from national governments with some support from the EU for research projects. The Panel fully recognizes the major contributions in terms of funding, resources and infrastructure by some national governments. As a result BALTEX has given excellent value for money and the Panel hopes that this support will continue and be extended in the future. However if a strengthened coordinating role is to be established it would be appropriate to look to the EU for support in this respect. The EU has recently outlined its strategy for European Research in its New European Programme 2002 - 2006 and has developed this within the context of a European Research Area. BALTEX has many of the elements which should attract funding from the EU i.e.

- it is addressing one of the EU Priority Themes for research [Sustainable Development and Global Change];
- it has a major 'network of excellence' in place;
- it is completing the observational phase of BRIDGE and is linked with the internationally coordinated CEOP period; these may represent two possible focal points for such an effort;
- five EU member states and several accession countries are involved in the programme;
- its science has relevance to Europe well beyond the geographical area of the Baltic drainage basin.

The Panel suggests that the BALTEX community makes a coordinated bid for support under the New Framework Programme. There are also opportunities to make a preliminary bid into the October 2001 round of the Fifth Framework Programme and this should also be considered.

Summary

The BALTEX community has made significant progress in addressing the Programme's scientific objectives. All GEWEX programmes, including BALTEX, have contributed to major improvements in weather forecasting models.

A first water budget estimate for the basin has been made but there is need to continue all elements of the project so that the uncertainties in estimates of energy and water storage and fluxes can be reduced.

BALTEX has many strengths. In particular it has

- a well established, multi-disciplinary research community ;
- a strong science and infrastructure capacity;
- a wide range of modelling experience encompassing all relevant disciplines;
- some excellent centralized data bases.

Some project drift has occurred and there is thus a need to review the science strategy and objectives. All existing and future projects relevant to BALTEX should be designated by the Scientific Steering Group as 'core' or 'supporting' projects. This would help to improve the Programme's focus.

- A GEWEX PILPS type comparative study should be undertaken on the atmospheric and oceanographic models.
- A mechanism is needed so that the results from process experiments may be made more rapidly available for use by the modelling community.
- A means of providing free exchange of data within the international research community should be explored.
- There should be more quantitative use of remote sensing data.
- The relevance of the hydro-climatic modelling to other European and global regions should be examined.
- The Scientific Steering Group should identify 2 or 3 'big issues' of relevance to a wide user community.
- All weather, ocean and hydrological services in the BALTEX area and all other BALTEX members should clearly express the gains they have acquired through BALTEX and the gains they expect to realize in the future.
- Proposed changes in the management and committee structures should be effected quickly and a Project Manager and a Chief Scientist should be appointed as soon as possible.

BALTEX has given excellent value for money and it is hoped that national funding support will continue and be extended. It would strengthen coordination within BALTEX if research funding could be secured from the EU. There are many elements of BALTEX which should be attractive to the EU research programme.

RON STEWART, CHRISTIAN MATZLER, MIKKO ALESTALO, JOHN ROADS, BRIAN WILKINSON

Final Version 10 August 2001

Appendix 8: BALTEX Mid-term Review Recommendations Summary

Summary of BALTEX mid term review recommendations

1. Identify „core“ versus „supporting“ projects;

2. Extend model intercomparison initiatives to atmospheric and ocean models (such as PILPS for hydrological models);

3. Strengthen rapid knowledge exchange between field experiments and modelling community;

4. Improve data exchange policies (towards unrestricted and comprehensive exchanges within the entire science communities);

5. Strengthen transferability measures (e.g. examine the relevance of BALTEX models for other European and global regions, such as the GEWEX CSEs);

6. Make more quantitative use of remote sensing data;

7. The SSG to identify two or three “big issues” relevant to users;

8. Hydrometeorological Services and all BALTEX institutions to clearly express their past and expected future gains acquired through BALTEX;

9. Go for EU financial support in FP5 (network) and FP6 (integrated project(s));

10. Strengthen co-ordination measures (BALTEX Secretariat, project manager, chief scientist)

Appendix 9: CLIWA-NET Summary

By André van Lammeren, KNMI

Details on CLIWA-NET may be found at http://www.knmi.nl/samenw/cliwa-net.

Abstract

Global observations are important for detecting climate change, understanding the present climate and predicting climate variability. Such observations, integrated into models provide immediate benefits to society in the form of improved forecasts of weather and climate. Clouds are a high priority problem for the planned Global Climate Observing System and for atmospheric models (GCM's and weather forecast).

CLIWA-NET focuses on observations of cloud liquid water and vertical structures, and evaluation/improvement of parameterisations. A prototype of a European cloud observing system will be established. CLIWA-NET co-ordinates the use of existing, mostly operational, ground-based microwave radiometers and profiling instruments. The network data will be integrated with satellite estimates of cloud water. Based on these observations cloud parameterisations will be evaluated/improved.

The project is carried out in co-ordination with BALTEX.

Objectives

Contribute to the development and implementation of the Global Observing System with a focus on cloud observations.

- Implementation of a prototype of a European Cloud Observation Network. This network might also serve as an operational validation system for current and future satellite cloud missions (e.g. MSG, METOP, ENVISAT, CLOUDS);
- Development of an adequate observing system for the detection of icing conditions for aircraft;
- Objective evaluation and improvement of state-of-the-art cloud parameterisations for climate and weather forecast models, with a focus on integrated cloud liquid water and vertical structure of clouds;
- Design of a "low cost" microwave radiometer in co-operation with industry (SME);
- Contribute to BALTEX/BRIDGE.

Description of the work

The CLIWA-NET project establishes a prototype of a European cloud observing system by co-ordinating the use of existing, ground-based passive microwave radiometers and profiling instruments. In total 12 stations within the BALTEX modelling area will contribute to this network. An unprecedented microwave radiometer calibration campaign will be organised in combination with a regional network (100x100 km^2). The data from the ground-based remote sensing instruments will feed high quality cloud information, with high temporal but poorly spatial resolution, into the calibration of satellite-based estimates of cloud water content with high spatial resolution. New procedures will be developed to fully exploit the synergy.

The combination of vertical profiles of cloud water and temperature information will enable an accurate detection of super cooled water layers. These layers are responsible for in-flight icing, which is considered to be one of the major risks in today's aviation.

The retrieved CLIWA-NET data-sets are used for an objective evaluation of the performance of state-of-the-art cloud parameterisation schemes. The focus will be on liquid water path (LWP) and vertical structure of cloud amount and cloud water. Three lines of research are pursued:

- evaluation of cloud related output from leading European atmospheric models

- investigation of the sensitivity of model cloud parameters to the employed horizontal grid spacing in the meso-scale range from (1-10 km)

- to develop/improve/test cloud parameterisations and underlying assumptions.

The cost and complexity of the available microwave radiometers presently hamper the implementation of an operational network. For this reason, the design of a low-cost operational microwave radiometer by a commercial company is included in this project.

The end users organised in the "CLIWA-NET user's advisory group" will provide suggestions on, and judge the social-economic aspects of the project.

Milestones and expected results

The 5 CLIWA-NET workshops and the observational periods are important milestones.

- Prototype of a European Cloud Observation Network.
- Evaluation of assumptions used in cloud parameterisations. Improved formulations will be recommended.
- Design of a low cost microwave radiometer.
- A well maintained and accessible web site for internal and external use.
- Development of an operational validation system for current and future satellite cloud missions.

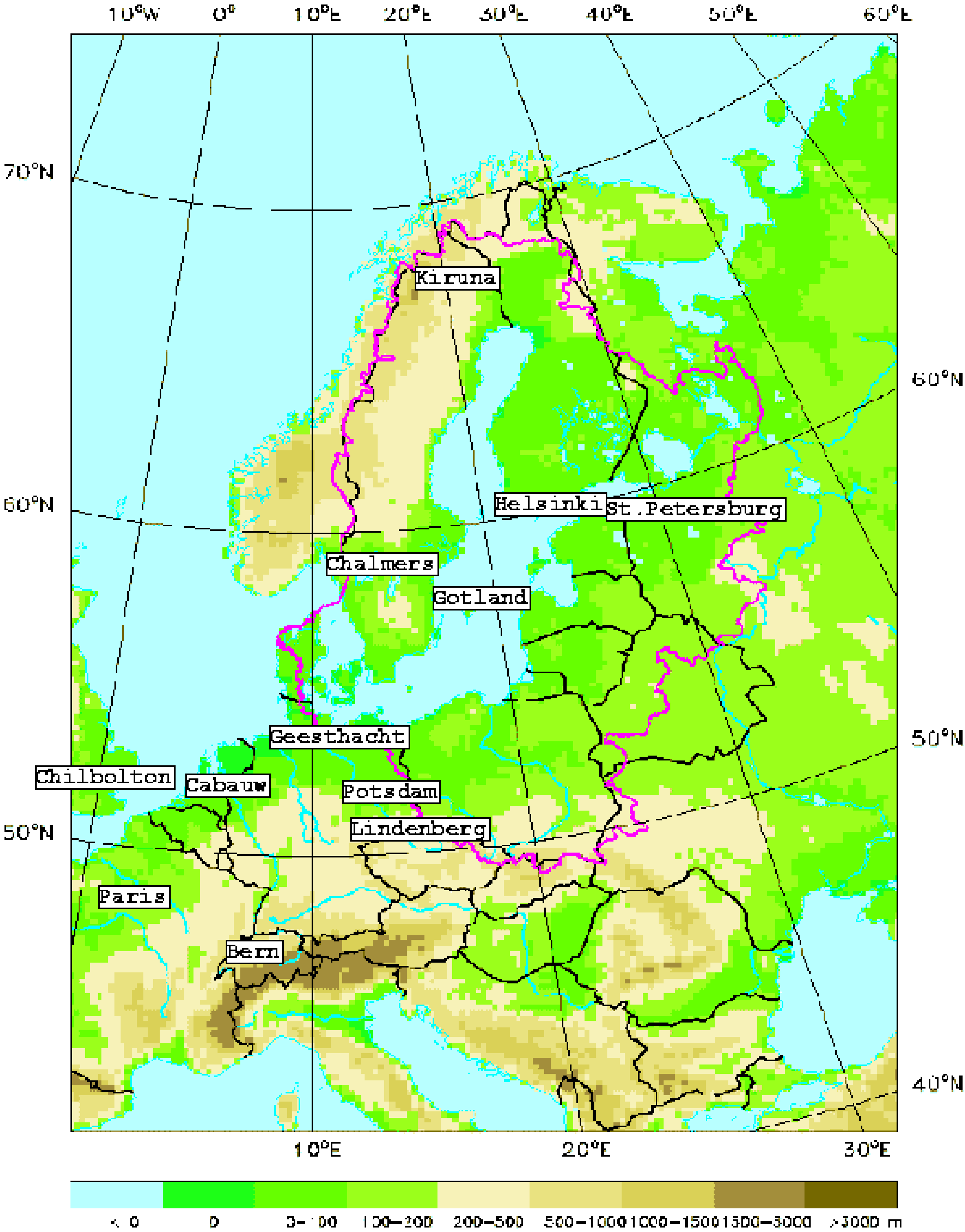


Figure 1: Location of the ground-based stations participating in the BALTIC Area Cloud Network (see Table 1). The area for which the modelling studies within CLIWA-NET are performed incorporates the shown BALTEX modelling area. The purple line indicates the drainage basin area of the Baltic Sea.

Appendix 10: Report of the BALTEX WG Radar

BSSG Nov. 12-14, 2001

STATUS REPORT OF THE BALTEX WORKING GROUP ON RADAR (WGR)

Jarmo Koistinen

Detailed description of the ongoing work and plans can be found from the Minutes of the 6th Meeting of the WGR (attached)
Sten Bergström will present the status report of BRDC on behalf of Daniel Michelson

Precipitation atlas:

WGR will publish a radar-gauge integrated precipitation image atlas from the BRIDGE period on CD-ROMs. The objective is to facilitate fast scanning of various weather cases.

The network:

Radar Ängelholm in Scania is included.
The Latvian radar has been delayed at least one year.
Tallinn radar is still not included due to technical problems in the system. FMI will help to adjust the radar.
Russia has joined to RMDCN-network and one radar in StPetersburg has been digitised. Preliminary comparison between the radar and the adjacent Finnish radar exhibits a good agreement (see the image pair). We hope to get the data from StPetersburg soon to BALTEX.
WGR is worried on the organisation of the implementation of the new Polish radar network: we have not been able to locate any responsible group or plan of the implementation and data flow. Thus, we can't foresee yet how and when the new network will produce data for BALTEX. The existing data transfer is semi- manual and the radar experts providing it are not involved in the development of the new network.

Ongoing research:

The EU Framework 5 Application CARPE DIEM (2002-2004) will be conducted by the Partners SMHI and FMI. Topic: improvement of quantitative radar based precipitation estimates applying NWP data and assimilation of Doppler winds into NWP.
NORDRAD Quality Assurance project has proven that intercomparison of the data from overlapping radars can solve elevation angle errors of ±0.1 degrees and system calibration errors of 0.5 dB. Preliminary results presented in the AMS Radar Conference.
DEKLIM (Gerhard Peters): A good agreement between a vertically pointing 30 Ghz radar and an ordinary scanning weather radar. Potential applications in radar calibration monitoring and vertical distribution of the hydrometeors.
HIRLAM community: A good agreement with the BALTRAD product RR and HIRLAM precipitation (Carl Fortelius, shown in the Study Conference). BALTRAD products are very useful in the validation of NWP precipitation processes. Together with COST 717, the methods on the use of Doppler winds in NWP assimilation are becoming established. The Doppler winds are accurate and good but a proper quality control is always needed (to avoid e.g. birds and aliasing due to the Doppler dilemma).
COST 717 (additional): The validation of the RR product has shown systematic differences both in the bias and random errors between two BALTEX radar systems . The gauge adjustment applied will remove the biases (shown in the Study Conference by Koistinen and Michelson). A radar reflectivity simulator has been implemented to the FMI HIRLAM (by Gunter Haase, Univ, of Bonn). Work at the Finnish Environmental Institute has shown that a hydrological model for a moderate sized catchment in western Finland, based earlier on gauge data only, can be replaced with radar data only. The verification shows on average equal flow with both inputs.
National research is quite active at FMI, SMHI and DWD to improve the accuracy of real time operational precipitation measurements . A good example is the pattern recognition technique developed at FMI to remove non meteorological echoes (birds, sea clutter, ships, the sun) from the measurements (see the images). Much of this work is expected to be implemented in the BRDC product generation in near future.

The next WGR meeting will be held in May 2002, probably in StPetersburg.

Appendix 12: Minutes of the 6th meeting of the BALTEX WG Radar

Minutes of the 6th Meeting of the BALTEX Working Group on Radar

DNMI
Oslo, Norway
28-29 May, 2001

1. Practical and administrative arrangements

Jarmo opened the meeting. Participating were Jarmo Koistinen, Chris Collier, Johann Riedl, Uta Gjertsen, and Daniel Michelson.
The group was joined by Oddbjørn Thoresen, Morten Salomonsen and
Jørgen Togstad, DNMI, following the administrative parts of the meeting. Daniel wrote the minutes.

The group decided that Tage Andersson will remain a WGR member for as long as he likes.

Johann has new phone, fax and e-mail:
Phone: +49 8805 954-200
Fax: +49 8805 954-102
E-mail: Johann.Riedl@dwd.de

Zdzislaw Dziewit may be leaving the IMGW soon, which may put the data transfer from the IMGW to the BRDC at risk. This should be investigated.

2. Minutes of last meeting at Salford

Product atlases: Jarmo contacted Ehrhard Raschke about producing BALTRAD atlases. According to Ehrhard, the cost of producing paper atlases is prohibitively expensive but CD-ROM should be feasible. Harri Hohti at FMI can lead the production and Daniel can assist. We agreed on two CDs: one covering the period October 1, 1999 - June 30, 2001, and the second from July 1, 2001 – the end of the BRIDGE or GEWEX CEOP period.

3. Developments in the BALTRAD network and data exchange

BRDC - nothing new

Sweden - Daniel is now SMHI's radar coordinator. The 12th Swedish radar is now installed in the south west, north of the town of Ängelholm. It is the former Teolo radar with dual polarisation which will be evaluated in due course. The Swedish radars' host platforms are targeted for replacement and the communications lines will be upgraded. New Doppler functionality out to 240 km is being tested at Radar Hudiksvall. If evaluated positively, this functionality will be phased into the Swedish radars. The host platforms are targeted for modernization, from VMS to UNIX or NT. Three radars are also targeted for relocation.

Norway - A new radar is being installed outside Trondheim which should be up and running in the summer of 2002. DNMI is conducting a site survey for a radar near Bergen with a possible start in 2003, although this radar is not yet financed. Initial problems with the transmitter cards have disappeared since October when they were changed last.

Denmark - A new radar has been installed about 50 km south of Kastrup. Data has not yet been added to the NORDRAD network.

Finland - Rovaniemi has been dismantled in August and Luosto was installed in the summer. Problems with the transmitter cards have prevented this radar from passing its tests, similarly to Hägebostad. Invers Oy is developing their signal processing techniques to work with this radar. No definite proof that this technique works has been presented yet but there is clear potential that it will; the principle has been proven on paper. FMI is working on trying to finance a gap filler, but without luck to date.

Estonia - Their Gematronik radar is semi-operational, and experiencing the same transmitter card failures as FMI and DNMI. EMHI is allied with FMI and DNMI to help get their operation up and running smoothly. FMI will be relaying Estonian data to NORDRAD and NORDRAD data to Estonia, provided NORDRAD helps fund a necessary upgrade of the communications lines between Helsinki and Tallinn.

Latvia - UK Met. Office will fund the travel of a LHMA expert to the AMS Radar Conference. LHMA has probably received funding for their first digital weather radar. FMI has supported the procurement process by sending a copy of their older ITT to the Director of LHMA (these information were received soon after the WGR meeting).

Lithuania - No money available for weather radar systems.

Poland - World Bank grant came through, but the organization of the project is unknown. Eight new radars are planned.

Germany - Nothing new regarding the network. DWD is now concentrating on modernizing the radar host platform with the same level of functionality, very similarly to the modernization going on in Sweden. The 16th and final radar is Dresden. Berlin is now running a digital receiver and new COHO, and this seems to be working well. Hamburg is targeted for relocation to a place outside the city. Quantitative clutter filters are being developed at DWD. There is a new national collaboration among regional authorities focused on fresh and wastewater management, in which quantitative precipitation forecasts are a central part. Convection in radar is also being studied based on a cell tracking algorithm developed by Peter Lang, called KONRAD. Johann showed some illustrations of these developments. Very limited ability to move ahead with dual polarization tests since Gematronik has changed pedestal to a much heavier one and they may now be willing to make dual polarization available through the old construction. This new design may affect DNMI since they cannot perform a helicopter installation with it. Eight bit data to the BRDC, which would be financed through the national DEKLIM programme, has been given the green light for financing but the project, led by Prof. Grassl, has been delayed due to lack of funds brought about by BSE and MKS campaigns. These activities will be lead by Jörg Seltmann.

Russia - Nothing new. Many organizations and little cooperation but with great knowledge.

NORDRAD2 ITT Release in June, 2001
The NORDRAD network will be upgraded with a new software system. A Nordic group has written an ITT which implies a new system that migrates from VMS and DECNet to UNIX and TCP/IP.

4. BRDC status

Inclusion of more German radars: Would it be advantageous to include more radars from Germany? For the composite, yes. For the gauge adjusted product, no, probably because the derived relations used in the gauge adjustment process would deteriorate due to precipitation from different regimes. As it stands, the RR product contains data from perhaps too many radars from different precipitation regimes. The group recommended that this issue should be resolved through a dialogue with the BALTEX modelling community, and that the BALTRAD network should concentrate on the Baltic Sea catchment. The German VAD products would be a real enhancement to the network. However, the DWD is unwilling to make the product available in the DWD's in-house ASCII format; the profiles could be made available once DWD has developed a BUFR converter; this work is in progress. This issue should be discussed with Dieter Fruehwald and Gerhard Adrian. Daniel should investigate whether WP products can be arranged from Hägebostad, Oslo, Göteborg, southern Germany, and the Czech Republic.

Modification of the RR product: new preliminary adjustment coefficients have been derived by Uta and Daniel during the autumn of 2000 which should be included into BRDC production.

Other products
There was some discussion on whether to add a hail diagnosis product. The group concluded that little support from the users exists at present, but that we can inform them that we can work on such activities together with them outside of the BRDC production. Other changes to products were not recommended.

Use of HDF5 - was accepted. As of July 1, 2001, the BRDC datasets will be stored and distributed using HDF5. The NCSA's HDF5 software will be distributed on one of the first BRDC CD-ROMs.

SMHI RMK 90: Has been produced since our last meeting.

5. Ongoing and planned research and papers

The EU Framework 5 Application CARPE DIEM (Critical assessment of Available Radar Precipitation Estimation techniques and Development of Innovative approaches for Environmental Management) has been accepted for negotiations with funding for 36 months. Radar research related to BALTEX will be conducted by the Partners SMHI and FMI including improvement of quantitative precipitation estimates (VPR corrections applying NWP data, attenuation corrections) and assimilation of Doppler winds into NWP. The Coordinator will be Dr. Pier Paolo Alberoni from Italy.

NORDRAD QA
Jarmo presented this work which is being conducted by Asko Huuskonen at FMI. The results were presented at AMS RADCAL in January, 2001, and will be presented again at AMS-30. The QA interim report was copied and distributed to the group. The QA work shows genuine potential and should be an integral part of the NORDRAD network.

DEKLIM
Johann presented information from this new German national research programme. He showed a comparison between data from Gerhard Peters' (MPI) vertically pointing 30 GHz radar against that from a 5 GHz weather radar. The agreement was very good. This could be a nice means of monitoring the calibration stability of a radar, and to study the vertical reflectivity profile, but it is not applicable to a spatial correction of weather radar data.

HIRLAM validation
Jarmo showed results generated by Carl Fortelius where he used BALTRAD RR products to compare with HIRLAM forecasts. A monthly 24-hr average was compared and the area of interest was centred over Finland. These results show good agreement between the two datasets, with realistic gradients in both. The results show that BALTRAD RR product is of high enough quality to be used in such a context, and as such, can show that the new moist physics used by Carl gives fine results. HIRLAM may overestimate and have overactive convection. BALTRAD precipitation may be overestimated over Finland due to poorly defined preliminary adjustment coefficients, which will be replaced shortly with better ones.
The results will be presented at the BALTEX conference in Åland. Carl may write this up as a paper in the near future. Daniel has not implemented the dBZ thresholds agreed upon at Hohenpeissenberg when deriving the radar sums prior to generating the RR product.

Vertical reflectivity profile correction
Jarmo presented work being conducted at FMI for a Finnish hydroelectric company. As Elena Saltikoff showed at ERAD, the VPR dominated the errors in radar precipitation estimations. FMI will develop a conventional VPR correction. They are currently figuring out how to perform a time integration of profile corrections. There is also a precipitation typing built into the method. There's also a quality control of the derived profile to identify physically unrealistic profiles (the vertial gradient may not exceed 1 dB per 200 m in the first few levels).

Radar simulator using NWP data
Günther Haase from the Meteorological Institute, Bonn University, has visited FMI on a Short Term Scientific Mission from COST 717 to create a HIRLAM interface to his radar simulator. Very promising first results.

Evaluating the RR product
Daniel presented results produced by himself and Uta, the work from which started as a COST 717 Short Term Scientific Mission to SMHI in November, dealing with the evaluation of the BALTRAD gauge adjustment technique. Daniel continued with this work following the STSM and has analyzed the systematic differences among Gematronik (with both Sigmet

and Rainbow software) and Ericsson. Systematic differences were found which can be evened out using the preliminary adjustment technique presented in the RMK 90 report, with more accurate coefficients. The adjustment technique was shown to work well, even out to full range although the scatter at full range is rather large.

Dynamic Z-R relations (DZRs)
This is a strategy to derive a more accurate phase typing and Z-R relation application, using HIRLAM forecast fields to provide the information on the height of the melting layer. Well-known Z/Ze-R/S relations are then applied when the phase is known. This is a pre-processing step prior to a VPR correction and it is difficult/impossible to evaluate without first performing the VPR correction. It was suggested that Iwan Holleman's recent report on hail detection could be used to refine the method used to diagnose and treat hail. At present the method proposed by Smyth & Illingworth (QJRMS vol. 124, 1998) is used. This work
will hopefully be presented at BALTEX and AMS-30 conferences.

Down to Earth
Daniel continued by presenting this unconventional VPR correction strategy. The original strategy presented at ERAD was found to be at a dead end, so it has been reformulated using broken-out moist physics code from Rasch and Kristjansson, which is the same as that used by Carl Fortelius in his work described above. The problem in using this code is that, like all Kessler-type schemes, it is very sensitive to the cloud water input to it. The HIRLAM data available for this task is depleted of cloud water, and it suffers from some spin-up and timing errors. Initial experiments using cloud water derived through an empirical relation with non-precipitating clouds and correctional "fudge factors" failed, as did attempts to use "corrected" HIRLAM cloud water. Two strategies are now being tested:
1)a physically-based approach using a reconstruction of the adiabatic profile and the R&K physics, and
2) a statistical approach using a derived relation based on a large dataset of spun-up and internally consistent HIRLAM profiles. In the latter strategy, stepwise statistical relation and neural network approaches are being tested. No matter which strategy is used, it is designed to provide a precipitation estimate at the cloud base which is then evaporated to the surface using another set of routines.
This work is also targeted for presentation at BALTEX and AMS-30 conferences.

Hydrological modelling
Jarmo presented recent results from Finland where radar data from Ikaalinen was adjusted with a constant factor which gave excellent agreement with gauges for a moderate sized catchment in western Finland. This work will be presented at the BALTEX conference.

Dealiasing radial winds
Tomas Landelius at SMHI is presently working on developing/implementing a dealiasing technique which would be used prior to deriving wind profiles and superobservations for variational data assimilation. Preliminary results look promising here as well.

Additional quality control
Pattern recognition techniques using polar scan data are being developed at FMI by Markus Peura which show potential for cleaning up signals from ships, birds, sun sectors, and other noise. Problems may occur when dealing with young, rapidly developing Cbs, and with determining a set of thresholds which can be used confidently in an automatic application.

6. Upcoming meetings related to WGR

3rd Study Conference on BALTEX. 2-6 July, 2001, Mariehamn. Daniel and Jarmo will present a joint invited talk.

7th Int'l Conf on Precip.: 2-6 July, 2001. Maine, USA. Chris will be attending. Should be lots of satellite work (TRMM, GPM).

AMS-30, 19-24 July, 2001, Munich: Neither Chris nor Jarmo will be attending. Johann hopes to attend. Daniel, Uta, and people from Salford and Hohenpeissenberg will attend.

Hydrological Uses of Radar Data: 19-23 November, 2001, Kyoto. Chris cannot attend. Salford may be represented by Faye Davis. Noone else from the WGR plans on going.

ERAD 2. 23-29 September, 2002, Delft.

ERAD 3 in 2004. Could be hosted by the WGR in a Nordic country, proximate to the Baltic Sea. One potential place is Visby on the island of Gotland. Daniel will try to communicate this at the next COST 717 meeting in September to get the group's feedback. Contact should be made with the EMS to see about nailing this down. Could the BALTEX Secretariat help us find European support? Perhaps a NORDMET collaboration? Daniel will start by discussing with SMHI. Then follows: BALTEX, COST 717 and then EMS.

Johann recommended that ERAD be renamed. To what? Possible name contest at next 717 meeting?

7. Next WGR meeting

Time: 28-29 May, 2002
Place: Primary: St. Petersburg, Secondary: Poland, Tertiary: Norrköping

Daniel will discuss Poland's potential hosting of this meeting at the next 717 meeting with Jan Szturc.

8. Any other business

Oddbjörn inquired about how to optimally site a radar to avoid sea clutter. Fences are a way but should optimally be located at a range of at least 100 m in order to operate on the fully developed beam. Images were presented that showed that the sea clutter from Hägebostad was minimized at 0.8 degree tilt. Smart scans which follow the horizon, and which can be programmed to lift to 0.8 degrees in contaminated sectors, were recommended combined with a high placement or on an island and with a fence integrated with the radar tower if a natural "bowl" location is not available.

About radar density, Oddbjörn asked what it should be. The group recommended that the density should be optimal from the outset and that the network should be established such that the radars be installed with this optimal spacing. If money runs out then it's easier to gain funding to continue with the same spacing, as opposed to first establishing a low density network and then trying to install gap fillers. Jarmo showed some images and plots illustrating the effects to be taking into account when defining this spacing. A spacing of 150-200 km is realistically as good as one can hope for. The bottom line is what the application is and what the budget is. Oddbjörn also showed cases where overhanging precipitation is not measured by the radar at close range. The group recognized that this is an inherent characteristic of how radars work. Gauges wouldn't have measured anything either, and satellites would have given a high indication of precipitation which, easily interpreted as reaching the surface, would have been the most erroneous measurement.

9. Jarmo closed the meeting.

Appendix 13: BALTEX Meteorological Data Centre Materials

BALTEX Meteorological Data Centre

Deutscher Wetterdienst

The **B**ALTEX **M**eteorological **D**ata **C**entre BMDC stores data in two different archives:

The BAMAR (**BA**LTEX **M**odel **Ar**ea) archiv

Synoptic data from
1700 stations with 3-hourly observations
300 ships with 8 reports/day

Aerological data from
90 stations with 1- 4 ascents/day.

The BACAR (**BA**LTEX **C**atchment **Ar**ea) archiv

3200	**Precipitation** (24- or 12-hourly totals)
60	**global Radiation**
20	**diffuse Radiation**
8	**reflected Radiation**
490	**Snow depth**
245	**Synop/Climate**
95	**Soil temperature**
40	**Soil moisture**
3	**Evaporation**

BALTEX Meteorological Data Centre

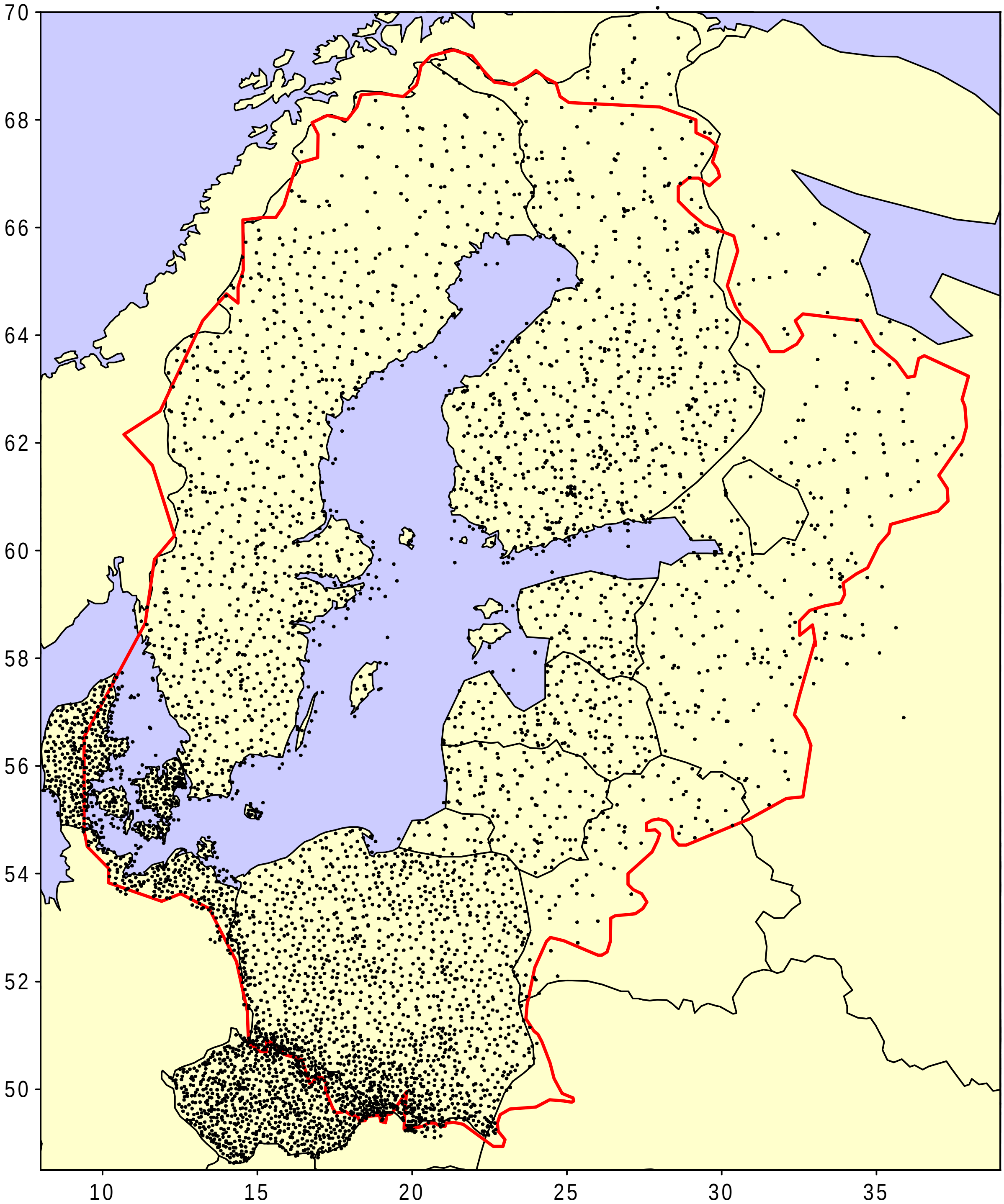


Fig. 7 Number of Precipitation Stations in BACAR, as reported in June 2000

BALTEX Meteorological Data Centre

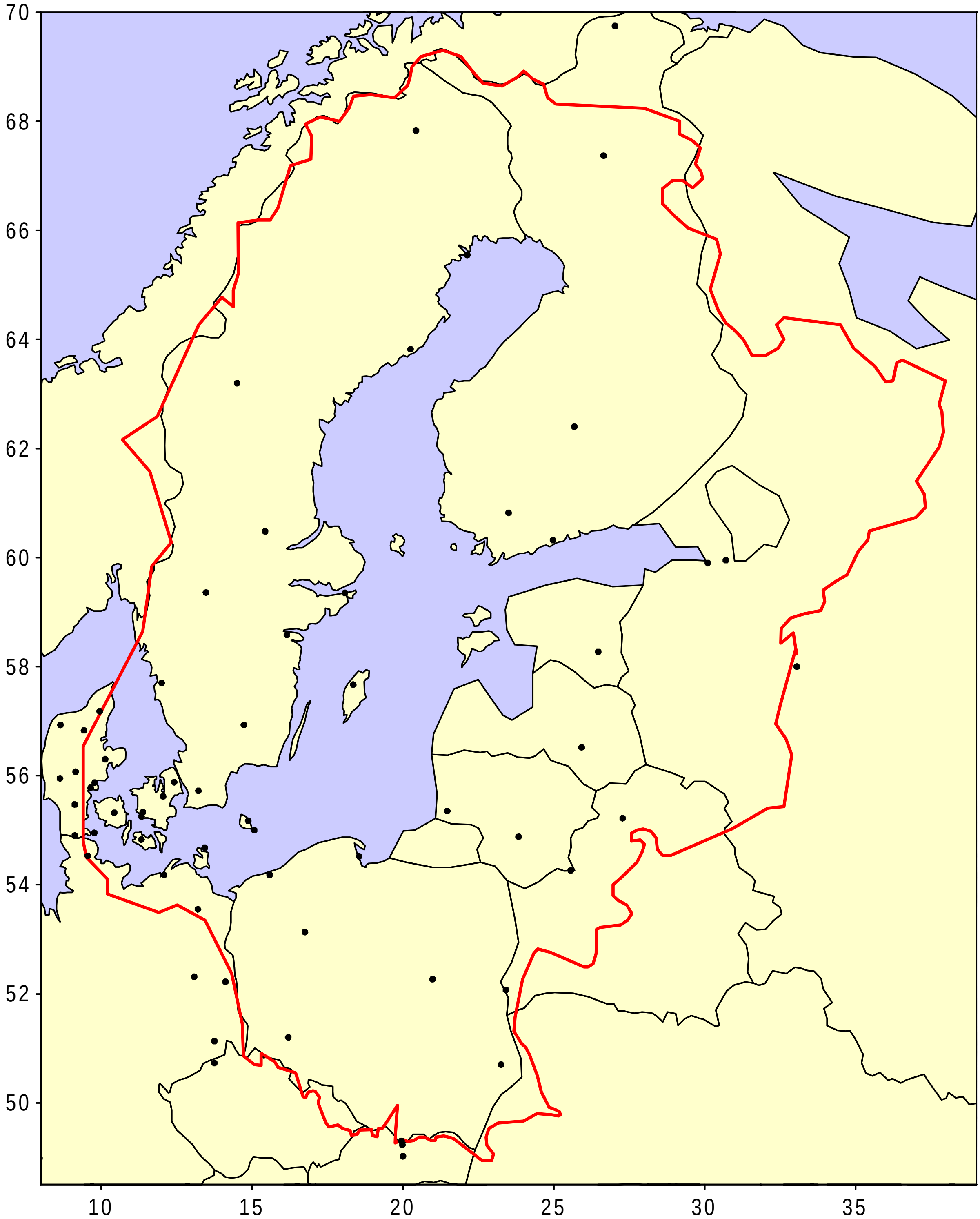
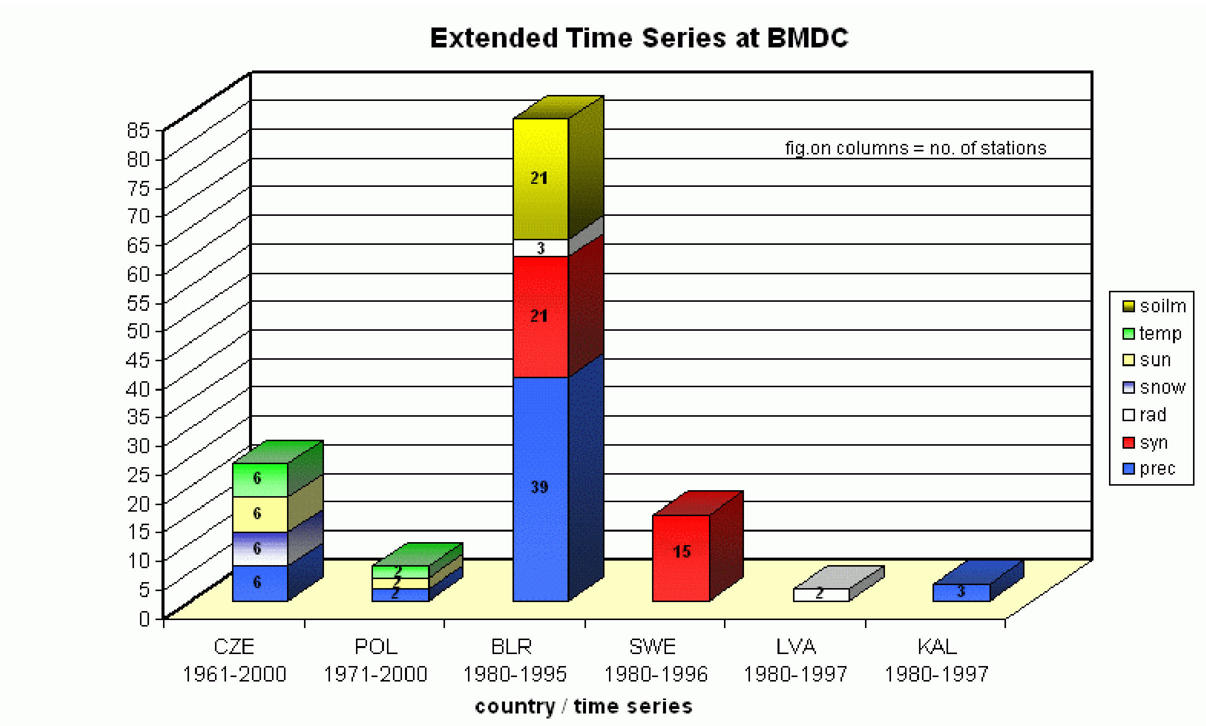


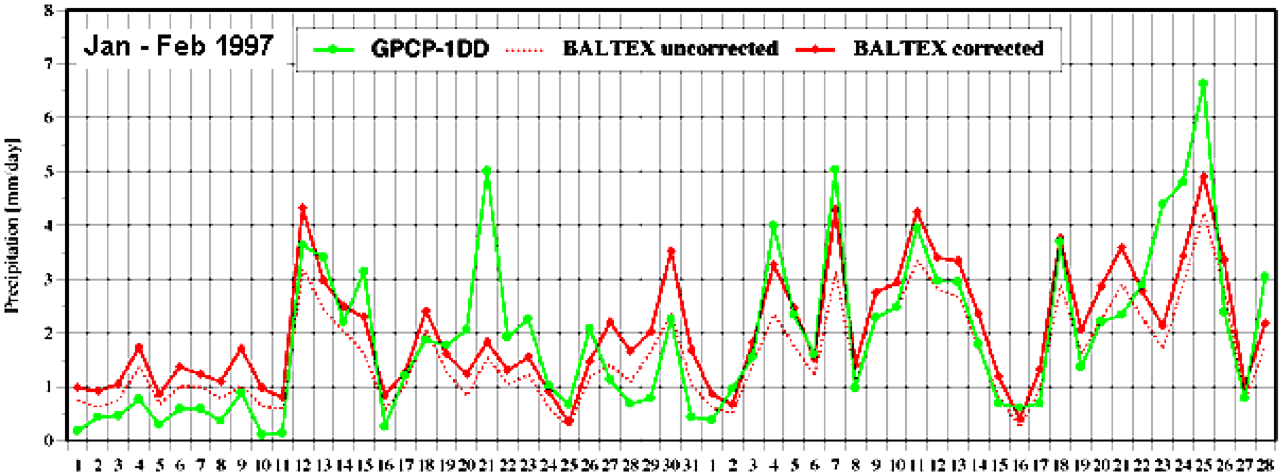
Fig. 9 Number of Radiation Stations in BACAR, as reported in June 2000

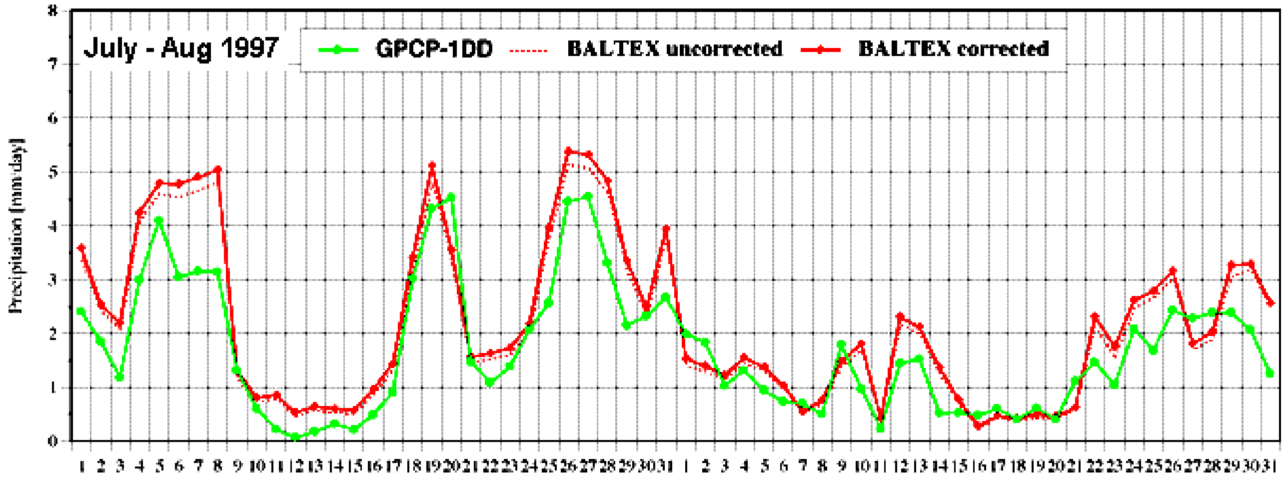
BALTEX Meteorological Data Centre

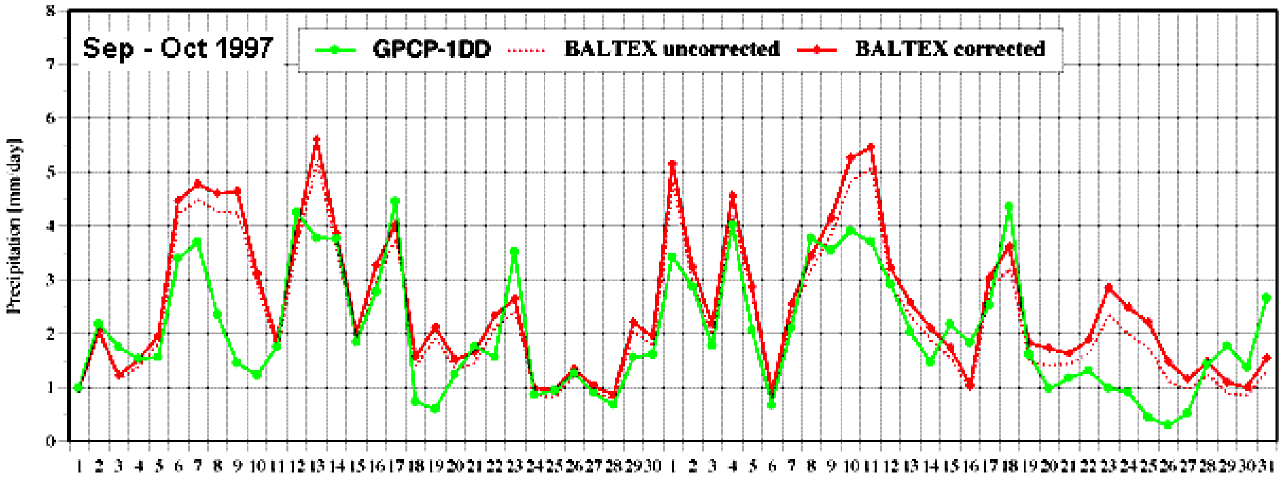


Global Precipitation Climatology Centre
Deutscher Wetterdienst

Comparison GPCP-1DD versus BALTEX in situ
Time-series of daily BALTEX area mean precipitation







BALTEX Meteorological Data Centre

Status November 2001

- analysed grib data in 1/6 degree
- Demands after analysed grib data in1/2 degree

Request to the Data Users:

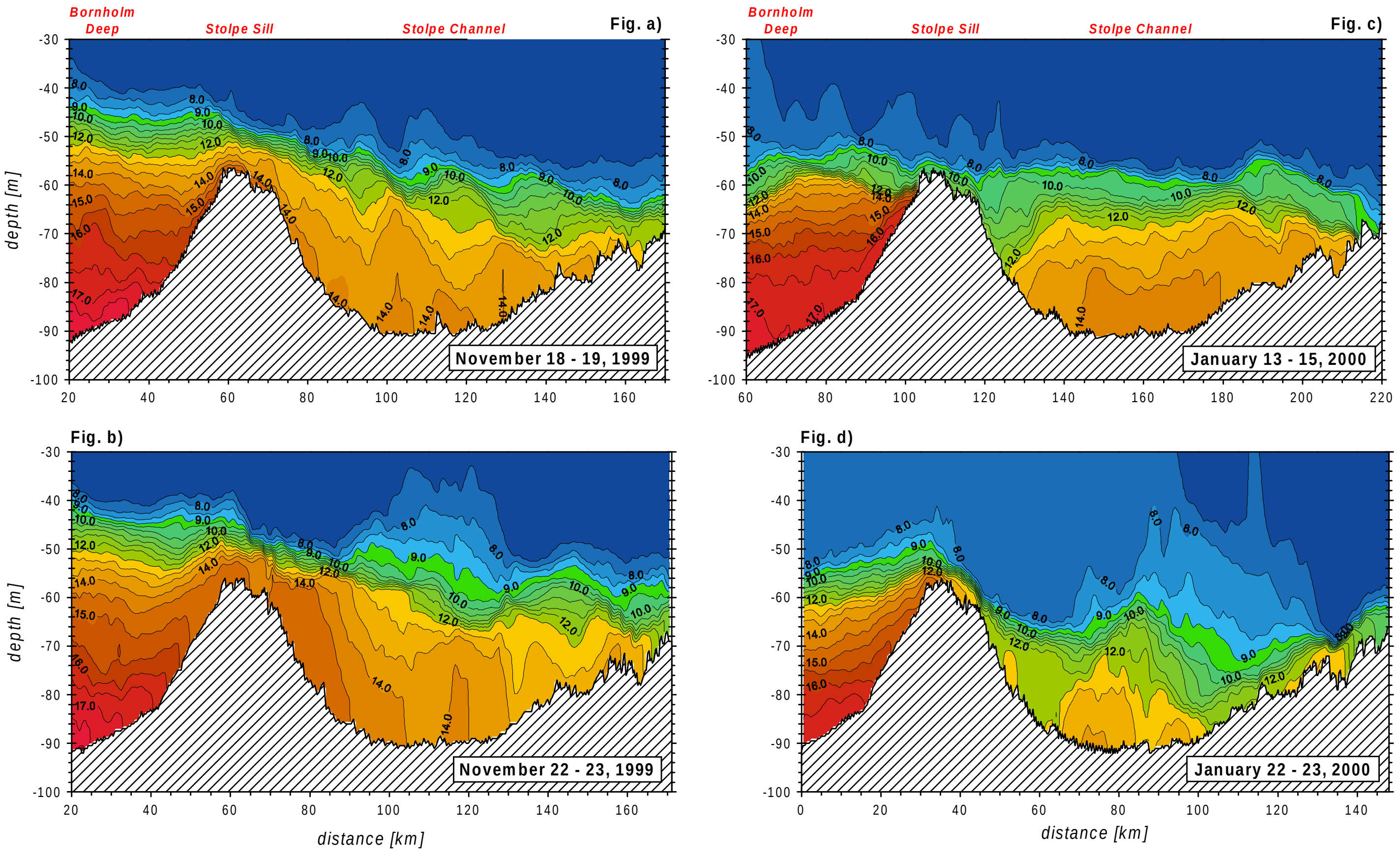
- feedback to the data suppliers.
- data users have assured feedback in the Licence Agreement with the BMDC.
- It is easier for us to continue to receive data if the data users give feedback.
  This is absolutely vital for the extension of the data into long-time series.

For further information: Report No. 5 (October 2001)

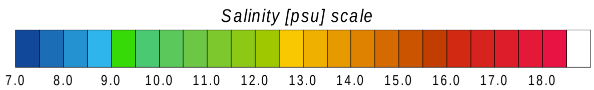
www.dwd.de/research/baltex/baltex.html

Appendix 14: Hydrography Survey Example during *BRIDGE*

DISTRIBUTIONS OF SALINITY [PSU] IN THE STOLPE CHANNEL AND STOLPE SILL AREA
IN NOVEMBER 1999 (figs. a, b) and JANUARY 2000 (figs. c, d)
R.v. 'Oceania, Institute of Oceanology PAS, Sopot



Institute of Oceanology PAS
Marine Hydrography Lab.



Appendix 15: BALTEX projects funded in Germany

DEKLIM Funding Programme (BMBF)

Project cluster **BASEWECS**
„Influence of the Baltic Sea and the Sea-ice Annual Cycle on the Energy and Water Budget of the BALTEX Region“
Co-ordination: W. Krauss, IfM Kiel, 3 projects, 1.2 Mill Euro

Project cluster **BALTIMOS**
„Development and Validation of a Coupled Model System for the Baltic Sea Region“
Co-ordination: D. Jacob, MPIfM, 8 projects, 2.3 Mill Euro

Project cluster **AREA PRECIPITATION**
„More Accurate Measurements of Areal Precipitation over Land and Sea“
Co-ordination: H. Graßl, MPIfM, 3 projects, 0.8 Mill Euro

Project cluster **EVA-GRIPS**
„Regional Evaporation on Gridpoint/Pixel Scale over Heterogeneous Landsurfaces“
Co-ordination: T. Mengelkamp, GKSS, 6 projects, 2.2 Mill Euro

4 individual projects on a) Snow modelling, b) Hydrological variability of the last 1000 years in the Baltic Sea environment, c) Variability of fresh water in the Polar Seas, d) Influence of C and N cycling on the terrestrial biosphere in the BALTEX region.
Co-ordinations at Uni Köln, IOW, AWI, MPIfM; 1.5 Mill Euro.

Total: 20 projects, 7.9 Mill Euro funding

Projects startet in 2001
Joint kick-off co-ordination meeting planned for early 2002

AFO2000 Funding Programme (BMBF)

Project 4DWOLKEN
„Inhomogeneous clouds - their influence on exchange and transport processes in the atmosphere“
Co-ordination: C. Simmer, Uni Bonn

Other projects with relevance to Water and Energy Cycles in the Baltic Sea Basin

Other BMBF Projects
Project ODRAFLOOD
„A flood forecasting system for the Odra drainage basin“
Co-ordination: T.Mengelkamp/W.Rosenthal, GKSS
Participation of Polish Institutions !

International BALTEX Secretariat Publication Series
ISSN 1681-6471

No. 1: Minutes of First Meeting of the BALTEX Science Steering Group at GKSS Research Center in Geesthacht, Germany, 16-17 May, 1994. August 1994

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No. 3: First Study Conference on BALTEX, Visby, Sweden, August 28 – September 1, 1995. Conference Proceedings. Editor: A. Omstedt, SMHI Norrköping, Sweden. August 1995, 190 pages

No. 4: Minutes of Second Meeting of the BALTEX Science Steering Group at Finnish Institute of Marine Research in Helsinki, Finland, 25-27 January, 1995. October 1995

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No. 9: The Main BALTEX Experiment 1999-2001 – ***BRIDGE*.** Strategic Plan. October 1997, 78 pages

No. 10: Minutes of Fifth Meeting of the BALTEX Science Steering Group at Latvian Hydrometeorological Agency in Riga, Latvia, 14-16 April, 1997. January 1998

No. 11: Second Study Conference on BALTEX, Juliusruh, Island of Rügen, Germany, 25-29 May 1998. Conference Proceedings. Editors: E. Raschke and H.-J. Isemer. May 1998, 251 pages

No. 12: Minutes of 7th Meeting of the BALTEX Science Steering Group at Hotel Aquamaris in Juliusruh, Island of RÜGEN, Germany, 26 May 1998. November 1998

No. 13: Minutes of 6th Meeting of the BALTEX Science Steering Group at Danish Meteorological Institute in Copenhagen, Denmark, 2-4 March 1998. January 1999

No. 14: BALTEX – BASIS Data Report 1998. Editor: Jouko Launiainen, 96 pages. March 1999.

No. 15: Minutes of 8th Meeting of the Science Steering Group at Stockholm University in Stockholm, Sweden, 8-10 December 1998. May 1999

No. 16: Minutes of 9th Meeting of the BALTEX Science Steering Group at Finnish Meteorological Institute in Helsinki, Finland, 19-20 May 1999. July 1999

No. 17: Parameterization of surface fluxes, atmospheric planetary boundary layer and ocean mixed layer turbulence for BRIDGE – What can we learn from field experiments? Editor: Nils Gustafsson. April 2000

No. 18: Minutes of the 10th Meeting of the BALTEX Science Steering Group in Warsaw, Poland, 7-9 February 2000. April 2000

No. 19: BALTEX-BASIS: Final Report, Editors: Jouko Launiainen and Timo Vihma. May 2001

No. 20: Third Study Conference on BALTEX, Mariehamn, Island of Åland, Finland, 2-6 July 2001, Conference Proceedings. Editor: Jens Meywerk, 264 pages. July 2001

No. 21: 11th Meeting of the BALTEX Science Steering Group at Max-Planck-Institute for Meteorology in Hamburg, Germany, 13-14 November 2000. July 2001.

No. 22: Minutes of 12th Meeting of the BALTEX Science Steering Group held at Royal Netherlands Meteorological Institute (KNMI), De Bilt, The Netherlands, 12-14 November 2001. April 2002

Copies are available upon request from the International BALTEX Secretariat.