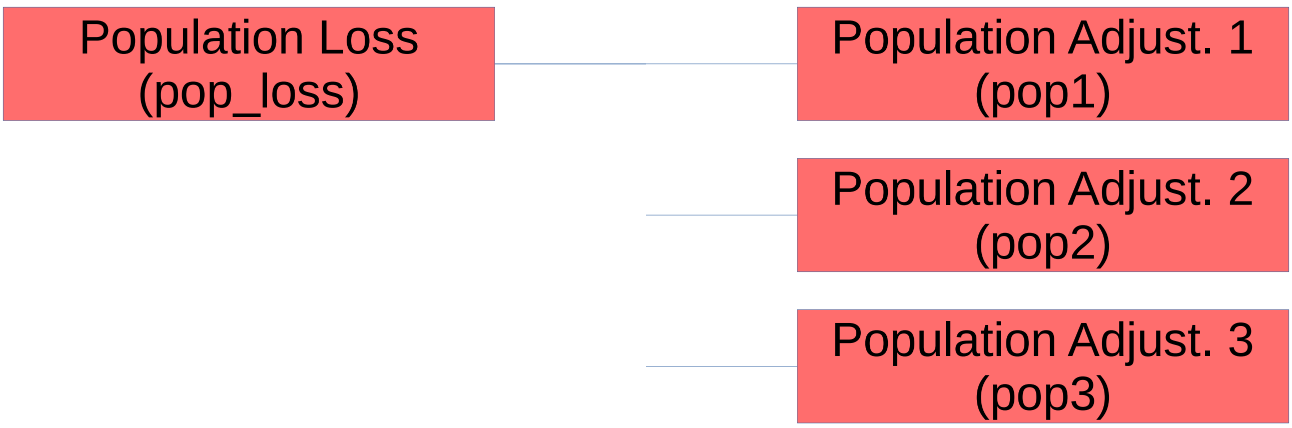
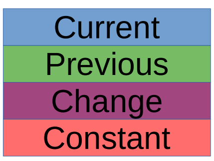
CONSTANTS

Plant Population Loss
(pop_loss / PopLoss)
[numeric]





$$\text{pop\_loss} = \frac{1}{3}\left(\sum_{i=1}^{3} pop_i\right)$$

Plant Population Adjustments
(pop_i / $Ppop_i$)
[numeric]

A model for the loss of potential yield based on plant population.

$i \in (1,2,3)$

Population Adjust. (pop_i) ← Population Observ. *i* (POP_i)

Current
Previous
Change
Constant

$$pop_i = if\left(POP_i < 90000, -0.0003 \times \left(\frac{POP_i}{1000}\right)^2 + 0.0456 \times \left(\frac{POP_i}{1000}\right) - 1.0246\right)$$

Soil Parameter b
(soil_b / b)
[numeric]

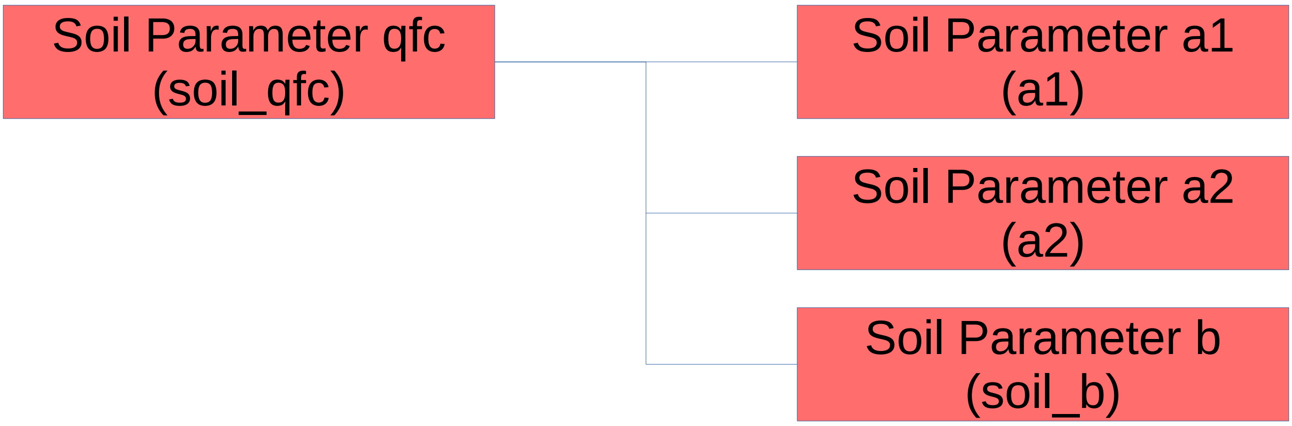
Comes from a look-up table

Soil Parameter b (b) $\leftarrow$ Look-up Table

Current
Previous
Change
Constant

$$if\left(b<1\right)b=2.1$$

Soil Water Holding Capacity
(soil_qfc / qfc)
[numeric]

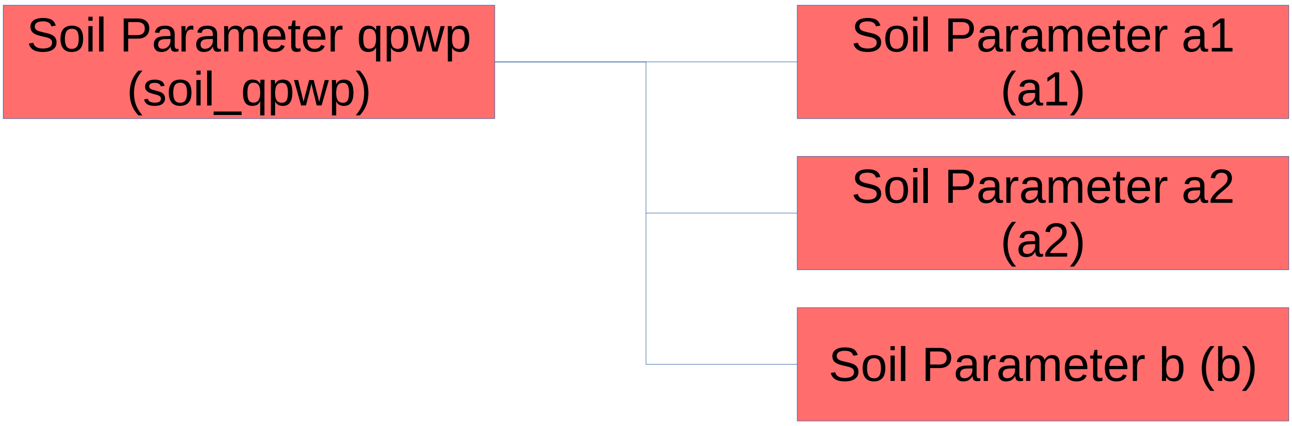


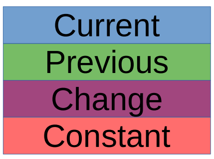
Current
Previous
Change
Constant

$$soil\_qfc = a2 \times \left(\frac{a1}{5}\right)^{\frac{1}{soil\_b}}$$

Soil Permanent Wilting Point
(soil_qpwp / qpwp)
[numeric]

This parameter is currently not employed in the code





$$qpwp = \left(\frac{a2 \times a1}{1500}\right)^{\frac{1}{b}}$$

Constants: soil type dependent

	b ≤ 20	b > 20
Kappa (κ)	0.0027	0.0008
Gamma (γ)	0.00014	0.00002701
stress_wA	2	5
stress_wB	0.6	0.8
stress_wC	300	200
RUEZero1	RUEZero	2.1

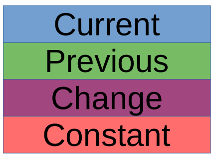
Constants: Constant

Parameter	Value	Calculation of	Comment
a1	0,4	qfc, qpwp	
a2	0,6	qfc, qpwp	
Albedo	0.23	radiation_solar	
beta0	0,00935	root_depth	
c1	378,8	rsum	
c2	8	rsum	
CSrad_k	-0,64	na	
CSrad_S	1,27	na	
delta	0,002715	root_depth	
DiseaseModel	0	na	
DiseaseProgress	0	na	
Dsowing	0,02	root_depth	
Extinction	0,7	na	
fZero	0,000015	f	
gamma2	0,00007	na	
Gsc	0,082	na	
kappa2	0,00148	na	
Ky	0,42	na	
LAImu	1150	na	
LAIsigma1	381	na	
LAIsigma2	700	na	
LAIzero	3200	na	
length0	0,0491	root_depth	
muMin02	-0,00017	na	
muZero	0,06556	na	
nuZero	0,005866	na	
psiCrop	-1500	esoil	
RUEZero	1,95	RUEZero1	
Tbase	3	ΔT	
Tzero	90	root_depth, bbch	
Albedo	0,23	na	
SBconstant	4,90E-09	radiation_LW	

INITIAL CALCULATIONS (COLUMN-WISE)

Day Of Year
(doy / doy)
[integer series]

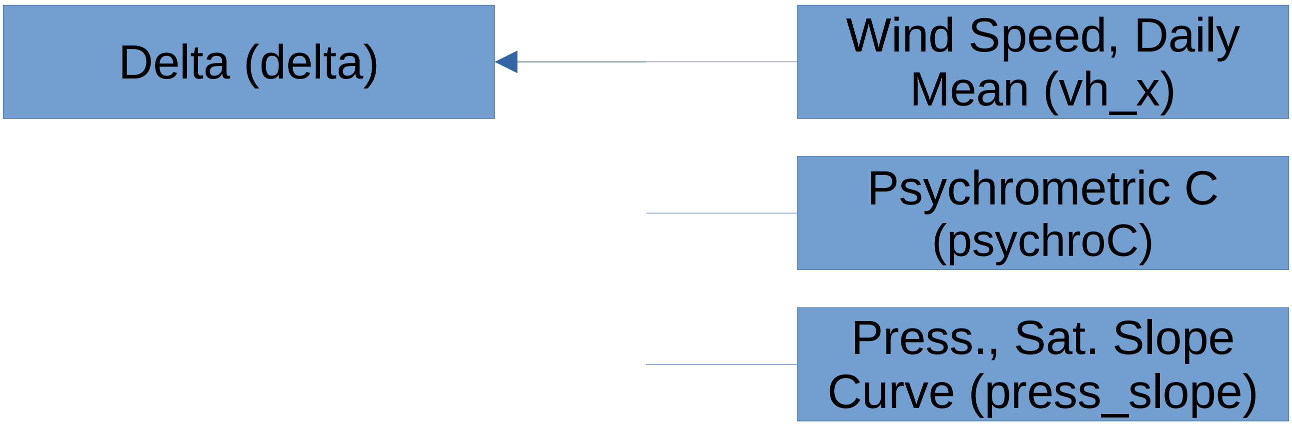
Leap years are basically ignored, i.e. in leap year, 29 Feb = doy 60, in non-leap year 1 March = doy 60.

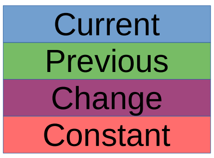


Day of year with base January 1

Delta
(delta / na)
[]

Not specifically given in OM, but is included as part of the et calculation.

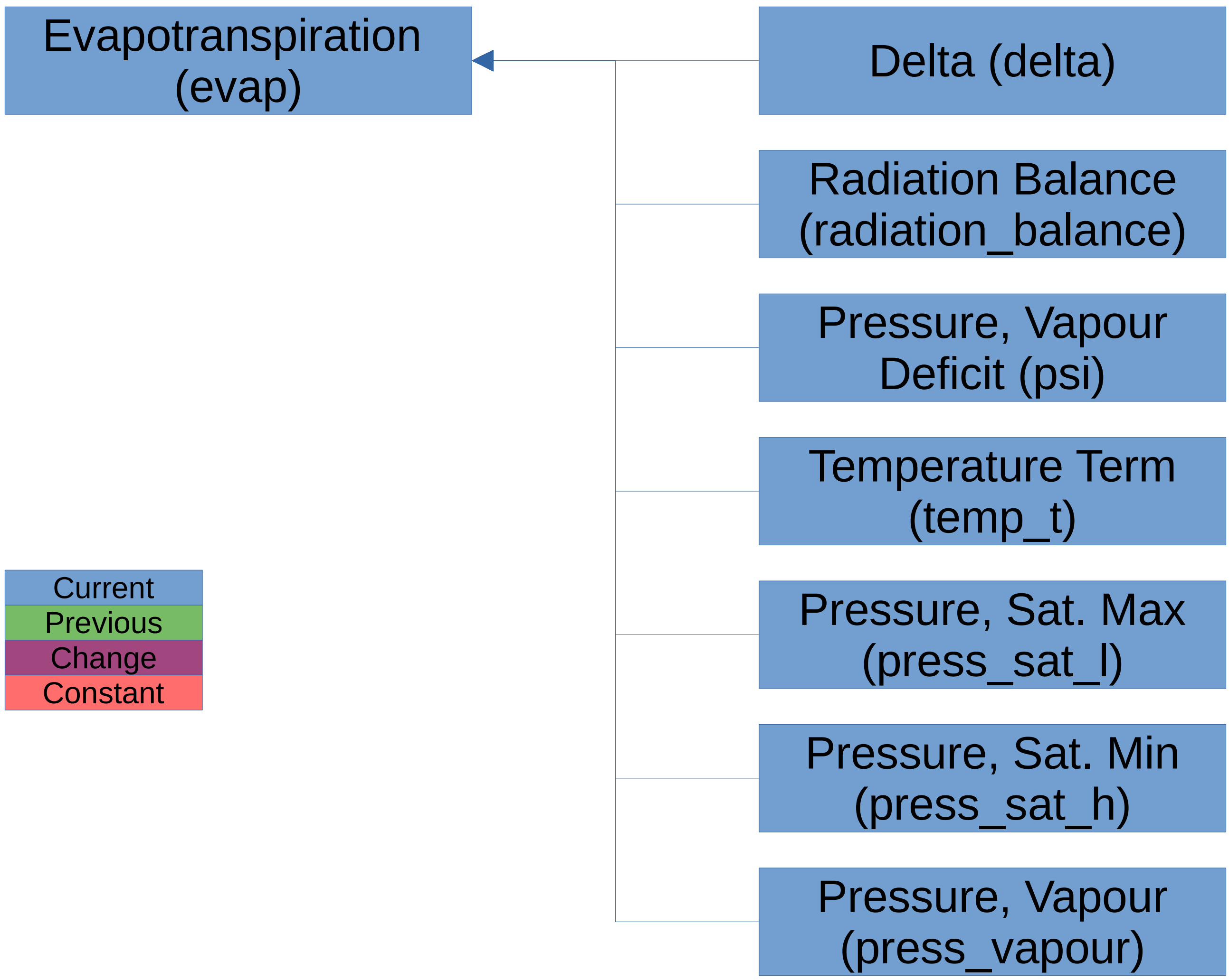




$$delta = \frac{\mathrm{press\_slope}}{\mathrm{press\_slope} + psychroC \times (1 + 0.34 \times \mathrm{vh\_x})}$$

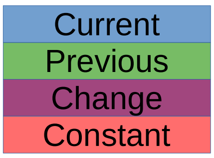
Evapotranspiration
(evap / Epenman)
[mm/day ? /]

The version used in R is slightly different from that in OpenModel. The way OM works, the evap values in a table post Evaluate have all been moved a day earlier. The R version is sourced from ???.



$$et = delta \times \mathrm{radiation\_balance} + psi \times \mathrm{temp\_t} \times \left(\frac{\mathrm{press\_sat\_h} + \mathrm{press\_sat\_l}}{2} - \mathrm{press\_vapour} \right)$$

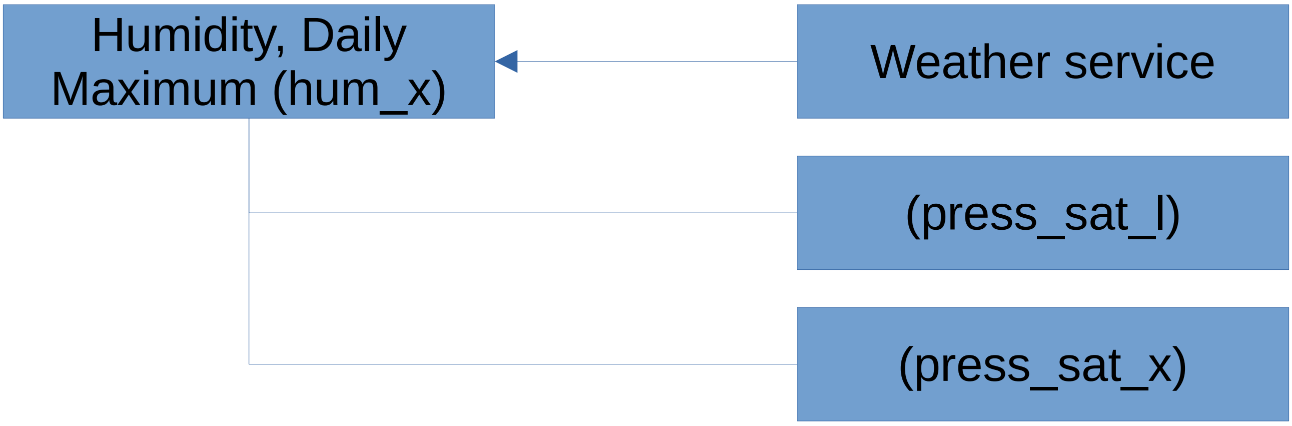
Humidity, Daily Maximum
(hum_h /)
[%]

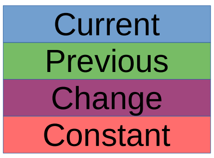


$$\text{hum\_h} = max\left(hum_t, for\ t \in \text{Daily\_obs}\right)$$

Humidity, Daily Mean
(hum_x / RH)
[%]

If hum_x is not available, it can be estimated following OM.

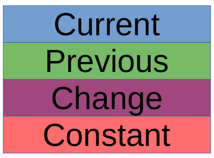




$$\text{hum\_x} = \frac{1}{n}\left(\sum_{i=1}^{n} hum_i\right)$$

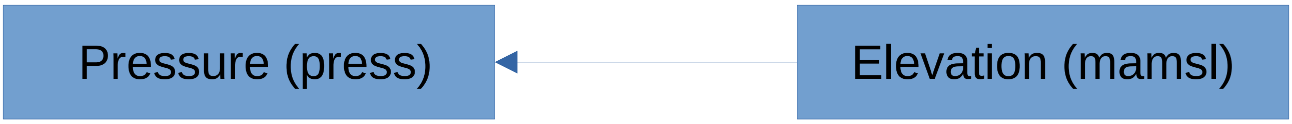
$$if\ \text{hum\_x} = na\,,\ \text{hum\_x} = \frac{\text{press\_sat\_l}}{\text{press\_sat\_x}} \times 100$$

Humidity, Daily Minimum
(hum_l /)
[%]



$$\text{hum\_l} = min\left(hum_t, for\ t \in \text{Daily\_obs}\right)$$

Pressure
(press)



Current
Previous
Change
Constant

$$press = 101.3 \times \left(\frac{293 - 0.0065 \times mamsl}{293} \right)^{5.26}$$

Pressure, Saturation Vapour, ”Actual”
(press_sat_a / eActual)

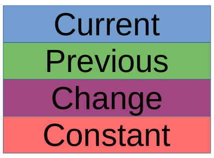
Used only in the estimation of radiation if this data is not available from sensors.

$$\begin{array}{c} \text{Pressure, Sat. Actual} \\ \text{(press\_sat\_a)} \end{array} \longleftarrow \begin{array}{c} \text{Pressure, Sat. Min.} \\ \text{(press\_sat\_l)} \end{array}$$

Current
Previous
Change
Constant

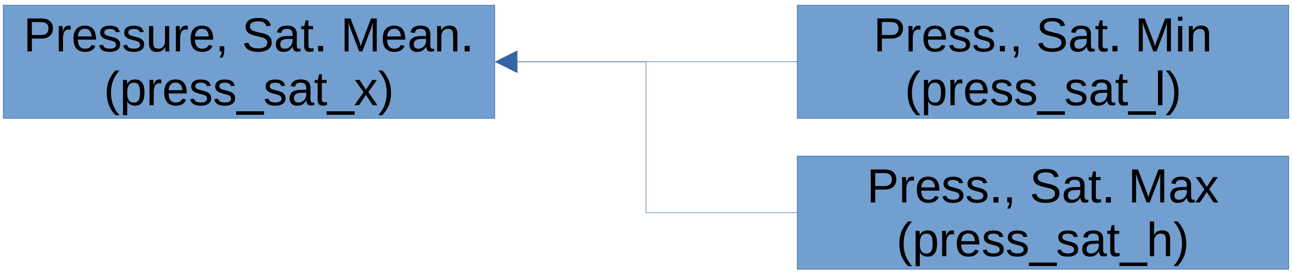
$$press\_sat\_a = press\_sat\_l$$

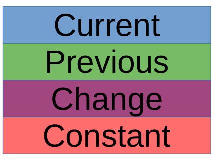
Pressure, Saturation Vapour, at Daily Maximum Temperature
(press_sat_h / esMax)



$$\text{press\_sat\_h} = 0.6108 \times \exp\left(\frac{17.27 \times \text{temp\_h}}{\text{temp\_h} + 237.3}\right)$$

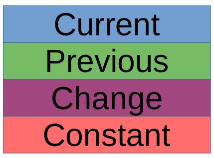
Pressure, Saturation Vapour, at Daily Minimum Temperature
(press_sat_x / esMean)





$$\text{press\_sat\_x} = \frac{\text{press\_sat\_l}}{\text{press\_sat\_h}} \div 2$$

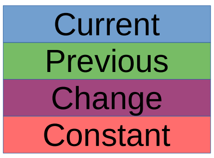
Pressure, Saturation Vapour, at Daily Minimum Temperature
(press_sat_l / esMin)



$$\text{press\_sat\_l} = 0.6108 \times \exp\left(\frac{17.27 \times \text{temp\_l}}{\text{temp\_l} + 237.3}\right)$$

Pressure, Saturation, Slope of Curve
(press_slope / VPslope)

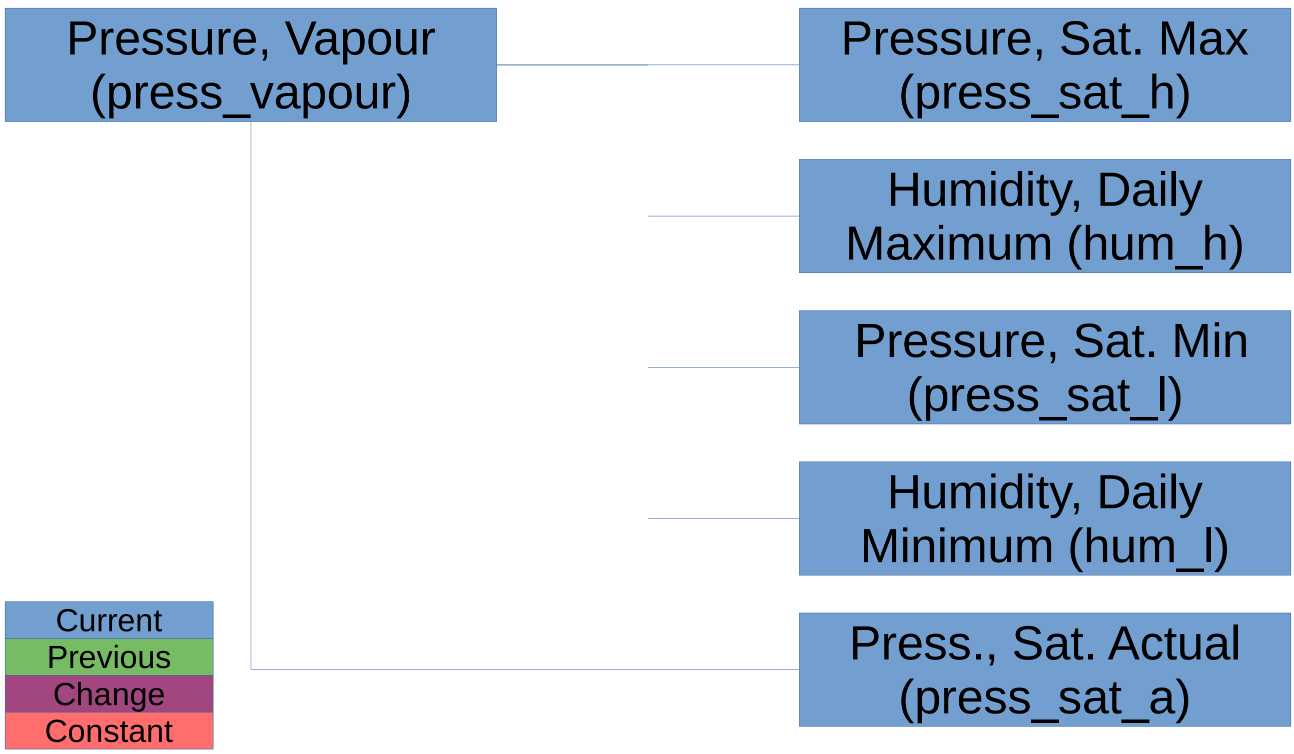
OM has the second constant as 0.6101. 0.6108 was taken from the original source???



$$\text{press\_slope} = \frac{4098 \times 0.6108 \times \exp\left(17.27 \times \text{temp\_x} \div \left(\text{temp\_x} + 237.3\right)\right)}{\left(\text{temp\_x} + 237.3\right)^2}$$

Pressure, Vapour, Daily Mean
(press_vapour)

The alternative / backup calculation is taken from OM.

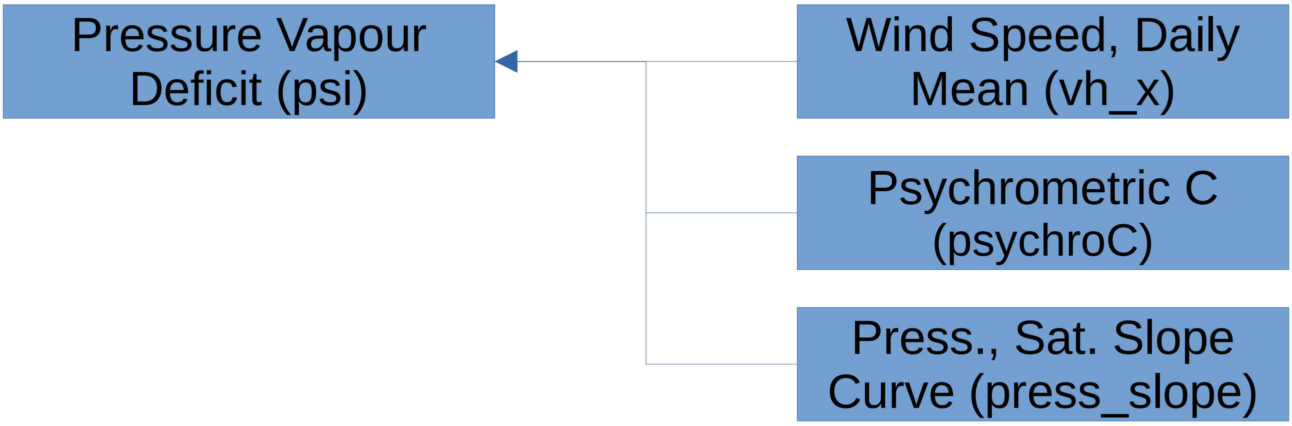


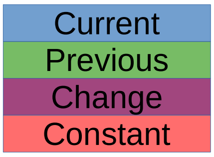
$$\text{press\_vapour} = \left(\frac{\text{press\_sat\_max} \times \text{hum\_h}}{100} + \frac{\text{press\_sat\_min} \times \text{hum\_l}}{100} \right) \div 2$$

$$\mathit{if}\ \text{press\_vapour} = \mathit{na}\ ,\ \text{press\_vapour} = \text{press\_sat\_a}$$

Pressure, Vapour, Deficit
(psi)

Not directly included in OM, but part of the calculations of et

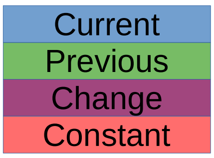




$$psi = \frac{psychroC}{\mathrm{press\_slope} + psychroC \times (1 + 0.34 \times \mathrm{vh\_x})}$$

Psychrometric C
(pyschroC)

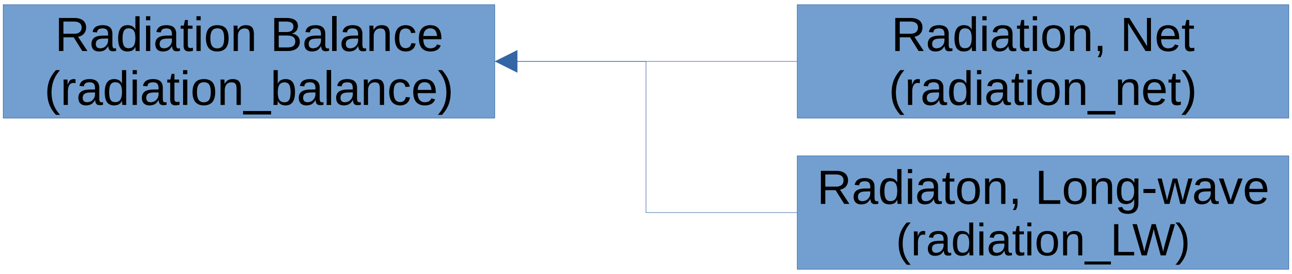
OM has 0.00065 in its calculation. Not sure if this an error by me, or a simplification in OM

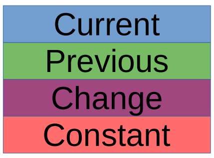


$$psychroC = 0.000665 \times press$$

Radiation, Balance
(radiation_balance / na)

Not directly included in OM, but part of the calculations of et

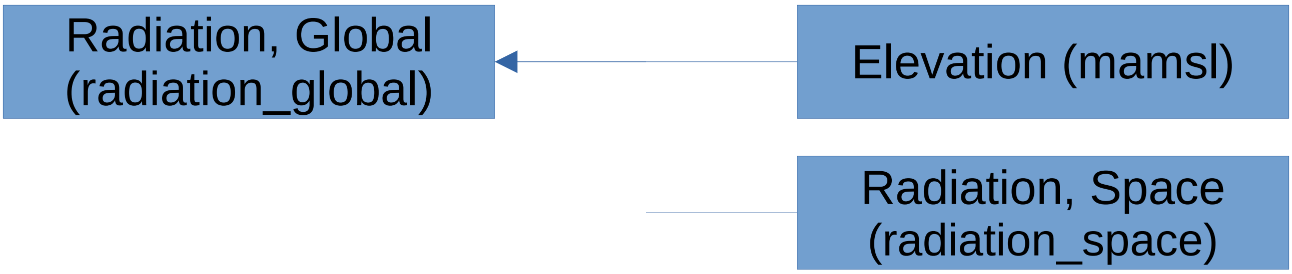


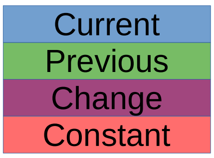


$$\text{radiation\_balance} = 0.408 \times \left(\text{radiation\_net} - \text{radiation\_LW}\right)$$

Radiation, Global
(radiation_global / Rso)

OM does not have the [+2x10-5 x mamsl] component.

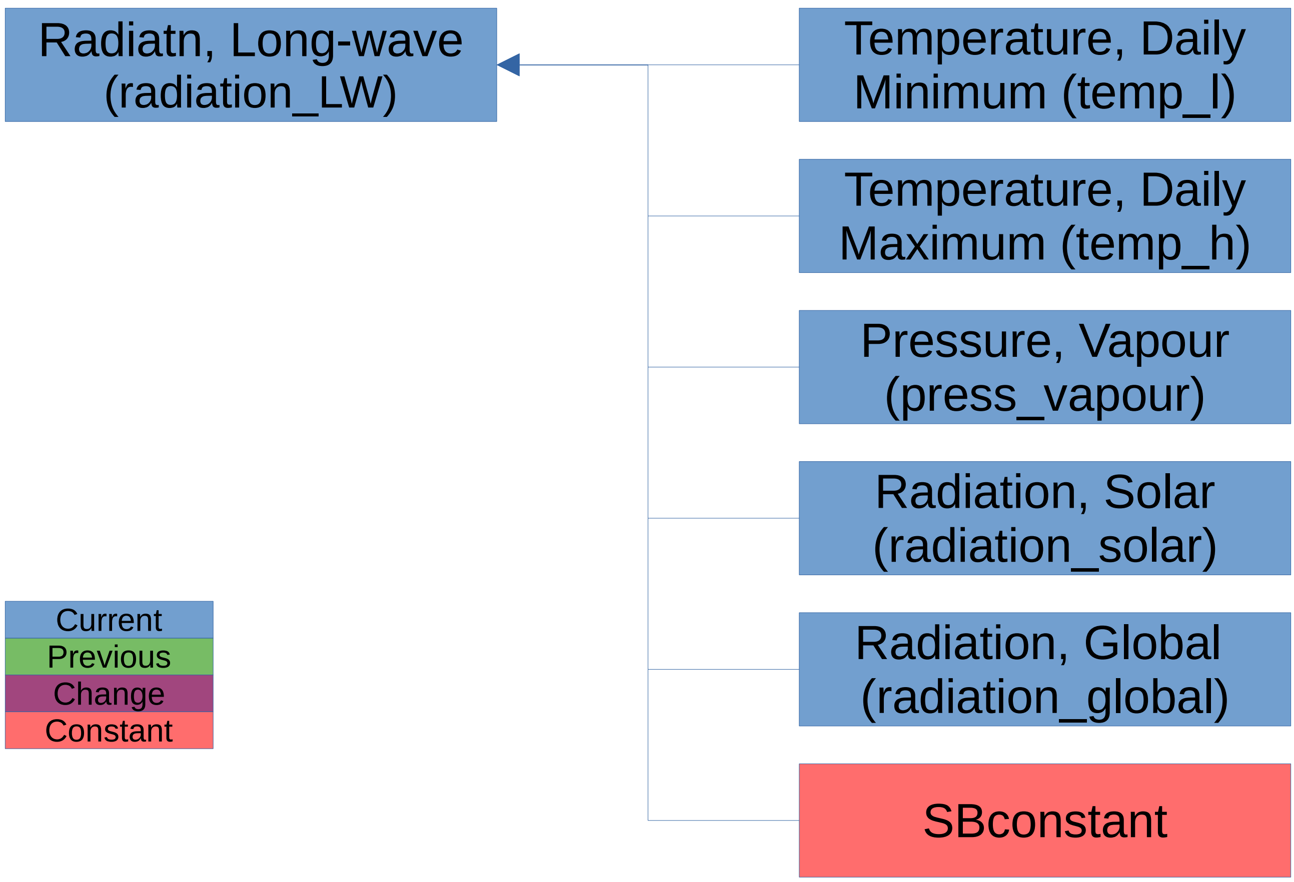




$$\text{radiation\_global} = \left(0.75 + 2\times10^{-5}\, mamsl\right) \times \text{radiation\_space}$$

Radiation, Long-wave (radiation_LW / Lnet)

Note that OM uses eActual^0.5 ≡ esMin^0.5 ≡ press_sat_l, instead of press_vapour^0.5 as used here.

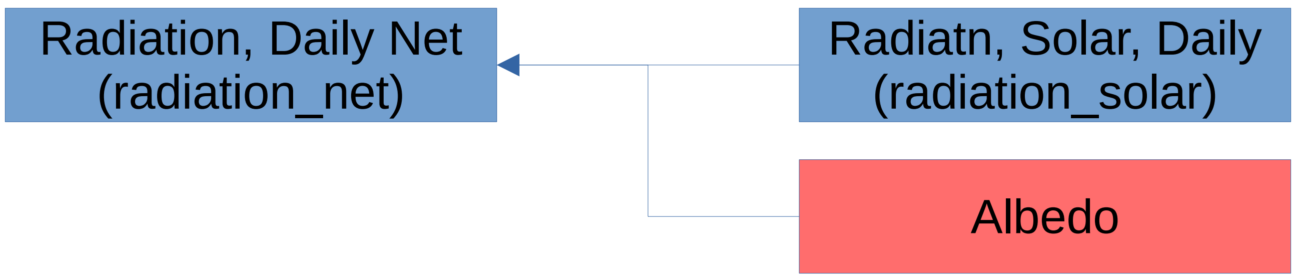


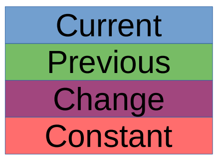
$$\text{radiation\_LW} = SBconstant \times 10^{-9} \times \left(\frac{(\text{temp\_l} + 273.16)^4 + (\text{temp\_h} + 273.16)^4}{2} \right)$$

$$\text{x} \left(0.34 - 0.14 \times \text{press\_vapour}^{0.5}\right) \times \left(\frac{1.35 \times \text{radiation\_solar}}{\text{radiation\_global}} - 0.35 \right)$$

Radiation, Daily Net
(radiation_net / Snet)
[MJ/m2/day]

Net short-wave radiation

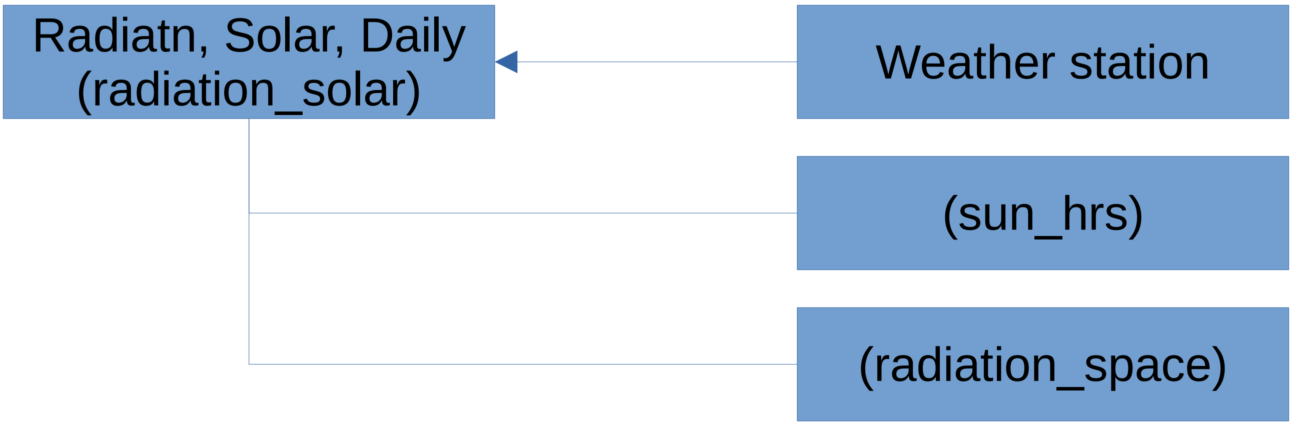


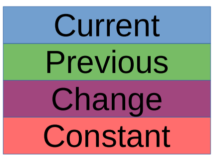


$$\text{radiation\_net} = (1 - Albedo) \times \text{radiation\_solar}$$

Radiation, Solar, Daily Total
(radiation_solar / Radiation)
[MJ/m2]

This is preferably taken direct from the weather stations, but if the data is missing, it can be calculated (method taken from OM). In OM, the constant 10 is called SunHrs, but has no description. It seems odd that the sun_hrs (≡ DaylightHrs in OM) is in the denominator here...



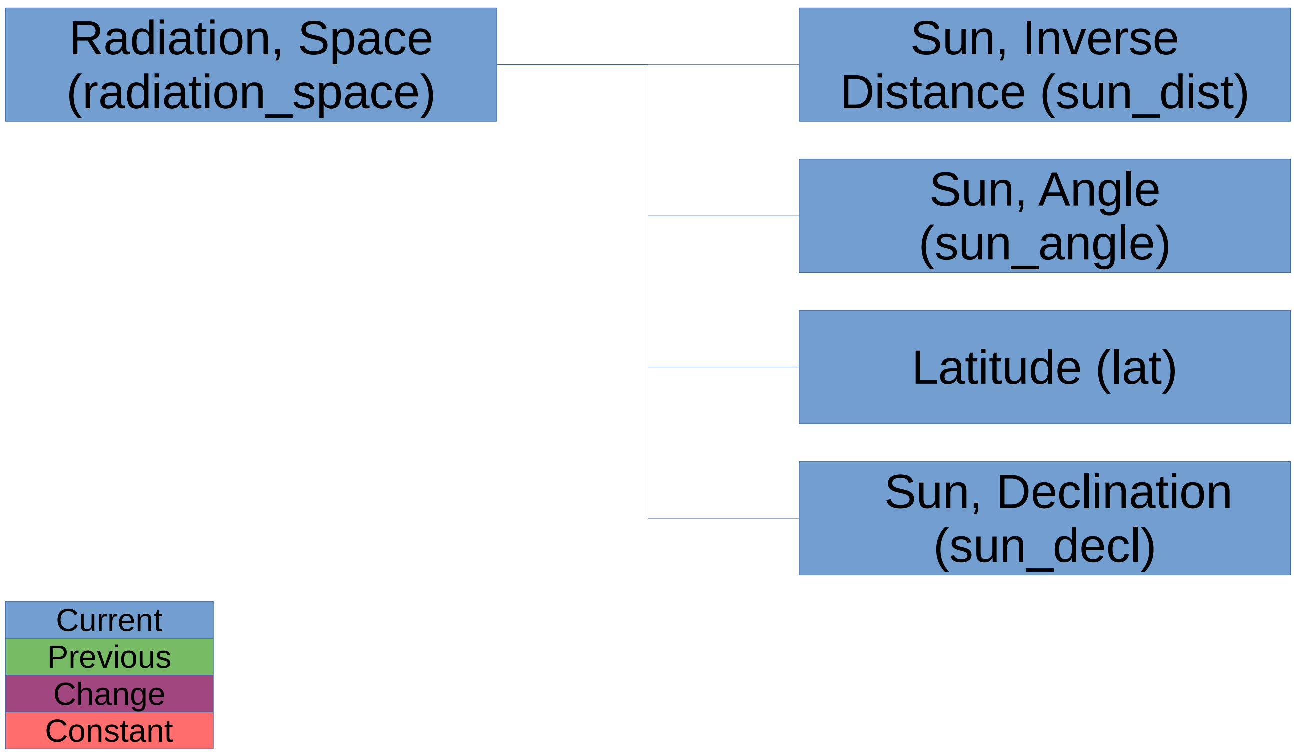


$$\textit{if}\ \mathrm{radiation\_solar} = na\,,\ \mathrm{radiation\_solar} = \left(0.25 + 0.5\,\frac{10}{\mathrm{sun\_hrs}}\right) \times 0.75 \times \mathrm{radiation\_space}$$

Radiation, Space
(radiation_space / Ra)
[]

Radiation at the top of the atmosphere.

OM uses 118.1 instead of 24 x 60 x sun_dist.



$$radiation\_space = \frac{24 \times 60 \times sun\_dist}{\pi} \times \left(sun\_angle \times \sin\left(\frac{lat \times \pi}{180}\right) \times \sin(sun\_decl) + \cos\left(\frac{lat \times \pi}{180}\right) \times \cos(sun\_decl) \times \sin(sun\_angle) \right)$$

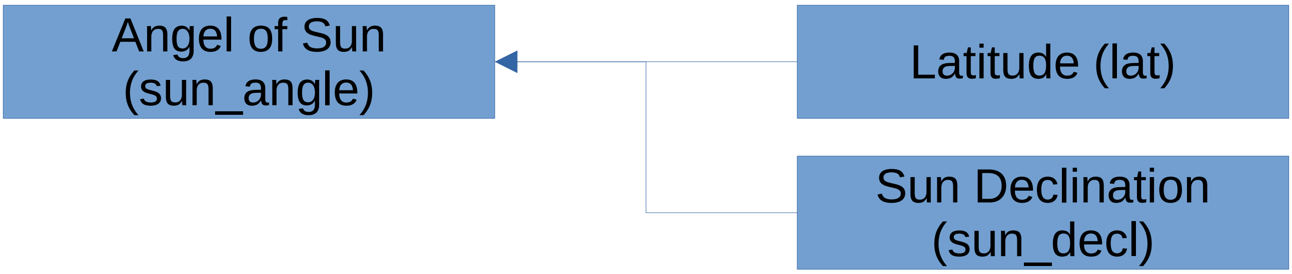
Sun, Angle Relative to Equator (Declination)
(sun_decl / dec)
[degrees]

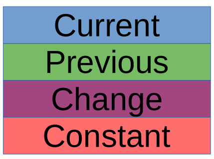
Current
Previous
Change
Constant

$$sun\_decl = 0.409 \times \sin\left(\frac{2 \times \pi \times doy}{365} - 1.39\right)$$

Sun, Angle Relative to Orbital Plane
(sun_angle / ws)
[degrees]

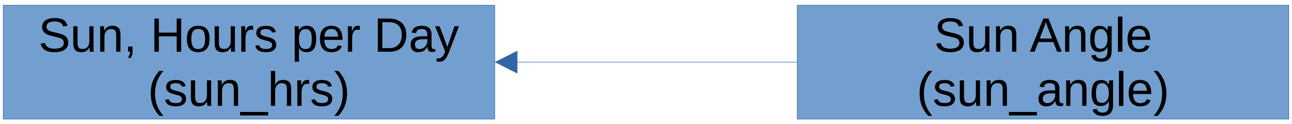
The angle of the sun relative to the equator is the declination (sun_decl). Note that lat x pi / 180 is used in the equation as R uses radian in trigonometry.

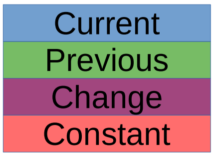




$$\text{sun\_angle} = acos\left(-\tan\left(\frac{lat \times \pi}{180}\right) \times \tan(\text{sun\_decl})\right)$$

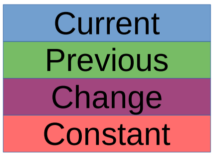
Sun, Hours per Day
(sun_hrs / DaylightHrs)
[]





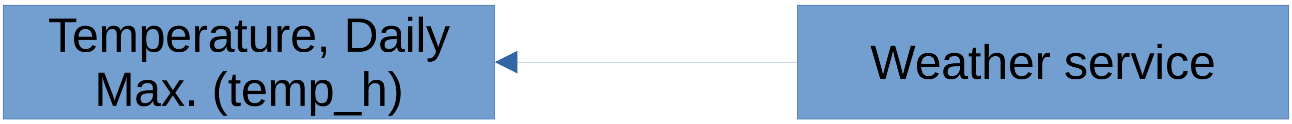
$$\text{sun\_hrs} = \frac{24 \times \text{sun\_angle}}{\pi}$$

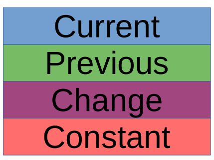
Sun, Inverse Distance
(sun_dist / dr)
[]



$$sun\_dist = 1 + 0.033 \times \cos\left(\frac{2 \times \pi \times doy}{365}\right)$$

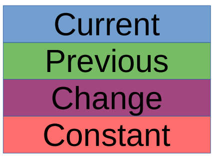
Temperature, Daily Maximum
(temp_h / Tmax)
[°C]





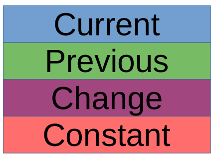
$$\text{temp\_h} = max\left(temp_t, for\ t \in \text{Daily\_obs}\right)$$

Temperature, Daily Mean
(temp_x / DailyTemp)
[°C]



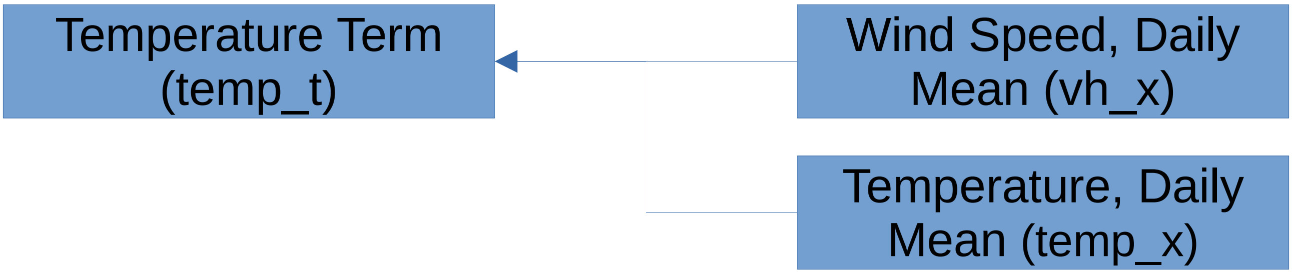
$$\text{temp\_x} = \frac{1}{n}\left(\sum_{i=1}^{n} temp_i\right)$$

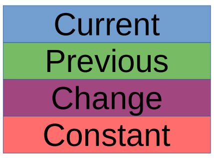
Temperature, Daily Minimum (temp_l / Tmin)



$$\text{temp\_l} = min\left(temp_t, for\ t \in \text{Daily\_obs}\right)$$

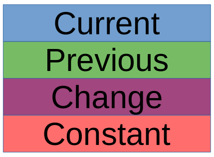
Temperature Term
(temp_t /)
[m/(sK)]





$$\text{temp\_t} = \frac{900 \times \text{vh\_x}}{\text{temp\_x} + 273.15}$$

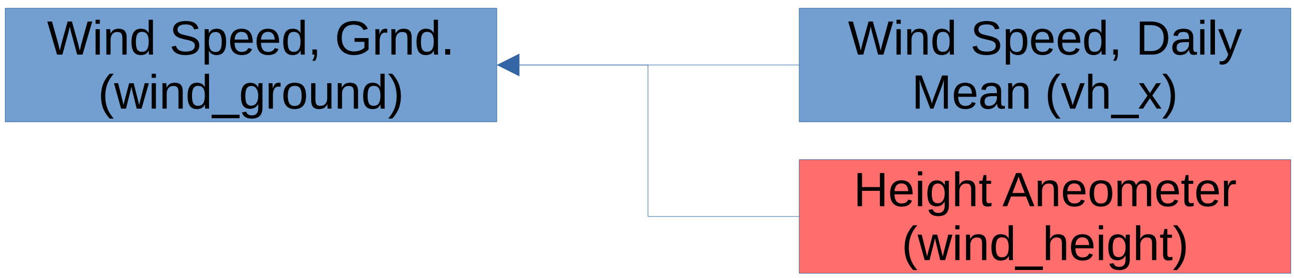
Wind, Speed, Daily Mean
(vh_x / WindSpeed)
[m/s]

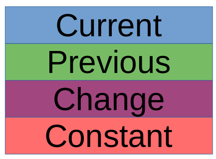


$$\mathrm{vh\_x} = \frac{1}{n}\left(\sum_{i=1}^{n} vh_i\right)$$

$$if\ \mathrm{vh\_x} = na,\ \mathrm{vh\_x} = 2$$

Wind, Speed, At Ground Level
(wind_ground)
[m/s]



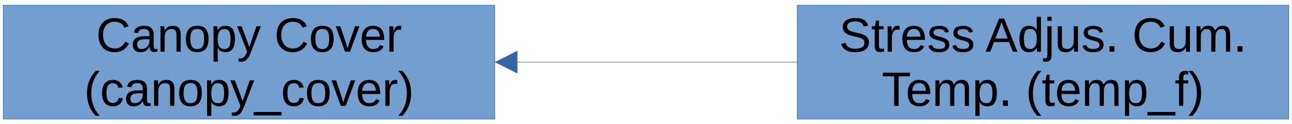


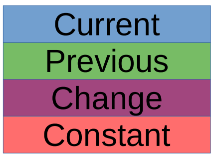
$$wind\_ground = \frac{vh\_x \times 4.87}{\log(67.8 \times wind\_height - 5.42)}$$

MAIN CALCULATIONS (ROW-WISE)

Canopy Cover
(canopy_cover / f)
[%]

A base level plus a sigmoidal growth fraction, dependent on the Stress Adjusted Cumulative Temperature (temp_f)





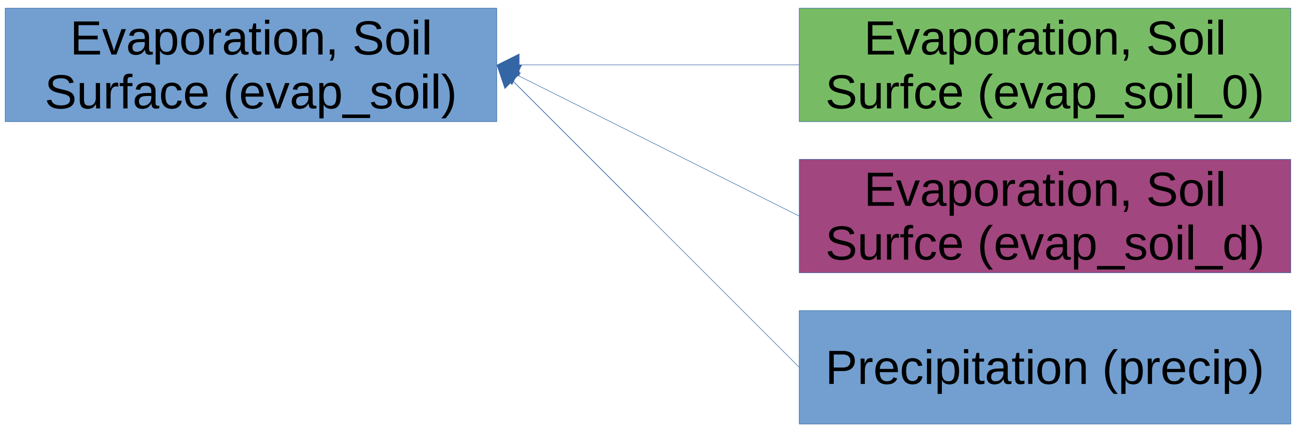
$$if\left(doy \geq \mathrm{sow\_doy}\right):$$

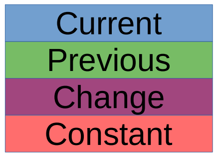
$$\mathrm{canopy\_cover} = 0.0015 + \frac{0.99 - 0.0015}{1 + \exp\left(-4 \times \log\left(\frac{\mathrm{temp\_f}}{1 - \mathrm{temp\_f}}\right)\right)}$$

$$if\left(doy < \mathrm{sow\_doy}\right) f = fZero$$

Evaporation, Soil Surface
(evap_soil / TotalSSE)

This is a combination of the OM steps, where TotalSSE.rate is calculated as evap_soil_d - precip





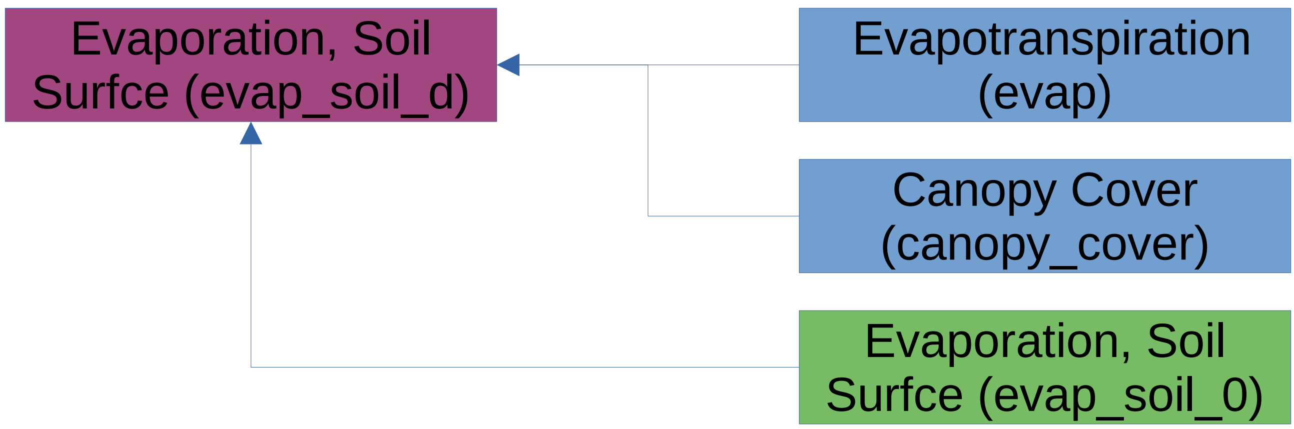
$$if\left(doy \geq \mathrm{doy\_sow}\right):$$

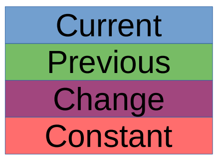
$$\mathrm{evap\_soil} = \mathrm{evap\_soil\_0} + \mathrm{evap\_soil\_d} - precip$$

$$if\left(\mathrm{evap\_soil} < 0\right), \mathrm{evap\_soil} = 0$$

$$if\left(doy < \mathrm{doy\_sow}\right), \mathrm{evap\_soil} = 0$$

Evaporation, Soil Surface, Change in / Daily (evap_soil_d / dSSE)

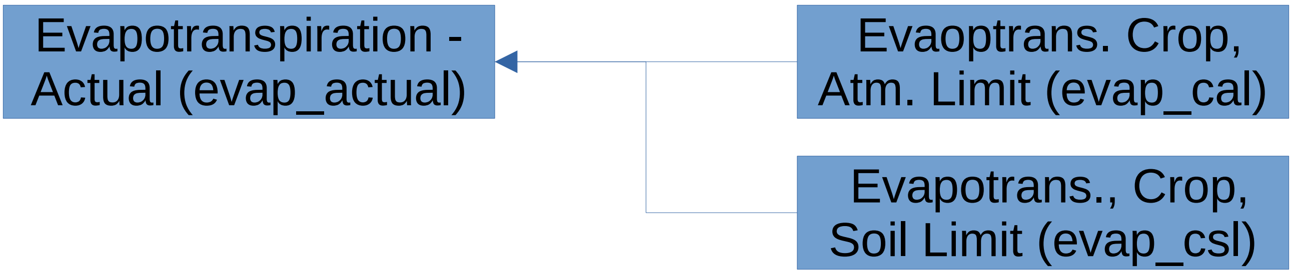


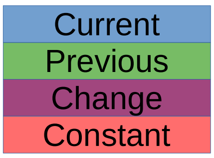


$$if\left(doy \geq \text{doy\_sow}\right):$$

$$\text{evap\_soil\_d} = \begin{cases} if\left(\text{canopy\_cover} < 1\right), min\left(1.5, evap\right) \times \left(1 - \text{canopy\_cover}\right) \\ if\left(\text{canopy\_cover} = 1\right), 0 \\ if\left(\text{evap\_soil\_0} > 20\right), 0 \end{cases}$$

Evapotranspriation, Crop, Actual
(evap_actual / ea)

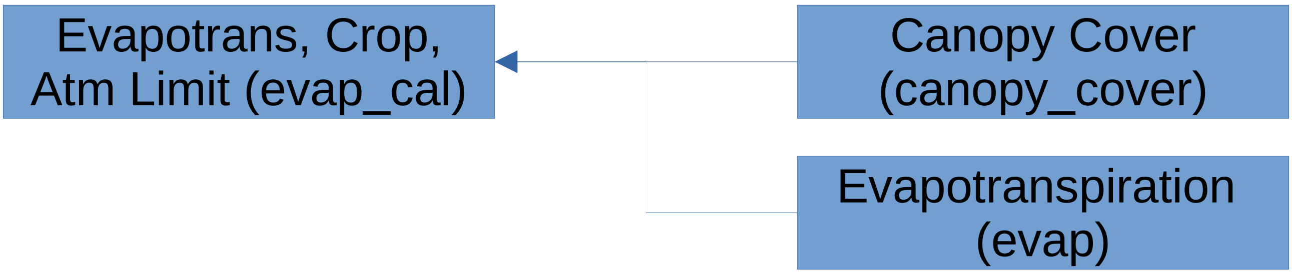


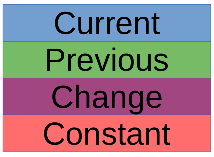


$$if\left(doy \geq \mathrm{doy\_sow}\right):$$

$$\mathrm{evap\_actual} = min\left(\mathrm{evap\_cal}, \mathrm{evap\_csl}\right)$$

Evapotranspiration, Crop, Atmosphere Limited
(evap_cal / eatmos).



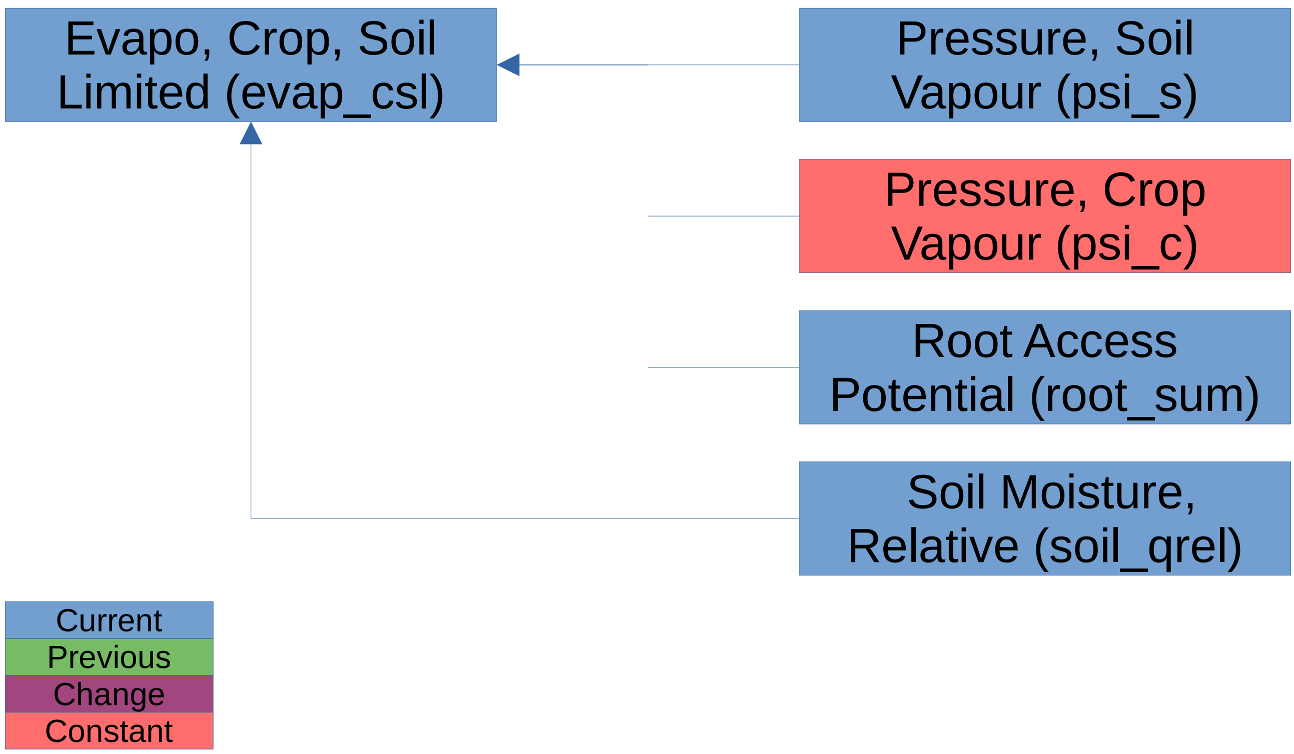


$$if\left(doy \geq \mathrm{doy\_sow}\right):$$

$$\mathrm{evap\_csl} = 1.2 \times \mathrm{canopy\_cover} \times evap$$

$$if\left(eatmos \leq 0\right) eatmos = 0.001$$

Evapotranspiration, Crop, Soil Limited (evap_csl / esoil)



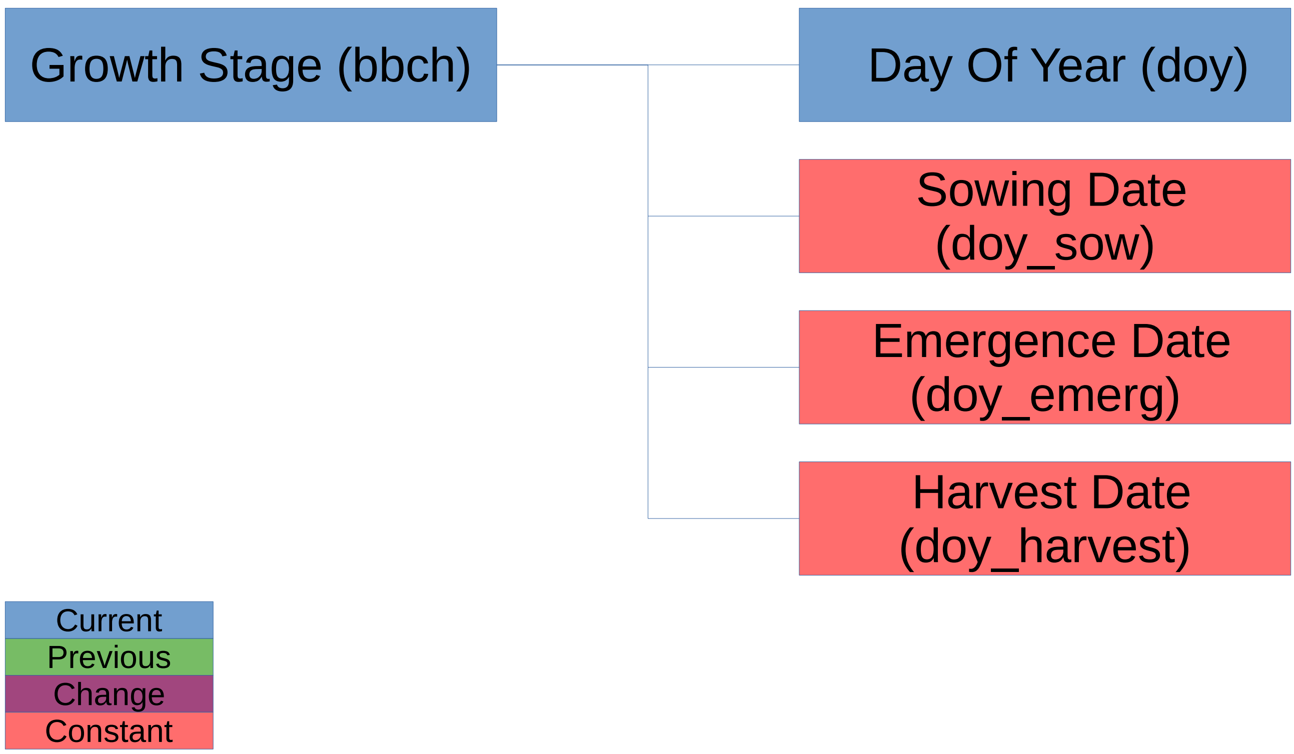
$$if\left(doy \geq \mathrm{doy\_sow}\right):$$

$$\mathrm{evap\_csl} = \frac{\psi_s - \psi_c}{rsum}$$

$$if\left(\mathrm{soil\_qrel} == 0\right), \mathrm{evap\_csl} = 0$$

Growth Stage (bbch)

The last conditional equation looks like an insurance policy. In OM, the variable Temp is used for this condition. Temp in R is a mix of both temp_b_cd_sow and temp_b_cd_em

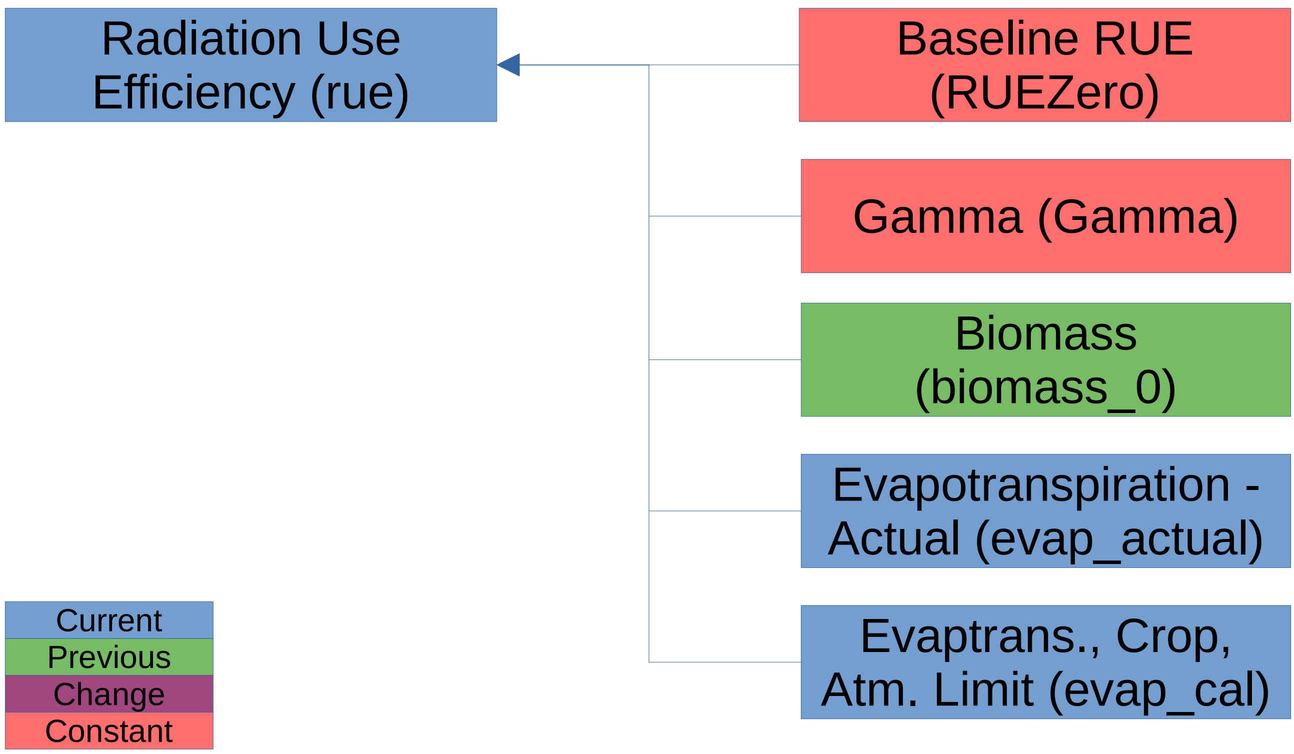


$$bbch=\begin{Bmatrix} if\left(doy \geq \mathrm{doy\_sow}, 01\right) \\ if\left(doy \geq \mathrm{doy\_emerg}, 09\right) \\ if\left(doy \geq \mathrm{doy\_harvest}, 99\right) \\ else\left(0\right) \end{Bmatrix}$$

$$if\left(\mathrm{doy\_emerg} \leq \mathrm{doy\_sow} \wedge \mathrm{temp\_b\_cd\_sow} \geq Tzero\right) bbch=09$$

Radiation Use Efficiency
(rue / RUE)

How much of the available solar energy can the plant use. Depends on amount biomass per hectare and the estimated rates of evapotranspiration.



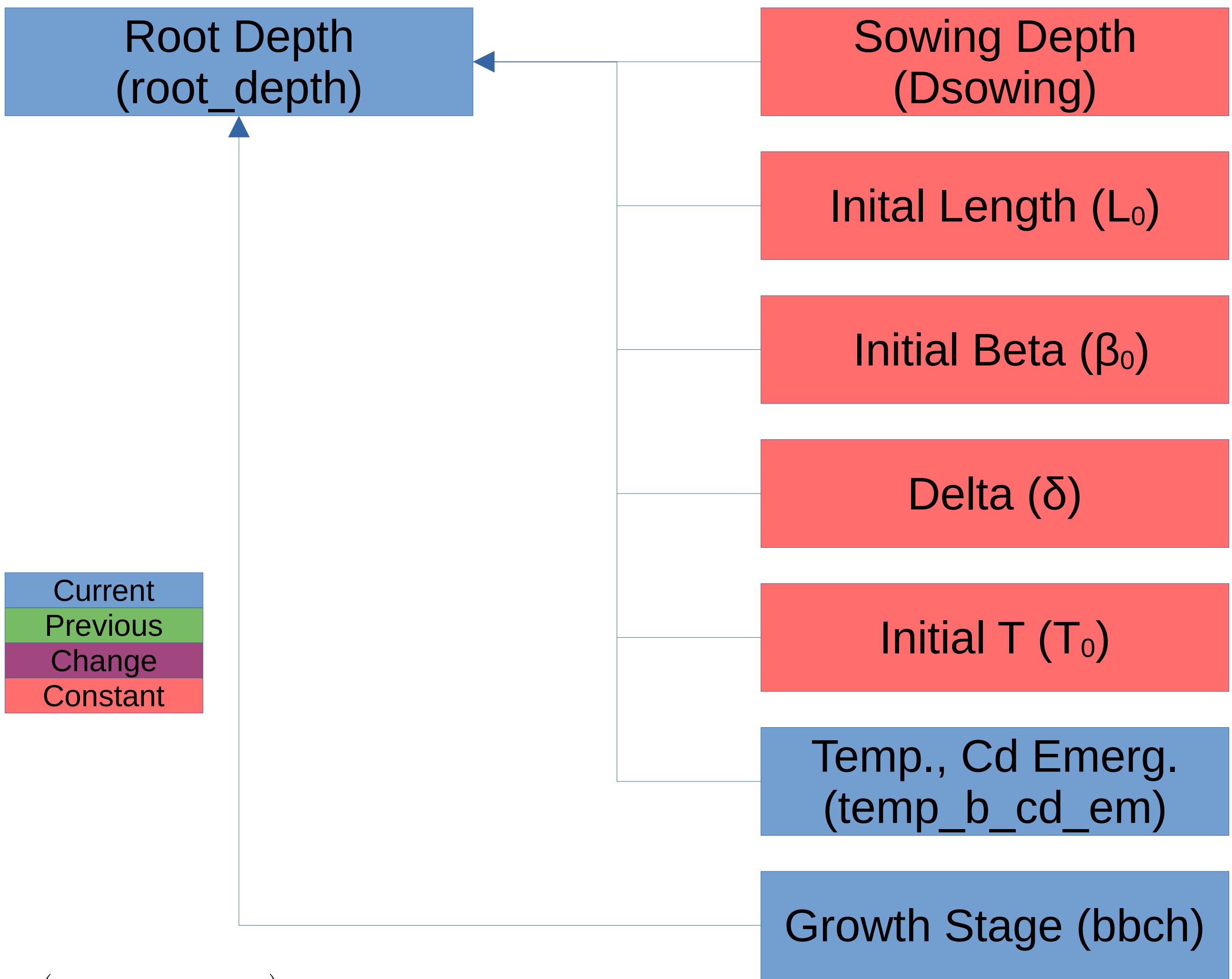
$$if\left(doy \geq \mathrm{doy\_sow}\right):$$

$$rue = 0.6 \times RUEZero \times \exp\left(-Gamma \times \mathrm{biomass\_0}\right) + \frac{0.4 \times RUEZero \times \mathrm{evap\_actual}}{\mathrm{evap\_cal}} \times \exp\left(-Gamma \times \mathrm{biomass\_0}\right)$$

$$rue = \left(RUEZero \times \exp\left(-Gamma \times \mathrm{biomass\_0}\right)\right)\left(0.6 + \frac{0.4 \times \mathrm{evap\_actual}}{\mathrm{evap\_cal}}\right)$$

Root depth
(root_depth)

Basically a function of sowing depth and cumulative temperature post-emergence.

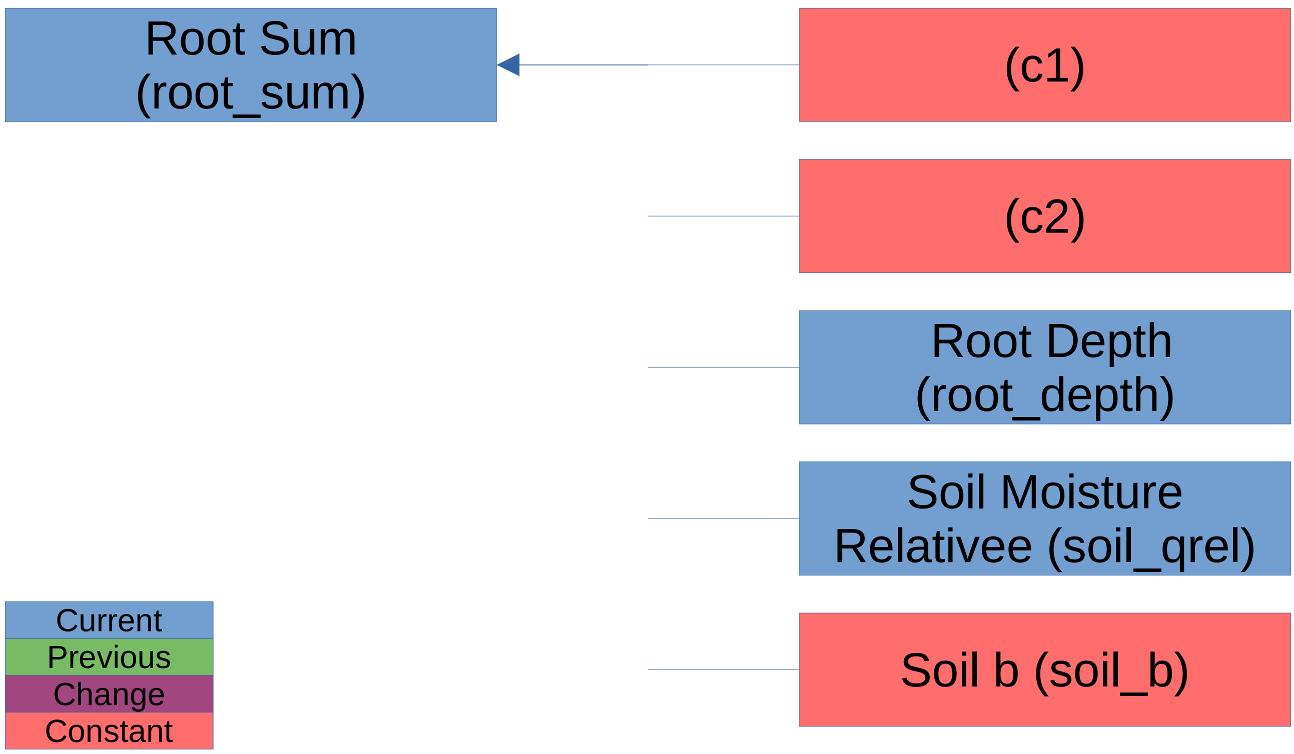


$$if\,(doy \geq \mathrm{doy\_sow}):$$

$$\mathrm{root\_depth} = Dsowing + L_0 * \exp\left(\frac{\beta \times (1 - \exp(-\delta \times (Cd_{em} - T_0)))}{\delta}\right)$$

$$if\,(bbch < 09)\ \mathrm{root\_depth} = Dsowing$$

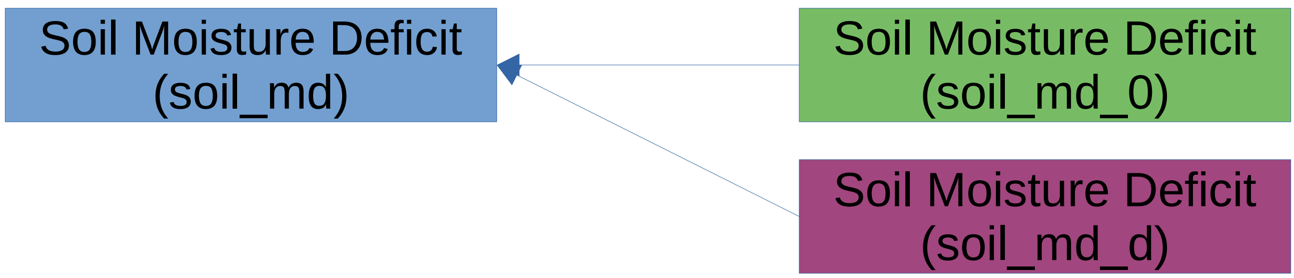
Root Sum
(root_sum)

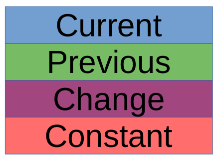


$$if\,(doy \geq \mathrm{doy\_sow}):$$
$$\mathrm{root\_sum} = c1 + \frac{c2 \times \mathrm{soil\_qrel}^{(-(2\times \mathrm{soil\_b}+3)-1)}}{\mathrm{root\_depth}}$$
$$if\,(\mathrm{soil\_qrel} == 0),\ \mathrm{root\_sum} = c1$$

Soil Moisture Deficit
(soil_md / SMD)

Estimate of how much more water the soil could hold.
Increases with soil_md_d > 0.





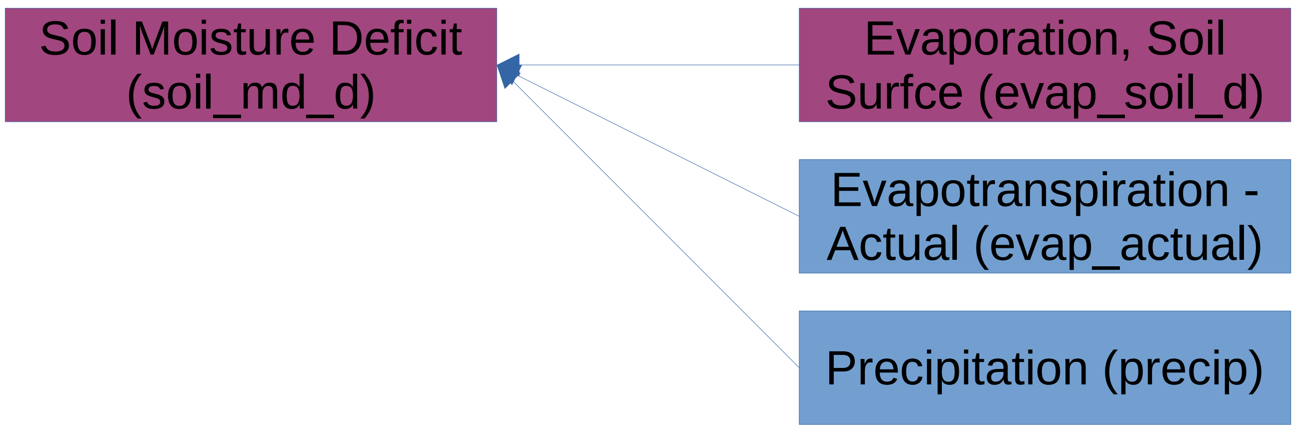
$$if\left(doy \geq \mathrm{doy\_sow}\right):$$

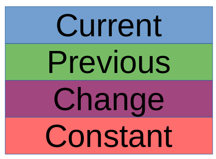
$$\mathrm{soil\_md} = \mathrm{soil\_md\_0} + \mathrm{soil\_md\_d}$$

$$if\left(doy < \mathrm{doy\_sow}\right), \mathrm{soil\_md} = 0$$

Soil Moisture Deficit, Change
(soil_md_d / SMD.rate)

The change in the amount of water in the soil. Positive if there is evaporation or transpiration, negative if there is rain. Taken as 0 if ΔSMD < 0 and SMD = 0 (IS IT????).



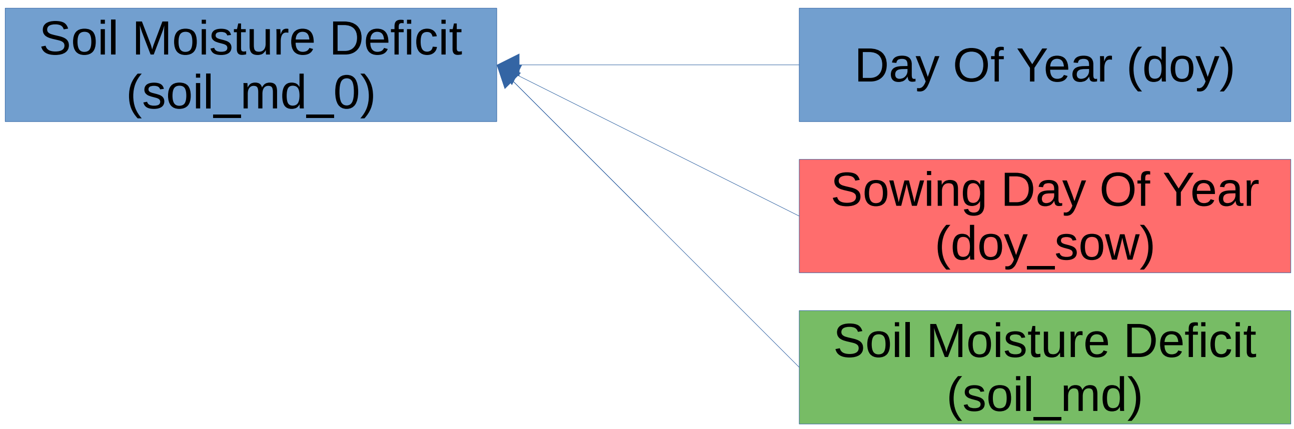


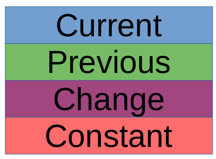
$$if\left(doy \geq \mathrm{doy\_sow}\right):$$

$$\mathrm{soil\_md\_d} = \mathrm{evap\_soil} + \mathrm{evap\_actual} - precip$$

Soil Moisture Deficit, Initial (soil_md_0)

Soil Moisture Deficit, Initial (soil_md_0) is given as from the previous period as the majority of the time.

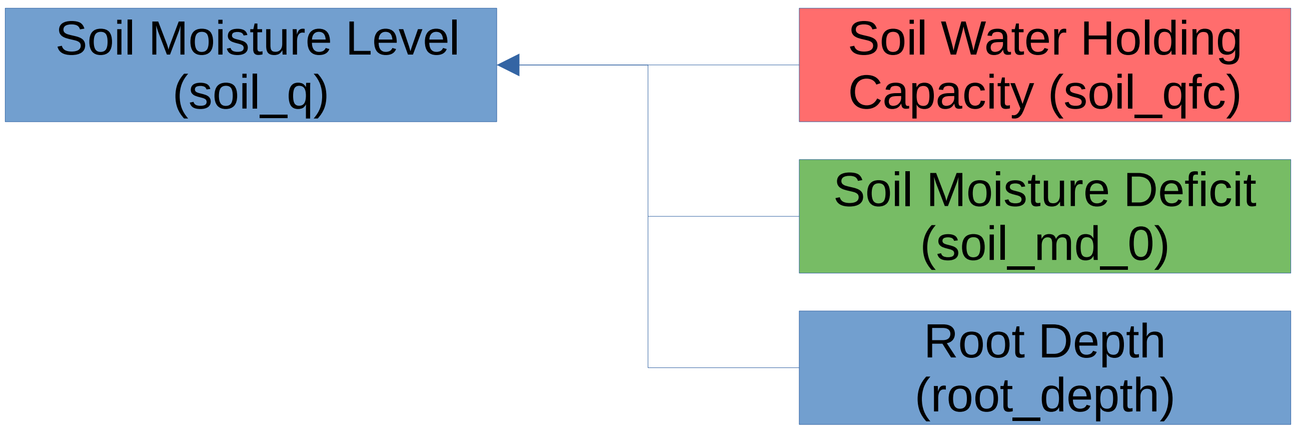


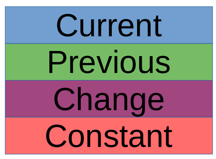


$$\mathrm{soil\_md\_0} = \begin{cases} if\,(doy < \mathrm{doy\_sow}), 20 \\ if\,(doy == \mathrm{doy\_sow}), 0 \\ if\,(\mathrm{soil\_md}_{t\text{-}1} < 0), 0 \\ else\,(\mathrm{soil\_md}_{t\text{-}1}) \end{cases}$$

Soil Moisture Level
(soil_q / Q)

Soil Moisture Deficit (soil_md_0) is given as from the previous period as the majority of the time, this is what it will be (see soil_md_0).



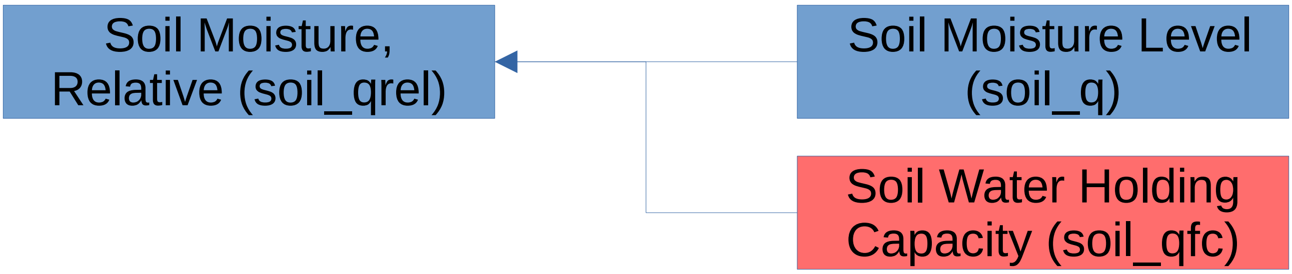


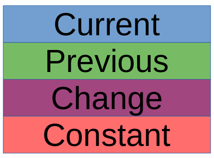
$$if\left(doy \geq \mathrm{doy\_sow}\right):$$

$$q = max\left(\mathrm{soil\_qfc} - \frac{\mathrm{soil\_md\_0}}{\mathrm{root\_depth}}, 0.01\right)$$

Soil Moisture, Relative Content
(soil_qrel / Qrel)

In the initial calculation, soil_qrel = (soil_q – soil_qpwp) / (soil_qfc - soil_qpwp)





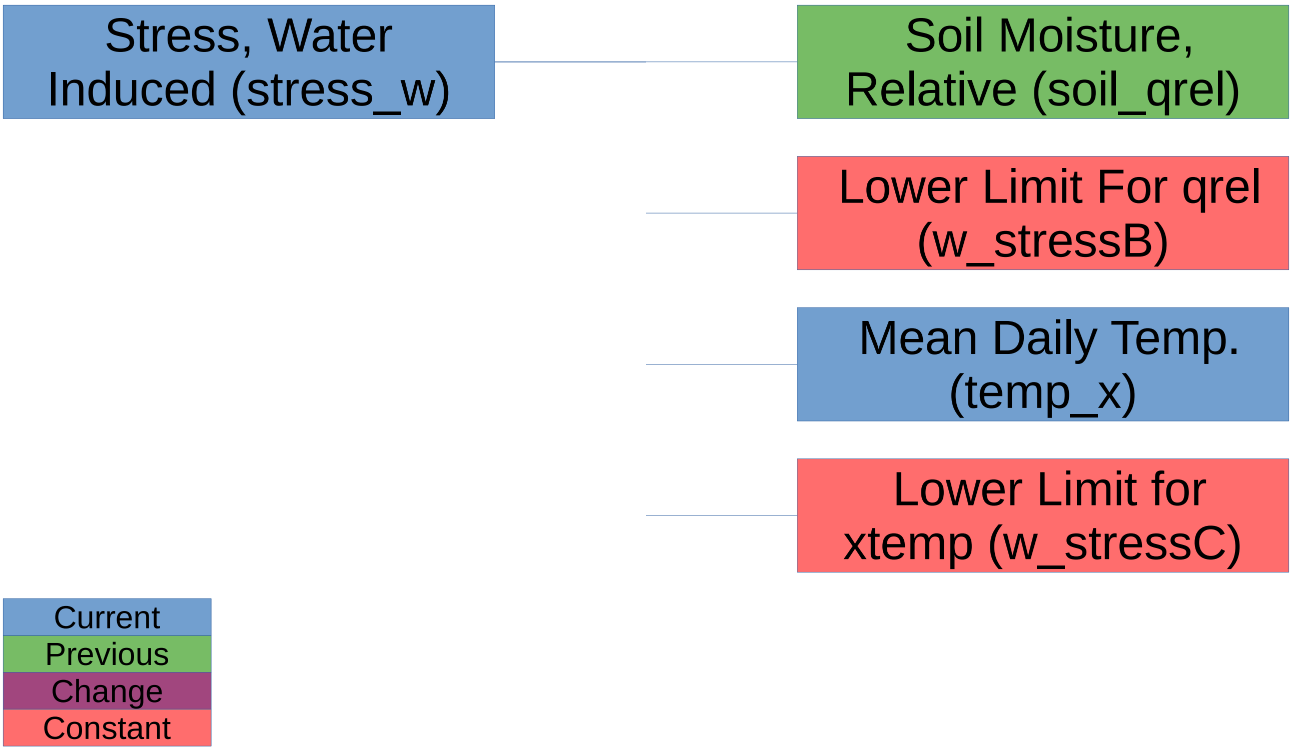
$$if\left(doy \geq \mathrm{doy\_sow}\right):$$

$$\mathrm{soil\_qrel} = \frac{\mathrm{soil\_q}}{\mathrm{soil\_qfc}}$$

$$if\left(doy < \mathrm{doy\_sow}\right)\mathrm{soil\_qrel} = 1$$

Stress, Water Deficit Induced
(stress_w)

NB: In my R code, I had w_stressC written as Wstresc at one point (last instance in calc of w_stress). Is this an error by me or an issue in the OpenModel version?

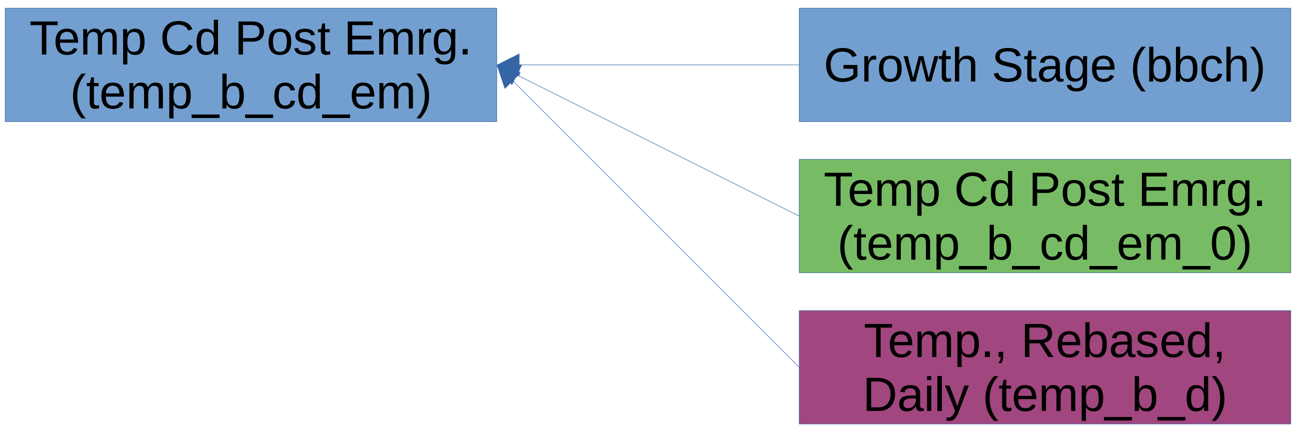


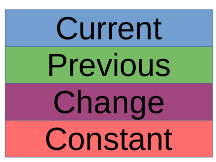
$$if\,(doy \geq \mathrm{doy\_sow}):$$

$$\mathrm{stress\_w} = \begin{cases} if\,(qrel < \mathrm{stress\_wB} \wedge \mathrm{temp\_x} > \mathrm{stress\_wC}), \left(\dfrac{\mathrm{soil\_qrel}}{\mathrm{stress\_wB}}\right)^{\mathrm{stress\_wC}} \\ else, 1 \end{cases}$$

Temperature, Rebased, Cumulative, Post Emergence (temp_b_cd_em / Temp)

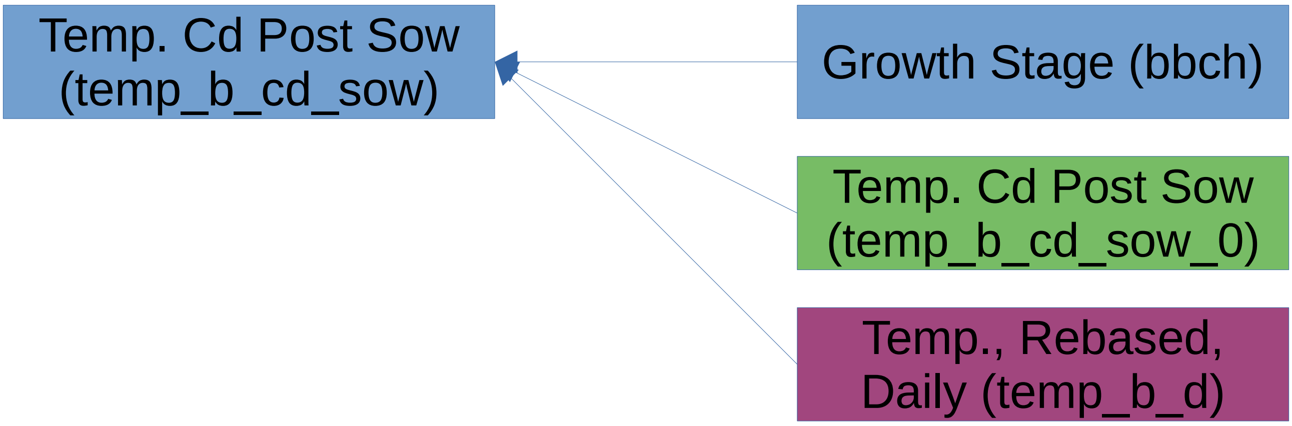
Temp in OM is equivalent to temp_cd_sow until emergence, when it goes over the temp_cd_em. There is also a days lag between the values





$$\mathrm{Cd\_em}_t = \begin{Bmatrix} if\left(bbch \geq 09, 90 + \mathrm{Cd\_em}_{t\text{-}1} + \Delta T\right) \\ else\left(0\right) \end{Bmatrix}$$

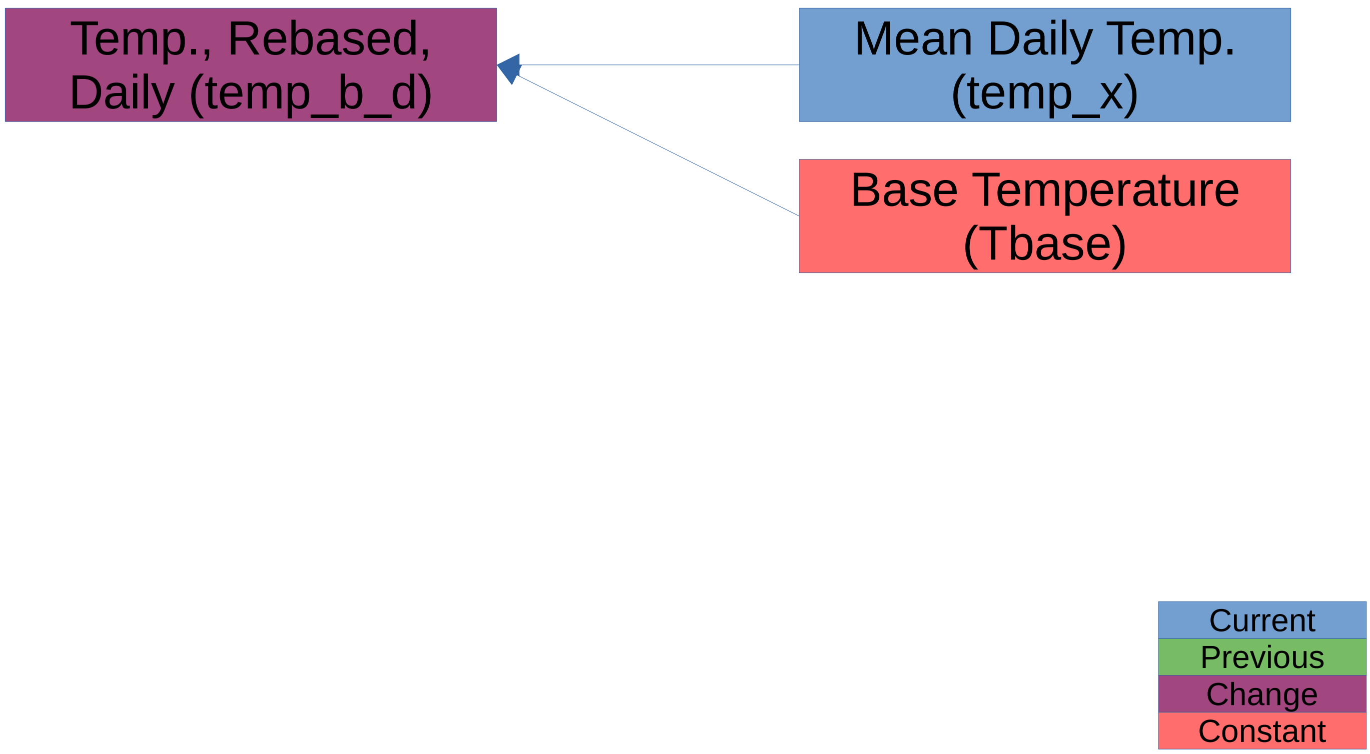
Temperature, Rebased, Cumulative, Post Sowing (temp_b_cd_sow / na)



Current
Previous
Change
Constant

$$\text{Cd\_sow}_t = \begin{cases} if\left(bbch \geq 01, \text{Cd\_sow}_{\text{t-1}} + \Delta T\right) \\ else\left(0\right) \end{cases}$$

Temperature, Re-Based, Daily
(temp_b_d / Temp.rate)

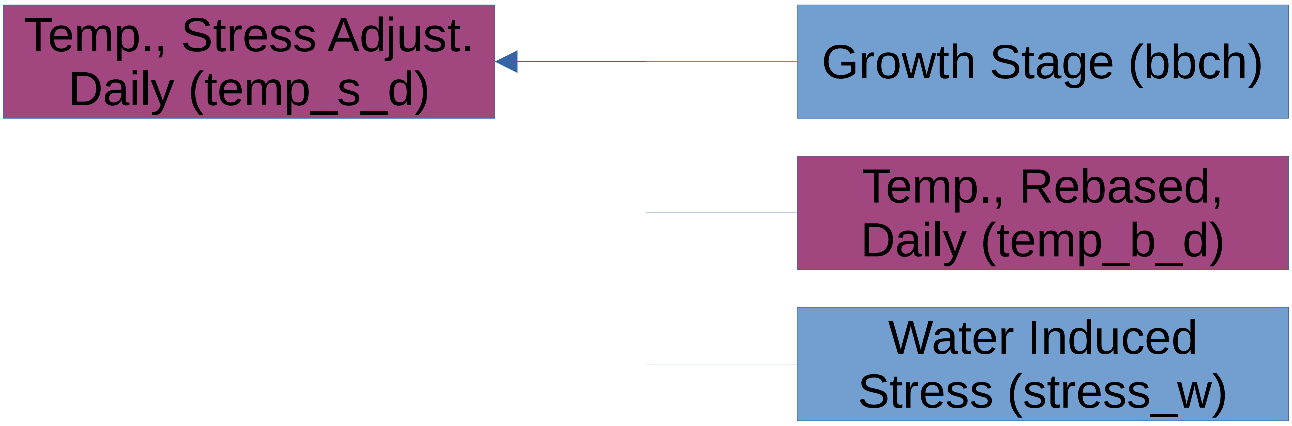


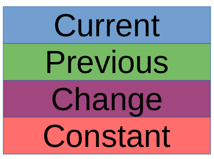
$$\text{temp\_d} = \text{temp\_x} - Tbase$$

$$if\,(\text{temp\_d} < 0),\ \text{temp\_d} = 0$$

Temperature, Stress Adjusted, Daily
(temp_s_d / DailyTemp)

OM uses temp_x – Tbase (3 C) instead of temp_b_d. This includes in the if statement, where the limits are 3 and 25, not 0 and 22.





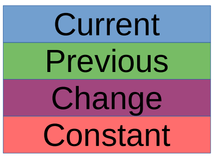
$$if\left(doy \geq \mathrm{doy\_sow}\right):$$

$$\mathrm{temp\_s\_d} = \begin{cases} if\left(\mathrm{temp\_b\_d} > 0 \wedge \mathrm{temp\_b\_d} < 22 \wedge bbch \geq 09\right), \mathrm{temp\_b\_d} \times \mathrm{stress\_w} \\ else, 0 \end{cases}$$

Temperature, Stress Adjusted, Cumulative
(temp_f / fTemp)

A fraction of Stress Adjusted Cumulative Temperature (Cd_stress). This seems unnecessary, except for...

Note that Cd_stress is readjusted after it is used to calculated fTemp, so fTemp can be above 0.950, but only by the amount of the current day’s Stress Adjusted Temperature.



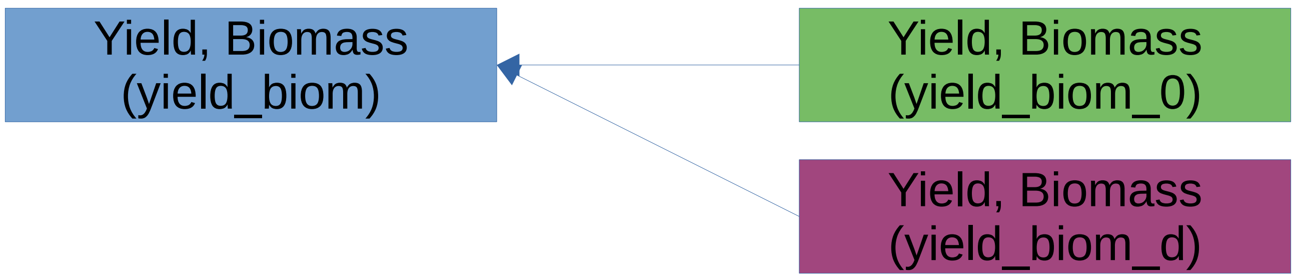
$$if\ (doy \geq \mathrm{doy\_sow}):$$

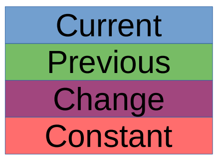
$$\mathrm{temp\_f} = \mathrm{temp\_s\_cd} \times 0.0001$$

$$if\ (temp_f \leq 0.00001)\ temp_f = 0.00001$$

Yield, Biomass
(yield_biom / Biomass)

Potential yield of biomass, dry matter (?) = root plus top(?)





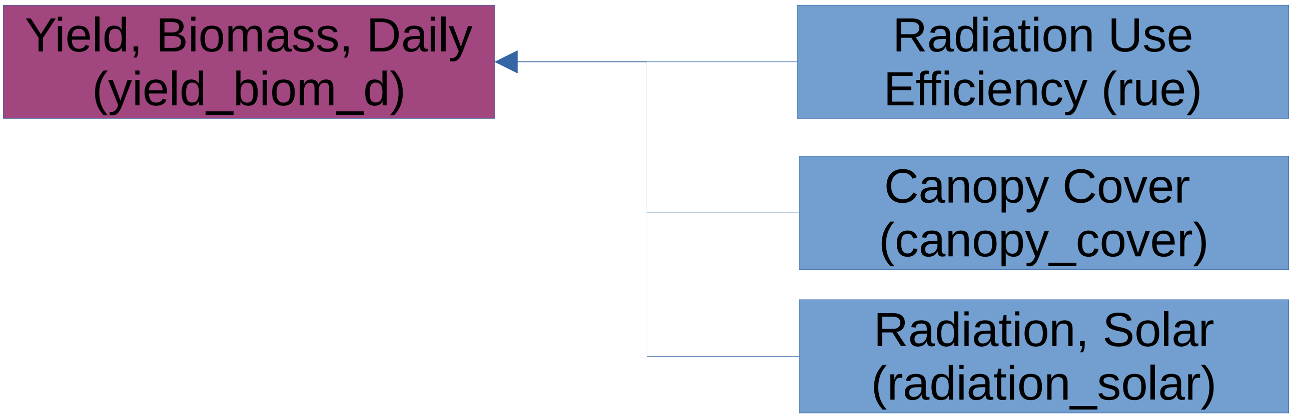
$$if\left(doy \geq \mathrm{doy\_sow}\right):$$

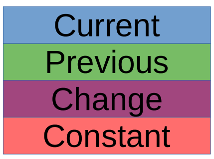
$$\mathrm{yield\_biom} = \mathrm{yield\_biom\_0} + \mathrm{yield\_biom\_d}$$

$$if\left(doy < \mathrm{doy\_sow}\right)\mathrm{yield\_biom} = 0$$

Yield, Biomass, Change in
(yield_biom_d / Biomass.rate)

Increase in biomass, dry matter(?) (root plus top(?)) in any given period.



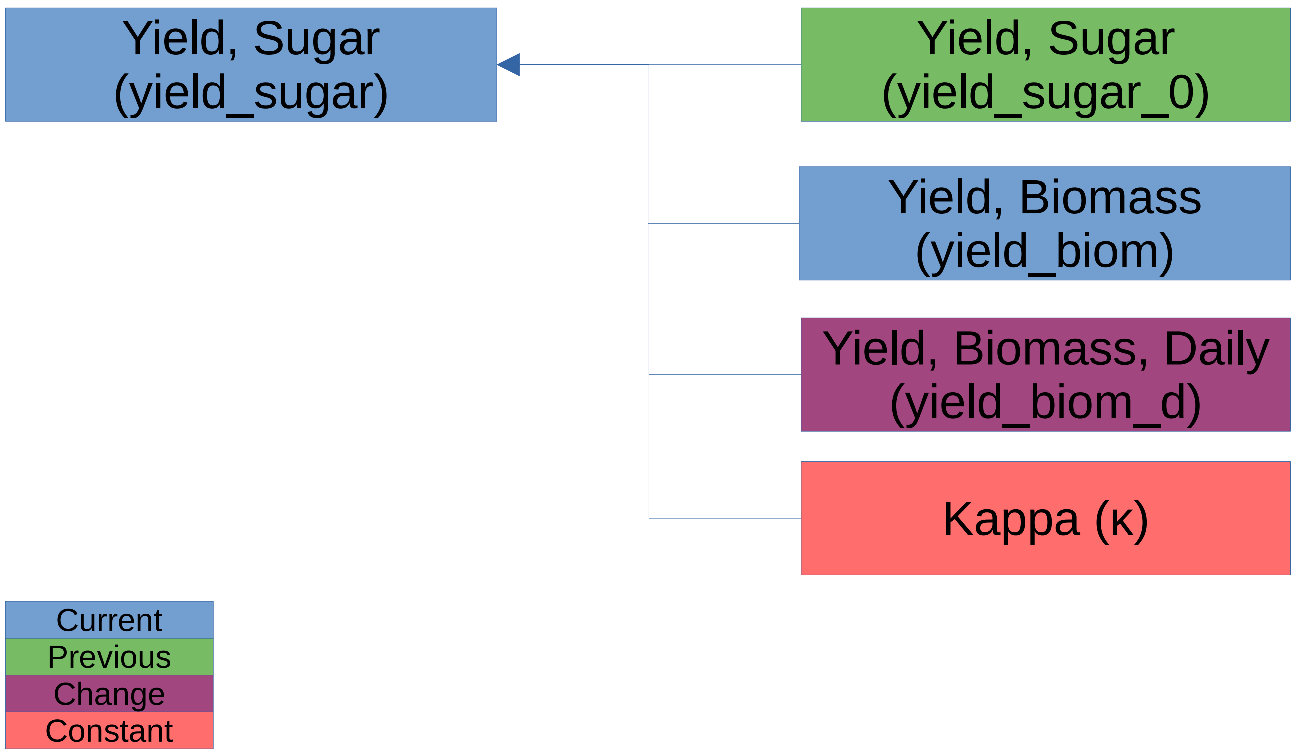


$$if\left(doy \geq \text{doy\_sow}\right):$$

$$\text{yield\_biom\_d} = rue \times \text{canopy\_cover} \times \text{radiation\_solar}$$

Yield, Sugar, Potential, Water limited
(yield_sugar / Yield)
[t/ha]

Potential sugar yield, water limited.



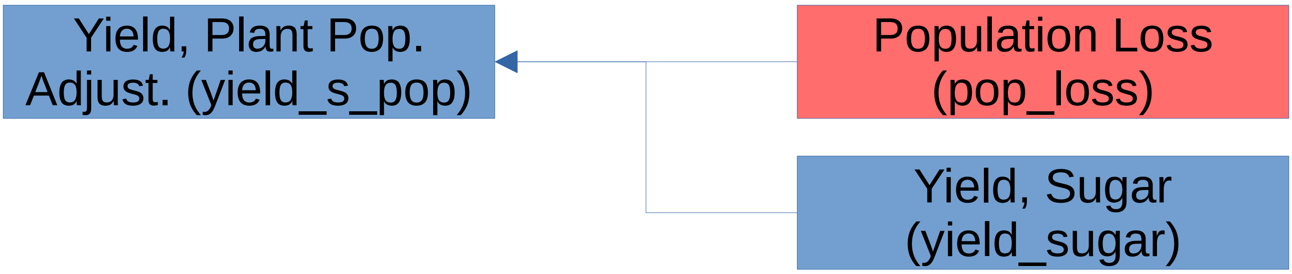
$$if\left(doy \geq \mathrm{doy\_sow}\right):$$

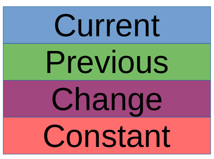
$$\mathrm{yield\_sugar} = \mathrm{yield\_sugar\_d} + \frac{\mathrm{yield\_biom\_d} \times \kappa \times \mathrm{yield\_biomass}}{1 + \kappa \times \mathrm{yield\_biomass}}$$

$$if\left(doy < \mathrm{doy\_sow}\right)\mathrm{yield\_sugar} = 0$$

Yield, Sugar, Plant Population Adjusted
(yield_s_pop)

Potential sugar yield adjusted for the observed plant population. Plant populations above 90 000 will result in no adjustment.



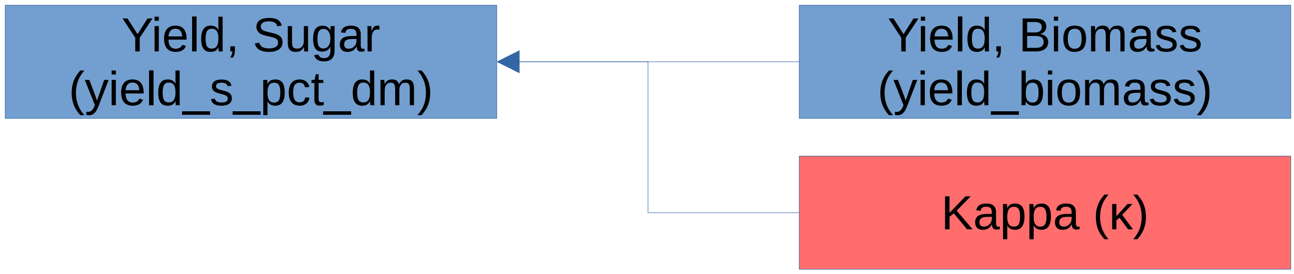


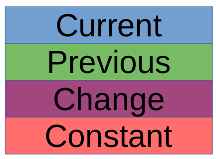
$$\mathit{if}\left(doy \geq \mathrm{doy\_sow}\right):$$

$$\mathrm{yield\_s\_pop} = \mathrm{pop\_loss} \times \mathrm{yield\_sugar}$$

Yield, Sugar, Percent of Dry Matter (?)
(yield_s_pct_dm / fsugar)

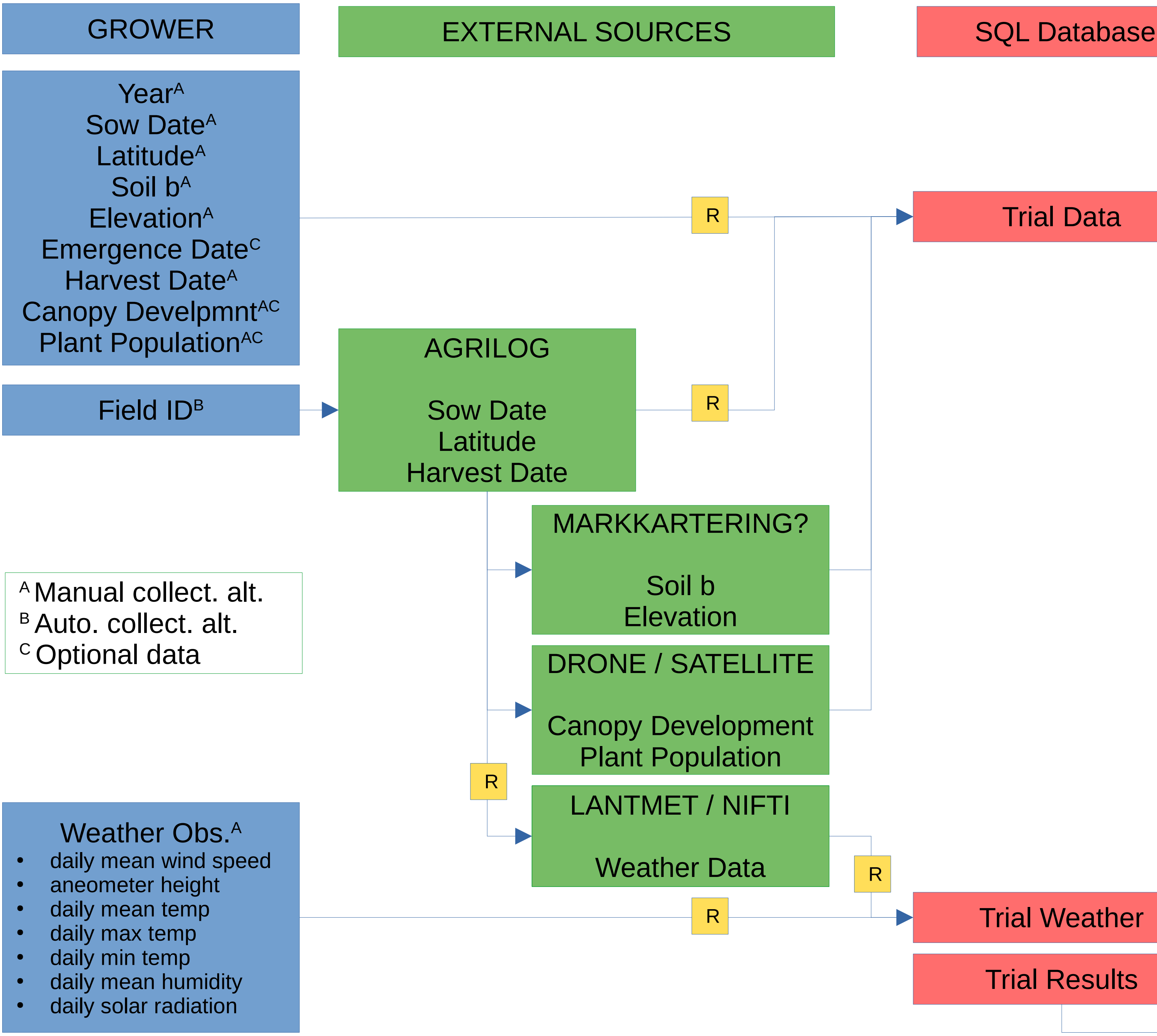
Potential sugar yield, percent of dry matter (?). Given Kappa is a constant, Sugar Yield Pct DM is in direct relation to the Biomass estimate.





$$if\left(doy \geq \mathrm{doy\_sow}\right):$$

$$\mathrm{yield\_s\_pct\_dm} = \frac{\kappa \times \mathrm{yield\_biomass}}{1 + \kappa \times \mathrm{yield\_biomass}}$$


GROWER
EXTERNAL SOURCES
SQL Database
Year^A
Sow Date^A
Latitude^A
Soil b^A
Elevation^A
Emergence Date^C
Harvest Date^A
Canopy Develpmnt^AC
Plant Population^AC
R
Trial Data
AGRILOG
Sow Date
Latitude
Harvest Date
Field ID^B
R
MARKKARTERING?
Soil b
Elevation
^A Manual collect. alt.
^B Auto. collect. alt.
^C Optional data
DRONE / SATELLITE
Canopy Development
Plant Population
R
LANTMET / NIFTI
Weather Data
Weather Obs.^A
• daily mean wind speed
• aneometer height
• daily mean temp
• daily max temp
• daily min temp
• daily mean humidity
• daily solar radiation
R
R
Trial Weather
Trial Results