Memo

To
Melissa Baustian (WI), Scott Duke-Sylvester, Jenneke Visser (UoL Lafayette)

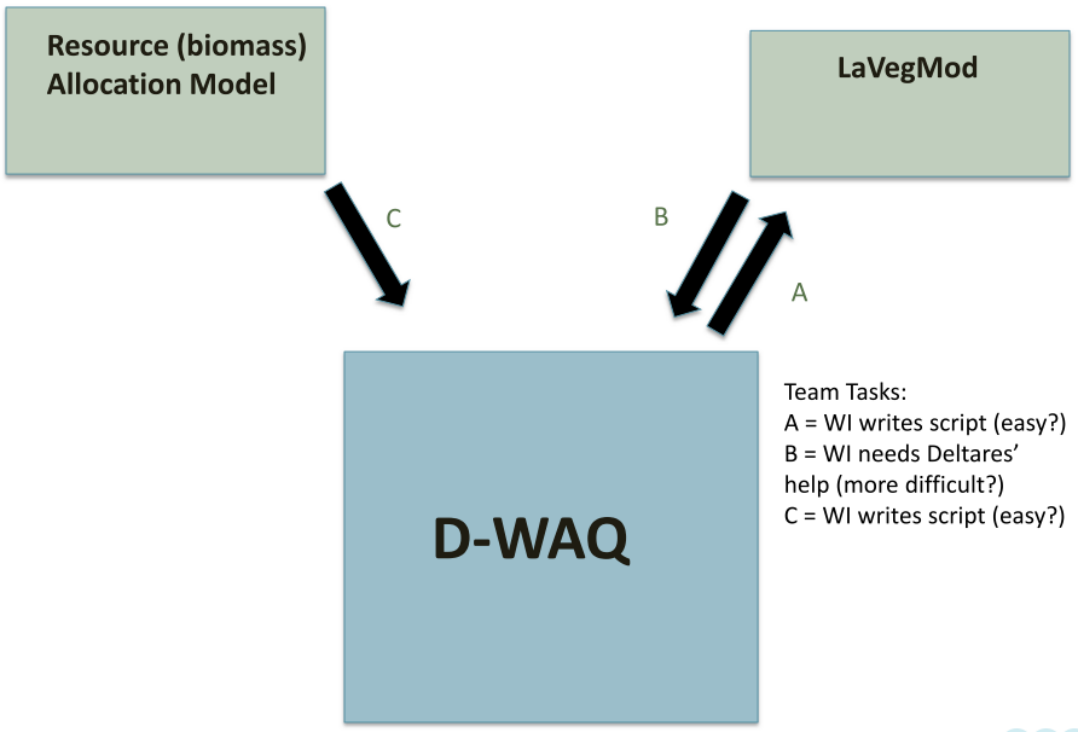
Date	Reference	Number of pages
2 December 2014	1209151-002-ZKS-0008	6
From	**Direct line**	**E-mail**
Johannes Smits	+31(0)88335 8155	johannes.smits@deltares.nl

Subject
WI TO27: Definition input-output parameters for Wetland vegetation modeling, version 3

---

1 Introduction

DWAQ's terrestrial vegetation module VEGMOD is to be extended with formulations to simulate wetland vegetation biomass (see memo 1209151-002-ZKS-0003). The extension requires a number of additional input and output parameters. A part of these parameters will be used to transfer information from DWAQ to LAVEGMOD and vice versa, and from the BIOMASS allocation model (ULL) to DWAQ. This was depicted by Melissa Baustian as follows:



The 3 models are run as stand-alone models, implying that models are coupled off-line and output-input parameter values are transferred before and after a year simulation with DWAQ. For the transfer output formats of the one model need to be converted into input formats of the other model, and interface scripts need to be constructed that do this in an automated procedure.

In this document the relevant input and output parameters of DWAQ's vegetation module VEGMOD are defined and described. This overview can be used to design and construct the transfer scripts.

2 DWAQ-VEGMOD input parameters

The input parameters for DWAQ-VEGMOD are listed below. A distinction is made between new input parameters and parameters that were already available for the original version of VEGMOD (the majority). If literature is indicated as a source of relevant data, the WI project team needs to undertake the collection of these data in collaboration with the UoL Lafayette team, as well as the determination of the best guess values and ranges. The parameters that have the highest priority are highlighted. The remaining parameters are numerical or logical parameters that will be determined pragmatically during model calibration.

The new VEGMOD requires the following additional input parameters:

Name	Symbol/Description	Unit	Type	Source
SwVegMod	option for growth and mortality formulations	-	constant	= 1 for wetland vegetation = 0 for terrestrial vegetation (default)
MinVB	minimum total biomass for each species	gC m^{-2}	constant	calibration, must be >0.0
Rc0GWVi	G_i^{20} - net growth rate for species i at 20 ^oC	day^{-1}	constant	literature and calibration
TcGWVi	kg_i - temperature coefficient of growth for species i	day^{-1}	constant	literature and calibration
AcGWVi	acg_i - acceleration factor for growth of species i	-	constant	calibration
MinRWVi	$MnBR_i$ - minimum biomass ratio	-	constant	calibration
TBmWVi	$BM_{for,i}$ - target total biomass for species i	tDM ha^{-1}	function	literature
AirTemp	T – daily average air temperature	^oC	function	meteo data
Rc0MSWVi	Ms_i^{20} - senescence mortality rate for species	day^{-1}	constant	literature and calibration

	i at 20 ^{o}C			
TcMSWVi	km_i - temperature coefficient of senescence mortality for species i	-	constant	literature and calibration
RcMGRWVi	Ms_i^{20} - grazing mortality rate for species i	g m^{-2} day^{-1}	time series or segment function	literature
AcMWVi	acm_i - acceleration factor for senescence mortality of species i	-	constant	calibration
MaxRWVi	$MxBR_i$ - maximum biomass ratio for species i	-	constant	calibration
CrdepVBi	critical depth for inundation mortality of species i	m	constant	literature and calibration
internal name *not implemented yet*	BMr_i - aboveground belowground biomass ratio for species i	-	internal look-up table or function of the concentration of available nutrients	biomass alloca-tion model ULL

i = index with values 1-9 (currently the maximum number of species/types in VEGMOD is 9)

The last parameter BMr_i in this table concerns item C in the above diagram. An output-input script would be needed for a look-up table. A function is to be preferred when it can be generic and simple so that we only need a few species specific input coefficients for this function.

VEGMOD for wetland vegetation additionally uses the following existing input parameters:

Name	Symbol/Description	Unit	Type	Source
SwIniVBi	option for initial biomass input parameter, use *IniVBi* or *IniCovVBi*	-	constant	=0 for t/ha biomass (default), =1 for % coverage
IniCovVBi	fa_i - percentage of area coverage for species i	%	parameter (default 10^{-6})	LAVEGMOD (ULL)
IniVBi *not used for the Barataria-Breton DWAQ model*	$BM_{dm,i}$ - initial total biomass for species i	tDM ha^{-1}	constant (default 10^{-3})	literature and calibration
F2VBi	$fr2BM_i$ - initial biomass fraction in compartment 2 (foliage) for species I, *F1VBi, F3VBi and F4VBi*	-	constant	literature and calibration

	are not used e.g. equal to zero			
F5VBi	*fr5BM$_i$* - initial biomass fraction in compartment 5 (fine roots) for species i	-	constant	literature and calibration
DMCfVBi	*dmc$_i$* - dry matter carbon ratio for species i	gDM gC^{-1}	constant	literature
RootDeVBi	rooting depth of species i	m	constant	literature
VegHeVBi	vegetation height of species i	m	constant	literature
CNF2VBi	*vn$_{1i2}$* - carbon nitrogen ratio for compartment 2 of species i	gC gN^{-1}	constant	literature
CNF5VBi	*vn$_{1i2}$* - carbon nitrogen ratio for compartment 5 of species i	gC gN^{-1}	constant	literature
CPF2VBi	*vn$_{1i2}$* - carbon phosphorus ratio for compartment 2 of species i	gC gN^{-1}	constant	literature
CPF5VBi	*vn$_{1i2}$* - carbon phosphorus ratio for compartment 5 of species i	gC gN^{-1}	constant	literature
CSF2VBi	*vn$_{1i2}$* - carbon sulphur ratio for compartment 2 of species i	gC gN^{-1}	constant	literature
CSF5VBi	*vn$_{1i2}$* - carbon sulphur ratio for compartment 5 of species i	gC gN^{-1}	constant	literature
FfacVBi	nutrient uptake form factor for species i	-	constant	fixed, default 1.0
RcMrtVBi	*Mi$_i$* - inundation mortality rate for species i	day^{-1}	constant	literature and calibration
CrnsfVBi	lag time for inundation mortality for species i	day	constant	literature and calibration
FfolPOC1	*Fd$_{1ij}$* - fraction of detritus from compartment 2 to POX1	-	constant	literature and calibration
FfolPOC2	*Fd$_{2ij}$* - fraction of detritus from compartment 2 to POX2	-	constant	literature and calibration
FfrootPOC1	*Fd$_{1ij}$* - fraction of detritus from compartment 5 to POX1	-	constant	literature and calibration
FfrootPOC2	*Fd$_{1ij}$* - fraction of detritus from compartment 5 to	-	constant	literature and calibration

	POX2			
SwDisVBi	vertical distribution option for mortality detritus fluxes for species i	-	constant	fixed, default 1.0
VBFrMaxU	maximal fraction of nutrients taken up in a timestep	-	constant	calibration
Initnsfd	inundation period prior to simulation start time	day	constant	modeler

The fractions of dead biomass allocated to the detritus pools can be determined on the basis of overall decomposition rate data for the plant detritus from the literature, relative to the decomposition rates of the detritus components in the model (generic values).

The input parameter to be provided by LAVegMod to DWAQ-VEGMOD is the percentage of area coverage for each species specified on the DWAQ computational grid (item B in the above diagram). This requires in fact a table with the grid cell numbers in the first column followed by the percentages of all potentially present vegetation species (types). We will probably convert an ascii table into a binary table. If DWAQ's and LAVegMod's grids are the same the transfer to DWAQ would only involve a change of format. However, it was decided to base LaVegMod on the DFLOW grid, which necessitates averaging of the coverage fractions/percentages for aggregated grid cells in DWAQ. The fractions should still add up to 1 after averaging. Possibly, scaling is necessary to make them add up to 1.

3 DWAQ-VEGMOD additional output parameters

The new VEGMOD model will produce the following additional output parameters:

Name	Description	Unit
rMrtVBi	actual total first order mortality rate for species i, for senescence and inundation, including temperature and acceleration effects (grazing not included)	day^{-1}
fMrtVBi	actual total mortality flux for species i, including senescence, inundation and grazing mortality, possibly limited by minimum biomass (MinVB)	$gC\ m^{-2}\ day^{-1}$

4 DWAQ output parameters for LAVegMod

DWAQ's output parameters for LAVegMod concern item A in the above diagram. The relevant output parameters will be available from additional "statistics" output as specified on the DWAQ grid. This includes:

- for wetland vegetation species, the standard deviation of the water depth (level) and the means of salinity and water temperature for a full year.
- for SAV, the means of water depth (level), salinity, water temperature and secchi depth for a the summer half year period (May 1 to October 30).

NB1: It was pursued to include turbidity as a habitat condition in LaVegMod, which failed because it turned out to be a reliable measure for light limitation. Instead secchi depth could be used.
NB2: Nutrients are relevant to vegetation too, but currently nutrients are not taken into account in LaVegMod. When they would be considered in a future version, DWAQ should provide means of total available nutrient quantities (for wetland vegetation, ammonium plus nitrate and adsorbed plus dissolved phosphorus within rooting depth per m^2; for SAV, ammonium plus nitrate and adsorbed plus dissolved phosphorus within water column and rooting depth per m^2). Phosphorus may turn out to be abundantly available and therefore not critical for species composition. Generating quantities per m^2 requires some post-processing of concentration data generated by the DWAQ model.

If DWAQ's and LAVegMod's grids are the same the transfer to LAVegMod would only involve a change of format. However, it was decided to base LaVegMod on the DFLOW grid, which necessitates disaggregation of the data from the aggregated grid cells in DWAQ.

Copy for
Ehab Meselhe, Ashok Khadka, Hoonshin Jung (WI),
Ellis Penning, Jasper Dijkstra, Tineke Troost, Hans Los, Jos van Gils, Michel Jeuken