Using WEPS with Measured Data

Introduction

The Wind Erosion Prediction System (WEPS) is designed to simulate soil loss by wind from cultivated fields by simulating weather and field conditions (Wagner, 1997). However, in some situations, WEPS may be run using measured or simulated data from other models. This is typically done to validate various components or submodels of WEPS, particularly the erosion portion of the model. For example, a user may have measured soil loss data and limited weather and soil data. This user can input the measured weather and soil data to compare the model soil loss with the measured loss. This section will explore the use of WEPS with measured or other simulated data.

WEPS is a process-based, continuous, daily time-step model that simulates weather, field conditions, and erosion by wind. It has the capability of simulating spatial and temporal variability of a field's soil, crop, and residue conditions and soil loss/deposition within a field. The saltation/creep, suspension, and PM10 components of eroding material are also reported separately by direction. The WEPS model is modular in design with submodels that simulate weather, soil conditions, crop growth, residue decomposition, management operations, and soil loss by wind. It is designed to be used by the USDA-NRCS, under a wide range of conditions throughout the U.S. However, with proper inputs, WEPS is easily adapted to other parts of the world.

In typical applications, input files are created within the user interface which supplies these files to the science portion of the model to calculate field conditions and erosion. WEPS requires the following input files for a simulation run; a 'Run file', Windgen file', 'Cligen file', 'Soil file', and a 'Management file'. These files can be modified with measured or other data and run with WEPS under certain constraints. All input files except the Management file, may be easily altered using a standard text editor or the WEPS user interface to reflect measured data. All input files must be formatted to meet the requirements for WEPS. A description of these input files and considerations for their creation with measured data are given below.

It is important to note that the purpose of the WEPS model is to simulate changes in field conditions as a result of management and weather to estimate wind erosion. To simulate these changes in field conditions, WEPS is intended for simulations of multiple day periods of time. If one desires to simulate only a single storm, field conditions are essentially static and the full WEPS model is not necessary. To simulate single erosion events of one day or less, the standalone erosion submodel is recommended. The use of the standalone submodel is also described below.

1.2 APPENDIX 4: USING WEPS WITH MEASURED DATA WEPS

WEPS can be run from either the interface or the command line. Typically, users will run the model through the interface where modified input files can be selected. See the individual input file descriptions below for information on how to select modified files within the interface. Some input files are best modified within the interface (e.g., soil and management files) while others require some sort of separate editing or creation with a separate program (e.g., weather files). Files that are modified by the user but input via the interface must be placed in the appropriate project directory (i.e., folder). Those wishing to run WEPS via the command are advised to see the section titled "Report Flags and Command Line Options" in the WEPS User Manual.

Output files obtained from WEPS are described elsewhere in the WEPS User Manual. For assistance using measured data with WEPS, please go to {http://www.weru.ksu.edu/weps}.

Run File

The default file name of the WEPS run file is 'weps.run'. This file contains general information for a simulation run including the dates of the simulation, the field and barrier dimensions, the field location, and the path and names of the other input files (described below). The 'run file' parameters can be modified to match the parameters for the field simulated. The list of the other input files should specify the path and name of measured data to be used. This file contains comments (indicated by a '#' in column one) which describes each line of input data to aid in checking and modifying input data.

Below is a description of the items required in the Run File of WEPS. An example Run File is shown in Figure 1.1. Note that lines beginning with '#' character are comment lines. Lines beginning with '# RFD' are comments used by the interface. Some of the parameters are critical to the science model (SC), some are critical to the operation of the interface (IC), some are critical to both (SC+IC), while others are not critical to either (NC). An example of non-critical parameters would include the User Name which does not affect the operation of WEPS and is used for informational purposes only. In all cases however, some sort of 'placeholder' is required, even for non-critical parameters. In other words, blank lines are not allowed and each expected line should be present and filled with some characters.

The interface is a simple way to input data into the Run file and is recommended. The information below is presented for the benefit of those users who wish to modify the input file themselves.

Run File Parameters:

--USER INFORMATION

UserName - This character variable holds the user name. (NC)

FieldNo - This character variable is a part of a field tract that is separated by permanent boundaries. (NC) Note that FieldNo, TractNo, FarmNo, RunMode, RunCycle, and RotCycle are all entered on one line with each parameter separated by the pipe "|" symbol.

TractNo - This character variable is often used by FSA and NRCS to identify a field. (NC)

FarmNo - This character variable is a farm identification number. (NC)

RunMode - This character variable specifies the type of run length as either the NRCS method (specifies a fixed number of cycles), use simulation run start and end dates on the main screen, or specify the use of management rotation cycles on the main screen. (IC)

RunCycle - This variable specifies the number of management rotation cycles to simulate in a WEPS run. (IC)

RotCycle - This character variable specifies the number of years in the rotation cycle. (IC)

SiteCounty and SiteState - This character variable specifies the county and state to be simulated. (NC)

--SITE INFORMATION

LatitudeSign - This parameter is used to specify the specify the hemisphere of the latitude. Enter a plus sign (+) for the Northern hemisphere and a minus sign (-) for the Southern hemisphere. (IC)

Latitude -The latitude of the location modeled in degrees and fraction of degrees. The CLIGEN and WINDGEN stations nearest to the center of the location county will then be determined by the interface and listed. Latitude is also used by the science model to determine day length and time of sunrise. (SC+IC)

LongitudeSign - This parameter is used to specify the specify the hemisphere of the longitude. Enter a plus sign (+) for the Eastern hemisphere and a minus sign (-) for the Western hemisphere. (IC)

Longitude -The longitude of the location modeled in degrees and fraction of degrees. The CLIGEN and WINDGEN stations nearest to the center of the location county will be determined by the interface. Longitude is used by the science model to determine day length

as well as time of sunrise. (SC+IC)

Elevation (meters) - The average elevation for the location to be modeled in the units of measure displayed on the screen (feet or meters). The science model requires elevation in meters and converts feet to meters. (SC+IC)

CliGenStationID - The name of the CLIGEN station used to generate many of the weather parameters for WEPS. (IC)

WindGenStationID - The name of WINDGEN station used to generate the wind parameters for WEPS. (IC)

--*SIMULATION PERIOD*
StartDate (day, month, year) - The "Start Date" is the date from which you want the simulation to begin. The format is the numerical value for day, month (e.g., 03 for March), and year (two or four characters), each separated by a blank space. (SC+IC)

> A typical run begins on January 1 and ends on December 31 with multiple years of simulation. However, for those using WEPS with historical data, other start and ending days and months may be entered. The correctness of output has not been tested in these situations.

EndDate (day, month, year) - The "End Date" is the date on which you want the simulation to end. The format is the numerical value for day, month (e.g., 03 for March), and year (two or four characters), each separated by a blank space. (SC+IC)

> A typical run begins on January 1 and ends on December 31 with multiple years of simulation. However, for those using WEPS with historical data, other start and ending days and months may be entered. The correctness of output has not been tested in these situations.

TimeSteps (per day) - The number of time steps per day used for the daily distribution of simulated wind speed for erosion calculations. If none is entered through the interface Configuration Screen, the number of time steps is assumed to be 24. (SC)

--*RUN FILE NAMES (INPUT)*
climate file - This character variable holds the path and CLIGEN input file name. (SC+IC)

wind file - This character variable holds the path and WINDGEN input file name. (SC+IC)

soil file - This character variable holds the path and soil input file name. (SC+IC)

management file - This character variable holds the path and management input file name. (SC+IC)

--*WEPS OUTPUT OPTIONS*
OutputFile - This character variable holds the path and general output file name. (SC+IC)

ReportForm - This variable was intended to hold six (6) flags for selecting various general report forms but is not used in the current version of WEPS. (NC)

OutputPeriod - This variable was intended to hold a flag for selecting the period of output but is not used in the current version of WEPS. (NC)

SubmodelOutput - This variable holds numerical flags to print detailed reports for various submodels. Submodel detail report flags are described elsewhere in the WEPS User Manual. (SC+IC)

DebugOutput - This variable holds numerical flags to print debug reports for various submodels. Submodel debug report flags are described elsewhere in the WEPS User Manual. (SC+IC)

--*SIMULATION REGION INFORMATION*
RegionAngle (degrees from North) - This is the angle of the field with respect to North. (SC enter angle 0-360 decrees, clockwise from North) or (IC enter angle up to +/- 45 degrees)

SimCoords1 (meters) - These two variables hold the X and Y coordinates of the origin of the simulation region. This is typically the lower left corner for the North-South oriented rectangular simulation region. (SC+IC)

SimCoords2 (meters) - These two variables hold the X and Y coordinates of the opposite corner of the simulation region (furthest from the origin). This is typically the upper right corner for the North-South oriented rectangular simulation regions. (SC+IC)

ScaleFactors - These two variables were intended to hold scale factors for displaying the simulation region in the interface but is not used in the current version of WEPS. (NC)

AcctRegNo - This variable holds the number of accounting regions in the simulation region. If more than one accounting region is present (i.e., AcctRegNo > 1), then the accounting region coordinates are repeated in succession to account for each accounting region. (SC+IC)

AcctCoords1 (meters) - These two variables hold the X and Y coordinates of the origin of the accounting region. This is typically the lower left corner for the North-South oriented

rectangular accounting region. (SC+IC)

AcctCoords2 (meters)- These two variables hold the X and Y coordinates of the opposite corner of the accounting region (furthest from the origin). This is typically the upper right corner for the North-South oriented rectangular accounting regions. (SC+IC)

SubRegNo - This variable holds the number of subregions in the simulation region. If more than one accounting region is present (i.e., SubRegNo > 1), then the subregion coordinates are repeated in succession to account for each subregion. (SC+IC)

SubCoords1 (meters) - These two variables hold the X and Y coordinates of the origin of the current subregion. This is typically the lower left corner for the North-South oriented rectangular subregion. (SC+IC)

SubCoords2 (meters) - These two variables hold the X and Y coordinates of the opposite corner of the subregion (furthest from the origin). This is typically the upper right corner for the North-South oriented rectangular subregions. (SC+IC)

AverageSlope (%) - The average slope of the subregion. This information is now obtained from the soil input file. (NC)

-- *BARRIERS*
NumberBar - This variable holds the number of barriers in the simulation region. If more than one barrier is present (i.e., NumberBar > 1), then the barrier information (i.e., barrier coordinates and parameters) are repeated in succession to account for each barrier. (SC+IC)

BarrierCoords1 (meters) - These two variables hold the X and Y coordinates of the origin of the barrier. This is typically the lower left corner of the barrier. (SC+IC)

BarrierCoords2 (meters) -These two variables hold the X and Y coordinates of the opposite corner of the barrier (furthest from the origin). This is typically the upper right corner of the barrier. (SC+IC)

BarrierType - This character variable specifies the name of the type of barrier. (NC)

BarrierHeight (meters) - This parameter is the barrier average height. (SC+IC)

BarrierWidth (meters) - This parameter is the barrier average width (not length). (SC+IC)

BarrierPorosity (%) - The barrier porosity is expressed as an optical porosity. It is the open space as viewed looking perpendicular through the barrier expressed as a percent of the total area (ie., ((1.0 - silhouette area) x 100).

Figure 1.1. Example Run file.

```
#------------ WEPS SIMULATION RUN FILE ------------
# Note: Lines beginning with '#' are comment lines.
#       Lines beginning with '#   RFD' are comments used by the interface.
#
# --USER INFORMATION
#   RFD-UserName
Dustin Fields
#   RFD-FieldNo RFD-TractNo RFD-FarmNo RFD-RunMode RFD-RunCycle RFD-RotCycle
789 | 456 | 123 | cycle | 2 | 2
#   RFD-SiteCounty and SiteState
Finney, Kansas
#
# --SITE INFORMATION
#   RFD-LatitudeSign RFD-Latitude
+38.00
#   RFD-LongitudeSign RFD-Longitude
-100.66
#   RFD-Elevation (meters)
801
#   RFD-CliGenStationID
CIMARRON
#   RFD-WindGenStationID
GARDEN CITY MUNI
#
# --SIMULATION PERIOD
#   RFD-StartDate (day_month_year)
01 01 01
#   RFD-EndDate (day_month_year)
31 12 4
#   RFD-TimeSteps (per_day)
24
#
# --RUN FILE NAMES (INPUT)
#   RFD-climate file
cli_gen.cli
#   RFD-wind file
win_gen.win
#   RFD-sub-daily file
none
#   RFD-SoilFile
Otero_101OF_100_FSL.ifc
#   RFD-ManageFile
KS_wheat_fallow.man
#
# --WEPS OUTPUT OPTIONS
#   RFD-OutputFile
output.tmp
#   RFD-ReportForm
0 0 0 0 0 0
#   RFD-OutputPeriod
2
#   RFD-SubmodelOutput
0 0 0 0 0 0
#   RFD-DebugOutput
0 0 0 0 0
#
# --SIMULATION REGION INFORMATION
#   RFD-RegionAngle (deg_clockwise_north)
21
```

```
#   RFD-SimCoords1 (meters)
0.0  0.0
#   RFD-SimCoords2 (meters)
1500.2  1500
#   RFD-ScaleFactors (place holder - needed for older versions of WEPS)
5.5 5.5
#
#   RFD-AcctRegNo
1
#   RFD-AcctCoords1 (meters)
    0.0  0.0
#   RFD-AcctCoords2 (meters)
1500.2  1500
#
#   RFD-SubregionNo
1
#   RFD-SubCoords1 (meters)
0.0  0.0
#   RFD-SubCoords2 (meters)
1500.2  1500
#   RFD-AverageSlope (%)
0.50
#  --BARRIERS
#   RFD-NumberBar
2
#   RFD-BarrierCoord1 (meters)
-1 0
#   RFD-BarrierCoords2 (meters)
0 1500
#   RFD-BarrierType
Snow fence
#   RFD-BarrierHeight (meters)
1.2
#   RFD-BarrierWidth (meters)
1
#   RFD-BarrierPorosity (%)
0.6
#   RFD-BarrierCoord (meters)
0 -2
1500.2 0
#   RFD-BarrierType
Sorghum(2 row)
#   RFD-BarrierHeight (meters)
2
#   RFD-BarrierWidth (meters)
2
#   RFD-BarrierPorosity (%)
0.5
#
#---------- END OF SIMULATION RUN FILE ------------
```

Weather Files

WEPS runs are made for multiple years in full year increments beginning on January 1. If only a partial year of weather data is available (typical), the user has two options. One is to substitute measured data within the simulated weather file and observe the output for the period with measured data. The other option is to use the stand alone Erosion model (described below) for single day simulations. Two weather files are required by the full WEPS model, a Windgen file and a Cligen file.

If alternative weather files are input through the interface they can be selected by first checking the appropriate wind or climate box on the "Run" tab of the "Configuration" window. Then enter the file name and path or choose the file by clicking the folder icon on the "Location Information"panel of the main screen..

Windgen File

The default Windgen file extension is "win" (e.g., windgen.win). This file contains both the wind speed (m s^{-1}) on a subdaily time step and one wind direction (degrees clockwise from North) for each day of the simulation. The subdaily wind speeds are by default the average hourly speeds (i.e., 24, 1 hourly averages) but can be of other time steps of equal length (e.g., 96, 15 minute averages or 8, 3 hour averages) if specified in the weps.run file. WEPS ignores the file header information which is in the first seven rows. Below is a description of the lines and columns required by WEPS as well as an example Windgen file (Figure 1.2).

Windgen File Parameters:

Lines 1 - 7:	Comment lines. These do not need to be filled out but WEPS does need to have these seven lined present with a '#' in column one.
Line 8 +:	daily weather data
Columns 1, 2, 3:	**day mo year** - the day, month, and year of simulation (integer).
Column 3:	**dir** - wind direction for the day. WEPS assumes that the direction is constant for the day (real- degrees clockwise with North = 0.0).
Columns 4 - end:	**hr1 hr2 . . .** - average hourly wind speeds, distributed throughout the entire day. These represent by default, twenty-four hourly average wind speeds (real-meters/second). If other time steps are used they should be of equal length and the number of these periods specified in the weps.run file.

Figure 1.2. Example WINDGEN file.

```
#    WIND_GEN3  $Revision: 1.12 $ Hourly values per day output
# station: 13985 DODGE_CITY, KS  USA
# lat:  37deg  46min N  lon:  99deg  58min W
# period: 19610421-19781231  el: 796m
# day mo year dir   hr1   hr2   hr3   hr4   hr5   hr6   hr7   hr8   hr9  .  .  .
#             deg   m/s   m/s   m/s   m/s   m/s   m/s   m/s   m/s   m/s  .  .  .
#
--------------------------------------------------------------------------------
  1  1    1   0.0   3.7   4.7   6.1   6.4   6.9   7.7   8.3   9.3  14.4  .  .  .
  2  1    1 180.0   3.5   4.7   5.5   5.8   6.4   6.9   7.5   7.9   8.5  .  .  .
  3  1    1   0.0   3.7   4.7   6.1   6.4   6.8   7.7   8.1   9.3  12.1  .  .  .
  4  1    1 157.5   2.9   3.5   4.1   4.3   4.6   5.0   5.4   5.6   7.4  .  .  .
  5  1    1 135.0   2.3   2.9   3.5   3.8   4.5   4.8   5.4   6.0   8.2  .  .  .
  6  1    1  22.5   3.5   4.6   5.2   5.8   6.6   7.2   7.9   8.8  11.0  .  .  .
  7  1    1 180.0   3.8   4.9   5.6   5.8   6.5   7.1   7.7   8.0   9.4  .  .  .
  8  1    1 202.5   4.0   4.8   5.2   5.7   5.9   6.2   6.7   7.2   8.1  .  .  .
  9  1    1  22.5   3.5   4.6   5.1   5.8   6.4   7.1   7.7   8.8  10.3  .  .  .
 10  1    1 135.0   2.1   2.8   3.4   3.8   4.4   4.7   5.3   5.8   6.7  .  .  .
 11  1    1 202.5   4.2   5.0   5.3   5.7   5.9   6.4   6.9   7.4   9.5  .  .  .
 12  1    1 337.5   3.1   3.6   4.4   4.9   5.5   6.5   7.1   8.0   9.0  .  .  .
 13  1    1 270.0   3.0   3.3   3.8   4.2   4.6   4.8   5.0   5.5   6.3  .  .  .
 14  1    1   0.0   3.6   4.4   5.7   6.3   6.6   7.2   7.9   9.0  10.1  .  .  .
 15  1    1   0.0   3.7   4.5   6.1   6.3   6.7   7.7   8.0   9.1  11.3  .  .  .
 16  1    1 157.5   2.5   3.4   3.9   4.3   4.5   4.9   5.2   5.6   6.1  .  .  .
 17  1    1 292.5   3.4   4.0   4.3   4.6   5.2   5.4   5.8   6.2   7.2  .  .  .
 18  1    1  22.5   3.3   4.5   5.0   5.6   6.2   7.0   7.7   8.5   9.0  .  .  .
 19  1    1 157.5   3.0   3.6   4.1   4.4   4.7   5.1   5.4   5.7   8.2  .  .  .
 20  1    1 180.0   3.8   4.8   5.6   5.8   6.4   7.0   7.7   8.0   8.9  .  .  .
 21  1    1   0.0   3.7   4.4   6.0   6.3   6.7   7.5   8.0   9.1  10.5  .  .  .
 22  1    1  22.5   3.5   4.7   5.2   5.8   6.6   7.3   8.0   8.9  11.7  .  .  .
 23  1    1 270.0   3.1   3.4   3.9   4.2   4.6   4.8   5.0   5.5   6.5  .  .  .
 24  1    1 135.0   2.0   2.8   3.4   3.7   4.2   4.7   5.3   5.8   6.5  .  .  .
 25  1    1 157.5   2.7   3.5   4.0   4.3   4.5   5.0   5.2   5.6   6.9  .  .  .
 26  1    1  22.5   3.4   4.6   5.1   5.7   6.2   7.1   7.7   8.6   9.7  .  .  .
 27  1    1 180.0   3.8   4.9   5.6   6.0   6.6   7.1   7.7   8.0  10.0  .  .  .
 28  1    1 315.0   2.8   3.5   4.1   4.5   4.9   5.5   6.1   6.4   7.1  .  .  .
 29  1    1 202.5   4.0   4.9   5.2   5.7   5.9   6.2   6.7   7.2   8.4  .  .  .
 30  1    1 247.5   2.6   3.1   3.6   4.2   4.5   4.9   5.2   5.6   6.7  .  .  .
 31  1    1   0.0   3.7   4.4   5.9   6.5   7.4   8.2   9.2  10.1  12.2  .  .  .
  .  .    .    .     .     .     .     .     .     .     .     .     .  .  .  .
  .  .    .    .     .     .     .     .     .     .     .     .     .  .  .  .
  .  .    .    .     .     .     .     .     .     .     .     .     .  .  .  .
```

Cligen File

The default Cligen file extension is "cli" (e.g., cligen.cli). The Cligen weather generator was developed for use with the Water Erosion Prediction Project (WEPP) (Flanagan, et.al., 2001) and is used by WEPS to simulate other weather parameters. The input file created by Cligen includes precipitation amount (mm), duration (hr), time to peak (fraction of duration), and peak intensity (mm hr^{-1}) as well as maximum and minimum air temperature (°C), solar radiation (ly d^{-1}), and dew point temperature (°C). This file also contains historical monthly averages for maximum and minimum temperature (°C) which are required by WEPS.

Although WEPS ignores non-needed data in the Cligen file, WEPS reads the entire file so each line and column in WEPS must be populated even though some elements may be 'dummy' variables not used by WEPS. For example, line 2 contains information not used by WEPS but must be present with any characters present. The Cligen file is read in free format. Below is a description of the lines and columns WEPS requires as well as an example Cligen file (Figure 1.3).

Cligen File Parmeters:

Line 1: Cligen version number. Must be "5.110" for the file format described in this document.

Lines 2-6: Information in these lines are not required by WEPS but must be present as place holders.

Line 7: Observed monthly ave maximum temperatures (°C).

Line 8 Comment line.

Line 9: Observed monthly ave minimum temperatures ©).

Lines 10-15: Comment lines.

Line 16 +: daily weather data.

Columns 1, 2, 3: **day mon year** - the day, month, and year of simulation (integer).

Column 4: **prcp** - total precipitation for the day including snow, hail and rain (real- milimeters).

Column 5: **dur** - duration f the rainfall event (real- hours).

Column 6: **tp** - fraction of time to peak (real- time to peak in hours/duration in hours).

Column 7: **ip** - WEPP data, ignored in WEPS but must have some numbers present (e.g., 0.0)(real).

Columns 8, 9: **tmax tmin** - the maximum and minimum daily air temperature (real - C).

Column 10: **rad** - daily solar radiation (real - ly/day).

Columns 11-12: WEPP wind data, ignored in WEPS but numbers must be present (e.g., 0.0) (real).

Column 13: **dew** - dew point temperature (real - C).

Figure 1.3. Example Cligen File.

```
5.110
  1   0   0
  Station:  CIMARRON KS                                  CLIGEN VERSION 5.110 -r:    0 -I: 0
Latitude Longitude Elevation(m) Obs. Years  Beginning year  Years simulated Command Line:
   37.80  -100.35      801         54           1             6        -S14 -s1522 -idb\cligen_fs.db -b1
Observed monthly ave max temperature ©)
  6.9  10.1  14.5  20.8  25.3  31.1  34.2  33.2  28.8  22.8  13.8   8.3
Observed monthly ave min temperature ©)
 -8.1  -5.8  -2.1   4.1   9.8  15.3  18.0  17.0  12.2   5.3  -2.4  -6.7
Observed monthly ave solar radiation (Langleys/day)
253.0 317.0 420.0 525.0 564.0 643.0 635.0 578.0 491.0 374.0 307.0 234.0
Observed monthly ave precipitation (mm)
 14.3  17.0  33.6  48.3  90.9  89.8  87.2  68.4  45.1  37.0  21.5  13.4
da mo year  prcp  dur   tp     ip  tmax  tmin  rad  w-vl w-dir  tdew
            (mm)  (h)              ©)   ©) (l/d) (m/s)(Deg)   ©)
 1  1    1   0.0  0.00 0.00   0.00   3.9  -2.6 250.  5.5   75.  -0.4
 2  1    1   0.0  0.00 0.00   0.00  -2.5  -5.5 143.  6.0  297.  -6.8
 3  1    1   0.0  0.00 0.00   0.00   0.3  -4.0 219.  8.2  238. -16.9
 4  1    1   0.0  0.00 0.00   0.00  17.8 -10.2 253.  4.0  227. -16.5
 5  1    1   0.0  0.00 0.00   0.00   6.3 -12.3 254.  5.9  314.  -4.9
 6  1    1   0.0  0.00 0.00   0.00  15.3  -3.6 148.  8.3  238.  -4.0
 7  1    1   0.0  0.00 0.00   0.00   0.5 -10.2 257.  7.0   23.  -9.4
 8  1    1   0.4  1.66 0.01   1.01  13.9 -14.2 258.  7.9  355.  -8.5
 9  1    1   0.0  0.00 0.00   0.00   7.1  -5.6 230.  2.6  328.  -6.5
10  1    1   0.0  0.00 0.00   0.00  10.1  -6.2 283.  8.6   49.  -4.8
11  1    1   0.0  0.00 0.00   0.00  10.0  -9.0 263.  0.0    7. -20.9
12  1    1   0.0  0.00 0.00   0.00   2.8 -12.2 231.  6.9  222.  -4.8
13  1    1   0.0  0.00 0.00   0.00  -0.3 -14.1 267.  1.2  317.  -7.3
14  1    1   0.0  0.00 0.00   0.00  -4.0  -6.7 173.  3.4  313. -12.1
15  1    1   0.0  0.00 0.00   0.00  -1.7 -14.8 270.  2.7  132. -18.0
16  1    1   2.3  1.29 0.04   1.01   0.6  -4.9 262.  9.9   15. -13.7
17  1    1   0.0  0.00 0.00   0.00   6.0  -5.0 241.  7.0  338. -12.3
18  1    1   0.0  0.00 0.00   0.00   7.8  -9.1 203.  4.2  262. -13.5
19  1    1   0.0  0.00 0.00   0.00  12.3 -10.5 181.  3.7  275.  -8.1
20  1    1   0.0  0.00 0.00   0.00  -8.9 -10.5 266.  6.0    6. -17.9
21  1    1   0.0  0.00 0.00   0.00  14.7  -9.8 283.  5.7  264.  -3.7
22  1    1   0.0  0.00 0.00   0.00   3.9  -8.0 132.  3.5  233.  -8.2
23  1    1   0.0  0.00 0.00   0.00  11.2 -10.0 196.  4.9  150.  -6.5
24  1    1   0.0  0.00 0.00   0.00   2.3 -15.9 230.  4.6  136. -19.5
25  1    1   0.0  0.00 0.00   0.00  12.6 -13.7 172.  6.2  312.  -0.7
26  1    1   0.0  0.00 0.00   0.00  14.4  -6.0 272.  7.5  156.   4.0
27  1    1   0.0  0.00 0.00   0.00   2.6   0.9 213.  5.7  176.  -5.1
28  1    1   4.2  1.19 0.00   1.01  15.2 -15.3 173.  7.7  170. -14.8
29  1    1  10.6  1.73 0.05   1.01  24.8  -3.5 302.  4.8  206.  -7.3
30  1    1   3.5  1.92 0.29   4.81   8.3  -5.9 280.  2.7  277. -14.0
31  1    1   0.0  0.00 0.00   0.00  20.9   2.3 228.  2.9  240.   1.3
 1  2    1   0.0  0.00 0.00   0.00   7.5  -4.9 241.  7.3  316.  -5.8
 2  2    1   0.0  0.00 0.00   0.00   7.6  -4.6 316.  2.2  169. -10.1
 3  2    1   0.0  0.00 0.00   0.00   3.6 -12.8 326.  4.3  322.  -4.7
 4  2    1   0.0  0.00 0.00   0.00  13.0   1.1 307.  5.1  146. -18.0
 .  .    .    .    .    .      .      .     .     .    .      .    .
 .  .    .    .    .    .      .      .     .     .    .      .    .
```

Soil File

The default soil file name has an "ifc" extension (e.g., amarillo.ifc). This file contains the initial soil conditions at the start of a simulation run. The soil and management submodels then simulate the changes in these conditions as affected by weather, management, and erosion for each simulation day. Even intrinsic parameters such as particle size distribution will change with tillage as layers are mixed. If simulated soil parameters vary significantly from measured values, it is recommended that the user use the stand alone Erosion model (described below). The soil input file includes the taxonomic order, number and thickness (mm) of soil layers, detailed particle size distribution (fraction), wet and dry bulk density ($Mg\ m^{-3}$), aggregate stability ($ln(J\ m^{-2})$), density ($Mg\ m^{-3}$), and size distribution (fraction), soil crust properties (varies), random and oriented (ridge) roughness (mm), soil water characterization parameters (varies), dry albedo (fraction), organic matter (fraction), pH, calcium carbonate (fraction), and cation exchange capacity (meq $100g^{-1}$). This file also contains comments (indicated by a '#' in column one) which describes each line of input data to aid in checking and modifying input data. Below is a description of the items required by WEPS which can be viewed and edited within soil panel of the WEPS interface. The absolute range is that allowable by WEPS. The typical range lists the range of values to be expected with typical soils. An example Soil file is shown in Figure 1.4.

The soil interface is a simple way to edit input data in the Soil file and is recommended. It is also recommended that the user select an existing soil file from the database with similar properties to the desired soil and modify its properties. Existing soil database files are accessed through the "Template" icon and the soil interface is accessed by clicking the "Soil" button at the bottom of the main screen. The information below is presented for the benefit of those users who wish to modify the input file themselves.

Soil File Parameters:

Soil Identification

State - The state in which the soil occurs (character). The state is not critical to the operation of WEPS and is used for identification purposes only.

County - The county in which the soil occurs (character). The county is not critical to the operation of WEPS and is used for identification purposes only.

Soil Survey Area Name - The soil survey area name in which the soil occurs (character). The soil survey area name is not critical to the operation of WEPS and is used for identification purposes only.

Soil Survey Area ID - The soil survey area identification for the soil (character). The soil survey area identification is not critical to the operation of WEPS and is used for

identification purposes only.

Map Unit Symbol - The symbol used to uniquely identify the soil map unit in the soil survey (character). The map unit symbol is not critical to the operation of WEPS and is used for identification purposes only.

Component Name - The name of the soil (character). The soil component name is not critical to the operation of WEPS and is used for identification purposes only.

Component Percent - The percentage of the soil component of the map unit (integer). The soil component percent is not critical to the operation of WEPS and is used for identification purposes only.

Absolute range = >0 to 100 Typical range = >0 to 100

***Local Phase - Phase criterion to be used at the local level to help identify soil components (character). The local phase is not critical to the operation of WEPS and is used for identification purposes only.

Soil Order - The taxonomic soil order is the name for the highest level in soil taxonomy (character). The taxonomic soil order is not critical to the operation of WEPS and is used for identification purposes only.

***Soil Loss Tolerance (T factor) - The maximum amount of erosion at which the quality of a soil as a medium for plant growth can be maintained. (Tons/acre/year) The soil loss tolerance is not critical to the operation of WEPS and is used for identification purposes only.

Absolute range = 1 - 5 Typical range= 1 - 5

***Slope Gradient - The difference in elevation between two points, expressed as a percent of the distance between those points (%).

Absolute range = 0 - 100.0 Typical range= 0 - 30.0

Number of Layers - The number of soil layers used in the subregion. (integer)

Absolute range = 1 to100 Typical range = 1 to 5

Soil Surface Properties

Soil Crust

Soil Crust Thickness - Average thickness of the consolidated zone in the surface layer (mm).

Absolute range = (>0.01) to 23.0 Typical range = 0.0 to 10.0

Estimated by: 0.01

Soil Crust Density - The density of the soil crust (Mg/m^3).

Absolute range = 0.6 to 2.0 Typical range = 0.8 to 1.6
Estimated by: aggregate density

Soil Crust Stability - Mean of natural log of crust crushing energies (ln(J/kg))
Absolute range = 0.1 to 7.0 Typical range = 0.3 to 5.0
Estimated by: aggregate stability

Soil Crust Fraction - Fraction of surface covered with consolidated soil as opposed to aggregated soil (m^2/m^2).
Absolute range = 0.0 to 1.0 Typical range = 0.0 to 1.0
Estimated by: 0.0

Loose Material on Crust

Loose Material on Crust: Mass - Loose, saltation-size soil on the surface soil crusted area (kg/m^2).
Absolute range = 0.0 to 2.0 Typical range = 0.0 to 1.0
Estimated by: 0.0

Loose Material on Crust: Fraction - Fraction of total soil surface area covered with loose material on the crust (m^2/m^2).
Absolute range = 0.0 to soil crust fraction. Typical range = 0.0 to 0.5
Estimated by: 0.0

Roughness

Random Roughness - The standard deviation of heights of a random soil surface including any flat biomass adjusted as suggested by Allmaras (1966) (mm).
Absolute range = 1.0 to 30.0 Typical range = 2.0 to 10.0
Estimated by: 4.0

Ridge Orientation - Direction of the tillage ridge, clockwise from true north (degrees).
Absolute range = 0.0 to 179.0 Typical range = 0.0 to 179.0
Estimated by: 0.0

Ridge Height - The height of soil ridges from bottom of furrow to top of ridge (mm).
Absolute range = 0.0 to 500. Typical range = 0.0 to 300.0
Estimated by: 0.0

Roughness Spacing - Spacing between ridge tops (mm).
Absolute range = 10.0 to 2000.0 Typical range = 60.0 to 1000.0
Estimated by: 0.0

Ridge Width - Width of the top of the ridge (i.e. bed width) (mm)

Absolute range = 10.0 to 4000.0 Typical range = 100.0 to 2000.0
Estimated by: 0.0

Soil Albedo Dry - The estimated ratio of the incident short-wave (solar) radiation that is reflected by the air dry, less than 2 mm fraction of the soil surface (unitless).
Absolute range = 0.00 to 1.00 Typical range = 0.05 to 0.25
Estimated by: method of Post et.al. (2000) or method of Baumer (1990).

***Surface Fragment Cover - The fraction of the surface area covered by rock greater than 2.0 mm (m3/m3).
Absolute range = 0.0 to 1.0 Typical range = 0.0 - 0.5
Estimated by: Surface layer volume

Soil Layer Properties

Layer Number - The layer number.
Absolute range = 1 to 50 Typical range = 5 to 20
Estimated by: user defined

Thickness - The thickness of each soil layer (mm). WEPS requires a specific layer structure which is determined by the soil interface.
Estimated by: user defined

Sand - Mineral particles 0.05 to 2.0 mm in equivalent diameter as a weight fraction of the less than 2.0 mm fraction (kg/kg).
Absolute range = (>0.0) to 1.0 Typical range = [1.0 - (silt + clay)]
Estimated by: sand = 1.0 - (silt + clay)

Silt - Mineral particles 0.002 to 0.05 mm in equivalent diameter as a weight fraction of the less than 2.0 mm fraction (kg/kg).
Absolute range = (>0.0) to 1.0 Typical range = [1.0 - (sand + clay)]
Estimated by: silt = 1.0 - (sand + clay)

Clay - Mineral particles less than 0.002 mm in equivalent diameter as a weight fraction of the less than 2.0 mm fraction (kg/kg).
Absolute range = (>0.0) to 1.0 Typical range = [1.0 - (sand + silt)]
Estimated by: clay = 1.0 - (silt + sand)

Rock Fragments - The volume fraction of rock greater than 2.0 mm (m3/m3).
Absolute range = 0.0 to 1.0 Typical range = 0.0 - 0.5
Estimated by: user defined

Sand Fractions

Sand Fractions: Coarse - Mineral particles 0.5 to 1.0 mm in equivalent diameter as a weight fraction of the less than 2 mm fraction (kg/kg).

Absolute range = 0.0 to 1.0 Typical range = 0.0 to 1.0
Estimated by: user defined

Sand Fractions: Medium - Mineral particles 0.2 to 0.5 mm in equivalent diameter as a weight fraction of the less than 2 mm fraction (kg/kg).

Absolute range = 0.0 to 1.0 Typical range = 0.0 to 1.0
Estimated by: user defined

Sand Fractions: Fine - Mineral particles 0.1 to 0.2 mm in equivalent diameter as a weight fraction of the less than 2 mm fraction (kg/kg).

Absolute range = 0.0 to 1.0 Typical range = 0.0 to 1.0
Estimated by: user defined

Sand Fractions: Very Fine - Mineral particles 0.05 to 0.1 mm in equivalent diameter as a weight fraction of the less than 2 mm fraction (kg/kg).

Absolute range = 0.0 to 1.0 Typical range = 0.0 to 1.0
Estimated by: user defined

Bulk Density

Bulk Density Dry - The oven dry weight of the less than 2 mm soil material per unit volume of soil exclusive of desication cracks, measured on a coated clod (Mg/m^3).

Absolute range = (>0.0) to 10.0 Typical range = 0.8 to 1.6
Estimated by: user defined

Bulk Density 1/3 Bar - The oven dry weight of the less than 2 mm soil material per unit volume of soil at a tension of 1/3 bar (Mg/m^3).

Absolute range = (>0.0) to 10.0 Typical range = 0.8 to 1.6
Estimated by: user defined

***Linear Extensibility Percent - The linear expression of the volume difference of natural soil fabric at 1/3 or 1/10 bar water content and oven dryness. (m^3/m^3)

Absolute range = 0.0 to 0.3 Typical range = ?
Estimated by: NRCS (1996)

Aggregate

Aggregate GMD - Soil aggregate geometric mean diameter of the modified log-normal distribution (mm).

Absolute range = 0.03 to 30.0 Typical range = 0.1 to 15.0

Aggregate GSD - Soil aggregate geometric standard deviation of the modified log-normal

distribution (dimensionless).
Absolute range = 1.0 to 20.0 Typical range = 4.0 to 15.0

Aggregate Max. Size - Upper limit of the modified log-normal aggregate size distribution (mm).
Absolute range = 1.0 to 1000.0 Typical range = 2.0 to 100.0

Aggregate Min. Size - Lower limit of the modified log-normal aggregate size distribution (mm).
Absolute range = 0.001 to 5.0 Typical range = 0.006 to 0.020

Aggregate Density - The aggregate density for (Mg/m^3).
Absolute range = 0.6 to 2.5 Typical range = 0.8 to 2.0

Aggregate Stability - Mean of natural log of aggregate crushing energies (ln(J/kg))
Absolute range = 0.1 to 7.0 Typical range = 0.5 to 5.0

Water Content

Water Content: Initial - Soil water content at the beginning of the simulation (cm^3/cm^3).
Absolute range = 0.005 to 0.440 Typical range = varies with soil texture

Water Content: Saturation - Soil water content when soil pores are completely filled (i.e. zero soil matric potential) (cm^3/cm^3).
Absolute range = 0.208 to 0.440 Typical range = varies with soil texture
Note: Saturated water content > Field capacity water content > Wilting point water content

Water Content: Field Capacity (1/3 bar) - The amount of soil water retained at 1/3 bar (33 kPa), expressed as a fraction of the less than 2 mm, oven dry soil by volume (cm^3/cm^3).
Absolute range = 0.012 to 0.335 Typical range = varies with soil texture
Note: Saturated water content > Field capacity water content > Wilting point water content

Water Content: Wilting Point (15 bar) - The amount of soil water retained at 15 bars (1500 kPa), expressed as a percentage of the less than 2 mm, oven-dry soil by volume (cm^3/cm^3).
Absolute range = 0.005 to 0.242 Typical range = varies with soil texture
Note: Saturated water content > Field capacity water content > Wilting point water content

????Water Content: 1/10 bar - The amount of soil water retained at 1/10 bar (10 kPa), expressed as a fraction of the less than 2 mm, oven dry soil by volume (cm^3/cm^3).

????CB - The power of Campbell's model of the soil water characteristics curve (unitless).
Absolute range = 0.917 to 27.027 Typical range = varies with soil texture

Air Entry Pot. - The air entry potential is defined as the potential at which the largest water-filled pores start to drain and hence gas flow can be observed (Joules/kg).
Absolute range = -17.91 to 0.0 Typical range = varies with soil texture

Sat. Hydraulic Conductivity - The amount of water that would move vertically through a unit area of saturated soil in a unit time under unit hydraulic gradient (m/s).
Absolute range = 0.0 to 1E-3 Typical range = 0.0 to 1E-3

Other Layer Properties
Organic Matter - The amount by weight of decomposed plant and animal residue expressed as a weight fraction of the less than 2 mm soil material (kg/kg).
Absolute range = 0.0 to 0.1 Typical range = 0.0005 to 0.05

pH - The negative logarithm to the base 10, of the hydrogen ion activity in the soil using 1:1 soil:water ratio method (unitless). A numerical expression of the relative acidity or alkalinity of a soil sample.
Absolute range = 1.0 to 14.0 Typical range = 4.0 to 9.0

CaCO3 - The quantity of carbonate (CO3) in the soil expressed as CaCO3 and as a weight percentage of the less than 2 mm size fraction (kg/kg).
Absolute range = 0.0 to 1.0 Typical range = 0.0 to 0.3

CEC - The cation exchange capacity (meq/100g).
Absolute range = 0.0 to 400.0 Typical range = 0 to ?

Figure 4 Example Soil File.

```
Soil ID KS181-KUU-Kuma-100-SIL-Kansas-Sherman County-Sherman County, Kansas
# Taxorder
Mollisols
# number of soil layers
3
# Layer thickness (mm)
130    610    780
# Sand fraction
0.113    0.073    0.114
# Silt fraction
0.677    0.662    0.686
# Clay fraction
0.210    0.265    0.200
# Rock fragments
```

0.020 0.020 0.040
Sand fraction coarse
0.000 0.000 0.000
Sand fraction medium
0.009 0.007 0.009
Sand fraction fine
0.033 0.022 0.034
Sand fraction very fine
0.066 0.038 0.066
Water dispersible clay
0.000 0.000 0.000
Bulk Density (dry)
1.310 1.490 1.520
Bulk Density (1/3 bar)
1.250 1.300 1.450
Aggregate geometric mean diameter for layer
0.030 17.562 26.157
Aggregate geometric standard deviation for layer
1.000 13.917 11.730
Maximum aggregate size for layer
1.000 53.043 62.079
Minimum aggregate size for layer
0.010 0.010 0.010
Aggregate density for layer
1.688 2.000 2.000
Aggregate stability for layer
3.077 3.319 3.018
Soil crust thickness (mm)
0.010
Soil crust density
1.688
Soil crust stability
3.08
Soil crust surface fraction
0.00
Loose material on crust (kg)
0.00
Fraction of loose material on crust
0.00
Random roughness
4.00
Ridge orientation
0.00
Ridge height
0.00
Spacing between ridge tops
0.00
Ridge width
0.00
Initial soil water content for layer
0.212 0.228 0.197
Saturation soil water content for layer
0.394 0.391 0.338
Field capacity water content for layer
0.286 0.300 0.273
Wilting point water content for layer

```
0.138     0.157     0.121
# 0.1 Bar on Sand Soil
-999.000     -999.000     -999.000
# Soil CB value for layer
4.212     4.748     4.119
# Air entry potential for layer
-4.544     -4.224     -4.686
# Saturated hydraulic conductivity for layer
9.0E-6     9.0E-6     9.0E-6
# curve number---good
0.00
# curve number---poor
0.00
# Dry soil albedo
0.230
# Organic matter for layer
0.030     0.018     0.005
# Soil PH for layer
7.30     7.50     8.50
# Calcium carbonate equivalent for layer(CaCO3)
0.50     0.03     0.08
# Cation exchange capacity for layer
12.50     15.00     11.50
# Sum of bases for layer
0.00     0.00     0.00
# Electrical Conductivity
0.00     0.00     0.00
# Sodium Adsorption Ratio
0.00     0.00     0.00
# Available nitrogen for layer
0.00     0.00     0.00
# Available phosphorus for layer
0.00     0.00     0.00
```

Management File

The default file name is '*.man'. This file contains parameters for the manipulation of soil and biomass properties as a result of various management operations performed on the field on a given date. These operations include planting, harvesting, cultivation, defoliation, fertilization, and irrigation. The management file should only be altered using the Management Crop Rotation Editor for WEPS (MCREW) to guarantee that parameters are correct. MCREW is accessed through the WEPS user interface.

Stand Alone Erosion Submodel

The Erosion submodel (tsterode) can also be operated as a stand alone model to simulate erosion for a single storm (i.e., daily). Input parameters which must be provided for the day include the field and barrier dimensions as well as biomass, soil, hydrology, and weather parameters. Wind speed can be entered either as Weibull distribution parameters or listed as average wind speeds for each time period throughout the day. The input file contains

comments (indicated by a '#' in column one) which describes each line of input data to aid in checking and modifying input data. Specific definitions of these parameters are documented within the input file (Fig. 1.5).

Command Line Options

Usage: tsterode -i"input_filename" <"input_filename" >"output_filename" -x# -y# -t# -u -E -Plot -?

Valid command line options:

-? or -h — Display the available command line options.

-x# — Number of grid points in x direction (min. = 3; max. = 500). The submodel calculates the loss/deposition over a series of individual, equal sized grid cells representing the entire simulation region. The more grid points, the smaller the area in each grid cell. The recommended total number of grid cells is 30 for a field without a barrier and 60 for a field with a barrier. Increasing the number of grid cells, increases the accuracy of the soil loss/deposition estimates as well as increases the run time. If not specified, th number of grid points is calculated within the model.

-y# — Number of grid points in x direction (min. = 3; max. = 500). The submodel calculates the loss/deposition over a series of individual, equal sized grid cells representing the entire simulation region. The more grid points, the smaller the area in each grid cell. The recommended total number of grid cells is 30 for a field without a barrier and 60 for a field with a barrier. Increasing the number of grid cells, increases the accuracy of the soil loss/deposition estimates as well as increases the run time. If not specified, th number of grid points is calculated within the model.

-t# — Interval for surface updating in seconds (min. = 60 seconds; max. = 86400 seconds). This is used to specify a fixed surface updating interval and is primarily for testing and evaluation purposes. Since the erosion code contains an update loop dependent upon the number of time intervals/day and an inner loop that allows more frequent surface updating to occur, the imp interval must be evenly divisible into both

	the number of time intervals/day and 24 (hours in a day). If these conditions are not met the program aborts with an error message.
-u	Disable erosion surface updating.
-i"input_filename"	Specify input filename (must use prior to -E option).
<"input_filename"	Specify input filename.
>"output_filename"	Specify output filename (default is to print to screen).
-E	Erosion summary (kg/m^2) (positive values are soil loss). The output in the file contains the following: Total salt/creep susp PM10 input_filename The "-E' option requires that the input file (-i"input_filename") be specified as a commandline argument prior to the "-E" option, e.g.: tsterode -i input_filename.ext -E The "input_filename" in the erosion summary is the same name as the input_filename with a ".ero" extension and will be created in the same directory specified for the input_filename.
-Plot	Enable printing of file which can be used to plot various data.

Default options are set to:
-t900

Note that these command line options cannot be specified when the erosion submodel is run through the WEPS interface.

Figure 1.6 is an example standalone erosion submodel output file. It contains a listing of the inputs to the submodel followed by the generated results labeled 'OUTPUT FROM ERODOUT.FOR'. This section lists the amount of total, suspension, and PM10 leaving each boundary and field grid cell. At the bottom of the file is the filed average of each of these grid cells.

Figure 1.5. Example stand alone erosion input file.

```
# Input file for the erosion standalone model.
#
# All lines beginning with a "#" character are comment lines
# and are skipped.
#
# +++DEBUG FLAGS +++
#   Debug flag for providing different levels of debug information
#        value of 0 will print no debug information
#        value of 1 will print out and number all input lines
#        value of 2 will print out and number all DATA input lines
#        value of 3 will do both 1 and 2
 0
#      EROSION initialization flag
 .TRUE.
#      EROSION "print" flag
 1
#
# +++ SIMULATION REGION +++
#
#      Simulation region diagonal coordinates (meters)
#       specify in this form: x1,y1  x2,y2
 0.0,  0.0  180.0,  180.0
#      Simulation region orientation angle (degrees from North)
 0.0
#      Number of accounting regions (must be 1)
 1
#
# +++ ACCOUNTING REGIONS +++
#
#      Accounting region diagonal coordinates (meters)
#       specify in this form: x1,y1  x2,y2
 0.0, 0.0  180.0, 180.0
#
# +++ BARRIERS +++
#
#      Number of barriers (0-5)
 0
#      Barrier diagonal coordinates (meters)
#       specify in this form: x1,y1  x2,y2
# 0.0, 0.0  0.0  100.0
#      Barrier height (meters), porosity (m2/m2), width (meters)
# 1.2 0.50 2.0
#      Repeat the above two input lines for each barrier
#
# +++ SUBREGION REGIONS +++
#
#      Number of subregions (must be 1)
 1
#      Subregion diagonal coordinates (meters)
#       specify in this form: x1,y1  x2,y2
 0.0, 0.0  180.0, 180.0
#
# +++ BIOMASS +++
#
#      Height of standing biomass (meters)
 0.0
#      Stem area index (m2/m2), leaf area index (m2/m2)
#       both refer to STANDING biomass only
 0.0  0.0
```

```
#      Crop row spacing (meters), 0.0=broadcast; plant location (0=furrow,1=ridge)
 0.0, 0
#      Flat biomass cover (m2/m2)
 0.04
#
# +++ SOIL +++
#
#      Number of soil layers (3-10)
 3
#      The following soil inputs are repeated for each layer
#
#      layer thickness (mm)
 10.0  40.0 200.0
#      bulk density (g/cm3)
 1.4   1.4  1.4
#      sand content, 0.05-2.0 mm (kg/kg)
 0.83  0.83 0.83
#      very fine sand, 0.05-0.1 mm (kg/kg)
 0.20  0.20 0.20
#      silt content (kg/kg)
 0.09  0.09 0.09
#      clay content (kg/kg)
 0.08  0.08 0.08
#      rock volume (m3/m3)
 0.0   0.0  0.0
#      aggregate density (g/cm3)
 1.8   1.8  1.8
#      aggregate stability (ln[J/kg])
 1.93  2.65 2.65
#      The next 4 parameters define the aggregate size
#        distribution for each layer.
#        aggregate geometric mean diameter (mm)
 0.28  0.98 0.98
#        minimum aggregate size (mm)
 0.001 0.01 0.01
#        maximum aggregate size (mm)
 14.9  48.8 48.8
#        aggregate geometric standard deviation (mm/mm)
 25.4  20.4 20.4
#      The next six variableas are surface crust variables
#        for each layer.
#        fraction of soil surface that is crusted (m2/m2)
#        crust (consolidated zone) thickness (mm)
#        fraction of crusted surface covered by loose material (m2/m2)
#        mass of loose material on crusted surface (kg/m2)
#        crust density (g/cm3)
#        crust stability (ln[J/kg])
 0.5   3.51  0.29  0.255   1.2   1.93
#      Allmaras random roughness (mm)
 1.7
#      The next four variables are ridge variables for each layer.
#       Ridge height (mm)
#       Ridge spacing (mm)
#       Ridge width (mm)
#       Ridge orientation (degrees from North)
 20.0  1016.0    0.0   90.0
#      Dike spacing (mm)
 0.0
#      Snow depth (mm)
 0.0
#
# +++ SOIL WATER +++
```

```
#
#      Soil layer wilting point water content (kg/kg)
 0.05  0.05  0.05
#      Soil layer water content (kg/kg)
 0.01  0.05  0.05
#      HOURLY soil water content at soil surface (kg/kg)
#       two lines, with 12 values on each line
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
#
# +++ WEATHER +++
#
#      Air density (g/cm3)
 1.2
#      Wind direction (deg)
 286.0
#      Number of intervals/day, maximum = 96
 48
#      Information about the anemometer
#       anemometer height (meters)
#       aerodynamic roughness at anemometer site (mm)
#       anemometer location flag (0 - away from field, 1 - on field)
 2.0   25.0    1
#      Wind/Weibull flag (0 -use Weibull parameters, 1 -use wind speeds)
 0
#      Wind statistics. These parameters are used only when the Wind/Weibull flag = 0
#       Fraction of time that winds are calm (hr/hr)
#       Weibull "c" factor (m/s)
#       Weibull "k" factor
 0.217  7.125  2.971
#      Wind speeds (m/s).  The wind data are used only when the Wind/Weibull flag = 1
#       Must have as many wind speeds as number of intervals/day.
#       Must have 6 values per line.
#       Wind data should be AVERAGES for the period.
#       Hourly averages will likely underestimate wind erosion somewhat.
#       30-min averages or shorter is more suitable (As is done here).
#    0.00    0.00    0.00    0.00    0.00    1.19
#    2.76    3.47    4.00    4.44    4.84    5.20
#    5.54    5.87    6.20    6.53    6.86    7.20
#    7.56    7.95    8.39    8.91    9.57   10.64
#   11.86   10.02    9.21    8.64    8.16    7.75
#    7.38    7.03    6.69    6.36    6.04    5.71
#    5.37    5.02    4.64    4.23    3.75    3.15
#    2.24    0.00    0.00    0.00    0.00    0.00
#
# +++ VARIABLES TO WRITE TO 'PLOT.OUT' +++
#
#      Flag for writing variables to 'plot.out'.
#       -1 = write nothing
#        0 = write erosion variables;
#      Write variables below if flagged with a 1
 0
#
#      Next are 2 lines per variable:
#       1st line: flag (0=don't write, 1=do write) and variable description
#       2nd line: this info is used as a header in 'plot.out'
#           place header within first 12 positions of the line
#
#      Field length (m)
0
    length(m)
#      biomass height(m)
```

```
1
    bio_ht(m)
#      Stem area index (m2/m2)
1
    stem_area
#      Biomass leaf area index (m2/m2)
1
    lai_area
#      Biomass flat fraction cover (m2/m2)
0
    flat_cov
#      Soil fraction very fine sand in layer 1 (kg/kg)
0
    vfsand
#      Soil fraction sand in layer 1 (kg/kg)
0
     sand
#      Soil fraction silt in layer 1 (kg/kg)
0
     silt
#      Soil fraction clay in layer 1  (kg/kg)
0
     clay
#      Soil volume rock in layer 1(m3/m3)
0
   rock_vol
#      Soil aggregate stability (ln[J/kg])
0
    ag_stab
#      Aggregate geometric mean diameter (mm)
0
    ag_gmd
#      Minimum aggregate size (mm)
0
    ag_min
#      Maximum aggregate size (mm)
0
    ag_max
#      Aggregate geometric standard deviation (mm/mm)
0
    ag_std
#      Fraction of soil surface that is crusted (m2/m2)
0
    crust_cv
#      Crust (consolidated zone) thickness (mm)
0
  crust_z(mm)
#      Faction of crusted surface covered by loose material (m2/m2)
0
    los_cv
#      Mss of loose material on crusted surface (kg/m2)
0
  los(kg/m2)
#      Crust density (g/cm3)
0
    cr_den
#      Crust stability (ln[J/kg])
0
    cr_se
#      Allmaras random roughness (mm)
0
    rr(mm)
```

```
#      Ridge height (mm)
0
  z_rgh(mm)
#      Ridge spacing (mm)
0
  x_rgs(mm)
#      Ridge width (mm)
0
  x_rgw(mm)
#      Ridge orientation (degrees from North)
0
  a_rgo(deg)
```

Figure 1.6. Example stand alone erosion output file.

```
REPORT OF INPUTS (read by erodin.for)

+++ Control Flags, etc. +++

ntstep  am0eif  nsubr  nacctr  nbr am0efl
 48      T      1      1      0      1

+++ SIMULATION REGION +++

orientation and dimensions of sim region
amasim(deg)  amxsim - (x1,y1) (x2,y2)
    0.00    0.00    0.00  276.00  276.00

+++ ACCOUNTING REGIONS +++

nacctr - number of accounting regions
1
accounting region dimensions (x1,y1) (x2,y2)
    0.00    0.00  276.00  276.00

+++ BARRIERS +++

 no barriers

+++ SUBREGIONS +++

nsubr - number of subregions
1
subregion dimensions (x1,y1) (x2,y2)
    0.00    0.00  276.00  276.00

********************** Subregion  1  **********************

+++ BIOMASS +++

Biomass ht, SAI,    LAI,  flat cover
   0.000   0.000   0.000   0.000

+++ SOIL +++

nslay - number of soil layers
3

layer depth b.density vfsand   sand   silt   clay    rock vol
  1  230.00    1.05    0.14    0.22    0.71    0.08    0.00
  2  680.00    1.05    0.14    0.22    0.71    0.08    0.00
  3  610.00    1.05    0.14    0.22    0.71    0.08    0.00

layer    AgD     AgS  GMD    GMDmn     GMDmx    GSD
  1    1.87    1.00    1.64    0.01   36.73   15.13
  2    2.00    1.87    7.68    0.01   41.79   16.17
  3    2.00    1.87   30.00    0.01   70.96    9.98

Cr frac mass LOS frac.LOS, density stability
    0.00    0.00    0.00    1.87    1.87
```

```
    RR,    Rg ht,  width, spacing, orient., dike spacing
    1.50    0.00    0.00    0.00    0.00    0.00

+++ HYDROLOGY +++

Snow depth (mm)
0.00000000E+00

layer  wilting and actual water contents
  1    0.05    0.02
  2    0.05    0.02
  3    0.05    0.02
Hourly water contents - ahrwc0
    0.02    0.02    0.02    0.02    0.02    0.02
    0.02    0.02    0.02    0.02    0.02    0.02
    0.02    0.02    0.02    0.02    0.02    0.02
    0.02    0.02    0.02    0.02    0.02    0.02

+++ WEATHER +++

 anemht    awwzo   wzoflg
2.00000000 25.0000000 1
 wind dir (deg) and max wind speed (m/s)
  250.00   11.86

Wind speeds (m/s) -  48  intervals
    0.00    0.00    0.00    0.00    0.00    1.19
    2.76    3.47    4.00    4.44    4.84    5.20
    5.54    5.87    6.20    6.53    6.86    7.20
    7.56    7.95    8.39    8.91    9.57   10.64
   11.86   10.02    9.21    8.64    8.16    7.75
    7.38    7.03    6.69    6.36    6.04    5.71
    5.37    5.02    4.64    4.23    3.75    3.15
    2.24    0.00    0.00    0.00    0.00    0.00

END OF INPUTS

OUTPUT FROM ERODOUT.FOR

Total grid size: ( 31 , 31 )   Inner grid size: ( 29 , 29 )

  Passing Border Grid Cells - Total    egt (kg/m)
  top(i=1,imax-1,j=jmax) bottom(i=1,imax-1,j=0) right(i=imax,j=1,jmax-1) left(i=0, j=1,jmax-1)
      0.72      1.98      3.58      5.51      7.90     10.63     13.56     16.56     19.55     22.35
   24.57     26.02     26.87     27.36     27.64     27.79     27.88     27.92     27.95     27.96
 27.97     27.98     27.98     27.98     27.98     27.98     27.98     27.98     27.98
      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
  0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
     13.93     37.80     59.60     70.80     74.85     76.21     76.66     76.81     76.86     76.87
   76.88     76.88     76.88     76.88     76.88     76.88     76.88     76.88     76.88     76.88
 76.88     76.88     76.88     76.88     76.88     76.88     76.88     76.88     76.88
      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
  0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

  Passing Border Grid Cells - Suspension     egtss (kg/m)
  top (i=1,imax-1, j=jmax) bottom (i=1,imax-1, j=0) right (i=imax, j=1,jmax-1) left (i=0, j=1,jmax-1)
      0.21      0.72      1.65      3.09      5.03      7.52     10.57     14.18     18.34     23.03
   28.15     33.59     39.21     44.95     50.76     56.59     62.45     68.32     74.20     80.08
 85.96     91.85     97.73    103.61    109.50    115.38    121.26    127.15    133.03
      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
  0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
     10.00     33.70     67.44    105.62    144.28    181.22    215.22    245.57    271.88    294.03
  312.14    326.54    337.67    346.04    352.18    356.56    359.62    361.70    363.09    364.00
364.58    364.95    365.17    365.31    365.39    365.44    365.46    365.48    365.49
      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
  0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

  Passing Border Grid Cells - PM10    egt10 (kg/m)
  top (i=1,imax-1, j=jmax) bottom (i=1,imax-1, j=0) right (i=imax, j=1,jmax-1) left (i=0, j=1,jmax-1)
    0.0046    0.0193    0.0473    0.0912    0.1488    0.2196    0.3027    0.3977    0.5039    0.6207
  0.7463    0.8784    1.0145    1.1531    1.2931    1.4338    1.5750    1.7164    1.8579    1.9995
2.1412    2.2828    2.4245    2.5662    2.7079    2.8496    2.9913    3.1329    3.2746
```

```
   0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
   0.3050    0.9706    1.8304    2.7605    3.6919    4.5786    5.3937    6.1209    6.7510    7.2814
  7.7153    8.0603    8.3271    8.5281    8.6755    8.7810    8.8547    8.9051    8.9387    8.9607
8.9748    8.9836    8.9891    8.9924    8.9944    8.9956    8.9963    8.9966    8.9969
   0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000

  Leaving Field Grid Cells - Total    egt (kg/m^2)
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.75     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.75     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.75     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.75     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.75     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.75     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.75     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.75     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.75     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.75     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.75     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.75     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.75     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.76     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.51     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.76     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.50     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.76     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.50     -1.73     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.87     -1.80     -1.76     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.50     -1.72     -1.91     -2.06     -2.16
  -2.12     -1.99     -1.88     -1.80     -1.76     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.50     -1.72     -1.91     -2.06     -2.16
  -2.13     -1.99     -1.88     -1.80     -1.76     -1.73     -1.72     -1.71     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.50     -1.72     -1.90     -2.05     -2.16
  -2.13     -2.00     -1.89     -1.81     -1.76     -1.74     -1.72     -1.71     -1.71     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.25     -1.50     -1.71     -1.89     -2.04     -2.15
  -2.14     -2.02     -1.90     -1.82     -1.77     -1.74     -1.72     -1.71     -1.71     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
    -0.27     -0.51     -0.73     -0.97     -1.24     -1.49     -1.70     -1.88     -2.03     -2.14
  -2.15     -2.04     -1.93     -1.84     -1.79     -1.75     -1.73     -1.72     -1.71     -1.71
```

```
 -1.71     -1.71     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
     -0.27     -0.51     -0.73     -0.96     -1.23     -1.48     -1.68     -1.86     -2.00     -2.12
   -2.16     -2.09     -1.97     -1.88     -1.82     -1.78     -1.75     -1.74     -1.73     -1.72
 -1.72     -1.72     -1.71     -1.71     -1.71     -1.71     -1.71     -1.71     -1.71
     -0.27     -0.51     -0.73     -0.95     -1.21     -1.45     -1.65     -1.81     -1.96     -2.08
   -2.16     -2.14     -2.05     -1.96     -1.89     -1.84     -1.80     -1.78     -1.77     -1.76
 -1.75     -1.75     -1.74     -1.74     -1.74     -1.74     -1.74     -1.74     -1.74
     -0.26     -0.50     -0.72     -0.93     -1.18     -1.40     -1.59     -1.75     -1.89     -2.01
   -2.10     -2.16     -2.15     -2.09     -2.02     -1.97     -1.92     -1.89     -1.87     -1.85
 -1.84     -1.83     -1.82     -1.82     -1.82     -1.81     -1.81     -1.81     -1.81
     -0.26     -0.49     -0.70     -0.88     -1.12     -1.32     -1.50     -1.65     -1.78     -1.89
   -1.98     -2.07     -2.13     -2.16     -2.17     -2.15     -2.13     -2.10     -2.08     -2.06
 -2.04     -2.03     -2.02     -2.01     -2.01     -2.00     -2.00     -1.99     -1.99
     -0.26     -0.47     -0.67     -0.81     -1.01     -1.19     -1.35     -1.49     -1.61     -1.71
   -1.79     -1.87     -1.94     -1.99     -2.04     -2.08     -2.11     -2.13     -2.15     -2.16
 -2.17     -2.18     -2.18     -2.18     -2.18     -2.18     -2.18     -2.18     -2.18
     -0.24     -0.41     -0.59     -0.72     -0.81     -0.96     -1.08     -1.20     -1.30     -1.38
   -1.45     -1.52     -1.57     -1.62     -1.66     -1.69     -1.72     -1.74     -1.76     -1.78
 -1.80     -1.81     -1.82     -1.82     -1.83     -1.83     -1.84     -1.84     -1.84
     -0.20     -0.30     -0.40     -0.50     -0.59     -0.65     -0.70     -0.74     -0.76     -0.79
   -0.82     -0.84     -0.86     -0.87     -0.88     -0.89     -0.90     -0.90     -0.91     -0.91
 -0.91     -0.91     -0.92     -0.92     -0.92     -0.92     -0.92     -0.92     -0.92

  Leaving Field Grid Cells - Suspension     egtss (kg/m^2)
     -0.06     -0.15     -0.27     -0.41     -0.56     -0.72     -0.88     -1.04     -1.20     -1.35
   -1.48     -1.57     -1.62     -1.66     -1.68     -1.69     -1.69     -1.69     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
     -0.06     -0.15     -0.27     -0.41     -0.56     -0.72     -0.88     -1.04     -1.20     -1.35
   -1.48     -1.57     -1.62     -1.66     -1.68     -1.69     -1.69     -1.69     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
     -0.06     -0.15     -0.27     -0.41     -0.56     -0.72     -0.88     -1.04     -1.20     -1.35
   -1.48     -1.57     -1.62     -1.66     -1.68     -1.69     -1.69     -1.69     -1.70     -1.70
 -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70     -1.70
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  Leaving Field Grid Cells - PM10    egt10 (kg/m^2)
   -0.0013   -0.0043   -0.0081   -0.0127   -0.0166   -0.0204   -0.0240   -0.0274   -0.0307   -0.0337
 -0.0363   -0.0381   -0.0393   -0.0400   -0.0404   -0.0406   -0.0408   -0.0408   -0.0409   -0.0409
-0.0409   -0.0409   -0.0409   -0.0409   -0.0409   -0.0409   -0.0409   -0.0409   -0.0409
   -0.0013   -0.0043   -0.0081   -0.0127   -0.0166   -0.0204   -0.0240   -0.0274   -0.0307   -0.0337
 -0.0363   -0.0381   -0.0393   -0.0400   -0.0404   -0.0406   -0.0408   -0.0408   -0.0409   -0.0409
-0.0409   -0.0409   -0.0409   -0.0409   -0.0409   -0.0409   -0.0409   -0.0409   -0.0409
   -0.0013   -0.0043   -0.0081   -0.0127   -0.0166   -0.0204   -0.0240   -0.0274   -0.0307   -0.0337
 -0.0363   -0.0381   -0.0393   -0.0400   -0.0404   -0.0406   -0.0408   -0.0408   -0.0409   -0.0409
-0.0409   -0.0409   -0.0409   -0.0409   -0.0409   -0.0409   -0.0409   -0.0409   -0.0409
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**Averages - Field
     Total    salt/creep      susp       PM10
     egt                      egtss      egt10
   -----------------kg/m^2--------------------
     -1.58       -0.34       -1.24     -0.0308

**Averages - Crossing Boundaries
Location      Total      Suspension      PM10
--------------------kg/m---------------------
top           21.59        55.45         1.39
bottom         0.00         0.00         0.00
right         72.45       287.44         7.12
left           0.00         0.00         0.00

   Comparision of interior & boundary loss
      interior       boundary    int/bnd ratio
   -120593.77      120593.91             -1.00

repeat of total, salt/creep, susp, PM10:      1.58      0.34      1.24    0.0308
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1.34 APPENDIX 4: USING WEPS WITH MEASURED DATA WEPS