DSSAT-SALUS Simple: short user's guide April 15, 2013

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The SALUS (System Approach to Land Use Sustainability, Basso et al., 2006) crop model contains two modeling approaches: a complex approach based on the CERES models and a simple approach based on EPIC (Erosion Productivity Impact Calculator, Williams et al., 1989) and ALMANAC (Agricultural Land Management Alternatives with Numerical Assessment Criteria, Kiniry et al., 1992). The simple SALUS model (SALUS-Simple) was integrated in DSSAT to make a simple model available for DSSAT users. The model is generic and can be potentially parameterized for several crops and grasses from literature or available data. A detailed description of the model, an uncertainty and sensitivity analysis and results from model testing can be found in Dzotsi et al. (2013) and Dzotsi (2012).

Running SALUS-Simple in DSSAT

The SALUS-Simple model can be run from a traditional DSSAT file X which has to be manually edited to specify SALUS as the model to run. This can be done from the simulation control section as indicated below:

```
*SIMULATION CONTROLS
@N GENERAL     NYERS NREPS START SDATE RSEED SNAME.................... SMODEL
1 GE              1     1     S 89100  2150 FACE EXPERIMENTS           SALUS045
```

The cultivars can be defined in the file SALUS045.CUL (a list of calibrated cultivars is available in this file). The first few lines and columns from this file look like this:

```
*GENERIC SALUS MODEL PARAMETERS: SALUS045 MODEL
@CROP# CROPNAME........ EXPNO   ECO#    EMGINT    EMGSLP    TTGERM  HRVINDEX    LAIMAX
MZ0001 Maize Early Limited              34.715     5.100    18.500     0.470     5.328
```

The cultivar parameters are defined in Table 1. The cultivar can be defined in the cultivar section of file X with the crop always specified as "MZ" as follows:

```
*CULTIVARS
@C CR INGENO CNAME
 1 MZ MZ0001 Maize Early Limited
```

Management inputs specifically used by SALUS-Simple are **plant density**, **row spacing** and **sowing depth**. The current version of SALUS-Simple simulates potential and water-limited production (no N or P limitation). To simulate a water-limited treatment, users can activate the appropriate switch under simulation control. Additional cultivar parameters used by SALUS-Simple to simulate water limitation are **RLWR**, **StresLAI** and **StresRUE** (Table 1). Irrigation can be configured in the same way as for other DSSAT models.

Output files

In addition to normal DSSAT output files, specific growth variables calculated by SALUS-Simple can be found in SALUS.OUT (header definitions in Table 2).

Table 1. List of SALUS-Simple crop model parameters and definitions

No.	Parameter	Unit	Description
1	EmgInt	^{o}C-day	Intercept of emergence thermal time calculation
2	EmgSlp	^{o}C-day cm^{-1}	Slope of emergence thermal time calculation
3	HrvIndex	-	Crop harvest index
4	MaxLAI	m^{2} m^{-2}	Maximum expected Leaf Area Index
5	RelLAIP1	-	Parameter for shape at point 1 on the potential LAI curve
6	RelLAIP2	-	Parameter for shape at point 2 on the potential LAI curve
7	RelTTSn	-	Relative thermal time at beginning of senescence
8	RelTTSn2	-	Relative thermal time beyond which the crop is no longer sensitive to water stress
9	RLWR	cm g^{-1}	Root length to weight ratio
10	RUEMax	g MJ^{-1}	Maximum expected Radiation Use Efficiency
11	SeedWt	g seed^{-1}	Seed weight
12	SnParLAI	-	Parameter for shape of potential LAI curve after beginning of senescence
13	SnParRUE	-	Parameter for shape of potential RUE curve after beginning of senescence
14	StresLAI	-	Factor by which LAI senescence due to water stress is increased between RelTTSn and RelTTSn2
15	StresRUE	-	Factor by which RUE decline due to water stress is accelerated after the beginning of leaf senescence
16	TBaseDev	^{o}C	Base temperature for development
17	TFreeze	^{o}C	Threshold temperature below which crop development and growth stop
18	TOptDev	^{o}C	Optimum temperature for development
19	TTGerminate	^{o}C-day	Thermal time from planting to germination
20	TTMature	^{o}C-day	Thermal time from planting to maturity

Table 2. Definition of header in SALUS.OUT

Header	Definition	Unit
BIOMASS	Aboveground dry matter	kg ha^{-1}
CUMDTT	Cumulative thermal time	^{o}C-day
DAP	Day after planting	-
dBIOM	Rate of aboveground dry matter growth	g m^{-2} d^{-1}
dLAI	Rate of LAI growth	m^2 m^{-2} d^{-1}
DTT	Daily thermal time	^{o}C-day
RELTT	Relative thermal time	-
ROOT	Root dry matter	kg ha^{-1}
RUE	Radiation use efficiency	g MJ^{-1}
WATFAC	Water stress factor (1 indicated no stress, 0 is maximum stress)	-
XHLAI	Leaf area index (LAI)	m^2 m^{-2}
YRDOY	Year-day of year	-

References

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