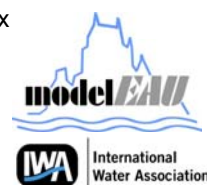


Biokinetic parameter values that require your attention for each system being simulated ?

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ASM's: what can we learn ?

Model	Year	WWTP#	Processes	Components	Parameters*
'ASM0'	1987	C	2	3	4
ASM1	1987	C,N	9	13	19
ASM2	1994	C,N,P	20	19	65
ASM2d	1999	C,N,P	22	19	67
ASM3	1999	C,N	13	13	36
ASM3P	2001	C,N,P	24	17	71
ADM1	2002	X	28	36	96
BioWin	2007	C,N,P,X	51	62	470

*C= COD-removal, N= N-removal, P= P-removal, X = Sludge digestion

*Parameters: stoichiometric, kinetic & composition parameters

Important biokinetic parameters (Vanrolleghem)

Non-identifiability: what to do?

Four different approaches are observed:

1. Just live with the problem and estimate all par's
2. Reduce the model
3. Get additional, informative data
4. Select identifiable parameters and leave the others at « default » values

Important biokinetic parameters (Vanrolleghem)

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How to select identifiable parameters ?

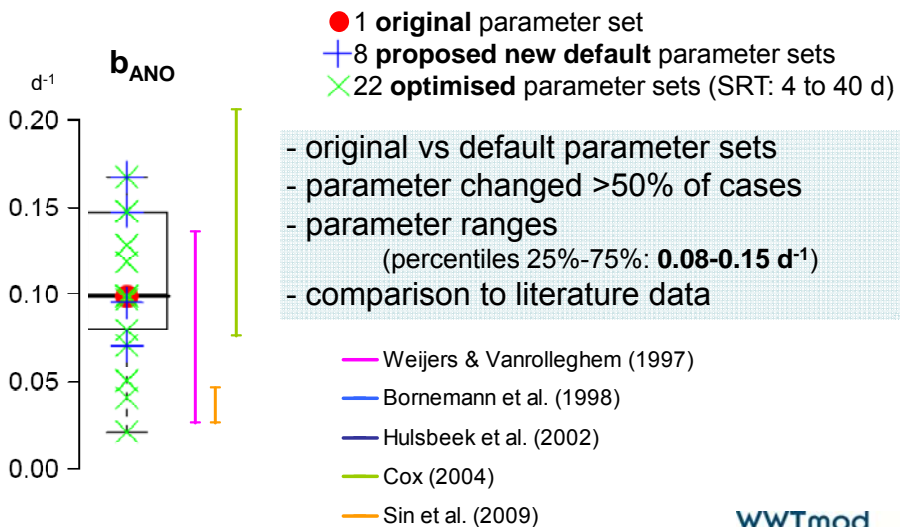
Follow your peers (Hauduc et al., tomorrow)

- A database of calibration studies was created
 - Questionnaire (28 answers)
 - Literature (50 papers)
- Analysis for ASM1 and ASM2
- What parameters should be changed?

Important biokinetic parameters (Vanrolleghem)

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Results for ASM1



9 Important biokinetic parameters (Vanrolleghem)



Results for ASM1

	default ≠ original	modified >50%	large ranges >33%	ranges ≠ literature
b_{ANO}	X	X	X	X
$\mu_{ANO, Max}$	X	X		
Y_{OHO}	X	X		
$K_{SB, OHO}$	X		X	X
$K_{NOx, OHO}$	X		X	
$K_{NHx, ANO}$	X			X

14 Important biokinetic parameters (Vanrolleghem)



Finding important parameters

Different methods proposed:

Most promising one:

Local sensitivity analysis (Brun et al., 2002):

$$\delta_j = \sqrt{\frac{1}{n} \sum_{i=1}^n s_{i,j}^2} \quad \text{with} \quad s_{i,j} = \frac{\Delta p_j}{s c_i} \cdot \frac{\partial y_i}{\partial p_j}$$

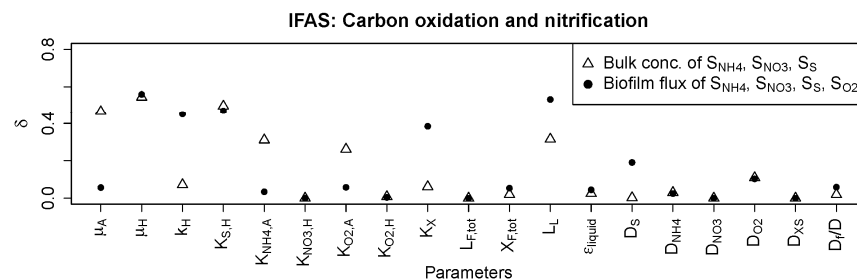
= Sum of sensitivities of all measured variables i to a parameter j

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Important biokinetic parameters (Vanrolleghem)

Finding important parameters

Sensitivity of bulk conc. \neq biofilm flux

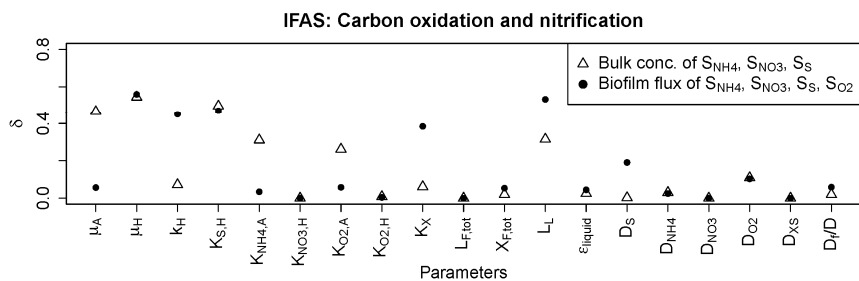


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Important biokinetic parameters (Vanrolleghem)

Finding important parameters

Sensitivity of bulk conc. \neq biofilm flux (20 °C)

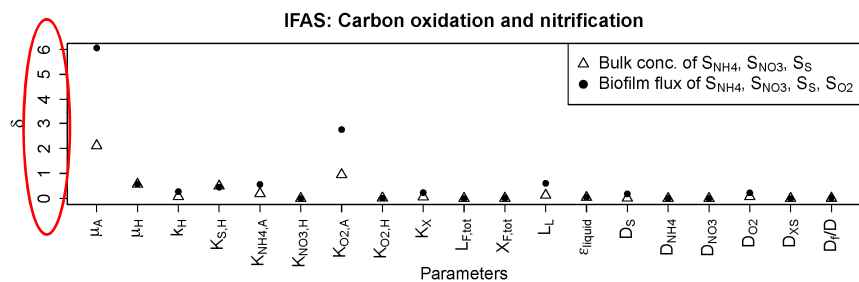


Important biokinetic parameters (Vanrolleghem)



Finding important parameters

Sensitivity of bulk conc. \neq biofilm flux (12 °C)



Important biokinetic parameters (Vanrolleghem)



Conclusions of the benchmark study:

1. Lumped parameters (K_S , ...) lead to process-dependent parameters (not intrinsic) → delump !
2. Mass transfer boundary layer thickness!
3. Sensitivity ranking depends on temperature (μ_A , $K_{O,A}$)
4. Model results are sensitive to the parameters that influence the transport/transformation of the substrate that is least available inside the biofilm
5. Perform a preliminary modelling study to:
 - prepare a sensitivity analysis to identify system-specific influential parameters, and
 - guide a testing program design

Important biokinetic parameters (Vanrolleghem)

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Important biokinetic parameters (Vanrolleghem)

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