7. FRANCE

This country fiche provides a comprehensive overview and assessment of climate change adaptation in France. After detailing the vulnerability of the French coastal zones, the responsibility and financing for coastal protection is explained. Next, the fiche presents the relevant research activities, the coastal defence, risk reduction and adaptation plans available in France as well as the current and future protection and adaptation expenditure. The persons contacted and sources of information used are listed at the end.

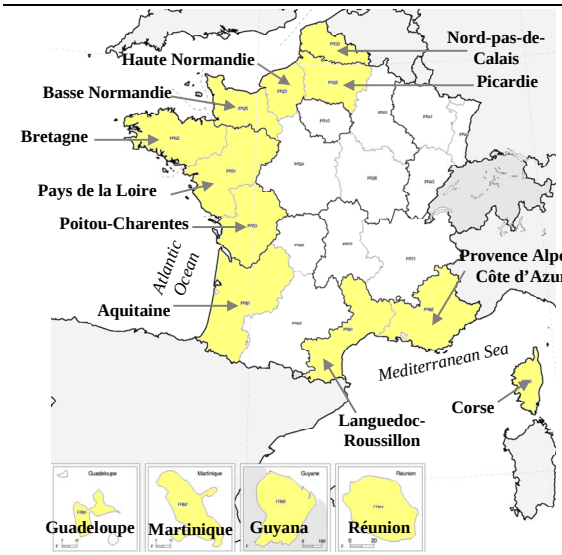
7.1. VULNERABILITY OF FRENCH COASTAL ZONES TO CLIMATE CHANGE

France is divided in 26 administrative regions[1] of which 15 are located along the sea. As illustrated in *Figure 7-1*, the 11 coastal regions of the mainland border the Mediterranean Sea in the south-east and the Atlantic Ocean in the west. In addition, France has 4 overseas regions, namely Guadeloupe, Martinique, French Guiana and the Reunion Island[2]. The total coastline of the mainland measures 8 245 km.

[1] France is a highly decentralised country where 26 regions are further divided in about 100 departments and almost 37 000 communes.

[2] The outermost regions are discussed in a separate fiche.

Figure 7-1: Coastal regions of France and their main physical and socio-economic indicators



Physical and socio-economic indicators	*North Sea*	*Atlantic Ocean*	*Mediterranean Sea*
Sea Level Rise	High	High	Medium
Coastline length	8 245km		
10 km coastal zone below 5 metres elevation	4.7%		
Coastline subject to erosion	2055 km (25%)		
GDP in 50 km zone (€ million)	256 430 (17%)		
Population in 50 km zone	16 185 472 (26%)		

Source: Policy Research based on EEA, 2006, The changing faces of Europe's coastal areas (for Sea Level Rise and 10 km coastal zone below 5 metres elevation); European Commission (Eurosion study), 2004, Living with coastal erosion in Europe: Sediment and space for sustainability (for coastline length and coastline subject to erosion); Eurostat 2004 (for GDP and population in 50 km zone)

The following paragraphs discuss the main climate change risks for the coastal zones of France.

a/ Flooding and erosion

All French coastal regions are to some extent affected by erosion, but their vulnerability to erosion is extremely variable. Sandy coasts representing about 30% of the French coastline are the most exposed. In contrast, muddy coasts in France are generally advancing and the majority of the rocky shores are considered stable. Consequently, the regions most vulnerable to erosion are Nord-Pas-de-Calais, Haute Normandie, Aquitaine and Languedoc-Roussillon. Over 50% of the coastline is receding in the departments Pas-de-Calais, Seine-Maritime, Pyrénées-Atlantiques and Gard. From a marine basin perspective, the Atlantic coasts are most vulnerable to erosion.

Concerning coastal flood-risks, the impact of Sea Level Rise (SLR) along the French coasts is still unknown. Nevertheless, along the sandy beaches waves will get closer to the beach when the problem of erosion is not counteracted sufficiently. This might increase coastal flood-risk in France, especially during storm surges.

b/ Freshwater shortage

Since 1976, France has been registered as one of the countries in Europe that has the highest frequency of droughts. In 2003, the summer combined limited precipitation with a period of very high temperatures. During the summer of 2005, around 400 km of permanent rivers were totally dry.

With respect to the impact of drought on freshwater supply, no detailed information seems to exist to date. Although climate change might aggravate potential freshwater shortage, the main factors that currently impact the quality as well as quantity of water are the overexploitation of existing resources and pollution. Communication campaigns launched in response to the recent drought events have raised awareness in the manufacturing sectors concerning the use of water[3].

c/ Loss of coastal eco-systems

In France, more than 20% of the land is located less than 250 metres away from receding coastlines. The majority of this land contains natural habitats such as wetlands. In this respect, the Camargue wetlands, situated along the deltaic plain of the Rhône river are actually the most important hot-spots as far as impacts from SLR concerns[4]. In order to protect the wetlands, part of the area was designated as natural park and nature reserve in 1970.

Following the 2003 heat wave, 67 French departments put into place an eco-system observation network. Fish mortality was registered in Loire-Bretagne and Rhône-Méditérranée. Many rivers and related eco-systems suffered from alga bloom development and increased eutrophication[5].

7.2. RESPONSIBILITY AND FINANCING FOR COASTAL PROTECTION AND CLIMATE ADAPTATION

In France, coastal protection is at present mainly a sub-national and private affair. Capital measures are exceptionally open to co-financing by the national government and the EU in case a high-risk situation as a natural disaster occurs or subject to prior agreements between the region and the state. Overall, the capital and maintenance cost needs to be born entirely by private landowners and regional and local authorities.

At national level, the *Ministry of Ecology, Energy, Sustainable Development and Land Settlement* is the competent authority for coastal defence of inhabited areas and the public maritime domain[6]. This

[3] ONERC, Groupe Interministériel, 2008, *Impacts du changement climatique, adaptation et coûts associés en France.*

[4] Paskoff R., 2000, *Implications of accelerated sea-level rise for France*, proceeding of SURVAS expert workshop on European vulnerability and adaptation to impacts of accelerated sea-level rise (ASLR), France.

[5] A high chemical nutrient level mainly caused by land, sea and air pollution, which results in low oxygen levels as well as algal blooms and dead sea beds.

[6] A definition of the exact width of the area could not be identified.

ministry is in charge of providing a coherent policy for coastal protection, but is not obliged to act in order to prevent erosion or flooding or to maintain the coastline. Support is provided by the *French Institute for the Environment* which collects and analyses all relevant information in relation to the environment and environmental risks[7] as well as by the *Conservatoire du littoral*, a French coastal protection agency acquiring and thereby protecting threatened natural areas across the 22 mainland regions.

At sub-national level the actors responsible for coastal protection are extremely diverse and the structures differ depending on the region. Besides private landowners, the relevant authorities that oversee coastal protection are the *regional and departmental directorates* for infrastructure, for the environment as well as for maritime affairs. In each region, the state is represented by a prefect. With respect to coastal protection, prefects are mainly involved in spatial planning regulation.

By law[8], the financial responsibility is set out to private property owners and to some extent to the devolved administrations, the local authorities. In some instances, regions may obtain funding by the state by means of state-regional planning contracts (CPER[9]). These 'regional development' contracts are established for a 7-year period and include the agreed funds put forward by the state, the region and the European Regional Development Fund. Measures related to coastal protection and adaptation to climate change can be included.

As to the management of water, France has been divided into 6 hydro-graphic basins[10] which all consist of a basin committee, a water agency[11] and a governing board. Water management plans and strategies known as *Schemas Directeurs d'Aménagement et de Gestion des Eaux* (SDAGE) outline the overall strategic directions in each catchment area.

7.3. RESEARCH INTO CLIMATE CHANGE VULNERABILITY AND CLIMATE CHANGE SCENARIOS IN FRANCE

Climate change research is mainly initiated at the national level. Although climate change scenarios and the variability of SLR along the French coast are currently unknown, some climate impact studies have recently been carried out. ONERC, *l'Observatoire National sur les Effets du Réchauffement Climatique*, has a coordinating role with respect to climate change research and policies in France.

7 The French Institute for the Environment is part of the Ministry of Ecology, Energy, Sustainable Development and Land Settlement.

8 The Law of 1807 attributes the responsibility for coastal protection to the coastal property owner.

9 CPER stands for Contrat de Project Etat Région.

10 Each water agency is responsible for a specific area: Artois-Picardie, Rhin-Meuse, Seine-Normandie, Loire-Bretagne, Adour-Garonne and Rhone-Méditérranée-Corse.

11 A water agency fights pollution (by means of constructing, extending or improving purification plants and waste water collection systems or induction of cleaner production procedures), develops and manages surface and groundwater resources and restores and maintains aquatic environments.

The '*Bureau de Recherches Géologiques et Minières*' (BRGM) and the '*Centre d'Etudes Techniques Maritimes et Fluviales'* (CETMEF) are two national research institutes regularly involved in climate change and coastal protection studies.

Studies currently supported by the French government and coordinated by the *Bureau de Recherches Géologiques et Minières* are VULSACO (2008-2010) and MISEEVA (2007-2010) both investigating the vulnerability of sandy coasts to climatic and human pressures, especially concerning erosion. The *Centre d'Etudes Techniques Maritimes et Fluviales* coordinated between 2004 and 2008 the DISCOBOLE project aiming to predict the long term impact of climate change for the coast and maritime sector in order to provide a better design and maintenance of coastal defence and waterworks.

In 2008, the *Caisse des Dépôts*[12] launched an international research programme on adaptation to climate change focusing on the design and modification of existing infrastructure in the light of climate change. Within the framework of this programme, two initiatives have already been set up, namely a symposium on climate change adaptation and a 'cities and climate change club'[13]. The programme will be implemented in partnership with ONERC, academic researchers, major infrastructure companies and (inter)national institutes as Météo France and OECD.

7.4. COASTAL DEFENCE, RISK REDUCTION AND ADAPTATION PLANS IN RELATION TO CLIMATE CHANGE

In France, the topic of climate change receives quite some attention. Although concrete efforts are to date mainly focused on mitigation, adaptation plans are under preparation at national as well as sub-national level. A dedicated organisation, ONERC, was established in 2001 to deal with the effects of global warming. Coastal protection as such is primarily a local affair. Regions can undertake actions in the framework of state-regional planning contracts and the state encourages the creation of risk prevention plans. The protection of the natural values of the French coastal zone is the responsibility of the Conservatoire du Littoral. Climate change scenarios are not taken into account in any of the operational actions currently undertaken.

a/ Studies and strategies

In France, *l'Observatoire National sur les Effets du Réchauffement* (ONERC) was created in 2001 to collect and disseminate information, studies and research on risks associated to climate change and

[12] *La Caisse des Dépôts* is a French financial institution under the authority of the French government.

[13] The club aims to pool knowledge on the management and financing of infrastructure and climate change and is focused on local authorities; three annual meetings will be set up to facilitate the discussion between local authorities and companies providing development services in the building, energy, transport and water sector.

extreme climate events. In addition, ONERC gives recommendations on potential measures of prevention and adaptation in order to limit the risks associated with climate change.

Under the *Plan Climat*[14], ONERC's mission has been extended to the coordination of adaptation measures in France and the preparation of an overall strategic framework. To this end, ONERC published in 2007 a *National Adaptation Plan to Climate Change*[15]. The plan was established on the basis of extensive consultations with different ministries and is an intermediate step between impact studies published by scientists and the development of an action plan ready for implementation. Recommendations formulated in the plan and most relevant in the scope of coastal protection include:

- Perform more in-depth research to the risk of climate change and the probability of extreme events, identify the vulnerability of socio-economic systems and natural eco-systems and cover different adaptation options;
- Promote strategic retreat in coastal areas where climate change impacts are predicted;
- Use coastal risk prevention plans[16] for planning purposes and enforce the Coastal Law more effectively in relation to areas where building is not permitted;
- Carry out a study to the possible funding mechanisms of climate change adaptation, following a prior assessment of the cost of adaptation.

In addition, and according to the stipulations of the *Plan Climat*, ONERC together with the Directorate General for Energy and Climate established in March 2007 an inter-ministerial working group to assess the impacts and the cost related to climate change. One year later, the group published its first intermediate report[17] which sets out the methodological framework for climate adaptation in France and presents the current state-of-play of climate vulnerability in 7 sectors including agriculture and water resources, tourism, health as well as natural risks and insurance. A final report and more concrete adaptation plans detailing sectoral measures to be undertaken is expected for 2009.

Climate change is also receiving increased attention at regional level. In 2003, *Languedoc-Roussillon* local authorities in cooperation with the state[18] defined strategic guidelines for the management of erosion in the region and identified 8 specific locations in need of additional protection. A technical and methodological guide was developed in 2005 to assist managers in dealing with the problem of coastal erosion locally. In 2007, the prefect of the *Nord-Pas-de-Calais* region organised a meeting with coastal stakeholders on natural risks and climate change. As a follow-up, the prefect initiated a research programme to assess the current situation regarding coastal flooding and to perform a

[14] The climate plan for France 2004-2012 (*Plan Climat*) was established in 2004 and updated in 2006; it represents the French action plan in counteracting global warming and complying with the Kyoto Protocol; the plan mainly focuses on mitigation measures, adaptation is only briefly referred to.

[15] ONERC, 2007, *Stratégie nationale d'adaptation au changement climatique.*

[16] Plans de prévention des risques littoraux.

[17] ONERC, Groupe Interministériel, 2008, *Impacts du changement climatique, adaptation et coûts associés en France.*

[18] Comité Interministériel d'Aménagement du Territoire, 2002, *Orientations stratégiques pour la gestion de l'érosion en Languedoc-Rousillon.*

regional analysis of the potential climate change consequences as well as flooding probability between 2050 and 2100.

b/ Operational measures

By law, private property owners are responsible for coastal protection measures. As a result, coastal protection measures are undertaken by a wide variety of actors at the sub-national level including private landowners, the local communes, the region and the department and are not recorded in a systematic manner. State-regional planning contracts (CPER) are the only reference documents for coastal protection measures scheduled by the regions that could be identified. The CPERs of Languedoc-Roussillon and Nord-Pas-de-Calais, two of the regions most vulnerable to coastal erosion, are presented as case in point. In addition, different types of coastal risk plans are established at the local level. However, SLR or other climate scenarios are not taken into account in any of the measures undertaken.

In terms of the protection of natural coastal areas, the activities of the 'Conservatoire du Littoral' are worthwhile mentioning.

State Regional Planning Contracts

State-regional planning contracts or *Contracts de Project Etat Région* (CPERs) formalise sustainable regional development in France. The contracts are signed between the regional prefect, representing the state, and the head of the regional council and define the joint actions of the region and the state for a period of 7 years. Contracts moreover coincide with EU-funding timeframes. Each CPER defines high-level development priorities, a number of major projects and specific actions.

In the CPER 2007-2013 of Nord-Pas-de-Calais two major projects partly relate to coastal protection and climate change, namely the *development and preservation of the coast* and the *creation of a regional climate plan and management of the environment*. The development and preservation of the coast primarily includes research into coastal flood-risk[19] as well as the monitoring of the coastline with respect to erosion. The regional climate plan on the other hand mainly focuses on mitigation. Under this project, the management of flood-risk is also referred to, but this action is not dedicated to the coastal zones specifically.

The CPER 2007-2013 of Languedoc-Roussillon devotes predominantly attention to the *preservation of the environment to ensure regional attractiveness*. To this end, the following actions have been included in the CPER:

[19] The prefect of Nord-Pas-de-Calais initiated a research programme to assess the current situation regarding coastal flooding and to perform a regional analysis of the potential climate change consequences and flooding probability between 2050 and 2100.

- Prevent natural risks: floods concern the most important risk for the region, especially along the coast; actions mainly focus on research with respect to impact and risk reduction;
- Ensure sustainable management of water resources: water resources need to be sufficiently available and of good quality; actions need to be undertaken to cope with increased demands, preserve the quality of water resources and to anticipate the effects of the changing climate; actions focus on the optimisation of water usage by means of water saving and demand management measures and where need be the installation of alternative water supplies;
- Preserve and valorise biodiversity: actions focus on the development of management plans for natural national and regional parks, Natura 2000 listings, the study and restoration of eco-system landscapes and the implementation of a lagoon monitoring network (started in 2000);
- Fight against climate change: Languedoc-Roussillon is highly energy dependent; actions focus on mitigating climate change effects.

In addition, the *sustainable management of the coast* project is primarily focused on the rehabilitation and additional protection of 8 coastal sites[20] highly exposed to erosion[21]. Besides the implementation of concrete protection measures, actions encompass studies to better understand the impact of climate change and erosion for the coastal zones.

Risk prevention plans

Risk prevention plans or *'Plans de Prévention des Risques'* (PPR) are spatial plans established at community level[22] under the authority of the regional prefects. PPRs indicate the areas at risk of natural or industrial disasters in France. For the coastal zones, three relevant types of PPR can be distinguished:

- Plan de Prévention des Risques d'Inondation (flood);
- Plan de Prévention des Risques Falaises Littorales (coastal cliffs);
- Plan de Prévention des Risques Zones Basses (low-lying areas).

Each plan includes hazard areas as well as building restrictions[23]. Building restrictions and protection policies in coastal zones vary greatly among the different regions, from allowing natural retreat to complete artificial modification of the coast.

The creation of risk prevention plans is encouraged by the state, who will verify the existence of such plans before allocating funds for coastal protection measures. Climate scenarios as such are not taken into consideration in any of the plans.

[20] These sites include: Grand Site de la petite Camargue, Lido du petit du grand Travers, Lido de Villeneuve les Maguelone à Frontignan, Lido de Sète a Marseillan, Côte Ouest de Vias, Ile des Coussoules, Étang de Canet Saint Nazaire and Site de Paulilles sur la commune de Port-Vendres.

[21] Selected by the 'Comité Interministériel d'Aménagement du Territoire' at the end of 2002.

[22] Some plans are developed by a group of communes and run by a 'syndicat mixte'.

[23] Building is forbidden in red zones, allowed under certain conditions in blue zones and allowed for any kind of development in white zones.

Protection of natural coastal areas

Already in 1975, the French government created a public coastal protection agency entitled 'Conservatoire du Littoral' to ensure the protection of natural areas on the coast, banks of lakes and stretches of water. The agency's concrete remit is the acquisition of threatened natural areas across the 22 mainland regions on the basis of three main criteria:

- The site is threatened by urbanisation;
- The site has deteriorated and needs rapid restoration;
- The site is closed to the public whereas it should be open to everyone.

Land may be acquired on the basis of private agreements, by pre-emption in coastal areas defined by the departments or by expropriation[24]. Land may also be given to the Conservatoire by means of donation or legacy. On average, 20 to 30 km² of land is acquired each year. When the necessary restoration works have been completed, the agency entrusts the management of the land to local authorities or specific organisations. The working budget of the agency is mainly provided by the national government. The EU, local authorities and private organisations occasionally contribute a minor part.

7.5. PAST, PRESENT AND FUTURE ADAPTATION EXPENDITURE

In France, the coastal protection and climate change adaptation expenditure for the coastal zones can be divided between the amounts spent to coastal flooding and erosion and those related to the protection of natural habitats.

a/ Flooding and erosion

In France, private property owners are in first instance responsible to finance coastal protection works. Regions may however obtain financial support from the national government as well as the EU through CPERs[25]. Therefore, the coastal related expenditures within the CPERs of the 4 regions most vulnerable to coastal flooding and erosion in France are presented in *Table 7-1*[26]. In these regions, the coastal protection expenditure over the period 1998-2015 totals € 207 million.

In 2008, the total coastal protection investment in mainland France was close to € 27.30 million. The region Languedoc-Roussillon in particular devotes attention to the protection against coastal flood-risk and erosion, with the related expenditure amounting to € 22.68 million in 2008.

[24] Expropriation only occurs in exceptional circumstances and on land of public interest.

[25] The contribution of the EU and the state differs for every region; in the CPER of Languedoc-Roussillon the national government contributes about 35% and the EU about 20%; in the CPER of Nord-Pas-de-Calais the state contributes about 67%; in the CPER of Haute Normandie the state contributes about 53%.

[26] The budgets dedicated to coastal protection in the CPER's of the other regions seem negligible.

Table 7-1: Expenditure to protect against coastal flooding and erosion *(in € million)*

Year	CAPITAL EXPENDITURE				INDIRECT EXPENDITURE *Studies and research*	**TOTAL**
	*CPER Nord-Pas-de-Calais**	*CPER Languedoc-Roussillon***	*CPER Haute Normandie****	*CPER Aquitaine*****		
1998	*n.a.*	*n.a.*	*n.a.*	0.00	<1	1.00
1999	*n.a.*	*n.a.*	*n.a.*	0.00	<1	1.00
2000	0.00	0.70	*n.a.*	0.00	<1	1.70
2001	0.00	0.70	*n.a.*	0.00	<1	1.70
2002	0.00	0.70	*n.a.*	0.00	<1	1.70
2003	0.00	0.70	*n.a.*	0.00	<1	1.70
2004	0.00	0.70	*n.a.*	0.00	<1	1.70
2005	0.00	0.70	*n.a.*	0.00	<1	1.70
2006	0.00	0.70	*n.a.*	0.00	<1	1.70
2007	0.86	22.68	2.76	0.00	<1	27.30
2008	0.86	22.68	2.76	0.00	<1	27.30
2009	0.86	22.68	2.76	0.00	<1	27.30
2010	0.86	22.68	2.76	0.00	<1	27.30
2011	0.86	22.68	2.76	0.00	<1	27.30
2012	0.86	22.68	2.76	0.00	<1	27.30
2013	0.86	22.68	2.76	0.00	<1	27.30
2014	*n.a.*	*n.a.*	*n.a.*	0.00	<1	1.00
2015	*n.a.*	*n.a.*	*n.a.*	0.00	<1	1.00
TOTAL	6.02	163.64	19.32	0.00	18.00	**206.98**

* *The CPER for the period 2000-2006 does not include any actions against coastal flooding or erosion; for the period 2007-2013 the CPER accounts for investments in both studies with regard to coastal flooding and measures against coastal erosion*

** *The CPER expenditure on coastal flooding and erosion for the period 2000-2006 has been converted to Euro based on the Euro fixed conversion rate of 6.55957; for the period 2007-2013, Policy Research has taken into account 70% of the expenditure foreseen for the actions focused on the prevention from natural risks (€ 16.58 million per year) and the sustainable management of the coast (€ 6.1 million per year)*

*** *The CPER of Haute Normandie for the period 2000-2006 is not publicly available, for the period 2007-2013 the CPER expenditure on flooding, erosion and the drainage of rain water has been taken into account*

**** *The CPER of Aquitaine for the period 2000-2006 does not include any actions against coastal flooding or erosion; the CPER for the period 2007-2013 refers to the creation of a risk reduction plan concerning ground movements but this seems not to be particularly related to the coastal zone; in the projects related to the coasts, none are related to protection against violence from the sea or climate change; small amounts are integrated in the financial annex of the CPER for what concerns flood-risk, but seem not specifically related to coastal zones*

b/ Coastal eco-systems

Besides the protection against coastal flooding and erosion, the *Conservatoire du Littoral* ensures the protection of natural coastal areas by means of land acquisition and habitat restoration works. In 2008, the total expenditure amounted to € 28.6 million. This amount is not specifically related to flooding or erosion. A detailed overview is presented in *Table 7-2*.

Table 7-2: Protection of natural coastal areas *(in € million)*[*]

Year	CONSEVATOIRE DU LITTORAL		**TOTAL**
	Land acquisition	*Habitat restoration works*	
1998	10.86	4.84	15.70
1999	9.95	4.62	14.57
2000	11.90	2.29	14.19
2001	23.55	3.89	27.44
2002	10.86	3.66	14.52
2003	21.05	3.67	24.72
2004	17.11	6.11	23.22
2005	16.94	4.37	21.31
2006	10.87	4.76	15.63
2007	24.39	7.20	31.59
2008	21.00	7.60	28.60
2009	20.00	7.00	27.00
2010	20.00	7.00	27.00
2011	20.00	7.00	27.00
2012	20.00	7.00	27.00
2013	20.00	7.00	27.00
2014	20.00	7.00	27.00
2015	20.00	7.00	27.00
TOTAL	318.48	102.01	**420.49**

[*] *Figures provided by the Conservatoire du Littoral*

7.6. PERSONS CONTACTED AND SOURCES OF INFORMATION USED

7.6.1. PERSONS CONTACTED

Name	***Organisation***
Armand, Ludovic	Ministry of Ecology, Energy, Sustainable Development and Land Settlement
Arnold, Pascal	Ministry of Ecology, Energy, Sustainable Development and Land Settlement
Bazin, Patrick	Conservatoire du littoral
Colas, Sebastien	French Institute for the Environment
Clus-Auby, Christine	Secretary General EUCC-France
Gayraud, François	Regional Directorate for Maritime Affairs Languedoc-Roussillon
Henique, Julien	Regional Directorate for the Environment Nord-Pas-de-Calais
Jaquimoussara, Helene	Délégation interministérielle à l'aménagement et à la compétitivité des territoires
Dr Lenôtre, Nicole	Bureau de recherches géologiques et minières
Letellier, Casimir	Regional Directorate for Infrastructure - Dunkerque
Morvan, Regis	Ministry of ecology, energy, sustainable development and land settlement
Musson, Marine	Conservatoire du Littoral
Vanroye, Cyril	Regional Directorate for the Environment Languedoc Roussillon
Verger, Fernand	École Normale Supérieure – Department of Geography

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