



UNIVERSITY OF SASKATCHEWAN

Final Report

Workshop on Global Water Quality Modelling

October 13th and 14th, 2010

The National Hydrology Research Centre (NHRC), Saskatoon, SK, Canada

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1. Introduction

Global assessments of water health are increasing in frequency of reporting (Gleick 1993, 2006, 2007) and in need. Many global environmental status reports use water health assessments on a routine basis to track global change with respect to water quality, environmental quality, biodiversity, etc. (WWAP 2003, 2006, 2007; UNEP GEMS/Water 2005, 2007; Butchart et al 2010; Emerson et al 2010). Unfortunately, there is a complete disconnect between the reporting conducted and the level of data needed for accurate assessments.

Global assessments of water health can include existing state health reports for specific indicators such as water quality or predictive models to assess how indicators may change in the future and relative to different pressures such as increased anthropogenic stress or climate change.

The global water quality database, GEMStat (www.gemstat.org) of the GEMS/Water Programme (www.gemwater.org), coupled with the hydrological database of the Global Runoff Data Centre (GRDC, <http://grdc.bafg.de>) and supplemented with other data sources, offers a huge potential for modelling and understanding the impacts of large-scale processes on the world's waters.

GEMS/Water has long recognized the benefits of modelling to achieve its original purpose, which is to determine whether the quality of inland waters is improving or deteriorating. It is also well recognized that a major impact on the world's oceans and near-shore marine environments comes from land-based sources.

In this context, the United Nations Environment Programme (UNEP) through the University of Saskatchewan organized the **Workshop on Global Water Quality Modelling**, held on October 13-14, 2010 at the National Hydrology Research Centre (NHRC) in Saskatoon, SK, Canada. This report outlines the outcomes of this event coordinated by Dr. Gabriela Silva, Dr. Richard Robarts and Dr. Monique Dubé.

The objectives of the workshop were:

1. To form a GEMS/Water global water quality modelling working group,
2. To review current activities in global water quality modelling related to climate and land-use changes upon inland and near-shore marine waters that are summarized in a document for publication,
3. From this review, to look at ways how the members of the working group could use GEMStat supplemented with other data sources to enhance the output from global WQ modelling activities, and
4. To examine the possibility of using a modelling approach to increase the spatial coverage of GEMStat, particularly to remote regions and areas where there are currently no active water quality monitoring programmes.

2. Attendance and lectures

Participation in this initial workshop was purposely kept small by having mainly researchers that have been working on water quality modelling at the global scale (see Annex B for a list of participants). There were eight lectures. In their presentation, participants provided a description of their current and future research interests. They highlighted how these could help GEMS/Water achieve its objectives 3 and 4.

The first day focused on participants' lectures; second day was devoted to group discussion. On Day 1, Dr. Robarts gave a brief introduction to the workshop while an explanation of the role and operational mode of the UNEP GEMS/Water Programme and a new version of the GEMStat website was presented by Ms. Kelly Hodgson and Ms. Yvonne Stokker. A complete list of presentations is given in Annex A. On Day 2, Dr. Dubé facilitated the group discussion. The research outcomes developed by groups in North America, Europe and Asia were discussed. The participants identified the gaps and research needs on related to global water quality modelling.

3. Group discussion

Participants recognized the importance of the UNEP GEMS/Water Programme and Global Runoff Data Centre (GRDC) in compiling water quality and quantity datasets at a global scale and the potential of their databases for addressing water issues at very large scales.

A few common concerns emerged from the working group. They included:

1. Lack of awareness of the importance of monitoring data in general and its critical role in generating accurate global water assessments. This concern also related to the ongoing lack of support (financial and governance) to sustain global monitoring databases.
2. Data availability - difficulty in assessing reliable data for many parts of the world.
3. Data reliability due to different methodologies used to generate the data.
4. Data value and unevenness – some data were very old, infrequent sampling schedules used, not enough stations for a particular system, etc.
5. Difficulty in convincing countries to share data with the international water research community through GEMStat and GRDC.

A focusing question posed at the end of Day 1 for the group discussion was what would be the real value and use of integrated water quality and quantity databases? That is, in practical terms, what would be the advantages of having reliable and available information on water quality and quantity?

It was generally agreed that the group could make a significant contribution to our knowledge of large-scale water processes in relation to issues such as climate change, land use changes and urbanization of the world's population. Previous studies and publications (e.g., Vorosmarty et al. (2010) in Nature, see <http://www.nature.com/nature/journal/v467/n7315/full/nature09440.html>)

by other groups were referenced in the discussion. It was felt that the strength of the GEMS working group was in the integration of data on water quality and quantity of superior quality. Through the use of integrated water quality and quantity data to generate integrated water health assessments, common challenges such as communicating the essential needs for monitoring could be tackled better as a group. In addition, the products of the integrated analysis could serve to establish a more visible network of excellence and critical mass in this area.

4. Workshop outcomes and recommendations

It was unanimously agreed to form a Scientific Steering Committee to evaluate the state of science in water modelling worldwide. Specifically, the group felt that the most effective way to illustrate the value of our monitoring programs is to show how the data can be used to provide critical information for water managers and water policy makers. It was therefore suggested that a comparative study where excellent data quality and coverage existing in one area would be compared to an area where data quality and coverage were of lesser scope and quality. A comparison of results would demonstrate in a highly obvious fashion how much more we could do for science, managers and policy with better data, coverage of monitoring stations, integration of global data sets, and greater support of integrated partnerships for global water assessments. The results of this global study would help demonstrate how effective prediction and adaptive responses could be if water data and metadata were reliable and available.

For the purpose of this research, the group initially identified a few target areas, such as the Himalayas (Asia), Nile river basin (Africa), the Amazon and La Plata river basins (South America), U.S. and Canada (North America). The participants finally agreed that a valuable starting point should be a study comparing the value to water managers, policy makers and researchers of the vast amount of North American (U.S. and Canada) data from active and effective water monitoring programmes, including the widespread availability of supporting information on specific economic activities and the number of treatment plants versus that available in Africa. They argued that demonstrating what could be achieved in water research, water management and water policy development where there are rich and available sources of data compared to regions where such data were limited, unreliable or non-existent, would provide strong support for the development of monitoring programmes that provide relevant and reliable data that is readily shared by a plethora of users.

According to Dr. Robarts, the UNEP GEMS/Water Programme would hopefully provide initial funding for this research. For further funding, the group identified a few possibilities, such as:

1. Global Environment Facility (GEF)
2. Governments through aid agencies (IDRC and CIDA in Canada, JICA in Japan and USAid in the USA)
3. Foundations that support water projects in developing countries.

The group proposed to hire a postdoctoral fellow to write the research proposal. This initial appointment should be a term appointment from January 2011 to March 2011. Once the proposal was approved and financed, two postdoctoral fellows would be hired to work on this research. One would be located and work with Dr. Balazs M. Fekete at the City University of New York (CUNY), with possible collaboration with the University of New Hampshire (UNH), while the second position would be located and work with Dr. Monique Dubé and, Dr. Richard Robarts in Saskatoon. Overall coordination and supervision of the research would be the responsibility of the members of the new GEMS/Water Scientific Steering Committee for global WQ modelling .

In addition, Dr. Yamashiki asked participants to consider providing manuscripts to the journals *Hydrological Processes* (Special Issue) and *Hydrological Research Letters* (Special Collection). The purpose is to join the group in a collective publication on global water quality modelling.

Finally, the group hoped that the workshop would be the starting point to develop future common research on interests of global water quality modelling. It was hoped that funds would be available to the group to meet again to assess progress in implementing the research proposal but that members would keep in touch through email and conference calls.

5. References

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Annex A: Workshop program

October 13th. Wednesday

[09.30 – 10.00] Welcome and introduction

Dr. Richard Robarts. UNEP GEMS/Water Programme

Dr. Monique Dubé. University of Saskatchewan

Dr. Gabriela Silva. University of Saskatchewan

[10.00 – 11.00] "GEMS/Water Input to Global Water Quality Modelling"

Kelly Hodgson. UNEP GEMS/Water Programme

Yvonne Stokker. UNEP GEMS/Water Programme

[11.00 – 11.45] "Water Quality and Quantity Monitoring building a global network"

Ulrich Looser. Global Runoff Data Centre (GRDC)

[11.45 - 12.30] "UNEP and GEMS water: Changing perspective"

Dr. Ashbindu Lingh. UNEP Division of Early Warning & Assessment- North America.

[12.30 - 13.30] Lunch

[13.30 - 14.15] "Loading estimation from major river basin using GEMS/Water and GRDC dataset, combined with continental scale river basin model"

Dr. Yosuke Yamashiki. Kyoto University

[14.15 – 15.00] "Development of an integrated biogeochemical modeling frame to estimate global nitrogen pollution"

Dr. Bin He. Kyoto University

[15.00 - 15.45] "The impacts of climate change on the hydrology and hydrochemistry of small prairie wetlands"

Dr. Hua Zhang. University of Regina.

[15.45 – 16.00] Coffee

[16.00 – 16.45] "River flow and constituent fluxes assessment in a Global-scale, fully coupled hydrological model"

Dr. Balazs M. Fekete. City University of New York

[16.45 – 17.30] "Towards modelling water quality at the scale of Europe – current situation and some possible futures"

Richard Williams. Centre for Ecology & Hydrology, UK.

[17.30 – 17:45] Closing

Dr. Richard Robarts. UNEP GEMS/Water Programme

Dr. Monique Dubé. University of Saskatchewan

[19.30] Social event

October 14th. Thursday.

[09.30 – 12.00] Facilitated discussion

Dr. Monique Dubé. University of Saskatchewan

[12.00 - 13.00] Lunch

Annex B: Participants list (in alphabetical order)

<i>Participant</i>	<i>Contact</i>	<i>Institution</i>
Ashbindu Singh	ashbindu.singh@unep.org	UNEP
Balazs M. Fekete	bfekete@ccny.cuny.edu	City University of New York
Bin He	hebin@flood.dpri.kyoto-u.ac.jp	Kyoto University
Dean Shaw	das146@mail.usask.ca	University of Saskatchewan
Gabriela Silva	gabriela.silva@ec.gc.ca	University of Saskatchewan
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Richard Williams	rjw@ceh.ac.uk	Centre for Ecology & Hydrology
Todd Pugsley	top740@campus.usask.ca	University of Saskatchewan
Ulrich Looser	Looser@bafg.de	Global Runoff Data Centre
Yosuke Yamashiki	yamashiki.yosuke@flood.dpri.kyoto-u.ac.jp	Kyoto University
Yvonne Stokker	yvonne.stokker@gemswater.org	GEMS/Water