Climate change and water resources management

-

French feedbacks

eau seine NORMANDIE – Agence de l'eau

Conservatoire du littoral

CODAH – Communauté de l'Agglomération Havraise

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MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE ET SOLIDAIRE

COP23 FIJI – UN CLIMATE CHANGE CONFERENCE – BONN 2017

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Context

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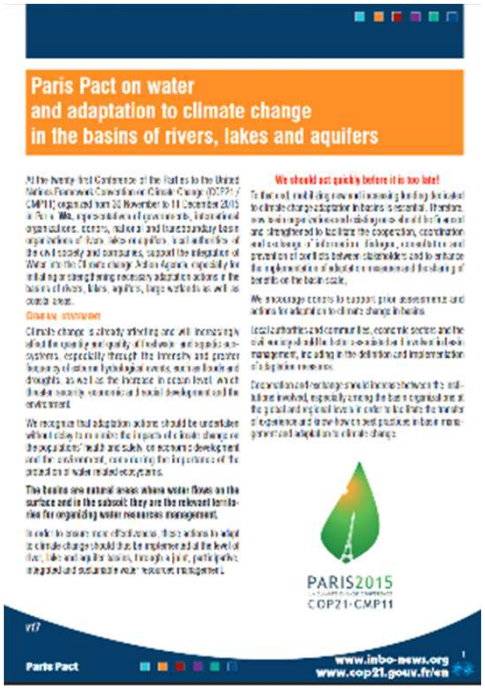

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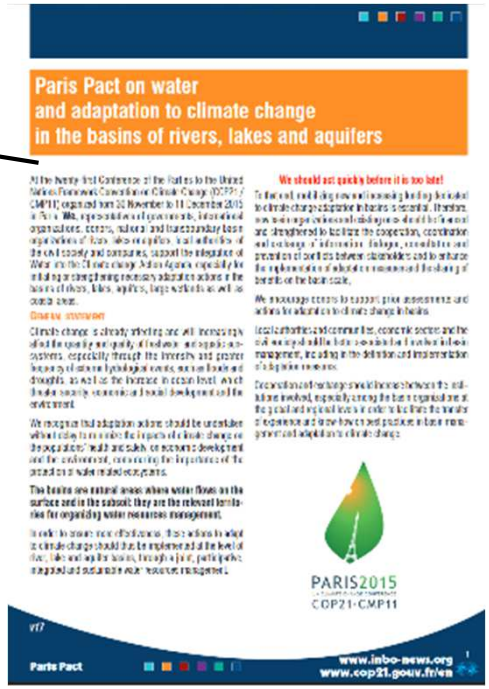
- establish basin-wide networks for monitoring and data exchange and water information systems, which are integrated, permanent, reliable, open, representative, interoperable and accessible, as a decision making support tool for adaptation measures,
- develop an interface on the effects of climate change and water between decision makers and research organizations on environmental and human sciences,



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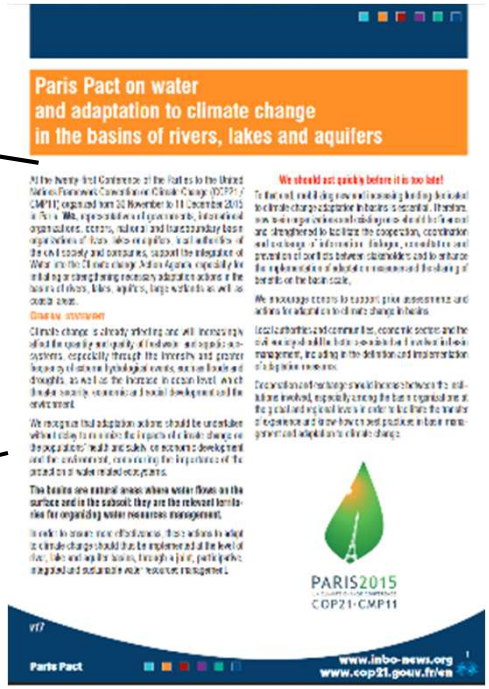
❷ Adapt basin management planning to climate change:

- at the level of the basins, assess the impacts of climate change and the vulnerabilities and produce strategies for adapting water management to climate change,
- develop basin management plans and actions programs for the implementation of these strategies and measures for adaptation to climate change, and organize regular performance reviews based on suitable indicators,



Observations and knowledge

–

Observer et comprendre

Céline Nowak
project director in charge of quantitative characterisation of water resources, department of observation systems and data

Claire Magand
project manager of water resources and climate change, department of research and innovation

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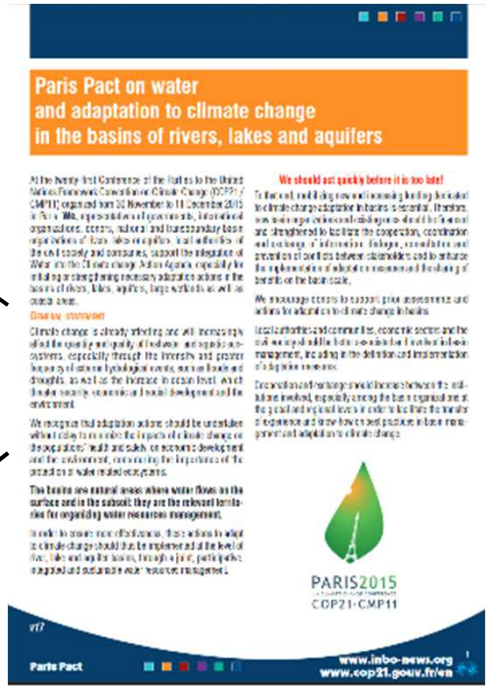
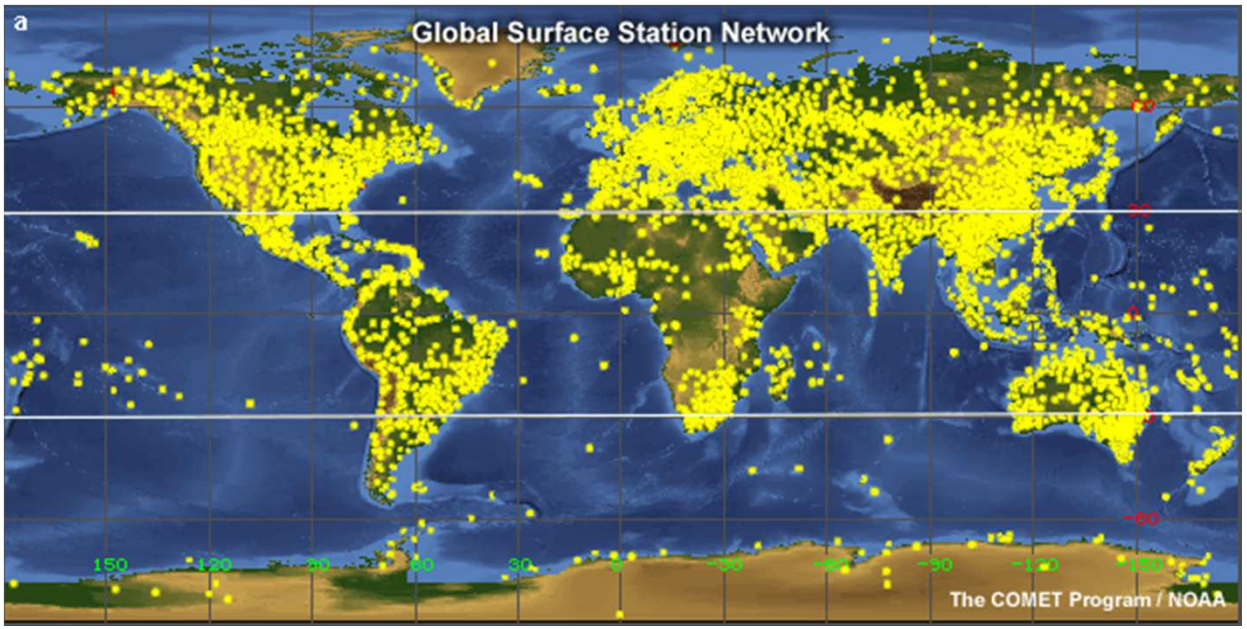


World map of discharge networks? or rainfall networks?



Global network of regular surface stations. source : www.goes-r.gov

around 11 000 stations

heterogeneous distribution of surface observations : sparse in the tropics

In a few regions, the surface network and regularity of reports have diminished over the past two decades

Observations networks in France

Céline Nowak, project director in charge of quantitative characterisation of water resources, French Agency for biodiversity (AFB)

Dynamics that drive natural flow episodes result from hydro-meterological phenomena such as climate parameters, river flow rates or groundwater levels…

- **What are the standard observations networks to better characterize water resources (3 examples) ?**
- **Why should we complete these networks in metropolitan France ? and how?**

Standard observations networks

Climate : http://climatheque.meteo.fr

To monitor basic climate parameters

Data : rainfalls, air temperature, wind (speed and direction) and humidity level

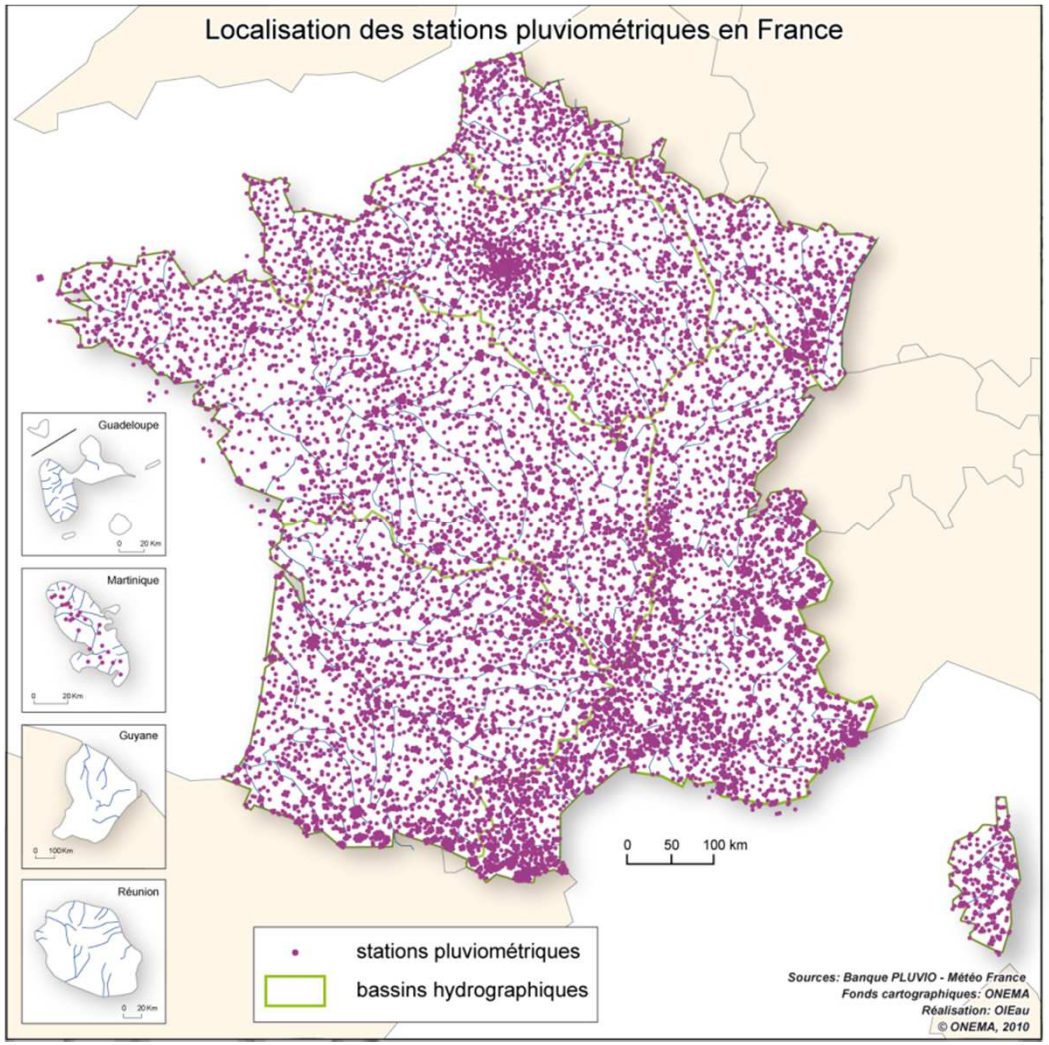
Network administrator : Météo France

Data producers : Météo France, in partnership with other organizations :

- electricity producer (EDF)
- the general office of risks prevention of the Ministry of the Environment
- the French National Institute of Research for Agriculture

Key figures !

More than 12 000 stations :
- about 1500 real time stations
- about 400 stations with a long data collection period



Standard observations networks

ADES : **http://www.ades.eaufrance.fr**

To monitor groundwater (GW) levels

Data : daily GW levels

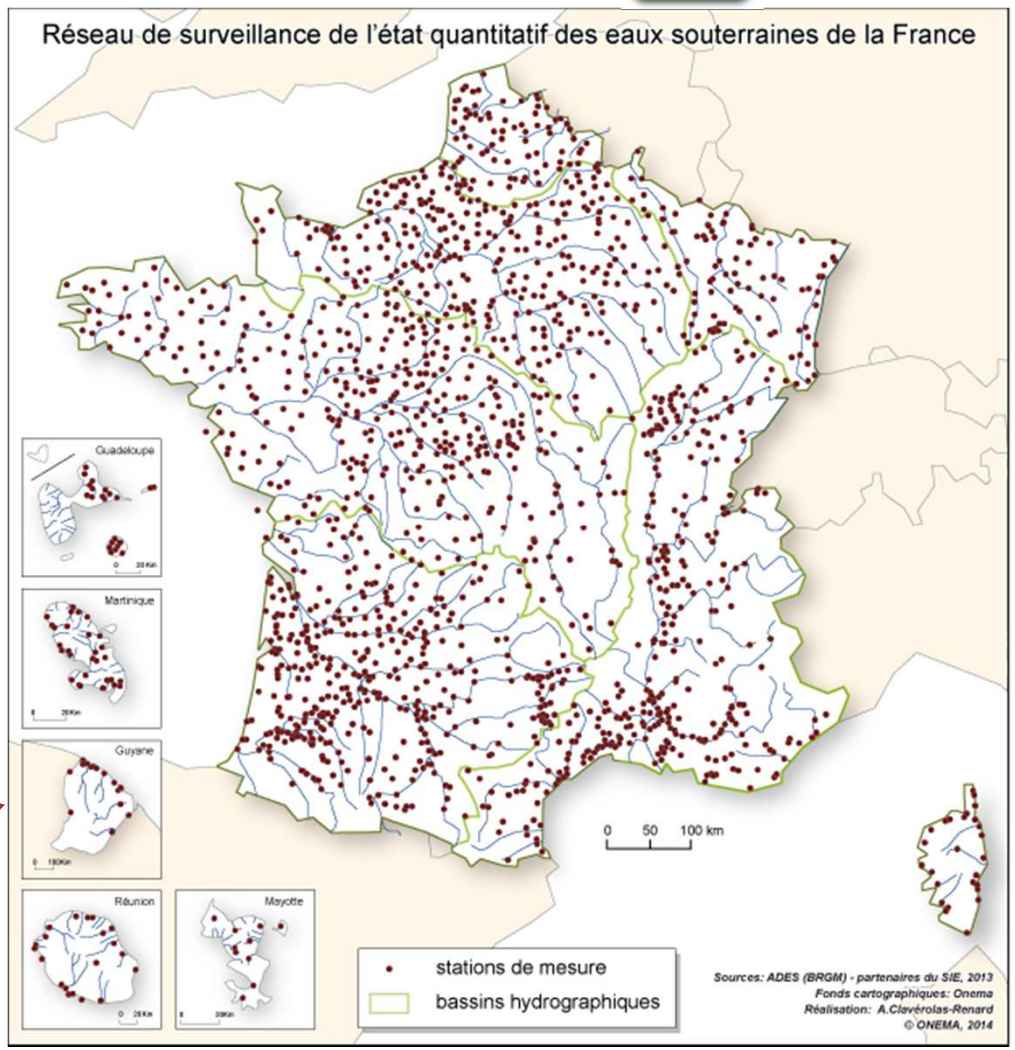
Network administrator : BRGM (french geological survey)

Data producers :
- BRGM
- regional offices of the Ministry of the Env.
- local authorities, (…)

Key figures !

77 292 monitoring stations :
- 74 243 qualitometers (chemical quality)
- 4 505 piezometers (GW levels)
- 14 081 836 GW levels

Ex. : network for monitoring quantitative status of GW for WFD :
- more than 1700 stations
- with sometimes up to 40 years of data



Standard observations networks

HYDRO : **http://www.hydro.eaufrance.fr**

To monitor river flow rates

Data : water height measurements

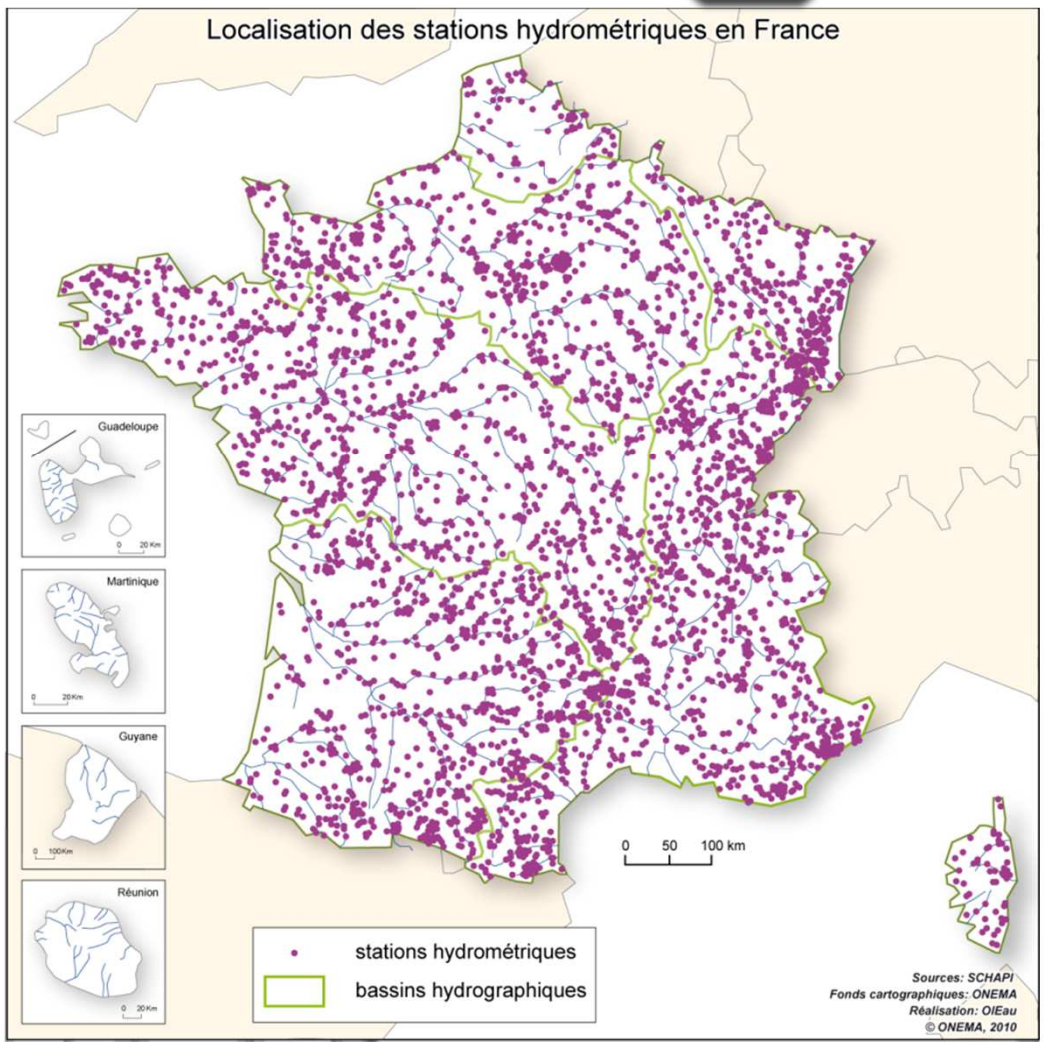
Network administrator : SCHAPI (office of the Ministry of the Environment)

Data producers :
- local offices of the Ministry of the Env.
- flood forecasting services
- waters agencies
- electricity producers (EDF)
- some research organizations (ex. Irstea, universities)

(…)

Key figures !

About 3 150 actives stations with some stations with a long data collection period (more than 40 years)



Additional observations networks

Why should we complete these standard networks?

- **Not dense enough to monitor french hydrographic network**
- **HYDRO stations monitore mostly great rivers (for flood management) and are mainly located in downstream parts of catchment areas**
- **Some of France's rivers are intermittent, however they are less well understood than so-called "perennial rivers"**
- **Better understanding of how aquatic ecosystems work**
- **Better drought planning and management**
- **Better understanding (and anticipating) the consequences of climate change**

How to complete Standard observations networks ?

- **With low monitoring costs…**
- **But providing robust data**

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Additional observations networks

ONDE, Observatoire national des étiages

Objective : to monitore and understand low-flow levels during summer of small and medium-sized rivers located in upstream parts of catchment areas

Protocol :
In the field, AFB staff visually assess the river flow level, using four main descriptors :

2 types of monitoring

to provide a stable baseline of knowledge over time	⇨ “ongoing” monitoring	Same protocol right across France, every month between May and Sept. (as near 25th of each month)	Every year
to anticipate and manage crisis situations	⇨ “additional” monitoring	A frequency determined by local stakeholders (maximum weekly observations)	In case of sensitive situation

Additional observations networks

ONDE : **http://www.onde.eaufrance.fr**

To monitor summer low flow

Data : river flow assessed (only) visually

Data producer : AFB

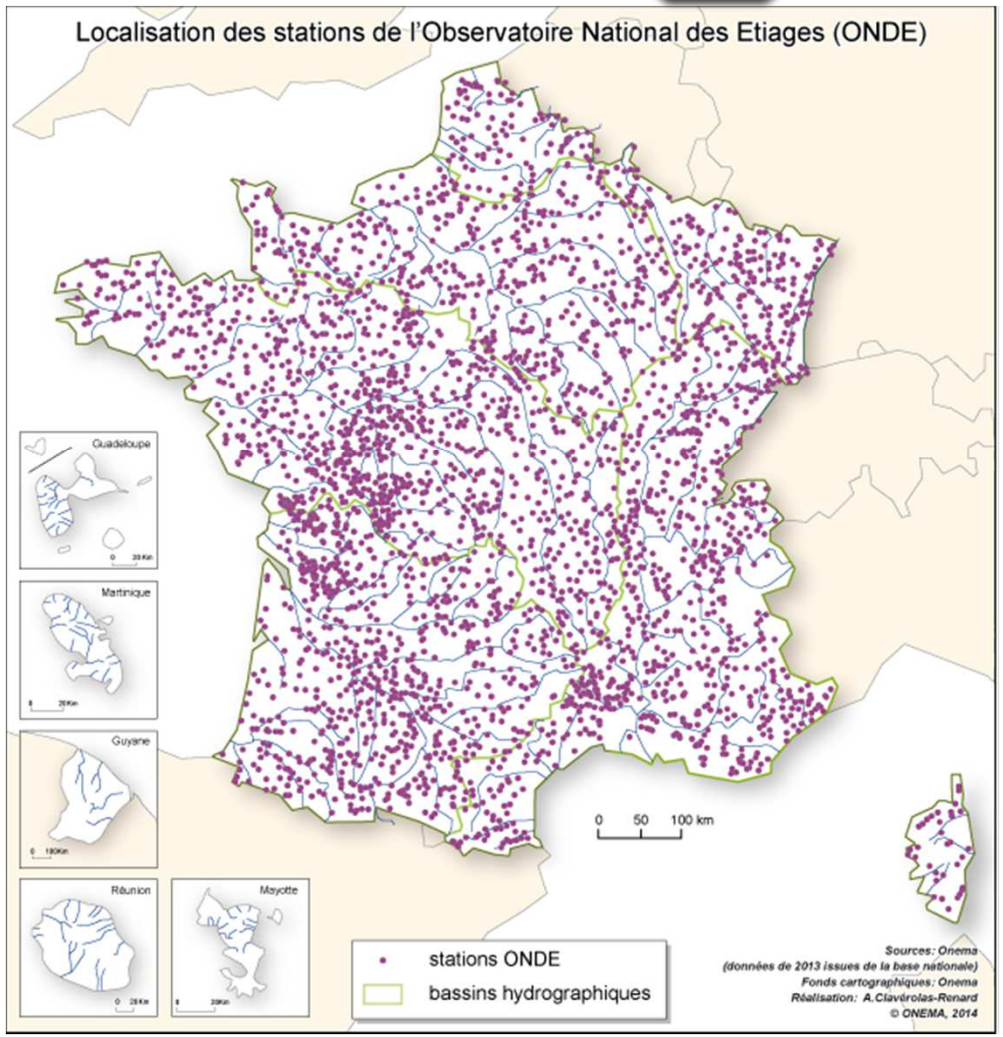
Network administrator : AFB

Official network : Onde is mentioned in a circular on crisis management

Key figures !

About 3 500 stations

122 187 observations (2012-today) :
95 949 for ongoing monitoring
26 238 for additional monitoring



Additional observations networks

Why densify river flow observations with a citizen science programme ?

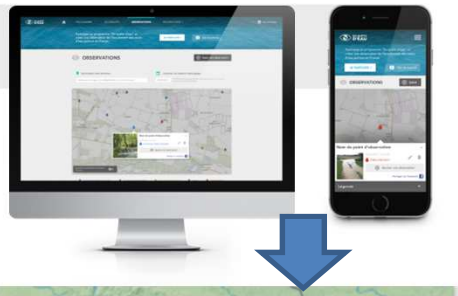
- ONDE network has been made since 2012 => a **stable network** of knowledge **but**…
- Data collection is **only during summer time**
- It is composed of (‘only’) an average of **35 stations / département** and…
- … given the extent of the French river network, **there still remain some stretches of rivers that are not monitored**

- **Others stakeholders** than AFB staff monitor rivers (ex. state services, fishing federations or citizens)
- ONDE observation’s protocol is **easy to implement** (the four main descriptors)
- **Subject connected with climate change,** a concern of everybody (institutional stakeholders or general public)

- Real need to improve knowledge of river flows by **increasing the number of visual observations** (« crowdsourcing »)

Additional observations networks

En quête d'eau : **http://www.enquetedeau.eaufrance.fr**



To monitor a larger number of rivers over a longer period of time (the project is currently in the planning)

Data : river flow assessed (only) visually

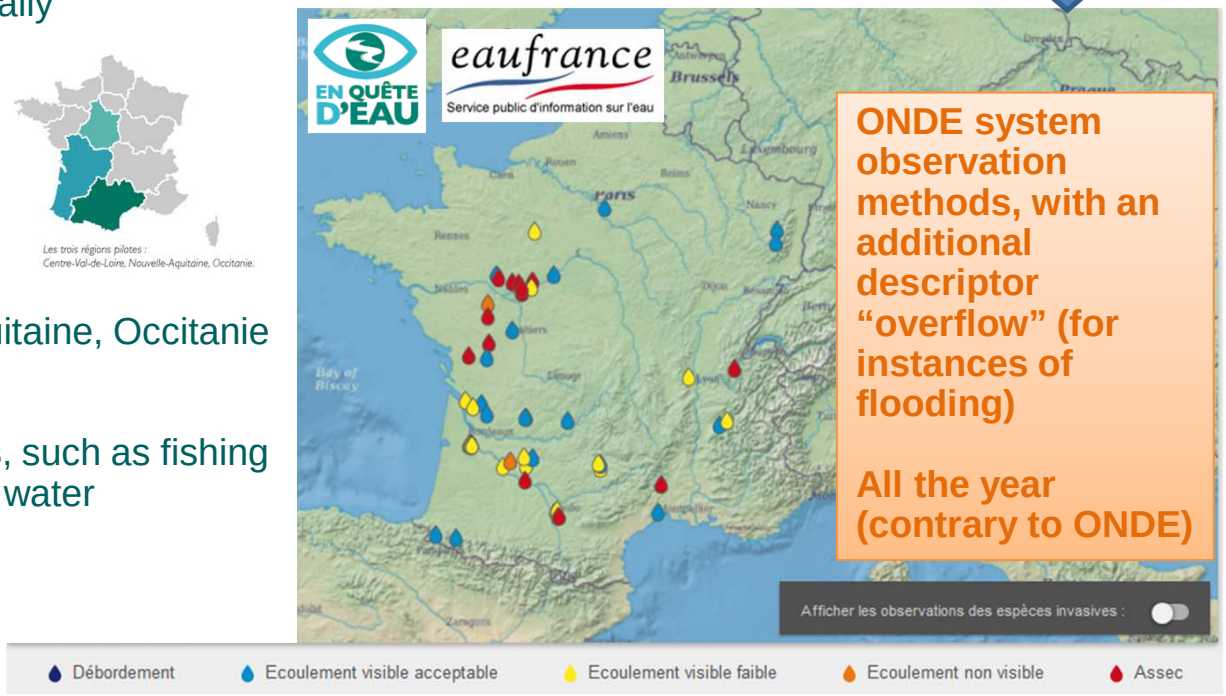
Network administrator : AFB

Data producers :

2017 : a test is in progress

- In **3 pilot regions** – Nouvelle Aquitaine, Occitanie and Centre-Val-de-Loire
- **With various river stakeholders**, such as fishing federations, river technicians and water management plan coordinators

2018 : national opening with everybody !



ONDE system observation methods, with an additional descriptor "overflow" (for instances of flooding)

All the year (contrary to ONDE)

Key figures !

First step of the test (july – sept)

→ About 40 members
More than 60 stations
Almost 100 observations

Second step of the test (oct. to march)
In progress !

Knowledge : Research projects on intermittent rivers

- **What are intermittent rivers ?**
- **What are the scientific and management issues?**
- **How the ONDE's network can help solving these issues and understanding hydrological processes?**
- **What are the functioning of the species living in these intermittent rivers? How to get information?**
- **SMIRES (networking, topical working groups, involving managers..)**

What are intermittent rivers?

- **Intermittent rivers are waterways that locally cease to flow and sometimes dry** (Larnet *et al*., 2010 ; Datry *et al.*, 2011 ; Datry *et al*., 2014)

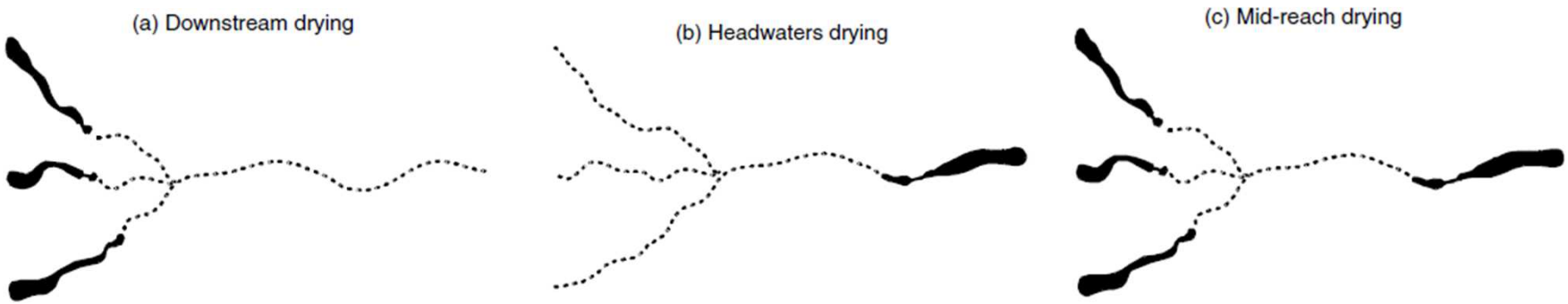
Calavon, an intermittent river in France, during an aquatic phase in autumn and during a dry phase in summer

- **They cover more than half of the global river network and are expanding due to global change (land-use change but also climate change)**

How are they characterized? Where are they?

- **These rivers are characterized by different factors :**

  - **season of intermittence :** summer/winter
  - **frequence :** yearly or irregular (every 10 years for example)
  - **duration :** from few days to years
  - **location** (Lake, 2003 ; Gordon *et al*., 2004 ; Skoulikidis *et al*., 2015)



  - **Intensity :** pools or completely dry (Lake, 2003 ; Gordon *et al*., 2004 ; Skoulikidis *et al*., 2015)

➡ These intermittences are often amplified by anthropogenic pressures (water withdrawals, catchment management or climate change)

Why are they important ?

- During the dry phase
  - **no aquatic habitat** but a **rich biodiversity** in these aquatic-terrestrial ecosytems (taxons)
  - **Refuge areas can become traps** : amplification by water withdrawals of drying rates

- When the river flows again
  - **water quality** : increase of nitrate levels and conductivity
  - intermittent rivers can be used for fishes reproduction => importance for them to get access to spawning areas (**ecological continuum**)
  - **diatoms** recolonize after few weeks
  - diversity and density of **macro-invertebrates** depend on the duration and frequency of the dry phases

Scientific and management challenges

- Despite their prevalence**,** there is a **lack in knowledge** about :
  - **the occurrence of intermittency**
  - **hydrological processes**
  - **ecology**
  - **biogeochemistry**
  - **social perception –** dry phase often not recognized as rivers
  - **economic value**

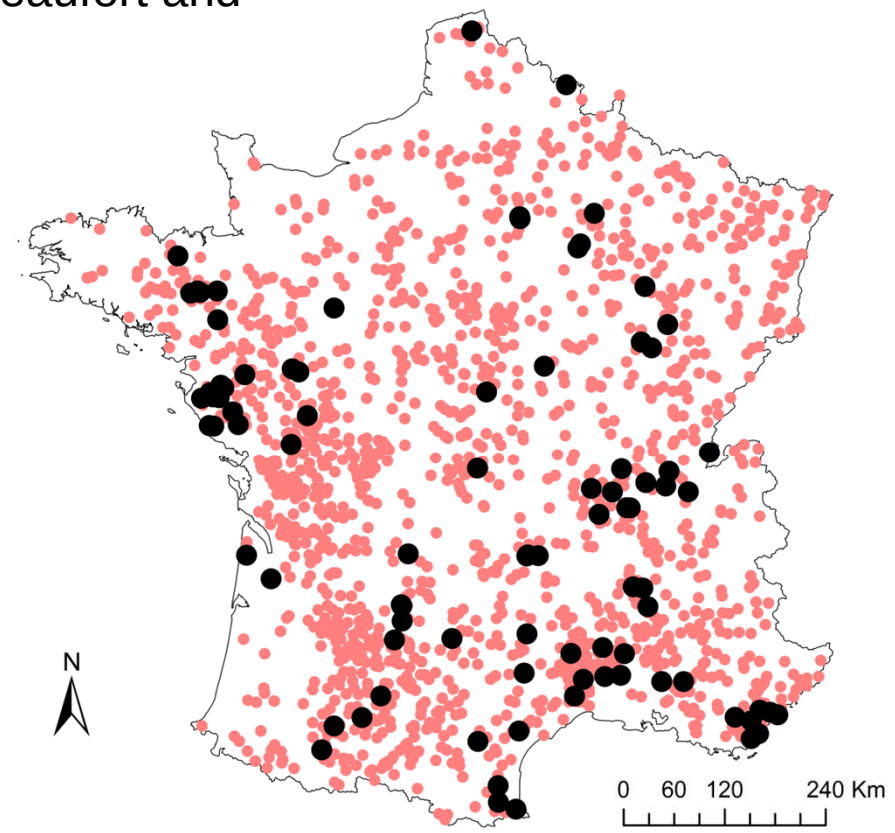
Example of a dry river used as a road

These specific systems are **hardly ever not addressed** in water resources management plans (*e.g*. the european WFD**)** and are thus **poorly protected by legislations.**

Hydrology : ONDE network and intermittent rivers

Research work by Aurélien Beaufort and Eric Sauquet

- Understanding remains limited:
  - gauging stations preferentially located along perennial rivers
  - proportion of intermittent rivers (IR) highly underestimated
- 1100 (35%) ONDE stations of flow intermittence against only 90 (8%) conventional hydrometric stations (HYDRO) between 2012 and 2016.
- A more homogeneous representation of intermittent rivers across France



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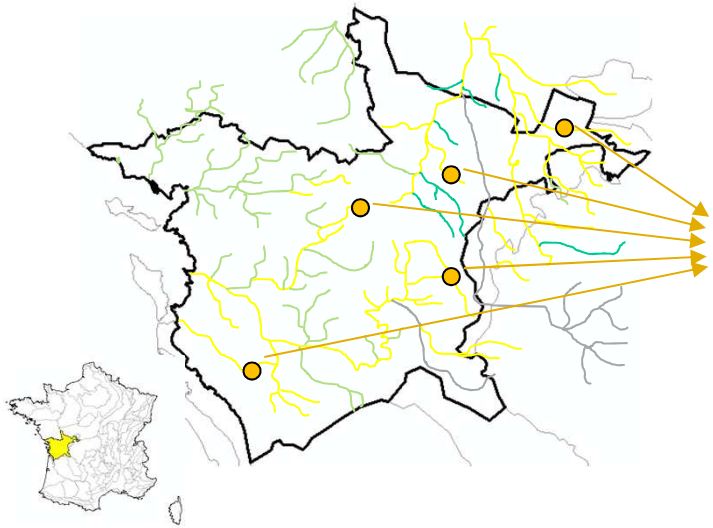

ONDE site

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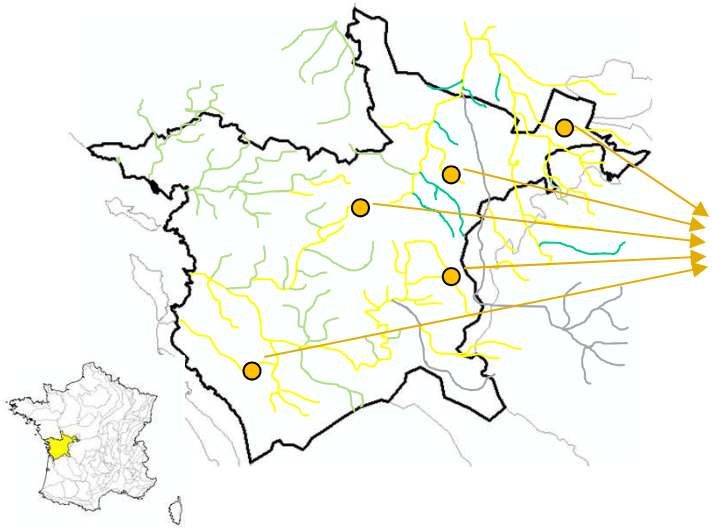

ONDE site

Proportion of zero-flow at each observation date

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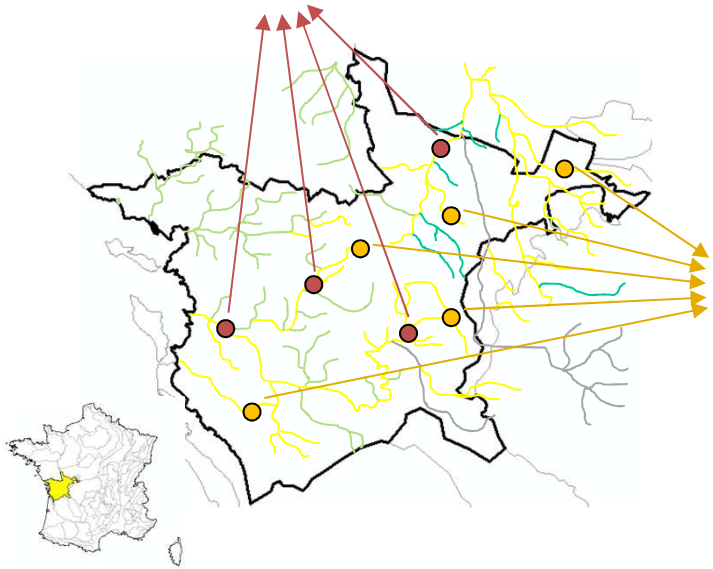

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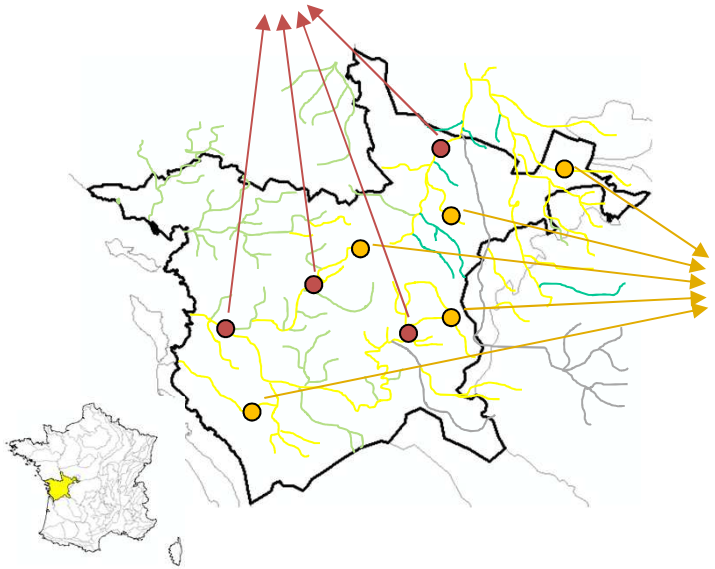
Non-exceedance frequency of river discharge



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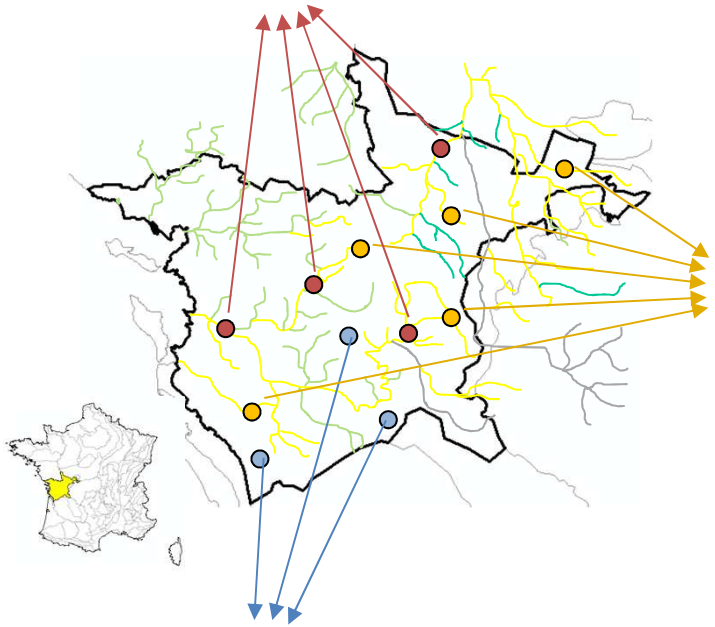

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Groundwater level (piezometer)

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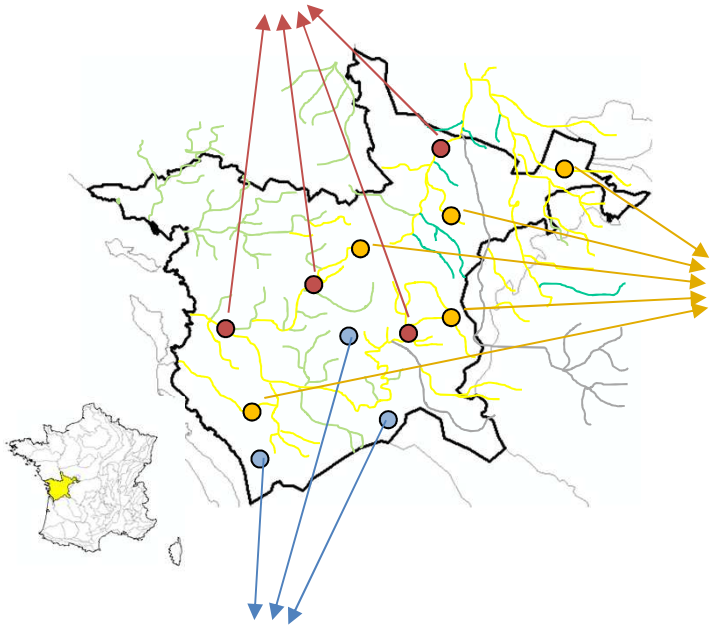

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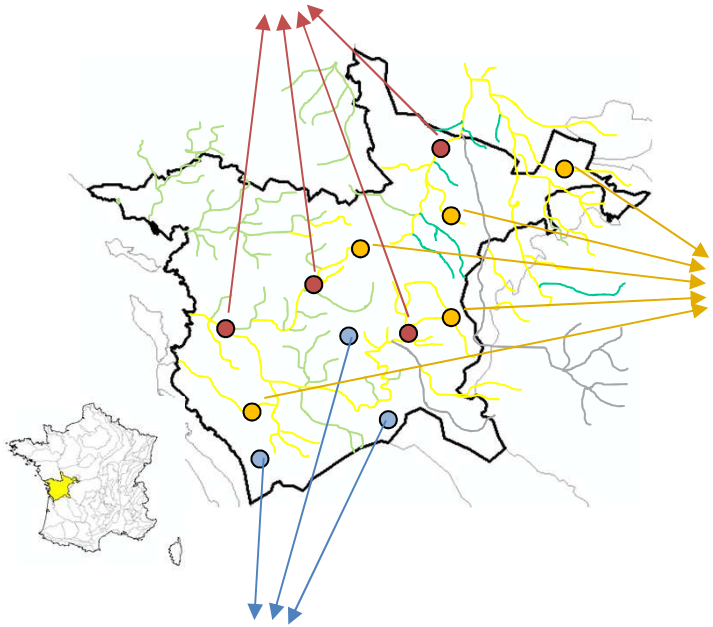

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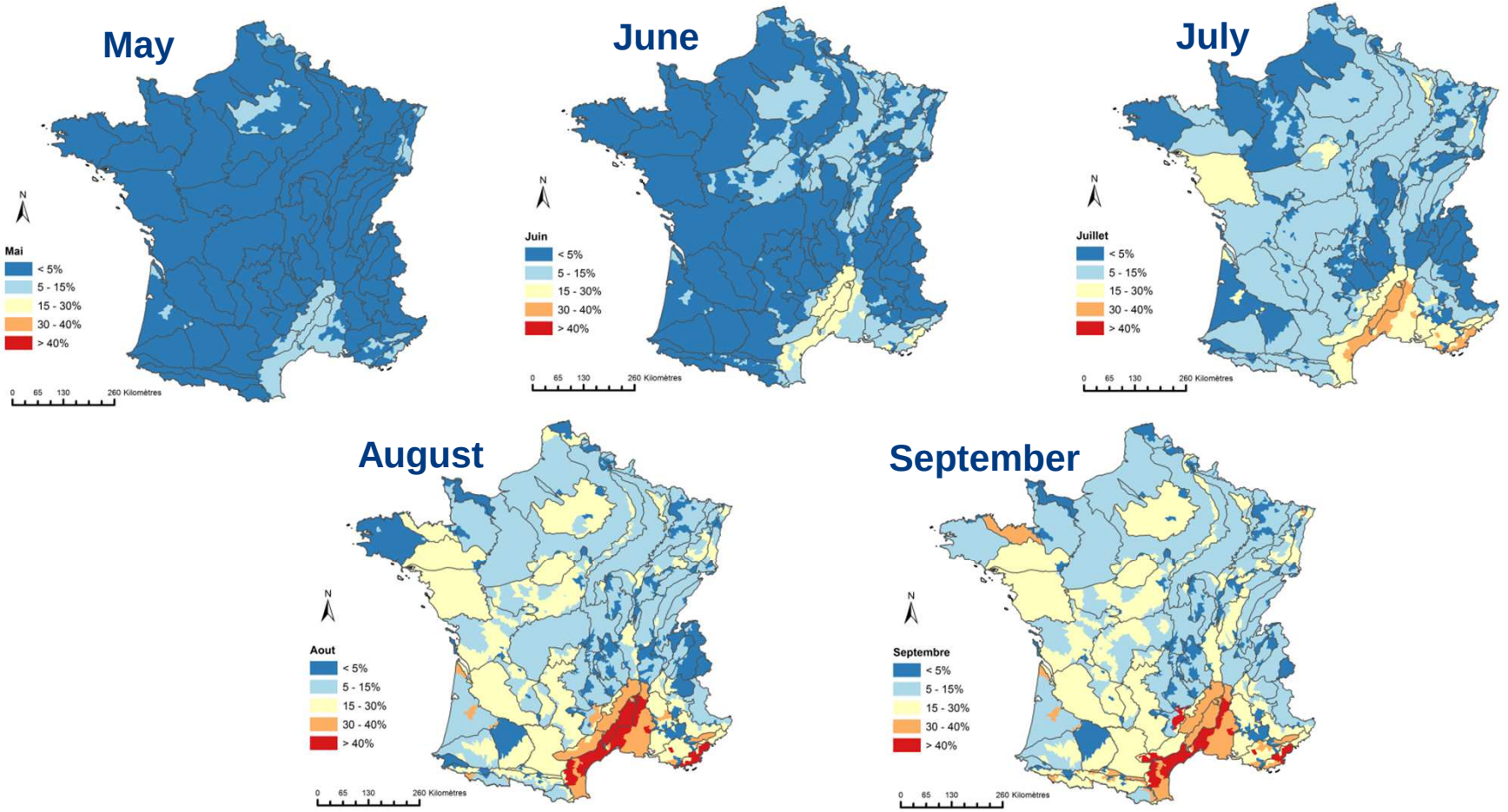
1. Modelling the risk of intermittence: Regional approach

- Regions with high probabilities of intermittence close to the Mediterranean Sea (proportion of zero-flow modelled > 40% between August and September)



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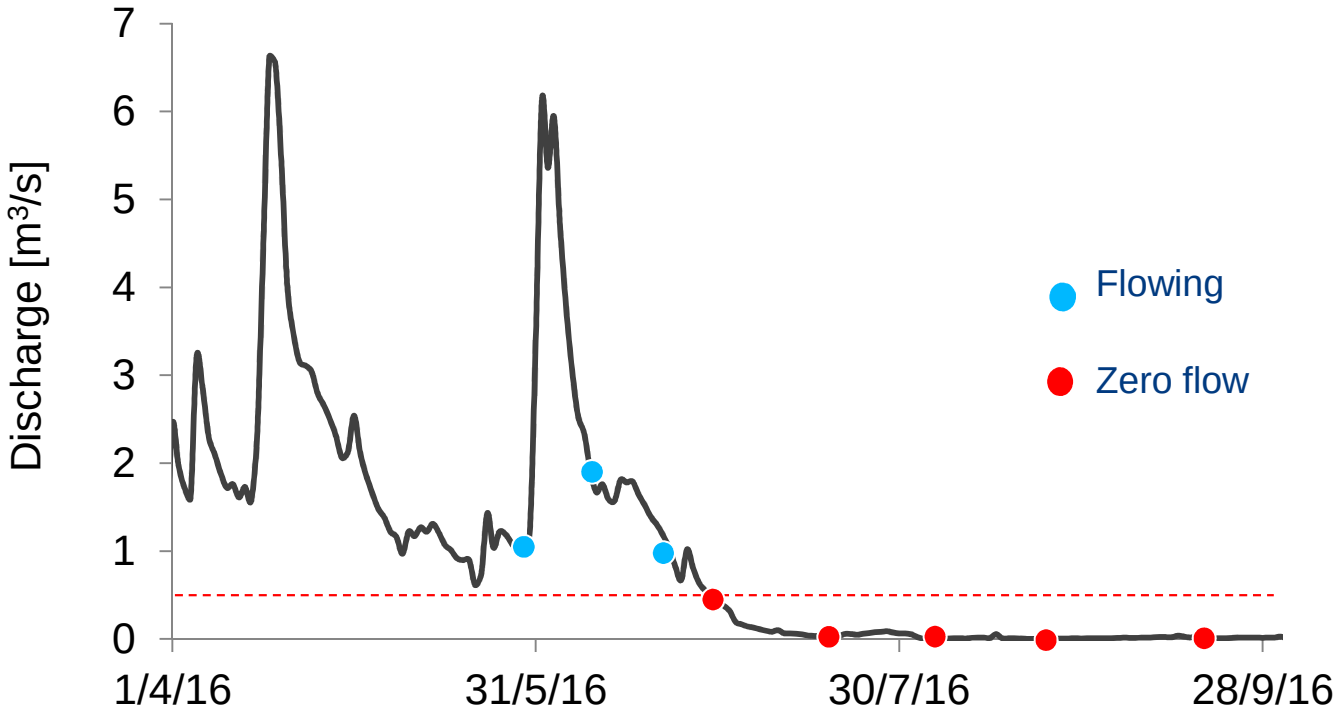
2. Perspective - Flow intermittence dynamic: Local approach

- Objective: Converting discontinuous observations of ONDE into continuous time series of river flow states
- Reconstruct the temporal variability at ONDE sites taking into account a nearby gauged catchment
  - Determine a threshold discharge for zero-flow



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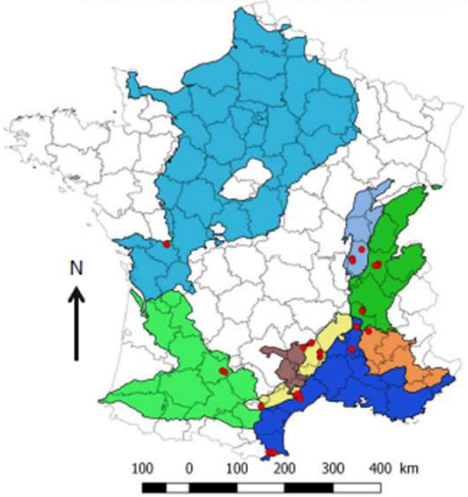
Ecology : Monitoring of fishes in intermittent rivers

- Organization of elecrofishing in intermittent rivers to :
  - ✓ understand the effect of intermittence on composition, richness, biomass and density of fishes communities.
  - ✓ study the impact of intermittence orignated from anthropogenic activities on fished communities.

- Electofishing before and after dry-out in 20 stations all over France
- Project going on the following years.



SMIRES

COST Action funded by the European Union to :

- ✓ generate networking
- ✓ capacity building and knowledge synthesis in IRES science and management

Development of novel and sometimes unexpected multi-disciplinary solutions that **meet key challenges in IRES science and management**

Who can contribute and how ?

200 collaborators from across and beyond Europe – researchers and water stakeholders

4 topical working groups : hydrology ; ecosystem services, biogeochemistry and ecology
Forum of Young reseachers and Stakeholder commitee

SMIRES

visit the project website : http://www.smires.eu/ !!

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Conclusions of

- **Implementing additional observations networks are efficient :**
  - ✓ to provide a stable baseline of knowledge over time
  - ✓ to anticipate and manage crisis situations

- **BUT**, these networks are complementary and **cannot replace** standard observation networks (rainfalls, water heights, gwd levels)!

- Better distribution of data collection over France, raised awareness of the importance of intermittent rivers, providing numerous ecosystem functions

- Climate change could amplified duration and intensity of dry-out of existing intermittent rivers and turn perenial rivers into intermittent.

- They cannot be ignored in water resources management anymore !

Thank you for your attention !

Any questions?

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