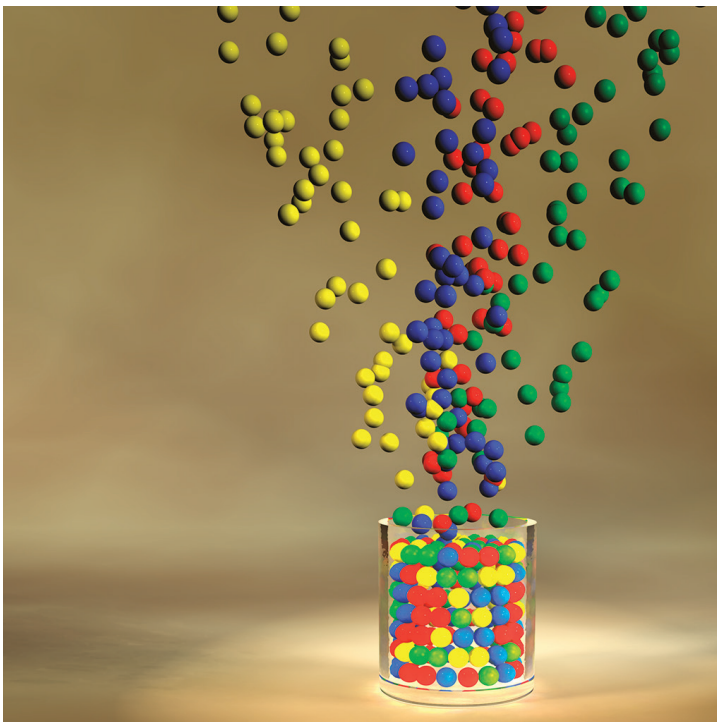


METEOROLOGY

The THORPEX Interactive
Grand Global Ensemble
(TIGGE): concept and objectives



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The THORPEX Interactive Grand Global Ensemble (TIGGE): concept and objectives

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The THORPEX Interactive Grand Global Ensemble (TIGGE) is a key component of THORPEX, one of the major components of the World Weather Research Programme (WWRP) of the World Meteorological Organization. TIGGE will contribute to achieving one of the WWRP-THORPEX goals: to accelerate improvements in the accuracy of one-day to two-week high-impact weather forecasts for the benefit of humanity. In addition TIGGE is registered as a specific task for GEO (Group on Earth Observation). It has high relevance to the GEO societal benefit areas that need access to advanced global weather forecasts and the derived products, especially in areas related to risk management, disaster mitigation, energy, health etc.

The objectives of TIGGE are:

- Enhancing collaboration on ensemble prediction, internationally and between operational centres and universities.
- Developing new methods to combine ensembles from different sources and to correct for systematic errors (biases, spread over-/under-estimation).
- Achieving a deeper understanding of the contribution of observation, initial and model uncertainties to forecast error.
- Exploring the feasibility and the benefit of interactive ensemble systems responding dynamically to changing uncertainty.
- Enabling evolution towards an operational system, the “Global Interactive Forecast System (GIFS)”.

Phase 1 and Phase 2 of TIGGE

The TIGGE objectives will be reached by a two-phase implementation. In the current Phase 1 data are collected in near-real time at a small number of central data archives using existing network and storage capabilities. They are then made accessible to scientists for research and education through specific data portals. The delay to access any forecast data is 48 hours. The implementation of TIGGE Phase 1 is described in the article in this edition of the *ECMWF Newsletter* which starts on page 10.

In Phase 2, to be developed in the near future subject to the success of Phase 1, the real-time preparation and distribution of multi-model products will be the main focus. This will require substantial software development, specific funding and coordination with the evolving WMO Information System (WIS). Archiving arrangements may also be reviewed in Phase 2.

The highest priority data accumulated in the TIGGE archive are the ensemble forecasts generated routinely (operationally) at major forecast centres around the world. This core data stored in the TIGGE archive is accumulating at a daily rate of approximately 240 GB from ten providers around the world. Additional special datasets may be added in the future for specific research and applications.

The databases and data portals of Phase 1 have been developed by three archive and distribution centres: ECMWF, US National Centre for Atmospheric Research (NCAR) and China Meteorological Agency (CMA). The operational forecasting centres supplying daily forecasts are given in Box A.

TIGGE has strong links with the North American Ensemble Forecasting System (NAEFS). Although NAEFS is initially an operational project, TIGGE and NAEFS share many technical aspects, and NAEFS plans to implement results from TIGGE. It is believed that TIGGE and the NAEFS will ultimately evolve into a single operational system.

Centres supplying daily forecasts to the TIGGE archive**A**

- ECMWF
- US National Centers for Environmental Prediction (NCEP)
- Meteorological Service of Canada (MSC)
- Australian Bureau of Meteorology (BoM)
- China Meteorological Administration (CMA)
- Brazilian Centra de Previsao de Tempo e Estudos Climatico (CPTEC)
- Japan Meteorological Administration (JMA)
- Korea Meteorological Administration (KMA)
- Météo-France
- UK Met Office

Data access

Data providers supply their products to the TIGGE archive centres under an agreed set of rules, which include re-distribution rights. Access is provided for research and education through a simple electronic registration process, with valid e-mail address and acknowledgment of conditions of supply. Under the simple registration process, access is given with a delay (48 hours) after the initial time of the forecast. Real-time access is granted in some cases, e.g. for field experiments and projects of special interest to THORPEX. Registration for real-time access is handled via the THORPEX International Programme Office.

Data access is operated via the TIGGE data portals at NCAR, ECMWF and CMA. Information about how to access these portals and their functionality are given in Box B. These portals also provide selection of parameter subsets. ECMWF offers grid interpolation and a wide choice of spatial subsets. In the future NCAR and CMA plan to offer these expanded services.

TIGGE data portals**B**

Data access is operated via the TIGGE data portals.

- NCAR portal: <http://tigge.ucar.edu>
- ECMWF portal: <http://tigge-portal.ecmwf.int/>
- The CMA portal: <http://wisportal.cma.gov.cn/tigge/>
- The functionalities of the data portal are:
 - Registration.
 - Search, discover, and download files.
 - Select data by initialization date/time, data provider, file type and forecast time.
 - Check volume and download data.

Outlook

TIGGE is considered by THORPEX as paving the way towards a Global Interactive Forecasting System (GIFS). The primary need for further development is to accelerate data exchange between the partners. In the upcoming Phase 2 of TIGGE, which is still subject to funding, requirements for massive data transfers will be alleviated by a distributed data access concept.

It is anticipated that limited-area ensemble prediction systems will also form an important component of the GIFS whose development is dependent upon TIGGE. The priority requirement here is to develop standard formats which will enhance the interoperability of the existing systems. One key objective is to facilitate the use of lateral boundary conditions from various global systems by various limited-area systems. A panel of experts (called TIGGE-LAM) has recently been set-up to organize the limited-area-model component of TIGGE. The three archive centres have accepted in principle to host results from LAM ensemble prediction systems as part of the TIGGE archive for Phase 1.

Data from the TIGGE archive is already being used for a variety of research and development activities. An example of how TIGGE data has been used to study predictability is given in the article starting on page 16 of this edition of the ECMWF Newsletter.

There is no doubt that there are immense benefits in optimizing the use of the output from ensemble prediction systems. Having scientist make full use of the data in the TIGGE archive will help realize those benefits. ECMWF encourages European scientists to engage in using the TIGGE archive to fully assess the merits of multi-model forecasting.

Further Reading

WMO, 2005: First Workshop on the THORPEX Interactive Grand Global Ensemble (TIGGE), Final Report *WMO/TD-No. 1273, WWRP/THORPEX No. 5* (available from www.wmo.int/thorpex).

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