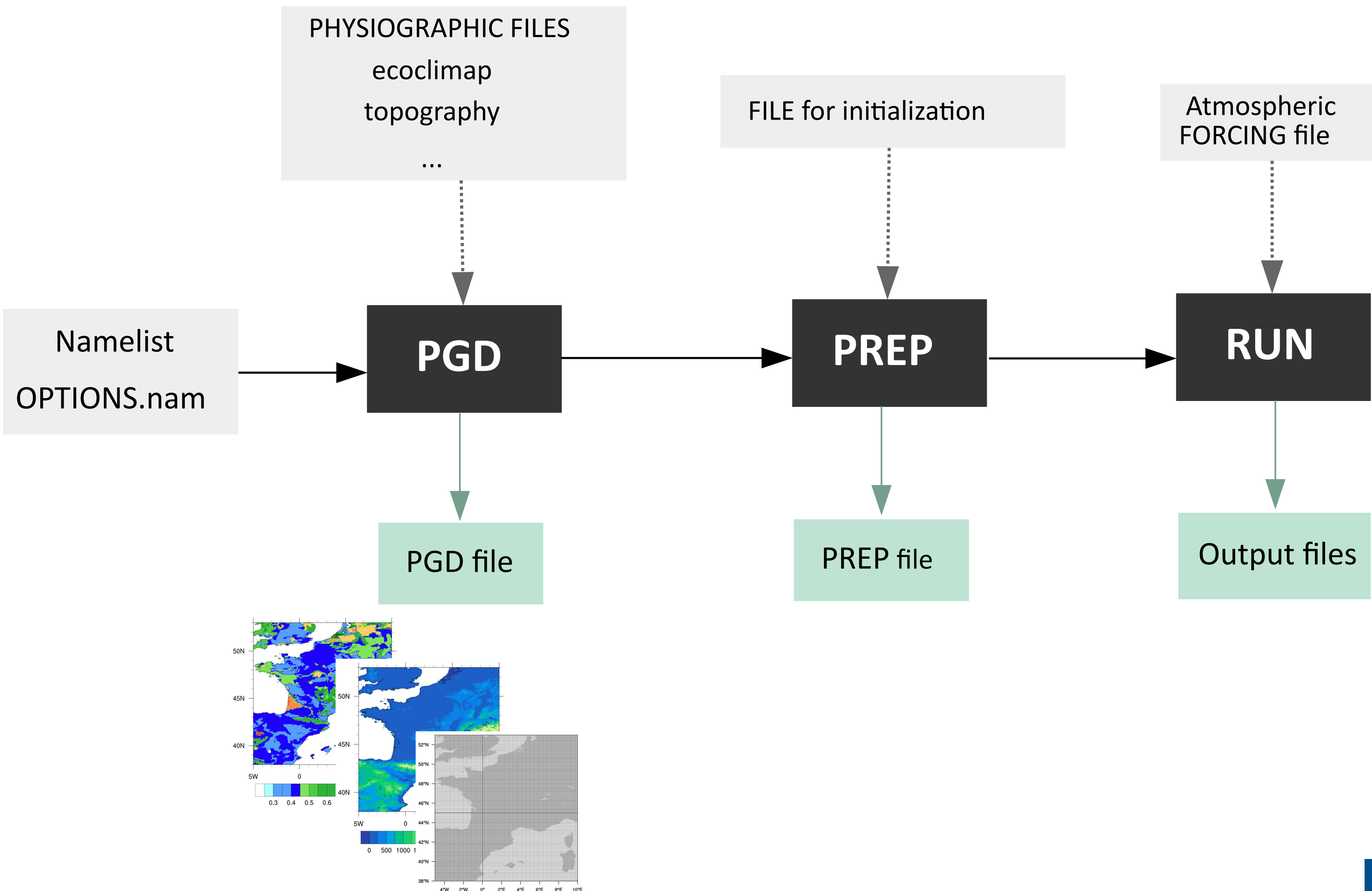
ECOCLIMAP in SURFEX & PGD step

SURFEX course
12 – 15 March 2024

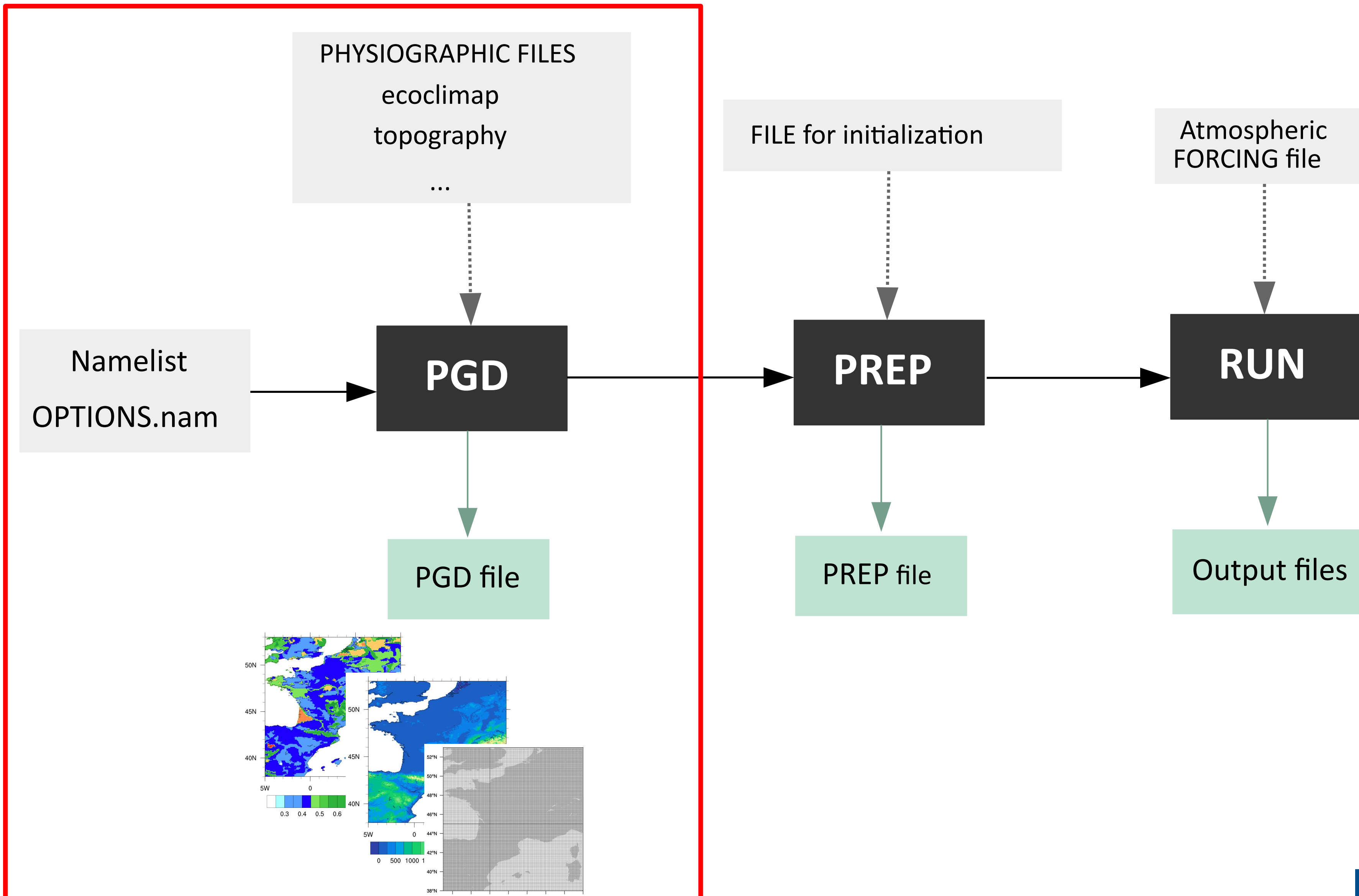
Plan

1. Introduction to PGD
2. Physiographic databases available on the SURFEX website
3. ECOCLIMAP-I and ECOCLIMAP-II
4. ECOCLIMAP-SG
5. PGD: list of namelist options used at this step

1. The PGD step in SURFEX: introduction



1. The PGD step in SURFEX: introduction



1. The PGD step in SURFEX: introduction

PGD = PhysioGraphic Data

- orography, land cover, clay & sand fractions, bathymetry

  + data for specific Surfex options
- constant fields
- need to be fixed for each grid point of the experiment

PGD step

The first step when you run SURFEX

- you choose the surface schemes
- you choose and define the grid for the surface
- physiographic fields are defined, averaged and interpolated on this grid

→ written in an PGD file

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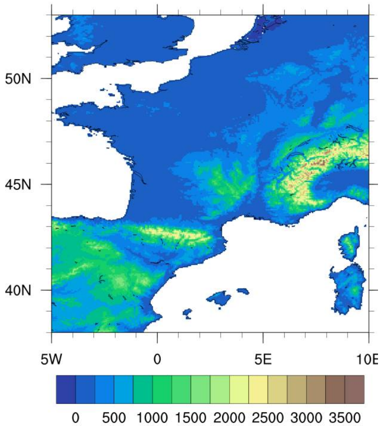
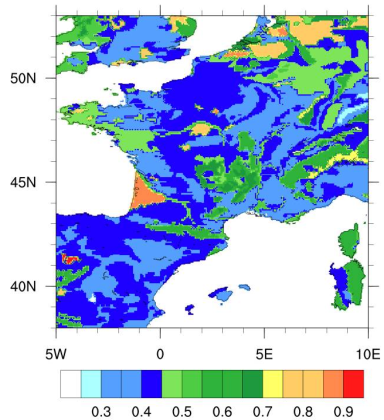
1. The PGD step in SURFEX: introduction

Examples of variables written in PGD file

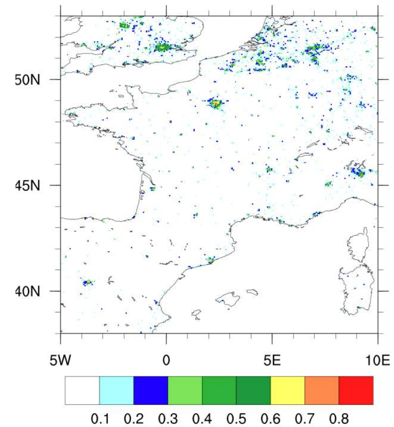
- DIM_FULL total number of points
- DIM_NATURE / DIM_SEA / DIM_TOWN / DIM_WATER : number of points for each tile
- SEA / NATURE / TOWN / WATER : scheme chosen for each tile
- GRID_TYPE/ XLON / XLAT / LONMIN/ LONMAX / … : grid information



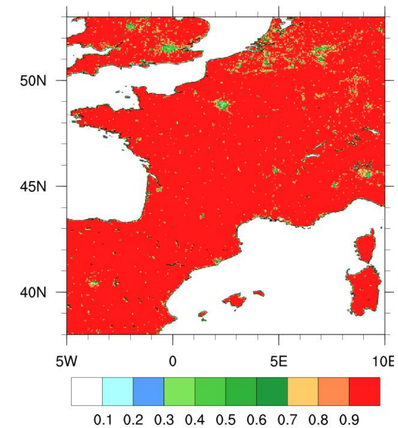
ZS : orography



SAND : sand fraction



FRAC_TOWN : fraction of town for each grid point



FRAC_NATURE : fraction of nature for each grid point

- COVER131 : fraction of cover 131 for each grid point.
- COVER137

…

1. The PGD step in SURFEX: OPTIONS.nam

The namelist OPTIONS.nam is the SURFEX codified external ASCII file where the user defines the configuration for its experiment.

Exemple OPTIONS.nam

```
&NAM_FRAC               LECOCLIMAP = T
/
&NAM_COVER              YCOVER     = 'ECOCLIMAP_I_GLOBAL',
                        YCOVERFILETYPE = 'DIRECT'
/
&NAM_PGD_GRID           CGRID = 'CONF PROJ '
/
&NAM_CONF_PROJ_GRID     XLONCEN = -76.,
                        XLATCEN = 20.,
                        NIMAX   = 216,
                        NJMAX   = 120,
                        XDX     = 10000,
                        XDY     = 10000
/
&NAM_CONF_PROJ          XLON0 = -76.,
                        XLAT0 = 20.,
                        XRPK  = 0.,
                        XBETA=0.
/
&NAM_PGD_SCHEMES        CNATURE = 'ISBA  ',
                        CSEA    = 'SEAFLX',
                        CTOWN   = 'TEB   ',
                        CWATER  = 'WATFLX'
/
&NAM_ZS                 YZS='gtopo30',
                        YZSFILETYPE='DIRECT'
/
```

- Succession of different namelist blocks

- Some namelist are specific for PGD

1. The PGD step in SURFEX: OPTIONS.nam

The namelist OPTIONS.nam is the SURFEX codified external ASCII file where the user defines the configuration for its experiment.

Exemple OPTIONS.nam

```
&NAM_FRAC              LECOCLIMAP = T
/
&NAM_COVER             YCOVER     = 'ECOCLIMAP_I_GLOBAL',
                       YCOVERFILETYPE = 'DIRECT'

/
&NAM_PGD_GRID          CGRID = 'CONF PROJ '
/
&NAM_CONF_PROJ_GRID    XLONCEN = -76.,
                       XLATCEN = 20.,
                       NIMAX   = 216,
                       NJMAX   = 120,
                       XDX     = 10000,
                       XDY     = 10000
/
&NAM_CONF_PROJ         XLON0 = -76.,
                       XLAT0 = 20.,
                       XRPK  = 0.,
                       XBETA=0.
/
&NAM_PGD_SCHEMES       CNATURE = 'ISBA  ',
                       CSEA    = 'SEAFLX',
                       CTOWN   = 'TEB   ',
                       CWATER  = 'WATFLX'
/
&NAM_ZS                YZS='gtopo30',
                       YZSFILETYPE='DIRECT'

/
```

Possibility to use external database/maps

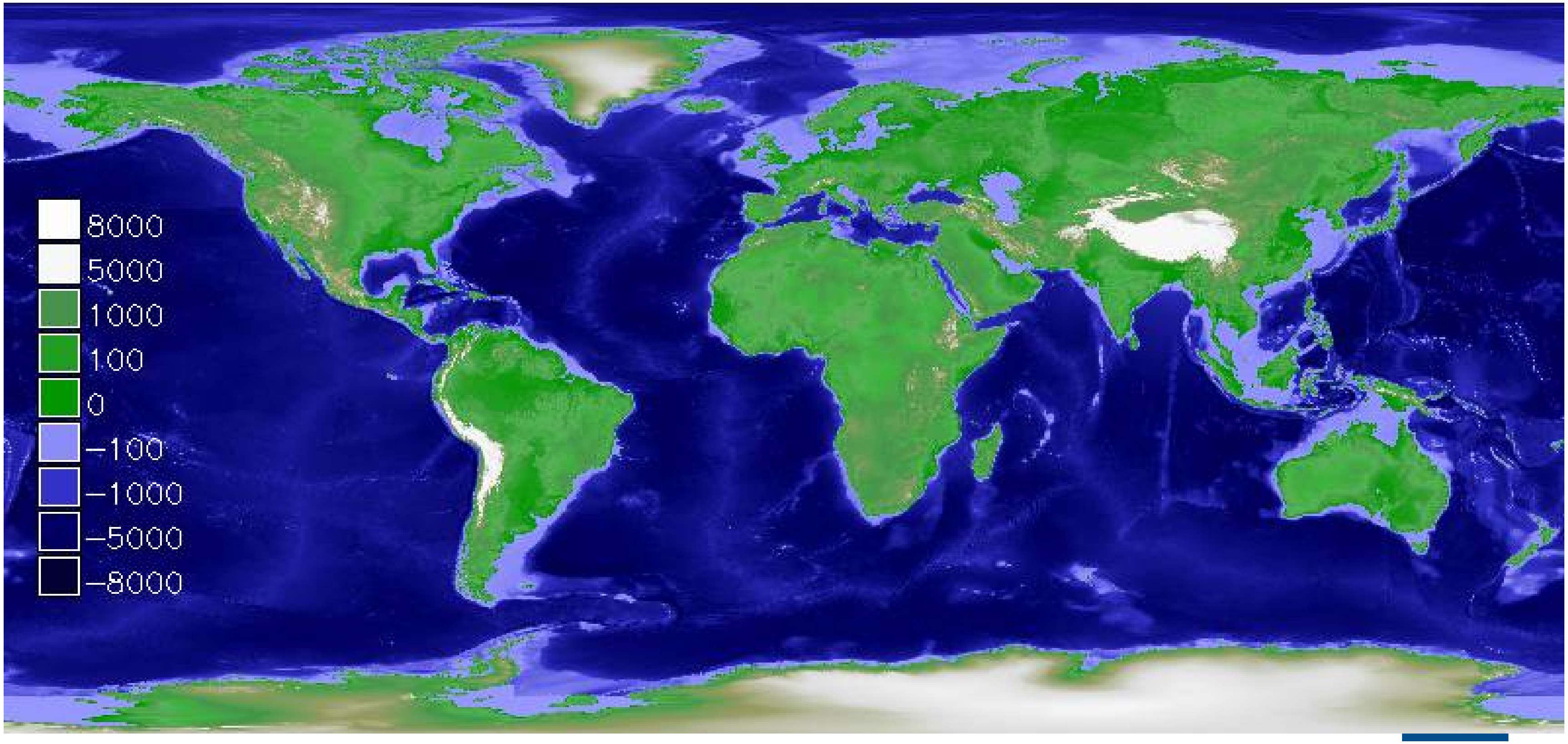
(covers, topography, sand/clay fractions, bathymetry, organic carbon fractions,...)

2. Physiographic databases available on Surfex website

Can be downloaded on the SURFEX website : Home > Physiographic maps

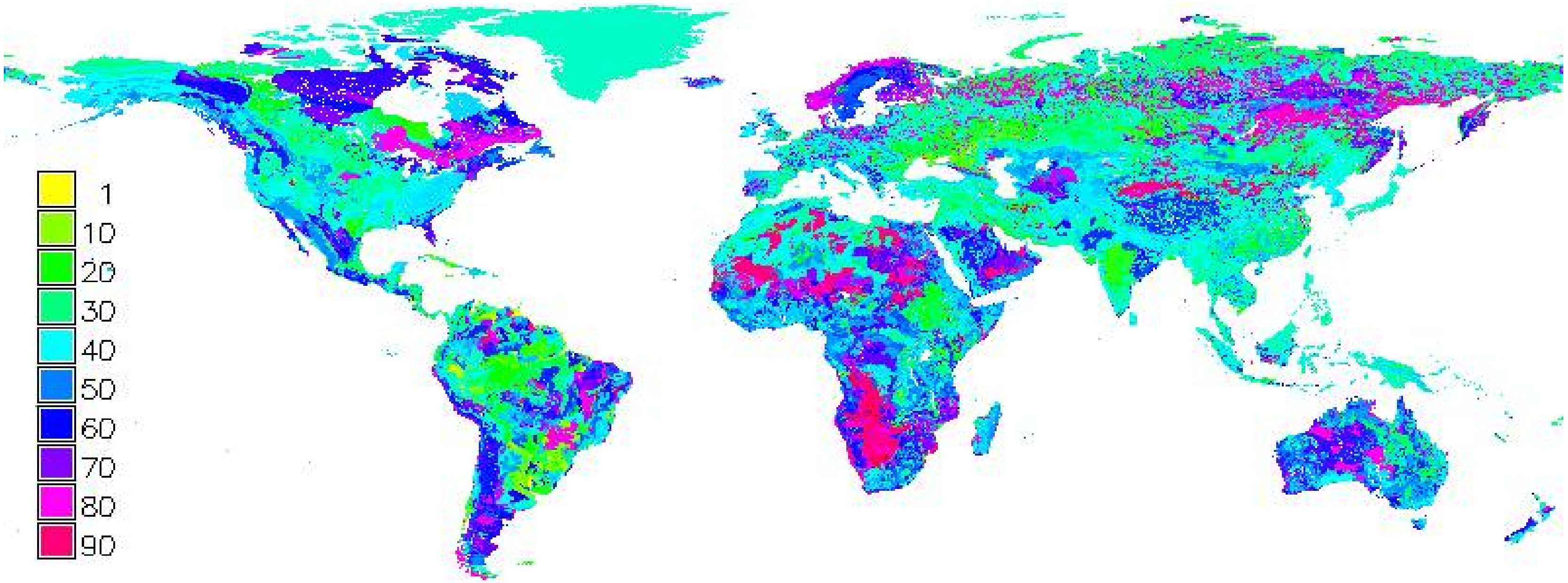
http://www.umr-cnrm.fr/surfex/spip.php?rubrique14

- BATHYMETRY :etopo2 from NOAA (4km resolution)



2. Physiographic databases available on Surfex website

- <u>SOIL TEXTURE</u> (CLAY and SAND fractions): Global
  - FAO at 10km resolution
  - HWSD at 1km resolution + Maps of topsoil and subsoil organic carbon
  - SOILGRIDS at ~300m resolution

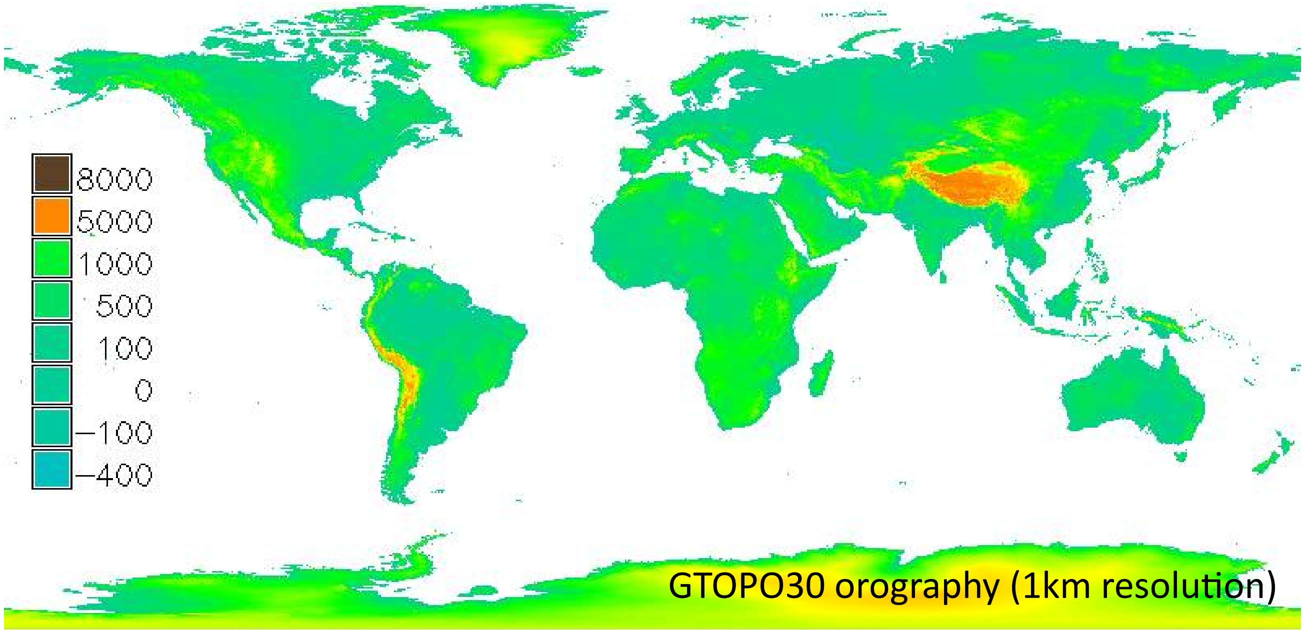


SAND fraction from HWSD (1km resolution)

2. Physiographic databases available on Surfex website

- TOPOGRAPHY:
  - GTOPO30, global, from USGS at 1km resolution
  - GMTED2010 (1km and 250m resolution)
  - srtm250 at 250m resolution
  - srtm90 at 90m resolution / srtm60 at 60m resolution over France

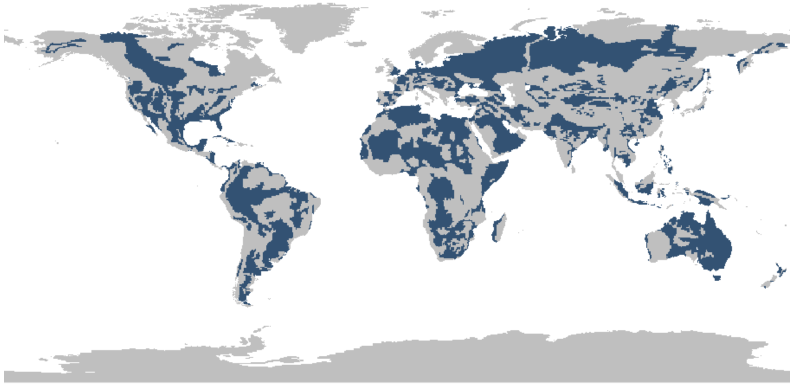
- TOPOGRAPHIC INDEX: HYDRO1K, derived from GTOPO30.



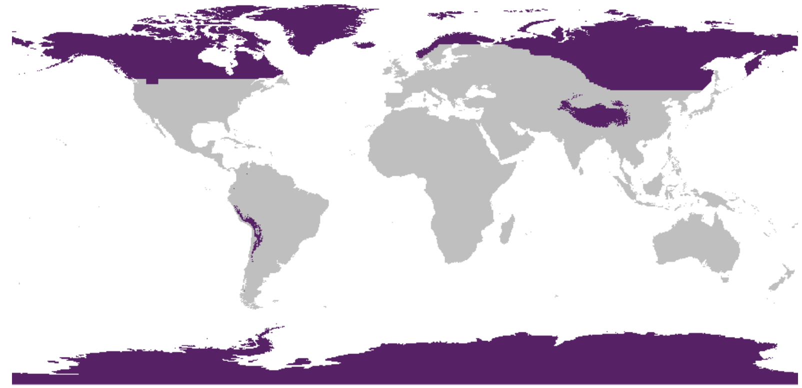
GTOPO30 orography (1km resolution)

2. Physiographic databases available on Surfex website

- Global groundwater map at 10km resolution



- Global potential permafrost area at 10km resolution



- LAND COVER : ECOCLIMAP database, developed at Meteo-France
  - ECOCLIMAP I & ECOCLIMAP II
  - ECOCLIMAP-SG

- LAKE DEPTH: a 1km global database (from E. Kourzeneva)
  + 2 other versions where lake depth is collocated with 2 versions of ECOCLIMAP

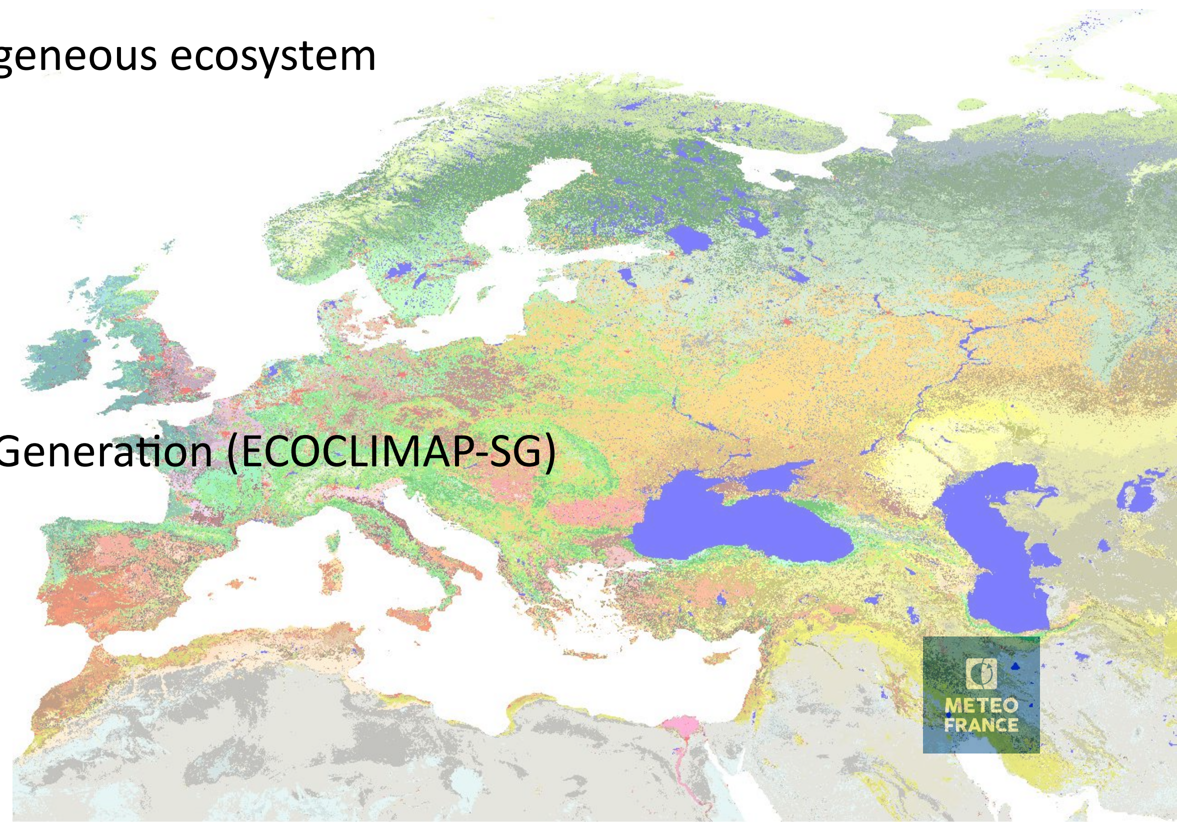
3. Introduction to ECOCLIMAP

- ECOCLIMAP is the CNRM home-made global database of land covers.

- It describes the types of surface covering the whole Earth, and associated land surface parameters.

- 1 cover = 1 area of homogeneous ecosystem

- 3 versions of ECOCLIMAP
    - ECOCLIMAP-I
    - ECOCLIMAP-II
    - ECOCLIMAP Second Generation (ECOCLIMAP-SG)



3. ECOCLIMAP-I and ECOCLIMAP-II

- Resolution = 1km

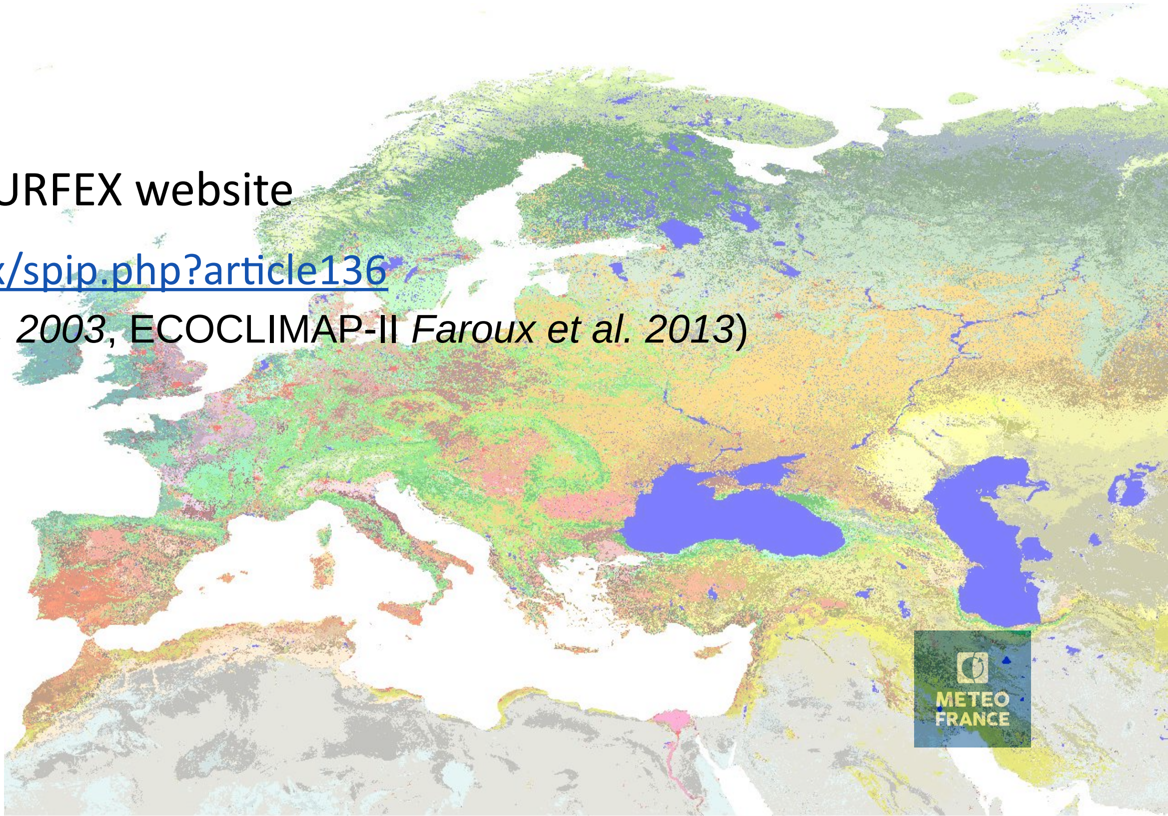
- ECOCLIMAP-I 215 covers

  ECOCLIMAP-II (update of ECOCLIMAP-I) +273 covers over Europe

Can be downloaded on the SURFEX website

https://www.umr-cnrm.fr/surfex/spip.php?article136

(ECOCLIMAP-I see *Masson et al. 2003*, ECOCLIMAP-II *Faroux et al. 2013*)



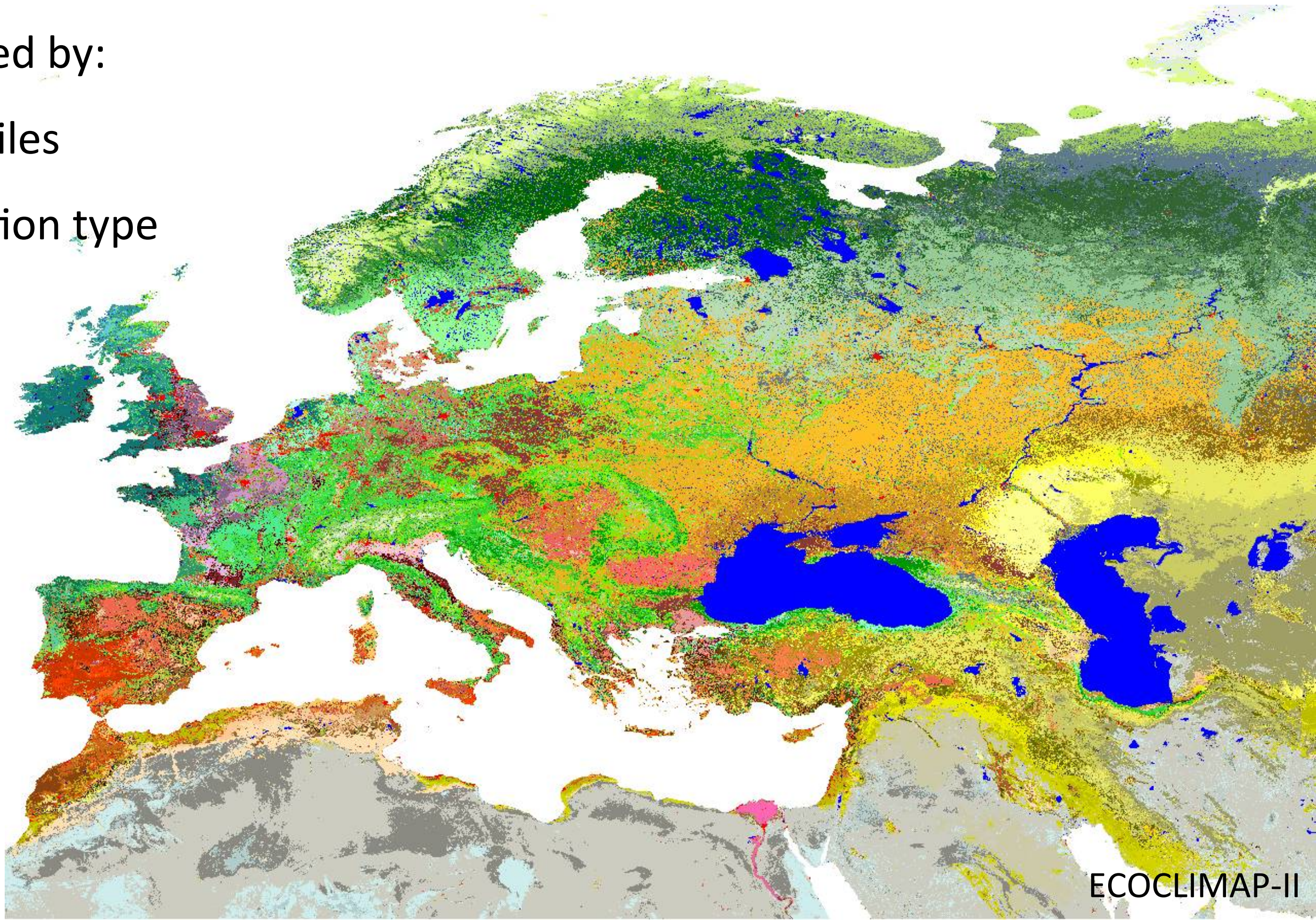
3. ECOCLIMAP-I and ECOCLIMAP-II / covers

A cover is an area of homogeneous ecosystem.

On the ECOCLIMAP map, a cover is a set of pixels, where the surface cover is considered as homogeneous.

A cover is characterized by:

- a fraction of the 4 tiles
- fractions of vegetation type



ECOCLIMAP-II

3. ECOCLIMAP-I and ECOCLIMAP-II / covers

A cover is characterized by:

- a fraction of the 4 tiles SEA,WATER,TOWN, NATURE
- if the tile NATURE is present, fractions for each of the 19 vegetation types.

VEGETATION TYPES					
1	NO	No vegetation - Bare soil	11	TROG	Tropical grassland
2	ROCK	Bare rock	12	PARK	Peat bogs, parks and garden (irrigated grass)
3	SNOW	Permanent snow and ice	13	TRBD	Tropical broadleaf deciduous
4	TEBD	Temperate broadleaf cold-deciduous	14	TEBE	Temperate broadleaf evergreen
5	BONE	Boreal needleleaf evergreen	15	TENE	Temperate needleleaf evergreen
6	TRBE	tropical broadleaf evergreen	16	BOBD	Boreal broadleaf cold-deciduous
7	C3	Winter crops	17	BOND	Boreal needleleaf cold-deciduous
8	C4	Summer crops	18	BOGR	Boreal grass
9	IRR	Irrigated crops	19	SHRB	Shrub
10	GRAS	Grassland			

3. ECOCLIMAP-I and ECOCLIMAP-II / covers

example

COVER	NAME	TILE				19 VEGETATION TYPES					
		SEA	WATER	TOWN	NATURE	NO	...	TEBD	BONE	...	PARK
02	Lakes	0	1	0	0	-	-				

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3. ECOCLIMAP-I and ECOCLIMAP-II / covers
example

COVER	NAME	TILE				19 VEGETATION TYPES					
		SEA	WATER	TOWN	NATURE	NO	...	TEBD	BONE	...	PARK
02	Lakes	0	1	0	0	-	-				
04	Bare land	0	0	0	1	1					

- NO : no vegetation
- TEBD : temperature broadleaf decidous
- BONE : boreal needleleaf evergreen
- PARK : irrigated grass

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3. ECOCLIMAP-I and ECOCLIMAP-II / covers

example

COVER	NAME	TILE				19 VEGETATION TYPES					
		SEA	WATER	TOWN	NATURE	NO	...	TEBD	BONE	...	PARK
02	Lakes	0	1	0	0	-	-				
04	Bare land	0	0	0	1	1					
160	Urban Parks	0	0	0.1	0.9			0.5			0.5

- NO : no vegetation
- TEBD : temperate broadleaf decidous
- BONE : boreal needleleaf evergreen
- PARK : irrigated grass

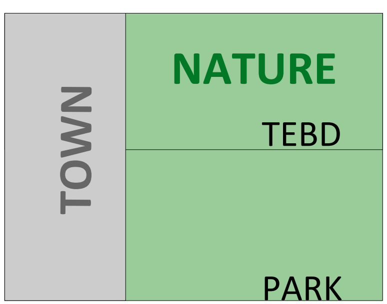
3. ECOCLIMAP-I and ECOCLIMAP-II / covers

example

COVER	NAME	TILE				19 VEGETATION TYPES					
		SEA	WATER	TOWN	NATURE	NO	...	TEBD	BONE	...	PARK
02	Lakes	0	1	0	0	-	-				
04	Bare land	0	0	0	1	1					
160	Urban Parks	0	0	0.1	0.9			0.5			0.5

- NO : no vegetation
- TEBD : temperature broadleaf decidous
- BONE : boreal needleleaf evergreen
- PARK : irrigated grass

COVER 160 : URBAN PARKS



- 10% TOWN
- 0.9x0.5 = 45% TEBD
- 0.9x0.5 = 45% PARK

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3. ECOCLIMAP-I and ECOCLIMAP-II / files

<u>Global map with covers</u>

- Different versions available on the SURFEX website.
- 1pixel = 1 cover number

ECOCLIMAP_*.*dir* is **BINARY** and contains the rough grid of covers numbers.

ECOCLIMAP_*.*hdr* is **ASCII** and contains the metadata for the upper binary file.

3. ECOCLIMAP-I and ECOCLIMAP-II / files

Global map with covers

- Different versions available on the SURFEX website.
- 1pixel = 1 cover number

ECOCLIMAP_*.*dir* is **BINARY** and contains the rough grid of covers numbers.

ECOCLIMAP_*.*hdr* is **ASCII** and contains the metadata for the upper binary file.

Compiling SURFEX creates 2 binary files in directory MY_RUN/ECOCLIMAP

- **ecoclimapI_covers_param.*bin***
- **ecoclimapII_eu_covers_param.*bin***

These files contain the description of all ECOCLIMAP covers ***for version I and version II.***

3. ECOCLIMAP-I and ECOCLIMAP-II / files

Surface parameters defined in files .bin

ecoclimapI_covers_param.*bin* and **ecoclimapII_eu_covers_param.*bin***

▸ the fraction of the 4 tiles SEA,WATER,TOWN, NATURE

▸ the fraction for each of the 19 vegtypes (if NATURE present)

▸ Land surface parameters depending on tiles and vegetation types

- Mean ALB_SOIL_NIR (*soil albedo in Near InfraRed*)
- Mean ALB_SOIL_VIS (*soil albedo in VISible*)

For each **vegtype** with not null fraction:

- 3 soil depths (root, soil, ice)
- Height of trees (if vegtype for tree)
- Mean ALB_VEG_NIR and ALB_VEG_VIS (36 10-days period)
- LAI (Leaf Area Index) 36 10-days period

LAI : 1 year for ecoclimap1 - 1992, 5 years for ecoclimap2 – 2002->2006)

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3. ECOCLIMAP-I and ECOCLIMAP-II / files

Surface parameters defined in files .bin

▸ For **Town** (if not null fraction):

- Z0, BldHgt, WOHor, Bld frac, Garden frac
- Alb & Emis for Roof, Road, Wall
- Hc, Tc, D for each layer of Roof, Road, Wall
- H & LE for Traffic and Industry

▸ Some parameters are calculated from other ones:

- VEG (fraction of vegetation) from LAI and vegtype
- Z0 (roughness length) from LAI, H_TREE and vegtype
- EMIS (emissivity) from VEG and vegtype

Like LAI, these parameters deduced from LAI are 10-day defined.

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3. ECOCLIMAP-I and ECOCLIMAP-II / files

example .bin file for COVER 160

```
COVER 160
 FRACTION   Town Nature  Water    Sea
    160   0.10   0.90   0.00   0.00
 FRACTION    No   Rock   Snow   Tebd   Bone   Trbe    C3    C4    Irr   Gras   Trog   Park   Trbd   Tebe   Tene   Bobd   Bond   Bogr   Shrb
    160   0.00   0.00   0.00   0.50   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.50   0.00   0.00   0.00   0.00   0.00   0.00   0.00
 mean ALB_SOIL_NIR (36 10-day periods)
             Jan                Feb                Mar                Apr
    160  0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000
             May                Jun                Jul                Aug
    160  0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000
             Sep                Oct                Nov                Dec
    160  0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000 0.2000
 mean ALB_SOIL_VIS (36 10-day periods)
             Jan                Feb                Mar                Apr
    160  0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000
             May                Jun                Jul                Aug
    160  0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000
             Sep                Oct                Nov                Dec
    160  0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000
VEGTYPE   Tebd
       DEPTH   Root   Soil    Ice
    160   Tebd   2.00   3.00   1.60
        LAI  YEAR 1992 (36 10-day periods)
              Jan        Feb        Mar        Apr
    160   Tebd 1.0 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.8 1.9 2.1 2.4
              May        Jun        Jul        Aug
    160   Tebd 2.6 2.9 2.9 3.0 3.0 2.9 2.9 2.8 2.8 2.8 2.8 2.7
              Sep        Oct        Nov        Dec
    160   Tebd 2.7 2.6 2.5 2.3 2.2 2.0 1.8 1.6 1.4 1.3 1.1 1.1
  |   HT|
    160   Tebd  5.
```

3. ECOCLIMAP-I and ECOCLIMAP-II / files

example .bin file for COVER 160

```
 mean ALB_VEG_NIR (36 10-day periods)
            Jan             Feb             Mar             Apr
 160  Tebd 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500
            May             Jun             Jul             Aug
 160  Tebd 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500
            Sep             Oct             Nov             Dec
 160  Tebd 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500 0.2500
    mean ALB_VEG_VIS (36 10-day periods)
            Jan             Feb             Mar             Apr
 160  Tebd 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500
            May             Jun             Jul             Aug
 160  Tebd 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500
            Sep             Oct             Nov             Dec
 160  Tebd 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500 0.0500
VEGTYPE  Park
    DEPTH  Root  Soil  Ice
 160  Park  1.50  2.00  1.20
     LAI  YEAR 1992 (36 10-day periods)
          Jan      Feb      Mar      Apr
 160  Park 1.0 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.8 1.9 2.1 2.4
          May      Jun      Jul      Aug
 160  Park 2.6 2.9 2.9 3.0 3.0 2.9 2.9 2.8 2.8 2.8 2.8 2.7
          Sep      Oct      Nov      Dec
 160  Park 2.7 2.6 2.5 2.3 2.2 2.0 1.8 1.6 1.4 1.3 1.1 1.1
    mean ALB_VEG_NIR (36 10-day periods)
            Jan             Feb             Mar             Apr
 160  Park 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000
            May             Jun             Jul             Aug
 160  Park 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000
            Sep             Oct             Nov             Dec
 160  Park 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000 0.3000
```

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3. ECOCLIMAP-I and ECOCLIMAP-II / files

example .bin file for COVER 160

```
mean ALB_VEG_VIS (36 10-day periods)
            Jan           Feb           Mar           Apr
  160  Park 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000
            May           Jun           Jul           Aug
  160  Park 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000
            Sep           Oct           Nov           Dec
  160  Park 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000 0.1000
 TOWN    Z0 BldHgt  WOHor   Bld Garden
  160  0.50    5.  0.10  0.10  0.00
 TOWN  AlbRf  AlbRd  AlbWl EmisRf EmisRd EmisWl
  160  0.15  0.08  0.25  0.90  0.94  0.85
 TOWN Hc_Roof1 Hc_Roof2 Hc_Roof3 Hc_Road1 Hc_Road2 Hc_Road3 Hc_Wall1 Hc_Wall2 Hc_Wall3
  160 2.11E+06 2.80E+05 2.90E+05 1.94E+06 1.28E+06 1.28E+06 1.55E+06 1.55E+06 2.90E+05
 TOWN Tc_Rf1 Tc_Rf2 Tc_Rf3 Tc_Rd1 Tc_Rd2 Tc_Rd3 Tc_Wl1 Tc_Wl2 Tc_Wl3
  160 1.5100 0.0800 0.0500 0.7454 0.2513 0.2513 0.9338 0.9338 0.0500
 TOWN  D_Rf1  D_Rf2  D_Rf3  D_Rd1  D_Rd2  D_Rd3  D_Wl1  D_Wl2  D_Wl3
  160  0.050  0.400  0.100  0.050  0.100  1.000  0.020  0.125  0.050
 TOWN  H_Trf Le_Trf  H_Ind Le_Ind
  160    0.    0.    0.    0.
```

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3. ECOCLIMAP-I and ECOCLIMAP-II

Depend only on surface type,ie on tile & vegtype, and not on spatial localisation (cover).

Correspondence tables are directly written in SURFEX code (file ***ini_data_param.F90***).

These are ALBVIS, ALBVEG, RSMIN, GAMMA, WRMAX_CF, RGL, CV, GMES, RE25, GC, BSLAI, DMAX, STRESS, SEFOLD, LAIMIN, CE_NITRO, CF_NITRO, CNA_NITRO, ROOT_EXTINCTION, ROOT_LIN, SOILRC_SO2, SOILRC_O3.

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3. ECOCLIMAP-I and ECOCLIMAP-II
How to use ECOCLIMAP

NAM_FRAC : This namelist defines if ECOCLIMAP will be used or not.

```
&NAM_FRAC              LECOCLIMAP   = T,

/
```

NAM_COVER : this namelist gives the information to compute the surface cover fractions when ECOCLIMAP is used

```
&NAM_COVER          YCOVER= « ECOCLIMAP_I_GLOBAL_V1.6 »,
                    YCOVERFILETYPE = « DIRECT»
/
```

All files (.dir/.hdr and .bin) need to be linked in your run directory

3. ECOCLIMAP-I and ECOCLIMAP-II

How to use ECOCLIMAP

Remark on albedo

To use albedos from the *.bin ECOCLIMAP files (more precise and evolving in time), and not those from ini_data_param.F90 (very rough), you need to activate, in NAM_ISBA, CALBEDO = « CM13 » during the run SURFEX.

```
&NAM_ISBA          CALBEDO=  « CM13 »,
/
```

3. ECOCLIMAP-I and ECOCLIMAP-II

How to use ECOCLIMAP

It is possible to not use ECOCLIMAP, or to use it partially, only for some variables.

NAM_FRAC : It's also where the fractions of the 4 main types of surfaces or tiles are given if ECOCLIMAP is not used to define them.

```
&NAM_FRAC                 LECOCLIMAP    = F,
                          XUNIF_SEA     = 0.,
                          XUNIF_WATER   = 0.,
                          XUNIF_TOWN    = 0.,
                          XUNIF_NATURE  = 1.
/
```

NAM_DATA_… (ISBA, TEB, BEM, TEB_GARDEN, TEB_GREENROOF, SEAFLUX, FLAKE) : Allows the user to replace one, several, or all ECOCLIMAP parameters by its own data.

For detailed descriptions, cf namelists documentation in user's guide on surfex website. http://www.umr-cnrm.fr/surfex/spip.php?rubrique10

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4. ECOCLIMAP-SG

ECOCLIMAP Second Generation is the latest version of ECOCLIMAP, produced at **300m-resolution** and following a new philosophy.

The notion of "cover" containing several fractions of vegetation types is not used anymore. **1 cover is pure.**

The land cover map is based on ESA-CCI LCC.

33 covers of ECOCLIMAP-SG					
1	Sea and oceans	**12**	Boreal needleleaf evergreen	**23**	Flooded grassland
2	lakes	**13**	Temperate needleleaf evergreen	**24**	LCZ1 : compact high-rise
3	rivers	**14**	Boreal needleleaf deciduous	**25**	LCZ2 : compact midrise
4	Bare land	**15**	shrubs	**26**	LCZ3 : compact low-rise
5	Bare rock	**16**	Boreal grassland	**27**	LCZ4 : open high-rise
6	Permanent snow	**17**	Temperate grassland	**28**	LCZ5 : open midrise
7	Boreal broadleaf deciduous	**18**	Tropical grassland	**29**	LCZ6 : open low-rise
8	Temperate broadleaf deciduous	**19**	Winter C3 crops	**30**	LCZ7 : lightweight low-rise
9	Tropical broadleaf deciduous	**20**	Summer C3 crops	**31**	LCZ8 : large low-rise
10	Temperate broadleaf evergreen	**21**	C4 crops	**32**	LCZ9 : sparsely built
11	Tropical broadleaf evergreen	**22**	Flooded trees	**33**	LCZ10 : heavy industry

4. ECOCLIMAP-SG

Maps of primary parameters, defined by cover in classic ECOCLIMAP, are now given in namelist during PGD step :

LAI, ground depths, height of trees, visible and near infrared soil and vegetation albedos

The maps of parameters come from the COPERNICUS satellite data (LAI, albedos) or from the NASA (Height Of Trees)

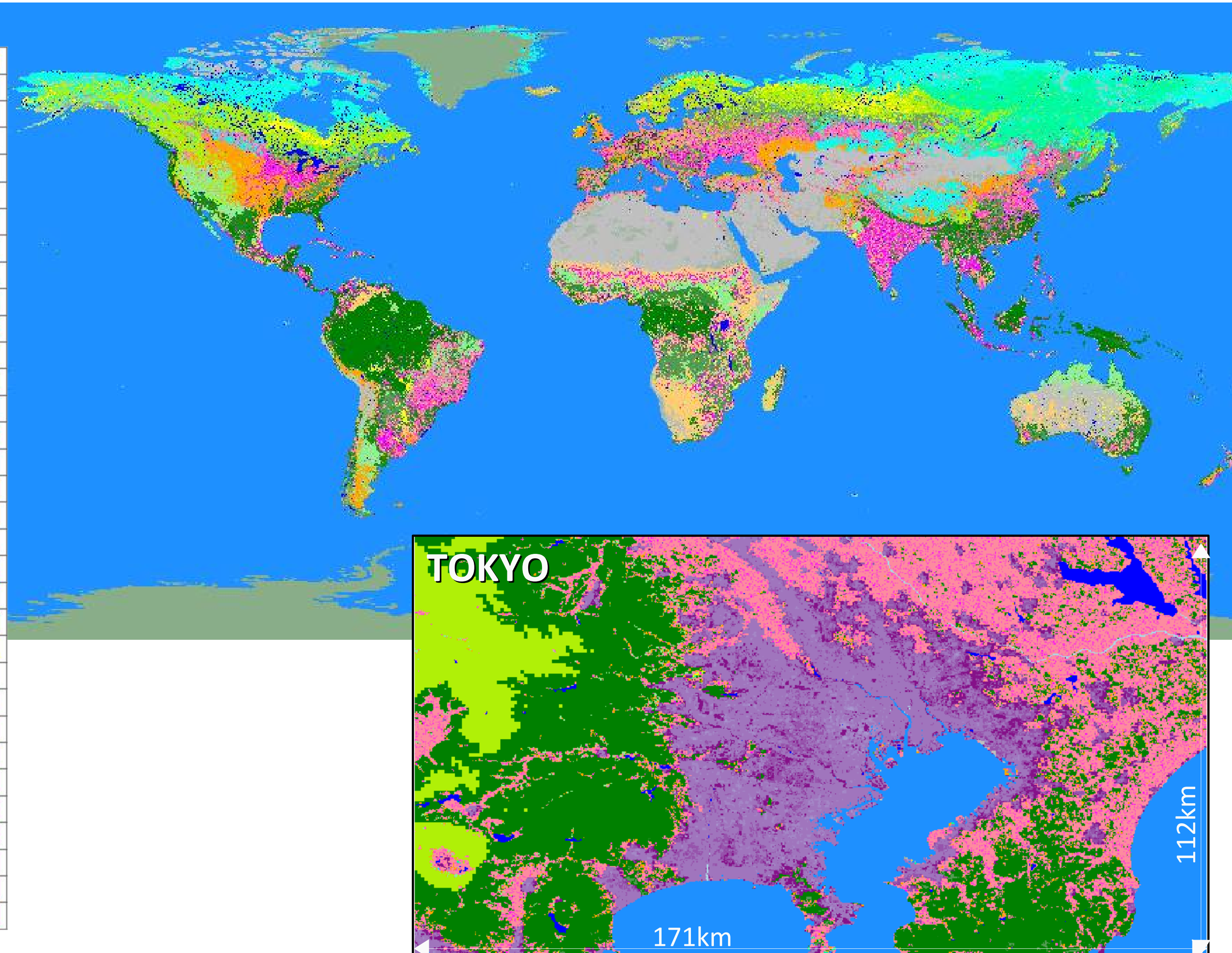
36 maps for LAI, 36*4 maps for albedo + 1 map height of trees → 600Go

Documentation / download :

https://opensource.umr-cnrm.fr/projects/ecoclimap-sg/wiki

4. ECOCLIMAP-SG

1	Sea and oceans	
2	Lakes	
3	Rivers	
4	Bare soil	
5	Bare rock	
6	Permanent snow	
7	Boreal broadleaf deciduous	
8	Temperate broadleaf deciduous	
9	Tropical broadleaf deciduous	
10	Temperate broadleaf evergreen	
11	Tropical broadleaf evergreen	
12	Boreal needleleaf evergreen	
13	Temperate needleleaf evergreen	
14	Boreal needleleaf deciduous	
15	Shrubs	
16	Boreal grassland	
17	Temperate grassland	
18	Tropical grassland	
19	Winter C3 crops	
20	Summer C3 crops	
21	C4 crops	
22	Tree cover, flooded	
23	Shrub or herbaceous, flooded	
24	urban LCZ1: compact high-rise	
25	urban LCZ2: compact midrise	
26	urban LCZ3: compact low-rise	
27	urban LCZ4: open high-rise	
28	urban LCZ5: open midrise	
29	urban LCZ6: open low-rise	
30	urban LCZ7: lightweight low-rise	
31	urban LCZ8: large low-rise	
32	urban LCZ9: sparsely built	
33	urban LCZ10: heavy industry	



4. ECOCLIMAP-SG

How to use ECOCLIMAP-SG

NAM_FRAC : activate the namelist key LECOSG

```
&NAM_FRAC                LECOCLIMAP   = T,
                         LECOSG       = T
/
```

NAM_COVER : indicate the ECOCLIMAP-SG land cover map

```
&NAM_COVER          YCOVER= « ecosg_final_map »,
                    YCOVERFILETYPE = « DIRECT»
/
```

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4. ECOCLIMAP-SG

How to use ECOCLIMAP-SG

NAM_DATA_ISBA : you will need to update your namelist NAM_DATA_ISBA with the names of the files you use for the primary parameters

```
&NAM_DATA_ISBA     CFNAM_LAI(1,1) = 'LAI_0105_c'
                   CFTYP_LAI(1,1) = 'DIRTYP'
                   CFNAM_LAI(1,2) = 'LAI_0115_c'
                   CFTYP_LAI(1,2) = 'DIRTYP'
                   . . .
                   CFNAM_ALBNIR_VEG(1,1) = 'ANV_DESAG_0105_c'
                   CFTYP_ALBNIR_VEG(1,1) = 'DIRTYP'
                   CFNAM_ALBNIR_VEG(1,2) = 'ANV_DESAG_0115_c'
                   CFTYP_ALBNIR_VEG(1,2) = 'DIRTYP'
                   . . .
                   CFNAM_H_TREE(1) = 'new_ht_c'
                   CFTYP_H_TREE(1) = 'DIRTYP'
                   . . .
/
```

Namelist example on : https://opensource.umr-cnrm.fr/projects/ecoclimap-sg/wiki

5. Namelists and options at PGD step

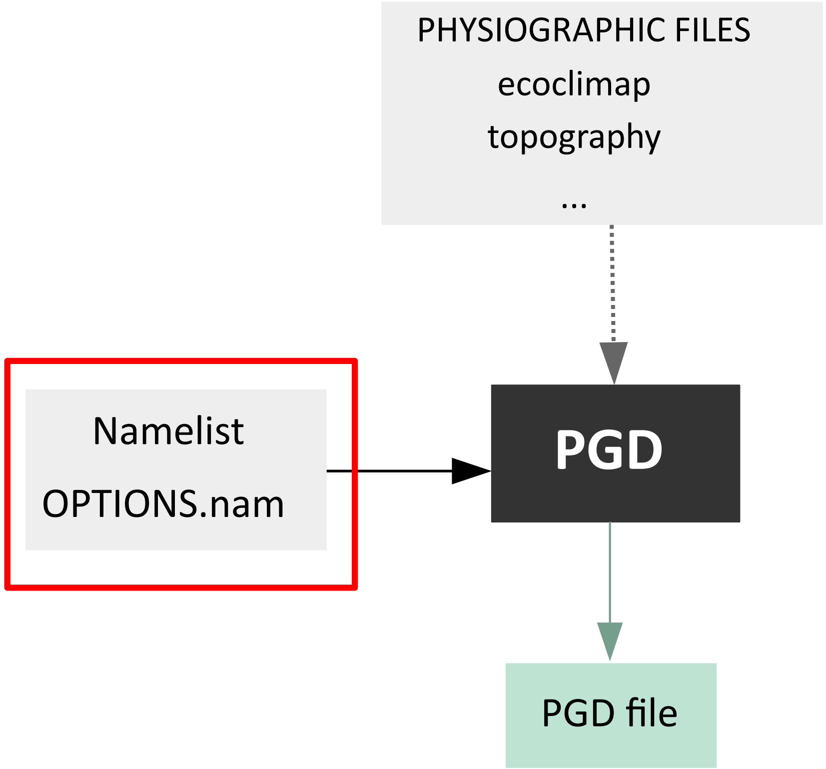
PGD step :

• you choose the surface schemes

• you choose and define the grid for the surface

• fractions of tiles (SEA,WATER,NATUREn TOWN) and fractions of type of vegetation are calculated in each grid point

• physiographic parameters are defined, averaged and interpolated on this grid



5. Namelists and options at PGD step

general

&NAM_IO_OFFLINE:

CSURF_FILETYPE = « NC / ASCII / LFI / FA » : filetype for PGD and PREP output files

NHALO = 0 (default value) : halo size for the interpolation of missing input physiographic data

LWRITE_COORD = T : to write XX and XY in PGD and PREP files.

/

5. Namelists and options at PGD step

grid definition

- NAM_PGD_GRID defines the grid type, specified or from an existing surface file

  &NAM_PGD_GRID

  CGRID = « CONF PROJ / CARTESIAN / GAUSS / LONLAT REG / LONLATVAL / IGN »: *type of grid. (IGN = lambert, CONF PROJ = mercator).*

  YINIFILE = « [surfex file where to take the grid definition] »

  YINIFILETYPE = « [type of the upper surfex file] »

- Other specific namelists to define parameters according to the grid type.

  NAM_LONLAT_REG

  NAM_CONF_PROJ

  NAM_CARTESIAN

  ...

5. Namelists and options at PGD step
grid definition

NAM_PGD_GRID : exemples

```
&NAM_PGD_GRID
   CGRID = 'CONF PROJ '
/
&NAM_CONF_PROJ_GRID
   XLONCEN = -76.,
   XLATCEN = 20.,
   NIMAX   = 216,
   NJMAX   = 120,
   XDX     = 10000,
   XDY     = 10000
/
&NAM_CONF_PROJ
   XLON0 = -76.,
   XLAT0 = 20.,
   XRPK  = 0.
   XBETA=0.
```

Regular grid (in meters in x and y perpendicular directions) on Mercator projection

```
&NAM_PGD_GRID
   CGRID = 'LONLAT REG',
/
&NAM_LONLAT_REG
   XLONMIN=-32,
   XLONMAX=42,
   XLATMIN=20,
   XLATMAX=72,
   NLON=200,
   NLAT=200,
/
```

A regular latitude-longitude grid

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5. Namelists and options at PGD step
grid

Consequences of grid type and resolution on ECOCLIMAP: spatial aggregation of parameters

4 types of averaging surface parameters (weights according to fractions present in grid points):

- **ARITHMETIC**: value in one grid point = sum of weighted data / sum of weights → *main parameters*

- **INVERSE**: value in one grid point = sum of weights / sum of weighted (1 / values) → *RSMIN & CV*

- **INVERSE OF SQUARE LOGARITHM** : base data used is 1 / (ln (dz / data)**2. → *Z0*

- **MAJORITY**: value in one grid point = value of the most present data in the gridpoint. → *dates for seeding and reaping*

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6. Namelists and options at PGD step

grid

Consequences of grid type and resolution on ECOCLIMAP: spatial aggregation of parameters

C1	C1	C2	C2
C1	C1	C1	C2
C1	C1	C1	C1

One grid point i:

Cover 1 is present at 9/12 = 75 %

Cover 2 is present at 3/12 = 25 %

ARI : Param(i) = (9 * Param1 + 3 * Param2) / 12

INV : Param(i) = 12 / (9 * 1/Param1 + 3 * 1/Param2)

MAJ : Param(i) = Param1

5. Namelists and options at PGD step
schemes for each tile

To define the four schemes that will be used, one for each type of surface (SEA, NATURE, TOWN, WATER).

&NAM_PGD_SCHEMES

CNATURE = « NONE / FLUX / TSZ0 / ISBA »

CSEA = « NONE / FLUX / SEAFLX »

CWATER = « NONE / FLUX / WATFLX / FLAKE »

CTOWN = « NONE / FLUX / TEB »

LGARDEN = F

/

FLUX refers to an ideal configuration where heat and evaporation surface fluxes are given in namelist NAM_IDEAL_FLUX

TSZ0 refers to a special configuration where TS (surface temperature) and WG (ground water) are forcing given in namelist NAM_DATA_TSZ0.

FLAKE refers to the lake model: http://www.flake.igb-berlin.de/

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5. Namelists and options at PGD step
orography

NAM_ZS To define the orography file and orographic treatment to be done.

&NAM_ZS:

XUNIF_ZS = uniform orography in meters

Or

YS = external orographic data file

YZSFILETYPE = type of YS file

/

```
&NAM_ZS        XUNIF_ZS=500.,
/
```

uniform value of orography imposed on all points (real,meters)

```
&NAM_ZS        YZS='gtopo30',
               YZSFILETYPE='DIRECT'
/
```

An orography file is read

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5. Namelists and options at PGD step

ECOCLIMAP

&NAM_PGD_ARRANGE_COVER

LWATER_TO_NATURE = F : *to replace water (not lakes) by nature*

LTOWN_TO_ROCK = F : *to replace town by rock.*

/

&NAM_COVER

XRM_COVER = 1.E-6 : *limit in fraction value to remove a cover from a grid point. For each point, all fractions of ecosystems that are below XRM_COVER are removed*

XRM_COAST = 1.: *idem for land part in a coastal grid point.*

XRM_LAKE = 0.: *idem for lake in a land grid point.*

XRM_SEA = 0.: *idem for sea in a land grid point.*

/

5. Namelists and options at PGD step
additional data to ECOCLIMAP

To initialise SST from external files, Treats SST as a forcing variable

&NAM_DATA_SEAFLUX:

LSST_DATA = F : to give climatological temporal SST data (SST = sea surface temperature)

NTIME_SST = 12: number of available SST data.

CFNAM_SST, CFTYP_SST : file containing SST data.

NYEAR_SST, NMONTH_SST, NDAY_SST, XTIME_SST: date and hours for SST data.

/

5. Namelists and options at PGD step
additional data to ECOCLIMAP

Some parameters can be specified by the user in the namelist

&NAM_DATA_FLAKE

XUNIF_WATER_DEPTH / YWATER_DEPTH / YWATER_DEPTHFILETYPE :
data for lake water depth

YWATER_DEPTH_STATUS : associated status file for the depth database.

Other data for: WATER_FETCH, T_BS, DEPTH_BS, EXTCOEF_WATER (FLAKE specific parameters, BS = bottom sediments, fetch for the wind).

/

5. Namelists and options at PGD step

additional data to ECOCLIMAP

&NAM_ISBA

XUNIF_CLAY=0.33 : uniform prescribed value of clay fraction

YCLAY : clay fraction data file name

YCLAYFILETYPE : type of clay data file

Same for :

- SAND fraction in NAM_ISBA
- RUNOFFB, WDRAIN : subgrid runoff coefficient, subgrid drainage
- SOC_TOP, SOC_SUB : organic carbon topsoil ans subsoil fractions
- PERM : permafrost distribution (CISBA=DIF)
- PH, FERT : pH and soil fertilization rate

5. Namelists and options at PGD step
ISBA

ISBA physical options known and needed at PGD step

&NAM_ISBA

CISBA = « 2-L / 3-L / DIF »: type of soil discretization and physics in ISBA : force restore method with 2 or 3 layers or diffusive scheme.

NGROUND_LAYER : 2, 3, or any for DIF.

XSOILGRID : depths for the vertical grid in diffusive scheme (ideal 14 depths by default)

CPHOTO = « NON / AST / NIT / NCB » : type of photosynthesis physics

CPEDO_FUNCTION = « CH78 / CO84 »: pedo-transfert function.

LTR_ML = F : to activate radiative transfert calculation (only if cphoto/=NON)

NPATCH = 1 to 12 or 19 : number of patchs for which ISBA will separately run.

5. Namelists and options at PGD step

ISBA

Concept of PATCH

- The user is not constraint to consider each vegetation type separately of the others, he can work with a number of patches between 1 (19 types aggregated) and 19 (19 types separated).
- A patch is consequently a merge of several vegetation types.
- If the number of patches is lower than 19, values of surface parameters are calculated no longer by vegetation type but by patch, following an aggregation process lying on the composition of patchs in terms of vegetation types.

5. Namelists and options at PGD step

ISBA

Concept of PATCH

	19	12	11	10	9	8	7	6	5	4	3	2	1
NO	1	1	1	1	1	1	1	1	1	1	1	1	1
ROCK	2	2	2	1	1	1	1	1	1	1	1	1	1
SNOW	3	3	3	2	2	2	2	1	1	1	1	1	1
C3	7	7	7	6	5	4	4	3	3	3	3	1	1
C4	8	8	8	7	6	5	4	3	3	3	3	1	1
GRASS	10	10	10	9	8	7	6	5	5	3	3	1	1
BOGR	18	10	10	9	8	7	6	5	5	3	3	1	1
TROG	11	11	10	9	8	7	6	5	5	3	3	1	1
IRR	9	9	9	8	7	6	5	4	4	4	3	1	1
PARK	12	12	11	10	9	8	7	6	4	4	3	1	1
TEBD	4	4	4	3	3	3	3	2	2	2	2	2	1
TRBD	13	4	4	3	3	3	3	2	2	2	2	2	1
TEBE	14	4	4	3	3	3	3	2	2	2	2	2	1
BOBD	16	4	4	3	3	3	3	2	2	2	2	2	1
SHRB	19	4	4	3	3	3	3	2	2	2	2	2	1
TRBE	6	6	6	5	3	3	3	2	2	2	2	2	1
BONE	5	5	5	4	4	3	3	2	2	2	2	2	1
TENE	15	5	5	4	4	3	3	2	2	2	2	2	1
BOND	17	5	5	4	4	3	3	2	2	2	2	2	1

5. Namelists and options at PGD step

ISBA

Concept of PATCH

	19	12	11	10	9	8	7	6	5	4	3	2	1
NO	1	1	1	1	1	1	1	1	1	1	1	1	1
ROCK	2	2	2	1	1	1	1	1	1	1	1	1	1
SNOW	3	3	3	2	2	2	2	1	1	1	1	1	1
C3	7	7	7	6	5	4	4	3	3	3	3	1	1
C4	8	8	8	7	6	5	4	3	3	3	3	1	1
GRASS	10	10	10	9	8	7	6	5	5	3	3	1	1
BOGR	18	10	10	9	8	7	6	5	5	3	3	1	1
TROG	11	11	10	9	8	7	6	5	5	3	3	1	1
IRR	9	9	9	8	7	6	5	4	4	4	3	1	1
PARK	12	12	11	10	9	8	7	6	4	4	3	1	1
TEBD	4	4	4	3	3	3	3	2	2	2	2	2	1
TRBD	13	4	4	3	3	3	3	2	2	2	2	2	1
TEBE	14	4	4	3	3	3	3	2	2	2	2	2	1
BOBD	16	4	4	3	3	3	3	2	2	2	2	2	1
SHRB	19	4	4	3	3	3	3	2	2	2	2	2	1
TRBE	6	6	6	5	3	3	3	2	2	2	2	2	1
BONE	5	5	5	4	4	3	3	2	2	2	2	2	1
TENE	15	5	5	4	4	3	3	2	2	2	2	2	1
BOND	17	5	5	4	4	3	3	2	2	2	2	2	1

5. Namelists and options at PGD step

ISBA

Concept of PATCH

	19	12	11	10	9	8	7	6	5	4	3	2	1
NO	1	1	1	1	1	1	1	1	1	1	1	1	1
ROCK	2	2	2	1	1	1	1	1	1	1	1	1	1
SNOW	3	3	3	2	2	2	2	1	1	1	1	1	1
C3	7	7	7	6	5	4	4	3	3	3	3	1	1
C4	8	8	8	7	6	5	4	3	3	3	3	1	1
GRASS	10	10	10	9	8	7	6	5	5	3	3	1	1
BOGR	18	10	10	9	8	7	6	5	5	3	3	1	1
TROG	11	11	10	9	8	7	6	5	5	3	3	1	1
IRR	9	9	9	8	7	6	5	4	4	4	3	1	1
PARK	12	12	11	10	9	8	7	6	4	4	3	1	1
TEBD	4	4	4	3	3	3	3	2	2	2	2	2	1
TRBD	13	4	4	3	3	3	3	2	2	2	2	2	1
TEBE	14	4	4	3	3	3	3	2	2	2	2	2	1
BOBD	16	4	4	3	3	3	3	2	2	2	2	2	1
SHRB	19	4	4	3	3	3	3	2	2	2	2	2	1
TRBE	6	6	6	5	3	3	3	2	2	2	2	2	1
BONE	5	5	5	4	4	3	3	2	2	2	2	2	1
TENE	15	5	5	4	4	3	3	2	2	2	2	2	1
BOND	17	5	5	4	4	3	3	2	2	2	2	2	1

5. Namelists and options at PGD step
ISBA

Concept of PATCH

	19	12	11	10	9	8	7	6	5	4	3	2	1
NO	1	1	1	1	1	1	1	1	1	1	1	1	1
ROCK	2	2	2	1	1	1	1	1	1	1	1	1	1
SNOW	3	3	3	2	2	2	2	1	1	1	1	1	1
C3	7	7	7	6	5	4	4	3	3	3	3	1	1
C4	8	8	8	7	6	5	4	3	3	3	3	1	1
GRASS	10	10	10	9	8	7	6	5	5	3	3	1	1
BOGR	18	10	10	9	8	7	6	5	5	3	3	1	1
TROG	11	11	10	9	8	7	6	5	5	3	3	1	1
IRR	9	9	9	8	7	6	5	4	4	4	3	1	1
PARK	12	12	11	10	9	8	7	6	4	4	3	1	1
TEBD	4	4	4	3	3	3	3	2	2	2	2	2	1
TRBD	13	4	4	3	3	3	3	2	2	2	2	2	1
TEBE	14	4	4	3	3	3	3	2	2	2	2	2	1
BOBD	16	4	4	3	3	3	3	2	2	2	2	2	1
SHRB	19	4	4	3	3	3	3	2	2	2	2	2	1
TRBE	6	6	6	5	3	3	3	2	2	2	2	2	1
BONE	5	5	5	4	4	3	3	2	2	2	2	2	1
TENE	15	5	5	4	4	3	3	2	2	2	2	2	1
BOND	17	5	5	4	4	3	3	2	2	2	2	2	1

5. Namelists and options at PGD step
TEB

TEB physical options known and needed at PGD step

&NAM_TEB
NTEB_PATCH = 1 : TEB patches are associated to road orientations defined at PREP step.
CBEM = « DEF / BEM »: building energy model
LAUTOSIZE = F: to activate autosize calculation
CHEAT_COIL = « IDEAL / FINCAP »: type of heating coil (BEM)
CCOOL_COIL = « IDEAL / DXCOIL »: type of cooling coil (BEM)
NROAD_LAYER = 5 : number of layers in roads
NROOF_LAYER = 5 : idem in roofs
NWALL_LAYER = 5 : idem in walls
NFLOOR_LAYER = 5 : idem in floors (BEM)
LGREENROOF = F : to activate the greenroof ISBA modelization
LHYDRO = F : urban hydrology (not implemented yet)
LSOLAR_PANEL = F : to activate solar panels representation.
/

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QUESTIONS ?