LES ORRES 9 JANUARY 2023

Smart Mountain for tomorrow

19th OCOVA FORUM

REFINING THE KNOWLEDGE OF THE HYDROSYSTEM

For greater reactivity in a context of climate change

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RÉGION SUD PROVENCE ALPES CÔTE D'AZUR

Hautes-Alpes le département

COMMUNAUTÉ DE COMMUNES SERRE-PONÇON

LES ORRES

CRÉDIT AGRICOLE

Two intersecting trends:
- The evolution of the hydrosystem in mountain areas
- Increasing water demand in stations

An attitude of vigilance made possible by better knowledge at the sub-catchment level

THE CHANGING MOUNTAIN HYDROSYSTEM

A few reminders of what lies ahead, a development that has already been observed and will be amplified in the next 10 to 20 years

- An increase in average temperature, more rapid than in the plains (+ 2°C / + 1 over the last 20 years), very rapid alternations and amplitudes between hot and cold ("drops")
- Similar annual rainfall amounts but distributed differently in time and space. Heavy rainfall (higher hourly intensity), winter rainfall, alternating wet and dry periods less predictable than before, more random frequency...

➡ evolution of the torrent regime: from glacio-nival to nivo-pluvial or even pluvial (= peak flooding earlier in the spring)

➡ changes in the way small basin head aquifers are filled

INCREASED WATER DEMAND

Water resource, support...

- Water supply: less leaky networks but higher demand linked to the rise in quality (drinking water spa in all new constructions or renovations)
- Snowmaking: 35% of the areas in the French Alps, with higher aspirations for some (Les Orres, Réallon, etc.)
  NB: until now, the withdrawal for snow use was staggered // maximum withdrawal from the water supply (autumn // February). This is likely to change to a concomitant with the priority for water supply
- Hydroelectricity: development of small projects (some by optimising the water already withdrawn for water supply or from the snowmaking network, but always with an annual withdrawal higher than the existing one)
- Agriculture: reduction of water abstraction from the canals (replaced by a pressurised sprinkler network), but development of projects requiring irrigation, made possible by milder temperatures, and made relevant by the relocation of food production

INCREASED WATER DEMAND

... Or the postcard component

- Water and white water sports: adaptation to flow and earlier high water period necessary
- Postcard: increase in the number of visitors to aquatic environments, fresh and relaxing... (with the double risk of degradation of the environments on the one hand, and disappointment when the environments are dried up!)

⇒ the demand for water, whether as a resource, as a support for activity or as a landscape, will have to deal with hazards and decreasing availability (and sometimes with increasing risks)

INCREASED WATER DEMAND

Examples of developments

volumes annuels en m3

	Neige culture		Distribués AEP*		
	2004/2005	2009	2010	2020	part neige/aep en 2010
Grandes Rousses	509 700	600 000			27,6%
commune Villard Reculas			25 333	27 690	
commune Auris			42 405	106 687	
commune Vaujany			1 375 380	1 026 128	
Commune Huez			727 188	689 641	
les 2 Alpes	198 800	200 000	947 342	798 418	21,1%
l'Alpe du Grand Serre	7 500	30 000			37,5%
commune la Morte			79 921	55 772	
Chamrousse		50 000	204 008	142 455	24,5%
la Grave / le Chazelet		400	316 067	97 920	0,1%

* la distribution est déjà inférieure au prélèvement dont une partie retourne au milieu

sources : CLE, Agence de l'eau RMC 2020. Traitement cimeo 2021

AT THE CROSSROADS OF THESE TWO TRENDS, HOW CAN WE ANTICIPATE?

We know in general what is going to happen and therefore how to deal with it

We know how to control energy, water in pipes...

We don't know how to control water in the natural environment

Models exist, but they are outdated and need to be adjusted. There are ratios at the world, French and regional levels... but the more you zoom in, the more specificities become preponderant

➡ However, a station must be understood at the sub-catchment level

A VERY DISPARATE AVAILABILITY OF DATA / RESOURCE

Many sources of information but little sharing

- Academics: very precise data on a few sites (sentinel lakes, glaciers)
- Hydropower producers: long flow records... jealously guarded
- Meteorologists: long temperature and precipitation series, but few stations to distinguish the variability from one slope to another
- Evapotranspiration data: tricky to use
- Hydrogeological data: sporadic, linked to abstraction authorisations

VERY DISPARATE AVAILABILITY OF DATA / USES

Many sources of information but little sharing

- The SDAEP, the catchment protection files, the abstraction authorisations, etc. give a picture at a given time, and need to be updated. It is not always possible to compare communes or to have access to the details
- The volumes withdrawn for different uses are communicated to the Water Agency annually but are difficult to access and compare
- Measuring the use of water as a medium requires an economic and sociological approach (number of boats, turnover, bivouac counts, etc.) that is not usually combined with flow rates. Empirical and sporadic knowledge

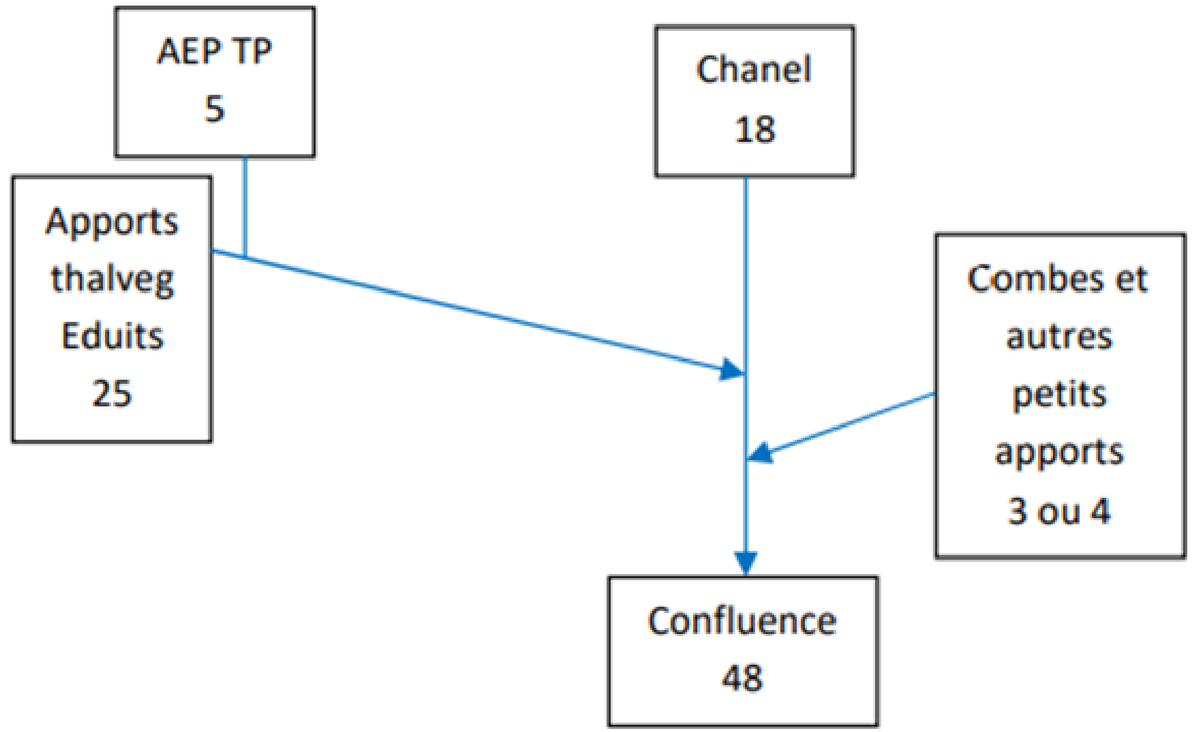
➡ Difficulty of having a global and fair approach on a station territory

EXAMPLES WHERE FIELDWORK QUESTIONS OR CLARIFIES MODELS

Ex 1 - hydroelectricity project on the snowmaking network in the resort

the abstraction becomes annual = need to review the authorisation and the impact on hydrology. The fieldwork showed that :

- **The surface geology** creates a groundwater flow that is not in the direction of the thalweg
- **Drainage of** ski **slopes** changes the expected surface runoff
- **The overflow of the AEP reservoir** varies according to the population in the station
- Small but numerous **unauthorised withdrawals** reduce the flow at the measuring point


AEP TP
5
Chanel
18
Apports
thalveg
Eduits
25
Combes et
autres
petits
apports
3 ou 4
Confluence
48

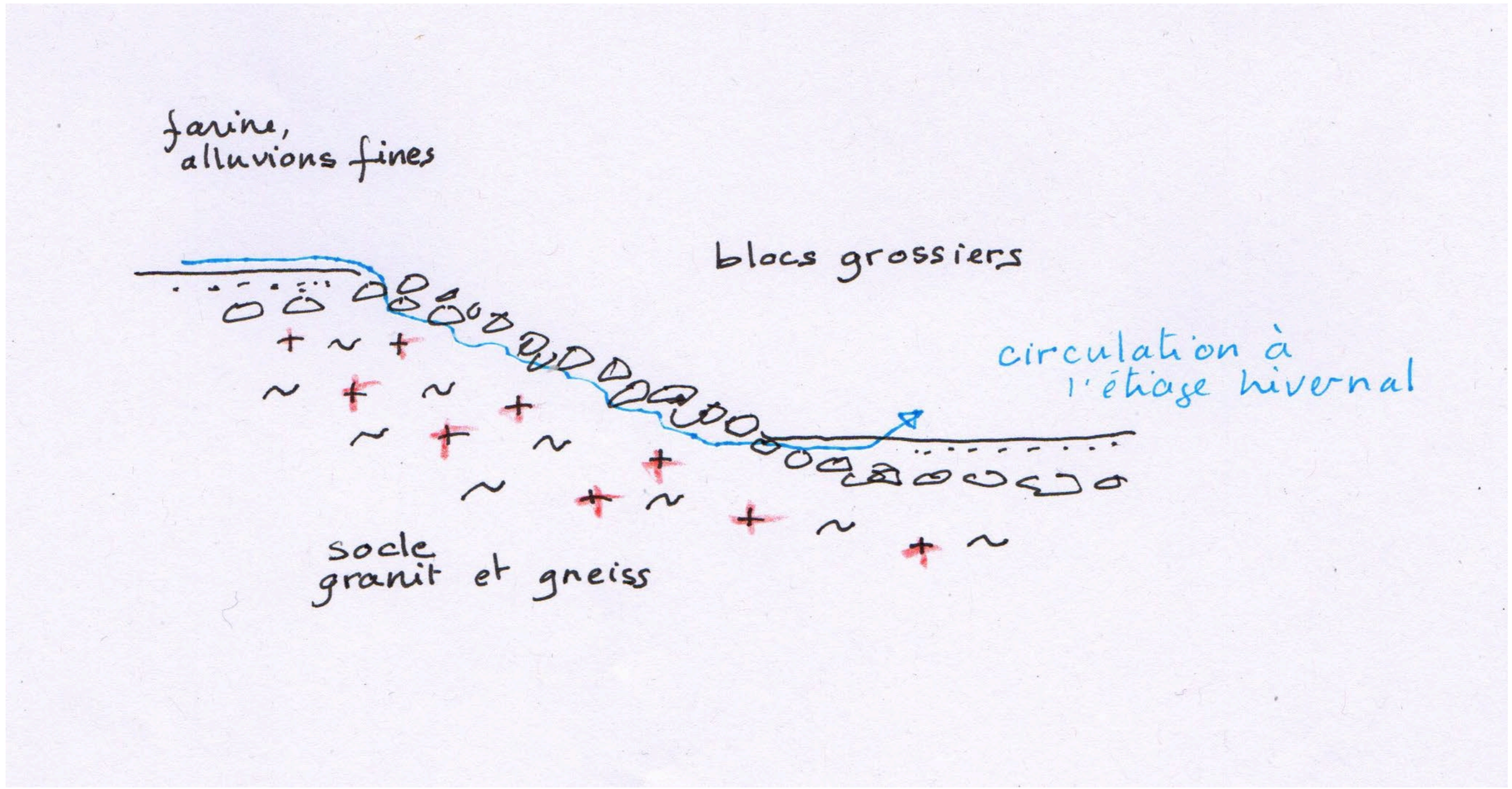
EXAMPLES OF WHERE FIELDWORK COUNTERS MODELS

Ex 2 - A hydroelectric project in a torrent at the foot of a glacier

The torrent visible at the bridge shows a **significant flow** (several cubic meters/second), but :

- The snow usually hides the winter droughts (the torrent seeps under its chaos of blocks before emerging in a resurgence)
- A winter without snow and a year of bi-monthly measurements allowed us to refine the approach

Conclusion: irrelevance of the project on a torrent that is dry 6 months a year


farine,
alluvions fines
blocs grossiers
circulation à
l'étiage hivernal
socle
granit et gneiss

EXAMPLES WHERE FIELDWORK IS NEEDED TO REFINE THE MODELS

Ex 3 - The regional study on the viability of stations in 2050

The study shows that (almost) all of them are viable, "with artificial snow". The Region therefore has the arguments to subsidise the networks. But :

- The way in which the **hill reserves** would be filled was not studied. **Hydrogeology** was not part of the specification. Simulations of the volumes of water needed for crop snow were done "without constraints
- A resort fills its snow reserve by **pumping the water table**. That's fine. But how do you know that the water table will be sufficiently and reliably supplied?
- One station fills its reserves by **pumping from the river**. What happens with the evolution of water regimes?
- A station fills its reserves with **the excess of drinking water**, what about the increase in demand with the rise of the range?

SO HOW CAN WE REFINE THE KNOWLEDGE?

More difficult in the absence of a SAGE!

- Sharing between data producers, cross-referencing information from different sectoral approaches (water supply, industrial and agricultural withdrawals, environmental studies, etc.). Example of the community of communes of Serre Ponçon
- Undertake multi-annual measurement campaigns, a survey of old and recent hydrogeological studies, photographic monitoring, etc.
- And instrumentalize appropriately!

Euros and time ... But greater reactivity is the key

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Mais si le but de cette étude est de poser des problèmes, il nous semble qu'il en est un important, celui de la connaissance la plus précise possible des ressources hydrauliques. Il faudrait donc dès à présent entreprendre des inventaires des ressources en eau de ces régions, contrôler avec soin durant une période assez longue les variations des débits des sources, des niveaux des nappes et faire une étude hydrologique de toute la région. Ceci permettrait de connaître les réserves en eau et ainsi de développer l'irrigation dans les plaines et le tourisme dans toute la région.

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