EADS Innovation Works

Journée Validation de codes numériques

Co-organisée par le GDR CNRS MASCOT NUM, l'Institut de maîtrise des Risques et la Société Francaise de Statistiques

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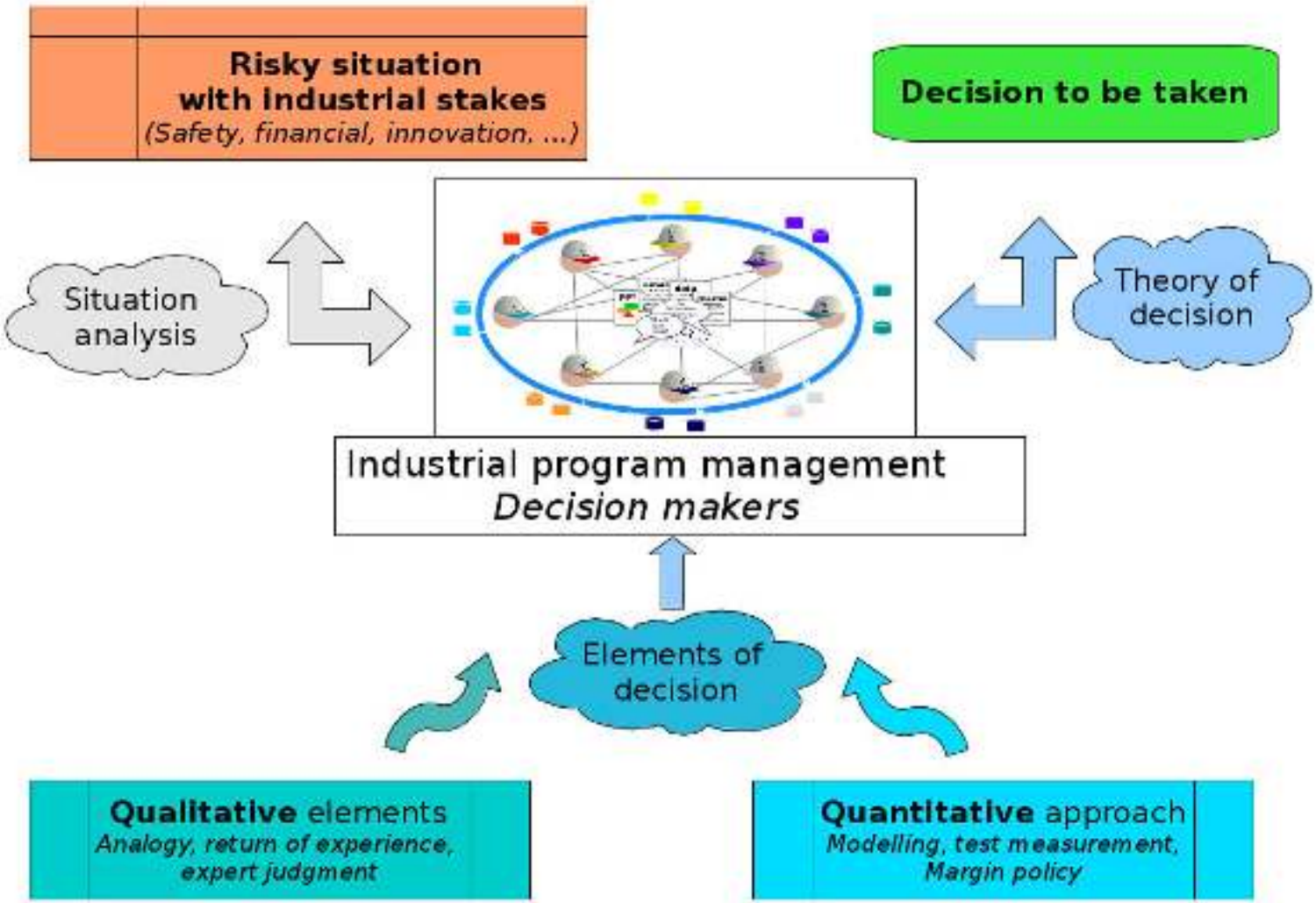
Paris, le 13 novembre 2013

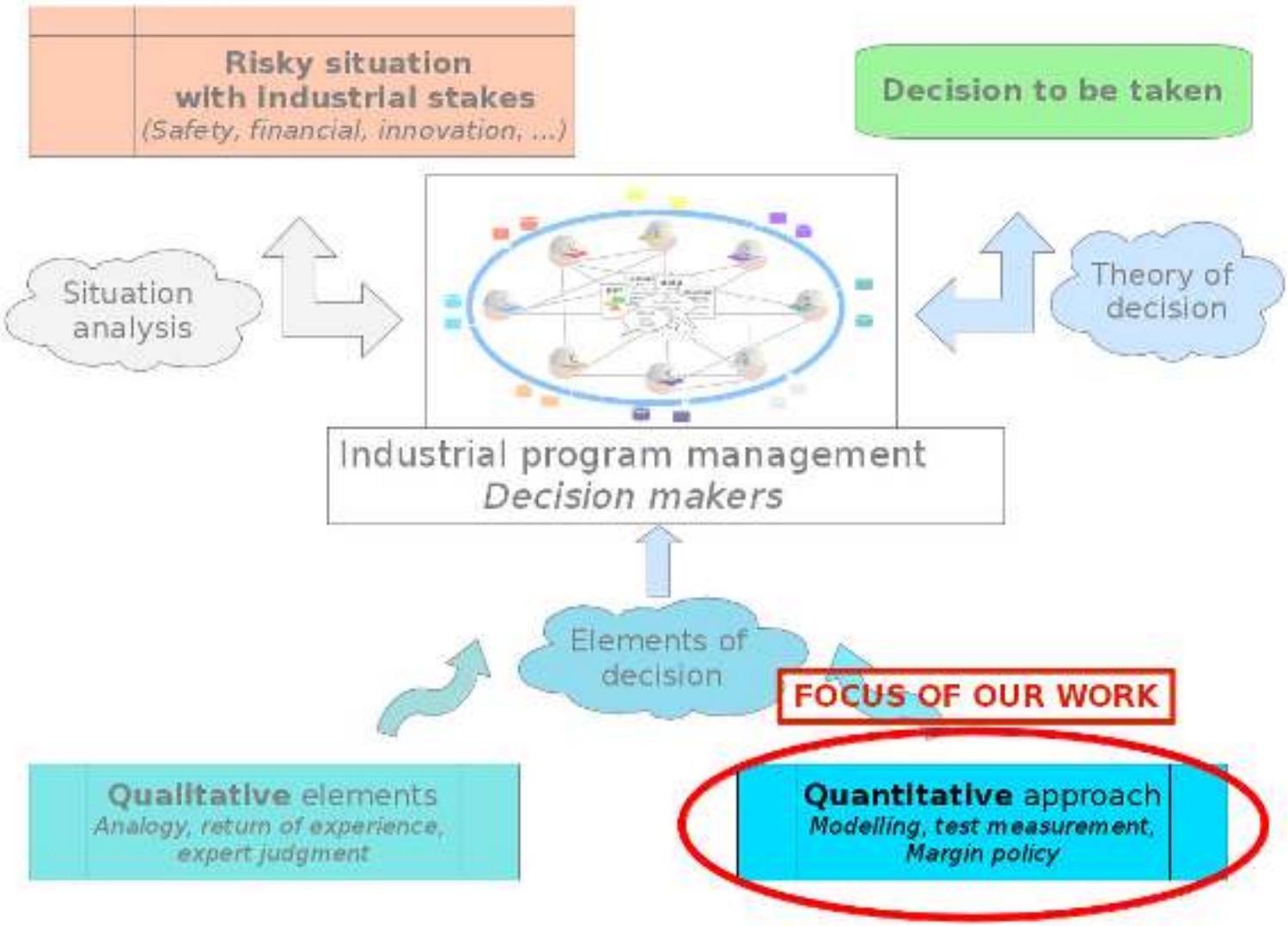
Outline

Outline

Support to decision process



Support to decision process



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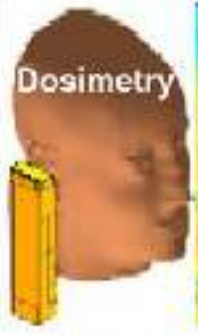
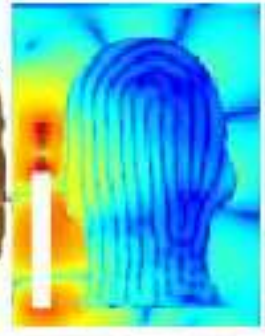
Various contexts of validation

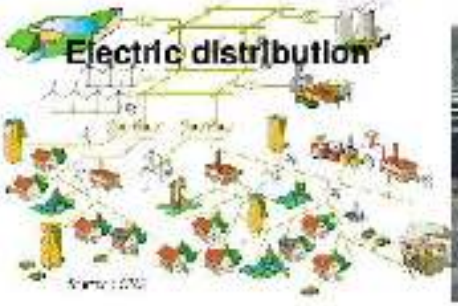
SAFETY CONTEXTS

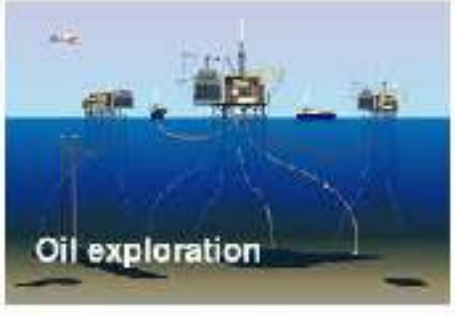




Various contexts of validation

ECONOMICAL CONTEXTS





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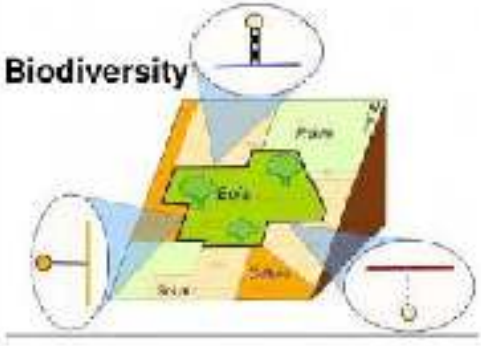
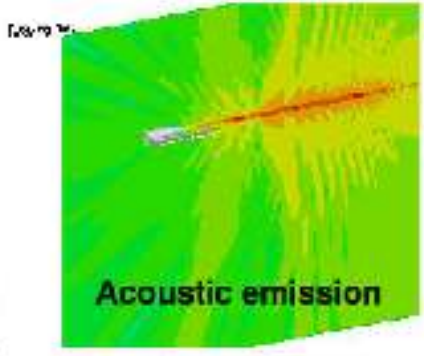
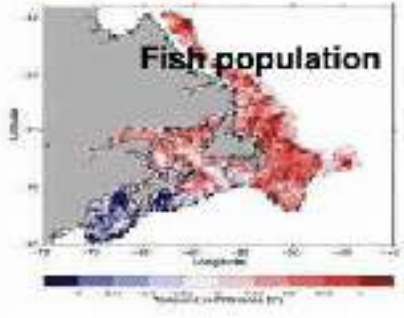
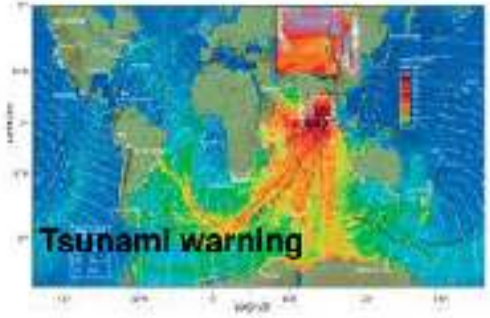
Various contexts of validation

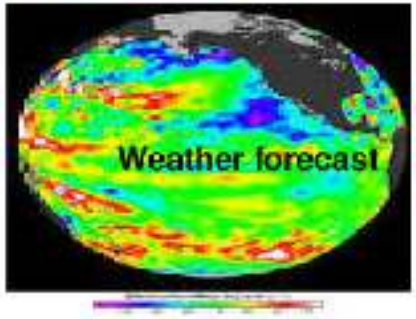
ENVIRONMENTAL CONTEXTS











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Outline

Complexity of the physical representation

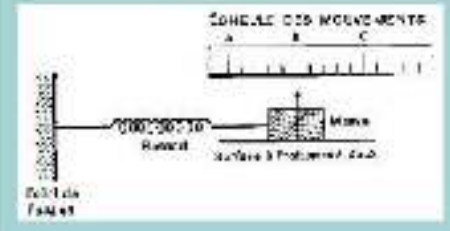
BASIC ELEMENTS TO MEASURE THE COMPLEXITY OF A SIMULATION

- Modelling assumptions
- Level of detail
- Linearity

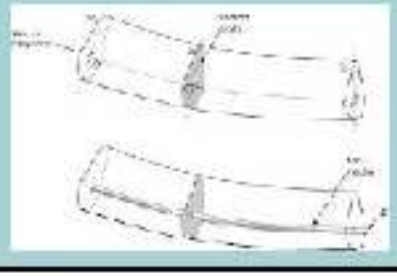
→ ***Complexity to represent the disciplinary problem***

Example

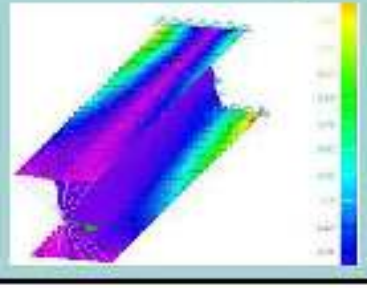
Spring



Beam



Linear elasticity



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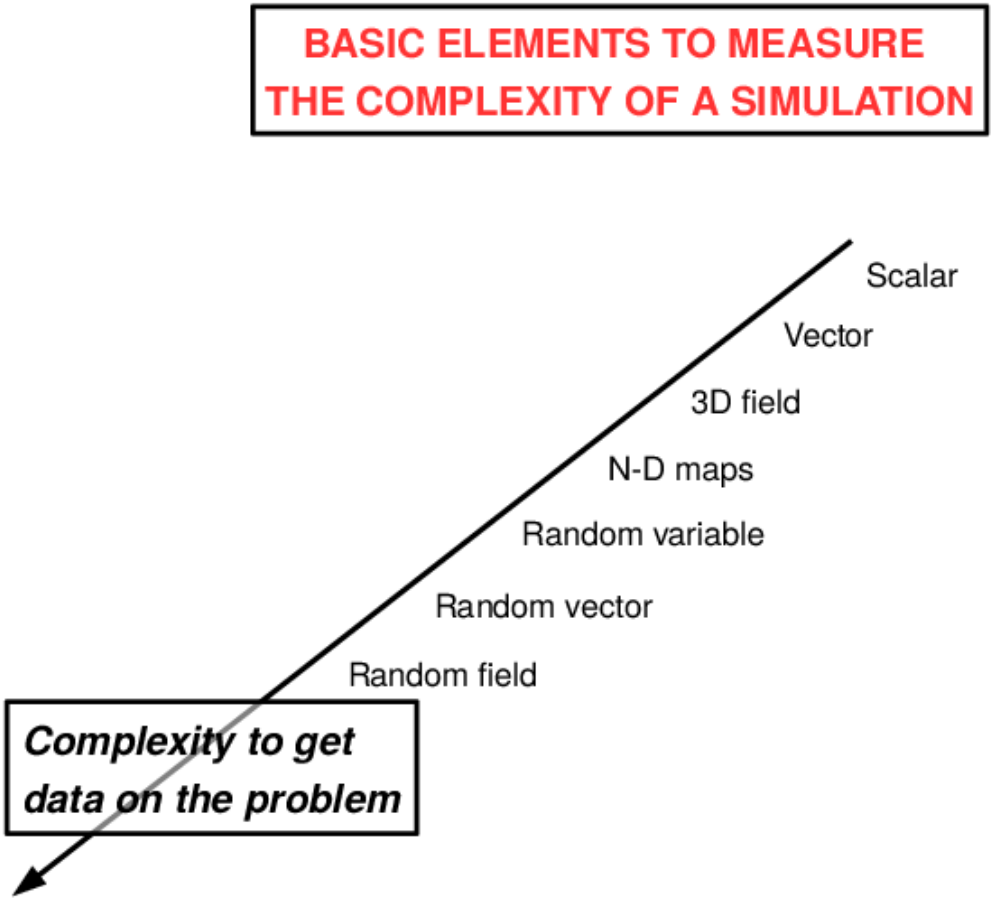
Complexity linked to the input data model



Complexity linked to the multiplicity of actors and location

BASIC ELEMENTS TO MEASURE THE COMPLEXITY OF A SIMULATION

Organisation

Size of the model

Complexity to build the numerical model

- # of actors to build/shape/integrate the compoenents of the numerical model
- # of numerical components to build the model
- # of degrees of freedoms

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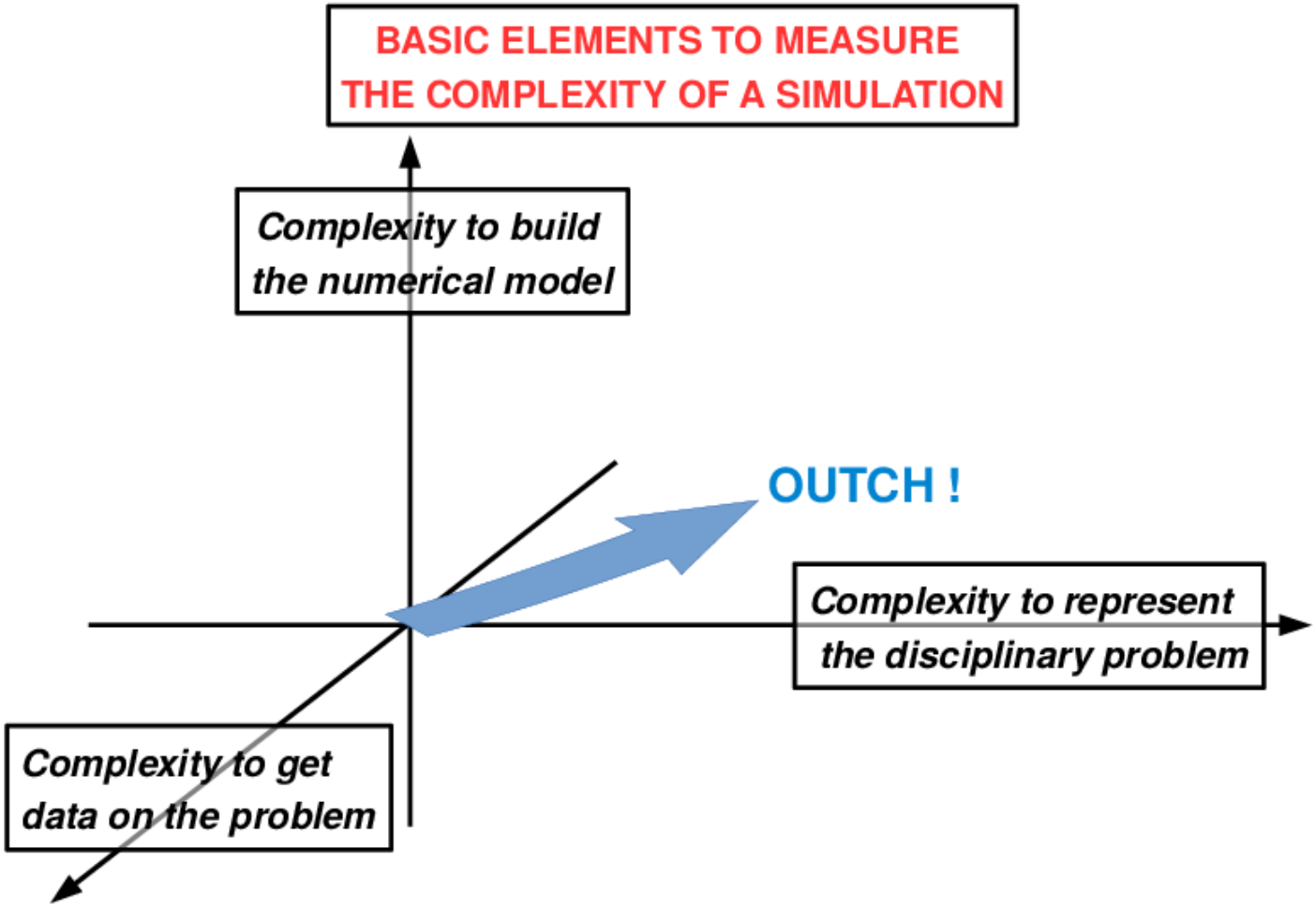
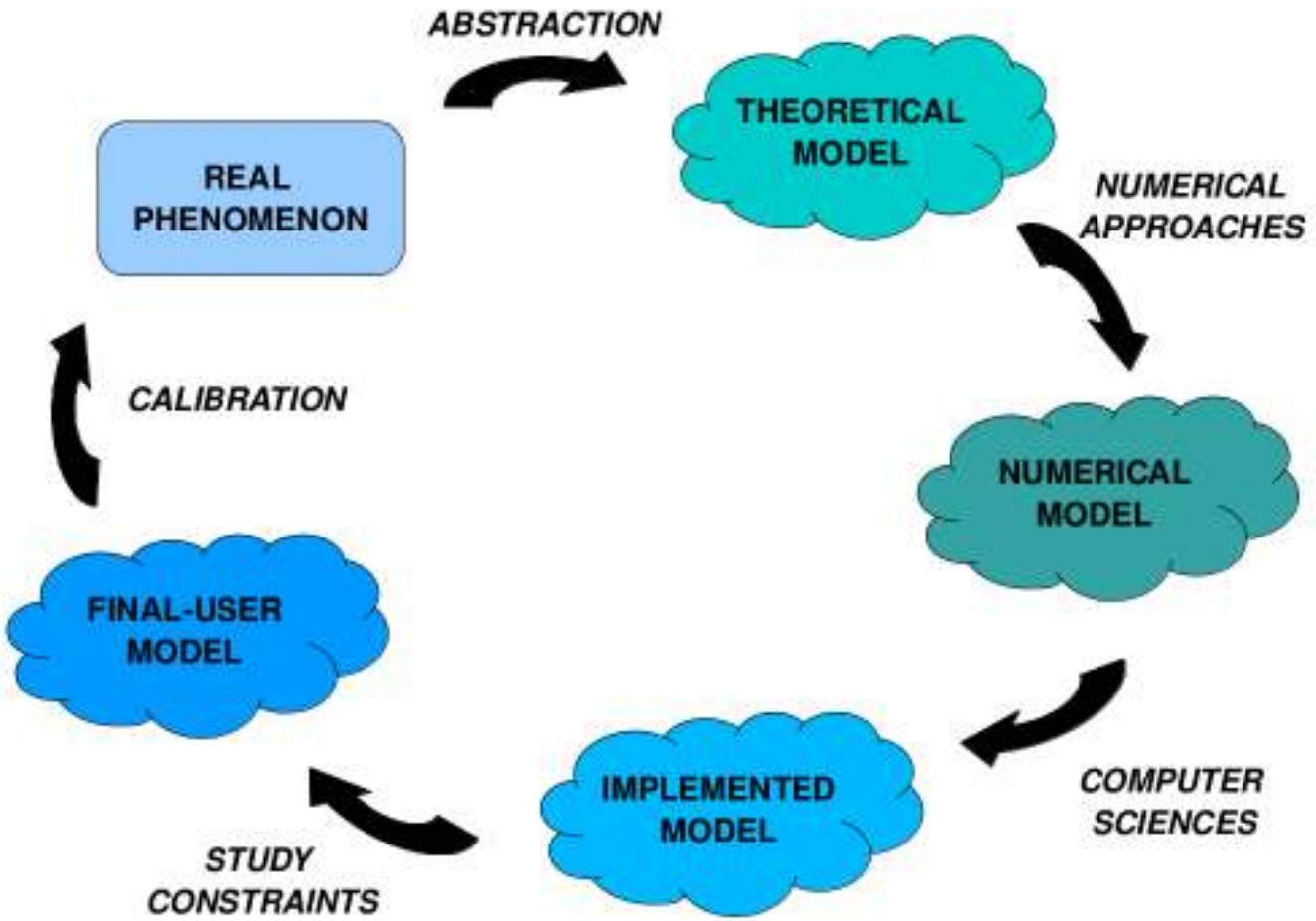
The challenge of complexities



The modelling circle



Standards and tools

Example of Credibility Scoring – With Factor Weighting (NASA HRP Implementation)

Credibility Assessment Factors	Evidence			Technical Review		Factor Score	Weighted Subfactor Score	Overall Score	Sufficiency Threshold
	Score*	Weight	Threshold*	Score*	Threshold*				
1 Verification	2	0.20	3	2	3	2	0.40	1.75	2.54
2 Validation	2	0.25	2	2	3	2	0.50		
3 Input Pedigree	2	0.10	3	2	3	2	0.20		
4 Results Uncertainty	0	0.10	2	0	3	0	0.00		
5 Results Robustness	2	0.10	2	2	3	2	0.20		
6 Use History	1	0.15	2	N/A	N/A	1	0.15		
7 M&S Management	2	0.05	3	N/A	N/A	2	0.10		
8 People Qualifications	4	0.05	3	N/A	N/A	4	0.20		

* Maximum = 4, where 0=insufficient evidence and 4=highest fidelity/rigor achievable

† Minimum = 0.05, maximum = 0.25 and sum of all weights must equal 1.0

*Threshold: The required score agreed to by the end user/customer and M&S provider to achieve sufficient confidence in the M&S for intended use

Subfactors	Weight
Evidence	0.7
Technical Review	0.3

Legend	
	CAS Score ≥ Threshold *Assess credibility requirements*
	Threshold ≥ CAS Score ≥ (Threshold-0.5) *Ready for use*
	(Threshold-0.5) ≥ CAS Score ≥ (Threshold-1.0) *Use with caution*
	CAS Score < (Threshold-1.0) *Use not recommended or to be used with EXTREME CAUTION by subject matter experts only*

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Outline

Open challenges

- Formalization of the various validation problems
- The challenges of complexity
- Where to begin the validation ?
- What can be automized ?
- What is the economical value of these validation activities ?
- Organisational challenge
- Development of standards/process/tools

Outline

9:00	Welcome of the participants	
9:15 - 9:30	Introduction	F. Mangeant
9:30 - 10:30	The Validation issue in Modeling and Simulation	M. Sancandi
10:30 - 10:45	Coffee Break	
10:45 - 11:15	Virtual Hybrid Testing Framework: focus on model V&V aspects	E. Garcia
11:15 - 11:45	UQ for complex CFD codes: methods and applications	R. Camy
11:45 - 12:15	Systems Uncertainty Management chez ASTRIUM	C. Elegbede
12:30 - 14:00	MIAM MIAM	
14:00 - 14:45	Statistical calibration by a Bayesian approach	P. Barbillon
14:45 - 15:30	A posteriori estimators for PDEs	T. Abboud
15:30 - 15:45	Coffee Break	
15:45 - 16:15	ONERA's recent activities in verification and UQ for aerodynamics	J. Peters & A. Re
16:30 - 17:00	A Bayesian approach to characterize the physical aleas with numerical experiments	N. Bousquet
17:00	End of the workshop	