Exercise on advection tests

Use the PENCIL CODE from http://pencil-code.googlecode.com to simulate the advection of a passive scalar obeying the equation

\[ \frac{dc}{dt} = -U \frac{dc}{dx} + \kappa \frac{d^2c}{d^2x} \]  \hspace{1cm} (1)

where \( U = \text{const} \) is a parameter. Use a smoothed hat function as initial condition. You may choose

\[ \texttt{&pscalar_init_pars} \]
\[ \texttt{initlncc='hatwave-x', ampllncc=1e-0, widthcc=.1} \]

1. Determine values of pscalar_diff for which the Gipps phenomena are kept at a minimum.

2. Study how this depends on the width parameter of the initial profile, \texttt{widthcc=.1}.

3. How does the run time affect the results?