

Good Modelling Practice in AS modelling

From existing guidelines to a unified protocol

Sylvie Gillot
IWA Task Group on Good Modelling Practice

http://www.modeleau.org/GMP_TG/

From existing guidelines to a unified protocol

Introduction

Quality assurance is essential to increase the use of AS models in practice

- AS modelling:
 - 4 main protocols (BIOMATH, HSG, STOWA, WERF)
 - Japanese Sewage Works protocol
 - others more or less visible (case studies)
- General guidelines (water management)
 - HarmoniQuA project (MoST)

From existing guidelines to a unified protocol

Introduction

Objectives:

- Combining existing protocols developed in the WWT field (AS modelling)
- Taking into account key elements of general Quality Assurance Guidelines

⇒ A unified protocol

From existing guidelines to a unified protocol

Introduction - Table of content

Introduction to GMP

Unified Protocol

Objectives, application, pitfalls, model limitations

How to run a model

Wastewater characterisation

Data collection, evaluation and reconciliation

Plant model set-up

Calibration (sub-models)

Model prediction quality

Use of models

Documentation and reporting

Industrial wastewater

Appendix (Methods, parameter sets, etc.)

From existing guidelines to a unified protocol

Outline

Brief comparison of existing protocols

Towards a unified protocol

Overview of the proposed protocol

Implications for The GMP Guidelines

From existing guidelines to a unified protocol

Existing protocols (1/4)

Similarities in AS modelling guidelines

- mainly practical protocols
- definition of the project objectives
- calibration/validation step
- data quality checking important

Topic	Description	Chapter Nos.
Project overview	Synopsis of project background and objectives and of current activated sludge models and simulators	1.0-3.0
Parameter characterization	Identification and discussion of parameter measurement/estimation methods. Describes background and methods of measuring six components of COD, TRN components and influent solids characterization	4.0-12.0
Stoichiometric model parameters	Description of background and methods of measuring COD, N and P content of biosolids	13.0-15.0
Nitrification	Description of background and methods of measuring nitrification rate, nitrifier decay rate and denitrification rate	16.0-19.0
Model calibration	Guidance on the use of activated sludge model simulators of model calibration	19.0-21.0
Examples of model calibration - municipal applications	Demonstration of utilizing bench and pilot scale data, and full-scale applications for carbonaceous oxidation, biological nitrogen control and biological nitrogen and phosphorus control	22.0-25.0
Examples of model calibration - industrial applications	Model calibration in petroleum refineries, a petrochemical plant and a chemical plant	26.0-30.0
Compilation of experimental work in support of method development	Summary of experimental data for testing the low F/M, high F/M and washout methods of measuring nitrification rate and the flocculation/filtration, ultrafiltration and bioassay methods of measuring RBCOD	31.0-40.0

BIOMATH

HSG

STOWA

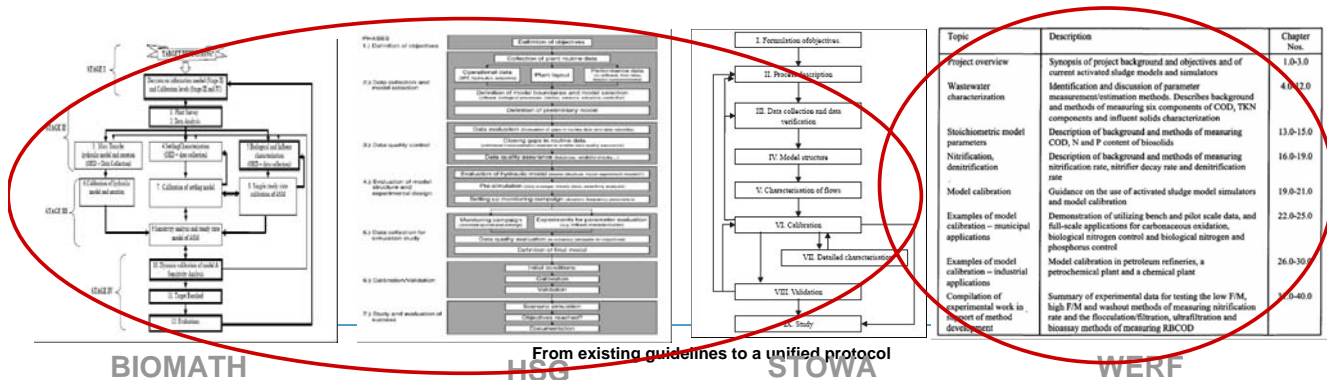
WERF

From existing guidelines to a unified protocol

Existing protocols (2/4)

Main differences

- structured overview vs reference manual
- practical protocols
 - design of measuring campaigns
 - experimental methods
 - calibration procedures



Existing protocols (3/4)

Main differences may be explained by the rationale for the development of the guidelines

- BIOMATH: modelling methodologies
- HSG: practical framework
- STOWA, WERF: practical procedures, experimental methods

Existing protocols (4/4)

Requirements to a practical use and acceptance
(Refsgaard *et al.*, 2005, HarmoniQuA project):

- Scientific maturity
- Market maturity
- Specific aspects on the interaction modeller and client

From existing guidelines to a unified protocol

Towards a unified protocol (1/3)

In addition to practical protocols, guidance of the
interaction between modeller and client:

- Define the objectives
- Define the performance criteria
(model accuracy vs objectives)
- Review the different steps

From existing guidelines to a unified protocol

Towards a unified protocol (2/3)

Key elements:

- a structured overview, including feedback loops
- data requirements (objectives)
- practical methodologies:
 - characterisation of: influent WW, biomass, settling, hydraulics and biological processes
 - data quality checking methods

From existing guidelines to a unified protocol

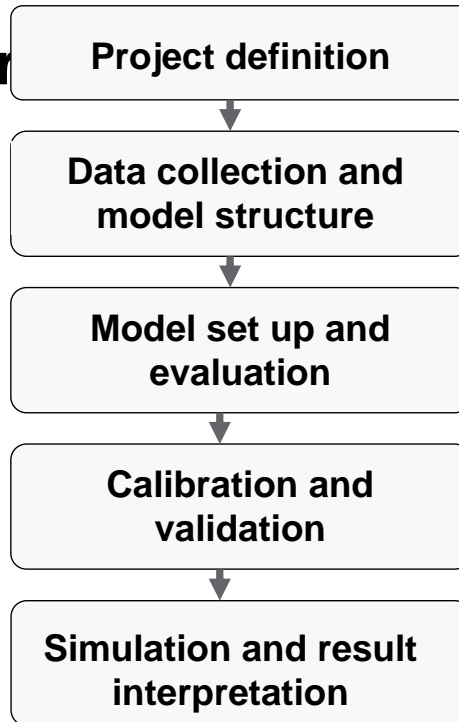
Towards a unified protocol (3/3)

Key elements:

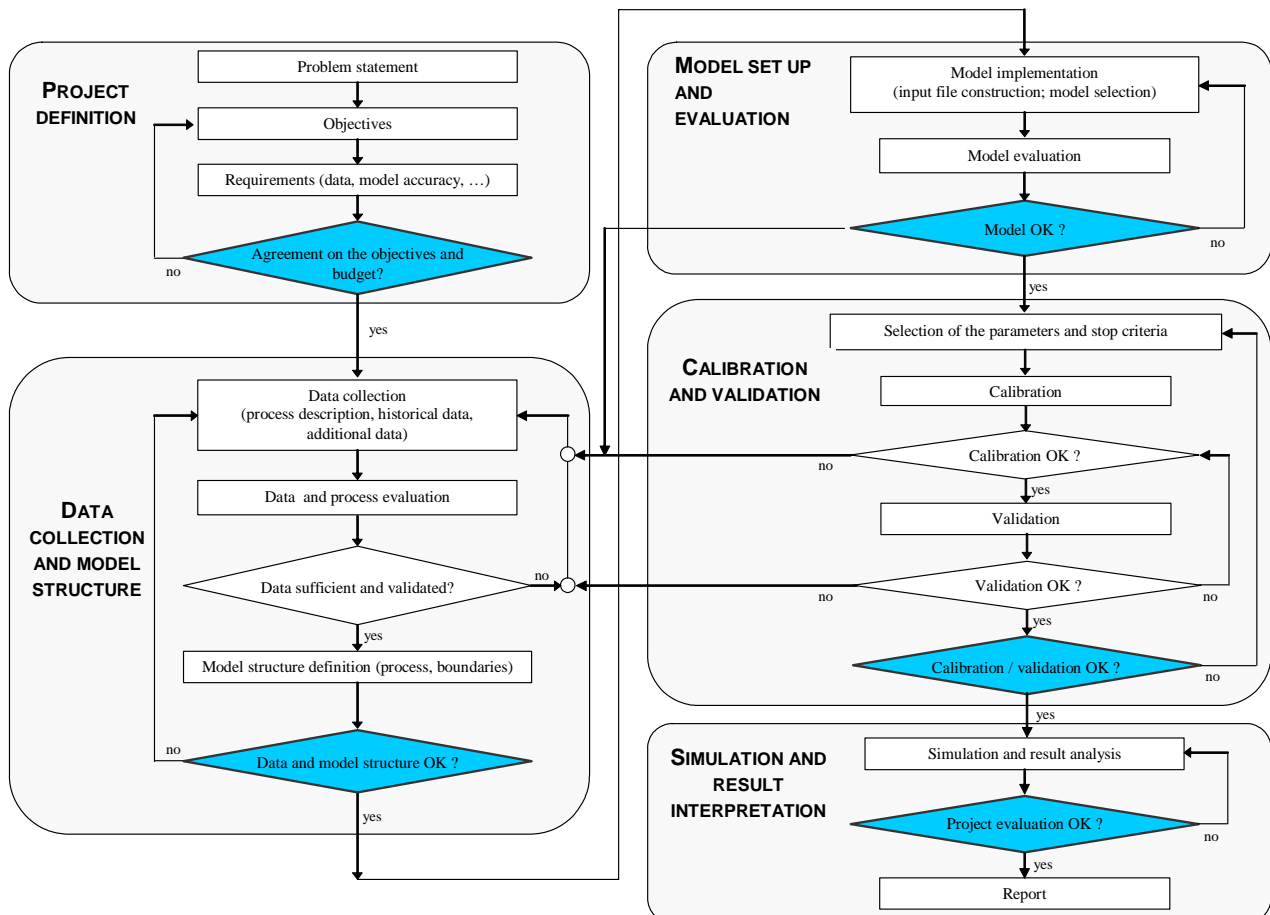
- calibration/validation procedures - parameter selection, in relation to the objectives (calibration level)
- model accuracy
- examples, including pitfalls

From existing guidelines to a unified protocol

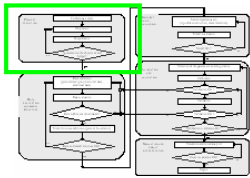
Proposed protocol



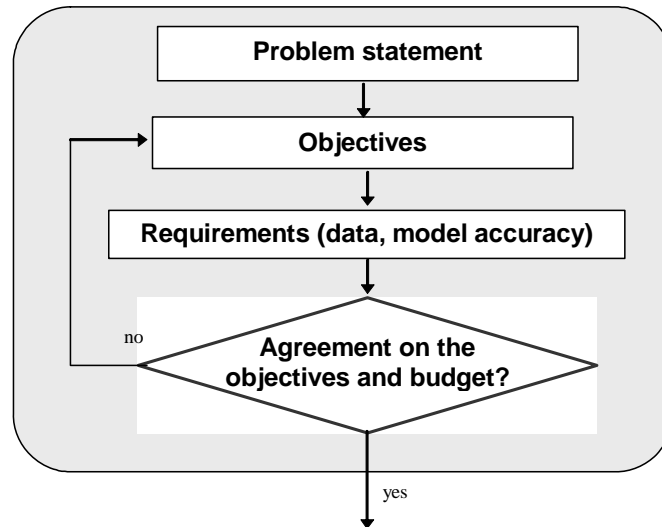
From existing guidelines to a unified protocol



(HarmoniQuA structure)

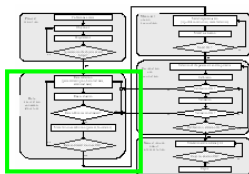


Step 1

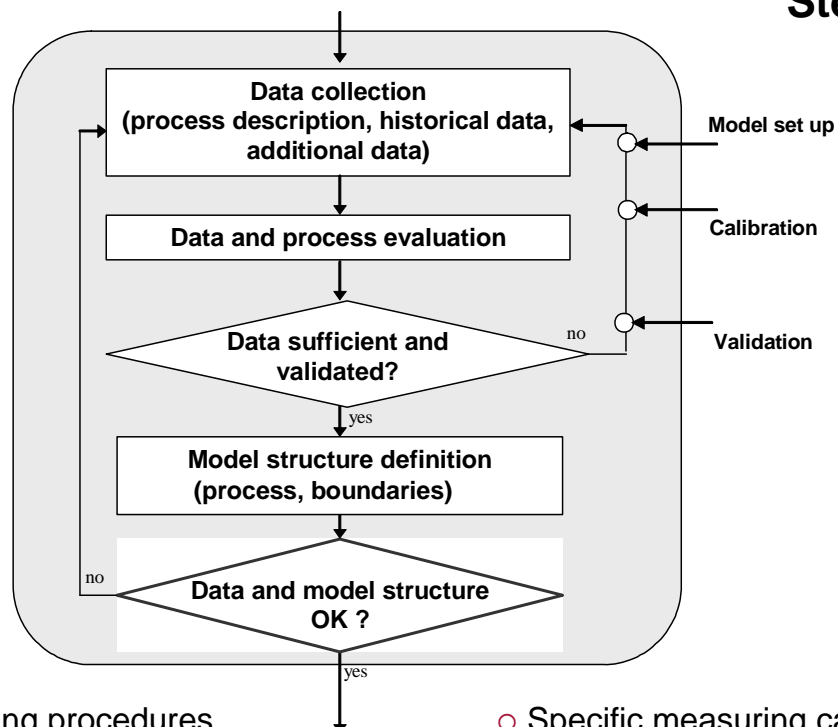


- Define scope and set milestones
- Define data requirements and model accuracy, in relation to the objectives

From existing guidelines to a unified protocol

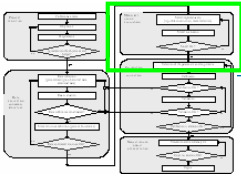


Step 2

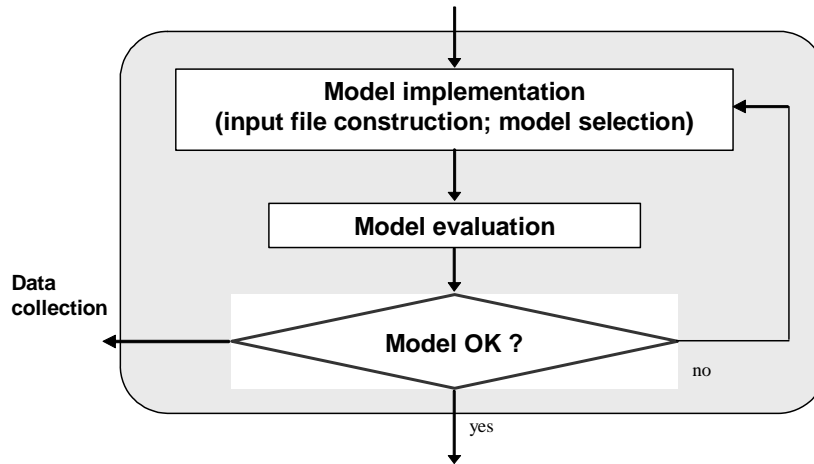


- Data quality checking procedures
- Specific measuring campaigns

From existing guidelines to a unified protocol

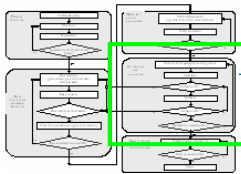


Step 3

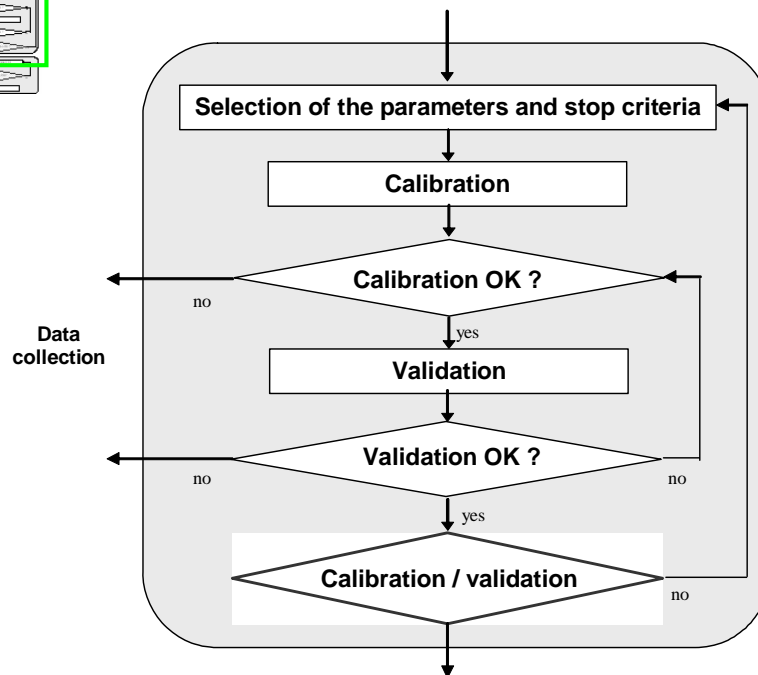


- o Procedures/guidance for model selection
(model structure, settling model, biological model)

From existing guidelines to a unified protocol

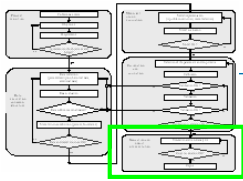


Step 4

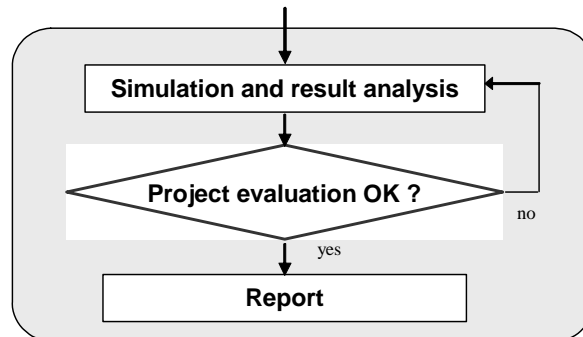


- o Calibration/validation procedures
(Define performance criteria, Sensitivity analysis (if required))

From existing guidelines to a unified protocol



Step 5



From existing guidelines to a unified protocol

Conclusion

Proposed unified protocol, 5 main steps

- Definition of the project
- Data collection and model structure
- Model set up and evaluation
- Calibration and validation
- Simulation and result interpretation

From existing guidelines to a unified protocol

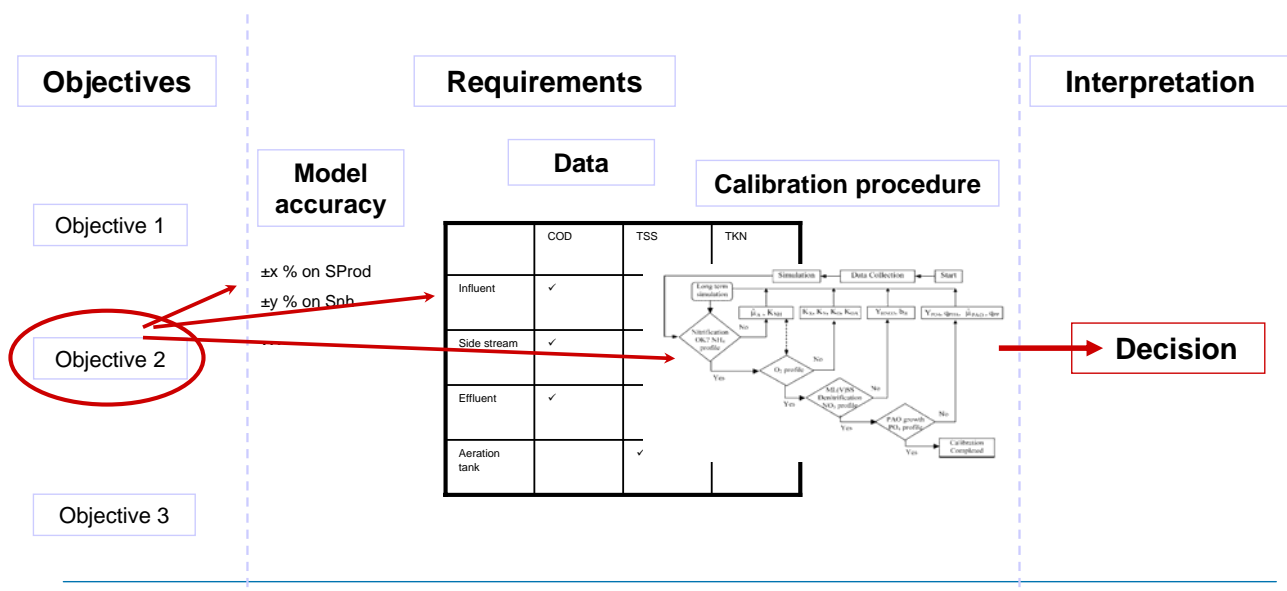
Conclusion

IWA Guidelines on Good Modelling Practice

- Guidance of the interaction modeller and client (Objectives, Performance criteria, Reviews)
- Practical guidance (Data requirements, Practical methodologies, Calibration/validation procedures, model accuracy)
- A way to present the different levels (of data requirements, calibration, ...) as a function of the defined objectives

From existing guidelines to a unified protocol

An application matrix ?



From existing guidelines to a unified protocol



Sylvie Gillot



sylvie.gillot@cemagref.fr