

International Research Collaboration in High Impact Weather Prediction

(Second Draft)

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WHAT: Approximately 45 experts from academic and operational institutions and funding agencies from North America, Europe, and Asia met to discuss the prospect of international collaboration in weather prediction research after the completion of THORPEX

WHEN: 9 January, 2013

WHERE: Townhall held at the 93rd AMS Annual Meeting in Austin, Texas

The Observing system Research and Predictability EXperiment (THORPEX) is an international research and development program conducted under the auspice of the World Weather Research Programme (WWRP) of the World Meteorological Organization (WMO), with the goal to accelerate the improvements in the accuracy of one-day to two-week high impact weather forecasts for the benefit of society, the economy, and the environment. THORPEX was launched in 2004, and is scheduled to conclude in 2014.

Under THORPEX, interactions between the weather research and operational communities have significantly increased world-wide. Numerous science symposia, workshops, working group meetings, and training programs have been conducted to promote and coordinate weather forecast research and help transition research products into operations. The THORPEX Interactive Grand Global Ensemble (TIGGE, Bougeault et al., 2010) archive has been established to provide academic researchers ready access to ensemble forecast products from multiple operational forecast centers. Major international field campaigns and programs, such as the North Atlantic THORPEX Regional Campaign (NA-TReC), the THORPEX Pacific Asian Regional Campaign (TPARC), and the Year Of Tropical Convection (YOTC, Waliser et al., 2012 – a program conducted under the joint sponsorship of WWRP/THORPEX and the World Climate Research Programme (WCRP)) have been conducted. In the U.S., THORPEX contributed to the establishment of the North American Ensemble Forecast System (NAEFS), the implementation of the ensemble based Hybrid GSI-EnKF data assimilation system at the National Center for Environmental Prediction, and the establishment of the Winter Storm Reconnaissance (WSR) program by the National Weather Service.

With THORPEX nearing its conclusion, WWRP recently initiated two new international projects – the Polar Prediction Project (PPP) and Sub-Seasonal to Seasonal (S2S) project. A third major project has been proposed to complement PPP and S2S by focusing on improving forecasts of high impact weather events

and their impacts on timescales from minutes to weeks¹. The THORPEX town hall meeting was organized by the US THORPEX Science Steering Committee to provide input to an international planning workshop, to be conducted in Karlsruhe, Germany on 18-19 March, 2013, to further discuss the proposed project and initiate the development of a project plan.

During the townhall meeting, a recurring theme emphasized by many participants was that no one country has the capability to solve the weather forecasting problem on their own. THORPEX has invigorated international collaboration between the best scientists around the world, and the community should work hard to continue this momentum. Such opportunities in leveraging international expertise and resources should be emphasized by scientists participating in THORPEX legacy projects to make a compelling case to funding agencies (both in the US and internationally) to support these projects.

Speakers at the townhall meeting pointed out that several recent US government agency initiatives are highly relevant to the proposed high impact weather project as well as the PPP and S2S projects. The Earth System Prediction Capability (ESPC) effort is a collaborative effort between the National Oceanic and Atmospheric Administration (NOAA), US Navy, Air Force, the Department of Energy (DOE), the National Aeronautics and Space Administration (NASA), and the National Science Foundation (NSF) to promote the development of an earth system analysis and prediction system, especially focusing on the challenging time scales of the weather to climate interface. Another initiative, NOAA's Weather Ready Nation (WRN), is an effort to build community resilience in the face of increasing vulnerability to extreme weather and water events. Participants remarked that such agency efforts should be leveraged in the development of the new project.

Other speakers promoted the use of operational models in academic research where appropriate in order to streamline the research to operations transition process. A related concern raised was that U.S. operational agencies have barely sufficient computing resources to perform their operational tasks, leaving inadequate resources for research using the operational models. This shortcoming must be addressed before broader collaborations between operational and academic scientists can become practical in using the operational models. Another suggestion for possibly bridging the weather and climate forecast time scales was to experiment using high resolution weather prediction models to predict climate. Questions like how much resolution is needed for seasonal forecasting and to probabilistically predict high impact weather are problems that can be tackled jointly with the climate community.

One of the focus areas of THORPEX was Socio-Economic Research and Applications (SERA). It was remarked that prior to THORPEX, societal impact of

¹ A copy of a brief draft proposal for this project can be found at http://www.ucar.edu/na-thorpeX/documents/THORPEX_Follow-on_HIW_project_v3.pdf

weather was a relatively neglected area. THORPEX jump started research in this area. Currently this field is much more active than it was 10 years ago, with agencies funding programs for multi-disciplinary research involving physical and social sciences and engineering with consideration of the societal impact of natural processes and the associated hazards (e.g. Interdisciplinary Research in Hazards and Disasters (Hazards SEES) and Coastal Science, Engineering and Education for Sustainability (Coastal SEES) of NSF). Speakers at the townhall argued that the new project should not stop at improving the prediction of high impact weather but should aim at developing methods to predict the societal and economic impact of weather as well.

The recent high impact weather events over the U.S. like the tornado outbreaks in 2011 and Hurricane Sandy in 2012 clearly demonstrate the need for this type of research, aimed at the prediction of high impact weather and the assessment of the expected social, economic, and environmental impacts of such events. It was pointed out that impact forecasting requires adequately high spatial and temporal resolution, with a quantitative assessment of forecast uncertainties in the form of ensembles, as well as access to often only locally available information on vulnerability to weather events. In a few years' time, most modeling centers will be using models that will start to resolve convective scales. The skill of current weather forecast systems in predicting details crucial for the prediction of the impact of weather is lacking, so the need for related research is high.

Overall, the participants at the townhall endorsed the main ideas behind the proposed project. The funding agencies emphasized the need for innovative research related to forecasting significant weather events and their impact. A suggestion at the meeting was to keep the proposed project well focused. This can ensure that interested scientists can easily align their research with the community effort and that the project objectives can be successfully accomplished over the lifetime of the project, with the limited resources available. Key participants will take the input from the US THORPEX Townhall meeting to the international planning workshop held in Karlsruhe, Germany, where scientists from various countries will further refine the scope and objectives of the proposed project.

References:

- Bougeault, P., and coauthors, 2010: The THORPEX Interactive Grand Global Ensemble. *Bull. Amer. Meteor. Soc.*, 91, 1059-1072.
- Waliser, D.E., and coauthors, 2012: The "Year" of Tropical Convection (May 2008 – April 2010): Climate Variability and Weather Highlights. *Bull. Amer. Meteor. Soc.*, 93, 1189-1218.