

WRA Bulletin 38

May 2014

Water Quality

WRA collectively have a long standing expertise in understanding the quality of natural terrestrial waters whether in rivers and streams, lakes, or groundwater. A range of chemical and physical contaminants can have an impact on the quality of water such as excess nutrients and pesticides from agricultural land, eroded sediment, bacteria, spillages of noxious chemicals, and even changes in the temperature of water.

The INCA (Integrated Nitrogen in CATCHments) model is the main water quality component of the WRA modelling portfolio. This is a process based model giving a representation of the plant/soil system and in-stream biogeochemical dynamics. It was developed initially to predict the nitrogen export from different land use types and in-stream processing in rivers of the UK. It has since been extended to cover other contaminants such as phosphorus and been applied to other parts of the globe.

Modelling the Impacts of Climate Change on Water Quality in India and Bangladesh

As part of the NERC funded ESPA Delta Project Assessing Health, Livelihoods, Ecosystem Services And Poverty Alleviation In Populous Deltas (see www.espadelta.net) Paul Whitehead has applied the INCA model to the Ganga, Brahmaputra and Meghna river systems, as shown in Figure 1. This has involved using the multibranch version of INCA N to simulate over 26 tributaries and 85 reaches of the river systems.



Figure 1 Map showing the GBM River Systems draining into India and Bangladesh

The UK Met Office has provided 3 climate scenarios based on the Regionally Coupled Model linked to the

HadCM3 Global Circulation Model, and the simulations have been downscaled to a 25km grid across the catchments. The modelling of the climate indicates increased trends in temperature in all three climate scenarios as well as increased precipitation with temperature increases from 2.6 °C by mid century to 4.3 °C at the end of the century. Precipitation is modelled to increase by between 10% by mid century and 15% by the end of the century.

The effects on the flows in the Ganga River system at Furraka in the lower Ganges is shown in Figure 2 and indicates increased flows in the monsoon period by the mid century, with the potential for increased flooding. The water quality has also been modelled with nitrate reducing into the future as increased flows dilute discharges and also the Ganga Mananment Plan delivers improved water treatment of effluents from the major cities. The downstream flow and water quality time series are being transferred to a range of other modellers in the project simulating the estuary systems, the Bay of Bengal, agriculture, fisheries and the impacts of of change on poverty alleviation in Bangladesh.

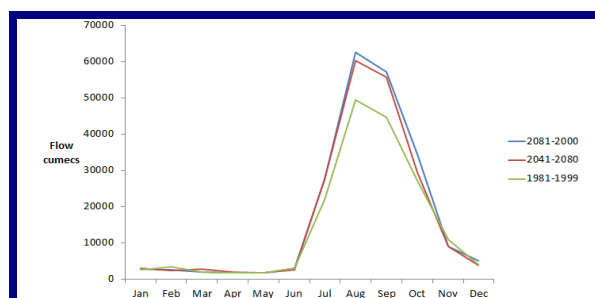


Figure 2 Monthly Flows in the lower Ganga River System for current and future climate conditions

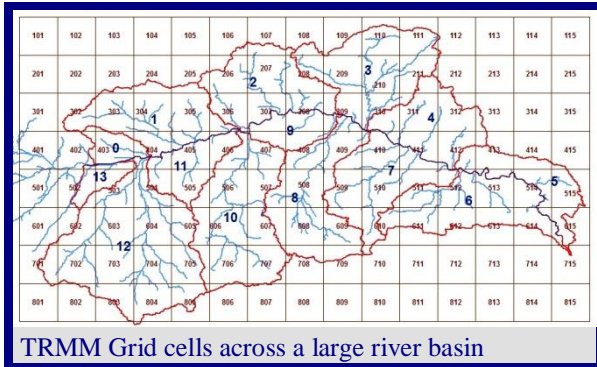
WRA Software

TRMM sys

David Plinston has recently extended the TRMM software and database configuration to include the analysis of continuous rainfall time-series leading to rainfall intensity-duration-frequency (IDF) curves that can be produced easily for any point on the globe between the 50 degree latitudes. The software analyses TRMM rainfall by quarter degree grid cell at a 3 hour

resolution for the 1998-2014 period, a record of 192 months of short-duration rainfall data. Further development is in progress to provide project support for flood analysis in large basins.

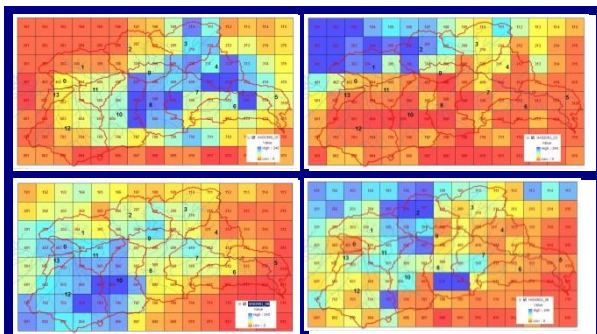
This global database and software system can provide a rapid response to project requirements anywhere in the Earth's tropical and sub-tropical regions. An IDF relationship or specific storm events can therefore be investigated for any location with relative ease. So far, the data have been used and tested by WRA in Brunei, Sarawak, Indonesia, Yemen and Angola.



TRMM Grid cells across a large river basin

The Tropical Rainfall Measuring Mission (TRMM) is a joint NASA-JAXA (Japanese) satellite mission to monitor tropical and subtropical precipitation and to estimate its associated latent heating. TRMM provides Real-Time Multi-Satellite Precipitation Analysis.

TRMM data represent an areal rainfall averaged across the grid cell, as opposed to a point-rainfall, measured at a rainfall station. The areal measure of rainfall in each cell varies with latitude, and grid-cells are 28 by 28 km at the equator, which represent an area of 784 km². <http://pmm.nasa.gov/node/158>



Distribution of TRMM rainfall across a river basin in four different rainfall events

WRA Partner/Associate News

Changes in the company structure at WRA have seen Sean Avery, Pat Reynolds and Andrew Wade move from being Partners to Associates as part of a transition to the Limited Liability Partnership status.

Frank Farquharson has completed his final visit to India where for the past five years he has been part of the Technical Assistance and Management Team on the World Bank funded Hydrology Project Phase II. Frank has been involved in this project on and off since 1994, where he was part of the WB project initiation missions, and then through Phase I from 1996 to 2002, and finally throughout all of Phase II from 2009 to 2014. This major project (Phase I \$140mill and Phase II \$135mill) has provided surface, groundwater and water quality support to 13 States and eight Central Agencies. The project aimed to extend and promote the sustainable use of hydrological data by all potential users concerned with water resource planning and management. A web-based Hydrological Information System has been developed to store all of the relevant hydrological data thereby contributing to increased productivity and cost-effectiveness of water-related investments.

The project involved provision of improved hydrometric equipment, construction of new data centre buildings and water quality laboratories and training of many thousand staff over the two phases. The aim is to raise the standards of hydrological data collection, processing and particularly use of such data for improved water resources assessment and management. More information can be found on the project website: <http://www.ijcid.com/hp/default.html>.

Harvey Rodda has represented a local group, the Tanners Meadow Action Group, as an expert witness for a public inquiry held by the Mole Valley District Council. The group are concerned about the increased flood risk posed by a proposed residential development of some 30 houses on a greenfield site which is regularly flooded. Work undertaken on behalf of the developers had not properly addressed the risk of flooding and WRA were given the task of ensuring that the issue of flooding was properly considered by all parties involved.

Next WRA Board Meeting

4th July 2014, Blewbury

The WRA Bulletin is a quarterly publication, and relies on contributions submitted by Directors, Associates and Consultants. The document is circulated by email, and published on the WRA web-site, aiming to keep the WRA network, up-to-date with respect to current activities. Please email contributions for future issues to Harvey Rodda: harvey@watres.com

Water Resource Associates Ltd, PO Box 838, Wallingford, Oxon OX10 9XA. Tel: +44(0) 1491 838 190, www.watres.com