To continue with air concentration uncertainty we will take a look at a turbulence ensemble. Normally when we are computing dispersion, particle dispersion, we want to release a sufficiently large number of particles to ensure that each simulation gives us similar results. In a turbulence ensemble, what we will do is reduce the particle number, so that the results are sensitive, or become more sensitive to the dispersion that's calculated for each simulation. The trick to this is that, normally when you run the dispersion calculations, the turbulence is generated by the random number generator of the computer. When that random number generator is initiated, it is always initiated with the same random number seed, which means that if you do the same simulation twice, you will always get the same answer, because the turbulent values that are generated will be the same. However, we can change the configuration so that the turbulent seed is different for each simulation. In that situation, if you release a sufficient number of particles, and regardless of the seed, you should get the same answer, but as you reduce the particle number, you will get different answers, with different turbulent seeds.

So if that is the basic approach and to configure the simulation, let's go ahead and start with the ensemble that you did in the last section, so if you're continuing on, you do not, you can just leave things the way they are, if not you should retrieve both the CONTROL file and the setup file from that last section.

And we're going to make just a few changes. First, in the setup menu, in the ensemble, we started at 200 m, we should go back to 10 m.   And also we should give it a unique output file name, so that it doesn't conflict with what was created in the last section.   So let's just call this ENS for ensemble and then TURB for turbulence, and we can do a save to close all these menus.   And the trick as I mentioned is we need to reduce the particle number. Now this is configured the same way, it'll automatically do 27 simulations, and if we want the answer to be the same as the 10,000 particle simulation, then we should divide this by, 10,000, by 27 and that would give us approximately 1852 particles for the simulation.   So if we're to do these 27 simulations and put together the results to get a mean simulation over those 27, it should give us the same result as we were doing a 10,000 particle simulation.   And so that are really the only two changes that are required, and as you might guess this is a special run, and it's an ensemble run, and it's the turbulence ensemble.   This actually calls a special executable and we want to continue.

And this should not take that long because we are only doing 27 members.   While it’s calculating, I do want to point out to you, that in the working directory, there are files generated when you select an ensemble view.   So in the last section, as an example here, this is the file, the prob50, that was generated when you did the ensemble view for the 50th percentile for the median concentration. So every time you do an ensemble view to generate maps, that is display ensemble view, to generate maps, it generates these, that view map option here, every time you do that, it will recalculate all these probability maps, as well as the mean concentration map, that's cmean. For instance, here is the mean concentration map. The number of members map. These output files are described in a little more detail in the User's Guide. But you will see where I'm going with this, these files are all compatible with the concentration plotting program. And that of course is what is used when doing these.

And we can see where, finished, and hidden underneath all of these menus was the fact that we finished. So the reason I explained this to you, that these are produced each time, and you can see this in the scripts, if you look at the processing. Here we've just gone through the 27 members and the next step is that we need to call the probability program which generates the information, those probability files, prob05, prob10, that are actually used by the boxplot program. So the boxplot program needs the files created by the probability program.

So therefore, once this run has competed, you would go to display, ensemble, and you would have to view map first, even though I don't really care about the map right now. So I'm going to select this again and so this is now the 50th percentile for the turbulence ensemble. But I'm more interested in the boxplot. So now we can do the boxplot step. You have to do the view map step to generate the probability files that boxplot uses. We will enter again Little Valley New York, which was 42.25 and -78.80 and execute. And, if you recall, the boxplot for Little Valley New York for the meteorological grid ensemble, the variances especially around the, or the range, the concentration range around the peaks, was on the order of an order of magnitude, to a factor of 20 or 40, where here we're seeing a much smaller range. So that the turbulence ensemble, perhaps only accounts for, I'm looking here at the peak, one, going across here, one, two, maybe three, we're looking at a factor of 3 or 4, at the most in the peak concentration range. The tails here go down to zero, so it's a little difficult to determine a range. From the standpoint of the tracer, numbers much below 1×10^{-11} here are effectively zero; it's below the detection limit.

But the concluding remarks about this is that the turbulence, the particle turbulence only accounts for a relatively small fraction of the uncertainty that we see in the concentration predictions.

And that concludes the turbulence ensemble.