

WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR ATMOSPHERIC SCIENCES

**INTERNATIONAL CORE STEERING COMMITTEE
FOR THORPEX
Fifth Session**

Melbourne, Australia
30 November – 2 December 2005

CAS/ICSC-5/Doc.2.2.1
(17. XI. 2005)

Item: 2.2.1

Original: ENGLISH

GIFS-TIGGE DEVELOPMENTS

(Submitted by Philippe Bougeault (co-chair of the GIFS-TIGGE WG))

Summary and purpose of the document

Report from the first meeting of the GIFS-TIGGE Working Group

Decision/Actions required

For information and decision on formal approach to be taken to establish the TIGGE Data Bases

Financial Summary

None

Reference

None

CHAIRMAN'S REPORT ON THE FIRST MEETING OF THE GIFFS-TIGGE WORKING GROUP

(NCAR, Boulder, Colorado- 15-16 November 2005)

The First Session of the GIFFS-TIGGE Working Group took place at the National Centre for Atmospheric Research (NCAR), Boulder Colorado (15-16 November 2005). The Agenda for the session and a list of participants is attached in appendices A and B.

This report is concentrated on the following topics.

- Establishment of the TIGGE Data Bases
- The relationship between THORPEX and NAEFS
- The links between the GIFFS-TIGGE Working Group and other THORPEX WGs
- The establishment of cooperation with the WCRP Task Force on Seasonal Prediction (TFSP)

A full report of the session will appear in due course.

1. Establishment of the TIGGE Data Bases

1.1 Background

TIGGE, the THORPEX Interactive Grand Global Ensemble, is a key component of the WMO's THORPEX World Weather Research Programme to accelerate the improvements in the accuracy of 1-day to 2-week high-impact weather forecasts.

The first TIGGE workshop was held on 1-3 March 2005 in the ECMWF. Sixty scientists, from international organizations, national and regional meteorological and hydrological services, universities and private companies, attended the workshop. The workshop discussed the scientific aims, user requirements and infrastructure for TIGGE data bases and Centres. The report of the workshop has been posted on the WMO website and has been published in the WMO series WMO/TD-No. 1273 WWRP/THORPEX No. 5. Three centres (CMA, ECMWF and NCAR) have indicated willingness to become TIGGE Data Centres.

The key objectives of TIGGE are:

- Enhanced international collaboration between operational centres and universities on the development of ensemble prediction
- Development of new methods of combining ensembles of predictions from different sources and of correcting for systematic errors (biases, spread over-/under-estimation)
- Increased understanding of the contribution of observation, initial and model uncertainties to forecast error
- Increased understanding of the feasibility of employing, operationally, an interactive ensemble system which responds dynamically to changing uncertainty (including the use of adaptive observing, variable ensemble size, on-demand regional ensembles) and which exploits new technology for grid computing and high-speed data transfer

- Evaluation of the elements required of a TIGGE Prediction Centre to produce ensemble-based predictions of high-impact weather, wherever it occurs, on all predictable time ranges
- Development of a prototype future Global Interactive Forecasting System

To achieve TIGGE's key objectives, it is necessary to:

- Determine the user requirements for TIGGE data, including the types, volumes, format of data, access methods and timeliness
- Design the TIGGE infrastructure to meet these requirements
- Determine resource requirements and secure necessary funding if required
- Establish commitments from data contributors, TIGGE archive centres and prospective users
- Implement proposed infrastructure, collecting, archiving, and providing access to TIGGE data
- Develop and maintain close links with TIGGE users, including other THORPEX sub-programmes, field campaigns and Demonstration Projects, as well as other partners
- Have the flexibility to respond to evolving user needs as scientific understanding increases during the project

Data sharing between TIGGE users:

- Ensemble forecasts generated routinely (often operationally) at different centres around the world - the core data of the TIGGE archive; initially, the total daily data volume is expected to be around 200GB
- Observational data and existing datasets including re-analyses and re-forecasts
- Additional special datasets generated for specific research projects and applications

Data policy:

- TIGGE data should be available to all users for research purposes
- Consideration needs to be given to the issue of real-time access to data, in particular for demonstration projects and field experiments
- The process of obtaining approval for data access should be transparent, streamlined and reasonably fast
- The user interface for access to the central archives should be user-friendly and should make it as easy as possible for researchers in disciplines not used to dealing with exceptionally high data volumes to obtain subsets of data
- Open-source sharing of post-processing software (calibration, combination, decision-making) should be promoted in order to maximise benefit for both researchers and end-users

TIGGE should provide real-time support for:

- International Polar Year field campaigns in 2007-2008
- Beijing 2008 Olympics WWRP Research and Development project
- Regional and global experiments on the enhanced disaster management systems, including those initiated in the framework of Multi-Hazard Strategy
- Other major campaigns – users of TIGGE, which should be yet identified

The TIGGE infrastructure will be developed in two phases:

- **Phase-1** - during which data are collected in near-real time (via internet ftp) at a small number of central TIGGE data archives; this can be implemented now at little cost and could handle the estimated 200 GB per day data volumes with current network and storage capabilities
- **Phase-2** - during which data archives are distributed over a number of repositories, instead of all being held centrally, but efficient and transparent access to users is maintained; this is a more flexible solution with the potential to eliminate routine transfers of large data volumes; however, this will require substantial software development over a number of years, in coordination with the WMO Information System, and will require additional funding

In 2005:

- Development of Phase-1
- Secure commitment from institutions willing (currently there are offers from CMA, ECMWF and NCAR) to act as central data archives for TIGGE's Phase-1 and from initial contributors to the TIGGE database
- Agreement on data exchange protocols and data formats
- Finalise a first list of datasets and parameters to store in the TIGGE archive and provide access
- Help and encourage contributing centres to begin development to provide data in agreed formats
- Address data access policy, including consideration of requirements for real-time access, particularly for field campaigns and demonstration projects
- Consider the strategy required to initiate work on Phase-2 of TIGGE, including funding and resources
- Work within THORPEX and with external partners to develop detailed planning for the first real-time demonstrations using the TIGGE infrastructure (including evaluation of potential use during the IPY and the Beijing Olympics)

In 2006:

- TIGGE data centres will begin collecting available data in near-real time
- Links will be available to other established data archives
- Link with the North American Ensemble Forecast System (NAEFS), which is planned to become fully operational by March 2006
- Research access will be available to TIGGE data (through the existing access infrastructure of the archive centres)
- Work will begin on Phase 2 software developments (once required funding is secured)

1.2 Content of the TIGGE Data Archives and Data exchange procedures

Technical meetings for the representatives of potential TIGGE Data Centres and for Providers of global ensemble data were held at ECMWF during the autumn and reports from these meetings were reviewed during the first session of the GIFS-TIGGE WG.

The following tables contain the lists, as agreed by the working group, of variables to be archived in the common TIGGE database. The proposed content encompasses basically all variables identified for ensemble exchange between MSC and NCEP, that in NAEFS. Entries that are highlighted are additional to those proposed in the report of the first TIGGE workshop. The format and the exchange procedures were also agreed by the WG.

Surface Fields

Parameter	Output frequency	Accum
Mean sea level pressure	6h	Inst
Surface Pressure	6h	Inst
10m U-velocity	6h	Inst
10m V-velocity	6h	Inst
Surface air temperature	6h	Inst
Surface air dew point temperature	6h	Inst
Surface air max temperature	6h	det_lo
Surface air min temperature	6h	det_lo
Total precipitation (liquid+frozen)	6h	acc_st
Snow fall	6h	acc_st
Snow depth	6h	Inst
Total cloud cover	6h	Inst
Total column water	6h	inst
Surface latent heat flux	6h	acc_st
Surface sensible heat flux	6h	acc_st
Surface solar radiation	6h	acc_st
Surface thermal radiation	6h	acc_st
Sunshine duration	6h	acc_st
Convective available potential energy	6h	inst
Sea surface temperature		
Soil moisture		
Soil temperature		
Outgoing Long wave radiation		
Convective Inhibition		
Single level PV field		
Orography (Geopotential at the surface)		
Land-sea mask		

inst: instantaneous output; det_lo: determined over period from last output time to current output time; acc_st: accumulated over period from start of forecast to current output time (or alternatively accumulated from last output time to current output time; to be decided)

Upper air fields

It is proposed to archive 5 parameters on 9 pressure levels, i.e. 45 fields.

Parameter	Output frequ.	Comments
Temperature	6h	Inst
Geopotential	6h	Inst
U-velocity	6h	Inst
V-velocity	6h	Inst
Specific Humidity	6h	Inst

at levels 1000, 925, 850, 700, 600, 500, 300, 250, 200 hPa.

1.3 Potential Data Providers of operational Global Data

Representatives from a number of forecasting centres attended the March workshop and the first session of the Working Group and expressed interest in providing global data to the TIGGE archives. The table below summarizes these expressions of interest. It does not constitute a commitment of these centres, nor does it constitute a full survey of the potential providers of global data.

Centre	Informal commitment made at first session of the Working Group
BMRC	Not present
CPTEC	Yes
UKMO	Yes
Meteo-France	Not present
MS Canada	Yes
KMA	Yes
ECMWF	Yes
CMA	Not present
NCEP	Yes
JMA	Yes
FNMOG	Yes

1.4 Data Archiving Centres

Three centres, CMA, ECMWF and NCAR, have offered to provide central data archives for TIGGE's Phase-1 and all three centres have been actively involved with many of the Data Providers in developing the technical plans for the implementation of the project. In addition to providing archive services, the ECMWF has offered to maintain the TIGGE web site and NCAR has offered to hold and update the Meta Data describing the content of the archive.

1.5 Usage

The TIGGE data will be used to support a wide variety of research and development:

- Verification studies
- Predictability Research
- Creation of probabilistic forecast products
- Support for demonstration projects

The WG reviewed the potential usage of the TIGGE data base and came to the conclusion that many data requests will concern time series at single geographical points, or retrieval of a single-parameter field on a limited-area, latitude-longitude grid. The archive centres will organize the data archive in such a way that such simple requests can be handled with maximum efficiency.

Concerning verification, it was agreed that the Joint Working Group on Verifications (under WGN and WWRP) will be asked to serve as a resource group to issue guidance for the verification of TIGGE products. Many results will be displayed on the Internet Site maintained by JMA as a contribution to the activities of the ET-EPS of the CBS. In addition to operational ensemble forecasts, it is expected that specific numerical experiments will be proposed by the THORPEX scientific community for limited periods. The TIGGE data bases will be used to archive and distribute results from these experiments.

1.6 Data Policy and access arrangements

It is proposed that Data Providers supply their products to the Archive Centres under an agreed set of rules, which will include re-distribution rights. Access to the archives will be provided for Research and Education through a simple electronic registration process which will check for valid e-mail addresses and secure an acknowledgment of that the data will be used for research purposes only. Archive Centres will be asked to maintain a record of registered users.

Under the simple registration process, access to archived data will be given with a delay of 48 hours after initial time of the forecast (defined as the reference time of data in GRIB2).

It is also anticipated that when the archives are “up and running”, real time support will be required for a number of THORPEX projects. Such requests for access in real-time will be handled by the THORPEX IPO.

1.7 Action required of the ICSC

It is requested that the ICSC adopt the Data Policy and access arrangements set out in section 1.6 above and instruct the Manager of the IPO to:

- seek formal agreement from CMA, ECMWF and NCAR to act as TIGGE Data Centres
- obtain commitments from Data Providers

It is assumed that such agreements and commitments will be obtained by the office of the Secretary General of WMO.

2. Relationship between NAEFS & THORPEX

Coordination with NAEFS has been discussed at all TIGGE meetings. The NAEFS will provide operational products based on ensemble forecasts from NCEP, CMC, and possibly other forecasting centres in the future. NAEFS products will not be archived for external access. The formats and the list of fields agreed for the TIGGE data bases are very close to the fields exchanged under the NAEFS. There is a general feeling that NAEFS and TIGGE are fully complementary and that the liaison between the two projects is satisfactory.

3. Links between the GIFS-TIGGE Working Group and other THORPEX Working Groups

Representatives from the PDP, DAOS, OS, and SEA WGs attended the GIFS-TIGGE WG meeting and presented the status of the work in their respective WGs. The GIFS-TIGGE WG appointed one of its members (Dr. Mark Roulston) as a liaison with the SEA WG. Further links will be established during the "kick-off" workshop to be held in March 2006.

4. Links between THORPEX and the WCRP Task Force on Seasonal Prediction

A representative from the GIFS-TIGGE WG attended the initial workshop of the WCRP Task Force on Seasonal Prediction (TFSP), and presented the TIGGE project. Commonalities between TIGGE and the emerging project for coordinated experimentation in seasonal forecasting under the TFSP were stressed, and the TFSP invited TIGGE to appoint a member as permanent liaison. Dr. Pedro Silva Dias has accepted to take this duty.

5. TIGGE Phase 2

The objective of Phase 2 of TIGGE will be to continue the same archiving and distribution service as in Phase 1, involving databases distributed in a larger number of centres, with transparent access for all users. Phase 2 was discussed at the meeting, and a number of data providers expressed interest in developing an archive and distribution service for TIGGE under Phase 2. Some partners also declared their interest in providing a regional distribution service for subsets of data covering certain geographical areas. It was generally agreed that Phase 2 will require new software tools, the development of which will require specific funding. The partners of the TIGGE project will explore a number of possibilities to secure this necessary funding.

6. GIFS development

Finally the WG discussed possible steps towards the GIFS. The provision of TIGGE data to field experiments on adaptive observations was considered a powerful way to progress towards the objectives of the GIFS, in order to further develop targeting techniques. Phase 2 of TIGGE will enable more rapid distribution of the ensemble forecasts, which may evolve towards real-time distribution at a later stage, and is also a notable step towards the GIFS. Finally the importance of defining standard formats for limited-area ensemble forecasts was noted, together with the opportunity offered by the WWRP projects Beijing08 and MAP D-Phase to implement rapidly these formats. It was agreed that the WG will work in this direction in 2006.

Appendix 1

WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR ATMOSPHERIC SCIENCES

**THORPEX ICSC
GIFS-TIGGE Working Group
First Meeting**

Mesa site, NCAR, Boulder, USA
15-16 November 2005

CAS/THORPEX ICSC
GIFS-TIGGE-01/
Doc.1.2 (1)_rev1
(4.XI.2005)

Item: 1.2

Original: ENGLISH

PROVISIONAL AGENDA AND TIMETABLE

Tuesday 15 November

08.30 Continental Breakfast

09.00 – 12.45 Sessions 1 and 2

1. ORGANISATION OF THE MEETING

- 1.1. Opening of the meeting
- 1.2. Adoption of the agenda
- 1.3. Working arrangements for the meeting

2. REPORT BY THE DIRECTOR OF THE IPO (DB)

3. REPORT FROM THE TECHNICAL MEETINGS (PB)

14.00 – 17.30 Sessions 3 & 4

4. CONTENT OF THE FIRST TIGGE DATA BASE – PHASE 1 (PB)

5. COMMITMENTS – TO THE TIGGE DATA BASES (General discussion)

6. NAEFS (ZT)

18.00 - Reception

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Wednesday 16 November

08.30 Continental Breakfast

09.00 – 12.45 sessions 5 & 6

7. VERIFICATION (BB)

8. DATA POLICY AND ACCESS ARRANGEMENTS (General discussion)

9. USER INTERFACE AND PRIORITIES (TH)
 10. REQUIREMENTS (General discussion)
 - 10.1. RESEARCH PROJECTS
 - 10.2. DEMONSTRATION PROJECTS
 - 10.3. Most Likely Usage
 11. THORPEX AND COPEX (DB & MS)
 - 11.1. Report from the Trieste meeting on seasonal forecasting (PB)
 12. PHASE 2 OF TIGGE
- 14.00 – 17.30 sessions 7 & 8**
13. DEVELOPING GIFS
 14. REPORT TO THE ICSC V MEETING IN MELBOURNE (PB & DB)
 15. MEETINGS
 16. ANY OTHER BUSINESS
 17. REVIEW OF DECISIONS AND ACTIONS
 18. THE NEXT MEETING

Appendix 2

List of Participants

Working Group Members

Philippe Bougeault
 Laurie Wilson
 Waren Tennant
 Richard Swinbank
 Zoltan Toth
 Martin Ehrendorfer
 Mark Roulston
 Pedro Silva Dias
 Hee-Dong Yoo
 Yoshiaki Takeuchi
 Barbara Brown
 Tom Hamill

THORPEX IPO

David Burridge

Observers

Craig Bishop	PDP WG
Rolf Langland	DAOS WG
David Parsons	NARC
Steve Worley	NCAR
Mohan Ramamurti	DPM WG
Walter Dabbert	OS WG
Mel Shapiro	SAB
Jeff Lazo	SEA WG
Jim Purdom	OS WG