
IVAN'S ENGINEERING, INC. MEMORANDUM

To: File.
From: Ivan A. Walter, P.E.
Subject: Description of Kc ETref analysis
Date: 3/21/2010
cc:

This memoranda description the process of calculating Standardized Reference Evaporation using the ASCE standardized equations for E_{r_s} and $E_{t_{05}}$. I recommend that you review the PowerPoint presented at the workshop for an overview of the process. The process is a done in four steps, which are outlined below.

- 1) 1st Step: Download Data from data source
 - a) CoAgMet: http://ccc.atmos.colostate.edu/~coagmet/rawdata_form.php
 - b) NCWCD: http://www.ncwcd.org/ims/ims_weather_form.asp
 - c) I find data exports easily into the Excel if data is saved as a *.csv file.

- 2) 2nd Step: QA/QC data & Select only good data
 - a) XX COAG.xls -- Excel file developed for this task.
 - i) There are several sheet in the file, which are describe briefly. On each sheet are notes in purple shaded cells with instructions and pointers. Read them. Also, each sheet with data are 'conditionally formatted" to show up highlighted if a data problem or calculated values is suspect, of concern or bad. Their purpose is to guide the user in selection of good and bad data.
 - ii) Sheet: CoagMet
 - (1) Paste into the weather data that was downloaded. Make note of the units of the downloaded data.
 - iii) Sheet: RawData
 - (1) The data in this sheet is used for all calculations. Data from CoagMet is converted into the appropriate units. Verify your conversion factors. Manual 70 or FAO-56 has that information.
 - (2) Warning: NCWCD imported data is not in the same units as CoAgMet data.

- iv) Sheets: HumChk, RH Chart, Tdew Chart
 - (1) Calculation for QA/QC of ea & Tdew.
 - (2) There are several checks on this page. Equations 5 – 8, & 11 from the Standardized report are used.
 - (3) When viewing the charts review the guidelines that Tom Ley described or review Appendix D of the Standardized Report.
 - v) Sheets: RS Chk, Rs Chart
 - (1) Calculation for checking of solar radiation data.
 - (2) NOTE: Ra is not calculated. Ra365.exe and Ra366.exe applications will calculate that value. You can then paste the result into the spreadsheet. Ra is a constant each year but different in leap years (Ra366.exe). I will probably do that by May 2010, so check with me for an update.
 - vi) Sheets: Wind, Wind Chart
 - (1) Check wind data:
 - vii) Sheet: Prcp
 - (1) Precipitation data check
 - viii) Sheet – Data Use
 - (1) Export to TEXT Files = XXXEtrData.prn
 - (a) I like to use tab separated *.prn type file.
 - (2) Data for ETref equations (Colcrbte.exe)
 - ix) Sheet -- Data T&P = XXX T&P.prn
 - (1) Data -- Prcp, Tmax, Tmin, Tavg, Tavg(5Day)
 - (2) Data for a separate Hargreaves calculation. (ETRETOH 2.exe)
- 3) Step 3: Calculation of Hargreaves Factors & ET_{rs} and ET_{os}
- a) Location: HGRV COEF Folder
 - i) Application: Colcrbt.exe
 - (1) Linear regression analysis to determine ratio of Reference ET to Hargreaves ET
 - ii) Input file = XXXETRDATA.prn
 - (1) Edit 3rd line -- Delete column heading (text)
 - (2) It is OK to not have a continuous record. If data is missing or bad leave it out.**
 - iii) Outfile -- XXXETR.Out
 - (1) Results of Regressions analysis

- (a) ET_r to ET_{HGRV} , Et_{os} to ET_{HGRV}
 - (b) Monthly values
 - (2) Other Output Files – Daily Values
 - (a) ETRSETOS -- Et_{rs} , Et_{os} , Precipitation
 - (b) DAILY – Et_{rs} , ETrASCE, ErKim82, Et_{os} , EToASCE, ET_{HGRV} , ETOAgro
 - (c) Elements, Solar, NEGDATA, KM82ETOS
- 4) Step 4: Calculation of E_{trs} and E_{tos} using Hargraves
 - a) Location: ETRETO_File Folder
 - b) Application: ETRETOH 2.exe
 - i) Input -- COEFHGRV.dat
 - (1) The coefficient calculated in Step 3 need to be edit into this file.
 - ii) Input File -- XXX T&P.prn
 - (1) Edit 2nd line
 - (a) Latitude, Longitude (4016 10357)
 - (2) Edit 3rd line
 - (a) Elevation, 1st year, 2nd year (4320 1996 2008)
 - (3) Data starting on line 4
 - (a) YEAR, MONTH, DAY, JULIAN DATE, PRECIPITATION, Tmax, Tmin, Tavg, T5day avg.
 - (b) It is NOT OKAY to have missing daily data in the input file.**
 - iii) You can create your data file from NOAA data or another weather station, just make sure you the data is in the correct order.
 - iv) Outfile
 - (1) XXX.etr
 - (2) Daily Values -- Precip., Et_{rs} , Et_{os}
- 5) Step 5: Application of Data
 - a) Nearest NOAA or other station w/ Temp & Precip
 - b) Adjust Tmax and Tmin for site, if necessary.
 - c) ETRETO 2.exe -- Entire Study Period