Software

We developed a tool to calculate some fire weather indices from meteorological parameters, consisting of a library, a command line application and a graphical interface application.
We used the Scala language, which is targetting the Java virtual machine (jvm).

This tool reads meteorological data from a *.csv file and calculates the fire weather indices according to the inputs, storing the results in another *.csv file and the details of the calculation in a text file (log). For each index multiple possible input parameters have been specified, according to a ranking from the optimal to the less suitable choice. For example for the canadian FWI if the parameters at noon are not available, the program will try to compute it with other meaningful daily values. Variable choice is indicated in the logs.

Input file

The program can read *.csv files (comma separated values), with headers with a specific name (columns with other names will not be considered). The case (upper/lower) is not relevant. For a list of the abbreviations used see the Variable section. The values are checked for missing values and range validity. The values of the input variables wich are out of range are replaced with a missing value (not in the original file, only to perform the calculations).

Settings

You can change the settings according to your local situation. In the missing variables tab you can specify some parameters which can be used for the calculation as a replacement. The parameter can also be imported form a file (see Preferences).

Preferences

You can specify if the parameters and missing variables should be read from the ui (user interface), a parameter file (*_PAR.txt) or both (file parameters have the precedence over ui parameters). The file option allows you to use different parameters for different stations in the multi file calculation. The parameters in the *_PAR.txt file should be specified as the following example:
Altitude 500
Latitude 46.0
FireSeasonStart 15.01
FireSeasonEnd 15.10
Climate 3

Output files

The program generates two files, one containing the results (xxx_RESULTS.csv) and one reporting the log (xxx_LOG.txt), which are stored in the same directory as the input file (xxx.csv). For each calculated variable, a log is given with the calclulation details:
start: initial value
(required variables)->(used variables)
[parameters used]

Parameters

Here is a list of the parameters and missing variables that can be specified in a *_PAR.txt file (see paragraph on preferences).

Altitude	Altitude	m
Latitude	Latitude	°
Krs	Krs	
Albedo	Albedo	
RainyDayThreshold	Threshold for rainy day	mm
KBDIstart	KBDIstart	
FFMCstart	MFFMCstart	
DMCstart	DMCstart	
DCstart	DCstart	
FireSeasonstart	Start of the fire season	day-month
FireSeasonEnd	End of the fire season	day-month
M68VegCorrStep3Start	vegCorrStep3Start	
M68VegCorrStep3End	vegCorrStep3End	--
XsnowcoverStart	XsnowcoverStart	day-month
XsnowcoverEnd	XsnowcoverEnd	day-month
XbirchLeaves	XbirchLeaves	day-month
XrobiniaBlossom	XrobiniaBlossom	day-month
MeanAnnualRain	Mean annual rain	mm/year
Climate	Climate class (Deeming et al. 1977)	1-4
I	Heat index	

Variables

Here is a list of the variables used with the abbreviations, units and variables required for the computation.

Inputs:

DateYYYYMMDD	e.g. 20081231	
T	Temperature average	°C
T12	Temperature at 12:00	°C
T13	Temperature at 13:00	°C
T15	Temperature at 15:00	°C
Tmin	Minimal temperature	°C
Tmax	Maximal temperature	°C
P	Rainfall sum at 06:00	mm/day
P12	Rainfall sum at 12:00	mm/day
P13	Rainfall sum at 13:00	mm/day
P15	Rainfall sum at 15:00	mm/day
U	Windspeed average	m/s
U12	Windspeed at 12:00	m/s
U13	Windspeed at 13:00	m/s
U15	Windspeed at 15:00	m/s

H	Relative humidity	%
H12	Relative humidity at 12:00	%
H13	Relative humidity at 13:00	%
H15	Relative humidity at 15:00	%
Hmin	Minimum Relative humidity	%
Hmax	Maximum Relative humidity	%
Cc	Cloud cover fraction	ratio

Optional inputs:

SnowCover	Snow cover	0/1	(T, XsnowcoverStart, XsnowcoverEnd)
BirchLeaves	Phenological phase first birch leaves	0/1	(T, XbirchLeaves)
RobiniaBlossom	Phenological phase robinia blossom	0/1	(T, XrobiniaBlossom)
PC	Phenological coefficient	100/200	(r)
PDur	Duration of rainfall in a day	h	(P, Climate)

Calculables: (from inputs or settings)

Tdew	Dewpoint temperature	°C	(T, H)
Tdew12	Dewpoint temperature at 12:00	°C	(T12, H12)
Tdew15	Dewpoint temperature at 15:00	°C	(T15, H15)
PDur	Duration of rainfall in a day	h	(P, Climate)
SnowCover	Snow cover	0/1	(T, XsnowcoverStart, XsnowcoverEnd)
RobiniaBlossom	Phenological phase robinia blossom	0/1	(T, XrobiniaBlossom)
BirchLeaves	Phenological phase first birch leaves	0/1	(T, XbirchLeaves)
PC	Phenological coefficient	100/200	(r)
N	Daylight hours FAO	day	(T, Latitude)
DaysSinceRain	Days since last rainfall	day	(P, RainyDayThreshold)
AgeRainEvent_2_20	Age of last significant rainfall event (days > 2mm in past 20 days)(day with max rain in event)	days	(P)
WeekRain	One week rainfall	mm/week	(P)
RainSum	Sum of consecutive rainfall	mm	(P)
lastRainSum	Sum of last consecutive rainfall	mm	(P)
lastRainSum_2_20	Sum of last significant rainfall event (days > 2mm in past 20 days)	mm	(P)
VPD	Vapour pressure deficit value	kPa	(Tmax, Tmin, H)
VPD13	Vapour pressure deficit value at 13:00	kPa	(T13, H13)
Angstroem	Angstroem index value	—	(T, H)
Nesterov	Nesterov index value	—	(T15, Tdew15, P15)
Munger	Munger index value	—	(P)
EMC	Equilibrium moisture content	%	(T, H)
EMCfa	Equilibrium moisture content at fuel-atmosphere interface	%	(T, H, Cc)
EMC24	Weighted 24-hour average EMC	%	(Tmin, Tmax, Hmin, Hmax, N)
FFWI	FFWI index value	—	(EMC, U)

FFWImod	modified FFWI index value	—	(KBDI, FFWI)
KBDI	KBDI index value	inches/100	(Tmax, P, MeanAnnualRain, KBDIstart, RainSum, WeekRain, RainyDayThreshold)
KBDISI	KBDISI index value	mm	(Tmax, P, MeanAnnualRain, KBDIstart, RainSum, WeekRain, RainyDayThreshold)
Sharples	Sharples index value	—	(T, H, U)
FMI	Sharples fuel moisture index	—	(T, H)
Baumgartner	Baumgartner index	—	(P, PETpen)
BaumgartnerDanger	Baumgartner Danger classes	—	(Baumgartner)
NetRad	Net Radiation	—	(H, Tmax, Tmin, Latitude, Altitude, Krs, Albedo)
PETpen	Potential evapotranspiration value Penmann formula	mm/day	(NetRad, T, U, VPD, Altitude)
PETthorn	Potential evapotranspiration value Thorntwaite formula	mm/day	(T, I, N)
PETthorn_camargo	Potential evapotranspiration value Thorntwaite formula, with Tef of Camargo et al (1999)	mm/day	(Tmin, Tmax, I, N)
PETthorn_pereira	Potential evapotranspiration value Thorntwaite formula, with Tef of Pereira and Pruitt (2004)	mm/day	(Tmin, Tmax, I, N)
r	soil water reserve (Orieux Index)	mm	(P, PETthorn, WeekRain, KBDIstart)
OrieuxDanger	Orieux Danger classes	(r, U)	
rs	surface soil water reserve (Carrega 1988)	mm	(P, PETthorn, RainSum)
I87	I87 index (Carrega 1988)	—	(T, H, U, P, r, rs, PC)
RN	Numerical risk index	—	(T, Tdew, U, Cc, r)
M68	M68 index value	—	(pM68, P, BirchLeaves, RobiniaBlossom, M68VegCorrStep3Start, M68VegCorrStep3End)
pM68	pM68 index value	—	(T13, VPD13, P13, SnowCover, FireSeasonstart, FireSeasonEnd)
M68dwd	M68 index value (DWD modification)	—	(pM68dwd, P, BirchLeaves, RobiniaBlossom, M68VegCorrStep3Start, M68VegCorrStep3End)
pM68dwd	pM68 index value (DWD modification)	—	(T13, H13, P13, SnowCover, FireSeasonstart, FireSeasonEnd)
FFDI	MacArthur5 index value	—	(DFgriffithAdj, T15, H15, U15)
DFnoble	Drought factor (Noble 1980)	—	(lastRainSum, DaysSinceRain, KBDISI)
DFgriffith	Drought factor (Griffith 1999)	—	(lastRainSum_2_20, AgeRainEvent_2_20, KBDISI)
DFgriffithAdj	Drought factor (Finkele et al.2006)	—	(lastRainSum_2_20, AgeRainEvent_2_20, KBDISI)
FWI	Fire weather index	—	(BUI, ISI)
ISI	Initial spread index	—	(FFMC, U12)
BUI	Buildup index	—	(DMC, DC)
FFMC	Fine fuel moisture code	—	(T12, H12, U12, P12, SnowCover, FFMCstart)
DMC	Duff moisture code	—	(T12, H12, P12, SnowCover, DMCstart)
DC	Drought code	—	(T12, P12, SnowCover, DCstart)

MC1	1-hour timelag fuel moisture	%	(EMCfa)
MC10	10-hour timelag fuel moisture	%	(EMCfa)
MC100	100-hour timelag fuel moisture	%	(EMC24, PDur)
MC1000	1000-hour timelag fuel moisture	%	(EMC24, PDur)
Ifa	Ifa index (Portuguese Index)	—	(T12, Tdew12, P, U12, FireSeasonstart, FireSeasonEnd)

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