CliMAF Earth System Model Evaluation Platform

CliMAF
Sharing – Simplifying – Optimizing

Evaluating/comparing a set of simulations/models on Ciclad/Curie: Use for DYNAMICO

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MODÈLES NUMÉRIQUES

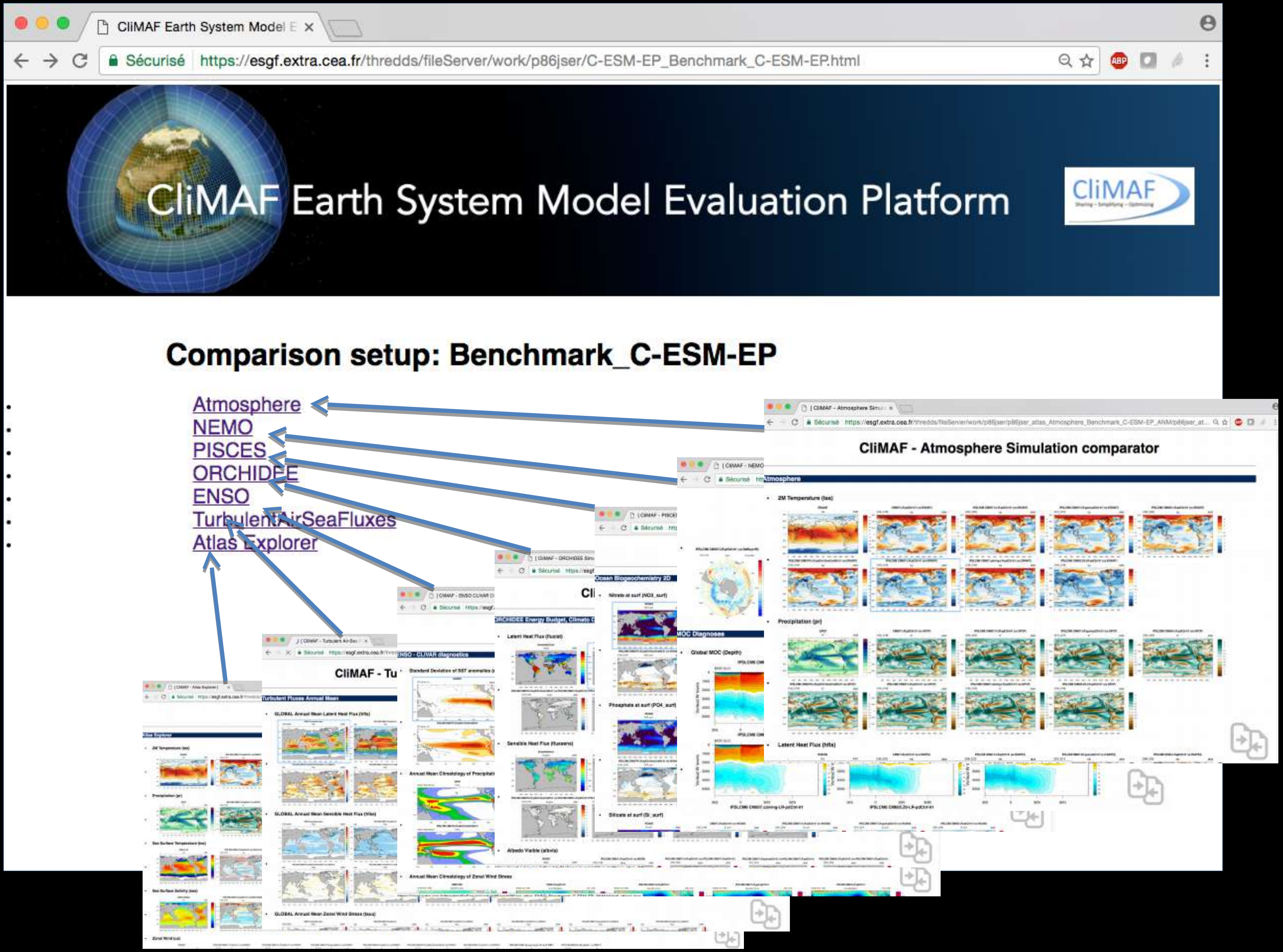
The C-ESM-EP

Definition

- A predefined – community validated (IPSL-CNRM-CERFACS) set of evaluation diagnostics **by component/thematic**

- **an efficient way to systematically compare** results of different simulations while benefiting from ways to finess the diagnostics (choosing the periods for a set of diagnostics, controlling the plot parameters…) => concept of 'comparison'

- a front html page with links to the html pages of the atlases of the different components/thematics.



CliMAF Earth System Model E

Sécurisé https://esgf.extra.cea.fr/thredds/fileServer/work/p86jser/C-ESM-EP_Benchmark_C-ESM-EP.html

CliMAF Earth System Model Evaluation Platform

Comparison setup: Benchmark_C-ESM-EP

- Atmosphere
- NEMO
- PISCES
- ORCHIDEE
- ENSO
- TurbulentAirSeaFluxes
- Atlas Explorer

CliMAF
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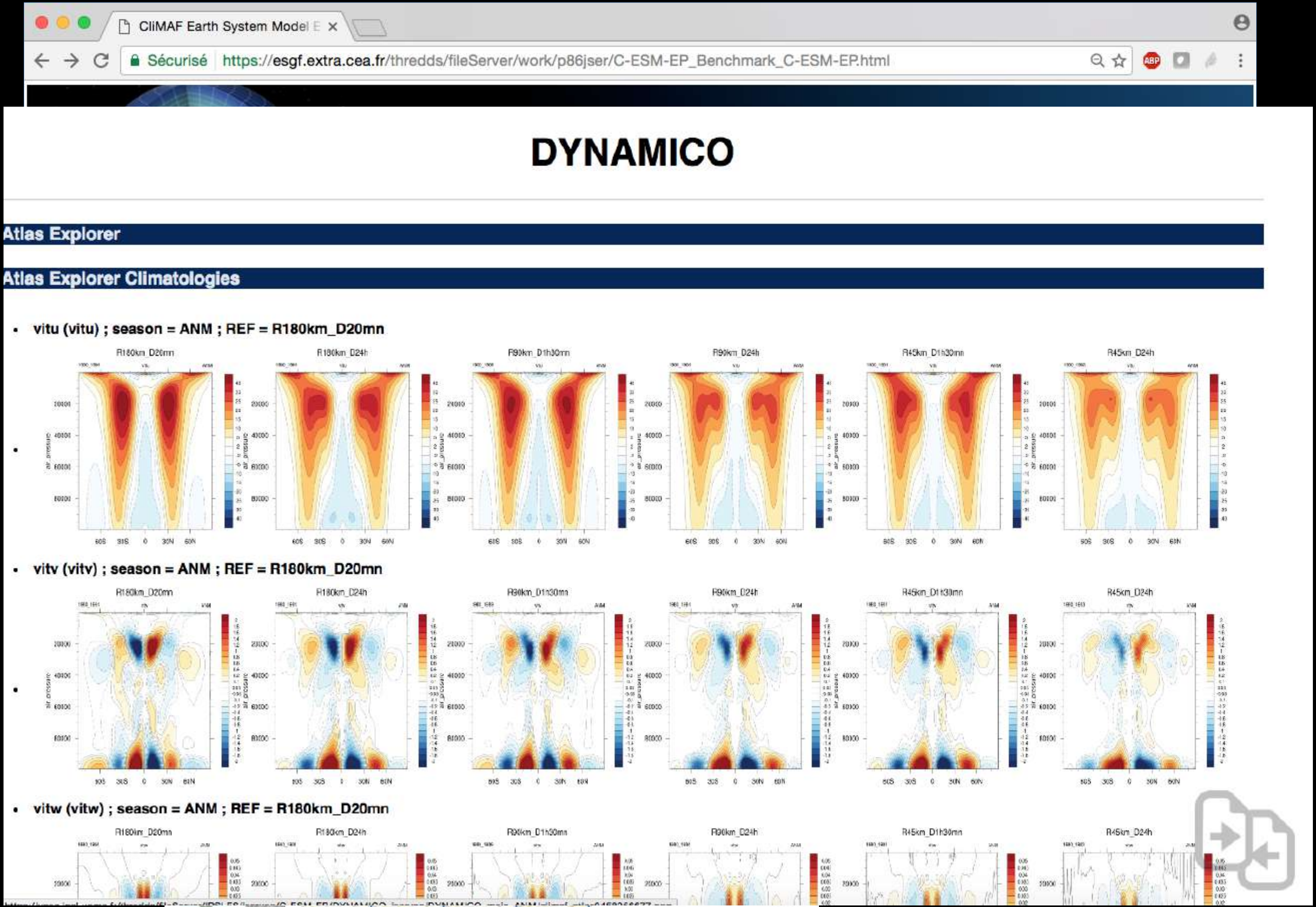
CliMAF - Atmosphere Simulation comparator
Atmosphere
2M Temperature (tas)
Precipitation (pr)
Latent Heat Flux (hfls)
MOC Diagnoses
Global MOC (Depth)
Ocean Biogeochemistry 2D
Nitrate at surf (NO3_surf)
Phosphate at surf (PO4_surf)
Silicate at surf (Si_surf)
ORCHIDEE Energy Budget, Climato
Latent Heat Flux (fluxlat)
Sensible Heat Flux (fluxsens)
Albedo Visible (alb_vis)
ENSO - CLIVAR diagnostics
Standard Deviation of SST anomalies
Annual Mean Climatology of Precipitation
Annual Mean Climatology of Zonal Wind Stress
CliMAF - Tu
Turbulent Fluxes Annual Mean
GLOBAL Annual Mean Latent Heat Flux (hfls)
GLOBAL Annual Mean Sensible Heat Flux (hfss)
GLOBAL Annual Mean Zonal Wind Stress (tauu)
Atlas Explorer
2M Temperature (tas)
Precipitation (pr)
Sea Surface Temperature (tos)
Sea Surface Salinity (sos)
Zonal Wind (ua)



CliMAF Earth System Model E
Sécurisé
https://esgf.extra.cea.fr/thredds/fileServer/work/p86jser/C-ESM-EP_Benchmark_C-ESM-EP.html

DYNAMICO

Atlas Explorer

Atlas Explorer Climatologies

- **vitu (vitu) ; season = ANM ; REF = R180km_D20mn**

- **vitv (vitv) ; season = ANM ; REF = R180km_D20mn**

- **vitw (vitw) ; season = ANM ; REF = R180km_D20mn**

CliMAF

Sharing – Simplifying – Optimizing

The C-ESM-EP is based on **CliMAF** (http://climaf.readthedocs.io/en/latest/), an advanced python framework developed in collaboration between CNRM-GAME and IPSL to provide the french community with an efficient way to gather-share diagnostics and apply them routinely on the climate models outputs.

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CliMAF

Sharing – Simplifying – Optimizing

Main strengths:

- Standardised way to access the data => can be adapted to any CF-compliant netcdf files => encourage sharing the diagnostics!
- Automatically manage the output in a smart cache (uses the existing results) => fast!
- Simplified way to do those daily pretreatments (averaging, period/geographical domain selection, …) based on CDO
- Easy way to do plots (using an NCL script) and put them in an html page
- Easy to plug your own script of diagnostic

The C-ESM-EP in a nutshell

The quick way to use the C-ESM-EP on Ciclad

1. Copy the sources in a working directory:

```
cd my_working_directory
mkdir -p C-ESM-EP ; cd C-ESM-EP
cp –r ${sources} . ; cp –r src work
cd work
```

2. Setup your comparison:

```
cp -r comparison_example/ my_comparison/
```

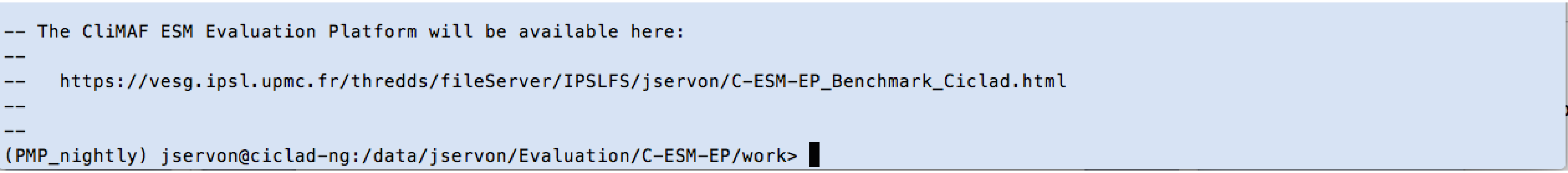
3. Enter your datasets:

```
vi my_comparison/datasets_setup.py
```

4. Run all the components together or just a subset:

```
python run_C-ESM-EP.py my_comparison [Atmosphere_Surface,ENSO]
```

5. See the results on the URL returned by run_C-ESM-EP.py

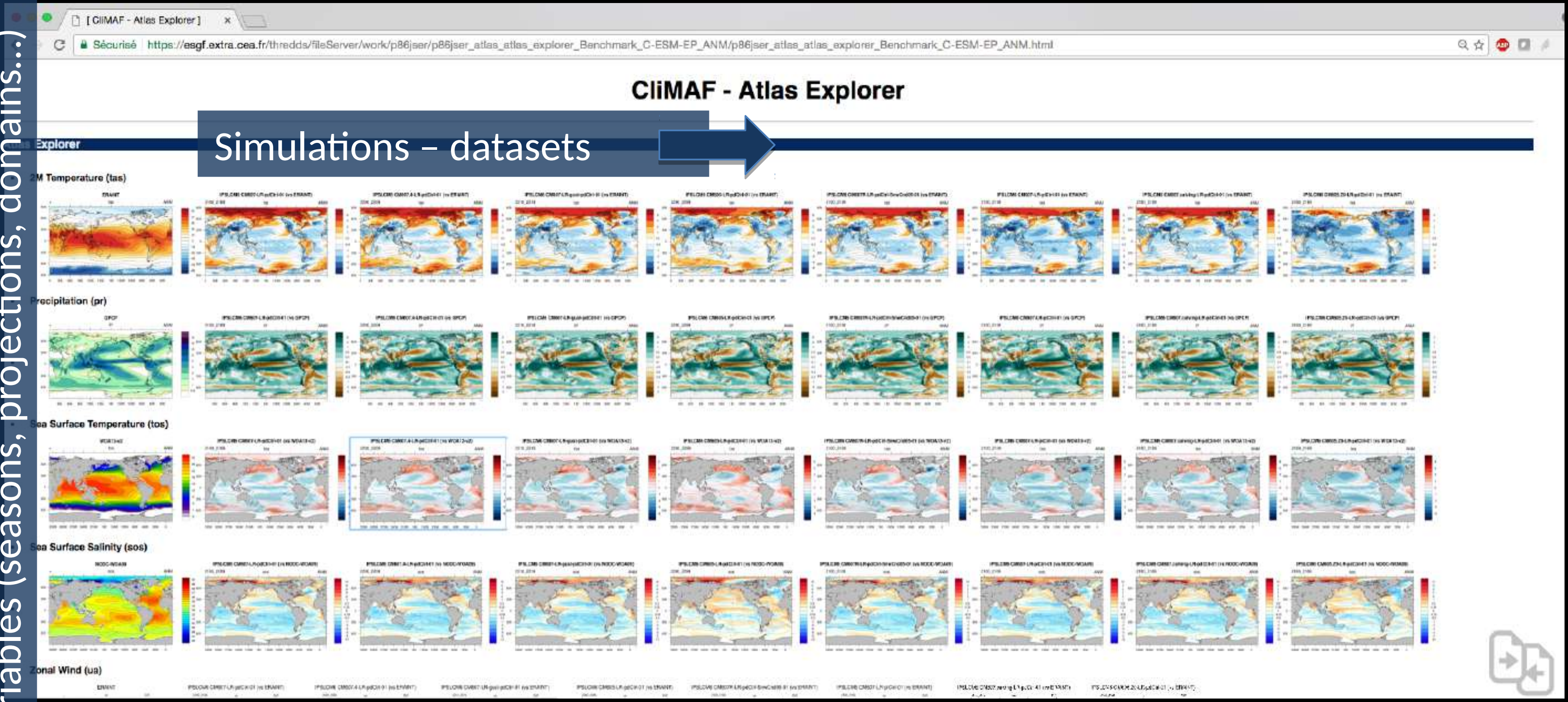


```
-- The CliMAF ESM Evaluation Platform will be available here:
--
--   https://vesg.ipsl.upmc.fr/thredds/fileServer/IPSLFS/jservon/C-ESM-EP_Benchmark_Ciclad.html
--
--
(PMP_nightly) jservon@ciclad-ng:/data/jservon/Evaluation/C-ESM-EP/work> 
```

Atlas Explorer

Definition

- **An easy and flexible working space within the C-ESM-EP** to produce an html page showing climatologies and difference maps (with a reference)
  - on a set of datasets (simulations, models, different periods…)
  - for a set of user-defined variables



[CliMAF - Atlas Explorer]

Sécurisé | https://esgf.extra.cea.fr/thredds/fileServer/work/p86jser/p86jser_atlas_atlas_explorer_Benchmark_C-ESM-EP_ANM/p86jser_atlas_atlas_explorer_Benchmark_C-ESM-EP_ANM.html

CliMAF - Atlas Explorer

Simulations – datasets

Variables (seasons, projections, domains…)

The user works on only two python parameter files:

- One for the datasets
- One for the variables + specs

DYNAMICO atlas in a nutshell

Quick way to use Atlas Explorer for DYNAMICO

1. Install the C-ESM-EP and setup a comparison (as seen for the C-ESM-EP)

2. Go into the directory of your comparison and add your datasets in datasets_setup.py

```
cd my_DYNAMICO_comparison
vi datasets_setup.py
```

3. Edit the DYNAMICO_main parameter file to setup what you need

```
vi DYNAMICO_main/params_DYNAMICO_main.py
```

4. Run the DYNAMICO atlas interactively:

```
./job_C-ESM-EP.py DYNAMICO_main
```

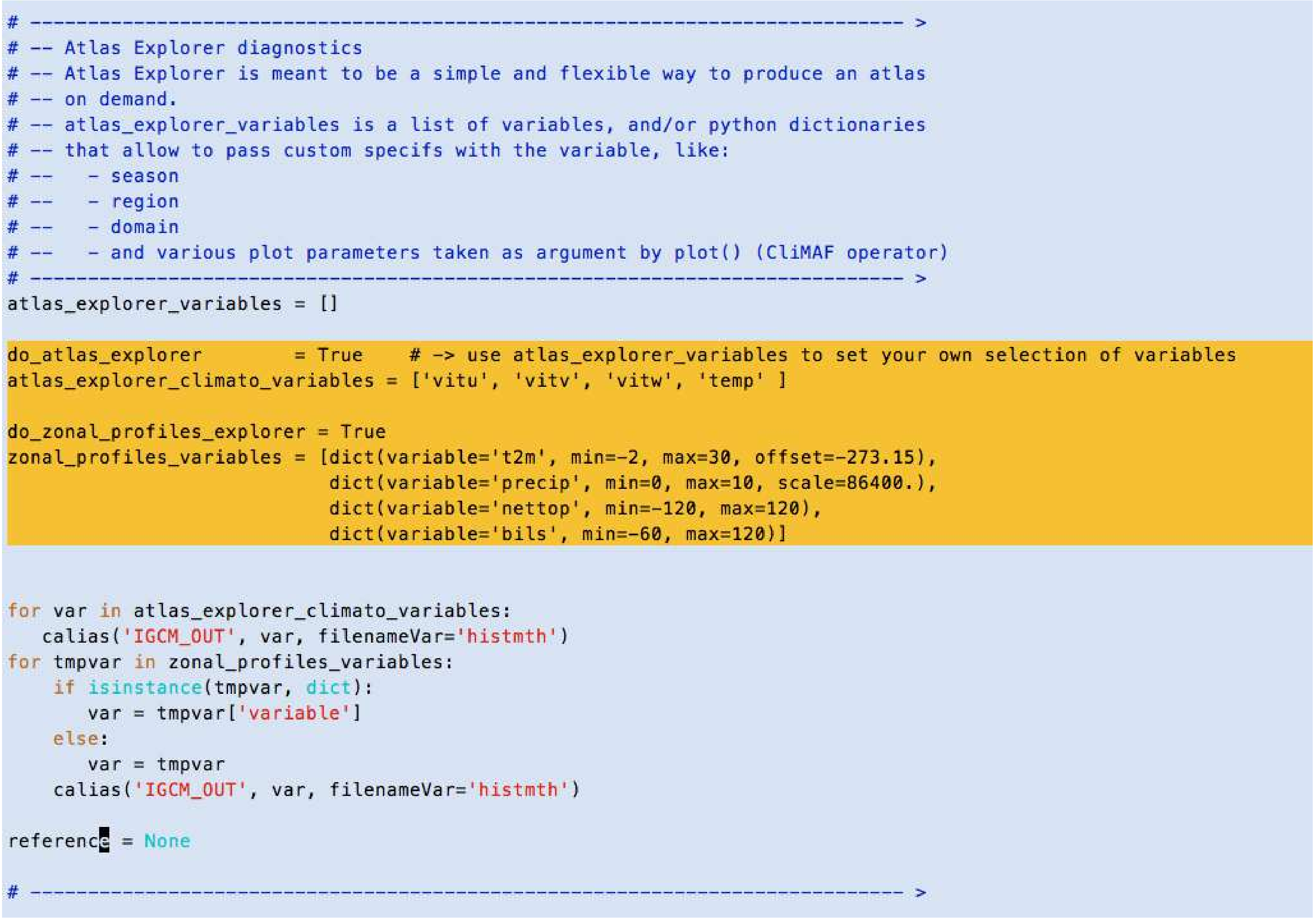
See the results on the URL returned at the end of the execution.

5. Or submit a job from the main directory:

```
cd ../
python run_C-ESM-EP.py my_DYNAMICO_comparison/ DYNAMICO_main
```

DYNAMICO atlas in a nutshell

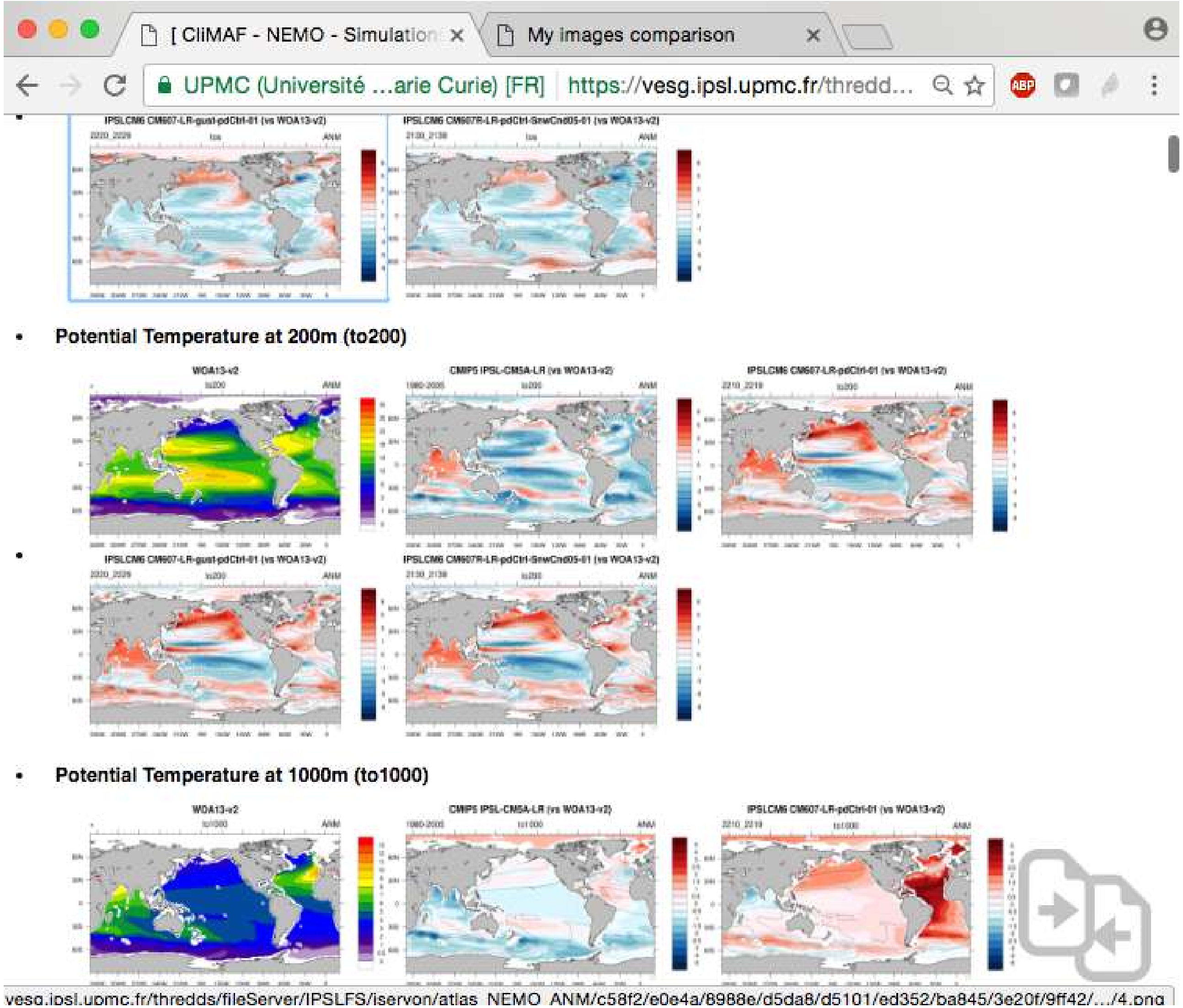
Edit the DYNAMICO_main parameter file



```
# ---------------------------------------------------------------------------- >
# -- Atlas Explorer diagnostics
# -- Atlas Explorer is meant to be a simple and flexible way to produce an atlas
# -- on demand.
# -- atlas_explorer_variables is a list of variables, and/or python dictionaries
# -- that allow to pass custom specifs with the variable, like:
# --    - season
# --    - region
# --    - domain
# --    - and various plot parameters taken as argument by plot() (CliMAF operator)
# ---------------------------------------------------------------------------- >
atlas_explorer_variables = []

do_atlas_explorer        = True    # -> use atlas_explorer_variables to set your own selection of variables
atlas_explorer_climato_variables = ['vitu', 'vitv', 'vitw', 'temp' ]

do_zonal_profiles_explorer = True
zonal_profiles_variables = [dict(variable='t2m', min=-2, max=30, offset=-273.15),
                            dict(variable='precip', min=0, max=10, scale=86400.),
                            dict(variable='nettop', min=-120, max=120),
                            dict(variable='bils', min=-60, max=120)]


for var in atlas_explorer_climato_variables:
   calias('IGCM_OUT', var, filenameVar='histmth')
for tmpvar in zonal_profiles_variables:
    if isinstance(tmpvar, dict):
       var = tmpvar['variable']
    else:
       var = tmpvar
    calias('IGCM_OUT', var, filenameVar='histmth')

reference = None

# ---------------------------------------------------------------------------- >
```

The compareCompanion

Display a selection of figures on the fly


[CliMAF - NEMO - Simulation
My images comparison
UPMC (Université ...arie Curie) [FR]
https://vesg.ipsl.upmc.fr/thredd...
IPSLCM6 CM607-LR-gust-pdCtrl-01 (vs WOA13-v2)
2020_2029
tos
ANM
IPSLCM6 CM607R-LR-pdCtrl-SnwCnd05-01 (vs WOA13-v2)
2130_2139
tos
ANM

- Potential Temperature at 200m (to200)

WOA13-v2
to200
ANM
CMIP5 IPSL-CM5A-LR (vs WOA13-v2)
1980-2005
to200
ANM
IPSLCM6 CM607-LR-pdCtrl-01 (vs WOA13-v2)
2210_2219
to200
ANM
IPSLCM6 CM607-LR-gust-pdCtrl-01 (vs WOA13-v2)
2020_2029
to200
ANM
IPSLCM6 CM607R-LR-pdCtrl-SnwCnd05-01 (vs WOA13-v2)
2130_2139
to200
ANM

- Potential Temperature at 1000m (to1000)

WOA13-v2
to1000
ANM
CMIP5 IPSL-CM5A-LR (vs WOA13-v2)
1980-2005
to1000
ANM
IPSLCM6 CM607-LR-pdCtrl-01 (vs WOA13-v2)
2210_2219
to1000
ANM

vesg.ipsl.upmc.fr/thredds/fileServer/IPSLFS/jservon/atlas_NEMO_ANM/c58f2/e0e4a/8988e/d5da8/d5101/ed352/ba845/3e20f/9ff42/.../4.png

The compareCompanion

Select your figures with ‘s’

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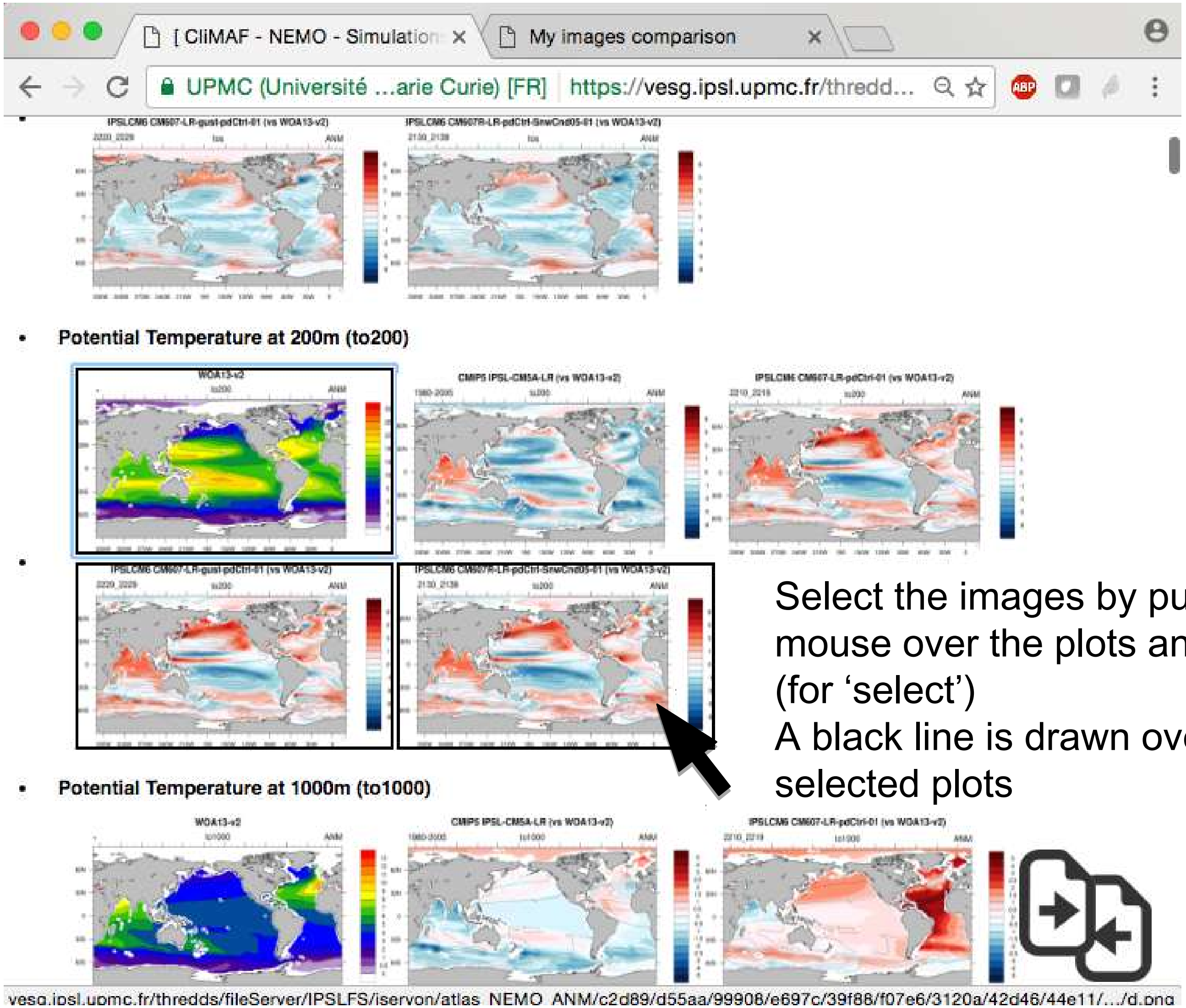
[CliMAF - NEMO - Simulation
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UPMC (Université ...arie Curie) [FR]
https://vesg.ipsl.upmc.fr/thredd...
IPSLCM6 CM607-LR-gust-pdCtrl-01 (vs WOA13-v2)
IPSLCM6 CM607R-LR-pdCtrl-SnwCnd05-01 (vs WOA13-v2)
WOA13-v2
to200
ANM
CMIP5 IPSL-CM5A-LR (vs WOA13-v2)
IPSLCM6 CM607-LR-pdCtrl-01 (vs WOA13-v2)
WOA13-v2
to1000
ANM

- Potential Temperature at 200m (to200)
- Potential Temperature at 1000m (to1000)

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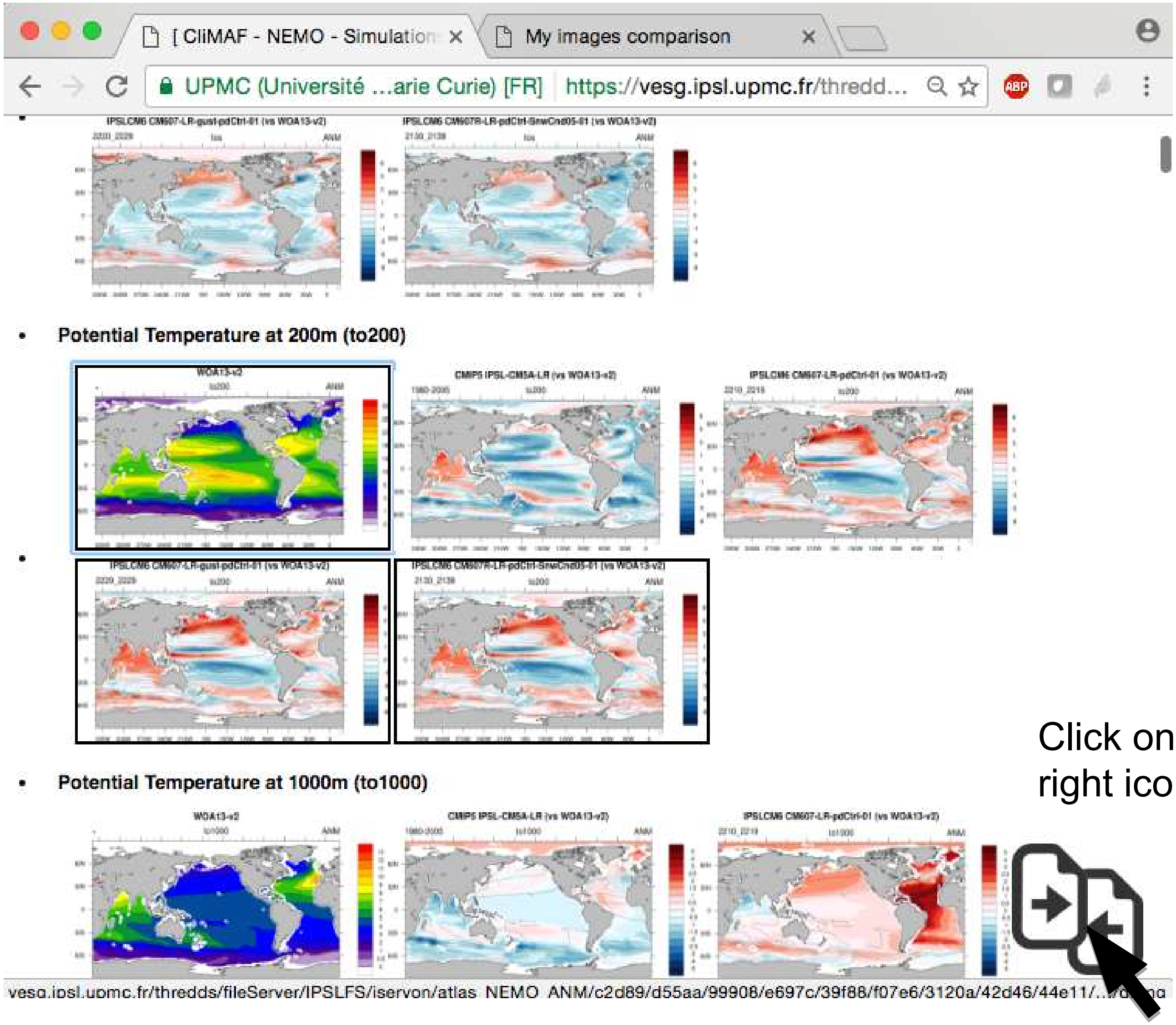
Select the images by putting the mouse over the plots and press ‘s’ (for ‘select’)
A black line is drawn over the selected plots

The compareCompanion

Select your figures with ‘s’


[CliMAF - NEMO - Simulation ×
My images comparison ×
UPMC (Université …arie Curie) [FR]
https://vesg.ipsl.upmc.fr/thredd…
IPSLCM6 CM607-LR-gust-pdCtrl-01 (vs WOA13-v2)
IPSLCM6 CM607R-LR-pdCtrl-SnwCnd05-01 (vs WOA13-v2)
WOA13-v2
CMIP5 IPSL-CM5A-LR (vs WOA13-v2)
IPSLCM6 CM607-LR-pdCtrl-01 (vs WOA13-v2)
IPSLCM6 CM607-LR-gust-pdCtrl-01 (vs WOA13-v2)
IPSLCM6 CM607R-LR-pdCtrl-SnwCnd05-01 (vs WOA13-v2)
WOA13-v2
CMIP5 IPSL-CM5A-LR (vs WOA13-v2)
IPSLCM6 CM607-LR-pdCtrl-01 (vs WOA13-v2)

- Potential Temperature at 200m (to200)

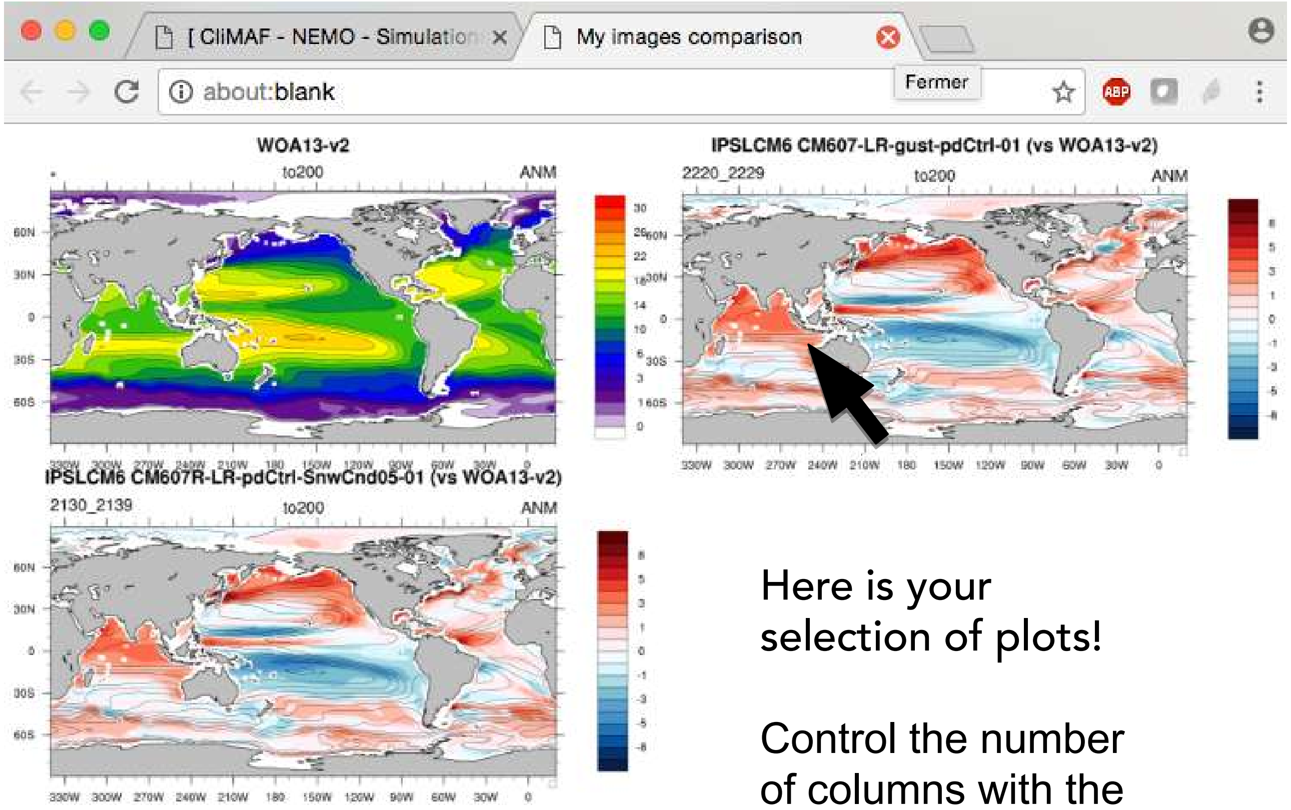
- Potential Temperature at 1000m (to1000)

vesg.ipsl.upmc.fr/thredds/fileServer/IPSLFS/jservon/atlas_NEMO_ANM/c2d89/d55aa/99908/e697c/39f86/f07e6/3120a/42d46/44e11/…/d…ng

Click on the bottom right icon…

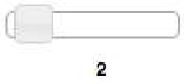
The compareCompanion

Display a selection of figures on the fly


[CliMAF - NEMO - Simulation
My images comparison
Fermer
about:blank
WOA13-v2
to200
ANM
IPSLCM6 CM607-LR-gust-pdCtrl-01 (vs WOA13-v2)
2220_2229
IPSLCM6 CM607R-LR-pdCtrl-SnwCnd05-01 (vs WOA13-v2)
2130_2139
60N
30N
0
30S
60S
330W 300W 270W 240W 210W 180 150W 120W 90W 60W 30W 0

Here is your selection of plots!

Control the number of columns with the slider…



And switch their positions by dragging the image you want at the position of your choice

Questions? jerome.servonnat@lsce.ipsl.fr

CliMAF

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The CliMAF Earth System Model Evaluation Platform, 2017

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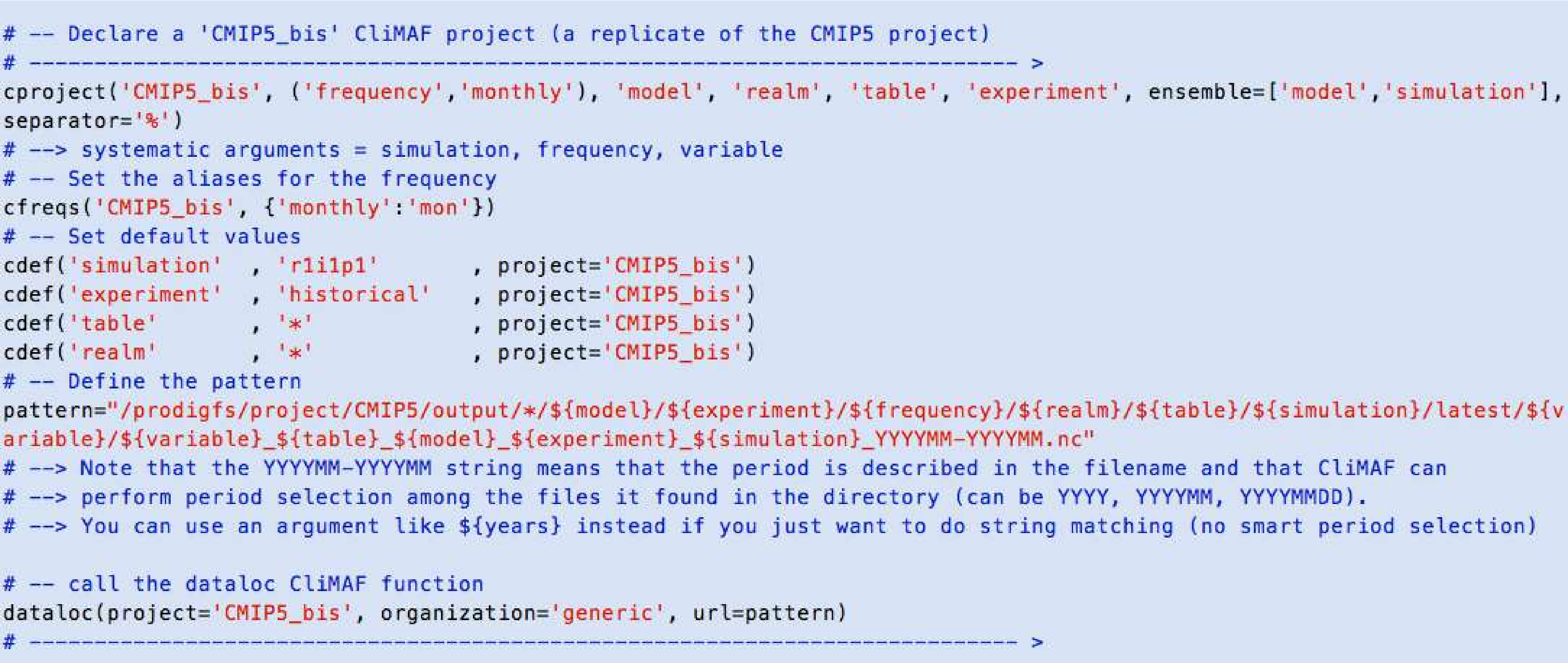
The authors would like to give special credit to A. Voldoire for showing the way for CliMAF, and to F. Hourdin and the LMDz team for the structure of the C-ESM-EP that is largely inspired from the LMDz evaluation atlas.

Add your own project

Add access to your own data structure



```
# -- Declare a 'CMIP5_bis' CliMAF project (a replicate of the CMIP5 project)
# ---------------------------------------------------------------------------- >
cproject('CMIP5_bis', ('frequency','monthly'), 'model', 'realm', 'table', 'experiment', ensemble=['model','simulation'],
separator='%')
# --> systematic arguments = simulation, frequency, variable
# -- Set the aliases for the frequency
cfreqs('CMIP5_bis', {'monthly':'mon'})
# -- Set default values
cdef('simulation'  , 'r1i1p1'       , project='CMIP5_bis')
cdef('experiment'  , 'historical'   , project='CMIP5_bis')
cdef('table'       , '*'            , project='CMIP5_bis')
cdef('realm'       , '*'            , project='CMIP5_bis')
# -- Define the pattern
pattern="/prodigfs/project/CMIP5/output/*/${model}/${experiment}/${frequency}/${realm}/${table}/${simulation}/latest/${v
ariable}/${variable}_${table}_${model}_${experiment}_${simulation}_YYYYMM-YYYYMM.nc"
# --> Note that the YYYYMM-YYYYMM string means that the period is described in the filename and that CliMAF can
# --> perform period selection among the files it found in the directory (can be YYYY, YYYYMM, YYYYMMDD).
# --> You can use an argument like ${years} instead if you just want to do string matching (no smart period selection)

# -- call the dataloc CliMAF function
dataloc(project='CMIP5_bis', organization='generic', url=pattern)
# ---------------------------------------------------------------------------- >
```

Data access

Example of a CMIP5 and IGCM_OUT dataset definition

Definition of a CMIP5 dataset, an IPSLCM6 simulation and a DYNAMICO simulation (SE):

```
models = [
       dict( project = ’CMIP5’, model = ’IPSL-CM5A-LR',
             experiment = ’historical’, simulation = ’r1i1p1’,
             frequency = ’monthly’, period = ’1980-2005'
           ),
       dict( project = 'IGCM_OUT’, model = 'IPSLCM6',
             root = '/ccc/store/cont003/thredds’, login =
    'p86caub’        simulation = 'CM605-LR-pdCtrl01',
             frequency = 'seasonal’, clim_period = '2020_2029'
           ),
       dict( project='IGCM_OUT', model='LMDZICOSA',
             root='/prodigfs', login='fabric', status='/',
             experiment='AQUA_CMIP5A’, simulation='R180km_D24h',
             frequency='seasonal’, clim_period='1980_1984’
           ),
    ]
```