

COMPUTATIONAL AND STOCHASTIC MODELING

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Research Focus

Engineering
& Physics

Numerical modeling

Uncertainty quantification

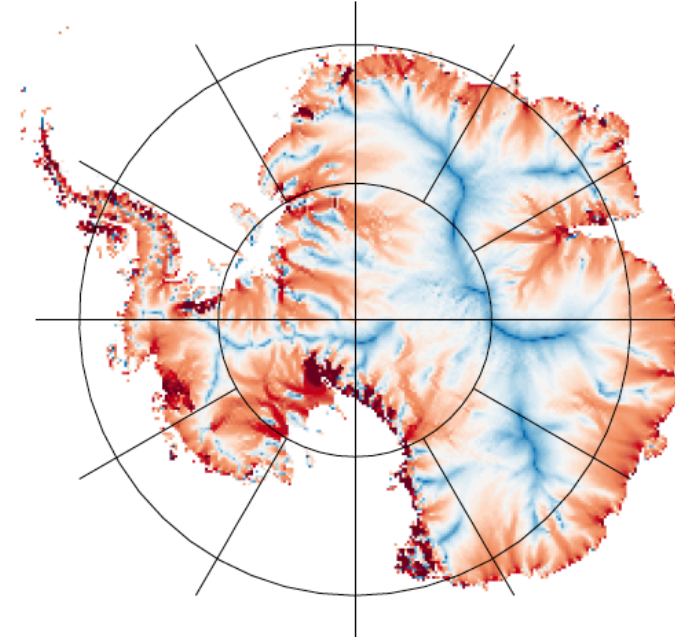
“The true logic of the world lies
in the calculus of probabilities”
(J.C. Maxwell)

Numerical methods

Mathematics
Probability theory

*How does uncertainty affect our world?
How can we engineer under uncertainty?*

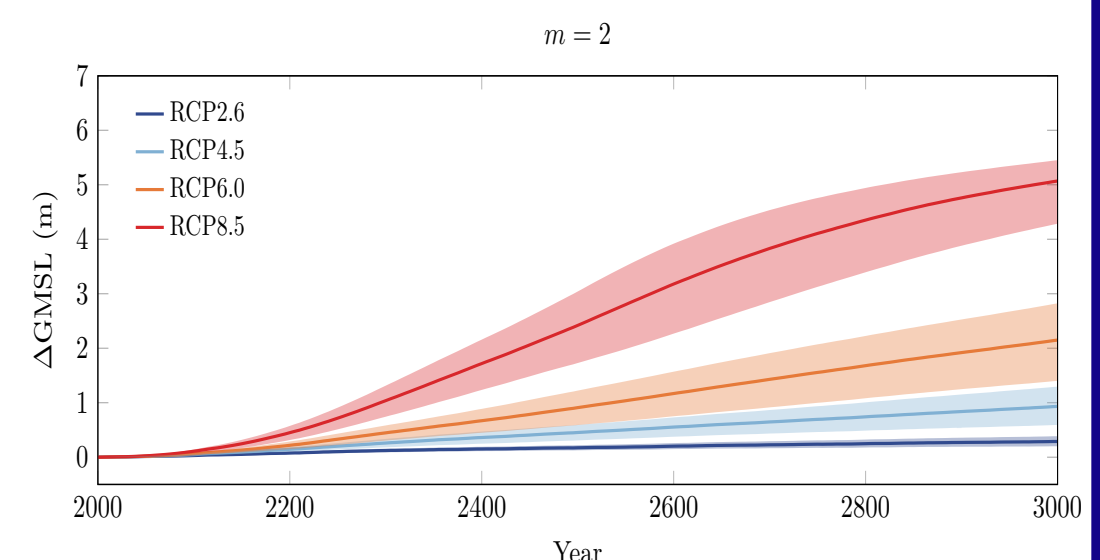
Large-scale geophysical problems Nonlinear dynamics & instabilities – K. Bulthuis



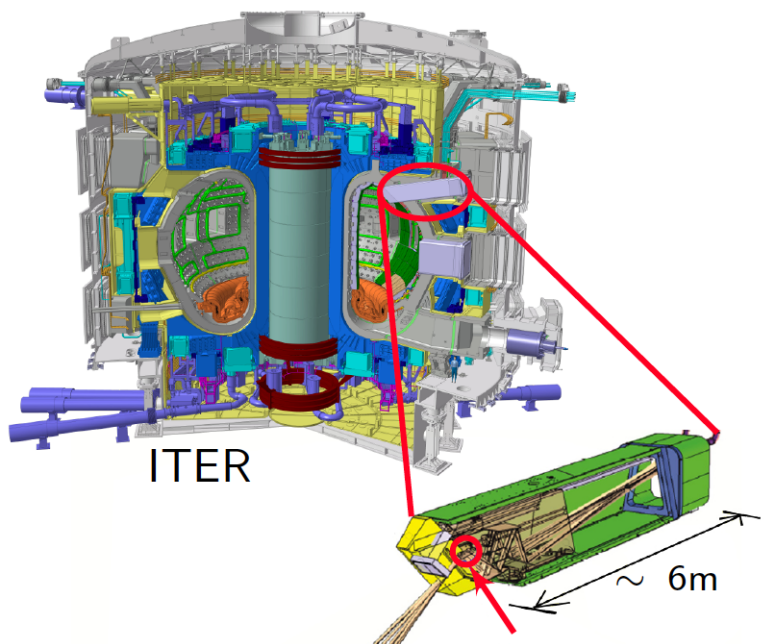
Highlights: - Stochastic modeling
of the Antarctic ice sheet
- Nonlinear systems
- Large-scale problems
- Critical transitions

Collaborations: - ULB (F. Pattyn)

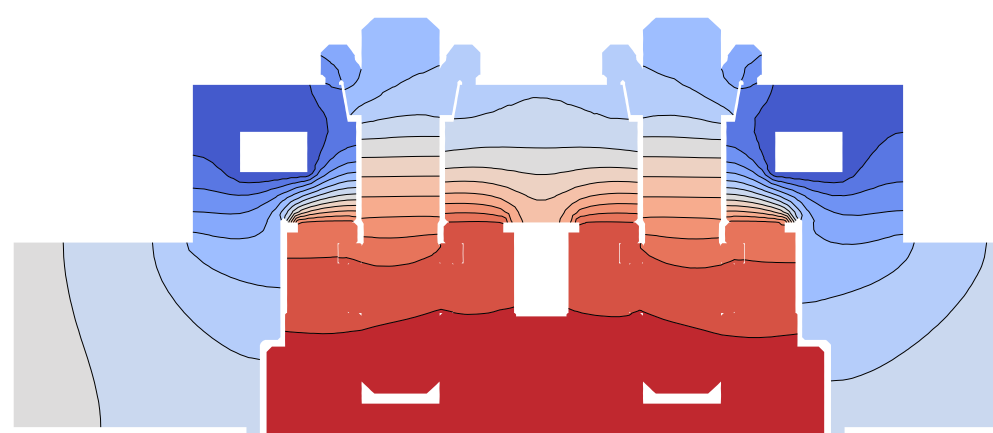
Motivation: Development of
uncertainty-quantified simulations for
geophysical flows with application to
the quantification of the impact of
uncertainties on the response of the
Antarctic ice sheet to climate change.



High-performance computing Multiphysics – K. Liegeois



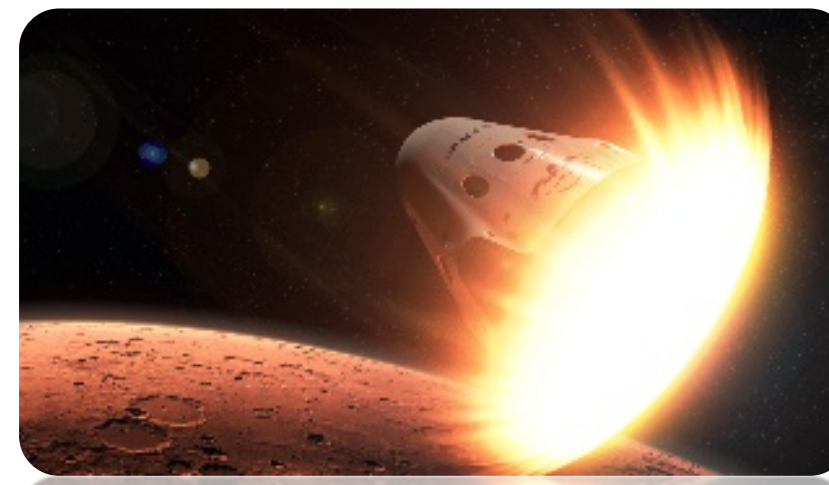
Motivation: Development of high-
performance computing methods for
efficient uncertainty quantification of
thermomechanical contact problems on
emerging architectures.



Highlights: - Ensemble propagation
- HPC libraries & simulations
- New computing architecture
- Thermo-mechanical contact

Collaborations: - LTAS lab (R. Boman)
- Sandia National
Laboratories
- Jülich Research Center

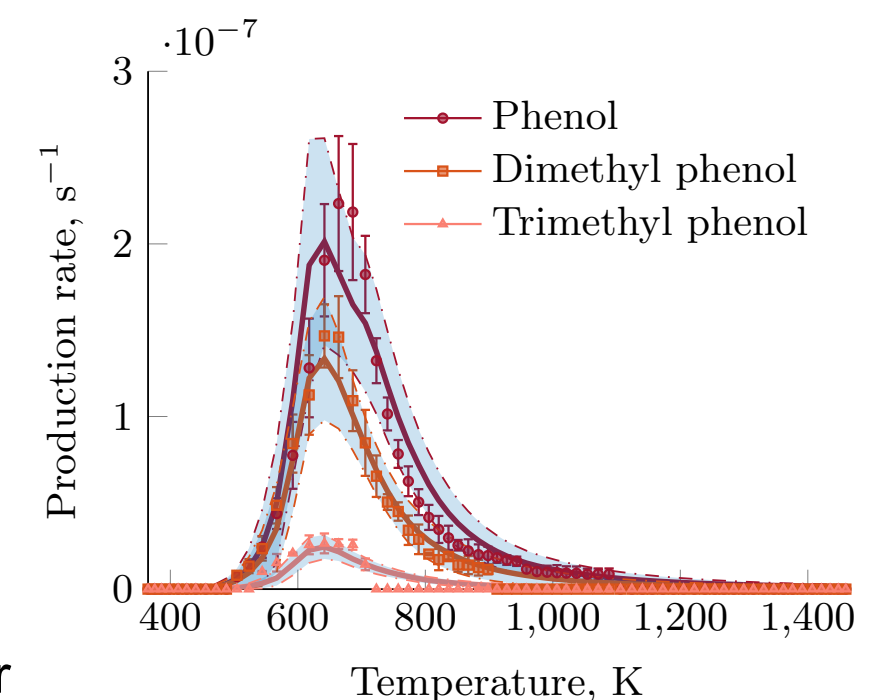
Fluid-material interaction and reacting flows Atmospheric entry problem – J. Coheur



Motivation: Development of uncertainty-
quantified numerical simulations of the ablation
of new porous composite materials of thermal
protection systems of spacecraft. Uncertainty
analysis of the impact of uncertainties on the
decomposition of thermal protection material.

Highlights: - Material properties
- Bayesian inference
- Fluid-material interactions
- CFD simulations

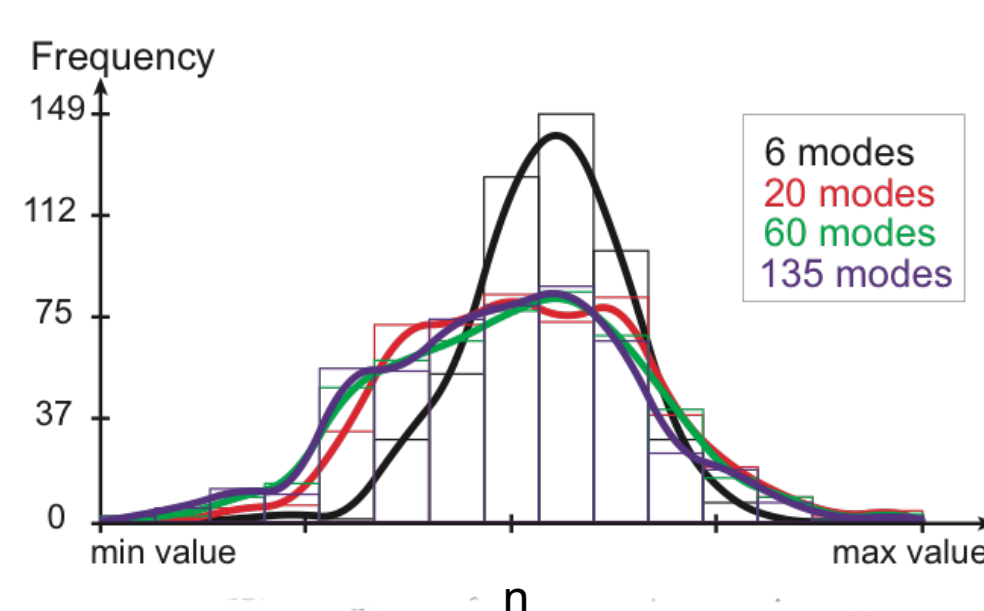
Collaborations: - UCLouvain (P. Chatelain)
- VKI (T. Magin)
- Cenaero
- Nasa Ames Research Center



Fluid-structure interaction Impact of geometric uncertainties – A. Budo



Motivation: Development of robust
simulations for low-pressure compressors
with integrated manufacturing errors in
shape geometry.



Highlights: - CFD simulations
- Fluid-structure interactions
- Geometric uncertainties
- Performance analysis

Collaborations: - MTFCLab (V. Terrapon)
- Safran Aero Boosters
- Cenaero
- EMS

Optimization in aerodynamics Nonlinear structures – J. Todesco



Motivation: Development of robust
optimization methods for nonlinear
structural dynamics and fluid-structure
interactions in aerodynamics.

Highlights: - Stochastic modeling of
uncertainties in FEM codes
- Propagation of uncertainty
- Optimization of nonlinear
structures
- Fluid-structure interaction

Collaborations: - MMS Lab (O. Brüs)
- Cenaero
- OpenEngineering
- NUMFLO

