In this section we will review the options within HYSPLIT to compute multiple trajectories in time. In the past trajectory computations, we have always started the trajectories at a single location at a single time. There are features within the model that can be invoked to compute multiple trajectories either in time or space.

So to continue on with this, lets go ahead and open up the graphical user interface. Now before we get started, we've been doing many different calculations in previous sections, and the various user interface variables are set to many different options, and sometimes that can lead to confusion or perhaps even the wrong result. So what you should do at this point is perhaps click the reset button, this will set the variables within the graphical user interface back to their default values, and if you were to do a calculation, it would for that test case.

So for example, if I open setup run, you can see that everything is back now to this October test case that comes with the HYSPLIT distribution. Now to do the multiple trajectories in time, let’s work with the same example case that we have been using in the past, the mid boundary layer trajectory from the Dayton, Ohio, starting location. So let's go ahead and retrieve, if you do not have this file, we will review the settings that are required. So it's traj_fwrd_control.txt and you can see the starting time, the 25th at 1700 UTC, the one starting location at Dayton, Ohio, at 750 m AGL, for 68 hours, in the forward direction, using the vertical motion data that's available with the North American Regional Reanalysis,

and we will leave the output file name the same. So go ahead and save.

Now I did not mention this previously, but in every one of the examples in the tutorial where I mention that you can retrieve the file that you saved previously, to get, to simplify the setup, these files have been saved in the tutorial. If you were to go to the tutorial directory under files, you'll find that every one of the examples is here. So the one that we just loaded traj_fwrd_control.txt can be found in the tutorial/files directory. Also I should add that all of these files are configured for the default installation. That is tutorial is attached to the “C” drive as well as the HYSPLIT directory. If you configure the installation differently, then you would have to edit those directories after you load the information from these files.

So the next step, we've configured the model to do the single mid boundary layer trajectory, but let's say we want to start trajectories in time. So go to the advanced menu. I'm going to create a name list file for trajectory and menu number three here is for multiple trajectories in time. And there are three settings here, the first is the restart interval, so that means how often, and what's the time interval, over, in hours that we want to start new trajectories. So we will start them every hour, from the starting time that is set in the CONTROL file, that is, 1700. And we’re only going to do this for 4 hours, so we’re only going to start 4 trajectories. We will discuss the levels option later. So go ahead and save, and save. If you were to go to the working directory, the hysplit4/working directory, you can

see we created this namelist file SETUP.CFG, and we created, while we, we set two different namelist variables, nstr to one, that is the start interval every hour, and we're going to be doing starts only for four hours, so the mhrs variable in the namellist file is what you created when you selected those buttons, you selected the changes options within the graphical user interface.

So now you can run model, and you're going to run using the setup file, and display the result. And you can see the four trajectories, each one starting one hour later, going from the red at the northernmost point at hour 17, down to the last one that started at hour 20. And you can see that the winds progressively are shifting so that the trajectories go further to the south. And this is starting to give us a sense of what the tracer pattern looks like for a three-hour release. It's not sufficient to describe the tracer concentration distribution that we saw in the original example, covering New York and Pennsylvania with a single trajectory. So not only do we need, we need to cover the time interval as well.

So let’s go on and do a little more complicated set up for multiple trajectories. So in this case we're going to start multiple trajectories in time, but we're going to have new starting points along the trajectory. Of course having a new starting point at the point of the trajectory is not going to give you a different trajectory, it will be the same trajectory. But what we will be doing is starting trajectories at different starting heights.

So let's go back to advanced, configuration, trajectory, menu number three and let's make this a little more complicated, not complicated, but let's expand it in time little bit. So let's start a new trajectory every six hours, and let's, and you'll see why I'm doing this once you see the result, let's do these new trajectory starts for 24 hours. And now we are also going to set this variable, that is we are going to start, when this variable is nonzero, the namelist variable in this case is nver, we're going to set this to 3, we're going to start trajectories at three different altitudes whenever we start a new trajectory. I haven't really explained this very well yet, and it'll be much easier to explain when you see the final result.

So go ahead and save, and save, and now we will do the run model. Well I made a mistake, we have to do one other thing; we need to define the three levels that we are going to start trajectories for. So let's change this to a 3 and I'm going to copy and paste the starting location into the other locations. The Dayton location should be valid for all of them, and we will start the first one at 10 m, the second at 250 and the last one, at 750, rather, and the last one at 1500. This is identical to the three boundary layer trajectories that we ran, the low level, the mid boundary layer, and the upper boundary layer that we ran in an earlier example. Now I go ahead and save, okay save, and now run model, and this should work, and display results.

So we have here, we will start by looking at the vertical projection, and you can see a new trajectory is started in

time every six hours, but only for 24 hours, so we have four starts in time. And at the end of the first restart time, so this is six hours downstream, we have our first restart of new trajectories. What the code does is it looks at each of these three trajectories that we started and at that location in space, so somewhere in this region here, it will start three new trajectories, below this trajectory, at seven fifty, at fifteen hundred, seven fifty, and ten meters. The same way with this blue trajectory, it will restart new trajectoryies at 1500, continue with this one at 750, and start a new one at 10 meters.

So what is the problem here, is that these are all, not so much of a problem, the reason that you get this distribution is that these three trajectories all have a slightly different spatial location and when you start new trajectories at different levels, what the results will reflect is the change in wind direction and wind speed and the boundary layer at a different locations. So in some ways this is a very simple representation of mixing and the results, the trajectory results that you would get when the atmosphere mixes at different locations in space. And you can see from the overall result, at least in the first 24 hours, that the change of wind direction with height really seems to encompass all the places where the tracer was measured. And these trajectories really do not really incorporate any mixing. We're just assuming that the the boundary layer was well mixed and so a trajectory that was transported, say at mid boundary layer, rapidly mixes up to the top of the bound layer as well as to the lowest levels and continues along in those directions for

the winds at those heights, resulting in this distributed pattern.

So I think the take away from this example is that it is not possible, this example and previous examples, it is not possible to represent the complex dispersion patterns by a single trajectory.

In the next section we will discuss how to compute multiple trajectories in space.