

Analysis of vegetation-atmosphere transfers simulated by the Interaction Soil-Biosphere-Atmosphere (ISBA) model for a beech forest in Lorraine, France

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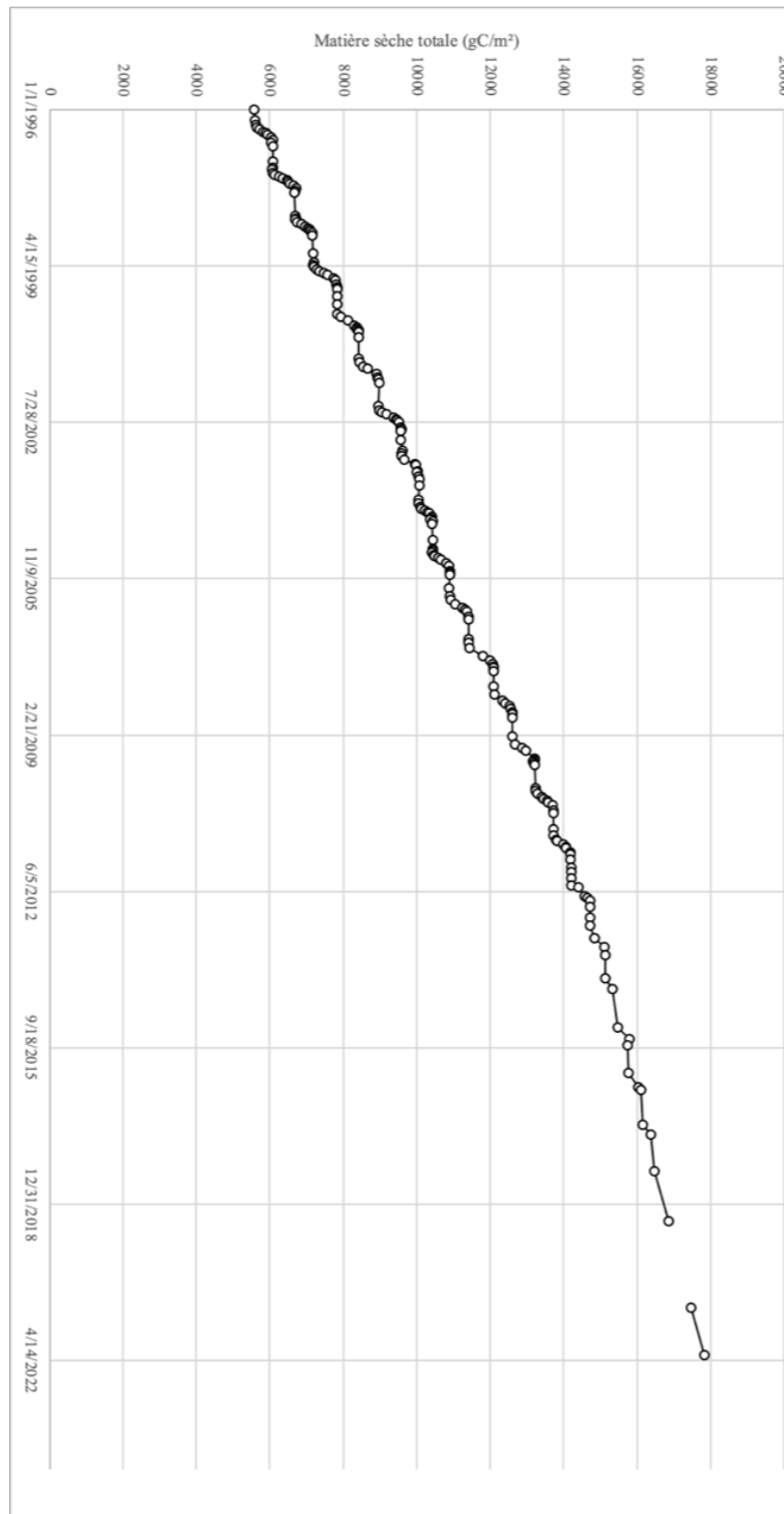
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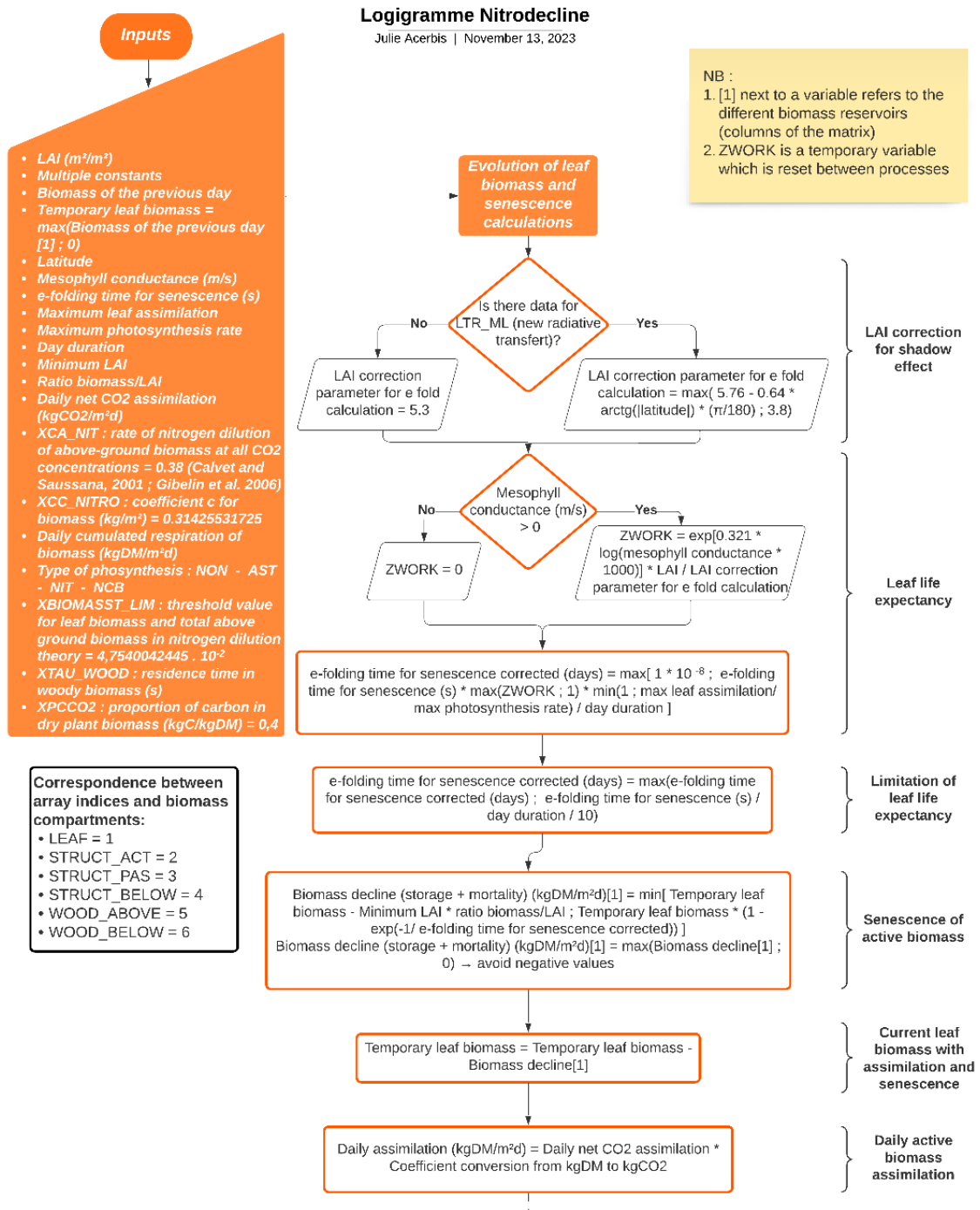
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A Temporal evolution of total dry matter using the allometric relation of Ottorini, 2012 from Montigny (2021-2022)



B Nitrodecline.F90 flow chart



LAI correction for shadow effect

Leaf life expectancy

Limitation of leaf life expectancy

Senescence of active biomass

Current leaf biomass with assimilation and senescence

Daily active biomass assimilation

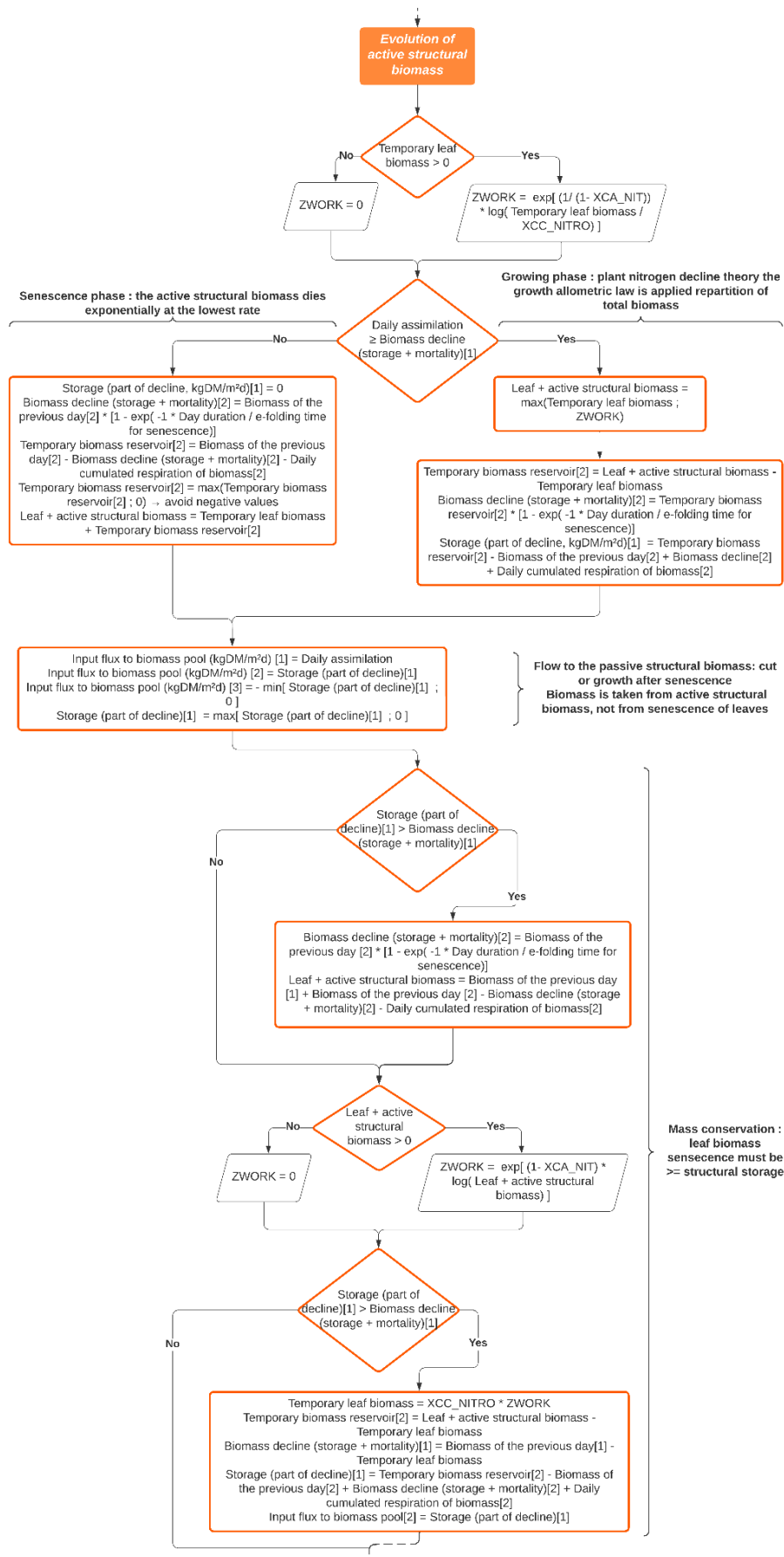
Correspondence between array indices and biomass compartments:

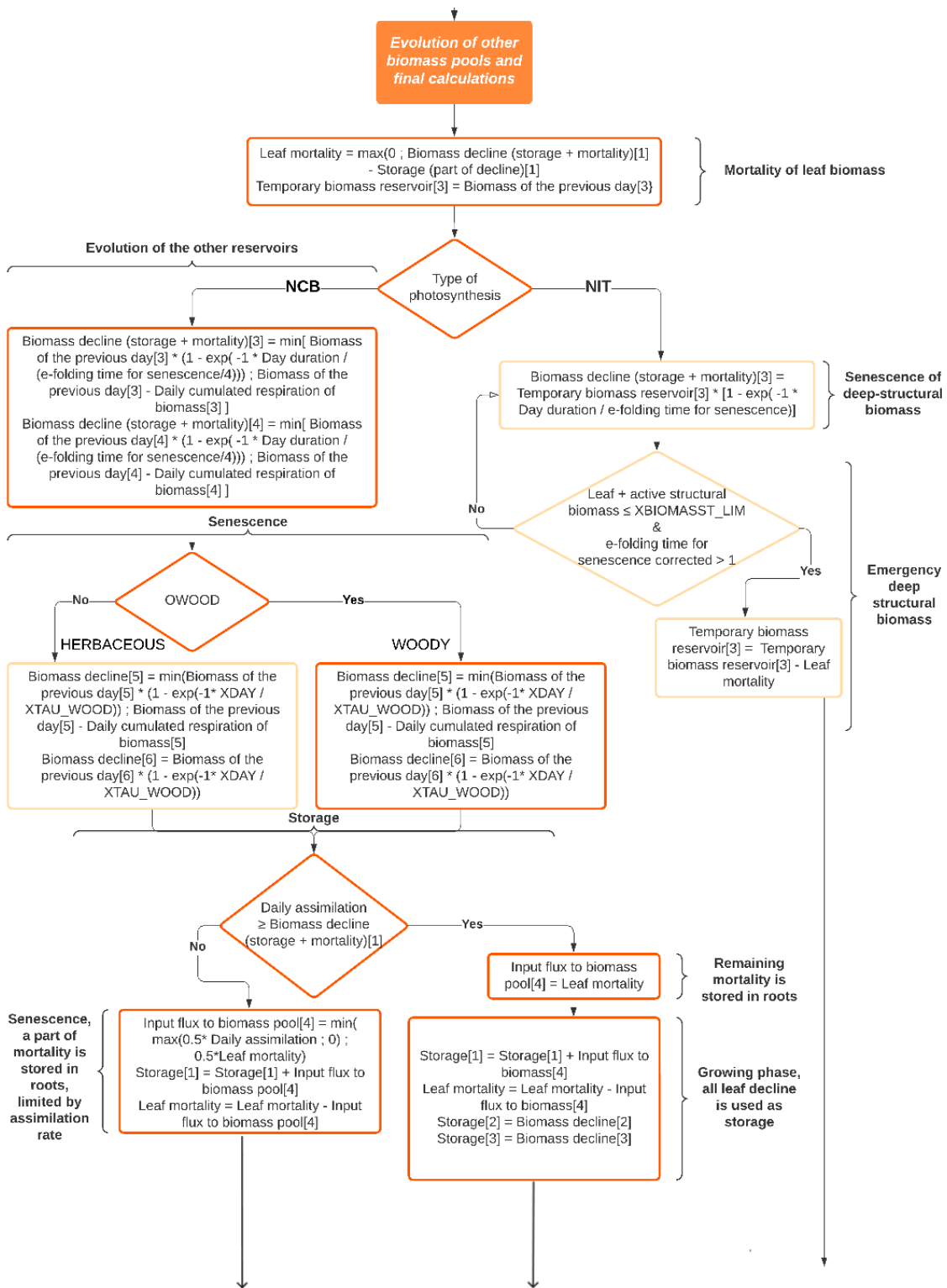
- LEAF = 1
- STRUCT_ACT = 2
- STRUCT_PAS = 3
- STRUCT_BELOW = 4
- WOOD_ABOVE = 5
- WOOD_BELOW = 6

NB :

1. [1] next to a variable refers to the different biomass reservoirs (columns of the matrix)
2. ZWORK is a temporary variable which is reset between processes

- LAI (m²/m²)
- Multiple constants
- Biomass of the previous day
- Temporary leaf biomass = $\max(\text{Biomass of the previous day} [1] ; 0)$
- Latitude
- Mesophyll conductance (m/s)
- e-folding time for senescence (s)
- Maximum leaf assimilation
- Maximum photosynthesis rate
- Day duration
- Minimum LAI
- Ratio biomass/LAI
- Daily net CO₂ assimilation (kgCO₂/m²d)
- XCA_NIT : rate of nitrogen dilution of above-ground biomass at all CO₂ concentrations = 0,38 (Calvet and Saussana, 2001 ; Gibelin et al. 2006)
- XCC_NITRO : coefficient c for biomass (kg/m³) = 0.31425531725
- Daily cumulated respiration of biomass (kgDM/m²d)
- Type of photosynthesis : NON - AST - NIT - NCB
- XBIOMASST_LIM : threshold value for leaf biomass and total above ground biomass in nitrogen dilution theory = $4,7540042445 * 10^{-2}$
- XTAU_WOOD : residence time in woody biomass (s)
- XPCCO₂ : proportion of carbon in dry plant biomass (kgC/kgDM) = 0,4





C Spin-up outputs

The blue lines correspond to the modelled values on the 255 years of the spin-up, and the red line is the median for each iteration. The median was chosen as it isn't sensitive to extreme values.

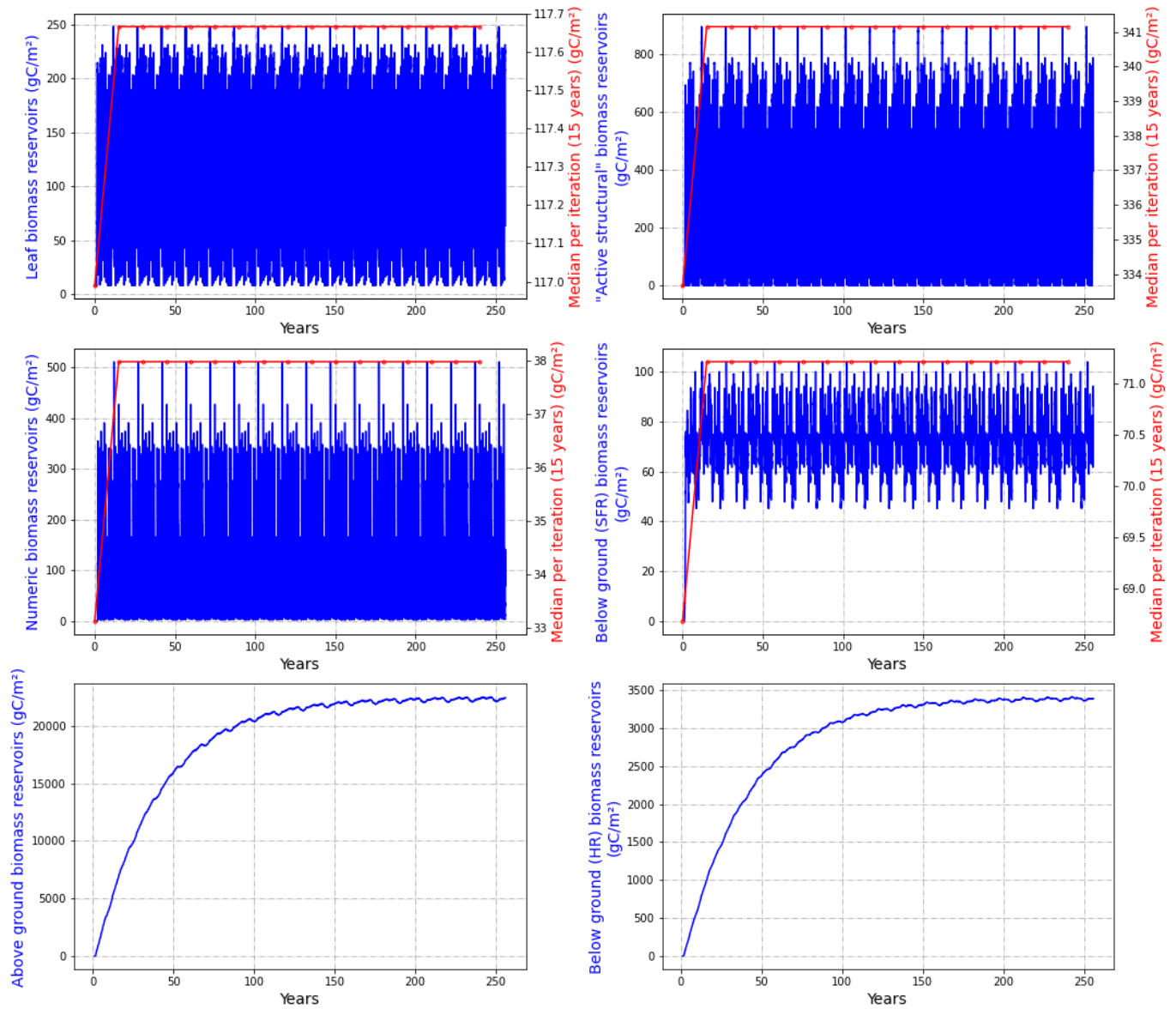


Figure 17: The outputs for the spin for each biomass.

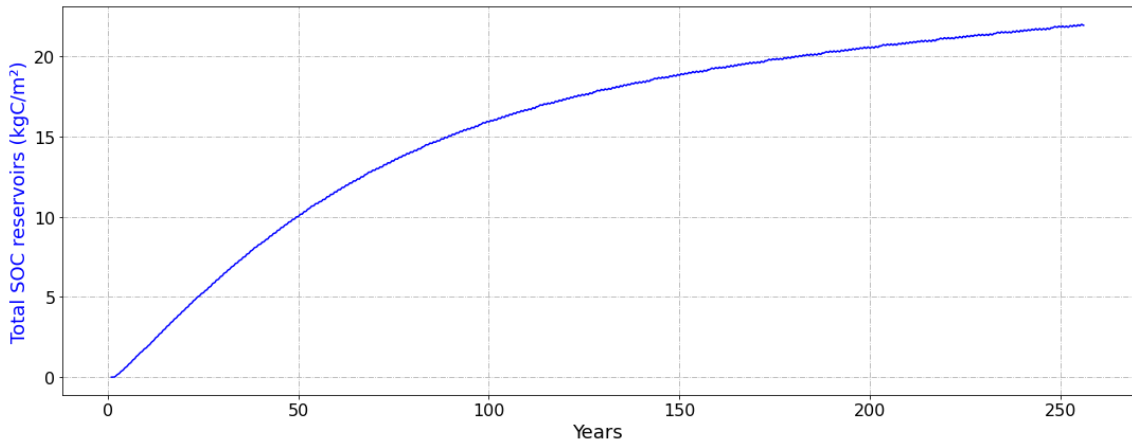


Figure 18: The outputs for the spin of the total soil organic carbon.

D Graphs of the water vapour fluxes

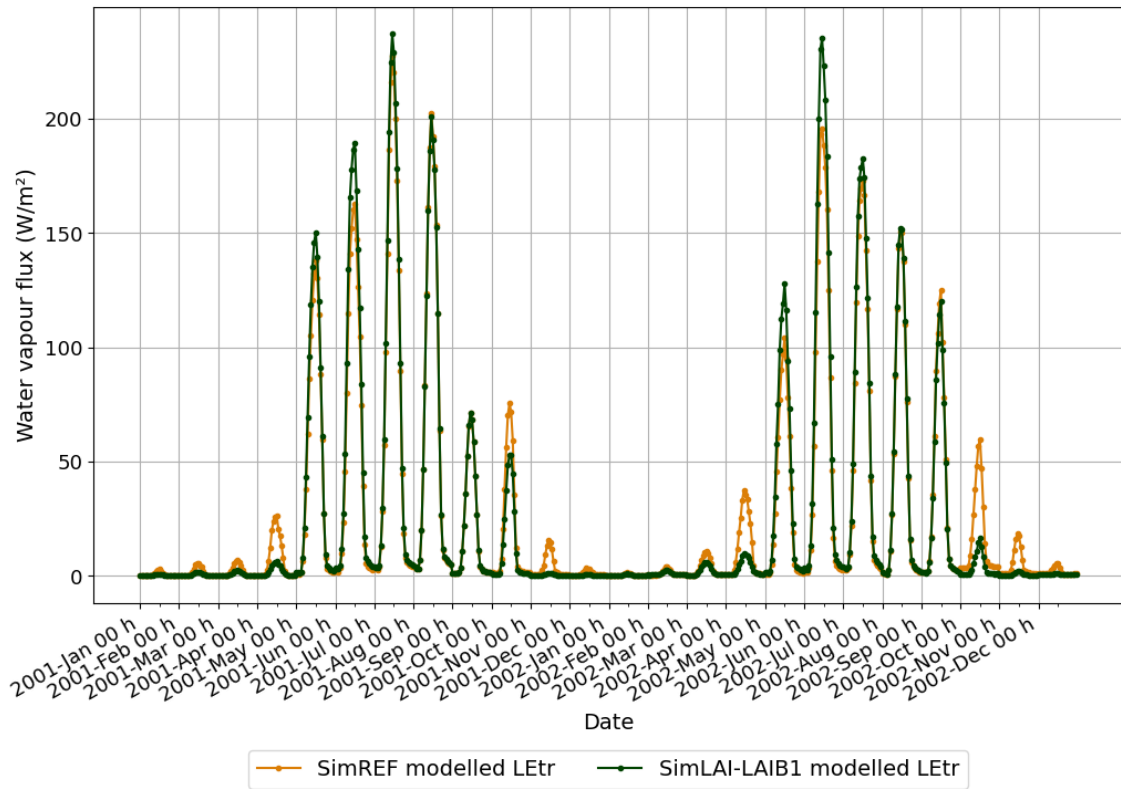


Figure 19: Graphs of the monthly average diurnal cycle of simulated transpiration from the foliage fraction which isn't covered by intercepted water for 2001 and 2002.

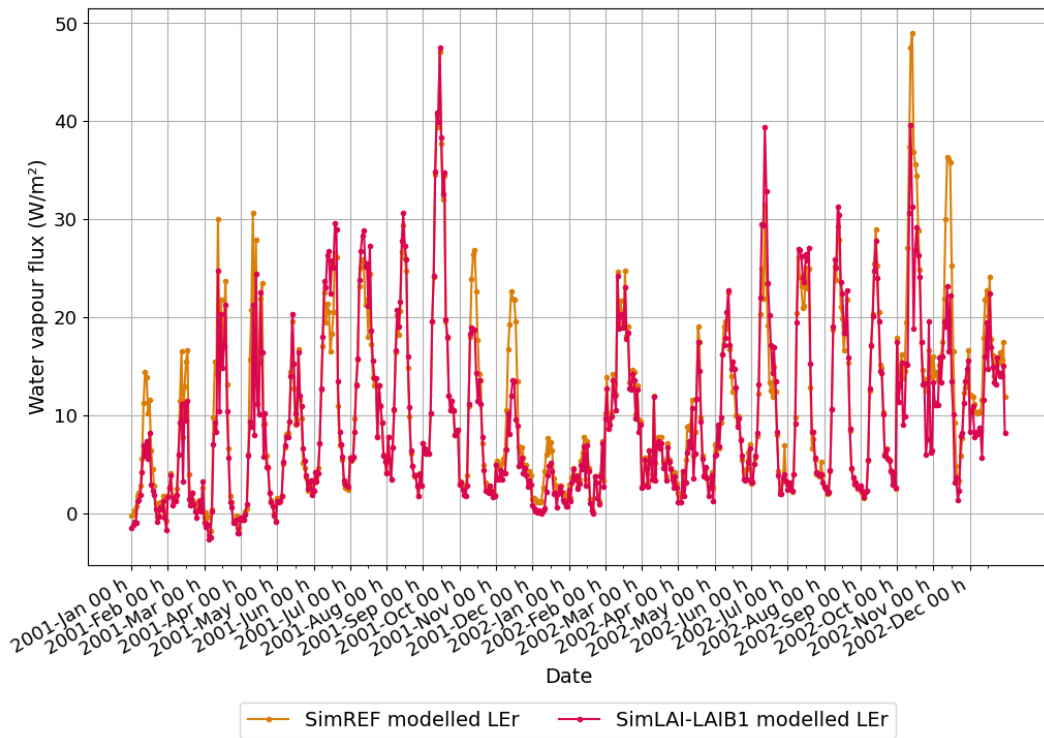


Figure 20: Graphs of the monthly average diurnal cycle of simulated direct evaporation from the fraction of the foliage covered by intercepted water for 2001 and 2002.

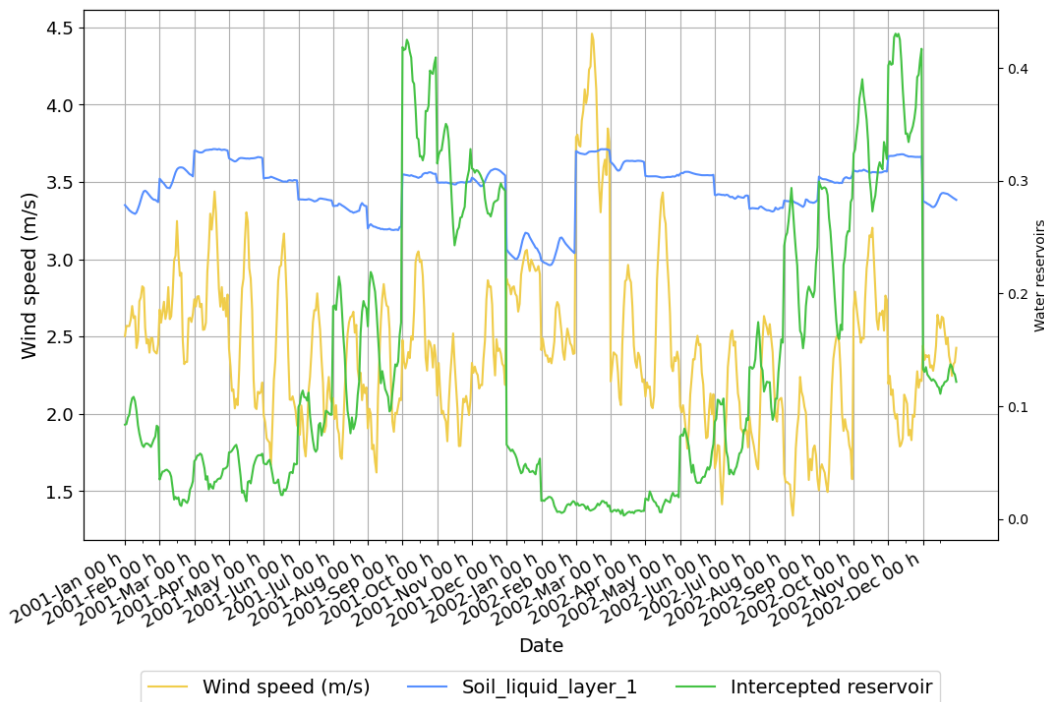


Figure 21: Graphs of the monthly average diurnal cycle of prognostic variables of the latent heat flux for 2001 and 2002 (SimREF).

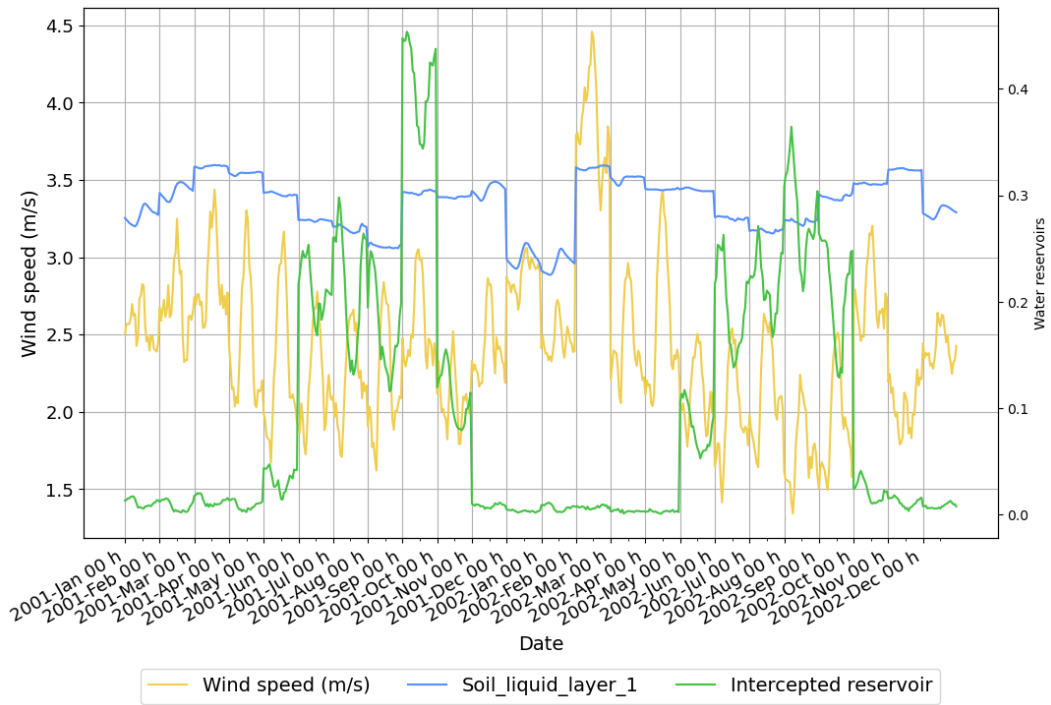


Figure 22: Graphs of the monthly average diurnal cycle of prognostic variables of the latent heat flux for 2001 and 2002 (SimLAI-LAIB1).

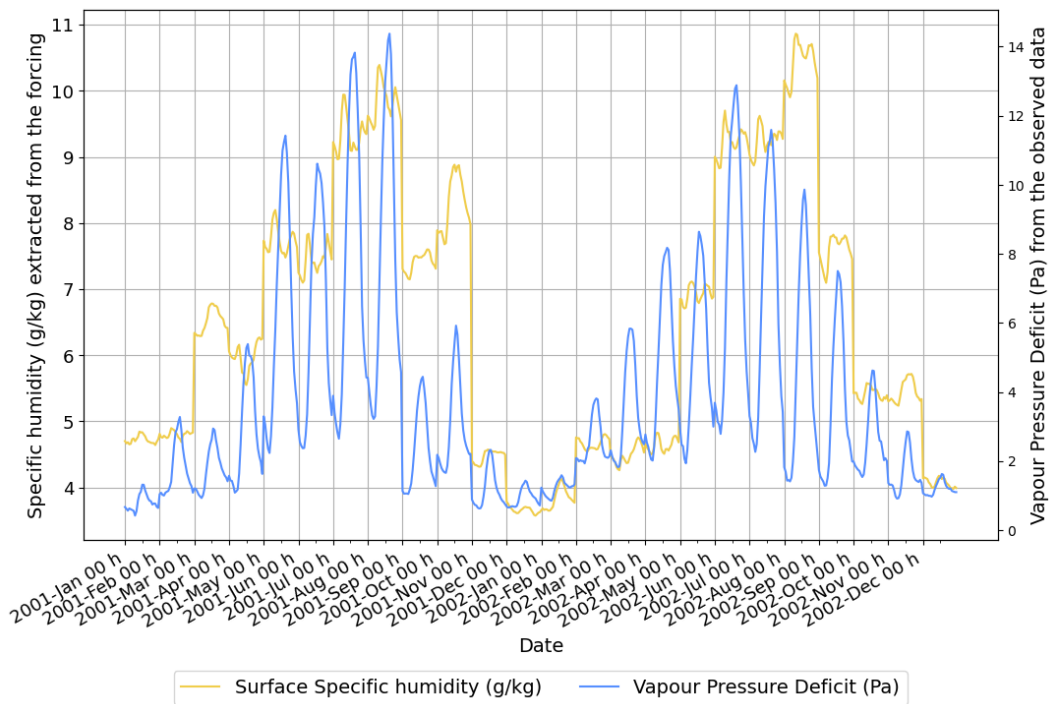


Figure 23: Graphs of the monthly average diurnal cycle of vapour deficit pressure (hPa) and specific humidity for 2001 and 2002.

E Graphs of the monthly average diurnal cycle for the drought year 2003

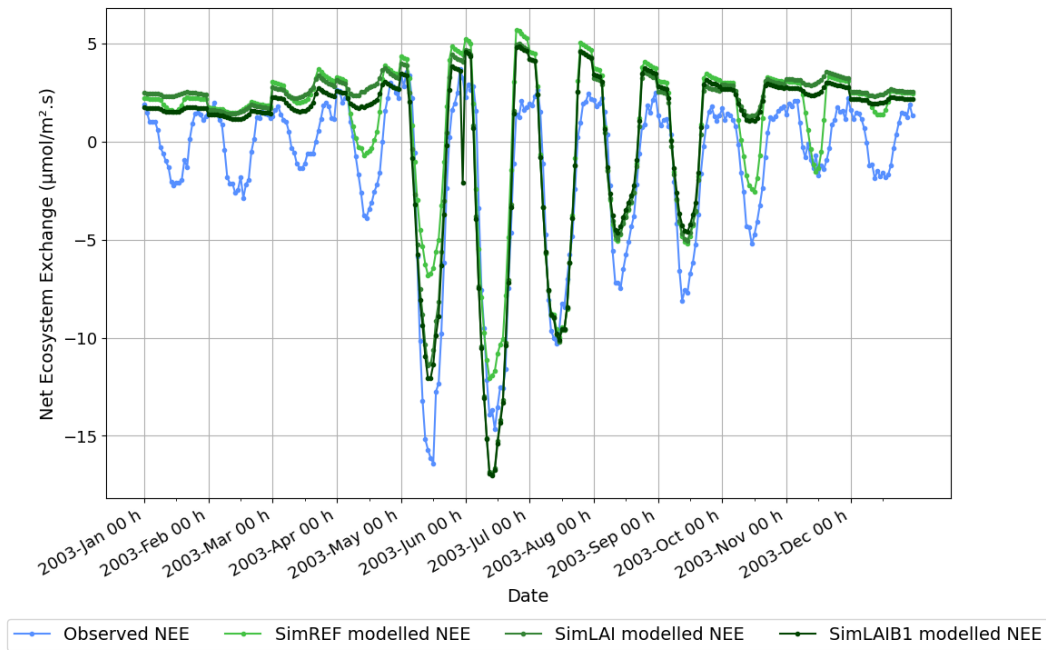


Figure 24: Graphs of the monthly average diurnal cycle of observed and simulated Net ecosystem exchange ($\mu\text{mol}/\text{m}^2\text{s}$) for the drought of 2003.

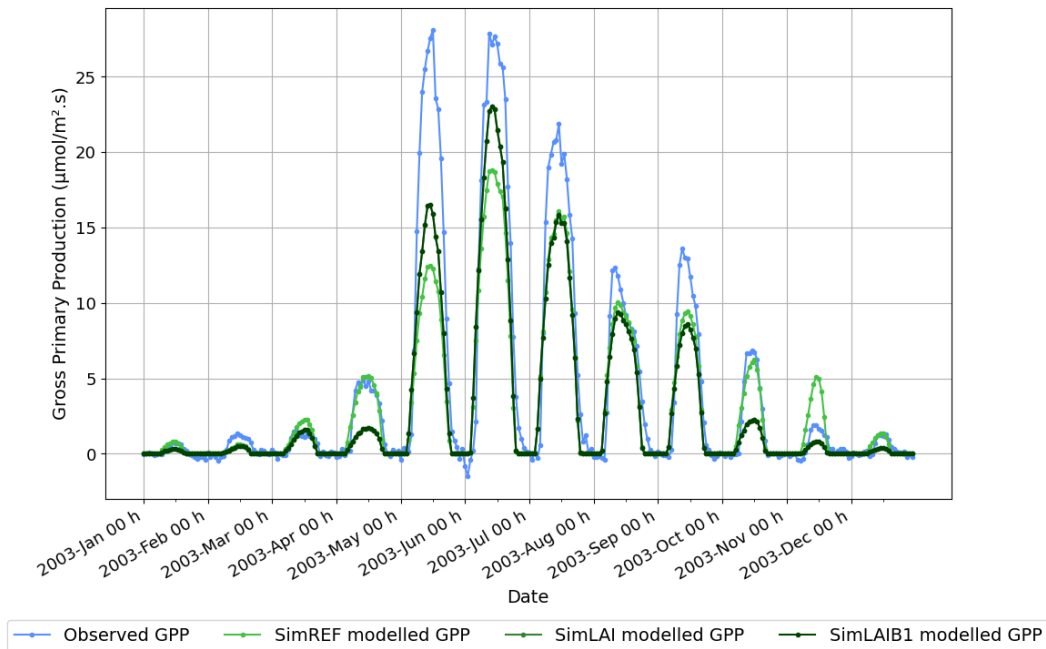


Figure 25: Graphs of the monthly average diurnal cycle of observed and simulated Gross Primary Production ($\mu\text{mol}/\text{m}^2\text{s}$) for the drought of 2003.

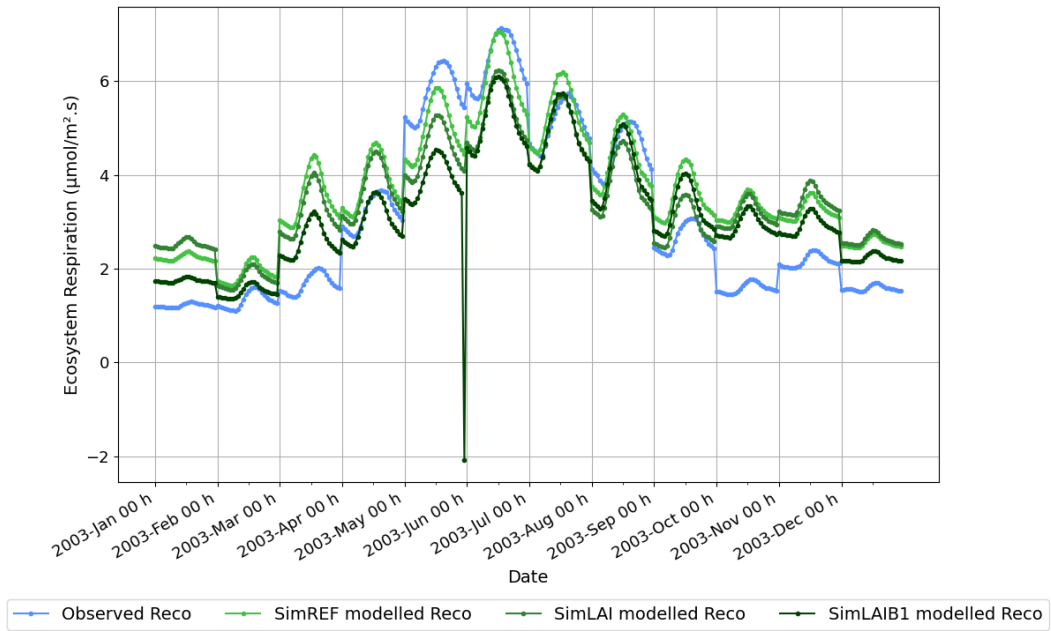


Figure 26: Graphs of the monthly average diurnal cycle of observed and simulated Ecosystem Respiration ($\mu\text{mol}/\text{m}^2\text{s}$) for the drought of 2003.

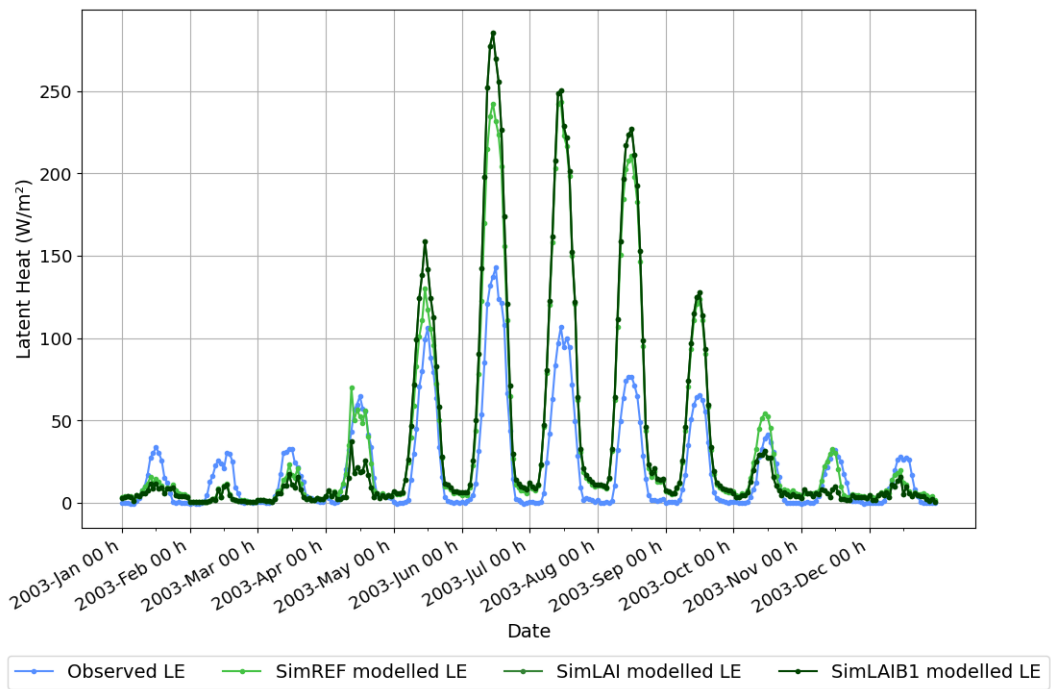


Figure 27: Graphs of the monthly average diurnal cycle of observed and simulated Latent Heat (W/m^2) for the drought of 2003.

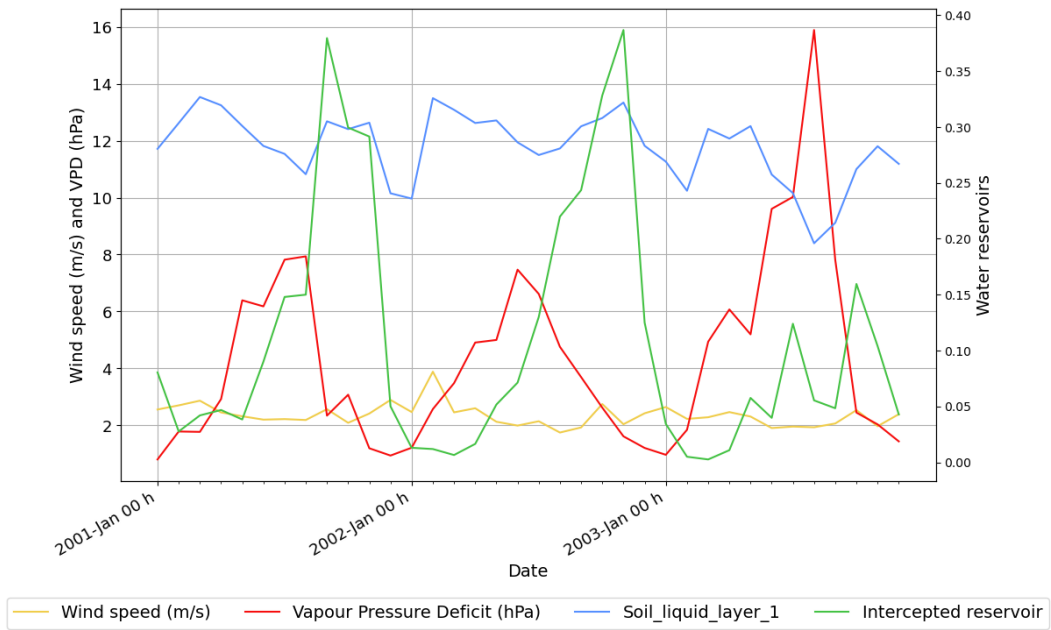


Figure 28: Graphs of the monthly average diurnal cycle of observed wind speed (m/s) and vapour deficit pressure and simulated Latent Heat (W/m^2) for the drought of 2003.