<u>Exercise 1 Answers</u>

- **Move the location of the point sources to the opposite side of the domain**
  In the case of the horizontal plan this should make no difference, you should simply get a reversed version of the water profile. In the case of the adverse slope model, clearly water will flow down the slope, at faster speeds. This does however cause it to reach the other end of the domain, where (unless you had changed anything in the bci file) water cannot leave because boundaries are closed as default, so water will begin to pool and back-up from the boundary. You will need to modify the start_depth and bci files...

- **Increase sim_time – what happens (or doesn't happen) in the horizontal plane test case when the water reaches the opposite side of the domain? Why is this? Can you change this outcome by varying the input files? *You will need to change the sim_time and the bdy file and possibly the bci file***
  If you increase the sim_time (and the length of the boundary file) then water flows from one side of the domain to the other, and when it reaches the other side it fills the domain because water does not flow out.

- **Create a manningfile with spatially varying floodplain friction. Try bands of low and high friction values perpendicular to the flow direction**
  Causes water profile to undulate with as the water velocity increases and decreases across the domain as the mannings n values decreases and increases respectively. Causes water to backup or race ahead.

- **For the acceleration model look at the effect of setting the value of theta to 1 for the low friction scenarios**
  Rather than the water depth decreasing smoothly towards the wave-front, the water depth is unstable and oscillates around a mean.

- Using the flow limited solver, try varying the initial time step (initial_tstep) to try and improve results, or vary the Qlim value
  Increasing the timestep increases the distance which the flowfront gets by the end of the simulation and brings the simulated profile closer to the analytical solution. Thats because although the flow-limiter is being implemented each time, there are more timesteps before the end of the simulation. If the timestep is reduced then it also takes longer, for example ~5 seconds for an initial timestep of 2 seconds to ~5 mins when initial timestep is 0.01. Increasing the qlimfact values allows more water to flow between cells, and very quickly causes a chequer board effect (5). Increasing by a factor of 4 allow the wavefront to get only a little further, but only has an effect similar to decreasing the timestep from 2 seconds to 0.5 seconds.

- **Vary fpfric (other example values could range from ~0.016 for asphalt, 0.035 for short grass and up to 0.15 for wooded floodplain). You could use the equations in the "looking in more detail" exercise box to create boundary conditions and an analytical solution for specific combinations of u and n, investigate the effect of varying u on the accuracy of the acceleration model.**
  Generally decreasing the fpfric will increase the speed at which the wavefront moves across the floodplain. If you look at calculating an analytical solution, you will find that as u increases the inertial model becomes less accurate compared to the analytical solution. For more details see de Almeida and Bates