

WORLD METEOROLOGICAL ORGANIZATION

Report

**PWS Workshop on Warnings of Real-Time Hazards by Using
Nowcasting Technology**

Sydney, Australia

9-13 October 2006



FINAL REPORT



INTRODUCTION

1. The Workshop on Warnings of Real-Time Hazards by Using Nowcasting Technology was held at the Bureau of Meteorology in Sydney, Australia, from 9-13 October 2006 as one of the deliverables under the Expert Team on PWS in Support of Disaster Prevention and Mitigation established by the CBS Open Programme Area Group (OPAG) on PWS. The workshop was co-chaired by Dr Tom Keenen (BOM Research Centre) and Dr M.C. Wong (Hong Kong Observatory). The participants at the workshop were drawn from experts on Nowcasting, forecasters and PWS managers from NMHSs, representatives of media, representatives from disaster management organizations and communicators and educators. The participants represented all WMO Regions and varied levels of development. The overall objective of the workshop was to:

- Explore possibilities of maximizing the application of nowcasting systems
- Generate new or improved PWS products for benefit of community
- Transfer technology from developed to developing world

2. The workshop provided a brainstorming forum to discuss the state of the art in Nowcasting and how to bring it to the users. The final aim of the workshop was to prepare a proposal on the application of nowcasting technology, targeted to developing countries in support of safety of life and protection of property.

3. The programme of the workshop is attached as Appendix I and the list of participants as Appendix II to this report. The workshop discussions were organized under the three themes of:

- Nowcasting Systems Overview – State of the Art and Development Trends; Forecast Demonstration Projects (FDPs)
- Nowcasting Applications: Communication and Training Aspects; Disaster Preparedness and Mitigation Aspects; PWS Aspects
- Where to go from here?

4. Theme 1: Nowcasting systems Overview – State of the Art and Development Trends

4.1 Experts from Australia, Brazil, China, Hong Kong, China and United States of America presented the state-of-the-art nowcasting systems being developed and/or currently in operation. These included the Autonowcaster of NCAR, the nowcaster server/rainfields of the Bureau of Meteorology, the SWIRLS of Hong Kong Observatory, the satellite data assimilation and lightning testbed activities of the NASA Short-Term Prediction Research and Transition (SPoRT) Centre, and the nowcasting research and systems of the University of Sao Paulo, Brazil. The characteristics and performances of these systems were described and future research activities discussed. A variety of heuristic approaches with varying degrees of complexity and automation were evident. Simpler systems are based on radar echo tracking and extrapolation to produce 0-1 hour nowcasts, while the more complex include blending with numerical weather prediction and probabilistic techniques to extend the nowcasting time up to 6 hours. Tracking of satellite and lightning signatures are also employed in some systems. Recognizing that automated techniques have not been sufficient to adequately capture growth and decay of many features, built-in forecaster interactive capability is also employed in some systems. Optimizing the role of the human in the development of an end to-end nowcast process is an on-going issue. Development of improved forecast systems that lead to real time verifications and rapid product generation and dissemination in various compatible forms (automated

text, graphical raw data etc) is an important development area with significant implications for the timeliness and effectiveness of PWS products.

- 4.2 Forecast demonstration projects (FDP) have been organized through WMO to test and verify the usefulness of latest nowcasting applications in an end-to-end forecast process employing a wide range of end users during the Olympic Games. The first FDP was successfully carried out in 2000 in Sydney and another will be conducted during the 2008 Beijing Olympics. Participants were briefed on the experiences of the Sydney 2000 FDP and the status as well as challenges of the Beijing 2008 FDP, which would include a comprehensive social and societal impact study.
- 4.3 Noting that nowcasting systems are actively being developed, tested and employed around the world, the experts considered that encouraging mechanisms to enhance the transfer of mature nowcasting systems to operations for delivery of PWS products to be used in warnings can potentially result in savings in lives and costs arising from hazardous weather phenomena. Encouraging scientific developers, the forecasting community and users to collaborate on optimum methods for utilization of nowcasting science and technology was considered essential.

5. Theme 2: Nowcasting Applications: Communication, Disaster Preparedness and Mitigation and PWS Aspects

- 5.1 This theme highlighted the importance of training and the development of a truly end-to-end view of the forecast process. Interaction with end users in the development of this process was considered essential. Approaches to assess the effectiveness of the nowcast process through incorporation of social, societal and economic impact studies were deemed important. On communication, the media experts recommended that it would be important to be able to provide the warnings in a user-friendly and understandable way. Advice on the type of response actions to take should also be included as part of the warnings. The communication should include information on what had happened, what is happening at the moment and what would happen. Multi-agency cooperation was considered essential to increase the effectiveness of the PWS products. Nowcasting products could provide very effective visualization of the sequences of events.
- 5.2 On disaster preparedness and mitigation applications, experts from Bangladesh, Hong Kong, China, Jamaica and the Republic of Korea all highlighted the importance of having an end-to-end process to get the warning information to the community under threat. Examples of innovative methods of visualization of nowcasting products and proactive dissemination techniques were given by the speakers. It was noted that, however, there still exist considerable limitations in the capability and capacities of many countries to develop a truly effective nowcast service. Access to basic observations, on-going support for observational systems, access to nowcasting systems and communication infrastructure often severely hinder effective transmission of observation information and timely dissemination of warnings.
- 5.3 On PWS aspects, experts from Brazil, Colombia, Croatia, Jamaica, Malaysia, Philippines, Republic of Korea, Romania, South Africa and Vietnam made presentations on the needs, gaps and the status of development of nowcasting technology in their respective countries. While all would agree that nowcasting systems could provide timely and useful information on real-time severe weather hazards, there is quite a difference in the degree of sophistication in the level of hydrometeorological networks, nowcasting applications, and dissemination systems ranging from manual interpretation of observational data and reliance upon unofficial channels of communication to highly-automated networks and nowcasting systems

with advanced dissemination means. Regional cooperation in the use of nowcasting techniques and technology transfer were recurrent themes in the various presentations.

6. Theme 3: Where to go from here?

6.1 Following presentations and discussions on the state of the art and possibilities offered by nowcasting technology to improve early warning systems on the one hand and the possibilities of the users to benefit from such technology on the other hand, the workshop set about to prepare a business plan for a PWS framework within which the objectives of the workshop as stated on top of this report could be realized. The plan is outlined as shown below.

7. PWS Nowcasting Framework: Way Forward

Vision

A safer and more economically sustainable society enabled by PWS nowcasting of high impact weather.

Mission Statement

Increase the capacity of NMHSs to deliver nowcasts to enable informed decision making in mitigating the effects of high impact weather and weather related disasters.

Strategy

- Identify existing capabilities, gaps, and needs as regards providers of nowcasting services (observations, communications, training, forecasting tools and processes)
- Identify end user needs and capacity to effectively use nowcasting products and services and facilitate mechanisms to address these requirements
- Build on existing nowcasting-community partnerships, actions and collaborations (e.g., OPERA, EUMETCAL, ICEED..)
- Encourage and develop new activities as appropriate with WMO and partners (e.g., FDPs, RDPs....)

Objectives

- Advisory functions and information sharing between Members with varying technological and service capability
- Capacity Building through:
 - o Developing and sharing technologies and techniques,
 - o Providing a sample framework of a design for a severe weather warning system including the objectives of severe weather warnings, observations required and warning methods to be used;
 - o Provision of training as appropriate to increase expertise for:
 - Technical experts
 - Managers
 - Forecasters
 - Decision makers and end users
 - o Identification and engagement of advocates
 - o Definition of skills and knowledge (defining competencies and best practices)

- Public education and outreach
- Monitoring and evaluation (metrics) of nowcasts
- Economic and societal impact assessments
- Partnership development between providers and users
- Support to continuous and sustainable processes for the above

Approach

- Every interested Member will determine their particular needs and priorities
- Develop activities to address priorities and needs including
 - Identification of Near Term Opportunities for Quick Success
 - Development of PWS connection to on-going WWRP NWG activities (B08, LAN 2, MAP D, V10) NCEP/Storm Prediction Center Spring Program, Romania NMHS training or visits opportunities
 - Develop mechanisms as appropriate to access available training material (e.g., EUMETSAT Nowcasting workshops, EUMETRAIN, COMET, EUMETCAL, ABOM, SPORT Workshops, WWRP Training workshops) and encourage new training workshops to support PWS nowcasting needs
 - Provide an inventory of existing nowcasting tools and capabilities
 - Initiate and support expert exchange programs
- Encourage establishment of and links to “Open” and “Virtual Laboratories” with different levels of activities/types of nowcasting projects e.g., FDP’s, testbeds
- Encourage the establishment of Regional Partnerships
- Provide a governance structure for the execution of PWS nowcasting activities including the establishment of a WMO steering committee to oversee the processes

Proposed Timeline of Activities

- Finalize report of Workshop including Business Plan and circulate to WS participants (Action: Haleh Kootval: 21 October 2006)
- WG participants to agree on the report of workshop (Action: All participants: 15 November 2006)
- Co-Chairs of the Workshop to draft TOR and membership list (Action: Tom Keenen and M.C. Wong:1 December 2006)
- WMO agreement on Business plan (CBS and CAS OPAGs on PWS and WWRP: TBD)
- Establishment of Steering Committee (contingent on above (TBD))
- Steering Committee to develop an initial implementation plan (TBD)

Requirements

- Steering Group/Coordinating Committee
 - Terms of Reference
 - Who, How many
- Access to expert advisors/mentors
- End-to-end-to-end feedback loop between developers and end users
- Fellowships to sponsor participants
- Requirements for Hosts of regional and partnership programmes who provide testbeds and open laboratories:
 - How can they benefit from the partnership

- o Define expectations
 - o Provide mentoring
 - o Provide facility
- Requirements for Participants at the regional and partnership programmes:
 - o Define service needs
 - o Identify tools/applications desired
 - o Commitment to implement new capability on return from open laboratory/RDP/FDP/test bed
 - o Provide feedback

PWS Workshop on Warnings of Real-Time Hazards by Using Nowcasting Technology**Sydney, Australia, 9-13 October 2006****Programme****Monday, 9 October**

- 0900-0930 **Opening**
Bureau of Meteorology
WMO Secretariat
- 0930-1000 **Background, objectives and expected outcomes of the workshop, Introduction of the Workshop participants**
Haleh Kootval, Chief, Public Weather Services Programme, WMO
Tom Keenen & M. C. Wong, Workshop Co-Chairs
- 1000-1030 Coffee Break
- 1030-1200 **Theme 1(a): Nowcasting Systems Overview – State of the Art and Development Trends**
- (1) Tom Keenen; Weather Forecasting Group, BMRC, Australia
 (2) Augusto José Pereira Filho; University of Sao Paolo, Brasil
 (3) Steven Goodman; NASA, USA
- 1200-1330 Lunch
- 1330-1500 **Theme 1(a) (continued)**
- (5) James Wilson; NCAR, Boulder, USA
 (6) M.C. Wong; Hong Kong Observatory, Hong Kong, China
 (7) Tom Keenen; Sydney 2000 FDP; BoM, Australia
- 1500-1530 Coffee Break
- 1530-1630 **Open Discussion on Theme 1(a)**

Tuesday, 10 October

- 0900-1000 **Theme 1(b): Nowcasting Systems Overview – Forecast Demonstration Projects (FDPs)**
- (1) Linda Anderson Berry; Bureau of Meteorology
 (2) Wang Yubin; Beijing 2008 FDP; Beijing Meteorological Bureau, CMA, China
- 1000-1030 **Wrap-up of Theme 1: Co-Chair**
- 1030-1100 Coffee Break

- 1100-1200 **Theme 2(a): Nowcasting Applications - Communication Aspects**
- (1) Ian Bell, Former BOM & Roger Deslandes, BOM; Training aspects of Nowcasting
 - (2) Jennifer Marshal, Australian News Channel & Julie Evans, BOM: Media Aspects of Nowcasting
- 1200-1230 **Open Discussion on Theme 2(a)**
- 1230-1400 Lunch
- 1400-1530 **Theme 2(b): Nowcasting Applications - Disaster Preparedness and Mitigation (DPM) Aspects**
- (1) Aslam Alam; Ministry of Food and Disaster Management, Bangladesh
 - (2) M.C. Wong; Hong Kong Observatory, Hong Kong, China
 - (3) Dugkeung Park; National Emergency Management Agency, Republic of Korea
- 1530-1600 Coffee Break
- 1600-1630 **Theme 2(b) (continued)**
- (4) Norman Harris; Mines and Geology Division, Ministry of Agriculture and Lands, Jamaica
- 1630-1700 **Open Discussion on Theme 2(b)**

Wednesday, 11 October

- 0900-1040 **Theme 2(c): Nowcasting Applications – PWS Aspects**
- (1) Carina Reinke; National Meteorological Service, Brasil
 - (2) Natasa Strelec Mahovic; National Meteorological and Hydrological Service, Croatia
 - (3) Kong Chiew Low; Meteorological Department, Malaysia
 - (4) Lucrecio About, Jr; Philippines Atmospheric, Geophysical and Astronomical Services Administration, Phillipines
 - (5) Aurora Stan-Sion; National Meteorological Administration, Romania
- 1040-1110 Coffee Break
- 1110-1230 **Theme 2(c) (continued)**
- (6) Thao Le Van; Hydrometeorological Service, Vietnam
 - (7) Ezekiel Sebego; Weather Service, South Africa
 - (8) Young-Youn Park; Korean Meteorological Service
- 1230-1400 Lunch

1400-1500	Theme 2(c) (continued)
	(9) Humberto Gonzalez; Institute of Meteorology, Hydrology and Environmental Studies, Colombia
1500-1530	Coffee Break
1530-1630	Open Discussion on Theme 2(c)
1630-1700	Wrap-up of Theme 2: Co-Chair

Thursday, 12 October

0900-1030	Theme 3(a): “Where to go from here?” - Discussion on the Proposal for the Pilot Project
1030-1100	Coffee Break
1100-1200	Theme 3(a) (continued)
1200-1330	Lunch
1330-1700	Visit to the BoM and the Sydney 2000 Olympics FDP site

Friday, 13 October

0900-1000	Theme 3(b): “Where to go from here?” - Roadmap for Nowcasting in support of PWS Requirements
1000-1030	Wrap-up of Theme 3: Co-Chair
1030-1100	Coffee Break
1100-1230	Review and Adoption of the Workshop Report
1230	Closure

PWS Workshop on Warnings of Real-time Hazards by using Nowcasting Technology

(Sydney, Australia, 9-13 October 2006)

LIST OF NAMES AND CONTACT DETAILS OF PARTICIPANTS

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Disaster experts invited

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Nominees from NMHSs

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