

# ON SOME APPROACHES TO ACHIEVING HYDROLOGICAL OUTCOMES IN WMO

Ann Calver<sup>1</sup>

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## 1 Background and introduction

At the WMO RA VI (Regional Association VI – Europe) Hydrology Forum at Koblenz in May 2012, held under the auspices of the Working Group on Climate and Hydrology (RA VI WG-CH), a number of activities were seen as being helpful to the development of hydrological endeavours in the region. This present paper is the response to the desire for a note ‘*providing an overview on how actual challenges are addressed*’.

The content of this paper therefore covers how the aspirations of countries for a particular piece of hydrological work to be achieved through WMO, or with WMO involvement, may in practice be met. This paper does not address the formalities of WMO procedures: the main procedural and policy documents can be found on the WMO web site at [http://www.wmo.int/pages/governance/policy/index\\_en.html](http://www.wmo.int/pages/governance/policy/index_en.html). Rather, this paper describes, in sections 2 to 7 below, some examples of WMO hydrological initiatives across a range of subject matters and, importantly in this context, a range of types of approach (see table 1) to achieving the desired aims whether primarily through the Geneva secretariat, the Regional Associations and/or the Technical Commissions, particularly the Commission for Hydrology (CHy). The examples discussed are not necessarily all ‘flagship’, large or the most successful initiatives, nor of course are the examples comprehensive, but it is hoped that this range gives useful guidance for ways ahead for the future and offers lessons of various approaches. The individual examples below also contain general information (for example the role of WMO Technical Commission work plans and of panels of experts, etc) which applies much more widely than in the case of an individual example.

A useful general background to WMO directions is provided by the current strategic plan at [http://www.wmo.int/pages/about/documents/1069\\_en.pdf](http://www.wmo.int/pages/about/documents/1069_en.pdf).

## 2 Streamflow gauging

The twelfth Commission for Hydrology of 2004 promoted the issue of revising and updating WMO publication no. 519 ‘*Manual on Stream Gauging*’ in the light of advances in approaches and methods. Vernon Sauer (formerly of the US Geological Survey) led the writing in his role as a member of the CHy Open Panel of Experts (OPACHE). The new manual was published in 2010 as WMO publication no.1044: *Manual on Stream Gauging*, volume I *Fieldwork* and volume II *Computation of Discharge*. The question of publication languages is always an issue, translation costs being a strong consideration over and above

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<sup>1</sup> UK Hydrological Adviser; member of Commission for Hydrology Advisory Working Group

<b>Table 1: Examples of approaches discussed in this paper</b>			
<b>example as numbered in text</b>	<b>area of hydrology</b>	<b>type of organisation / individual involved</b>	<b>type of output</b>
2	river gauging	CHy <sup>2</sup> AWG <sup>3</sup> member and hydrological experts <sup>4</sup>	manual
3	data rescue	hydrological experts	conference paper; e-reports
4	climate and hydrological prediction	CHy AWG member	WMO Bulletin paper
5	river flood frequencies	CHy AWG member, hydrological experts, European Union	reports
6	flash floods	WMO secretariat, experts, regional hydrological personnel, aid organisation	regional implementation of early warnings; training
7	hydrological observations	WMO secretariat, experts, regional hydrological personnel, development organisation, river basin authority	upgraded observations and data management; capacity building

<sup>2</sup> WMO Commission for Hydrology

<sup>3</sup> Advisory Working Group of CHy

<sup>4</sup> Recognised competent contributors, frequently from WMO's 'Open Panel of CHy Experts' (OPACHE)

printing costs (at this time it could not be readily assumed that all countries had ready e-access). The product is available in English with summaries additionally in French, Russian and Spanish. Volume I is currently available in hard copy at 61 CHF; volume II as a CD at 40 CHF. Both volumes are freely downloadable from the WMO web site at <http://www.wmo.int/pages/prog/hwrr/publications.php>.

Work undertaken in the context of CHy is generally, and perhaps obviously, directed towards world-wide hydrology – if not specifically, then with some generic relevance. In contrast it is entirely appropriate that Regional Association endeavours are region-directed.

### **3 Data rescue needs and guidance**

A further item requested in the 2004-2008 CHy work programme was to advance the issue of hydrological data rescue. Matt Fry (CEH Wallingford, UK ) and Ross James (Bureau of Meteorology, Australia), both OPACHE members, were contacted by the relevant CHy AWG member and agreed to work on this item.

To gather information on the extent of the need for hydrological data rescue, secretariat staff of the (then) Hydrological and Water Resources Department worked with Mr Fry and Mr James to develop a questionnaire which was, between 2006 and 2008 sent to 183 WMO countries. Responses were received from 56 countries, which is a relatively good level for this type of exercise. Mr Fry and Mr James accordingly analysed these replies in the form of a short report in 2008 which was posted on the WMO website.

To follow up this work, the CHy programme of the subsequent 2008-2012 session sought to look into methods of hydrological data rescue. Mr Fry was willing to develop this aspect in terms of producing a report on guidelines for hydrological data rescue. In this context he liaised with Bogdan Ozga-Zielinski (Polish Institute of Meteorology and Water Management), a CHy expert, and Steve Palmer (UK Met Office), an expert involved in climatological data rescue, in particular in the DARE (Data Rescue) project. A paper on some of the findings was presented at a FRIEND<sup>5</sup> conference in Morocco in 2010 and published as '*Hydrological data rescue – the current state of affairs*', IAHS Publication 340 of 2010. At the time of writing, a report for WMO is scheduled to be posted on the WMO website in summer 2012.

### **4 Regional climate modelling and hydrological prediction**

The 2008-2012 CHy work programme proposed work in areas linking water and climate science. Addressing in particular the item '*Prepare guidance material on the potential use of the current capabilities in regional climate modelling for water resources assessment and management*', Ann Calver, the Advisory Working Group member with responsibility for this area wrote an article, reviewed by Secretariat staff, for the WMO Bulletin: *Water and climate: issues, examples and potential in the context of hydrological prediction*: v 58(3) July 2009. The rationale for taking this approach was to capitalise on the dissemination opportunity afforded by the circulation of the Bulletin, reaching the climatological as well as the

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<sup>5</sup> UNESCO programme '*Flow regimes from international experimental and network data*'

hydrological community, particularly since this was the volume produced specifically in association with the 2009 World Climate Conference-3.

The paper dealt with the key types of information transferred between atmospheric and hydrological domains, with examples of modelling for broad-scale flood risk assessment and for water resource availability and with challenges to be addressed to enhance predictive hydrological performance. As well as hard-copy versions, the article remains downloadable at [http://www.wmo.int/pages/publications/bulletin\\_en/archive/58\\_3\\_en/index\\_en.html](http://www.wmo.int/pages/publications/bulletin_en/archive/58_3_en/index_en.html).

## **5 River flood frequencies under changing conditions**

At CHy-13 in 2008 interest was expressed in the state of knowledge of methods for river flood frequency estimation under changing environmental conditions – notably of climate but also of land use and management. Accordingly a work programme item for 2008-2012 was established, namely *'Prepare guidance material for factoring transient climates, non-stationary nature of data sets and uncertainty analysis in the estimation of design floods'*.

As a contribution to addressing this, the AWG member leading on 'Water, Climate and Risk Management', Ann Calver, considered it useful and efficient to liaise with a European COST (European Cooperation in Science and Technology) Action, 'Floodfreq' <http://www.cost-floodfreq.eu> which runs from 2010 to 2014 and has, as one of its main strands, *'Impacts of environmental change on flood frequency estimation'*. WMO was welcomed as a member of the Action, Dr Calver attended the June 2011 Floodfreq meeting in Budapest, and it was agreed that such WMO countries as could would join the European partners in producing short statements of their country's state of art on methods for river flood frequency estimation under changing conditions.

Although there were indications that responses would be forthcoming from a number of WMO countries (beyond Europe), only three – from Australia, India and the United States - were produced in the appropriate timescale for incorporation with the COST outputs. At the time of writing it remains to be decided whether dissemination is via the WMO web site and/or integrated as part of the COST report.

It is in some ways understandable that WMO contributions were sparse since the subject is more in the research arena at present rather than in operational practice. That said, this example is unfortunately not atypical in terms of level and timing of response. It has to be borne in mind that these are contributions sought from people who are volunteers in WMO terms but usually have considerable other professional commitments. It is expected that a call will be re-issued on the WMO website and/or at CHy-14 in November 2012 for further contributions on this topic, especially as techniques move into practical use in strategic planning.

## **6 Flash flood guidance in southeast Europe**

WMO has, since 2007, been involved in an international initiative on the development of flash flood guidance and early warning systems following recognition in country surveys that such rapidly-rising, heavy-rainfall-induced floods were seen as a major hazard in a majority

of the responding countries. An overview presentation on the guidance system can be found at [http://www.wmo.int/pages/prog/hwrrp/rwgh/RA\\_II/documents/FFGS\\_FINAL\\_GRABS.pdf](http://www.wmo.int/pages/prog/hwrrp/rwgh/RA_II/documents/FFGS_FINAL_GRABS.pdf). The initiative was initially funded by USAID in cooperation with NOAA (National Oceanic and Atmospheric Administration, US) and HRC (Hydrology Research Centre, San Diego, CA, US) and was based on systems developed in Central America and the Mekong Basin.

As a follow-up to the first exploratory meeting held in the WMO Geneva Secretariat in 2007, it was agreed to proceed, for the first project phase, with the implementation of a small number of pilot projects. Following from this, a launch meeting of a Black Sea and Middle East component of the Flash Flood Guidance System was held in Istanbul in 2010. The Turkish Meteorological Service is hosting the regional centre for the project, a steering committee has been established, and a five-year work plan has been developed working with a budget of 0.75 million US\$. The project seeks to develop and implement key components of the regional and country flash flood guidance and early warning systems for Armenia, Azerbaijan, Bulgaria, Georgia and Turkey. The launch of a sister project in the Balkan area, covering Albania, Bosnia-Herzegovina, Croatia, Kosovo, Macedonia, Moldova, Montenegro, Romania, Serbia and Slovenia and is envisaged for late 2012.

## **7 World Hydrological Cycle Observation Programme**

WMO's longstanding World Hydrological Cycle Observation Programme (WHYCOS), which is implemented world-wide on a regional basis in transboundary river basins, seeks to establish and upgrade hydrological information systems and capacity building in all aspects related to observations, data management, dissemination of data and derived products. The projects are demand-driven by stakeholders in transboundary river basins. The following example is drawn from RA II Asia.

WMO and the Mekong River Commission (MRC) entered into a memorandum of understanding in 2001 to undertake the Mekong-HYCOS project prompted in particular by the need for timely and accurate information on floods. This was followed by a letter of agreement in 2006 regarding the implementation of the project which is being funded by the French Development Agency.

The main aim of the Mekong-HYCOS project has been to develop and operate regional flood information systems based on active cooperation with the Mekong riparian countries including Cambodia, Lao PDR, Thailand and Vietnam. By the end of the project at the end of 2012, the Mekong-HYCOS will consist of a network of 52 hydrological stations, complemented by over 200 of WMO's GTS (Global Telecommunication System) rainfall stations and national terrestrial precipitation stations. Capacity building has been a prime concern, with emphasis on the education and training of technical and station observer personnel to ensure the quality-controlled operation of the stations. The data generated are used for flood forecasting in MRC's Flood Management and Mitigation Programme.

Following the success of this project, a 'sister-project', the Hindu Kush Himalaya HYCOS project, is currently under implementation in five countries through the International Centre on Integrated Mountain Development (ICIMOD) with funding provided by the government of Finland. A recent overall review presentation of the HYCOS programme is available at

## **8 Concluding remarks**

It will be apparent that key (but not the only) times in terms of suggesting and promoting a work item are in association with meetings affecting the establishment of work programmes for forthcoming sessions. The Commission for Hydrology has been increasingly offering background papers and opportunities to contribute ideas in advance of the meetings it holds. At the time of writing, for example, the CHy web e-board and e-forum are featuring items in association with the November 2012 once-in-four-year meeting of the commission.

More generally, the WMO web site offers much scope for noting procedures and developments across WMO once a familiarity with the layout and style of the site has been achieved. Activities and outcomes including a water perspective are, under the relatively new regime of reporting under cross-cutting categories of 'expected results', to be found in a number of locations.

The WMO budget plainly covers the secretariat role but budgets for CHy and for Regional Associations are not great and work is therefore very dependent on work contributions on a voluntary basis. Extra-budgetary funding contributed to WMO is naturally generally associated with achieving the particular aim of the donor. The dependence on volunteer input can raise issues of quality, of timing and of spread of involvement across countries. In practice it also tends to mean that the often ambitious programmes of work requested by countries cover more items than can be readily achieved: calls for high quality volunteer input are a recurring theme.

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