

Modelling of Forest Processes for Climate Change Impact Studies

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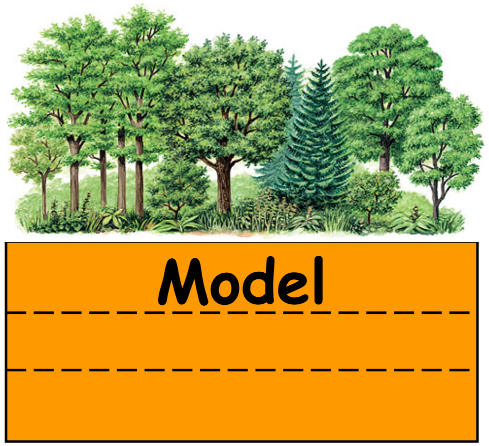
1. Introduction:

Purpose of Forest Growth Models

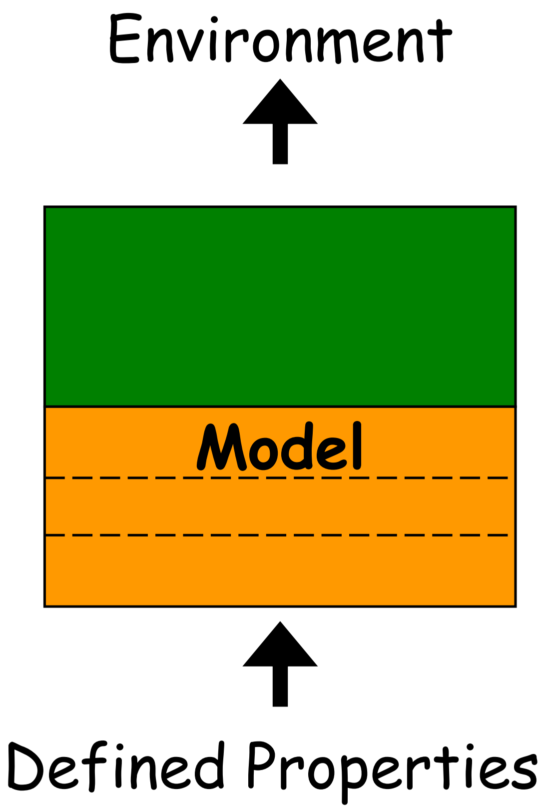
Environment

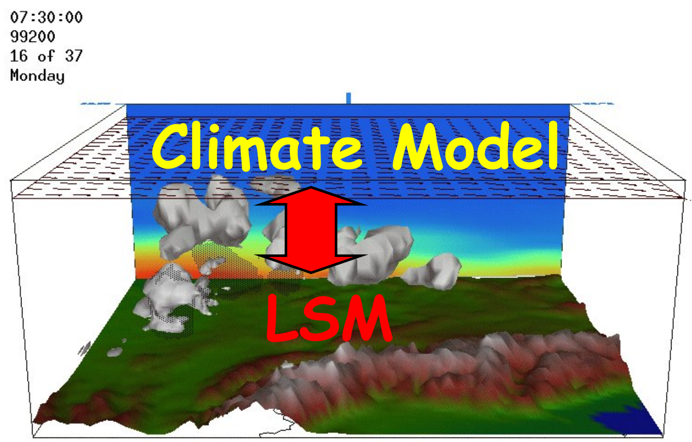


Biosphere Change &
Indicators for Management

1. Introduction:

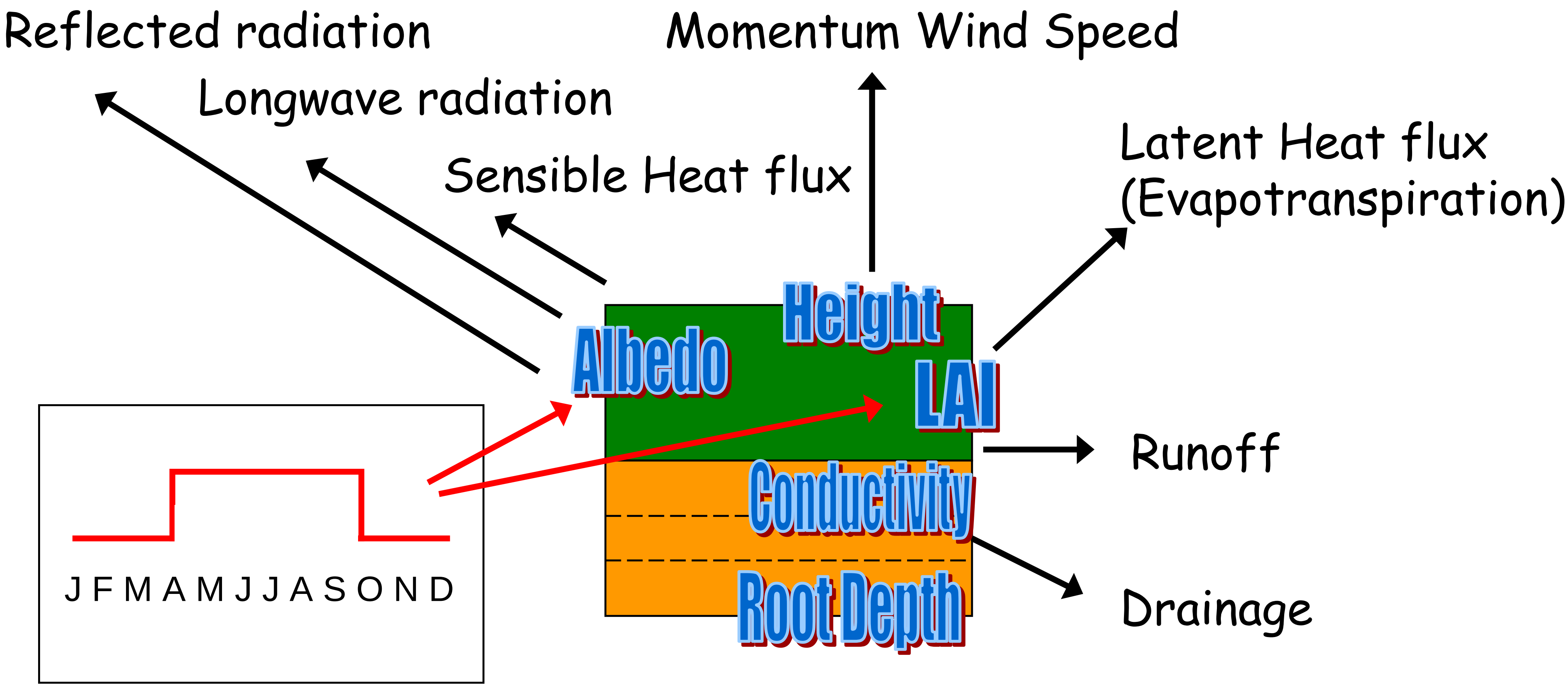
Purpose of Land-Surface-Models (LSM's) – 1D! -





1. Introduction:

Purpose of Land-Surface-Models (LSM's)



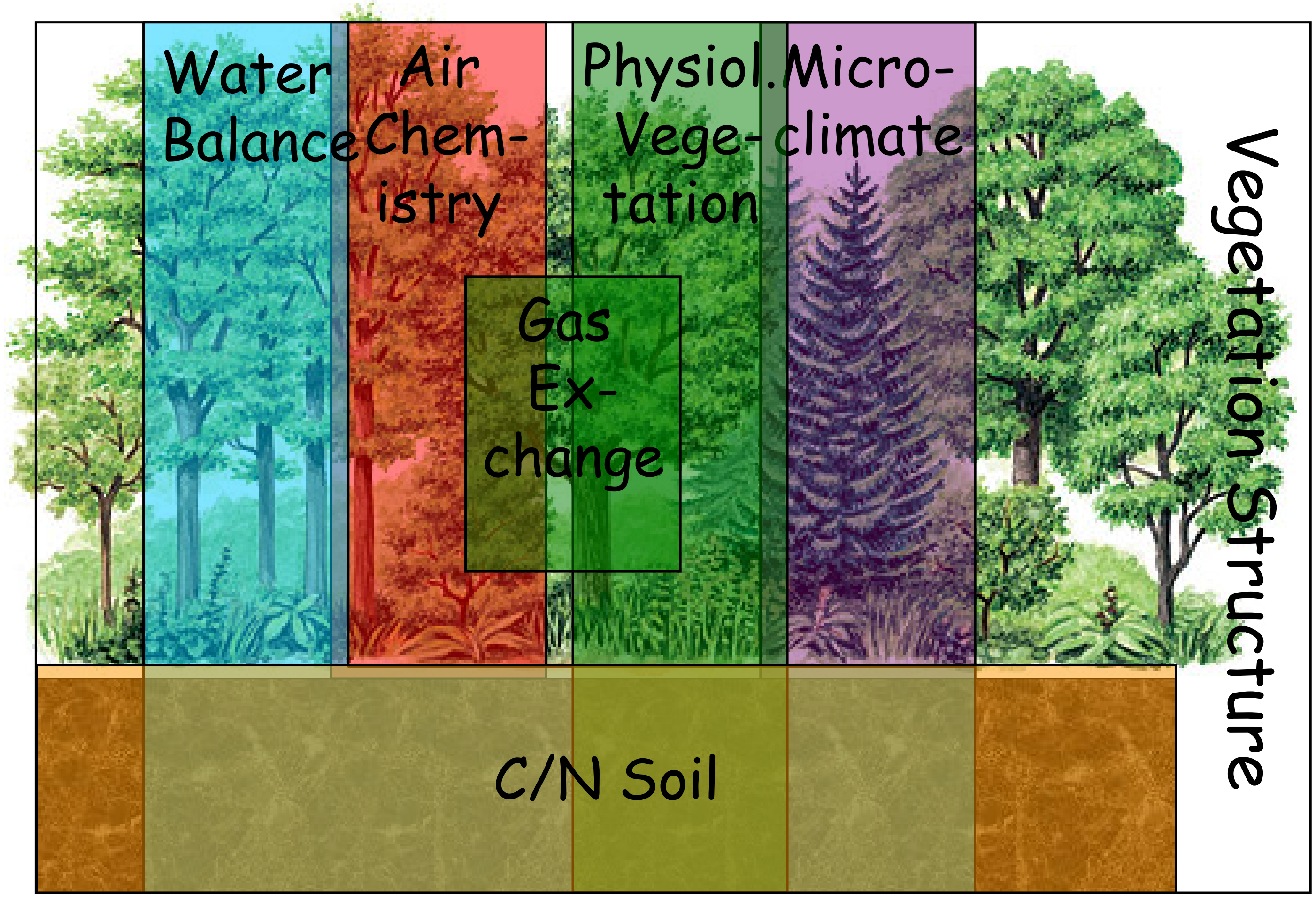
2. **Objective:** Improvement of common LSM's

AIMS

1) **Improve seasonal dynamics of LAI and ALBEDO**
2) **Improve initialization and long-term dynamics of HEIGHT**
   - → Increased spatial resolution (regional climate models)
   - → Increased length of simulation runs
3) **Include carbon cycle (seasonal CO_2 (and CH_4) dynamics)**
   - → Greenhouse effect (global climate models)
4) **Include nitrogen cycle (N_2O and NOx emission)**
   - → Ozone formation (regional air chemistry models)
   - → Greenhouse effect (global climate models)
5) **Include emission of other reactive trace gases (VOC)**
   - → Ozone formation (regional air chemistry models)

2. Objective: Improvement of common LSM's

BIOSPHERE PROCESS GROUPS



→ **Veg. Physiology**

→ **Microclimate**

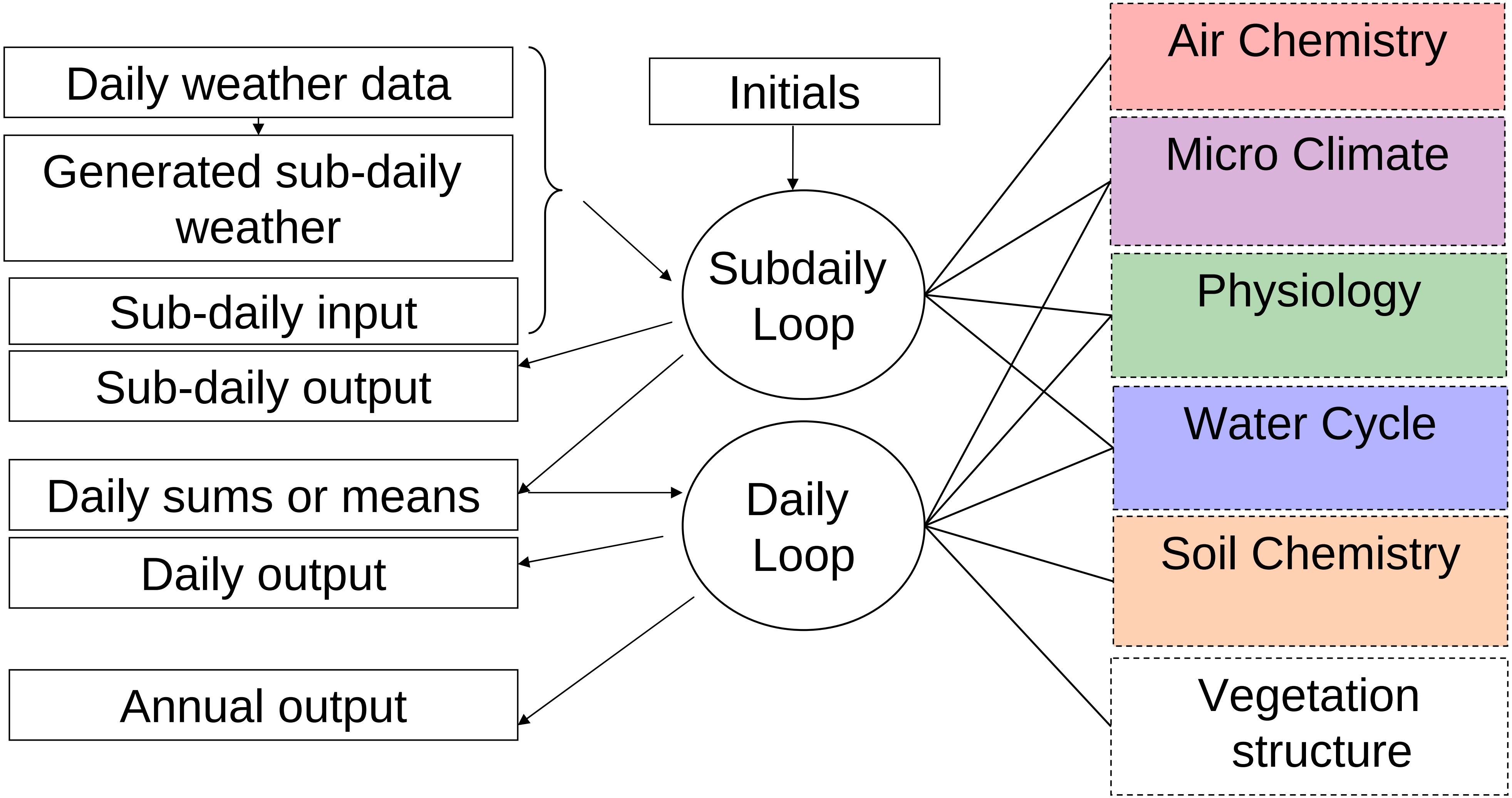
→ **Water Balance**

→ **Veg. Structure**

→ **Soil Processes**

→ **Canopy Air Chemistry**

3. Method: MoBiLE FRAMEWORK (possibly used later on as a LSM)



3. Method: MoBiLE FRAMEWORK

	Sub-Daily	Daily
Air Chemistry	acCACHE	
Micro Climate	mcECM, mcDNDC, mcCANOAK, mcOSU	
Physiology	phFARQUHAR, phBIM, phGUENTHER, phNIINEMETS	phPSIM, phMYCOPHON, phPNET, phDNDC
Water Cycle	wcCANOAK, wcOSU, wcDNDC	wcDNDC, wcBROOK90, wcQUERCUS
Soil Chemistry	scDNDC2, scMICNIT	scDNDC, scSAFE
Veg. structure		vsTREEDYN

Grote et al., EMS, submitted

3. **Method:** MoBiLE FRAMEWORK

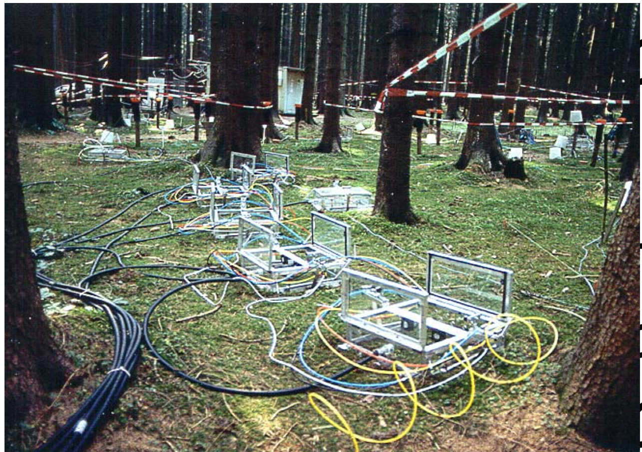
ADVANTAGES

- Flexible selection of biosphere process-groups according to aims
- Flexible selection of models within each process group
- Simple introduction of new models or model versions (distributed workload)
- Simulations with different model combinations based on the same boundary conditions (model comparison)

4. Simulation Examples

A) Spruce Forest (Höglwald, South Germany)

- Initialization of height and DBH from inventory and soil survey
- Input is daily climate from 1982-2004
- Generation of hourly climate data

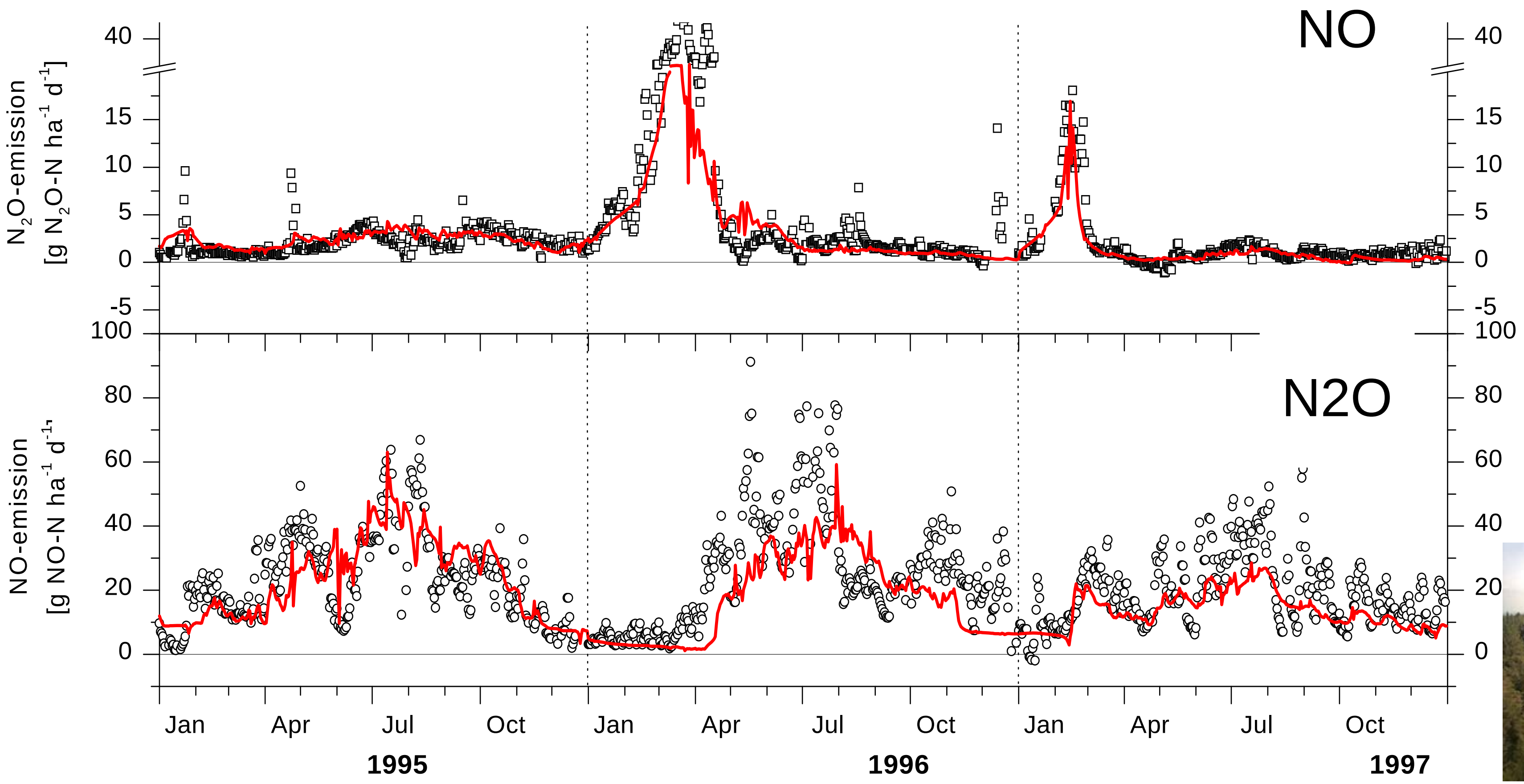


nitrification and denitrification)

- Watercycle: DNDC (sophisticated bucket approach)

4. Simulation Examples

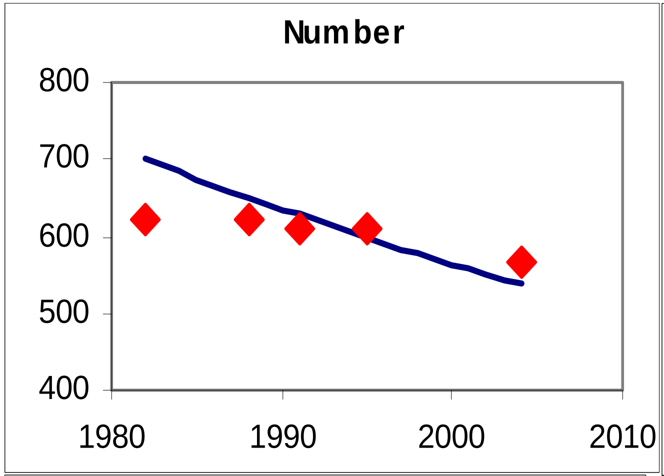
A) Spruce Forest (Höglwald, South Germany)

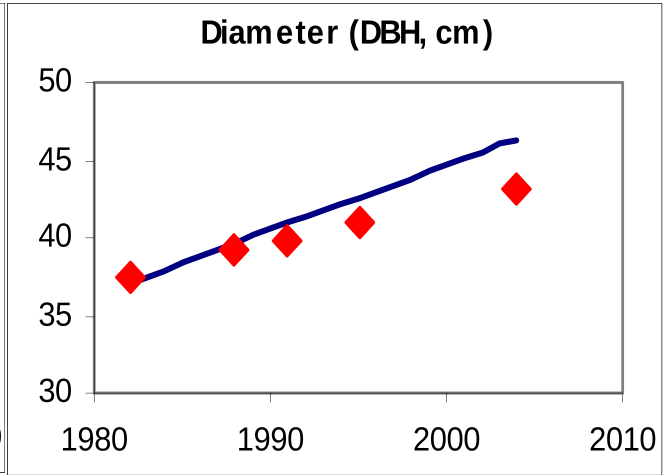


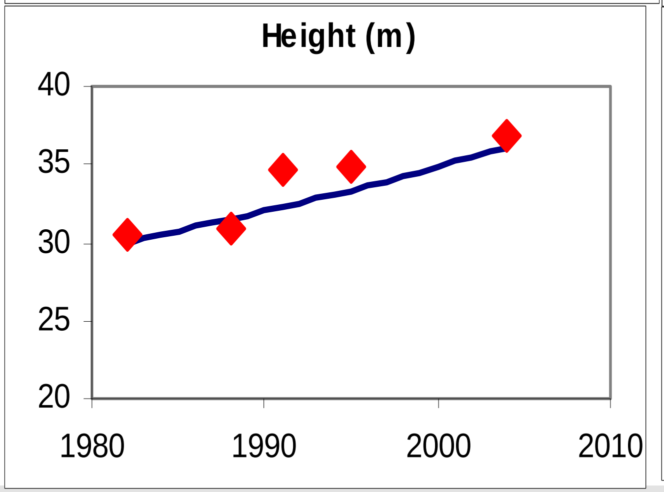
4. Simulation Examples

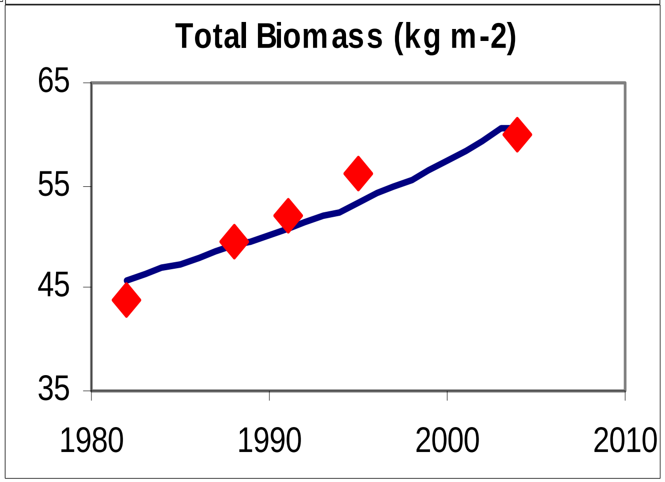
A) Spruce Forest (Höglwald, South Germany)

- With additional vegetation structure model: modified TREEDYN









4. Simulation Examples

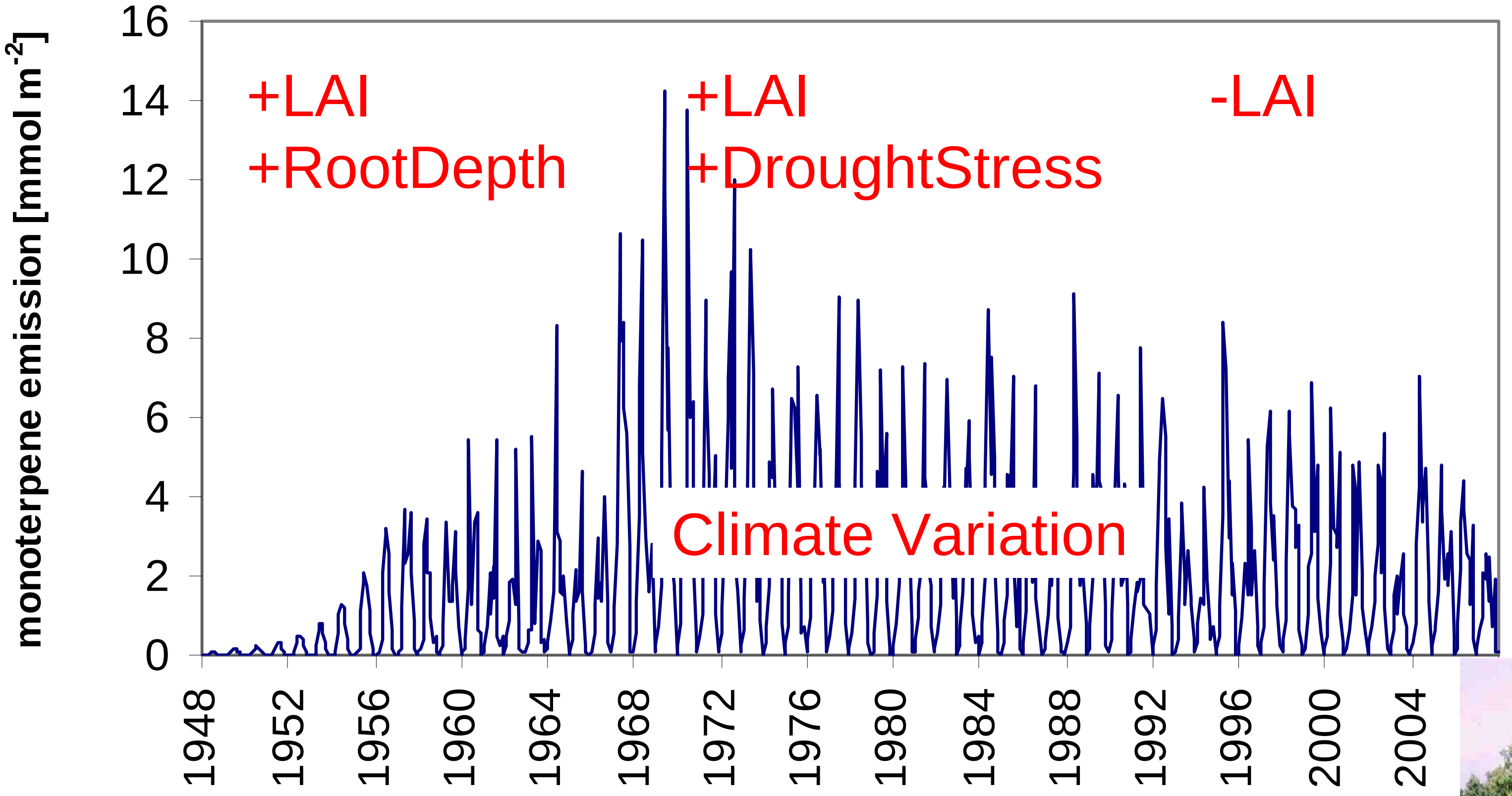
B) Holm oak forest (Puechabon, South France)

- Initialization of height and DBH from inventory and soil survey
- Input is daily climate from 1983-2005
- Generation of hourly climate data

4. Simulation Examples

B) Holm oak forest (Puechabon, South France)

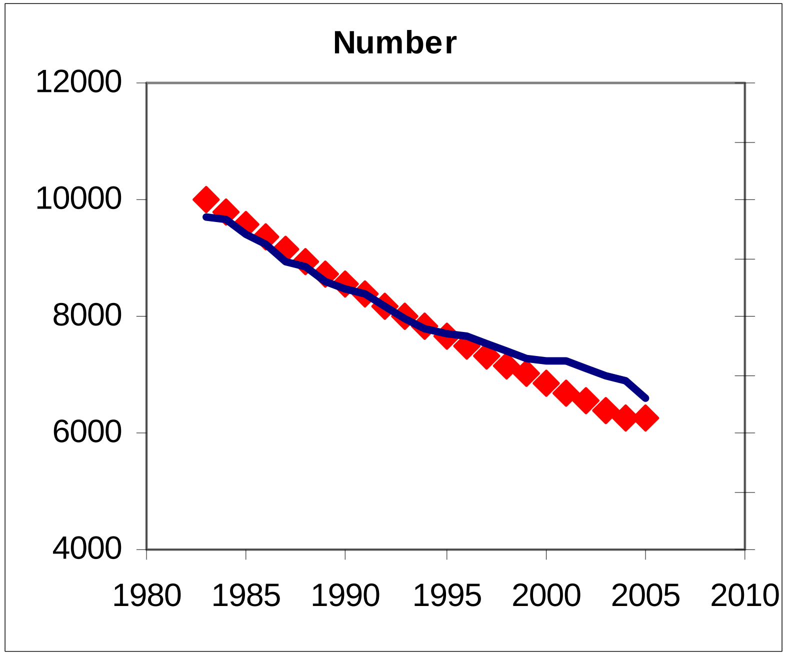
Grote et al., EMS, submitted

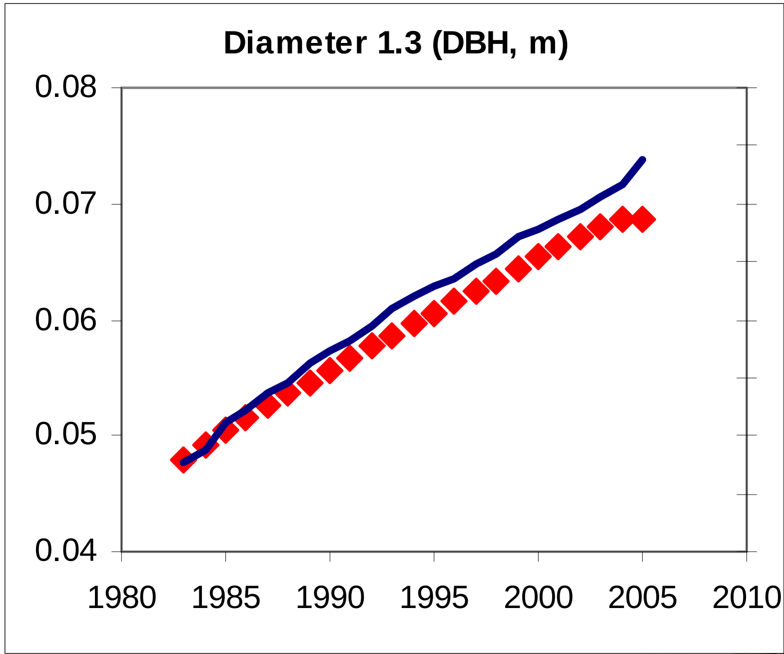


4. Simulation Examples

B) Holm oak forest (Puechabon, South France)

- With additional vegetation structure model: modified TREEDYN





4. Simulation Examples

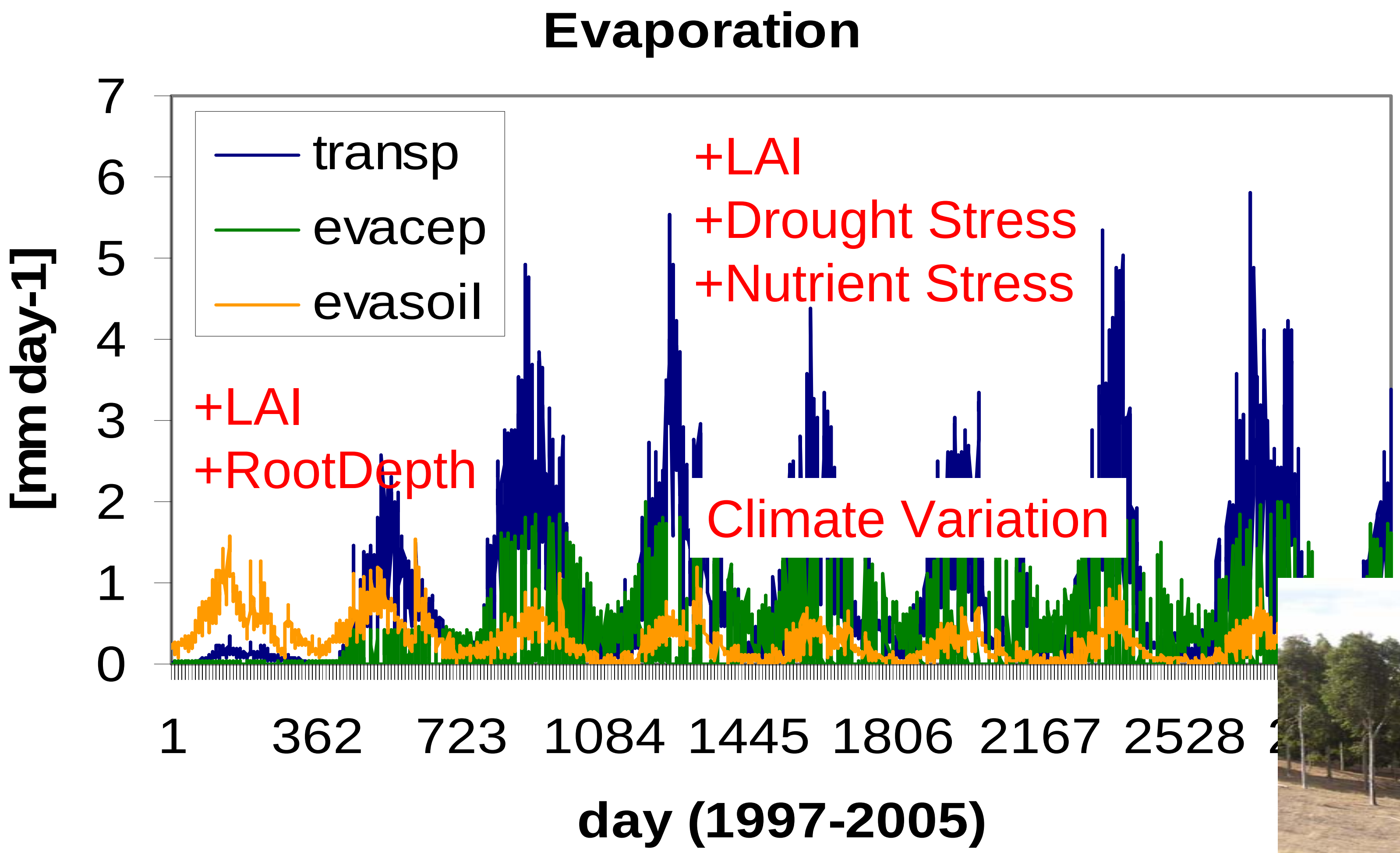
C) Eucalypt plantation (Victoria, South Australia)

- Initialization with standard seedling dimensions
- Input is daily climate from 1997-2005

- al distribution of
  canopy)
- photosynthesis,
- d bucket approach)
- ased C- and N balance)

4. Simulation Examples

C) Eucalypt plantation (Victoria, South Australia)



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C) Eucalypt plantation (Victoria, South Australia)

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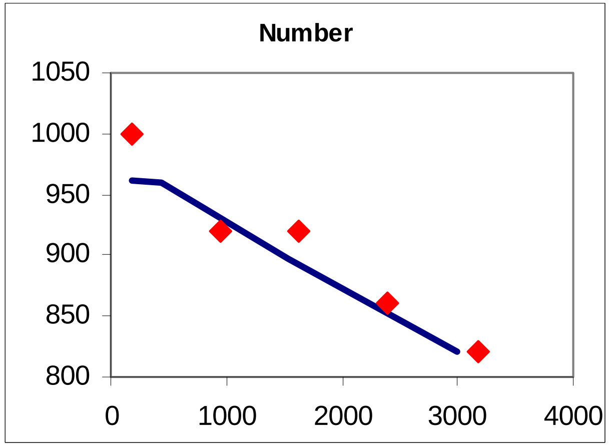

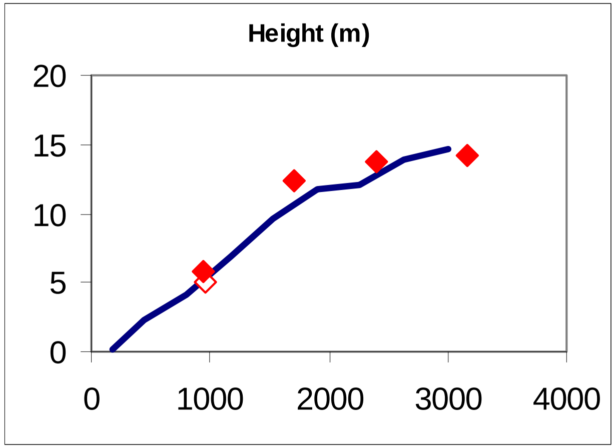

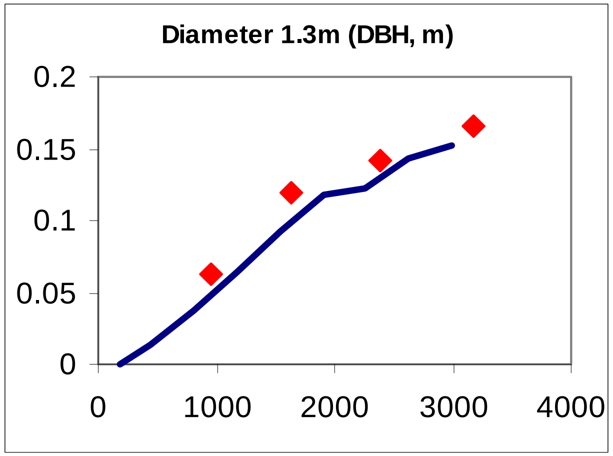

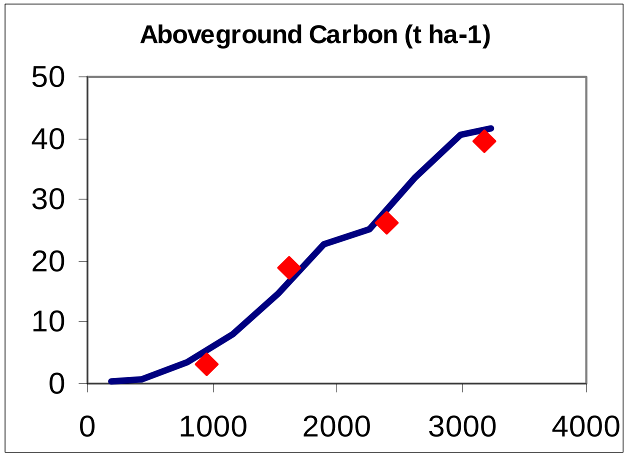

Miehle et al., EJFR, submitted

5. Outlook

Evolving from 1D to regional:

- Ongoing biosphere evaluation (various ecosystems)
- Species specific regional application (inventories)
- Coupling with regional air chemistry models (e.g. air quality)