In this section we will determine the mixed layer depth. As you recall in the trajectory calculation that we did originally, we used a starting height of 10 m and the trajectory followed the northern edge of the tracer plume. In the trajectory animation that was done in a subsequent section, we started the trajectory at mid boundary layer, 750 meters above ground. This trajectory was a bit more representative of the tracer plume but still not totally accurate. So how do we determine the mixed layer depth. The mixed layer is the lower part of the atmosphere that interacts with the surface, either through turbulent mixing or convective buoyancy. The atmosphere we'll mix in this region. And for the purposes of this tutorial we will use boundary layer depth or mixed layer depth interchangeably.

The best way to start is to open up the graphical user interface, meteorology tab, display data, text profile. Now here we will select the North American Regional Reanalysis for the CAPTEX experiment two. So go to the tutorial directory, under captex, and select the captex2_narr. Now we know that the tracer release started at 1700, the data file starts at 1500, you can review the meteorological data information in an earlier section to confirm this. And so will start at three hours after the beginning of the meteorology file. We only need to see the first time period. That would be 1800. If I were to select every three hours, we would see the text profile every three hours. And you want to enter the starting location of the trajectory, which would be the Dayton, Ohio, location, 39.9 North and 84.22 West.

Now we just go ahead and run profile. This creates, if I can open this a little wider. Now this creates a file valid at 1800 UTC. The file started at 1500 and this provides a profile of meteorological information at the trajectory starting location. And now you can see, for more information about these variables, these are the four character abbreviations for the meteorological variables, you should go to the user's guide.

But the height of the planter boundary layer is what we are looking for and in this case it is 1716, one thousand seven hundred and sixteen meters above, in this case mean sea level. How do we know that, well if I were to look at the vertical profile, we can see another variable is the surface pressure. This is the pressure, the absolute atmospheric pressure at the terrain height and it is 984 Hecto Pascals. So that falls in between these two layers and you can see below the ground, since the data file is written in pressure units, there will be pressure levels below terrain, but the information really is not, is only representative what's happening at the surface. So the terrain actually falls, the surface, falls between these two heights. So somewhere between 200 and 400 m above mean sea level. So the terrain height in this case is about 300 m. You can compute it more precisely. And if I were to go up to the profile, to the place where mixing stops, and I look here, if you look at the turbulent kinetic energy, so this is the variable that represents how turbulent the wind velocities are, the second moment of the wind velocity components, you can see that above 850 it's starting to drop and then

above 850 it drops to an anomalously small value. So this really represents the top of the mixed layer depth, of the mixing, and you can see here it falls at approximately 1700 m, halfway between these two. But if you subtract out the 300 m terrain height, that would be about 1400 m above ground level. So if I would select a height that is approximately mid-boundary layer, I would select the height of about 700 m above ground level.

There is other information here. For instance, you can see that within the boundary layer, I should see the specific humidity field, so the moisture is relatively well mixed with in the boundary layer, but above the boundary layer it becomes drier. And also, for instance, is the potential temperature, this is a computed variable, so that within a well mixed layer, the potential temperature is approximately the same, uniform with height. And you can see that the potential temperature only starts to increase above the mixed layer depth.

Not all meteorological data files will contain the mixed layer depth. For those files that do not contain it, HYSPLIT will compute, or will estimate the mixed layer depth by looking at the potential temperature profile to see at which height it first increases.

In the next section we will review trajectory computations with different mixed layers. This concludes the section on how to determine the mixed layer depth.