# Multi-tiling developments in ORCHIDEE

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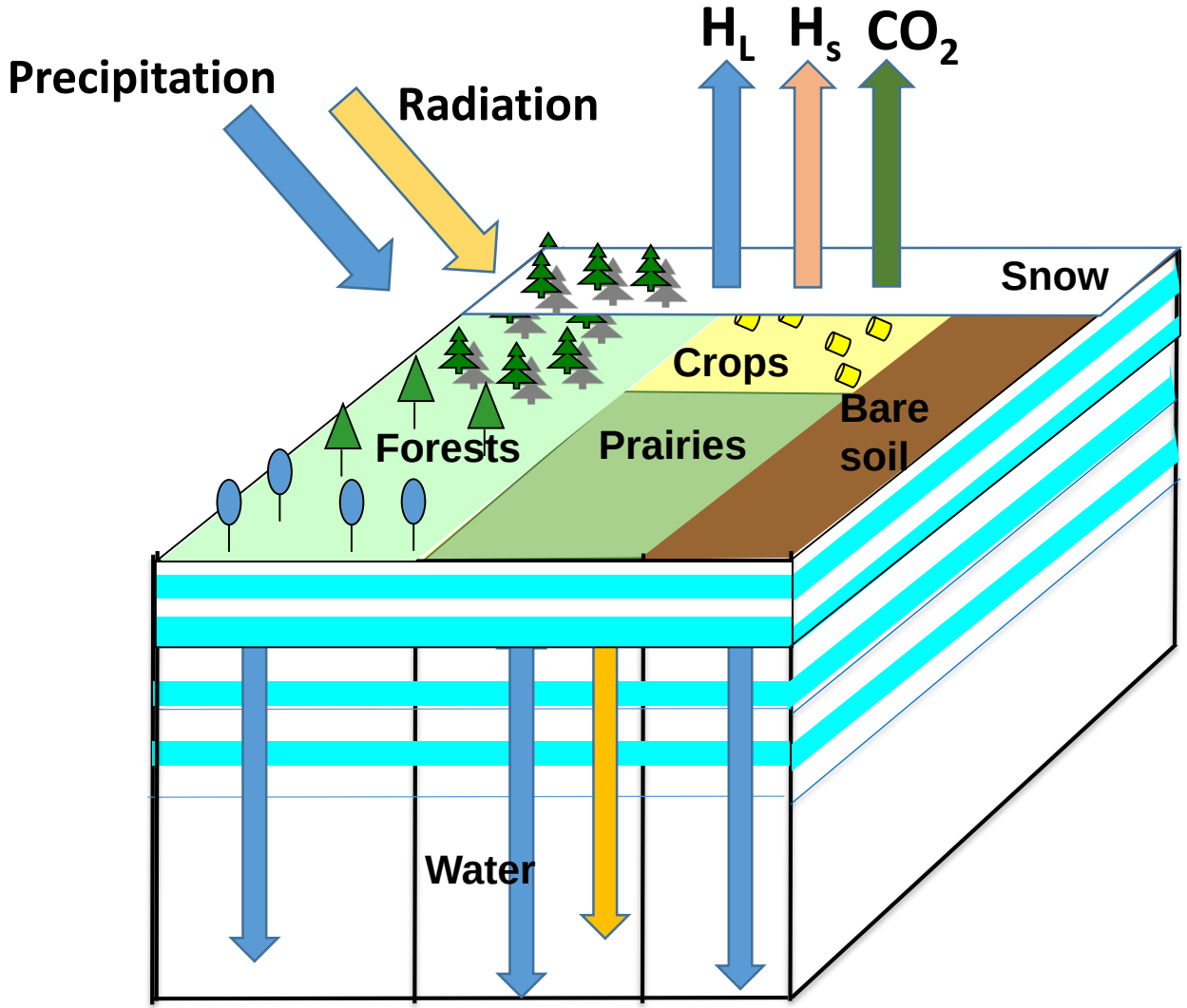
# ORCHIDEE standard version

PFT approach: 15 PFTs + NOBIO surfaces (glaciers)

- 1 single Energy budget/soil thermal (implicit resolution), 1 atmospheric column

- 1 fractional snow cover with snow temperature resolved (BIO and NOBIO separated)

- 3 water budgets in 3 soil columns (PFT grouping and column number parameterized, can be easily changed)



# ORCHIDEE standard version

- Deficiencies of PFT approach:
    - Needs to add or group PFTs (ages classes, species, …)
    - Needs to consider and model explicitly other non vegetated surfaces (glaciers, lakes, urban, …)
- Deficiencies of composite approach:
    - Needs to resolve separate energy budgets for different types of surfaces
    - Needs to resolve separate or to group differently water / carbon budgets
    - Needs to account for vegetation / soil /topography links

**Proposition to move from Plant Functional Type to Surface Functional Type:**

- To allow the grouping of eco-hydrological entities
- Example of SFTs: savannah ecosystems, summer crops, prairies in lowlands, lakes, etc..

and to resolve separate energy / water / carbon budgets for each SFTs or group of SFTs (allowing to come back to the Trunk configuration)

In other words, we envision a FLEXIBILITY meeting individual demands

# ORCHIDEE DOFOCO and MEB versions

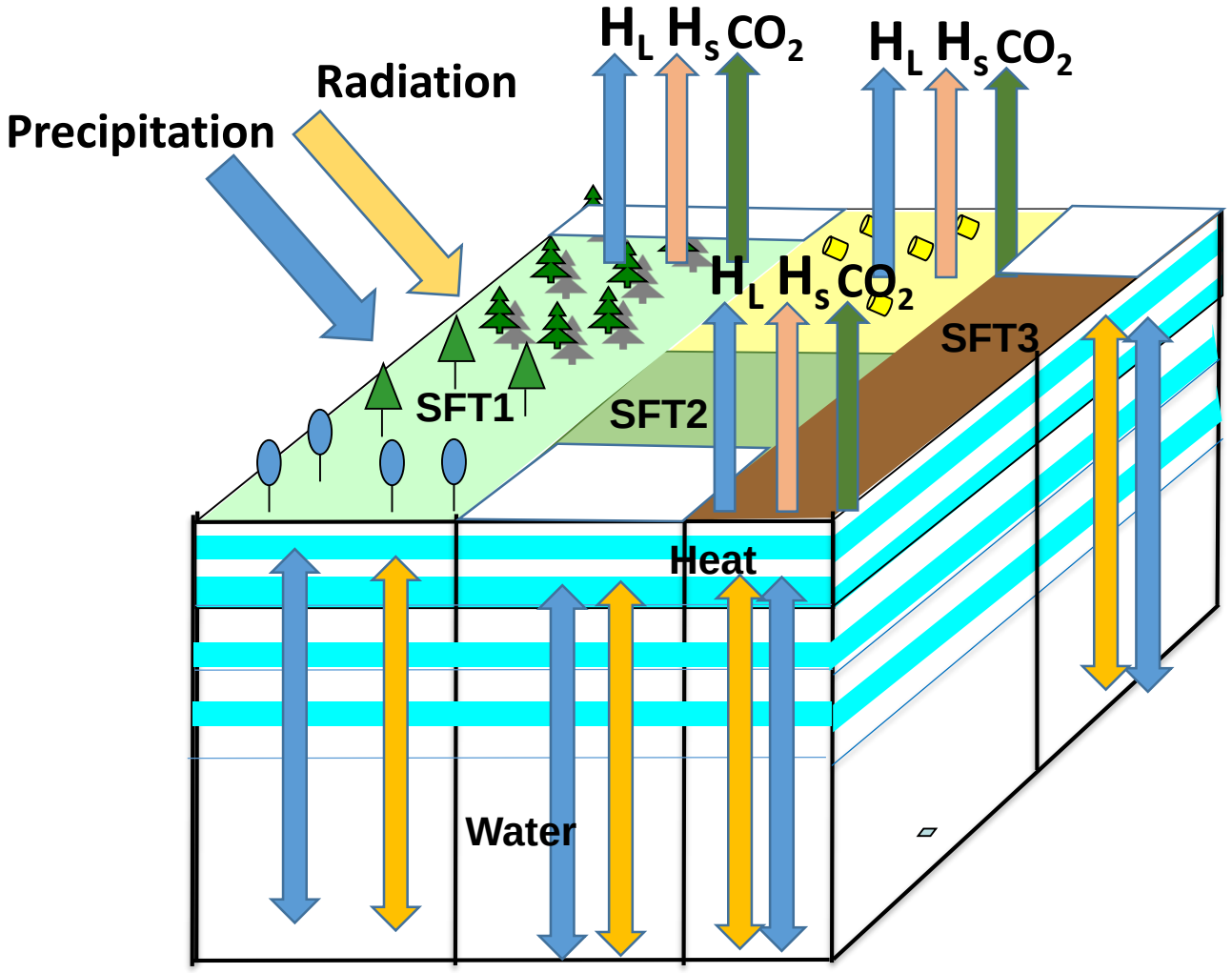
**Definition of SFT fractions in the grid cell:**
- SFTs could be single PFT or group of PFTs or NOBIO fractions
- SFTs could be associated to N soil columns
- SFTs are associated to a single atmospheric column (one energy budget, one soil thermics, one snow budget)

**Links vegetation/soil are insured by the soil definition for each SFT**

<u>Standard case (1):</u> SFT= 1, grouping all PFTs, 1 energy budget, 3 soil water columns

<u>Case 2:</u> Numbers of SFTs = NSFT, nsoil column=1 (1 per SFT), n_atmosph_column = nenerbil_column= NSFT

<u>Case 3:</u> NSFT energy budgets and 1 single water budget (to be coded)



# ORCHIDEE MEB version

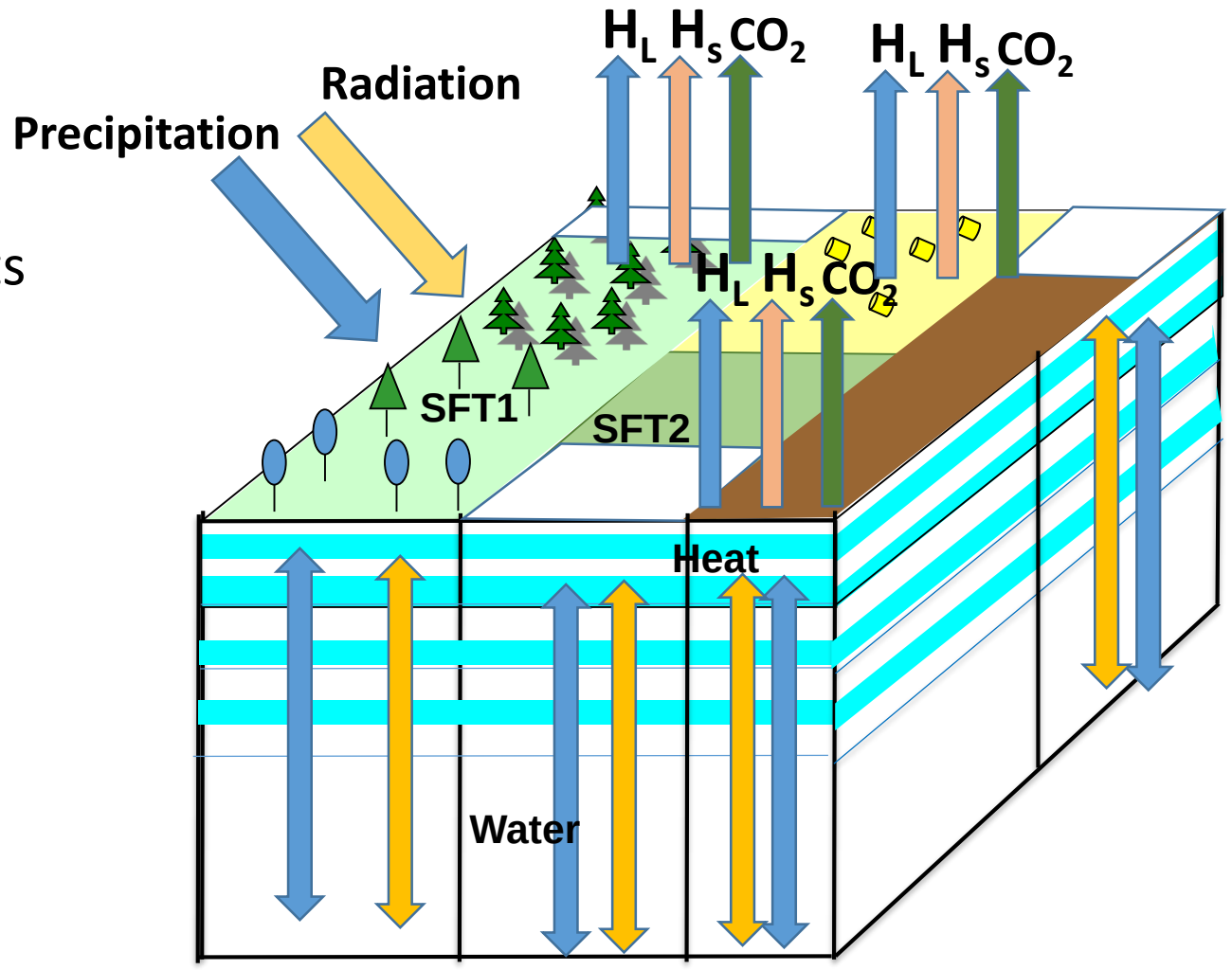
Limitations:

- NSFT drives the number of energy budgets

- Number of snow budgets equals the number of energy budgets/SFTs

- Number of soil thermics has to equal the number of energy budgets (to conserve implicit scheme)

- Number of soil columns can not be lower than the number of SFTs (if 2 LC types compete for water they need to be in the same SFT)



# ORCHIDEE MEB version: present code

## Modifications already done:

- ✓ Dimension of the number of energy budgets has been added to all the IN/OUT variables of all SECHIBA and STOMATE routines
- ✓ Loops on NSFT and Pre and Post routines added to all routines to transfer IN/OUT variables to variables_mc
- ✓ Grid cell implementation where SFTs composition is prescribed

## Modifications still to be done

- No implementation of SFTs, SFT= single PFT or group of PFT and NOBIO fractions not revised properly
- Routing processes not revised and does not work
- INPUT /OUTPUT not coded
- Case 3 with flexibility in the number of water budgets not coded

# ORCHIDEE MEB version: present code

Exemple: SECHIBA_main

```
DO nmc = 1, ncol_enerbil
        call pre-routine1_mc (IN_mc, IN)
        call routine 1 (IN, OUT)
        call post-routine1_mc (OUT, OUT_mc)
END DO

DO nmc = 1, ncol_enerbil
        call pre-routine2_mc (IN_mc, IN)
        call routine 2 (IN, OUT)
        call post-routine2_mc (OUT, OUT_mc)
END DO
```

Etc…

# Questions?

- ✓ Are there some combinations, needed and not treated ?
- ✓ Should we code the tiling differently ?
- ✓ Extension at global scale and SFTs definition for standard configurations need to be developed rapidly
- ✓ Will speed be a limitation?
- ✓ Atmospheric coupling issues?
- ✓ Others?