11   Program operation

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11.1   Program input

A summary of all input files in given in Table 5, a more detailed description of these files is given in Appendix 6. Some files are required, other files are optional. The extensions of the files are fixed. The names of the input files can be freely chosen and have to be specified in the *.swp file.

Table 5 Input data files

Input file	Description	Appendix	
*.swp	Main input	7	Required
*.yyy	Daily meteorological data	8	Required
*.crp	Crop growth	9 and 10	Optional
*.dra	Drainage data	11	Optional

In the input files of each parameter the symbolic name, a description and an identification is given. The identification between square brackets uses the following convention:
1)   range
2)   unit
3)   data tye (I = Integer, R = Real, Ax = character string of x positions)
For example: [-5000 .. 100 cm, R] means: value between -5000 and +100 with a unit in cm, given as a Real datatype (which means that a dot must be added).
Ranges of all input parameters are given in Appendix 17.

General rules for the formats of input files are:
- order of variables is fixed
- free format with the structure 'VariableName' = 'value' or in a table
- comment in lines is allowed starting with '*' or '!'
- blank lines are allowed.

The meteorological data must be specified in the *.yyy file separately for each year. The extension of these files consists of the last three digits of the year. Missing values should be indicated with -99.0 or lower. The following rules apply to missing meteo data:
- missing values of rainfall are never allowed
- if potential evapotranspiration must be calculated (specified in *.swp), no missing values are allowed of the data RAD, Tmin, Tmax, HUM and WIND
- no missing values for Tmin and Tmax are allowed if a crop is present or soil temperature must be simulated
- no missing values for RAD is allowed in case the detailed crop model or the detailed grass model is active.
Violation of these rules cause program termination, after first writing the date and cause of the fatal error to the log file.

11.2   Program execution

The *.swp file and the executable need to be present in the same directory. All other input files should exist on the directory, which has been specified in the file *.swp
A simulation can be excecuted by entering the name of the executable of SWAP from the command line, optionally followed by the name of the main input file. For the example file in Appendix 7 (Hupsel.swp) this would be:

```
Swap.exe Hupsel
```

Indirectly a simulation can be excecuted by entering the name of a batch file referring to the SWAP executable and the *.swp file.

In the *.swp file the names of the other files are given and also their location. Therefor it is possible to have a separate data directory with meteorological, crop and drainage data.

Output files will be generated in the same directory as the main input file. Also the log file will be placed here. This file (swap.log) contains a copy of the *.swp file and, errors and warnings, and when the simulation is successful, the following line:

```
'Swap simulation succesfully terminated!'
```

There are two types of warnings: fatal errors, the simulation will be terminated, and warnings with the advise to adapt the input data.
A third type of errors is generated by the utility library TTUTIL (Kraalingen & Rappoldt, 2000), and these handle the formats of the input data..

11.3   Program output

Table 6 Output data files

Output file	Description	Optional
*.bal	Short water and solute balance	No
*.blc	Extended water balance	Yes
*.inc	Incremental water balance	No
*.wba	Cummulative water balance	No
*sba	Cummulative solute balance	Yes
*.ate	Soil temperatures	Yes
*.vap	Soil profiles	Yes
*.irg	Irrigation	Yes
*.crp	Crop growth	No
*.drf	Extended drainage components	Yes
*.swb	Surface water management 1	Yes
*.man	Surface water management 2	Yes
*.snw	Snowpack water balance	Yes
*.bma	Detailed water balance Macropores	Yes
swap.log	Log file	No
*.end	Final values of state variables	No

Different ASCII output files (Table 6) can be generated which can be switched on or off by means of variables given in the main input file (when optional in the above table). All these files have the same header with the project name, file content, file name, model version, date of generation, period of calculations and the depth of the soil profile. Appendix 12 lists the variables which are printed in each output file.

Formatted and unformatted (binary) export files can be generated with data that cover the entire simulation period. These output files can be directly used as input for pesticide and nutrient models like PEARL (Leistra et al, 2001) and ANIMO (Groenendijk et al, 2003). A description of these files is given in Appendix 15 and Appendix 16)