

# Oregon State University Extension Service Computer Software

## WEATHERWIZARD PILOT VERSION

- DESCRIPTION:** Provides average weather data and possible daily weather sequences for a selected time period for any location in north central Oregon. Specific weather data for 19 weather stations are on file. Data for other locations are generated using a triangulation process.
- USERS:** Researchers, Extension agents, Soil Conservation Service personnel, and growers in north central Oregon who need predicted weather data for making crop management and other weather-dependent decisions.
- COMPATIBILITY:** Requires IBM PC or PC-compatible microcomputer with at least 256 K random access memory and PC DOS or MS DOS. Single, dual, or hard-disk drive system.
- AUTHORS:** John Zuzel, hydrologist, Agricultural Research Service-USDA, Columbia Basin Agricultural Research Center, Pendleton, and Russ Karow, Extension agronomist (cereals), Oregon State University.
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*Agricultural Experiment Station*

# WEATHERWIZARD

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### INTRODUCTION

WEATHERWIZARD is a microcomputer program that provides average weather data for any location in north central Oregon within the area shown in Figure 1. These data can be provided for any time period from ten days to one year. In addition, the program uses a weather generation model to provide the user with 10 possible daily sequences of maximum and minimum air temperature (<sup>o</sup>F), percipitation (inches), and solar radiation (langleys) for the selected time period<sup>1</sup>. These synthetic traces are based on the statistical characteristics of historical data and each sequence represents a possible weather scenario at the location for the selected time window. Included on the disks are 19 data files (average daily weather data) and 19 parameter files (used in data generation) for weather stations in north central Oregon. These files provide the basic data for the program and should never be altered.

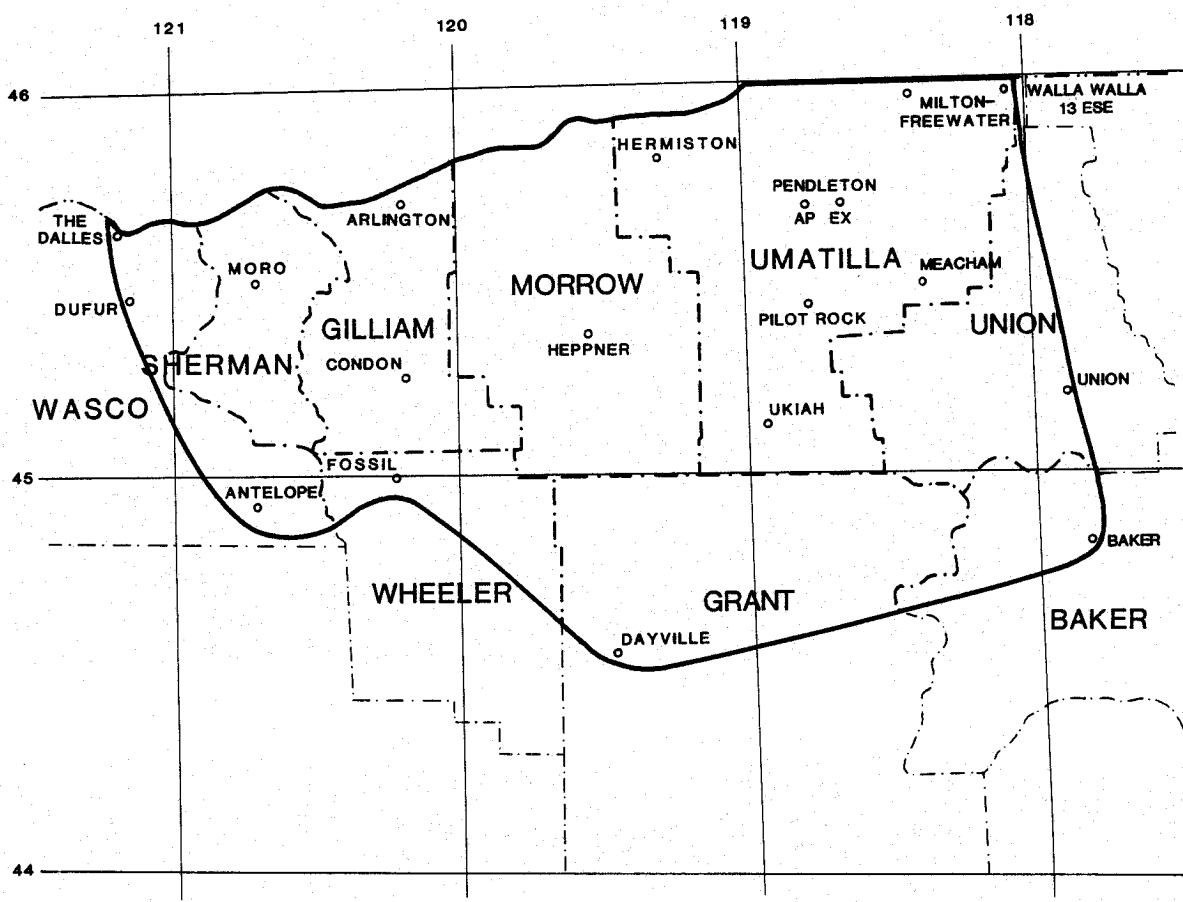


Figure 1. Area of program applicability.

<sup>1</sup>C.L. Hanson and C.W. Richardson. "SPUR Climate Component". In SPUR - Simulation of Production and Utilization of Rangelands: A Rangeland Model for Management and Research. USDA, Agricultural Research Service. Miscellaneous Publication Number 1431. p. 5-16. 1983.

The daily sequences of generated weather data are not to be considered forecasts. They do, however, cover an expected range of precipitation and temperatures and as such will provide possible weather scenarios for planning activities which are weather dependent. Additionally, the program provides average weather data for any time period and is not restricted to monthly or seasonal averages.

Data generation procedures, in contrast to using historical records, have several distinct advantages including: 1) Storage space conservation. Eleven years of daily historical weather data requires in excess of 200K bytes of storage while the parameters necessary to generate an unlimited number of years of synthetic data require only about 500 bytes; 2) Flexibility. Through an averaging process, weather records can be generated for locations not having an actual weather record. Data from nearby locations with actual records are interpolated to generate data for any desired location; 3) Range. The generation process itself depends on random number generation and this insures that a wide range of precipitation and temperature data are produced.

The computer program is intended for farmers and ranchers, Extension and Soil Conservation Service field staff personnel and others whose planning process must include weather considerations.

A. System Requirements

IBM PC or PC compatible computer  
PC DOS or MS DOS  
256K Memory  
Double sided disk drive and/or hard disk.

B. Operation Notes

All DOS operating restrictions apply, especially the eight character limitation on file names.

Once a drive is specified to the program, (in response to a program prompt) it remains the default drive for the remainder of the session. The program assumes drive A or B to be floppy disk drives and drive C to be a hard disk. No other drive designations or partitions are recognized.

-----\* WARNING \*-----

The generated data files and average data files are direct access files and should never be altered using any text editor. Refiling from a text editor under the same file name will cause unpredictable results when used in the program.

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Make a copy of both disks. Use the copies and keep the masters in a secure place.

Depending on computer configuration, the data generation phase of the program can be in excess of 20 minutes.

The time required to calculate the trace characteristics is a function of the number of days processed. The longer time windows require longer processing time.

### C. Definitions

**Average Data File:** Contains historical average daily values for temperature and rainfall for each station. Also an interpolated file created by the program when using the latitude-longitude option (see warning under operation notes).

**Degree Days:** The sum of average daily temperatures above a user specified base temperature for the time window. Average daily temperature is calculated by adding the daily minimum to the daily maximum and dividing by 2. Degree days for each day are calculated by subtracting the base temperature from the average daily temperature. If the result is negative, degree days for that day is set to zero.

**Generated Data File:** Contains the 11 years of daily weather data created within the program and always named GEN.DAT until renamed by the user (See warning under operation notes).

**Parameter File:** A file provided for each station incorporated in the program which contains statistical information necessary for data generation. Also an interpolated file created by the program when using the latitude-longitude option.

**Summary Data File:** Contains a month by year summary of the generated data file. Always named SUMM.DAT and suitable for printer output. Contains FORTRAN carriage control characters.

**Time window:** The time period of interest specified by the user. This time period must not be less than 10 days.

**Trace:** The listing of generated weather variables by date for the specified window.

### D. File Naming Conventions

All files used by the program are named by adding AVE or PAR to 4 or 5 letters of the station name and adding the suffix .DAT. For example, HERMIAVE.DAT is the average data file for Hermiston while FOSSIPAR.DAT is the parameter file for Fossil. Following is a listing of file names by station.

STATION	AVERAGE FILE	PARAMETER FILE
ANTELOPE	ANTELAVE.DAT	ANTELPAR.DAT
ARLINGTON	ARLINAVE.DAT	ARLINPAR.DAT
BAKER	BAKERAIVE.DAT	BAKERPAR.DAT
CONDON	CONDOAVE.DAT	CONDOPAR.DAT
THE DALLES	DALLEAVE.DAT	DALLEPAR.DAT
DAYVILLE	DAYVIAVE.DAT	DAYVIPAR.DAT
DUFUR	DUFURAVE.DAT	DUFURPAR.DAT
FOSSIL	FOSSIAVE.DAT	FOSSIPAR.DAT
HEPPNER	HEPPNAVE.DAT	HEPPNPAR.DAT
HERMISTON	HERMIAVE.DAT	HERMIPAR.DAT
MEACHAM	MEACHAVE.DAT	MEACHPAR.DAT
MILTON-FREEWATER	MILFRAVE.DAT	MILFRPAR.DAT
MORO	MOROAVE.DAT	MOROPAR.DAT
PENDLETON AIRPORT	PENAPAVE.DAT	PENAPPAR.DAT
PENDLETON EXPERIMENT STATION	PENEXAVE.DAT	PENEXPAR.DAT
PILOT ROCK	PILRKAIVE.DAT	PILRKPAR.DAT
UKIAH	UKIAHAVE.DAT	UKIAHPAR.DAT
UNION	UNIONAVE.DAT	UNIONPAR.DAT
WALLA WALLA 13ESE	WALI3AVE.DAT	WALI3PAR.DAT

### PROGRAM OPERATION

#### A. Hard Disk System:

1. Copy **WIZARD** (Disk 1) and data files (Disk 2) to C: and store in an appropriate directory.
2. Type **WIZARD** to run the program. The program will prompt you for the drive being used.

#### B. Single or Dual Floppy Disk Systems:

1. Copy **WIZARD** (Disk 1) and data files (Disk 2) to blank formatted disks. Use these copies to execute the program. The program will not work using the write-protected disks.
2. In addition to disks 1 and 2, you will need a blank formatted disk to contain the generated files and the data and parameter files.
3. Insert disk 1 into either drive A or drive B
4. Type **WIZARD** to begin running the program. The program will prompt you for the drive being used.
5. The program will inform you when to insert disk 2 and when to insert a blank formatted disk.

Three sample sessions follow. All user responses are underlined and are followed by a carriage return.

## SAMPLE SESSION 1 - EXISTING WEATHER STATION DATA GENERATION

Start the program by typing **WIZARD** and hitting return. You will then be prompted for the active drive.

Which drive will be used for this run? [A, B, C] C  
The screen will then clear and look like this:

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### WEATHERWIZARD

DAILY RAINFALL, TEMPERATURE, AND SOLAR RADIATION GENERATOR  
PROGRAMMED BY JOHN F. ZUZEL, USDA, ARS, PENDLETON, OREGON  
CONTRIBUTIONS BY RUSS KAROW, OSU EXTENSION, CORVALLIS, OREGON

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You have a choice of generating data by entering your geodetic position (latitude and longitude), using one of the weather stations available to this program, or using a pre-existing generated data file.

PLEASE MAKE A SELECTION:

- 1- GEODETIC POSITION DATA GENERATION
- 2- EXISTING WEATHER STATION DATA GENERATION
- 3- USE EXISTING DATA FILES
- 4- EXIT AND RETURN TO DOS

Your selection? 2

NEXT SCREEN:

These stations are available to this program:

1	ANTELOPE
2	ARLINGTON
3	BAKER
4	CONDON
5	THE DALLES
6	DAYVILLE
7	DUFUR
8	FOSSIL
9	HEPPNER
10	HERMISTON
11	MEACHAM
12	MILTON-FREEWATER
13	MORO
14	PENDLETON AIRPORT
15	PENDLETON EXPERIMENT STATION
16	PILOT ROCK
17	UKIAH
18	UNION
19	WALLA WALLA 13ESE

Enter the station number you want to use or enter any number greater than 19 to exist program: 14

NEXT SCREEN:

Wait.....Daily data for your location being generated

Data generation complete

Enter the base temperature to use for degree day calculations 32

Enter month to start - Enter any integer greater than 12 to exit program 1

Enter day of the month to start 15

Enter month to stop 2

Enter day of the month to stop 28

Please wait ....



## NEXT SCREEN:

For your time window of: 1/15 to 2/28

AVERAGE RAINFALL = 2.10 INCHES AND AVERAGE TEMPERATURE = 37 F.

DEGREE DAYS > 32 F. = 219 CHARACTERISTICS OF THE GENERATED TRACES ARE:

TRACE	TOTAL RAIN	AVERAGE TEMPERATURE	TOTAL DEG. DAYS > 32	TOTAL RADIATION
1	2.43	35	189	5896
2	1.57	38	338	7784
3	2.79	37	293	6873
4	1.84	37	270	7575
5	2.58	33	168	6419
6	1.94	33	156	7690
7	2.78	38	307	6847
8	1.13	34	175	6626
9	2.50	31	156	7798
10	0.88	34	236	7379

Enter trace number you want to see; if none, enter any number greater than 10 1

## NEXT SCREEN:

Please wait....

MONTH	DAY	TRACE NUMBER	DAY NUMBER	RAIN	--TEMPERATURE--		SOLAR RADIATION
					MAXIMUM	MINIMUM	
1	15	1	15	0.07	38	26	44
1	16	1	16	0.02	40	23	44
1	17	1	17	0.00	44	27	191
1	18	1	18	0.00	55	31	121
1	19	1	19	0.00	57	29	164
1	20	1	20	0.02	41	30	46
1	21	1	21	0.01	36	14	47
1	22	1	22	0.00	43	34	119
1	23	1	23	0.06	44	29	48
1	24	1	24	0.13	37	29	48
1	25	1	25	0.00	42	26	119
1	26	1	26	0.00	29	15	183
1	27	1	27	0.06	30	22	50
1	28	1	28	0.02	38	29	51
1	29	1	29	0.00	34	31	132
1	30	1	30	0.00	49	37	187
1	31	1	31	0.14	50	40	57
2	1	1	32	0.20	46	33	54

Screen full. Do you want to see more of this trace? [Y,N] N

## NEXT SCREEN:

For your time window of: 1/15 to 2/28

AVERAGE RAINFALL = 2.10 INCHES AND AVERAGE TEMPERATURE = 37 F.

DEGREE DAYS > 32 F. = 219 CHARACTERISTICS OF THE GENERATED TRACES ARE:

TRACE	TOTAL RAIN	AVERAGE TEMPERATURE	TOTAL DEG. DAYS > 32	TOTAL RADIATION
1	2.43	35	189	5896
2	1.57	38	338	7784
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4	1.84	37	270	7575
5	2.58	33	168	6419
6	1.94	33	156	7690
7	2.78	38	307	6847
8	1.13	34	175	6626
9	2.50	31	156	7798
10	0.88	34	236	7379

Enter trace number you want to see; if none enter any number greater than 10 11

Enter month to start, any integer greater than 12 to exit program 22

NEXT SCREEN:

This run has created the following files:

GEN.DAT - Contains 11 years of daily data

SUMM.DAT - Contains a summary of the daily data

Please rename these files to save them for another run

The station used for this run was PENDLETON AIRPORT

The station parameter file used is named PENAPPAR.DAT

The average data file is named PENAPAVE.DAT

Stop - Program terminated

At the conclusion of Sample Session 1, the file GEN.DAT should be renamed PENAPGEN.DAT by the user using the DOS RENAME command (RENAME GEN.DAT PENAPGEN.DAT). PENAPGEN.DAT will now be used in Sample Session 2 and can be used for other runs.

## SAMPLE SESSION 2 - USE EXISTING DATA FILES

Start the program as in Sample Session 1 and enter 3 in response to the prompt "Your selection?" (USE EXISTING DATA FILES). The screen will clear and you will be prompted for file names and your time window.

File name for parameter data file? PENAPPAR.DAT

File name for average data file? PENAPAVE.DAT

File name for generated data file? PENAPGEN.DAT

Enter the base temperature to be used for degree day calculations 32

Opening file PENAPGEN.DAT

Indicate your time window

Enter month to start, any integer greater than 12 to exit program 1

Enter day of the month to start 1

Enter month to stop 1

Enter day of the month to stop 15

Please wait....

The remainder of the session would proceed as in Sample Session 1. On program termination, the following will appear:

The parameter file used for this run is named PENAPPAR.DAT

The average data file is named PENAPAVE.DAT

The generated data file is named PENAPGEN.DAT

Stop - Program terminated

### SAMPLE SESSION 3 - GEODETIC POSITION DATA GENERATION

Start the program as in Sample Session 1 and enter 1 in response to the prompt "Your selection?" (GEODETIC POSITION DATA GENERATION). The screen will clear and you will be prompted for the latitude and longitude of your location. Latitude and longitude may be obtained from figure 1 or more precisely from any topographic map and some local or county maps. The screen will look like this at the completion of this step.

Enter the latitude in degree and hundreths [xx.xx]

45.48

Enter longitude in degree and hundredths [xxx.xx]

120.19

Using the following stations in the calculation of distance weighted parameters:

STATION	WEIGHT
ARLINGTON	0.32
CONDON	0.31
MORO	0.21
HEPPNER	0.17

Please wait....

Proceed with data generation? [Y,N] Y

The remainder of the session would proceed as in Sample Session 1 and you would be prompted for your time window. On program termination, the following will appear:

This run has created the following files:

INTERAVE.DAT - Contains average daily data

INTERPAR.DAT - Contains generation parameters for the location

SUMM.DAT - Contains a summary of the daily data

GEN.DAT - Contains 11 years of daily data

Please rename these files to save them for another run

Stop - Program terminated

The files created during this session must be renamed if they are to be used for another run. It is advisable to rename them immediately to avoid confusion or loss. (See comment in session one on rename command.)

## ADVANCED TECHNIQUES

While the program is structured to generate an eleven year weather sequence, the only limitation to the number of years generated is the available disk space. The number of years generated is controlled by an entry in the parameter file. For those users who require a wider range of generated data, this entry may be altered. In addition, both the generated data file, and the average data file may be used as input to user programmed applications.

### A. File Structure

Parameter files (\_\_\_PAR.DAT): A sequential access file whose values may be altered via a text editor. Size is approximately 435 bytes.

Average data files (\_\_\_AVE.DAT): A direct access file which can be converted to sequential access for user applications or be read directly by user programs or commercial software. It is a formatted file with a record length of 31. Size is 12,045 bytes.

Generated data file (always named GEN.DAT by the program and renamed by the user): A direct access file with the same characteristics as the average data files except that the record length is 50. Size is 208,780 bytes for an 11 year record.

Summary data file (always named SUMM.DAT by the program and renamed by the user): A sequential access file containing a month by year summary of the generated data. Size is 10,136 bytes for an 11 year record.

### B. File Format

Average data file:

Day of Year	Month	Day	Average Maximum	Average Minimum	Average Rainfall
1	1	1	38.1	25.5	0.02
2	1	2	36.7	22.5	0.08
3	1	3	34.9	22.6	0.05
4	1	4	36.5	22.3	0.04
5	1	5	39.4	23.9	0.05
6	1	6	39.0	26.2	0.06
7	1	7	39.9	26.8	0.04
8	1	8	38.7	26.8	0.03
9	1	9	38.7	25.5	0.05

## Generated data file:

Month	Day	Trace Number	Day of Year	Rainfall	Maximum	Minimum	Radiation
1	1	1	1	0.00	40.	30.	134.
1	2	1	2	0.01	42.	20.	39.
1	3	1	3	0.01	38.	17.	39.
1	4	1	4	0.00	35.	30.	111.
1	5	1	5	0.00	27.	26.	79.
1	6	1	6	0.12	27.	16.	40.
1	7	1	7	0.00	34.	08.	203.
1	8	1	8	0.00	43.	28.	123.
1	9	1	9	0.00	40.	17.	116.

Summary data file: Annotated with headings and is self-explanatory.

C. Increasing the Number of Years of Generated Data.

Invoke a text editor and read a parameter file into the buffer. In this example we use PENAPPAR.DAT, the parameter file for Pendleton airport. The file consists of 11 lines of data. The first 2 lines look like this:

```
GENERATE PENDLETON AIRPORT DATA
11 1 45. 7 0 0
```

To increase the number of years of generated data change the 11 on line 2 to the number of years required. File the altered file under the same filename. Run **WIZARD** using the existing weather station option (option 2). When data generation is complete GEN.DAT contains the requested number of years and SUMM.DAT contains summaries for the requested number of years. Any of the additional years (i.e. greater than 11) are not accessible to **WIZARD** and must be accessed by user specified processes. Data other than parameter 1 on line 2 (11 in the example) should never be altered.

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