

TRAVEL REPORT FORM

출장보고서

결 재	선임연구 원	팀장	부서장	원장직무 대행
	10/01	10/01	10/01	10/01
협 조	이승수	문자연	유진호	유진호

I. Travel Overview 출장개요

1. Traveler(s) 출장자

Department 소속	Position 직위(직급)	Name 성명	Note 비고
예측기술팀	선임연구원	이승수	

2. Travel Period 출장기간

: 2018/9/22 ~ 2018/9/28

3. Occasion and destination 행사 및 출장지

행사명 : Urban Drainage Modelling 2018(UDM 2018)
출장지 : 팔레르모, 이탈리아

II. Major Activities 주요업무 수행내용

1. Main Contents and Activities 주요내용 및 활동

출장보고서 첨부 파일 첨부하였음

2. Relevance to APEC Climate Center’s Activities 결론 및 소감

3. Suggestions and Remarks 건의사항

III. References (Presented and Collected Materials) 주요 수집자료

(with attachment of any information or report in case of attendance of conferences, workshops and meetings) 학술대회, 워크숍, 회의 등 참석 시 관련 정보 및 문서 첨부

: 학회 일정, 발표자료 등



11th International Conference on **Urban Drainage Modelling**
23-26 Sep | Palermo - Italy

11th International Conference on Urban Drainage Modelling

23-26 September, 2018

Palermo (ITALY)

Preliminary Programme

23 July 2018



Segreteria organizzativa Convegno Internazionale:

11th Int. Conference on Urban Drainage Modelling - UDM2018

c/o Dipartimento di Ingegneria Civile, Ambientale, Aerospaziale, dei Materiali (DICAM), Università di Palermo

Viale delle Scienze, Edificio 8, 90128 Palermo – tel: 091 238 96 556/14; e- mail: giorgio.mannina@unipa.it;

info@udm2018.it

	SEPTEMBER 24 (MONDAY)						
	09:30-10:30	11:00-12:00	13:00-14:00	14:10-15:10	17:00-17:30	18:15-18:45	18:15-18:45
PARALLEL #1 ROOM 9	A1: Infiltration processes Moderator Elizabeth Fassman-Beck	A2: Rainfall harvesting and smart systems Moderator David Butler	A3: Resilience and green infrastructure Moderator Virginia Stovin	F1: Drainage and impact mitigation Moderator Luca Vezzaro	Keynote#1 David Butler	Keynote#2 Gustaf Olsson	Keynote#3 Steven Chapra
PARALLEL #2 ROOM 10	B1: Receiving water quality modelling Moderator Jeroen Langeveld	B2: Stormwater Control and uncertainty Moderator Ana Deletic	B3: Hydrodynamic for quality control Moderator Ilaria Gnecco	F2: Frontiers in urban drainage Moderator Manfred Kleidorfer			
PARALLEL #3 ROOM 11	C1: Integrated modelling and stormwater control Moderator Yanchen Liu	C2: Green Infrastructure modelling Moderator Christian Berretta	C3: From quantity to quality issues for LID modelling Moderator Mathias Uhl	F3: Rainfall Moderator Søren Thorndahl			
PARALLEL #4 ROOM 12	D1: Frontiers in urban drainage Moderator Manfred Schüetze	D2: Stormwater management and monitoring Moderator Peter M. Bach	D3: Flooding and risk modelling Moderator Slobodan Djordjevic	F4: Urban Hydrology Moderator Lothar Fuchs			
	Moderators Ana Deletic and Mariachiara Zanetti						
UDM TOPICS:	1. Drainage and Impact Mitigation	4. Rainfall	7. Interaction and integrated systems				
	2. Frontiers in urban drainage	5. Urban Hydrology&Flooding	8. Transport and sewer processes				
	3. Receiving water body	6. Tools, techniques and analysis	9. Urban water management				

SEPTEMBER 25 (TUESDAY)							
	09:00-09:40	10:00-11:00	11:30-12:10	12:30-13:30	14:30-15:10	15:30-16:30	17:00-18:00
PARALLEL #1 ROOM 9	Keynote#4 William James Moderators: David Butler & Ashok Pandey	A4: Rainfall harvesting and climate chance Moderator Karsten Arnbjerg-Nielsen	Keynote#5 Ana Deletic Moderators: Jean-Luc Bertrand-Krajewski & Manfred Kleidorfer	A5: Advanced tools in urban drainage Moderator Luca Vezzaro	Keynote#6 A. Jakeman Moderators: David MacCarty & Wolfgang Rauch	A6: Advanced flood modelling Moderator Lothar Fuchs	F5: Integrated Urban Drainage modelling Moderator Wolfgang Rauch
PARALLEL #2 ROOM 10		B4: Advances in rainfall modelling Moderator Søren Thorndahl		B5: In sewer processes Moderator Jean-Luc Bertrand-Krajewski		B6: New Tools and tequiniques Moderator Dusan Prodanovic	F6: Tools and techniques Moderator Manfred Schütetze
PARALLEL #3 ROOM 11		C4: Advances in real time control and overflow mitigation Moderator Manfred Kleidorfer		C5: Flood and risk modelling Moderator Dirk Muschalla		C6: Advances in water quality modelling Moderator Richard Ashley	F7: Drainage and Impact mitigation Moderator David Butler
PARALLEL #4 ROOM 12		D4: Advanced tools for urban drainage modelling Moderator Juan Pablo Rodríguez Sánchez		D5: Green Infrastructure modelling Moderator John Sansalone		D6: Micropollutants modelling Moderator Alma Schellart	F8: Water Management Moderator Bares Vojtech
UDM TOPICS:							
	1. Drainage and Impact Mitigation	4. Rainfall	7. Interaction and integrated systems				
	2. Frontiers in urban drainage	5. Urban Hydrology&Flooding	8. Transport and sewer processes				
	3. Receiving water body	6. Tools, techniques and	9. Urban water management				

SEPTEMBER 26 (WEDNESDAY)							
09:00-09:40		10:00-11:00	11:30-12:10	12:30-13:30	14:30-15:10	15:30-16:30	17:00-17:30
PARALLEL #1 ROOM 9	Keynote#7 Wolfgang Rauch Moderators: Steven Chapra & Manfred Schüetze	A7: Sewer particle transport Moderator Mathias Uhl	Keynote#8 Jean-Luc Bertrand-Krajewski Moderators: Gustaf Olsson & Jeroen Langeveld	A8: Sewer leakages and RTC Moderator David McCarthy	Keynote#9 Peter Vanrolleghem Moderators: Richard Ashley & Anthony Jackman	A9: Water management, society and smart control Moderator Steven Chapra	Poster Session
PARALLEL #2 ROOM 10		B7: Frontiers in urban drainage Moderator Lorenzo Benedetti		B8: Green infrastructures and decentralised systems Moderator Neil Armitage		B9: New methods and tools Moderator Dirk Muschalla	
PARALLEL #3 ROOM 11		C7: Flood and damage modelling Moderator Bares Vojtech		C8: Sewer sediments and CFD Moderator Thomas Einfalt		C9: New frontiers in urban drainage Moderator Gaspare Viviani	
PARALLEL #4 ROOM 12		D7: Precipitation and rainfall harvesting Moderator Malte Henrichs		D8: Integrated urban drainage modelling Moderator Karl-Erich Lindenschmidt		D9: Sewer maintenance Moderator Patrizia Piro	
UDM TOPICS:							
1. Drainage and Impact Mitigation		4. Rainfall	7. Interaction and integrated systems				
2. Frontiers in urban drainage		5. Urban Hydrology&Flooding	8. Transport and sewer processes				
3. Receiving water body		6. Tools, techniques and	9. Urban water management				

Session	Date	Time	Room	Order	Presenter	Title	Authors
Session name A1 Infiltration processes							
Chairman	Elizabeth Fassman-Beck						
A1	24 Sep 2018	9.30-9.45	9	1	Salar Haghighatafshar	A physically-based model for mesoscale SuDS – an alternative to large-scale simulations	Salar Haghighatafshar and Magnus Larson
A1	24 Sep 2018	9.45-10.00	9	2	Christoph Brepols	Model-Based Sewer Network Control - Practical Experiences	Christoph Brepols
A1	24 Sep 2018	10.00-10.15	9	3	Ignacio Andrés-Doménech	Nitrogen in infiltrated water from pervious pavements under different rainfall regimes and pollution build-up levels	Carmen Hernandez-Crespo, Miriam Fernandez-Gonzalvo, Miguel Martin and Ignacio Andres-Domenech
A1	24 Sep 2018	10.15-10.30	9	4	Jeremie Bonneau	Where does infiltrated stormwater go? Interactions with vegetation and sub-surface anthropogenic features	Jeremie Bonneau, Tim D. Fletcher, Justin F. Costelloe, Matthew J. Burns, Robert B. James and Peter J. Poelsma
Session name B1 Receiving water quality modelling							
Chairman	Jeroen Langeveld						
B1	24 Sep 2018	9.30-9.45	10	1	Deborah Panepinto	Analysis of the Po River Environmental Compatibility	Deborah Panepinto, Mariachiara Zanetti, Eugenio Lorenzi and Margherita Deceglia
B1	24 Sep 2018	9.45-10.00	10	2	Antonio Manuel Moreno Rodenas	Parametric inference in large water quality river systems	Antonio M. Moreno Rodenas, Jeroen Langeveld and Francois Clemens
B1	24 Sep 2018	10.00-10.15	10	3	Mia Bondelind	Transport of Traffic-Related Microplastic Particles in Receiving Water	Mia Bondelind, Ailinh Nguyen, Ekaterina Sokolova and Karin Björklund
B1	24 Sep 2018	10.15-10.30	10	4	Liliane Manny	Policy Analysis for Better Protection of Receiving Waters during Wet Weather	Liliane Manny, Manuel Fischer and Jörg Rieckermann
Session name C1 Integrated modelling and stormwater control							
Chairman	Yanchen Liu						
C1	24 Sep 2018	9.30-9.45	11	1	Claudia Campusano G	Implementing sustainable sanitation in an integrated Model – A straightforward approach for long-term simulation	Claudia Campusano Garcia and Inka Kaufmann Alves
C1	24 Sep 2018	9.45-10.00	11	2	Olivia Bailey	Developing a Stochastic Sewer Input Model to Support Sewer Design Under Water Conservation Measures	Olivia Bailey, Jan Hofman, Tom Arnot, Zoran Kapelan, Mirjam Blokker and Jan Vreeburg
C1	24 Sep 2018	10.00-10.15	11	3	Nahad Rezazadeh Helmi	Developing a new modelling tool to allocate Low Impact Development practices in a cost optimized method	Nahad Rezazadeh Helmi, Boud Verbeiren, Mohamad El Hattab, Ana Mijic and Willy Bauwens
C1	24 Sep 2018	10.15-10.30	11	4	Dr Matthew J Burns	Understanding the impacts of stormwater control measures at the streetscape scale	Matthew Burns, Tim Fletcher, Peter Poelsma, Robert James, Joshphar Kunapo and Tim Craig
Session name D1 Frontiers in urban drainage							
Chairman	Manfred Schütze						
D1	24 Sep 2018	9.30-9.45	12	1	Peter A. Vanrolleghem	Frontiers in Urban Drainage - How will Ubiquitous Sensing Change Urban Drainage Management?	Jörg Rieckermann, Frank Blumensaat, João Paulo Leitão, Christoph Ort, Andreas Scheidegger, Peter A. Vanrolleghem and Kris Villez
D1	24 Sep 2018	9.45-10.00	12	3	James Shucksmith	Understanding Pollutant Transport in Urban Floodwater for Health Impact Assessment using a Physical Scale Model	James Shucksmith, Matteo Rubinato, Ricardo Martins, Georges Kesserwani, Jorge Leandro and Slobodan Djordjevic
D1	24 Sep 2018	10.00-10.15	12	3	Maria Pinto	Holistic Water Cycle Management in Priority Growth Area in Sydney's West by Managing the Water Cycle Strategies of Individual Precincts	Maria Pinto
D1	24 Sep 2018	10.15-10.30	12	4	Constantin Radu Gogu	Interaction between City Subsurface Infrastructure and Groundwater	Constantin Radu Gogu, Mohamed Amine Boukhemacha, Dragos Gaitanaru and Irina Moraru

Session	Date	Block Time	Room	Order	Presenter	title	authors
Session name A2 Rainfall harvesting and smart systems							
Chairman	David Butler						
A2	24 Sep 2018	11.00-11.15	9	1	Xiaowen Liu	The rainfall interception performance of urban tree canopy in Beijing, China	Xiaowen Liu and Qing Chang
A2	24 Sep 2018	11.15-11.30	9	2	Peter Melville-Shreeve	Quantifying Long-term Benefits of Multi-Purpose Rainwater Management Systems	Peter Melville-Shreeve and David Butler
A2	24 Sep 2018	11.30-11.45	9	3	Rodrigo Santos	Study for the proper management of rainwater withing the Mexican Water Technology Institute	Rodrigo Santos-Tellez, Oscar Laguno Guilberto, Manuel Rodriguez Varela and Manuel Figueroa Mendiola
A2	24 Sep 2018	11.45-12.00	9	4	Antonio Lastra	Development of a smart system for the operation of a complex sanitation system. A study case: Madrid	Antonio Lastra, Monica Ortega, Alejandro Pinilla, Joaquin Suarez, Jerónimo Puertas, Jose Anta and Xavier Falcó
Session name B2 Stormwater Control and uncertainty							
Chairman	Ana Deletic						
B2	24 Sep 2018	11.00-11.15	10	1	Nils Kändler	Controlling Stormwater Runoff from Impermeable Areas by Using Smart Inlets	Nils Kändler, Ivar Annus, Anatoli Vassiljev, Raido Puust and Katrin Kaur
B2	24 Sep 2018	11.15-11.30	10	2	Matej Radinja	Multi-criteria Evaluation of Sustainable Urban Drainage Systems	Matej Radinja, Joaquim Comas, Luis Corominas and Nataša Atanasova
B2	24 Sep 2018	11.30-11.45	10	3	Elizabeth Fassman-Beck, Ph.D.	Exploring Uncertainty in Uncalibrated Bioretention Models	Elizabeth Fassman-Beck and Firas Saleh
B2	24 Sep 2018	11.45-12.00	10	4	Anja Randelović	Assessing uncertainty of a biofilter micropollutant transport model MPIRe	Anja Randelovic, Kefeng Zhang, David McCarthy and Ana Deletic
Session name C2 Green Infrastructure modelling							
Chairman	Christian Berretta						
C2	24 Sep 2018	11.00-11.15	11	1	Camilla Tuomela	Modelling Stormwater Pollutant Reduction with LID Scenarios in SWMM	Camilla Tuomela, Daniel Jato-Espino, Nora Sillanpää and Harri Koivusalo
C2	24 Sep 2018	11.15-11.30	11	2	Ilaria Gnecco	Enhancing the Retention Performance of a Small Urban Catchment by Green Roofs	Anna Palla, Ilaria Gnecco and Paolo La Barbera
C2	24 Sep 2018	11.30-11.45	11	3	Marina Batalini de Macedo	LID quantity and quality efficiencies in a subtropical urban catchment	Cesar Do Lago, Marina de Macedo and Eduardo Mendiondo
C2	24 Sep 2018	11.45-12.00	11	4	Juan Pablo Rodríguez Sánchez	A prioritization tool for SUDS planning in large cities by coupling an Urban Drainage Model with Mixed Integer Linear Programming	Maria Narine Torres Cajiao, Zhenduo Zhu and Juan Pablo Rodriguez Sanchez
Session name D2 Stormwater management and monitoring							
Chairman	Peter M. Bach						
D2	24 Sep 2018	11.00-11.15	12	1	Ditte Reinholdt Jensen	Early stage planning tools for stormwater quantity and quality management in Denmark and China	Ditte Marie Reinholdt Jensen, Sara Maria Lerer, Luca Vezzaro, Hjalte Jomo Danielsen Sørup, Karsten Arnbjerg-Nielsen, Xuyong Li and Peter Steen Mikkelsen
D2	24 Sep 2018	11.15-11.30	12	2	Scott Struck	Modelling for Integrated Stormwater Management of the Renfrew Neighbourhood: A Pilot Study	Scott Struck, Marc Leisenring, Lucas Nguyen, David Seeliger, Bert van Duin, Pablo Lopez Hernandez and Joshua Cantone
D2	24 Sep 2018	11.30-11.45	12	2	Takuma Kiyosu	Study on Realization of Storm Water Sewerage with Water Level Monitoring by the Use of Inundation Simulation	Takuma Kiyosu, Kaoru Kariya, Isao Ideta and Hidekazu Matsuoka
D2	24 Sep 2018	11.45-12.00	12	4	Karl-Erich Lindenschmidt	Interfacing stakeholder involvement into a surface water-quality modelling system for water management and policy development	Karl-Erich Lindenschmidt, Eric Akomeah, Helen Baulch, Lisa Boyer, John-Mark Davies, Elmira Hassanzadeh, Luis Morales Marin, Graham Strickert and Michelle Wauchope

Session	Date	Block Time	Room	Order	Presenter	title	authors
Session name A3 Resilience and Green infrastructure							
Chairman	Virginia Stovin						
A3	24 Sep 2018	13.00-13.15	9	1	Tanveer Adyel	Shifts of Resilience and Recovery of Aquatic Metabolism in Stormwater Green Infrastructure	Tanveer Adyel
A3	24 Sep 2018	13.15-13.30	9	2	David Ramier	FAVEUR- A Simple Model for Design Extensive Green Roofs	David Ramier, Emmanuel Berthier and Bernard de Gouvello
A3	24 Sep 2018	13.30-13.45	9	3	Varnede Lucie	Modelling of Green Permeable Car Park Water Retention	Lucie Varnède, David Ramier, Pierre Georget and Marie-Christine Gromaire
A3	24 Sep 2018	13.45-14.00	9	4	Dazhen Zhang	Resilience and its relation to system structure of combined sewer systems: virtual case study based on stochastic generation	Dazhen Zhang, Xin Dong and Siyu Zeng
Session name B3 Hydrodynamic for quality control							
Chairman	Ilaria Gnecco						
B3	24 Sep 2018	13.00-13.15	10	1	Manuel Regueiro Picallo	Flume test facility for the study of sediment transport in sewer pipes with raw wastewater	Manuel Regueiro-Picallo, Jose Anta, Joaquín Suárez, Esteban Sañudo, Jerónimo Puertas and Alfredo Jácome
B3	24 Sep 2018	13.15-13.30	10	2	Tree Sn Chan	Flow Features of an Unstable Tangential Vortex Intake	Shu Ning Chan, Q.S. Qiao and J.H.W. Lee
B3	24 Sep 2018	13.30-13.45	10	3	John Sansalone	Can a surface overflow model predict particulate matter separation of unit operations?	Subba-Srikanth Pathapati and John Sansalone
B3	24 Sep 2018	13.45-14.00	10	4	Dr. Dhruv Mehta	Numerical and CFD-based modelling of concentrated domestic slurry in turbulent flow through circular pipes	Dhruv Mehta, Adithya Krishnan Thota Radhakrishnan, Jules van Lier and Francois Clemens
Session name C3 From quantity to quality issues for LID modelling							
Chairman	Mathias Uhl						
C3	24 Sep 2018	13.00-13.15	11	1	Ambika Khadka	The Effects of LID-based Urban Designs on Water Balance	Ambika Khadka, Teemu Kokkonen, Elisa Lähde, Tero Niemi, Nora Sillanpää and Harri Koivusalo
C3	24 Sep 2018	13.15-13.30	11	2	Virginia Stovin	Seasonal variations in green roof hydrology	Simon De-Ville and Virginia Stovin
C3	24 Sep 2018	13.30-13.45	11	3	Thomas Larm	Modelling different types of stormwater treatment facilities considering irreducible concentrations	Thomas Larm and Anna Wahlsten
C3	24 Sep 2018	13.45-14.00	11	4	Christian Berretta	Dissolved phosphorus treatment in stormwater biofilters enhanced with media amendments	Andrea Aiello, Christian Berretta and Martin Tillotson
Session name D3 Flooding and risk modelling							
Chairman	Slobodan Djordjevic						
D3	24 Sep 2018	13.00-13.15	12	1	Søren Thorndahl	Influence of flood water contribution from multiple sources in extreme event statistics of urban flooding	Søren Thorndahl, Damian Murla-Tuyls, Rasmus Vest Nielsen, Marc Schleiss and Jonas Olsson
D3	24 Sep 2018	13.15-13.30	12	2	Giovanna Grossi	Flood risk mitigation in a Mediterranean Urban Area: the case study of Rossano Scalo (CS – Calabria, Italy)	Patrizia Piro, Mario Maiolo, Vito Cataldo Talarico, Salvatore Falco, Gennaro Nigro, Michèle Pezzagno, Filippo Carlo Pavesi, Francesca Berteni and Giovanna Grossi
D3	24 Sep 2018	13.30-13.45	12	3	Juan Naves	Use of a 2D shallow waters model to assess the physical model topography obtained with a low cost photogrammetric technique	Juan Naves, Jose Anta, Jerónimo Puertas, Manuel Regueiro-Picallo, Joaquín Suarez and Esteban Sañudo
D3	24 Sep 2018	13.45-14.00	12	4	Matthew Moy de Vitry	Calibrating urban flood models with qualitative probabilistic flooding information extracted from CCTV footage	Matthew Moy de Vitry, Simon Kramer, Kris Villez, Jan Dirk Wegner and Joao P. Leita

Session	Date	Block Time	Room	Order	Presenter	title	authors
Session name F1 Drainage and impact mitigation							
Chairman	Luca Vezzaro						
F1	24 Sep 2018	14.10-14.13	9	1	David McCarthy	Model Testing and Laboratory Validation of Real-Time Control Strategy for Stormwater Biofilters	Pengfei Shen, Ana Deletic and David McCarthy
F1	24 Sep 2018	14.13-14.16	9	2	Siyu Zeng	A Method to Identify Key Sub-catchments for LID Placement based on Monte Carlo Sampling	Hao Guo, Siyu Zeng and Xin Dong
F1	24 Sep 2018	14.16-15.19	9	3	Ashley Wright	Assessing stakeholder receptivity to flood mitigation adaptation pathways.	Ashley Wright, Dwinanti Marthanty, Christoph Brodnik and Christian Ulrich
F1	24 Sep 2018	14.19-15.21	9	4	Zhangjie Peng	Internal fluctuations in green roof substrate moisture content during a storm event	Zhangjie Peng and Virginia Stovin
F1	24 Sep 2018	14.21-14.24	9	5	Eero Assmuth	Impact of biochar on treatment performance of roadside sand filters – field monitoring and geochemical modelling	Eero Assmuth, Nora Sillanpää, Laura Wendling and Harri Koivusalo
F1	24 Sep 2018	14.24-14.27	9	6	Snezana Gavric	Modelling long-term retention of conservative particulate metals (Cu, Pb, Zn) by grass swales using soil chemistry data	Snezana Gavric, Günther Leonhardt, Heléne Österlund, Jiri Marsalek and Maria Viklander
F1	24 Sep 2018	14.27-14.30	9	7	Mohamad El Hattab	Adaptation of SuDS Modelling Complexity to End-Use Application	Mohamad El Hattab and Ana Mijic
F1	24 Sep 2018	14.30-14.33	9	8	Vanessa Greaves	Water Recycling Long Term Plan for Managing Growth Risk	Kerry Rhodes and Vanessa Greaves
Session name F2 Frontiers in urban drainage							
Chairman	Manfred Kleidorfer						
F2	24 Sep 2018	14.10-14.13	10	1	Jiri Prochazka	Swinging self-cleaning screen bars the Tube Hobas CSO Chamber, their physical properties and design	Jiri Prochazka, Jaroslav Pollert and Ondrej Svanda
F2	24 Sep 2018	14.13-14.16	10	2	Alexandra Finotti	Modelling bioretention systems	Alexandra Finotti and Marie Christine Gromaire
F2	24 Sep 2018	14.16-15.19	10	3	Martina Zelenakova	Surface Runoff in Urban Area – Case Study	Martina Zelenáková, Zuzana Vranayová, Adam Repel and Daniela Kaposztasová
F2	24 Sep 2018	14.19-15.21	10	4	Rocco Palmitessa	Urban Tunnel Systems for Conveyance and Storage of Storm- and Wastewater: Features, Classification, and Modelling	Rocco Palmitessa, Morten Borup and Peter Steen Mikkelsen
F2	24 Sep 2018	14.21-14.24	10	5	Mark Randall	Continuous SWMM modelling of LID infrastructure in the Upper Qing Catchment, Beijing	Mark Randall and Marina Bergen Jensen
F2	24 Sep 2018	14.24-14.27	10	6	Ondrej Svanda	Development of Screening Methods for Secondary Settling Tanks Monitoring and Optimization	Ondřej Svanda, Jaroslav Pollert and Iva Johanidesová
F2	24 Sep 2018	14.27-14.30	10	7	Maria Fernanda Nóbrega dos Santos	Exploring the Use of Low Impact Development Strategies in a Low-Income Settlement in São Carlos, Brazil	Maria Fernanda Nóbrega Dos Santos, Anaí Floriano Vasconcelos and Ademir Paceli Barbassa
Session name F3 Rainfall							
Chairman	Søren Thorndahl						
F3	24 Sep 2018	14.10-14.13	11	1	Christoffer Bang Andersen	Investigation of Impacts of Spatial Variability and Motion of Rainfall in Urban Drainage Modelling	Christoffer B. Andersen and Søren Thorndahl
F3	24 Sep 2018	14.13-14.16	11	2	Jonas W. Pedersen	Performance of High-Resolution Numerical Weather Predictions with a Rapid Updating Cycle for Urban Runoff Forecasting	Jonas Wied Pedersen, Luca Vezzaro, Henrik Vedel, Henrik Madsen and Peter Steen Mikkelsen
F3	24 Sep 2018	14.16-15.19	11	3	Tanja Vonach	Rain Gauge vs. Radar Measurements - Modelling an Extreme Rain Event with High Spatial Variability	Tanja Vonach, Thomas Einfalt, Wolfgang Rauch and Manfred Kleidorfer
F3	24 Sep 2018	14.19-15.21	11	4	Maciej Mrowiec	Influence of dynamic properties of rainfall on urban drainage infrastructure	Maciej Mrowiec, Ewa Ociepa and Robert Malmur
F3	24 Sep 2018	14.21-14.24	11	5	Tala Kanso	Hydrological Modelling of a Road-side Vegetated Filter Strip: Validation of a Coupled Two Dimensional Overland Flow Model	Tala Kanso, Marie-Christine Gromaire, David Ramier and Ghassan Chebbo
F3	24 Sep 2018	14.24-14.27	11	6	Cecilie Thrysoe	Importance of Subdivision Resolution of Surrogate Models for Emulating Catchment Response and Surcharge	Cecilie Thrysoe, Morten Borup and Karsten Ambjerg-Nielsen
F3	24 Sep 2018	14.27-14.30	11	7	Andrew Bailey	The Use of an Autocorrelation Function to Determine Urban Hydrological Catchment Characteristics	Andrew Bailey, Alma Schellart and Simon Tait
F3	24 Sep 2018	14.30-14.33	11	8	Xin Dong	Assessing cost-effectiveness of different system structural characteristics in enhancing resilience of urban drainage systems	Zhiwei Xu, Yinan Zhao, Xin Dong and Pengfei Du
Session name F4 Urban hydrology							
Chairman	Lothar Fuchs						
F4	24 Sep 2018	14.10-14.13	12	1	Marcelo Miguez	Multilayer Modelling as a Supporting Tool for Flood Diagnosis and Drainage System Design	Marcelo Gomes Miguez, Fernanda Dias Radesca, Aline Pires Veról, Matheus Martins de Sousa and Laurent Feu Grancier Silva Oliveira
F4	24 Sep 2018	14.13-14.16	12	2	Johannes Leimgruber	Sensitivity of water balance components to green roof parameters	Johannes Leimgruber, Gerald Krebs and Dirk Muschalla
F4	24 Sep 2018	14.16-15.19	12	3	Nina Voßwinkel	Transport capability of intake vortices at horizontal intake structures	Nina Voßwinkel, Andreas Schlenkhoff, Jörg Steinhardt and Rainer Mohn
F4	24 Sep 2018	14.19-15.21	12	4	Yanchen Liu	Uncertainty analysis of pollutant-hydrograph model in assessing inflow and infiltration of sanitary sewer system	Yanchen Liu
F4	24 Sep 2018	14.21-14.24	12	5	Boris Richter	Integration of green areas into a suburban flood model	Boris Richter, Christine Stapel and Jens Tränckner

F4	24 Sep 2018	14.24-14.27	12	6	Matheus Sousa	How important is the Physical interpretation and the role of the model user in urban flooding simulation?	Matheus Sousa, Marcelo Miguez, Antonio de Oliveira and Bianca Maria Da Silva
F4	24 Sep 2018	14.27-14.30	12	7	Osvaldo Rezende	Urban Floods Resilience Assessment Framework	Beatriz Franco, Antonio de Oliveira, Ana Caroline Jacob and Marcelo Miguez
F4	24 Sep 2018	14.30-14.33	12	8	Adithya	Challenge of Transport: Exploring the Limit of Gravity Sewers to Transport Concentrated Domestic Slurries	Adithya Krishnan Thota Radhakrishnan, Jeroen Langeveld, Jules van Lier and Francois Clemens

Session	Date	Block Time	Room	Order	Presenter	title	authors
Session name A4 Rainfall harvesting and climate chance							
Chairman	Karsten Ambjerg-Nielsen						
A4	25 Sep 2018	10-10.15	9	1	Alan Lu	A Generator-Disaggregation Approach for Evaluating Climate Change Impact on Urban Drainage	Wei Lu and Xiaosheng Qin
A4	25 Sep 2018	10.15-10.30	9	2	Sangaralingam Ahilan	The influence of household rainwater harvesting system design on water supply and stormwater management efficiency	Sangaralingam Ahilan, Peter Melville-Shreeve, Zoran Kapelan and David Butler
A4	25 Sep 2018	10.30-10.45	9	3	Hossein Tabari	Anomalous Extreme Rainfall Variability Over Europe – Interaction Between Climate Variability and Climate Change	Hossein Tabari and Patrick Willems
A4	25 Sep 2018	10.45-11	9	4	Pierfabrizio Puntorieri	Flash floods in urban areas: case studies in Reggio Calabria (Italy)	Marcello De Franco, Marianna Minniti, Rosa Versaci, Giandomenico Foti, Caterina Canale and Pierfabrizio Puntorieri
Session name B4 Advances in rainfall modelling							
Chairman	Søren Thorndahl						
B4	25 Sep 2018	10-10.15	10	1	Julian David Reyes Silva	Automatic calibration approach for multiple rain events in SWMM using Latin Hypercube Sampling	Benjamin Wagner, Julian David Reyes Silva, Christian Förster, Jakob Benisch, Björn Helm and Peter Krebs
B4	25 Sep 2018	10.15-10.30	10	2	Tero Niemi	Automated Approach for Rainfall-Runoff Model Generation	Tero Niemi, Gerald Krebs and Teemu Kokkonen
B4	25 Sep 2018	10.30-10.45	10	3	John Tyner	Type II (and Atlas 14) Storm Distribution Assumptions Yield Massive Over-estimates of Rainfall Intensity	John Tyner and Daniel Yoder
B4	25 Sep 2018	10.45-11	10	4	Sara Simona Cipolla	Sewer flow prediction at a large urban scale: influence of radar rainfall spatial resolution	Sara Simona Cipolla, Giulia Paola Di Ventura, Marco Maglionico, Pier Paolo Alberoni and Attilio Castellarin
Session name C4 Advances in real time control and overflow mitigation							
Chairman	Manfred Kleidorfer						
C4	25 Sep 2018	10-10.15	11	1	Nuno Simoes	Real-time CSO spill control using existing in-sewer storage	Nuno Simoes, Luis Girao, Lucas Maluf, Will Shepherd, Sonja Ostojin, Alfeu Sá Marques, Stephen Mounce, Pete Skipworth, Simon Tait and João Paulo Leitão
C4	25 Sep 2018	10.15-10.30	11	2	Luca Vezzaro	System-Wide Real Time Control Strategies for Overflow Volume Reduction - Extrapolating Annual Performance Indicators	Luca Vezzaro
C4	25 Sep 2018	10.30-10.45	11	3	John Okedi	Benefits of Real Time Control for Catchment Scale Stormwater Harvesting in Cape Town, South Africa	John Okedi and Neil Armitage
C4	25 Sep 2018	10.45-11	11	4	Kristyna Soukupova	Assessment of Separation Efficiency of Reconstructed Combined Sewer Overflow in Debr (Czech Republic)	Kristyna Soukupova, Jana Nabelkova, Jaroslav Pollert and Petr Chmatal
Session name D4 Advanced tools for urban drainage modelling							
Chairman	Juan Pablo Rodríguez Sánchez						
D4	25 Sep 2018	10-10.15	12	1	Jaroslav Pastorek	Commercial Microwave Links in Urban Drainage Modelling: On Deriving Precipitation Estimates for Various Link Lengths	Jaroslav Pastorek, Martin Fencel, Jörg Rieckermann and Vojtěch Bares
D4	25 Sep 2018	10.15-10.30	12	2	Yi Hong	Efficient calibration and validation of physical stormwater quality modelling by meta-model based approach	Yi Hong, Qinzhuo Liao, Céline Bonhomme and Ghassan Chebbo
D4	25 Sep 2018	10.30-10.45	12	3	Rasmus Nielsen	Sensitivity Analysis of an Integrated Urban Flood Model	Rasmus Nielsen and Søren Thorndahl
D4	25 Sep 2018	10.45-11	12	4	Anai Vasconcelos	Modeling Infiltration Wells in SWMM and Comparing Its Performance with a Real-Scale Well	Anai Floriano Vasconcelos, Thays Santos Ferreira, Maria Fernanda Nóbrega Dos Santos and Ademir Paceli Barbassa

Session	Date	Block Time	Room	Order	Presenter	title	authors
Session name A5 Advanced tools in urban drainage							
Chairman	Luca Vezzaro						
A5	25 Sep 2018	12.30-12.45	9	1	Karen Finney	Automatic Discretization and Parameterization of watersheds using a digital elevation model	Karen Finney, Rob James, Nandana Perera and Tiehong Xiao
A5	25 Sep 2018	12.45-13.00	9	2	Kefeng Zhang	Testing of new stormwater pollution build-up algorithms informed by genetic programming approach	Kefeng Zhang, Peter Bach, David McCarthy and Ana Deletic
A5	25 Sep 2018	13.00-13.15	9	3	Baiqian 'Luke' Shi	Should we account for unexpected sources in improving the prediction of urban stormwater quality?	Baiqian Shi, Anna Lintern, Peter Bach, Kefeng Zhang, Rhys Coleman, Leon Metzeling, David McCarthy and Ana Deletic
A5	25 Sep 2018	13.15-13.30	9	4	Julie Skrydstrup	How do we make our models relevant for decision-makers?	Julie Skrydstrup, Herle Mo Madsen, Roland Löwe, Henrik Thorén and Karsten Arnbjerg-Nielsen
Session name B5 In sewer processes							
Chairman	Jean-Luc Bertrand-Krajewski						
B5	25 Sep 2018	12.30-12.45	10	1	Berislav Tomicic	Dynamic Modelling and Comparison of H ₂ S Mitigation Strategies	Berislav Tomicic, Morten Just Kjølby and Mikkel Holmen Andersen
B5	25 Sep 2018	12.45-13.00	10	2	Frits Rooyackers	Numerical Modeling of Biogenic Sulfide Corrosion in Concrete Sewer Pipes	Frits Rooyackers, Emanuela Bosco, Akke Suiker and Francois Clemens
B5	25 Sep 2018	13.00-13.15	10	3	Feng Jiang	Evaluation of hydrogen sulphide formation in a mega-sized tunnel sewer system: experimental and modelling Investigations	Zhensheng Liang, Jianliang Sun and Feng Jiang
B5	25 Sep 2018	13.15-13.30	10	4	Madhu K Murali	Developing and Validating a Model to Assess Sewer Solids Issues from Changing Wastewater Inflows and Concentration	Madhu K Murali, Matthew R Hipsey, Anas Ghadouani and Zhiguo Yuan
Session name C5 Flood and risk modelling							
Chairman	Dirk Muschalla						
C5	25 Sep 2018	12.30-12.45	11	1	Katya Pyatkova	Modelling Road Transport Congestion Due to Flooding	Katya Pyatkova, Albert S. Chen, David Butler and Slobodan Djordjevic
C5	25 Sep 2018	12.45-13.00	11	2	Stefan Leitner	Integrated urban flash flood risk assessment	Leitner Stefan, Roman Maier, Axel Sauer, Cornelia Jöbstl, Regine Ortlepp, Rudolf Hornich and Dirk Muschalla
C5	25 Sep 2018	13.00-13.15	11	3	Sutapa Bhattacharjee	Urban Flood Risk Modelling using Geospatial Tools for Bhubaneswar City, India	Sutapa Bhattacharjee, Pramod Kumar, Praveen Kumar Thakur and Kshama Gupta
C5	25 Sep 2018	13.15-13.30	11	4	Michael Jeskulke	Determination of pluvial flood hazards for critical infrastructures and buildings	Michael Jeskulke, André Liebscher, Holger Hoppe and Theo G. Schmitt
Session name D5 Green Infrastructure modelling							
Chairman	John Sansalone						
D5	25 Sep 2018	12.30-12.45	12	1	Yang Yang	Hydrologic performance simulation of green infrastructures: why data-driven modelling can be useful?	Yang Yang and Ting Fong May Chui
D5	25 Sep 2018	12.45-13.00	12	2	Vladimír Hamouz	Modelling of Green and Grey Roofs in Cold Climates using EPA's Storm Water Management Model	Vladimír Hamouz and Tone Muthanna
D5	25 Sep 2018	13.00-13.15	12	3	Veljko Prodanovic	Hydrology of Green Walls: Factor Assessment and Water Balance Modelling	Veljko Prodanovic, Ankun Wang and Ana Deletic
D5	25 Sep 2018	13.15-13.30	12	4	Olivier Cortier	Quantifying Benefits of Permeable Pavement on Surface Runoff, an Agent-Based-Model with NetLogo	Olivier Cortier, Mohamed Boutouil and Olivier Maquaire

Session	Date	Block Time	Room	Order	Presenter	title	authors
Session name A6 Advanced flood modelling							
Chairman Lothar Fuchs							
A6	25 Sep 2018	15.30-15.45	9	1	Seungsoo Lee	Integrated 1D/2D Urban Inundation Modelling with Refined Grid and OpenMP Parallelization	Seungsoo Lee
A6	25 Sep 2018	15.45-16.00	9	2	Daniel Jato-Espino	Multiple regression analysis as a comprehensive tool to model flood hazard in sewersheds	Daniel Jato-Espino, Nora Sillanpää, Ignacio Andrés-Doménech and Jorge Rodríguez-Hernandez
A6	25 Sep 2018	16.00-16.15	9	3	Ben Hodges	A new Saint-Venant solver for SWMM	Ben R. Hodges, Frank Liu and A. Charles Rowney
A6	25 Sep 2018	16.15-16.30	9	4	Nelly Peyron	Long wave oscillations in a canal explained by a dynamic (PC)SWMM model	Nelly Peyron and William James
Session name B6 New Tools and techniques							
Chairman Dusan Prodanovic							
B6	25 Sep 2018	15.30-15.45	10	1	Mahmood Mahmoodian	Emulation of a Detailed Urban Drainage Simulator to Be Applied For Short-Term Predictions	Mahmood Mahmoodian, J. A. Torres-Matallana, Ulrich Leopold, Georges Schutz and Francois Clemens
B6	25 Sep 2018	15.45-16.00	10	2	Nadia Lund	Using the Ensemble Kalman Filter to update a fast surrogate model for flow forecasting	Nadia Lund, Maurizio Mazzoleni, Henrik Madsen, Ole Mark, Peter Steen Mikkelsen, Dimitri Solomatine and Morten Borup
B6	25 Sep 2018	16.00-16.15	10	3	Bernat Joseph-Duran	Comparison of Volume-based and Pollution-based Model-Predictive Controllers for Combined Sewer Network Regulation	Bernat Joseph-Duran, Thibaud Maruejols, Duy Khiem Ly, Jordi Meseguer and Gabriela Cembrano
B6	25 Sep 2018	16.15-16.30	10	4	Amin E. Bakhshpour	A graph-theory based algorithm to generate decentralized urban drainage layouts	Amin E. Bakhshpour, Milad Bakhshizadeh, Ulrich Dittmer, Wolfgang Nowak and Ali Haghighi
Session name C6 Advances in water quality modelling							
Chairman Richard Ashley							
C6	25 Sep 2018	15.30-15.45	11	1	Julia M. Ledergerber	Experimental design to support water quality modelling of sewer systems	Julia Margrit Ledergerber, Thibaud Maruéjols and Peter A. Vanrolleghem
C6	25 Sep 2018	15.45-16.00	11	2	Tiku Tanyimboh	Active Control of Combined Sewer Systems Based on Flow and Water Quality	Tiku Tanyimboh
C6	25 Sep 2018	16.00-16.15	11	3	Afshin Sadeghikhah	Modelling of heavy metals and PAHs concentration in urban stormwater runoff	Afshin Sadeghikhah, Jin Zhang and Peter Krebs
C6	25 Sep 2018	16.15-16.30	11	4	Frank Blumensaat	Digitalization meets reality – Concept and Experiences from long-term wireless data collection with 50+ sewer monitors	Frank Blumensaat, Andreas Scheidegger, Christian Ebi, Simon Dicht, Fabian Schaltegger, Andreas Rüst, Uwe Schmitt and Max Maurer
Session name D6 Micropollutants modelling							
Chairman Alma Schellart							
D6	25 Sep 2018	15.30-15.45	12	1	Remy Schilperoort	Illicit Connections and Antibiotic Resistant Bacteria in Urban Surface Water: What is Their Relation?	Remy Schilperoort, Hetty Blaak, Heike Schmitt, Arjo Hof, Joan Meijerink, Bert Palsma and Jeroen Langeveld
D6	25 Sep 2018	15.45-16.00	12	2	Riccardo Delli Compagni	Conceptual Modeling of Micropollutant Fate in Sewer Systems – A GIS-Based Approach to Define Model Structure	Riccardo Delli Compagni, Fabio Polesel, Kerstin Johanna Felicitas von Borries, Zhen Zhang, Andrea Turolla, Manuela Antonelli and Luca Vezzaro
D6	25 Sep 2018	16.00-16.15	12	3	Tanguy Pouzol	A Dynamic Pharmaceuticals Loads Source Generator	Tanguy Pouzol, Jean-Luc Bertrand-Krajewski and Yves Levi
D6	25 Sep 2018	16.15-16.30	12	4	Maria Viklander	Estimation of Faecal Indicator Bacteria in Stormwater by Multiple Regression Modelling and Microbial Partitioning to Solids	Helen Galfi, Heléne Österlund, Jiri Marsalek and Maria Viklander

Session	Date	Block Time	Room	Order	Presenter	title	authors
Session name F5 Integrated Urban Drainage modelling							
Chairman		Wolfgang Rauch					
F5	25 Sep 2018	17.00-17.03	9	1	Sina Borzooei	Impact evaluation of Wet-weather Events on Influent Flow and Loadings of a Water Resource Recovery Facility	Sina Borzooei, Ramesh Teegavarapu, Soroush Abolfathi, Youri Amerlinck, Ingmar Nopens and Maria Chiara Zanetti
F5	25 Sep 2018	17.03-17.06	9	2	Justine Henonin	An integrated model to develop and optimize wet weather strategies for river water quality in Odense (DK)	Justine Henonin, Lorenzo Benedetti, Annette Brink-Kjær, Elliot Gill, Peter Rasch, Per Hallager and Per Henrik Nielsen
F5	25 Sep 2018	17.06-17.09	9	3	Lauri Harilainen	Estimating flows in urban creeks – two case studies in Finland	Lauri Harilainen, Perttu Hyöty, Tiina Okkonen and Adam Lunden-Morris
F5	25 Sep 2018	17.09-17.12	9	4	Stavropoulos-Laffaille Xenia	Coupling Urban Water and Energy Budgets with TEB-Hydro: Case Study on the French Catchment Pin Sec	Xenia Stavropoulos-Laffaille, Katia Chancibault, Hervé Andrieu, Aude Lemonsu and Valéry Masson
F5	25 Sep 2018	17.12-17.15	9	5	Svenja Kemper	Calculation of the hydraulic capacity of grate inlets with supercritical surface flow and unsaturated drainage flow conditions	Svenja Kemper and Andreas Schlenkhoff
F5	25 Sep 2018	17.15-17.18	9	6	Irene Scheperboer	Numerical soil model for analysing sewer pipe-soil interactions	Irene Scheperboer, Akke Suiker, Emanuela Bosco and Francois Clemens
F5	25 Sep 2018	17.18-17.21	9	7	Anneke Döring	Generation of artificial rain sewer networks using spatial data	Anneke Döring and Insa Neuweiler
Session name F6 Tools and techniques							
Chairman		Manfred Schütze					
F6	25 Sep 2018	17.00-17.03	10	1	Leena Sankiaho	SWMM Model Data Management and Development Using FME Software	Leena Sankiaho
F6	25 Sep 2018	17.03-17.06	10	2	Ico Broekhuizen	Selection of calibration events for modelling green urban drainage	Ico Broekhuizen, Günther Leonhardt, Jiri Marsalek and Maria Viklander
F6	25 Sep 2018	17.06-17.09	10	3	Khiem Ly	Potential of Using Mass-Volume Curve for Water Quality-based Real Time Control	Duy Khiem Ly, Thibaud Maruéjols, Guillaume Binet and Jean-Luc Bertrand-Krajewski
F6	25 Sep 2018	17.09-17.12	10	4	Marie-Ève Jean	Conceptual Framework for Integrating Real-Time Control and Source Control Solutions for CSO Frequency Control	Marie-Ève Jean, Sophie Duchesne, Geneviève Pelletier and Martin Pleau
F6	25 Sep 2018	17.12-17.15	10	5	Morten Borup	Robust model for estimating pump characteristics and sewer flows from pumping station data	Martin Fencel, Morten Grum, Morten Borup and Peter Steen Mikkelsen
F6	25 Sep 2018	17.15-17.18	10	6	Sanit Wongsas	Urban Flooding and Adaptation to Climate Change in Sukhumvit Area, Bangkok, Thailand	Sanit Wongsas, Varameth Vichienan, Napaporn Piamsa-Nga and Shinichiro Nakamura
F6	25 Sep 2018	17.18-17.21	10	7	Maria Elisa	Hydrological Modelling and Detention Ponds Evaluation at Paranoa Lake - Brazil.	Fernanda Pereira Souza, Maria Elisa Leite Costa and Sergio Koide
Session name F7 Drainage and Impact mitigation							
Chairman		David Butler					
F7	25 Sep 2018	17.00-17.03	11	1	Philipp Baum	The effect of pollutant loading in different particle size fractions to the pollutant loads of urban stormwater runoff.	Philipp Baum and Ulrich Dittmer
F7	25 Sep 2018	17.03-17.06	11	2	Ali Alouache	Just Suspended Speed For Solid Particle Transport In Torus Reactor	Ali Alouache, Ammar Selatnia, Farid Hallet, Abdelouahab Lefkir, Houssein Eddine Sayah and Boubekeur Nadjemi
F7	25 Sep 2018	17.06-17.09	11	3	Legaire Pinedo Ortiz de Merville	Numerical Unsaturated Flow Model of Railway Drainage Systems	Legaire Pinedo Ortiz de Merville, Christian Berretta and Andrew Sleight
F7	25 Sep 2018	17.09-17.12	11	4	Marlene Rio	Characterization of the Dynamics of Microbiological and Chemical Contaminants in an Urban Catchment in South of France: From Field Data Collection to Modelling	Marlene Rio, Marie-Georges Tournoud, Christian Salles, Chrystelle Bancon-Montigny, Patrick Monfort, Claire Rodier, Mylene Toubiana and Pierre Marchand
F7	25 Sep 2018	17.12-17.15	11	5	Sezar Gülbaz	A Water Quality-Quantity Model for Avcilar Campus of Istanbul University Incorporating LID Implementation	Sezar Gülbaz, Abdulsamed Yıldırım and Cevza Melek Kazezyılmaz-Alhan
F7	25 Sep 2018	17.15-17.18	11	6	Zolal Ayazpour	Combined Sewer Flow Prediction Using Hybrid Wavelet Artificial Neural Network Model	Zolal Ayazpour, Amin E. Bakhshpour and Ulrich Dittmer
F7	25 Sep 2018	17.18-17.21	11	7	Patrizia Piro	Mitigation of Urban Surface Runoff through LID solutions: Case study in Mediterranean Area	Francesca Principato, Aldo Pedro Ferrante, Ferdinando Frega, Manuela Bartolo and Patrizia Piro
Session name F8 Water Management							
Chairman		Bares Vojtech					
F8	25 Sep 2018	17.00-17.03	12	1	Zuzana Vranayová	Percolation of Water from Surface Runoff – Case Studies	Martina Zelenáková, Petr Hluštík, Gabriel Marković, Gabriela Hudáková and Ladislav Tometz

F8	25 Sep 2018	17.03-17.06	12	2	Nathalie Hernandez	Optimizing SVM model as predicting model for sewer pipes in the two main cities in Colombia	Nathalie Hernandez, Nicolas Caradot, Hauke Sonnenberg, Pascale Rouault and Andres Torres
F8	25 Sep 2018	17.06-17.09	12	3	Katerina Donevska	Climate Change Impact on Water Supply Demands: Case Study of the City of Skopje	Katerina Donevska and Angelco Panov
F8	25 Sep 2018	17.09-17.12	12	4	Hans Korving	Impacts of in-sewer defects on human health risks compared with impacts of climate change	Hans Korving and Marco Van Bijnen
F8	25 Sep 2018	17.12-17.15	12	5	Alberto Pistocchi	Combined sewer overflow management: proof-of-concept of a screening level model for regional scale appraisal of measures	Alberto Pistocchi and Chiara Dorati
F8	25 Sep 2018	17.15-17.18	12	6	Iman Alharsha	An assessment of per capita water consumption in Sirte, Libya	Iman Alharsha, Fayyaz Memon and Raziye Farmani
F8	25 Sep 2018	17.18-17.21	12	7	Steffen Davidsen	Applying Socioeconomic Optimisation on Blue-Green Climate Adaptation Projects in an Urban Catchment	Steffen Davidsen, Thomas Kruse, Trine Stausgaard Munk and Karsten Arnbjerg-Nielsen

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Session name A7 Sewer particle transport							
Chairman Mathias Uhl							
A7	26 Sep 2018	10-10.15	9	1	Abigail Legge	Modelling of Food Waste Disposer particle transport through a sewer network	Abigail Legge, Andy Nichols, Simon Tait, Henriette Jensen and Richard Ashley
A7	26 Sep 2018	10.15-10.30	9	2	Robert Sámán	Forecasting pollution transport in drainage water	Robert Sámán, Insa Neuweiler and Thomas Graf
A7	26 Sep 2018	10.30-10.45	9	3	santiago sandoval	Revisiting conceptual stormwater quality models by alternative linear and non-linear formulations: an event-based approach	Santiago Sandoval and Jean-Luc Bertrand-Krajewski
A7	26 Sep 2018	10.45-11.00	9	4	Tamara Fernández-Arévalo	Model based assessment of sanitation systems for the integrated management of industrial discharges	Luis Miguel García, Jesús Antonio Pelegino, Luis Sancho, Alberto Ciriza, Monica Gutiérrez and Támara Fernández-Arévalo
Session name B7 Frontiers in urban drainage							
Chairman Lorenzo Benedetti							
B7	26 Sep 2018	10-10.15	10	1	Milos Milasinovic	Cellular Automata Approach for 2D pollution transport modelling in urban groundwater	Milos Milasinovic, Anja Radelovic, Nenad Jacimovic and Dusan Prodanovic
B7	26 Sep 2018	10.15-10.30	10	2	Alma Schellart	QUICS: how to deal with "fake" news in integrated models?	Franz Tschekner-Gratl, Vasilis Bellos, Alma Schellart, Jeroen Langeveld, Francois Clemens, Gerard Heuvelink, Lorenzo Benedetti, Miguel Angel Rico-Ramirez, Rita F. Carvalho, Lutz Breuer, James Shucksmith and Simon Tait
B7	26 Sep 2018	10.30-10.45	10	3	Oriol Gutierrez	Longer pipes or smaller treatment plants? Impacts of connecting neighbouring sewer systems considering construction, detrimental emissions and its control strategies.	Lluís Corominas, Sadurni Morera and Oriol Gutierrez
B7	26 Sep 2018	10.45-11.00	10	4	Rosa De Santis	Visual Risk Communication of Urban Flooding in 3D Environments based on Terrestrial Laser Scanning	Rosa De Santis, Francesco Macchione, Pierfranco Costabile and Carmelina Costanzo
Session name C7 Flood and damage modelling							
Chairman Bares Vojtech							
C7	26 Sep 2018	10-10.15	11	1	Lena Simperler	Analysing the cause of urban pluvial flooding in a hillside settlement	Lena Simperler, Florian Kretschmer and Thomas Ertl
C7	26 Sep 2018	10.15-10.30	11	2	Paul A. DeBarry	Implementation of GIS and Hydrologic/Hydraulic Modeling for Integrated Floodplain/Stormwater Management	Paul De Barry and Gerald Longenecker
C7	26 Sep 2018	10.30-10.45	11	3	Masaru Morita	Flood Damage Estimation Quantifying Uncertainty in Inundation Damage Statistics for Urban Drainage Risk Management	Masaru Morita and Yeou Kounng Tung
C7	26 Sep 2018	10.45-11.00	11	4	Behzad Jamali	Caffe – a Cellular Automata Fast Flood Evaluation Model	Behzad Jamali, Luke Cunningham, Peter M. Bach and Ana Deletic
Session name D7 Precipitation and rainfall harvesting							
Chairman Malte Hennrichs							
D7	26 Sep 2018	10-10.15	12	1	Anna Bachmann	Using Precipitation and Combined Sewer Overflow Data for Predicting Hygienic Contaminations in Bathing Waters – A Data Analysis	Anna Bachmann-Machnik, Ulrich Dittmer and Annika Schönfeld
D7	26 Sep 2018	10.15-10.30	12	2	Thomas Einfalt	Coordinated Precipitation Evaluation of Damage-Producing Events: First Steps	Thomas Einfalt, Marc Scheibel and Sascha Hinsken
D7	26 Sep 2018	10.30-10.45	12	3	Paola Aldana	Integrated hydraulic and hydrological modeling of a constructed wetland for storm water management	Paola Andrea Aldana González, Néstor Alonso Mancipe Muñoz and Andres Eduardo Torres Abello
D7	26 Sep 2018	10.45-11.00	12	4	Sara Corvaro	Rainwater harvesting system efficiency and economic assessment for different residential building typologies	Sara Corvaro

Session	Date	Block Time	Room	Order	Presenter	title	authors
Session name A8 Sewer leakages and RTC							
Chairman	David McCarthy						
A8	26 Sep 2018	12.30-12.45	9	1	Bram Stegeman	Detection of exfiltration in sewer systems with tracers	Bram Stegeman, Jeroen Langeveld, Thom Bogaard and François Clemens
A8	26 Sep 2018	12.45-13.00	9	2	Aaron Peche	Modeling storm water pipe leakage: transient vs. steady-state groundwater flow	Aaron Peche, Thomas Graf, Lothar Fuchs and Insa Neuweiler
A8	26 Sep 2018	13.00-13.15	9	3	Simon Berkahn	Real-time water level prediction based on artificial neural networks	Simon Berkahn, Insa Neuweiler and Lothar Fuchs
A8	26 Sep 2018	13.15-13.30	9	4	Manfred Schütze	Distributed Sewer System RTC in Öhringen – On the Way to the Internet of Things	Manfred Schuetze, Nico Suchold and Horst Geiger
Session name B8 Green infrastructures and decentralised systems							
Chairman	Neil Armitage						
B8	26 Sep 2018	12.30-12.45	10	1	Martijn Kuller	Supporting the needs and necessity for urban green stormwater infrastructure – a novel planning-support system	Martijn Kuller, Peter Bach, Simon Roberts, Dale Browne and Ana Deletic
B8	26 Sep 2018	12.45-13.00	10	2	Martin Oberascher	Smart Rain Barrels: Advanced LID management through measurement and control	Martin Oberascher, Jonatan Zischg, Stefania Anna Palermo, Carolina Kinzel, Wolfgang Rauch and Robert Sitzenfrei
B8	26 Sep 2018	13.00-13.15	10	3	Richard Ashley	Uncertainties in estimating the economic benefits from blue and green stormwater infrastructure	Richard Ashley, Berry Gersonius, Horton Bruce, Chris Digman and Paul Shaffer
B8	26 Sep 2018	13.15-13.30	10	4	Adam C. Castonguay	Modelling strategies to enable the uptake of decentralised water treatment technologies	Adam Charette-Castonguay, Md Sayed Iftekhar, Christian Urich and Ana Deletic
Session name C8 Sewer sediments and CFD							
Chairman	Thomas Einfalt						
C8	26 Sep 2018	12.30-12.45	11	1	Dominik Leutnant	Using Mass-Volume-Curves to Assess the Empirical Pollutant Modelling Concept	Dominik Leutnant, Dirk Muschalla and Mathias Uhl
C8	26 Sep 2018	12.45-13.00	11	2	Maike Wietbüscher	The efficiency of storm water sedimentation tanks for fine particles in urban run-off	Maike Wietbüscher, Nina Voßwinkel and Rainer Mohn
C8	26 Sep 2018	13.00-13.15	11	3	Katharina Teuber	Multiphase CFD-Simulation of Transport Phenomena in Sewer Systems	Katharina Teuber, Tabea Broecker, Shibashish D. Jaydev, Gebregziabher M. Goitom, Maria Sielaff, Daneish Despot, Dietmar Stephan, Matthias Barjenbruch and Reinhard Hinkelmann
C8	26 Sep 2018	13.15-13.30	11	4	Gislain Lipeme Kouyi	Valuable outcomes in urban hydrology deriving from CFD modelling approach	Lipeme Kouyi Gislain
Session name D8 Integrated urban drainage modelling							
Chairman	Karl-Erich Lindenschmidt						
D8	26 Sep 2018	12.30-12.45	12	1	Lisha Guo	Conceptualizing the sewage collection system for integrated sewer-WWTP modelling and optimization	Lisha Guo, Sovanna Tik, Julia Ledergerber, Domenico Santoro, Elsayed Elbeshbishy and Peter Vanrolleghem
D8	26 Sep 2018	12.45-13.00	12	2	Roland Löwe	Impacts of urban development on urban water management at varying spatial and temporal scales	Roland Löwe, Michael Mair, Agnethe N. Pedersen, Wolfgang Rauch, Manfred Kleidorfer and Karsten Arnbjerg-Nielsen
D8	26 Sep 2018	13.00-13.15	12	3	Mathias Riechel	Relevance Of Different CSO Outlets For Bathing Water Quality In A River System	Mathias Riechel, Wolfgang Seis, Andreas Matzinger, Erika Pawlowsky-Reusing and Pascale Rouault
D8	26 Sep 2018	13.15-13.30	12	4	Laura Barone	Measuring and modelling the nutrients residual load from the combined sewer of the eastern shore of Lake Iseo	Laura Barone, Marco Pilotti, Manuel Murgioni, Giulia Valerio, Steven C. Chapra, Matteo Balistrocchi and Luca Milanese

Session	Date	Block Time	Room	Order	Presenter	title	authors
Session name A9 Water management, society and smart control							
Chairman	Steven Chapra						
A9	26 Sep 2018	15.30-15.45	9	1	Boud Verbeiren	FloodCitiSense: Early Warning Service For Urban Pluvial Floods For And By Citizens and City Authorities	Boud Verbeiren, Solomon Dagnachew Seyoum, Ihab Lubbad, Patrick Willems, Tian Xin, Marie-Claire ten Veldhuis, Christian Onof, Li-Pen Wang, Susana Ochoa-Rodriguez, Carina Veeckman, Michelle Boonen, Linda See, Dominique Nalpas, Barry O'Brien and Andy Johnston
A9	26 Sep 2018	15.45-16.00	9	2	James Webber	Evaluating city scale surface water management using a rapid assessment framework in Melbourne, Australia	James Webber, Matt Burns, Guangtao Fu, David Butler and Tim Fletcher
A9	26 Sep 2018	16.00-16.15	9	3	Malte Henrichs	Model based estimation of a natural water balance as reference for planning in urban areas	Malte Henrichs, Isabel Scherer, Mathias Uhl, Andreas Steinbrich, Hannes Leistert, Markus Weiler and Tobias Schuetz
A9	26 Sep 2018	16.15-16.30	9	4	Stefania Anna Palermo	Parameter Sensitivity of a Microscale Hydrodynamic Model for Smart Water Control	Stefania Anna Palermo, Jonatan Zischg, Robert Sitzenfrei, Wolfgang Rauch and Patrizia Piro
Session name B9 New methods and tools							
Chairman	Dirk Muschalla						
B9	26 Sep 2018	15.30-15.45	10	1	Yao Hu	A Data-driven Method to Modeling Flows Across Combined Sewer Systems	Yao Hu and Branko Kerkez
B9	26 Sep 2018	15.45-16.00	10	2	Jeff Sadler	Leveraging Open Source Software and Parallel Computing for Model Predictive Control Simulation of Urban Drainage Systems using EPA-SWMM5 and Python	Jeffrey Sadler, Jonathan Goodall, Madhur Behl and Mohamed Morsy
B9	26 Sep 2018	16.00-16.15	10	3	Peter M. Bach	Virtual Reality in Water Sensitive Urban Design – new data and insight or just playful participation?	Peter Bach, Hannah Bragge and Meead Saberi
B9	26 Sep 2018	16.15-16.30	10	4	Damjan Ivetic	Electro-Magnetic Velocity meters: Assessment of the (Missing) Technical Parameters	Damjan Ivetic, Dusan Prodanovic and Luka Stojadinovic
Session name C9 New frontiers in urban drainage							
Chairman	Gaspere Viviani						
C9	26 Sep 2018	15.30-15.45	11	1	Joao P. Leita	Modelling overland flow from local inflows in "almost no-time" using Self-Organizing Maps	João P. Leitão, Mohamed Zaghloul and Vahid Moosavi
C9	26 Sep 2018	15.45-16.00	11	2	David Sample	Water Quality Characterization of Irrigation and Storm Runoff for a Nursery	Mohammad Nayeb Yazdi, David Sample, Durelle Scott and James Owen
C9	26 Sep 2018	16.00-16.15	11	3	Steve Adkins	Wastewater System Ventilation – a Friend or Adversary?	Steve Adkins, Slobodan Djordjević and Dragan Savić
C9	26 Sep 2018	16.15-16.30	11	4	Ting Liu	Sewer-groundwater Interaction in Urban Coastal Areas	Ting Liu, Maryam Beheshti, Xin Su and Valentina Prigobbe
Session name D9 Sewer maintenance							
Chairman	Patrizia Piro						
D9	26 Sep 2018	15.30-15.45	12	1	Matthijs Rietveld	From unknown to uncertain: A statistical model on gully pot silting	Matthijs Rietveld, Jeroen Langeveld, Nadia Mobron and Francois Clemens
D9	26 Sep 2018	15.45-16.00	12	2	Tone Merete Muthanna	Remobilization of Sediments in Gully Pots During High Intensity Precipitation Events	Tone Merete Muthanna and Maria Viklander
D9	26 Sep 2018	16.00-16.15	12	3	Alla Abbas	Improving the hydraulic integrity to separate the sewer system in hilly regions using a new manhole design	Alla Abbas, Iacopo Carnacina, Felicite Ruddock, Rafid Alkhaddar, Glynn Rothwell and Robert Andoh
D9	26 Sep 2018	16.15-16.30	12	4	Alberto Campisano	Validation of an unsteady flow numerical model for sediment transport induced by flushing operation in combined sewers	Gashin Shahsavari, Alberto Campisano, Carlo Modica and Gilles Arnaud-Fassetta

Poster	
Title	Authors
Redesign of water quality network for the urban river "Salitre" in Bogotá, Colombia, using an artificial neural network	Carlos Peña-Guzmán, Paula Balaguera, Natalia Hernandez and Ronal Sierra
Use of shrimp-shell for adsorption of metals present surface runoff	Aline Schuck Rech, Julio Rech, Jakcemara Caprario, Fabiane Tasca and Alexandra Finotti
Temporal Pattern Analysis of Rainstorm Events for Supporting Rainfall Design in a Tropical City	Changhyun Jun, Xiaosheng Qin and Wei Lu
Flood Risk Management in an Urban Area by Applying LID Techniques	Hamed Ghafghazi, Beatrice Dionisi and Antonio Zarlena
Influence of drainage network and compensatory techniques on urban flooding susceptibility	Jakcemara Caprario, Aline Rech, Fabiane Tasca and Alexandra Finotti
Green infrastructure and storage unit combinations for mitigating peak flows in drainage systems	Yang Yang and Ting Fong May Chui
Frontiers in urban drainage - An analysis of a Water Quality Recovery Program Plan in a developing country	Fabiane Tasca, Camila Silva, Maria Lima and Alexandra Finotti
A data analysis and modelling approach to understand the role of urbanization features on the hydrological regime	Guido Petrucci, Kevin De Bondt and Philippe Claeys
Selection of the Best Water Supply Scenario for Urban Demand based on the Risk Analysis in Decision-Making Model	Reza Javidi Sabbaghian and Amir Pouyan Nejadhashemi
An Alternative Model Calibration Strategy for Watersheds Lacking Proper Data Records: Case Study of Riohacha, Colombia.	Antonio de Oliveira, Marcelo Miguez, Osvaldo Rezende, Matheus Sousa and Ianic Lourenço
Effect of Aged Pipe Roughness's on Urban Flooding: Results from Sensitivity Tests with SWMM Model	Marinne Gourcerol, Mathieu Lepot, Antonio Moreno Rodenas and Francois H.L.R. Clemens
Modelling study on the impacts of BMPs at Riacho Fundo (Brasília, Brazil)	Vitor Camuzi, Maria Costa, Arthur Schleicher, Jeferson Costa and Sergio Koide
Advanced modelling of surface drainage systems drainage systems in reducing pluvial flood risk in urban areas.	Dario Rappazzo and Giuseppe Aronica
Preliminary analysis about the effects on the SPI values computed from different best-fit probability models in two Italian regions	Claudio Mineo, Benedetta Moccia, Federico Lombardo, Fabio Russo and Francesco Napolitano
Use of retention basin for flood mitigation and urban requalification in Mesquita, Brazil	Osvaldo Rezende, Matheus Sousa, Ana Caroline Jacob, Luiza Ribeiro, Antonio de Oliveira, Marcelo Miguez and Cícero Arrais
Impact of urbanization (trends) on hydrological behaviour of Belo Horizonte watersheds (Brazil)	Martin Seidl, Luiz Palmier, Guide Petrucci and Nilo Nascimento
Energy Assessment of Seawater Toilet Flushing in Qatar	Hamish R. Mackey, Saad Hafiz and Sami G. Al Ghamdi
Modelling climate changes impacts in a subtropical urban drainage	Cesar Do Lago, Marina de Macedo and Eduardo Mendiondo
Spatiotemporal modelling of sediment-related blockages in the sewer system of Bogotá (Colombia)	Eliana Soriano Pulido, Carlos Valencia Arboleda and Juan Pablo Rodríguez Sánchez
URBAN STORMWATER MONITORING AND MODELLING AT THE RIACHO FUNDO SUB-BASIN, BRASÍLIA – DF	Thays Mitsuko Tsuji, Maria Elisa Leite Costa and Sergio Koide
Overall Rate Kinetics Model of Chlorine Demand in Urban Drainage	Joshua Dickenson and John Sansalone
Urban Flood Management Based on Ensemble Precipitation Forecasts	Thomas Einfalt, Sandra Hellmers and Alrun Jasper-Tönnies
Heavy metals in wash-off from facade and road surface	Wang Zhenyu, Afshin Sadeghikhah, Jin Zhang and Peter Krebs
Hybrid Filtration System for Treatment of Stormwater Runoff	Junho Lee, Seungho Yang and Song Daehyun
Stormwater Runoff Treatment Filtration System and Backwashing System	Junho Lee, Myungjin Lee and Seungho Yang
Performance analysis of low impact development (LID) practices for the management of surface runoff: Applying the sponge city concept to a campus area	Wenyu Yang, Kurt Brueggemann, Kiwanuka David Seguya, Afshin Sadeghikhah, Jin Zhang and Peter Krebs
Heavy metals potential removal efficiency of permeable pavement	Michele Turco, Giuseppe Brunetti, Michele Porti, Giovanna Grossi, Mario Maiolo and Patrizia Piro
Modelling of storm precipitation	Vitaly Ilinich, Alexander Belolubtcev, Alessandro Cavalli, Ilyas Veliev and Maxim Lapushkin
An integrated approach for assessing the impact of urban stormwater discharge on the fecal contamination in a recreational lake near Paris	Yi Hong, Chenlu Li, Bruno Lemaire, Frederic Soullignac, José Rodolfo Scarati Martins, Adelaide Roguet, Françoise Lucas and Brigitte Vincon Leite
GESTOR: a new tool for the proactive management of sewer systems	Oriol Gutierrez, Lluís Corominas, Silvia Busquets, Lluís Bosch, Javier Garcia-Garcia, Pedro Jose Martinez, Oscar Macias, Isabel Tormos, Jose Guillermo Berlanga, Narcis Pi, Agustí-Pere Figueres and Oscar Soria
Virtual modelling of city defence from spring flood with help of water reservoir	Vitaly Ilinich, Alex Perminov and Fidanna Khairullina
Modelling runoff in watershed without calibration using PCSWMM	Daniela Carvalho, Maria Elisa Costa, Jeferson Da Costa and Sergio Koide
Partitioning of metals in urban drainage from paved source area catchments	Ilaria Gnecco, Anna Palla and John Sansalone
Modelling Urban Drainage in Taquari – Federal District in Brazil	Tamara Silva, Maria Elisa Leite and Conceição De Maria Albuquerque
Evaluation of urban flooding hazard through the application of Bayesian Modelling Ensemble	Gabriele Freni and Vincenza Notaro
Urban Flood Area Delimitation using Reverse Water Local Flow Paths	Sergio Rosim, João Ricardo de Freitas Oliveira, Monica De Martino, Alfonso Quarati and Alexandre Copertino Jardim
Comparison of cost benefits of new installation and retrofitted rainwater harvesting systems for commercial buildings	Nor Hafizi Md Lani, Achmad Syafiuddin and Zulkifli Yusop
Promoting Successful Urban Watershed Restoration through Enhanced Bioretention Cell Modelling	Whitney Lisenbee, Jon Hathaway and Ryan Winston
Study on the Evaluation Methods for Drainage System of Ancient Buildings	Jun Li, Shaoqin Zhang and Shan Wu
Mathematical modelling of in-sewer processes as a tool for sewer system design	Giorgio Mannina, Paolo Calabrò, Gaspare Viviani
Wastewater modification processes in a stabilization reservoir: a new mathematical model	Giorgio Mannina, Gaspare Viviani and Steven C. Chapra
Multiregression analysis of the kinetic constants in ephemeral rivers: the case study of the Oreto river	Angela Candela, Giorgio Mannina and Gaspare Viviani
Uncertainty Propagation In Integrated Urban Water Quality Modelling	Mannina
Rainwater reuse in urban areas: a mathematical model and a long-term modelling approach	Freni, Mannina, Torregrossa e Gaspare Viviani
Long term efficiency analysis of infiltration trenches subjected to clogging	Gabriele Freni and Giorgio Mannina

2018년도 도시배수모델링 학회 (UDM) 국외 출장

【2018. 10. 01.(월) / APEC 기후센터】

I. 출장 개요

○ 배경 및 목적

- 기후변화에 따른 도시유역 침수 및 오염 물질 확산 그리고 친환경적 도시 유역 수재해 저감을 위한 Green Infra-structure 관련 최신 기술에 관한 연구에 특화되어 있는 도시배수모델링 학회에 참석하여 최신 연구 동향을 파악하고 관련연구의 공유/조사를 통해 관련 정책 수립의 기초자료 마련이 필요함
- 수재해 관련 최신 연구 동향을 파악하여 향후 연구 과제 도출의 필요성

○ 출장기간 : 2018.10.22. ~ 10.28 (4박 7일)

○ 대상국가 : 이탈리아(Palermo)

○ 출장자 및 주요 수행업무

소속(직위)	성명	업무수행 내용
기후예측기술팀 (선임연구원)	이승수	○ UDM 2018 참석을 통한 최신 연구 동향 파악 ○ 최신 연구 내용 공유 ○ 관련 분야 선도 연구 그룹과의 Network 구축

○ 출장 일정

일정	주요 수행 내용
10.22(토)	○ 한국(부산) 출발 → 인천 공항 경유 → 이탈리아(로마) 경유 → 이탈리아(팔레르모) 도착
10.23(일)	○ 학회 등록 ○ Ice-Break meeting 참석
10.24(월) ~ 10.26(수)	○ 학회 참관 및 발표 - 최신 연구 동향 조사 - 최신 연구 결과 발표 • Integrated 1D/2D Urban Inundation modelling with Refined Grid and OpenMP Parallelization - 인적 네트워크 구축을 위한 소셜프로그램 참석
10.27(목)	○ 이탈리아(팔레르모) 출발 → 이탈리아(로마) 경유 → 인천 경유 → 부산 도착

II. 출장 내용

1. 도시배수 모델링(Urban Drainage Modelling 2018, UDM 2018) 학회 참가

○ UDM 2018 개요

- 올해로 11회를 맞는 UDM 2018은 유럽에서 시작된 도시유역 수재해 및 물관리 관련 최신 연구 결과를 공유하고 연구자들간의 네트워크를 구축하는 학회임
- 주로 영국, 스위스, 스웨덴, 이탈리아, 덴마크, 네덜란드 등과 같은 유럽 국가의 연구자들이 주축을 이루고 있으나 미국, 중국, 일본, 한국 등과 같이 비유럽 국가에서도 참석을 하고 있는 국제학회임
- 구두발표와 포스터 발표를 포함하여 약 350여개의 연구 발표가 있었으며 연구내용은 하수 관거 자료 관측 기법, 도시침수 자료 관측 기법, 저영향 개발(Low Impact Development, LID) 기법, 도시침수 원인 분석, 도시침수 저감 기법 등이 주를 이룸.

○ 주요 발표 내용

1) Frontier in Urban Drainage

번호	주요 내용
1	○ 주제 : Frontiers in Urban Drainage - How will Ubiquitous Sensing Change Urban Drainage Management? ○ 발표자 : Peter A. Vanrolleghem ○ 발표 내용 - 도시배수 관리에 있어서 관측 데이터의 중요성을 강조하고 현재 그 관측데이터가 매우 부족함을 지적 - 저비용의 센서를 활용한 밀도 높은 하수관로내의 수리적 자료 수집을 통한 모델링 검증 자료 획득 및 모니터링 자료를 통한 도시유역 배수 관리 기법에 관한 소개를 통해 다양한 센싱 자료의 중요성을 강조하고 효율적인 도시 배수 관리 기법을 통한 재해 절감 기법에 대해 소개
2	○ 주제 : Understanding Pollutant Transport in Urban Floodwater for Health Impact Assessment using a Physical Scale Model ○ 발표자 : James Shucksmith ○ 발표 내용 - 수량적 측면에 관한 연구는 상대적으로 많이 이루어졌으나 침수 발생에 따른 하수관로내에 존재하는 오염물질과 도시유역 내에 존재하는 비점 오염원에 의한 오염물질 확산에 관한 연구가 상대적으로 부족함을 지적함 - 도시 침수 발생시 유역내 오염물질 확산에 따라 침수 발생 종료 후에도 악취 발생, 수인성 전염병 발생에 의한 피해 예측을 위해 모델링을 통한 사전 예방이 중요함을 강조 - 하수관망에서 역류하는 오염물질 이송확산 모델 개발을 위한 실험실 규모 실험을 수행하고 관련 데이터를 얻기 위한 최신 관측 기법에 관해 소개함 - 오염물질 이송확산 모델을 개발하고 실험데이터를 이용해 모형을 검증한 결과를 공유함

3	○ 주제 : Controlling Stormwater Runoff from Impermeable Areas by Using Smart Inlets ○ 발표자 : Nils Kändler ○ 발표 내용 - 유입량 조절이 가능한 smart inlet 개념에 대한 소개 - 하수관로내의 유량 관측을 통해 smart inlet을 통해 지표면에서 하수관망으로 유입되는 유량을 조절하는 기법에 대해 소개함 - smart inlet 조절을 통한 지표면-하수관망 유입 유량 조절을 통해 도시유역 침수 발생을 저감시킬 수 있음을 강조함
4	○ 주제 : Enhancing the Retention Performance of a Small Urban Catchment by Green Roofs ○ 발표자 : Ilaria Gnecco ○ 발표 내용 - 도시유역의 불투수층 증가로 인한 지표면 유출량 증가로 인한 침수 발생빈도 및 강도가 증가함을 지적 - 구조적 수재해 저감 기법의 단점 및 한계를 지적하고 LID 기법의 일환인 green roof 개념에 대해 소개함 - 도시유역 건물의 옥상 또는 지붕에 식물을 재배하여 강우 발생으로 인한 유출량을 저감시키는 방법에 대해 소개함
5	○ 주제 : Early stage planning tools for stormwater quantity and quality management in Denmark and China ○ 발표자 : Ditte Reinholdt Jensen ○ 발표 내용 - 중국과 덴마크가 공동으로 연구한 지표면 유출 수량 및 수질 관리를 위한 초기단계 모델링 기법에 관한 연구를 발표함 - 일반적인 모델링 기법은 완성된 도시의 인프라에 대해서 침수 발생 및 수질 관리 모델링을 통해 적응력 또는 최대 이송 능력에 대한 평가를 수행하고 있으나 본 연구는 도시 계획 초기 단계에서 계획에 따라 완성된 도시가 감당할 수 있는 우출수 이송량과 수질 관리 능력을 평가 하기 위한 툴을 개발하여 도시 계획에 따른 위험관리 능력을 평가하고 그 계획이 다시 도시계획에 반영될 수 있도록 하는 개념에서 출발한 연구임
6	○ 주제 : Study on Realization of Storm Water Sewerage with Water Level Monitoring by the Use of Inundation Simulation ○ 발표자 : Takuma Kiyosu ○ 발표 내용 - 하수관로내의 피에조 압력 및 수위 계측을 통해 침수 모델링 결과를 검증하고 침수 발생 원인에 관한 분석을 수행한 연구 결과를 발표함
7	○ 주제 : Interfacing stakeholder involvement into a surface water-quality modelling system for water management and policy development ○ 발표자 : Karl-Erich Lindenschmidt

	○ 발표 내용 - 도시유역 수질 관리를 위한 연구 수행시 정책결정자와 그 결과를 함께 공유하여 모델링의 중요성에 대해 인식 시키고 모델링 결과가 향후 정책에 결정에 관련 근거가 될 수 있도록 한 사례에 대해 발표함 - 향후 국내 연구 결과도 정책 결과에 반영될 수 있도록 초기단계부터 정책결정자와 연구 내용을 공유하여 그 중요성을 인식 시키기 위한 노력이 필요할 것으로 판단됨
	○ 주제 : Calibrating urban flood models with qualitative probabilistic flooding information extracted from CCTV footage ○ 발표자 : Matthew Moy de Vitry ○ 발표 내용 - CCTV에 기록된 화면에서 침수면적과 침수심을 추출하는 기법에 대해 소개 - 추출된 자료를 활용하여 모델링 검증에 활용
	○ 주제 : A new Saint-Venant solver for SWMM ○ 발표자 : Ben Hodges ○ 발표 내용 - SWMM은 전세계적으로 도시유역 배수 시스템 해석에 가장 많이 사용되는 모형임 - 그러나 SWMM은 링크-노드 컨셉에 기반하여 수치모의를 수행하므로 급격히 변하는 지형이나 단면간의 거리가 멀면 불안정한 수치해석 결과를 도출함 - 이러한 단점을 해결하기 위하여 새로운 solver를 개발하였음 - 새로운 solver는 링크-노드컨셉에서 element 개념을 추가하여 보다 안정적인 수치해석 결과를 도출 할 수 있음을 보임 - 또한 최근 CPU 개발 속도가 정체되어 있으며 최근 10년간 병렬코어 개발로 무게추가 옮겨진 것을 지적하고 SWMM도 병렬해석이 가능하도록 기능을 추가하였음 - 향후 활용도가 더욱 증가할 것으로 판단됨

Ⅲ. 시사점

- 최근의 도시배수 관련 연구는 전통적 개념의 수리/수문학적 개념을 벗어나 도시유역에 특화된 기법을 기반으로 수량, 수질적 측면뿐만 아니라 저영향개발(LID) 기반 Green Infra-structure라는 고유의 영역을 개척하고 있음
- 상대적으로 국내의 관련연구는 아직도 전통적 개념의 수리/수문학적 해석을 응용한 확장적 개념에 국한되어 있음
- 따라서 최신 연구 동향을 지속적으로 파악하고 글로벌 연구 트렌드에 뒤처지지 않는 연구 방향 설정 및 관련 연구 성과를 도출하는 것이 필요할 것으로 판단됨
- 또한 아직까지는 도시배수 분야 관련 연구에서 기후자료를 활용한 연구가

미진한 것으로 판단되므로 향후 APCC에서 틈새시장을 공략하여 관련 연구 수요를 만들어 내는 방안도 고려 대상이 될 수 있을 것으로 판단됨.



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ON URBAN DRAINAGE MODELLING
23-26 SEPTEMBER | PALERMO - ITALY



Integrated 1D/2D Urban Inundation modelling with Refined Grid and OpenMP Parallelization

Seungsoo Lee
(APEC Climate Center, APCC)



APCC
APEC CLIMATE CENTER

Introduction

Urban inundation damages...



Residential area



Underground space



Traffic jam



Waterborne epidemic



Damage due to hurricane Harvey

Introduction



- Toward **street resolving** urban flood **predictions**

- A dramatic increase in high-resolution info from **weather radars and remote sensing**



Introduction

➤ Problem

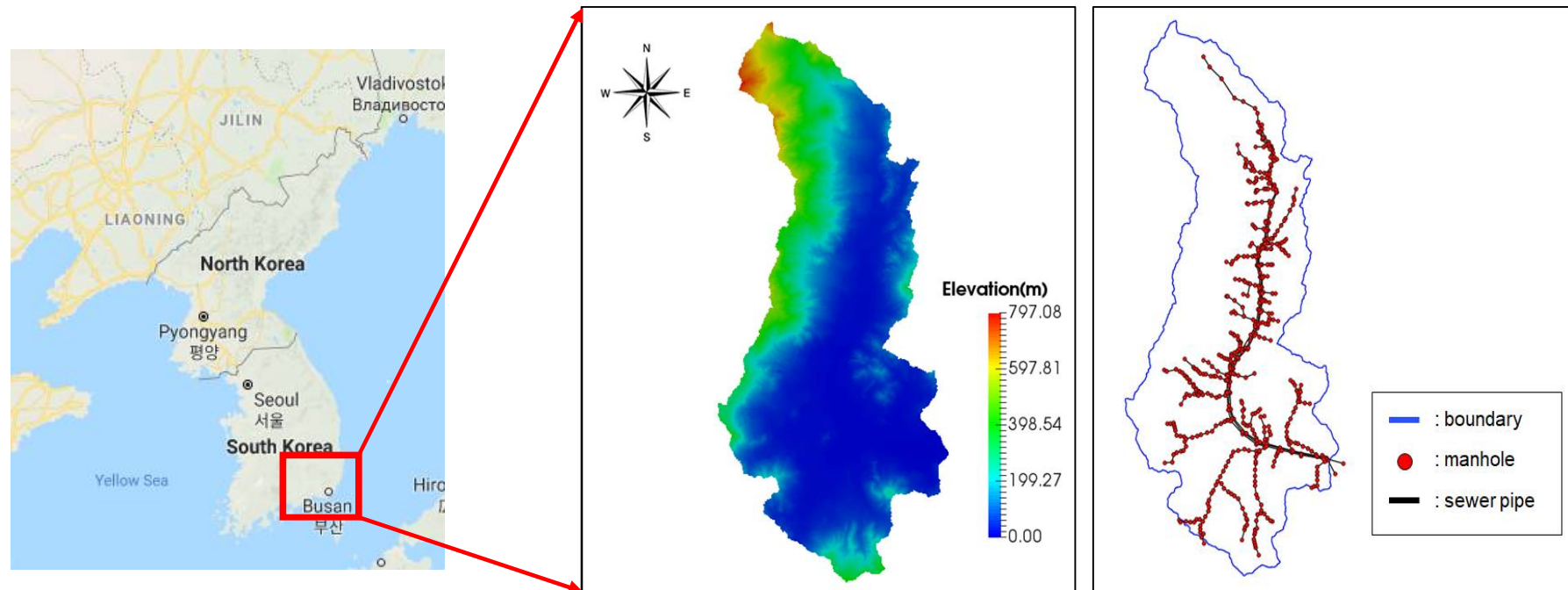
- **Complex interacting flow** between surface and sewer system
- Demanding for **High Resolution** modelling results
- Huge amount of **computational load**
- **Too much long** calculation time

➤ Solution

- Dual-drainage modelling
- Refined grid method
- Parallelized computing technique

Materials and Methods

Study area



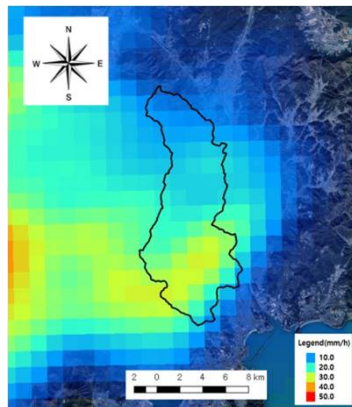
Oncheoncheon basin, South Korea

<5m × 5m, 56.28km²>

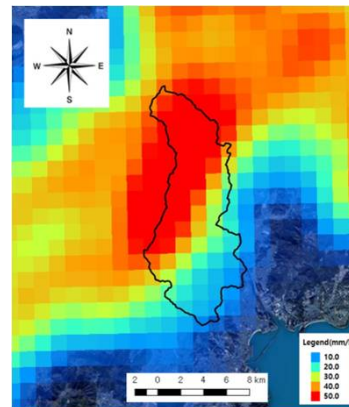
<596 pipes, 556 manholes>

Materials and Methods

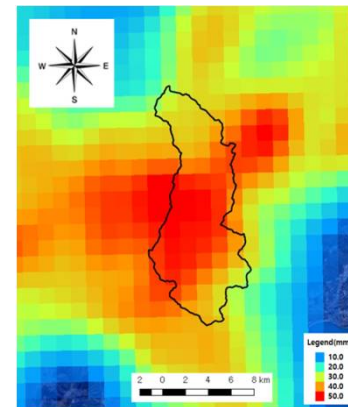
Rainfall(2015.08.25)



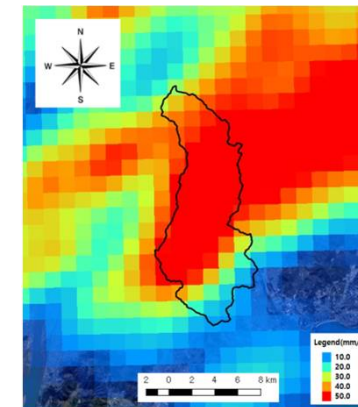
13:00



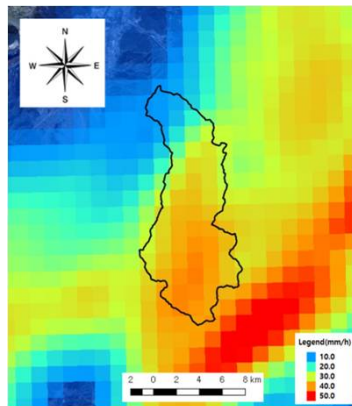
13:30



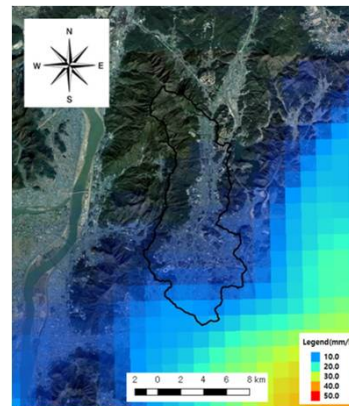
14:00



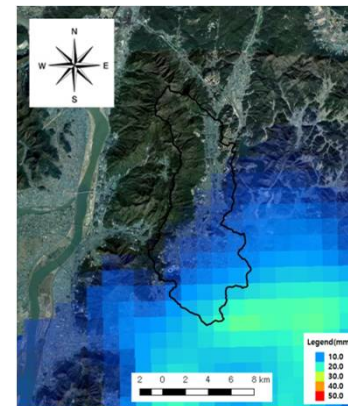
14:30



15:00



15:30



16:00

Materials and Methods

Governing Equation

2D surface flow

$$\frac{\partial h}{\partial t} + \frac{\partial M}{\partial x} + \frac{\partial N}{\partial y} = r_e - q_{stb}$$

$$\frac{\partial M}{\partial t} + \frac{\partial(uM)}{\partial x} + \frac{\partial(vM)}{\partial y} = -gh \frac{\partial H}{\partial x} - gn^2 \frac{M\sqrt{u^2 + v^2}}{h^{4/3}}$$

$$\frac{\partial N}{\partial t} + \frac{\partial(uN)}{\partial x} + \frac{\partial(vN)}{\partial y} = -gh \frac{\partial H}{\partial y} - gn^2 \frac{N\sqrt{u^2 + v^2}}{h^{4/3}}$$

h : water depth, t : time, $M(=uh)$: x-direction flux, u : x-direction velocity, $N(=vh)$: y-direction flux, v : y-direction velocity, r_e : rainfall intensity, q_{stb} ($=Q_{e1}/A_{sur}$): interacting discharge between the surface and drain box, Q_{e1} : calculated discharge from the water depth in the surface and drain box using the weir and orifice equation (Lee et al., 2016), A_{sur} : area of surface grid, g : gravitational acceleration, H : water elevation, and n : Manning's roughness coefficient.

1D Sewer sewerage system

$$\frac{\partial A}{\partial t} + \frac{\partial Q}{\partial x} = q_{btp} - q_{man}$$

$$\frac{\partial Q}{\partial t} + \frac{\partial(uQ)}{\partial x} = -gA \frac{\partial H_p}{\partial x} - gn^2 \frac{Q|Q|}{R^{4/3}A}$$

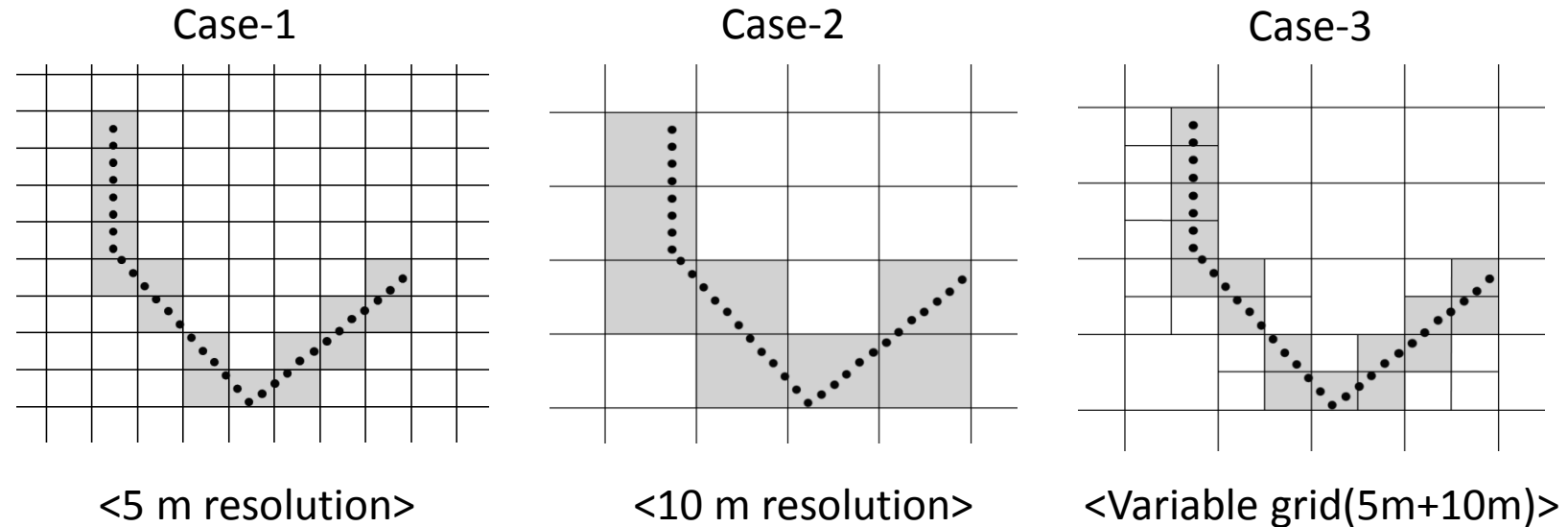
$$\frac{\partial h_{db}}{\partial t} = q_{stb} - \frac{\sum_{i=1}^n Q_{e2_i}}{A_{db}},$$

$$\frac{\partial h_{man}}{\partial t} = \frac{\sum_{i=1}^n Q_{man_i}}{A_{man}},$$

A : wetted area of the sewer pipe, Q : flow discharge, q_{btp} ($=Q_{e2}/dx_{sw}$): interacting discharge between the drain box and sewer pipe, Q_{e2} : calculated discharge from the water depth in the drain box and sewer pipe using the weir and orifice equation dx_{sw} : length of sewer pipe grid, q_{man} ($=Q_{man}/dx_{sw}$): interacting discharge between the manhole and edge of sewer pipe per unit pipe length, Q_{man} : interactive flow discharge between manhole and sewer pipe, $H_p(=z_b + h_p)$: piezometric head, z_b : bottom elevation of sewer pipe, h_p : water depth in sewer pipe, and R : hydraulic radius.

Materials and Methods

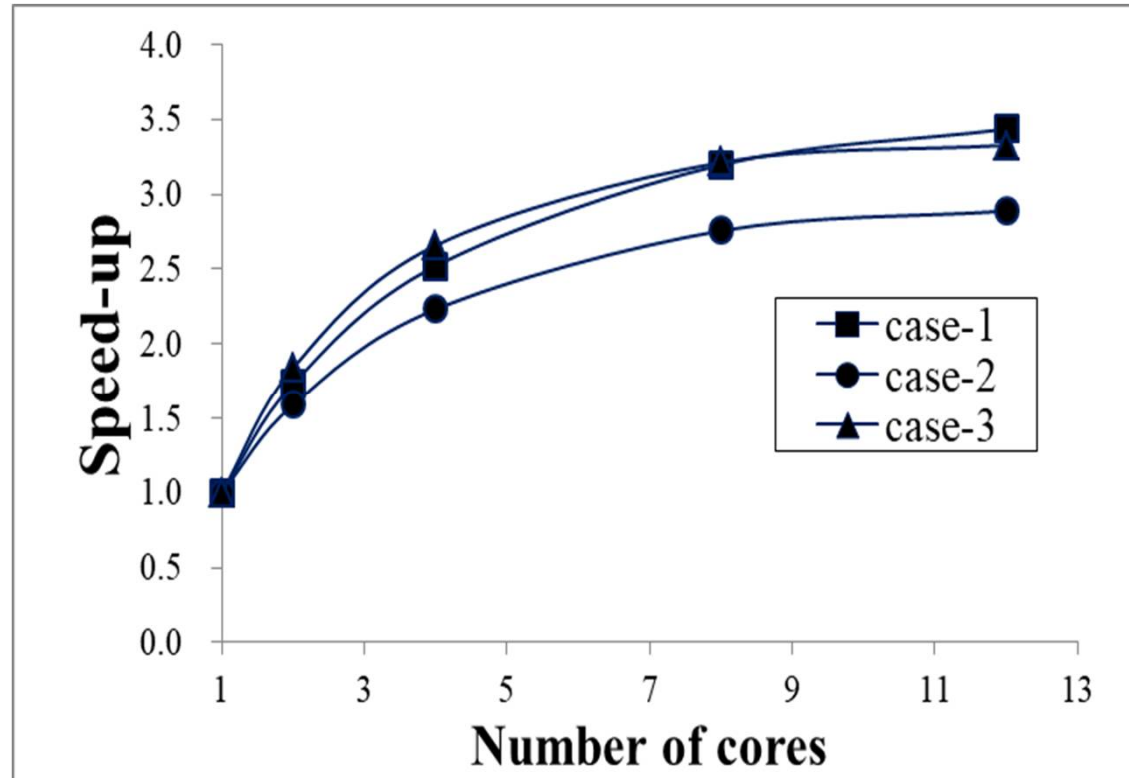
Study case



	Num. of road grid	Area of road grid (m ²)	Num. of storm drain
Case-1	327,082	8,177,050	81,770
Case-2	114,612	11,461,200	114,612
Case-3	353,877	8,846,925	88,469

Results

Speed-up

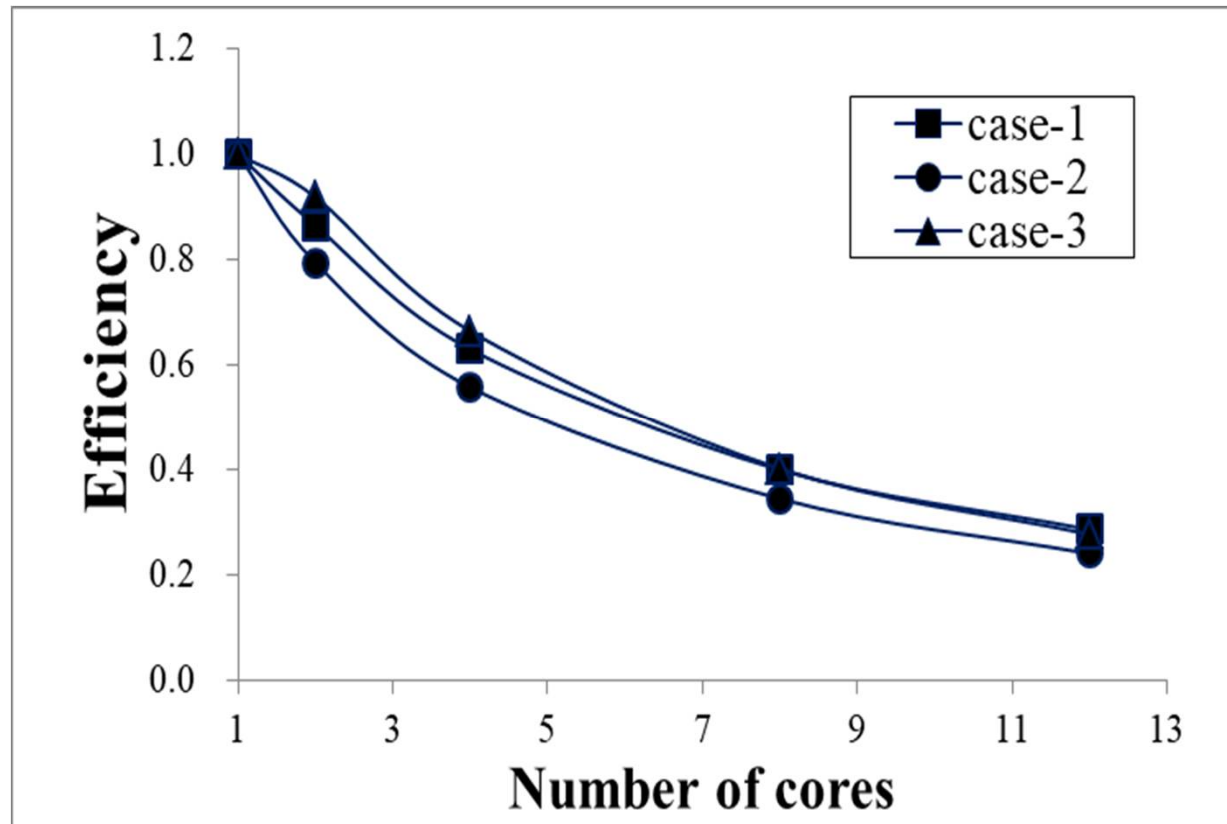


3.44 times
3.33 times
2.89 times

$$\text{speed-up} = \frac{\text{serial run time}}{\text{parallel run time}}$$

Results

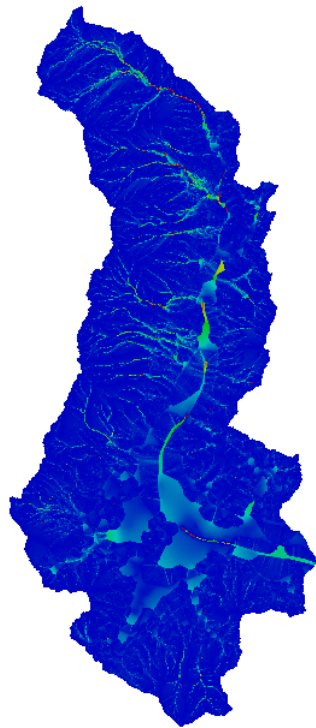
Efficiency



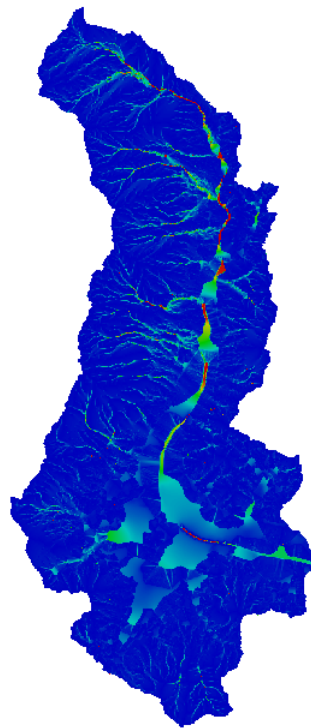
$$Efficiency = \frac{speed - up}{number\ of\ CPU\ cores}$$

Results

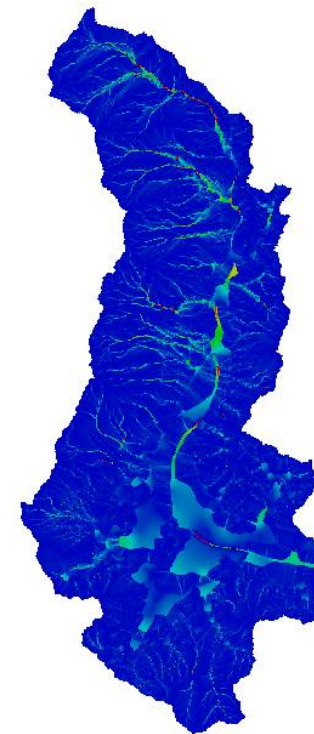
Comparison of Inundation depth



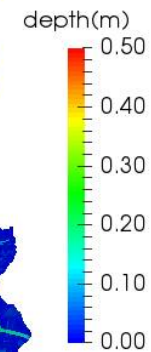
Case-1



Case-2

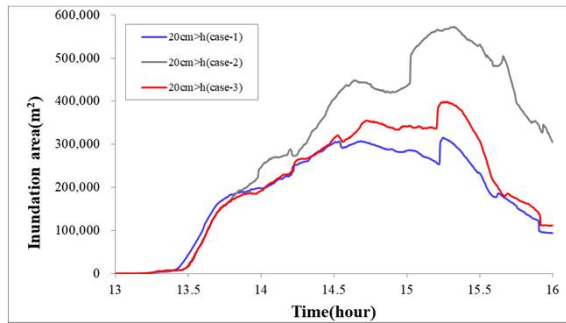


Case-3

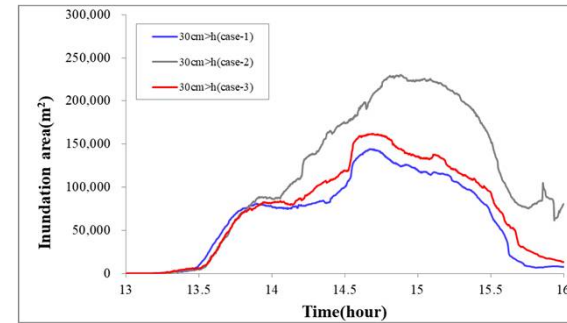


Results

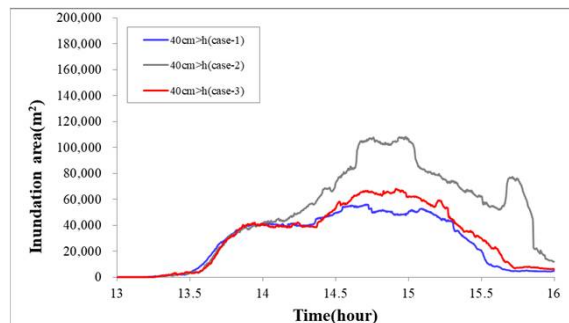
Time variation of inundation depth



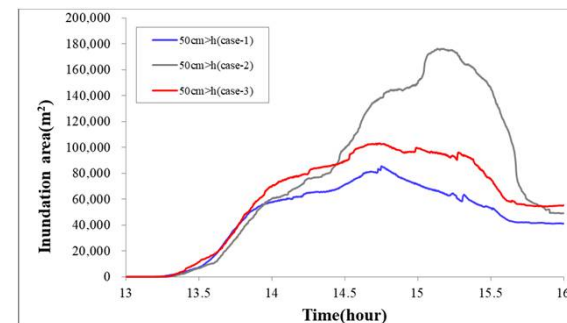
20 cm ≤ depth < 30 cm



30 cm ≤ depth < 40 cm



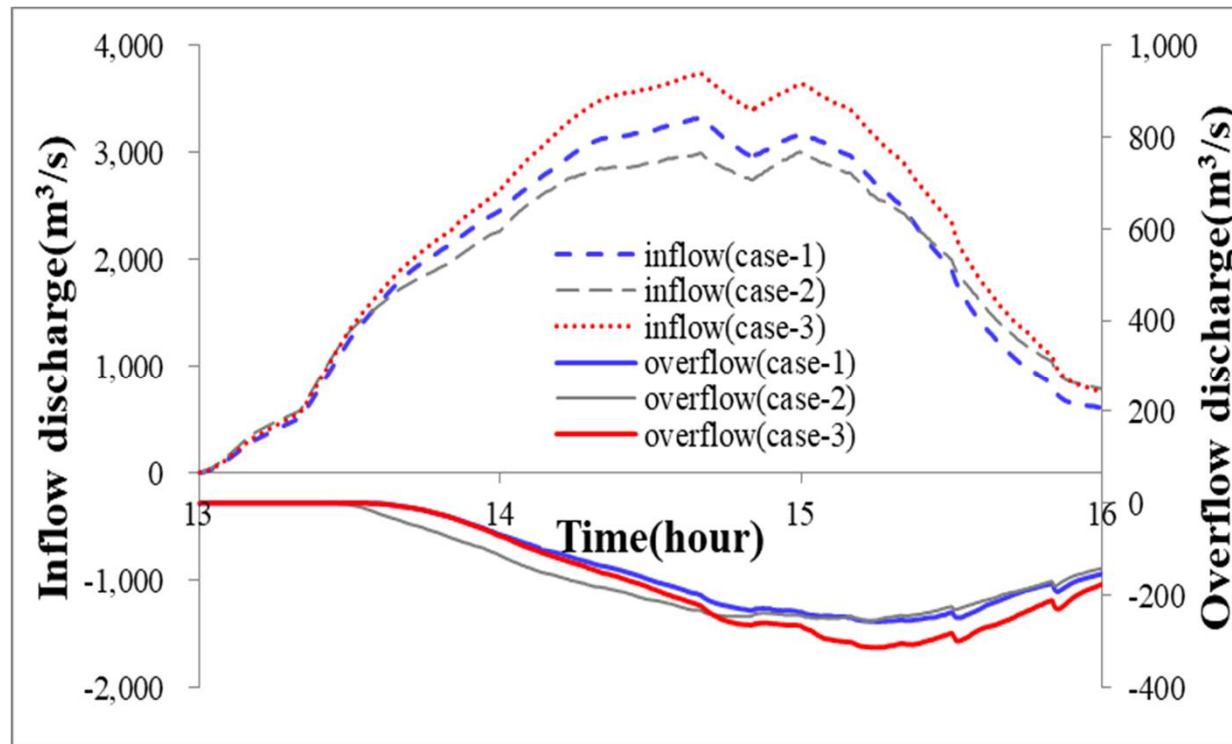
40 cm ≤ depth < 50 cm



50 cm < depth

Results

Time variation of interacting discharge



Conclusion

- Parallelisation efficiency is reduced on a somewhat lower computational load.
- The storm water capturing capacity of storm drains can affect the hydraulic behaviour of the sewerage system and a high capturing capacity may accelerate the overflow from the sewerage system.
- Early overflow from the sewerage system can interrupt inflow from the surface to the sewerage system so that a paradoxically high storm water capturing capacity may accelerate urban inundation.
- When the storm water conveyance capacity of a sewerage system is not fully exceeded, overflow can partly occur so that a fully coupled 1D/2D model is recommended for more realistic urban inundation modelling.

An aerial architectural rendering of a modern, multi-story building. The building features a large, transparent glass sphere in its center, which appears to be a central atrium or a large-scale art installation. The building's facade is composed of glass and metal panels, and it has a flat roof covered in green vegetation. The building is situated on a city street corner, with a pedestrian plaza in front of it. The plaza is paved with light-colored tiles and is populated with many small figures of people walking and sitting on benches. There are several young trees planted in the plaza. The surrounding area includes a road with cars and a crosswalk. The overall scene is bright and clear, suggesting a sunny day.

Thank you