Wastewater treatment plant influent disturbance models

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The objective of this work is to present different concepts that have been developed over the past years for generating dynamic WWTP influent flow rate and load scenarios.

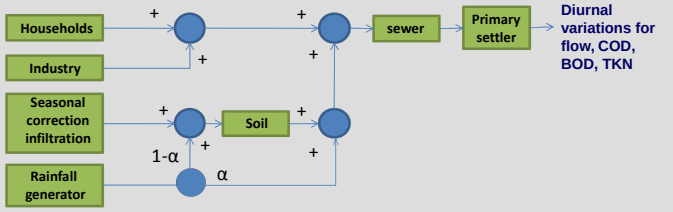
Problem: Dynamic plant inputs are a necessity to obtain a realistic picture of the simulated plant performance; normally measurements with the desired frequency and quality are not available.

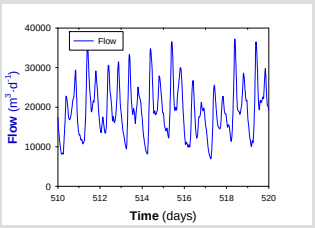
Solution: Dynamic influent flow rate data can be generated by means of Fourier series (e.g. Langergraber *et al*., 2008) a more complex phenomenological model (e.g. Gernaey *et al*., 2005) or a very complex and detailed deterministic model of the complete catchment area (e.g. Hernebring *et al*., 2002).

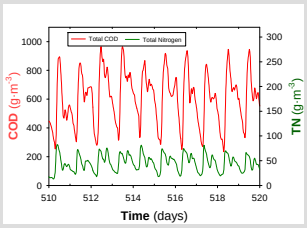
Benchmarking models (detailed example)

Gernaey *et al.* (2005, 2006)

Objective: Allow benchmark developers to generate an influent file containing all characteristics that are considered necessary for a thorough evaluation of **control** systems in BSM2.







Benchmarking models (other proposals)

Rosen *et al.*, 2008

Objective: Describe toxic or inhibitory influent shock loads in the influent using a Markov chain approach to evaluate **fault detection** methods. Used in the BSM1_LT platform.

Benedetti (2006)

Objective: Simulate influent scenarios for weather (alpine, oceanic, continental, Mediterranean), loading (ratio between households and industry) and seasonal activities (tourism) to evaluate the robustness of **plant designs and operation strategies**

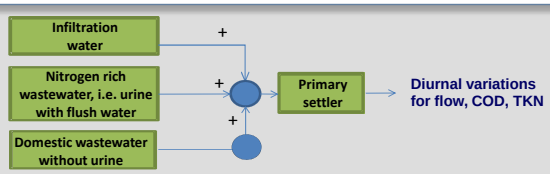
Lindblom *et al.* (2006) and De Keyser *et al.* (2010)

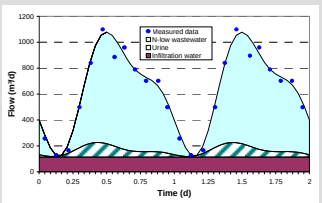
Objective: Generation of influent micropollutant profiles in order to model the **fate of micropollutants** in WWT systems.

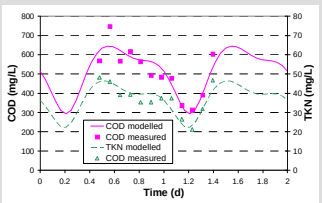
Full-scale application models (detailed example)

Langergraber *et al.* (2008) and Alex *et al.* (2009)

Objective: Generate realistic diurnal variations for dynamic influent data in the case that no measured data are available to **decrease additional effort for calibration/validation**.







Full-scale application models (other proposals)

Devisscher *et al.* (2006)

Objective: Provide synthetic data to fill the gaps in experimental records in view of **estimation of costs and benefits of advanced control on treatment plants**.

Pons *et al.* (2009) and Béraud *et al.* (2007)

Objective: Provide synthetic data to fill the gaps in experimental records to generate dynamic influent profiles for **modeling** studies

TAKE HOME MESSAGE

- ✓ Different influent generators are used for model calibration, control, WWTP design, fault detection and fate of pollutants modeling
- ✓ A review is necessary to:
  - ✓ Identify critical knowledge gaps in current WWTP influent disturbance models
  - ✓ Define specific research tasks that should be addressed in the future to promote more general acceptance and use of WWTP influent disturbance models