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19th CONGRESS OF THE ASIA AND PACIFIC DIVISION OF THE INTERNATIONAL ASSOCIATION FOR HYDRO ENVIRONMENT ENGINEERING AND RESEACH

IAHR - APD 2014

21st - 24th September 2014

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Biomass and Nutrient stock of lotus(*Nelubo nucifera*) in lake izunuma

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ABSTRACT

Lake Izunuma is a shallow lake located in the northern part of Miyagi Prefecture in Japan, and eutrophication in the lake is a serious problem. Moreover, lotus (*Nelumbo nucifera*) has become the dominant species of aquatic macrophyte in the lake, the coverage area of which community has been expanding rapidly in recent years. Accumulation of fragmented dead body of the vegetation into the sediment is considered one of the major causes of eutrophication and water quality deterioration. The purpose of this study is to evaluate the effects of the lotus community on the water environment in Lake Izunuma. Measurements were conducted on the condition of the lotus community and sediment from June-2013 to March-2014. The storage of nutrients was calculated from the data of the observations (biomass and nutrient content rate of lotus). In the growing season, lotus appears to have an ability to remove the nutrient load from the lake by saving it in the stems and leaves mainly. On the other hand, nutrient stock is large in dead body from late autumn to spring. It is possible that water pollution is caused by decompositon of the dead plant. Nutrient content rate in sediment reduced because the lotus has absorbed nutrients and carbon content rate in sediment increased because the dead body of lotus decomposed from summer to winter. Therefore, it is considered lotus community affects the sediment composition.

Keywords: Aquatic macrophyte, Biomass, Nutrient stock, Shallow lake

1. INTRODUCTION

Lake Izunuma is a shallow lake located in the northern part of Miyagi Prefecture in Japan with a lake surface area of 2.89km², the maximum water depth of 1.76m, the average water depth of 0.76m(Fig. 1). Shape of the lake is long east-west direction. There are several feeder rivers in the lake. Arakawa river is main stream and Jyodo river is feeder river from Lake Uchinuma. On the other hand, outflow is one place in eastern end of the lake. Further, the water level of the lake is managed by a gate which is placed at the downstream end.

Wetlands around Lake Izunuma is a habitat of a variety of birds and plants, is registered in the Ramsar Convention as major areas of migratory birds flying. However, water quality is degraded due to inflow of domestic sewage, the effects of food and feces of waterfowl and so on. Eutrophication of the lake has become a problem(Umeda et al., 2011). According to the results of the water quality of the lake which is measured by the Ministry of the Environment in 2009, the annual average value of COD is 10mg/l, it become the worst in Japan. In addition, the result of annual average value of COD in 2011 and 2012 is 8.8mg/l both, water quality measures are still not enough. Submerged macrophyte

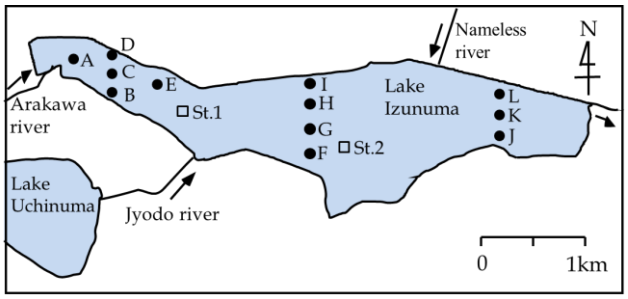

Figure 1. Ground plan of Lake Izunuma and observation points

grew abundantly in Lake Izunuma several decades ago, but it decreased sharply due to the changes of environment in the lake(Miyagi Prefecture., 2011). Lotus(*Nelumbo nucifera*), which is emergent macrophyte, has become a dominant species. Futhermore, its population has been expanding in recent years. Area of lotus community to the area of the lake is expanding rapidly from 23% in 2006 to 44% in 2008(Shikano et al., 2008).

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EVALUATION OF ECOLOGICAL DISCHARGE BASED ON FLOW DURATION AND ENVIRONMENTAL MANAGEMENT CLASS IN DAY RIVER, VIETNAM

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ABSTRACT

Rivers, which are critical to social and economic growth of the countries, have been severely impacted by climate change and human activities. As a contributor to preservation of natural river ecosystem, this study provides new technique and procedures via analyzing flow duration in a river basin. The process is carried out by applying a method to estimate environmental flow developed by the International Water Management Institute, and simulate the effects of runoff characteristics to a river and frequently changes of flow under basin development on aquatic ecosystem. A water balance analysis based upon the water requirements in the river basin is used to estimate natural flow in the Day river basin, a tributary of Red River. Afterwards, flow duration curves are analyzed and assessed according to EMCs based upon natural flow of the river. Additionally, the typical species of fishes in the river are determined to present the properties of habitats making favorable conditions for estimating allowable ecological discharge. For this study, PHABSIM (Physical Habitat Simulation System) is used to project the relations between flow discharge and Weighted Usable Area (WUA), and EMCs consistent with flow duration curves along with in-stream flow are evaluated. The results from this study are seen as a fundamental data sources in making plan helping water practitioners monitor and manage aquatic ecosystems in the river system efficiently.

Keywords: Ecological flow rate, flow duration, EMC, GEFC and PHABSIM

1. INTRODUCTION

Under the impacts of climate change and human activities, water resources in the river in terms of quality and quantity have changed significantly leading to adverse impacts on the river ecosystem. "Native fish, once providing both food and commercial catch, are now on the brink of extinction" (Flow-The essentials of environmental flows, 2nd edition. Grand, Switzerland: IUCN) is an example. The deterioration of water quality, water shortages and uneven distribution of water sources reduce the crops yields which once growing strongly in the clean and sufficient water. In the long term, the conservation of aquatic ecosystem is becoming essential to our wellbeing, especially fishers, farmers, environmental activists and recreational river users.

In these days, the science of 'environmental flow' (EF) which once called instream flow is still relatively a young concept with many water specialists, but it plays an important role in the field of integrated water resources management (IWRM), especially conservation of aquatic ecosystem. It is defined as "the water regime provided within a river, wetland or coastal zone to maintain ecosystems and their benefits where there are competing water uses and where flows are regulated" (Flow-The essentials of environmental flows, 2nd edition. Grand, Switzerland: IUCN). In other words, it can be seen as a flow regime to maintain a healthy river satisfying environmental criteria and ensuring the development of the species on the river, but still meets the water resources development requirement for water-related users in agriculture, industry and domestic water use.

There are many environmental flow assessment techniques, which have emerged in recent years and have been reviewed in some sources (Tharme, 2003; Acreman M, Dunbar MJ, 2004). They consist of hydrological methods, ecological methods, hydraulic methods, optimization, and so on. However, Smakhtin and Eriyagama (2008) agreed that the estimation of EF in reality is complex because of the distinct gaps in awareness and the lack of ecological quantitative data involved about the relationship between the studied rivers flows and multiple components of their ecology. They are the fundamental input data to produce reliable outcomes for users.

Bunn SE, and Arthington AH (2002) presented in term of hydrological characteristics that many ecologists are paying attention to an significantly important factor of the rives called "flow variability". This not only has effects on the structural and functional diversity of the rivers, but also impacts to their floodplains, from which affects to the diversity of the aquatic species. The natural hydrological regime and the ecological condition of a river system are related to each other (Hughes DA, Hannart P 2003; Naiman et al. 2002; Richter et al. 1997; Smakhtin et al. 2006). In 2008, the International Water Management Institute in Sri Lanka, in collaboration with the Water Systems Analysis Group of the University of New

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The effects of vegetation on the hydraulic residence time of stormwater ponds

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ABSTRACT

Storm water ponds treat polluted run-off from urban areas, highways and agricultural land. Vegetation plays a key role in water treatment, but further understanding is required to identify how vegetation density and spatial distribution within a pond affect the residence time, an important parameter with respect to water treatment. This paper presents results from a preliminary study where the residence time distribution and discharge of a water treatment pond were measured at two stages within the vegetation's seasonal growth cycle, representing the minimum and maximum states of the vegetation's density. The results show clear and significant differences between the residence time distribution for the two cases, and highlight the need for further work on the topic.

Keywords: Residence times; Residence time distribution; Storm water ponds; Vegetation

1. INTRODUCTION

Stormwater ponds are used to reduce the negative environmental impact of run-off from urban areas, highways and agricultural land, through detention and water treatment (SEPA, 2003). Vegetation plays a key role in water treatment by providing the appropriate biological environment for the degradation of pollutants (Hansson *et al*., 2005). However, water treatment is also a function of the pond's residence time, as contaminated water needs to reside in the pond for a sufficient time to be treated effectively. Uniform vegetation can increase the residence time of a pond by reducing the pond's mean velocity. However, the effects on the residence time of more complex vegetation patterns and varying densities, such as those created naturally by the vegetation's variation throughout the seasonal growth cycle, are less well understood.

Current estimates of pond residence times rely on the 'nominal residence time' (pond volume/discharge) which is the pond's residence time assuming plug flow. However, a large amount of work has shown this parameter to provide a poor estimate of the pond's residence time, as the flow fields in real stormwater ponds are often more complex (Wörman & Kronnäs 2005, Jenkins & Greenway 2005, Min and Wise 2009, Shilton *et al*. 2008, Persson *et al*. 1999). The effects of geometric short circuiting (for example, when the outlet is placed adjacent to the inlet) are generally well understood. However, the effect of vegetation on the pond's flow field and corresponding residence time is less well understood. Vegetation patches can create preferential flow paths within the pond, leading to short-circuiting which creates a reduced effective volume of the pond, and thus a residence time lower than the nominal residence time. The degree to which preferential flow paths are created around vegetation patches is affected by the vegetation's density and type, and thus is a function of the seasonal growth and succession cycle, as the density of vegetation patches changes as vegetation grows though the year.

This paper presents results from a preliminary study to investigate the effects of vegetation density on the residence time of a large agricultural pond in Southern Sweden. Tracer experiments were conducted at two times throughout the year. One set of tests in March/April, a point of minimum vegetation density just before the start of the growth season, and a set of tests in November, at the end of the growth season when vegetation density is near the maximum level from the previous season's growth. In addition, for the set of tests conducted in March/April, two contrasting discharges were investigated to highlight the effect of discharge upon the ponds residence time distribution.

2. EXPERIMENTAL SETUP

The experimental test program was conducted on a water treatment pond designed to treat run-off from agricultural land in Lyby, Southern Sweden. The system consists a sediment trap and two ponds in series, with tests conducted on the lower pond in the system, as shown in Figure 1.

Figure 1. Treatment pond in Lyby, Southern Sweden (Taken late 2001 just after construction, prior to any vegetation growth).

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PARTICLE PLUMES IN A TURBULENT BACKGROUND

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ABSTRACT

We report in this paper the first study on particle plumes in a turbulent background. A jet array in which each jet was programmed to turn on and off randomly was used to generate a roughly isotropic and homogeneous turbulence. Particles of sizes range from 0.0675 mm to 0.725 mm were discharged continuously from a submerged hourglass to produce steady plume flows into the turbulent background. The changes in plume mixing characteristics (comparing to plumes in quiescent ambient) due to the effect of turbulence is reported. The breakdown of some plumes due to the turbulence were observed and a criteria for the breaking down of plume is presented.

Keywords: Two-phase flows; Turbulence; Particle Plumes; Plume breakdown.

1. INTRODUCTION

A particle plume is a continuous source of buoyancy generated by dense/buoyant particle flows. It is an important type of two-phase flow related to many geophysical, air quality, and environmental fluid mechanics problems. 'Black smokers' released from hydrothermal vents on seabed in deep ocean (Turner and Campbell, 1987), carrying dissolved minerals and sulfide particles, can support communities of chemosynthetic organisms; ash carried by volcano eruptions to the atmosphere (Woods, 2010) can severely affect air traffic; dispersion of chimney plumes can have an impact to the surrounding air quality. Of particular importance to Singapore is the land reclamation, in which sediment is dumped into water continuously in some cases to create land mass; sediment loss to the surroundings during its descent can affect adversely the nearby water quality. It is often essential to predict the mixing characteristics of these plumes, for example in environmental impact assessment or disaster management. Extensive studies of a plume have been made in the past and there are now established theories to make predictions (e.g. Fischer et al., 1979, Lee and Chu, 2003).

Quite often, the ambient fluid of these plumes is not quiescent but contains a certain degree of turbulence. It is of interest to understand how the plume mixing will be affected in a background turbulence. Only a few studies in the past have made such an attempt. Ching et al. (1995) had studied a line plume in turbulent background generated by an oscillating grid, and found that the line plume breaks down when its characteristic velocity is less than 1.6 times of the background turbulence intensity. Cuthbertson et al. (2006) had made similar study of a round turbulent buoyant jet, and established the breakdown criteria for the jet using dimensional analysis. Hubner (2004) developed an integral model of a plume in a background turbulence, and was reasonably successful in predicting the sudden spread of the plume close to its breakdown point. Recently, Khorsandi et al. (2013) studied the effect of roughly isotropic and homogeneous turbulence on a jet using a random jet array (Variano and Cowen, 2008), and reported important several jet mixing characteristics changes due to the turbulence.

In all of these studies, only a single-phase plume flow was studied; the effect of particles together with a background turbulence on a plume has never been explored. We report in this paper the first attempt to study a particle plume in a turbulent background. Experiments carried out will first be described, followed by observation. The change in particle plume mixing due to turbulence will be reported, and finally a theory will be presented to estimate the plume breakdown point.

2. EXPERIMENTS

Experiments were carried out in a 2.4 m long x 1.2 m wide x 2.0 m deep glass tank. The experimental setup of this study is given in Figure 1. An isotropic turbulent background with low mean flow was generated using an array of bilge pumps mounted on a vertical wall covering an area of 1.2 m x 2.0 m, and programmed to turn on and off randomly (Variano and Cowen, 2008). Experiments were first carried out to characterize the generated turbulence. Then, a region in the tank was chosen such that the particle plume experienced a roughly isotropic and homogeneous turbulent background with mean root-mean-square (rms) velocity $[\Sigma u_{rms}^2]^{1/2}$ of 1.5±0.30 cm/s. A particle plume of initial diameter D = 1.0 cm and constant efflux velocity was generated by releasing a fixed mass (600 g) of wet glass beads (by gravity) underwater using a submerged-hourglass release mechanism. Particle density was 2500 kg/m^3, and median diameters d_{50} ranged from 0.0675 – 0.725 mm, producing an estimated initial velocity

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Title		Writer	
Estimating groundwater storage changes in South Korea by combining satellite - and land - base data	-	*Jae Young Seo, Sang Il Lee*	Open
Study on reducing levee breach of earth-filled embankment	-	*D. Tobita, T. Kakiuma, Y. Shimizu*	Open
Intensity-duration-quantity (IDQ) analysis for expedite river flood management	-	*J.G. Kim, B.S. Kang ,Y.D. Kim*	Open
Hazardous event analysis for drinking water production by managed aquifer recharge	-	*Hyon Wook Ji, Sang-Il Lee And Seung Jin Lee*	Open
Experimental study of flow discharge through the drainage gates on the Saemangeum tidal barrier	-	*Jae-Sang Jung, Sejong Han, Herin Cho, Yong-Sik Cho*	Open
Experiments on the submarine cable protection methods according to connection type	-	*Jae-Seon. Yoon, Sejong Han, Seok-Il. Jeong, Yong-Sik. Cho*	Open
Studying forecasting river bank erosion process in Nambo plaine area due to global climate change and proposing solution for treatment	-	*Pham Huu Sy*	Open

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Keynotes and Invited Lecturers

1. TSUNAMI MITIGATION BY USING A SHORE-PARALLEL CANAL AND COASTAL EMBANKMENT
Hitoshi TANAKA

2. SUSTAINABLE DELTA DEVELOPMENT IN TIMES OF CLIMATE CHANGE
A.E. Mynett

3. NKING CLIMATE CHANGE TO HYDROLOGICAL IMPACT AND ADAPTATION STUDIES: RECENT DEVELOPMENTS IN DOWNSCALING METHODS
Van-Thanh-Van Nguyen

4. UNDERSTANDING IMPLICATIONS OF CLIMATE CHANGE FOR WATER RESOURCES
Young-Oh KIM

5. LONG WAVE PROPAGATION AND BORE DYNAMICS IN COASTAL AND ESTUARINE ENVIRONMENTS
Philippe Bonneton

6. CLIMATE EXTREMES AND CLIMATE CHANGE IN VIET NAM
Tran Thuc

7. STUDY ON AERATION FOR AVOIDING CAVITATION DAMAGE IN HYDRAULIC ENGINEERING
Weilin XU

Invited Lectures

The importance of groundwater and surface water interaction in hydrological cycle under climate change
Maki Tsujimura

Advanced concrete block technology in Japan
M. Hanzawa, A. Matsumoto, N. Hirose, M. Tanaka, J. Mitsui, S. Maruyama

The Mekong river delta: “living with flood proactively”
Dao Xuan Hoc

Keynote Speaker of the 19th congress of IAHR-APD

Keynote Speaker

Hitoshi TANAKA, Tohoku University, JAPAN

Title of the Speech

TSUNAMI MITIGATION BY USING A SHORE-PARALLEL CANAL AND COASTAL EMBANKMENT

Personal Profile

Professor Hitoshi Tanaka finished his PhD study at Tohoku University, Japan in 1984. After job experience in other universities such as Utsunomiya University (Japan) and Asian Institute of Technology (Bangkok), he was promoted to a full-professor of Tohoku University. His main research interest lies in fluid mechanics such as turbulent wave boundary layers, related sediment movement and also resulting morpho-dynamics in costal and estuarine environment. His study sites are not confined in Japan, but covering various countries such as Vietnam, Thailand, Indonesia,Oman, Bolivia etc. Since 2011, he serves as a chairman of Asian and Pacific Division (APD) of IAHR.

ABSTRACT

The Great East Japan Earthquake and Tsunami of 2011 had caused huge damage to people and civil infrastructure around Japan. This large-scale disaster has been provided many valuable practical lessons regarding the huge consequences and potential impact of megaearthquake and megatsunamis. There have been many studies on the effects of construction solutions such as coastal embankment, breakwater, as well as non-structural solutions such as pine trees, mangrove forest, and coastal dunes for reducing tsunami energy when it spreads to coastal areas. But the fact that most of these solutions only make significant in the case of relatively smaller tsunami events; in terms of multiple defense against largest tsunamis, there is a need to combine multiple solutions together. The main objective of this lecture is to introduce the effectiveness of a shore-parallel canal together with coastal embankment structure on tsunami mitigation.

Keynote Speaker of the 19th congress of IAHR-APD

Keynote Speaker

Van-Thanh-Van Nguyen

- Chair of Department of Civil Engineering and Applied Mechanics
- Director of the Brace Centre for Water Resources Management at McGill University, Canada

Title of the Speech

Linking Climate Change to Hydrological Impact and Adaptation Studies: Recent Developments in Downscaling Methods

Personal Profile

Professor Nguyen is holder of the Endowed Brace Chair Professor in Civil Engineering at McGill University (Canada). He is also Chair of Department of Civil Engineering and Applied Mechanics and Director of the Brace Centre for Water Resources Management at McGill. His scientific and professional contributions over more than 30 years have been mostly in the areas of Hydrology and Water Resources Management. His research interests cover a remarkable range of topics including: modelling and analyses of various hydrologic processes (rainfalls, temperature extremes, floods, river flows, ice accumulations, reservoir inflows); modelling of river basin and urban storm drainage systems; assessment of climate change impacts on water resources; regional estimation of extreme hydrologic variables; forecasting and simulation of hydrologic series; and management of water resources systems for sustainable development. He is author or co-author of over 200 articles in refereed journals, specialized monographs and conference proceedings since 1979 to date. He has been invited to serve in various national and international expert committees (WMO, UNESCO, etc.), scientific journal editorial boards (ASCE J. of Hydrologic Engineering, IAHR J. of Hydro-environment Research, IAHR J. of Hydroinformatics, etc.) as well as to deliver keynote lectures at many universities, scientific conferences, and training workshops in Canada and abroad. He has been invited professors at universities in Australia, Canada, Japan, Malaysia, Singapore and Thailand. Finally, since several years he has been being active in international co-operation activities with colleagues in North-America, Europe, and in Asia-Pacific region. He has been elected as

President of the Hydrological Science Section of the Asia-Oceania Geosciences Society (2006-2008).

Abstract: Climate change has been recognized as having a profound impact on the hydrologic cycle; and Global Climate Models (GCMs) have been extensively used in many studies for assessing this impact. However, outputs from these models are usually at resolutions that are too coarse (generally greater than 200km) and not suitable for the hydrological impact assessment at a regional or local scale. Hence, different downscaling methods have been proposed for linking GCM predictions of climate change to hydrologic processes at the relevant space and time scales for these impact studies. Of particular importance for hydrologic applications are those procedures dealing with the linkage of the large-scale climate variability to the historical observations of the precipitation and temperature processes at a local site or over a given watershed. If this linkage could be established, then the projected change of climate conditions given by a GCM could be used to predict the resulting changes of the local precipitations and temperatures and other related hydrologic variables such as runoff characteristics. Therefore, the overall objective of the present paper is to provide a review of some recent progress in the modeling of precipitation and extreme temperature processes in a changing climate from both theoretical and practical viewpoints. In particular, the main focus of this paper is on recently developed statistical downscaling methods for linking GCM climate predictors to the observed precipitations and temperature extremes at a single site as well as at many sites concurrently. Notice that many previous works have been dealing with downscaling of these hydrologic processes at a single site, but very few studies are concerned with the downscaling of these series for many locations concurrently because of the complexity in describing accurately both observed at-site temporal persistence and observed spatial dependence between the different sites. Examples of various applications using data from different climatic conditions in Canada and in other countries in Asia will be presented to illustrate the feasibility and accuracy of the proposed methods.

Keynote Speaker of the 19th congress of IAHR-APD

Keynote Speaker

Young-Oh KIM, Seoul National University, Korea

Title of the Speech

Understanding Implications of Climate Change for Water Resources

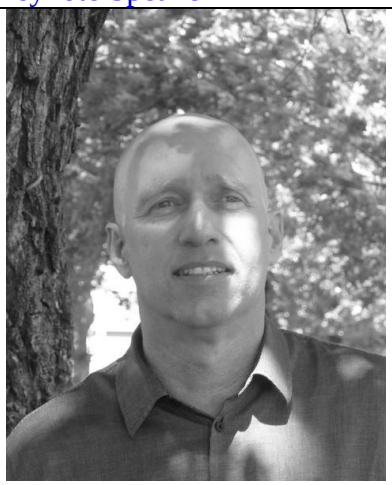
Personal Profile

Dr. Young-Oh Kim is Professor of Department of Civil and Environmental Engineering at Seoul National University, Korea. He received a Ph.D. degree from University of Washington, USA. His research interests include hydrologic forecasting, development of simulation and optimization models for water resources systems, and integrated climate change assessments. As a principal investigator, Professor Kim recently completed approximately a 3-year, 3-millionUSD project titled "Climate Change Assessment and Projection for Hydrology in Korea" where 14 organizations and more than 80 researchers. He currently serves as a vice chairman of Water Resources Management Committee of IAHR.

ABSTRACT

Keynote Speaker of the 19th congress of IAHR-APD

Keynote Speaker



Philippe Bonneton, Director of Research CNRS,

Bordeaux University; CNRS; UMR 5805 EPOC, FRANCE

http://www.epoc.u-bordeaux.fr/indiv/bonneton/index.html

Title of the Speech

Long wave propagation and bore dynamics in coastal and estuarine environments

Personal Profile

Philippe Bonneton is Director of Research at CNRS (French National Centre for Scientific Research) at EPOC laboratory in Bordeaux, France. He acquired an expertise in geophysical fluid dynamics through his PhD at the National Center for Meteorological Research (1989-1992) and after his entrance to CNRS at the Institute of Fluid Mechanics in Toulouse (1993-1997). In 1998 he set up a new research group in Bordeaux at the EPOC laboratory, the METHYS team, which is mainly involved in the field of coastal and estuarine dynamics. The METHYS team recently organized the 7th International Conference on Coastal Dynamics. Currently, Philippe Bonneton's main research interest lies in wave dynamics and wave-induced circulation in shallow water environments.

Abstract: Storm-surge waves and tsunamis can cause tremendous damage to coastal and estuarine areas. As these long waves propagate on-shore, nonlinear interactions are enhanced by the water depth decrease and by estuary convergence. This nonlinear wave transformation can frequently lead to the formation of bores (undular or breaking). The understanding and the prediction of this phenomenon represent an important issue for coastal and estuarine disaster management. However, the complex competition between energy dissipation, nonlinear and dispersive effects, which govern bore dynamics, makes the modelling of its evolution a challenging task. During this talk, we will present recent advances on fully nonlinear weakly dispersive long wave modelling, and we will show the efficiency of these approaches for predicting tsunami-bore and tidal bore propagating up estuaries.