

In all of the previous sections, we've looked at transport distances on the order of hundreds if not thousands of kilometers. In this situation, or this simulation, we will look at very short range dispersion. So we will look at a different experiment. So we will do a case, and this example we will look at is the experiment called project Sagebrush and it was conducted only a few hundred, or only a kilometer, at most 2 km downwind at the Idaho National Engineering Laboratory. And you can see, this is a Google Earth superimposed image of the plume that we will be calculating, and you can see there are sampling arcs from the release location at various distances. We will be looking only out to the 1600 meter arc so this is a very short range calculation.

And as in many of the other examples, all the data you need to do this are in the tutorial directory called sage and if you've take a quick look at that, right here, you will find the 1 km resolution WRF meteorological data as well as the measurement data, which by the way is in parts per trillion, so these are volume mixing ratios. And a sample CONTROL file and name list file. So we will use those as a short cut to configure the simulation and I will describe the changes that are needed as we go through each of the menus.

So start by pressing reset and let's do a concentration set up, retrieve, and we're going to retrieve from the tutorial/sage directory, the CONTROL file. And let's do the same thing for the name list, that is the setup file. And now let's go look at the menus. So let's start with the

set up menu. And you can see this experiment took place in 2013 on October 18 and we will start the calculation at 19 UTC. And the center of the tracer release was there in the desert in, near, Idaho Falls, and the nominal release height of 10 m is what we're going to use. And we only need to run for 3 hours, these, the tracer release only occurred for 2 1/2 hours, and we only need to run this till the end of the release. The next, and I mentioned we will be using the WRF model output at one kilometer resolution that has been especially prepared for this experiment. And the tracer that was released was sulfur hexafluoride SF₆ and the quantity that was released was 3700 grams per hour for approximately 2 1/2 hours, well exactly 2 1/2 hours. And the release started 30 minutes after we started the model calculation.

Now since we are doing a very high resolution calculation we need the concentration grid also to be high resolution. And so this is the location of the release and we're going to send it to .001° in latitude/longitude and this is about 100 m, this resolution is about 100 m, and we're only going to cover 0.2 of a degree in latitude and longitude, that is the span. So that is quite, that is a 20 km, approximately twenty kilometer span, so that's large. And normally we were using about 100 m for the vertical depth of the layer but because this is such a short transport distance, we will not have uniform mixing in the lowest 100 m, so we're going to cut this again down to about 25 which is sort of the lowest roughness, surface layer region. However, you know we can go even smaller, but we would have to release more particles to make this a useful

calculation. Remember the smaller the grid cell, the more particles are needed to give us a decent calculation. And the sampling, we'll start on the whole hour, one hour after the start of the experiment, or 30 minutes after the start of the release. And it will end 2 hours later. And the sample duration will be 10 minutes. So this is the actual sample duration. These are very short samples and all ground level. And of course the SF6 does not deposit and these fields are all zero.

Now as far as the name list, let's go to, let's go to the menu, and what we need to do is release enough particles, and I think for this particular calculation, we're going to do 50,000 particles, we can do more if you like, but do it on your own time. And as I pointed out when we started, the measurement data are in parts per trillion, that is a volume mixing ratio. So let's go ahead and do the conversion to mixing ratio or to volume mixing, to mixing ratio directly in HYSPLIT and so you know that would be in menu number 10, and we're going to divide the output the concentration by air density to get a mixing ratio. And that is all we are going to need to do for now. So the next step is simply to run the model.

And while it's running, I will point out, this is actually not going to take very long, what we're going to do, the conversion to parts per trillion, in other words we need to correct for the molecular weight. And if you're not sure of this correction, you need to go back and look at the previous section that discusses air concentration versus mixing ratio, volume and mass mixing ratio. But the SF6

molecular weight is 146. Air is 29, so to go from grams per cubic meter to ppt, okay, we're going to need to do a conversion factor of, I'm sorry, we're going to do a conversion factor of 1.9×10^8 , here, that was the answer: 1.9×10^8 . So this this gives us a conversion to, from grams per kilogram to ppt and as I mentioned, if you're unsure of how to do this, go to the previous section and review the equations, it is simply the ratio of molecular weights, and we just need to make sure the other units are correct.

This has completed and so we're going to do a scatter diagram and compare this to the measured data. So we will open the concentration, utilities, Convert to DATEM menu, and the measured data will be the sage5_meas.txt. Those are in parts per trillion and we need our data to be in parts per trillion, so this is grams per kilogram, right because we released grams, we didn't release kilograms, so it's grams per kilogram, and that would be $1.986E+08$. And we would create the DATEM file and we compute statistics. We have a correlation coefficient of 0.80, which is good, 2.57 for the rank, we have not a whole lot of bias, the ratio of the means here is 0.87, the fractional bias is very small.

So let's exit and look at the scatterplot and you can see it's actually quite good. There looks like there is a little bit of under-prediction right here at the highest concentrations, and somewhat over-prediction at the lower concentrations, but there is a range, quite a range, and the bulk of the predictions are well with a factor of 10 of each other.

And we do have another display option for these high-resolution, let's take a look at the display menu, and we will look at contours. Now to get a better looking close-in display, sometimes it's good to turn on the rings, which sort of forces a high-resolution map, and we can draw five rings at 1 km intervals here. And we need the concentration conversion factor, again to go to PPT, $1.986E+08$, and we can do parts per trillion, and let's set the contours, probably starting at 10,000, and let's execute.

There are multiple frames, obviously because we're outputting every 10 minutes, and we can scroll down here and we can right-click to zoom in a little bit here, but there is still a lot of black ink here with the measured data. So you can see the 1600 kilometer arc, this this is about as high resolution as you're going to get on this kind of display. And we can actually do a little better on the on the units and labeling, we can open up another, the panel of, the border labels rather, and we can change this to sagebrush, and the layer we cannot average, but say between, it is a little more accurate. The units will be PPT and there is no volume. Clear that and now if we do the display, I'm not sure this is going to have much effect, but let's try. Not much effect but now can see the labels are correct but it is still very difficult to view the concentrations, especially at the very close in distances. So you can if you like convert this to output for Google Earth by selecting the, this option, but I'm not going to do that, you were introduced to that right in the beginning, when I showed you the graphic.

But this is how you would do a very high resolution simulation. One thing to remember is that HYSPLIT does limit the minimum time step to one minute and so when HYSPLIT is running with a one minute time step, it does, and if the concentration grid is finer than, or if interpolation is required, it will do a linear interpolation to make sure that particles do not miss any of the concentration grid cells. So you can run with data that's less than one minute, well you can run with the particle positions that vary at less than one minute, which is below the minimum time step, but these are interpolated particle positions. That is one thing to keep in mind. Future revisions of the model will permit time steps on the order of seconds as well. But the current version does not.

And that concludes the discussion of high-resolution or configuring a high resolution simulation.