

This document report summarizes the presentations, discussion and decisions of the 3<sup>rd</sup> Joint Scientific Committee (JSC) of the Open Programme Area Group (OPAG) of the World Weather Research Programme. This meeting of the JSC took in Monterey, California on 9 to 11 September 2009. The general intent is to cover recent efforts and for the JSC to examine and guide future projects. Regarding guidance on future programmes, the role of the JSC regarding the efforts of the WWRP's THORPEX Programme is to provide input for the final decisions of the THORPEX's International Core Steering Committee. The goals of the JSC meeting include:

- i) Finalize the Strategic Plan of the WWRP for general release
- ii) Review the recently completed major activities of the WWRP including the presentation of the final reports on the MAP D-PHASE Project and Beijing 08 Projects
- iii) Make decision on the future direction of the WWRP including recommendations on future projects of the WWRP
- iv) Develop recommendations to the THORPEX International Core Steering Committee on the scientific directions of THORPEX
- v) Prepare for the upcoming 2009 CAS meeting, including discussion of CAS Vision Papers
- vi) Discuss 2010 and 2011 workshops, symposia and conferences

## **1. Opening sessions on the organization of the meeting**

The meeting was opened by Dr. Gilbert Brunet who is the Chair of the JSC. The JSC adopted the agenda after some slight modification, discussed the goals and the working arrangements. The JSC welcomed and introduced the Invited Experts. A list of the participants are included in Appendix A. The opening activities also included a welcome by Dr. Jim Hansen of Naval Research Laboratory, the US THORPEX lead, who kindly organized the meeting. The JSC thanked Dr Hansen for his role in organizing this meeting and also his role in the 3<sup>rd</sup> THORPEX Science Symposium that follows the JSC meeting.

## **2. MANAGEMENT REPORTS**

**2.1 Report of the Chair:** The JSC Chair, Dr. Gilbert Brunet, reported on the status of the WWRP and on the activities during the past year. He noted the successes of the past year including the completion of the 1<sup>st</sup> Strategic Plan for the Implementation of the WWRP. He noted the completion of successful projects including the MAP D-PHASE and Beijing 08 Forecast Demonstration Projects (FDPs) and the Beijing 08 RDP. The completion of the five vision papers for the Bulletin of the American Meteorological Society, the long-term vision papers for the upcoming Committee for the Atmospheric Sciences (CAS), and the findings of the WMO Executive Committee's Research Task Team were all mentioned as documents that provide long-term direction for the WWRP.

**2.2 Outcomes of the 61<sup>st</sup> WMO/Executive Committee (EC) and the EC Task Team on Research (EC-RTT):** Dr David Parsons, Chief of the World Weather Research Programme, presented a review of relevant items from the meeting of the 61<sup>st</sup> WMO Executive Committee (61<sup>st</sup> EC) and the EC-RTT. He noted that many of the EC decisions and the EC-RTT report recommended research activities that clearly expanded the scope of the WWRP

to include collaborations with climate, hydrological, ocean (storm surge) and environmental prediction. The 61<sup>st</sup> EC and the EC-RTT also called for a greater emphasis on FDPs and a greater involvement of the developing nations.

**Decision 2.1:** The JSC noted that the Members have expanded their involvement in the WWRP so that the WMO Secretariat is already stretched to the limit. Extending the scope of the WWRP will only make matters worse. The WWRP structure needs to be examined in light of this expansion of scope and these new demands. A strong case exists for additional funding for the WMO Secretariat, both for staffing and for support of the WWRP programme. Action: The JSC Chair, the THORPEX IPO and WWRD Chief to bring this issue to the attention of the CAS Management Committee.

### 3. WWRP: STATUS AND FUTURE RESEARCH ACTIVITIES

#### 3.1 Report on the status of the Strategic Plan for the Implementation of the WMO's World Weather Research Project:

Dr. Gilbert Brunet presented the status of the nearly complete Strategic Plan for the Implementation of the WMO's WWRP and the time-line for completion of this plan so that it can be brought to the CAS Management Committee for approval and subsequently presented at the CAS XV.

**Decision 3.1:** The JSC acknowledged the importance of the completion of this first strategic plan for the WWRP and how this effort brought together the different components of the WWRP. The JSC accepted the Strategic Plan and will rapidly move toward submission of the plan to the CAS Management Committee for their approval. A number of modest revisions were suggested to the plan including: i) Modification of the Figure 2.1 that outlines the organization and activities of the WWRP. ii) Seeking to gain more consistency between the tasks listed in the plan with the inclusion of timelines, when possible, and iii) also placing the tasks in an appendix. The motivation for this later change in the plan is that the tasks will change with each JSC, while the strategic goals will likely be valid for the time period 2009 through 2017. Action: JSC Chair, Working Group Chairs and WWRD Chief to work with Pierre Dubrieul on completion of the document in the next two weeks (e.g., all comments in to Pierre for incorporation by 25 September 2009). Also, WWRD Chief to arrange some mechanism for the WMO to acknowledge the efforts of the editor of this document.

#### 3.2 FINAL REPORTS OF RECENT WWRP FORECAST DEMONSTRATION PROJECTS (FDPs) AND RESEARCH AND DEVELOPMENT PROJECTS (RDPs)

##### 3.2.1 Final report on the MAP D-PHASE FDP:

Dr. Mathias Rotach made a presentation on the MAP D-PHASE FDP, which was an operational follow on to the successful MAP RDP. The presentation was accompanied by a "Final" Report to the JSC on the MAP D-PHASE Project. The word "final" is in quotes since the MAP D-PHASE research continues and the project has an operational follow-on.

**Decision 3.2.1:** The JSC noted the success of the MAP D-PHASE project and thanked those involved including the lead organization (Meteo Swiss) and all those involved in the effort. The written report to the JSC is accepted. JSC in particular noted the long-term legacies of the MAP D-PHASE including i) operational continuation of the project in that MAP D-PHASE visualization platform served as prototype for the Swiss Natural Hazards project called GIN, ii) that D-PHASE has become a Testbed for several other projects including several long-term funded research projects, iii) that operational hydrological efforts have developed out of D-PHASE. Action: The WMO Secretariat should arrange for a letter

from the Sec. General's Office acknowledging the efforts of Meteo Swiss. In addition, the value of the "final" report on MAP D-PHASE is acknowledged as a valuable record of the lessons learned from this successful project that can be applied to other WWRP projects, collaborations between weather and hydrological research as well as broader efforts to transition research into the operational environment.

### **3.2.2 and 3.2.3 Final report on the Beijing 08 RDP and 3.2.4 Final report on the Beijing 08 RDP**

The final Final report on the Beijing 08 FDP and RDP were presented by Dr. Jianjie Wang and Jiandong Gong, respectively. The FDP concentrated more on operational nowcasting. The RDP focused more on the use of limited area ensemble models in a research mode with some operational deliverables reaching operational forecasting through the communication of the modeling results to the FDP. These projects were both successful in meeting their goals in large part due to the work of the international team of research and operational scientists, the support of the CMA and the long lead time for the planning and execution of these projects. In terms of this lead time, these projects should not be considered as activities that happened only during the Beijing 08 Games, but instead a multi-year effort to test and improve nowcasting systems, regional ensemble models and delivery of services to the community.

**Decision 3.2.2:** The JSC MAP D-PHASE and the Beijing 08 FDPs are quite successful in terms of providing lasting operational improvements. The JSC stressed that the WMO Secretariat should better raise the visibility of these two FDPs within the organization and the weather community. Members representatives, in particular, need to know the lasting value of the FDP to service delivery within the host NHMS and the value of these efforts to the participating nations. Members also need to be informed that the commitment of financial and Member resources have been an impediment to such efforts in developing and least developing countries. Action: WMO Secretariat should propose a session on FDPs at the WMO Executive Council and ensure high visibility of these two FDPs in the upcoming CAS and pre-CAS meetings. CAS documents should reflect these projects and their implications for the developing world.

**Decision 3.2.3:** The JSC noted the success of the Beijing 08 FDP and RDP and the JSC wishes to acknowledge everyone involved, including the lead organization (CMA). The written report presented to the JSC should be formally published as a single document and subsequently accepted by the JSC. JSC in particular noted the long-term legacies of the CMA including: i) the development of nowcasting systems and services in Beijing and the potential to improve operational nowcasting throughout China and spread this success to other countries in Asia; ii) the role of these projects in improving the nowcasting systems of the participating nations; iii) the progress in ensemble nowcasting and in developing blended nowcasting-FDP systems; iv) the contribution of the RDP in advancing our knowledge of the design and use of mesoscale ensemble prediction systems in an operational setting. Action: The WMO Secretariat offers its assistance in editing and publishing the "final" report on the Beijing FDP and RDP. After the CMA completes the publication of their report and presents it to the WMO, the WMO Secretariat should arrange for a letter from the WMO Sec. General's Office acknowledging the efforts of the CMA. The JSC also recommends that the Nowcasting Research and Mesoscale Forecasting Research Working Groups should work with the CMA and the leads of the Beijing 08 projects to undertake a training session based on the Beijing 08 projects in 2010 or early 2011. The extension of these results to other areas of China and to other nations in the region would be an important legacy of these efforts.

**Decision 3.3.4:** The discussions noted the role the JSC had in initiating and guiding MAP D-PHASE and the Beijing 08 projects. Action: In addition to considering FDPs and RDPs proposed and brought forth to the JSC by members of the research community, time should

be given at the next JSC for the Committee Members and Invited Experts to discuss and propose new themes for future FDPs. This dialog at the JSC would be more effective if exchanges of ideas on this topic took place prior to the JSC and the JSC Chair is asked to name a focal point(s) on the JSC for this topic.

### **3.3.1 Report of the Working Group (WG) on Nowcasting Research**

Dr. Tom Keenan, the Chair of the Working Group on Nowcasting Research presented the activities of this Working Group and their plan for the future. The issues and activities presented included a discussion of the recently completed International Symposium on Nowcasting and Very Short Range Forecasting (WSN09) that was held in Whistler, British Columbia, from 30 August to 4 September 2009. The presentation also updated the JSC on collaborations with the PWS (Public Weather Service) on the World EXPO 2010 Nowcast Services (WENS) Demonstration Project and the growing linkages between the Working Group on Nowcasting Research and the Working Group on Mesoscale Forecasting Research. The critical role of the Working Group on Nowcasting Research in the Beijing 08, SNOW V10 projects was also noted.

**Decision 3.3.1** During the discussions, the JSC noted that a CBS representative was not present, but a representative needs to attend the next JSC meeting. Action: The WMO Secretariat is asked to contact CBS and ask that a representative be represented. The WMO Secretariat needs to ensure attendance of this representative at the next JSC.

**Decision 3.3.2:** The JSC also noted the tendency and need for mesoscale and nowcasting research working groups (and research communities) to work more closely on problems of interest. The JSC also noted the variety of Member needs that require high-resolution predictions, improved nowcasting techniques and optimal forecaster-machine interfaces for a variety of applications (e.g., megacities, hydrology, marine environment, aviation, tropical nowcasting). The JSC noted the unique difficulties associated with the observational components in nowcasting and mesoscale prediction (e.g., radar quality control, international access to aerosol and radar data in real-time, need for high-resolution observations to verify and initialize models). For many nations, the aerosol and hydrological observations line outside of the national meteorological services. These difficulties and challenges need to be outlined in the vision paper on regional prediction. Another issue that needs to be considered in the future is to define the role of forecasters including how to develop a more automated forecast systems with increasing integrated and seamless applications for high-impact events. Action: The JSC supported the general concepts outlined in this Vision Paper on Regional Prediction. However, the authors of this vision paper are asked to take these issues raised into account in completing this document and the JSC Committee Members are asked to provide comments on this vision paper as soon as possible.

**Decision 3.3.3:** The nowcasting symposium is a successful activity, important for NMHSs and the only major international forum for this discipline. Action: The JSC requested that the Secretariat consider holding this symposium every 3 years.

**Decision 3.3.4:** The Chair of the Nowcasting Working Group noted the need to revisit the membership of Working Group on Nowcasting Research as membership mandates have been over extended and new research avenues are investigated; Action: NWG Chair to work with JSC Chair and WMO Secretariat on the future membership of this Working Group.

**Decision 3.3.5:** The JSC discussed the upcoming CBS-CAS Workshop on “forecast systems”. Action: The Chairs of the Nowcasting Research and Mesoscale Forecasting Research Working Groups and the JSC Chair need to work together to ensure the variety of points of view within the JSC are represented in the design of this workshop.

### 3.3.3 SNOW V2010 RDP

Dr. George Isaac presented the general motivation for the SNOW V2010 RDP and the current status of this project. The JSC noted that this project addresses a new area of research (winter nowcasting in a challenging orographic environment) for the nowcasting research community linked to the WWRP. While the RDP planning has been closely linked to the Working Group on Nowcasting Research, the SNOW V10 has not yet been endorsed as a WWRP Project. Thus, this agenda item was to seek both endorsement and guidance of the JSC to the SNOW V2010 RDP.

**Decision 3.3.6:** The JSC appreciated with the progress in planning this project and concurs that nowcasting for winter weather is an important and relevant topic for the WWRP. Action: The JSC approved SNOW V10 as a RDP of the WWRP. Environment Canada is urged to complete the participant invitation and formal agreements following the model of the Beijing 08 as soon as possible.

### 3.3.4 Sochi 2014

Dr. Dmitri B. Kiktev of the Hydrometeorological Centre of Russia presented the forecast and societal challenges of the Sochi 2014 Winter Olympic and Paralympic Games. The presentation discussed how these challenges impact the requirements for observing system and forecast capabilities. The intent of this presentation was to determine if there was interest in developing a WWRP role in the forecasting for the Sochi Games.

**Decision 3.3.7:** The JSC noted the successful WWRP FDP and RDP efforts in association with the Games in Sydney and Beijing Games and that a FDP project for Sochi 2014 will build upon the results of the upcoming SNOW V10 Project. Action: The JSC strongly encouraged a WWRP project be developed in association with the Sochi 2014 Games. The next step is to have a meeting between possible critical persons who may be involved in this effort meet in 2010. This group should include a representative(s) of Roshydromet, the relevant WWRP Working Groups (e.g., Nowcasting, Mesoscale, Verification, SERA), SNOW V10 and WMO Secretariat. A representative of THORPEX and/or the JSC Chair should also be considered.

**Decision 3.3.8:** The JSC noted the possibility of broader scientific areas of research (e.g., satellite data assimilation, high resolution deterministic and mesoscale ensemble modeling) that could be associated a forecasting effort for Sochi. Action: As the project develops the project leaders are encouraged to work with the THORPEX Data Assimilation Working Group and that EUMETNET and EUMETSAT organizations are asked to play a role in this effort.

## 3.4 Regional Modeling

### 3.4.1 and 3.4.2 Report of the Mesoscale Forecasting Research Working Group Chair (including COPS and EUROPREDICT)

Dr. Jeanette Onvlee presented the report of the plans and progress of the Working Group on Mesoscale Forecasting Research. The presentation discussed the contributions of this Working Groups to a variety of efforts including the MAP D-PHASE FDP, the Beijing 08 efforts, the COPS research project, the proposed EUROPREDICT Project, Shanghai MHEWS, AMARYTH and a variety of other efforts. The report also noted that the nowcasting and mesoscale working groups had increased their collaborations.

**Decision 3.4.1:** The JSC noted that the concept of a testbed and integrated research environment is a critical component of the activities of this Working Group. However, this concept is not defined in the implementation plan. Action: The chair of the Mesoscale

Forecasting Research Working Group is asked to provide a concise definition of this concept in order for the JSC to have a criteria to judge these efforts. This concept and criteria need to be included in the Strategic Plan.

**Decision 3.4.2:** The JSC noted the lack of international modeling partners found for the mesoscale ensemble prediction RDP for Shanghai MHEWS. Action: The resources required for the relatively long six month time-period for the Shanghai Multi-hazard project is one of the main reasons why modeling partners outside of China have not volunteered for this effort. Any efforts to gain modeling partners for this effort need to move rapidly as the planning window is quite short. To overcome the long period of commitment these modeling efforts could focus on the periods when tropical cyclone are present over the NW Pacific with simulations only for periods when typhoons have developed. The Mesoscale Forecasting Research Working Group Chair, the Shanghai Tropical Cyclone lead, the lead of the THORPEX Asian Regional Committee and the lead of Tropical Cyclone Panel to encourage such modeling efforts. The efforts to find modeling partners by contacting tropical modeling groups prior to the mid-October Shanghai meeting.

**Decision 3.4.3:** The JSC noted the success of the COPS effort. Action: The COPS leads are urged to attend the next JSC and make a presentation of the progress of this effort and consider a written report (following MAP D-PHASE and Beijing 08) on this WWRP Project.

**Decision 3.4.4** The JSC supports the tendency for the mesoscale and nowcasting working groups to closer together on research problems of mutual interest. Action: The JSC supports the proposed small focused workshop on the mesoscale modeling for nowcasting time-scales proposed by these two working groups.

### **3.4.3 Sand and Dust Storm Prediction**

The status of the WWRP-GAW Joint Project on Sand and Dust Storm Warning, Advisory and Assessment System (SDS-WAS) was presented by Dr. David Parsons. The recent progress of the SDS-WAS Project included the development of an implementation plan for the project and significant progress toward the establishment of two regional nodes: i) In Spain for Europe, the Middle East and Northern Africa, ii) In China for Asia.

**Decision 3.4.4:** The JSC notes had several concerns about this project including: i) The lack of reporting by the leads of this project to the JSC as the WMO Secretariat has reported on this effort at the last three JSCs; ii) The need for forecast products on this web site to include a defined measure of the skill that could be expected to such forecasts; iii) Whether the project has a significant focus devoted to verification; iv) Whether the effort has a strong and active research component devoted to identifying and reducing the barriers to improved sand and dust prediction including research activities to advance data assimilation and the quality of the numerical models (e.g., improvement in relevant physical parameterizations, role of increased resolution etc); v) whether the science committees have a significant representation with modeling and data assimilation expertise; vi) whether formal participation agreements have been drafted for the contributing modeling and observational partners; vii) presentations often show a general lack of recognition of the WWRP JSC and the Arab League in the initiation of this project as these groups were instrumental in calling for the first workshop on this topic. Action: A scientific project lead from outside the WMO needs to report on the status of this project at the next JSC and in the short term the WMO Secretariat needs to communicate these concerns to the chair(s) of the scientific committee of this project. The WMO Secretariat also needs to distribute the science and implementation plans for this project.

### **3.4.5 TIGGE LAM**

A presentation was made by Dr. Tiziana Paccagnella on TIGGE-LAM (THORPEX Interactive Grand Global Ensemble – Limited Area Modeling) Project. Dr Paccagnella chairs the

THORPEX working group on TIGGE-LAM. The progress on TIGGE LAM was noted by the JSC including the outcomes of the first meeting of the TIGGE-LAM Working Group such as establishment of priority fields to be archived and establishing the interest of archive centres and modeling groups. It was also evident from this presentation that the implementation of TIGGE-LAM activities would be easier in Europe with its relatively large number of nations with limited area modeling systems.

**Decision 3.4.5:** The JSC noted the important goals of TIGGE LAM and the more general need to develop a research and implementation plan for advancing mesoscale ensemble prediction. The JSC urged that the THORPEX ICSC consider asking the TIGGE LAM working group to develop a concise plan outlining the motivation and scientific issues for advancing mesoscale ensemble prediction and how these issues could be advanced by TIGGE LAM and related WWRP activities. Other working groups in THORPEX and the WWRP (e.g., Working Groups on Mesoscale Forecasting Research, Joint Working Group on Verification Forecasting Research, SERA) could play a strong role in developing this document. Action: The JSC urged that the TIGGE LAM lead, the chair of the Mesoscale Forecast Working Group, the THORPEX IPO and the co-chair of the GIFS-TIGGE Working Group discuss and decide on the path forward. This path forward should be discussed at the THORPEX ICSC.

### 3.5 Verification and Assessment of Forecast Skill

#### 3.5.1 Report of the Working Group on Forecast Verification Research

The Chair of the Joint Working Group on Forecast Verification Research, Ms Barbara Brown, made a presentation on the recent activities of this working group. The highlights of this groups activities included: i) the publication of a WMO report on precipitation verification; ii) the role of the working group in the Beijing 08 FDP and RDP and the upcoming Shanghai and SNOW V10 projects; iii) the work on cloud verification that will also lead to a WMO publication; iv) the spatial intercomparison project, which will lead to a special collection of papers in Weather and Forecasting; v) the 4<sup>th</sup> International Workshop on Verification and the associated verification tutorial, which included students from 24 nations; vi) a variety of outreach activities (e.g., EUMETCAL training modules, access to web-based through the verification web page and three travelling tutorials).

**Decision 3.5.1:** The JSC noted the cross-cutting success of this group and the importance of these activities, tools and techniques to the academic, weather research and operational communities. The JSC also notes that means need to be found to reduce the workload on the members of this working group. Action: The JSC urges the following steps: i) the Working Group Co-chair and the WMO Secretariat ask the CBS Verification Group to take a greater role in training sessions on new techniques and to further the operational transition of research methods; ii) future FDPs and RDPs that require verification try to make use of existing verification packages and on-line tutorials; iii) other means to conduct training be considered (e.g., training an early part of RDPs and FDPs, travelling training sessions in a specific region, developing and transferring training modules to other groups and training new presenters).

**Decision 3.5.2:** Strong support was noted for avenues of new research proposed by the chair of the joint verification working group. These new research areas for verification include deterministic and ensemble predictions of tropical cyclone, warnings, extreme/high impact events and user needs. Action: The JSC urges the chairs of the Verification and SERA Working Groups to consider these topics in their future activities.

#### 3.5.1 Working Group on Numerical Experimentation (WGNE)

Dr David Burrige of the THORPEX IPO presented a talk assembled for WGNE on the accomplishments and future directions of WGNE. This presentation documented the current

and future role of WGNE in both the WCRP and the programmes of CAS. One aspect of the future work of WGNE is an increased role in model development including efforts to improve the physical/dynamical parameterizations of subgrid scale processes.

**Decision 3.5.3:** The JSC notes that research to improve prediction through reducing model error are important to the activities of the WWRP and THORPEX. The JSC notes the expanding scope of WGNE in this area. Action: Efforts should be made to clarify the interaction between the WWRP (including THORPEX) and WGNE activities in this area. The JSC notes the importance of the joint meeting of the THORPEX ICSC and WGNE and the subsequent CAS meeting in addressing this issue.

**Decision 3.5.4:** The relationship between high resolution modeling in WWRP and WGNE needs to be developed. Action: The Chair of the Mesoscale Forecasting Research Working Group should attend the WGNE meeting and the WMO Secretariat needs to ensure these activities are on the agenda by working with the WGNE Co-chairs.

**Decision 3.5.5:** The JSC noted the upcoming conference on Physical System Parameterization. Action: The JSC stressed that the WWRP needs to be equal partners with WCRP in this conference. For example, the meeting should have a co-chair from WCRP and one from the WWRP. This recommendation will be communicated to the WGNE Chairs by the JSC Chair and the WMO Secretariat (e.g., THORPEX IPO) through the CAS President.

### 3.6 THORPEX programme

A presentation on the status of the THORPEX programme was made by Dr David Burridge, the Manager of the THORPEX International Project Office at the WMO. A wide variety of THORPEX activities were presented including i) the Year of Tropical Convection (YOTC); ii) the THORPEX cluster of ten projects during the International Polar Year, iii) GIFS-TIGGE, iv) the THORPEX regional campaigns, v) THORPEX Africa. Several of these items (e.g., GIFS-TIGGE, YOTC and the T-NAWDEX regional campaign) are discussed in more detail later in the agenda.

**Decision 3.6.1:** The JSC appreciated the presentation on THORPEX. Action: The JSC looks forward to discussions at the ICSC 8 to clarify the role of the JSC in providing scientific guidance to THORPEX.

**Decision 3.6.2:** The JSC noted the variety of activities associated with the Indian THORPEX effort and with Indian Megacities project. Action: Since the representative from India was unable to attend this meeting, the JSC asks that the THORPEX IPO consider inviting a representative to the THORPEX ICSC and also that a better connection be made between the WMO Secretariat, the Nowcasting and Mesoscale Forecasting Research Working Groups and the Indian effort including the possibility of a visit to the appropriate research and operational institutions in India.

#### 3.6.2 T-NAWDEX

Dr. Pat Harr of the Naval Postgraduate School presented the status of the planning for the T-NAWDEX (THORPEX North Atlantic Waveguide and Downstream Impact Experiment) project. T-NAWDEX will have two experimental components: an international field experiment and theoretical/diagnostic/modeling. Both components will address the following phases of wave guide disturbances: 1) Triggering of wave guide disturbances by different dynamical processes; 2) Downstream evolution of the disturbances along the wave guide 3) Downstream impact of wave guide disturbances over Europe and North Africa. The field phase is planned to be performed in autumn 2012 in conjunction with HYMEX - the Hydrological Cycle in the Mediterranean Experiment.

**Decision 3.6.2:** The JSC noted with appreciation the plans for the T-NAWDEX project and encourages further activities to plan this effort. *Action: The JSC wishes that the organizers of T-NAWDEX to consider the following issues: i) the need for broader international involvement; ii) the importance of satellite data assimilation including the space lidar data if it is available; iii) the greater involvement of the THORPEX DAOS in the planning; the importance of following the model and/or tools of the YOTC project to satellite access.*

### **3.6.3 GIFS (Global Interactive Forecast System)-TIGGE and GIFS FDP and links to Severe Weather Forecasting Demonstration Project (SWFDP)**

Richard Swinbank presented the status of the GIFS-TIGGE project, research using the TIGGE data sets and plans for future activities. The project has made a strong increase in the number of researchers who are accessing output from operational ensemble modeling systems including a growing number of users from developing nations. The skill of the TIGGE multi-model approach relative to the individual models have been explored for middle latitude and tropical upper-air parameters, rainfall, surface temperature and tropical cyclones. The presentation also discussed the plans for FDPs based on the multi-model approach envisioned for GIFS including an FDP in association with the SWFDP in southern Africa. The SWFDP is a CBS project. The flow of forecast information that utilizes model output from the ECMWF, Met Office and NCEP, which is sent to the Regional Specialized Meteorological Centre at the S Africa Weather Service. This regional centre then utilizes these products to cascade forecast information to the other nations of southern Africa. A proposed general framework for these FDPs was presented that begins with tropical cyclones prediction and then moves to heavy rainfall.

**Decision 3.6.3:** The JSC stressed the importance of success of a THORPEX GIFS FDP effort in association with the SWFDP since the SWFDP effort is improving prediction and saving lives in the developing world. Such an effort is also part of the THORPEX Africa plans. *Action: The JSC wishes that organizers of this project consider: i) the potential role of mesoscale deterministic and ensemble prediction in this effort and that the organizers welcome partners in this area in ways that will not distract from the central goals; ii) strongly encourage a verification and SERA component in this project; iii) the importance of supporting TIGGE research to quantify the potential advances of a multi-model approach and to guide the implementation of any research effort ; iv) utilize the expertise and structure of the other WWRP groups in tropical research including the upcoming IWTC meeting in La Reunion where a talk or session on GIFS FDPs should take place.*

## **3.7 Tropical Meteorological Research**

### **3.7.1 Report of the Working Group on Tropical Meteorological Research**

The Chair of the Working Group on Tropical Meteorological Research, Professor Lianshou Chen, presented the recent activities and current plans of this working group. The working group was involved in three major conferences: i) 2<sup>nd</sup> International Working on Tropical Cyclone Landfall Processes, ii) The 4<sup>th</sup> International Workshop on Monsoons; iii) the 1<sup>st</sup> Conference on Climate Change and Tropical Cyclones in the Indian Ocean. The Working Group also was involved in the T-PARC/TCS-08, an updated statement on tropical cyclones and climate change and the plans for three data centres related to monsoon meteorology. Future meetings were also discussed. The presentation included an overview of forecast challenges and damage from tropical cyclone Morakot, which had unusual variations in its velocity near landfall perhaps associated with significant orography. The CMA is proposing a project to study tropical cyclone near landfall and it could be a focal point for future international studies. There is also interest short-term forecasting and nowcasting for tropical cyclone landfall impacts (e.g., precipitation, storm surge, winds, etc).

**Decision 3.7.1:** The JSC noted the importance of research advances on understanding the inter-annual variability of tropical cyclones and also the progress by the Tropical Working Group on the relationship between seasonal prediction and even climate change. Action: The JSC urges discussions between relevant parties of the WWRP THORPEX and Tropical Meteorological Research WG and WCRP on formulating how to addressing this issue.

### 3.7.2 Tropical Cyclone Panel

Professor Russ Elsberry, the Chair of the WWRP Panel on Tropical Cyclones presented an overview of the activities of the panel. The presentation noted the important role the panel members played in defining the vision and implementing T-PARC and TCS-08. The panel members were also involved in planning for SWICE, which was discussed later in the agenda. The report also addressed efforts of the panel in the updating the book *Global Perspectives on Tropical Cyclones*, which is expected in about six months and the recent work on developing a web site for seasonal forecasts of tropical cyclones. The panel is also leading the planning for the upcoming IWTC- 2<sup>nd</sup>, International Workshop on Tropical Cyclone Landfall Processes (IWTC-LP-II) will be held in Shanghai, PRC during 19-23 October 2009 and 7th International Workshop on Tropical Cyclones (IWTC-VII) will be held in late November 2010 in La Reunion, France. Finally, the presentation also noted the role of the panel plays in ensuring that the national and agency efforts, such as PREDICT and Hurricane Forecast Improvement Project (HFIP) report at the critical WMO meetings on tropical cyclones.

**Decision 3.7.2:** The JSC noted that the national and agency projects that are not WWRP projects are highlighted both in presentations and strategic plan of the Tropical Meteorological Research Working Group. Action: The text on these non-WWRP projects should be removed from the Strategic Plan and the role of "affiliated", agency and national projects needs to be clarified. It was clear, however, that any affiliation needs to be requested by the Principal Investigators of the projects. A small meeting will take place following the JSC between Tom Keenan, the WWRD Chief and the JSC Chair to provide a proposal for moving forward that distinguishes how the WWRP treats projects, RDPs, FDPs and national efforts.

**Decision 3.7.3:** The JSC noted the need for an expansion of the scientific goals of the tropical section of the plan to be consistent with the goals of recent WWRP projects and recent research and operational trends (genesis, structure, intensity, ensemble prediction and post-land fall flooding). The strategies of the Tropical Research Working Group needs to include strategies that define the role of this working group in delivering research programme for the international community that focuses on the intersection of challenging research topics and the need to improve numerical weather prediction. Action: Text to be drafted by JSC Chair and WWRD Chief and incorporated into the Strategic Plan. The Working Group and Panel Chairs will have an opportunity to comment on this text.

**Decision 3.7.4** The JSC noted the existence of several non-WWRP tropical cyclone projects in the Pacific. Action: The JSC noted that there was these process studies can be focal points for bringing together nations for the proposed FDP on tropical cyclones in Asia and the Panel is asked to establish strong links.

### 3.7.3 T-PARC including TCS-08

Dr. Pat Harr, one of the Principal Investigators of this experiment presented the status of the THORPEX Pacific Asian Regional Campaign (T-PARC) project. T-PARC is a multi-national field campaign that addresses the shorter-range dynamics and forecast skill of high-impact weather events in one region (Eastern Asian and the western North Pacific) and the downstream impact on the medium-range dynamics and forecast skill of another region (in particular, the eastern North Pacific and North America). Although many significant weather events occur over eastern Asia and the western North Pacific, the focus of T-PARC is on

various aspects of typhoon activity, which include formation, intensification, structure change, motion, and extratropical transition. Because of the significant impact of typhoon activity on the region of eastern Asia and the western North Pacific, T-PARC also included several affiliated programs. These programs and their national sponsor include:

- Tropical Cyclone Structure-2008 (TCS-08) [United States];
- Typhoon Hunter-2008 (TH-08) [Japan];
- Predictability and Observation Experiment (PROBEX) [South Korea];
- Tibetan Plateau Experiment [China];
- The South China Sea Experiment [China];

T-PARC also coordinated its efforts with the Dropsonde Observations for Typhoon Surveillance near the Taiwan Region (DOTSTAR) Project taking place at the same time. This T-PARC effort included an operational and research modeling component, targeting and an extensive set of measurements for process studies. The research is ongoing but the early results look promising and a number of firsts have been achieved.

**Decision 3.7.5:** The JSC noted the success and breadth of this project. Action: The WMO Secretariat needs to make all efforts to raise the visibility of this effort in the community and within the WMO. A high profile talk in WMO, such as nomination for an IMO lecture, should be considered as well as actions to have this project presented in meetings such as the Pre-CAS and CAS meetings.

**Decision 3.7.6:** The JSC noted the extensive targeting component of T-PARC and the challenges of attempting to draw conclusions from a targeting campaign of limited duration. Action: The JSC recommends that the DAOS group of THORPEX become more involved evaluating the targeting efforts and that the studies build upon the extensive time series of results from past tropical cyclone targeting efforts.

### 3.7.4 SWICE

Dr. Russ Elsberry, Chair of the Tropical Cyclone Panel, presented an overview of the South West Indian Ocean Tropical Cyclone Experiment (SWICE) campaign. This project is proposed primarily by French researchers and is planned to take place in January to March 2011. The goals of SWICE include: i) Validate empirically derived estimates of tropical cyclone winds and intensity through in-situ observations, ii) Quantify the contribution of objectively targeted supplementary observations on cyclogenesis, track & intensity forecasts, iii) Evaluate the influence of synoptic perturbations on tropical cyclone, iv) Characterize the microphysical (→ radiative) properties of ice hydrometeors in the upper troposphere. The campaign has a strong deterministic and ensemble modeling component and will include satellite cal-val and satellite assimilation efforts utilizing the MeghaTropiques.

**Decision 3.7.7:** The JSC noted with appreciation of the presentation on SWICE and noted that the project builds upon the results of T-PARC in many aspects (e.g., targeting, dynamical studies, orographic interactions). Action: The JSC endorses SWICE as a WWRP project with the following caveats to be addressed by the SWICE PIs: i) the SWICE and the T-PARC/TCS-08 PIs discuss possible collaborations and also ensure that the lessons learned in T-PARC are incorporated into SWICE including verification techniques; ii) the GIFS-TIGGE Working Group and SWICE PIs investigate whether SWICE can be the foundation for the proposed GIFS FDP on tropical cyclones in association with the SWFDP since the RSMC in La Reunion is the focal point for both efforts; iii) the SWICE PIs consider a societal component and working with Africa THORPEX and the SERA committee on this effort expansion of the project to include other interested limited area modeling groups. SWICE is also asked to expand the international character of the effort and then attempt to receive an endorsement of the JSC as an RDP.

### 3.7.5 Shanghai MHEWS FDP on Tropical Cyclones

Dr. Jiandong Gong , Deputy Director of CMA/NMC, made a presentation on the latest plans for a tropical cyclone FDP during the Shanghai Multi-Hazard Early Warning System (MHEWS). This project is planned to take place during the Shanghai Expo, which takes place between May and October 2009. Over 30 million people are likely to attend this event and the forecasting and data dissemination is complex in this megacity. The project concentrates on the utilization of the GIFS-TIGGE tropical cyclone track information, which was exchanged in real-time for T-PARC.

**Decision 3.7.8:** The JSC acknowledged the importance of multi-hazard prediction, the need to improve the tropical cyclone prediction in Asia and the goal of exploring multi-model prediction. Action: The JSC noted that the planning documents lack the sufficient detail and stressed that filling in these details to develop a full FDP that quantifies the forecast improvement both in terms of verification and a SERA component would be very difficult in this time frame. The JSC also noted that project also needed a greater degree of international involvement. However, given the scientific importance of this project and the recommendations of CBS and the WMO Executive Committee to test tropical cyclone GIFS-TIGGE tropical cyclone prediction in real-time , a path forward will be developed and presented at the THORPEX ICSC. The first step in developing a path forward is to discuss the project at the meeting of the GIFS-TIGGE Working Group. Since this meeting took place less than one week after the JSC, the outcome of these discussions are included in Appendix 2.

### 3.7.6 Year of Tropical Convection (YOTC)

Dr. Mitch Moncrieff discussed the YOTC Project, which is aimed at improving the treatment of tropical convection and its two-way interaction with the large-scale flow in weather and climate models. YOTC focuses on the use of numerical weather prediction models and existing satellite and in-situ data sets. High resolution cloud-system resolving models are a critical bridge between the observations and the numerical weather prediction models. The project is a collaboration between WWRP and WCRP. Dr. Moncrieff discussed the recent progress outlined as a YOTC meeting in August 2009. This progress included the establishment of a YOTC Project Office by agencies in the US, the selection of priority cases, the ECMWF data set that includes forcing data and the agreement of NASA to provide a tools for access to satellite data.

**Decision 3.7.9:** The JSC noted with appreciation the substantial progress made with YOTC, since the last meeting including the creation of the ECMWF data set, defining of priority cases and the assistance of NASA in solving of the problem of access to satellite data. The following actions are encouraged: i) T-PARC and TCS-08 PIs are asked to identify their priority cases and communicate this information to the YOTC leads; ii) YOTC is asked to give consideration to a greater emphasis on coupled models; iii) if YOTC is to ask for any extension of the modeling archive, it needs to be completed in the near term and make use of ERA interim reanalysis; iv) efforts should be made to include the involvement of more nations in the tropics including scientists from developing countries, and the Tropical Panels could be enlisted in this regard; v) promote broad research outside of the tropics using the YOTC data base.

### 3.7.7 Monsoon panel and proposed data centres

Professor CP Chang discussed the recent and proposed activities of the Monsoon Panel. The panel is not focusing on severe weather within monsoon systems. The activities of the panel included overseeing the 4<sup>th</sup> International Workshop on Monsoons panel and publication of Vol. 5: The Global Monsoon System: Research and Forecast, 2<sup>nd</sup> Ed. Eds. CP Chang (NPS), YH Ding (CMA), R Johnson (CSU), G Lau (GFDL), B Wang (UH) and T

Yasunari (Nagoya U) and two WWRP Reports (TD 1447 IWM-IP proceedings and in Late 2009: Severe Weather Lectures in IWM-IV training workshop eds: M. Wheeler (BOM), R Fovell (UCLA), H Uyeda (Nagoya U). The panel also presented the plans for three archive centres: 1. Legacy Data Set (Colorado State University), 2. Radar Information (Nagoya University), 3. Monitoring and Assessment of Extreme Weather and Climate Events (BCC/EAMAC, CMA). All three proposals circulated among all Panel members and Expert Team co-leaders, and received strong endorsements from both researchers and NMHSs, and Chair of the Working Group on Tropical Meteorological Research. Finally, the plans for future meetings were discussed.

**Decision 3.7.10** The JSC noted the international cooperation associated with the development of the three data centres. Action: The JSC approved the three data archive centres on monsoon (Legacy Data Sets, Radar Information and Monitoring and Assessment of Extreme Weather and Climate Events).

**Decision 3.7.11:** The JSC also noted that the JSC does not have any criteria for data centres. Action: Criteria need to be drafted for the description and approval of data centres with the assistance of the Monsoon Panel Chair. These materials need to be submitted for inclusion into the Strategic Plan during the week of 21 September 2009.

### 3.7.8 Discussion on coordination among tropical research activities

A discussion on collaboration between the different activities within the Working Groups and THORPEX programme of the WWRP. The efforts often have different strengths and weaknesses in approach. For example, a strength of THORPEX, the Mesoscale and Nowcasting Research Working Groups is their focus on developing, implementing and delivering a research programme to improve weather prediction, while the Working Group on Tropical Meteorological Research has a focus on bringing researchers, forecasters and users together to set research and operational priorities and to communicate research advances to forecasters.

**Decision 3.7.12:** The breadth of activities in tropical meteorological research is impressive and the historical differences in approach of the different groups were noted. The THORPEX Working Groups (e.g. GIFS-TIGGE, DAOS and PDP), the Verification, Mesoscale Forecasting Research, and Tropical Meteorological Research Working Groups are all involved in tropical research in addition to the two panels of the Tropical Meteorological Working Groups and several THORPEX Regional Committees. The consensus of the JSC was that some projects could benefit from collaboration between these groups. The need for a focal point to begin collaboration was noted. Actions: The proposed GIFs Tropical Cyclone FDP/RDP(s) should be as a focal point for collaboration between different tropical efforts. Thus we ask broad participation in the planning of this effort (see Appendix 2). The prospective of the Tropical Cyclone Panel and Asian THORPEX Regional Committee would benefit the design of products for this project as well as identifying the research issues. The GIFS-TIGGE Working Group would provide ensemble expertise and the verification and SERA Working Groups are also needed. We also ask various WWRP leads in tropical research (YOTC, GIFS-TIGGE FDP, Panels and Working Groups of the Tropical Meteorological Research Programme) to design the section of the agenda on the tropical meteorological for the next JSC. CP Chang is to be the focal point for this action. Finally, the JSC noted the importance of a unified front on depicting tropical collaboration between the WCRP and WWRP within the WMO.

### 3.8 SERA Working Group

Mr. Brian Mills presented the activities in this area. Emphasis over the past several months has been placed on developing the Working Group membership; exchanging ideas concerning specific collaborations, start-up projects, and funding opportunities; and finalizing draft SERA elements of the WWRP Strategic Plan. Actions and recommendations for WG

SERA from WMO Executive Council and THORPEX ISCS have also been identified. Finally, Mr Mills noted the developing relationship with the ICSU/ISSC/ISDR Programme on Integrated Research on Disaster Risk and the movement towards a joint committee.

**Decision 3.8.1:** The JSC noted the recent progress in partnering with the ICSU initiated Integrated Research on Disaster Risk and thanked the Chair of the Working Group for his efforts. Actions: The JSC noted the societal importance of high impact events in the tropics and the lack of membership from tropical nations on the SERA (and JSC) committees. The upcoming SERA Working Group meeting should aim to select a SERA project linked to the wide variety of existing and proposed WWRP Projects. This strategy of providing guidance on SERA activities within WWRP projects, such as the verification group does for forecast verification in WWRP projects, should also be mentioned in the strategic plans. The JSC noted that the description of the activities and plans of the SERA Working Group focused on understanding the use of forecast information, while the effort should be on understanding and improving the use of this information. These changes should be made to the strategic plan. Finally, the JSC asks the support of the other Working Groups in the development of SERA activities as knowledge of physical processes, predictive skill and to get insight in likely future improvements in predictive skill that are sometimes required for long term planning by the SERA Working Group.

#### **4. VISIONS FOR THE FUTURE**

##### **4.1 Bulletin of the American Meteorological Society (BAMS) Vision Papers**

Dr. Melvyn Shapiro presented the background and status of the five vision papers on the future of climate and weather research to be published in BAMS. The papers are in press. He also reviewed careful discussion between GEO and THORPEX that led to the selection of several THORPEX and WWRP efforts within GEO. He noted the importance of GEO in providing visibility to various THORPEX and WWRP efforts and that the World Climate Conference 3 also provided some high level visibility to these efforts to develop the next generation forecast systems.

**Decision 4.1:** During the discussion, the JSC was informed that the weather tasks within GEO were being redefined to downplay contributions to weather prediction so that the WWRP and THORPEX-related efforts would no longer be relevant contributions. The JSC noted the link between GEO and THORPEX effort and the importance of continuing this relationship. Action: The THORPEX IPO, the WWRD Chief and the Research Director should work with the WMO Secretariat and GEO staff to ensure that the tasks for weather within GEO still include prediction in order to ensure that these activities continue to be highly visible. If this narrow redefinition persists, the THORPEX IPO must inform lead participants in WWRP tasks within GEO of this situation.

##### **4.2 Links to Hydrology**

Dr. David Parsons opened this section of the agenda by noting the growing opportunity for collaboration between researchers in hydrological and weather prediction research. He also noted the success of the MAP D-PHASE to foster collaboration between weather and hydrological prediction research that led to the development of operational deterministic and ensemble hydrological prediction systems.

##### **4.2.1 AMARANTH – A paradigm of African resiliency to climate and weather extremes built through a multi-disciplinary network and enhanced research capacity**

Dr. Tizianna Paccagnella made a presentation on a proposed project for African research and prediction named AMARANTH. The project was proposed in response to a call for proposals by the 9th European Development Fund to support develop research capacity and networks in African, Caribbean and Pacific (ACP) regions. The concept included a

Demonstration Project making use of GIFS-TIGGE, regional limited area ensembles, and river flow forecasts. The project was able to attract eleven African NHMS and river basin management partners, several European regional and national HMS and the International Centre for Theoretical Physics in Trieste (which provided much of the hydrological modelling capacity). The project was supported by the TIGGE-LAM, Mesoscale Forecasting Research Working Group and the Joint Working Group on Verification Research. Unfortunately, the project, and two others with WMO involvement was not funded, as it scored high in many categories but did not score high in terms of sustainability. Sustainability is a difficult factor for regional ensembles in Africa.

**Decision 4.2:** The JSC wishes to thank all those involved in this proposal, especially in regards to obtaining a broad variety of African partners. This project illustrates how many WWRP related efforts can be developed in the time-frame between JSC meetings. Such projects that are driven by proposal deadlines require rapid decisions for endorsement. Action: Future projects that are seeking endorsement between the meetings of the JSC should, as in the CAS of AMARANTH, contact the JSC Chair, relevant Working Group Chairs and the Chief of the WWRD within the WMO for guidance as to how to proceed. The researchers proposing AMARANTH should continue to seek funding for the components of this effort. The upcoming meeting in Trieste is a step in the right direction in this regard and ICTP is thanked for hosting the series of meetings on Africa (e.g., High Impact Weather Information System, THORPEX African Regional Committee meeting and Forecasters Handbook) and the SERA Working Group meeting. Working Groups and THORPEX programme are urged to support activities in Africa.

#### 4.2.2 HEPEX (Hydrological Ensemble Prediction Experiment)

Dr Parsons then made a presentation on a proposed collaboration between THORPEX and HEPEX. This talk was authored by John Schaake, Jutta Thielen and Florian Pappenburger of the HEPEX project. This project is an international R&D program aimed at developing reliable hydrologic ensemble prediction systems mainly for flood forecasting and water management applications on the short-, medium- and long term. Since hydrology is a critical user of weather prediction information, HEPEX is a natural partner for THORPEX and the WWRP. Since HEPEX partners with GEWEX, a partnership with THORPEX and the WWRP would allow a “seamless” approach to ensemble prediction across the weather and climate time-scales. The HEPEX presentation also listed possible science questions and areas for collaboration including a focus between TIGGE and hydrological ensemble prediction. The talk concluded with a summary of 1<sup>st</sup> HEPEX Workshop on Post-Processing and Downscaling Atmospheric Forecasts for Hydrological Applications where the participants recommended strong collaboration occur between HEPEX and THORPEX leading to the establishment of a joint committee.

**Decision 4.3:** The JSC noted the significant scientific and eventual societal benefits from interactions between research on weather and hydrological prediction as outlined in the EC-RTT reports. Thus, exploring collaboration between the WWRP-THORPEX and HEPEX is a priority for the WWRP. The JSC also noted that discussions have been ongoing between THORPEX and HEPEX for several years as well as an attempt of collaboration between HEPEX and MAP D-PHASE. Unfortunately, these discussions have not led to viable activities or any joint projects. Action: The JSC asks that the WMO Secretariat in THORPEX International Project Office communicate the following points to the leads of the HEPEX project and to the THORPEX ICSC: i) A collaboration between research and development on weather and hydrological ensemble systems is desirable. Hydrological prediction is one of the most important users of weather forecasts. ii) Although the general concept of collaboration on ensemble prediction is desirable, the establishment of a joint THEPS committee with HEPEX and THORPEX is premature. The JSC recommends that the first step is for the principals on both side to determine if 1 or 2 specific projects of mutual interest can be agreed upon. One criterion for selecting these projects is whether a strategy can be developed to seek any resources necessary so that the researchers and the operational partners can carry out this collaborative project(s). The JSC Chair, Dr Tom Keenan and

WWRD Chief will work discuss these issues with Dr. John Schaake, who is one of the leads of HEPEX. Very preliminary discussions have already taken place at the 3<sup>rd</sup> THORPEX Science Symposium. These discussions are summarized in Appendix 3. iii) The benefits to HEPEX of collaboration with the WWRP extend beyond THORPEX as the WWRP has more experience in linking to hydrological researchers and users. Thus, HEPEX should name a contact to discuss HEPEX-WWRP collaborations on shorter time-scales with Dr. Tom Keenan who is the WWRP contact in this regard.

#### **4.2.3 Proposal for establishing links between Hydrological cycle in the Mediterranean Experiment (HyMeX) and WWRP-THORPEX**

Dr. David Parsons presented an overview of the HyMeX prepared by the lead investigators: of the project, Dr. P. Drobinski and V. Ducrocq. HyMeX is an international project which aims (i) at improving our understanding of the water cycle, with emphases on extreme events by monitoring and modelling the Mediterranean coupled system (atmosphere-land-ocean), its variability (from the event scale, to the seasonal and interannual scales) and characteristics over one decade in the context of global change, and (ii) at evaluating the societal and economical vulnerability to extreme events and the adaptation capacity. Several observation periods based on deployment of research means but also on enhancement of existing operational systems are foreseen during the 2010-2020 time-window. The HyMeX program already has an international scientific steering committee (ISSC) and working groups and more than 260 registered members from 17 countries that contribute to the project (Algeria, Croatia, Cyprus, France, Egypt, Germany, Greece, Italy, Israel, Morocco, Portugal, Romania, Spain, Tunisia, Turkey, UK, USA). HyMeX will benefit the multi-disciplinary research to improvement:

- (1) observational and modelling systems, especially of coupled (ocean-atmosphere-land) systems through new processes modelling, parameterization development, novel data assimilation systems for the different Earth compartments, reduction of uncertainty in climate modelling,
- (2) the prediction capabilities of high-impact events,
- (3) the accurate simulation of the long-term water-cycle,
- (4) the definition of adaptation measures, especially in the context of global change.

**Decision 4.4:** The Principal Investigators of HyMeX have formally applied for carrying out the HyMeX project under the umbrella of the WWRP/THORPEX program. In view of the progress of HyMeX, its international dimension and shared science objectives with the THORPEX program and the emphasis of the EC-RTT and CAS vision papers on future collaborations between WWRP and hydrological research, the JSC recommends to the THORPEX ICSC that THORPEX establish a strong interaction with HyMeX as proposed by the HyMeX Principal Investigators. The JSC also noted the high level of international involvement including countries of N. Africa, the progress in establishing scientific plans and implementation strategies and mutual scientific interests. Action: The THORPEX International Project Office will convey this information to the THORPEX ICSC and the HyMeX lead investigators. Issues to be considered by the ICSC include how to plan collaborations and report research results.

#### **4.3 The CAS Vision Papers**

The CAS Management Group recommended an exploration of the long-term vision of the research entities under CAS through a series of vision papers. Five vision papers have been completed including i) The report of the EC-RTT, ii) The next generation of regional prediction systems for weather, water and environmental application, iii) Advancing weather, ice and environmental prediction in the polar regions: An IPY Legacy, iv) Ocean modelling issues related to weather and climate, and v) a vision paper dealing with atmospheric chemistry and its links to weather and climate. Four of the five vision papers are posted on line. The fifth vision paper deals with the future of regional prediction (the 2<sup>nd</sup> paper in this list). The intent is to gain feedback from the community on these papers prior to the CAS

meeting. Dr. David Parsons led a discussion on these papers with a focus on the regional prediction paper where Dr Brunet and Parsons have played a lead role.

**Decision 4.5:** The JSC reiterated the issues raised earlier regarding the need for resources in the Secretariat for the WWRP and the research community as the programme broadens to accommodate these new areas of activity and also the challenges of implementing the regional prediction paper. The JSC also noted that the regional prediction paper represented the general societal needs and research trends. Exploration needs to continue on how to implement a WWRP programme on coupled regional prediction to meet user needs for multi-parameter, high resolution prediction. One clear challenge for the WMO is that success of the regional vision and indeed the broader aspects of the EC-RTT report rest upon incorporating observational, data assimilation, and modeling expertise of the hydrological, oceanic and air quality communities as well as data exchanges and the development of coupled data assimilation. Action: The JSC recommends that the general intent of the regional prediction vision paper and the implementation of its end result of implementing a WWRP programme in this area be presented to CAS.

## 5. MEETING SCHEDULE FOR 2010 AND 2011

Decision 5.1: This agenda item was deferred to an email exchange of information. The WMO Secretariat will compile a list of future WWRP (non-THORPEX) meetings and make recommendations on whether the planned schedule of meetings is indeed feasible from a financial and staffing viewpoint. Action: The WWRD Secretariat will compile this list, contact Working Group Chairs for missing information and present their recommendations on scheduling to the JSC members.

## 6. CAS XV (18-25 November 2009) and the Pre-CAS Technical Conference to be held in Incheon City, Korea

The plans for these meetings was discussed. CAS oversees the efforts of the WWRP including THORPEX..

**Decision 6.1:** Close collaboration will be needed between the Working Group Chairs and the WMO Secretariat to ensure deadlines for CAS are met. Action: Email exchanges on the decisions and resolutions of CAS need to be responded to very rapidly by the WMO Secretariat and the Working Group Chairs. Dr. Burridge will be the contact at the WMO for the THORPEX documents and Dr. Parsons will be the contact for the remaining Working Groups of the WWRP. The JSC decisions will form the basis for the CAS decisions. In addition, several of the Working Group Chairs and project leads will need to attend the Pre-CAS Technical Meeting and/or the CAS meeting itself.

**Decision 6.2:** The JSC noted the importance of Members in guiding the WWRP programme. Action: All JSC participants are urged to discuss with participating scientists and their management whether their nations will be represented at CAS. This effort is particularly important for tropical panels which have high-level representation of many Member nations.

## 7. DATE AND PLACE OF NEXT MEETING

The point was discussed as to the timing of the next JSC meeting. The meeting will be held late in the calendar year as to be able to review the outcomes of the working groups and THORPEX activities. Action: The next meeting is proposed to be in November 2010. The WMO Secretariat and the JSC Chair will propose and agree upon a date before the CAS meeting.

## 8. CLOSURE OF THE MEETING

The meeting was closed by the JSC Chair who once again thanked the local hosts and also the committee members and the Invited experts.

**Appendix 1: Participants**

**LIST OF PARTICIPANTS**

**(WWRP-OPAG, JSC, Monterey, 9-11 September 2009)**

**LIST OF PARTICIPANTS**

**(WWRP-OPAG, JSC, Monterey, 9-11 September 2009)**

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## Appendix 2: A way forward for the Shanghai GIFS-TIGGE Tropical Cyclone Prediction

Following the JSC, two discussions took place on a way forward for the Tropical Cyclone FDP for Shanghai. The first discussion was at the meeting of the GIFS-TIGGE Working Group on September 15<sup>th</sup> 2009 at the 3<sup>rd</sup> THORPEX Science Symposium and the 2<sup>nd</sup> discussion was on September 16<sup>th</sup> among interested parties: THORPEX IPO, WWRD Chief, representatives of CMA, the Chair of the Tropical Meteorological Research Working Group, a representative of the GIFS-TIGGE Working Group and the Chair of the THORPEX Asian Regional Committee (who also represented the GIFS-TIGGE Working Group). The outcomes of this and other discussions with the Chair of the Tropical Cyclone Panel are:

- i) The project should focus on investigating and documenting the utility of the track information in a real-time forecast environment as the ensemble tracks are still relatively experimental. Thus, while the project is a real-time effort, it is preliminary to consider the effort an FDP where the focus on evaluated the benefits of a research tested approach in terms of forecast accuracy and user needs. The project will also likely be a multi-year effort that includes a subsequent Forecast Demonstration Project (FDP) if the outcome of this research project proves suitable. Since some of the participants in the Shanghai effort were involved in the Beijing 08 RDP, the project should follow the RDP format. Action for all: Implement the project as an RDP for the NW Pacific nations with the Shanghai project embedded in that overall effort.
  
- ii) There is considerable value in making the track information available to all nations in the region and such an approach may make the forecast providers more likely to participate. The JSC also recommended more international participation so that having the data more widely available will help satisfies this requirement. Action: Dr. Nakazawa, Dr. Parsons and Jim Caughey are to develop and implement the invitation for data providers and users to participate. The THORPEX Asia Regional Chair will make appropriate contact with the regional cyclone committee(s) and the relevant Tropical Cyclone Regional Specialized Meteorological Centre(s). Dr. Parsons will also contact the Tropical Cyclone Programme in the WMO. Thus, the RDP will be international in scope.
  
- iii) It is considered crucial to establish the details of this project at the upcoming October meeting on the Shanghai project and have a written plan. One critical aspect includes the details of the data request as to whether additional data such as surface pressure, maximum winds, and other fields be requested in addition to the track location information. Another issue is to establish the scientific aspects of this project including how the data information will be assessed and if forecasters find it to be useful. Questions to be addressed include: i) Does the track probabilities from GIFS-TIGGE or subsets of GIFS-TIGGE provide information useful in defining the forecast cone of uncertainty which will require that the forecast probability represents the probabilities of the atmospheric flow? ii) Does this GIFS-TIGGE information extend the range of tropical cyclone prediction including information on genesis? iii) Can the GIFS-TIGGE ensemble data set outperform the ensemble of deterministic models which is also available from the TIGGE data set? Action: The participants in the Shanghai tropical cyclone project, the THORPEX Asian Regional Chair/Committee and the Tropical Cyclone Panel/Chair are responsible for defining the data request, the science questions and establish links on the forecast verification.
  
- iv) The vision of the project includes a web site showing the ensemble track forecasts from the combined data set and the individual ensemble modeling systems along with the deterministic track that are included in TIGGE. This web site would enable the WMO Members in Asia to obtain the track information in visual form as well as direct access to the track information. The web site would be available to WMO Members and “approved”

research participants through a password protection system. Action: Develop a plan to implement this password protected web site at the meeting in Shanghai.

v) Making ensemble predictions of tropical cyclones available to Members without experience or training in using such ensembles is unwise and may have a detrimental effect. Action: A training session prior to the start of project needs to be arranged by the WMO and the lead participates in this effort. Since the project will start in May, the training session should be done prior to May. A training meeting in early April may be optimal and training materials and lecturers need to be identified.

vi) One question is to determine the data transfer means for the tropical cyclone track information (e.g., CXML vs. buffer over the GTS). Action: David Richardson is tasked with investigating and reporting on the issue of how best to transfer the data within the context of the data needs of the project and the capacity of the GFS-TIGGE data providers.

vi) Asian nations interested in tropical cyclone prediction should work together on this project but to work towards a multi-year effort towards an FDP on tropical cyclone prediction that is based on this pilot effort. Again, the planning should include the Working Groups on GFS-TIGGE, the Mesoscale Forecasting Research, SERA, Verification Forecasting Research, the THORPEX Asian Regional Committee and the Tropical Cyclone Panel.

**Appendix 3: The first steps on a way forward on the collaboration between WWRP and HEPEX.**

Discussions at the 3<sup>rd</sup> THORPEX Science Symposium took place on 17 September 2009 between Dr. John Schaake, Dr. Gilbert Brunet, and Dr. David Parsons. Dr Mathias Rotach also participated in some of the discussions. The outcomes of these discussions are:

i) Two possible projects of mutual interest could be a Great Lakes project in N. America or expanding ongoing work in SE Europe to include a HEPEX-THORPEX collaboration. Both efforts have a strong chance of obtaining the resources necessary for the community to carry out these research and development activities. Action: These very preliminary thoughts on collaboration will be shared with the JSC, THORPEX IPO and the HEPEX leads.

ii) One alternative to a joint HEPEX-WWRP committee is to explore the possibility of a broader WWRP-HEPEX ad-hoc committee aimed at establishing and guiding links between the WWRP and the hydrological research community. On the hydrological side, this committee could include representatives from HEPEX, HYMEX, MAP D-PHASE and AMMA. Action: This treatment of WWRP and hydrological interactions will be a topic for discussion and decision at the THORPEX ICSC and the CAS. This topic will be explored within the CAS vision paper on regional prediction.