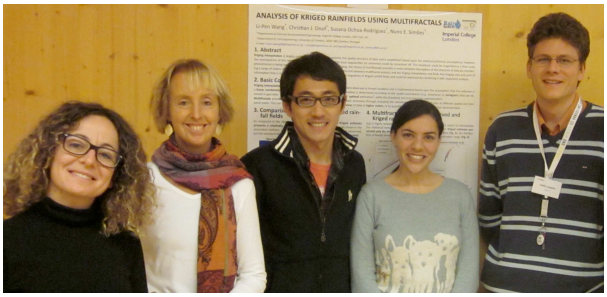
Issue 2 I October 2012
Newsletter RainGain Project

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

Welcome by the coordinator



As we move from summer into autumn, North-West Europe is experiencing beautiful autumn weather, a pleasant break from the showers and cold temperatures that would repeatedly drift in from the Ocean over summer. The RainGain project is starting its second year where we will see the installation of two X-band radars and plan to make further progress in flood modelling for the pilot areas in Leuven, London, Paris and Rotterdam. Meanwhile, the project team has been enriched by a couple of new PhD students, adding up to a total of seven young researchers working on the project. In this newsletter they will introduce themselves and the research topics they will address in the next years. You will find a great diversity of experience and backgrounds they bring to the project, from radar signal processing to multifractal analysis, to high resolution hydrological modelling and flood prediction. All young researchers are working in close cooperation with operational water managers and weather institutes to get the best out of interactions between theoretical methodologies and operational knowledge. This exchange is one of the highlights of the RainGain project.

The RainGain consortium is looking forward to the next year and we wish you pleasant reading,

Marie-claire ten Veldhuis
Coordinator RainGain

In this issue:

Guendalina Bruni

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

Host: TU Delft
WP: WP3 and WP4
PhD Title: Towards the use of dual polarimetric X-band radar rainfall estimates into urban hydrology: flood protection and prediction
Key words: X-band, urban drainage, spatial variability, flood protection
Start of PhD: February, 2012
Email: g.bruni@tudelft.nl

Brief presentation

Guendalina Bruni comes from Grottammare, a beautiful little town along the Adriatic coast, in Italy. She got graduated as environmental engineer at the University of Bologna, in 2004. Once finalized her study she moved to Spain where she started working as hydrologist for the Basin Authority of Jucar, which is the main river system of Valencia region. She worked in catchment hydrology as well as in drinking water network design. She dedicated the last 2 years to the River Basin Management Plan, under the Water framework European directive, in particular to the assessment of environmental minimum flows of the whole Jucar basin. Since February 2012 she moved to Nederland and she started working at TU Delft as PhD candidate. She is working in RAINGAIN project within WP3, implementing rainfall data in existing urban water models of Rotterdam to enhance pluvial flood modelling, and within WP4, identifying flood prone locations as well as developing and implementing solutions to cope with flood and to optimise operational control of storage basins and pumping systems

PhD Topic

More severe and more frequent storms are expected, having a strong impact in urban catchments, which will become more prone to floods. Because of the short duration and rapid variation in intensity especially of summer storms, there is a strong need of both spatial and temporal high resolution rainfall estimates. Moreover, urban hydrological modelling requires high resolution rainfall data to be able to simulate fast runoff processes and related short response times. This can be provided by X-band radars. In her research, she will use first data from IDRA, the dual- polarimetric X-band radar at the Cabauw Experimental Site for Atmospheric Research (CESAR, Cabauw, the Netherlands), which is based on a particular rainfall rate retrieval that is independent of the absolute radar calibration and not affected by attenuation as long as the radar signal is not totally extinct. Then she will take rainfall estimates from another dual-polarimetric radar that will be installed on top of the Delftse Poort building of Rotterdam during the first half of 2013, within RainGain project. Her research is focused on the adaptation of radar product for hydrological applications, and afterwards on the simulation and prediction of urban flooding down to the street level. For this purpose three sewer districts of Rotterdam have been selected: Spaanse polder, Kralingen and Centrum. X-band data will be compared to rain gauge data available in Rotterdam urban area (11 rain gauges). The districts will be modelled by a hydrodynamic sewer model coupled with an overland flow module: most likely the 3Di distributed modelling of runoff and overland flow will be applied to one or more case study areas. The results will be used to improve flood protection, such as warning systems and optimisation of storage capacity and pumping management in the city of Rotterdam.

Rotterdam, Kralingen district: location and sewer model.

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

Laurens Cas Decloedt

Host:	KU Leuven
WP:	Mostly WP 2 (+ interfacing between WP 2 and 3)
PhD Title:	X-band based fine scale rainfall estimation and nowcasting for urban drainage applications
Key words:	Rainfall estimation, rainfall forecasting, weather radar, X-band, urban drainage...
Start of PhD:	October, 2011
Email:	cas.decloedt@bwk.kuleuven.be

Brief presentation

Laurens Cas Decloedt graduated from the university of Leuven (KU Leuven, Belgium) as a Civil Engineer in 2011 with a master thesis about the impact of climate change on storm surges at the Belgian coast. He is now pursuing a PhD at the Department of Civil Engineering of KU Leuven in the field of spatial rainfall variability and urban drainage.
Besides his research, he has a strong interest in sports, especially martial arts and he is a trainer in his local Judo club.

PhD Topic

Laurens Cas will conduct research in the field of urban drainage and spatial variability of rainfall fields, using radar measurements from the X-band Local Area Weather Radar (the city model, LAWR-City Radar, by DHI, see Figure 1).
He will mostly focus on work package 2 of the RainGain project, where the fine scale rainfall estimation and (now- and) forecasting are important aspects.
He will work on the further calibration and adjustment of the LAWR-City Radar, integrating other sources (C-band radars, rain gauge information etcetera) to obtain the best possible fine scale rainfall estimates. These estimates will be tested not only based on the comparison of the different rainfall estimates, but also the sewer model results of these estimates will be compared to sewer measurements.
Further on, Laurens Cas will follow the actions of RainGain's Work Package 3 with interest, especially the interfacing with WP 2, as WP 3 will include the further validation of the fine scale rainfall estimates from WP 2.

The LAWR-City Radar in Leuven

Auguste Gires

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

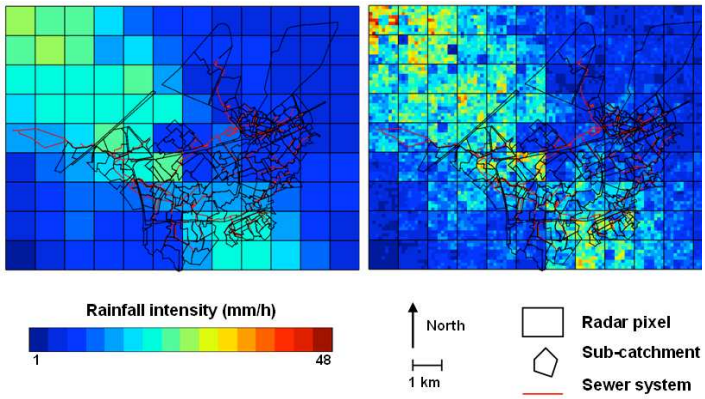
Host:	Ecole des Ponts ParisTech
WP:	WP2 and WP3
Key words:	Universal Multifractals, X-band radar, nowcasting, radar – raingauge merging, downscalingurban drainage...
Start of research position	October, 2012
Email:	auguste.gires@leesu.enpc.fr

Brief presentation

Auguste Gires graduated from Ecole Polytechnique and Ecole des Ponts ParisTech (France) in 2008. His MSc thesis dealt with a multifractal comparison of rainfall radar estimates and rainfall output of a meso-scale numerical meteorological model during a heavy rainfall event that occurred in the South of France. Then he started a PhD at Ecole des Ponts ParisTech whose title was “Improving storm water management in urban and peri-urban areas with the help of multifractal analysis and simulations”. During his PhD he stayed for two month at Imperial College London. In April 2012, he was awarded with the "Outstanding Student Poster Award (OSP)" by the European Geosciences Union. In October 2012, he was awarded his PhD degree and started to work as a researcher in Ecole des Ponts ParisTech.
Besides his research, he is married and father of two sons who are $4^{1/2}$ and $1^{1/2}$ year.

Research Topic

During his PhD, Auguste Gires showed that small scale rainfall variability had a significant impact on urban hydrology. More precisely, he quantified the uncertainty associated with small scale unmeasured rainfall variability, i.e. the one occurring at scales smaller than 1 km in space and 5 min in time, which are usually available with the standard C-Band radars operated by most European Meteorological services. This was achieved by stochastically downscaling rainfall fields with the help of Universal Multifractals.



Example of downscaling for a 5 min time step over the studied 34 km2 area in Seine-Saint-Denis

Within the RainGain project, he will use the enhanced rainfall data provided by the up-coming X-band radar to be installed nearby Ecole des Ponts ParisTech to: (i) Improve rainfall modeling and simulation within the framework of Universal multifractals; (ii) develop innovative comparison and merging tools between radar and rain gauges relying on (i); (iii) suggest nowcasting techniques relying on (i). He will test these new rainfall processes on two case studies: (i) a 34 km^2 mainly urban area located in Seine-Saint-Denis (North-East of Paris) modeled with an operational 1D semi-distributed model, with a focus on a 1.4 km^2 area represented with the help of a fully distributed model; (ii) a 2.5 km^2 steep urban area located in Jouy-en-Josas (South-West of Paris).

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

Abdellah Ichiba

Host:	Conseil Général Val-de-Marne and Ecole des Ponts ParisTech
WP:	WP4
PhD Title:	Use of rainfall data acquired through a band X radar for predictive management of storm-water storage basins
Key words:	X band radar, numerical modeling, management of storage basins
Start of PhD:	September, 2012
Email:	abdellah.ichiba@leesu.enpc.fr

Brief presentation

Abdellah Ichiba is 26 years old, Moroccan national. He is hydraulic engineer and he is more particularly interested in water management.
Last year he made a research master at Ecole des Ponts ParisTech, called "Systèmes Aquatiques et Gestion de l'Eau". For his final study project at Ecole des Ponts, he worked with Ms. Agathe Giangola-Murzyn on the Multi-Hydro Model under the supervision of Professor Ioulia Tchiguirinskaia. He was particularly involved in the integration of an infiltration module in Multi-Hydro.
This year, he was hired by the Conseil Général du Val-de-Marne in order to prepare a PhD thesis in the framework of RainGain project with the collaboration and the scientific supervision of Ecole des Ponts ParisTech.

PhD Topic

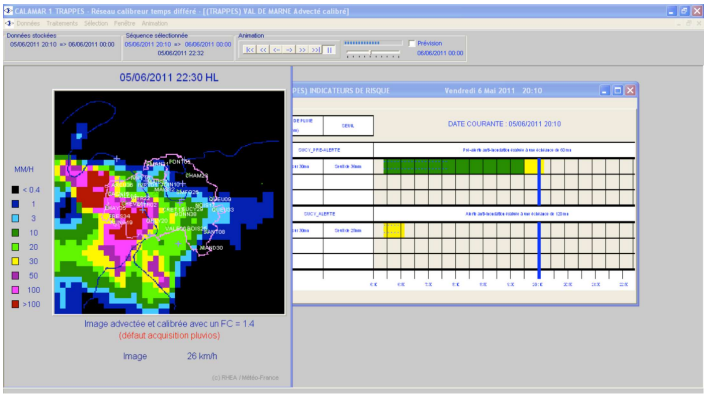
After the floods of 2000 in Sucy-en-Brie and all the damage caused, the Conseil Général du Val-de-Marne (CG94) decided to build a retention basin that will achieve two functions:

- Depollution of water before release into the natural environment
- Protection against flooding by storing water about to lead to floods

The management procedure that was set up in early 2008 by the DSEA is based on the forecasting system CALAMAR has to be enhanced. Indeed:

- An important risk of false alarm exists
- CALAMAR needs a real-time calibration, which may not be available during severe storms

Within the INTERREG RainGain project, an X-band radar will be installed next to Ecole des Ponts. His PhD thesis project will study the use of this technology for the management of storage basins and the protection against floods. This work is part of WP 4 but will use the results of WP 2 and 3 when it comes to extract the radar data and input it directly into hydrological models.



The forecasting system CALAMAR, currently used by CG94 to manage the retention basin of Sucy-en-Brie

Susana Ochoa Rodríguez

Host:	Imperial College London
WP:	WP3
PhD Title:	Estimation and reduction of uncertainty in urban pluvial flood modelling and forecasting
Key words:	urban pluvial flooding, surface water flooding, forecasting, uncertainty, sensitivity analysis
Start of PhD:	November, 2011
Email:	sochoaro@imperial.ac.uk

Brief presentation

Susana graduated with a BEng in Civil Engineering from the School of Engineering of Antioquia (Medellín, Colombia) in 2007 and then did an MSc in water resources at Universidad de los Andes (Bogotá, Colombia), where she worked as a research assistant for 2 years, dealing mainly with optimisation of water distribution systems. She then moved to Imperial College London in 2010, where she has worked as investigator and coordinator of UK and EU funded projects focusing on modelling, forecasting and management of urban pluvial flooding. Projects in which she has worked include FRMRC2, EU-CRUE funded project DIANE-CM and the recently started Interreg RAINGAIN project, within which she is doing her PhD.

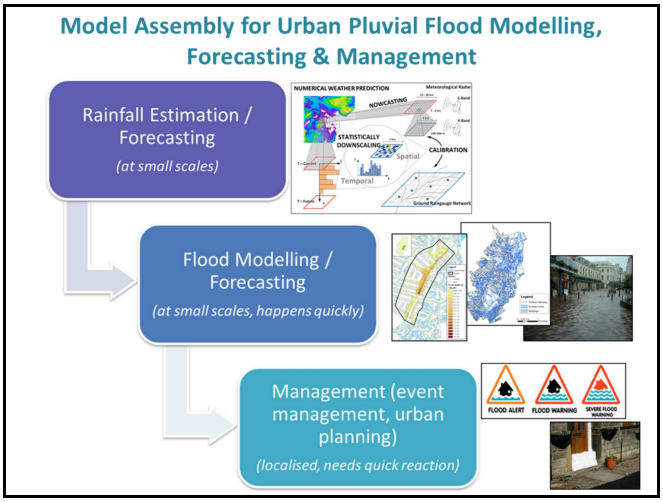
.

PhD Topic

Flood risk management has historically focused on fluvial and coastal flooding; however, recent events have revealed the imminent risk imposed by urban pluvial (surface water) flooding. The small spatial and temporal scales at which pluvial flooding takes place make predicting and pinpointing of this type of flooding much more difficult than doing so for river or coastal flooding.

Recent pluvial flood events have received significant attention, triggering efforts to effectively model, forecast and manage this type of flooding. Nonetheless, the uncertainties associated with urban pluvial flood modelling and forecasting are still too high, limiting its operational use. In addition, a number of studies of the different components of urban pluvial flood modelling and forecasting have been carried out independently; however, these have not yet been integrated and tested in full scale.

The main goals of this research are: (1) to implement and test in full scale a pilot urban pluvial flooding forecasting system, which uses as input the improved rainfall estimates and forecasts produced in WP1 and WP2 of the RainGain Project; (2) to develop and test a methodology for estimating the overall uncertainty of final pluvial flood estimates, in such a way that an indicator of the quality/reliability of the forecast can be provided. This will enable urban water managers to adequately cope with intense storms, reducing vulnerability of populations and critical infrastructure.



Model assembly for urban pluvial flood modelling, forecasting and management

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

Ricardo Reinoso Rondinel

Host:	TU Delft
WP:	WP1 and WP2
PhD Title:	High resolution rainfall rate estimation and prediction.
Key words:	Rainfall rate retrieval, X-band radar, and polarimetric.
Start of PhD:	April, 2012
Email:	r.r.reinosorondinel@tudelft.nl

Brief presentation

Ricardo is originally from Peru, but in August 2011 he graduated from the Atmospheric Radar Research Center of the University of Oklahoma, USA, with a Master of Science degree in Electrical & Computer Engineering. Working as a graduate research assistant has confirmed his interest in, and talent for, weather radar studies. As a result of hard work, one paper was successfully published in the Journal of Atmospheric and Oceanic Technology. By mid-April, he moved to the Netherlands to join the PhD program at the Faculty of Electrical Engineering, Mathematics, and Computer Science, Delft University of Technology.

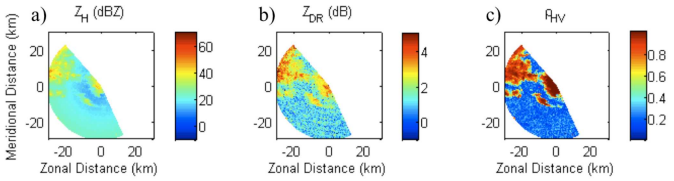
.

PhD Topic

The main focus of the PhD project is to achieve accurate estimation and forecast of rainfall rate at urban scale using a polarimetric X-band weather radar in Rotterdam city. Estimation and forecast of rainfall rate are not straightforward : (i) First, rain events may include other type of hydrometeors, e.g., ice crystals, hailstones, and snowflakes, which contaminate measured radar variables; (ii) Second, rain is hardly homogenous distributed, and therefore any assumption about rain distribution in space and time domains can produce biased outcomes; (iii) Third, scanning radars have a minimum update time, i.e., the radar is not able to scan the 360 degree area coverage faster than a given threshold. Therefore, some fast-evolving weather phenomena can be missed by the radar.

To overcome these problems, the following solutions are being considered.

Capabilities of polarimetric radars allow to better characterize physical properties of hydrometeors, so that, a retrieval rainfall rate algorithm can be correctly applied over rainy regions. The inhomogeneity of rain in space and time domains can be mitigated using a network of sensing instruments such a X-band radar, a micro rain radar (MRR), and disdrometers. A X-band and MRR are capable of providing high resolution in the horizontal and vertical spaces, allowing the analysis of raindrops size distribution (DSD) variability in both spaces. Disdrometers can deliver real DSDs at ground level. Then, statistical analysis of real DSDs in space and time domains will be performed to develop a robust DSD and rainfall rate retrieval algorithms. Finally, a better scan strategy of the environment can be obtained by employing collaborative-adaptive scanning based on X-band radar sector scans, C-band scans, and satellite sensing. Results are expected to provide accurate estimation and forecast of rainfall rate which will be used by urban water management models in order to reduce urban flooding damages in Rotterdam city.



Polarimetric X-band radar variables (EPFL): a) horizontal reflectivity, b) differential reflectivity, and c) cross-correlation coefficient.

Li-Pen Wang

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

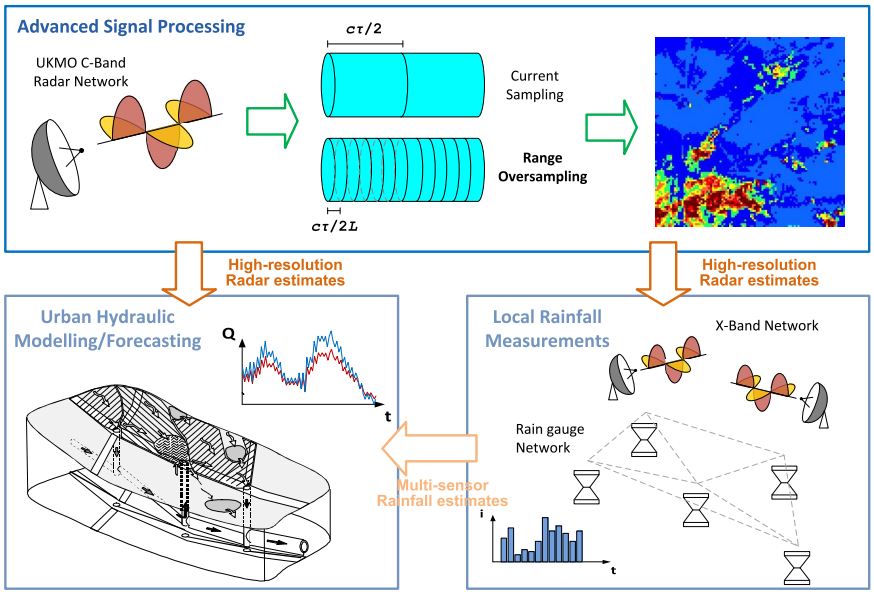
Host:	Imperial College London and UK Met Office
WP:	WP2
PDRA task:	(Working with UK Met Office, UKMO) development of advanced signal processing techniques to produce high-resolution radar rainfall estimates based upon the operational C-band radar network
Key words:	signal processing, range oversampling, downscaling, merging
Start of PDRA:	September, 2012
Email:	li-pen.wang08@imperial.ac.uk

Brief presentation

Li-Pen Wang obtained his BSc in civil engineering and his MSc in computer aided engineering from National Taiwan University (NTU), respectively in 2003 and 2005. After finishing his military service in early 2007, he worked as a research assistant in NTU, where he conducted fluid-dynamics research for 1.5 year. He then received a 3-year scholarship from the Ministry of Education (Taiwan) to study PhD programme at Imperial College London in October 2008. His PhD title was "Improved rainfall downscaling for real-time urban pluvial flood forecasting". In September 2012, he was awarded the PhD degree and started to work as a post-doctoral researcher. In December 2012, he received the "Best Young Scientist Poster (BYSP) Award" at the 9th International Workshop "Precipitation in Urban Areas" (St Moritz, Switzerland).

Research Topic

The research topic that Li-Pen Wang is working on is to produce very high-resolution rainfall estimates that enable detailed urban hydrological applications. Whereas other project partners focus on the use of new X-band radar, the UK partners (ICL and UKMO) would like to explore the possibility to generate high-resolution estimates based upon the operational UKMO C-band radar network by employing and developing advanced signal processing techniques. A new very high resolution ('super-resolution') radar product will be developed and implemented for a pilot study area in central London. Advanced signal processing software will be implemented to increase the resolution of radar data in range and azimuth with the aim of achieving overall spatial resolution of ~100m.



Advanced radar signal processing to produce very high-resolution radar data based upon the operational UKMO C-band network that enables direct or combined (with measurements from other sensors) rainfall inputs for urban-scale applications