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INTERNATIONAL CORE STEERING COMMITTEE FOR THORPEX

FINAL REPORT

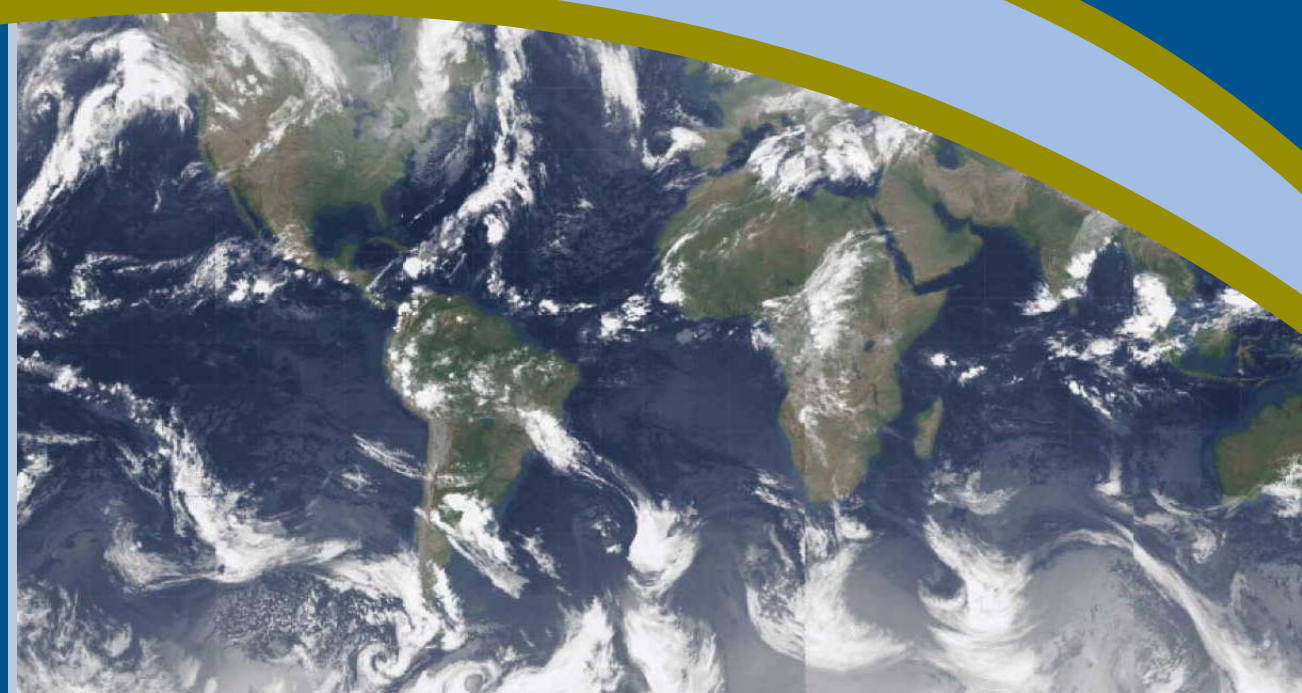
THORPEX International Programme Office
Atmospheric Research and Environment Programme Department

World Meteorological Organization
Secretariat
7 bis, avenue de la Paix
Case postale 2300
CH-1211 Geneva 2
Switzerland
www.wmo.int/thorpex



**World
Meteorological
Organization**
Weather • Climate • Water

WMO/TD-No. 1522
WWRP/THORPEX No. 13



World Weather Research Programme

WORLD METEOROLOGICAL ORGANIZATION

WORLD WEATHER RESEARCH PROGRAMME

COMMISSION FOR ATMOSPHERIC SCIENCES

INTERNATIONAL CORE STEERING COMMITTEE FOR

THORPEX

EIGHTH SESSION

(OFFENBACH, GERMANY, 2 - 4 NOVEMBER 2009)

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THORPEX
A World Weather Research Programme

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EXECUTIVE SUMMARY

The CAS International Core Steering Committee (ICSC) for THORPEX met in the Headquarters of the Deutscher Wetterdienst (Offenbach), 2 - 4 November 2009. The ICSC proceeded with the work assigned by the CAS, the WMO Executive Council and the Fourteenth World Meteorological Congress. This included reviews of the progress in planning and further development of THORPEX on the global and regional level, financial and administrative matters related to THORPEX management, the International Programme Office (IPO) and the Trust Fund. In addition, a half day was devoted to a joint session with Working Group on Numerical Experimentation. All documents presented at ICSC8 may be downloaded from <http://www.wmo.int/thorpex>

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GENERAL SUMMARY OF THE WORK OF THE MEETING

1. ORGANIZATION OF THE SESSION

1.1 Opening of the Session

1.1.1 The Eighth Session of the CAS International Core Steering Committee for THORPEX (ICSC 8) was opened by Dr Alan Dickinson (Chair of the ICSC) at 10.00 am on Monday 2 November 2009 at the Headquarters of the Deutscher Wetterdienst (DWD), Offenbach. In his opening remarks the Chairman noted that:

- Preparations for the quadrennial CAS meeting were to be discussed and that there was the need to establish key messages from the ICSC for this meeting concerning THORPEX
- The first joint ICSC/WGNE session provides an opportunity to look strategically at the links between the two groups

1.1.2 On behalf of the President of the DWD, Professor Gerhard Adrian welcomed participants to the meeting. He noted the strong interest of Germany in THORPEX and said that development of Numerical Weather Prediction, Data Assimilation and Observing System research together with the associated societal research were important topics for all countries. He hoped that more resources for this type of research would soon be available in Germany and that stronger links between the DWD and Universities would be established. A decision was being prepared by the German Parliament in 2010 which could lead to an enhanced German role in THORPEX.

1.1.3 On behalf of the WMO, David Parsons (Chief of the World Weather Research Programme (WWRP)) also welcomed delegates to the meeting. He noted that THORPEX was a success – notable achievements were the creation of the TIGGE data bases, the Third THORPEX International Scientific Symposium (TTISS), the THORPEX Pacific Asian Regional Campaign (T-PARC), the THORPEX IPY project cluster, evaluation of targeting etc. – noting that THORPEX output was becoming of great interest to operational centres. However, there were also challenges in the fields of model development, physics, very high-resolution models, implementation of Forecast Demonstration Projects (FDPs) and Research Demonstration Projects (RDPs). There was also the challenge of what new products to generate and to transition to operations? Exciting new projects had been set up in Europe including PANDOWE and PREVASSEMBLE.

1.2 Adoption of the Agenda

1.2.1 The ICSC adopted the agenda (as listed in the contents page above).

1.3 Working Arrangements for the Session

1.3.1 The ICSC agreed on the working arrangements of the session.

2. REPORTS

2.1 Report of the Chair (CAS/ICSC-8/Doc2.1)

2.1.1 The actions and decisions from ICSC 7 were discussed. Actions ICSC 7/9 (the issue of the Scientific Leadership of THORPEX) and 10 (the need to ensure that Working Groups and Regional Committees worked closely together) were highlighted and formed the subject of a paper (ICSC 8 doc. 2.3.1) at this meeting. The importance of Action ICSC 7/15 (an authoritative comprehensive statement from the DAOS Working concerning targeting) was emphasised. Regarding Action ICSC/22 (relating to the supply of AMDAR data across Africa) it was noted that Brussels Airlines may replace Air France, since the Air France aircraft could not use the required software for

operational reasons. Concerning ICSC7/24 and 25 (completion and publication of the European plan) it was noted that the intention is to have bi-annual workshops in Europe and put the European plan on the web by Dec. 2009. Little progress had been made with ICSC7/38 (preparation of a mid-term review of THORPEX). Following discussion it was agreed that this review of THORPEX should now be a priority for the International Programme Office in 2010

Decision/Action ICSC8(1): *Convene a meeting to review the THORPEX programme involving external experts, Working Group Chairs, Regional Committee Chairs. The experts will be appointed following consultation with the CAS President, Chair WWRP JSC etc.; prepare a report for ICSC 9 and publish highlights and achievements. It was agreed that the time-line for this review should be:*

- i Request review material from Working Group and Regional Committee Chairs, Field Experiment PIs etc. by 31 May 2010
- ii IPO to prepare preliminary draft paper
- iii Select independent experts (by EC3)
- iv Convene a small Workshop mid-September to prepare a reviewed draft for ICSC 9
- v Arrange publication of key achievements - post ICSC 9

2.2 Report of the President of CAS

2.2.1 The President of CAS, Dr Michel Beland, was pleased to see the strong involvement in THORPEX activities and asked that successes be well publicized in order to assist further development of the programme. Many aspects of the CASXV vision papers related to THORPEX and discussion of these should highlight and promote further initiatives in the programme. The possibility of ICSU co-sponsorship of THORPEX had been raised again although some issues needed to be resolved before this could proceed. It was noted that International Group of Funding Agencies (IGFA) for Global Change Research planned to devote considerable new funding to Global Change Research and that some of this should be allocated to weather research in the context of a changing climate.

2.2.2 At WCC-3 there was a call for WMO to form an international panel to consider a framework for global climate services but no mention was made of inclusion of extreme weather events. He felt that THORPEX should be a member of this panel and would work in this direction.

2.2.3 Finally, the President stressed the need for international scientific leadership to maintain credibility of the programme. It was also necessary to ensure that results were useful and could be translated into operations and that criticisms were acknowledged and taken seriously.

2.3 Report from the ICSC Executive Committee (CAS/ICSC-8/Doc2.3)

The report was introduced by the ICSC Chairman Dr Dickinson. Dr Dickinson noted that all the Actions and Recommendations had either been completed, implemented or were for consideration so the report was accepted without any further discussion.

2.3.1 *Scientific Leadership of THORPEX (CAS/ICSC-8/Doc2.3.1)*

2.3.2 The document, based on recommendations from the EC, was introduced by Dr David Burrige (Manager of the IPO). The EC proposal recommended that a strengthened WWRP/JSC could provide the appropriate scientific leadership that THORPEX requires. In this case the WWRP/JSC would advise the ICSC on the key scientific direction of the programme. To do this effectively the WWRP/JSC would require a greater number of independent experts, and the THORPEX Working Group Chairs and, and if required, the Regional Committee Co-Chairs should be represented at WWRP/JSC meetings. It was agreed, therefore that such a reconstituted WWRP/JSC could be asked to review, in concert with the WGNE ongoing THORPEX activities and report to the ICSC as required. The ICSC noted that this issue would also be the subject of the forthcoming meeting of the CAS.

Decision/Action ICSC8(2): *The recommendations contained in Doc. 2.3.1 concerning the improvement of the scientific leadership of THORPEX should be implemented.*

2.4 Management Report from the THORPEX International Programme Office (CAS/ICSC-8/Doc2.4)

2.4.1 Dr David Burridge, the Manager of the International Programme Office (IPO), reported briefly on the work of the IPO and noted that most of the activities supported by the IPO would be discussed during the Joint Session with the WGNE (Agenda item 6). In closing, he informed the ICSC that the Third THORPEX International Scientific Symposium (TTISS), held in Monterey in September, had been a notable success.

2.4.2 Contributions to the Trust Fund were in line with expectations – NOAA had agreed to contribute up to 150K\$ per year for 5 years. A number of European countries are reviewing contributions, Japan was expected to achieve more stable funding and KMA was now a contributor.

Decision/Action ICSC8(3): *The organisers of the TTISS should be congratulated on a successful event.*

2.5 GEO (CAS/ICSC-8/Doc2.5)

2.5.1 The current version of the GEO 2015 strategic target for weather was noted. This target has been the subject of much discussion within WMO and it was agreed that it should remain broad enough to encompass the THORPEX areas of interest. The particular GEO Tasks to which THORPEX contributes were then outlined and noted with appreciation.

3. WORKING GROUP REPORTS

3.1 Predictability and Dynamical Processes Working Group (PDP WG) (CAS/ICSC-8/Doc3.1)

3.1.1 Heini Wernli introduced the PDP Working Group report. The PDP Working Group Interest Groups still intend to publish an edited version of their work as a WMO article in early 2010. This will provide an up-to-date view of the main scientific predictability issues currently being studied. New national research projects including PREVASSEMBLE and PANDOWAE were described as was the support given by the Working Group to international field campaigns such as T-PARC and to HyMEX and T-NAWDEX planning. PDP topics from THORPEX had figured prominently at the MOCA-09 conference.

3.1.2 The links between WGNE and PDP Working Group were discussed and it was agreed to be highly beneficial to both sides. Thomas Jung would represent PDP Working Group within WGNE. It was recommended that THORPEX PDP activities should figure prominently at the next IAMAS and IUGG conferences.

3.1.3 Finally, the proposed Summer School in Banff was strongly supported.

Decision/Action ICSC8(4): *THORPEX should figure prominently in the next IUGG meeting (Melbourne 2011) and IAMAS meeting (Davos 2013).*

3.2 Data Assimilation and Observing Strategies Working Group (CAS/ICSC-8/Doc3.2)

3.2.1 The paper (CAS/ICSC-8/DOC3.2) was introduced by Dr Roger Saunders co-Chair of the DAOS WG. He stressed that there was still a need to continue to review the make-up of the Group following the merger between the original DAOS and OS Working Groups. A main emphasis of the Group is better use of observations and the provision of advice for field campaigns. A preliminary targeting statement had been developed which emphasized that there were small but positive

impacts from additional targeted observations and that observations in sensitive areas had more value than those taken elsewhere; additionally, targeting tropical cyclones had a beneficial impact on the prediction of tropical cyclone tracks.

3.2.2 Some advances in the observational system were noted. Radar coverage had improved and there moves to develop a standard format for radar data. Some THORPEX field campaigns have led to an increase in observations in that they have not disappeared at the end of the campaigns:

- E-AMDAR humidity coverage was now being expanded over Europe
- The Chinese FY-3A Infrared and Microwave sounders have been proven useful for NWP but access to the data is now needed in real time

3.2.3 There is a requirement for continuity of the scatterometer data for the afternoon orbit – it may be that the Indian Oceansat 2 satellite will fill this potential gap but this is not yet agreed. Generally it was worrying that some satellite data sources and types were not yet agreed for the next decade. Work was also proceeding to draft a statement on the need for in-situ observations in the Southern Hemisphere, for coastal radiosondes and in Africa.

3.2.4 On the Data Assimilation side work was continuing on hybrid 4D-Var and Ensemble Kalman Filtering which looks promising. Experiments were taking place at ECMWF on weak constraint 4D-Var. Experiments at the Met Office running 3D-Var and the 2001 version of the model compared with 4D-Var and the 2007 version of the model showed that the latter was better with no satellite than the earlier 3D-Var with satellite data demonstrating the benefits of improvements to the model and data assimilation over the 6 years.

3.2.5 The results from the Greenland Flow Distortion Experiment GF-DEX were described. Radiosondes very close to the coast were found to have a negative impact on the forecast. Assimilation of AMSU–B Channel 2 data was now providing better humidity fields over Africa.

3.2.6 Analysis results were also now providing much more information and guidance about the impact of observations in different systems e.g. GEOS-5, NOGAPS and EC-M.

3.2.7 The future work of DAOS was noted and included – guidance for field experiments, optimal use of existing observing systems, exploring adaptive processing, evaluating AMDAR in Africa and continuing exchange of ideas and information.

3.2.8 It was agreed that the Working Group should meet in the summer of 2010. It was agreed that close links should be maintained with the CBS ET-EGOS so that research results would feed through into the CBS OPAG IOS.

3.2.9 The PREVIEW case studies were outlined and it was agreed that these should be investigated where possible.

Decision/Action ICSC8(5): *The ICSC encourages NMHSs to analyse the PREVIEW case studies identified by EUCOS.*

Decision/Action ICSC8(6): *The DAOS Working Group is encouraged to produce an overall authoritative statement on targeting taking account of the T-PARC results and the experience gained over the last 10 years.*

3.3 GIFS-TIGGE Working Group (CAS/ICSC-8/Doc3.3)

3.3.1 The GIFS-TIGGE report (CAS/ICSC-7/Doc3.4) was introduced by Dr Zoltan Toth, Co-Chair of the GIFS-TIGGE WG. The GIFS-TIGGE WG continued its very active programme of work concerning development of the TIGGE archive, GIFS planning and the TIGGE – LAM Panel. It was noted that India may join the countries contributing to the TIGGE archives. Access to the archives was being improved and it was noted that the Archive Centres' information pages should be consistent with one another.

Decision/Action ICSC8(7): *The TIGGE websites should be co-ordinated for example regarding references to available toolkits and software links.*

3.3.2 Papers based on use of the TIGGE data base had been published in the literature and a very useful TIGGE User Workshop held in association with the TTISS – there were now more than 500 TIGGE users. More research was needed to be done to answer some fundamental questions, for example the added value of multi-Centre ensembles, the best way to combine ensembles, optimal statistical corrections, product design and best training practices. These should be topics for the GIFS-TIGGE WG in conjunction with the other THORPEX Working Groups.

Decision/Action ICSC8(8): *EC 3 is invited to look at the future composition of the Working Groups, especially as regards future EPS research requirements, seasonal prediction etc.*

3.3.3 TIGGE – LAM was moving ahead in close co-ordination with the main Group it was encouraging a co-ordinated approach based on the global TIGGE experience and was trying to establish standard formats.

3.3.4 The emerging plans for a GIFS were then outlined. These would be discussed in February 2010 with CBS experts. Concerning GIFS prototype products the ICSC felt strongly that more research needs to be done. It recommended a way forward that involved close collaboration with the Joint Verification Working Group and that the work was set in the context of the SWFDPs developed by CBS (see agenda item 7.2).

4. THORPEX FIELD EXPERIMENTS

4.1 T-PARC

4.1.1 Several speakers outlined aspects of the very successful summer T-PARC experiment. This had been a major campaign involving four research aircraft flying 500 mission hours across 76 missions from 7 airfields. The European Data Targeting System (DTS) had been used and proved to be very efficient and useful. It was noted that all the science objectives of the field phase of summer T-PARC had been met.

4.1.2 Some aspects of targeting in summer T-PARC were then discussed. Although sensitive area calculations from the various centres were sometimes different, a consensus view was usually possible. In the main the extra data improved tropical cyclone track prediction but with a few notable exceptions in the case of some models. These were still being investigated. Issues with some of the observations from the C130 aircraft still needed to be resolved.

4.1.3 Winter T-PARC was then outlined. The main motivation was investigation of model error across North America at the 5 day time scale originating in the western Pacific Ocean. The experiment involved collaboration across many agencies. Additional E-AMDAR data had been made available and other observing systems had been enhanced. Preliminary results showed error reductions of up to 35% in the verification region (typically a 1000 km radius area in the continental USA). Roughly 75% of cases showed improvement and 25% were degraded. Examples were shown of improvements in west coast surface rainfall and east coast snowfall events. The winter T-PARC data set was now archived at NASA and was available for research. It was planned to hold a joint winter/summer T-PARC meeting in 2010.

4.1.4 The need for careful case selection was again emphasised as was the need for extended periods – winter T-PARC had only lasted 2 months.

4.1.5 The ICSC recognised the unique value of the T-PARC data sets and strongly encouraged the PDP, DAOS and SERA Working Groups to conduct analyses and research on the case studies. In addition, data assimilation groups were encouraged to assess the impact of satellite data during the T-PARC periods with particular attention being paid to the contribution from

Quikscat data in order to provide more evidence to support the maintenance of the valuable Quikscat data stream because there is a risk that Quikscat may be discontinued.

Decision/Action ICSC8(9): *The further involvement of the PDP /DAOS/SERA Working Groups in the analysis of T-PARC data sets is strongly encouraged.*

Decision/Action ICSC8(10): *The Impact of satellite data in T-PARC studies needs special attention, especially Quikscat data, which could be important to help maintain continuity of this data stream.*

4.2 T-NAWDEX Plans

4.2.1 The developing plans for T-NAWDEX were described. The focus was on the physical processes responsible for degradation of the 1-7 day forecast over Europe. There were experimental, theoretical, diagnostic and modelling components. The plan is to focus on the tropical North Atlantic out to five days ahead and the polar triggering of disturbances on the timescale 1-3 days. The ICSC recommended careful consideration of the available satellite data that could support the work and encouraged early distribution of the draft Plan for comment by the THORPEX Working Groups.

4.2.2 Considering the lead times being considered the involvement of the USA and Canada was seen as relevant and strongly encouraged.

Decision/Action ICSC8(11): *The early publication of the draft science plan for T-NAWDEX was encouraged as was the full involvement of the PDP/DAOS Working Groups in its further evolution.*

5. REGIONAL DEVELOPMENTS AND ACTIVITIES

5.1 African Regional Committee (ERC)

5.1.1 The Science and Implementation Plans were outlined and recent activities described including the successful workshop held at the ICTP concerning the proposed information system for high impact weather in Africa. It was expected that this information system would facilitate and stimulate PDP and SERA research in Africa. The ICTP had agreed to provide the computer facilities. African regions had been defined with contact points in each region. These contact points would collate and submit case studies from each region for inclusion in the information system. Access to appropriate societal and economic impact information was being obtained. The funding possibilities being pursued were described and offers of assistance for modelling and evaluation from some NMHSs was noted. A meeting in mid-2010 in Africa to advance the implementation activities was agreed.

Decision/Action ICSC8(12): *Regarding THORPEX Africa, the Working Groups were asked to continue to support this initiative. A meeting in mid-2010 to advance the Information System and PDP studies was agreed.*

5.2 Asian Regional Committee (ARC)

5.2.1 Recent meetings of the ARC were reviewed. Also, the results from analyses of tropical cyclone tracks which used data in the CXML format from some TIGGE centres was discussed. Examples from CMA and JMA were described. It was recommended that the NMHSs generating these tracks should be asked to continue to do so in real time for research purposes.

Decision/Action ICSC8(13): *Request permission from NMHSs to continue transmission of the tropical cyclone CXML files for research purposes referring to the earlier letter on this subject and the WMO EC encouragement to continue this service.*

5.2.2 The need for further training in the use of the CXML products was noted and it was recommended to hold a 1 day “hands on” session on GIFS-TIGGE during the 2 week IWTC meeting in November 2010.

Decision/Action ICSC8(14): *The Chief of the WWRP should contact the Co-Chairs of the 2010 IWTC meeting and explore the possibility of a 1 day “hands on” session training session on the TIGGE data bases.*

5.3 European Regional Committee (ERC)

5.3.1 The many and varied aspects of European involvement in THORPEX programmes were outlined (Doc.5.3). It was noted that flood forecasting using TIGGE data was being actively studied, TIGGE data were proving useful for general predictability studies, the variability of extra-tropical transitions were seen to be well captured in the TIGGE ensembles and that the PREVIEW DTS had worked exceptionally well in T-PARC/TCS-08. The important European role in the THORPEX IPY cluster of projects was noted with appreciation. In this regard it was felt that more observational support to CONCORDIASI was important

Decision/Action ICSC8(15): *More countries should be encouraged to launch additional radiosondes to support CONCORDIASI and NWP centres are encouraged to assess the impact of the extra data.*

5.3.2 There was a strong desire in Europe to work with YOTC global data sets. The Plans being developed for a European THORPEX Workshop lasting 2-3 days in 2011 at the University of Karlsruhe were noted. It was expected that these Workshops would be held every two years in Europe and it had been agreed that the Chair of the Workshop organising committee would be the point of contact with the IPO for European THORPEX activities. Sarah Jones, of the University of Karlsruhe, would act as the contact point for the next 2 years. Appreciation was expressed to George Craig as he stood down from his role as Co-Chair of the current ERC.

Decision/Action ICSC8(16): *The ICSC was pleased to recognise the contributions of George Craig to European activities in his role of Co Chair of the ERC and asked the IPO to send a letter of appreciation*

5.4 North American Regional Committee (NARC)

5.4.1 Recent activities were reviewed including the successful TTISS held in September 2009 in Monterey. The ICSC encouraged papers from the TTISS to be published in BAMS.

Decision/Action ICSC8(17): *The ICSC encouraged the submission of TTISS papers for publication the special issue of Monthly Weather Review.*

5.4.2 The major field campaigns summer and winter T-PARC were briefly outlined. Proposed SERA activities were discussed and it was felt that these plans should be more closely coordinated with the work of the WWRP-SERA WG.

Decision/Action ICSC8(18): *US SERA activities should involve the WWRP SERA Working Group*

5.4.3 The USTEC had met recently and it was noted that Jim Hansen will remain as Chair of the Science Committee.

5.4.4 Advice was currently being sought on the NARC Plan – it was hoped to complete this work soon. A new Co-Chair for the NARC was needed – it was felt that a suitable candidate from Mexico should be identified.

5.4.5 Mel Shapiro was retiring from UCAR and the ICSC thanked him for his long standing contributions to THORPEX. It asked the IPO to send a letter of appreciation.

Decision/Action ICSC8(19): *The ICSC recommends that the WMO formally recognises and thanks Mel Shapiro for his long standing contributions to the THORPEX programme.*

5.5 Southern Hemisphere Regional Committee

5.5.1 The successful WMO/THORPEX workshop on 4DVAR and ETKF inter-comparisons held in Buenos Aires in November 2008 was described. This meeting created considerable interest in THORPEX in South America. The Main areas of interest for the SHRC included participation in the SWFDP being developed for the South Pacific and in collating experiences in running the Met Office UM in Australia, New Zealand and S. Africa.

Decision/Action ICSC(20): *Argentina should become a member of the SHRC.*

6. JOINT SESSION WITH THE WGNE

6.1 Introduction

6.1.1 In his introduction to the programme for the joint session, David Burrige (IPO Manager) noted that while the WGNE had traditionally devoted a part of the agenda to THORPEX matters this first joint session was motivated by the growing collaboration between THORPEX and the WGNE.

6.2 THORPEX Activities

6.2.1 An overview of the THORPEX structure and programme was provided. It amounted to around 50% of the WWRP as a whole and was now fully integrated into the WWRP strategic plan. The Working Groups and the plans of the Regional Committees were outlined. The important campaigns of the programme were the A-TReC, E-TReC, summer and winter T-PARC and the IPY cluster of projects. Planning was advancing concerning T-NAWDEX and HyMeX. Other achievements included TIGGE, TIGGE-LAM and YOTC. Planning for GIFS was proceeding.

6.2.2 In terms of the future the focus would be on basic predictability issues concerning high impact weather, the required initial conditions for good forecasts, the effectiveness of targeting, handling of the tropical and polar regions and moving ahead with seamless prediction.

6.3 Report from the 3rd Meeting of the WWRP/JSC

6.3.1 The broad objectives of the WWRP were described. These included improving public safety, accelerating the prediction of high impact weather, demonstrating improvements, increasing understanding of atmospheric processes and encouraging NMHSs to implement these advances.

6.3.2 Future WWRP research would focus on high resolution convection permitting models, mesoscale DA, the representation/parameterisation of convection, the role of the surface and reduction in model imbalance and “spin up”. The EC-RTT report encouraged an expanded scope including collaboration with the climate and environment communities. These aspects would be addressed. In addition, the WWRP would make efforts to link to the operational centres through WGNE, encourage DAOS Working Group and WGNE collaboration, as well as pursue advances in verification and physical processes.

6.4 Report of the Joint Working Group on Verification

6.4.1 The highlights of recent activities were publication of methods to verify heavy rainfall predictions and new work on cloud verification. Real time verification supporting forecasters during Beijing 2008 had also been very successful. An inter-comparison of verification methods for very high resolution models was being progressed. Most importantly an initiative was underway to develop methods for the verification of extreme weather events. Outreach was taking place through the EUMETNET EUMETCAL project and through workshops and tutorials.

6.4.2 In general spatial methods were still not being used much and this was an area the Working Group was keen to progress. Publications were pending including an overview article in BAMS.

6.4.3 During discussion, concern was expressed about the statistical significance of scores and more guidance was needed on how experiments should be constructed to achieve reliable scores. It was also emphasised that “wind” observations was an important parameter especially in relation to energy planning and assessment. Regarding verification of extreme events it was recognised that new ideas were needed from academia. ECMWF had set up a group to study this problem. A strong “weather” focus for the Working Group was suggested since other groups were looking at the climate time scale. In essence “seamless” verification was needed for “seamless” prediction.

6.4.4 It was noted that the forthcoming CAS meeting would ask the THORPEX to establish a sub-seasonal to seasonal prediction project.

6.5 Outcome of the WMO/EC Research Task Team (ECRTT)

6.5.1 The history, activities and main recommendations of this Task Team were outlined. The Team looked at all timescales and across all WMO sponsored programmes - the WCRP, WWRP, GAW and THORPEX. In essence the desire was to see WMO members deliver a better range of services from now-casting through seasonal to climate timescales. The broad recommendations of the ECRTT to move this forward were as follows.

- i. Better co-ordinate and accelerate prediction research
- ii. Link operations, research and service delivery through FDPs
- iii. Consider the future role of the WMO Commissions

6.5.2 In practice for (i) above this meant identifying the really challenging research topics for joint action as was already taking place for organised tropical convection through YOTC. Other areas might include parametrization packages, cloud parametrization and convection generally. The focus for the ICSC and WGNE should be on the common priorities for research.

6.6 WCRP Survey of Model Development

6.6.1 A very broad target audience had been sent a number of questions. In all 73 independent replies had been obtained split amongst the communities - NWP 11, Seasonal 21, Decadal 22 and Climate 61 (note occasionally there was more than one reply from a particular organisation). Consequently, results were thus biased towards climate timescales. In terms of priorities for model improvement there was a strong consensus across the returns. These were

- i. Tropical biases (ICTZ, MJO etc.,)
- ii. Cloud feedback processes
- iii. Carbon cycle
- iv. Troposphere-stratosphere interaction
- v. Parametrization in high-resolution models (convection, boundary-layer processes etc)

6.6.2 In terms of making progress there were significant problems, such as the few people working in the area, weak links between top-down and-bottom up approaches, poor links between observations and process studies and inadequate links between NWP and climate approaches. Short range forecasts should be used to identify model problems at longer time-range. If possible the fragmentation in the community should be reduced and leadership improved. Most importantly, the focus should be on understanding problems and not just “describing” the differences in model performance. Overall the key objectives should be to:

- i. Encourage more scientists to work on modelling
- ii. Investigate links between model error and prediction error
- iii. Reduce the “disconnect” between modelling, process studies and observations

6.6.3 For the future it was hoped to complete the analysis of the responses by late November. Report to the WCRP JSC in Feb. 2010 (the joint meeting called for the work to be reported to the WWRP JSC as well). A second call for additional information would be considered. Finally, the results would be used to organise workshops on model development and parameterisation in 2010/11. BAMS papers would report the final outcomes.

6.7 Year of Tropical Convection (YOTC)

6.7.1 The science objectives and implementation activities were described – the Science and Implementation Plans can be downloaded from www.ucar.edu/yotc. During discussion it was agreed that the science workshop planned for the autumn of 2010 should be broadened to include a somewhat wider community. The importance of maintaining “focus” on key events of interest within the defined period was agreed. Some of these events were identified at the workshop held at the University of Hawaii in July 2009. It was also strongly recommended that a synoptic review of the YOTC period of interest should be written.

6.8 Hydrology – HEPEX, HyMeX and MEDEX

6.8.1 Document 6.8 was presented. HyMeX science is organised along 5 major research themes with corresponding Working Groups

- WG1 - Water budget of the Mediterranean basin
- WG2 - The continental hydrological cycle
- WG3 - Heavy precipitation and flash flooding
- WG4 - Intense air-sea exchanges
- WG5 - Vulnerability factors and adaptation capacity

6.8.2 HyMeX was noted to be in effect an excellent example of a “seamless prediction” project with considerable relevance to both THORPEX and WCRP (GEWEX). It was expected that it would be designated a GEWEX RHP – Regional Hydrological Project.

6.8.3 It was noted that MEDEX would be subsumed into HyMeX although in the short term MEDEX intended to carry out some targeting campaigns using operational networks in the Mediterranean area with support from EUCOS and the PREVIEW DTS during the 2009/2010 winter.

6.8.4 HEPEX is an international research and development programme considering the use of EPSs for flood forecasting on the short, medium and longer time scales. There was significant interest in collaboration with THORPEX (TIGGE) and WCRP (GEWEX). It was important to now develop specific proposals for joint projects to get the work underway.

6.9 Strengthening the THORPEX PDP Working Group and WGNE Connection

6.9.1 The key area for collaboration was seen as model error and model development. It was noted that a new convection scheme at ECMWF had reduced model error by 10-20%. Also that better horizontal resolution improves blocking performance. The models were improving substantially yet important challenges remain. Some ways to reduce errors could include systematic feedback from forecasters, physical reasoning, process studies and climate runs. It was essential to properly diagnose the problems and the underlying responsible processes. Some of these were well known such as the influence of extra-tropical transitions in increasing ensemble spread others less so such as the downstream influence of strong convection over North America.

6.9.2 The way forward should be to engage the community in improved model diagnostic studies, secure extra funding and set up further special data sets to assist in the study of problems (for example the TIGGE and YOTC archives). It was also necessary to improve access to forecast systems to allow more experimentation.

6.9.3 The next steps to improve the collaboration between the PDP Working Group and WGNE should be an invitation to WGNE members to join the Working Group meeting in 2010 and advance plans for a workshop on these issues in 2010/2011.

6.9.4 The wider links between WGNE and the WWRP were then discussed. Collaboration could take place in several areas

- i. Parametrization
- ii. Verification
- iii. Links to operational centres
- iv. Data assimilation

6.9.5 The best way to establish better collaboration would be through joint projects – perhaps involving the WWRP Mesoscale Working Group. Given that the use of very high-resolution models (with horizontal resolutions the 2-4 km range), it was recommended that this topic be followed up at a joint workshop between the WGNE and the WWRP Mesoscale Working Group.

6.10 CASXV

6.10.1 Preparations for CASXV were noted.

6.11 Collaboration and Summary

6.11.1 The main recommendations and conclusions from items 6.1 to 6.10 were reviewed, collated and summarised as follows (**Decision/Action ICSC8(22) – Annex II**)

- i. Atmospheric composition particularly the inclusion of aerosol in NWP systems is currently being discussed by the WGNE and WWRP efforts should await the outcome of this discussion
- ii. In addition to its work on the verification of ensemble prediction systems and the predictions of high-impact weather, the JWGFVR were requested to address the verification of sub-seasonal prediction; the verification of longer-range forecasts were the pervue of WCRP groups
- iii. EC-RTT – the ICSC/WGNE response should be to identify a few key research projects for WCRP/WWRP to champion
- iv. It was agreed that WWRP/THORPEX should be involved in the model development survey and the follow-up – THORPEX should consider what support can be given by the PDP Working Group
- v. It was agreed that the PDP Working Group would be involved in the WGNE in the Parametrization Workshop
- vi. It was recommended that the planned YOTC science meetings should be broadened; in addition, a “synoptic” summary of the tropical events/weather during the YOTC “year” should be prepared
- vii. The GEWEX and THORPEX support for HyMeX should be coordinated as should the support, where appropriate, for T-NAWDEX
- viii. The development of HEPEX should be monitored
- ix. The WGNE and the PDP Working Group should establish cross-representation on each group; the PDP Working Group should “write-up” a diagnostic work-programme in collaboration with the WGNE
- x. It was agreed to establish a joint project to study the issues of model resolutions in the “grey zone” where deep convection is not resolved and cannot easily be parametrized (horizontal resolutions around 5 km) – the project to be lead by the WGNE and the WWRP Mesocale Working Group
- xi. Communications between the groups should be improved

7. GIFS FORECAST DEMONSTRATION PROJECTS

7.1 Organization and Management of THORPEX FDPs

7.1.1 The paper was discussed and the proposals adopted.

Decision/Action ICSC8(23): *Doc.7.1 defining the organisation and management of THORPEX FDPs was endorsed.*

7.2 GIFS FDPs

7.2.1 The current GIFS plan was outlined including the critical elements, formation of focus groups, etc. Focus group 1 would concentrate on the science whilst 2 would work on data exchange. The product types remained TC tracks and characteristics and heavy precipitation. Application would be through SWFDPs.

7.2.2 The ICSC continued to feel that some fundamental science issues had still not been properly resolved including the expected value adding from multi model ensembles. Furthermore there seemed to be no process in place to answer these questions. Also the work of the GIFS-TIGGE WG should not be exclusively on RPDs/FDPs – the Working Group needed to take the science questions seriously and also note seasonal prediction was an important topic that must also be addressed.

7.2.3 The ICSC agreed that the joint meeting with CBS SWFDP experts should go ahead in February but strongly advised that more modest objectives should be followed and the that project should make maximum use of local expertise and existing frameworks.

Decision/Action ICSC8(24): Reflecting the ICSC concerns expressed on the current GIFS plans the meeting strongly encouraged the GIFS-TIGGE WG to focus on two topics taking a “bottom-up approach” – TC tracks and heavy precipitation and to follow these up in the context of existing FDPs e.g. Shanghai, Southern Africa , Pacific Islands.

8. IPY

8.1 IPY Legacy

8.1.1 The paper was outlined. It was noted that the possible formation of a Polar Programme would be discussed at CAS. There could interest in the application of TIGGE data in Polar Regions as well as from DAOS and PDP Working Groups. It was recommended that a workshop be convened to further consider a THORPEX Polar project as element of an overall Polar programme.

Decision/Action ICSC8(25): *Convene a workshop to develop proposals for an IPY follow on THORPEX polar project.*

9. PROGRAMME OF WORK FOR 2010/11

9.1 Programme and Expenditure 2010

9.1.1 The programme of work and budget for 2010 were adopted.

Decision/Action ICSC8(26): *The future budget and programme of meetings was agreed.*

10. ANY OTHER BUSINESS

10.1 There was no other business.

11. DECISIONS AND ACTIONS

11.1 The ICSC8 Decisions and Actions are listed in Annex III.

12. DATE AND PLACE OF NEXT MEETING

12.1 It was agreed that should be in Geneva at a time to be decided in conjunction with the Chair of the WWRP JSC.

13. CLOSURE OF THE MEETING

13.1 At the closure of the session the, the Chair, Dr Alan Dickinson, thanked the President and staff of the DWD for their hospitality and support and the Regional Committees, Working Groups, the IPO staff and the other participants for developing the THORPEX Programme.

LIST OF PARTICIPANTS

- Alan Dickinson **ICSC Chair**
 Met Office
 Fitzroy Road
 Exeter, EX1 3PB
 United Kingdom
 Tel: 44 13 92 88 6662
 Fax: 44 1392 88 5681
 Email: Alan.dickinson@metoffice.gov.uk
- Michel Beland **President of CAS**
 Meteorological Service of Canada
 2121 Transcanadienne
 Dorval, Quebec H9P, 1J3
 Canada
 Tel: 1 514 421 4771
 Fax: 1 514 421 2106
 Email: michel.beland@ec.gc.ca
- Gerhard Adrian Prof Gerhard Adrian
 Deutscher Wetterdienst Zentralamt
 Postf. 100465
 63004 Offenbach am Main
 Germany
 Email: Gerhard.Adrian@dwd.de
- Fred Branski **President of CBS**
 Operations Support
 Data Management Branch
 W/CIO11m RTH
 Washington
 U.S. National Weather Service
 USA
 Email: fred.branski@noaa.gov
- Gilbert Brunet **Chair of the WWRP/JSC**
 Recherche en Prévision Numérique
 Service météorologique du Canada
 2121, Voie de Service nord
 Route Trans-Canadienne
 Dorval (Québec) H9P 1J3
 Canada
 Email: gilbert.brunet@ec.gc.ca
- Jiandong Gong **China Meteorological Administration (CMA)**
 46, Zhongguancun South Street
 Beijing, 100081
 China
 Tel: 86 10 6840 7074
 Fax: 86 10 6217 3225
 Email: gongjd@cma.gov.cn

- Dong-Eon Chang **Korea Meteorological Administration (KMA)**
45 Gisangcheong-gil, Dongjak-gu
Seoul, Korea 156-720
Tel: 82-2-6712-0200
Fax: 82-2-849-0668
Email: dechang@kma.go.kr
- George Craig **European Regional Committee**
DLR Oberpfaffenhofen
Institut fuer Physik der Atmosphaere
Muenchner Strasse 20
D-82234 Wessling
Germany
Tel: 49-8153-28-2581
Fax: 49-8153-28-1841
Email: george.craig@dlr.de
- Huw Davies **WWRP/JSC**
Institute for Atmospheric and Climate Science, ETH, Zurich
Hönggerberg HPP, CH-8093 Zürich
Switzerland
Tel: 41 (01) 633 3506
Fax: 41 (01) 633 1058
Email: huw.davies@env.ethz.ch
- Jochen Dibbern **EUMETNET**
EUCOS Programme Manager
Kaiserlesistrasse 29/35
63067 OFFENBACH
Germany
Tel: 49 69 80 62 4491
Fax: 49 69 8062 4954
Email: jochen.dibbern@dwd.de
- Aida Diongue Niang **Co-Chair of the African Regional Committee**
NWP Unit
Research and Development Team
Direction de la Météorologie Nationale du Sénégal
BP 8257 Dakar-Yoff
Senegal
Email: aida_dniang@yahoo.fr
- Veronique Ducrocq Véronique Ducrocq
CNRM/GMME/D
CNRM-GAME (Météo-France & CNRS)
42 Av G.Coriolis
31057 TOULOUSE CEDEX
France
Email: veronique.ducrocq@meteo.fr
- Christian Jakob **Co-Chair of the WGNE**
Christian Jakob
School of Mathematical Sciences
Monash University, VIC 3800
Australia
Email: christian.jakob@sci.monash.edu.au

Sarah Jones **European Regional Committee**
Prof. Sarah Jones
Institut für Meteorologie und Klimaforschung
Karlsruher Institut für Technologie (KIT)
KIT-Campus Süd, Kaiserstr. 12, 76131 Karlsruhe
Germany
Email: sarah.jones@imk.uka.de

Thomas Jung **PDP Working Group**
ECMWF
Shinfield Park
Reading, RG
United Kingdom
Email: Thomas.Jung@ecmwf.int

Mitch Moncrieff **YOTC**
National Center for Atmospheric Research,
Box 3000, Boulder CO 80307-3000
USA
Overnight mail: 3450 Mitchell Lane
Boulder CO 80301
Tel. 1 303 497 8960
Fax: 1 303 497 8181
Email moncrief@ucar.edu

Martin Miller **Co-Chair of the WGNE**
ECMWF
Shinfield Park
Reading, RG
United Kingdom
Email: martin.miller@ecmwf.int

Tetsuo Nakazawa **Chair of the Asian Regional Committee**
Typhoon Research Department, Meteorological Research Institute
Japan Meteorological Administration
1-1 Nagamine, Tsukuba, Ibaraki 305-0052
Japan
Tel: 029-853-8671
Fax: 029-853-8735
Email: nakazawa@mri-jma.go.jp

Thor Erik Nordeng **THORPEX IPY Cluster Leader**
Norwegian Meteorological Institute
P.O. Box 43 Blindern
NO 0313 OSLO
Norway
Email: thoren@met.no

Kamal Puri **Bureau of Meteorology Research Centre**
G.P.O. Box 1289K
Melbourne, Vic.3001
Australia
Tel: 61 3 96694433
Fax: 61 3 96694660
Email: k.puri@bom.gov.au

Roger Saunders **Co-Chair of the DAOS Working Group**
UK Met Office
Met Office
Fitzroy Road
Exeter, EX1 3PB
United Kingdom
Email: roger.saunders@metoffice.gov.uk

Kiyo Sato **Japan Meteorological Agency (JMA)**
1-3-4 Otemachi, Chiyoda-ku
Tokyo 100-8122
Japan
Email: kiyo.sato@met.kishou.go.jp

Ulrich Schumann **Germany**
DLR Oberpfaffenhofen
Institut fuer Physik der Atmosphaere
Muenchner Strasse 20
D-82234 Wessling
Germany
Email: ulrich.schumann@dlr.de

Zoltan Toth **Co_Chair of the GIFS-TIGGE Working Group**
Environmental Modelling Center, NOAA/NWS/NCEP
5200 Auth Rd., Rm. 207, Camp Springs, MD 20746
Tel: 1 301 763-8000/ext. 7596
Fax: 1 301 763-8545
Email: Zoltan.Toth@noaa.gov

Heini Wernli **Co-Chair of the PDP Working Group**
Institute for Atmospheric Physics
University of Mainz
Bechweg 21
D-550099 Mainz
Germany
Tel. 49 6131 392 3157
Fax. 49 6131 392 3532
Email: wernli@uni-mainz.de

Len Barrie **World Meteorological Organization**
7 bis, avenue de la Paix Case Postale 2300
CH-1211 Geneva 2
Switzerland
Tel: 41 22 730 8040
Fax: 41 22 730 8049
Email: lbarrie@wmo.int

Ghassem Asrar **Director of the WCRP**
World Meteorological Organization
7 bis, avenue de la Paix Case Postale 2300
CH-1211 Geneva 2
Switzerland
Email: gasrar@wmo.int

David Parsons

World Meteorological Organization
7 bis, avenue de la Paix Case Postale 2300
CH-1211 Geneva 2
Switzerland
Tel: 41 22 730 8071
Fax: 41 22 730 8049
Email: dparsons@wmo.int

David Burridge

World Meteorological Organization
7 bis, avenue de la Paix Case Postale 2300
CH-1211 Geneva 2
Switzerland
Tel: 41 22 730 8054
Fax: 41 22 730 8049
Email: d.m.burridge@btinternet.com; Dbridge@wmo.int

Jim Caughey

World Meteorological Organization
7 bis, avenue de la Paix Case Postale 2300
CH-1211 Geneva 2
Switzerland
Tel: 41 22 730 8054
Fax: 41 22 730 8049
Email: jcaughey@wmo.int

THORPEX MANAGEMENT STRUCTURE
(As agreed at the seventh session of the THORPEX ICSC
Implementing decisions ICSC7/7 and ICSC7/39))
UPDATED 1 FEBRUARY 2010

1. THORPEX International Core Steering Committee

- i. **Representatives of Nations** (Canada, France, Korea, Russia, South Africa, Morocco, Japan, Australia, UK, USA, Germany, India, Norway, China) who have voting rights.
- ii. **Representatives of International Organisations and Committees** who have observer status - currently:
- iii.

President of CAS	Dr Michel Beland
EUMETSAT	Dr Lars Prahm
EUMETNET	Dr Jochen Dibbern
ECMWF	Dr Philippe Bougeault
Chair of the WWRP/JSC	Dr Gilbert Brunet
Chair of the WWRP/SERA WG	Dr Brian Mills
CO-Chair of the WGNE	Dr Martin Miller
CGMS	Dr Jim Purdom
CBS	Dr Fred Branski
WCRP/JSC	Professor Anthony Busalacci
- iv. **One representative from each THORPEX Working Group and Regional Committee** who have observer status
- v. **Members of the ICSC Executive Committee** who have voting rights if they are members of category i (representatives of nations).
- vi. **Secretariat** including D/AREP, D/IPO(C/WWRP) and the Manager/IPO

2. ICSC Executive Committee membership

The THORPEX Executive Committee (EC) comprises the following drawn from the ICSC membership.

	Currently
Chair – the ICSC Chair	Alan Dickinson
A Trust Fund representative	Vacant
Representative of the Co-Chairs	Zoltan Toth
A representative from the WWRP/JSC	Huw Davies
A representative from the CAS Management Board	Vacant
A representative of CBS	Walter Zwiefelhofer
A secretariat	THORPEX/IPO

3. Working Groups

Three working groups, reporting to the ICSC and the EC as required, are charged with developing and coordinating the THORPEX programmes.

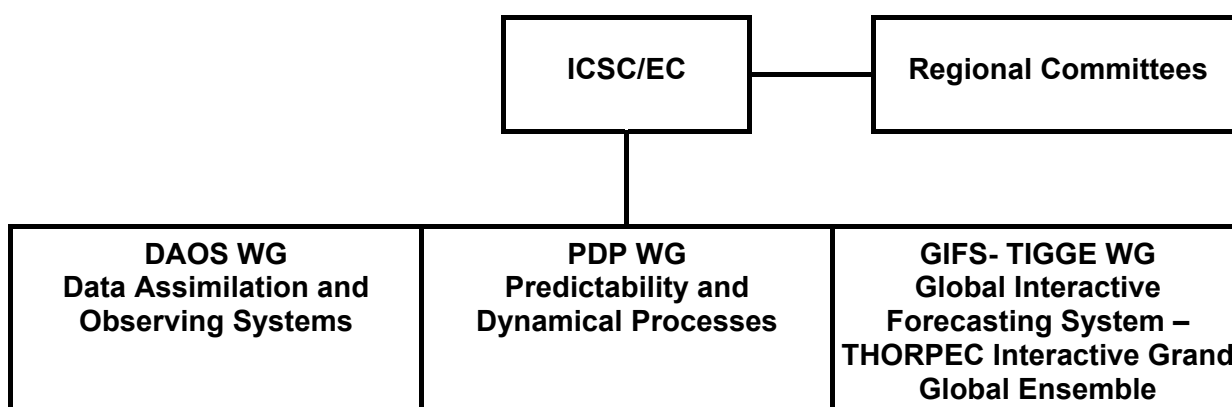
- Predictability and Dynamical Processes Working Group (PDP WG)
- Data Assimilation and Observing Systems Working Group (DAOS WG)
- Global Interactive Forecasting System (GIFS) – THORPEX Interactive Grand Global Ensemble Working Group (GIFS-TIGGE WG).

4. Regional Committees

Nations and consortia of nations have established THORPEX Regional Committees (RCs) that define regional priorities for participation in THORPEX within the framework of the THORPEX International Science and Implementation Plans. These THORPEX Regional Committees develop regional activities within the framework of the international plans and their plans are discussed by the EC and reviewed and approved by ICSC. To date Regional Committees have been established for Asia (ARC), Africa (AfRC), Europe (ERC), North America (NARC) and the Southern Hemisphere (SHRC).

5. Organigramme

The organigramme for the agreed Management Structure is:



6. Working Group Membership (as of 1 February 2010)

Data Assimilation & Observing Systems Working Group (DAOS WG)

Members	Affiliation
Pierre Gauthier (Co-chair)	CMC
Roger Saunders (Co-chair)	UKMO
Florence Rabier	Météo France
Bertrand Calpini	MeteoSwiss
Carla Cardinale	ECMWF
Ron Gelaro	NASA
Tom Hamill	CDC
Tom Keenan	BoM
Ko Koizumi	JMA
Rolf Langland	NRL
Andrew Lorenc	UKMO
Tetsuo Nakazawa	JMA
Peter Steinle	BoM

Michael Tsyroulnikov	Russia
Christopher Velden	USA
Jochen Dibbern	EUMETNET/DWD
Representative from the OPAG IOS	TBD

Predictability and Dynamical Processes Working Group (PDP WG)

Members	Affiliation
Heini Wernli (Co-chair)	University of Mainz
Istvan Szunyogh (Co-chair)	Texas A&M University
Sarah Jones	University of Karlsruhe
Craig Bishop	NRL
Thomas Jung	ECMWF
Shuhuei Maeda	JMA
Olivier Talagrand	LMD
Pat Harr	NPS

Global Interactive Forecasting System (GIFS) – THORPEX Interactive Grand Global Ensemble Working Group (GIFS-TIGGE WG)

Members	Affiliation
Zoltan Toth (Co-chair)	NCEP USA
Richard Swinbank	UKMO UK
David Richardson	ECMWF
Jing Chen	CMA China
Beth Ebert	BOM Australia
Young-Youn Park	KMA Korea
Pedro Silva Dias	CPTEC USA
Laurie Wilson	Laurie Wilson
Kiyo Sato	JMA Japan
Steve Worley	NCAR
Laurent Descamp	Météo France

Observers

Verification Working Group (Barbara Brown)
 Representatives from WWRP/SERA, PDP, DAOS WGs

LIST OF ICSC8 DECISIONS/ACTIONS

ICSC 8 Action/Decision	Responsibility	Timescale
ICSC8(1) Convene a meeting to review the THORPEX programme involving external experts, Working Group Chairs, Regional Committee Chairs. The experts will be appointed following consultation with the CAS President, Chair WWRP JSC etc.; prepare a report for ICSC 9 and publish highlights and achievements. The time-line for this review is set out in Annex IIIa below.	IPO & Working Groups & Committee Chairs	ICSC 9
ICSC8(2) The recommendations contained in Doc. 2.3.1 concerning the improvement of the scientific leadership of THORPEX should be implemented.	Chair of the WWRP JSC and the THORPEX IPO	Before the next WWRP JSC meeting
ICSC8(3) The organisers of the TTISS should be congratulated on a successful effective event.	IPO	ASAP
ICSC8(4) THORPEX should figure prominently in the next IUGG meeting (Melbourne 2011) and IAMAS meeting (Davos 2013).	IPO and THORPEX Working Groups	2010/2012
ICSC8(5) ICSC encourages NMHSs to analyse the PREVIEW case studies identified by EUCOS.	IPO and ICSC members, Working Groups and Regional Committees	ASAP
ICSC8(6) The DAOS Working Group is encouraged to produce an overall authoritative statement on targeting taking account of the T-PARC results and the experience gained over the last 10 years.	DAOS Working Group	ICSC 9
ICSC8(7) The TIGGE websites should be co-ordinated for example regarding references to available toolkits and software links.	TIGGE Working Group	ASAP
ICSC8(8) EC 3 is invited to look at the future composition of the Working Groups, especially as regards future EPS research requirements, seasonal prediction etc.	EC 3	Next EC meeting
ICSC8(9) The further involvement of the PDP /DAOS/SERA Working Groups in the analysis of T-PARC data sets is strongly encouraged.	DAOS/PDP/SERA Working Groups	ASAP
ICSC8(10) Impact of satellite data in T-PARC studies needs special attention – especially Quikscat data – which could be important to help maintain continuity of this data stream.	DAOS Working Group	ASAP
ICSC8(11) The early publication of the draft science plan for T-NAWDEX is encouraged and the full involvement of PDP/DAOS Working Groups in its further evolution.	T-NAWDEX	ASAP

ICSC 8 Action/Decision	Responsibility	Timescale
ICSC8(12) Regarding THORPEX Africa the Working Groups were asked to continue to support this initiative. A meeting in mid-2010 to advance the Information System and PDP studies was agreed.	THORPEX Working Groups and the IPO	Mid-2010
ICSC8(13) Request permission from NMHSs to continue transmission of the TC CXML files for research purposes referring to the earlier letter on this subject and the WMO EC encouragement to continue this service.	IPO	ASAP
ICSC8(14) The Chief of the WWRP should contact the Co-Chairs of the 2010 IWTC meeting and explore the possibility of a 1 day "hands on" session training session on the TIGGE data bases.	Chief WWRP	ASAP
ICSC8(15) More countries should be encouraged to launch additional radiosondes to support CONCORDIASI and NWP centres are encouraged to assess the impact of the extra data.	IPO/Chair CBS	ASAP
ICSC8(16) The ICSC was pleased to recognise the contributions of George Craig to European activities in his role of Co Chair of the ERC and asked the IPO to send a letter of appreciation.	IPO	ASAP
ICSC8(17) The ICSC encouraged the submission of TTISS papers for publication the special issue of Monthly Weather Review.	ICSC members	ASAP
ICSC8(18) US SERA activities should involve the WWRP SERA Working Group.	NARC	ASAP
ICSC8(19) The ICSC recommends that the WMO formally recognises and thanks Mel Shapiro for his long standing contributions to the THORPEX programme.	IPO	ASAP
ICSC8(20) Argentina should become a member of the SHRC.	SHRC	ASAP
ICSC8(21) The IPO should take note and follow up EC actions/decisions on the EC-RTT Report related to THORPEX.	IPO	June 2010
ICSC8(22) – actions and recommendations from the joint session of the ICSC and the WGNE may be found in Annex IIIb below.		-
ICSC8(23) Doc.7.1 defining the organisation and management of THORPEX FDPs was endorsed.	IPO	ASAP
ICSC8(24) Reflecting the ICSC concerns expressed on the current GIFS plans the meeting strongly encouraged the GIFS-TIGGE WG to focus on two topics taking a "bottom-up approach" – TC tracks and heavy precipitation and to follow these up in the context of existing FDPs e.g. Shanghai, Southern Africa , Pacific Islands.	GIFS-TIGGE WG	Feb.2010

ICSC 8 Action/Decision	Responsibility	Timescale
ICSC8(25) Convene a workshop to develop proposals for an IPY follow on THORPEX polar project.	IPO/Norwegian Meteorological Institute	Spring 2010
ICSC8(26) The future budget and programme of meetings was agreed.	IPO	ASAP

ANNEX IIIa - Time-line for preparation of a draft mid-term review of the THORPEX achievements

- i. Request review material from Working Group and Regional Committee Chairs, Field Experiment PIs etc. by 31 May 2010
- ii. IPO to prepare preliminary draft paper
- iii. Select independent experts (by EC3)
- iv. Convene a small Workshop mid-September to prepare a reviewed draft for ICSC 9
- v. Arrange publication of key achievements - post ICSC 9

ANNEX IIIb - Actions and recommendations arising from the joint ICSC and WGNE session

ICSC/WGNE Actions/Recommendations	Responsibility	Timescale
(i) Atmospheric composition particularly the inclusion of aerosol in NWP systems is currently being discussed by the WGNE and WWRP efforts should await the outcome of this discussion.	WGNE; WWRP/JSC and ICSC Chairs	WGNE26; WWRP/JSC; ICSC9
(ii) In addition to its work on the verification of ensemble prediction systems and the predictions of high-impact weather, the JWGFVR were requested to address the verification of sub-seasonal prediction; the verification of longer-range forecasts were the pervue of WCRP groups.	Chairs of the JWGFVR to report to WWRP/JSC and the ICSC	WWRP/JSC4 ICSC9
(iii) EC-RTT – the ICSC/WGNE response should be to identify a few key research projects for WCRP/WWRP to champion.	IPO/ICSC/WGNE	WGNE26/ ICSC9
(iv) It was agreed that WWRP/THORPEX should be involved in the model development survey and the follow-up – THORPEX should consider what support can be given by the PDP Working Group.	IPO and the PDP Working Group	ASAP
(v) It was agreed that the PDP Working Group would be involved in the WGNE in the Parametrization Workshop.	IPO and the PDP Working Group	ASAP
(vi) It was recommended that the planned YOTC science meetings should be broadened; in addition, a “synoptic” summary of the tropical events/weather during the YOTC “year” should be prepared.	Mitch Moncrieff and Duane Waliser (YOTC PIs)	ASAP
(vii) The GEWEX and THORPEX support for HyMeX should be coordinated as should the support, where appropriate, for T-NAWDEX.	IPO/GEWEX SSG	ASAP
(viii) The development of HEPEX should be monitored.	ICSC/WGNE	WGNE26/ ICSC9

ICSC/WGNE Actions/Recommendations	Responsibility	Timescale
(ix) The WGNE and the PDP Working Group should establish cross-representation on each group; the PDP Working Group should “write-up” a diagnostic work-programme in collaboration with the WGNE.	PDP Working Group/ WGNE/ IPO	WGNE26/ ICSC9
(x) It was agreed to establish a joint project to study the issues of model resolutions in the “grey zone” where deep convection is not resolved and cannot easily be parametrized (horizontal resolutions around 5 km) – the project to be lead by the WGNE and the WWRP Mesocale Working Group.	WWRP and WGNE Chairs	WGNE26
(xi) Communications between the groups should be improved.	Chairs of WCRP. WGNE, GEWEX, WWRP and the ICSC	ASAP

LIST OF ICSC PERMANENT ACTIONS

PERMANENT THORPEX ICSC ACTIONS (4 November 2009)

Number	Reference	Action	Responsible	Status/Due
ICSC-P/01	Cg-XIV ICSC-2	To encourage WMO Members to actively participate in implementation of THORPEX.	ICSC, RCs, IPO	Ongoing
ICSC-P/02	Cg-XIV ICSC TOR	To assist WMO Members in the International coordination of THORPEX.	ICSC, IPO, SSC-WWRP, WGNE, CBS	Ongoing
ICSC-P/03	Cg-XIV	To assist WMO Members from developing countries in their utilization of THORPEX-related forecast product.	ICSC, RCs, CBS, IPO	Ongoing
ICSC-P/04	Cg-XIV	To assist THORPEX in coordination with CBS, WCRP, JCOMM and other WMO programmes as appropriate.	ICSC, IPO	Ongoing
ICSC-P/05	Cg-XIV	To facilitate the participation in THORPEX of other international bodies.	ICSC, IPO	Ongoing
ICSC-P/06	ICSC TOR	To provide the global and regional priorities with respect to the THORPEX sub-programmes.	ICSC, RCs	Ongoing
ICSC-P/07	ICSC TOR	To provide guidance to the NMHSs on the timely transition of THORPEX research and development to operations.	ICSC, RCs, CBS	Ongoing with CBS involvement
ICSC-P/08	Cg-XIV ICSC TOR	To identify and mobilize national and international resources, financial, technical and human, to support THORPEX activities.	ICSC, RCs, IPO, all members	Ongoing
ICSC-P/09	ICSC-3/17	ICSC members and Regional Committees to provide quarterly progress reports on activity and plans to the Chair of ICSC and IPO. Regional Committees to submit reports to the Chair of ICSC and IPO not later than at least 6 weeks prior the session of the ICSC.	ICSC Chair, members, RCs, IPO	Ongoing
ICSC-P/10	ICSC-2/02 ICSC-3/15	All THORPEX members to make annual contributions to the THORPEX Trust Fund in accordance with the approved budget and not later than 31 March.	All THORPEX members	Ongoing
ICSC-P/11	ICSC-2/02 ICSC-3/16	All THORPEX members to make provisions and ensure allocation of necessary funds for next year before 31 October.	All THORPEX members	31 October

Number	Reference	Action	Responsible	Status/Due
ICSC-P/12	ICSC-2/04 ICSC-3/14	ICSC members to consider secondment of experts to serve at the THORPEX IPO and to inform the ICSC Chair and WMO/AREP Director on any progress.	All THORPEX members	Closed for China and UK. Ongoing for other members
ICSC-P/13	ICSC-3/18	ICSC Members to regularly update status of implementation of actions and inform the IPO.	ICSC, IPO	Ongoing
ICSC-P/14	ICSC-3/09	ICSC members to pursue national inputs to GEO framework and Implementation Plan. ICSC with assistance of IPO to provide when appropriate related THORPEX requirements for consideration in relevant GEO deliberations.	ICSC, IPO	Ongoing
ICSC-P/15	ICSC-3/11	The Regional Committees to ensure that regional plans are developed in coordination with ICSC, EB, core sub programmes, and between regions, and are consistent with the International Science and Implementation Plans.	ICSC, RCs	Ongoing

LIST OF THORPEX SERIES PUBLICATIONS

1. International Core Steering Committee for THORPEX, Third Session, 16-17 December 2003, Montreal, Canada. Final Report. WMO/TD-No. 1217, WWRP/THORPEX No. 1.
2. M.A. SHAPIRO, A.J. THORPE, 2004: THORPEX International Science Plan Version 3. WMO/TD-No.1246, WWRP/THORPEX No. 2.
3. International Core Steering Committee for THORPEX. Fourth Session 2-3 December 2004, Montreal, Canada. Final Report. WMO/TD-No. 1257, WWRP/THORPEX No. 3.
4. THORPEX International Research Implementation Plan Version 1. WMO/TD-No. 1258, WWRP/THORPEX No. 4.
5. First Workshop on the THORPEX Interactive Grand Global Ensemble (TIGGE), Reading, United Kingdom, 1-3 March 2005, WMO/TD-No. 1273, WWRP/THORPEX No.5.
6. Symposium Proceedings - The First THORPEX International Science Symposium, 6-10 December 2004, Montreal, Canada, WMO/TD-No. 1237 WWRP/THORPEX No. 6.
7. Symposium Proceedings – The Second THORPEX International Science Symposium, 4-8 December 2006, Landshut, Bavaria, Germany, WMO/TD-No. 1355, WWRP/THORPEX No. 7.
8. International Core Steering Committee for THORPEX. Sixth Session 25-27 April 2007, Geneva, Switzerland. Final Report. WMO/TD-No. 1389, WWRP/THORPEX No. 8.
9. The YOTC Science Plan – A Joint WCRP-WWRP/THORPEX International Initiative. WMO/TD-No. 1452, WCRP-130, WWRP/THORPEX No. 9.
10. African Science Plan – Version 1. WMO/TD-No. 1460, WWRP/THORPEX No. 10.
11. WWRP/THORPEX African Implementation Plan – Version 1. WMO/TD-No. 1462, WWRP/THORPEX No. 11.
12. International Core Steering Committee for THORPEX. Seventh Session 18-20 November 2008, Geneva, Switzerland. Final Report. WMO/TD-No. 1495, WWRP/THORPEX No. 12
13. International Core Steering Committee for THORPEX. Eighth Session 2-4 November 2009, Geneva, Switzerland. Final Report. WMO/TD-No. 1522, WWRP/THORPEX No. 13.