V.3.3-RSNWELEV RAIN-SNOW ELEVATION OPERATION

Identifier: RSNWELEV

Application: All programs

Description: The Operation computes the elevation that separates rain from snow.

Input variables are air temperature and optionally the freezing level (elevation where the temperature is 0 DEGC). Parametric input consists of the threshold temperature (temperature that divides rain from snow), the lapse rate during precipitation periods, and the elevation associated with the air temperature data.

The rain-snow elevation is computed as:

Ers = Ev + ((Tv - PXTEMP) * (100/Lp))

where:

Ers	is the elevation separating rain from snow (M)
Ev	is the elevation of input variable (M): Ev = Ze when input variable is freezing level Ev = Te when input variable is air temperature
Ze	is the freezing level (M)
Te	is the elevation associated with air temperature data (M)
Tv	is the temperature at Ev (DEGC): Tv = 0 DEGC when input variable is freezing level Tv = Ta when input variable is air temperature
Ta	is the air temperature (DEGC)
PXTEMP	is the threshold temperature (DEGC)
Lp	is the lapse rate during precipitation periods (DEGC/100M)

If freezing level data are available, it is used to compute the rain-snow elevation. If freezing level data are not available or if a given freezing level value is missing, then the rain-snow elevation is computed using the air temperature. A mean rain-snow elevation is computed for each time interval. Since freezing level data are instantaneous values, the Operation generates a mean value for a time interval by averaging the freezing levels at the beginning and end of the period before computing the rain-snow elevation. The time interval of all time series used by this Operation must be the same.

During precipitation periods the lapse rate typically is nearly wet adiabatic or about 3DEGF/1000FT (.55DEGC/100M). Various studies have shown that the most likely value of the threshold temperature is in the range of 34 to 36 DEGF (about 1 to 2 DEGC). Using the wet adiabatic lapse rate and a threshold temperature of 35 DEGF (1.7 DEGC), the rain-snow elevation would typically be about 1000 FT lower than the freezing level. For this Operation it is recommended that a

lapse rate of .55DEGC/100M and a threshold temperature of 1 to 2 DEGC be used.

Allowable Data Time Intervals: 1, 2, 3, 4, 6, 8, 12 and 24 hours.

Time Series Used: Time series used in this Operation are as follows:

General Type	Dimn	Units	Use	Required	Form of Output T.S.	Data Time Interval	Missing Values Allowed
Rain-snow Elevation	L	M	O	yes	replaces	any	no
Air temperature	TEMP	DEGC	I	yes	n/a	any 1/	no
Freezing Level	L	M	I	no	n/a	any 1/	yes

1/ Must be the same as the rain-snow elevation time series.

Input Summary: The card input for this Operation is as follows:

Card	Format	Columns	Contents
1	2X,2A4	3-10	Rain-snow elevation time series identifier
	1X,A4	12-15	Rain-snow elevation data type code
	3X,I2	19-20	Time interval of all time series
	F5.0	21-25	Threshold temperature (PXTEMP) (DEGC)
	F5.0	26-30	Lapse rate during precipitation (DEGC/100M)
	7X,2A4	38-45	Air temperature time series identifier
	1X,A4	47-50	Air temperature data type code
	F5.0	51-55	Elevation of air temperature data (M)
	2X,2A4	58-65	Freezing level time series identifier (blank if no freezing level data)
	1X,A4	67-70	Freezing level data type code (blank if no freezing level data)
	1X,I1	72	Read carryover switch (only needed if freezing level data used): 0 = assume freezing level at the beginning and end of the initial period are the same.

Card	Format	Columns	Contents
			1 = read initial freezing level

Card 2 only needed if freezing level data used and column 72 on Card 1 is 1.

2	F10.0	1-10	Initial value of the freezing level (M)

Sample Input and Output: Sample input is shown in Figure 1. Sample output from the parameter print routine is shown in Figure 2. There is no execution routine output.

Error and Warning Messages: The error and warning messages generated by this Operation and the corrective action to take when they occur are as follows:

A. Messages that can occur during setup:

1. **ERROR** THE LAPSE RATE CANNOT BE ZERO.

   Action: Use a non zero lapse rate.

2. **WARNING** THE LAPSE RATE IS NOT POSITIVE. CHECK THAT VALUE IS CORRECT.

   Action: Temperature normally decreases with elevation which means a positive lapse rate. A negative lapse rate will cause the temperature to increase with elevation. Make sure that the lapse rate is correct.

Carryover Transfer Rules: Carryover only exists when freezing level data are used. The carryover is not changed due to any parameter changes. When carryover did not previously exist, new carryover is set to the value indicated on the input cards.

Punched Card Rules: The punched card formats for this Operation are as follows:

Parameter or Variable	Format
Threshold temperature (PXTEMP)	F5.1
Lapse rate during precipitation	F5.2
Elevation of air temperature data	F5.0
Initial freezing level	F10.0

Figure 1. Sample Card Input For Operation RSNWELEV

```
                                    - Column -
    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
RSNWELEV    ANMWE
  ANMCORWE RSEL    6  3.0 0.55       ANMWELWR MAT  2195  ANMCORWE ZELV 0
```

Figure 2. Sample Output From Operation RSNWELEV Print Parameter Routine

```
********************

RSNWELEV OPERATION     NAME=ANMWE        PREVIOUS NAME=

********************

          RAIN-SNOW ELEVATION OPERATION--PXTEMP= 3.0 DEGC     LAPSE RATE=  .55 DEGC/100 M

                    TIME SERIES USED

               CONTENTS              I.D.     TYPE   TIME INTERVAL     OTHER

          RAIN-SNOW ELEVATION      ANMCORWE   RSEL      6 HOURS
          AIR TEMPERATURE          ANMWELWR   MAT       6 HOURS     ELEV= 2195. M
          FREEZING LEVEL           ANMCORWE   ZELV      6 HOURS

          PREVIOUS FREEZING LEVEL= -999. M
```