



The importance of the science-policy interface for water and climate

Symposium organised by Onema, the Water agencies and the Ecology ministry

The symposium titled “Water and climate - Interaction between scientists and politicians for action” was held in Paris in February 2015. The purpose of the event, a forerunner to the 7th World water forum and the “Paris-Climat 2015” meeting (COP21), was to facilitate discussions between scientists and elected officials on the topic of water and climate change in view of jointly laying the groundwork for future improvements in the science-policy interface. These discussions are essential in order to transform scientific knowledge into actual water planning and management policy.

Undeniable, unequivocal, without precedent, etc. are the terms used to drive home the point that climate change not only exists, but is caused in large part by anthropogenic increases in the emissions of greenhouse gasses (GHG). The repercussions of climate change are significant, notably for water and aquatic environments. The impacts on precipitation, evaporation, the availability of surface water and groundwater, as well as on the biodiversity of aquatic environments are already visible or soon will be.

The current situation and the projections produced by scientific studies must be taken into account by public policies, notably management plans such as the river-basin management plans (RBMPs). However, the shift from science to policy is rarely an easy task for elected officials who claim that they lack the information, data and tools required. “To make progress, policy decisions and proposals must be based on solid science that is

in fact usable”, noted Serge Lepeltier, a former minister and president of the French Water academy.

The Water and climate symposium consisted of a day of meetings where decision-makers could express their

needs and expectations concerning knowledge on the impact of climate change on water and the means available to manage uncertainties. Climate projections and forecasts are highly complex operations with uncertainties embedded at multiple levels.



The symposium served to firmly anchor the topic of water in discussions on the climate and it also produced a number of observations and recommendations intended to reinforce the science-policy interface in France.

The recommendations had also to be reiterated throughout the year 2015 during a number of international events including the 7th World water forum in April, the international scientific conference titled "Our common future under climate change" in July and the United Nations Framework Convention on Climate Change 21st Conference of the parties (COP) in Paris in December.

Scientific knowledge, quantified impacts

Climate change has been studied for decades by a vast number of scientists, in particular by the U.N. Intergovernmental panel on climate change (IPCC). In their latest report, the data presented confirm the existence of climate change and its impacts, notably the 3 mm yearly rise in sea levels, one of the clearest indications of global warming. "France will be impacted by the consequences of climate

change, even if it is not the most vulnerable country on the planet", indicated Jean Jouzel, research director at the CEA institute and vice-president of the IPCC scientific group. He added that the IPCC proposes a diagnosis rather than recommendations, in order to assist in decision making. Unfortunately, attempts to transfer global results to the regional level increase uncertainties.

A report on climate scenarios for France, prepared primarily by the researchers at the Institut Pierre-Simon Laplace and Météo-France, was submitted to Ségolène Royal, Ecology minister, in September 2014. The report indicated that temperature rise will be greater in the southern sections of the country, but will nonetheless occur throughout the country. Summers by the end of this century will be 5°C hotter on average and there will be a greater number of extremely hot summers with temperatures 7 or 8°C higher than an average summer during the 1900s (see Figure 1). Droughts during the summer along the Mediterranean coast will also be more severe. Warmer winters along the Atlantic coast will result in higher numbers of storms.

Concerning rainfall, a number of projections, taking into account the inherent uncertainties, nonetheless conclude that there will be "a moderate reduction in average precipitations in France, with sharper reductions locally", noted Florence Habets, director of research in hydrometeorology at the CNRS (national centre for scientific research).

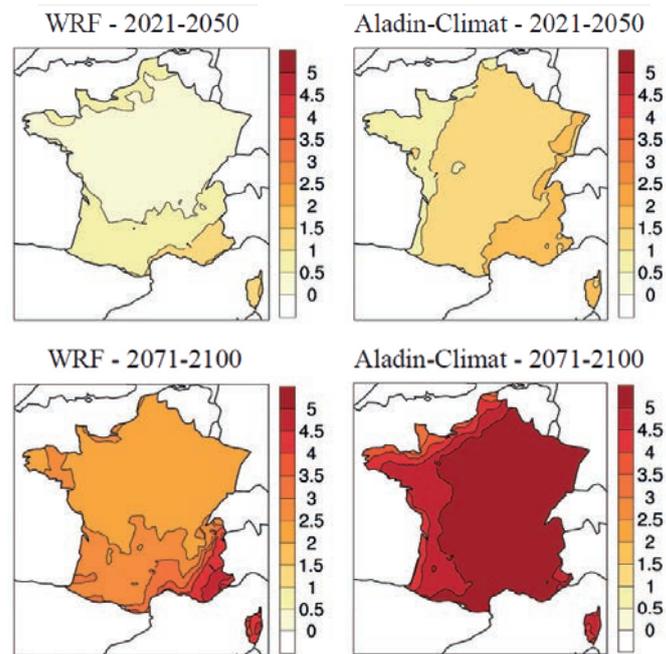


Figure 1. Anomaly (°C) in summer temperatures in France with respect to the 1976-2005 average value, using the RCP 8.5 scenario of greenhouse gasses concentration evolution, for the periods 2021-2050 and 2071-2100. WRF and Aladin-Climat regional models. Source: Jean Jouzel, *Le climat de la France au XXI^e siècle*.

In addition, the higher temperatures will increase evaporation at the end of winter and beginning of spring, which will in turn result in greater water stress.

A significant reduction of approximately 30% in mean rivers discharges should be expected by 2050 (see Figure 2), though with spatial and seasonal variations.

Jean Jouzel, CEA research director and VP of the IPCC scientific group

All countries have agreed to take measures to limit global warming to 2°C compared to the pre-industrial baseline. By limiting temperature rise to 2°C, it would be more or less possible to adapt to the main impacts, but certain phenomena would continue unabated, e.g. the rise in sea levels. Limiting our use of fossil fuels will be the prime factor in holding temperature rise to less than 2°C. At the current rate of CO2 emissions, we have only 25 years left, i.e. 80% of the accessible fossil-fuel reserves must be left in the ground. The transition is technically possible and economically feasible; the real difficulty lies in the lack long-term vision on the part of politicians.

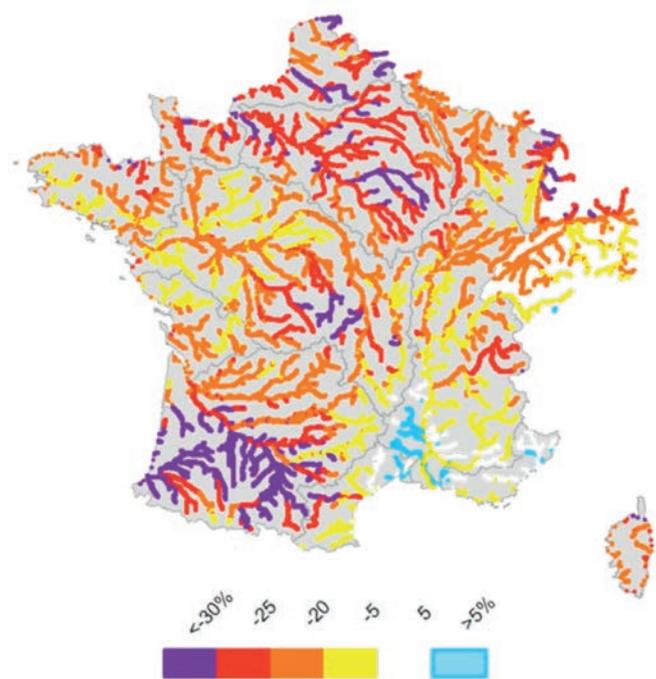


Figure 2. Evolution of rivers discharges in France by 2050. Figure adapted of Habets et al., HESS 2014

Transmitting and setting priorities for scientific information

In some cases, the scientific data required to make a decision is not available, however the opposite situation, i.e. excessive information, can also create confusion. *“Sometimes, it is better to limit the data set and to update it regularly rather than to generate countless parameters that one never has the time to update”*, said Hervé Paul, the mayor of Saint-Martin-du-Var, who also noted that *“elected officials must also raise awareness, i.e. make the information accessible and understandable for citizens and, above all, highlight the important information”*. It is necessary to create the communication tools required to disseminate understandable and reliable information in view of raising awareness among the population. However, *“there is resistance, a form of reticence to admitting that things will change with climate change. But each elected official must make people aware, without overly dramatising”*, explained Viviane Le Dissez, president of the Seaside and Lake Conservation Trust board and MP from the Côtes-d’Armor department.

“Low-flow periods will be longer and more severe. The heads of river basins will run completely dry, which will have consequences on aquatic environments”, indicated Florence Habets. It should be noted that reductions will not be linear, i.e. there is a risk of sudden drops.

These impacts of climate change will also affect groundwater, the less visible side of hydrology and the main source of drinking water. Piezometric levels may drop and reach thresholds requiring crisis management (abstractions in limited quantities or completely forbidden). For example, by 2050 in the sediment basin of the Seine River, drops in piezometric levels leading to bans on abstractions are projected to increase considerably and could cause serious problems.

Species at greater risk of local extinction important

By impacting water and aquatic environments, climate change has already and will continue to have consequences for biodiversity.

Fish are an excellent indicator of anthropogenic pressures due to their presence in virtually all surface waters and have been scientifically monitored by Onema for many years. The resulting long-term data series are important elements in understanding the effects of climate change. The initial conclusions drawn from the statistical models show that different species are confronted with different situations, i.e. a contraction or expansion of their habitat ranges, or with a shift upstream. Cold-water fish, e.g. trout and Atlantic salmon, face a reduction in favourable habitats and fish inhabiting warmer waters, e.g. chub, have seen their habitats expand. *“Of the 32 species studied and on average, we observed that the fish move upstream and gain altitude relatively quickly (13 metres per decade). But in spite of that effort, their adaptation is far slower than the shift in altitude of isotherms (57 metres per decade)”*, explained Nicolas Poulet from Onema. Adaptation by species is slower than global warming and *“many populations are already confronted with unfavourable climatic conditions, hence greater risks of local extinctions”*, indicated further the Ph.D in aquatic ecology.

Restoring (or at least not degrading) the ecological functioning of rivers is in all cases a “no-regrets” adaptation measure.

The knowledge acquired on these major disruptions that are already in progress must now find its way into public policies, however the difficulty lies in making decisions in a highly uncertain context.



A trout

The difficult task of integrating uncertainty in decision-making processes

“There are no certainties in climate change. Climate projections are not predictions, they are just statistical probabilities”, noted Hervé Paul, the mayor of Saint-Martin-du-Var. The elected official finds it very difficult to discern and to manage uncertainty in the decision-making process. But in spite of the uncertain context, choices must be made in developing a useful management policy for water resources and aquatic environments.

That is difficult in certain sectors, for example agriculture where there are strong interactions with water and forests, a situation that creates significant uncertainty for decision-makers. *“We have a number of different GHG-emission scenarios and, using those scenarios, the climate models produce different projections for a given section of the country. We also have agronomic models for forests, for water resources, and we*

Nicolas Poulet, Onema scientific officer

Limiting the causes of climate change will require concerted efforts on the planetary level. However, measures intended to limit the impacts on fish are feasible on the local level, notably to assist the ecosystem in maintaining its resilience, in other words the means to buffer the effects of climate change. The purpose of these measures is to preserve and restore the natural functioning of ecosystems, i.e. restore ecological continuity, respect hydrological regimes, control abstractions, maintain the physical-chemical quality of water, etc. They are already required to achieve the objectives of the various European environmental directives and regulations such as the Water framework directive, the Nitrate directives, the Habitats directive and the eel management plan.

Madeleine Jouye de Grandmaison, former president of the Martinique basin committee and of the International network of river-basin organisations, and former Euro MP

Even though water management has existed for only 20 years in Martinique, climate change and its consequences were built into the 2010-2015 RBMP. One of the recommendations was to make greater use of groundwater given that currently, surface water provides 80 to 90% of drinking water. According to BRGM, groundwater is not as affected by variations in the climate because recharging of water tables takes place more during the rainy season. A shift in resources is therefore possible and we must put work into developing use of groundwater. However, attention must be paid to the penetration of saltwater wedges that would render the groundwater unusable. The RBMP recommends other measures as well, including improvements in the efficiency of water networks and the use of techniques to produce drinking water requiring the least energy.

must put all these pieces together to learn how to manage these complex systems", explained Jean-François Soussana, the scientific director at INRA and member of the IPCC adaptation group.

Given the reductions in river discharges and groundwater levels, questions concerning irrigation will arise at some point. Jean-François Soussana added, however, that *"agronomic know-how will make it possible to compensate the negative impacts to a large degree, but not in all regions"*. There is therefore some margin for adaptation by basing development decisions on available knowledge, for example by favouring rainfed crops rather than irrigated crops, which ensures better recharging of groundwater.

Taking vulnerability into account

In the Seine-Normandie river basin, a meeting of the basin committee was devoted in 2013 specifically to global warming. Even though it took place outside the revision process for the RBMP, it served to highlight the consequences of the phenomenon. A reduction in river discharges in the basin and in groundwater levels, notably in the Beauce region, could lead to halts in irrigation. *"The basin committee did not go as far as to model a halt in abstractions"*, noted Michèle Rousseau, general director of the Seine-Normandie water agency.

To improve management programmes, it would be useful to have more precise forecasts on winter precipitations given the links between precipitation and pollution levels in rivers.

To the south, the Nice Côte d'Azur urban area decided to integrate the uncertainty in its development and management policy for water resources. An assessment of the vulnerability of the urban area to climate change was therefore included in the territorial climate-energy plan. The plan in turn served to integrate adaptation to vulnerabilities in the urban planning documents (SCoT and PLU)¹.



River in Martinique

A few thousand kilometres away, the Caribbean islands are already familiar with extreme events and are, of course, also confronted with climate change. For example, by 2050, Martinique may have lost 70 of its 1080 square kilometres of land due to rising sea levels (P. Saffache, 2006). Aware that time was of the essence, the local authorities and scientists organised in 2006 a symposium titled "Climate change, a danger for the Caribbean". Very quickly, the Departmental council and local authorities set up measures to adapt to rises in the sea level in an integrated policy including monitoring of floods, structures to limit coastal erosion, artificial algae and breakwaters.

In addition, *"scientific information must be made easier to understand for the*

population, without provoking panic", said Madeleine Jouye de Grandmaison, former president of the Martinique basin committee and former Euro MP. *"The Departmental council has set up an information service for the general public including exhibits, conferences and shows specifically for school children and older people"*.

Tools and data to assist decision-makers

In taking into account climate change and its inherent uncertainties in public policies, decision-makers have access to a number of tools and databases. The DRIAS² tool was launched in July 2012 primarily for local governments. It presents regional climate projections up to 2100, in time steps of 30 years. Thanks to support from the Ecology ministry, Météo-France and French research institutes (IPSL, CNRM-GAME and CERFACS), the tool provides maps that are easy to read and data that can be used in formulating management plans. It also proposes a function to assist in determining how the information should be used depending on the specific need. *"Right from the design phase of the tool, future users were brought in and their remarks helped in targeting the necessary improvements, for example links between past climate condition assessment data and the need for more data on impacts"*, said Patrick Josse, director of climatology at Météo-France.

Another source of information is ONERC, the National observatory on the effects of global warming, a major provider of knowledge on the climate and adaptation. *"ONERC recently created a 'WiKlimat', which will showcase decentralised adaptation projects by local governments"*, noted Nicolas Bériot, secretary general of ONERC. The purpose is to share feedback from adaptation projects.

On the EU level, the Climate-Adapt platform assists not only in inserting adaptation in sectoral policies and facilitating adaptation projects between cross-border regions, but also in sharing scientific knowledge and information on adaptation tools. For each country, information will include the legal context, assessment reports on impacts and vulnerability, and any existing plans.

² Give access to French regional climatic scenario of impact and adaptation of our society and the environment

¹ Local development plan (SCoT) and the local zoning plan (PLU)

Serge Lepeltier, former minister, president of the Water academy and of the steering committee for the symposium

In 1999, I wrote the first parliamentary report on climate change. The preliminary work included auditions of major experts and technicians who predicted the effects that we now observe. The general population is aware of the problems, but a great deal of work is still required to convince elected officials. Two-thirds of the French people already say they know that climate change will have serious consequences, but only one-third of their MPs would say they are aware of that. Given the heavy workloads of elected officials, it is not easy to communicate with them. That is why it is better to suggest full-day meetings with experts who have the time to put a clear message across. That would be a good way to raise their awareness.

"It is difficult to stimulate acceptance of the need to work on climate change, however it is important that we acquire it on the part of the general population and the various business sectors", noted Denis Cheissoux, a journalist at France-Inter radio.

Informational tools exist, but are not well known and consequently are not widely used, notably by decision-makers.

Adapting management plans

In some river basins, elected officials and local stakeholders have established climate-change adaptation projects based on scientific data and forward-looking studies.

For example, the purpose of the Garonne 2050 study, managed by the Adour-Garonne water agency, was to devise differing scenarios concerning water needs, resources and management spanning the entire basin of the Garonne River. The starting point consisted of an assessment of past trends and of the major climate-change factors having an effect on water. In addition to support

from the basin scientific council, the study received input from numerous experts and adopted a participative approach including eight months of wide-ranging discussions, 13 meetings in the field, a special internet site, newsletters, workshops, etc. *"Garonne 2050 is not itself an objective, it is a temporary tool to further a forward-looking approach to our basin",* noted Martin Malvy, president of the Adour-Garonne basin committee. The study became the guideline document for the revision of the 2016-2021 RBMP and resulted in concrete measures concerning governance, knowledge, quantitative management and the preservation of environmental functions.



Session *Tools for action*

In the Rhône-Méditerranée basin, it was the plan for adaptation to climate change, the first such plan set up for a major river basin in France, that set the guidelines for the 2016-2021 RBMP. Launched in 2014, the plan addresses the vulnerabilities of basin territories to various issues, e.g. water resources, soil-moisture levels, biodiversity, nutrient levels in water. It also established highly concrete measures to reduce vulnerabilities. *"However, these messages have no impact unless they are based on solid and credible results. In addition, people tend to accept issues and plans only as long as they remain theoretical",* indicated Michel Dantin, president of the Rhône-Méditerranée

basin committee. It is necessary to go beyond institutional settings in the effort to communicate. To that end, there is a need for information relays to make people aware of good practices. There is also a great deal to be learnt from other countries and from the past.

The importance of the science-policy interface

Given the uncertainty inherent to climate change and the need to undertake action to preserve water resources, scientific knowledge can assist in clarifying the debate, understanding the issues and setting priorities.

Managing water is synonymous with managing complexity and science is the means to bring together different viewpoints and skills. It is therefore important to provide scientists with a clear and permanent role in decision-making. *"One of the first difficulties for scientists is to demonstrate their added value given the difficult financial conditions determining the decision-making of elected officials",* stressed Joël Pélicot, president of the Loire-Bretagne basin committee.

Unfortunately, communication between officials and scientists is not easy with each side encountering difficulties in understanding the other. *"It is not easy to explain fundamental and applied research to a basin committee because not everyone has the same approach to the information",* said Bernard Rousseau, the head of water policy at France Nature Environnement.

Greater contacts between the two communities would improve mutual understanding. Through meetings, scientists



Session *Planning in uncertainty*

can learn more about how management policies are developed. The scientific approach to problems can also be enhanced by interaction with other approaches, notably concerning political decisions. The result is greater relevance of scientific work due to better integration of the constraints weighing on water stakeholders, all of which contributes to developing a more integrated view of the region as a whole.

Public organisations (Onema, the Water agencies, etc.) have a role to play in encouraging the science-policy interface through projects such as the symposium.

Including scientists in management entities

More generally, it is important to create a community with shared practices that will contribute to mutual understanding and

to the development and dissemination of knowledge. At the very least, there should be scientific councils working with the communication and management entities (e.g. the basin committees) to play the interface role, i.e. guide decision-making, justify the decisions made and assess the results. *“The scientific council is in a position to generate solid opinions on long-term issues and questions, like climate change, on the major water policies implemented in the river basin and on the emerging issues that must be taken into account. We place importance on a strategic and forward-looking vision”*, said Corinne Larrue, president of the scientific council of the Seine-Normandie basin committee.

For managers, *“paying attention to the scientific issues is a means to develop a new, often divergent approach that expands thought processes and clarifies the debate”*, noted Michèle Rousseau,

general director of the Seine-Normandie water agency.

It is also worthwhile to note the value of promoting “knowledge transmitters” capable of instilling life in the interface, such as environmental associations, specialised organisations and engineering firms.

Finally, elected officials must also learn about the issues by auditioning scientists, participating in symposia and feedback meetings on scientific research, or even by taking training courses.

Participative approaches should also be encouraged to bring in a maximum number of stakeholders because they can support efforts to disseminate information and to train people in view of raising awareness of climate change. ■

Denis Salles, research director for sociology at Irstea

Relations between science and policy are being shaken up by the issue of climate change. The issue is difficult to manage given that it cuts across different sectors, different territories, it combines inherited and latent effects, it produces an array of impacts on water and the scientific uncertainties are a source of controversy. The need for more scientific knowledge and political regulation persists, but climate change also requires better integration of citizens and civil society in the decision-making process. This three-party approach (science, policy and society) is indispensable if we are to succeed in ensuring effective, democratic dialogue in fighting climate change and avoid seeing both the issue captured by interest groups and water become the topic of endless conflicts. Numerous territorial initiatives already address adaptation to climate change, including Aqua 2030, Garonne 2050, etc. These projects are often characterised by a “standard” scientific approach. They would do well to shift closer to the interface between scientific knowledge and the tools for political reform. They should also be managed by “border organisations” and mediators capable of mixing different types of knowledge. Concerning water management, adaptation to climate change comprises a number of options (adjustment, complete change of the economic model, a security-oriented approach, etc.) that will not be decided on the basis of scientific knowledge (though it remains necessary), but rather political decisions formulated through democratic debate that must be enhanced.

Elected officials should take advantage of the upcoming COP21 meeting and, in spite of heavy schedules, play an active role with scientists in spreading information on climate change with citizens and water users who are already confronted with the effects and will have to adapt in the future.

For more information

http://www.onema.fr/3-fevrier-Seminaire-eau-et-climat?var_recherche=eau%20et%20climat

Meeting organisation

Organising committee chaired by Serge Lepeltier, former Minister

Frédérique Martini, Research and development department, Onema

Onema MEETINGS



Publisher: Elisabeth Dupont Kerlan
 Coordination: Véronique Barre (Research and development department) and Claire Roussel (Information and communication department)
 Authors: Clément Cygler and Frédérique Martini
 Translation: Cary Bartsch (info@bartsch.fr)
 Editorial secretary: Béatrice Gentil, Information and communication department
 Layout design: Eclats Graphiques
 Production: www.kazoar.fr
 Printed on paper from sustainably managed forests by: CFI
 Onema : 5 Square Félix Nadar - 94300 Vincennes
 Document available at:
<http://www.onema.fr/Les-rencontres-de-l-Onema>

