Laboratoire de
Géologie

Boundary Conditions for numerical modelling of seismic ruptures

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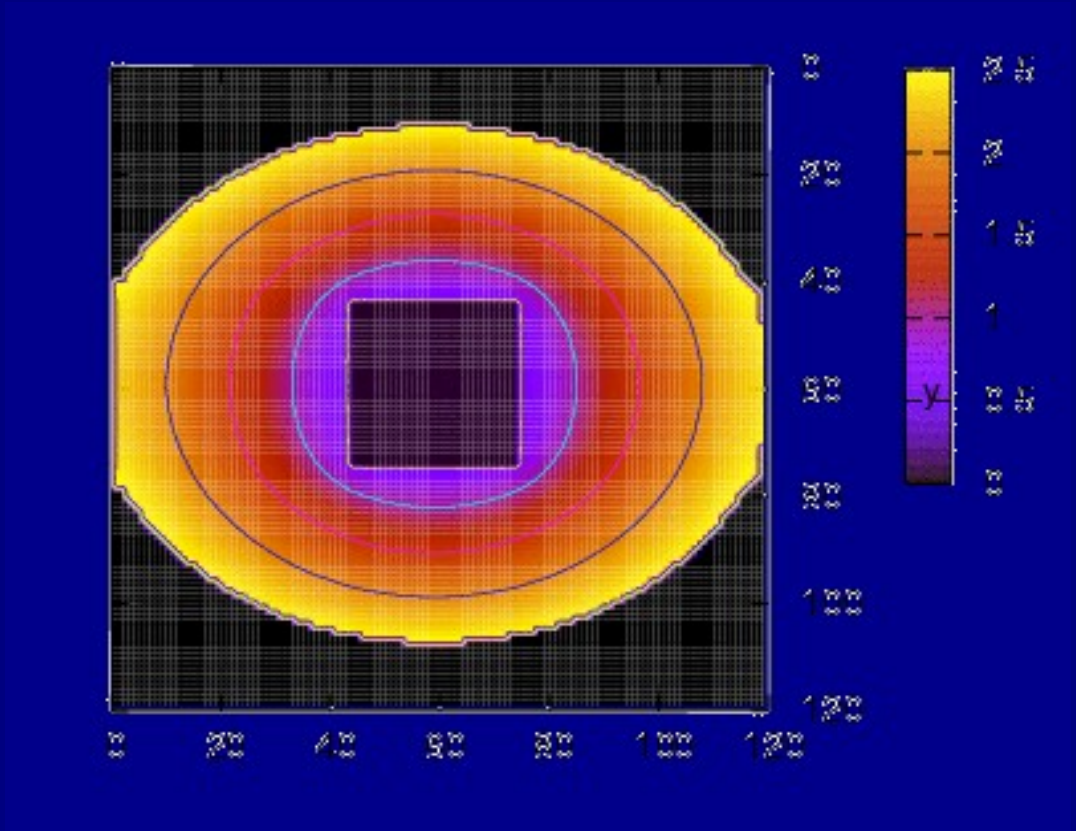
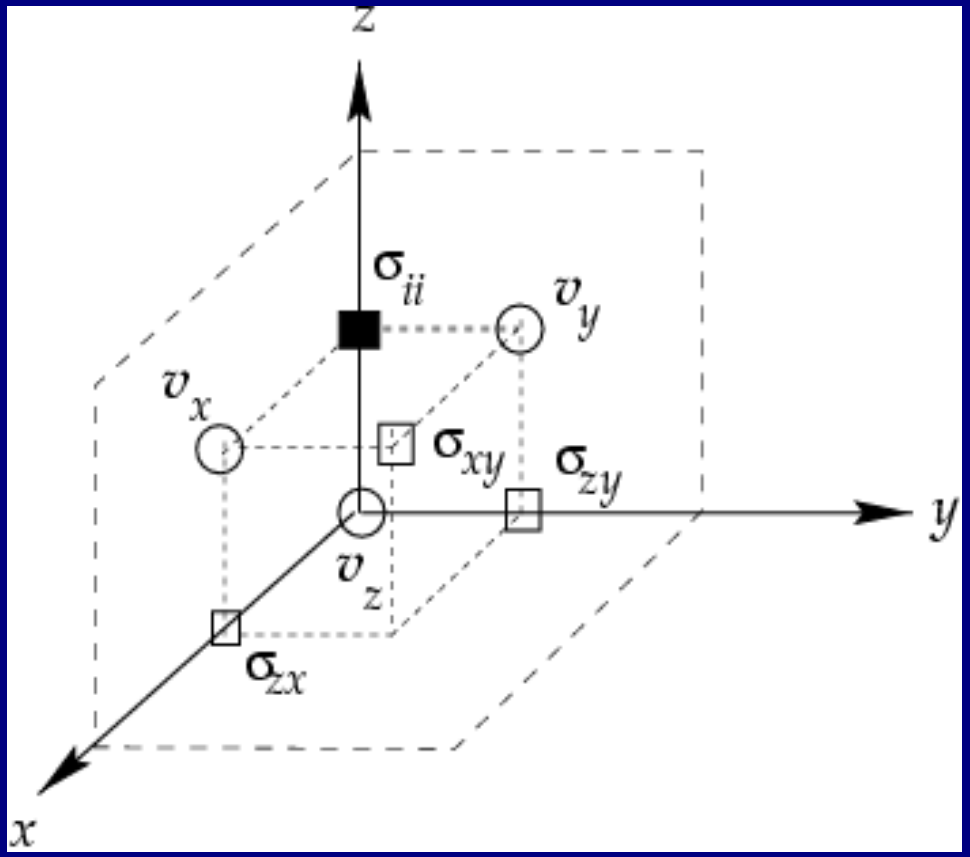


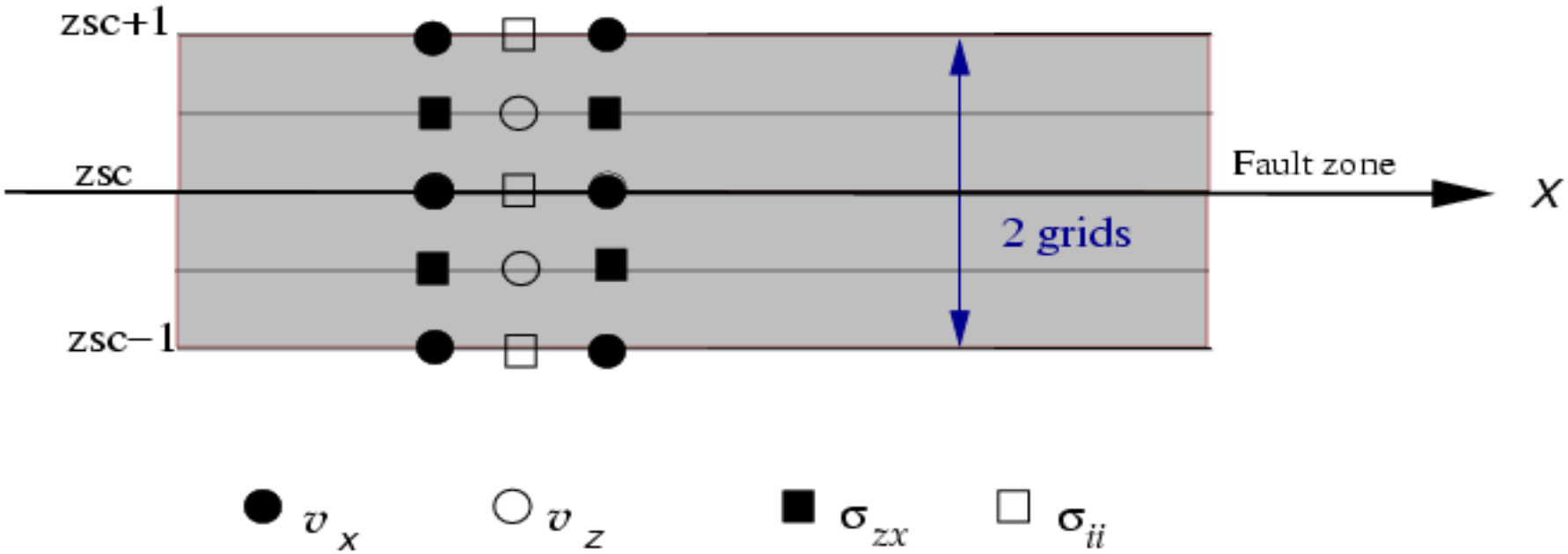
Finite difference simulation in staggered grids

- Velocity-stress formulation
- 4th order in space,
- 2nd order in time
- Constant Dx and Dz
- Thick or thin boundary conditions

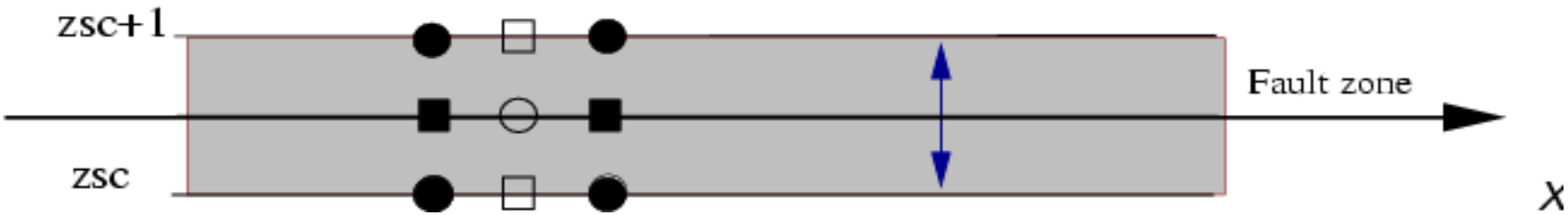


Boundary conditions for dynamic faulting in Finite Differences

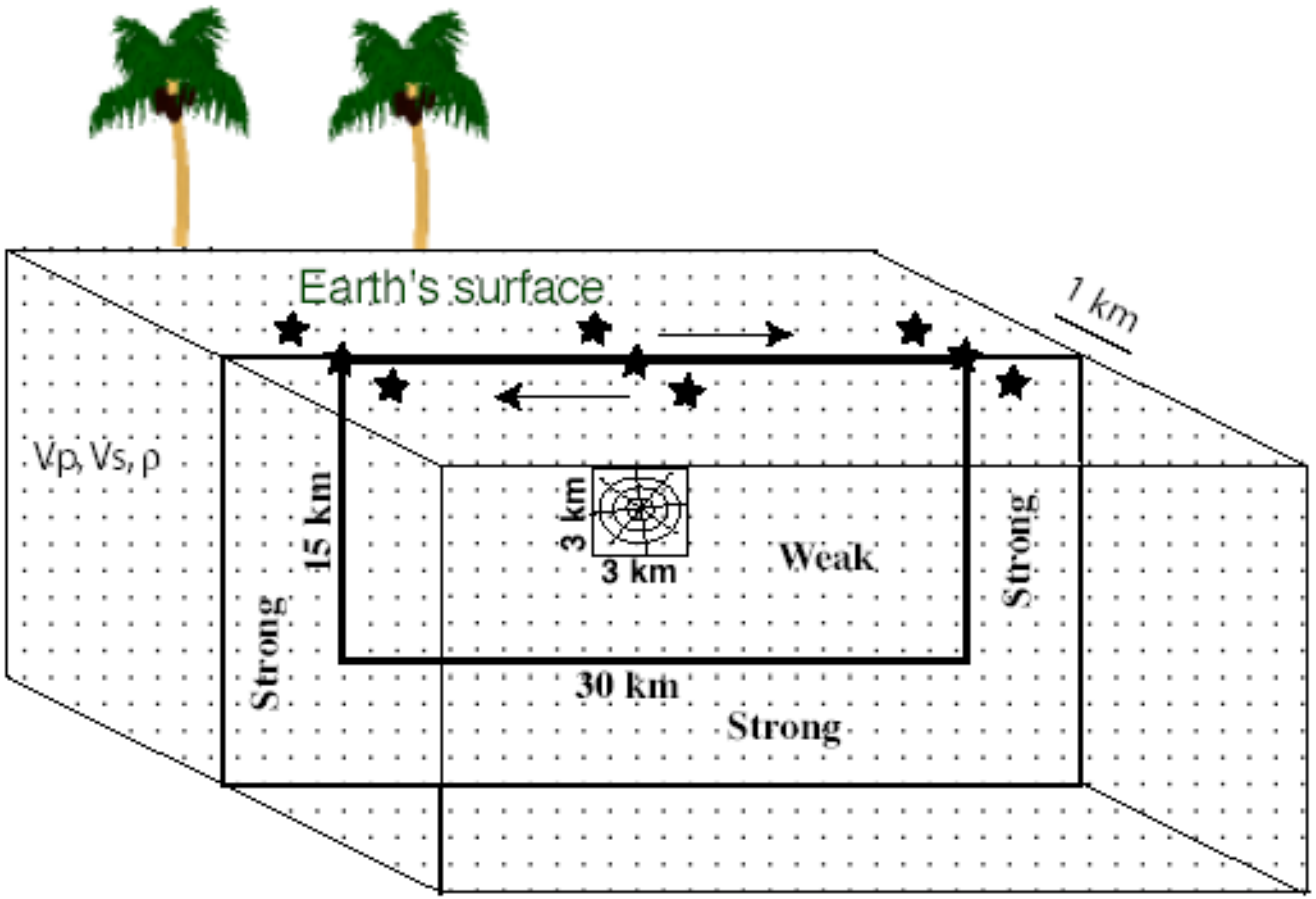
Thick Boundary conditions



Thin Boundary conditions

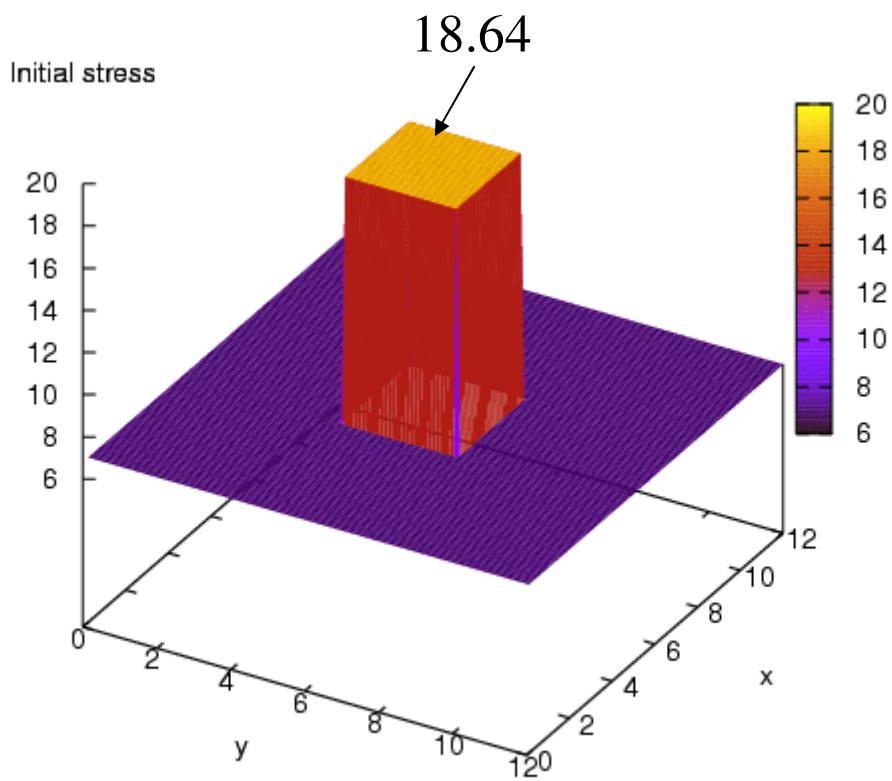


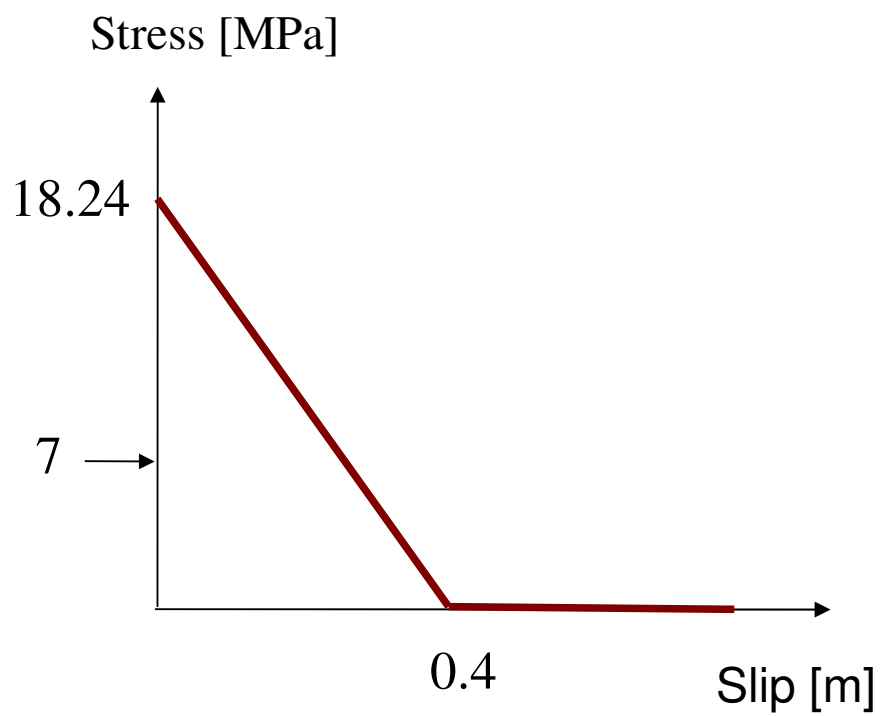
The SCEC Original Problem



Simplified version of SCEC problem by Luis Dalguer

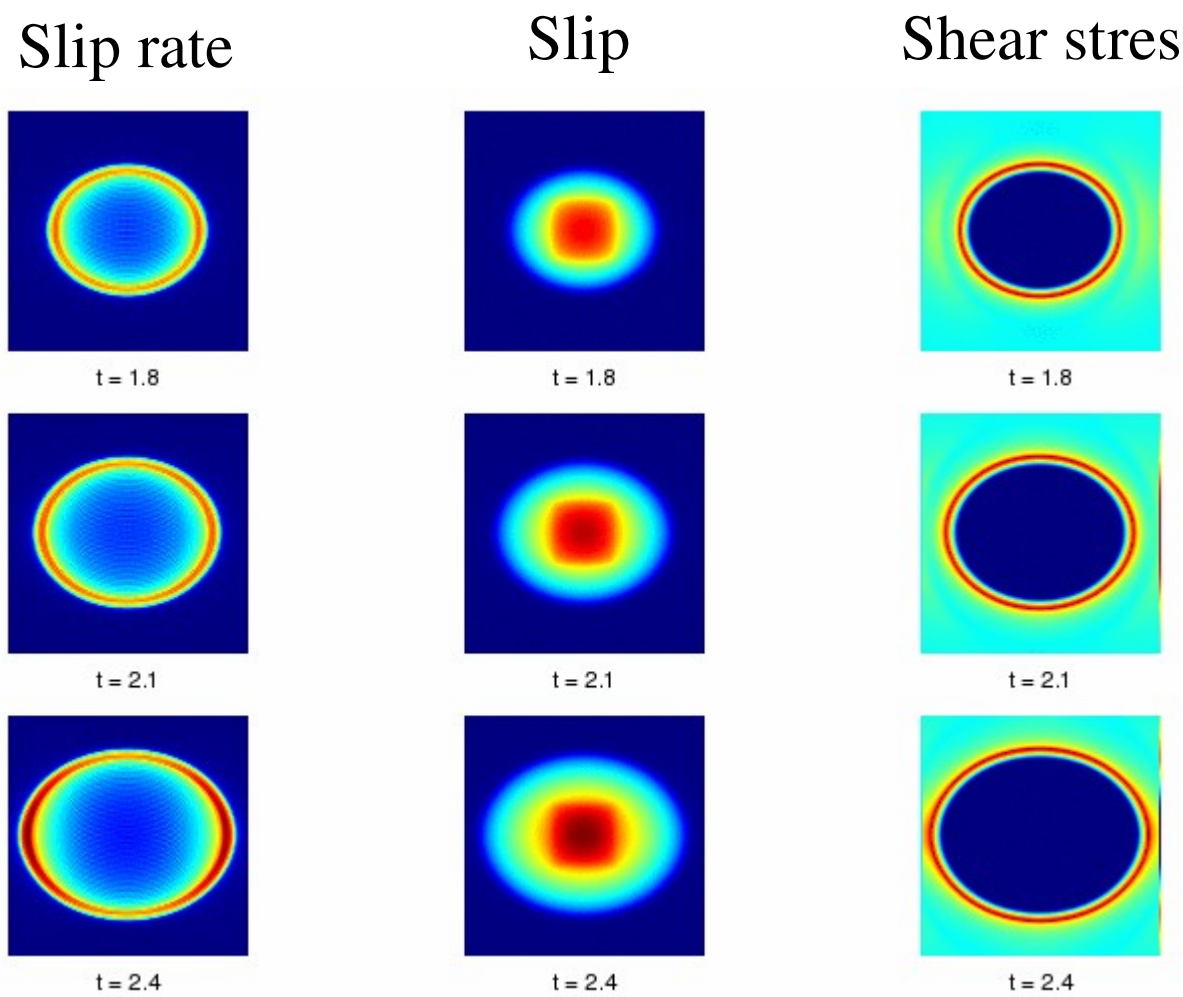
Homogeneous rupture resistance
Homogeneous initial shear stress field
except for 3x3 km asperity





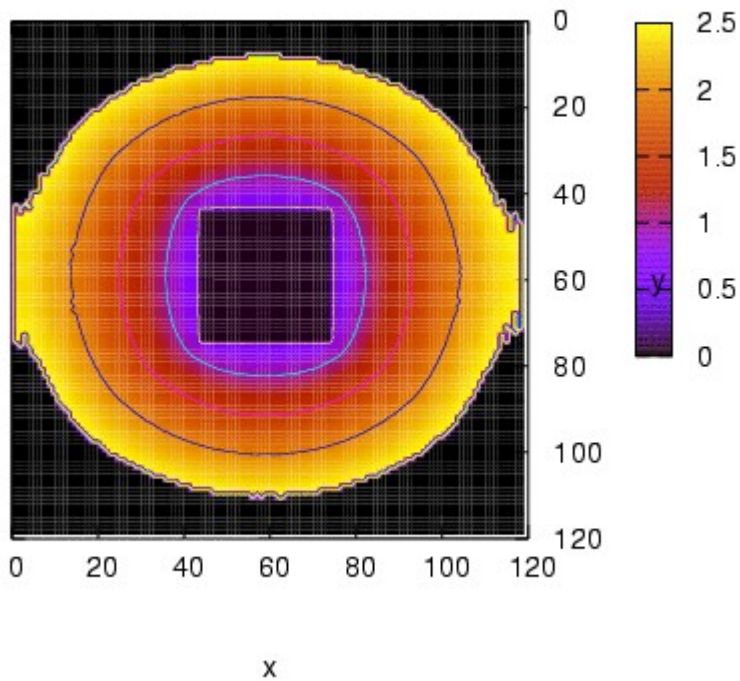
Our best Finite Differences Solution

Thin Boundary conditions

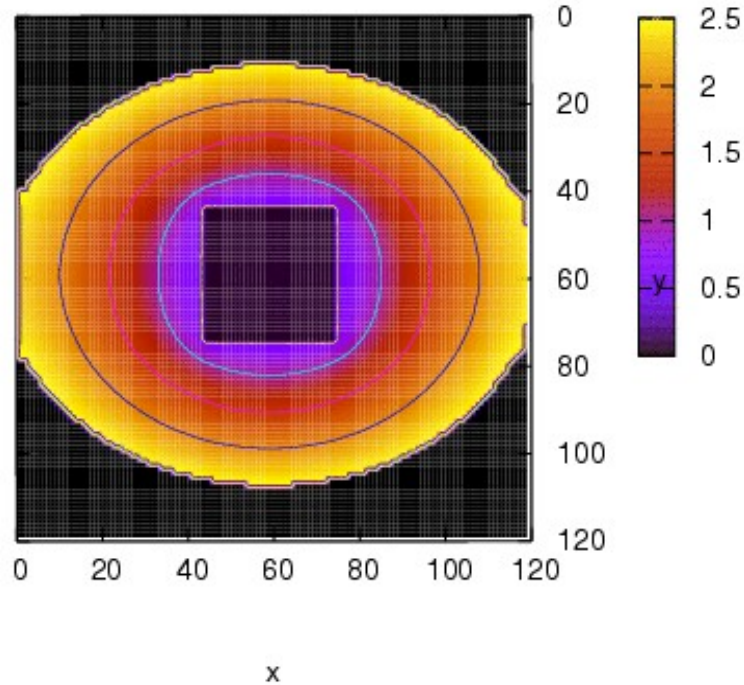


Comparison of two implementations of the boundary conditions

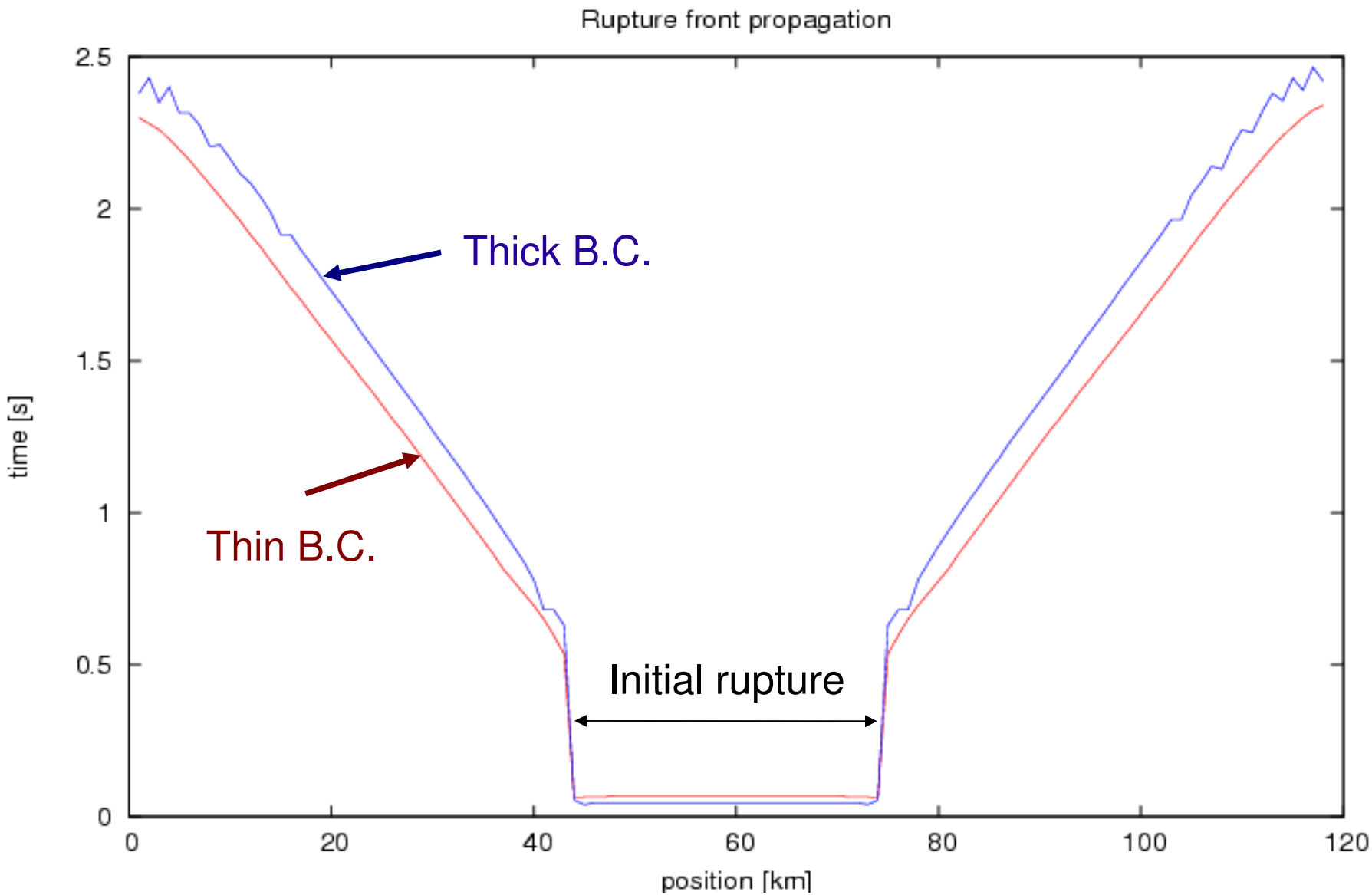
Thick Boundary Conditions



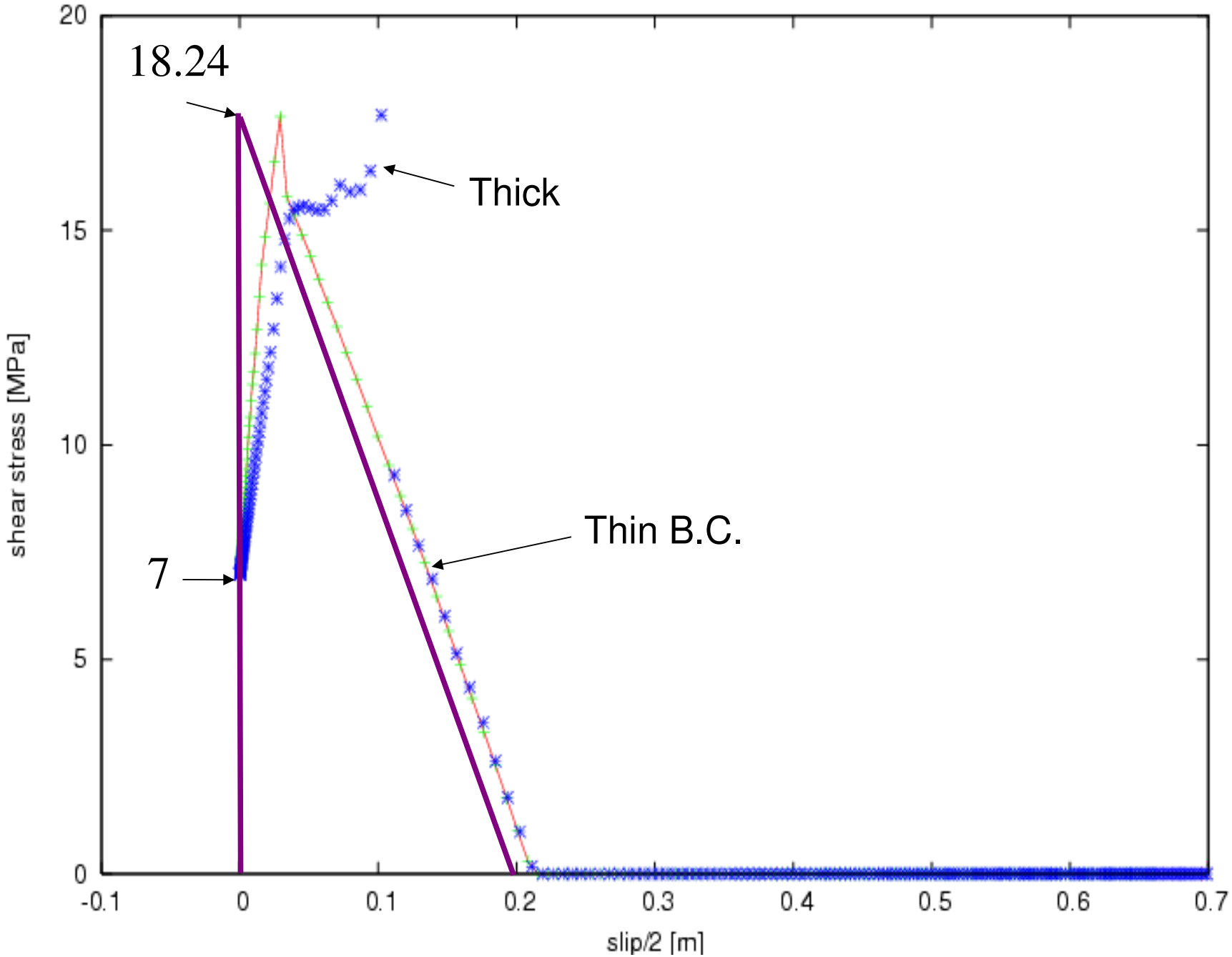
Thin Boundary Conditions



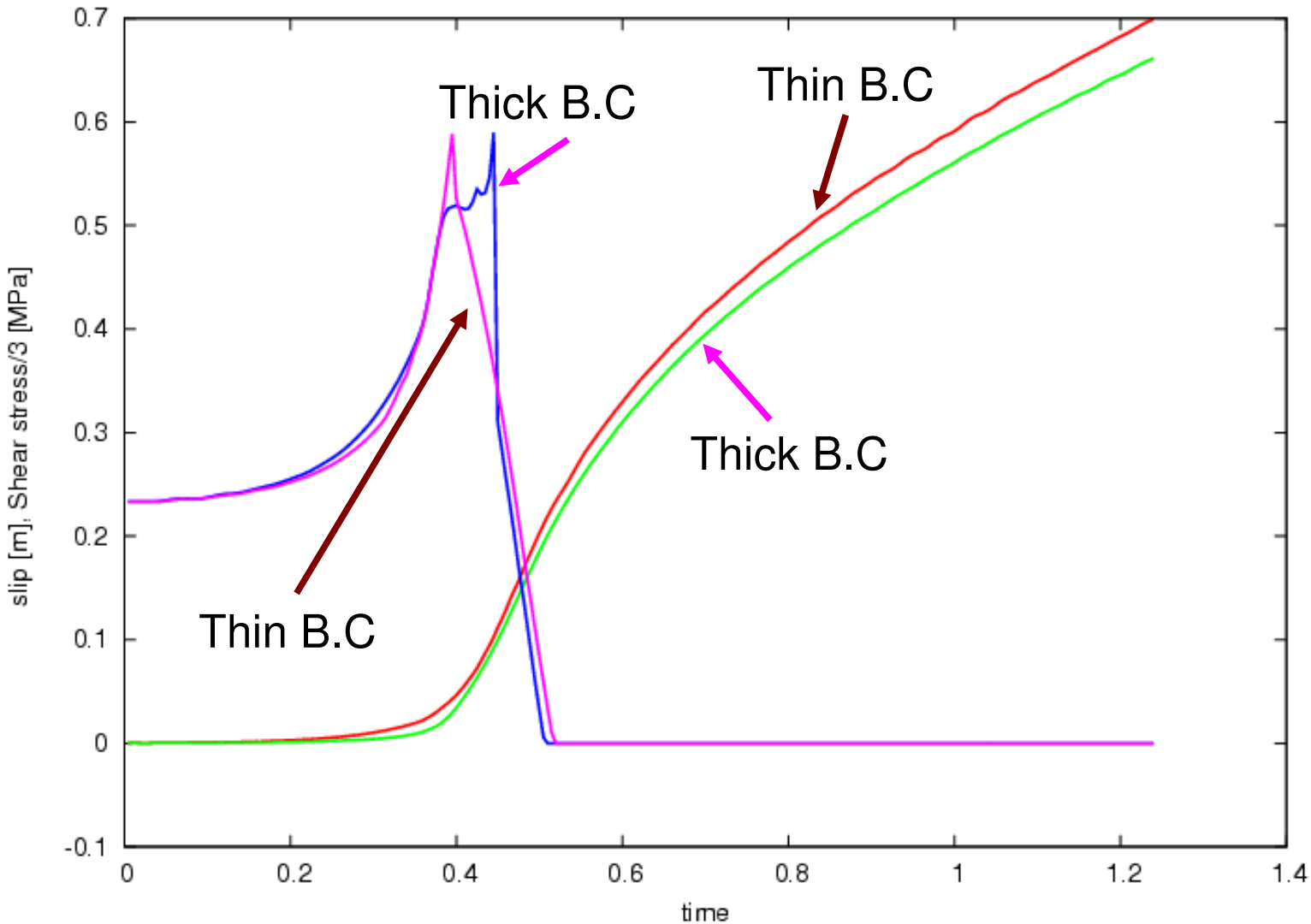
Comparison of two implementations of the boundary conditions



Why do they differ ? -> Poor modelling of friction law



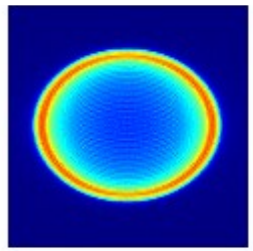
Why we did not see it?

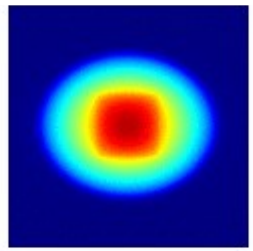


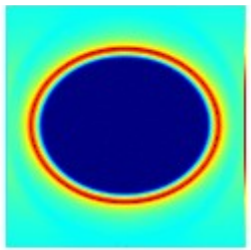
Which is the good one?

t=2.1 s

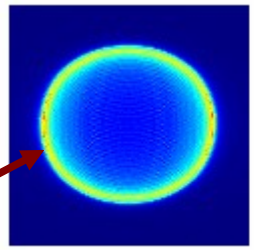
Slip rate | Slip | Shear stress

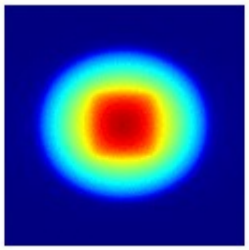


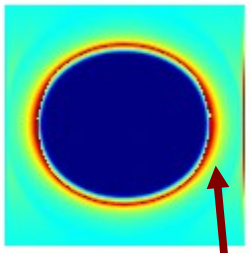




Thin B.C.







Thick B.C.

Poorly resolved

Conclusions

- Resolution of crack boundary conditions is very delicate
- For the same delta x thin boundary zones do a better job
- For the same accuracy thick BC require twice as many points
- The error is difficult to see, since it only exists in inplane mode

Thin B.C.