MODELING BIOGENIC EMISSIONS OF VOLATILE ORGANIC COMPOUNDS

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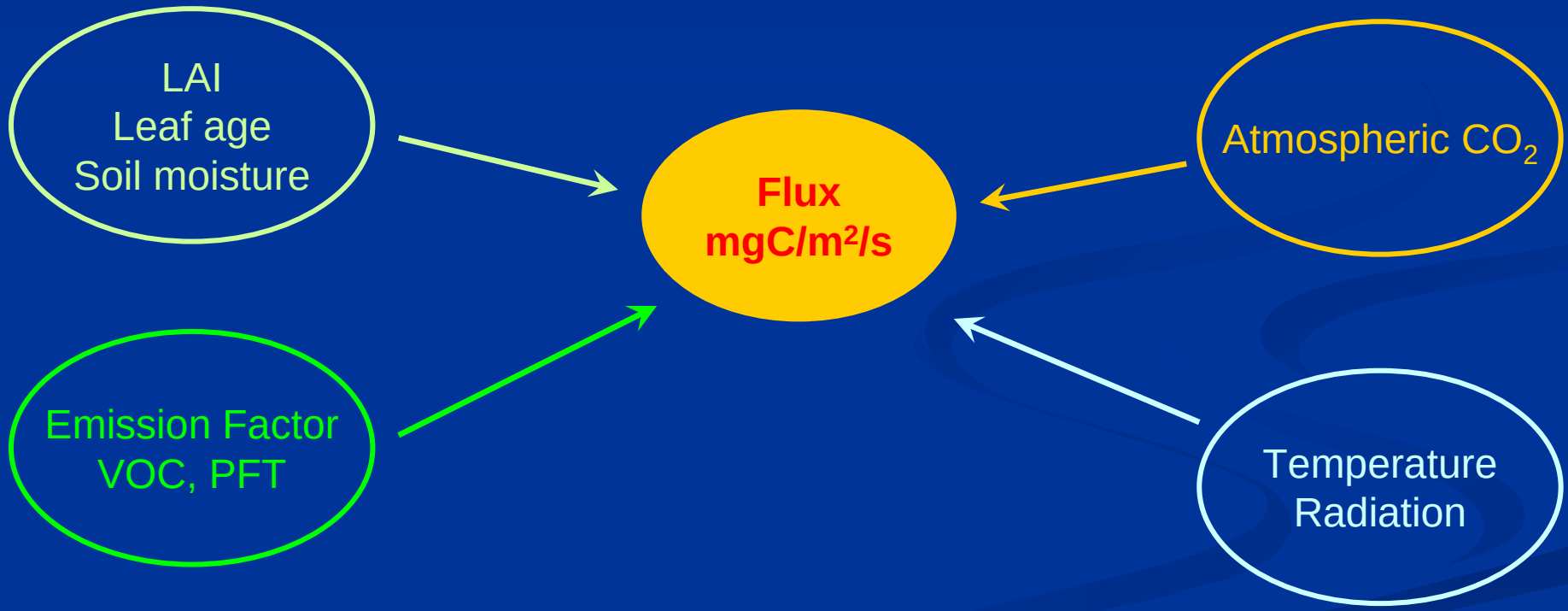
Model development

- **Isoprene**
- **Monoterpenes**
- **Other VOCs (bulk emission)**



Model development

- **Model structure**

① **Isoprene:** from Guenther et al. (2006) (MEGAN)

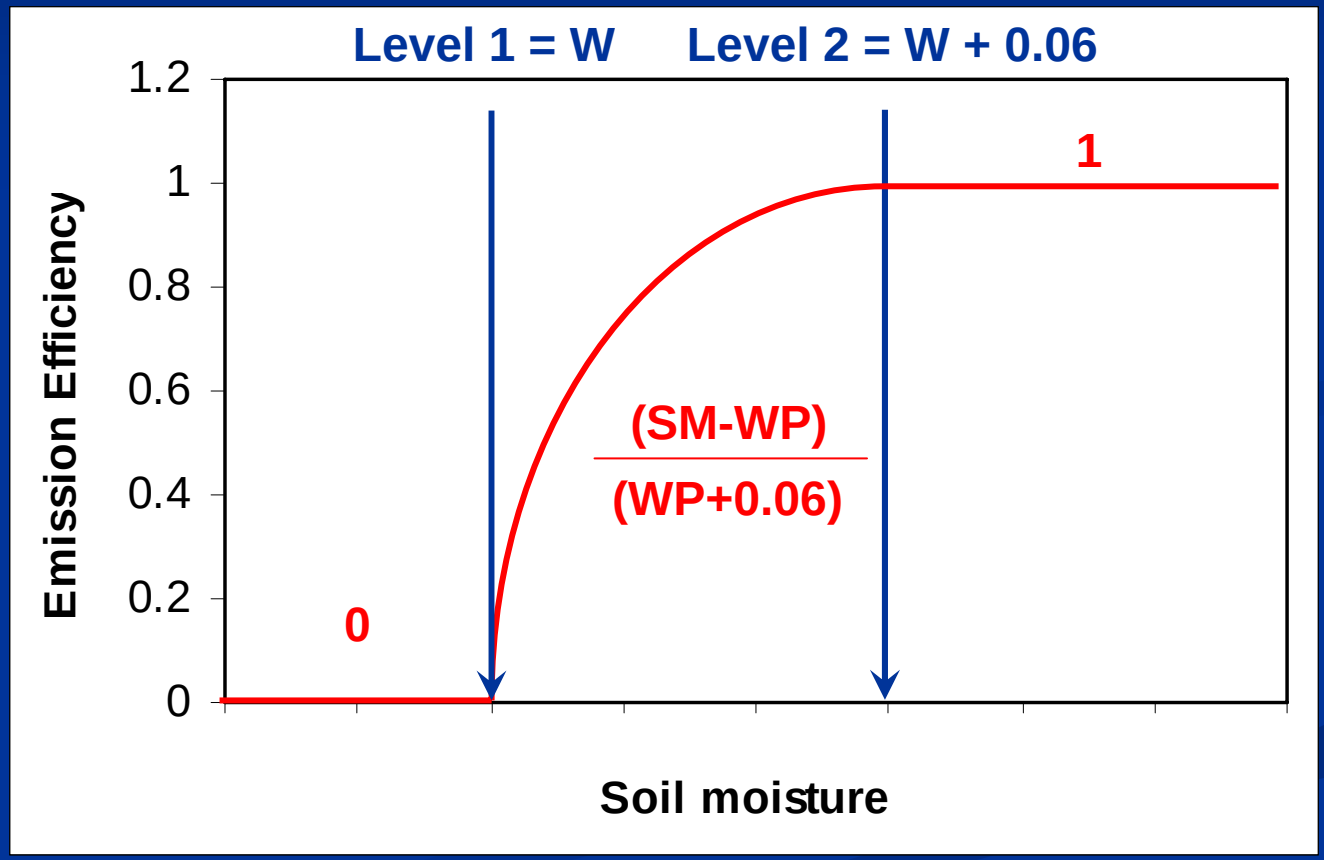
→ Temperature and radiation dependent
→ Soil moisture
→ Canopy loss: 4%
→ Leaf age
→ Global map for emission factors available for the present-day

→ Impact of atmospheric CO_2 implemented

Model development: Isoprene

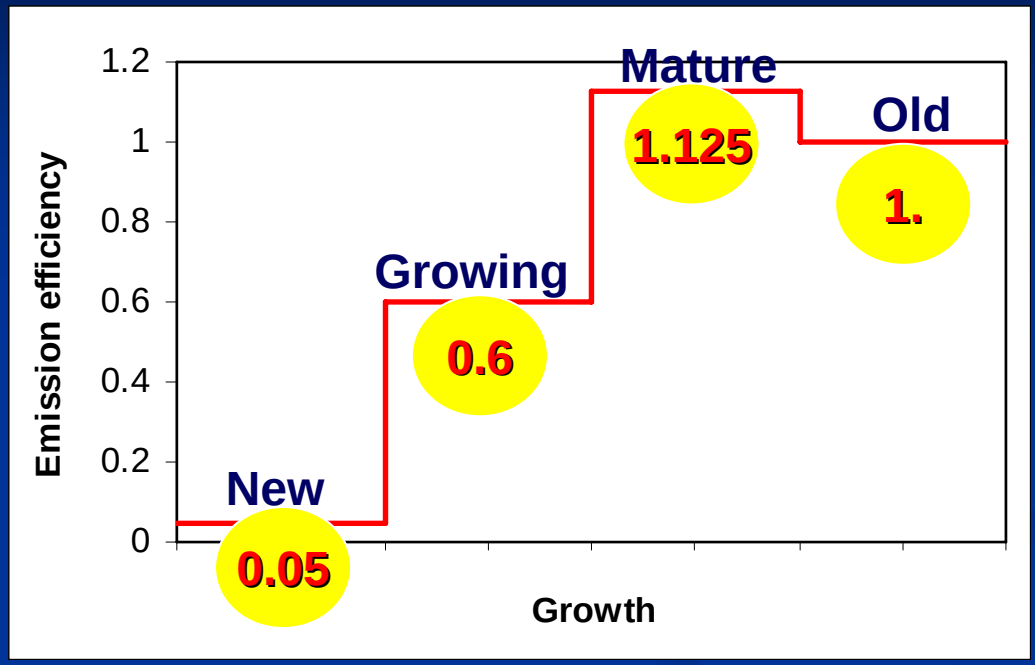
- **Impact of soil moisture: limitation of emission**

→ **Wilting Point:** moisture level below which the plant can't extract the water from the soil anymore.



Model development: Isoprene

- **Leaf age: varying efficiency for isoprene**



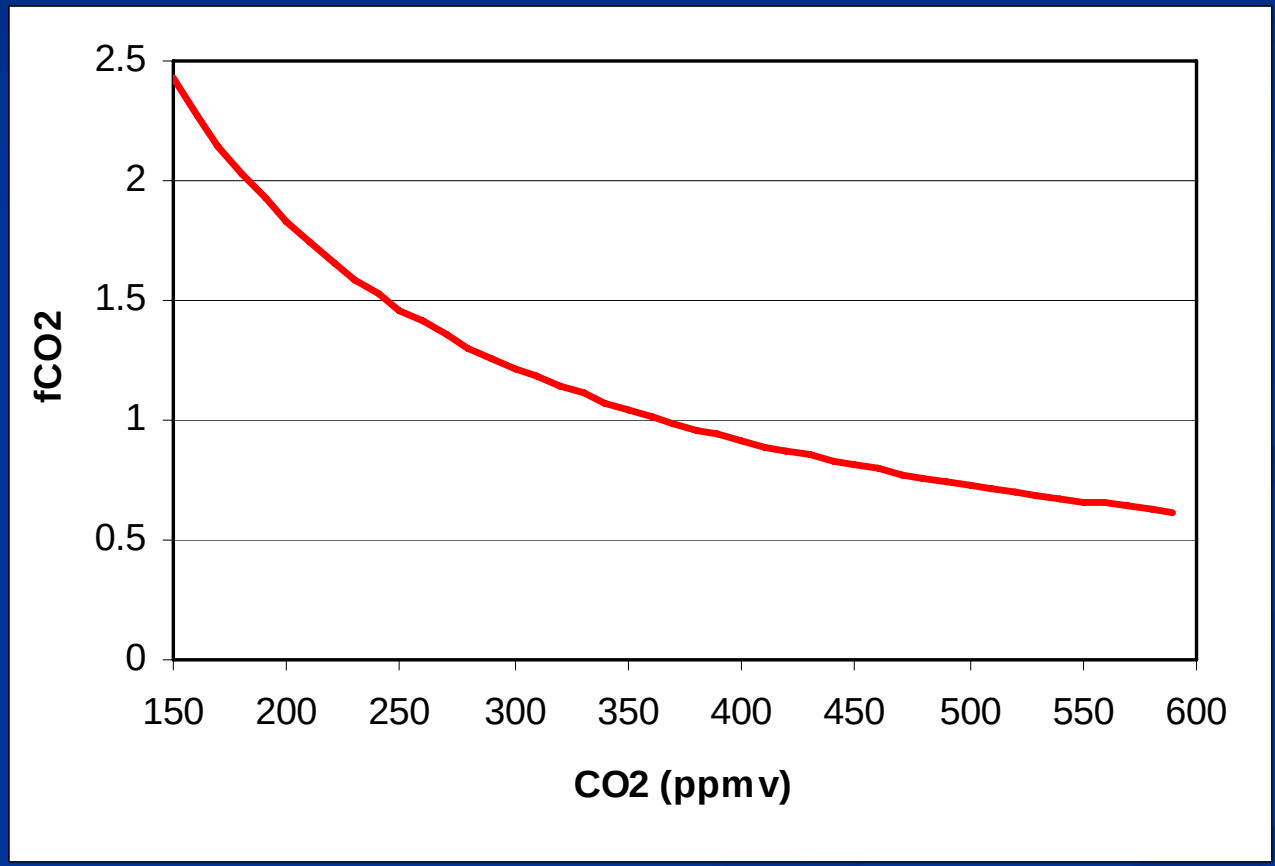
→ Foliage separated in 4 leaf age classes

→ Foliage Efficiency calculation:

- **Deciduous PFTs:**
  $FE = \sum (EmEf_i \times Frac_i)$ with i= new, growing, mature, old
- **Evergreen PFTs:**
  FE = 1

Model development: Isoprene

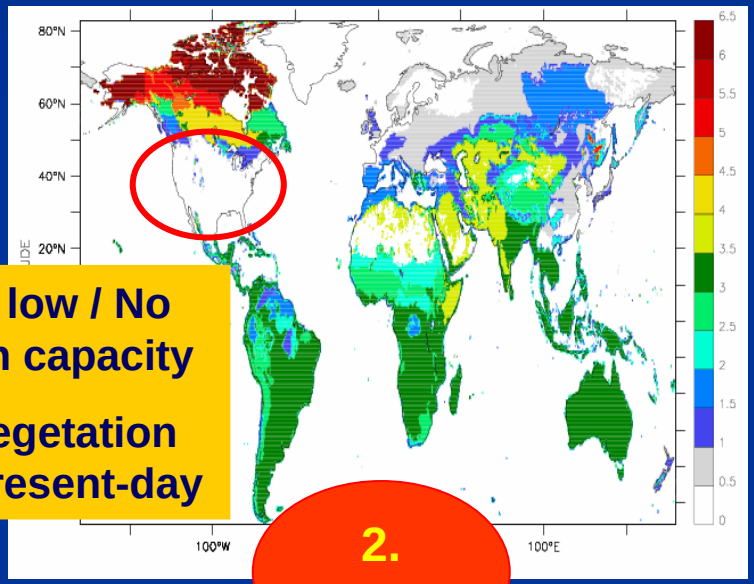
- Atmospheric CO_2 (Possel et al. 2005)



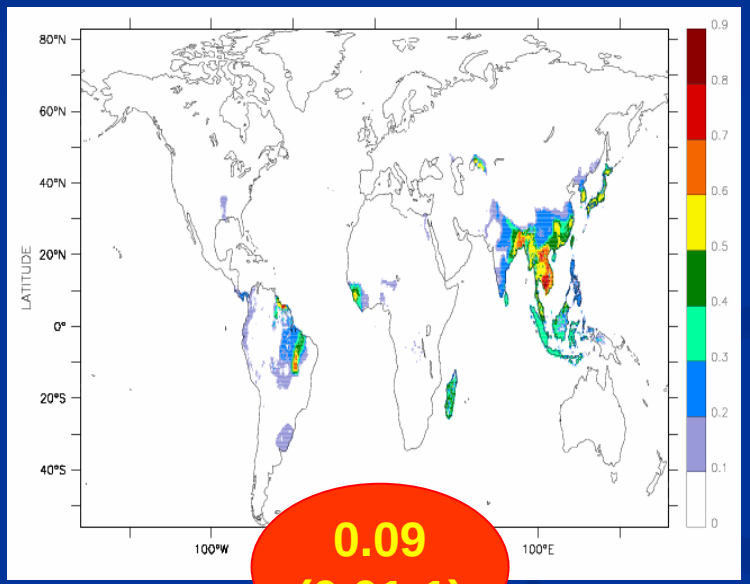
Model development: Isoprene

- **Emission factors:**
  - **Present-day: global maps 0.5°x0.5 °**

Fineleaf evergreen trees



Crops



→ Very low / No emission capacity

→ No vegetation for the present-day

2. (0.01-13)

0.09 (0.01-1)

mgiso/m²/h

  - **Past and Future scenarios**

Model development

Model structure

① Isoprene: from MEGAN (Guenther et al., 2006)

- Temperature and radiation dependent
- Leaf age, soil moisture
- global map for emission factors available for the present-day
- Impact of atmospheric CO_2 implemented

② Monoterpenes: from Guenther et al. (1995)

- Temperature dependent
- EF assigned for each PFT

③ Other VOCs: from Guenther et al. (1995)

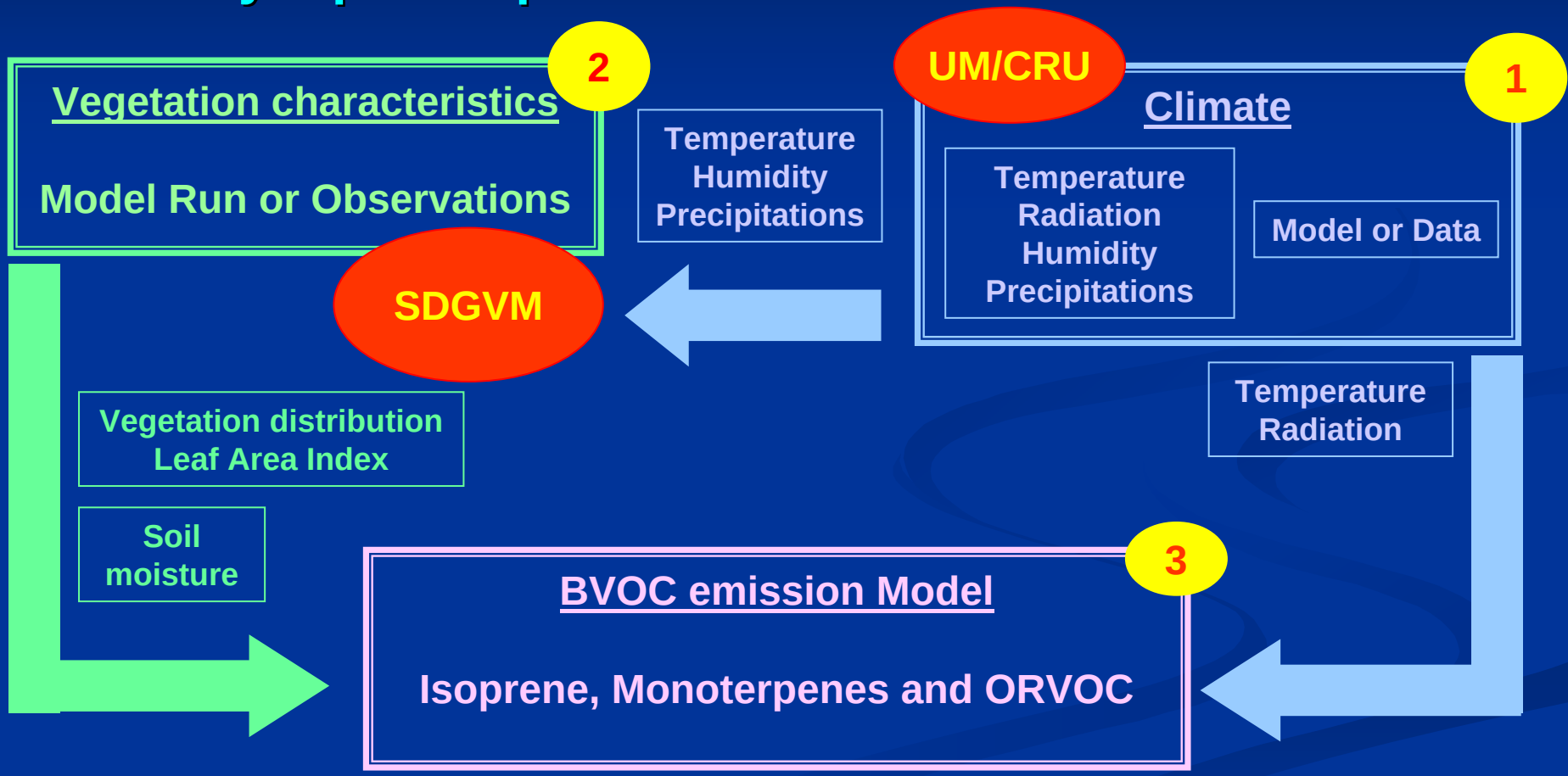
- Bulk emission
- Temperature dependent
- One EF for every PFTs

Monoterpenes and Other VOCs: EF

Plant Functional Types	Emission Factor (µgC/g/h)	
SDGVM	Monoterpenes	Other VOCs
Bare soil	0	1.5
C3 grass	0.8	
C4 grass	1.2	
Evergreen broadleaf tree	0.4	
Evergreen needleleaf tree	2.4	
Deciduous broadleaf tree	0.8	
Deciduous needleleaf tree	1.2	

Using the BVOC emission model

- FORTRAN 90 program: off-line model (intercomparisons)
- Monthly input/output



Implementation in JULES

- **Model: off-line FORTRAN 90 (< 1000 lines)**
  - **→ Can be easily implemented in any other model**
  - Reasonable estimates
- **Designed for global scale study / computing resources**
  - Monthly input/output
  - History of past temperature/radiation (last day and last 10 days) not considered
    - **→ Can be easily modified based on JULES timestep**
    - **→ Other individual BVOCs could be implemented**
- **Poster:** "Two centuries of changing isoprene emissions from the terrestrial biosphere: 1900 to 2100 AD"