

CORRESPONDENCE/MEMORANDUM

DATE: April 1, 2013

TO: Dispersion Modeling Team – AM/7

FROM: John Roth – AM/7

SUBJECT: Revised Processed Meteorological Data (2006-2010) for Use in AERMOD

On December 17, 2012 USEPA revised AERMET, the meteorological data processor for the recommended refined dispersion model, AERMOD. The changes involved a bug correction during the transition between night and day boundary layers and the ability to set a lower threshold wind speed. On January 18, 2013 USEPA revised AERSURFACE, the tool used to establish land cover parameters for input to AERMET. The changes involved adjustment to the spatial averaging of land cover parameters in each sector, to be consistent with published guidance. On March 8, 2013 USEPA issued a clarification memo on the lower wind speed threshold.

These revisions, along with a December 2011 update to AERMINUTE, the tool used to calculate hourly wind information from minute-reported 2-minute data, as well as comment from USEPA on a PSD permit application, triggered the need for revisions to the 2006-2010 AERMOD meteorological data.

For ASOS stations in Wisconsin, NCDC provides minute-by-minute 2-minute averaged wind speed and direction. The 17 ASOS stations in Wisconsin all have a full five-year data archive from 2006-2010, inclusive. Full ISH archives were obtained only for the stations that had minute wind data available. Upper air data for two locations (GRB and MPX) were also downloaded. Per the previous processing, the LNR data was discarded due to excessive missing data due to the Wisconsin River flooding of 2008.

First, AERMINUTE was run for each of the 16 stations. One input file per station was created that contained the proper IFWGROU keyword, and the full ISH archive was referenced as SURFDATA. Each station was processed five times (one per calendar year). All log files, check files, and summary files were archived for each year by station name. No errors of any kind were noted.

Second, the anemometer for each ASOS was geographically located. Several internet sites were used, including Bing Maps Birds Eye, Google Maps/Earth, and the Gladstone site. The Gladstone site allowed for repositioning of the point to obtain latitude and longitude of the anemometer to four decimals. Elevation of the anemometer was taken from the “anemometers.doc” document provided by NCDC, but verified on USGS topographic maps.

Third, AERMET Stage 1 was run after preparing the data. Several of the stations have WBAN ID of “99999” for 2006, 2007, and most of 2008, then are assigned a unique WBAN ID for the remainder of 2008, and all of 2009 and 2010. The WBAN ID is stored within the ISH files on each individual observation (record). A FORTRAN program was written to change the WBAN ID within each record of the ISH data file for a given station. Then the two parts of calendar year 2008 were concatenated together to produce five ISHD files, with the correct WBAN ID, for each station.

For example, Ashland, WI (ASX) has a WBAN ID of “99999” for 2006, 2007, and part of 2008. A second file for calendar year 2008 contains the rest of the archive, but with WBAN ID “94929”. All records within 2006, 2007, and the first file of 2008 were modified to the WBAN ID “94929” using the FORTRAN program. Then the two files from 2008 were concatenated with Notepad. The result is five ISH files for ASX, one for each year 2006 through 2010, and all with the WBAN ID “94929”.

Then the ISHD files were prepared to account for the UTC to LST conversion. In Wisconsin, the next meteorological day begins during the evening of the previous day. For the end of the year, this means the calendar day December 31st extends into the beginning of the following year, according to the UTC-based meteorological data. To account for this, the data from the following Jan 1st was copied (with Notepad) into the previous year; for Dec 31, 2010, the same data was repeated and then renamed into Jan 1, 2011 for each station.

With the data prepared, an input file for each station was prepared for AERMET Stage 1 processing. Each year was processed individually, and no errors were reported. Station elevation data was entered on the LOCATION card. The five-years of upper air data for GRB were processed in one run, as was the MPX data. AERMET Stage 2 processing incorporated the minute wind data for each station as well as either the GRB or MPX upper air data, as appropriate.

Fourth, the snow cover conditions for each month were established as well as the soil moisture conditions for each month for each year. For soil moisture, long-term Palmer index data from the Climate Prediction Center for the middle of each month was used. The moisture condition in each of nine climate sectors in Wisconsin for each month Jan 2006-Dec 2010 inclusive was recorded (i.e. below, normal, above). The moisture conditions for the entire year for each climate sector was calculated from a 16 value average, with the summer months May, June, July, and Aug weighted twice as high as the other months to account for the importance of moisture during the main growing season. For snow cover, data from the National Snow and Ice Data Center for the beginning of the month was used. The number of days of snow cover was estimated from NSDIC maps for the nine climate sectors.

Fifth, AERSURFACE was run for each station for either average, wet, or dry conditions, and considering snow or no snow (i.e. up to six runs per station). Surface characteristics for each of twelve sectors and twelve months are output from AERSURFACE. Adjustments were made by hand to account for months with snow cover for only some of the days. For each sector and month, a weighted average value for Bowen ratio, albedo, and roughness was calculated based on the number of days with and without snow cover. One file for each of the five years was created for each station to account for these variations.

Most stations had current land use (based on 2008 and 2010 aerial photos) consistent with the 1992 NLCD. The data for Rhinelander (RHI) is not representative of current conditions, but it appears that the NLCD data was never representative. The open space across the main east-west runway is much larger than in the 1992 NLCD. A search of other airports in the area was performed and no other match of land use was found. To account for the open land, the radius of the roughness circle in AERSURFACE was reduced, and the center point adjusted slightly south, until a representative match (based on the ratio of open land to the total area of the circle) to the 2008 photo was found. The revised parameters are Lon - 89.4825, Lat 45.6303, radius 300m.

Prior adjustments to Ashland (ASX) and Eau Claire (EAU) were no longer needed, based on higher resolution aerial photos now available. For this round of processing, the standard method was followed.

Boscobel (OVS) airport installed another runway since 1992, so the NLCD was not representative. Reducing the roughness circle does not improve representativeness, so manual adjustments were made similar to ASX. Roughness for sectors 1 and 2 was set to the value in sector 12.

Sixth, with the surface characteristic data prepared for each year for each station, an input file was prepared for AERMET Stage 3 processing. At this stage the lower wind threshold of 0.5 m/s, as per USEPA guidance, was applied for all data years. Each year was processed individually, and no errors were reported.

The table below lists the AERMOD-pertinent details of the 16 stations, and is unchanged from 2011.

| <i>USAF ID</i> | <i>WBAN ID</i> | <i>FAA ID</i> | <i>STATION</i> | <i>Upper Air ID (WBAN #)</i> | <i>LAT</i> | <i>LON</i> | <i>ELEV (m)</i> |
|----------------|----------------|---------------|--------------------|------------------------------|------------|------------|-----------------|
| 726419 | 94929 | ASX | ASHLAND | MPX (94983) | 46.5528 | -90.9139 | 251 |
| 726438 | 94994 | OVS | BOSCOBEL | GRB (14898) | 43.1561 | -90.6775 | 205 |
| 726435 | 14991 | EAU | EAU Claire | MPX (94983) | 44.8658 | -91.4874 | 276 |
| 726506 | 04840 | FLD | FOND du Lac | GRB (14898) | 43.7695 | -88.4907 | 246 |
| 726450 | 14898 | GRB | GREEN Bay | GRB (14898) | 44.4794 | -88.1378 | 214 |
| 726508 | 94973 | HYR | HAYWARD | MPX (94983) | 46.0206 | -91.4503 | 370 |
| 726505 | 04845 | ENW | KENOSHA | GRB (14898) | 42.5954 | -87.9386 | 226 |
| 726430 | 14920 | LSE | LA Crosse | MPX (94983) | 43.8789 | -91.2528 | 202 |
| 726410 | 14837 | MSN | MADISON Truax | GRB (14898) | 43.1406 | -89.3453 | 261 |
| 726574 | 94985 | MFI | MARSHFIELD | GRB (14898) | 44.6379 | -90.1874 | 382 |
| 726400 | 14839 | MKE | MILWAUKEE Mitchell | GRB (14898) | 42.9549 | -87.9045 | 211 |
| 726456 | 94855 | OSH | WITTMAN | GRB (14898) | 43.9669 | -88.5582 | 246 |
| 727415 | 04803 | RHI | RHINELANDER | GRB (14898) | 45.6314 | -89.4825 | 495 |
| 726425 | 04841 | SBM | SHEBOYGAN | GRB (14898) | 43.7749 | -87.8491 | 227 |
| 726463 | 14897 | AUW | WAUSAU | GRB (14898) | 44.9283 | -89.6286 | 366 |
| 726452 | 04826 | ISW | WISCONSIN Rapids | GRB (14898) | 44.3590 | -89.8369 | 308 |

The low wind speed threshold and the other corrections affected the number of calm and missing hours in the data. The table below lists the 2011 missing/calm hours and the 2013 missing/calm hours. The stations are grouped by similar climatology. Note that all stations satisfy the USEPA and WDNR requirements for number of available hours.

| <i>ID</i> | <i>STATION</i> | <i>2011 Calm</i> | <i>2011 Missing</i> | <i>2013 Calm</i> | <i>2013 Missing</i> | <i>2013 Total</i> | <i>% Available</i> |
|-----------|--------------------|------------------|---------------------|------------------|---------------------|-------------------|--------------------|
| ASX | ASHLAND | 437 | 1807 | 578 | 1806 | 2384 | 94.6 |
| AUW | WAUSAU | 401 | 1414 | 589 | 1413 | 2002 | 95.4 |
| HYR | HAYWARD | 623 | 2094 | 3348 | 2054 | 5402 | 87.7 |
| RHI | RHINELANDER | 277 | 1627 | | | | |
| EAU | EAU Claire | 764 | 1388 | 1123 | 1386 | 2509 | 94.3 |
| MFI | MARSHFIELD | 133 | 2427 | 284 | 2427 | 2711 | 93.8 |
| ISW | WISCONSIN Rapids | 342 | 2344 | 1107 | 2342 | 3449 | 92.1 |
| FLD | FOND du Lac | 279 | 1716 | 468 | 1751 | 2219 | 94.9 |
| GRB | GREEN Bay | 240 | 1113 | 349 | 1115 | 1464 | 96.7 |
| OSH | WITTMAN | 301 | 1852 | 446 | 1852 | 2298 | 94.8 |
| MSN | MADISON Truax | 1003 | 900 | 1526 | 899 | 2425 | 94.5 |
| OVS | BOSCOBEL | 657 | 1622 | 2337 | 1622 | 3959 | 91.0 |
| LSE | LA Crosse | 308 | 1458 | 442 | 1457 | 1899 | 95.7 |
| MKE | MILWAUKEE Mitchell | 325 | 800 | 493 | 800 | 1294 | 97.0 |
| ENW | KENOSHA | 319 | 1288 | 363 | 1291 | 1654 | 96.2 |
| SBM | SHEBOYGAN | 195 | 1684 | 437 | 1684 | 2121 | 95.2 |

List of Acronyms

ASOS – Automated Surface Observation System
USEPA – United States Environmental Protection Agency
DNR – Department of Natural Resources
ISH – Integrated Surface Hourly
LST – Local Standard Time
USGS – United States Geologic Survey
NCDC – National Climatic Data Center
NLCD – National Land Cover Data
UTC – Coordinated Universal Time
WBAN – Weather Bureau Army Navy