

ORCHIDEE

ORganizing Carbon and Hydrology in Dynamic EcosystEms

URL: <http://labex.ipsl.fr/orchidee/>



Model Objectives:

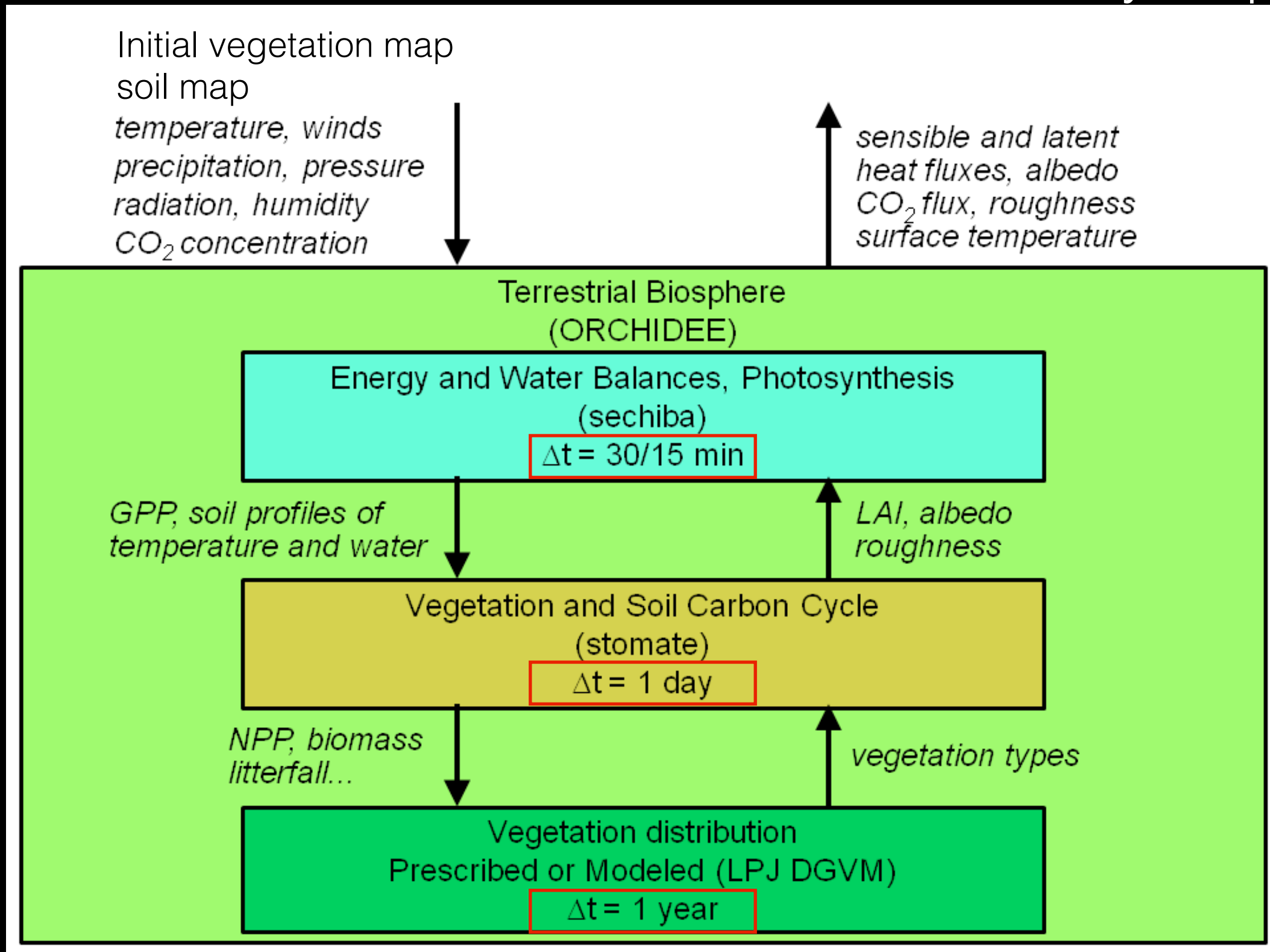
A global land surface model that simulates the processes that influence global carbon cycle and latent, sensible, and kinetic energy exchanges at soil and plant surfaces

First described by Krinner et al. 2005

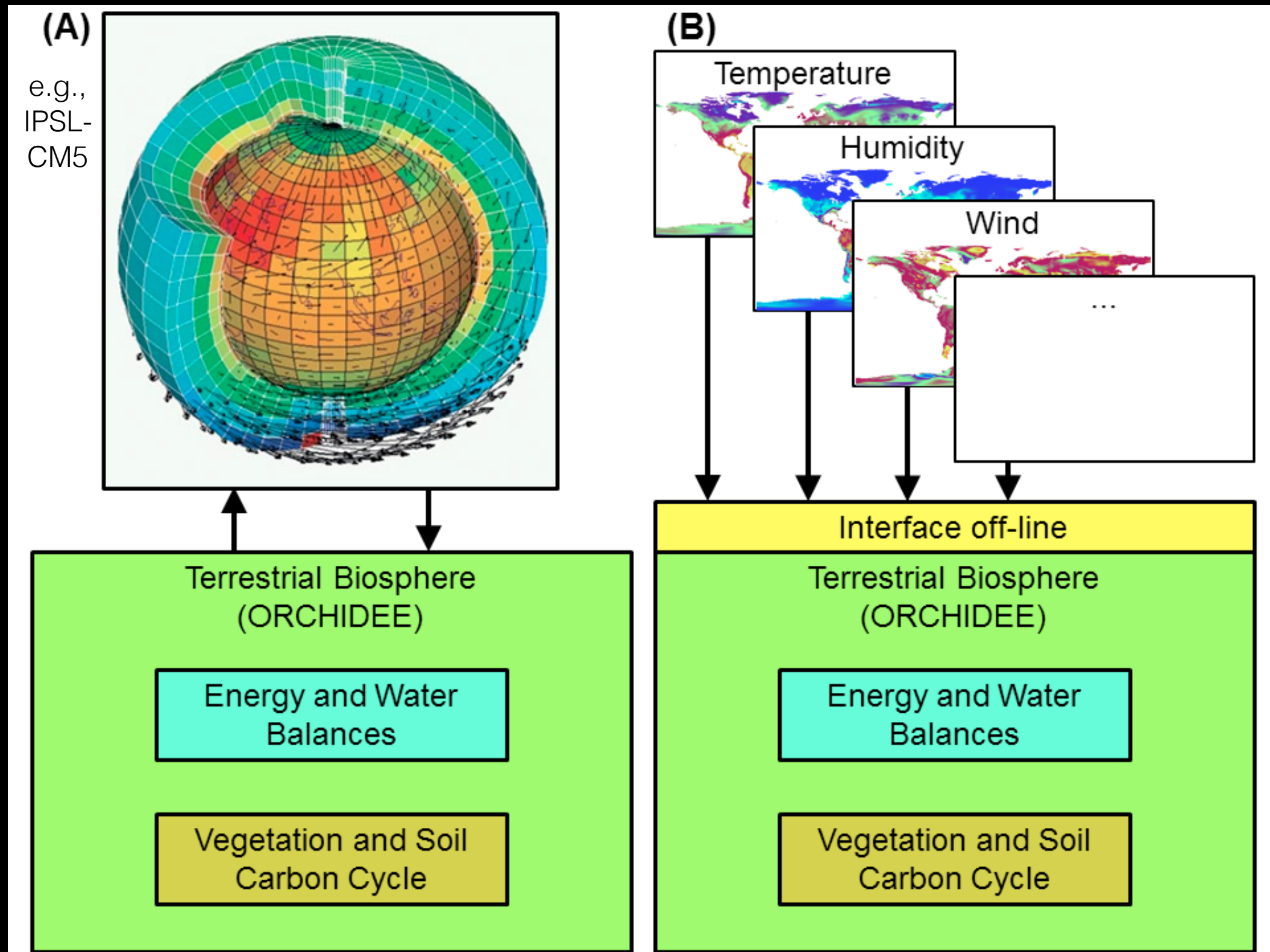
ORCHIDEE integrates three models...

Input drivers

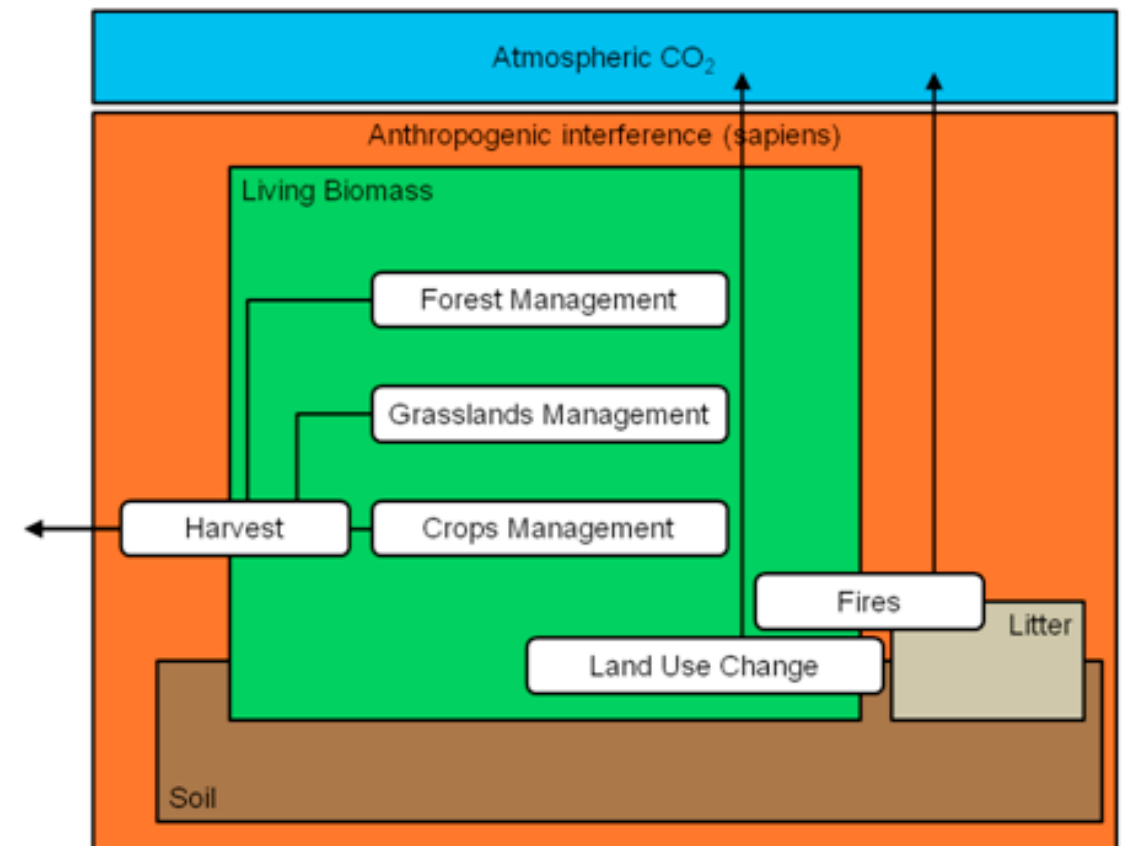
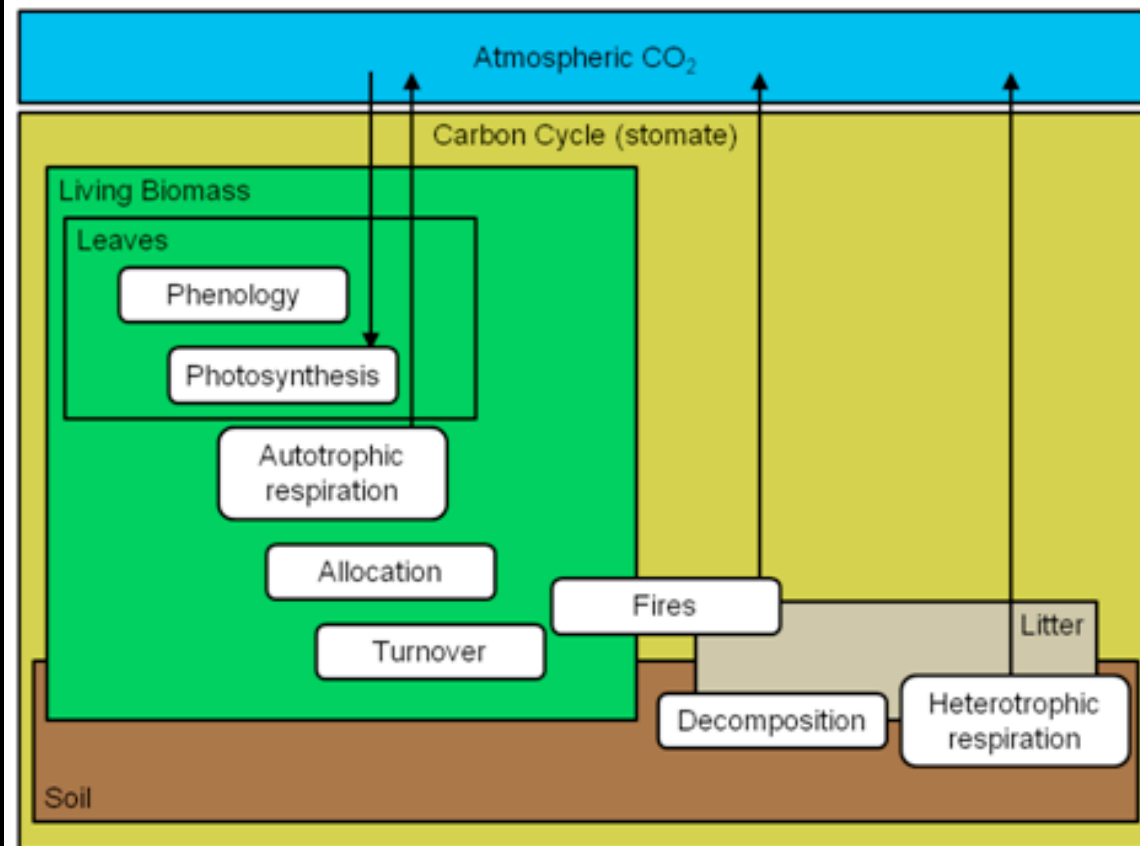
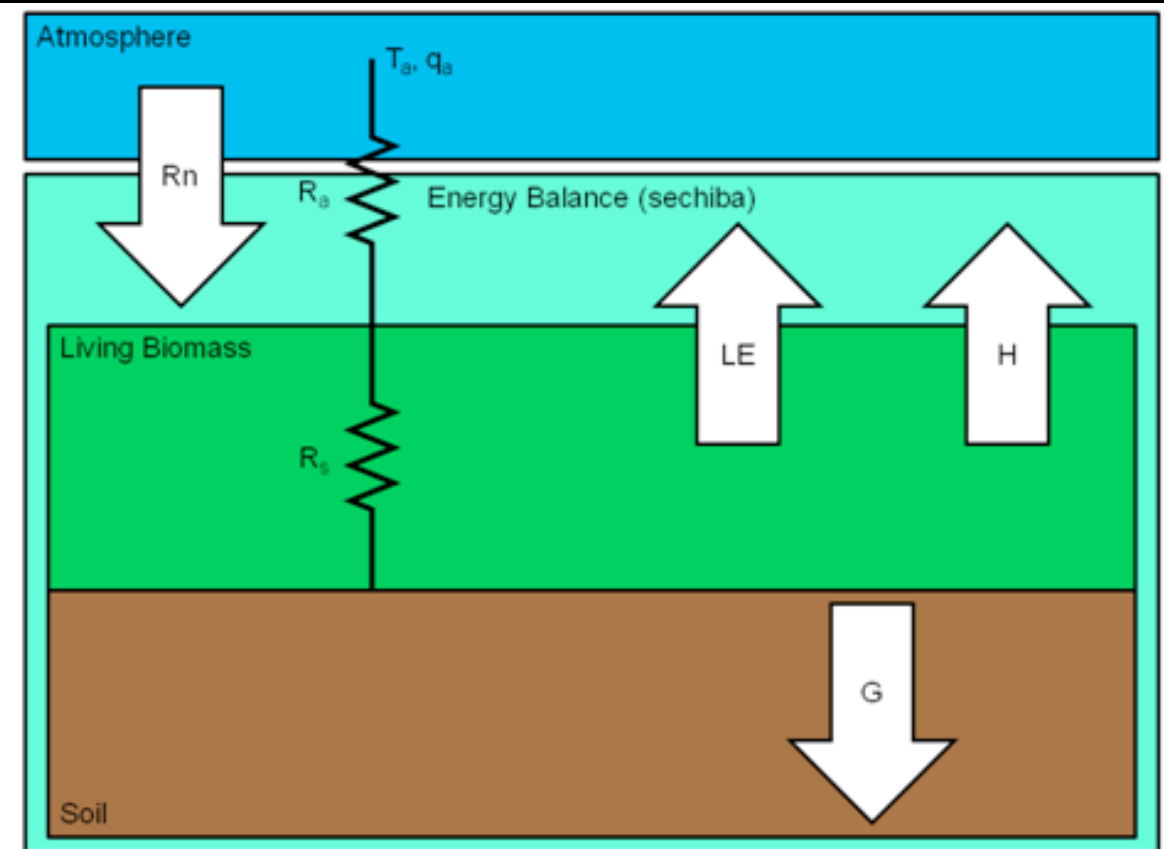
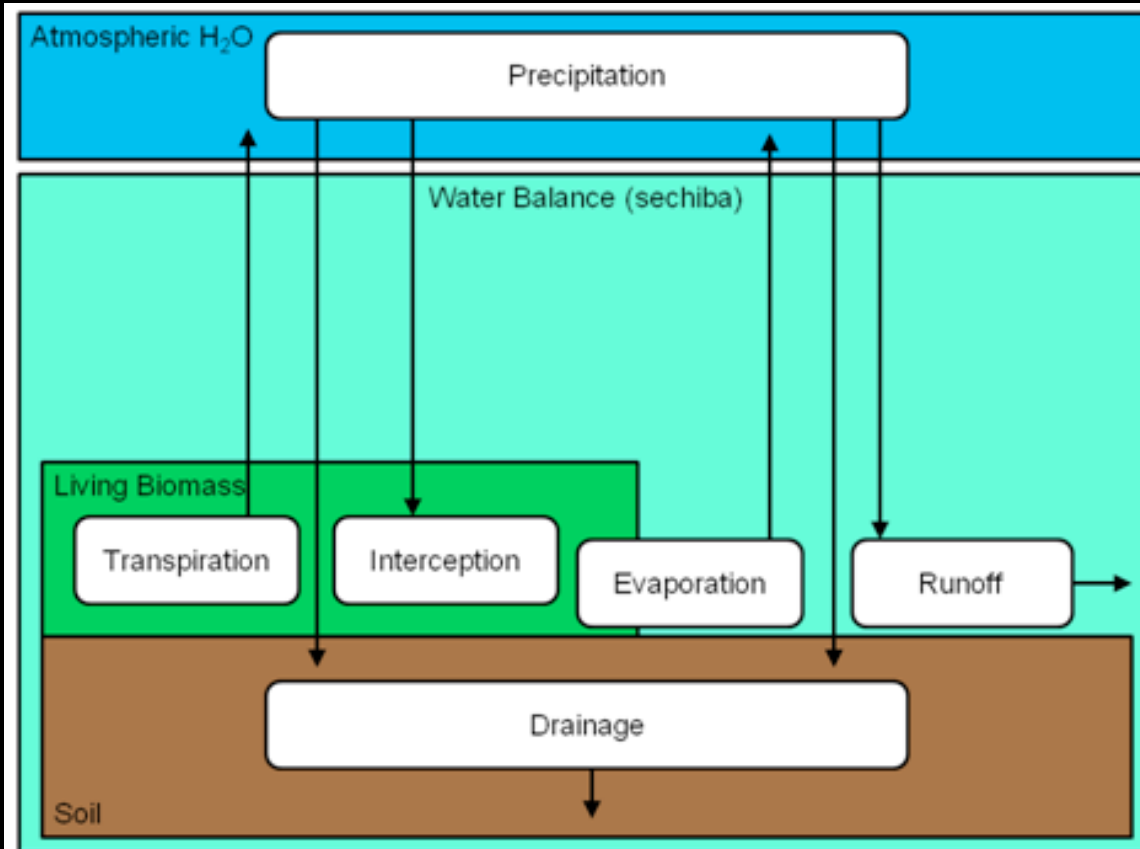
Key outputs



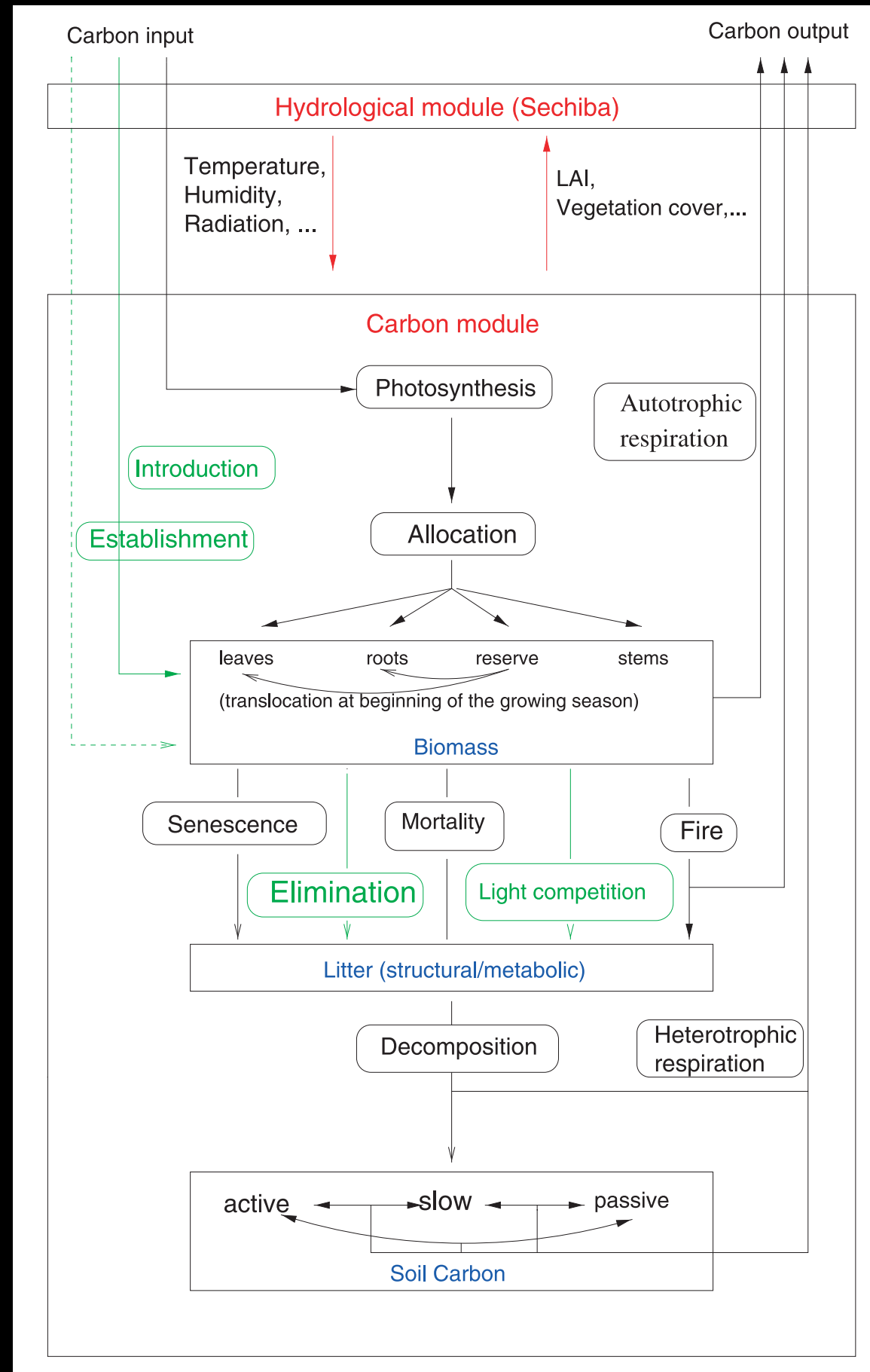
...and can be coupled to global circulation models



Modelled processes in ORCHIDEE



Modelled processes in ORCHIDEE



Initial vegetation map specifies location and proportion of 13 different plant functional types (PFTs) - but is dynamic

- TrBE - Tropical broadleaf evergreen
- TrBR - Tropical raingreen evergreen
- TeNE - Temperate needleleaf evergreen
- TeBE - Temperate broadleaf evergreen
- TeBS - Temperate broadleaf summergreen
- BoNE - Boreal needleleaf evergreen
- BoBS - Boreal broadleaf summergreen
- BoNS - Boreal needleleaf summergreen
- NC3 - Natural C3 grass
- NC4 - Natural C4 grass
- AC3 - Agricultural C3 grass
- AC4 - Agricultural C4 grass

...and bare soil

	Max ps ($\mu\text{mol m}^{-2}\text{s}^{-1}$)		Max LAI	Root depth profile	Leaf albedo		Leaf senescence	Weekly temp for leaf shed	Weekly H ₂ O stress for leaf shed
Table 1. PFTs and PFT-Specific Parameters in ORCHIDEE ^a									
PFT	$V_{\text{cmax, opt}}$	T_{opt}	λ_{max}	Z_{root}	α_{leaf}	h	A_c	T_s	H_s
TrBE	50	37	10	1.25	0.12	25	910	-	0.3
TrBR	60	37	10	1.25	0.14	25	180	-	0.3
TeNE	37.5	27	5	1.	0.14	15	910	-	-
TeBE	37.5	32	5	1.25	0.14	15	730	-	-
TeBS	37.5	28	5	1.25	0.14	15	180	12.5	-
BoNE	37.5	25	4.5	1.	0.14	10	910	-	-
BoBS	37.5	25	4.5	1.	0.14	10	180	5	-
BoNS	35	25	4	1.25	0.14	10	180	7	-
NC3	70	$27.5 + 0.25T_l$	2.5	0.25	0.20	0.2	120	4	0.2
NC4	70	36	2.5	0.25	0.20	0.2	120	5	0.2
AC3	90	$27.5 + 0.25T_l$	6	0.25	0.18	0.4	150	10	0.2
AC4	90	36	3	0.25	0.18	0.4	120	10	0.2

^aThe PFTs are: tropical broadleaf evergreen trees (TrBE), tropical broadleaf raingreen trees (TrBR), temperate needleleaf evergreen trees (TeNE), temperate broadleaf evergreen trees (TeBE), temperate broadleaf summergreen trees (TeBS), boreal needleleaf evergreen trees (BoNE), boreal broadleaf summergreen trees (BoBS), boreal needleleaf summergreen trees (BoNS), natural C₃ grass (NC3), natural C₄ grass (NC4), agricultural C₃ grass (AC3), and agricultural C₄ grass (AC4). $V_{\text{cmax,opt}}$: Optimal maximum rubisco-limited potential photosynthetic capacity ($\mu\text{mol m}^{-2} \text{s}^{-1}$); T_{opt} : Optimum photosynthetic temperature ($^{\circ}\text{C}$), function of multiannual mean temperature T_l ($^{\circ}\text{C}$) for C₃ grasses; λ_{max} : Maximum LAI beyond which there is no allocation of biomass to leaves; Z_{root} : exponential depth scale for root length profile (m); α_{leaf} : prescribed leaf albedo; h :

Multiple PFTs can coexist in one grid cell

Some Key Assumptions:

Soil is 2m deep everywhere

Grasses can't grow below trees

Each grid cell is one big leaf - with varying proportions of PFTs that influence processes

Tree PFTs can't exist where warm season temperature is lower than 7°C

Net
Radiation

R_n

(MJ m⁻²)

Sensible
Heat Flux

H

(MJ m⁻²)

Latent
Heat Flux

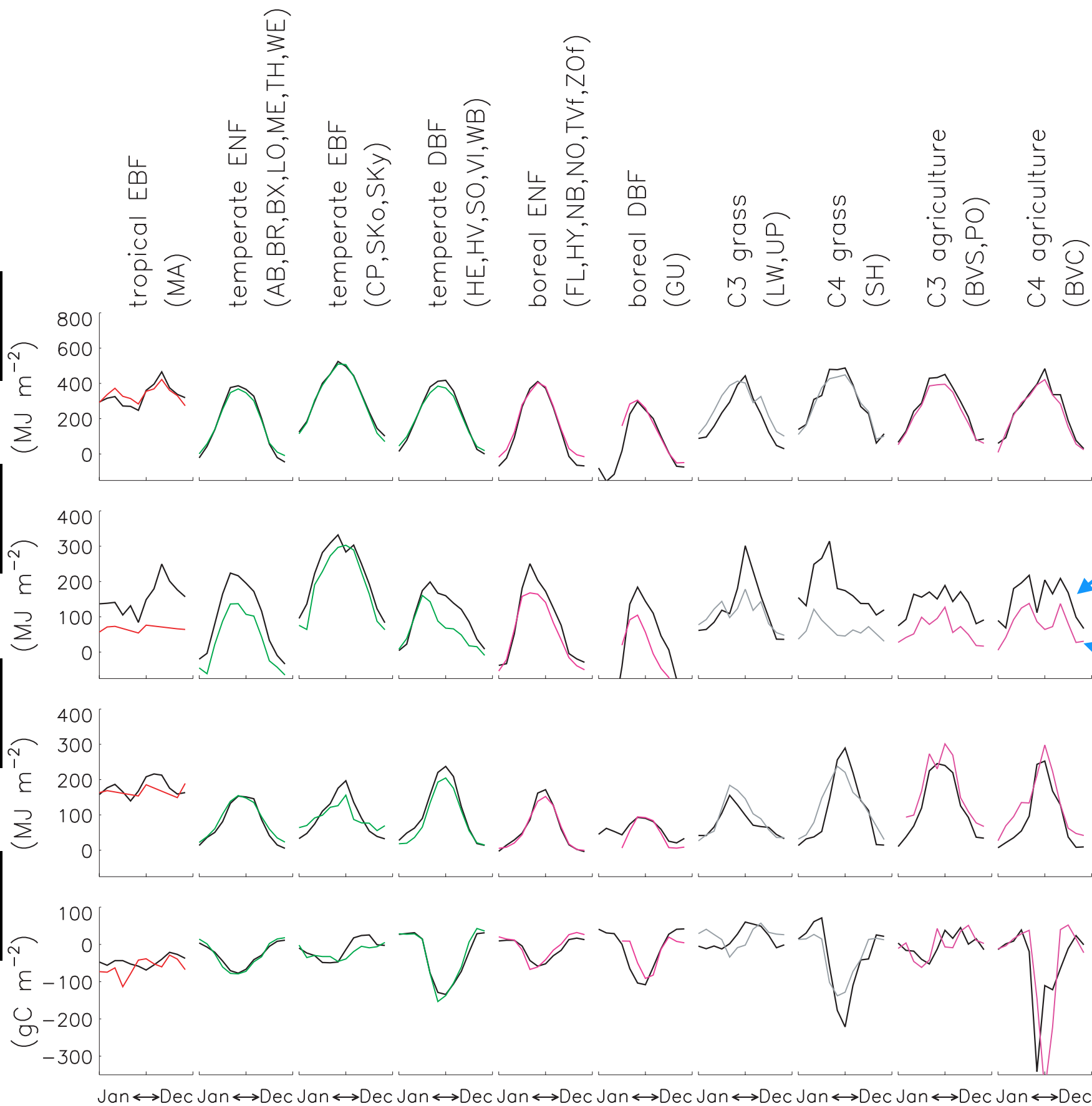
LE

(MJ m⁻²)

Net CO₂
Flux

NEE

(gC m⁻²)



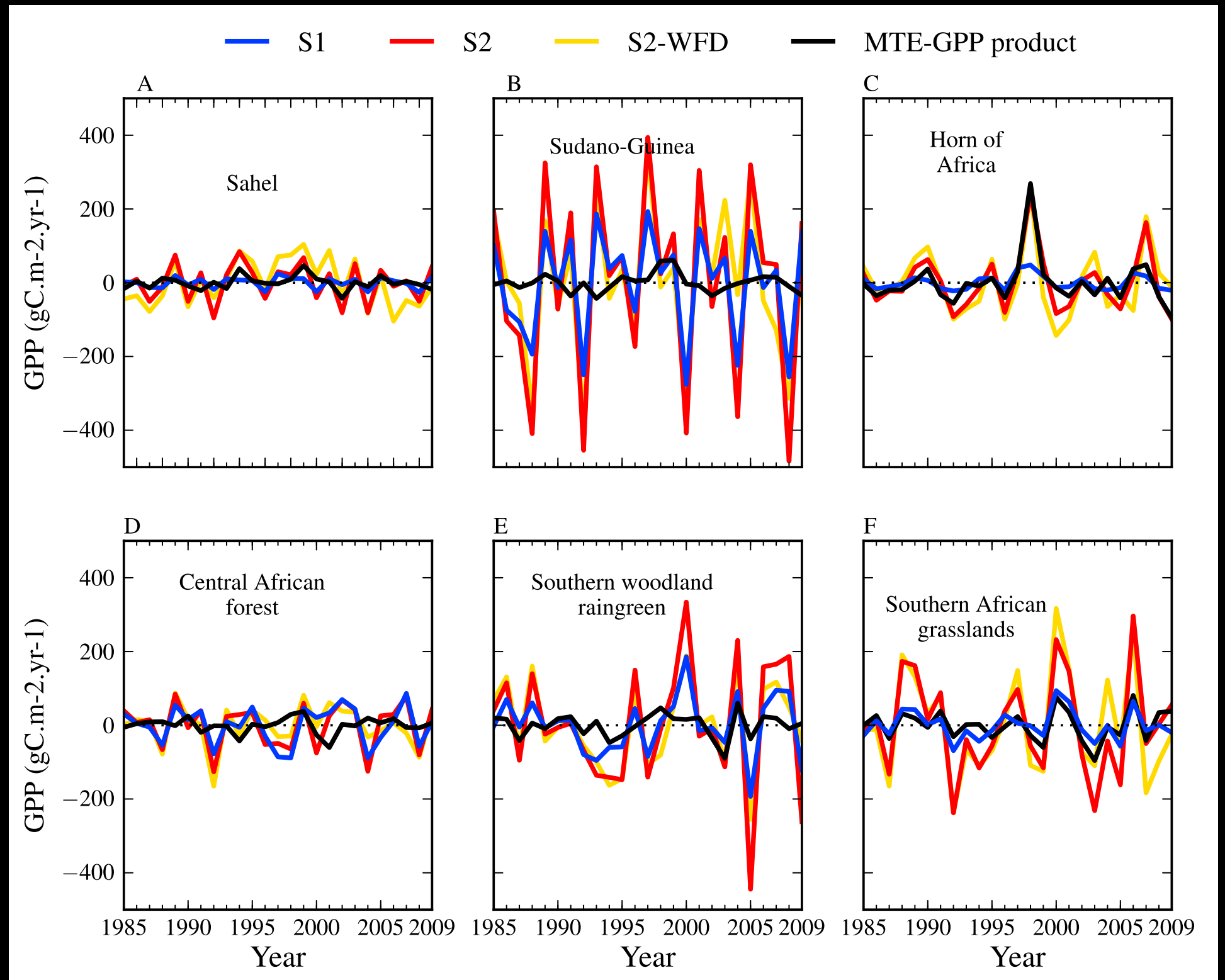
Modelled

Measured

Krinner et al. 2005

GPP too
sensitive too
precip.

Increased
WUE during
drought?



Traore et al. 2014. Evaluation of the ORCHIDEE ecosystem model over Africa against 25 years of satellite-based water and carbon measurements. *Journal of Geophysical Research: Biogeosciences*.

User Interface?

```
| If any tests fail, please see the netCDF web site:
| http://www.unidata.ucar.edu/software/netcdf/
|
| NetCDF is developed and maintained at the Unidata Program
| Center. Unidata provides a broad array of data and software
| tools for use in geoscience education and research.
| http://www.unidata.ucar.edu
+-----+
```

```
sh-3.2# svn co http://forge.ipsl.jussieu.fr/igcmg/svn/modipsl/trunk MY_ORCHIDEE
```

```
A MY_ORCHIDEE/util
A MY_ORCHIDEE/util/mod.def
A MY_ORCHIDEE/util/script_diff_model
A MY_ORCHIDEE/util/ins_m_prec
A MY_ORCHIDEE/util/model
A MY_ORCHIDEE/util/correct-cvs-diff.awk
A MY_ORCHIDEE/util/script_log_analyse
A MY_ORCHIDEE/util/AA_make.gdef
A MY_ORCHIDEE/util/script_recup_model
A MY_ORCHIDEE/util/ins_job
A MY_ORCHIDEE/util/recup_my_ORCHIDEE
A MY_ORCHIDEE/util/w_i_h
A MY_ORCHIDEE/util/ins_make
A MY_ORCHIDEE/tmp
A MY_ORCHIDEE/config
A MY_ORCHIDEE/doc
A MY_ORCHIDEE/doc/NEMO_CeCILL.txt
A MY_ORCHIDEE/lib
A MY_ORCHIDEE/bin
A MY_ORCHIDEE/modeles
```

```
Checked out revision 2442.
```

```
sh-3.2# cd MY_ORCHIDEE/util
```

```
sh-3.2# ./model ORCHIDEE_TAG
```

```
./log
```

```
A IOIPSL/src/calendar.f90
A IOIPSL/src/def.prec
A IOIPSL/src/AA_make.ldef
A IOIPSL/src/mathelp.f90
A IOIPSL/src/restcom.f90
A IOIPSL/src/ioipsl.f90
A IOIPSL/src/AA_make
A IOIPSL/src/getincom.f90
A IOIPSL/src/stringop.f90
A IOIPSL/src/histcom.f90
A IOIPSL/src/flincom.f90
A IOIPSL/src/erriopsl.f90
A IOIPSL/src/fliocom.f90
```

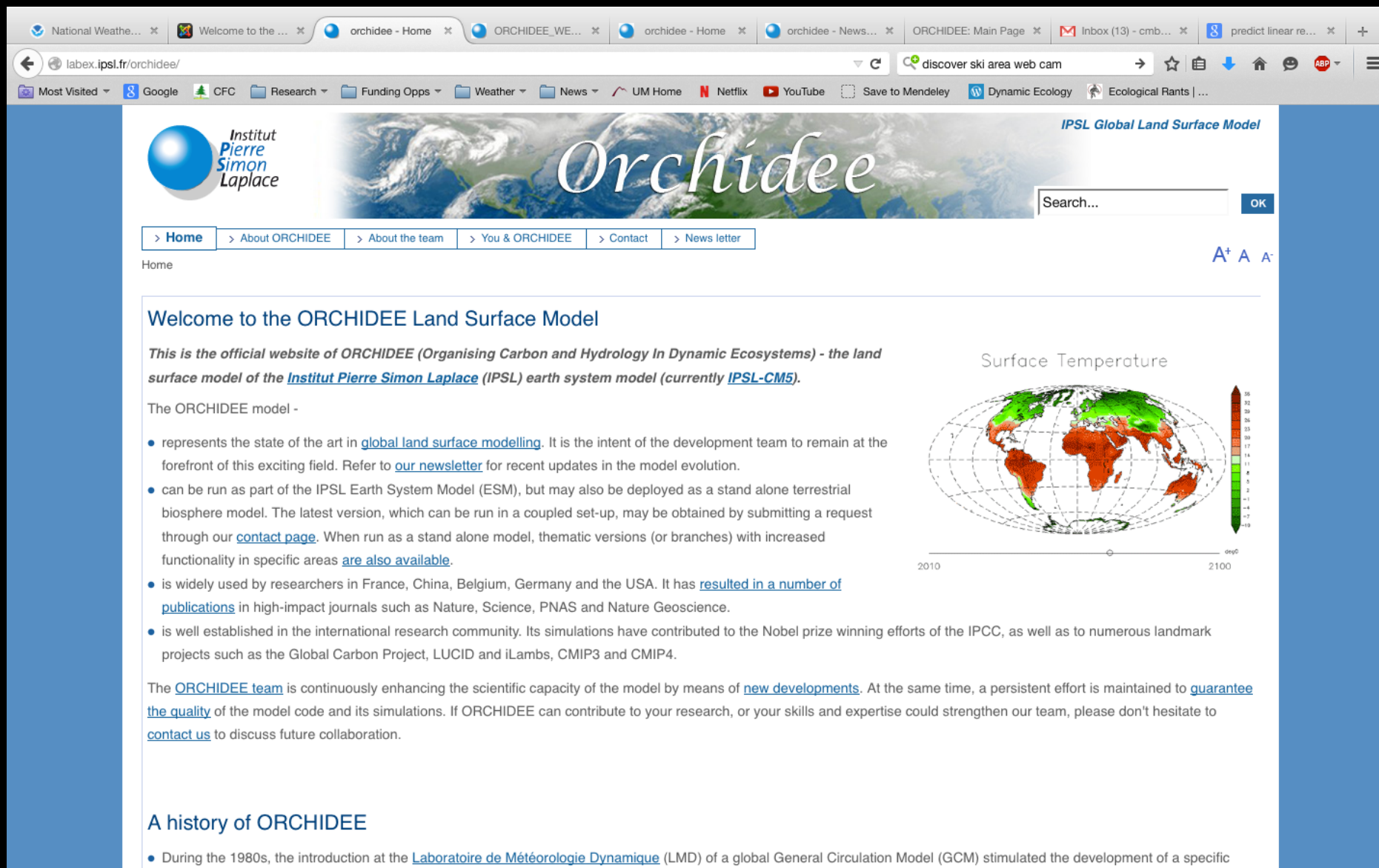
```
Checked out revision 2442.
```

```
A libIGCM/AA_create_multi_se
A libIGCM/AA_atlas_ORCA_LIM
A libIGCM/AA_job
A libIGCM/libIGCM.card
A libIGCM/AA_pack_restart
A libIGCM/ins_job
A libIGCM/AA_monitoring
A libIGCM/AA_additionnal
A libIGCM/AA_clean_month
A libIGCM/AA_SaveSourceModifications
A libIGCM/AA_RunChecker
A libIGCM/AA_atlas_LMDZ
A libIGCM/AA_SE_Checker
A libIGCM/AA_metrics_LMDZ
A libIGCM/libIGCM_documentation
```

ORCHIDEE continues to develop

20 permanent staff

Web of Science search “ORCHIDEE model” returns 113 articles



The screenshot shows the official website of the ORCHIDEE Land Surface Model. The browser's address bar displays 'labex.ipsl.fr/orchidee/'. The website header features the Institut Pierre Simon Laplace logo and the 'Orchidee' title. A navigation menu includes links for Home, About ORCHIDEE, About the team, You & ORCHIDEE, Contact, and News letter. A search bar is located on the right side of the header. The main content area is titled 'Welcome to the ORCHIDEE Land Surface Model' and provides a brief description of the model as the official website of ORCHIDEE (Organising Carbon and Hydrology In Dynamic Ecosystems). It lists key features and achievements of the model, such as its use in the IPSL Earth System Model (ESM), its deployment as a stand-alone terrestrial biosphere model, and its widespread use by researchers in various countries. A world map titled 'Surface Temperature' is displayed on the right, showing temperature variations from 2010 to 2100. The bottom section, 'A history of ORCHIDEE', mentions the model's development at the Laboratoire de Météorologie Dynamique (LMD) in the 1980s.

National Weathe... Welcome to the ... orchidee - Home ORCHIDEE_WE... orchidee - Home orchidee - News... ORCHIDEE: Main Page Inbox (13) - cmb... predict linear re...
labex.ipsl.fr/orchidee/ discover ski area web cam
Most Visited Google CFC Research Funding Opps Weather News UM Home Netflix YouTube Save to Mendeley Dynamic Ecology Ecological Rants | ...
Institut Pierre Simon Laplace
Orchidee
Search... OK
> Home > About ORCHIDEE > About the team > You & ORCHIDEE > Contact > News letter
Home
A⁺ A A⁻
Welcome to the ORCHIDEE Land Surface Model
This is the official website of ORCHIDEE (Organising Carbon and Hydrology In Dynamic Ecosystems) - the land surface model of the Institut Pierre Simon Laplace (IPSL) earth system model (currently IPSL-CM5).
The ORCHIDEE model -

- represents the state of the art in [global land surface modelling](#). It is the intent of the development team to remain at the forefront of this exciting field. Refer to [our newsletter](#) for recent updates in the model evolution.
- can be run as part of the IPSL Earth System Model (ESM), but may also be deployed as a stand alone terrestrial biosphere model. The latest version, which can be run in a coupled set-up, may be obtained by submitting a request through our [contact page](#). When run as a stand alone model, thematic versions (or branches) with increased functionality in specific areas [are also available](#).
- is widely used by researchers in France, China, Belgium, Germany and the USA. It has [resulted in a number of publications](#) in high-impact journals such as Nature, Science, PNAS and Nature Geoscience.
- is well established in the international research community. Its simulations have contributed to the Nobel prize winning efforts of the IPCC, as well as to numerous landmark projects such as the Global Carbon Project, LUCID and iLambs, CMIP3 and CMIP4.

The [ORCHIDEE team](#) is continuously enhancing the scientific capacity of the model by means of [new developments](#). At the same time, a persistent effort is maintained to [guarantee the quality](#) of the model code and its simulations. If ORCHIDEE can contribute to your research, or your skills and expertise could strengthen our team, please don't hesitate to [contact us](#) to discuss future collaboration.

A history of ORCHIDEE

- During the 1980s, the introduction at the [Laboratoire de Météorologie Dynamique](#) (LMD) of a global General Circulation Model (GCM) stimulated the development of a specific

Surface Temperature
2010 2100

Many thematic versions (branches):

ORCHIDEE-multi-soil-hydro
ORCHIDEE-CN
ORCHIDEE-FM
ORCHIDEE-HIGHLATITUDE
ORCHIDEE-EXT
ORCHIDEE-STICS
ORCHIDEE-PASIM
ORCHIDEE-BVOC

