

Report of GIFS-TIGGE WG
(Submitted by Richard Swinbank and Masayuki Kyouda)

1. Introduction

The GIFS-TIGGE working group was established in 2005, first to develop the TIGGE (THORPEX Interactive Grand Global Ensemble) data set of ensemble predictions, and second to foster research and development on ensemble prediction and the application of ensemble forecasts in order to contribute towards a future Global Interactive Forecast System (GIFS).

Presently, there are a large number of registered users across the three archive centres, but a more meaningful statistic is that there are at least 110 active archive users each month – see Figure 1.

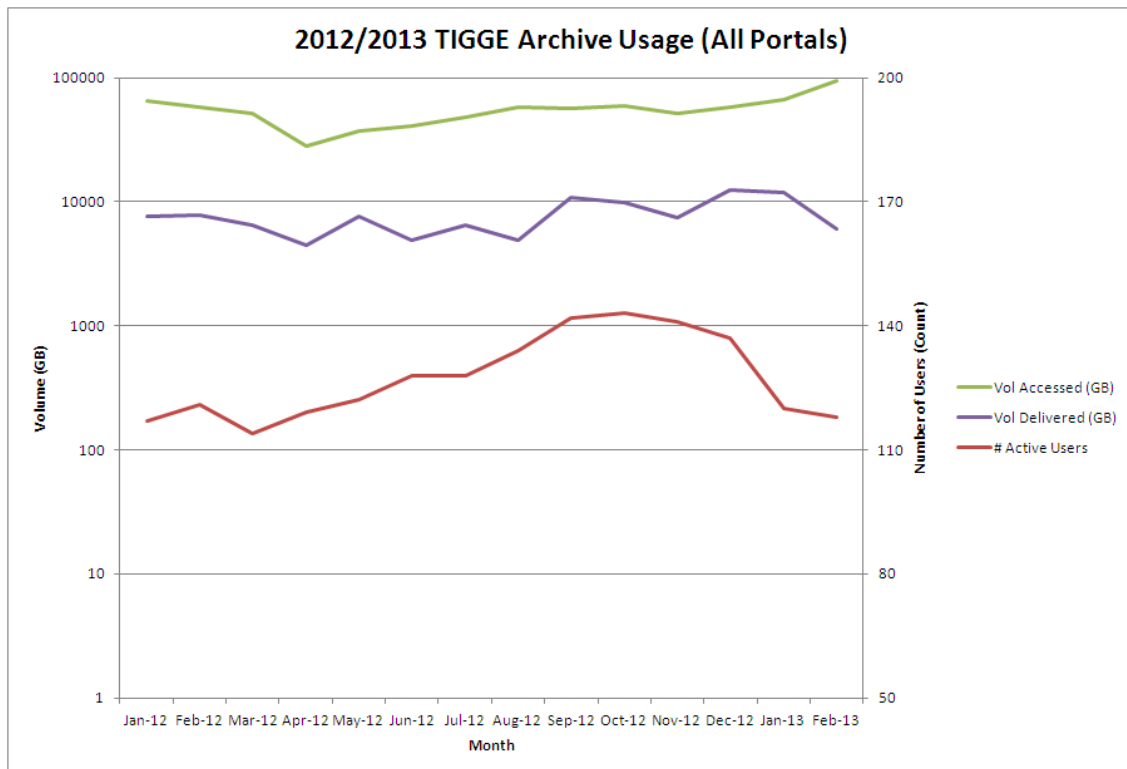


Figure 1 – Time series of monthly usage of all TIGGE archive portals from January 2012 through February 2013.

2. Meetings relevant to TIGGE and GIFS

Members of the GIFS-TIGGE working group contributed to several meetings and conferences since the ICSC10 meeting, including:

35th Hurricane Committee meeting, Curacao, April 2013

R. Swinbank attended the Hurricane meeting to represent WWRP and to present information about future WWRP plans and recent progress on tropical ensemble forecasts and products using TIGGE data.

11th GIFS-TIGGE WG, Exeter, June 2013

The aims of the meeting were to review and consolidate recent progress with GIFS-TIGGE project, and to plan for the future, after THORPEX ends in 2014. Support from the EU-funded GEOWOW project has underpinned several developments, including the commencement of the TIGGE-LAM archive for Europe and the development of products to support the CBS Severe Weather Forecast Demonstration Project (SWFDP).

The future membership of the group was considered, and the proposed list of members is shown in Annex A. Annex B lists the actions that were agreed at the meeting.

3. TIGGE activities

The TIGGE dataset is a rich resource for a range of research studies, with about 70 publications based on TIGGE data. This illustrates the increasing acceptance by universities and funding agencies of the value of the TIGGE dataset, underlining the value of maintaining and adding to the dataset.

Various ongoing developments of TIGGE are being supported via the GEOWOW project, funded by the European Union under the FP7 research programme. This is a 3-year project, started in September 2011, with the main focus on the development of GEOSS (Global Earth Observation System of Systems) which will facilitate the multi-disciplinary use of TIGGE data. This project is supporting ongoing developments to TIGGE, including the archiving of TIGGE-LAM data, the improved treatment of time-series data and (if resources allow) the provision of data in NETCDF format as an alternative to GRIB2.

4. Product development & support of SWFDP

Ensemble forecast data in the TIGGE database provides a valuable resource to develop prototype products to support forecasts of high-impact weather up to two weeks ahead. The working group established a GIFS development project to support the development of additional forecast products to contribute to the regional subprojects of the SWFDP. This will enhance links between WWRP-THORPEX and the operational weather forecasting community. With the help of funding from the GEOWOW project, products based on multi-model ensemble forecasts from the TIGGE partners are starting to come on stream to supplement the SWFDP products available to operational forecasters in the SWFDP regions.

In order to guide future developments, a questionnaire was distributed via the SWFDP. The results from the survey confirmed that probabilistic products focused on tropical cyclones, heavy precipitation and strong winds are particularly important to forecasters, but other issues including predictions of sea state also need to be addressed. The main focus of forecasters is on the short-range, underlining the need to be able to provide ensemble-based products as close to real time as possible.

Some initial multi-model ensemble products have been developed, based on the exchange of tropical cyclone track forecasts, using the Cyclone XML (CXML) – see Figure 2. The exchange of CXML was initiated during the T-PARC field programme, and has been maintained to support the SWFDP and other regional demonstration projects.

At JMA/MRI, a set of products has been developed using gridded TIGGE data to highlight the risks of severe weather, including heavy rainfall, strong winds and extreme temperatures (Matsueda and Nakazawa, 2013). Since the products currently use data from the TIGGE archive, they are delayed by at least 48 hours. With the help of GEOWOW funding, work is in hand to set up a real-time version of this suite of products to support the SWFDP, in a joint project between JMA/MRI and the UK Met Office.

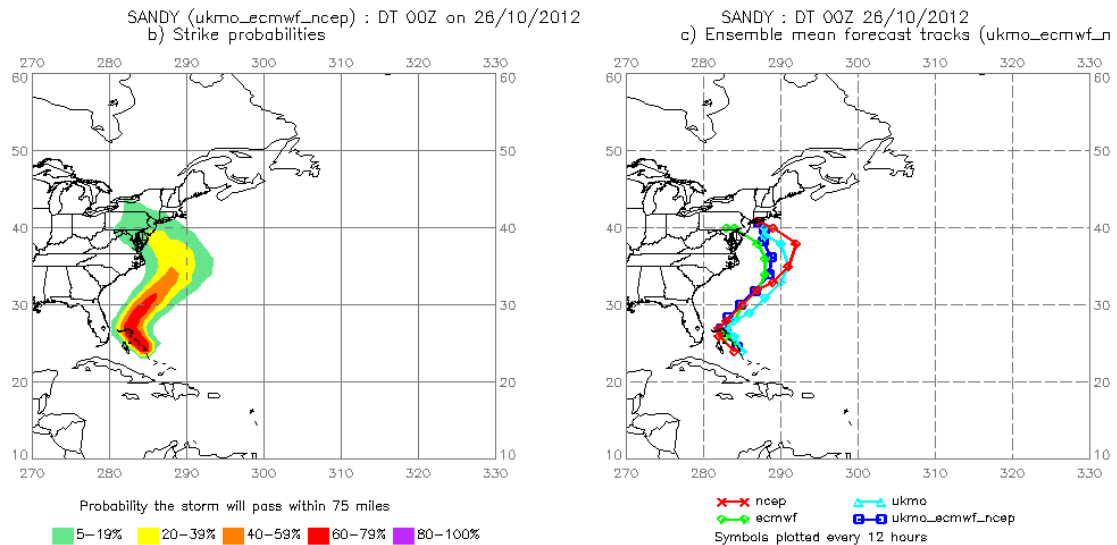


Figure 2 - Multi-model ensemble tropical cyclone products, combining results from Met Office, ECMWF and NCEP ensembles, illustrated for forecasts of hurricane Sandy with initial time 00 UTC on 26th October 2012. Left: strike probability over next 5 days; right: ensemble mean track from single model ensembles and grand ensemble.

5. Proposed Continuation of the TIGGE archive

There has been strong interest from users of the TIGGE database in the continuation of the TIGGE archive and data provision after the completion of THORPEX at the end of 2014. The ICSC10 meeting asked the GIFS-TIGGE working group to consider the number of archive centres and data providers that would be needed to continue with TIGGE. The working group has concluded that at least one archive centre needs to be committed to continue to archive TIGGE data and serve the data to users, with most of the current data providers continuing to supply ensemble prediction data.

In order to assess the future viability we sounded out the three archive centres about their plans; in brief their responses are:

- ECMWF plans to continue as a TIGGE archive centre. Archiving of European TIGGE-LAM data is in progress.
- NCAR plans to stop all TIGGE archiving activities after the end of 2014. Their model validation portal will continue to be available and can be linked to TIGGE. NCAR will continue to ingest, archive and serve the TIGGE CXML (tropical cyclone forecast data).
- CMA is still assessing the future of the Beijing TIGGE archive centre.

In order to confirm their intentions, the WMO secretariat will be contacting each of the archive centres over the next few months to invite them to continue to support TIGGE. The secretariat will also be writing to the data providers to invite them to continue to supply ensemble predictions to TIGGE.

The working group recognises the importance of supporting the new post-THORPEX projects, particularly the Polar Prediction and High-Impact Weather (HIW) Projects. (The Sub-seasonal to Seasonal Project is establishing an archive of longer-range ensemble predictions, based on the TIGGE data formats and protocols). Once the projects are established, we will consider adding extra parameters to the TIGGE archive. We will also review the usage of existing TIGGE parameters.

We should consider the future name of TIGGE, after the end of THORPEX. While it would be helpful to continue with the TIGGE “brand”, we could change the reference to THORPEX, and perhaps also to its originally-envisaged “interactive” nature. We suggest keeping the

acronym “TIGGE” even if changing the name (to, e.g., “The International Grand Global Ensemble”).

6. TIGGE-LAM

To complement the global focus of the GIFS-TIGGE WG, a TIGGE-LAM expert panel was established to focus on regional ensemble forecasting. The panel facilitates the interoperability of the different regional modelling systems contributing and coordinates the archiving of limited-area ensemble forecasts. The TIGGE-LAM group has established a strong working relationship with the WWRP/MWFR (Mesoscale Weather Forecasting Research) group, but also maintains strong technical and scientific links with the GIFS-TIGGE working group. The original plans for TIGGE-LAM envisaged archiving data from largely overlapping regional models with grid scale of 10+ km. With the recent introduction of convection-permitting (1-3 km) ensembles by several national met services, TIGGE-LAM is now focusing on those higher-resolution systems (but with little, if any, overlap between different model domains).

In 2007, the panel proposed that the three TIGGE archive centres host a sub-set of high priority TIGGE-LAM data. With funding from the EU GEOWOW project, ECMWF is now starting to archive European TIGGE-LAM data. At the time of writing, data is being archived from COSMO-LEPS and ALADIN LAEF, and it is expected that data from about 10 systems will be being archived, and available for use, by the end of the GEOWOW project in August 2014. However, there are currently no firm plans for archives of TIGGE-LAM output for regions outside Europe.

In addition to the current focus on routine archiving of high-resolution operational ensembles, it would also be very valuable to set up archives of high resolution ensemble prediction data in conjunction with future RDPs and FDPs (for example the FROST 2014 campaign linked with the Sochi winter Olympics), including WMO-endorsed projects outside Europe. This standardized archiving platform would facilitate the use of these research datasets by a wider scientific community and would set archiving standards for future projects.

With the completion of THORPEX at the end of 2014, it is an opportune time to consider the future organisation of TIGGE-LAM. We recognise that it is important for the TIGGE-LAM dataset to address the requirements of future projects. It may be most appropriate for the HIW project team to provide scientific direction of the TIGGE-LAM dataset, since that project will have a particular focus on high resolution predictions. The name “TIGGE-LAM” might also be changed to reflect a link with the HIW project.

7. Proposed Predictability Dynamics & Ensemble Forecasting Expert Team

Following initial discussion at the ICSC10 meeting, we are proposing that a Predictability, Dynamics and Ensemble Forecasting expert team be constituted as part of the future core WWRP programme. The proposed expert team would provide a centre of expertise on predictability, dynamical processes and ensemble forecasting in support of WWRP projects. It would combine most of the scope of the current PDP working group, with the scientific role of the GIFS-TIGGE working group. A paper on the proposed expert team has been prepared by the co-chairs of the GIFS-TIGGE and PDP working groups, and is tabled for discussion at the ICSC11 meeting.

References

Matsueda, M. and T. Nakazawa (2013): ‘Early warning products for extreme weather events derived from operational medium-range ensemble forecasts’, submitted to *Meteorological Applications*

Annex A: Proposed GIFS-TIGGE WG membership, for endorsement by ICSC

Richard Swinbank, co-chair,	Met Office, UK
Masayuki Kyouda, co-chair	JMA, Japan
Philippe Arbogast	Météo-France, France
Jiandong Gong	CMA, China
Seung-Woo Lee	KMA, Korea
Osvaldo Moraes	CPTEC, Brazil
Michael Naughton	BoM, Australia
Tiziana Paccagnella	ARPA-SIM, Italy
David Richardson	ECMWF, UK
Doug Schuster	NCAR, USA
<i>(To be nominated)</i>	EC, Canada
Yuejian Zhu	NOAA/NCEP, USA

Laurie Wilson (EC, Canada) stood down from the group after the 11th meeting, and is due to be replaced.

Annex B: Actions from 10th meeting of GIFS-TIGGE WG

Permanent Actions

Action P.1: All **archive centres** to update statistics on TIGGE data users on an annual basis (end of each year), using similar statistics for users, active users, etc. Doug Schuster to coordinate.

Action P.2: **Yuejian Zhu** to carry out literature search for papers based on TIGGE data on an annual basis (end of each year), and summarise results. Archive centres to ask users to inform them when TIGGE papers are written, to enable the list of TIGGE publications to be kept up to date.

Action P.3: All **data providers** to provide model descriptions in agreed Excel format and to update the files after significant changes and send to ECMWF.

Action P.4: **Co-chairs** to request reports before each WG meeting on all actions, plus relevant progress reports.

Action P.5: **Working Group members** to consider adding to training material on the TIGGE data portals, including data access and manipulation examples, to help potential users of the TIGGE archive.

Actions carried over from GIFS-TIGGE 10

Action 10.6.3: The Working Group encourages **providing centres** to include information on forming tropical storms in CXML messages (initially using location / time as identification and subsequently discuss a naming convention).

Action 10.7.1: **Christopher Cunningham** to consult with **Tiziana Paccagnella** to ensure transfer of benefits from the TIGGE-LAM work to the La Plata Basin Project

Actions from GIFS-TIGGE 11

Action 11.3.1: **Yuejian Zhu** to inform ECMWF of the name of technical contacts at NCEP and NCDC to liaise over the practicalities of providing the NCEP data to the ECMWF archive centre, by end of July 2013.

Action 11.3.2: **WMO secretariat** to send a formal letter to NCDC by end of July 2013, to convey appreciation of their work and to request continuation of the provision of NCEP data to the TIGGE archive after the end of THORPEX.

Actions 11.3.3: The working group requests **Christopher Cunningham** and **Yuejian Zhu** to ensure that missing data from CPTEC and NCEP is minimised by liaising with contact points to respond to requests from archive centres to fill any gaps.

Action 11.3.4: **Archive centres** are requested to investigate which types of TIGGE data are most widely used.

Action 11.3.5: **JMA** and **CMA** are requested to consider extending CXML tropical cyclone forecast data to all ocean basins.

Action 11.3.6: **WMO secretariat**, in consultation with the **co-chairs**, to prepare letter(s) to archive centres by October 2013, with the aim of confirming their plans regarding the future of TIGGE in the post-THORPEX era.

Action 11.3.7: **WMO secretariat**, in consultation with **co-chairs**, to prepare a letter to current data providers by October 2013 enquiring about their willingness to continue to provide data to the TIGGE archive in the post-THORPEX era.

Action 11.3.8: **Craig Bishop** to approach Fleet Numerical (NRL) to sound out their willingness to provide data to the TIGGE archive in the future.

Action 11.3.9: **Working Group members** to consider & clarify the future of the TIGGE-LAM panel after THORPEX and make recommendations to ICSC before EC-66.

Decision: Members of the GIFS-TIGGE working group agreed in principle to the proposed merger of the current GIFS-TIGGE WG with PDP WG as outlined in the paper by the co-chairs of the two working groups.

Action 11.4.1: Co-chairs of both GIFS-TIGGE and PDP working groups to amend the paper on the proposed merger of GIFS-TIGGE and PDP groups and then submit it to the two working groups and table it for discussion at ICSC-11, in preparation for discussion by CAS.

Action 11.4.2: Co-chairs of both GIFS-TIGGE and PDP working groups to consider the advantages of convening a joint working group meeting early in 2014 to consider scientific priorities of the proposed merged group.

Action 11.4.3: Working group members to consider how TIGGE and TIGGE-LAM should best support and contribute to the proposed High-Impact Weather project.

Action 11.6.1: Co-chairs & other co-authors to prepare a draft TIGGE review paper within the next 6 months with intention of publishing it in BAMS.