Continuing with the air concentration uncertainty, we're going to look at the physics ensemble. One of the aspects of the physics ensemble is different assumptions about how the turbulence is computed, or how the stability is computed from the meteorological data. So if you have some questions about this, you can go back to section 9 and review the air concentration parameter sensitivity discussions. The physics ensemble is going to rely upon going through multiple variations, in this case 20 different variations, and they are done one at a time, so this calculation actually could take quite some time. And I would propose that you probably do this on your own, the calculation with 10,000 particles may take as long as one or two hours depending upon your computer. Even the simulation with 2500 particles could take 10 or 20 minutes. But some of the things that we go through and these are the options. For instance, the file 001, remember one would just do a default 3-D particle calculation, and then we go through some of the puff-particle combinations, computing mixed layer different ways, assuming a different minimum mixing depth, we have not discussed this at all in any of the sections, scaling the mixing differently, looking at using the different, Beljaars scheme versus the Kanthar-Clayson scheme, that's discussed in section 9, using different Lagrangian timescales. This is you remember, this number is used to convert, to generate the turbulent velocity, so it's the time it takes for the turbulence to become uncorrelated. So we can adjust that to get different answers. So the main purpose of this and that was the way it was described in section 9, of the physics variations, is to look at other possible solutions, all of which could be valid, and to see what the sensitivity of the model output would be with those variations in the internal model assumptions.

So to configure this, we can start, if we are continuing on, not many changes are required, I will go over them. But otherwise you should start by loading the previously saved CONTROL and name list files that were generated in the meteorological grid ensemble. So the changes that are required are few, in the set up make sure that the starting height is 10 m, it was not for the meteorological grid ensemble. We should have another unique output name for this ensemble, and let's call it ENSPHYS for the physics ensemble. And the last item would be the particle number. Now this is the number we use for the turbulence ensemble, which was the last thing that was done. I couldn't set this to 2500 or 10,000. I'm going to set it to 10,000 and let this run for a while. If you're doing this interactively, you could try it with a smaller number first, and then see what the, how the answers compare with what we're doing at 10,000.

So I'm going to save this and then as before to run this you go to concentration, special runs, ensemble, and physics, and now run. And this menu will be open while it's running so you can see which variation is being worked on, and as each variation completes, this text will be updated. The first simulation, like I said, is the default simulation, the 3-D particle calculation using the 10,000 particles in this case. After this first simulation completes, I will pause the video, and then I will start up again, when the entire runs, all the runs have completed.

Well finally the calculations have completed. Let's just take a quick look in the working directory and we can see here that the last one completed at 12:41, and the first one completed at 12:22, so surprisingly this did not take as much time as I thought it would. And to confirm that the right particle number was set, I can check the setup file and the NUMPAR is 10,000. Surprisingly faster than I thought, maybe I have a better computer than I used to have. Well by now you know the next step, and that would be to display the concentrations, the ensemble concentrations that is, and we know that we have to do the view map first.

And well, we can do it a little differently, let's select the 90th percentile concentration this time and execute. And now these concentrations, and you can see that it's PC 90, which means that only 10% of the members have higher concentrations then this value. Let's say in the yellow region here, which is 10^{-8}, there are only 3 members, approximately 10% of 30, three members that would have higher concentrations in this region. And we can scroll down to the end and getting near, we're going to look at Little Valley New York again.

So let's quit this and now that we ran the probability program to generate those output files, if you were to look at the output files, the latest ones ever created, these are the probability files, the graphic that we just created, these are the PROB concentrations at different probability levels.

The other ones, these are the probabilities for exceeding concentrations at a certain level. We have not discussed this, but you can read about it in the help file, the mean concentration, the number of members at each grid point, the variance, the concentration variance at each grid point. These are all generated by the program.

So we can now go ahead and do the boxplot and fortunately Little Valley New York is still entered in the latitude/longitude field, and we execute display, and we have this final plot. And that shows the percentiles, and you can see this is actually, if you go back and look at the other boxplots that were generated in the physics, in the turbulence ensemble, and the meteorological grid ensemble, these so far are the smallest, the range, also on the order of a magnitude or less for some of these, especially in the quartiles. The quartile distribution is quite small in these highest predicted concentrations.

So far what we found is that the largest ensemble, or the largest uncertainty is due to the gridding of the meteorological data; the turbulence or the physics assumptions are not as significant, and we will look at the meteorological data some more in a subsequent section.

And this concludes our ensemble, our physics ensemble discussion.