

Coastal adaptation to climate change : from observations to public policies in France

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Climate Change and Sea Level Rise: Coastal vulnerability and societal impacts
Collège de France, June 10-11th 2013

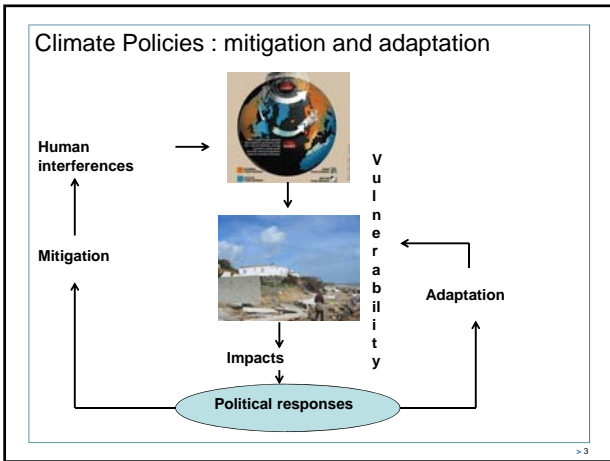
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Coastal Risks

- > Currently, 25% of the French coastline is eroding
- > Vulnerability to coastal inundation has been highlighted by the impacts of several severe storms:
 - Lothar in 1999 and Xynthia in feb 2010 along the Atlantic coast
 - 1982, 1997, and 2003 storms on the Mediterranean coast
- > Climate change impacts will exacerbate existing coastal erosion and inundation hazards in the 21st century (Nicholls et al., 2007)

Inundation during Xynthia, March 2010. Source: Régis Duvigneau

Damage to port structures (Île de Ré, port de La Flotte). Source: Pedersen et al. (2010)



Key messages conveyed to the Ministry of Environment

- > Some sections of the coastline are vulnerable, whatever the future effects of climate change
- > In some regions, we expect an increase of coastal hazard together with increased human pressure
- > In these regions, it is still possible to choose between an increase urbanisation OR to limit it on sea front
- > Without any impulse from the national authorities, we expect increase of urbanisation in hazardous coastal areas

Data: BRGM, DREAL, IGN

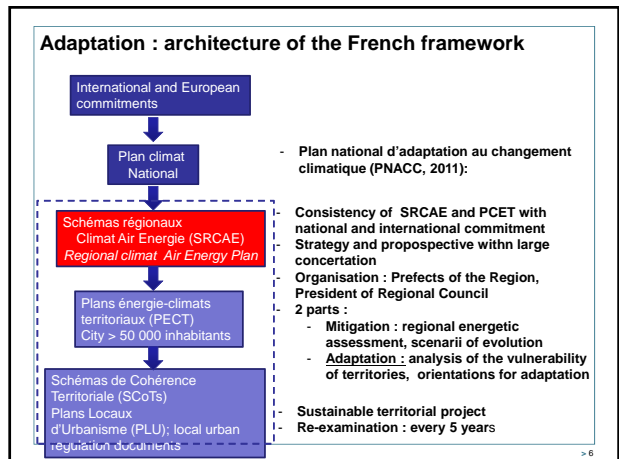
Photos: Y. Krien, BRGM

Photo : Agglo Thau

Recent progresses in adaptation policies implementation

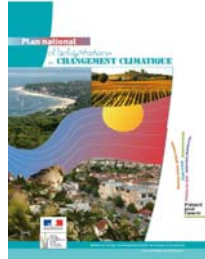
- > Grenelle de l'Environnement (2007)
 - > Law 3rd August 2009 "Grenelle 1"
 - > Law 12th July 2009 "Grenelle 2"
- > Grenelle de la Mer (2009)
 - ➔ Stratégie nationale de gestion intégrée du trait de côte (2012)- National strategy for integrated management of coastline
- > Plan Climat (2006)
 - National WGs : RNACC 2008 – 2010 (Risques naturels, assurances, changement climatique – Natural risks, insurances, climate change)
 - Dialogue (government, elected representatives, the employers, unions, NGO, Experts) 2010
- ➔ Plan National d'adaptation au changement climatique (2011) National Plan for adaptation to climate change

Use existing instruments and add consideration of climate change



Plan National d'Adaptation au Changement Climatique
PNACC 2011 - *National Plan for Climate Change Adaptation*

- > **Items** : energy, water resources, road infrastructures, natural risks, coastal risks (**erosion, marine submersion**)
- > **Integration of climate change adaptation to already existing public policies**
- > **when possible: to adapt the regulation and types of governances**
- > **to adopt a national strategy to manage coastline and develop observatory networks of littoral (long terms series)**
- > **to improve knowledge of natural and anthropic phenomena and their evolution,**
- > **Cost benefit and multi-criteria analysis**



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Which Sea Level Rise scenario for adaptation policies?

- > **Sea level projections for 2100 :**
 - 30 to 60 cm (IPCC, 2007)
 - 1m or more (Semi-empirical approaches: Rahmstorf, 2007; Grinsted et al., 2009;...)
 - Nowadays : 50 cm to 1m, with high regional variability? (e.g. Slangen et al., 2012, ...)
- > **As science is progressing, sea level rise projections are evolving**
- > **However, at the same time, authorities must take adaptation and risk prevention decisions**

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French Sea Level Rise Policy

- > **Different French studies/synthesis**
 - "Impacts à long terme du changement climatique sur le littoral métropolitain" (Etudes et documents MEDDE, n° 55 , octobre 2011
 - Ministerial group RNACC
- > **ONERC (Observatoire national sur les effets du réchauffement climatique) :**
 - WG of Experts to define values ("Sea level rise report", 2012)
 - Document : Prise en compte de l'élévation du niveau de la mer en vue de l'estimation des impacts du changement climatique et mesures d'adaptation possibles. *SLR to estimate impacts of climate change and adaptation*

Official values for coastal risks prevention plans

Hypothesis	2030	2050	2100
Optimistic	10	17	40
Pessimistic	14	25	60
Extreme	22	41	100

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Plan de prévention des risques naturels prévisibles (PPR) :
PPR-littoraux - *Foreseeable natural risk plan*

Law 02/02/1995, opposable document
Basin of risk
Scale 1 : 25 000 enlarged to 1 : 10 000

- > **PPR-L (1995)**
 - Submersion : occurrence 100 yrs, without SLR .
 - SLR exceptionally taken into account if lot of elements at risk (estimated margin)
 - Assessment undertaken by regional agencies of the administration
- > **Revised PPR-L (2011)**
 - **submersion for a centenal return period**
 - Present hazard : + 20 cm (present SLR)
 - Hazard in 2100 : + 60 cm SLR
 - Uncertainty (model, quality of data, ...) : + 25 cm

Inland hydrodynamic flooding models have a better accuracy (some cm) than the best existing DTM (LIDAR +/- 20 cm)
Above 1 m height of inundation : Building is not allowed

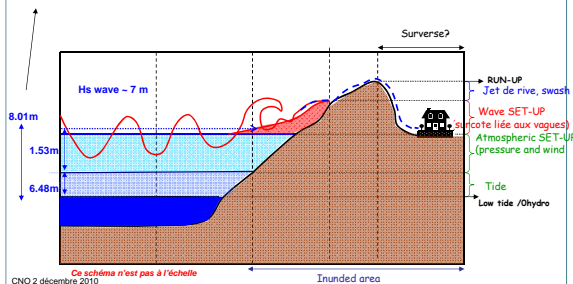
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Modeling submersion – Set-up

Caractérisation Xynthia 28th feb 2010
(Source SHOM, à la Rochelle – la Pallice)

Terrestrial Zéro = Hydro Zéro - 3,504 m

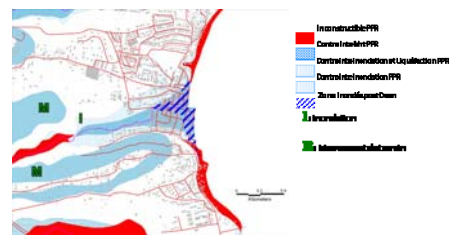
Atm Set-up = 4.506 m (NGF)



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Example of Multi-hazards PPR
Guadeloupe (West Indies)

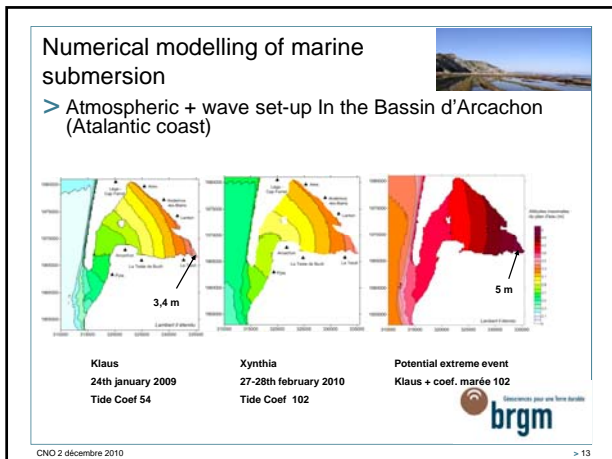
Inundation, landslide, coastal erosion, marine submersion



Comparison between PPR and impact of Dean Cyclone (2009)

Report BRGM/RP-44911-FR

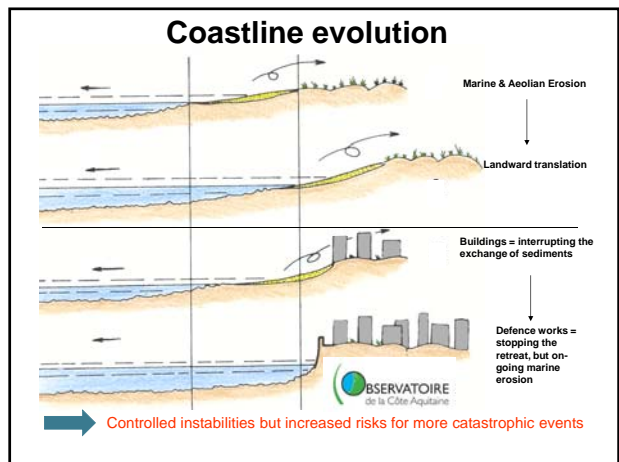
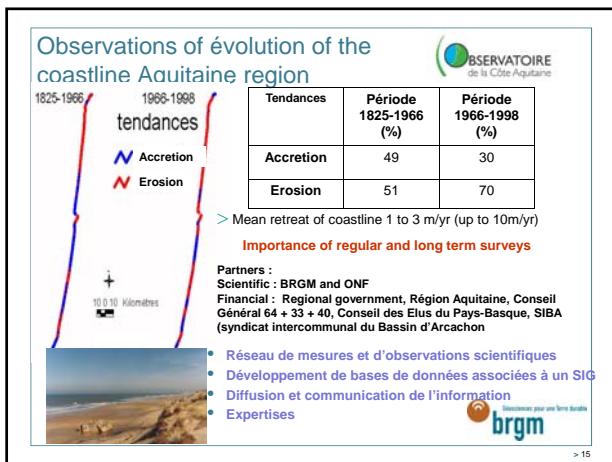
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Stratégie nationale de gestion intégrée du trait de côte (2012) - National strategy to coastline integrated management

- > Includes climate change
- > To create a national network of observation and monitoring of evolution of coastline with regional actors
- > National mapping of coastal erosion and identify territories with erosion risks
- > Better use of urban and prevention risk tools PLU, SCOT, ...
 - Enlarge the 100 m littoral public property
 - Multi-risks PPR (marine submersion, estuarian dynamics, coastal erosion)
 - Defense works at the right scale of the phenomenon (sedimentary cell)
- > Prepare the relocation of activities (large concertation with Government, local and regional authorities,
- > Identify financial mechanisms

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Example

> Interministerial WG « Risques naturels, assurances et changement climatique – Natural risks, insurances and climate change (2008 – 2010)

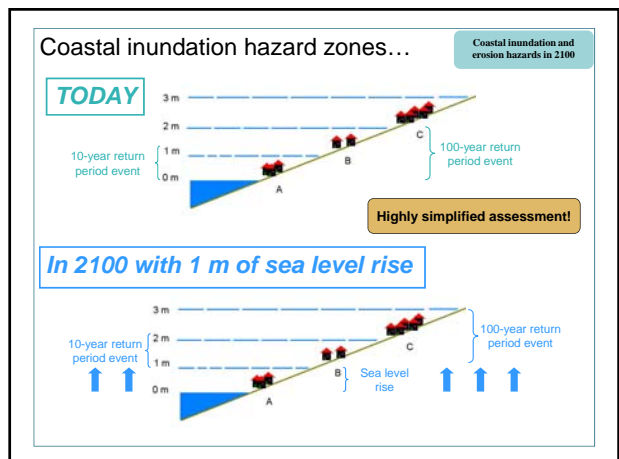
Sub working groups:

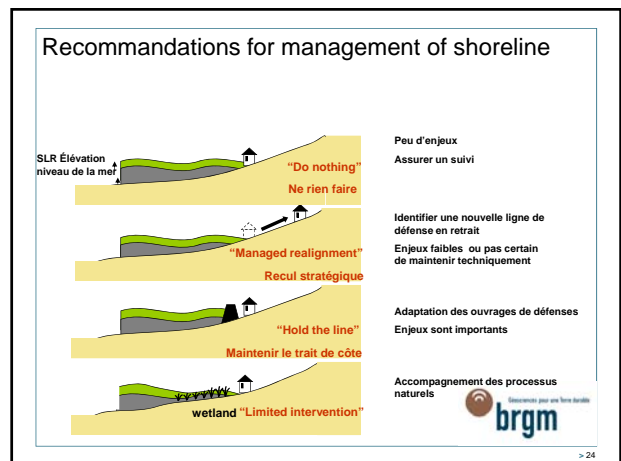
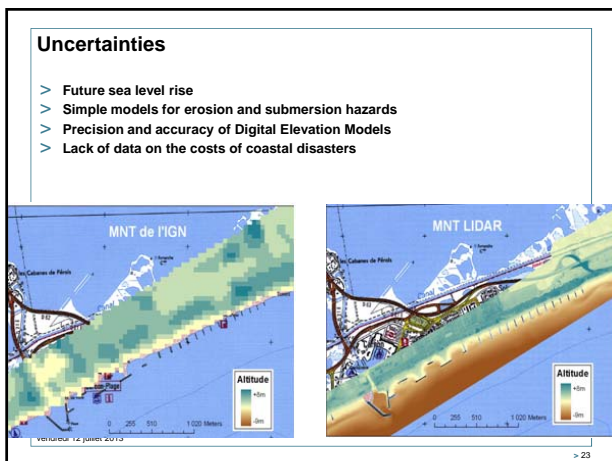
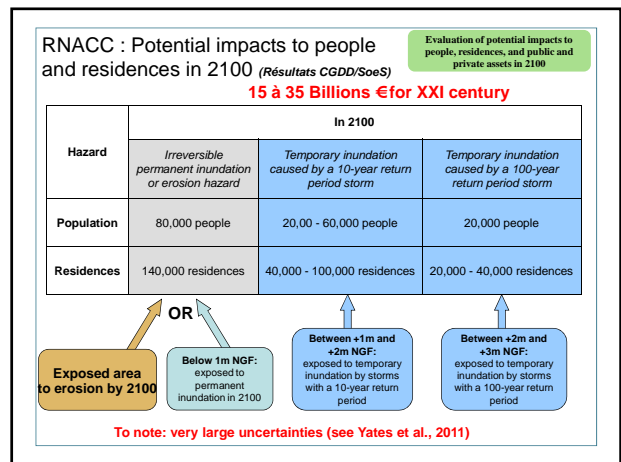
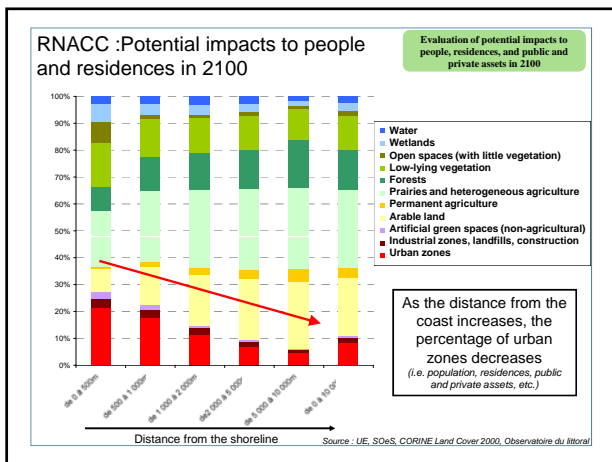
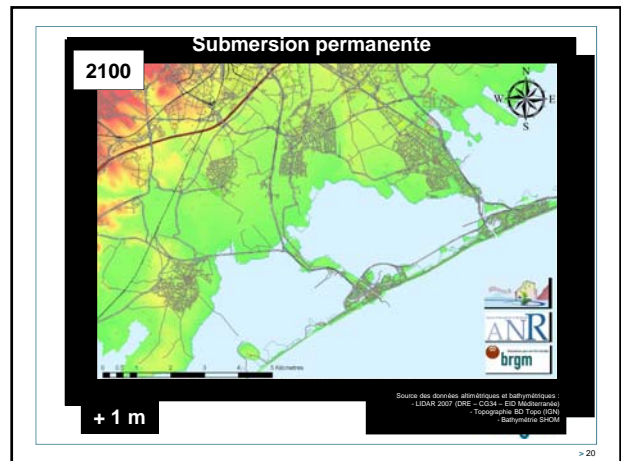
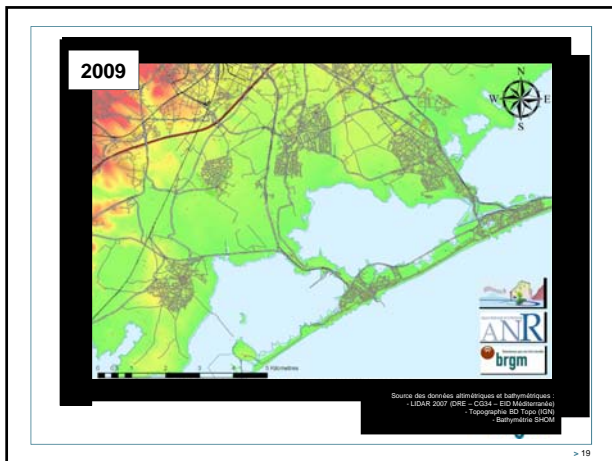
- Swelling and shrinking of clays
- Landslides
- Floods
- Coastal risks

Estimate costs of damages caused by coastal erosion and inundation, and identify what is specifically caused by climate change

> Focus on Languedoc-Roussillon Region (French Mediterranean coast)

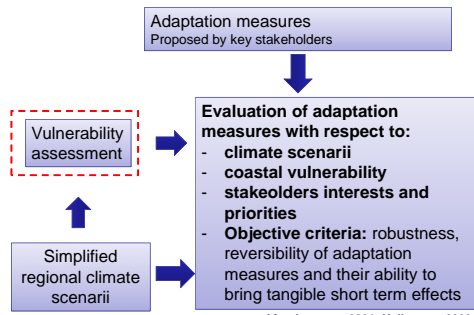
2003, Messina (2004)





How to connect vulnerability assessment and adaptation measures?

we suggested the « robust decision making » approach



After Lempert, 2001; Hallegatte, 2009

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Adaptation recommendations

- > Enhance knowledge, particularly with regular data collection at representative study sites to improve long term coastal evolution data and modeling
- > Need of accurate Digital Terrain Model (LIDAR) for all low coast areas
- > There is a gap between scientists and stakeholders/public : explain and share knowledge with them to accurately communicate risk perception
- > Development of planning programs that take into account climate change (e.g. government risk prevention plans, inundation zone maps, local urban planning documents, land use planning management)
- > Studies and protections have to be done at the right level (Basin of risk, sedimentary cell)
- > There is a panel of defence works (hard and/or soft) which are adapted to each case and can be used in a same area
- > Relocation and adaptation strategies at all levels of management (local, regional, and national)
- > Insufficient data for robust cost-benefit analysis
- > Adopting « without regrets » adaptation measures addressing today's risks as a first step toward addressing future coastal risks

Increased risk of over-adaptation (high cost of adaptation) and under-adaptation (high cost of damages), both with strong economic consequences (Hallegatte et al., 2006)



Wimereux 2005 ©Jean Cailé

Merci pour votre attention



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