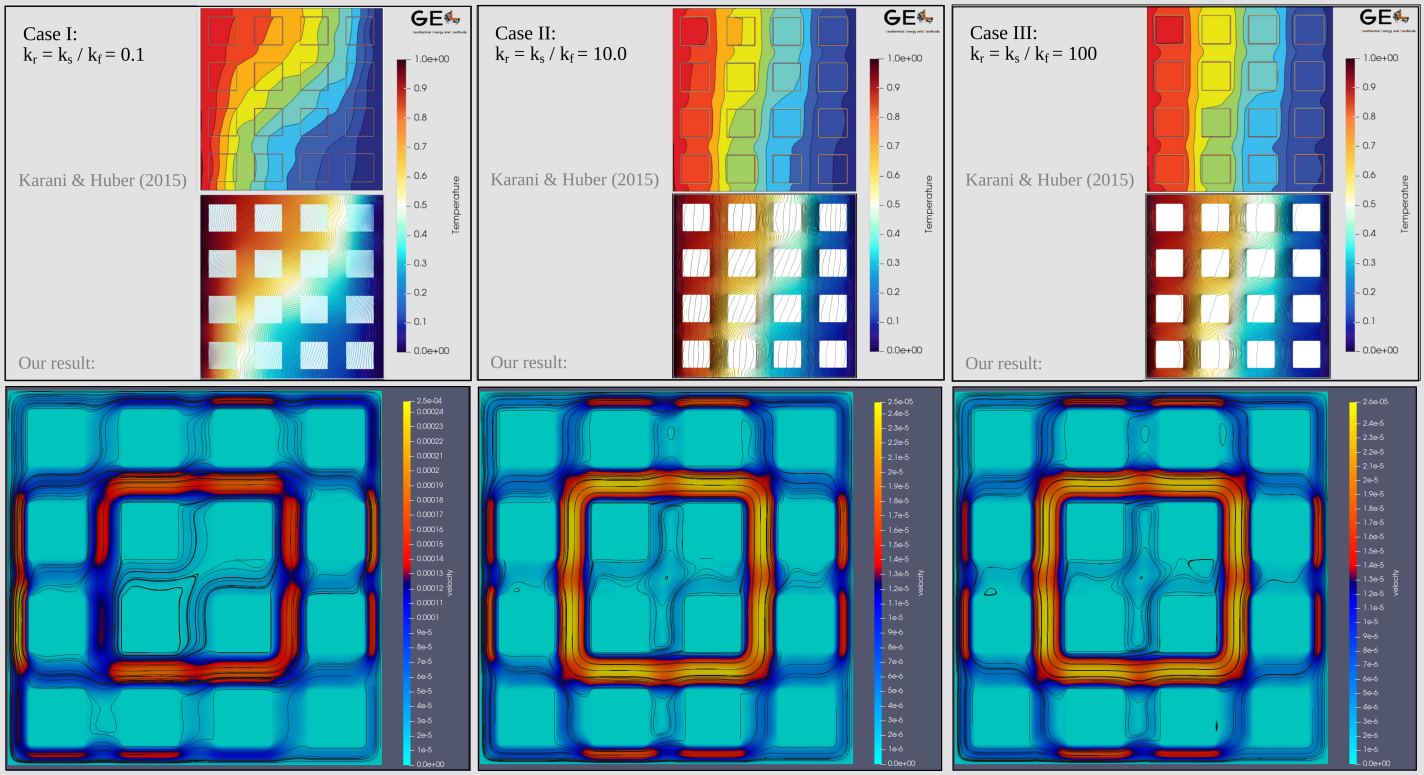

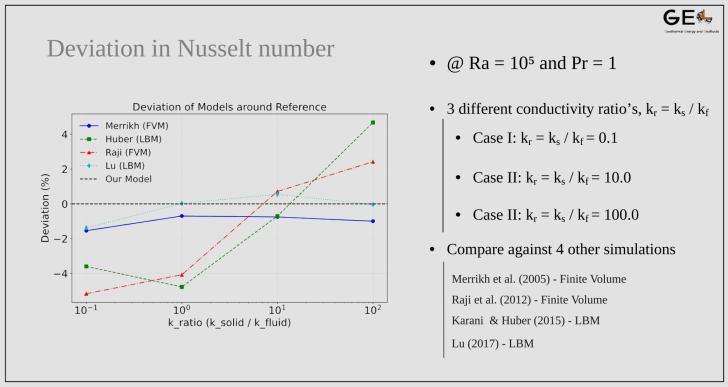

Streamlines and temperature fields of the benchmark. A clear compression of the isotherms at the left and right boundary for increasing k_r is observed. Therefore the boundary layer decreases in thickness. This increases the Nusselt number if a pure fluid, wall based calculation of the Nusselt number is chosen.

A comparison of steady state conductive heat fluxes shows:
$q_{cond}(k_r = 0.1) = 4.92e\text{-}05$ vs. $q_{cond}(k_r = 10) = 2.61e\text{-}05$ in lattice units.
The total kinetic energy in the system is:
Ekin(kr = 0.1)=1.36e-04 vs. Ekin(kr = 10)=2.16e-06.

The result is clear, with decreasing velocity in the domain (by more then one order), the decreased conductive background heat flux does not recover for the lower velocity. The Nusselt number decreases. Note that the porosity is 64 % and if the porosity goes below 50 % the trend with k_r and q_{cond} flips. However the Nusselt number still decreases, because the kinetic energy also decreases.

The comparison with our model, based on the 'old' values of the pure fluid, wall based Nusselt number calculation.