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Towards Improved Data and Information Exchange in the Ganges Basin

Bushra Nishat and Md Shamim Shams*

Introduction

Reliable data and information[1] on trends and condition of water resources; climate and flow regimes; water use and development practices provide the backbone for sound decision making and effective water resources management. Information is especially important in the case of transboundary water management (Chenoweth et al 2001, Nilsson 2003; Timmerman and Langaas 2005). Moreover, in transboundary basins, information exchange and sharing of data between riparian countries is regarded as a first and essential step towards fostering cooperation and trust (Timmerman and Langaas 2005; Gerlak et. al. 2013, Khan et. al. 2011). Unfortunately, restriction in the availability of data and information beyond borders in the riparian countries of the Ganges basin continue to prevail, and countries are often hesitant and cautious to share any kind of hydrological information (Hossain et al 2007, Nishat and Rahman 2009, Stimson Center 2012).

Spread over an area of around one million km2, the Ganga or Ganges Basin is extended across four countries–China, Nepal, India and Bangladesh. The river rises from the Himalayas and flows eastwards through India and meets up with another mighty river, the Brahmaputra (locally known as Jamuna) and the combined flows merge with another third river named the Meghna before falling into the Bay of Bengal. The Ganges plays a pivotal role in the hydro-geographic settings of the deltaic plains and dominates the socio-economic development of the countries within the basin. The hydrologic and characteristics of the basin affect the area with a variety of water related problems including floods in the monsoon, water scarcity in the dry season, sedimentation and erosion in the river and associated flood plains, drainage congestion in the low lying areas, salinity intrusion in the coastal regions and environmental and water quality issues. The region, however, has considerable development potential which can only be achieved through sustainable management of resources of

* Corresponding author

the basin. Against this background, this paper looks at the importance of sharing data and information between the riparian countries, and identifies the use of modern tools and technologies to facilitate this process.

The routine estimation of physical variables, such as precipitation, river discharge, soil moisture, snowmelt, land use change and the increased reliability and accessibility of the associated data means that information are not bound by borders anymore. The availability of technologically advanced geographic information systems, remotely sensed data, decision support systems, innovative analytical tools and web based communication materials in the public domain can be the catalyst for bringing changes in the current level of trans-boundary information exchange in the Ganges basin (Timmerman and Langaas 2005; Nishat and Rahman 2009, Stimson Center 2012; Gerlak et. al. 2013, Khan et. al. 2011). Around the world and in the region, the use and existence of modern state of the art technology at the country level is copious, but in trans-boundary water governance examples are few but increasingly becoming more common.

All countries in the Ganges basin have water resources data collection, assessment and monitoring systems which are stand alone and at country level. These systems need to be reconciliated and upscaled to the basin level. The paper goes on to discuss the mechanisms and frameworks needed to facilitate modern data and information exchange programmes in the Ganges region to support, reinforce and strengthen integrated water resources management in the basin.

Importance of Data and Information Exchange in Transboundary Water Management

The importance of exchange of data and information in transboundary water governance has been emphasized in the 1997 UN Convention on the Law of Non-Navigational Uses of International Watercourses, "….watercourse states shall on a regular basis exchange readily available data and information on the condition of the watercourse, in particular that of a hydrological, meteorological, hydrogeological and ecological nature and related to the water quality as well as related forecasts."

It is widely accepted that a structured process of transboundary water dialogue and cooperation often starts with the exchange of data and information (Timmerman and Langaas 2005; Gerlak et. al. 2013). This is often a key factor to ensuring transparency within the basin and in the cooperation process. When countries agree to share data and information freely it leads to trust building and confidence in the commitment of the riparian countries. Conversely, Wolf and Newton (2011) identifies unavailability and inadequacy of detailed hydrological data as an impediment to negotiations between Bangladesh and India in the Ganges basin.

Producing reliable data on water issues, water uses, quality at the national level and sharing this data contributes to developing mutual understanding of the basin. Moreover basin level holistic datasets ensure that water resources assessments are comprehensive and inclusive. Flood forecasting, climate change impact studies, e-flow assessment, water quality assessments are a few areas where basin level data have direct affect and are being used effectively. Examples from the Mekong River Commission show that riparian countries in the Lower Mekong routinely share water level and discharge data during 1st August to 30th September in each flood season. This data is used by the commission for flood forecasting as a service to the riparian countries (Mekong River Commission, 2013). In this basin, flood forecasting has been the entry point to increased cooperation through data and information sharing.

Data and Information Collection

Modern day decision making and planning with focus on water resources management has always been dependant on ground monitored data. In the Ganges basin India alone currently has over 6000 rainfall stations (Rajeevan and Bhate, 200). While in Nepal there are 440 stations (Kansaker et. al. 2004) and in Bangladesh, there are more than 350 stations (Mukherjee et al, 2012) . Due to the complexity and to a large extent economic considerations in collecting and handling information and data such as rainfall, river discharge, topographic parameters, land use, cropping pattern etc, the general trend on global ground level measurements is reported to be on the decline (see Stokstad, 1999; Shiklomanov, 2002). Similarly, topography, accessibility restrict the routine data collection which can consequently limit the accuracy of the data. In international river basins, such as the Ganges, further restriction in the availability of data and information beyond borders is a major hurdle (Hossain et al., 2007).

Emerging technologies and modern estimation algorithms are increasingly more reliable and accurate and are being seen as an alternative to ground based monitoring systems for estimation of hydro-meteorological variables. India is the only nation in the Ganges basin with modern state-of-the-art thematic satellites – such as Resourcesat, Cartosat and Oceansat/Metsat (South Asia Association for Regional Cooperation, 2008). Examples of some of these remote sense data sources from other sources include but not limited to,

Type of data	Source
Topography	Shuttle Radar Topographic Mission (SRTM) of Consortium for Spatial Information, Consultative Group for International Agriculture Research (CGIAR-CSI)
Rainfall	Rainfall Estimates (RFE) from the Climate Prediction Center (CPC), National Oceanic and Atmospheric Administration (NOAA)
	Tropical Rainfall Measuring Mission (TRMM) data from the National Aeronautics and Space Administration (NASA) and the Japan Aerospace Exploration Agency (JAXA)
Water level	TOPEX/Poseidon (T/P) satellite altimetry measurements Flying altimeters such as JASON-1, JASON-2, ENVISAT
Land use	Global Map of Land Use/Land Cover Areas (GMLULCA) of International Water Management Institute
Snow cover	Moderate Resolution Imaging Spectroradiometer (MODIS) of National Aeronautics and Space Administration (NASA)
Location of infrastructure	Google Earth

Furthermore many websites collect and provide data for public use, some examples include:
http://www.bafg.de/GRDC/EN/Home/homepage_node.html (Global Runoff Data Centre - GRDC), www.wunderground.com, http://www.ipcc-data.org/obs/cru_climatologies.html (Climate Research Unit -CRU), http://www.spatialhydrology.com/datawarehouse.html (Spatial Hydrology).

The easy access to mathematical modeling and various algorithms, the availability of satellite based data and different research reports in the public domain mean that even without collecting data across borders, riparian countries can estimate flows at the basin level. Recent studies have shown that it is possible to collect and compile a substantial volume of data and information for basin level modelling from secondary sources available in the internet and estimate Ganges stream flow to a certain level in Bangladesh (Nishat and Rahman, 2010; Moffit et al.,2011). These examples show, the hesitancy to share data and information is more of a political issue. More regions around the world are adopting these innovative technologies to facilitate data and information exchange across borders (Gerlak et. Al. 2013; Khan et. al. 2011). These modern tools and easy to access information can contribute and support data and information sharing in the countries in the Ganges basin.

Improving Water Management through Spatial Information

Emerging water recourses data is being used by scientists and researchers extensively, but only gradually by planners and decision makers involved in water resources management (Khan et. al. 2011). The limited use of these data and information sources has often been an issue of translation and communication. The technical data needs to be translated into easy to use, accurate, relevant, tailor made information for different users at different levels. Moreover, the need for people participation and transparency means that the information needs to be communicated to all stakeholders and easily accessible.

The riparian countries of the Ganges, Nepal, India and Bangladesh (Chinese portion of the basin is only 4%) are already using advanced prediction tools and in many cases integrating these into the management and decision making process. One of the major areas of use of prediction tools in the region has been flood forecasting but the lack of dissemination of warning to populations at risk is often a weakest link in the flood early warning system. The recent floods in Uttarakhand show that meteorological forecasts were available 3 days before the cloudburst and timely alert could have saved lives.[2] Nonetheless the countries in the basin are capitalizing on the internet and modern communication technology. Government initiatives in the countries include,

Nepal: The Department of Hydrology and Meteorology (DHM), under the Ministry of Environment, is mandated to monitor all the hydrological and meteorological activities in Nepal. DHM provides general and aviation weather forecasts, forecasting and early warning of hydro-meteorological hazards. Flood alerts on major locations in Nepal are available on the website, http://hydrology.gov.np/new/bull3/index.php/hydrology/home/main

India: The Central Water Commission (CWC) under the Ministry of Water Resources is the national organization which is carries out flood forecasting and early warning dissemination on the major rivers of India since 1958. Presently a network of 945 hydrological observation stations and issues level forecast for 145 sites and inflow forecasts of 28 dam barrage sites located on main rivers. The web site, http://www.india-water.com/ffs/ provides latest forecasts issued by the divisions of CWC.

Bangladesh: In response to annual floods every year the Government of Bangladesh established the Flood Forecasting and Warning Centre (FFWC) in 1972. Over the years FFWC has been equipped with modern ground station facilities and mathematical modelling tools and has a state of the art flood forecasting system for preparing flood forecasts and warnings. The accuracy and reliability of forecasts are well established and gives 72 hours lead time. The forecasts are sent to relevant government departments and also published on the FFWC website http://www.ffwc.gov.bd/ regularly.

Streamlining Data and Information Exchange into Transboundary Cooperation

The conventional approach to water resources data collection, assessment and monitoring has been essentially stand alone country level programs working in parallel. But water resources management at the basin level is increasingly becoming the predominant policy paradigm in international river basins. The need for data and information exchange and joint monitoring programmes is consequently mounting and many regions have already started to cooperate.

Analysis also shows that in many cases there is ambiguity in the exchange mechanism specified in the agreements. This may stem from the concern that, data and information can be used as a tool to directly blame riparian countries for basin degradation. Again, countries are concerned that bargaining positions may be weakened in negotiation data or information is divulged (Timmerman et' al 2004). Inspite of these concerns, the number of transboundary water agreements that have data and information exchange mechanisms have increased over time. The study by Gerlak et. al. (2013) of 287 transboundary water agreements show that 37% make direct reference to exchange of water resources data and information. The analysis shows that benefits of data and information exchange can be also ascertained in three distinct areas of any agreement, these are, formation, implementation, agreement, and effectiveness.

Even with the availability and easy accessibility of satellite based information there should remain a robust data exchange protocol between the riparian countries. Without a legal and institutional framework the data and information cannot be used in formal dialogues and negotiations. For example, in the Rhine river basin an international monitoring network under the framework of the International Rhine Commission is in operation for more than 40 years. International river basins in the European Union work in accordance with EU directives. At present a joint monitoring systems is being developed under the framework of the "Environmental Programme for the Danube River Basin" (Lack et. Al 2005).

A 1972 agreement on water quality in the St. John River and its tributary rivers between Canada and the United States categorically states that there should be "exchange appropriate information about plans, programs, and actions which could affect water quality in the Basin" (Gerlak et. Al. 2013). Agreements have also enabled the flood forecasting of the Mekong River Commission to perform successfully. Noteworthy in all of these examples is that innovative uses for the technology are continually being achieved riparian countries to support, reinforce and strengthen water resources management at the basin level (Khan et al, 2011).

In the Ganges basin, there are no instances of regional data and information exchanges, but bilateral processes already exist to a certain extent. A Joint Team of Experts (JTE) between India and Nepal consisting of experts from the both the countries are mandated to jointly asses and study effects of the planned Sapta Kosi and Burhi Gandaki dams, this exercise entails sharing of information on both tributaries. Additionally, the India—Nepal Joint Sub Committee on Embankment Construction is looking into planning. design and construction of embankments. More importantly since 1989, "Flood Forecasting and Warning System on rivers common to India and Nepal" maintains 42 meteorological / hydrometric sites in Nepalese territory.

Similar programmes exist between Bangladesh and India. The Joint River Commission between Bangladesh and India jointly monitor river flows at Farakka in Bihar during January-April according to agreement in the Ganges Treaty. However, this is just focussed on one location on the Ganges. Furthermore there is a system of transmission of flood forecasting data on major rivers like Ganga, Teesta, Brahmaputra and Barak during the monsoon season from India to Bangladesh.

While these initiatives are encouraging, these are still very segregated and piece meal. Countries are using modern technology at the country level more intensively. Again, many non-government initiatives of joint assessments between the scientists, researchers and civil society in the basin exist. But without government level political interventions these can play a small role in effective negotiations.

For future reconciliation it is important to ensure that data in all countries have the same authenticity level and adequacy. Data should be analyzed, interpreted, and converted in pre-determined formats, with application of corresponding analytical methods Standardisation of data and information can be ensured by existing regional bodies like SAARC Meteorological Research Centre as the necessary first step towards this type of exchange.

Conclusion

Modern tools and innovative technologies used in advantageous entry points in transboundary water such as flood management, climate change, energy security, water quality improvement can facilitate the process of a more comprehensive and inclusive data and information exchange. While there examples of data and information exchange in many international basins, these have taken a lot of time and experience to formulate. The countries in the Ganges basin are already using advanced prediction tools and in many cases integrating these into the management and decision making process at the country level. In order to combine and upscale country data and information for basin level assessment needs political will, institutional support as well as the availability of modern technological tools and expertise.

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ABOUT THE AUTHORS

Bushra Nishat is Project Manager for Ecosystems for Life: Ecosystems for Life: A Bangladesh–India Initiative and Md Shamim Shams, Sub-Divisional Engineer, BWDB (Bangladesh Water Development Board), Dhaka, Bangladesh.

Endnotes:

1. In this paper data refers to hard numbers related to water. These include numerical data on river flows, water quality, precipitation etc. Information is defined as the processed data that provides qualitative general information.

2. http://indiatoday.intoday.in/story/uttarakahand-floods-a-man-made-disaster-not-natural.-know-how/1/285692.html

Observer Research Foundation,
20, Rouse Avenue, New Delhi-110 002
Phone: +91-11-43520020 Fax: +91-11-43520003
www.orfonline.org email: orf@orfonline.org

The Asia Foundation
465 California St., 9th Floor, San Francisco, CA 94104
Tel: 415-982-4640 Fax: 415-392-8863
www.asiafoundation.org email: info@asiafound.org