

OPM Flow, status and ongoing work

OPM Summit, Utrecht, April 22, 2026

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A few highlights and numbers

How large is OPM?

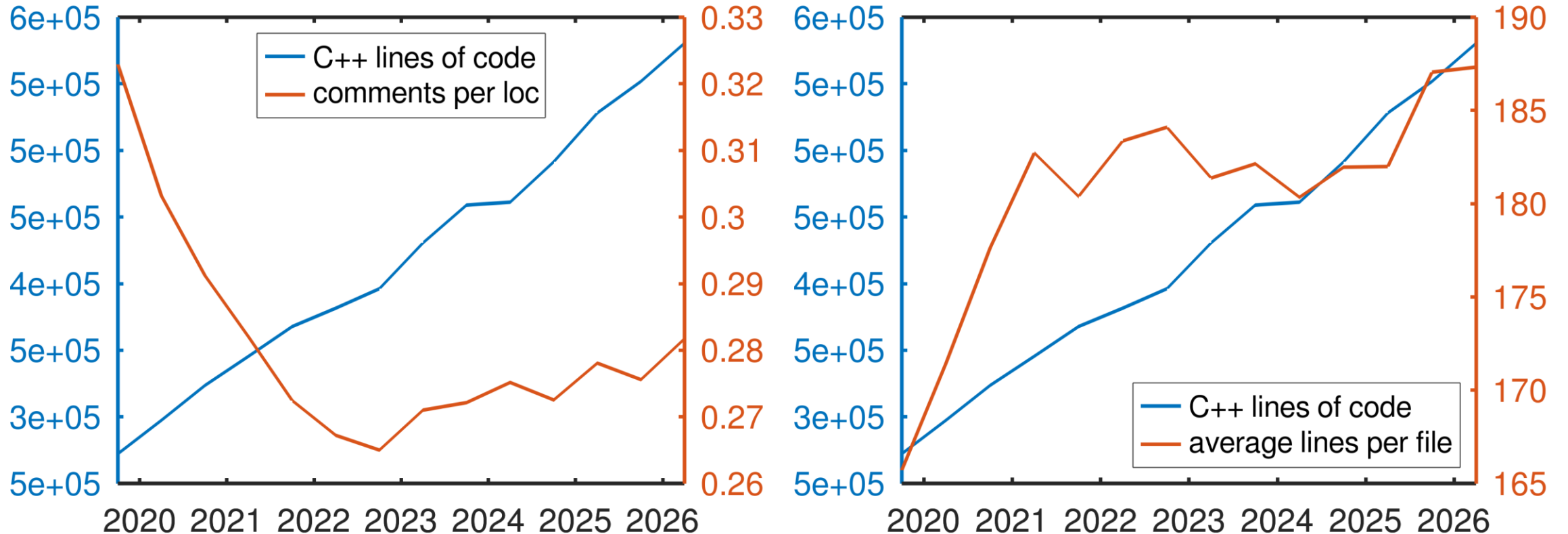


(Change from last OPM Summit in parentheses.)

Language	Files	Blanks	Comments	Lines of code	Comment/LoC
C++	3097 (+195)	148163	163708	581817 (+53675)	0.2814 (0.2781)*
Python	87 (+15)	1967	2087	8474 (+1908)	0.2463 (0.2313)
CMake	109 (-8)	1260	1858	12991 (-244)	0.1430 (0.1975)
JSON (keywords)	1209 (+17)	7	0	33450 (+477)	0

* Includes license block at top of files

C++ filesizes and comments over time



Maybe we are better at writing comments in winter than in summer!

Commits and PRs merged



Repo	Commits	PRs
Opm-common	1380	451
Opm-grid	371	110
Opm-simulators	1760	536

Between May 22, 2025 – April 20, 2026

Equinor Tech Awards finalist

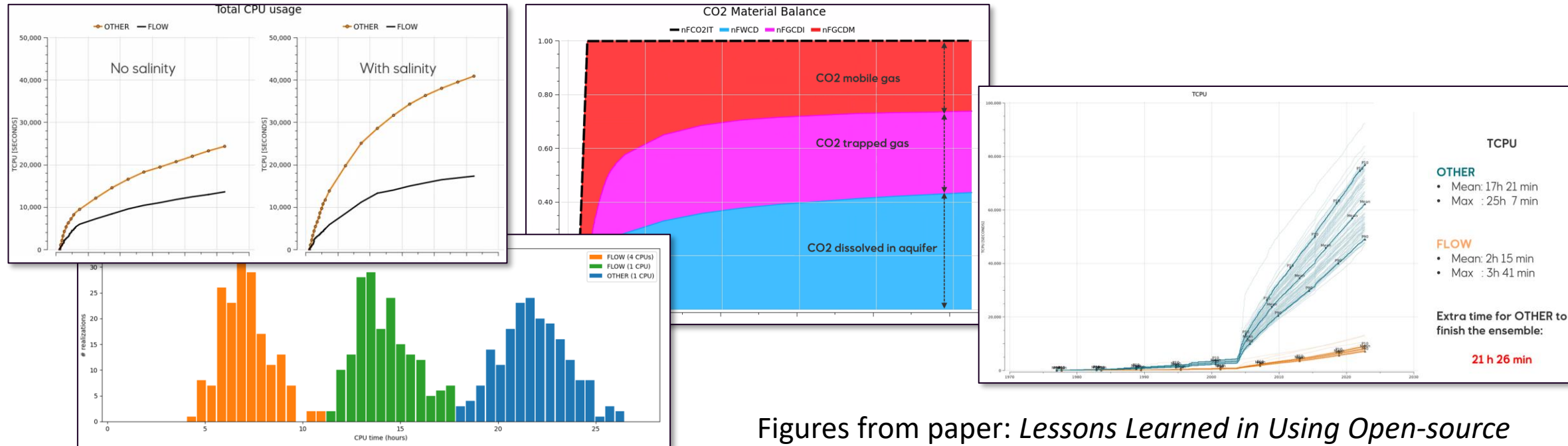


OPM Flow one of three finalists in the *Technology & Innovation* category

Talk by **Alf Birger Rustad** later today!

Some recent and ongoing work

Industrial usage at Equinor



Figures from paper: *Lessons Learned in Using Open-source Simulation Software On Real Asset Models*, Reiso et. al

Talks by **Edel Reiso** and **Vegard Kippe** later today!

Wells, groups, networks

Many small changes! In sum:

- Improved *robustness* and *performance*
- ...especially for complex industrial cases
- Such as: multi-level group controls
- Also for extended network model



Proposed new *group balancing algorithm*, talk by **Stein Krogstad** today!

Improved flexible restart

On-disk
representation that's
tailored to OPM
Flow's requirements

Capture more of the
simulator's internal
state

Fewer type and unit
conversions

- Current binary format (Eclipse) not ideal for OPM Flow
- Should result in better restarting, with high flexibility

Talk by **Torbjørn Skille** and **Bård Skaflestad** later today!

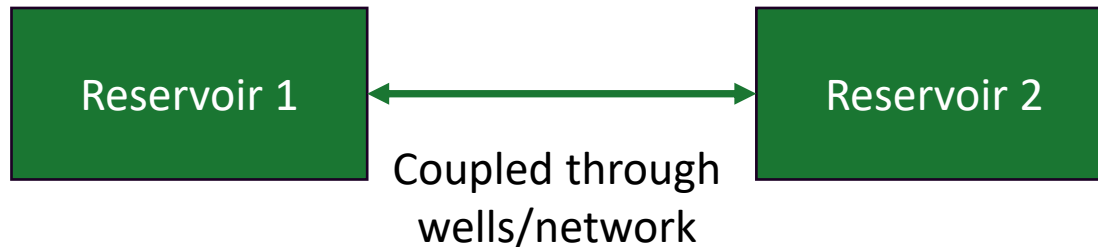
Reservoir coupling

The challenge:



Must solve large,
fully coupled system.
Cannot easily work
on just one part.

A solution:



Status:

- Already working test cases
- Ongoing work on
 - Network
 - Restart
- Estimate 2/3 complete

Talk by **Markus Blatt** later today!

CO₂ and H₂ storage

History matching, SPE11 benchmarking

Talk by **David Landa Marban** tomorrow!

Paper: *Exploring Convergence and Its Limits in Case B of the 11th SPE Comparative Solution Project*

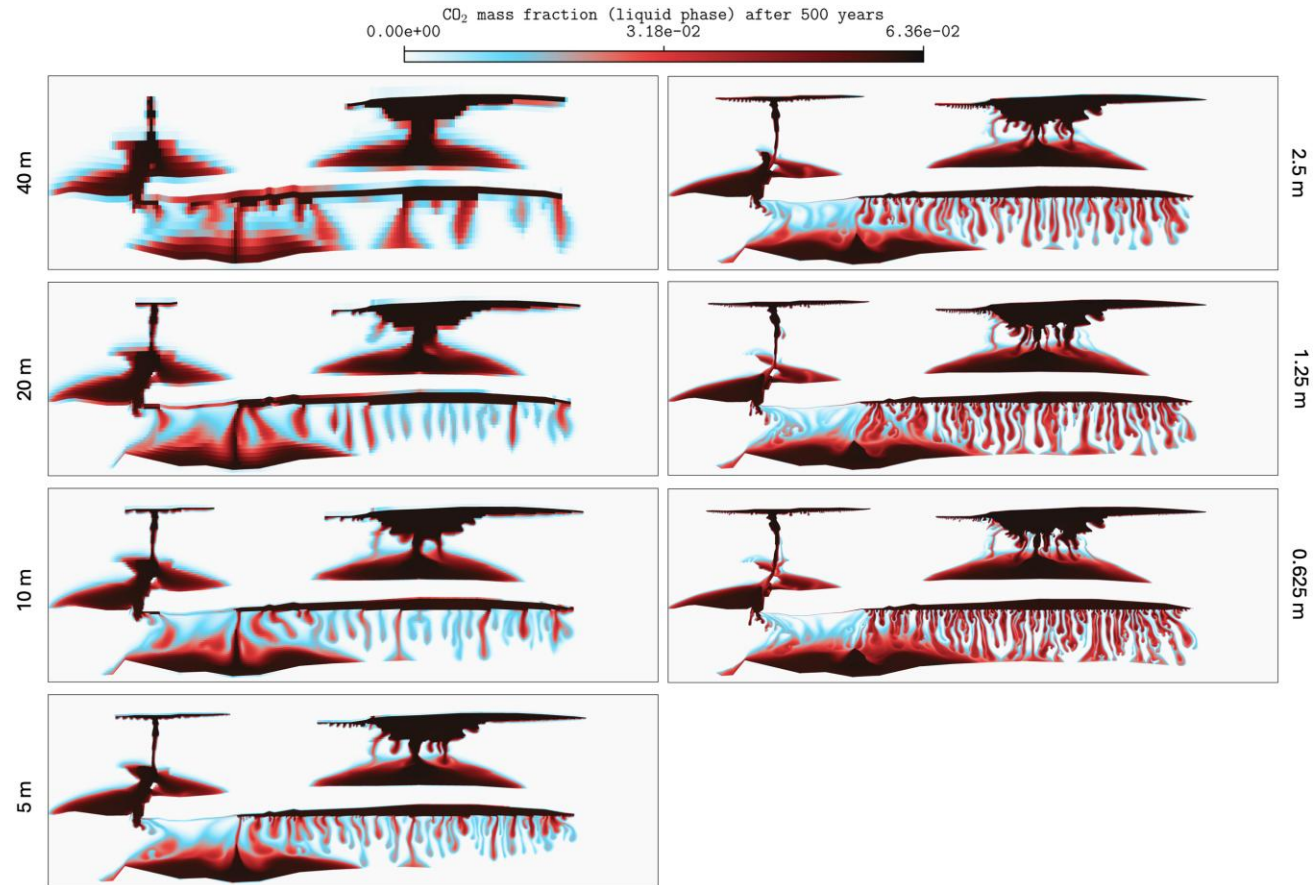


CO₂ injection in depleted hydrocarbon reservoirs

- New project started this year
- Supported by the Norwegian Climit program

Talk by **Tor Harald Sandve** today! **CLIMIT**

H₂ storage: discussion this afternoon



Compositional simulation

Current work: Make compositional less experimental!

- Necessary for CO₂ storage in depleted reservoirs
- Equilibration initialization for compositional models
- Applying to industrial cases

Talk by **Kai Bao** today!

Tooling and workflows are needed,
talk by **Negar Khoshnevis Gargar** today!

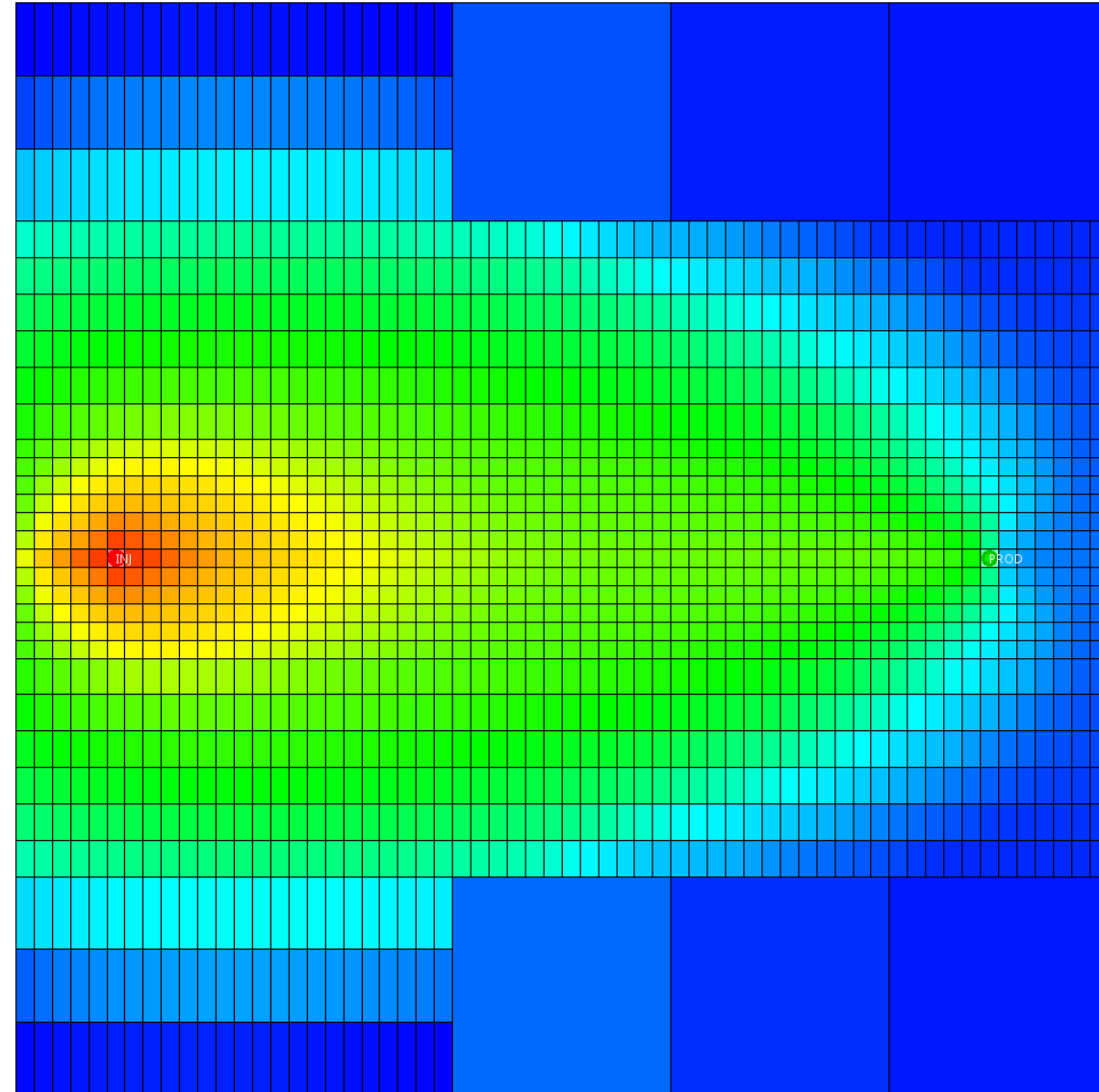
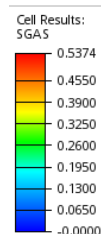


Local grid refinement (LGR)

Now includes:

- MPI parallel CpGrid with LGRs
- Wells (WELSPECL, COMPDATL)
- Output file support (EGRID, INIT, UNRST) including LGR transmissibilities

Talks by **Antonella Ritorto** and **Artur Castiel** today!



GPU acceleration

Current status:

Properties	Matrix assembly	Well assembly	Linear solvers
In progress	Near completion	In progress	Well supported (for single GPU)

AMG-CPR preconditioners in GpuSTL:

- AMGX and Hypre supported and optimized
- Multi-GPU via MPI in development
- Upcoming ECMOR paper!

Talk by **Tobias Meyer Andersen** later today!

Linear solver improvements

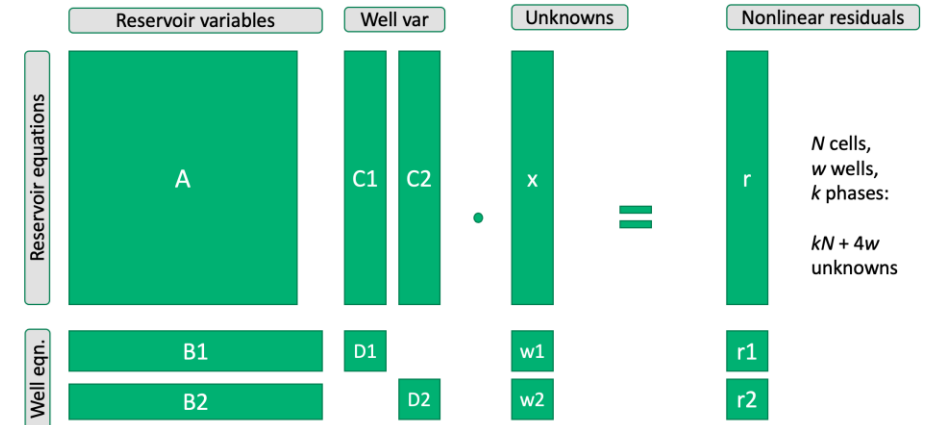
Full system solve for (X_r, X_w) now possible:

$$AX = b \Leftrightarrow \begin{pmatrix} A_{rr} & A_{rw} \\ A_{wr} & A_{ww} \end{pmatrix} \begin{pmatrix} X_r \\ X_w \end{pmatrix} = \begin{pmatrix} b_r \\ b_w \end{pmatrix}$$

$$A_{rr}^* X_r = b_r^*$$

$$A_{rr}^* = A_{rr} - A_{rw} A_{ww}^{-1} A_{wr}$$

$$b_r^* = b_r - A_{rw} A_{ww}^{-1} b_w$$



(Until now: Solve for just reservoir unknowns X_r , recover well unknowns.)

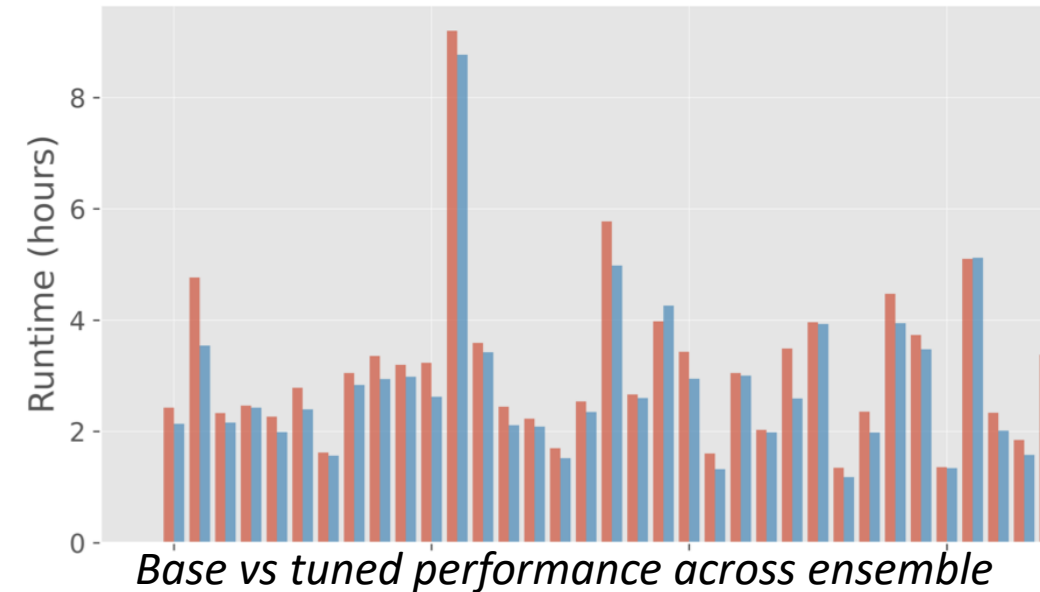
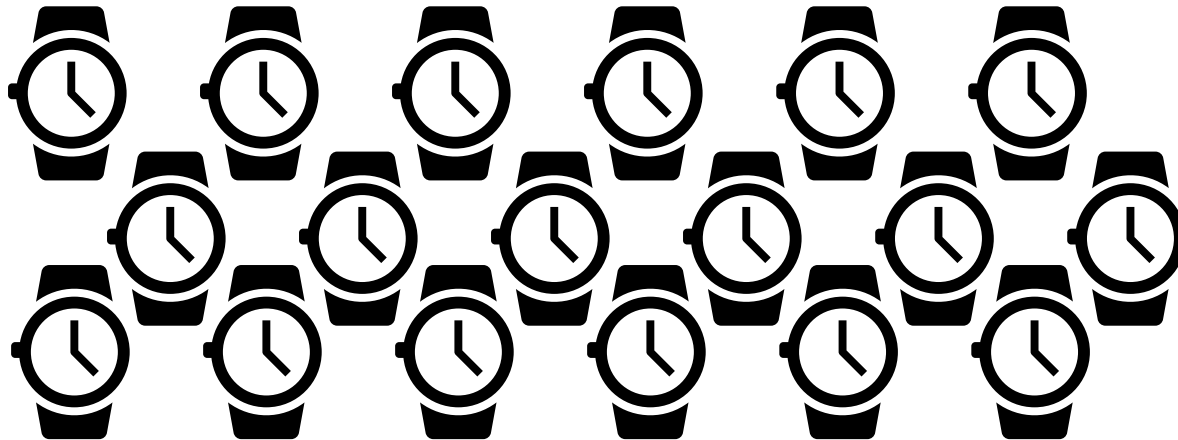
New CPR-based solver: talk by **Vinicius Martins** later today!

New matrix class: talk by **Santiago Ospina de los Ríos** tomorrow!

Parallel performance

- Automatic tuning of parallel CPR and AMG preconditioners

Talk by **Erik Sæternes** later today!



- Pre-coarsened partitioning for improved performance

Talk by **Andreas Thune** later today!

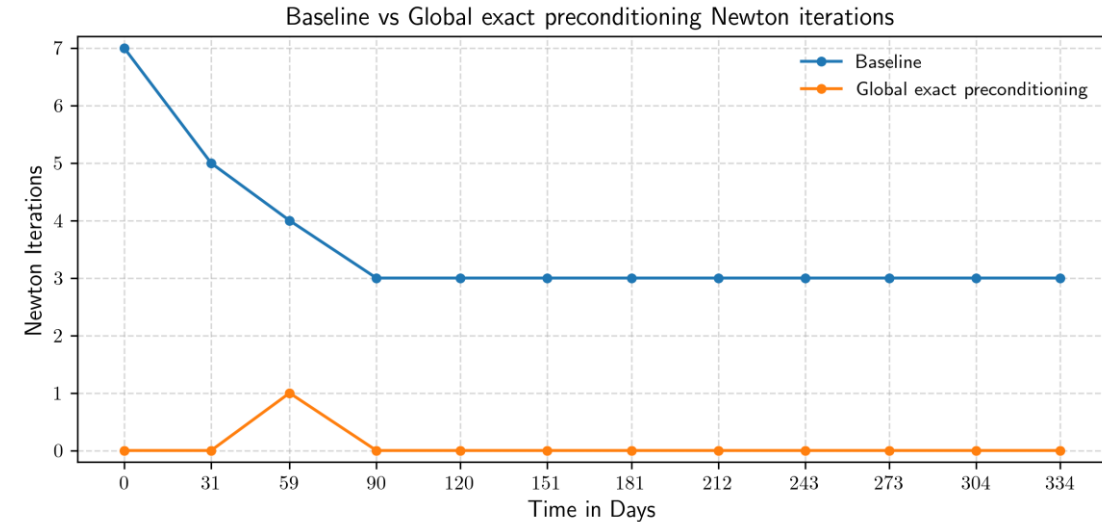
Machine learning in OPM Flow



Hybrid Newton implementation

- Combines ML-based preconditioning with Newton method.

Talk by **Antoine Lechevallier** tomorrow!



Global hybrid exact preconditioned Newton on SPE1

ML-based hysteresis model

- Aim: improve cyclic drainage/imbibition
- Trained surrogate with pore-scale simulations, ++

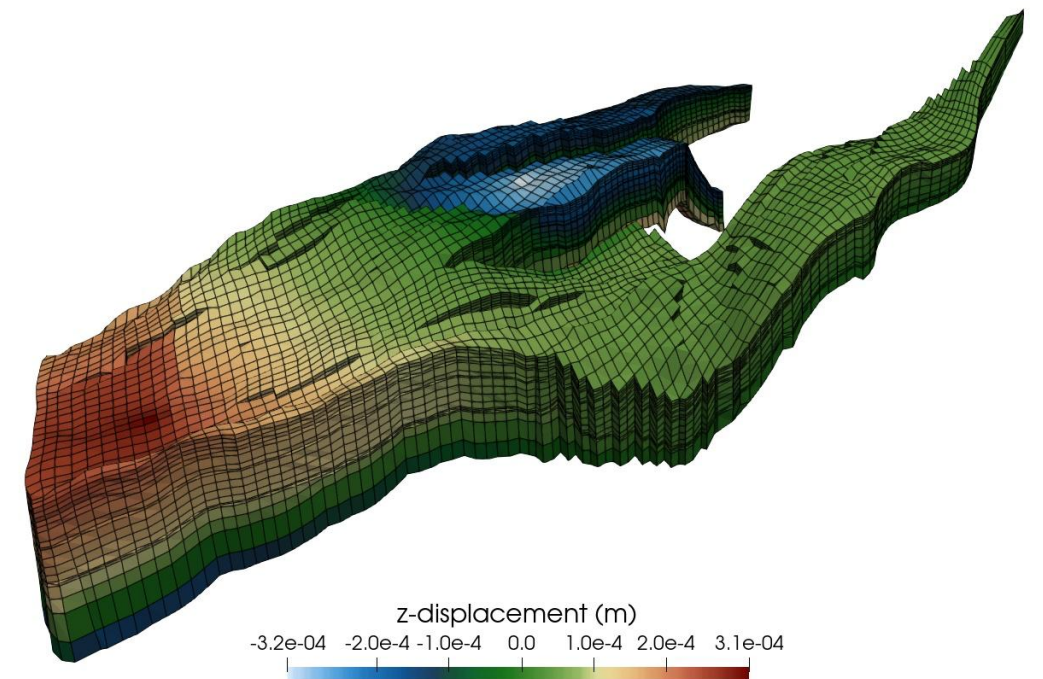
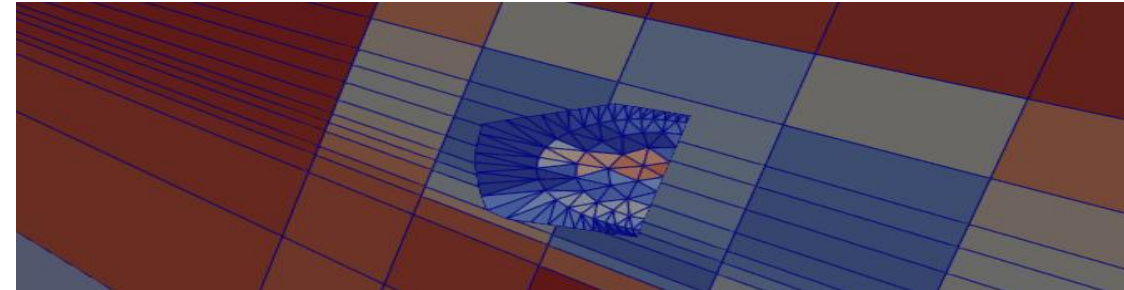
Talk by **Birane Kane** tomorrow!

Geomechanics

Not one, but two methods!

- Virtual element method (VEM)
 - Couple flow and geomechanics
 - Fracture propagation
- Two-point stress approximation method (TPSA)
 - Couple flow and geomechanics
 - Includes output, linear solver++

Talk by **Svenn Tveit** tomorrow!



Multiple applications and uses!



- Resinsight, talk by **Magne Sjaastad** today!
- Coupling power plant and reservoir models, talk by **Firdovsi Gasanzade** tomorrow!
- Geothermal, talk by **Sławomir Szklarz** tomorrow!
- AI enhanced simulation, talk by **Finlay Bertram** today
- Dynamic modelling, talk by **Zuzanna Crawford** tomorrow!
- Optimization with EVEREST and OPM Flow, talk by **Eduardo Barros** tomorrow!

... and more!

Some examples:

- Faster TEMP option (sequential thermal solver)
- More complete initialization (EQUIL) options
- Reduced memory usage (especially when no hysteresis)
- NLDD improvements: performance and group controls
- RSCONST supported
- Still more output options and improvements
- Lots of bugfixes!



SINTEF

Technology for a
better society