

Summary of the 1st Meeting of the
North-American THORPEX regional science committee

14-15 August 2003

University of Maryland, College Park

Maryland USA

Date: October 30, 2003

1. INTRODUCTION

At the World Meteorological Organization's (WMO) 14th Congress (5-24 May 2003, Geneva), the Congress adopted the resolution 3.3/1 (Cg-XIV) that establishes THORPEX as a ten-year long international Global Atmospheric Research Programme. The International Scientific Committee (ISC) of THORPEX has nearly completed the THORPEX science plan and a second version (in near final form) has been distributed to the North American (NA) THORPEX regional scientific committee for discussion at the first meeting. As stated in the science plan, "(...) *regional committees define regional priorities for participation in THORPEX within the framework of the THORPEX International Science and implementation plans (...)*". The goal of this first meeting was to begin establish these regional priorities and to relate those priorities to the four THORPEX sub-programs (predictability and dynamical processes; observing systems; data assimilation and observing strategies; societal and economic impact assessment). The meeting started with presentations on our respective research interests and the relationship of those interests to the THORPEX objectives. The meeting included an informal exchanges of ideas building on discussions that occurred during the presentations.

In the appendix, the list of members of the NA THORPEX regional committee is given along with a list of participants to the meeting. Material from the presentations has been collected and should be posted on the US THORPEX website (<http://www.mmm.ucar.edu/uswrp/programs/thorpex.html>).

2. SUMMARY OF PRESENTATIONS

This meeting was held at the University of Maryland at the invitation of Prof. Eugenia Kalnay. Opening remarks were presented by the chair of the International Core Steering Committee (ICSC), Michel Béland, who discussed the current status of the programme recently adopted by WMO. He presented his views on the challenges that it offers and how it relates to other international programmes. The co-chairs of the NA THORPEX regional committees, David Parsons and Pierre Gauthier, then presented their expectations for this meeting: to establish the regional priorities for North America and to find out the type of collaborations that could be established between the different participating research groups interested in THORPEX. Ultimately, a science plan must be produced to support proposals to fund THORPEX research activities.

Melvyn Shapiro presented an outline of the international science plan and emphasized the key goals of the project. From the resulting discussions, it became very clear that it is important to assess the societal and economic impacts of high impact weather. The metric that defines the impact clearly varies significantly depending on the user. Although hurricanes, winter storms and tornadoes are obvious cases of severe weather, they may not have much impact if they occur in sparsely populated areas. On the other hand, weather formally not considered severe can have a large socio-economic impact such when a heat wave persists for weeks (as it did in Europe this summer). Other less obvious types of high impact weather include those events that are primarily economic, such as when forecast errors in the surface temperature or in the upper-level winds have significant detrimental impacts on the energy or aviation sectors, respectively. The question of societal and economic impacts was discussed frequently during the meeting on various occasions. Laurie Neil presented some examples of what is considered high impact weather on the West Coast of Canada including an unpredicted high wind event and showing how wind forecast errors of a few meters per second can have a detrimental impact on the transportation of logs. Presentations by Roger Pielke and Rebecca Morss were specifically devoted to this sub-program, establishing the need to identify the different applications and to define suitable metrics. These presentations raise complex issues that need to be addressed. For example, the probabilistic estimate of the accuracy of a forecast can be used to assess the cost of actions associated to anticipated high impact weather.

The director of NCEP and the US representative on the THORPEX ICSC, Dr. Louis Uccellini, gave his thoughts on THORPEX planning and the difficulties in securing funding from the government. In this context, he stressed the importance of developing societal and economic applications to justify research needs. He also mentioned the importance of establishing international collaboration. As an example, he cited the collaboration between US and Canada to share the results from their respective ensemble global prediction systems and to make it available to the community. Dr. Pai-Yei Whung talked about the current status and role of the WMO THORPEX International Program Office (IPO). Its main tasks are to link THORPEX activities with other WMO programmes that share similar interest and assist the ICSC to coordinate the national, regional and international science planning.

Zoltan Toth then presented NOAA's THORPEX plan, which puts the goals within a contemporary paradigm in which forecasting, assimilation, the strategy of observations and socio-economic applications need to be considered as a whole and not individually. This philosophy builds on the success of the US operational community in utilizing special observing strategies to improve the prediction of hurricane landfall and winter cyclones. NOAA has issued a call for proposals to assist in the operational implementation of this forecast paradigm. The practical goal of NOAA's THORPEX program is the development of new techniques that will (1) accelerate the rate of forecast improvement over the next

decade, to allow, for the first time, detailed and skillful (2) precipitation forecasts for the 3-7 day period; and (3) daily weather forecasts for the 8-14 day period, both in probabilistic form. Pierre Gauthier then presented the status of the operational forecasting/assimilation systems of the Meteorological Service of Canada (MSC) and the current developments in the areas of 3D and 4D variational data assimilation, assimilation of satellite data and ensemble Kalman filtering. He also presented the content of a letter of intent for a research proposal to establish a research network of university scientists having research projects related to THORPEX. This letter of intent was submitted to the Canadian Foundation for Climate and Atmospheric Sciences and accepted in May 2003. The full proposal now needs to be completed by December 2003. The proposal puts an emphasis on the assimilation aspects by assessing the impact of data collected during THORPEX regional campaigns (TRECs) using different assimilation strategies in a quasi-operational context. Canada is also interested in and an active participant in the TRECs planned for the North Pacific and Atlantic. Jim Abraham and David Parsons briefly summarized the participation of Canada and the US to the upcoming Atlantic TREC later this fall.

NASA activities and plans were presented. Tim Miller presented background on NASA's Weather Research Program. The general NASA goals for THORPEX are to: i) Test new observational, data assimilation, and modeling strategies and techniques to improve weather forecasts. ii) Provide opportunities for, and value added to, validation measurements associated with space-based assets, and provide input into definition of requirements for future observing systems. iii) Perform research to develop a better understanding of weather processes. iv) Provide opportunities to demonstrate or benchmark the utilization of NASA knowledge or technologies to be used by operational entities in improving weather forecasting. v) Perform OSSEs and OSEs to determine the optimum blend of satellite and in situ observing systems to improve weather prediction and to evaluate the specific role of space-based observations in THORPEX and USWRP. In addition, Bob Atlas explained how Observing System Simulation Experiments (OSSEs) can be used to anticipate the impact of future instruments. Recent results showed that the impact obtained in OSSEs did correspond to that obtained with real data when they became available. The SeaWinds data on AELUS-II were given as an example. John Murray mentioned that during the Pacific TOST campaign last winter, a prototype of the instrument for GIFTS was flown and data collected to test the resulting data by comparing with other measurements. As such, the primary goal of this campaign was a calibration-validation effort although the TOST was coordinated with NOAA's operational Winter Storm Reconnaissance effort. As presented in the THORPEX science plan, the use of flow-dependent covariances can have a significant impact in the channel selection of an hyper-spectral sounder such as AIRS or IASI. A challenging area is also to find out how to best complement satellite data with ground measurements to get the most out of them. From the discussions, it

was made apparent that it is important to consider that the impact of data clearly depends on the assimilation and modeling systems.

Steve Tracton discussed General overview of outcomes from a recent ONR workshop on predictability. ONR has a history of involvement in both the theoretical and practical aspects of predictability. Carolyn Reynolds presented the current research going on at the Naval Research Laboratory on targeted observing methodologies, predictability and ensemble prediction. Adjoint-based techniques for predictability studies and targeted observing, were developed at NRL and since 1995, have provided a foundation for much of their research. Their potential research and technological contributions to THORPEX include: i) The development of methods to predict impact of observations on forecast error and design more effective observing networks. ii) Improve targeting methodologies through consideration of data assimilation characteristics. iii) Examine limitations of linear-based techniques for targeting and diagnostic purposes. iv) Adaptive observations for tropical cyclones and other mesoscale phenomena. Joe Tribbia presented an overview of NCAR activities that could be related to THORPEX. An ensemble Kalman filter framework is used to assess the impact of observation strategies. Assimilation efforts at NCAR also include work on 3 and 4-d variational techniques. Predictability studies are done to study the interaction of errors at different scale. The large-scale organization of Tropical convection is investigated to understand its relationship to the week-2 predictability. Research is also going on the dynamics of planetary wave initiation. Work at NCAR relevant to the observational component of THORPEX is focused on the development and testing of the driftsonde. Finally, work is also beginning to define the metrics suitable to a public policy perspective.

Eugenia Kalnay presented an outline of research going on at the University of Maryland on local ensemble Kalman filtering, data assimilation for hurricanes, coupled ocean-atmosphere data assimilation. She mentioned a study in which operational and reanalysis forecasts were compared to quantify the impact of the improvements implemented over the last 7 years. John Gyakum presented some interesting weather events in which the causes could be related to large scale dynamics while emphasizing the need to pay attention to smaller scale effects that can also make the difference in the life-cycle of a system. Bob Talbot described AIRMAP 2004, an international climate and air quality campaign that will take place in New England and over the Atlantic. The AIRMAP effort has been utilized to fund the development of targeted wind observation systems that are directly relevant to THORPEX efforts. Finally in the area of university participation Dave Parsons presented a brief overview of the THORPEX research interests of the US university community. The general response of the US university community to THORPEX has been quite strong with investigators from ~25 US university departments expressing interest. Many departments had more than one investigator express interest. The current research interests of the university community relevant to were strongest in the areas of data assimilation, predictability and

linking investigations of dynamical processes in the tropics to studies of how to improve week 2 prediction in middle latitude.

3. DISCUSSION ON THE SCIENCE PLAN AND GENERAL RESEARCH THEMES

For both Canada and the US, the first step is to organize and prioritize our respective national THORPEX activities. This step must take place prior to the development of a single plan for North America. The national efforts will, of course, be developed under the general framework of the International Science Plan. As part of the effort to organize national activities, a proposal, as mentioned earlier, will be submitted to Canadian Foundation for Climate and Atmospheric Sciences in December 2003. A US THORPEX Science and Implementation plan is being developed in response to the request of the interagency THORPEX management subgroup of the USWRP. The due date for version 1 of this US proposal is 1 November 2003. Since THORPEX is an international program, we are actively exploring topics for international collaborations both within North American and with the other THORPEX regional efforts as part of the national planning efforts. This meeting served the purpose of both organizing our national efforts and exchanging information between the US and Canada.

In the open discussion at this meeting, support was expressed for the international science plan and the organization of THORPEX into its four research components. The following points were emphasized during the discussion period:

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- Several groups have developed high quality simulations that have been utilized as a proxy for the true state of the atmosphere in observing system simulation experiments. The point was made that these “truth” simulations should be made readily and openly available to the broad THORPEX research community.
- The research community could benefit from a continuation and possible expansion of the policy of making forecast products, particularly information from the operational NA ensemble effort, available whenever feasible.
- Discussions were made as to whether certain types of high impact events should be stressed over other types. In this regard, support was expressed for Rossby wave trains investigations as a general research theme with several possible questions that could be addressed such as i) How often are these events associated with high impact weather? ii) How well can the onset time and location of an event be predicted and subsequently how well can we expect models to represent the propagation of these events at time scales beyond a few days? iii) Can effective targeting or assimilation strategies be

developed to improve or extend the predictive skill of these events? iv) How do these events and the tendency for associated high impact weather vary on different time-scales?

- Another weather situations discussed included the predictability of situations where a series of high impact weather events occurs repeatedly over a region, such as a series of intense coastal cyclones or repeated heavy rainfall systems. Another situation was the formation, intensification and breakdown of persistent weather high impact weather patterns. An example of the later type of an event could be a blocking ridge during the warm season associated with a heat wave.
- The upcoming Atlantic THORPEX experiment is an excellent opportunity to begin the establishment of international cooperation between operational centers and researchers. The experiment is relevant to several core THORPEX goals. However, acknowledgement was made that the planning process was too short for the response of several agencies.
- Discussions took place on whether the different components of THORPEX should have radically different priorities or whether any of the components should be phased in (or out) with time. However, there was generally no clear consensus on this point and several reasons why such a strategy will not succeed in practice. However, the need to have a strong societal impact component, rather than a secondary effort was recognized. In addition, there was not strong support for having another regional TReC effort that “immediately” follows the upcoming Atlantic TReC and there was more NA interest in working in the Pacific. The early North American THORPEX plans called for a Pacific regional campaign in 2007 or 2008, which consistent with these views. Other regional committees are beginning to formulate their plans for TReCs and TOSTs and the regional co-chairs have the issue under discussion.

**APPENDIX: MEMBERS OF THE NA THORPEX REGIONAL SCIENTIFIC STEERING
COMMITTEE AND LIST OF PARTICIPANTS**

The members of the NA THORPEX regional SSC are the following:

Co-chairs

David Parsons	NCAR
Pierre Gauthier	<i>Data assimilation and satellite meteorology division</i> Meteorological Service of Canada (MSC)

US REPS

NOAA

Dr. Zoltan Toth	NCEP/EMC (NOAA team leader)
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NASA

Dr. Tim Miller	NSSTC/GHCC/MSFC NASA Team Leader & Weather Roadmap Coordinator
Dr. Bob Atlas	GSFC/DAO - Data Assimilation and Assessment
Dr. John Murray	LaRC - Applications Aspects of THORPEX

DEPARTMENT OF DEFENSE

Dr. Carolyn Reynolds, ONR	
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NCAR

Dr. Joe Tribbia	NCAR, Climate and Global Dynamics Division
Dr. Rebecca Morris	NCAR, Environmental and Societal Impacts Group and Mesoscale and Microscale Meteorology Division

UNIVERSITY COMMUNITY

Prof. Eugenia Kalnay	U of Maryland
Prof. Berrien Moore	U of New Hampshire
Prof. Daniel Keyser	SUNY Albany

CANADIAN REPS

Mr. Jim Abraham	Director of Meteorological Research Branch Meteorological Service of Canada, MSC Dorval, Québec
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Dr. Mark Buehner	Research scientist Data assimilation and satellite meteorology division MSC Dorval, Québec
Prof. John Gyakum	Head of the Department of Atmospheric and Oceanic Sciences McGill University, Montréal. Québec
Mr. Laurie Neil	MSC Program Manager (Marine) Pacific region, MSC Vancouver, British Columbia

Invitees for the first meeting

Dr. Michel Béland	Director of Atmospheric and Climate Science Directorate, MSC and Chair of the <i>THORPEX International Core Steering Committee</i>
Mr. Jim Giraytys	NOAA
Dr. Steve Nelson	NSF
Prof. Roger Pielke Jr.	WWRP Societal Impacts and U of Colorado
Dr. Martin Ralph	Member Ex-Officio, NOAA/ETL (USWR Cool Season Co-lead)
Dr. Tom Schlatter	NOAA/FSL (USWRP observing system coordinator)
Dr. Mel Shapiro	Member Ex-Officio, NOAA/OAR and co-chair of the THORPEX International Scientific Committee
Dr. Steve Tracton	ONR
Dr. Louis Ucellini	Director of NCEP
Dr. Pai-Yei Whung	NOAA/OAR