



Computer Simulation of Fluid Flow, Heat Flow,
and Chemical Reactions.

WindSim User Meeting 2019

Recent and Ongoing Developments of the PHOENICS Solver

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PHOENICS 2019



Contents

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- CHAM and PHOENICS
- Unification of Processing of Boundary Conditions
- Latest Turbulence Models
- Solvers and Preconditioners
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- Grid Types



CHAM and PHOENICS

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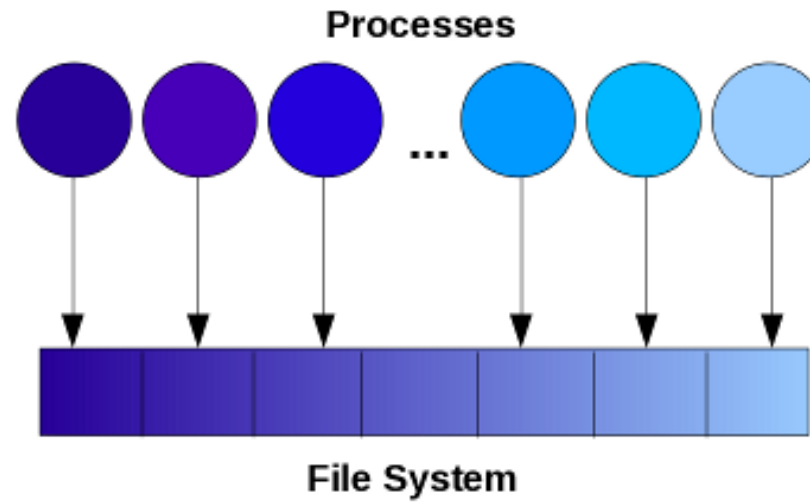
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- Concentration, Heat and Momentum Limited (CHAM)
- CFD consultancy and software house
- Founded by Prof. Brian Spalding in 1974
- PHOENICS - the first commercially available, general purpose CFD Software, initially released in 1981.
- Being further developed ever since!
- CFD engine behind WindSim



Parallel I/O

- Unification of sequential and parallel processing of boundary conditions

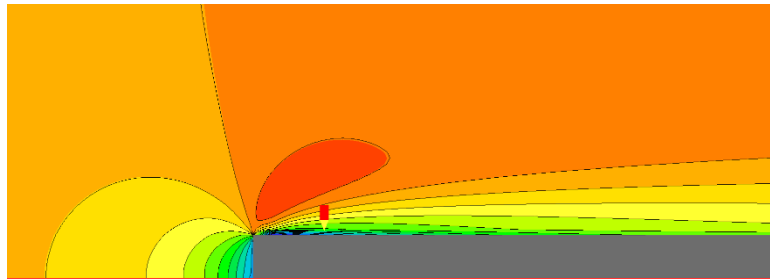




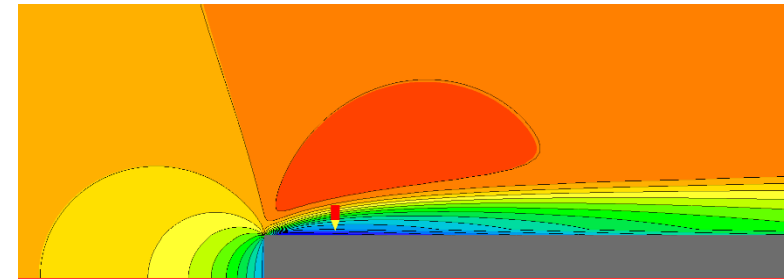
Turbulence Models

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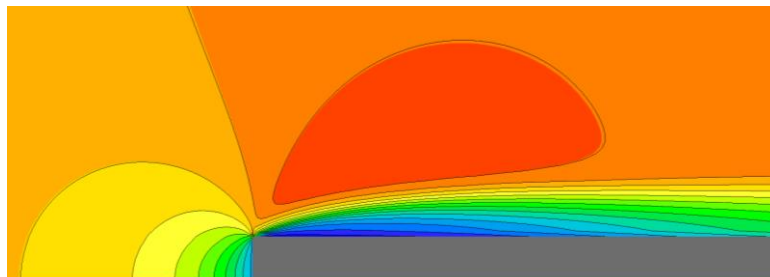
- Implementation of latest turbulence models
- Variations of k-omega, including SST



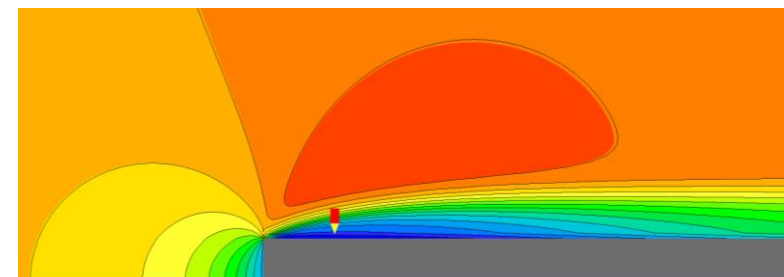
Standard K-Epsilon



K-Omega (Wilcox 2008)



Chen-Kim K-Epsilon



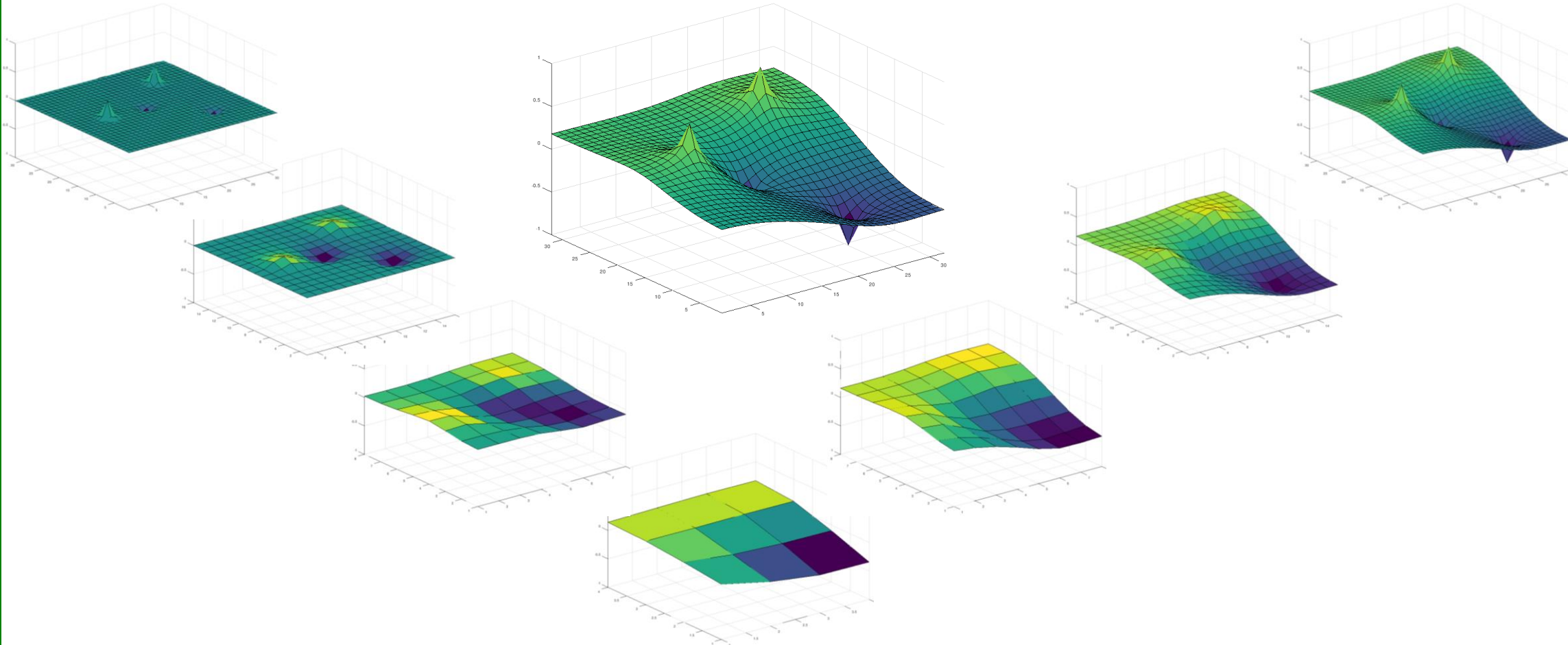
K-Omega SST



Solvers I

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- *hypre* high-performance preconditioners and solvers

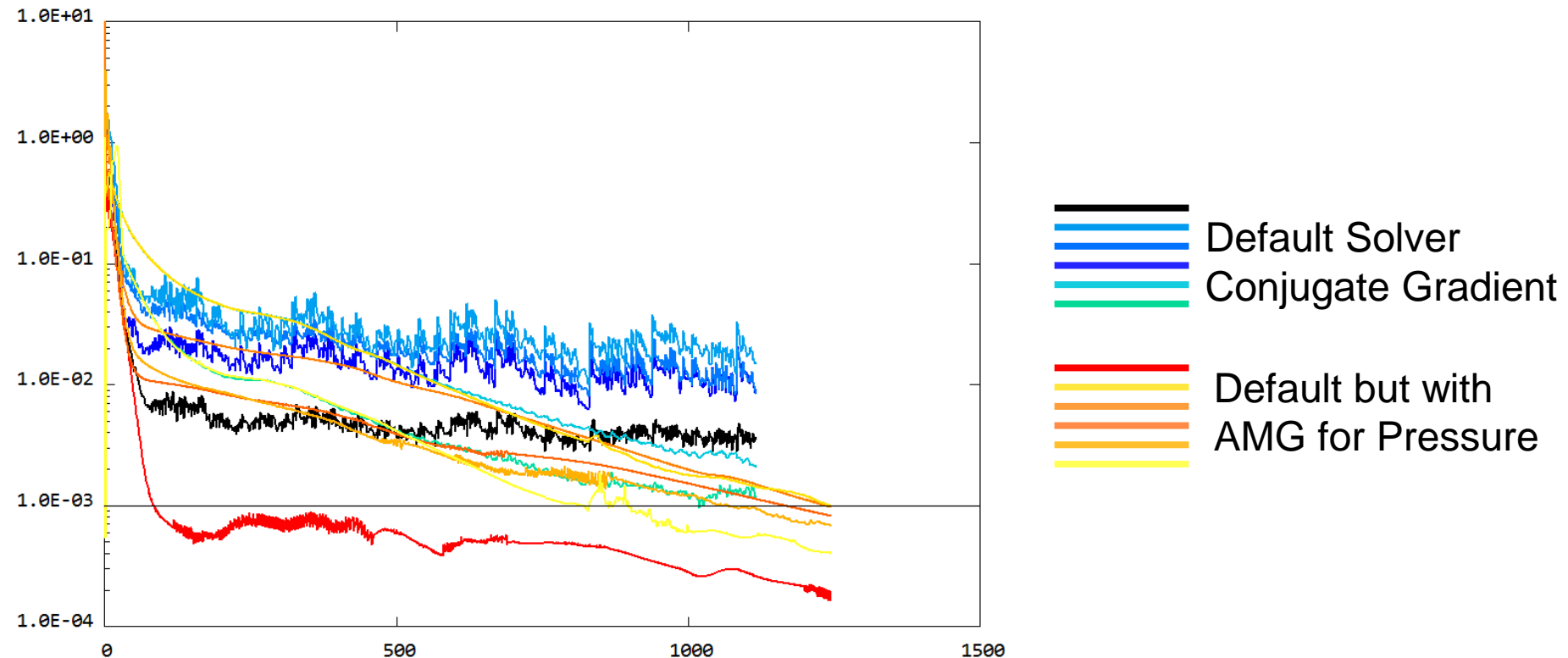


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Solvers II

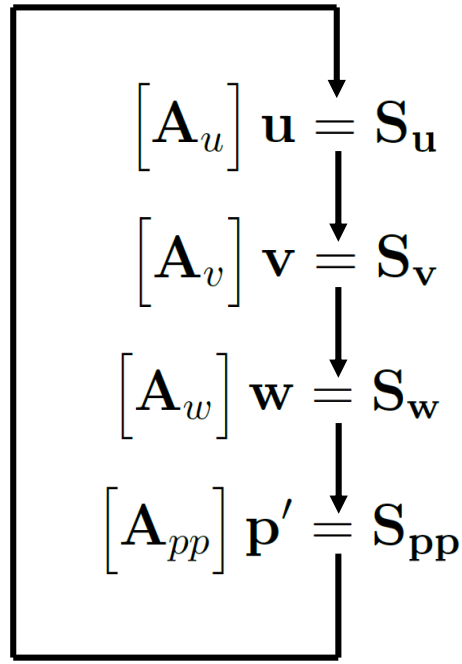
- *hypre* high-performance preconditioners and solvers



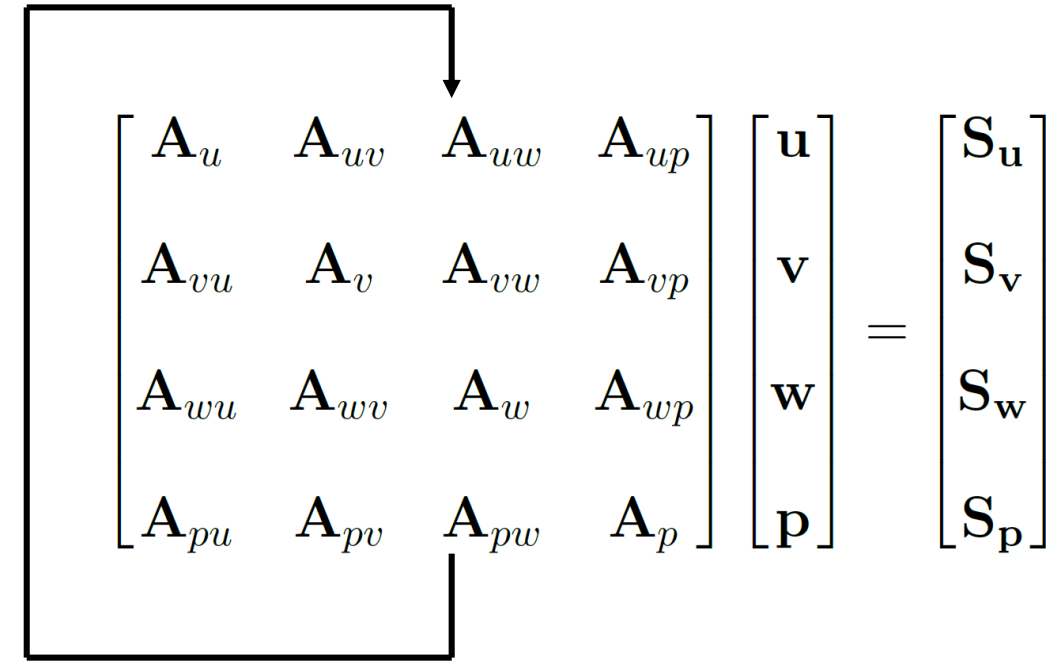


Solvers III

- *hypre* high-performance preconditioners and solvers



Segregated

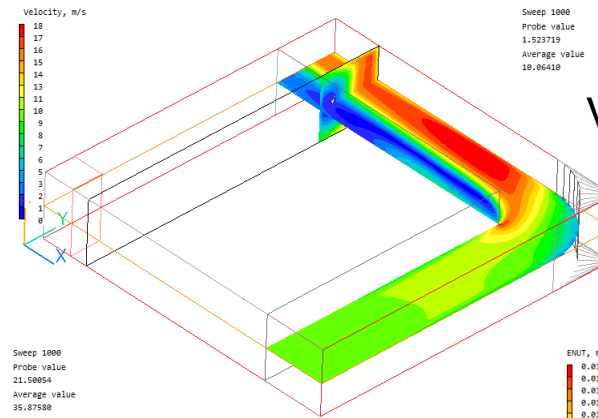
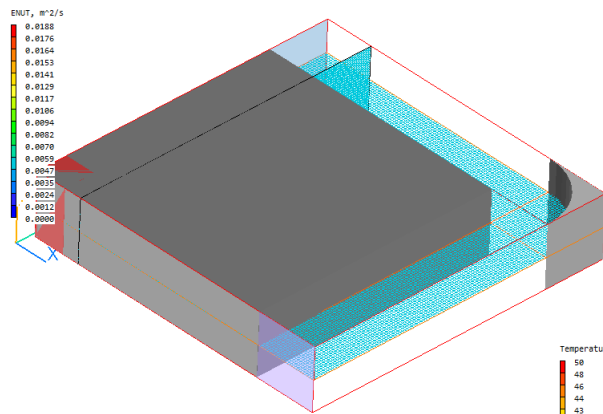


Coupled

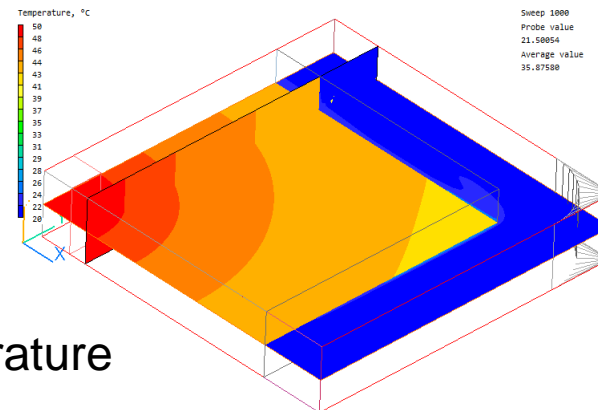


Solvers IV

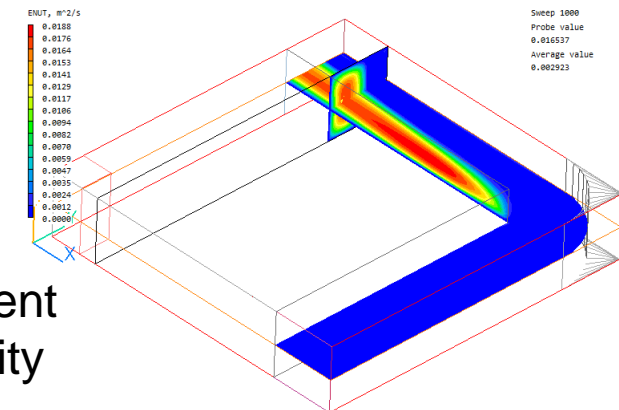
- Use of the HYPRE BoomerAMG Solver
 - This example shows the effect of the new solvers. The geometry is flow in an L-shaped duct:



Velocity



Temperature



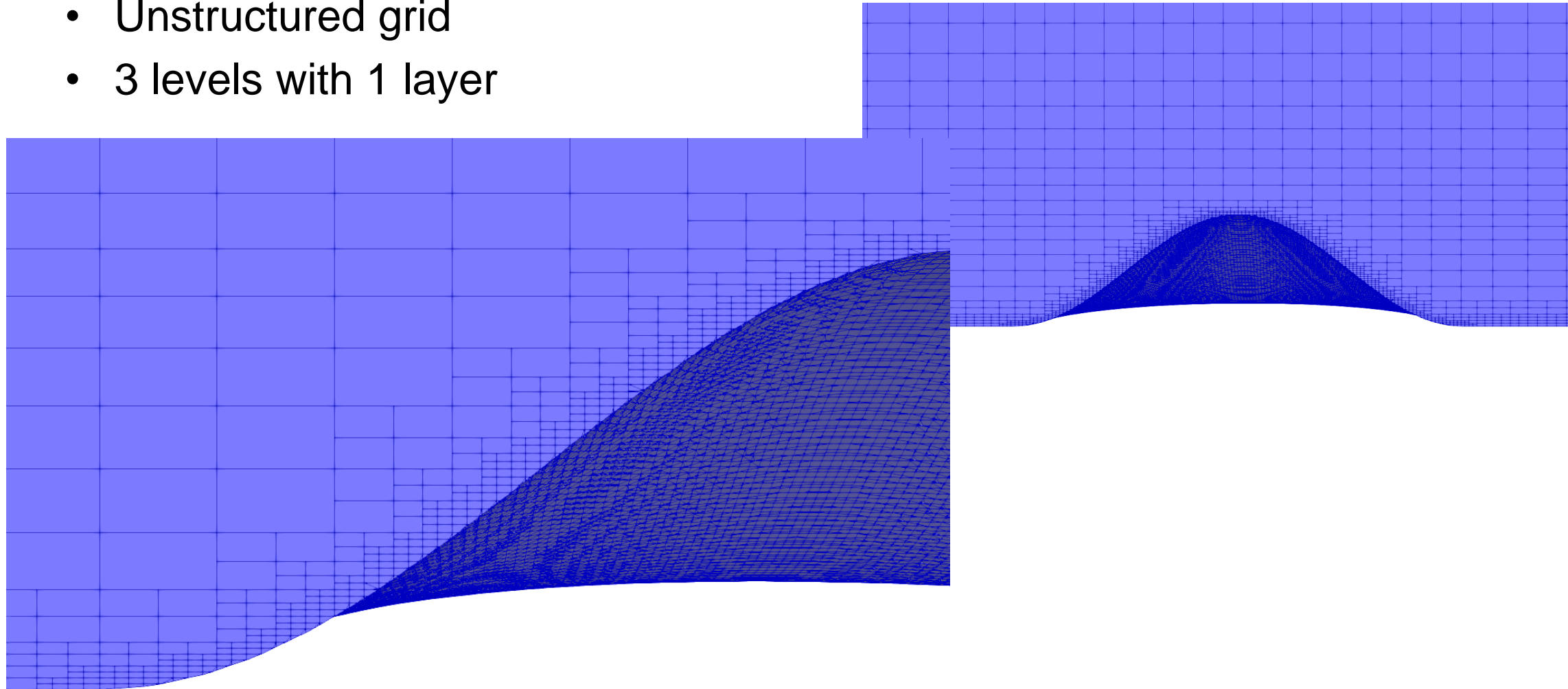
Turbulent Viscosity



Grid Types I

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- Unstructured grid
- 3 levels with 1 layer

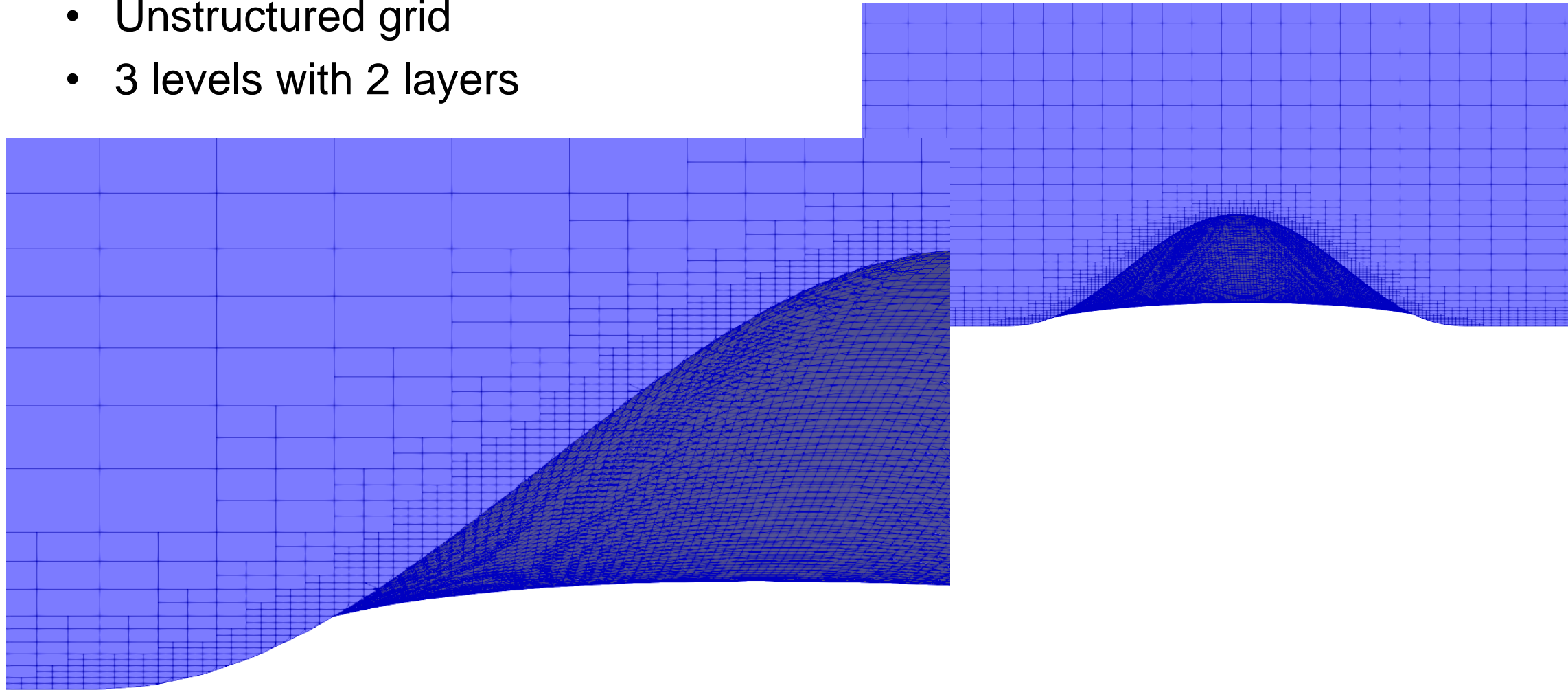




Grid Types II

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- Unstructured grid
- 3 levels with 2 layers





Thank you very much for your attention!