

# **Political, Economical Technological and Cultural Influences That Will Shape Service Delivery in the Next Decade**

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## ***ABSTRACT***

*Public Weather Services are often challenged to look beyond 5 days, and the purpose of is to provide insight on the major influences that will impact on the very nature and delivery over the next decade or even two. There are many powerful influences as we look to the decade ahead. However, one particular force which is often overlooked is that of culture. Be it language, customs or ways that we will be doing things in the future, culture will have a significant impact on not only how Public Weather Services are shaped, but also on the range of services delivered. It is also important to realize that these services will not necessarily be homogeneous across all our nations in future, just as is evident today. Moving forward, local capacities, influences and needs will play a significant role in defining the public weather services of the future. However there are many common drivers including socio-political concerns over a changing climate, a new digital age and the ever shifting expectations of stakeholders - an understanding of which will lead to improved future information and services.*

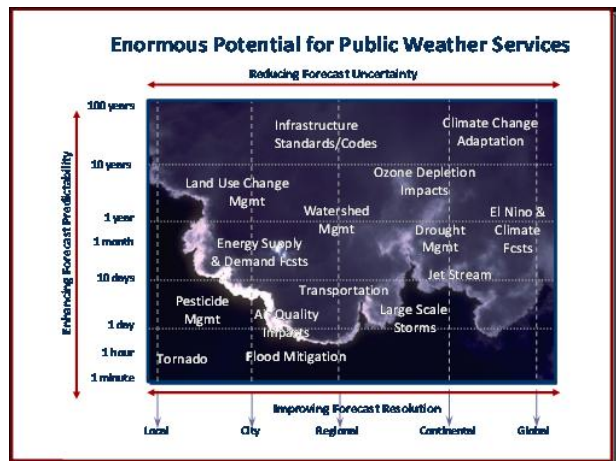
## Introduction

There are several key influences, presenting significant challenges and opportunities when considering the evolution of national Public Weather Services (PWS) programs today. A diagnosis of these factors should provide insights into effective planning and development of relevant, user-defined products and services of National Meteorological and Hydrological Services (NMHS) in the future.

Global trends on population demographics, changing climate, public security, economic competitiveness, unsustainable use of the Earth’s resources are challenging societies’ capacity to cope. Governments are under enormous pressures to mitigate against these escalating risks on their citizens on such concerns as food security, water availability and health. PWS can play a key role to alleviate these challenges.

## Glimpse of a Future

NMHS should be an essential part of this public policy response by providing the relevant information and services to permit society to adapt to future changes in weather, climate and other dimensions the environment over very short to long term time scales. Their public weather services programs should become increasingly recognized as providing an expanding core mission-critical capacity for government in more and more nations to cope with these public policy challenges.

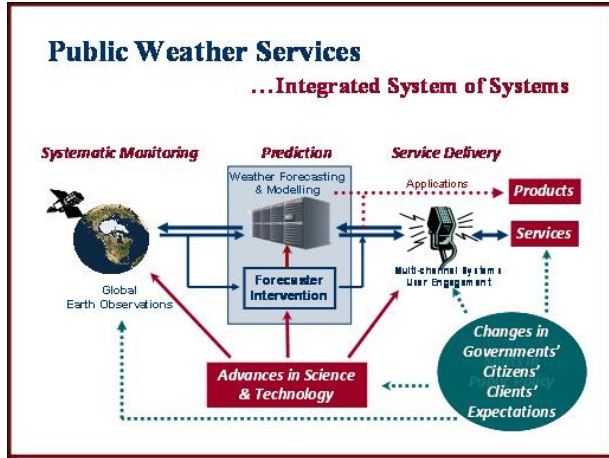


Therefore, the national Public Weather Services program should be different in a decade; however, this will require significant organizational commitment (change & investment) to become a reality. Early recognition and adaptation to changing circumstances (trends) will create opportunities for PWS’ to better serve governments, greater numbers of people and interests over the long term. And as a consequence, societies will effectively benefit by the assimilation of new and changing environmental information into policy formulation and decision-making processes that will likely challenge past customs and assumptions.

## Noteworthy Barometers

Public Weather Services are the “public” and often the “political” face of NMHS’. The provision of services for most is scientifically complex, and the figure illustrates typical interactions among various systems functioning to support them.

This visualization is also important to better appreciate the importance of monitoring two key barometers: *advances in science and technology* and *public policy expectations*. Both should have pervasive influence on the products and services of NMHS’ in the future. Public expectations, including those of their institutions are



technology into their PWS (weather forecast) systems.

## Key Global Influences

Natural and human-induced changes in the Earth’s land surface, atmosphere, oceans, cryosphere and biosphere will continue to significantly impact our planet, impeding social and economic progress of all nations. Scientific information, assessments and predictions derived from systematic monitoring are essential to support improved decision-making and informed, evidence-based policy development, underpinning legislation, conventions and treaties across a wide range of societal challenges. Specifically, there are several common key global influences<sup>1, 2</sup> that will implicate how governments should see the role of PWS’ in future and thereby their products.

First and perhaps foremost, PWS’ will be called upon to support their government’s goals to reduce their vulnerability to a changing climate. Adaptation responses will be informed by understanding changing patterns and severity of weather, water and climate. Concerns over the natural environment are growing in importance particularly the impacts that pertain to sustainable development. A future could invite PWS’ who have significant scientific and technical expertise to serve as watchdogs, reporting on changes to key environmental indicators.



Population growth and changing demographic patterns will result in continued intensification in urban centres, aging populations in developed countries and significant growth in developing ones.

<sup>1</sup> Global trends 2015. Central Intelligence Agency, U.S. Gov.

<sup>2</sup> Global trends 2005: An owner’s manual for the next decade. Michael J. Mazaar.

The use of scarce resources such as water and energy will be a challenge and PWS' will be expected to support local governments in allocating the wise use of these resources.

Human health concerns will continue to mount both in the developed and developing world requiring improved Earth system predictions to track and aid in the forecasting of conditions leading to possible disease outbreaks.

World continues to be unstable and will likely continue into the foreseeable future. Governments concerned about the growing security of citizens particularly from natural and human-induced hazards will turn more and more to PWS' for support in alleviating these risks. This should not be a surprise recognizing our unique science and service delivery capacities today and what they should resemble in future.

Economic globalization respects no borders. Changes in stock market volatility in one part of the globe have almost immediate impacts on others. Globalization is putting increased pressures on nations to become more innovative and competitive in order to remain effective. To this end, PWS' have always been viewed as supporting economic advantage for transportation and primary industries such as agriculture and agri-food. As economies continue to look for more niches in future, environmental factors will continue to impact on their effectiveness.

In future, due to liberal finance and trade policies, competitiveness factors and alternative governance considerations, non-state actors may assume many of the roles once established for NMHS both for profit and not for profit services. Efficiency and effectiveness considerations are important for reaffirming national or state roles for NMHS'.

Finally, sustainable growth is the culmination of all the factors and a long term goal of governments since the first Summit on the Environment in 1972. Understanding and integrating the impacts of societal growth requires a strong foundation of environmental knowledge. And, in many parts of the world, NMHS' play this role. In the future, reporting on environmental indicators and trends on the impacts of growth will assist governments in making effective choices about the future.

## Understanding Emerging Societal Risks



These major global trends continue to challenge national governments, individually and collectively to optimize the benefits and to mitigate the negative consequences. Risks and vulnerability to society continue to mount. Governments are becoming increasingly concerned over the health and well-being of their citizens, consequences on their cities (increasing urbanization and decreasing societal resilience), and access to clean life-essential natural resources (air, water, etc.). In addition to informed policy choices and decisions, governments are also seeking efficient means to effectively serve their people. This should have

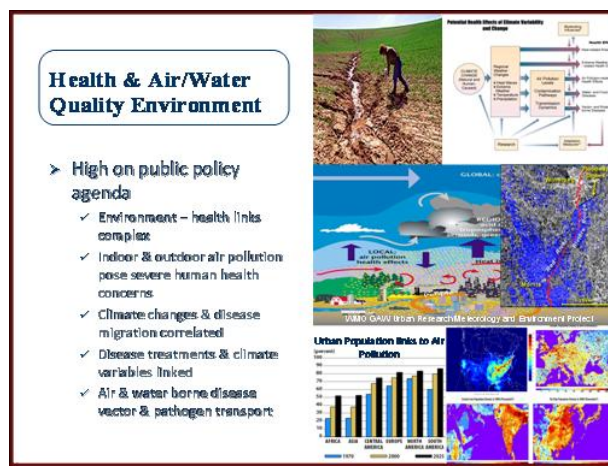
consequences on ways and means that governments choose to meet this goal, possibly even going beyond national borders. As a consequence, the outputs of NMHS', its PWS' must be responsive to the changing needs and requirements poised by policy problems, informing solutions but in the most effective and yet efficient way.

Over the past 2 decades there has been a dramatic rise in both numbers and impacts of natural hazards.<sup>3</sup> The 4th Assessment Report of the IPCC points to the increasing likelihood of severe weather and environmental events over time. In Canada for instance, floods have increased in number four fold as compared to 50 years ago.<sup>4</sup> As a consequence, Governments, emergency planning and management organizations will expect more from PWS' programming, particularly in the areas of reassessment of hazards, early warning and improved lead time to permit a more effective response. PWS' early warning systems in some parts of the world are a "one-of-a-kind" facility, permitting government agencies to leverage such capacity to serve other warning infrastructures through a multi-hazard approach.

The growing disparity between city and rural lifestyles indicates that specialized services will be required for each. The vulnerabilities of city dwellers will be very different from those in more remote locations. While coastal communities depend on water related hazard warnings, city dwellers may also regularly require information identifying the risks posed by environmental contaminants. Montreal, Canada is installing specialized radar to monitor local weather systems to ensure that the city is prepared to meet flow requirements for wastewater treatment during high impact events while minimizing treatment costs during less eventful times. Other examples worldwide include delivery of options for travel during forecasted poor air quality days, and new air and water borne disease forecasts linking disease with climate variables.

Also likely to rise are the linkages between PWS' and other UN programs such as the World Health Organization and UN-Water. Human health and water availability are very much influenced by environmental factors and PWS' will in future be expected to quantify and qualify these linkages.

Furthermore with the increased environmental pressures on health and water, linkages between PWS' and other UN programs such as the World Health Organization and UN-Water will become more important in future. Human health and water availability are very much influenced by environmental factors and PWS' will in future be expected to inform by quantifying and qualifying these linkages.



<sup>3</sup> EM-DAT: The OFDA/CRED International Disaster Database <http://www.em-datnet.UCL-Brussels>, Belgium.

<sup>4</sup> The Canadian Disaster Database. Public Safety Canada, Government of Canada.

Water security continues to remain a significant issue worldwide as demand continues to increase while droughts undermine development. Resolution of these issues is difficult as water ‘rights’ are almost always multi-jurisdictional requiring complex negotiation mechanisms. PWS’ may be able to play a significant policy role in this area through prediction of transboundary movement, systematic monitoring and reporting. It may be surprising to note that in Canada drought is ranked the number one disaster nation-wide and the Great Lakes (the largest freshwater body globally) are at their lowest level ever recorded.<sup>5,6</sup>

Energy demand is also greatest in cities and options for energy generation have never been so plentiful. PWS are poised to aid in the decision making process to ensure that the right mix of energy is generated for predicted meteorological and societal conditions. In Canada this type of service is currently delivered through the meteorological private sector. The Canadian PWS is exploring options to ensure that appropriate services are also made available through the public sector. In many cases, PWS’ will be able to provide a critical service to Government able to support decisions regarding energy consumption and conservation policies adopted. Surging population and corresponding energy use predicted through the next century will require development of PWS’ national scale energy availability alerts or warnings.<sup>7</sup>

## Technological Change and Prediction of the “Spheres”

Significant strides made in science, technology and telecommunications over the last decade realized major advancement of observational methods of the atmosphere with new breadth of satellite and earth based instrument sensing of the atmosphere, hydrosphere and cryosphere. These observations contributed to the significant advancements in atmospheric predictability through continued performance of global and regional numerical weather prediction models.

Further S&T advancements in the next decade will offer even more potential benefit for society in future. Continued improvements in computational capacity will improve predictability with even higher spatial resolution scientific environmental prediction models at global, regional and sub-regional levels. More interactive coupled models at earth surface (air-ocean-ice models) and aloft (troposphere-stratosphere) will result in improved predictions of changes in weather, water, climate and atmospheric chemistry. New scientific thrusts to observe, model and predict at the “Earth System” level through initiatives such as the Earth System Simulator and Global Earth Observation System of Systems will lead to better



<sup>5</sup> The Canadian Disaster Database. Public Safety Canada, Government of Canada.

<sup>6</sup> Great Lakes Disappearing Act. The Globe and Mail. Canada. September 24, 2007.

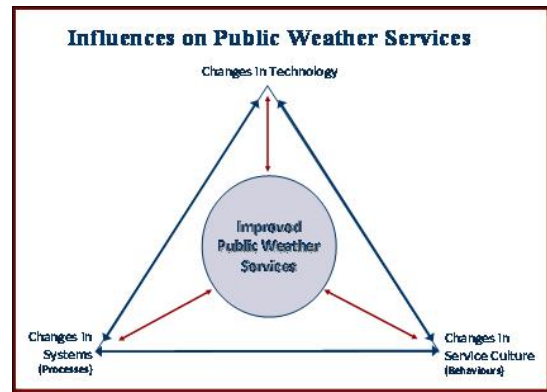
<sup>7</sup> Energy Projections: “Global Energy Perspectives” ITASA/WEC Population Projections: United Nations “Long Range World Population Projections: Based on the 1998 Revision”.

understanding of physical, chemical and biological processes and feedbacks. PWS' can serve as a primary information conduit by providing a variety of new information products and services that will inform decision-making, as well as sound policy and law-making mechanisms at local, national and international levels, beyond its current offerings.

## Technological Change and Service Culture

However, not to understate the importance of the benefits of scientific and computer computation enhancements over the past decade, likely the most beneficial advancement for PWS' from the users' perspective has been the world-wide-web and informatics systems facilitating access to knowledge and information *by anyone, at any time, and from anywhere to anywhere* allowing for integration into user designed decision-making processes. The internet, a form of global "real-time newspaper" has also permitted world citizens to become acutely aware of the importance of environmental issues such as climate change, air and water pollution. It has also allowed for improved networking of scientists and other experts world wide to advance the understanding of these issues.

Technology often outstrips the capacity of society to effectively realize the full benefit. For instance, while internet was only thought about two decades ago, the potential is still being exploited through popularization of social learning and networking of Web 2.0 applications today. This is a good illustration of the forces – technology, culture and system processes – that influence service provision that apply to PWS' programs. These influences are mutually interdependent. For example, for NMHS to adopt web-based technologies when citizens do not have access or understand how to use computing or internet technologies would not result in the expected benefit. Likewise, to connect to a "net ready generation" would require NMHS' to integrate information technologies and the necessary changes into their operating systems. For the future, successful PWS' will require simultaneous implementation changes in technologies, systems and internal operating cultures, recognizing the evolution of user means, methods, and needs that support their decision-making processes.



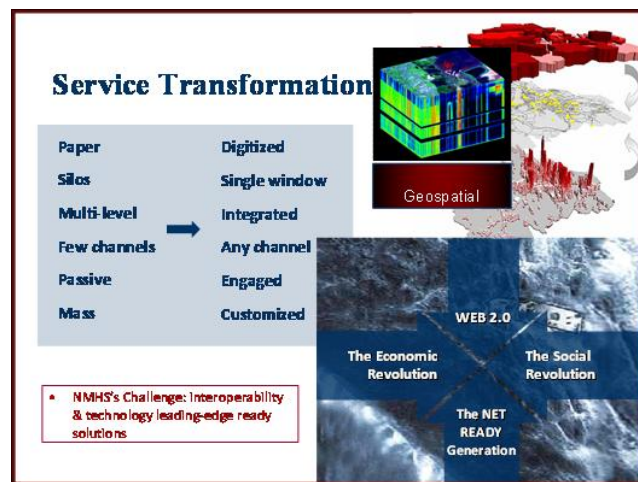
The onset of the digital age is already showing the *golden* promise of on-demand, selective access to user-specified programming and to all sorts of information integral to their decision-making. The rapid expansion of broadband communications, internet and digital broadcast systems (like TV, pod-casts, internet and radio), and the proliferation of intelligent, mobile personal information and wireless communication devices will support an on-demand (from anywhere at any time) fully interactive and integrated communications systems. This offers significant advantage for NMHS' and their PWS' programs where weather, water and climate information can be time-sensitive, such as alerts to potentially dangerous high impact events or instant updates on the status of developing storms. However, this also requires enhanced cooperation with communications systems vendors as well as among NMHS' to harmonize the

information content of their products and services, especially among neighbouring states.

This communications evolution will come with at least one significant challenge and one major opportunity for NMHS'. The challenge relates to being aware of not only "what" the citizens or specific clients require but also of their "service culture" or "how" these individuals or groups access information and learn.

## The Challenge – Service Transformation

Evolving technologies are amplifying expectations on NMHS to make more information accessible in a timely manner but also in a format and means that is amenable to their changing lifestyles and their preferred means of access. For example, not even two decades ago, newsprint, radio and television were the preferred channels to obtain weather information. When compared to today, the youngest generation of adults' preference is for internet methods, web searches, mobile text messaging and social networking. NMHS' should be already considering the implications of the "Net Ready Generation" by:



- Moving from paper products to digitized information which will improve the 'reach' of PWS' significantly;
- Transiting from a few individual delivery channels to multi-channel methods offering integrated solutions, which now are including typical Web 2.0 options such as using *Wikis*, *Blogs*, *Shared Forums*, *Feed Reader* and *Widgets*;
- Evolving from static and passive delivery methods to those that involve enhanced user engagement (interactive), push-technologies and user customized services.

There is growing emphasis placed on the value of weather, water and climate information and predictions as it contributes significantly to the efficiencies of National Economies and their global competitiveness. *Timely access to relevant information* is an important element of economic performance. A similar value statement can be said for societal pressures aimed at improving quality of life and the environment. Therefore, meeting the challenge will not only be by adopting advancing technologies but also respecting and integrating the changing practice of how information and learning is being assimilated by societies. Successful implementation will ensure that NMHS' through their public weather services remain a respected, trusted and responsive core responsibility of their governments.

## The Opportunity - *Embedded Services* -



The shifting orientation on the application and use of information technologies also present an opportunity for NMHS'. The recruitment and renewal of the workforce is attracting creative and innovative employees who are active users of these evolving technologies. Channelling these technological evolution and creativity capacity will offer significant potential for generating risk-based information and prediction services that would integrate the likelihood of high impact meteorological or hydrological events with their consequences and mitigation strategies. This form of *embedded* products will significantly rely on alliances and partnerships that capitalize on the *significant reach* of PWS' in future.

Successful Public Weather Service programs in future should be service outcome focussed, rather than output focussed. This considers having our outputs embedded within a broader based product or service. Canada's Public Weather Service provider has developed an Air Quality Health Index<sup>8</sup> which also incorporates not only an air quality forecast but information about who would be most impacted by a certain air quality event as well as effective strategies to limit their exposure to the risks to their health. This service is produced and delivered in partnership with health agencies.

Complementary to being outcome focused PWS' need to be stakeholder centric. There are significant differences between a *stakeholder-centric* and a *user-centric* service. The former actually orients PWS' to consider a more comprehensive perspective, moving away from considering solely the "client-server" relationship. It considers all of those impacted by the services beyond the direct recipient. Adoption of a stakeholder centric approach holds great promise and could very much enhance the relevance of PWS' to society.

## Conclusions

In conclusion, Public Weather Services will need to adapt to changing public policy, environmental risks and new ways of doing business. Making these changes will certainly not only lead to the sustainability of Public Weather Services over the long term, but rather should be viewed as a key means to support sustainable development goals enabling their governments to make improved choices.

Key will be a successful integration of security, health and environmental issues to further the development of embedded and stakeholder centric solutions. This has already started to take hold beyond energy resource concerns, e.g., growing appreciation of water security.

And finally, utilization of all that technology has to offer will be difficult without integrating the changes in its use by society. Successful Public Weather Services will utilize the most accessible systems and will capitalize upon engagement of stakeholders, partners and especially the decision-makers of the future.

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<sup>8</sup> <http://www.ec.gc.ca/cas-aqhi/default.asp?lang=En&n=065BE995-1>