2020-2022 GEO Work Programme

TIGGE and S2S

1. Executive Summary

TIGGE (The International Grand Global Ensemble) is a dataset, established by the World Weather Research Programme in 2006, comprised of operational global ensemble forecast data from ten weather forecasting centres. TIGGE is designed to span the medium-range (out to day 15), but a similar multi-model ensemble, the S2S dataset, a joint World Weather Research Programme (WWRP) and World Climate Research Programme (WCRP) effort, has been created in 2015 with contributions from 11 centres to extend across the sub-seasonal to seasonal range (up to day 60). Both systems provide data bases of ensemble predictions, for scientific research on predictability and development of probabilistic weather forecasting methods.

During 2018, S2S approved the Phase II implementation plan from 2019 to 2023. During 2019 it will see the renewal of the commitment by the ten weather forecasting centres to continue supporting TIGGE until 2023.

2. Purpose

The International Grand Global Ensemble (TIGGE) was a major component of The Observing System Research and Predictability Experiment (THORPEX) research program, whose aim is to accelerate improvements in forecasting high-impact weather. By providing ensemble prediction data from leading operational forecast centers, TIGGE has enhanced collaboration between the research and operational meteorological communities and enabled research studies on a wide range of topics.

TIGGE data have been used for a range of research studies on predictability and dynamical processes. Tropical cyclones are the most destructive weather systems in the world and are a focus of multimodel ensemble research. Their extratropical transition also has a major impact on the skill of midlatitude forecasts. Although TIGGE is a research project, it has proved and still is invaluable for the development of products for future operational forecasting. Examples include the forecasting of tropical cyclone tracks, heavy rainfall, strong winds, and flood prediction through coupling hydrological models to ensembles. TIGGE continues to help research into improving predictability and ensemble forecasting, including the new opportunities of convective-scale ensembles, links with ensemble data assimilation methods, and extension of the range of useful forecast skill.

To bridge the gap between medium range weather forecasts and seasonal forecasts, the World Weather Research program (WWRP) and the World Climate Research program (WCRP) jointly launched a research initiative called the S2S project. Its goal is to improve forecast skill and understanding of the sources of sub-seasonal to seasonal predictability, and to promote its uptake by operational centers and exploitation by the applications communities (http://www.s2sprediction.net). To address these issues, the S2S project has created an extensive database (the S2S Database) containing sub-seasonal (up to 60 days) forecasts and reforecasts (sometimes known as hindcasts) from 11 operational and research centers. It is modeled in part on the The International Grand Global Ensemble (TIGGE) database for medium range forecasts (up to 15 days)

Both TIGGE and S2S databases are archived at the European Centre for Medium-range Weather Forecasts (ECMWF), and the Chinese Meteorological Administration (CMA).

3. Background and Previous Achievements

The TIGGE database currently (Feb 2019) has over 3050 registered users. The S2S database has over 1050 registered users. The potential downstream users include all users of weather forecasts: the general public, decision makers, farmers, the energy sector, human health and civil protection etcetera.

The TIGGE database continues to acquire and serve data from ten data providers. Recently, India's National Centre for Medium-Range Weather Forecasts joined the group of data providers, supplying their ensemble forecast to TIGGE. The size of the database is 3.2 PiBytes and the service delivers an average of 15 TiBytes of data per month to some 220 users.

For the S2S database, it has been a period of consolidation. The database started activity in 2015, and during the last 3 years it has seen the addition of data from the 11 data providers originally planned. At the same time, it has been able to successfully accommodate changes in the configuration of various forecasting systems, such as upgrades to their models, changes in the number of ensembles and/or changes in the frequency of production. The size of the database is 96 TiBytes and the service delivers an average of 30 TiBytes of data per month to some 100 users.

In 2017 an S2S user survey was conducted, with questions ranging from current research topics using the S2S dataset, how to improve the dataset or how satisfied were they with the service and documentation. The survey can be accessed from the following address http://wwww.s2sprediction.net/file/database/S2S_survey_report-1.pdf

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address https://confluence.ecmwf.int/display/UDOC/2018+Survey%3A+TIGGE+dataset

4. Key Activities

In April 2019, ECMWF will host a Workshop on Predictability, dynamics and applications research using the TIGGE and S2S ensembles. This workshop will provide an opportunity to review the main scientific advances in predictability, dynamical process studies and applications of ensemble forecasts across the medium and S2S forecast ranges. Examples of sectors rapidly developing in ensemble applications include energy, retail and agriculture, as well as disaster risk mitigation worldwide. The emphasis will be on the utilisation of the TIGGE and S2S databases in research and contributions on seamless prediction, multi-model prediction and ensemble post-processing are particularly welcome. One session will be dedicated to the technical development of ensembles, the TIGGE and S2S data bases and proposals for future development. Workshop themes:
1. Database technical Development
2. Predictability and Dynamics
3. Prediction and Verification
4. Multi-model approaches to prediction
5. Application studies

During 2018, the Sub-seasonal to Seasonal Prediction Project S2S proposed a Phase II implementation plan (November 2018 - December 2023), which includes:
1. The S2S database enhahcements

2. Research activities
3. Enhancing operational infrastructures and user applications, such as
   - Research to Operations (R2O) and
   - Real-time pilot for S2S applications

The complete S2S Phase II implementation plan is available online: https://www.wmo.int/pages/prog/arep/wwrp/new/documents/WWRP_2018_4_S2S_Phase_II_Proposal.pdf

At the end of the THORPEX programme in 2014, TIGGE was extended for a further 5 years. The year 2019 is expected to define the extension of TIGGE until 2023, in order to be aligned with the S2S Phase II implementation

5. Relationship to GEO Engagement Priorities and to other Work Programme Activities

S2S engage in demonstration projects based on some recent extreme events and their impacts, in conjunction with the WWRP Working Group on Societal and Economic Research Application (SERA). In Phase II, there are plans for the creation of the S2S-SERA sub-group to get better feedbacks from the end-user community. Special attention will also be dedicated to establish stronger connections with the Global Framework with Climate Services (GFCS) and the Global Data-Processing and Forecasting System (GDPFS), which will be particularly relevant for the Real-time pilot for S2S applications research and demonstrations proposal

6. Governance

The governance of TIGGE and S2S lies ultimately within the World Meteorological Organisation, in particular the World Weather Research Programme (WWRP) and World Climate Research Programme (WCRP). These Programmes have delegated the governance of TIGGE and S2S to Working Groups that have dedicated Steering Committees and Technical Panels.

7. Data Policy

TIGGE and S2S have a public and free Data Policy. Users accept a set of terms and conditions before downloading the data. TIGGE has a 48 hour delay behind real-time, while S2S is available with a 3 week delay.

8. Annexes:

1. Brief CV of Project Leaders

Manuel Fuentes: Products Team Leader @ ECMWF

Manuel Fuentes leads the team responsible for the Meteorological Archive and Product Generation services at the European Centre for Medium-Range Weather Forecasts (ECMWF). He is the Chair of the TIGGE Panel, reporting to the PDEF WMO Working Group for TIGGE and the Chair of the Technical Committee for S2S, reporting to the S2S Steering Committee.