

Implementation of reactive and predictive RTC schemes to optimize dry stormwater detention ponds




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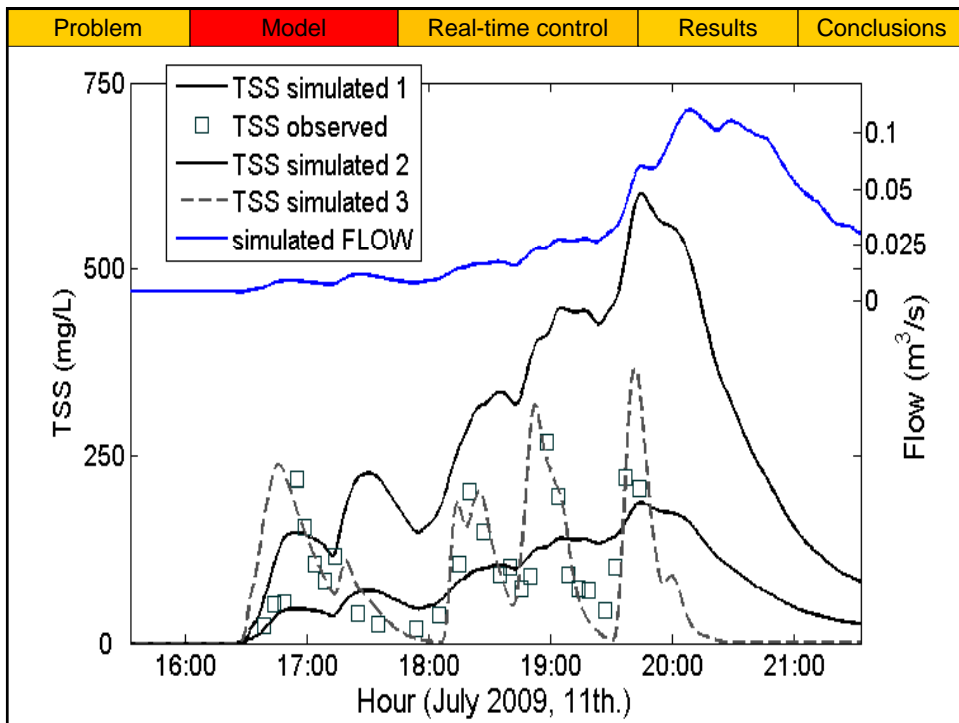
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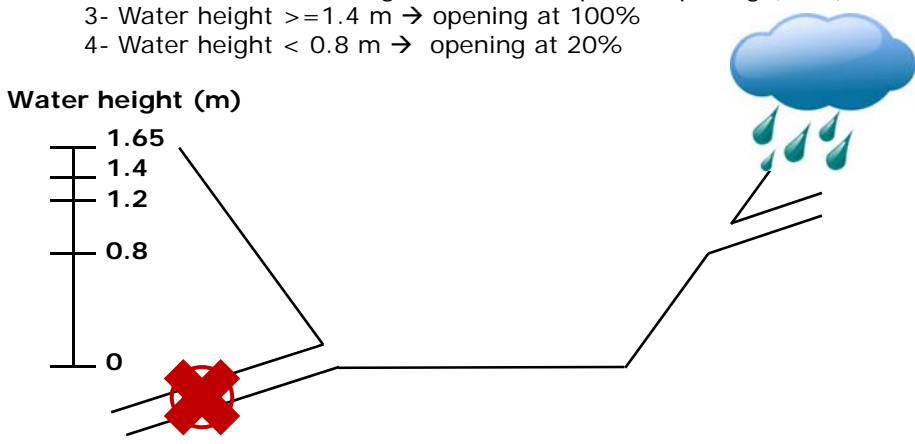
Problem	Model	Real-time control	Results	Conclusions
<h3 style="color: red;">Problem statement</h3>				
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Problem statement				
				
				
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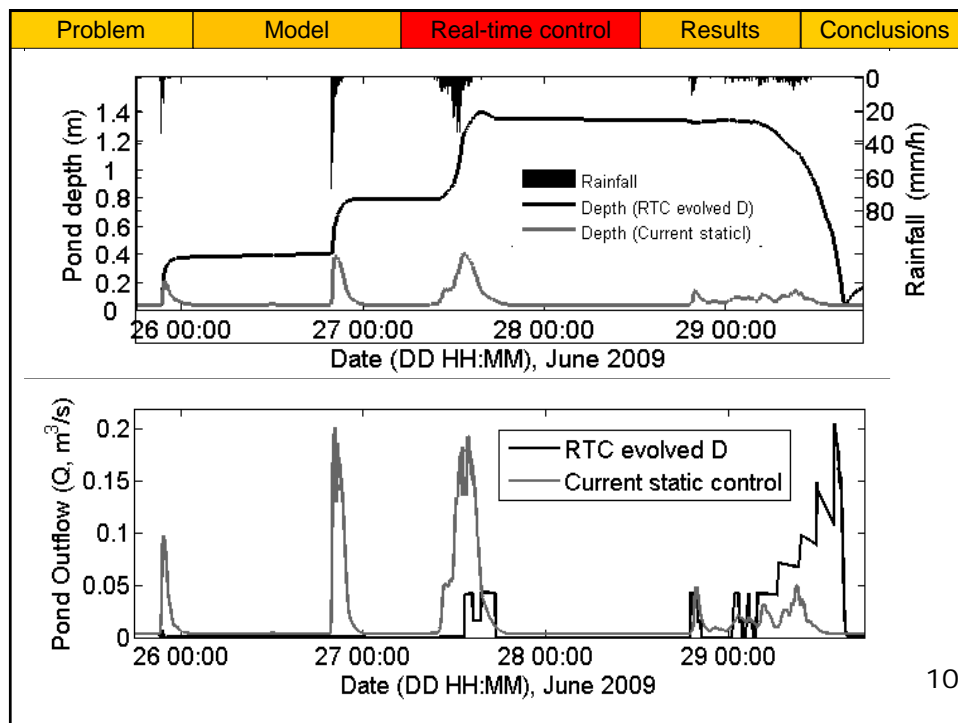
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Objective				
<p>➤ Develop rules to Control a stormwater pond's outflow in Real-Time (RTC):</p> <ul style="list-style-type: none"> • Reactive adaptation: P, H • Predictive adaptation: P, H, F 				
				
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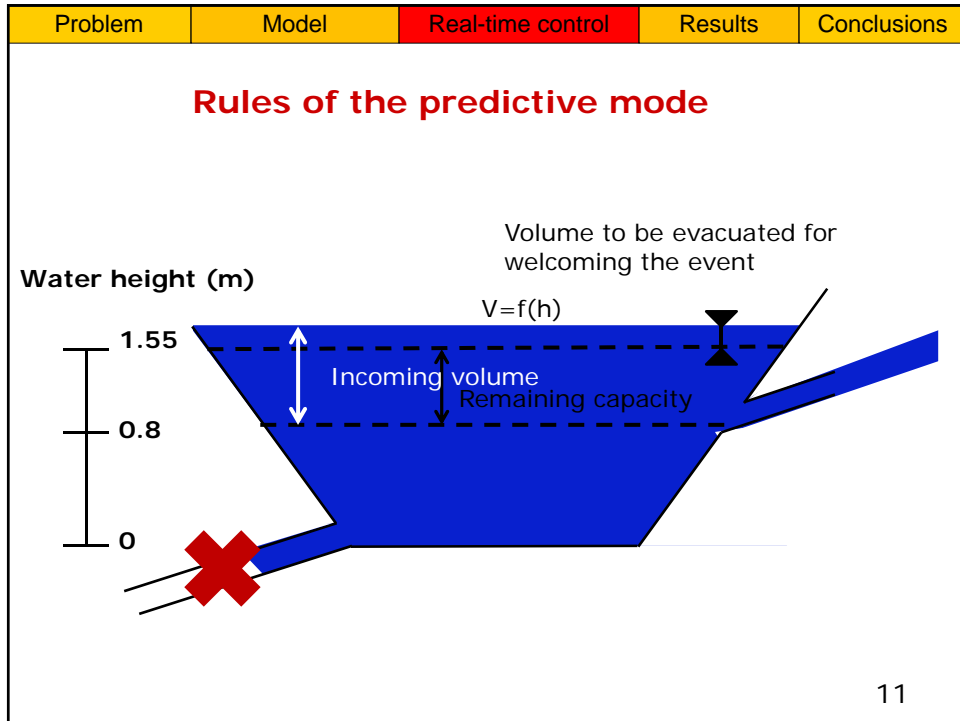


Problem	Model	Real-time control	Results	Conclusions
<p>Control objectives</p> <p>Aims / constraints</p> <ul style="list-style-type: none"> ➤ Detain first-flushed particles ➤ Maximize the water detention time ➤ Overflows are prohibited ➤ Perform a smooth emptying ➤ Avoid mosquitoes' breeding ➤ Minimize the number of operations to perform 				
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Problem	Model	Real-time control	Results	Conclusions
<p>Rules of the reactive mode</p> <ol style="list-style-type: none"> 1- Rainfall → outlet's closing 2- Rainfall and water height ≥ 1.2 m → partial opening (20%) 3- Water height ≥ 1.4 m → opening at 100% 4- Water height < 0.8 m → opening at 20% 				
<p>Water height (m)</p> 				
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Problem	Model	Real-time control	Results	Conclusions
Additional rules				
<ul style="list-style-type: none"> ➤ Mosquitoes If detention time > 3 days, partial opening (15%) ➤ Minimum detention time If 30 min. < dry time < 24h and $H \leq 1.10$ m, closing of the outlet ➤ Maximum "useful" detention time If 48h < dry time, outlet's opening at 15% 				
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Scenarios' evaluation

- Reactive: 6 consecutive summers (1030 days)
- Predictive: 3 months of 2010
- Indicators: TSS removal efficiency (%), hours with $Q > vs$, overflows, maximum detention time excesses
- Scenarios: current static, static 100L/s, evolved C, evolved D, Future E

	Maximum outflow (L/s)	Type	Mosquito breeding limitation
Static 1	350	Static	No
Static 2	100	Static	No
Evolved C	350	Reactive	No
Evolved D	350	Reactive	Yes
Future E	350	Predictive	Yes

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Problem	Model	Real-time control	Results	Conclusions		
Results: medium pond (1200 m³), long period						
		Static 1	Static 2	Evolved C	Evolved D	Future E
TSS removal (%)		49	50	86	84	78
Q > 0.06 m ³ /s (h)		251	312	153	137	140
Q > 0.15 m ³ /s (h)		66	0	38	35	40
Q > 0.20 m ³ /s (h)		21	0	38	35	19
Overflows (h)		0.5	18.6	4.8	4.1	0.5
Max. time excess (h)		0	0	3079	17	0
number of operations		0	0	1619	1950	15126
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Problem	Model	Real-time control	Results	Conclusions
Results: small pond (600 m³), short period				
		FE_OP	Evolved D	FE_FO
TSS removal (%)		57	69	68
Q > 0.06 m ³ /s (h)		14	7	13
Q > 0.15 m ³ /s (h)		5	4	4
Q > 0.20 m ³ /s (h)		0.0	0.2	0.2
Overflows (h)		1.1	1.3	1.3
Max. time excess (h)		0	0	0
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Problem	Model	Real-time control	Results	Conclusions
Conclusions				
<ul style="list-style-type: none"> ➤ Improved TSS removal efficiency (45 → 85–90%) ➤ Limited hydraulic shocks ➤ Safe strategies ➤ Mosquito breeding limitation ➤ Sensors: Water height and rainfall ➤ Predictive mode with real forecasts: worse than reactive mode 				
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Problem	Model	Real-time control	Results	Conclusions
Perspectives				
<ul style="list-style-type: none"> ➤ Integrated management of the whole system: urban areas + receiving rivers -> predictive on line ? ➤ Test other detention pond structures (wet pond, allowed overflows, floating risers, multiple-level outlets) ➤ Radar nowcasts 				
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