In this section we will discuss how to convert meteorological data into a format that HYSPLIT can use. HYSPLIT requires meteorological data on an evenly spaced grid, latitude/longitude or on a conformal projection, at multiple heights and time periods over the duration of the simulation. These data can be obtained from various sources already formatted for use by HYSPLIT or converted by each user to the proper format. As we noted earlier, these conversions can be difficult and it is recommended that you use data that have already been formatted for HYSPLIT use.

If you go to the graphical user interface, to the meteorology tab, convert to ARL, you will see various options available to you for converting data. WRF/ARW represents the Weather Research Forecast model, available from NCAR, the output of the format of the WRF model is NetCDF, Network Common Data Format. There is a program provided that can be used to do this conversion. We mentioned earlier that many of the CAPTEX calculations will be done using the North American Regional Reanalysis. These data have already been converted to HYSPLIT format and this application is not really needed. Global latitude/longitude data sets from NOAA or from ECMWF can be converted here. There's also another option for ECMWF reanalysis data, and for the original MM5 model from NCAR, version 3. This is a special format. Meteorological files for the CMAQ model, these are also a variant of NetCDF, can be converted. And we'll be discussing in a later section, you can create your own meteorological data set that can be converted

for use by HYSPLIT.

The point for most of these applications is that you need to be doing this on a UNIX or Mac system. Not all of these conversions are available on the PC.   But we do provide in the directory, the HYSPLIT directory, if you go to /hysplit4 for on your PC and look in the data2arl directory, software is provided so that you can do these conversions yourself and do a special compilation on your own machine. If you go to the metprog directory, there is a ZIP file here, you can see that the source code is provided for various conversion programs. This api2arl is used to convert GRIB format #2 data, GRIB is the gridded binary format common at many major meteorological centers. The PC converter only converts GRIB1 format data. GRIB2 data requires special libraries. These have not been compiled on the PC, so you would have to do your own compilation. The WRF/ARW converter, the standard lat-lon GRIB version 1 converter, the MM5 converter, and for the RAMS model. Most of these need special libraries, some of which are provided in the library directory. So generally speaking most of the software is provided, except for special GRIB2 or NetCDF libraries, which you have to obtain on your own.   So you can see this is a somewhat advanced topic and that is why we do not recommend, for most users, to do their own meteorological data conversions, but rely upon the data already provided by ARL.

If, for instance, as an example, if you were to go to the reanalysis archive …, so this is one that ARL does not

provide.   If you were to try to obtain these data for doing your own conversion, and let me go back here to the convert to ARL menu, ECMWF ERA, this is what this refers to, you can see here that it requires three different data sets: the 3-D data, the surface data, and the invariant data.   And then once you've loaded the GRIB formatted data, you can then select how you want to do the extraction, no extraction, meaning that it converts every latitude-longitude point on the GRIB data to every latitude-longitude point on the ARL HYSPLIT formatted data. Or you can do different extractions, re-projecting the data on a conformal projection.

But I want to point out when you try to obtain these data on your own, we recommend a location where you can go to get them, so for instance I can click on this link which takes you to the ECMWF, and you go to the ERA-40 directory, and you can see here, for instance, the different months you can select. The point I am getting to here is that this is a complicated process and requires some special knowledge. You know you would be, for instance, selecting, let's say you want to convert a particular month, we would select the month that you want, you would have to select four times a day, because you want to have every cycle available to you, and then you would select the variables at that date that you want for the surface. As an example, or you might certainly would want the 10 m U and V wind components, the 2 m temperature for instance.   You would probably want the precipitation field, you would probably want the sensible heat flux, that's used for computing mixing and so on.   There's a list

provided with the converter of the minimum fields and there are also pressure fields that are needed. These are the three-dimensional fields. So again you would select the month that you want, four times a day, and then he would have to select the variables at the different pressure levels. And as a minimum you would need the U and V component of the wind, temperature, humidity, either specific humidity or relative humidity, and the geopotential height, and the vertical velocity. So that's sort of the minimum data requirement for HYSPLIT. Then you would select levels from the surface up to the height that you want to do your calculations. So you can see that these files can get quite big and the variable selection is complicated, and that is the reason why we recommend that you do not do this on your own unless you know what you are doing. This is actually a good example of why these meteorological data fields, although you might think they are standardized, many of the meteorological centers provide data in GRIB format, but as you can see here, you are creating your own GRIB formatted file, but with variables you select, in the order you select, and so on. The meteorological data standards, whether it be GRIB or NetCDF, really only provide a standard as to the format of the meteorological data file, it does not provide a standard as to the contents of those files. And that is where the details lie, is to what these data are and how to interpret it.

Remember you can go to the READY web site, www.ready.noaa.gov, under the Get/Run HYSPLIT icon, has links to various HYSPLIT compatible meteorological data, the ARL server, the NCEP server for forecast data,

the ARL server also for forecast and archives, and also at the University of Alaska is a separate GDAS archive available.

We don't really advertise it much, but if you go to the HYSPLIT version that is run in Spain, and for instance, you do trajectory calculation there, you also have available to you the ECMWF reanalysis data as one of the options to do calculations. So, most of the data sets that you will run across are available. There are other data sets on the ARL web site that we don't talk about, but you can download just by going there. For instance, there are WRF data sets available for different time periods as well. And this concludes the meteorological data discussion. We didn't actually go through an example here, but I did want to go over the fact that this is a complicated process and there are really no standards as to what these files contain, and it's much better for these data to be produced or obtained from locations where there is a certain quality to the data you will be downloading.