



CGMS-36, WMO-WP-06
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Prepared by WMO
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UPDATE ON THORPEX: A WORLD WEATHER RESEARCH PROGRAMME

WMO WP-06 informs CGMS Members of activities and plans for THORPEX, with particular focus on major science activities related to remote sensing, on activities of the THORPEX Observing Systems Working Group and on its merging with the Data Assimilation and Observing Strategies Working Groups resulting in a new working group: the Data Assimilation and Observing Systems Working Group.

It reaffirms the importance of CGMS satellite operators' active participation in both the planning and execution of THORPEX, through active focal points.

CGMS Members are informed that the CGMS Rapporteur to THORPEX is retiring and that a new Rapporteur needs to be appointed.

Actions: CGMS Members are invited:

To note the report and comment as appropriate;

To actively participate in THORPEX field programmes and become engaged in the planning and execution of those programmes;

To confirm their agencies representatives for satellite issues to THORPEX (see Table 1 of Annex 1) in order to ensure their active participation in THORPEX activities;

To appoint a new CGMS Rapporteur to THORPEX.

Reference: Detailed information on THORPEX, including its structure, committees, field projects and activities may be accessed via internet at:

http://www.wmo.int/pages/prog/arep/wwrp/new/thorpex_new.html

Portions of the text in the document below are extracted from that web site.

UPDATE ON THORPEX: A WORLD WEATHER RESEARCH PROGRAMME

1 BACKGROUND

THORPEX was established in May 2003 by the Fourteenth World Meteorological Congress (Resolution 12) as a ten-year international global atmospheric research and development programme.

At CGMS-32, CGMS Members were informed about the status and activities of the THORPEX and sought CGMS involvement in THORPEX. CGMS Members requested representation in observer status on the THORPEX ICSC.

At CGMS-33, CGMS nominated Dr James Purdom as CGMS Rapporteur to THORPEX.

At CGMS-34, CGMS Members identified focal points within their agencies for THORPEX related satellite issues. CGMS was also informed of plans for the various THORPEX Regional Experiments and of THORPEX partnerships; it was reminded of the importance of THORPEX to satellite related activities and the need to assure their participation in THORPEX planning for future Regional Plans' campaigns and experiments.

At CGMS-35, CGMS Members were informed of activities and plans for THORPEX, with particular focus on major science activities related to remote sensing, activities of the THORPEX Observing Systems Working Group and the Data Assimilation and Observing Strategies Working Groups. CGMS Members were requested to confirm with the CGMS Rapporteur to THORPEX their agencies representatives for satellite issues to THORPEX in order to ensure their active participation in THORPEX activities. This was done as requested.

2 DISCUSSION

2.1 THORPEX and CGMS: THORPEX is a very important activity that will influence the evolution of the space-based and surface components of the GOS by providing a sound scientific basis for assuring its optimal use for a variety of application areas, but particularly NWP in the 1 to 14-day forecast time frame.

Since satellite data are so intrinsically linked to the success of NWP forecasts on the 1 to 14-day time frame, and since THORPEX is focused on increasing forecast skill on those time frames, THORPEX and its ultimate success are exceptionally important to the evolution of the space based portion of the GOS (surface based too).

THORPEX, an element of the WMO World Weather Research Programme, is a major contribution to the WMO Natural Disaster Reduction and Mitigation Programme. Under the auspices of THORPEX, regional and global projects and experiments will be carried out to:

- (1) Improve forecast skill by advancing the knowledge of global-to-regional influences on the initiation, evolution and predictability of weather systems;
- (2) Target satellite and in situ observations to design the strategy for interactive forecasting and observation, thus contributing to the evolution of the WMO Global Observing System (GOS), a core component of the Global Earth Observation System of Systems (GEOSS);
- (3) Create and evaluate systems for the assimilation of targeted observations from satellites and in situ measurements;
- (4) Accelerate improvements in the accuracy of numerical weather prediction, probabilistic forecasting and the description of uncertainty in initial conditions;
- (5) Test and demonstrate the effectiveness of a global multinational multi-model multi-analysis ensemble forecasting system;
- (6) Demonstrate societal and economic benefits of improved forecasts, by improving decision-support tools, which utilize advanced forecasting products to benefit directly social and economic sectors;

2.2 THORPEX Working Groups: A mini-workshop followed by parallel meetings of the Working Groups (WGs) took place the week of the 22 to 26 September 2008 in the WMO Headquarters in Geneva. Two WGs of primary interest to THORPEX, the Observing Systems WG (OSWG) and Data Assimilation and Observing Strategies Working Group (DAOS WG) were combined into a single WG named the Data Assimilation and Observing Systems WG, thus carrying forward the acronym DAOS but with a slight change in name.

2.2.1 Final meeting of OSWG: The following items relevant to CGMS were discussed at the final OSWG meeting and presented in plenary at the mini-workshop.

Issues brought forth on behalf of CGMS included:

- The need for a greater optimization of the LEO and GEO missions to support the space-based component of the GOS and its overall configuration.
 - THORPEX can be of service here for global and regional scale applications by studying various methods to assimilate high spatial and temporal resolution satellite data.
 - Because of the strong influence of the background field in NWP models, THORPEX must show how to target (i.e. extract higher resolution information) today's "thinned" satellite regions so that the maximum information can be infused into the background field.
- The need to understand that the space-based component of the GOS will evolve differently than in the past.
 - THORPEX can provide valuable information to guide that evolution.

Concerning satellites:

- The latest status of current and planned satellites contributing to the GOS is summarized on the CGMS web pages that are maintained by WMO (<http://cgms.wmo.int/>), with hyperlinks to the websites of the relevant satellite operators. Detailed information on instrument characteristics is available on

the WMO Space Programme web pages (http://www.wmo.int/pages/prog/sat/Instruments_and_missions/Instruments.html).

- Workshop on the Re-design and Optimization of the Space-based Global Observing System final report found at: <http://www.wmo.int/pages/prog/sat/documents/OPT-2FINAL-Report.pdf>.
- CGMS THORPEX focal points have been designated by each CGMS satellite operator.

The activities of the WMO CBS OPAG-IOS relevant to THORPEX were discussed in the context of the recent OPAG-IOS Implementation Team Coordination Meeting. Of particular note was the draft report "Vision for the GOS to 2025". It was pointed out that this vision provides high-level goals to guide the evolution of the Global Observing System in the coming decades. After intensive discussions it was clear that many of the activities of the OPAG-IOS covered the activities of the OSWG. It was decided that the needs of THORPEX could be best served with respect to observing systems if the OPAG-IOS became more closely linked with THORPEX and the OSWG was combined with the THORPEX DAOS and their terms of reference redefined. It was also felt that the OPAG-IOS interaction would best be focused through this revised WG. Since James Purdom is retiring from the OSWG it was suggested that he be replaced by Chris Velden, UW CIMSS, on the new DAOS WG. Thus the composition of the DAOS with Observing Systems expertise would be:

- Roger Saunders as Co-Chair reconstituted DAOS;
- Chris Velden as Satellite Expert;
- Tom Keenan as Radar Expert;
- Tetsuo Nakazawa as Field Campaign Observations Expert;
- TBD in-situ and New Technology Expert;
- Chair OPAG-IOS or representative as Rapporteur to DAOS.

2.2.2 New DAOS Working Group:

Summary of mission and strategy:

The DAOS WG ensures that THORPEX contributes to the optimization of the use of the current WMO Global Observing System. It contributes to the development of a well-founded strategy for the evolution of the GOS to support NWP (primarily 1-14 days).

The WG addresses issues in data assimilation and improved understanding of the sources and growth of errors in analyses and forecasts. It promotes research activities that lead to a better use of observations and the understanding of their value. It provides input and guidance for THORPEX regional campaigns for the deployment of observations to achieve their objectives. This will be done in collaboration with the CBS OPAG-IOS.

DAOS activities for the next 2 to 4 years

The WG will engage in field experiments and provide guidance on observational and data assimilation issues. Initial advice is the following:

- Observation campaigns should be designed with science plans that take into consideration assimilation issues;

- Decision to undertake observation campaigns would benefit from pre-project evaluation of expected value (e.g., using 'calibrated' OSSEs or OSEs);
- Regional (vs highly localized) and systematic targeting during low predictability flow regimes on a continuous basis (periods of days to weeks) should be explored;
- Adaptive processing and data selection of satellite data should also be explored.

The WG will engage in a review of the results from the Winter Storm Reconnaissance 2001-2008 as a guide for future planning.

The additional in situ data deployed during AMMA are used operationally by NWP centres and it is very important to keep in situ data to help improve forecasting systems. In support of the African regional plan, the WG encourages investigation of the impact of radiosonde and AMDAR data over Africa.

In the context of the International Polar Year, the WG will coordinate the work on satellite data assimilation over the polar regions and investigate the impact of better use of satellite data and of in situ observations.

For the summer phase of T-PARC, the WG will review data impact results. CAWCR and NRL have expressed an interest in performing re-analysis and evaluation of the impact of the observations (OSEs and Sensitivity experiments at NRL). ECMWF/DLR, GMAO and Environment Canada will test the impact of wind lidar observations.

For the winter phase of T-PARC, the WG will extend the observation impact intercomparison and will review the results of centres (NRL, Environment Canada, GMAO) which will evaluate the impact of observations. It supports the testing of the impact of enhanced Russian radiosonde network on operational data assimilation systems to determine the value of maintaining the extended network. The use of alternative satellite data sets that are not available operationally (e.g. BOM and CIMSS Atmospheric Motion Vectors) will be considered.

It encourages developments to optimize the deployment and usage of existing operational in situ observing systems. It also supports the use of well-calibrated OSSEs to evaluate the impact of new instruments.

The WG will exchange ideas and results on the assessment of model error using ensembles.

It will investigate fundamental issues such as the use of flow-dependent structure functions, the evaluation of the downscale impact of global scale improvements on the mesoscale and issues on coupled data assimilation and new data sets associated with it.

2.3 Regional Activities

Regional THORPEX Committees coordinate activities of regional groups of nations. Currently, there are Regional Committees and Regional Plans for North America (2002), Asia (2003), Europe (2003) and the Southern Hemisphere (2006). An African plan is under development. The most recent progress reports from the Regional Committees may be found on www.wmo.int/pages/prog/arep/thorpex/7_ec_meeting.html. All the Regional Committees are involved in overseeing and contributing to the management of research activities, including societal research on the applications of weather forecasts, and in efforts to implement mature techniques into operational practice. A great deal of the work on regional data assimilation strategies and the deployment of targeted observations is now carried out under the auspices of THORPEX.

The four established Regional Committees are making contributions to the work to build and maintain the THORPEX Interactive Grand Global Ensemble (TIGGE) database, to the planning of the Year of Tropical Convection (YOTC) campaign, and the three northern hemisphere regions have made major commitments to the TPARC observation field campaign which is being undertaken in two phases (1 August - 6 October 2008 and January-March 2009).

2.4. Major international projects and campaigns

2.4.1 TIGGE: The THORPEX Interactive Grand Global Ensemble (TIGGE) is a key component of THORPEX. A key goal of WWRP-THORPEX is to accelerate improvements in the accuracy of one-day to two-week high-impact weather forecasts. The highest priority data accumulated in the TIGGE archive are the ensemble forecasts generated routinely (operationally) at major forecast centres around the world.

2.4.2 THORPEX Pacific Asian Regional Campaign (TPARC) 2008: The TPARC observation field campaign is being undertaken in two phases: summer (1 August - 6 October 2008) and winter (January-March 2009).

The field campaigns for this summer/autumn phase of TPARC will provide monitoring and evaluation of initial tropical convection cloud clusters through to genesis, further development, structure change, re-curvedure, track prediction and land-fall, extra-tropical transition. If successful this would represent the most comprehensive overall studies of the evolution of individual systems ever achieved. TPARC provides a great opportunity to achieve major breakthroughs in understanding and predictability of tropical convection and the various phases of typhoon development and movement in the western Pacific Ocean. Satellite data will form a major part of the observational data base, especially the rapid scan data from the Japanese MTSAT series.

Winter TPARC is focused on the science theme of advancing knowledge of the evolution of perturbations from the tropics, Asia and the polar front as they travel through the waveguide(s) and subsequently initiate high-impact weather over the Arctic and North America. The experiment will conduct adaptive measurements and data impact studies aimed at making recommendations on the future of the global observation system.

2.4.3 European TReC (ETReC): The ETReC 2007 campaign took place over five weeks in July 2007, in conjunction with the meso-scale experiment COPS and the MAP D-PHASE forecast demonstration project. Sensitive regions were calculated daily at Météo-France, ECMWF and the Universitat de les Illes Balears (Spain). Special observations were made for seven events.

2.4.4 The Year of Tropical Convection (YOTC): The realistic representation of tropical convection in our global atmospheric models is a long-standing grand challenge for numerical weather prediction and climate projection. To address this challenge, WCRP and WWRP/THORPEX propose a year of coordinated observing, modelling and forecasting of organized tropical convection and its influences on predictability. There is a separate paper on YOTC presented at CGMS-36.

2.4.5 The IPY-THORPEX project cluster: The IPY-THORPEX project cluster currently includes 10 individual IPY projects from nine countries with the following main objectives:

- (1) Explore the use of satellite data and optimized observations to improve high-impact weather forecasts (for Polar THORPEX Regional Campaigns (TReCs) and/or provide additional observations in real-time over the WMO Global Telecommunication System;
- (2) Better understand physical/ dynamical processes in Polar Regions;
- (3) Achieve a better understanding of small -scale weather phenomena;
- (4) Utilize improved forecasts to the benefit of society, the economy and the environment;
- (5) Utilize the THORPEX Interactive Grand Global Ensemble (TIGGE) of weather forecasts for polar prediction.

IPY-THORPEX is supported by EUCOS and ECMWF, which will provide targeted runs and assimilate observations from field campaigns. Activities are mainly focused on the Arctic region. CONCORDIASI, however, has its focus on the Antarctic and one of its aims is to validate and improve the assimilation of Atmospheric Infrared Sounder/IASI satellite data in numerical models with emphasis on polar latitudes. Other important issues that will be investigated in IPY-THORPEX are the role of Greenland in terms of flow distortion and its effect on local and middle-latitude weather prediction, as well as the thermohaline circulation in the ocean; comparison of Arctic regional climate models; exploration of the use of satellite data and optimized observations to improve high-impact weather forecasts and improve understanding of physical/dynamical processes in polar regions with emphasis on small-scale weather phenomena.

Projects span a number of scientific issues from climate research to weather prediction. In brief they comprise:

The Greenland flow Distortion Experiment - The focus is upon Greenland tip jets, air-sea interactions, barrier winds and meso-scale cyclones; the field campaign took place in February 2007.

Storm Studies of the Arctic - Includes enhanced observations in the eastern Canadian Arctic, gap flow, air-sea interactions, orographic precipitation, interaction of cyclones with topography etc.

Concordiasi - Infrared Atmospheric Sounding Interferometer (IASI) assimilation in the Antarctic, assimilation of dropsondes launched from driftsondes, polar processes, the circumpolar vortex, using IASI data for climate monitoring, stable boundary layers, polar clouds and ozone, etc.

Norwegian IPY-THORPEX - Optimization of new satellite data, improved modelling of the latent heat cycle, extreme weather, improved operational NWP, ensemble simulations.

THORPEX Arctic Weather and Environmental Prediction Initiative (TAWEPI) - Study of various aspects of Arctic weather and the Arctic climate system (snow processes, polar clouds, sea-ice and ozone layer); develop and validate a regional weather prediction model and the use of satellite observations over the Arctic.

Greenland jets - Will consider meso-scale flows, including orographic disturbances, meso-cyclones and surface fluxes.

GREENEX - Considers forecasting of small-scale weather phenomena, including extremes. Meso- and fine-scale flows in the vicinity of orography and sea ice and downstream weather development as well as scale interactions.

Arctic Regional Climate Model Intercomparison Project - Targeted observations from the North Pole station over the Arctic Ocean; feedback between the planetary boundary layer and meso-cyclones; climate processes and feedbacks within the coupled Arctic climate system.

Impacts of surface fluxes on severe Arctic storms, climate change and Arctic coastal orographic processes - Includes studies of storm activity in the western Arctic in the context of surface fluxes from changing ice, ocean and land-surface conditions.

THORPEX Pacific Asian Regional Campaign (TPARC) - Includes studies of extra-tropical transition) and links between tropical/ mid-latitude and polar weather

2.5 SOME FUTURE THORPEX EVENTS

2.5.1 International Core Steering Committee Meeting (ICSC-7): The 7th meeting of the ICSC is to be held in Geneva, Switzerland, from 18 to 20 November 2008. Included on the ICSC are Members from International Organizations. CGMS is represented by the outgoing CGMS Rapporteur, Dr James Purdom; while EUMETSAT is represented by Dr Lars Prahm.

2.5.2 Third THORPEX International Science Symposium (STISS)

The "Third THORPEX International Science Symposium" (TTISS) will be held in Monterey (California) from 4 to 8 May 2009. A First Announcement and further announcements and information may be found at <http://wmo.int/thorpex>. A call for papers will be issued by the Organizing Committee in the near future.

3. SUMMARY

This report summarizes activities within the THORPEX programme and reaffirms the importance of CGMS satellite operators' active participation in both the planning and execution of that programme. This includes having active THORPEX focal points.

CGMS Members should particularly recognize the importance of the newly formulated THORPEX Data Assimilation Observing Systems Working Group and continue to support its activity.

CGMS Members should confirm their agencies representatives for satellite issues to THORPEX (see Table 1 of Annex 1) in order to ensure their active participation in THORPEX activities.

CGMS Members need to appoint a new Rapporteur to THORPEX who will also serve as its representative to the THORPEX ICSC (see Annex 2 for ICSC information).

ANNEX 1

CGMS Focal Points to THORPEX

Of interest was THORPEX planning for future Regional Plans campaigns and experiments in which all satellite operators should become involved. To that end, CGMS Members identified focal points within their agencies for THORPEX related satellite issues, as listed in Table 1.

Table 1: CGMS THORPEX Focal Points and Contacts

AFFILIATION	NAME	EMAIL
CGMS Rapporteur to THORPEX ICSC	Vacant	
CMA/NSMC	Mr. Xiaoxiang Zhu	zhuxx@nsmc.cma.gov.cn
ESA/ESRIN	Einar-Arne Herland	Einar-Arne.Herland@esa.int
EUMETSAT	Dr. Johannes Schmetz Dr. Ken Holmlund	Johannes.Schmetz@eumetsat.int Kenneth.Holmlund@eumetsat.int
IOC	Dr. Albert Fischer	a.fischer@unesco.org
ISRO (now has IMD role)	Mr. A.S. Kiran Kumar	kiran@sac.ernet.in
JAXA	Dr. Tsuguhiko Katagi	Awaiting update
JMA	Mr. Naotaka Uekiyo	uekiyo@met.kishou.go.jp
NASA	Dr. Ramesh Kakar	Ramesh.Kakar@hq.nasa.gov
NESDIS:	Dr. Fuzhong Weng Mr. Tim Schmit	Fuzhong.weng@noaa.gov tim.schmit@ssec.wisc.edu
Russian Fed.	Ms. Anna Khoklova	anna_x@meteo.ru
WMO Space Programme	Mr. Jerome Lafeuille	Jlafeuille@wmo.int
KMA	To be designated	

ANNEX 2

ICSC Members and Permanent Actions

Members

Representatives of Nations (Australia, China, France, Germany, India, Japan, Korea, Morocco, Norway, Russia, South Africa, UK, USA)

Representatives of International Organizations

Dr Lars Prahm, EUMETSAT

Dr Jochen Dibbern, EUMETNET

Dr Philippe Bougeault, ECMWF

Dr Gilbert Brunet, Chair WWRP/JSC

Dr Martin Miller, Chair of WGNE

Dr Jim Purdom, CGMS

Prof Geerd Hoffmann, CBS

Prof Jagadish Shukla, WCRP/JSC

Independent Senior Scientists and Technical Experts

Dr John Eyre, UK Met Office

One representative from each of the THORPEX Working Groups

Co-chairs of the THORPEX Regional Committees

Director of AREP

Permanent Actions

- To encourage WMO Members to actively participate in implementation of THORPEX
- To assist WMO Members in the international coordination of THORPEX
- To assist WMO Members from developing countries in their utilization of THORPEX - related forecast product
- To assist THORPEX in coordination with CBS, WCRP, JCOMM
- To facilitate the participation in THORPEX of other international bodies
- To provide the global and regional priorities with respect to the THORPEX sub-programmes
- To provide guidance to the NMHSs on the timely transition of THORPEX research and development to operations