

In this section we will examine what happens to the air concentration calculation when we use a single particle rather than thousands of particles. But first, let's go back to the original calculation that we did in reconfiguring the test case. You should still have that information in the graphical user interface. If you open the menu, that was the calculation that we started on the 25th at 17 UTC, from Dayton, Ohio. We only ran for 12 hours, we used the North American Regional Reanalysis data. We released one unit of mass for one hour, we set up a concentration grid of 5 km resolution, with a depth of 100 m, and we produced one output, a 12-hour average air concentration. That was that calculation. If you do not have that result, go ahead and run the model now.

One of the things that come out of that calculation, or any calculation, whether it is a trajectory or air concentration calculation, is that the model creates a message file. You can go to the advanced menu and view the MESSAGE file, or you can open up file explorer and look at the MESSAGE file in the working directory. And this MESSAGE file provides more detail about the simulation, in terms of when it was done, the meteorological data that it might have found, the size of the meteorological data, information about the name list parameters that were set, and we will going to these been much more detail. Various determinations that were made about what information was available and could be computed from the meteorological data file. And then it provides information each time step about the simulation. So as you recall in this test case calculation, we released one unit of mass,

and we released 2500 particles, that means we were following 2500 trajectories. So the calculation proceeded by each time step, in this case during the first hour, each time step was three minutes, and this number, the internal HYSPLIT time parameter, which is the number of minutes since the year 1900. And you can see over the course of one hour, the release took place over one hour, we released a total of 2500 particles, that with the round off error had a total mass of one, and that is the default configuration for HYSPLIT as far as the particle release rate is concerned and for different simulations it may be important that this parameter be adjusted.

So let's go back to doing a single particle trajectory calculation. So we're going to reconfigure the calculation to use one particle rather than 2500 particles. And we're going to make some other changes as well for educational purposes. So go back to the menu, concentration, set up, and we will start with the same settings as before, from Dayton, Ohio. But we're going to go into the deposition and grids menu for the pollutant, but now instead of releasing one unit of mass over one hour, we only want to release all the mass over a single time step. Now the minimum time step in HYSPLIT is 1 minute, therefore if I were to do the entire release over one hundredth of an hour that would essentially put all the mass out in the first time step. And because the emission rate is defined in units per hour and we want a total mass of one hour, I mean one unit, therefore we need to release a 100 units of mass per hour but only for one hundredth of an hour, to give us a total of one mass unit, save, and let's save.

And the next step is to generate only one particle, or release only one particle rather than 2500. So we need to go to the advanced configuration, set up menu for concentration. And, as you can see, we want to use menu number 4 which sets the release number limits, and here is the 2500, so instead we want to make this one. So this is defined as the particles that are released per emission cycle. And the emission cycle previously was one hour and we changed it to 1/100 of an hour, so we would release one particle per 1/100 of an hour, which is the entire release duration, in this case.

And now if we go ahead and run model, we created this name list file which we will use, and now we will do a display, and execute, and we don't see, we see a rather curious result. Actually just a few intersections here, near the release point. You can see the star for the release point. So this does not quite look right. Let's confirm that the calculation did what we thought it should do, so will view the MESSAGE file, and if we can scroll down here, sure enough we can see that the emission started and terminated, we have one unit, and one particle, for the entire simulation. One of the things that came out of the MESSAGE file is the vertical mass distribution, every six hours, and can see here this one particle is at 430 m, after six hours, and it's also still at the same height after 12 hours. Now, if you remember, in the concentration set up, grids, our output grid was from the ground to 100 m, and at hour six and hour 12 the particle was at 400 m, and therefore it was not captured in the sampling grid. So

remember that the particle trajectories associated with dispersion have a turbulent component added to them. So this particle is bouncing around within the boundary layer from time step to time step. So what we need to do is expand the size of the concentration grid in the vertical to cover the boundary line. So I will make it 5 km deep, let's do a save, and then rerun the calculation.

And now we actually see the track of that particle over the course of the 12 hour period. And so this shows a few things that you need to know. That is the concentration pattern that you see the output is very sensitive to how you define the concentration grid and we will cover this more as we go on in the next few sections.

And this concludes the discussion of a single particle trajectory.