Technical Memorandum
WRE # 367

Evapotranspiration Estimations for Wetland and Shallow Open-Water Systems in South Florida: Documentation for C Program *etcalcs*

September 1998

By
Daniel Downey

Hydrologic Reporting Unit
Resource Assessment Division
Water Resources Evaluation Department
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406

EXECUTIVE SUMMARY

Large scale constructed wetlands have been implemented for phosphorus load reductions in agricultural drainage and runoff systems. Several studies are currently in progress on these systems at the South Florida Water Management District. Water budget analyses are a major component in describing these wetland systems and their performance. Evapotranspiration estimates are an integral part of the water budget analyses.

This document describes use and background information for the C program *etcalcs*, a numerical program that estimates evapotranspiration rates from cattail and mixed marsh wetlands and shallow open water systems. The program is not intended for use on forested wetlands. The program was developed at the South Florida Water Management District to automate ET estimations for wetland systems using three estimation methods; the Penman-Monteith model, the Penman-Combination model, and a simple equation that estimates daily ET from solar radiation. The program is intended for evapotranspiration estimates typical of weather conditions in South Florida. Program input requirements are described, as well as evapotranspiration estimates using two weather stations located in a constructed wetland. The three evapotranspiration models used by the program are documented and explained. Although the program is an interactive routine, it is recommended that users read this document to explain assumptions and subtle details that were developed for these numerical estimation procedures.

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LIST OF SYMBOLS

Parameters required as inputs to *etcalcs*:

Rh_{min}	=	minimum daily relative humidity, %
Rh_{max}	=	maximum daily relative humidity, %
T_{min}	=	minimum daily air temperature, °C
T_{max}	=	maximum daily air temperature, °C
T_{avea}	=	average daily air temperature, °C
T_{aveh}	=	average daily water temperature, °C
P_{ave}	=	average daily atmospheric pressure, mm-Hg
R_t	=	total daily radiation, kW m^{-2}
R_n	=	net daily radiation, kW m^{-2}
W_{10}	=	average daily wind speed at 10 m height, mph
H	=	height of vegetation, m
F_c	=	fraction of vegetative cover, dimensionless
JD	=	day of year

Parameters calculated by, or defined within, *etcalcs*:

k	=	coefficient to account for variation in type of surface cover
ET	=	evapotranspiration, mm d^{-1}
ρ_{atm}	=	atmospheric density, kg m^{-3}
C_p	=	specific heat of moist air, kJ kg^{-1} $°C^{-1}$
W_2	=	adjusted windspeed at 2 m height, m s^{-1}
G	=	water heat flux, MJ m^{-2} d^{-1}

ea = daily saturation vapor pressure, kPa

ea_{tmax} = daily saturation vapor pressure (based on T_{max}), kPa

ea_{tmin} = daily saturation vapor pressure (based on T_{min}), kPa

ed = daily vapor pressure, kPa

vpd = daily vapor pressure deficit, kPa

r_a = aerodynamic resistance, s m^{-1}

r_c = canopy resistance, s m^{-1}

d = displacement height, m

z_o = aerodynamic roughness, m

z_{oh} = roughness length for heat and vapor tansfer, m

a_w, b_w = empirical coefficients, dimensions account for units

Δ = slope of vapor pressure curve, kPa $°C^{-1}$

λ = latent heat of vaporization, MJ kg^{-1}

γ = psycometric constant, kPa $°C^{-1}$

κ = von Karman constant for turbulent diffusion

INTRODUCTION

Evapotranspiration estimates for open water and aquatic vegetation wetland systems are one of the components used to estimate and predict hydrologic mass balances. Several equations have been developed that can predict evapotranspiration (ET) estimates for different surfaces (Jensen *et al.*, 1990; Maidment, 1993). Prior research on the use of these equations for quantifying ET of constructed wetland systems has been discussed (Abtew, 1996; Abtew and Mullen, 1997; Abtew and Obeysekera, 1995). Generally, ET estimates are made based on daily maximums, minimums, and averages of weather parameters. These parameters include temperature, pressure, relative humidity, windspeed, and solar radiation.

Currently, ET estimates for the Everglades Nutrient Removal (ENR) Project are made from combining multiple output files, containing measured daily weather parameters, into a spreadsheet for daily calculations. Estimates of ET are then reported in tabular or graphical format. The equations used to estimate ET reported in this document are described in detail with respect to their defining variables and constants. The plant communities within the ENR project consisted of natural cattails, mixed marsh, and an open water/algae system. The mixed marsh community included Spikerush (*Eleocharis spp.*), Pickerel weed (*Pontederia cordata*), Arrowhead (*Sagitteria latifolia*), Duckpotato (*Sagitteria lancifolia*), Maidencane (*Panicium hemitomon*), and Sawgrass (*Caladium jamaicense*) (Abtew, 1996). The open water/algae system consisted of an open water periphyton/submerged macrophyte community (Abtew, 1996).

This document describes a numerical estimation procedure written to predict ENR Project ET rates from weather station data using several common ET equations. The equations used are the Penman-Combination, the Penman-Monteith, and a simple equation that estimates daily ET from solar radiation. Program inputs, outputs, and user interactive options are explained. The program was written in C language on a Unix workstation, running SOLARIS 3.5.1, at the South Florida Water Management District (District).

EVAPOTRANSPIRATION MODELS

Simple Evapotranspiration Model

The simplest model to estimate ET rates in South Florida uses daily total radiation. The model used in the numerical estimation routine is (Abtew, 1996):

$$ET = \frac{k\,R_s}{\lambda} \qquad (1)$$

where,

ET = evapotranspiration, mm d^{-1},

k = coefficient to account for variation in wetland surface type,

R_s = solar radiation, MJ m^{-2} d^{-1},

λ = latent heat of vaporization, MJ kg^{-1}.

Estimates for k are 0.54 for cattail, 0.52 for mixed marsh, and 0.53 for open water/algae wetland systems (Abtew, 1996).

Solar radiation is recorded in units of kW m^{-2} in the District database (DBHYDRO). Conversion to MJ m^{-2} d^{-1} is straightforward by multiplying by 86.4 (kW to MJ d^{-1}). This procedure is carried out internally in the numerical program.

Latent heat of vaporization is the energy absorbed during the separation of water molecules (Maidment, 1993). The equation used to estimate this parameter is:

$$\lambda = 2.501 - (0.002361 * T_{aveh}) \qquad (2)$$

where the constant 2.501 is the energy in MJ required to evaporate 1 kg of water, 0.002361 is a constant (MJ kg^{-1} $°C^{-1}$) that enables the λ equation to approximate standard steam tables (*viz.*, Jensen et al., 1990), and T_{aveh} is the average surface temperature of water (°C). Often, water temperature is not available and air temperature is used to calculate latent heat of vaporization.

Penman-Monteith Evapotranspiration Model

The equation for evapotranspiration estimates for wetlands with the predominant vegetation as cattails or mixed marsh was developed in Abtew, (1996):

$$ET = \left[\frac{\Delta (R_n - G) + \rho_{atm} C_p (ea - ed) \left(\frac{1}{r_a} \right)}{\Delta + \gamma \left(1 + \left(\frac{r_c}{r_a} \right) \right)} \right] \left(\frac{1}{\lambda} \right) \qquad (3).$$

The term r_c is canopy resistance (s m^{-1}), and for cattail the average canopy resistance estimate is 90 (s m^{-1}), while for mixed marsh conditions, average canopy resistance estimate is 70 (s m^{-1}). These constants are set internally in the numerical program. The user is prompted for acceptance of these parameters and can change the r_c values if desired. Aerodynamic resistance (r_a) is calculated as:

$$r_a = \frac{\left(\ln \left(\frac{z_{10} - d}{z_o} \right) \ln \left(\frac{z_2 - d}{z_{oh}} \right) \right)}{\left(\kappa^2 \, W_2 \, 0.447 \right)} \qquad (4).$$

where,

z_{10}	=	wind speed measurement height (10 m), m,
d	=	displacement height, m,
z_o	=	aerodynamic roughness, m,
z_2	=	air temperature and humidity measurement height (2 m), m,
z_{oh}	=	roughness length for heat and vapor transfer (0.1 z_o), m,
κ	=	von Karmen constant for turbulent diffusion (0.41), and
W_2	=	adjusted windspeed, at height z_2, over the study site, m s^{-1} (Smith, 1991).

Note that,

$$d = 0.85 * F_c * H \qquad (5),$$

where,

Fc	=	fraction of vegetation cover, dimensionless,
H	=	average height of vegetation stand, m, and

$$z_o = 0.13 * (H - d) \qquad (6).$$

Also,

$$W_2 = W_{10} \frac{\ln\left(\frac{z_2 - d}{z_o}\right)}{\ln\left(\frac{z_{10} - d}{z_o}\right)} \quad (7)$$

where,

W_{10} = measured windspeed at height z_{10}, m s^{-1}.

Windspeed is generally recorded in units of miles per hour and conversion to m s^{-1} is straightforward with the numerical factor 0.447. This calculation is done internally in the numerical program. All other variables in the aerodynamic resistance equation are obtained empirically, as described in Abtew (1996), Abtew and Obeysekera (1995), and Smith (1991).

The γ term in the Penman-Monteith equation represents a psychometric constant, in units of kPa °C $^{-1}$. The equation describing this term (Maidment, 1993) is,

$$\gamma = C_p * P_{ave} * 0.001/(0.622 * \lambda) \quad (8)$$

where,

C_p is the specific heat of moist air (1.013 kJ kg^{-1} °C^{-1}), P_{ave} is the average daily pressure (kPa), 0.001 is a proportionality constant (dimensionless), and 0.622 is the ratio of the molecular weight of water to that for dry air. Recall that the λ term was defined earlier. Note that pressure is recorded in units of mm Hg and conversion to kPa is done internally in the numerical program.

The ea term in equation 3 represents daily saturation vapor pressure (kPa) and is represented as (Abtew and Obeysekera, 1995):

$$ea = ½(ea_{tmax} + ea_{tmin}) \quad (9)$$

where,

$$ea_{tmax} = 0.611 * \exp(17.27 * T_{max}/(T_{max} + 237.3)) \quad (10)$$

and

$$ea_{tmin} = 0.611 * \exp(17.27 * T_{min}/(T_{min} + 237.3)) \quad (11).$$

T_{max} and T_{min} are respectively, daily maximum and minimum air temperature in °C.

The ed term in equation 3 represents the daily vapor pressure in kPa. Abtew and Obeysekera (1995) estimate this parameter as:

$$ed = (0.5*ea_{tmax}*Rh_{min}/100) + (0.5*ea_{tmin}*Rh_{max}/100) \quad (12)$$

where,

Rh_{min} and Rh_{max} respectively represent daily minimum and maximum percent relative humidity.

The C_p term represents the specific heat of moist air, as mentioned earlier, but is estimated using the equation defined for γ. This is due to the embedded term λ, which, as shown earlier, is estimated using daily average water temperature. Therefore, the C_p term is calculated on a daily basis.

The atmospheric density term, ρ_{atm} (kg/m^3), is represented by the ideal gas law, which, upon simplification (Smith, 1991) becomes:

$$\rho_{atm} = 3.486*P_{ave}/(1.01*(T_{avea} + 273)) \quad (13)$$

where,

P_{ave} and T_{avea} respectively represent average daily air pressure (kPa) and average daily air temperature (°C). The term $(1.01*(T_{avea} + 273))$ converts temperature in °C to virtual temperature to account for the units embedded in the specific gas constant (shown as $1000/(287\ J\ kg^{-1}\ K^{-1})$).

The G term in equation 3 represents water heat flux (kW m^{-2}), and is represented as:

$$G = 4.18*d_w*(T_{aveh(i)} - T_{aveh(i-1)}) \quad (14)$$

where,

$T_{avch(i)}$ corresponds to average daily water temperature and $T_{aveh(i-1)}$ corresponds to the previous day's average daily water temperature. The constant 4.18 represents water heat flux (MJ m^{-3} °C^{-1}) and d_w represents depth of water (m). For numerical estimations, the G value is zero for the first day of ET calculations.

For weather stations without water temperature, air temperature measurements at 2 m height can be substituted for T_{aveh} in equation 14. In the case where air temperature is substituted for water temperature, d_w is multiplied by a factor of 0.844. The calculation for water depth in the absence of water temperature measurements was made by assuming the water heat flux (G) was equivalent for both water temperature results and air temperature results for stations ENR105 and ENR308. The result (an adjusted d_w value) is internal to the numerical program, however, the user is prompted to indicate whether air temperatures were used in lieu of water temperatures.

The R_n variable represented in equation 3 is the net incoming radiation flux measured at the surface. This parameter is measured in units of kW m^{-2} and conversion to MJ m^{-2} d^{-1} was described previously.

The last variable to consider in equation 3, Δ, represents the slope of the vapor pressure curve, also in units of kPa $°C^{-1}$. This variable was described by Maidment (1993) as the gradient of the ea term, that is:

$$\Delta \quad = \frac{d(ea)}{dT} = \frac{4098\, ea}{(237.3 + T_{avea})^2} \qquad (15)$$

where, ea was defined earlier and T_{avea} is the average daily air temperature.

Penman Combination Evapotranspiration Model

Evapotranspiration estimates for open water/algae wetlands used in the numerical estimation routine is obtained from (Abtew, 1996):

$$ET \quad = \left[\frac{(\Delta\,(R_n - G) + \gamma\, 6.43\,(a_w + b_w\, W_{s2})\,(ea - ed))}{(\Delta + \gamma)}\right]\left(\frac{1}{\lambda}\right) \qquad (16).$$

The terms λ, Δ, R_n, G, γ, W_{s2}, ea, and ed were defined previously. The remaining terms a_w and b_w are empirical constants represented as (Abtew and Obeysekera, 1995):

$$a_w \quad = \quad 0.1 + 3.0*\exp[-((JD-173)/58)^2] \qquad (17)$$

and

$$b_w \quad = \quad 0.04 + 0.2*\exp[-((JD-243)/80)^2] \qquad (18)$$

where,

JD = day of year.

NUMERICAL ESTIMATIONS

Estimations of evapotranspiration were made using daily values of air temperature, water temperature, relative humidity, air pressure, windspeed, total radiation, and net radiation. These measured weather parameters can be obtained from the District database as average daily values, maximum daily values, or minimum daily values. The numerical routine described in this report required daily output for the above parameters from the Internal Value Generator (IVG) program available on District workstations (*viz.*, runivg). A description of input and output requirements for the IVG program is available through the District.

In addition to the weather parameters used in the numerical estimation routine, several other parameters are required *a priori* to executing the program. These include height of vegetation (H), fraction of vegetation cover (F_c), and ending date for the period under analysis.

The numerical routine to estimate evapotranspiration, based on the above mathematical models, was written in C language. A copy of the program is given in Appendix A. The program prompts the user for several options that are described below. A copy of the program prompts and response examples (in italicized bold type-face) are given in Appendix B for two test cases described below.

The program requires the user to have downloaded, from IVG, the following weather station parameters: T_{avea}, T_{max}, T_{min}, T_{aveh}, Rh_{max}, Rh_{min}, P_{ave}, R_n, R_t, and W_{save} (R_n and R_t are average daily values). An example of the output downloaded by the IVG program is given in Table 1 for daily average air pressure. The numerical program, *etcalcs*, requires that the parameters be in this format, and that the names of files representing these parameters are equivalent to the names shown in Table 2. That is, AT corresponds to air temperature, MIN to daily minimum, MAX to daily maximum, and AVE to daily average. AP corresponds to air pressure, T0 to water temperature, RH to relative humidity, NR to net daily radiation, RT to total daily radiation, and WS to windspeed. Any missing values from the downloaded IVG results should be estimated using the nearest weather station with valid data. Additionally, tagged numerical entries (for example, E, L, or M) should be removed prior to running the numerical estimation program.

The ENR105 and ENR308 names correspond to the weather stations reporting the values. The program requires that the station name be six characters. The program also requires that the file names be in a generic *input file* less than 32 characters in length, including file extension. The numerical value 10 must be the first line within the *input file*. Note that the program is case sensitive and the file names do not have to be in the order depicted in Table 2. However, the first ten files should be representative of weather station parameters for cattail and the second ten files representative of mixed marsh and open water conditions.

Table 1. Example of average atmospheric pressure values downloaded from IVG.

ENR105AP	MEAN	199612010000	199612020000	763.328
ENR105AP	MEAN	199612020000	199612030000	762.920
ENR105AP	MEAN	199612030000	199612040000	764.306
ENR105AP	MEAN	199612040000	199612050000	765.609
ENR105AP	MEAN	199612050000	199612060000	764.320
ENR105AP	MEAN	199612060000	199612070000	763.064
ENR105AP	MEAN	199612070000	199612080000	761.618
ENR105AP	MEAN	199612080000	199612090000	762.433
ENR105AP	MEAN	199612090000	199612100000	767.759
ENR105AP	MEAN	199612100000	199612110000	769.229
ENR105AP	MEAN	199612110000	199612120000	767.594
ENR105AP	MEAN	199612120000	199612130000	766.369
ENR105AP	MEAN	199612130000	199612140000	764.889
ENR105AP	MEAN	199612140000	199612150000	765.334
ENR105AP	MEAN	199612150000	199612160000	766.727
ENR105AP	MEAN	199612160000	199612170000	764.818
ENR105AP	MEAN	199612170000	199612180000	763.206
ENR105AP	MEAN	199612180000	199612190000	762.749

Table 2. Weather parameter files listed in *input file* required as inputs to *etcalcs*.

10
ENR105AT.MIN
ENR105AT.MAX
ENR105AT.AVE
ENR105AP.AVE
ENR105T0.AVE
ENR105RH.MIN
ENR105RH.MAX
ENR105NR.AVE
ENR105RT.AVE
ENR105WS.AVE
ENR308AT.MIN
ENR308AT.MAX
ENR308AT.AVE
ENR308AP.AVE
ENR308T0.AVE
ENR308RH.MIN
ENR308RH.MAX
ENR308NR.AVE
ENR308RT.AVE
ENR308WS.AVE

The program assumes that there will be 20 files named within the *input file*. That is, this program was written to estimate ET rates for three wetland conditions. The first ten files (ENR105AA.BBB) contain weather parameters used to estimate ET from cattail wetlands, while the second ten files (ENR308AA.BBB) contain parameters used to estimate ET from mixed marsh and open water/algae wetlands. If one has access to data from only one weather station, then the second ten file names in the *input file* should be somewhat different, but representative of the first ten file names. That is, the program writes ET rates to an output file called, for example, ENR105.out. This output represents ET rates for cattail conditions, while ENR308.out represents ET rates corresponding to mixed marsh and open water/algae systems.

There are several other options and prompts the user must answer during execution. The user must choose to do either, simple ET calculations for each of the three wetland types based on the constant k (described earlier), or simple and complex ET calculations for each of the three wetland types. The user is also prompted for height and fraction of vegetation cover for both cattail and mixed marsh systems. The user has the option to select output as mm d^{-1} or in d^{-1}. Input weather parameters to the numerical estimation routine may be output in a spreadsheet type format for checking calculations.

During the discussion for the simple ET calculation, it was mentioned that the average daily water temperature is a required input. If this file is non-existent, that is, no water temperature data exists for the site, then the average daily air temperature file should be copied into a file with the average daily water temperature name. The user is prompted for this condition prior to numerical calculations. The final input required from the user is the ending date for the analysis. This date is obtained from any one of the input files listed in the *input file* and must be input as yyyymmdd.

Examples of results from executing etcalcs are given in Table 3. The results were produced using data from weather stations ENR105 and ENR308. ET output from the numerical program was compared to spreadsheet results for the period 1 December 1996 through 19 August 1997. Results for the last month in this time period are shown to provide users with expected output. Minimal differences exist between spreadsheet calculations and numerical estimates from the C program. These discrepancies are due to numerical round-off error since the respective applications use numbers with different significant digits during calculations.

Appendix C lists information for active weather stations within the District. If data for daily net radiation do not exist for a particular site, the user may contact the author of this document for another program used to estimate this parameter from total solar radiation.

Table 3. Comparison of numerical and spreadsheet results for ET calculations using the Penman-Monteith (cattail and mixed marsh) and Penman-Combination (open water) models.

		Numerical Simulation ------mm/d-------			Spreadsheet Calculation -------mm/d-------			*Percent Difference		
Year	J day	Cattail	Mixed	Water	Cattail	Mixed	Water	Cattail	Mixed	Water
1997	200	4.24	4.04	4.97	4.24	4.01	4.99	0	-1	0
1997	201	4.23	4.56	5.56	4.23	4.53	5.59	0	-1	0
1997	202	3.29	3.45	4.11	3.29	3.44	4.15	0	0	1
1997	203	3.08	3.20	3.73	3.08	3.19	3.75	0	0	0
1997	204	4.78	5.35	6.01	4.78	5.33	6.01	0	0	0
1997	205	4.53	4.70	5.30	4.53	4.68	5.30	0	0	0
1997	206	3.41	3.80	4.43	3.41	3.77	4.45	0	-1	0
1997	207	4.99	5.02	5.91	4.99	4.98	5.91	0	-1	0
1997	208	3.40	3.33	4.00	3.40	3.31	4.02	0	-1	1
1997	209	3.87	3.65	4.20	3.87	3.65	4.22	0	0	1
1997	210	3.07	3.17	3.57	3.07	3.16	3.59	0	0	1
1997	211	3.35	3.51	3.97	3.35	3.50	3.99	0	0	0
1997	212	5.93	5.59	6.40	5.93	5.59	6.40	0	0	0
1997	213	5.08	4.93	5.47	5.08	4.92	5.48	0	0	0
1997	214	2.46	2.96	3.27	2.46	2.95	3.29	0	0	0
1997	215	2.72	4.27	4.80	2.72	4.25	4.81	0	0	0
1997	216	3.10	4.68	5.21	3.10	4.64	5.21	0	-1	0
1997	217	3.93	4.28	4.82	3.93	4.21	4.77	0	-2	-1
1997	218	3.28	2.93	3.19	3.28	2.91	3.18	0	-1	0
1997	219	3.61	3.84	4.14	3.61	3.83	4.14	0	0	0
1997	220	4.20	4.45	4.92	4.20	4.41	4.90	0	-1	0

*Percent difference was reported to the nearest integer and assumed spreadsheet value as "true" value.

SUMMARY

This document has presented several common equations used in an applied numerical routine to estimate evapotranspiration. The equations estimate ET from cattail, mixed marsh and open water/algae wetlands, typical of the weather conditions in South Florida. Documentation has been provided detailing the parameters, constants, and conversions required to estimate ET from these unique systems using the Penman-Combination, Penman–Monteith, and a simple equation that calculates ET from daily solar radiation.

The numerical application routine processes multiple weather data files downloaded from the District database. These weather parameter files contain the required inputs necessary to estimate ET. Knowledge of system characteristics such as height and vegetative cover must be known prior to running the numerical application. ET estimation results based on the ENR Project weather stations were compared with the current estimation procedure using spreadsheet calculations. Minimal differences were observed, and are due to numerical round-off error.

Access to the executable program for estimating ET for cattail, mixed marsh, and open water/algae systems, typical of South Florida and associated weather conditions can be obtained from the /home/rad/ddowney/etcalculation directory on District workstations. Access on personal computers can be obtained through the Home_rad on B50home2 (H:) location, under the directory ddowney/etcalculation. The examples directory in this location contains the input files used in this report.

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APPENDIX A

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include<math.h>
//program written by ddowney 27 may 1998 program used to calculate ET for the cattail,
//mixed marsh, and open water/algae surface areas set parameters et al
main(void){
char names1[32], names2[32], outfile1[32], outfile2[32];
char exch[2], yy[4], dd[3], mm[3], lin0[17], lin1[17], lin2[17], lin3[17], lin4[17];;
char dailydata[32] = "weather.dat";
int  ef, t, kchk, eff, i, j, k, dcalc, dflg, opt, opt1, opt2, opt3, opt4, noyrs;
int  yr[400], mo[400], da[400], jday, leap, day1, day2, daychk, endmo, endda, mochk;
float tmax[4000], tmin[4000], tavea[4000], taveh[4000], pmin[4000], pmax[4000];
float a, pave[4000];
float rhmin[4000], rhmax[4000], rhave[4000], rnave[4000], rtave[4000], wsave[4000];
float hitec, hitem, fcc, fcm, rc1, rc2, k1a, k1b, k1c, lamda, gval, atmrho, cp, gamma, vpd;
float rac, ram, zoc, zom, dc, dm, ws2c, ws2m;
float delta, aw, bw, tad1, ea1, ea2, ea, ed, etsima[4000], etsimb[4000], etsimc[4000];
float etcat[4000], etmix[4000], etope[4000];
FILE fptr1, fptr2, fptr3, fptr4;
//print to screen preliminary indications for file usage et al...
printf("\n\n\n\n\n\n\nC PROGRAM: etcalcs, Version I\n");
printf("Written by D. Downey, July 1998\n\n");
printf("Hydrologic Reporting Unit\n");
printf("Resource Assessment Division\n");
printf("Water Resources Evaluation Department\n");
printf("South Florida Water Management District\n\n");
printf("This program calculates daily ET rates for cattail, mixed marsh\n");
printf("and open water/algae surface areas.\n\n");
printf("Maximum time period for daily ET calculations is 10 years\n\n");
printf("NOTE:  THIS PROGRAM IS CASE SENSITIVE.\n\n");
printf("IT IS RECOMMENDED THAT THE USER READ THE ACCOMPANYING
DOCUMENTATION\n");
printf("EXPLAINING THIS PROGRAM PRIOR TO EXECUTION.\n\n");
printf("This program prompts the user for an input file, upto 32 characters\n");
printf("in length,located in the current directory, containing thefile names\n\n");
printf("ZZZ###AA.BBB, where ZZZ corresponds to a three letter monikerfor the\n");
printf("weather station used for analysis, ### corresponds to station number\n");
printf("(depending on ET calculation performed), AA coresponds to AT, AP, etc., \n");
printf("and BBB corresponds to MIN, MAX, or AVE depending on the pararmeter
statistic.\n");
printf("The first line of the input should contain a numerical value\n");
printf("corresponding to the number of input files located in this file.\n\n");
printf("This program prompts the user for H (height) and Fc (vegetative cover)
values.\n\n");ef = 1;    do{printf("Press c to continue, x to exit:\n\n");scanf(s, exch);
if(exch[0] == 'x') exit(-1); if(exch[0] == 'c') ef = -1;  }while(ef !=  -1); ef = 1;
```

```
//prompt the user for the input file name containing file names
//open input file containing parmeter input file names
printf("\nEnter filename containing weather parameter filenames\n\n");
scanf(s, names1); if((fptr1 = fopen(names1, "r")) == NULL)
{ do{ printf("\nCan not find input file %s", names1); printf(" ...Press x to exit\n\n");
scanf(s, exch); if(exch[0] == 'x') exit(-1); }while(1);}
//prompt user for simple calculations or all three calculations.
printf("\nSelect one of two options:\n");
printf("simple ET calculations for all three scenarios = 1\n");
printf("simple and advanced ET calculations for all three scenarios = 2\n\n");
ef = 1; do{ printf("Enter calculation option 1 or 2:\n"); scanf(d, opt);
if(opt == 1) ef = -1; if(opt == 2) ef = -1; }while(ef != -1); ef = 1;
//prompt user for unit output as in/d or mm/d
printf("\nSelect one of two options:\n");
printf("output as in/d = 1\n");
printf("output as mm/d = 2\n\n");
ef = 1; do{ printf("Enter output option 1 or 2:\n"); scanf(d, opt1);
if(opt1 == 1) ef = -1; if(opt1 == 2) ef = -1; }while(ef != -1); ef = 1;
//read in data
if(opt == 2){
printf("\nEnter numerical height, H, for cattail stand:\n\n");
scanf(f, hitec);
printf("\nEnter numerical constant, Fc, for cattail land coverage:\n\n");
scanf(f, fcc);
printf("\nEnter numerical height, H, for mixed marsh stand:\n\n");
scanf(f, hitem);
printf("\nEnter numerical constant, Fc, for mixed marsh land coverage:\n\n");
scanf(f, fcm);
printf("\nThe following constants will be assumed:\n\n");
printf("k1 = 0.54, 0.52, 0.53 for cattails, mixed marsh, or open water/algae,\n\n");
printf("respectively, and rc = 90 for cattails, rc = 70 for mixed marsh.\n\n");}
rc1 = 90.0; rc2 = 70.0;do{
printf("Enter 1 if rc values are acceptable, otherwise enter 2 to change them\n");
scanf(d, opt3); if(opt3 == 1) ef = -1; if(opt3 == 2) {
printf("\nEnter rc value for cattails\n\n"); scanf(f, rc1);
printf("\nEnter rc value for mixed marsh\n\n"); scanf(f, rc2); ef = -1;
printf("\nrc for cattails = %5.2f, rc for mixed marsh = %5.2f\n\n", rc1, rc2); }
}while(ef != -1); ef = 1;
printf("\nSelect one of two options:\n");
printf("daily listing of weather parameters used in calculations = 1\n");
printf("no listing of daily weather parameters = 2\n\n");
do{ printf("Enter daily weather output option 1 or 2:\n"); scanf(d, opt2);
if(opt2 == 1) ef = -1;if(opt2 == 2) ef = -1; }while(ef != -1); ef = 1;
printf("\nSelect one of two options:\n");
printf("Water temperature file contains water temperatures = 1\n");
printf("Water temperature file contains air temperatures = 2\n\n");
```

```
do{ printf("Enter numerical value 1 or 2 pertaining to water temperature file:\n");
scanf(d, opt4); if(opt4 == 1) ef = -1; if(opt4 == 2) ef = -1; }while(ef != -1);
ef = 1; if(opt == 1) { hitec = 0.0; fcc = 0.0; hitem = 0.0; fcm = 0.0; }
printf("\nEnter endding date for current analysis as yyyymmdd\n\n");
scanf(s, lin0); printf("\n");
//set exit limits based on ending date for analysis
for(i=4; i<6; i++) mm[i-4] = lin0[i]; mm[2] = '\0'; for(i=6; i<8; i++) dd[i-6] = lin0[i];
dd[2] = '\0'; endmo = atoi(mm); endda = atoi(dd); j = 0; i = 0; ef = 0;
//read in number of files to process and parameter input file names
do{ fscanf(fptr1,d, dcalc); fscanf(fptr1, f, names2);
printf("Reading input parameters from %s\n\n", names2);
if((fptr2 = fopen(names2, "r")) == NULL) {
do{ printf("\nCan not find input file %s\n\n", names2); printf("...Press x to exit\n\n");
scanf(s, exch); if(exch[0] == 'x')exit(-1);
}while(1); }//begin parameter input
do {if(fscanf(fptr2, s s s s f, lin1, lin2, lin3, lin4, a) == EOF)
ef = -1; else{ if((lin1[6] =='A') && (lin1[7] == 'T') && (lin2[1] =='E')) {
tavea[j] = a;// determine year month day arrays only in the first file...
for(k=0; k<4; k++) yy[k] = lin3[k]; yy[4] = '\0'; yr[j] = atoi(yy);
for(k=4; k<6; k++) mm[k-4] = lin3[k]; mm[3] = '\0'; mo[j] = atoi(mm);
for(k=6; k<8; k++) dd[k-6] = lin3[k]; dd[3] = '\0'; da[j] = atoi(dd); }
if((lin1[6] =='A') && (lin1[7] == 'T') && (lin2[1] =='I')) tmin[j] = a;
if((lin1[6] =='A') && (lin1[7] == 'T') && (lin2[1] =='A')) tmax[j] = a;
if((lin1[6] =='T') && (lin1[7] == '0') && (lin2[1] =='E')) taveh[j] = a;
if((lin1[6] =='A') && (lin1[7] == 'P') && (lin2[1] =='E')) pave[j] = a;
if((lin1[6] =='R') && (lin1[7] == 'H') && (lin2[1] =='I')) rhmin[j] = a;
if((lin1[6] =='R') && (lin1[7] == 'H') && (lin2[1] =='A')) rhmax[j] = a;
if((lin1[6] =='N') && (lin1[7] == 'R') && (lin2[1] =='E')) rnave[j] = a;
if((lin1[6] =='R') && (lin1[7] == 'T') && (lin2[1] =='E')) rtave[j] = a;
if((lin1[6] =='W') && (lin1[7] == 'S') && (lin2[1] =='E')) wsave[j] = a;
j = j + 1; } }while(ef != -1); ef = 0; fclose(fptr2); j = 0; i = i + 1; }while(i < dcalc);
//name the output file based on the current input file
for(i=0; i<6; i++) outfile1[i] = names2[i]; outfile1[6] = '.'; outfile1[7] = 'o';
outfile1[8] = 'u'; outfile1[9] = 't'; printf("\nBegin ET Processing\n\n");
fptr3 = fopen(outfile1, "w"); if(opt == 1) {
fprintf(fptr3, "Year\tJ day\tET Simple-Cattail\n\n"); if(opt1 == 1)
fprintf(fptr3, "    \t    \tin/d\n\n"); else fprintf(fptr3, "    \t    \tmm/d\n\n"); }
if(opt == 2) { fprintf(fptr3, "Year\tJ day\tET Simple\tET Cattail\n"); if(opt1 == 1)
fprintf(fptr3, "    \t    \tin/d     \tin/d\n\n"); else
fprintf(fptr3, "    \t    \tmm/d     \tmm/d\n\n"); }if(opt2 == 1) {
fptr4 = fopen(dailydata, "w");fprintf(fptr4, "Daily Cattail input parameters\n");
fprintf(fptr4, "Year\tJ day\tTmax-a\tTmin-a\tTave-a\tTave-
h\tPave\t\tRhmin\tRhmax\tRnave\t Rtave\tWsave\n");
fprintf(fptr4, "\t\tC\tC\tC\tC\tkPa\t\t%%\t%%\tMJ/m2d\tMJ/m2d\tmph\n"); }
ef = 0; i = 0; j = 0;  k1a = 0.54; k1b = 0.52; k1c = 0.53; day1 = 0; do{
if((mo[j] == endmo) && (da[j] == endda)) { ef = -1; dflg = 1; }
```

```
//set julian day counter if((yr[j]%4 == 0 && yr[j]%100 != 0) || (yr[j]%400 == 0))
leap = 1; else leap = 0; if(leap == 0) { if(mo[j] == 1) jday = da[j]; else if(mo[j] == 2)
jday = 31 + da[j]; else if(mo[j] == 3) jday = 59 + da[j]; else if(mo[j] == 4)
jday = 90 + da[j]; else if(mo[j] == 5) jday = 120 + da[j]; else if(mo[j] == 6)
jday = 151 + da[j]; else if(mo[j] == 7) jday = 181 + da[j]; else if(mo[j] == 8)
jday = 212 + da[j]; else if(mo[j] == 9) jday = 243 + da[j]; else if(mo[j] == 10)
jday = 273 + da[j]; else if(mo[j] == 11) jday = 304 + da[j]; else if(mo[j] == 12)
jday = 334 + da[j]; }if(leap == 1) { if(mo[j] == 1) jday = da[j]; else if(mo[j] == 2)
jday = 31 + da[j]; else if(mo[j] == 3) jday = 60 + da[j]; else if(mo[j] == 4)
jday = 91 + da[j]; else if(mo[j] == 5) jday = 121 + da[j]; else if(mo[j] == 6)
jday = 152 + da[j]; else if(mo[j] == 7) jday = 182 + da[j]; else if(mo[j] == 8)
jday = 213 + da[j]; else if(mo[j] == 9) jday = 244 + da[j]; else if(mo[j] == 10)
jday = 274 + da[j]; else if(mo[j] == 11) jday = 305 + da[j]; else if(mo[j] == 12)
jday = 335 + da[j]; }//set constants for all equations...
pave[j] = 0.1333*pave[j]; mave[j] = 24.0*3.6*mave[j]; rtave[j] = 24.0*3.6*rtave[j];
if(rhmax[j] > 100.0) rhmax[j] = 100.0; lamda = 2.501 - (0.002361*taveh[j]);
etsima[j] = k1a*rtave[j]/lamda; if(opt1 == 1) etsima[j] = etsima[j]/25.4; if(opt4 == 1)
{ if(j == 0) gval = 0; else gval = 4.18*0.14*(taveh[j] - tad1); }if(opt4 == 2) { if(j == 0)
gval = 0; else gval = 4.18*0.118153*(taveh[j] - tad1); }
atmrho = 3.486*pave[j]/(1.01*(tavea[j] + 273));
gamma = 1.013*pave[j]*0.001/(0.622*lamda); cp = 0.622*lamda*gamma/pave[j];
ea1 = 0.611*exp((17.27*tmax[j])/(tmax[j]+237.3));
ea2 = 0.611*exp((17.27*tmin[j])/(tmin[j]+237.3)); ea = (ea1 + ea2)/2.0;
ed = ((0.5*ea1*rhmin[j])/100.0) + ((0.5*ea2*rhmax[j])/100.0); vpd = ea - ed;
dc = 0.85*fcc*hitec; zoc = 0.13*(hitec - dc);
ws2c = wsave[j]*log((2.0-dc)/zoc)/log((10.0-dc)/zoc);
rac = log((2.0 - dc)/zoc) * log((hitec - dc)/(0.1*zoc))/(0.41*0.41*ws2c*0.447);
delta = 4098.0*ea/((tavea[j] + 237.3)*(tavea[j] + 237.3));
etcat[j] = (delta*(mave[j] - gval) + (86400.0*atmrho*cp*vpd/rac))/(delta + gamma*(1.0
+ (rc1/rac)))/lamda;if(opt1 == 1) etcat[j] = etcat[j]/25.4; if((ef != -1) || (dflg == 1)) {
if(opt == 1)fprintf(fptr3, "%d\t%d\t%4.2f\n", yr[j], jday, etsima[j]); if(opt == 2)
fprintf(fptr3, "%d\t%d\t%4.2f\t\t%4.2f\n", yr[j], jday, etsima[j], etcat[j]);
if(opt2 == 1) {fprintf(fptr4,
"%d\t%d\t%4.2f\t%4.2f\t%4.2f\t%4.2f\t%6.3f\t\t%5.2f\t%5.2f\t%5.2f\t%5.2f\t%6.3f\n",
yr[j], jday, tmax[j], tmin[j], tavea[j], taveh[j], pave[j], rhmin[j], rhmax[j], mave[j],
rtave[j], wsave[j]); } }tad1 = taveh[j]; j = j + 1; }while(ef != -1); fclose(fptr3);
printf("Finished ET calculations for cattails and mixed marsh\n\n"); j = 0; i = 0; ef = 0;
//perform the same analysis for open water ET calculations...
do{fscanf(fptr1, s, names2);printf("Reading input parameters from %s\n\n", names2);
if((fptr2 = fopen(names2, "r")) == NULL){do{printf("\nCan not find input file %s\n\n",
names2);printf("...Press x to exit\n\n");scanf(s, exch); if(exch[0] == 'x') exit(-1);
}while(1); } do {if(fscanf(fptr2, s s s s f, lin1, lin2, lin3, lin4, a) == EOF) ef = -1;
else{if((lin1[6] =='A') && (lin1[7] == 'T') && (lin2[1] =='E')){tavea[j] = a;
// determine year month day arrays only in the first file...for(k=0; k<4; k++) yy[k] =
lin3[k]; yy[4] = '\0'; yr[j] = atoi(yy); for(k=4; k<6; k++)
mm[k-4] = lin3[k]; mm[3] = '\0'; mo[j] = atoi(mm); for(k=6; k<8; k++) dd[k-6] = lin3[k];
```

```
dd[3] = '\0'; da[j] = atoi(dd); }
if((lin1[6] =='A') && (lin1[7] == 'T') && (lin2[1] =='I')) tmin[j] = a;
if((lin1[6] =='A') && (lin1[7] == 'T') && (lin2[1] =='A')) tmax[j] = a;
if((lin1[6] =='T') && (lin1[7] == '0') && (lin2[1] =='E')) taveh[j] = a;
if((lin1[6] =='A') && (lin1[7] == 'P') && (lin2[1] =='E')) pave[j] = a;
if((lin1[6] =='R') && (lin1[7] == 'H') && (lin2[1] =='E')) rhave[j] = a;
if((lin1[6] =='R') && (lin1[7] == 'H') && (lin2[1] =='I')) rhmin[j] = a;
if((lin1[6] =='R') && (lin1[7] == 'H') && (lin2[1] =='A')) rhmax[j] = a;
if((lin1[6] =='N') && (lin1[7] == 'R') && (lin2[1] =='E')) rnave[j] = a;
if((lin1[6] =='R') && (lin1[7] == 'T') && (lin2[1] =='E')) rtave[j] = a;
if((lin1[6] =='W') && (lin1[7] == 'S') && (lin2[1] =='E')) wsave[j] = a;
j = j + 1; } }while(ef != -1); ef = 0; fclose(fptr2); j = 0; i = i + 1; }while(i < dcalc);
fclose(fptr1);//name the output file based on the current input file
for(i=0; i<6; i++) outfile1[i] = names2[i]; outfile1[6] = '.'; outfile1[7] = 'o';
outfile1[8] = 'u'; outfile1[9] = 't'; printf("\nBegin ET Processing\n\n");
fptr3 = fopen(outfile1, "w"); if(opt == 1) {
fprintf(fptr3, "Year\tJ day\tET Simple Mixed Veg\tET Simple-Open Water\n\n");
if(opt1 == 1) fprintf(fptr3, "    \t    \tin/d\t\tin/d\n\n"); else
fprintf(fptr3, "    \t    \tmm/d\t\tin/d\n\n"); } if(opt == 2) {
fprintf(fptr3, "Year\tJ day\tET Simple\tET Mixed Veg\tET Simple\tET Open
Water\n\n"); if(opt1 == 1) fprintf(fptr3, "    \t    \tin/d      \tin/d\tin/d      \tin/d\n\n");
else fprintf(fptr3, "    \t    \tmm/d      \tmm/d\t\tmm/d      \tmm/d\n\n"); }if(opt2 == 1)
{fprintf(fptr4, "\nDaily Mixed Vegetation and Open water input parameters\n");
fprintf(fptr4, "Year\tJ.day\tTmax-a\tTmin-a\tTave-a\tTave-
h\tPave\t\tRhmin\tRhmax\tRnave\t Rtave\tWsave\n");
fprintf(fptr4, "\t\tC\tC\tC\tC\tkPa\t\t%%\t%%\tMJ/m2d\tMJ/m2d\tmph\n");}ef = 0; i = 0;
j = 0; k1a = 0.54; k1b = 0.52; k1c = 0.53; day1 = 0;  do{ if((mo[j] == endmo) && (da[j]
== endda)){ef = -1; dflg = 1; }
//set julian day counter
if((yr[j]%4 == 0 && yr[j]%100 != 0) || (yr[j]%400 == 0)) leap = 1; else leap = 0;
if(leap == 0) { if(mo[j] == 1) jday = da[j]; else if(mo[j] == 2) jday = 31 + da[j];
else if(mo[j] == 3) jday = 59 + da[j]; else if(mo[j] == 4) jday = 90 + da[j];
else if(mo[j] == 5) jday = 120 + da[j]; else if(mo[j] == 6) jday = 151 + da[j];
else if(mo[j] == 7) jday = 181 + da[j]; else if(mo[j] == 8) jday = 212 + da[j];
else if(mo[j] == 9) jday = 243 + da[j]; else if(mo[j] == 10) jday = 273 + da[j];
else if(mo[j] == 11) jday = 304 + da[j]; else if(mo[j] == 12)jday = 334 + da[j];}
if(leap == 1){  if(mo[j] == 1)jday = da[j]; else if(mo[j] == 2)
jday = 31 + da[j]; else if(mo[j] == 3) jday = 60 + da[j]; else if(mo[j] == 4)
jday = 91 + da[j]; else if(mo[j] == 5) jday = 121 + da[j]; else if(mo[j] == 6)
jday = 152 + da[j]; else if(mo[j] == 7) jday = 182 + da[j]; else if(mo[j] == 8)
jday = 213 + da[j]; else if(mo[j] == 9) jday = 244 + da[j]; else if(mo[j] == 10)
jday = 274 + da[j]; else if(mo[j] == 11) jday = 305 + da[j]; else if(mo[j] == 12)
jday = 335 + da[j]; }//set constants for all equations...
pave[j] = 0.1333*pave[j]; rnave[j] = 24.0*3.6*rnave[j]; rtave[j] = 24.0*3.6*rtave[j];
if(rhmax[j] > 100.0) rhmax[j] = 100.0; lamda = 2.501 - (0.002361*taveh[j]);
etsimb[j] = k1b*rtave[j]/lamda; if(opt1 == 1) etsimb[j] = etsimb[j]/25.4;
```

```
etsimc[j] = k1c*rtave[j]/lamda; if(opt1 == 1) etsimc[j] = etsimc[j]/25.4;
if(opt4 == 1) {if(j == 0) gval = 0; else gval = 4.18*0.14*(taveh[j] - tad1); }
if(opt4 == 2) {if(j == 0) gval = 0; else gval = 4.18*0.118153*(taveh[j] - tad1);}
atmrho = 3.486*pave[j]/(1.01*(tavea[j] + 273));
gamma = 1.013*pave[j]*0.001/(0.622*lamda); cp = 0.622*lamda*gamma/pave[j];
ea1 = 0.611*exp((17.27*tmax[j])/(tmax[j]+237.3));
ea2 = 0.611*exp((17.27*tmin[j])/(tmin[j]+237.3)); ea = (ea1 + ea2)/2.0;
ed = ((0.5*ea1*rhmin[j])/100.0) + ((0.5*ea2*rhmax[j])/100.0); vpd = ea - ed;
dm = 0.85*fcm*hitem; zom = 0.13*(hitem - dm);
ws2m = wsave[j]*log((2.0-dm)/zom)/log((10.0-dm)/zom);
ram = log((2.0 - dm)/zom) * log((hitem - dm)/(0.1*zom))/(0.41*0.41*ws2m*0.447);
aw = 0.1+3.0*exp(-((((float)jday-173.0)/58.0)*(((float)jday-173.0)/58.0)));
bw = 0.04+0.2*exp(-((((float)jday-243.0)/80.0)*(((float)jday-243.0)/80.0)));
etmix[j] = (delta*(rnave[j] - gval) + (86400.0*atmrho*cp*vpd/ram))/(delta +
gamma*(1.0 + (rc2/ram)))/lamda; if(opt1 == 1) etmix[j] = etmix[j]/25.4;
etope[j] = (delta*(rnave[j] -
gval)+(gamma*6.43*(aw+bw*0.447*ws2m)*vpd))/(delta+gamma)/lamda;
if(opt1 == 1) etope[j] = etope[j]/25.4; if((ef != -1) || (dflg == 1)) {
if(opt == 1)fprintf(fptr3, "%d\t%d\t%4.2f\t%4.2f\n", yr[j], jday, etsimb[j], etsimc[j]);
if(opt == 2)fprintf(fptr3, "%d\t%d\t%4.2f\t\t%4.2f\t\t%4.2f\t\t%4.2f\n", yr[j], jday,
etsimb[j], etmix[j], etsimc[j], etope[j]); if(opt2 == 1) {
fprintf(fptr4,
"%d\t%d\t%4.2f\t%4.2f\t%4.2f\t%4.2f\t%6.3f\t\t%5.2f\t%5.2f\t%5.2f\t%5.2f\t%6.3f\n",
yr[j], jday, tmax[j], tmin[j], tavea[j], taveh[j], pave[j], rhmin[j], rhmax[j], rnave[j],
rtave[j], wsave[j]); } }tad1 = taveh[j]; j = j + 1; }while(ef != -1); fclose(fptr3);
fclose(fptr4); printf("Finished open water ET calculations...\n\n"); }
```

APPENDIX B

C PROGRAM: etcalcs, Version I
Written by D. Downey, July 1998
Hydrologic Reporting Unit
Resource Assessment Division
Water Resources Evaluation Department
South Florida Water Management District

This program calculates daily ET rates for cattail, mixed marsh and open water/algae surface areas.

Maximum time period for daily ET calculations is 10 years.

NOTE: THIS PROGRAM IS CASE SENSITIVE.

IT IS RECOMMENDED THAT THE USER READ THE ACCOMPANYING DOCUMENTATION EXPLAINING THIS PROGRAM PRIOR TO EXECUTION.

This program prompts the user for an input file, up to 32 characters in length, located in the current directory, containing the file names ZZZ###AA.BBB, where ZZZ corresponds to a three letter moniker for the weather station used for analysis, ### corresponds to station number (depending on ET calculation performed), AA coresponds to AT, AP, etc., and BBB corresponds to MIN, MAX, or AVE depending on the pararmeter statistic. The first line of the input should contain a numerical value corresponding to the number of input files located in this file.

This program prompts the user for H (height) and Fc (vegetative cover) values.

Press c to continue, x to exit:

c

Enter filename containing weather parameter filenames

enrfile

Select one of two options:
simple ET calculations for all three scenarios = 1
simple and advanced ET calculations for all three scenarios = 2

Enter calculation option 1 or 2:

2

Select one of two options:
output as in/d = 1
output as mm/d = 2

Enter output option 1 or 2:
2

Enter numerical height, H, for cattail stand:

1.5

Enter numerical constant, Fc, for cattail land coverage:

0.7

Enter numerical height, H, for mixed marsh stand:

0.7

Enter numerical constant, Fc, for mixed marsh land coverage:

0.85

The following constants will be assumed:

k1 = 0.54, 0.52, 0.53 for cattails, mixed marsh, or open water/algae,

respectively, and rc = 90 for cattails, rc = 70 for mixed marsh.

Enter 1 if rc values are acceptable, otherwise enter 2 to change them
1

Select one of two options:
daily listing of weather parameters used in calculations = 1
no listing of daily weather parameters = 2

Enter daily weather output option 1 or 2:
2

Select one of two options:
Water temperature file contains water temperatures = 1
Water temperature file contains air temperatures = 2

Enter numerical value 1 or 2 pertaining to water temperature file:
1
Enter ending date for current analysis as yyyymmdd

19970819

Reading input parameters from ENR105AT.MIN

Reading input parameters from ENR105AT.MAX

Reading input parameters from ENR105AT.AVE

Reading input parameters from ENR105AP.AVE

Reading input parameters from ENR105T0.AVE

Reading input parameters from ENR105RH.MIN

Reading input parameters from ENR105RH.MAX

Reading input parameters from ENR105NR.AVE

Reading input parameters from ENR105RT.AVE

Reading input parameters from ENR105WS.AVE

Begin ET Processing

Finished ET calculations for cattails and mixed marsh

Reading input parameters from ENR308AT.MIN

Reading input parameters from ENR308AT.MAX

Reading input parameters from ENR308AT.AVE

Reading input parameters from ENR308AP.AVE

Reading input parameters from ENR308T0.AVE

Reading input parameters from ENR308RH.MIN

Reading input parameters from ENR308RH.MAX

Reading input parameters from ENR308NR.AVE

Reading input parameters from ENR308RT.AVE

Reading input parameters from ENR308WS.AVE

Begin ET Processing
Finished open water ET calculations...

APPENDIX C

STATION BELLE GL — IFAS - EVERGLADES RESEARCH AND EDUCATION CENTER

SECTION 10 TOWN 44 RANGE 37

LAT 263924.000 XCOORD 620846.000 BASIN S2 QUAD SHEET 26080420

LONG: 803740.000 YCOORD 844509.000 COUNTY PAL LAND SURFACE 11.50 FT MSL

DBKEY:	TYPE	UNITS	STAT	FREQ	RCDR	STRATA	REP	START	END	GATE	SLOT
15344	AIRT	DEGREES	MIN	DA	????	0.00	0	02/01/1992	03/31/1998		
15345	AIRT	DEGREES	MAX	DA	????	0.00	0	02/01/1992	03/31/1998		
15346	AIRT	DEGREES	MEAN	DA	????	0.00	0	02/01/1992	03/31/1998		
15349	HUMI	PERCENT	MIN	DA	????	0.00	0	02/01/1992	04/16/1998		
15350	HUMI	PERCENT	MAX	DA	????	0.00	0	02/01/1992	03/31/1998		
15353	BARO	MM MERCURY	MIN	DA	????	0.00	0	02/01/1992	03/31/1998		
15354	BARO	MM MERCURY	MAX	DA	????	0.00	0	02/01/1992	03/31/1998		
15357	RADT	KILO WATT/M^2	MEAN	DA	????	0.00	0	02/01/1992	03/31/1998		
15359	WNDS	MPH	MEAN	DA	????	0.00	0	02/01/1992	03/31/1998		
DO524	WNDS	MPH	MEAN	DA	CR10	0.00	0	04/16/1996	05/31/1998		
DO527	RADT	KILO WATT/M^2	MEAN	DA	CR10	0.00	0	04/16/1996	04/30/1998		
DO529	HUMI	PERCENT	MEAN	DA	CR10	0.00	0	04/16/1996	05/31/1998		
DO530	AIRT	DEGREES	MEAN	DA	CR10	0.00	0	04/16/1996	05/31/1998		
DO531	BARO	MM MERCURY	MEAN	DA	CR10	0.00	0	04/16/1996	05/31/1998		

STATION CFSW — CLEWISTON FIELD STATION WEATHER STATION

SECTION 24 TOWN 43 RANGE 34

LAT 264405.000 XCOORD 534089.000 BASIN C21 QUAD SHEET 26080434 CLEWSTON SOUTH

LONG: 805344.000 YCOORD 872719.000 COUNTY HEN LAND SURFACE 99.00 FT MSL

DBKEY:	TYPE	UNITS	STAT	FREQ	RCDR	STRATA	REP	START	END	GATE	SLOT
15509	WNDS	MPH	MEAN	DA	CR10	10.00	0	10/21/1992	06/03/1998	00	00
15512	RADT	KILO WATT/M^2	MEAN	DA	CR10	10.00	0	10/21/1992	06/03/1998	00	00
15515	HUMI	PERCENT	MEAN	DA	CR10	10.00	0	10/21/1992	06/03/1998	00	00
15516	AIRT	DEGREES	MEAN	DA	CR10	10.00	0	10/21/1992	06/11/1998	00	00
15518	BARO	MM MERCURY	MEAN	DA	CR10	10.00	0	10/21/1992	06/11/1998	00	00

STATION ENR105 — WEATHER STATION IN CELL1 NEAR G254B CULVERT IN ENR PROJECT

SECTION 12 TOWN 44 RANGE 39

LAT 263920.000 XCOORD 692159.000 BASIN S5A QUAD SHEET 26080130

LONG: 802442.000 YCOORD 844373.000 COUNTY PAL LAND SURFACE

DBKEY:	TYPE	UNITS	STAT	FREQ	RCDR	STRATA	REP	START	END	GATE	SLOT
15852	WNDS	MPH	MEAN	DA	CR10	0.00	0	04/07/1994	03/25/1998		
15853	RADT	KILO WATT/M^2	MEAN	DA	CR10	0.00	0	04/07/1994	03/25/1998		
15855	RADN	KILO WATT/M^2	MEAN	DA	CR10	0.00	0	04/07/1994	03/25/1998		
15856	HUMI	PERCENT	MEAN	DA	CR10	0.00	0	04/07/1994	03/25/1998		
15857	AIRT	DEGREES	MEAN	DA	CR10	0.00	0	04/07/1994	03/25/1998		
15858	BARO	MM MERCURY	MEAN	DA	CR10	0.00	0	04/07/1994	03/25/1998		
15860	H2OT	DEGREE C	MEAN	DA	CR10	0.00	0	04/08/1994	03/04/1998		

```
**********************************************************************************************
* STATION  ENR308              WEATHER STATION NEAR INTERIOR LEVEE IN CELL3
*
* SECTION  22          TOWN    44          RANGE  39
*
* LAT     263720.000      XCOORD  683230.000  BASIN  S5A          QUAD SHEET   26080130
*
* LONG:  802621.000       YCOORD  832216.000  COUNTY PAL          LAND SURFACE
*
*  DBKEY: TYPE  UNITS              STAT  FREQ  RCDR   STRATA  REP    START       END        GATE  SLOT *
*  15879  WNDS  MPH                MEAN   DA   CR10     0.00   0   04/07/1994   03/24/1998
*  15880  RADT  KILO WATT/M^2      MEAN   DA   CR10     0.00   0   04/07/1994   03/24/1998
*  15882  RADN  KILO WATT/M^2      MEAN   DA   CR10     0.00   0   04/07/1994   03/24/1998
*  15883  HUMI  PERCENT            MEAN   DA   CR10     0.00   0   04/07/1994   03/24/1998
*  15884  AIRT  DEGREES            MEAN   DA   CR10     0.00   0   04/07/1994   03/24/1998
*  15885  BARO  MM MERCURY         MEAN   DA   CR10     0.00   0   04/07/1994   03/24/1998
*  15887  H2OT  DEGREE C           MEAN   DA   CR10     0.00   0   04/08/1994   03/24/1998
**********************************************************************************************
* STATION  FPWX                FLINT PEN STRAND, WEATHER STATION
*
* SECTION  33          TOWN    46          RANGE  26
*
* LAT     262556.000      XCOORD  263198.625  BASIN  ESTERO     QUAD SHEET   26081314  CORKSCREW NW
*
* LONG:  814325.000       YCOORD  763421.875  COUNTY LEE          LAND SURFACE
*
*  DBKEY: TYPE  UNITS              STAT  FREQ  RCDR   STRATA  REP    START       END        GATE  SLOT *
*  FZ589  WNDS  MPH                MEAN   DA   CR10     0.00   0   10/22/1997   04/20/1998
*  FZ592  RADT  KILO WATT/M^2      MEAN   DA   CR10     0.00   0   10/22/1997   04/20/1998
*  FZ594  RADN  KILO WATT/M^2      MEAN   DA   CR10     0.00   0   10/22/1997   04/20/1998
*  FZ595  HUMI  PERCENT            MEAN   DA   CR10     0.00   0   10/22/1997   04/20/1998
*  FZ596  AIRT  DEGREES            MEAN   DA   CR10     0.00   0   10/22/1997   04/20/1998
*  FZ597  BARO  MM MERCURY         MEAN   DA   CR10     0.00   0   10/22/1997   04/20/1998
**********************************************************************************************
* STATION  JBTS                JOE BAY WEATHER STATION
*
* SECTION   8          TOWN    60          RANGE  38
*
* LAT     251327.000      XCOORD  651978.000  BASIN  C111         QUAD SHEET   25080320
*
* LONG:  803225.000       YCOORD  323970.000  COUNTY DAD          LAND SURFACE      0.00 FT MSL
*
*  DBKEY: TYPE  UNITS              STAT  FREQ  RCDR   STRATA  REP    START       END        GATE  SLOT *
*  15081  WNDS  MPH                MEAN   DA   CR10     0.00   0   05/23/1991   03/16/1998
*  15084  RADT  KILO WATT/M^2      MEAN   DA   CR10     0.00   0   05/23/1991   03/16/1998
*  15085  HUMI  PERCENT            MEAN   DA   CR10     0.00   0   05/23/1991   03/16/1998
*  15087  AIRT  DEGREES            MEAN   DA   CR10     0.00   0   05/23/1991   03/16/1998
*  15088  H2OT  DEGREE C           MEAN   DA   CR10     0.00   0   05/23/1991   03/16/1998
*  15090  BARO  MM MERCURY         MEAN   DA   CR10     0.00   0   05/23/1991   03/16/1998
**********************************************************************************************
* STATION  JDWX                JONATHAN DICKINSON STATE PARK, WEATHER STATION
*
* SECTION   5          TOWN    40          RANGE  42
*
* LAT     270142.000      XCOORD  771654.562  BASIN  J DICKIN     QUAD SHEET   27080223  GOMEZ
*
* LONG:  000956.000       YCOORD  980328.250  COUNTY MAR          LAND SURFACE
*
*  DBKEY: TYPE  UNITS              STAT  FREQ  RCDR   STRATA  REP    START       END        GATE  SLOT *
*  G0850  WNDS  MPH                MEAN   DA   CR10     0.00   0   09/12/1997   05/11/1998
*  G0853  RADT  KILO WATT/M^2      MEAN   DA   CR10     0.00   0   09/12/1997   05/11/1998
*  G0855  RADN  KILO WATT/M^2      MEAN   DA   CR10     0.00   0   09/12/1997   05/11/1998
*  G0856  HUMI  PERCENT            MEAN   DA   CR10     0.00   0   09/12/1997   05/11/1998
*  G0857  AIRT  DEGREES            MEAN   DA   CR10     0.00   0   09/12/1997   05/11/1998
*  G0858  BARO  MM MERCURY         MEAN   DA   CR10     0.00   0   09/12/1997   05/11/1998
**********************************************************************************************
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STATION L001 LAKE OKEECHOBEE TOWER NORTH

SECTION 0 TOWN 38 RANGE 35

LAT 270819.000 XCOORD 568930.000 BASIN L OKEE QUAD SHEET 27080330

LONG: 804717.000 YCOORD 1019573.000 COUNTY OKE LAND SURFACE 15.00 FT MSL

DBKEY:	TYPE	UNITS	STAT	FREQ	RCDR	STRATA	REP	START	END	GATE	SLOT
16023	WNDS	MPH	MEAN	DA	CR10	10.00	0	08/04/1994	06/10/1998		
16024	RADT	KILO WATT/M^2	MEAN	DA	CR10	10.00	0	08/04/1994	06/10/1998		
16026	HUMI	PERCENT	MEAN	DA	CR10	10.00	0	08/04/1994	06/10/1998		
16027	AIRT	DEGREES	MEAN	DA	CR10	10.00	0	08/04/1994	06/10/1998		
16028	H2OT	DEGREE C	MEAN	DA	CR10	0.00	0	08/04/1994	06/10/1998		
16030	H2OT	DEGREE C	MEAN	DA	CR10	0.00	1	08/04/1994	06/10/1998		
16031	H2OT	DEGREE C	MEAN	DA	CR10	0.00	2	08/04/1994	06/10/1998		

STATION L002 LAKE OKEECHOBEE TOWER NORTH (#2)

SECTION 0 TOWN 38 RANGE 35

LAT 270507.000 XCOORD 569143.000 BASIN L OKEE QUAD SHEET 27080332 OKEECHOBEE SE

LONG: 804715.000 YCOORD 1000186.000 COUNTY OKE LAND SURFACE 15.00 FT MSL

DBKEY:	TYPE	UNITS	STAT	FREQ	RCDR	STRATA	REP	START	END	GATE	SLOT
12500	WNDS	MPH	MEAN	DA	CR10	20.00	0	08/16/1988	07/14/1994	00	00
12502	RADT	KILO WATT/M^2	MEAN	DA	CR10	0.00	0	08/16/1988	07/14/1994	00	00
12503	HUMI	PERCENT	MEAN	DA	CR10	10.00	0	08/16/1988	07/14/1994	00	00
12504	AIRT	DEGREES	MEAN	DA	CR10	10.00	0	08/16/1988	07/14/1994	00	00
12505	RAIN	INCHES	SUM	DA	CR10	0.00	0	08/16/1988	07/14/1994	00	00
12507	H2OT	DEGREE C	MEAN	DA	CR10	2.00	0	11/30/1988	07/14/1994	00	00
12508	H2OT	DEGREE C	MEAN	DA	CR10	2.00	1	01/01/1989	07/14/1994	00	00

STATION L005 LAKE OKEECHOBEE TOWER WEST (#5)

SECTION 0 TOWN 40 RANGE 37

LAT 265734.000 XCOORD 507420.000 BASIN L OKEE QUAD SHEET 26080444 COCHRANS PASS

LONG: 805838.000 YCOORD 954389.000 COUNTY GLA LAND SURFACE 15.00 FT MSL

DBKEY:	TYPE	UNITS	STAT	FREQ	RCDR	STRATA	REP	START	END	GATE	SLOT
12510	WNDS	MPH	MEAN	DA	CR10	20.00	0	08/05/1988	05/31/1998	00	00
12512	RADT	KILO WATT/M^2	MEAN	DA	CR10	0.00	0	08/05/1988	05/31/1998	00	00
12513	HUMI	PERCENT	MEAN	DA	CR10	10.00	0	08/05/1988	05/31/1998	00	00
12514	AIRT	DEGREES	MEAN	DA	CR10	10.00	0	08/05/1988	05/31/1998	00	00
12516	RADP	MICRO MOLE/S/M^2	MEAN	DA	CR10	0.00	0	08/05/1988	05/31/1998	00	00
12517	H2OT	DEGREE C	MEAN	DA	CR10	1.00	0	12/01/1988	06/10/1998	00	00
12518	H2OT	DEGREE C	MEAN	DA	CR10	1.00	1	12/01/1988	06/10/1998	00	00
16264	H2OT	DEGREE C	MEAN	DA	CR10	0.00	0	12/31/1994	06/10/1998		

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*******************************************************************************************
* STATION  L006               LAKE OKEECHOBEE TOWER SOUTH (#6)
*
* SECTION   0          TOWN     42          RANGE  35
*
* LAT     264920.000     XCOORD  570754.000  BASIN  L OKEE        QUAD SHEET   26080440
*
* LONG:   804659.000     YCOORD  904571.000  COUNTY PAL           LAND SURFACE     15.00 FT MSL
*
*  DBKEY: TYPE  UNITS             STAT  FREQ  RCDR   STRATA  REP    START       END        GATE  SLOT *
*  12520  WNDS  MPH               MEAN   DA   CR10    10.00   0   01/27/1989   06/01/1998   00     00
*  12522  RADT  KILO WATT/M^2     MEAN   DA   CR10    10.00   0   01/27/1989   06/01/1998   00     00
*  12523  HUMI  PERCENT           MEAN   DA   CR10    10.00   0   01/27/1989   06/01/1998   00     00
*  12526  H2OT  DEGREE C          MEAN   DA   CR10     1.00   0   08/09/1989   06/01/1998   00     00
*  12527  H2OT  DEGREE C          MEAN   DA   CR10     1.00   1   01/27/1989   06/01/1998   00     00
*  12911  AIRT  DEGREES           MEAN   DA   CR10    10.00   0   08/09/1989   06/01/1998   00     00
*  16221  H2OT  DEGREE C          MEAN   DA   CR10     0.00   0   08/09/1995   06/01/1998
*******************************************************************************************
* STATION  LOXWS              LOXAHATCHEE WEATHER STATION @CA1-0C AND L-40
*
* SECTION  35          TOWN     45          RANGE  41
*
* LAT     262955.000     XCOORD  754292.000  BASIN  C15      QUAD SHEET   26080214  UNIVERSITY PARK
*
* LONG:   801321.000     YCOORD  787655.000  COUNTY PAL           LAND SURFACE     99.00 FT MSL
*
*  DBKEY: TYPE  UNITS             STAT  FREQ  RCDR   STRATA  REP    START       END        GATE  SLOT *
*  DU547  BARO  MM MERCURY        MEAN   DA   CR10     0.00   0   09/12/1996   05/08/1998
*  DU548  AIRT  DEGREES           MEAN   DA   CR10     0.00   0   09/12/1996   05/08/1998
*  DU550  RADN  KILO WATT/M^2     MEAN   DA   CR10     0.00   0   09/12/1996   05/08/1998
*  DU551  RAIN  INCHES            SUM    DA   CR10     0.00   0   09/12/1996   05/08/1998
*  DU552  HUMI  PERCENT           MEAN   DA   CR10     0.00   0   09/12/1996   05/08/1998
*  DU554  RADT  KILO WATT/M^2     MEAN   DA   CR10     0.00   0   09/12/1996   05/08/1998
*  DU558  WNDS  MPH               MEAN   DA   CR10     0.00   0   09/12/1996   05/08/1998
*******************************************************************************************
* STATION  LZ40               LZ40 WEATHER STATION ON LAKE OKEECHOBEE
*
* SECTION   0          TOWN     0           RANGE  0
*
* LAT     265405.000     XCOORD  568713.000  BASIN  L OKEE        QUAD SHEET   26080440
*
* LONG:   804721.000     YCOORD  933344.000  COUNTY PAL           LAND SURFACE     13.00 FT MSL
*
*  DBKEY: TYPE  UNITS             STAT  FREQ  RCDR   STRATA  REP    START       END        GATE  SLOT *
*
*  13076  WNDS  MPH               MEAN   DA   CR10    10.00   0   04/25/1990   06/10/1998   00     00
*  13078  AIRT  DEGREES           MEAN   DA   CR10    10.00   0   05/02/1990   06/10/1998   00     00
*  13079  HUMI  PERCENT           MEAN   DA   CR10    10.00   0   05/02/1990   06/10/1998   00     00
*  13080  RADT  KILO WATT/M^2     MEAN   DA   CR10    10.00   0   04/25/1990   06/10/1998   00     00
*  16267  H2OT  DEGREE C          MEAN   DA   CR10     0.00   0   07/19/1990   06/10/1998
*  16268  H2OT  DEGREE C          MEAN   DA   CR10    -1.00   1   07/19/1990   06/10/1998
*  16467  H2OT  DEGREE C          MEAN   DA   CR10    -2.00   1   09/04/1995   06/10/1998
*******************************************************************************************
* STATION  ROTNWX             ROTENBERGER TRACT WEATHER STATION, LOCATED BY G606 AT STA6
*
* SECTION   7          TOWN     48          RANGE  35
*
* LAT     261953.938     XCOORD  539304.000  BASIN  98       QUAD SHEET   26080343  EVERGLADES 2 SW
*
* LONG:   805248.750     YCOORD  726125.625  COUNTY BRO           LAND SURFACE
*
*  DBKEY: TYPE  UNITS             STAT  FREQ  RCDR   STRATA  REP    START       END        GATE  SLOT *
*  GE345  WNDS  MPH               MEAN   DA   CR10     0.00   0   03/31/1998   04/30/1998
*  GE348  RADT  KILO WATT/M^2     MEAN   DA   CR10     0.00   0   01/31/1998   05/31/1998
*  GE350  RADN  KILO WATT/M^2     MEAN   DA   CR10     0.00   0   01/31/1998   05/31/1998
*  GE351  HUMI  PERCENT           MEAN   DA   CR10     0.00   0   01/31/1998   05/31/1998
*  GE352  AIRT  DEGREES           MEAN   DA   CR10     0.00   0   01/31/1998   05/31/1998
*  GE353  BARO  MM MERCURY        MEAN   DA   CR10     0.00   0   01/31/1998   05/31/1998
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***********************************************************************************************
* STATION  S7WX                    S7 WEATHER STATION
*
* SECTION  22             TOWN     47           RANGE  38
*
* LAT      262008.000     XCOORD  651660.250  BASIN  CA2A      QUAD SHEET   26080312  EVERGLADES 1 SE
*
* LONG:    803213.000     YCOORD  727893.688  COUNTY PAL             LAND SURFACE
*
*  DBKEY: TYPE  UNITS              STAT  FREQ  RCDR   STRATA  REP    START         END        GATE   SLOT *
*  GG621  WNDS  MPH                MEAN   DA   CR10    0.00    0   01/12/1998   06/12/1998
*  GG624  RADT  KILO WATT/M^2      MEAN   DA   CR10    0.00    0   01/12/1998   06/12/1998
*  GG626  RADN  KILO WATT/M^2      MEAN   DA   CR10    0.00    0   01/12/1998   06/12/1998
*  GG627  HUMI  PERCENT            MEAN   DA   CR10    0.00    0   01/12/1998   06/12/1998
*  GG628  AIRT  DEGREES            MEAN   DA   CR10    0.00    0   01/12/1998   06/12/1998
*  GG629  BARO  MM MERCURY         MEAN   DA   CR10    0.00    0   01/12/1998   06/12/1998
***********************************************************************************************
* STATION  S65C                    S-65C SPILLWAY ON CANAL C-38
*
* SECTION  27             TOWN     35           RANGE  32
*
* LAT      272404.000     XCOORD  462687.000  BASIN  S65C            QUAD SHEET   27081210
*
* LONG:    810654.000     YCOORD 1114952.000  COUNTY OKE             LAND SURFACE      35.00 FT MSL
*
*  DBKEY: TYPE  UNITS              STAT  FREQ  RCDR   STRATA  REP    START         END        GATE   SLOT *
*
*  12471  HUMI  PERCENT            MEAN   DA   SP01    4.00    0   04/07/1988   10/08/1991    00      00
*  12472  AIRT  DEGREES            MEAN   DA   SP01    4.00    0   04/07/1988   11/12/1991    00      00
*  12473  RADT  KILO WATT/M^2      MEAN   DA   SP01    0.00    0   04/07/1988   10/08/1991    00      00
*  12476  WNDS  MPH                MEAN   DA   SP01    8.00    0   04/07/1988   11/12/1991    00      00
*  12479  RADN  KILO WATT/M^2      MEAN   DA   SP01    0.00    0   04/08/1988   06/27/1989    00      00
***********************************************************************************************
* STATION  S65CW                   WEATHER STATION NEAR S-65C SPILLWAY ON CANAL C-38
*
* SECTION  27             TOWN     35           RANGE  32
*
* LAT      272404.000     XCOORD  462687.000  BASIN  S65C            QUAD SHEET   27081210
*
* LONG:    810654.000     YCOORD 1114952.000  COUNTY OKE             LAND SURFACE      35.00 FT MSL
*
*  DBKEY: TYPE  UNITS              STAT  FREQ  RCDR   STRATA  REP    START         END        GATE   SLOT *
*  15466  WNDS  MPH                MEAN   DA   CR10   10.00    0   10/20/1992   06/17/1998    00      00
*  15469  RADT  KILO WATT/M^2      MEAN   DA   CR10   10.00    0   10/20/1992   06/17/1998    00      00
*  15472  AIRT  DEGREES            MEAN   DA   CR10   10.00    0   10/20/1992   06/17/1998    00      00
*  15474  BARO  MM MERCURY         MEAN   DA   CR10   10.00    0   10/20/1992   06/17/1998    00      00
*  DJ240  HUMI  PERCENT            MEAN   DA   CR10    0.00    0   10/20/1992   06/17/1998
***********************************************************************************************
* STATION  S78W                    S-78 WEATHER STATION ON CALOOSAHATCHEE RIVER AT ORTONA
*
* SECTION  26             TOWN     42           RANGE  30
*
* LAT      264722.000     XCOORD  401134.000  BASIN  CALOOS.E        QUAD SHEET   26081142  GOODNO
*
* LONG:    811811.000     YCOORD  892714.000  COUNTY GLA             LAND SURFACE      99.00 FT MSL
*
*  DBKEY: TYPE  UNITS              STAT  FREQ  RCDR   STRATA  REP    START         END        GATE   SLOT *
*  15487  WNDS  MPH                MEAN   DA   CR10   10.00    0   10/21/1992   03/31/1998    00      00
*  15490  RADT  KILO WATT/M^2      MEAN   DA   CR10   10.00    0   10/21/1992   03/31/1998    00      00
*  15492  RADN  KILO WATT/M^2      MEAN   DA   CR10   10.00    0   03/14/1995   03/16/1995    00      00
*  15493  HUMI  PERCENT            MEAN   DA   CR10   10.00    0   10/21/1992   03/31/1998    00      00
*  15494  AIRT  DEGREES            MEAN   DA   CR10   10.00    0   10/21/1992   03/31/1998    00      00
*  15496  BARO  MM MERCURY         MEAN   DA   CR10   10.00    0   10/21/1992   03/31/1998    00      00
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* STATION  S140W              S-140 WEATHER STATION ON LEVEE L-28 NEAR ALLIGATOR ALLEY
*
* SECTION   3          TOWN    50        RANGE  35
*
* LAT     261018.000     XCOORD  556576.000  BASIN  CA3A          QUAD SHEET   26080330
*
* LONG:   804939.000     YCOORD  668093.000  COUNTY BRO           LAND SURFACE    100.00 FT MSL
*
*  DBKEY: TYPE  UNITS          STAT  FREQ  RCDR   STRATA  REP   START       END        GATE  SLOT *
*  15498  WNDS  MPH            MEAN   DA   CR10    10.00   0   10/21/1992   06/17/1998   00    00
*  15501  RADT  KILO WATT/M^2  MEAN   DA   CR10    10.00   0   10/21/1992   06/17/1998   00    00
*  15504  HUMI  PERCENT        MEAN   DA   CR10    10.00   0   10/21/1992   06/17/1998   00    00
*  15505  AIRT  DEGREES        MEAN   DA   CR10    10.00   0   10/21/1992   06/17/1998   00    00
*  15507  BARO  MM MERCURY     MEAN   DA   CR10    10.00   0   10/21/1992   06/17/1998   00    00
***********************************************************************************************
* STATION  S331W              S-331 WEATHER STATION ON L-31N
*
* SECTION   2          TOWN    55        RANGE  38
*
* LAT     253638.000     XCOORD  661472.000  BASIN  C1            QUAD SHEET   25080420
*
* LONG:   803036.000     YCOORD  464426.000  COUNTY DAD           LAND SURFACE      8.00 FT MSL
*
*  DBKEY: TYPE  UNITS          STAT  FREQ  RCDR   STRATA  REP   START       END        GATE  SLOT *
*  16253  WNDS  MPH            MEAN   DA   CR10     0.00   0   07/21/1994   06/18/1998
*  16256  RADT  KILO WATT/M^2  MEAN   DA   CR10     0.00   0   07/21/1994   06/18/1998
*  16258  RADN  KILO WATT/M^2  MEAN   DA   CR10     0.00   0   07/21/1994   06/18/1998
*  16259  HUMI  PERCENT        MEAN   DA   CR10     0.00   0   07/21/1994   06/18/1998
*  16260  AIRT  DEGREES        MEAN   DA   CR10     0.00   0   07/21/1994   06/18/1998
*  16262  BARO  MM MERCURY     MEAN   DA   CR10     0.00   0   07/21/1994   06/18/1998
*  16263  LEAF  STANDARD       MEAN   DA   CR10     0.00   0   07/21/1994   06/06/1995
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* STATION  WRWX               WALKER RANCH, WEATHER STATION (DISNEY WILDERNESS PRESERVE)
*
* SECTION  15          TOWN    28        RANGE  29
*
* LAT     280253.000     XCOORD  371068.375  BASIN  L HATCHI QUAD SHEET   28081233  LAKE HATCHINEHA
*
* LONG:   812359.000     YCOORD 1350330.125  COUNTY POL           LAND SURFACE
*
*  DBKEY: TYPE  UNITS          STAT  FREQ  RCDR   STRATA  REP   START       END        GATE  SLOT *
*  FF837  WNDS  MPH            MEAN   DA   CR10     0.00   0   04/16/1997   05/04/1998
*  FF840  RADT  KILO WATT/M^2  MEAN   DA   CR10     0.00   0   04/16/1997   05/04/1998
*  FF842  RADN  KILO WATT/M^2  MEAN   DA   CR10     0.00   0   04/16/1997   05/04/1998
*  FF843  HUMI  PERCENT        MEAN   DA   CR10     0.00   0   04/16/1997   05/04/1998
*  FF844  AIRT  DEGREES        MEAN   DA   CR10     0.00   0   04/16/1997   05/04/1998
*  FF845  BARO  MM MERCURY     MEAN   DA   CR10     0.00   0   04/16/1997   05/04/1998
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