Building of the new map for ECOCLIMAP-SG & first test in SURFEX

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Plan

- 1. Principles of ECOCLIMAP-SG
- 2. The ESA-CCI land cover map : comparisons
- 3. The new land cover types
- 4. Other data sources used to build the new map
- 5. Illustrations
- 6. First test in the Safran Isba Modcou (SIM) system
- 7. Conclusion
- 8. Prospects

1. Principles of ECOCLIMAP-SG (1/2)

- The specifications for ECOCLIMAP-SG were defined following a study of needs realized in 2015 inside and outside the CNRM :
  - A global land cover map at 300m (1/360°) resolution ;
  - **Each grid point stands for only ONE surface / vegetation / urban type ;**

    → The notion of ECOCLIMAP cover (= several surface / vegetation types in a homogeneous ecosystem) disappears.
  - The building of the land cover map aims at being mainly automatic so that it could be updated quite easily and regularly over the years.

- The basemap chosen to build the ECOCLIMAP-SG new land cover map is the **ESA CCI Land Cover** product :
  - Version 1.6.1 (28/01/2016)
  - Spatial resolution of 300m
  - Epoch 2010 (from 2008 to 2012)
  - Coming from satellite data from MERIS FR & RR and SPOT-VGT

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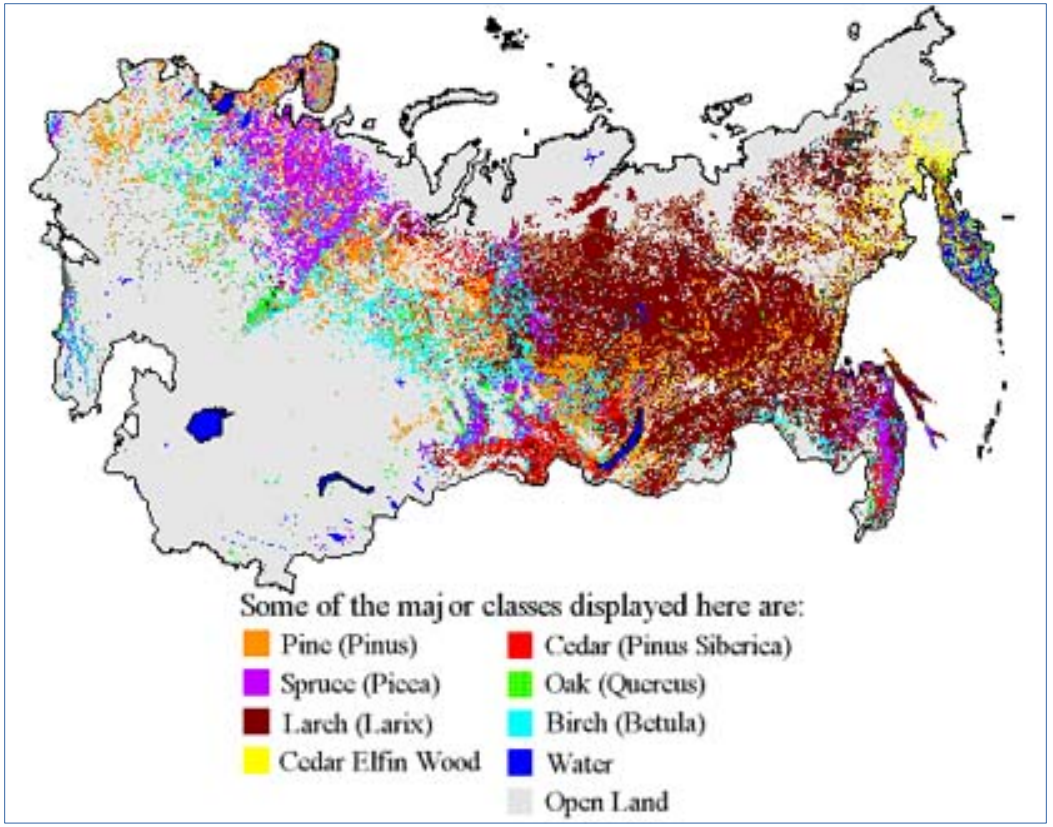
1. Principles of ECOCLIMAP-SG (2/2)

- To this land cover map will be associated global maps of primary parameters :
  - 10-day LAI
  - Root, soil and ice depths
  - Height of trees
  - Soil and 10-day vegetation albedos
  - Primary parameters for towns (to be defined)

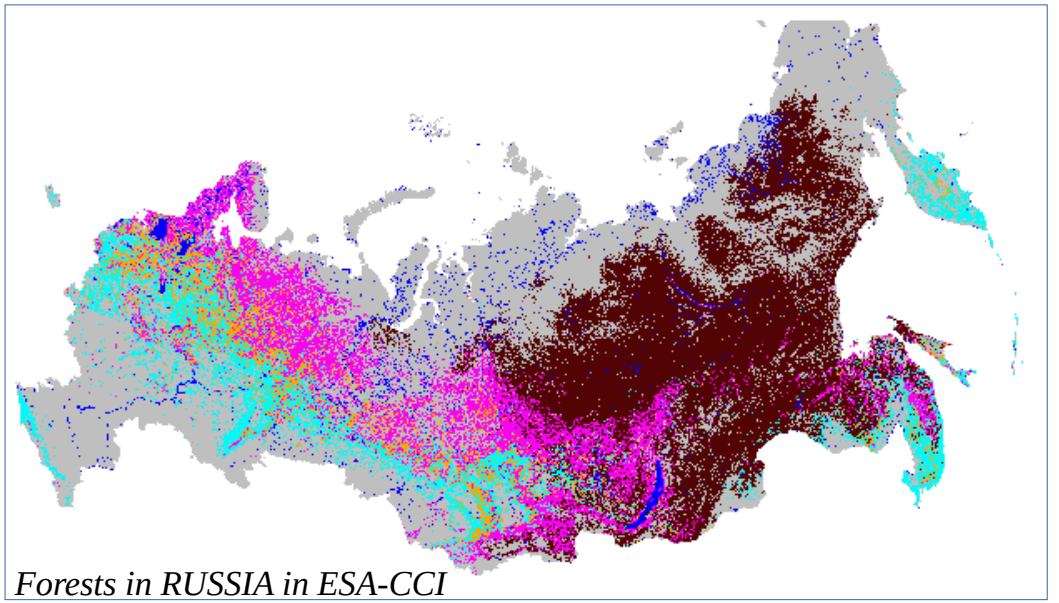
- The difficulty to build the map lies in :
  - Translating the ESA-CCI LC original cover types into our new ECOCLIMAP-SG land cover types ;
  - Doing it automatically enough to be able to repeat it when a new version of ESACCI-LC will be released.

- The algorithms to combine the ESA-CCI LC data and the other input data sources relies on the GRASS GIS software.

2. The ESA-CCI land cover map : comparisons (1/2) needleleaf deciduous forest in Russia



Forest Cover Map of the Former Soviet Union (January 1993)
(http://www.borealforest.org/world/rus_mgmt.htm)



Forests in RUSSIA in ESA-CCI

- **in brown, needleleaf deciduous** → Visually, the similarity is not too bad.

- In pink, yellow and red, needleleaf evergreen
- In light blue and green, broadleaf deciduous
- In orange, needleleaf evergreen on the left, mixed forest on the right

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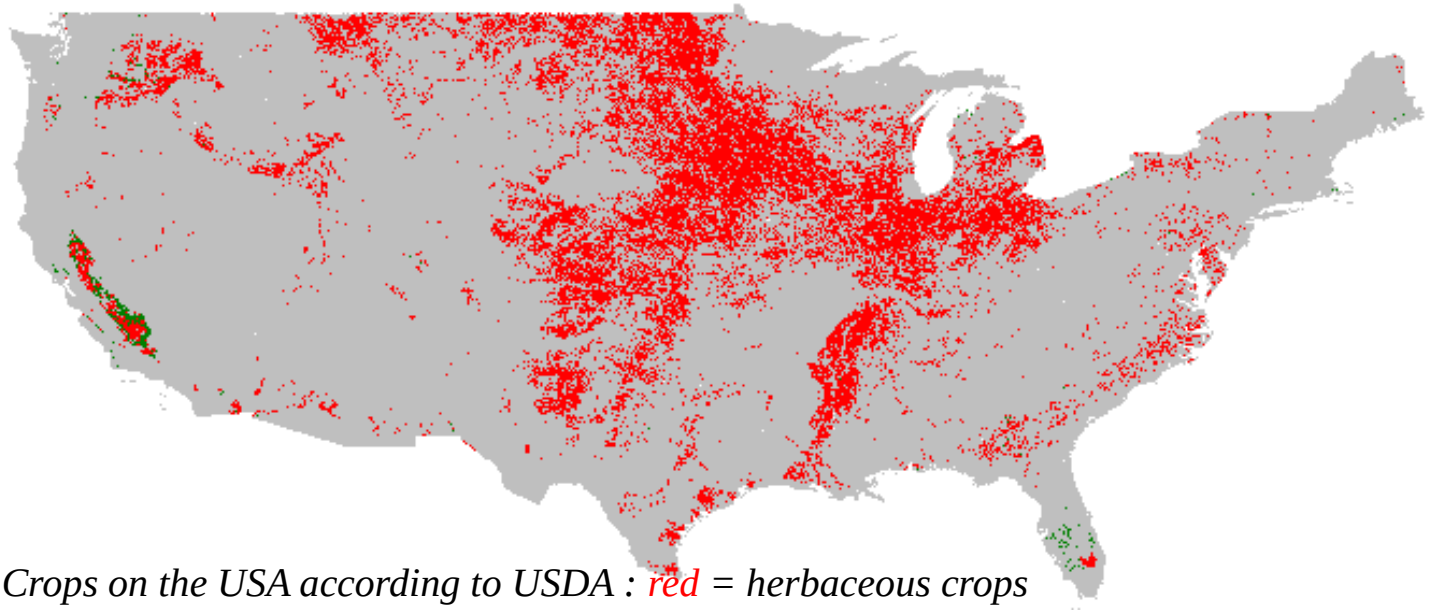
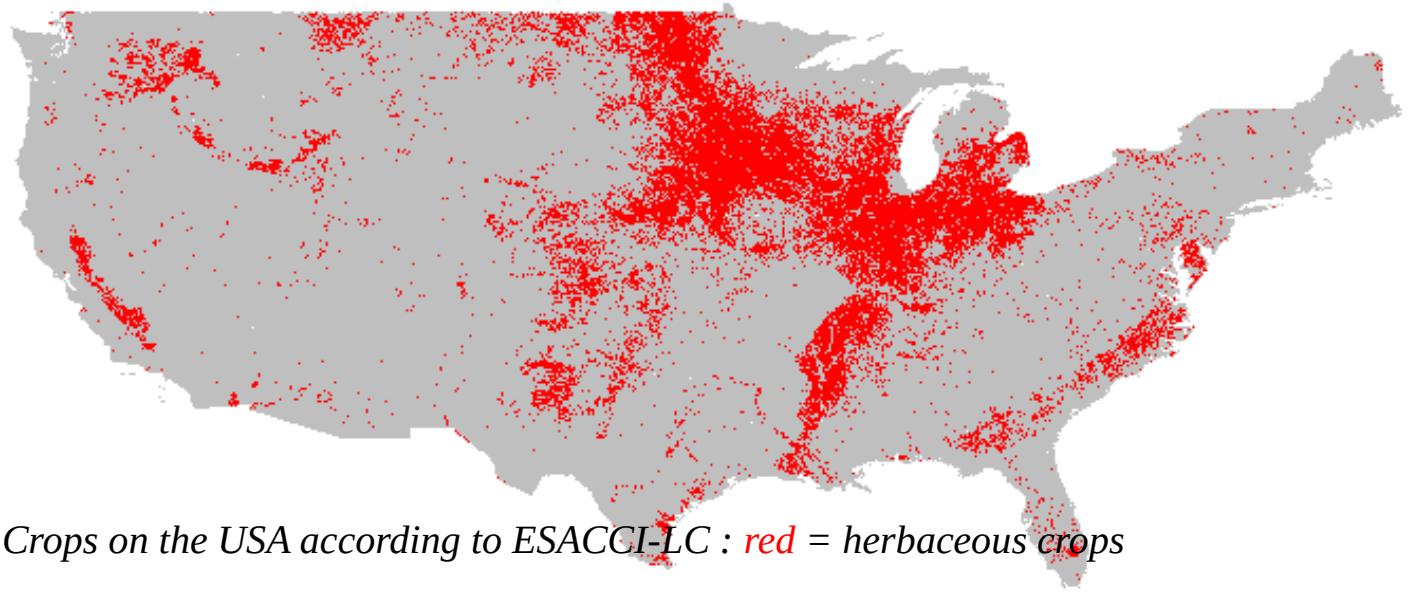
2. The ESA-CCI land cover map : comparisons (2/2) crops on the USA



Crops on the USA according to USDA : red = herbaceous crops



Crops on the USA according to ESACCI-LC : red = herbaceous crops

→ The similarity between crops according to USDA and according to ESA-CCI LC, on the USA, is visually not to bad.

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3. The new land cover types

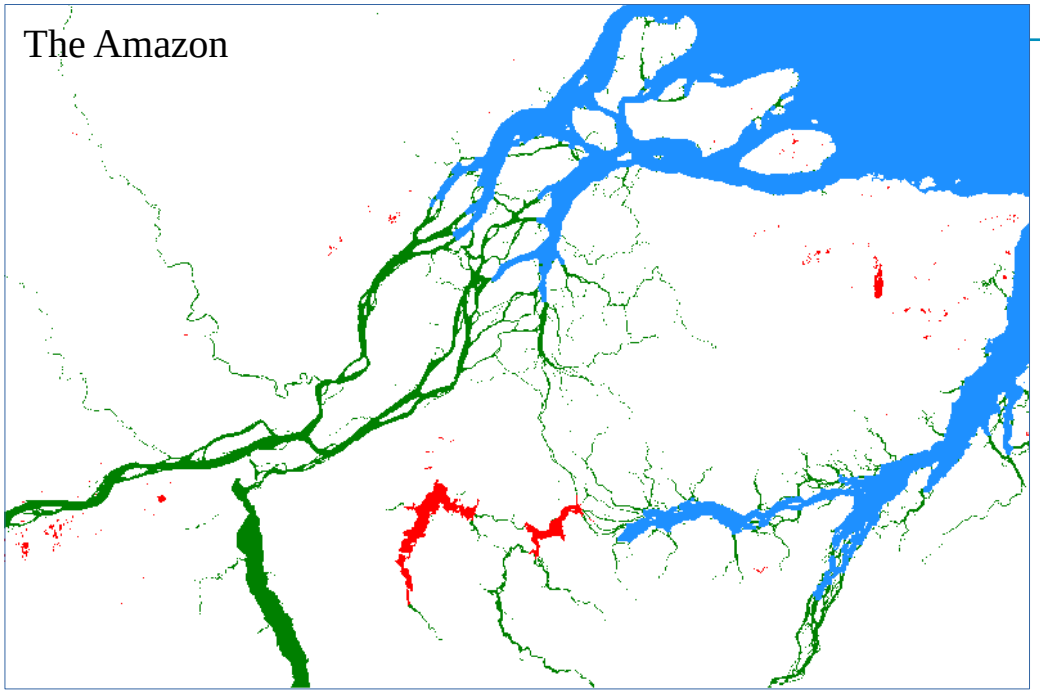
1. Sea and oceans (cov. 1)
2. Lakes (cov. 2)
3. Rivers (cov. 3)
4. Bare soil (veg. 1)
5. Bare rock (veg. 2)
6. Permanent snow (veg. 3)
7. boreal broadleaf deciduous (veg. 16)
8. temperate broadleaf deciduous (veg. 4)
9. tropical broadleaf deciduous (veg. 13)
10. temperate broadleaf evergreen (veg. 14)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

4. Other data sources used to build the new map

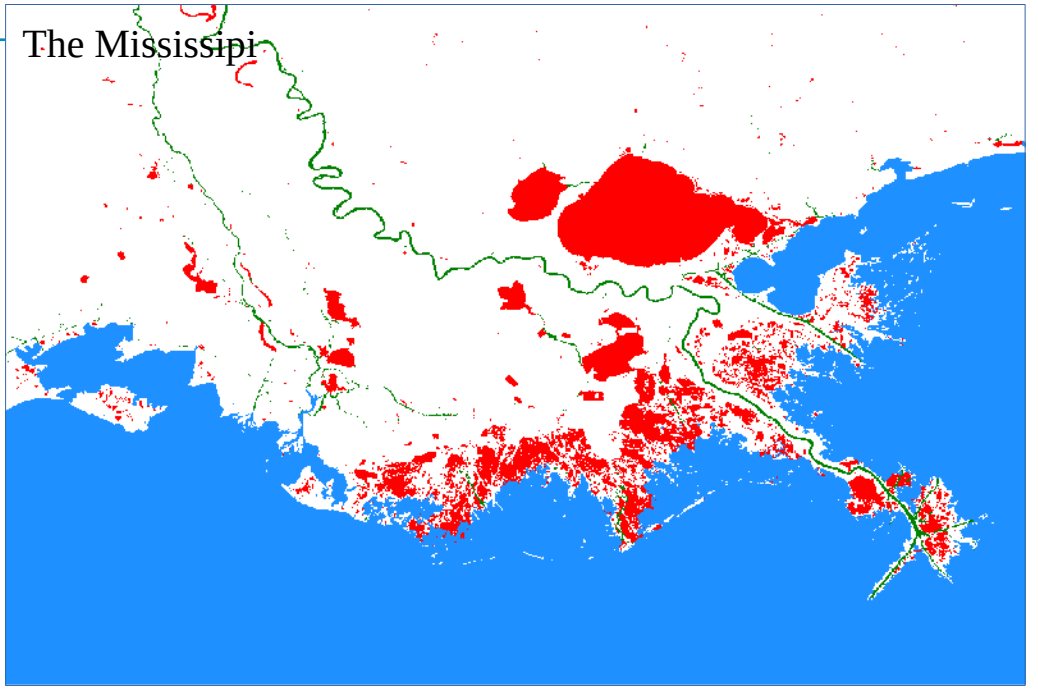
	Difficulty	*Data sources used*
Sea, lakes and rivers	To separate them	- personal try to manually separate them - SRTM Water Body Data from USGS - GSHHC and WDBII from NOAA
Bare soil and bare rock	To separate them	- GLC2000 regional tiles
Forests / grassland	To distinguish the boreal / temperate / tropical climatic areas	- The bioclim_LPJ.nc map (already used to move from 12 to 19 vegtypes)
Crops	To distinguish winter C3 / summer C3 / C4 crops	- FAO crops statistics by country for the whole world, year 2014 - USDA map of crops for the USA at 30m resolution, year 2015 - AGRESTE statistics by French departement, year 2015
Urban areas	To separate them into the 10 urban LCZs	- CLC2012 - GHSL_LABEL pre-release data

5. Illustrations : sea, lakes and rivers (1/2)

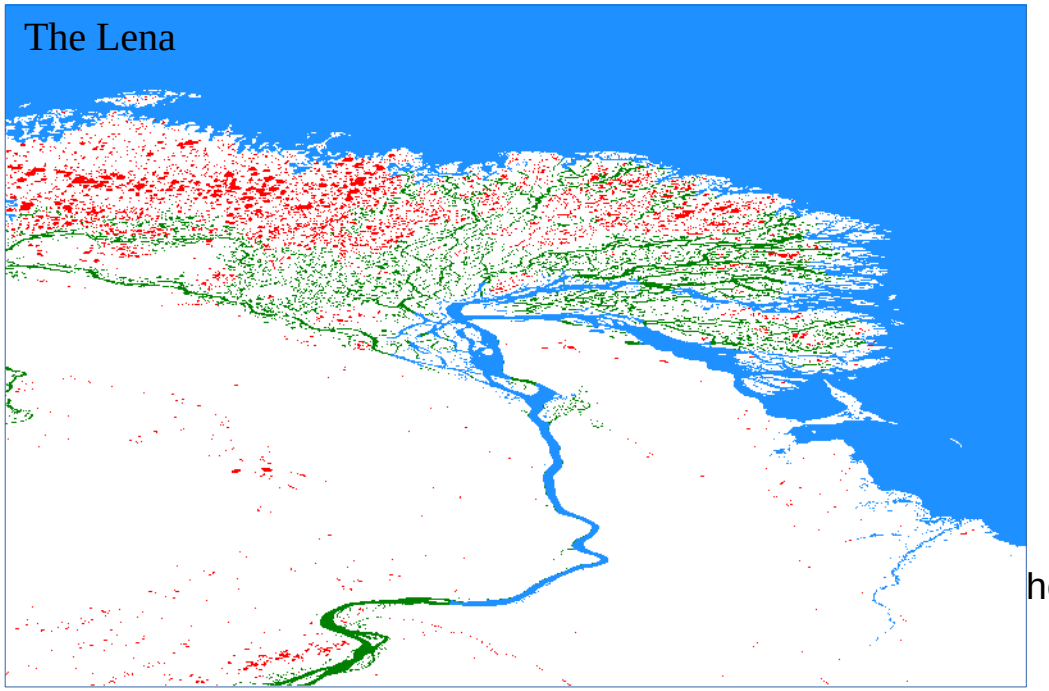
The Amazon



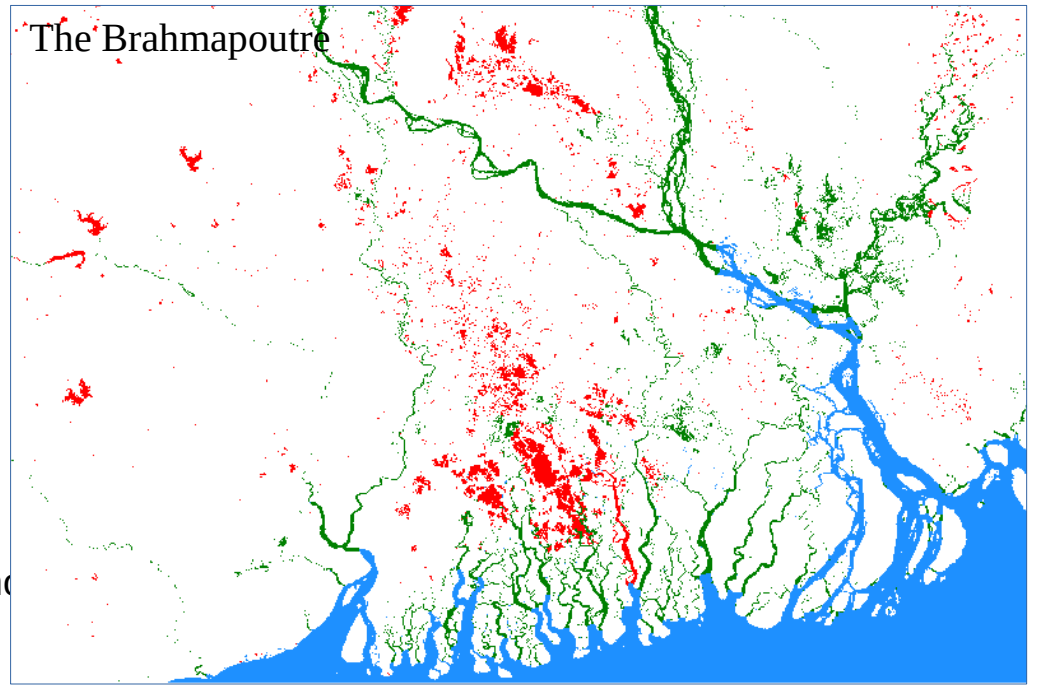
The Mississipi



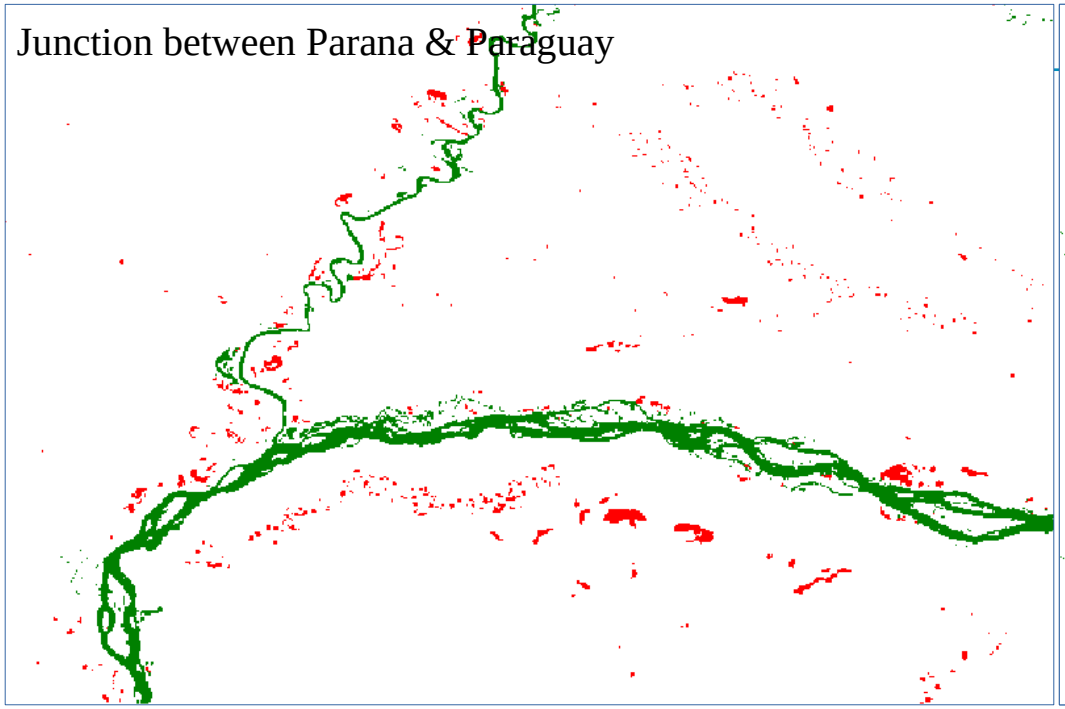
The Lena

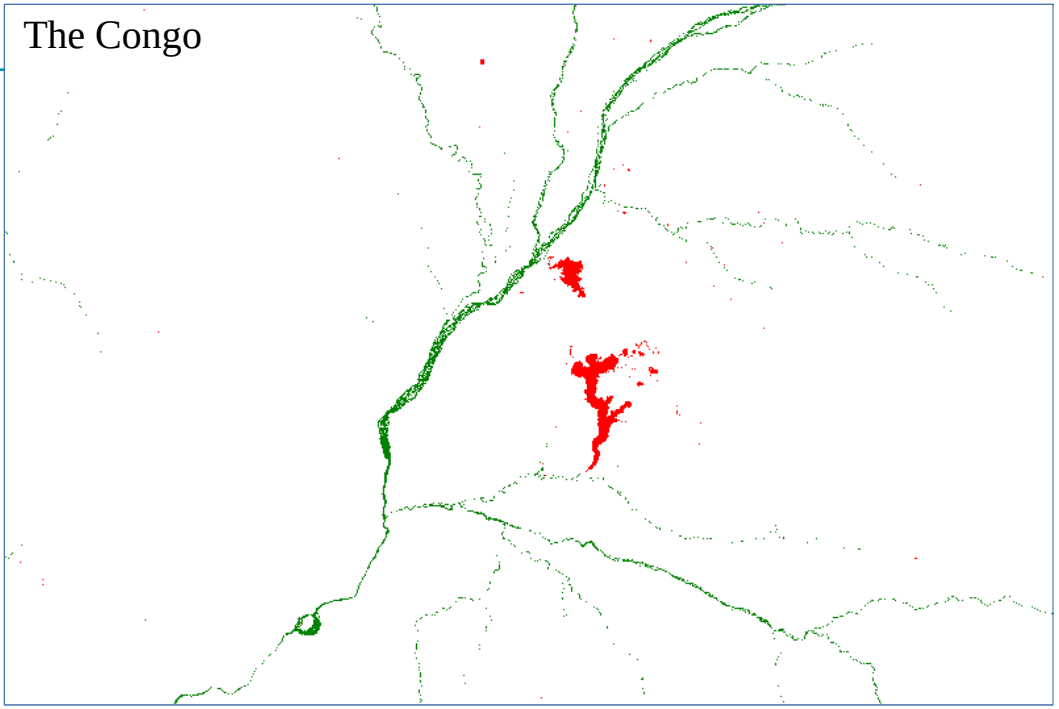


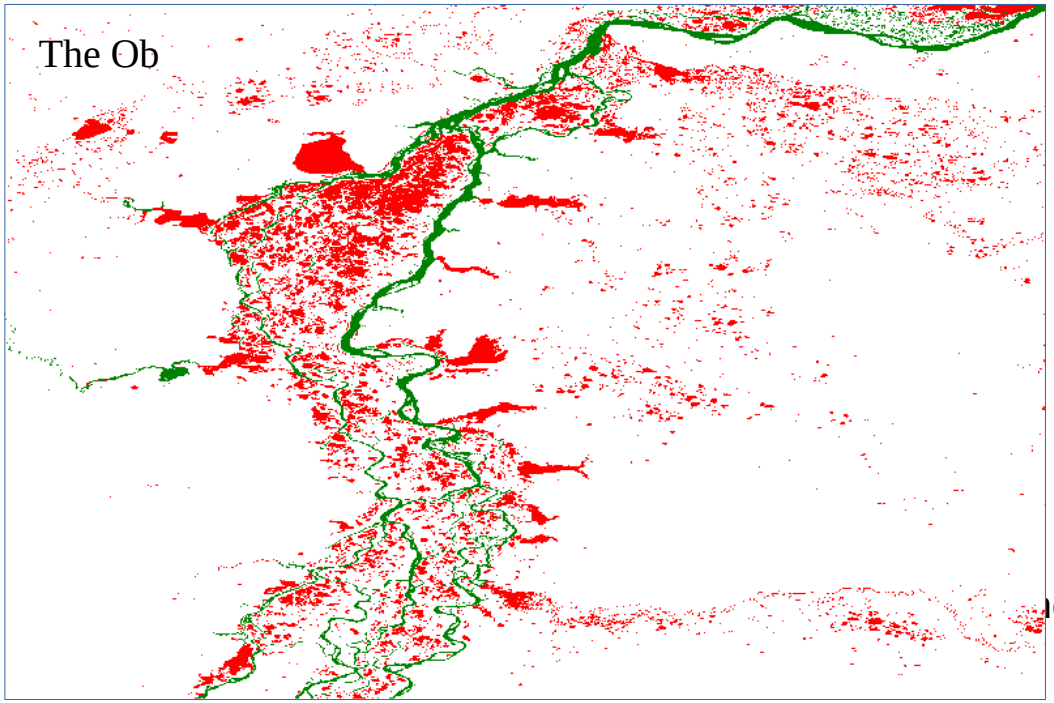
The Brahmapoutre

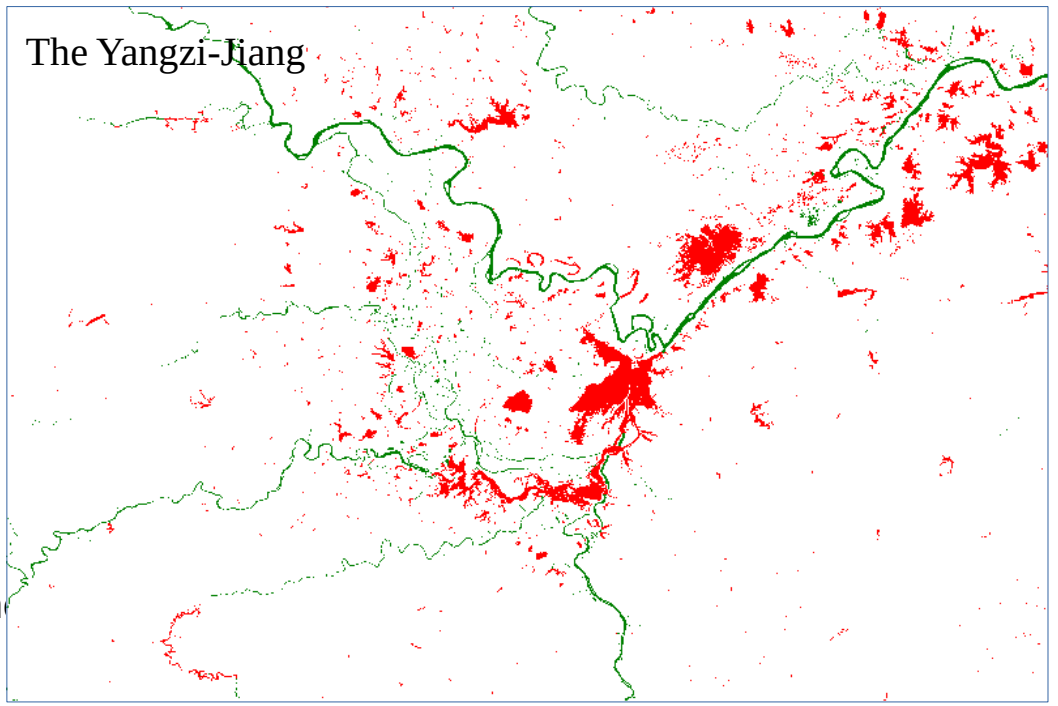


5. Illustrations : sea, lakes and rivers (2/2)

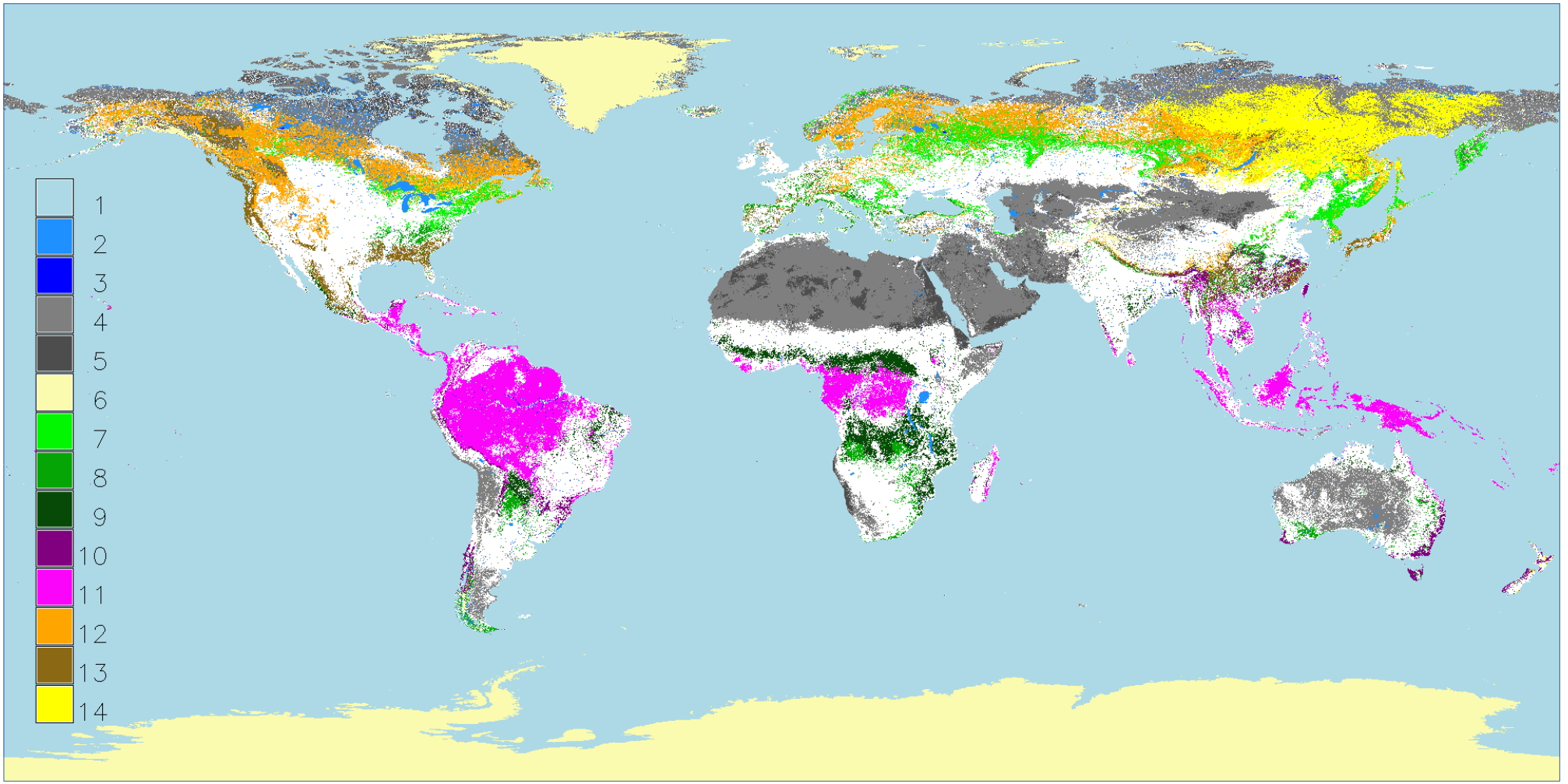








5. Illustrations : the forests



Global forests

7-**8**-**9** : broadleaf deciduous resp. boreal, temperate, tropical

10-**11** : broadleaf evergreen resp. temperate, tropical

12-**13** : needleleaf evergreen resp. boreal, temperate

14 : needleleaf deciduous, boreal

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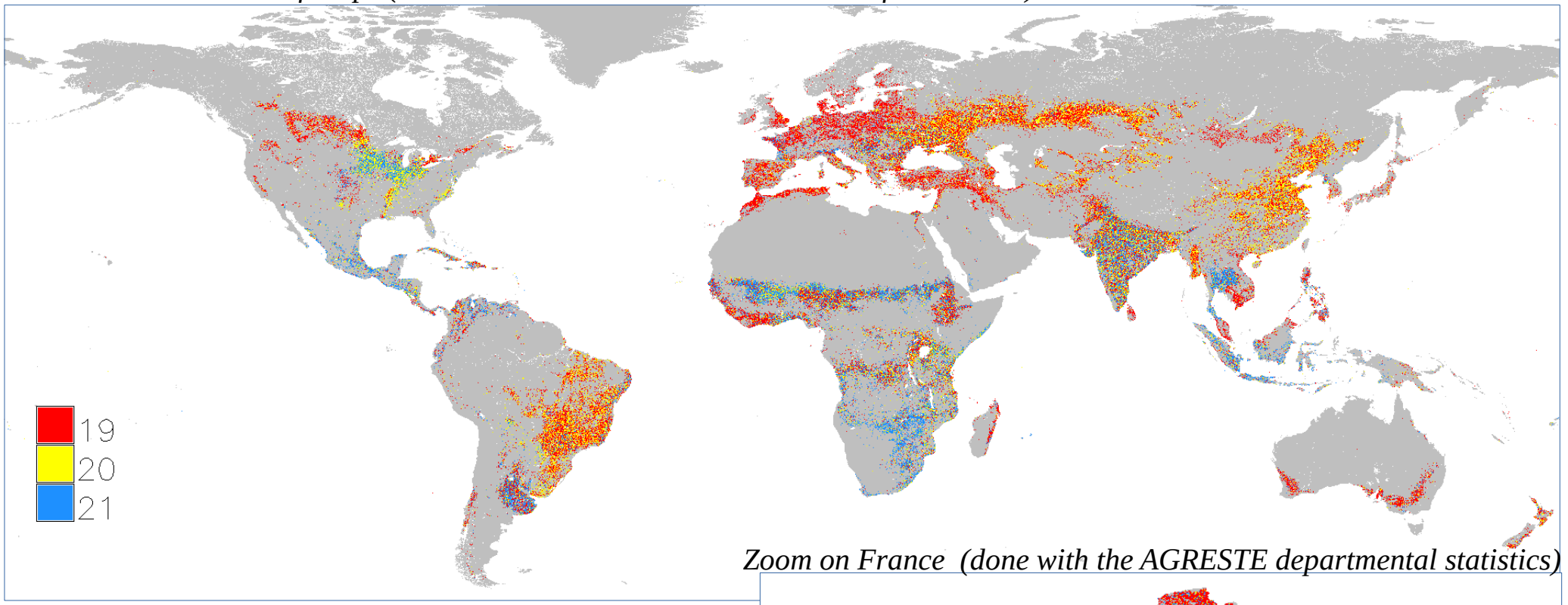
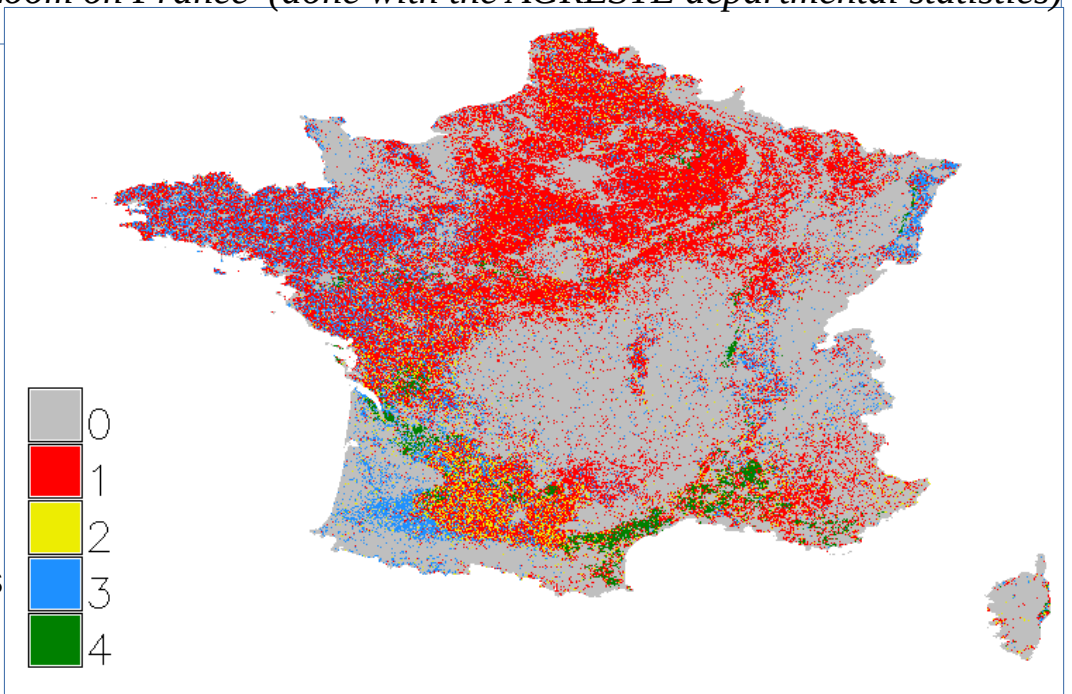
5. Illustrations : the crops

Global distribution of crops (done with the FAO statistics and USDA for the USA)



Zoom on France (done with the AGRESTE departmental statistics)



19 / 1 -red : winter C3 crops
20 / 2 – yellow : summer C3 crops
21 / 3 - blue : C4 crops

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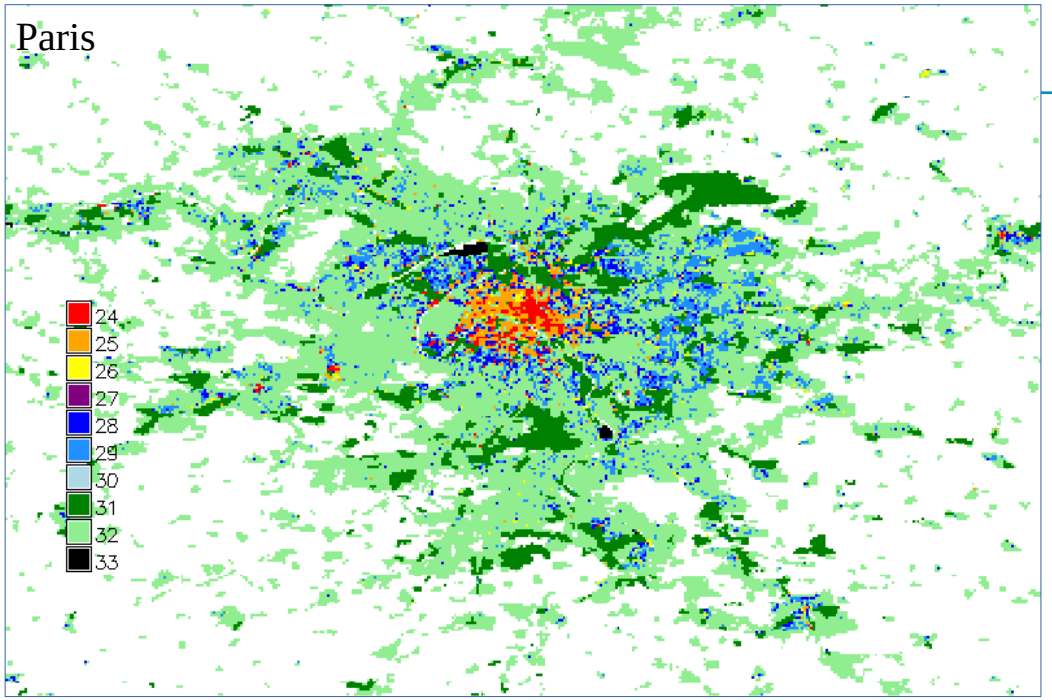
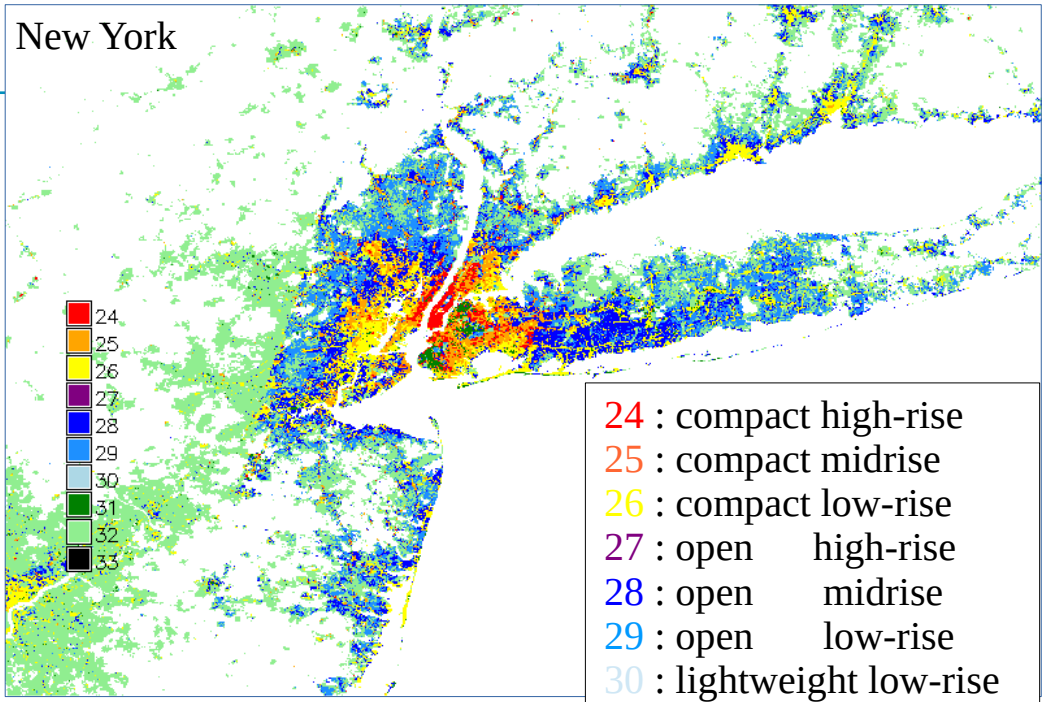
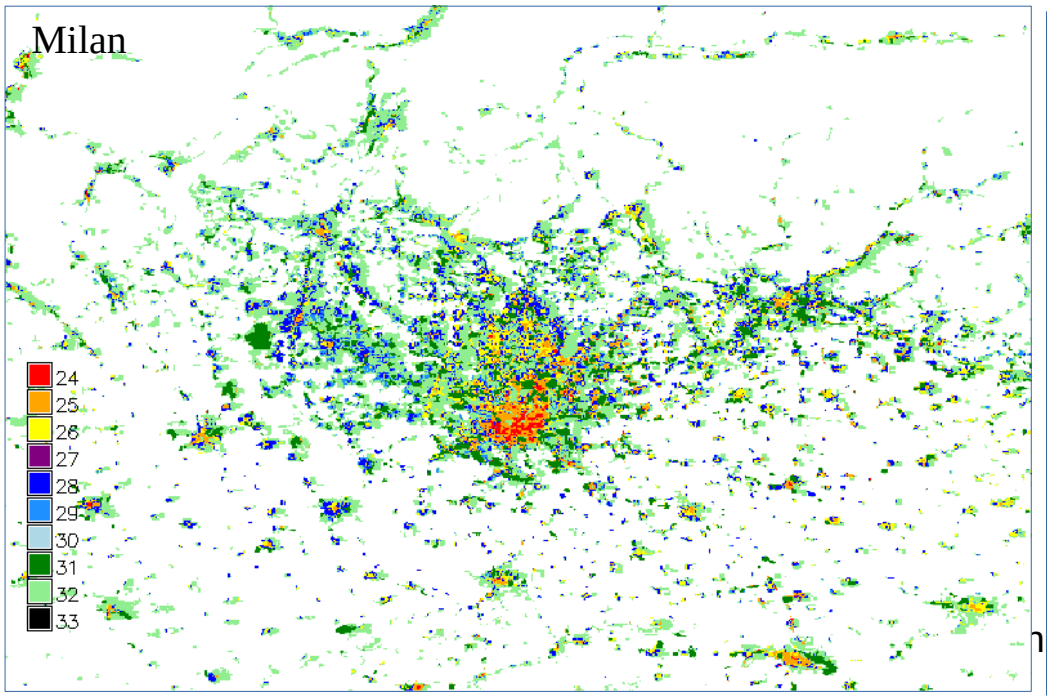
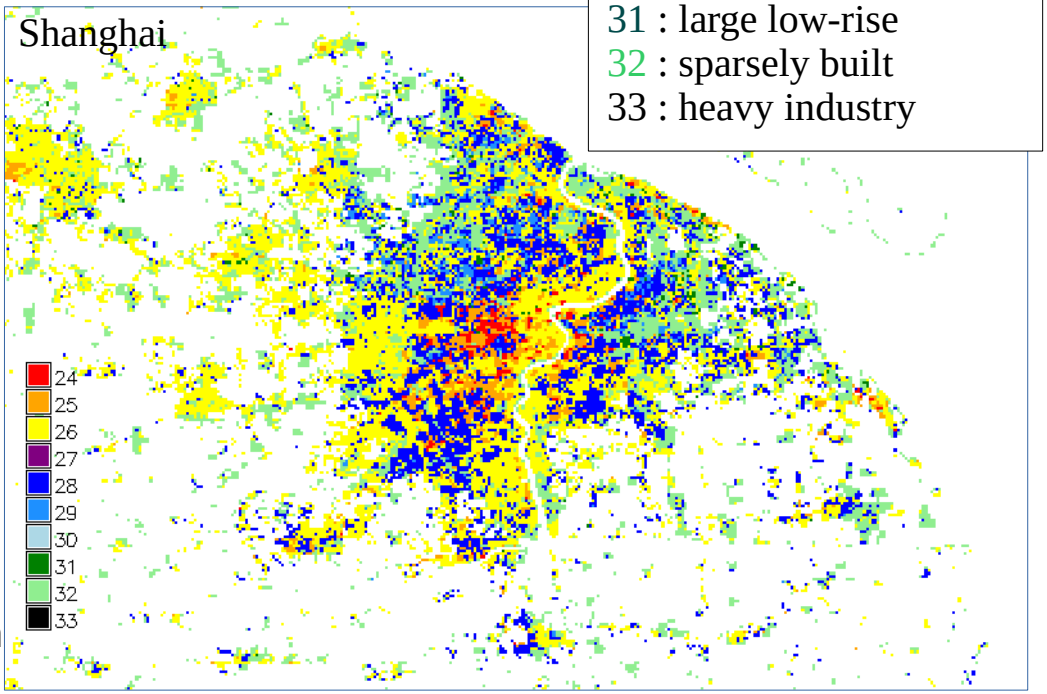
5. Illustrations : the urban areas





24 : compact high-rise
25 : compact midrise
26 : compact low-rise
27 : open high-rise
28 : open midrise
29 : open low-rise
30 : lightweight low-rise
31 : large low-rise
32 : sparsely built
33 : heavy industry





6. First test in the Safran Isba Modcou system (1/6)

- ISBA primary parameters tested :

  - *Soil albedo in the visible and infrared :*
    - Maps from the current ECOCLIMAP (option CM13)

  - *LAI / vegetation albedo in the visible and infrared* :
    - Maps from the current ECOCLIMAP maps by vegtype

  - *Root depth / soil depth* :
    - Maps from the current ECOCLIMAP maps by vegtype
    - As secondary parameters, ie constant by vegtype

  - *Height of trees :*
    - Maps from the current ECOCLIMAP maps by vegtype
    - As secondary parameters, ie constant by vegtype
    - Map of height of trees from the NASA (1km resolution)

6. First test in the Safran Isba Modcou system (2/6)

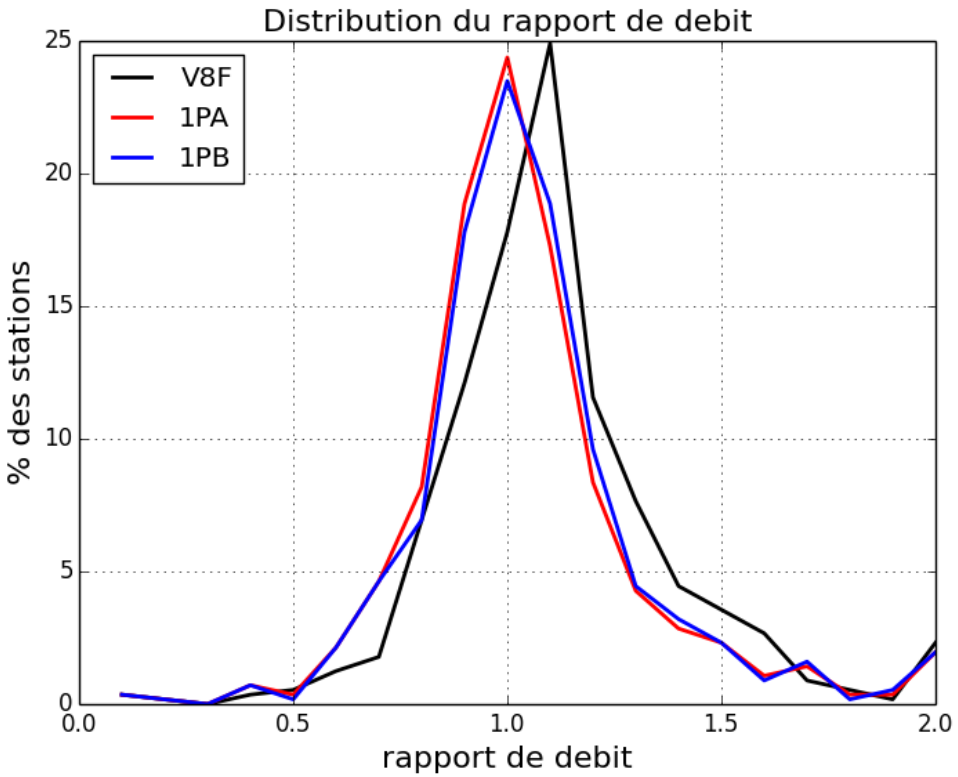
- Secondary parameters used (temporary) :
  - Summer C3 crops = winter C3 crops
  - Flooded trees = temperate broadleaf deciduous
  - Flooded grassland = swamped areas (PARK)

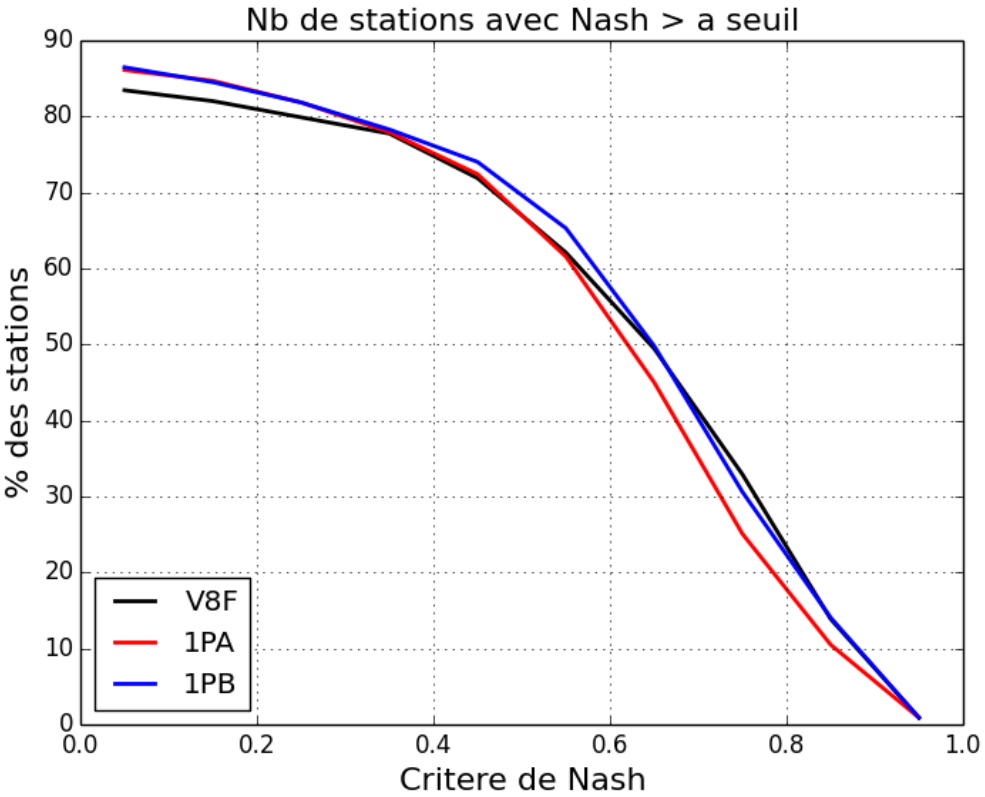
- Test realized :
  - On France at 8km resolution
  - Period : 1995 – 2005 with 3 years of spinup
  - Physics : ISBA-DIF, 12 patches, CALB = « CM13 »

- Sensitivity study to the surface parameters
  - Discharges scores first react to :
    - The ground depth : impact on the Nash criterion
    - The height of trees (through Z0) : impact on the discharge ratio (simulated / observed)

6. First test in the Safran Isba Modcou system (3/6)

Impact of the ground depth of temperate grassland on the Nash criterion with ECOCLIMAP-SG





V8F : ECOCLIMAP-II
1PA : ECOCLIMAP-SG and root depth / ground depth constant by vegtype (values inspired by ECOCLIMAP-II)
1PB : **1PA**+ ground depth for temperate grassland from 1.5m to 1.2m.

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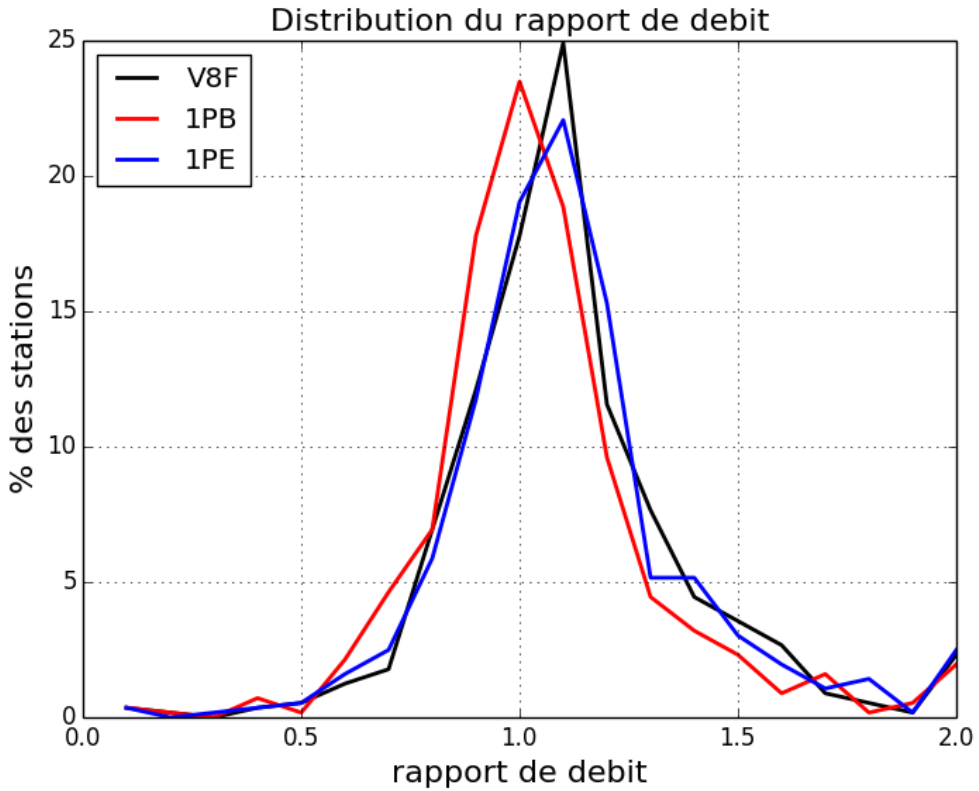
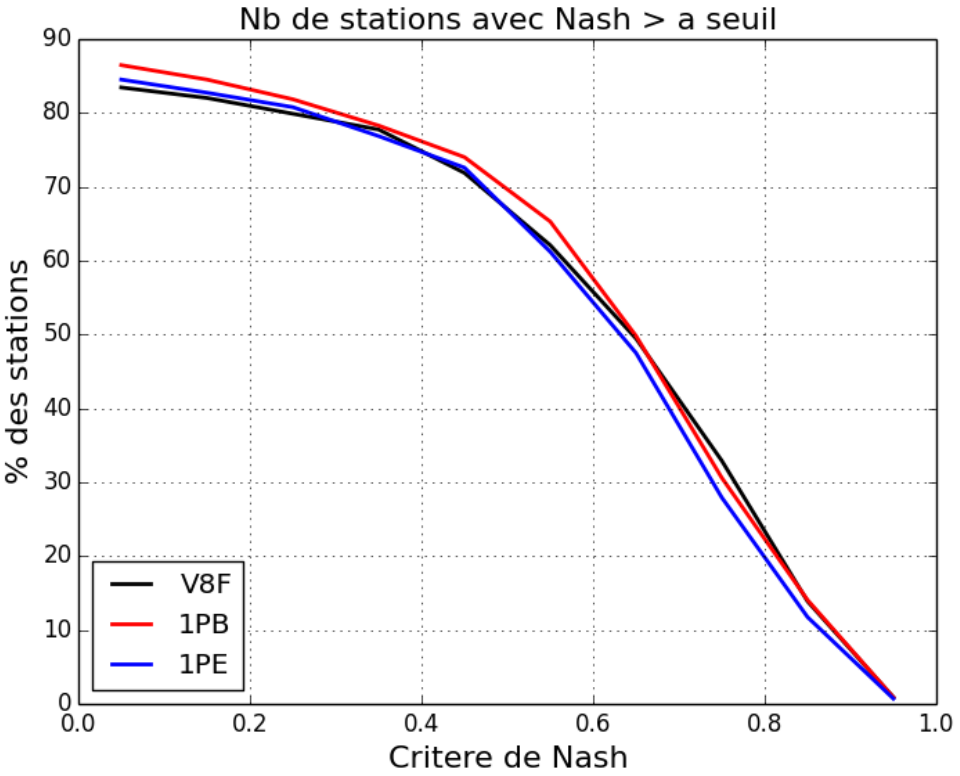
6. First test in the Safran Isba Modcou system (4/6)

Impact of the height of trees on the discharge ratio with ECOCLIMAP-SG

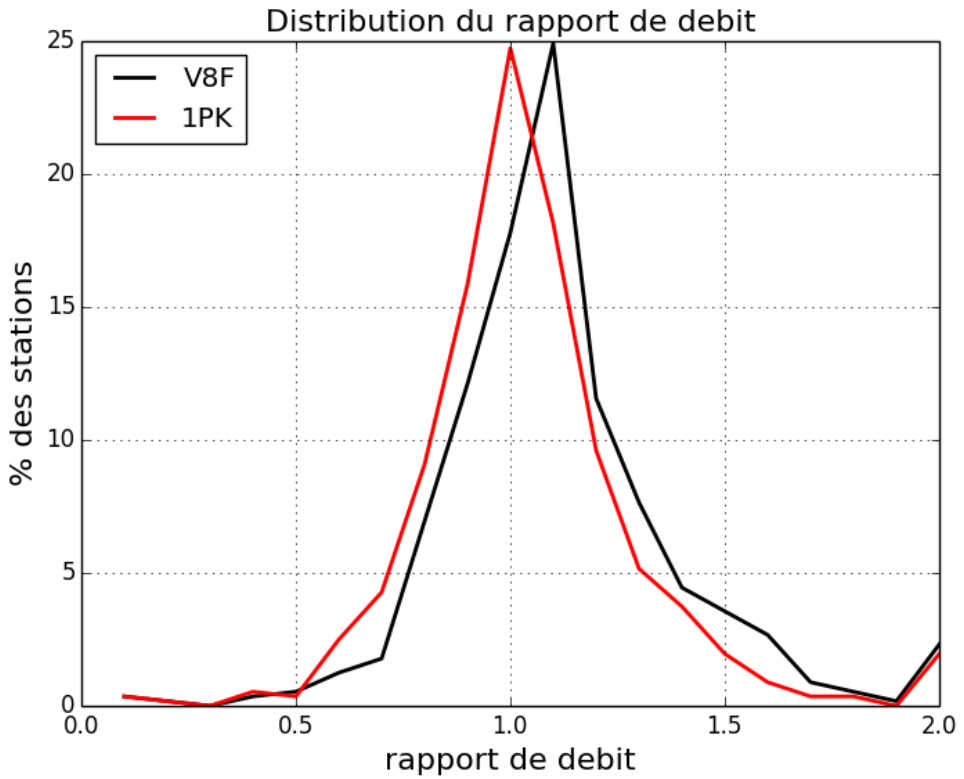


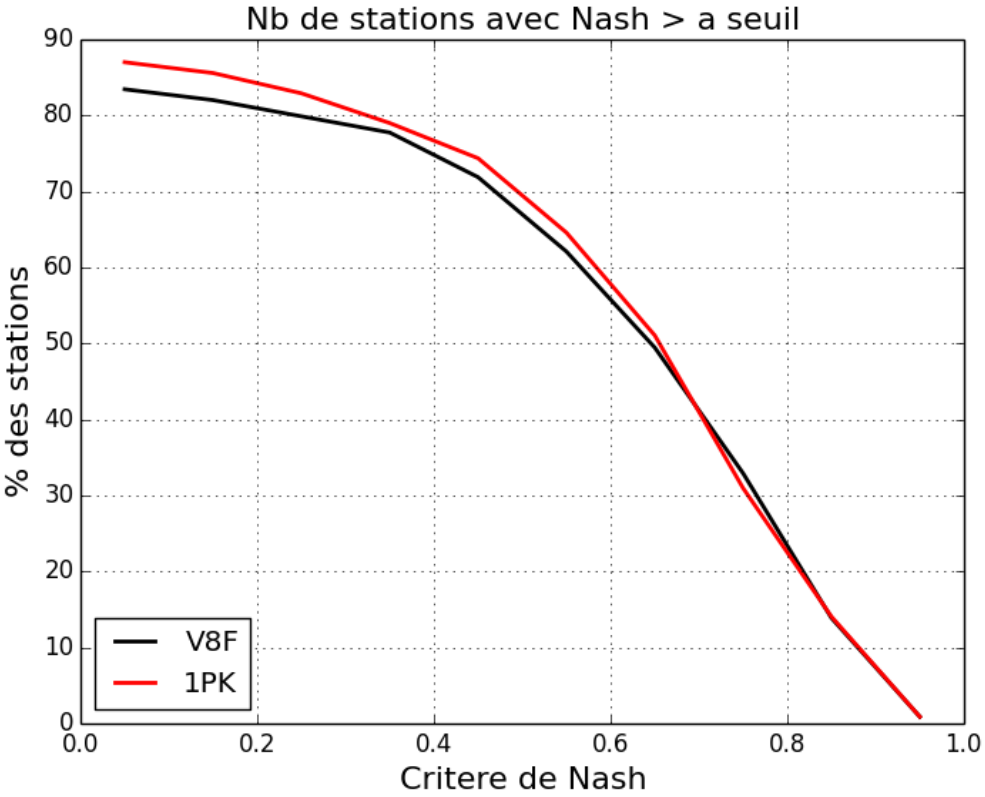


V8F : ECOCLIMAP-II
1PB : ECOCLIMAP-SG and the map for heights of trees from the NASA.
1PE : ECOCLIMAP-SG and the map for heights of trees from ECOCLIMAP-II.

6. First test in the Safran Isba Modcou system (5/6)

Best scores obtained with the different sets of primary parameters tested with ECOCLIMAP-SG





V8F : ECOCLIMAP-II

1PK : ECOCLIMAP-SG and :

- Root depth / ground depth constant by vegtype (values inspired by ECOCLIMAP-II), with ground depth for temperate grassland to 1.2m.
- Height of trees constant by vegtype (values inspired by ECOCLIMAP-II)
- LAI, vegetation albedos for vegetation from the current ECOCLIMAP maps by vegtype.

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7. Conclusion

- Conclusion for the new map :
  - The complete map was realized automatically to a large extent.

    → It will be possible to apply the algorithm again when a new version of ESACCI-LC is released.
  - It's unavoidable that the new map shows defects at some places :
    - We expect users :
      - to notify us of these defects when they meet some ;
      - If possible, to provide to us a better data source to correct our map ;
      - If possible, to do the correction themselves and provide to us an updated global map we can release to the other users.

- Conclusion for the first test with SIM :
  - Adjusting the primary and secondary parameters impact the scores for discharges.
  - With these first rough sets of primary and secondary parameters, ECOCLIMAP-SG gives correct results.
  - The choice of new sets of parameters will require a new stage of sensitivity study.

8. Prospects

- To run a global test case with TRIP :
  - more complete than the first test on France with MODCOU
  - following the same methodology
- To define correct values for the secondary parameters for the new land cover types, notably for the summer C3 crops, the flooded areas and the urban LCZs.
- If possible, to provide updated and improved maps of primary parameters for nature and town.
- To implement other appropriate OFFLINE tests (specific for towns, lakes…)
- To test the offline validated version of ECOCLIMAP-SG inline, with meso-NH and AROME.