

VIII.3.3-SAC-SMA SACRAMENTO SOIL MOISTURE ACCOUNTING OPERATION

Identifier: SAC-SMA

Operation Number: 1

Parameter Array: The FORTRAN identifier used for the parameter array for this Operation is PL. The contents of the PL array are:

<u>Position</u>	<u>Contents</u>
1	Operation version number (integer value)
2	Computational time interval in hours (integer value)
3-7	General name for the area or point where the Operation is applied
8-9	Rain plus melt time series identifier
10	Rain plus melt time series data type code
11-12	Runoff time series identifier
13	Runoff time series data type code
14	Location of potential evaporation (PE) time series information in the PL array: <u>1</u> / 0 = no PE data
15	Location of areal extent of snow time series information in the PL array: <u>2</u> / 0 = no areal extent of snow data
16	Location of runoff component time series information in the PL array: <u>3</u> / 0 = no runoff component time series
17	Location of soil moisture storage time series information in the PL array: <u>4</u> / 0 = no soil moisture storage time series
18	Location of sums of water balance, runoff and ET components in the PL array: <u>5</u> / 0 = sums are not stored
19	Control for printing detailed output: 0 = do not print If greater than zero: o Operational Forecast Program - print detailed output o Calibration System programs - location in PL of information on when to print detailed output <u>6</u> /

<u>Position</u>	<u>Contents</u>
20	Location of parameter values in the PL array <u>7</u> /
21	Location of seasonal ET-curve in the PL array <u>8</u> /
22	Precipitation multiplier - applied only during the computational period
23	Number of extra carryover values
24	Location in PL of frozen ground information: <u>9</u> / 0 = no frozen ground information
25	Number of values in the PL array
26-30	Unused

Notes:

- 1/ The contents of the optional 4 array positions for the PE time series information are:
 - o identifier (2 words)
 - o data type code
 - o carryover location

- 2/ The contents of the optional 5 array positions for the areal extent of snow cover time series information are:
 - o identifier (2 words)
 - o data type code
 - o data time interval
 - o carryover location

- 3/ The contents of the optional 5 array positions for the runoff component time series information are:
 - o identifier (2 words)
 - o data type code
 - o data time interval
 - o carryover location

- 4/ The contents of the optional 4 array positions for the soil moisture storage time series information are:
 - o identifier (2 words)
 - o data type code
 - o data time interval

- 5/ The contents of the optional array positions for the sums of water balance, runoff and ET components are:

For Calibration programs:

1. precipitation
2. runoff
3. recharge
4. actual-ET
5. residual
6. impervious

- 7. direct
- 8. surface
- 9. interflow
- 10. supplemental
- 11. primary
- 12. ET-Demand
- 13. ET-UZ
- 14. ET-LZ
- 15. ET-ADIMP
- 16. ET-RIVA

For Operational Forecast Program (values are stored for both the observed and future periods):

- 1. precipitation
- 2. runoff
- 3. surface
- 4. direct plus impervious
- 5. interflow
- 6. baseflow
- 7. ET-Demand
- 8. actual-ET

6/ The contents of the optional 15 array positions for the months to print detailed output are:

- o month currently being checked
- o month and year to be printed (maximum of 7 months; 14 values)

7/ Order of parameter values is:

- 1. PXADJ
- 2. PEADJ
- 3. UZTWM
- 4. UZFWM
- 5. UZK
- 6. PCTIM
- 7. ADIMP
- 8. RIVA
- 9. ZPERC
- 10. REXP
- 11. LZTWM
- 12. LZFSM
- 13. LZFPM
- 14. LZSK
- 15. LZPK
- 16. PFREE
- 17. RSERV
- 18. SIDE
- 19. IOPTET:
 - 0 = uniform daily ET variation
 - 1 = fixed diurnal variation is used
- 20. EFC

8/ Seasonal ET curve information is:

- o seasonal ET-demand or PE adjustment curve for January to December (12 values)
- o daily increments in seasonal ET-curve (first value is for mid-January to mid-February) (12 values)

9/ The contents of the optional array positions for the frozen ground information are:

1. identifier of air temperature time series (2 words)
3. data type code of air temperature time series
4. data time interval of air temperature time series
5. location of water equivalent information in the PF array:
0 = no water equivalent information
6. location of frost index information in the PF array:
0 = no frost index information
7. number of extra carryover values
8. frozen ground parameters:
 1. CSOIL
 2. CSNOW
 3. GCH
 4. RTHAW
 5. FRTEMP
 6. SATR
 7. FREXP
 8. not used
 9. not used
 10. not used
9. if PF(5)>0:
 - o identifier of water equivalent time series (2 words)
 - o data type code of water equivalent time series
 - o data time interval of water equivalent time series
10. if PF(6)>0:
 1. identifier of frost index time series (2 words)
 3. data type code of frost index time series
 4. data time interval of frost index time series

The PF array is the portion of the PL array for the frozen ground information.

Carryover Array: The FORTRAN identifier used for the carryover array is CL. The contents of the CL array are:

<u>Position</u>	<u>Contents</u>
1	UZTWC
2	UZFWC
3	LZTWC
4	LZFSC
5	LZFPC
6	ADIMC

Extra carryover is stored if PE, areal extent of snow cover, runoff components and/or frozen ground time series are used. Location in CL array equals 6+ carryover location stored for each time series in the PL array:

1. if PL(14)>0 then CL(6+IETCO) is the previous PE value where IETCO=PL(14)+3
2. if PL(15)>0 then CL(6+ISCO) is the previous snow cover value where ISCO=PL(15)+3

3. if PL(16)>0 then the current values of runoff components time series are:

CL(6+IROCL+0) is the total channel inflow
CL(6+IROCL+1) is the impervious runoff inflow
CL(6+IROCL+2) is the direct runoff
CL(6+IROCL+3) is the surface runoff
CL(6+IROCL+4) is the interflow
CL(6+IROCL+5) is the supplemental baseflow
CL(6+IROCL+6) is the primary baseflow

where IROCL=PL(16)

4. if PL(24)>0 then the frozen ground values are:

CL(6+NXCO+1) is the frost index (FINDX)
CL(6+NXCO+2) is not used
CL(6+NXCO+3) is not used
CL(6+NXCO+4) is not used
CL(6+NXCO+5) is not used
CL(6+NXCO+6) is not used
CL(6+NXCO+7) is the air temperature (PTA)
IF (LWE.GT.0) CL(6+NXCO+8) is the snow water equivalent

(PWE)

where NXCO=PL(23)
LWE=PL(24)+4

Subroutine Names and Functions

Subroutine Function

PIN1	Input cards and stores values in PL and CL arrays
PRP1	Print information in PL array
PRC1	Print information in CL array
EX1	Execute the Operation
COX1	Perform carryover transfer
PUC1	Punch information in PL and CL arrays
TAB1	Make entry into the Operations Table
FLAND1	Perform soil moisture accounting computations for one time period
FPMCO1	Retrieve values from PL and CL arrays
FCKCO1	Check and adjust carryover values
FSTCO1	Transfer state variables into the carryover array

Subroutine Function

FSTFG1 Transfer frozen ground parameters into the parameter
 array

Subroutines PIN1, PRP1, PRC1, COX1 and PUC1 have the standard
argument lists for these subroutines as given in Section VIII.4.3.

SUBROUTINE EX1 (PL,CL,PX,RO,PE,COVER,ROC,SM,TA,WE,FI)

Function: This is the execution routine for Operation SAC-SMA.

Argument List

<u>Argument</u>	<u>Input/ Output</u>	<u>Type</u>	<u>Dimension</u>	<u>Description</u>
PL	Input	R*4	Variable	Contains parameters and other information
CL	Both	R*4	Variable	Contains carryover values
FX	Input	R*4	Variable	Precipitation time series data
RO	Output	R*4	Variable	Runoff time series data
PE	Input	R*4	Variable	PE time series data (daily)
COVER	Input	R*4	Variable	Areal extent of snow time series data (daily)
ROC	Output	R*4	Variable	Soil moisture storage time series data (daily)
SM	Output	R*4	Variable	Soil moisture storage time series data (daily)
TA,WE,FI	-	R*4	Variable	Used for frozen ground model

SUBROUTINE FLAND1 (KINT,DT,PXV,EP,EPDIST,TCI,IPRINT,IDAY,IHOUR,IOUT,
IFRZE,TA,LWE,WE,ISC,AESC,IBUG,MONTH,IYEAR,KDA,
IOUTYP,OPNAME)

Function: This routine executes Operation SAC-SMA for one time period.

Argument List

<u>Argument</u>	<u>Input/ Output</u>	<u>Type</u>	<u>Dimension</u>	<u>Description</u>
KINT	Input	I*4	1	Period of the day
DT	Input	R*4	1	Computational time interval
PXV	Input	R*4	1	Precipitation or rain plus melt (units of MM)
EP	Input	R*4	1	ET demand for the day (units of MM)
EPDIST	Input	R*4	24	Decimal fraction of ET-demand to be applied during each period of the day
TCI	Output	R*4	1	Total channel inflow (units of MM)
IPRINT	Input	I*4	1	Print detailed output control: 0 = no print 1 = print
IDAY	Input	I*4	1	Current day (external clock)
IHOUR	Input	I*4	1	Current hour (external clock)
IOUT	Input	I*4	1	Unit number for printer output
IFRZE	Input	I*4	1	Frozen ground switch: 0 = frozen ground not considered 1 = use research frozen ground model
TA	Input	R*4	1	Air temperature (units of DEGC)
LWE	Input	I*4	1	Availability of water-equivalent: 0 = none available >0 = available (for frozen ground model)
WE	Input	R*4	1	Water equivalent (units of MM)

Argument	Input/ Output	Type	Dimension	Description
ISC	Input	I*4	1	Availability of areal extent of snow cover: 0 = none available >0 = available
AESC	Input	R*4	1	Areal extent of snow cover (decimal fraction)
IBUG	Input	I*4	1	Debug output control: 0 = no debug output 1 = print debug output
MONTH	Input	I*4	1	Month based on the internal clock
IYEAR	Input	I*4	1	Year based on the internal clock
KDA	Input	I*4	1	Day in internal clock time
IOUTYP	Input	I*4	1	Output control variable: <u>1</u> / 0 = text output only 1 = both text and graphics output 2 = graphics output only
OPNAME	Input	A8	1	Operation name

Notes:

1/ If IOUTYP equals 1 or 2, various values are written to a scratch file for use by a graphics program such as ICP. If IOUTYP equals 0 or 1, text output is generated by the program for those Operations that use the OUTCTL common block (currently WY-PLOT, SAC-SMA and SNOW-17). For example, when MCP3 is run from ICP, IOUTYP can be set to either 1 or 2, and when MCP3 is run by itself, IOUTYP is always equal to zero.

SUBROUTINE TAB1 (TL,LEFT,IUSET,NXT,LPL,PL,LCL,TS,MTS)

Function: This is the Operations Table entry routine for Operation SAC-SMA.

Argument List: The arguments for this subroutine are similar to the arguments for the Operation Table entry subroutine for other Operations. A description of the arguments is contained in Section VIII.4.2-TAB.

Operation Table Array: The contents of the TL array are:

<u>Position</u>	<u>Contents</u>
1	The number of this Operation
2	The location in the T array of the next Operation to be executed
3	The location of the parameter array for this Operation in the P array
4	The location of the carryover array for this Operation in the C array
5	Location of rain plus melt data in the D array
6	Location to put runoff values in the D array
7	Location of the PE data in the D array: 0 = not used
8	Location of areal snow cover data in the D array: 0 = not used
9	Location to put runoff components in the D array: 0 = not used
10	Location to put soil moisture storage data in the D array: 0 = not used
11-13	Location of air temperature, water-equivalent and frost index data for frozen ground model