



UNIVERSITY
OF TRENTO - Italy

Department of Civil, Environmental
and Mechanical Engineering



International Association
for Hydro-Environment
Engineering and Research

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New challenges in hydraulic research and engineering

Trento 12-14 June, 2018



Fast early flood warning systems exploiting catchment specific behavior

June 14, 2018

Sebastiano Rusca, Juan Pablo Carbajal
Eawag: Swiss Federal Institute of Aquatic Science and Technology

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General framework



source: https://www.geocaching.com/geocache/GC4T07C_hwy-49-crossing-1921?guid=6b2187dd-2cf0-4ce3-880c-70a6cc544114



source:
<https://www.espazium.ch/entschrfetes-risiko-auf-nordsdachse>

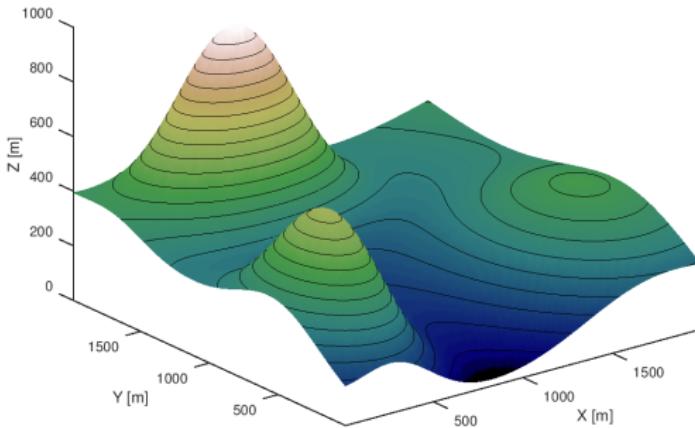


source:
<https://guardian.ng/news/heavy-rainfall-cuts-off-kuje-community>



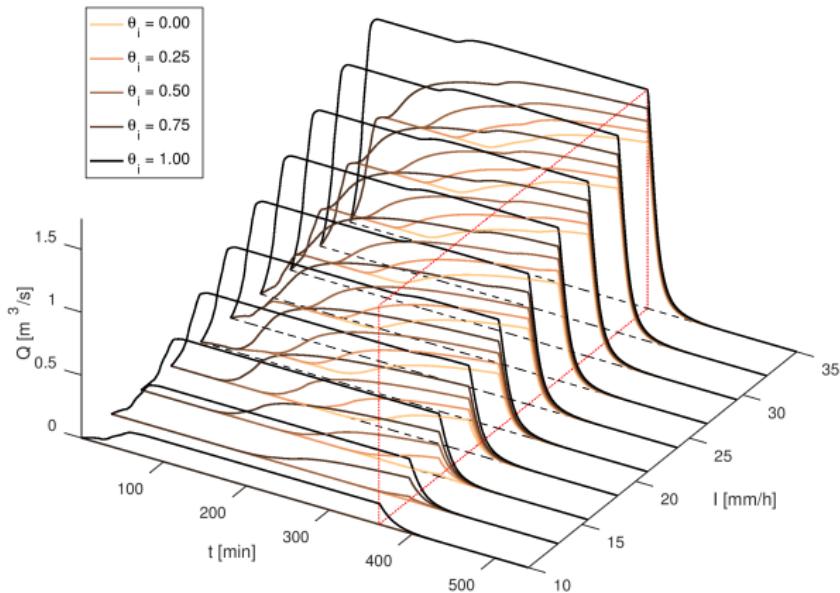
source: <https://www.endress.com/en/Field-instruments-overview/level-measurement/Radar-Micropilot-FMR10>

Simulations set-up

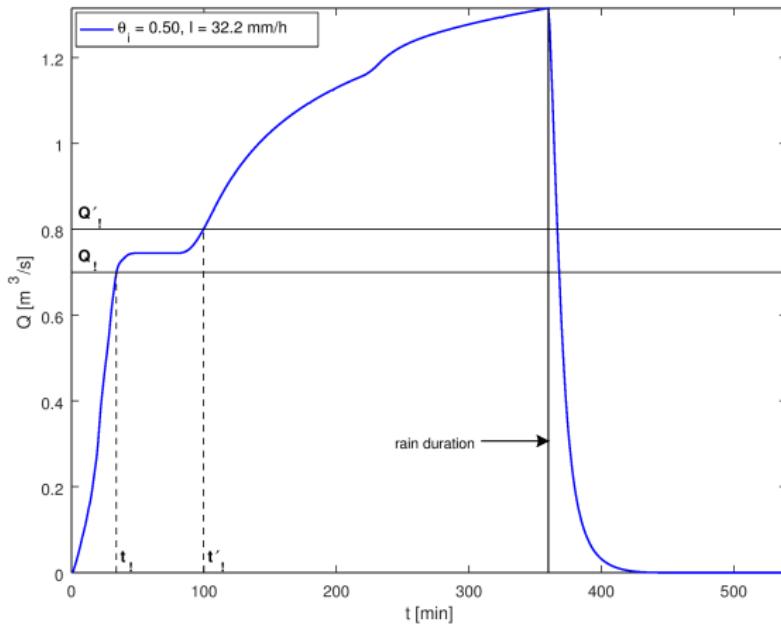


```
rain_intensities      = linspace (10, 35, 10); # [mm/h]
initial_saturations = linspace (0, 1, 5); # [-]
rain_duration        = 6; # [h]
simulation_duration = 9; # [h]
```

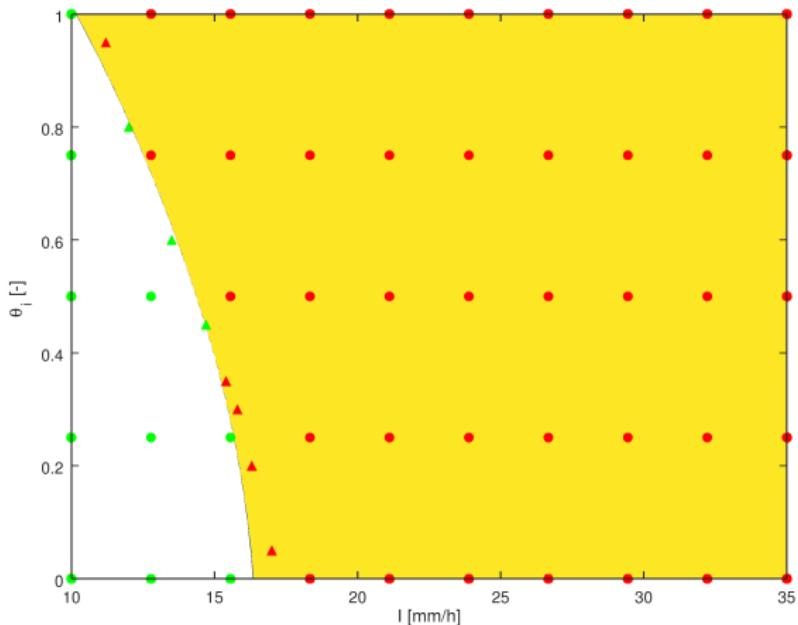
Simulations results



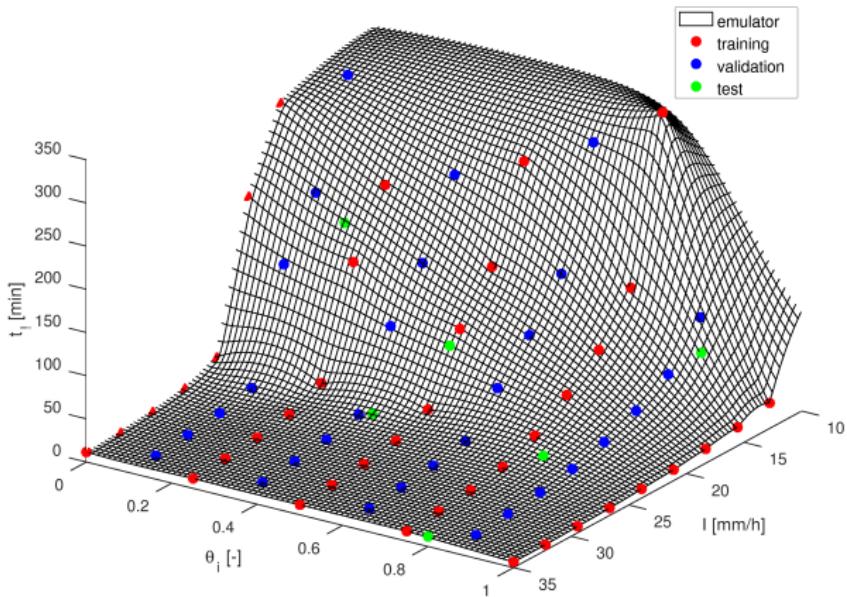
Dataset extraction



Rain events classification



Predicting the *time-to-threshold*



Predicting the *time-to-threshold*

Test performance

MAE [min, %]	RMSE [min]
6.0, 5.9	4.0

Duration one simulation: $\approx 30\text{ min}$

Duration one emulator-evaluation: $\approx 0.012\text{ s}$

speedup factor: $1.5 \cdot 10^5$

Conclusion & Outlook

- Gaussian Processes can be a valid technique to build efficient surrogate models for the solution of specific tasks
 - Training of the model with 86 data points $\approx 2.5\text{ s}$
 - Evaluation at one point $\approx 0.012\text{ s}$
- For computationally expensive numerical models, like those solving the shallow water equation, this results in enormous speedups
- Despite the simplicity of the considered model, the methodology developed can be used for the construction of more complex ones
- The performance of more complex models (e.g. with more parameters) should be tested on a real case study

THANK YOU FOR YOUR ATTENTION

<https://bitbucket.org/binello7/fswof2d>

https://bitbucket.org/binello7/master_thesis

