

Irrigation with ECOCLIMAP-Second Generation in SURFEX V9

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For a complete description, see Druel et al. 2020, in preparation

Introduction

To represent the complexity of agricultural practices and irrigation, and precisely their impact, the models have to be able to reproduce the vegetation behaviour simultaneously as the human action. However, currently most of the models represent only one type of irrigated vegetation (mostly C4 crops), with only one type of irrigation (e.g. sprinkling or flooding), such as C4 crops irrigated with sprinkling in the previous version (V8.1) of SURFEX-ISBA land surface model (Voldoire et al., 2017; Le Moigne et al., 2018).

A more detailed irrigation have been developed in SURFEX-ISBA, taking advantage of the recent new cover database (ECOCLIMAP-SG) in the ISBA land surface model of Météo-France. The principle is to allow the irrigation of each type of vegetation (and not only C4 crops), with other new possibilities, such as where the water is applied, the period of irrigation, the minimum interval between two irrigations or the water quantity applied by irrigation.

Concept of irrigation in ECOCLIMAP-SG

Contrary to the 19 types of nature in previous versions of ECOCLIMAP, there is no specific irrigated type in the 20 types of nature of ECOCLIMAP-SG. Thus, it was decided that all types of vegetation could be irrigated by the 3 main different types of irrigation: sprinkler, flood and drip.

The development of a high-resolution map of irrigation at global scale was necessary to compute the fraction of irrigated vegetation at ECOCLIMAP-SG resolution (see below the section dedicated to the description of this map). Moreover, to prevent an excessive increase in the number of nature type simulated (potentially non irrigated and 20×3 irrigated = 80), involving a large increase of complexity, memory and computing cost, some choices have been made:

- the user has to select for each simulation the number of irrigated types (and which ones) in order to limit the number of irrigated patch. By default 6 vegetation types are irrigated: temperate deciduous and evergreen trees to represent for example respectively fruits trees (Nb. 5 in Table 1.) or olive trees (Nb. 7), shrubs to represent vine plants (Nb. 12), and different irrigated crops (Nb. 16, 17 and 18).

- to consider for each grid cell and by nature type the main irrigation method used, considering that in one cell there is a dominating irrigation method used by vegetation type (e.g.: flooded rice in china or sprinkler corn in France).

In practice, that implies to duplicate a nature type if it is partially irrigated, then to attribute for each grid cell the corresponding fraction with and without irrigation, and lastly to select the main

irrigation type for each irrigated vegetation type and for each pixel. Afterwards, the both nature type are treated separately but with same main characteristics, one with and the other without water intake.

1	Bare soil	6	Tropical broadleaf deciduous	11	Boreal needleleaf deciduous	16	Winter C3 crops
2	Bare rock	7	Temperate broadleaf evergreen	12	shrubs	17	Summer C3 crops
3	Permanent snow	8	Tropical broadleaf evergreen	13	Boreal grassland	18	C4 crops
4	Boreal broadleaf deciduous	9	Boreal needleleaf evergreen	14	Temperate grassland	19	Tree cover, flooded
5	Temperate broadleaf deciduous	10	Temperate needleleaf evergreen	15	Tropical grassland	20	Shrub or herbaceous cover, flooded

Table 1: 20 types of nature in ECOCLIMAP-SG. In blue, the 6 vegetation types irrigated with a default configuration when irrigation is activated.

Map of irrigation provided with ECOCLIMAP-SG

A map of irrigation (binary file irrigtype.dir / irrigtype.hdr) is provided with the ECOCLIMAP-SG database. It's a global map, at 1km resolution. This map has been obtained by downscaling, from Meier et al. 2018.

For each pixel, a type of ECOCLIMAP-SG cover (between 1 and 33) is associated to a type of irrigation (0=no irrigation / 1=sprinkler irrigation). Currently, there is no explicit difference between sprinkling(=1) / dripping(=2) / flooding(=3). Thus, by default, irrigated surfaces are considered as sprinkling.

To use the default values for irrigation with ECOCLIMAP-SG, it is highly recommended to use this irrigation map.

Patch aggregation rules for irrigation

When irrigation is activated, the vegetation types irrigated are duplicated (irrigated and non irrigated). Consequently, to work with patches (aggregation of vegetation type together, to reduce computing time), it is important to consider this patch aggregation rules (Figure 1). It permits to understand how many patches have to be considered and indicated in namelist, according to the vegetation types irrigated.

For example, a user wants to continue to work with 9 patches (called 'original patches', in black in the tree) and wants to irrigate 4 vegetation types: temperate, boreal and tropical grasslands and shrubs. With these 9 patches, the irrigated vegetation types are included in 2 different patches ("3: Broadleaf trees +shrubs" and "8: Grasslands"). So, with irrigation, these 2 patches are duplicated. And finally, the user has to indicate in namelist NPATCH_TREE=9 and NPATCH=11 (see example 2 of namelist).

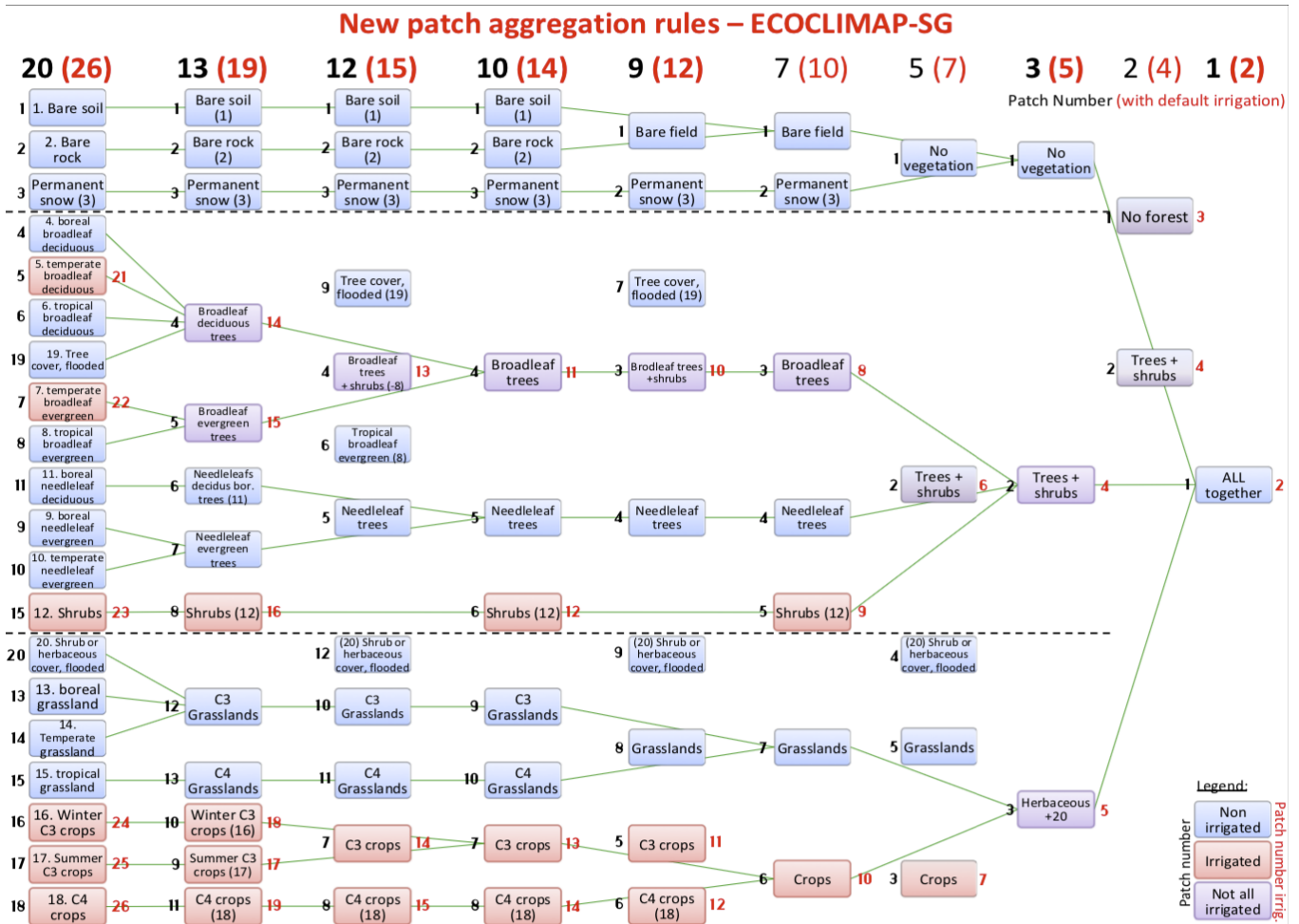


Figure 1: Patch aggregation rules with new patch distribution and default irrigated vegetation type. Red numbers for irrigation with default values, black numbers for "original" patch aggregation rules.

Technical description of keys and namelists to activate irrigation

Namelist: NAM_AGRI

Fortran name	Fortran type	Values	Default value
LAGRIP	logical	.TRUE./FALSE	.FALSE.
LIRRIGMODE	logical	.TRUE./FALSE	.FALSE.
NVEG_IRR	integer	[0-NVEGTYPE]	with ECOCLIMAP-SG and LIRRIGMODE: 6 without ECOCLIMAP-SG (not used): 0
NPATCH_TREE	integer	Between: 1, 2, 3, 5, 7, 9, 10, 12, 13 or NVEGTYPE	- (not needed without ECOCLIMAP-SG or if default values of NVEG_IRR and NVEG_IRR_USE are used)
XTHRESHOLD	float, dimension(4)	[0,1]	(/0.70,0.55,0.40,0.25/)
NIRR_STOP_BTR	integer	[0,365]	14 (days)

- LAGRIP: flag to activate agricultural practices (seeding and reaping), only for herbaceous (deactivate for wood-species in any case)
- LIRRIGMODE: flag to activate irrigation.

With LAGRIP and/or LIRRIGMODE, if ECOCLIMAP-SG is activated (LECOSG = T in namelist NAM_FRAC) the vegetation types associated (defined with NUNIF_VEG_IRR_USE, see below) are duplicated. By default you need nothing more without ECOCLIMAP-SG, although with ECOCLIMAP-SG it is extremely recommended to use the map "irrigcover_vX" provided with ECOCLIMAP-SG forcing (cf CFNAM_IRRIGFRAC and CFTYP_IRRIGFRAC in namelist NAM_DATA_ISBA). Otherwise, NPATCH (from namelist NAM_ISBA) have to be adapted to indicate how many patch are finally considered (with default irrigated vegetation type, is currently 2, 4, 5, 10, 12, 14, 15, 19 or 26).

- NVEG_IRR: if LAGRIP or/and LIRRIGMODE are activated, it corresponds to the number of patch irrigated or/and with agricultural practices. The default value is 6 with ECOCLIMAP-SG and LIRRIGMODE, 0 without ECOCLIMAP-SG. NB if you indicate 0, the default value is used.
- NPATCH_TREE: with ECOCLIMAP-SG and if LAGRIP or/and LIRRIGMODE are activated, it corresponds to the tree patch distribution without irrigation/agricultural practices. By default (if default values of NVEG_IRR and NVEG_IRR_USE are used) it takes automatically a value corresponding to NPATCH, else the value of patch aggregation rules without irrigation use has to be indicated (1, 2, 3, 5, 7, 9, 10, 12, 13 or NVEGTYPE).
- XTHRESHOLD: if LIRRIGMODE is activated, XTHRESHOLD is the 4 successive threshold values to trigger the irrigation. For example, with default values, the first irrigation will be trigger only if the hydric stress is below 0.7, the second one below 0.55, then below 0.4 and from the 4th below 0.25 (1 corresponds to a water saturated soil, and 0 a dry soil). This key can be overwritten by more specific values in the namelist NAM_DATA_ISBA (see below).
- NIRRR_STOP_BTR: Number of days corresponding to the time when the irrigation stops before reaping.

Namelist: NAM_DATA_ISBA

Fortran name	Fortran type	Default value	Values / units
NUNIF_VEG_IRR_USE	integer, dimension(NVEG_IRR)	(/5,7,12,16,17,18/) with ECOCLIMAP-SG and LIRRIGMODE (/9/) (=NVT_IRR) with ECOCLIMAP	
XUNIF_IRRIGTYPE_C	real	1 (for sprinkler) with ECOCLIMAP_SG 1 (for sprinkler) for irrigated vegetation type NVT_IRR (=9), 0 else with ECOCLIMAP	(0,1,2,3)
XUNIF_IRRIGTYPE	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_IRRIGTYPE	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_IRRIGTYPE	character(len=6), dimension(NVEGTYPE)	' '	

XUNIF_IRRIGFRAC_C	real	0.05 (but use by default the map "irrigcover_vX" provided with ECOCLIMAP-SG!)	[0-1]
XUNIF_IRRIGFRAC	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_IRRIGFRAC	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_IRRIGFRAC	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_IRRIGFREQ_CTYPE	real, dimension(NIRR_TYPE)	(/604800,0,604800/)	(s)
XUNIF_IRRIGFREQ_C	real	XUNDEF	
XUNIF_IRRIGFREQ	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_IRRIGFREQ	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_IRRIGFREQ	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_IRRIGTIME_C	real	28800	(s)
XUNIF_IRRIGTIME	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_IRRIGTIME	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_IRRIGTIME	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_WATSUP_C	real	30	(mm)
XUNIF_WATSUP_CTIME	real, dimension(NTIME_MAX)	XUNDEF	
XUNIF_WATSUP	real, dimension(NVEGTYPE, NTIME_MAX)	XUNDEF	
CFNAM_WATSUP	character(len=28), dimension(NVEGTYPE, NTIME_MAX)	' '	
CFTYP_WATSUP	character(len=6), dimension(NVEGTYPE, NTIME_MAX)	' '	
XUNIF_F2THRESHOLD_C	real	XUNDEF (cf NAM_AGR)	[0-1]
XUNIF_F2THRESHOLD_CTIME	real, dimension(NTIME_MAX)	XUNDEF	
XUNIF_F2THRESHOLD	real, dimension(NVEGTYPE, NTIME_MAX)	XUNDEF	
CFNAM_F2THRESHOLD	character(len=28), dimension(NVEGTYPE, NTIME_MAX)	' '	
CFTYP_F2THRESHOLD	character(len=6), dimension(NVEGTYPE, NTIME_MAX)	' '	

XUNIF_SEED_M_C	real	3	[1, 12]
XUNIF_SEED_M	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_SEED_M	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_SEED_M	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_SEED_D_C	real	15	[1, 31]
XUNIF_SEED_D	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_SEED_D	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_SEED_D	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_REAP_M_C	real	8	[1, 12]
XUNIF_REAP_M	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_REAP_M	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_REAP_M	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_REAP_D_C	real	31	[1, 31]
XUNIF_REAP_D	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_REAP_D	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_REAP_D	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_SEED_S2_M_C	real	XUNDEF	[1, 12]
XUNIF_SEED_S2_M	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_SEED_S2_M	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_SEED_S2_M	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_SEED_S2_D_C	real	XUNDEF	[1, 31]
XUNIF_SEED_S2_D	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_SEED_S2_D	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_SEED_S2_D	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_REAP_S2_M_C	real	XUNDEF	[1, 12]
XUNIF_REAP_S2_M	real, dimension(NVEGTYPE)	XUNDEF	

CFNAM_REAP_S2_M	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_REAP_S2_M	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_REAP_S2_D_C	real	XUNDEF	[1, 31]
XUNIF_REAP_S2_D	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_REAP_S2_D	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_REAP_S2_D	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_SEED_S3_M_C	real	XUNDEF	[1, 12]
XUNIF_SEED_S3_M	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_SEED_S3_M	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_SEED_S3_M	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_SEED_S3_D_C	real	XUNDEF	[1, 31]
XUNIF_SEED_S3_D	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_SEED_S3_D	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_SEED_S3_D	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_REAP_S3_M_C	real	XUNDEF	[1, 12]
XUNIF_REAP_S3_M	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_REAP_S3_M	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_REAP_S3_M	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_REAP_S3_D_C	real	XUNDEF	[1, 31]
XUNIF_REAP_S3_D	real, dimension(NVEGTYPE)	XUNDEF	
CFNAM_REAP_S3_D	character(len=28), dimension(NVEGTYPE)	' '	
CFTYP_REAP_S3_D	character(len=6), dimension(NVEGTYPE)	' '	
XUNIF_SEED_D_DELTA	real	0	(day)
XUNIF_REAP_D_DELTA	real	0	(day)

- NUNIF_VEG_IRR_USE: if LAGRIP or/and LIRRIGMODE are activated, it corresponds to the vegetation types irrigated or/and with agricultural practices (size: NVEG_IRR). By default if LECOCLIMAP-SG and LIRRIGMODE (with or without LAGRIP), it is

(/5,7,12,16,17,18/) (temperate broadleaf deciduous, temperate broadleaf evergreen, shrubs, C3 winter crops, C3 summer crops and C4 crops. With ECOCLIMAP, the default value is (/9/), the value of the NVT_IRR vegetation type.

For the other following parameters, there is a standard nomenclature for the parameters associated to the same variable and a hierarchy to select the value take into account. If the name of the key is XUNIF_*_C, is to give a constant value, identical for all vegetation types irrigated. If the key is XUNIF_*, is to give a constant value, by vegetation types irrigated. If the key is XUNIF_*_CTIME, is to give different values by decades (36 different for one year). Then, if the name starts by 'CFNAME_*' and 'CFTYP_*', is to indicate respectively the file name and the type of file ('DIRECT', 'BINLLF', 'BINLLV' or 'ASCLLV'). Priority order is: the map (CFNAME_* and CFTYPE_*) > XUNIF_* > XUNIF_*_CTIME > XUNIF_*_C.

- XUNIF_IRRIGTYPE_C, XUNIF_IRRIGTYPE, CFNAM_IRRIGTYPE, CFTYP_IRRIGTYPE: if LIRRIGMODE is activated, these keys indicate the irrigation type: 0 for none, 1 for sprinkling, 2 for dripping and 3 for flooding. By default with ECOCLIMAP-SG is 1 (but take into account only for irrigated vegetation type) and with ECOCLIMAP for irrigated vegetation type is 1 (sprinkler) and the others 0.
- XUNIF_IRRIGFRAC_C, XUNIF_IRRIGFRAC, CFNAM_IRRIGFRAC, CFTYP_IRRIGFRAC: if LECOCLIMAP-SG and LIRRIGMODE are activated, they indicate the irrigation fraction [0-1] for each vegetation type (but only the vegetation types indicated in NUNIF_VEG_IRR_USE will be irrigated). Please by default use the map of irrigation ("irrigcover_vX") provided with ECOCLIMAP-SG forcing.
- XUNIF_IRRIGFREQ_C, XUNIF_IRRIGFREQ_CTYPE, XUNIF_IRRIGFREQ, CFNAM_IRRIGFREQ, CFTYP_IRRIGFREQ: If LIRRIGMODE, keys to indicate the minimum time (in s) between two irrigation triggers. By default it is defined with XUNIF_IRRIGFREQ_CTYPE: values for the 3 types of irrigation, respectively sprinkling, dripping and flooding.
- XUNIF_IRRIGTIME_C, XUNIF_IRRIGTIME, CFNAM_IRRIGTIME, CFTYP_IRRIGTIME: If LIRRIGMODE, keys to indicate the duration of irrigation (in s).
- XUNIF_WATSUP_C, XUNIF_WATSUP_CTIME, XUNIF_WATSUP, CFNAM_WATSUP, CFTYP_WATSUP: If LIRRIGMODE, keys to indicate the irrigation amount (mm) for one irrigation.
- XUNIF_F2THRESHOLD_C, XUNIF_F2THRESHOLD_CTIME, XUNIF_F2THRESHOLD_C, FNAM_F2THRESHOLD, CFTYP_F2THRESHOLD: If LIRRIGMODE, keys to indicate the threshold [0-1] for irrigation triggering. By default the value given by XTHRESHOLD in the namelist NAM_AGR1 is used, but the value can be overwritten here.
- XUNIF_SEED_M_C, XUNIF_SEED_M, CFNAM_SEED_M, CFTYP_SEED_M: if LAGRIP or/and LIRRIGMODE are activated, they correspond to the seeding month and/or the month of the beginning of irrigation [1-12].
- XUNIF_SEED_D_C, XUNIF_SEED_D, CFNAM_SEED_D, CFTYP_SEED_D: if LAGRIP or/and LIRRIGMODE are activated, they correspond to the seeding day and/or the day of the beginning of irrigation [1-31].
- XUNIF_REAP_M_C, XUNIF_REAP_M, CFNAM_REAP_M, CFTYP_REAP_M: if LAGRIP or/and LIRRIGMODE are activated, they correspond to the reaping month and/or the month corresponding to 2 weeks after the end of irrigation [1-12].
- XUNIF_REAP_D_C, XUNIF_REAP_D, CFNAM_REAP_D, CFTYP_REAP_D: if LAGRIP or/and LIRRIGMODE are activated, they correspond to the reaping day and/or the day corresponding to 2 weeks after the end of irrigation [1-31].

NB : It is possible to deactivate these seeding/reaping/irrigation dates, by indicating a start date the 1st January and a end date the 31st December.

NB : In a similar way to the previous keys, it is possible to define the dates for a second or

third agricultural season. The nomenclature is identical, with “_S2” or “_S3” added. There is no default value (by default only one season is considered)

- XUNIF_SEED_D_DELTA: if LAGRIP or/and LIRRIGMODE are activated and date values given with ‘XUNIF_*’, this key changes the seeding date (= start date of irrigation) and adds a random value around the previously defined date (in a range equal to +/- XUNIF_SEED_D_DELTA). Take care: with this option each PGD will be different.
- XUNIF_REAP_D_DELTA: if LAGRIP or/and LIRRIGMODE are activated and date values given with ‘XUNIF_*’, this key changes the reaping date (= 2 weeks after the end of irrigation) and adds a random value around the previously defined date (in a range equal to +/- XUNIF_SEED_D_DELTA). Take care: with this option each PGD will be different.

Examples of namelists to activate irrigation with ECOCLIMAP-SG

Example 1. Default values for irrigation with ECOCLIMAP-SG

In this example, NPATCH=19, which corresponds to 6 patches irrigated or partially irrigated and 13 patches non irrigated (see the patch aggregation rules). Irrigation dates, seeding dates, reaping dates are the default values. The irrigation type is only sprinkling (default value for irrigation type). The irrigated fractions are directly obtained from the irrigation map provided with ECOCLIMAP-SG.

To use default values for irrigation with ECOCLIMAP-SG, you have to use the map of irrigation (provided with ECOCLIMAP-SG: irrigcover_v0.dir and irrigcover_v0.hdr) and add/change in the OPTIONS.nam:

```

&NAM_AGRI          LAGRIP      = T,  !(not required but extremely recommended by
                    LIRRIGMODE = T,
                    ! default)
...
/
&NAM_ISBA          NPATCH = 19 ! You can choose one of the default value as
! explained above and shown in the patch aggregation rules available below: 2, 4,
! 5, 7, 10, 12, 14, 15, 19 or 26 (red numbers in the patch aggregation rules for
! irrigation)
...
/
&NAM_DATA_ISBA    XUNIF_IRRIGTYPE_C = 1           ! Only sprinkling
                  CFNAM_IRRIGFRAC = 'irrigcover_v0' ! Read irrigated
fractions
                  CFTYP_IRRIGFRAC = 'DIRTYP'
...
/

```

NB: If on your domain you have an idea of the irrigation season (by ex. from the 15 March to the 31 August), it is **strongly recommended** to specify the season by adding:

```
&NAM_DATA_ISBA      XUNIF_SEED_M_C = 3 ,
                    XUNIF_SEED_D_C = 15 ,
                    XUNIF_REAP_M_C = 8 ,
                    XUNIF_REAP_D_C = 31 ,
                    XUNIF_SEED_D_DELTA = 15 , ! not require: only made random seeding
                                                ! date around the indicate date
                    XUNIF_REAP_D_DELTA = 15, ! not require: only made random reaping
                                                ! date around the indicate date
...
/
```

nb: If you used one delta, each dates made in your PGD will be not constant between to run (only when your making the PGD).

Example 2. Personalized irrigation

In this example, the user wants to irrigate only winter C3 crops, summer C3 crops and C4 crops, and wants to work with 10 “original” patch.

The user wants to choice which vegetation type will be irrigated with ECOCLIMAP-SG (by example the winter C3 crops, summer C3 crops and C4 crops, vegetation type numbers 16, 17 and 18). First you have to choose the “original” patch aggregation rules (black numbers in the aggregation rules for irrigation) that you would like to use. Here, for example, NPATCH_TREE = 10. Then, you have check how many “original” patches contain patches now irrigate. In our case the patches 7 and 8 indicate that 2 supplementary patches will be irrigated (see patch aggregation rules below). So, you have to indicate NPATCH = 12.

Then you have to use the map of irrigation (provide with ecoclimap-sg: irrigcover_v0.dir and irrigcover_v0.hdr) and add/change in the OPTIONS.nam as indicated in example 1:

```
&NAM_ISBA          NPATCH = 12 ! As found before
...
/
&NAM_AGR1          LAGRIP = T, ! (not required but extremely recommended by default)
                  LIRRIGMODE = T,
                  NVEG_IRR = 3 !3 type of vegetation irrigated (16,17,18)
                  NPATCH_TREE = 10
...
/
&NAM_DATA_ISBA    XUNIF_IRRIGTYPE_C = 1 ! Only sprinkling
                  CFNAM_IRRIGFRAC = 'irrigcover_v0'
                  CFTYP_IRRIGFRAC = 'DIRTYP'
                  NUNIF_VEG_IRR_USE(1) = 16
                  NUNIF_VEG_IRR_USE(2) = 17
                  NUNIF_VEG_IRR_USE(3) = 18
...
/
```

NB: (1) The possibilities for NPATCH (with the same irrigated vegetation type 16/17/18) could have been 23, 16, 14, 12, 11, 8, 4, 3 or 2, associated with the respective correspond

NPATCH_TREE: 20, 13, 12, 10, 9, 7, 3, 2, 1.

(2) As in example 1., if on your domain you have an idea of irrigation season, it is **strongly recommended** to indicate it as in “NB” of example 1

(3) A explicit list of the composition of the patches is written in the PGD file.

References

Druel et al. 2020, in preparation

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