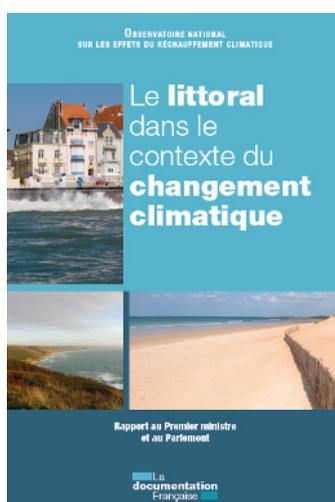


National Observatory on the Effects of Global Warming

The coastline in the context of climate change



Report to the
Prime Minister
and to Parliament

Foreword, Executive Summary

2015



ONERC Publications

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Stratégie nationale d'adaptation au changement climatique ("National climate change adaptation strategy"). La Documentation française, Paris, 2007.

Changements climatiques et risques sanitaires en France ("Climate change and health risks in France"). ONERC Report to the Prime Minister and Parliament, La Documentation française, Paris, 2007.

Changement climatique. Coûts des impacts et pistes d'adaptation ("Climate change. Impact costs and adaptation routes"). ONERC Report to the Prime Minister and Parliament, La Documentation française, Paris, 2009.

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President's address

The effects of global warming have an impact on coastal and mountainous regions earlier than elsewhere, and these impacts are already being felt by populations living in these areas. As such, these territories have a particular interest in climate matters, and efforts are now focusing on ways to anticipate and adapt to these impacts.

The average sea level has risen by around 20 cm since the start of the 20th century. This represents a significant change. For low-lying coastal areas, a rise of this magnitude results in flooding of several metres. As things stand, in 2015, this phenomenon can no longer be overlooked when it comes to coastal management strategies. This is particularly important given that sea levels will continue to rise for many years to come, primarily due to thermal expansion of the oceans and the melting of continental ice – a phenomenon that has accelerated in recent decades. During the first decade of the 21st century, the amount of water entering the oceans as a result of melting ice was equivalent to around one cubic kilometre per day. According to the IPCC's Fifth Assessment Report, the sea level will continue to rise between 26 and 82 cm by the end of the 21st century.

Climate change is heightening tensions around coastal developments, and these tensions will continue to accentuate in the future. Rising sea levels therefore have a major impact. However, this is not the only phenomenon that must be considered. Coastal erosion is also another important factor, and local populations have long implemented a range of different technical measures to combat this phenomenon. Today, however, the interaction between coastal erosion and rising sea levels poses a series of new questions. There is no obvious answer to the majority of these questions, and strategies and solutions will need to be developed for each territory, based on the specific risks concerned and in conjunction with the local populations. The task of identifying the most suitable solutions is also hindered by the limited nature of current knowledge of certain erosion mechanisms affecting our coastlines.

As well as natural phenomena, demographic changes also have a particularly strong impact on coastal development. Mainland France's coastlines are becoming increasingly popular, and this is leading to a greater concentration of housing in coastal municipalities. This increasing population density is being felt even more keenly in France's overseas territories and departments, where available land is often limited to a narrow coastal strip and where the demographic transition has yet to be completed. As a result of climate change, the need for coordinated, environmentally friendly coastal development is becoming ever more urgent.

Delivering a sustainable response to growing population needs poses a major challenge for all coastal territories, and especially island territories.

Should we really be extending our infrastructure into maritime areas at a time when sea levels are rising rapidly and coastal flooding is already a fact of life for many coastlines? Do we need to build new sea defences? Should we withdraw from coastal areas and scale back our socio-economic exploitation of these zones? Do we need to relocate property? There is now a pressing need to find the right balance between spatial occupation and resource use. The effects of climate change serve as a reminder that our planet is not infinite, that our resources are not unlimited and that inaction is not a viable option. We need to mobilise and face up to the challenges of the present, together, while preparing for the challenges of the future.

As things stand, our knowledge of many factors and phenomena remains limited. Nevertheless, we have sufficient information at our disposal to take action now. Using scientific research, the IPCC's Fifth Assessment Report, field studies and prospective models, we are well-placed to develop territorial projects that are consistent with future changes to our climate. As we seek to identify ways for future populations to live in our coastal territories, we also have a unique opportunity to achieve genuinely sustainable development.

Paul Vergès

Executive Summary

The coastline of France faces a range of highly specific challenges, in terms of demographics, urbanisation, socio-economic activities and the environment.

The attractiveness of coastlines, and the ever-growing trend for soil sealing, is making these territories increasingly vulnerable to the impacts of climate change.

The main impacts of climate change are rising temperatures, changing rainfall and cyclone patterns, the acidification of water and rising sea levels – an impact that is addressed in detail in this work.

Data gathered since the early 20th century reveal a significant trend, namely that sea levels rose substantially and quickly during the last century, at a rate five times faster than in previous millennia. In statistical terms, the average sea level rose by 1.7 ± 0.2 mm per year between 1901 and 2010, and by 3.2 ± 0.4 mm per year between 1993 and 2014.

All current climate models predict that average global sea levels will rise at a rate faster than that observed between 1971 and 2010 during the 21st century. This means that, in addition to the 20 cm rise in sea levels observed in the last 150 years, the sea is expected to rise by a further 26 to 82 cm by the end of this century. The exact rise will depend on the success of efforts to reduce greenhouse gas emissions.

Although the rise in average sea levels in the last 150 years may seem insignificant when compared with the height of waves and tides (which may exceed this figure by several orders of magnitude), the IPCC's summary report (2014) suggests that an average rise in sea levels of 0.5 m would, without suitable adaptation and protection measures, result in flooding occurring between 10 and 100 times more often.

In order to protect populations from flooding, a new risk, entitled "waves and flooding"¹ was added to the meteorological warning system in October 2011. This was developed by Météo-France, in conjunction with the French naval hydrographic and oceanographic service (SHOM) and with the support of the General Directorate for Risk Prevention at the Ministry of Ecology, Sustainable Development and Energy. The aim of this system is to notify the public and crisis management stakeholders in the event of a coastal flooding risk. It is the first link in the meteorological risk prevention and management chain. In a few rare cases, a population alert system may be triggered at departmental level, emergency services may be mobilised and shelter or evacuation orders may be issued.

Météo-France's marine and oceanographic forecasting service, the SHOM and government departments work closely together to continuously improve the "waves and flooding" warning system. This work involves improving observation and understanding of the phenomenon at local level, strengthening the tools available to forecasters (especially numerical wind, wave and storm surge models), and delivering training to forecasters.

Since the natural disaster compensation scheme was introduced in France in 1982, cost has been used as an indicator of event severity. This cost reflects the losses incurred by businesses and individuals affected by the natural phenomenon involved in the disaster, where the cause of the event has been officially recognised by ministerial order.

The cost of insurance payouts over the last 30 years reveals the increasing vulnerability of both homes and businesses. In order to reduce this vulnerability or, at the very least, to limit its rise, specific prevention and adaptation measures are needed to prevent the inevitable rise in the cost of natural disasters. However, there seems to be limited scope for adaptation when it comes to existing protection mechanisms, particularly when the emphasis is on feasible costs and guaranteed, sustainable security.

Improved long-term monitoring of natural phenomena, their consequences and the associated compensation costs will help to determine effective vulnerability reduction measures, with a view to avoiding risks and adapting to climate change, particularly on the coastline.

Following the significant damage caused by storms Lothar and Martin in 1999, Klaus in 2009 and Xynthia in

¹ This is one of the measures in the "Natural risks" sheet of the National Climate Change Adaptation Plan (PNACC) 2011-2015.

2010, the government has implemented a series of measures to regulate urbanisation in those areas exposed to erosion and coastal flooding risks. The “Flash Flood Plan” (PSR) was introduced in 2011 to meet operational needs in terms of preventing and protecting territories threatened by flood risks.

The National Flood Risk Management Strategy (SNGRI) – the EU Floods Directive as transposed into French law – sets out the short-term, medium-term and long-term flood risk prevention objectives. These national priorities will then be reflected locally in Flood Risk Management Plans (PGRIs), which will be used to plan, coordinate and implement priority actions in the most exposed territories.

Given the recognised impact of climate change on coastal risks, efforts must now focus on how to implement effective protective measures. This matter cannot be addressed without considering the role of these challenges within the system concerned. Anticipation of these risks must underpin all urbanisation strategies and must be reflected in a process of dialogue and consultation, in both the short and long terms, and all authorities must be involved in the associated governance process.

Another expected consequence of rising sea levels is coastal erosion, especially in low-lying and built-up coastal areas, although no systematic link between coastal erosion and rising sea levels in general has yet been clearly established.

With growing demographic pressure on its coastlines, the French government introduced a new strategy in March 2012 entitled “National integrated coastline management strategy: towards the relocation of activities and property”.

The challenge facing local authorities and the government is to reflect changes to the coastline in public policy, to make suitable, consistent urban planning and development decisions, and to adopt a long-term forecasting approach that considers the impacts of climate change and the consequences of these choices on the coastline and its uses.

The reconfiguration of territories must be treated as a genuine, alternative solution to traditional coastal protection and “coastal and sea defence” strategies, since these traditional approaches naturally involve soil sealing of the coastline, the disruption of exchanges between land and sea, and high expenditure on often ineffective operations.

Under a call for projects conducted under the above-mentioned national strategy, the Ministry of Environment has selected five projects involving coastal areas both in mainland France and overseas.

Based on the outcomes of these projects, a national guide will be developed, providing methodological and theoretical guidance on relocating activities and property in practice.

With modern GPS technologies, changes to France’s coastline are now monitored accurately and frequently in many areas, both in mainland France and overseas. However, due to insufficient knowledge of the complex processes that drive coastal erosion, the impacts of climate change and rising sea levels on these processes remain the subject of ongoing research and there are many unanswered questions. Coastal erosion cannot, therefore, be reduced to the linear transposition of past trends.

The sheer complexity of the problems facing scientists when seeking to assess the impact of climate change on the coastlines of mainland France can be clearly demonstrated by two examples, namely the beaches along the Mediterranean coastline and the chalk cliffs of Normandy.

Moreover, while it is now agreed that ecosystems make a contribution to coastal resilience, the extent of this contribution remains difficult to quantify.

Finally, the problem of coastal erosion is not exclusive to France – it is an issue faced by many European countries. International cooperation and dialogue between different political and cultural contexts therefore play a key role in facilitating cooperation between the population, local and national decision-makers and scientists. This was one of the ambitions of the European “LiCCO” (Living with a Changing Coastline) Interreg project, which ran from 2011 to 2014.

In conclusion, a futuristic short story illustrates some environmental and socio-economic changes that coastal regions may experience by the year 2070.