Adaptation, Uncertainty, and Climate Change

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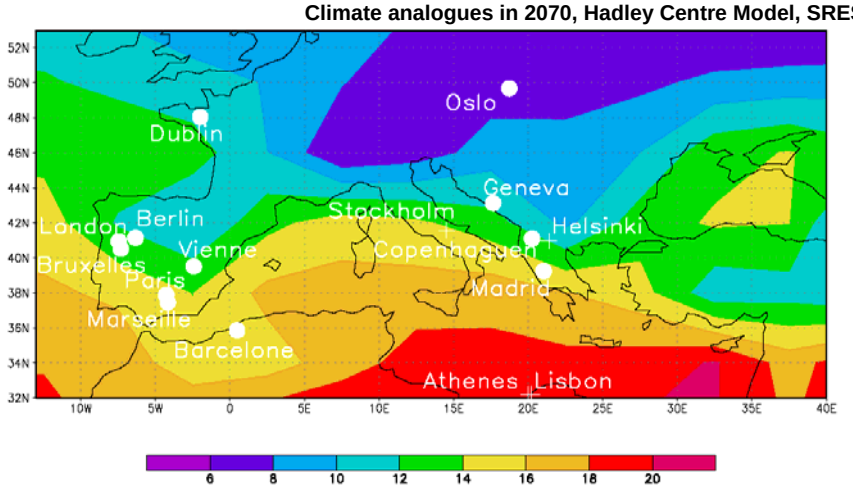
Adaptation means anticipation

- Adaptation will require **technical know-how** and **substantial funding.**
- **Adaptation requires also anticipation**, especially in sectors with long-term investments:
  - Water management infrastructure (lifetime: up to 200 years);
  - Energy production and distribution infrastructure (up to 80 years);
  - Transportation infrastructure (50 to 200 years) ;
  - Natural disaster protections (50 to 200 years);
  - **Urbanism, housing and architecture (25 years to centuries).**
- These infrastructures represent more than 200% of GDP in developed countries;
- In developing countries, cities and infrastructures are currently being built and it is urgent to take climate change into account.
- Anticipation is difficult, for two reasons.

Adapting to a changing climate

Climate analogues in 2070, Hadley Centre Model, SRES A2



After Hallegatte, Ambrosi, Hourcade (2007)

It is neither more difficult nor expensive to design a building for the Cordoba climate than for the Paris climate. But what about a building able to cope with both climates?

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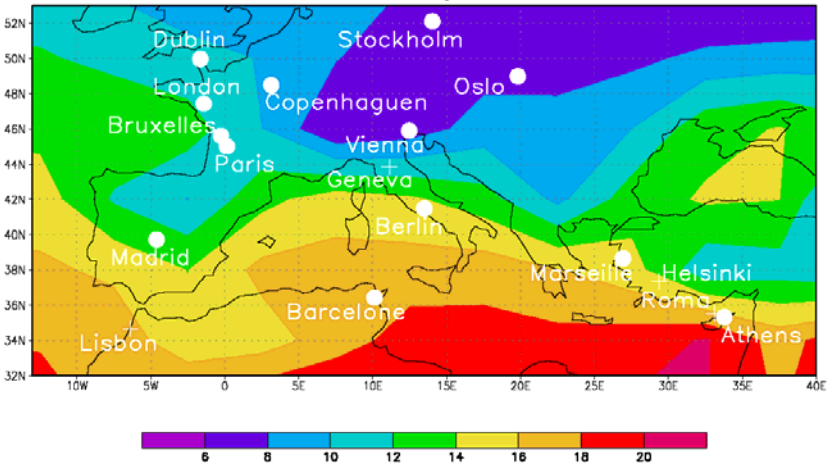
Coping with uncertainty

Climate analogues in 2070, Météo-France Model, SRES A2



After Hallegatte, Ambrosi, Hourcade (2007)

The « optimal » strategy is very different depending on the model that is used. **We need new decision-making methods to cope with this new problem**.

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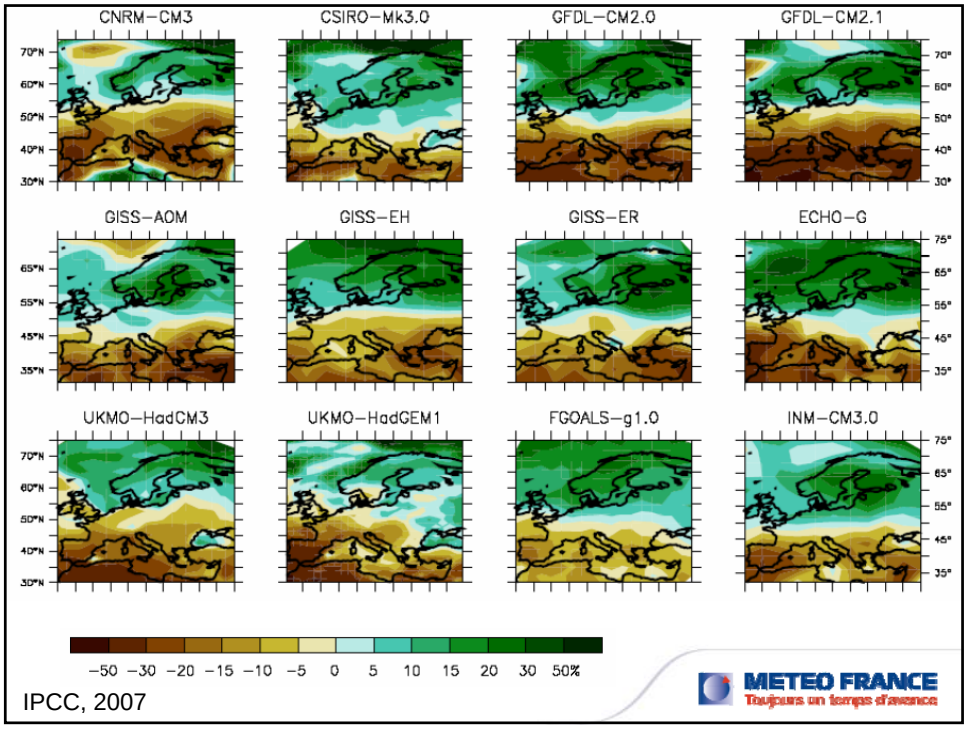

IPCC, 2007

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Developing adaptation strategies able to cope with uncertainty

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Looking for robustness

- **Selecting no-regret strategies that bring benefits even in absence of climate change, and for most climate scenarios:**
  - Most Disaster Risk Reduction Actions;
  - Improve building norms;

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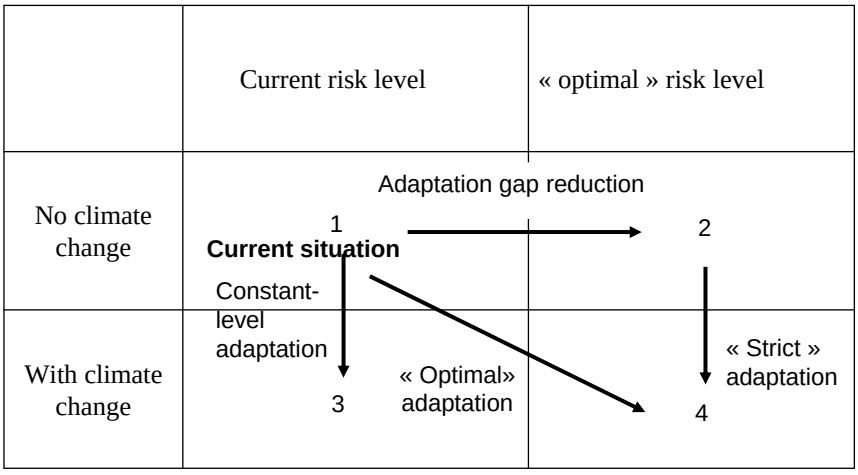
Several definition for adaptation



And it is not a two-stage process, but a dynamic process!

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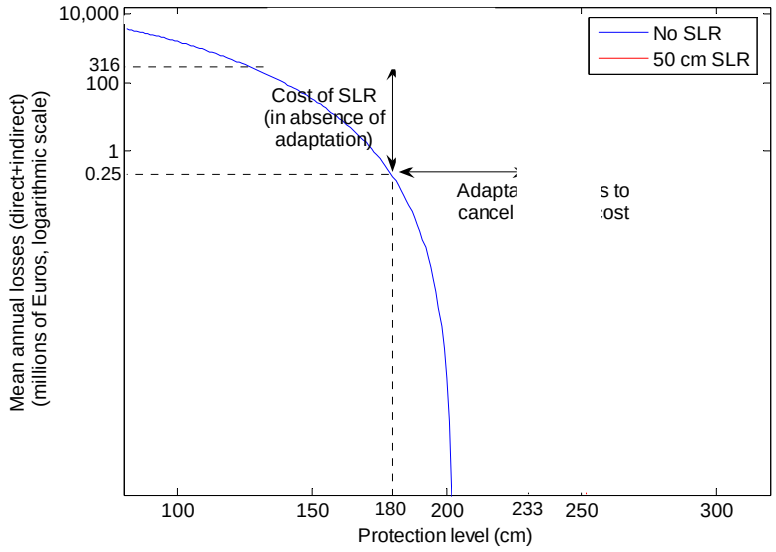
Cost of climate change vs. adaptation cost in Copenhagen

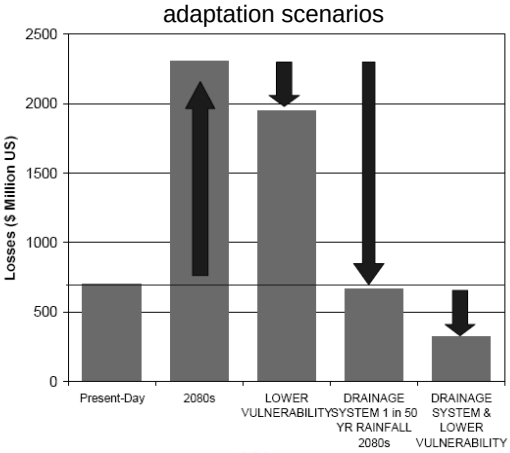
Assuming a homogenous 180 cm protection in Copenhagen.



Flood losses and adaptation in Mumbai

- **Adaptation can reduce direct losses below their current level**
- **Many adaptation options are no-regret.**
- **Why have these options been neglected so far?**
  - **Capital market imperfections?**
  - **Lack of political will or economic weight of marginalized population?**
  - **Institutional fragmentation?**

Loss from the 100-yr event in different adaptation scenarios



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- **Favoring reversible strategies over irreversible ones (avoid lock-ins):**
  - More restrictive land-use plans;

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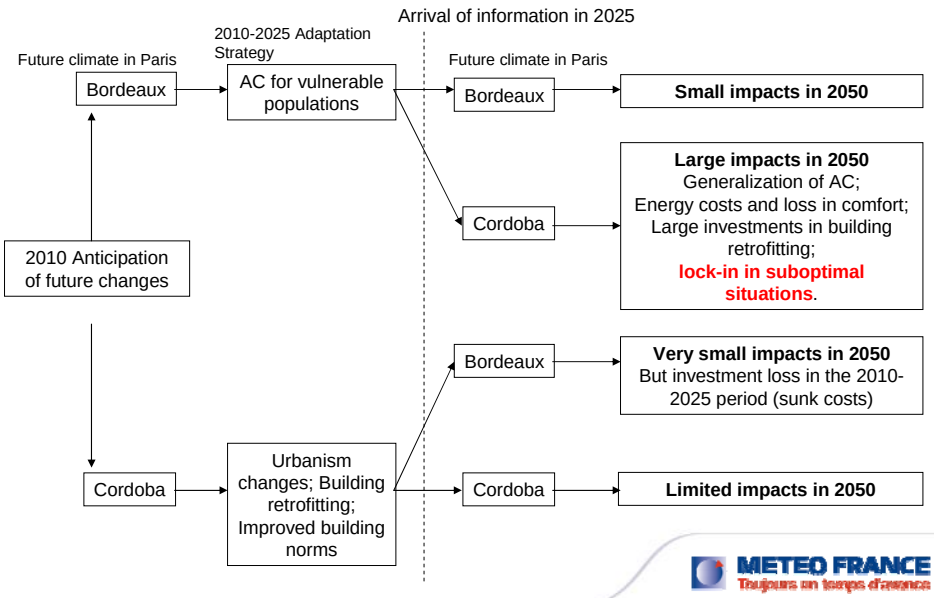
Long term anticipation and « lock-ins »



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- **Investing in low-cost "safety margins":**
  - Drainage infrastructures in Copenhagen.
- **Reducing investment lifetimes:**
  - Housing building quality and lifetime in hurricane-prone areas ("Building strong"?)
- **Favoring financial and institutional ("soft") adaptation over "hard adaptation":**
  - Early warning, evacuation and insurance vs. sea walls and dikes.
  - Changes in norms and regulations.

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- **Looking for synergies between adaptation and mitigation**
  - Energy cost and water desalinization.
  - Urban and land-use plans

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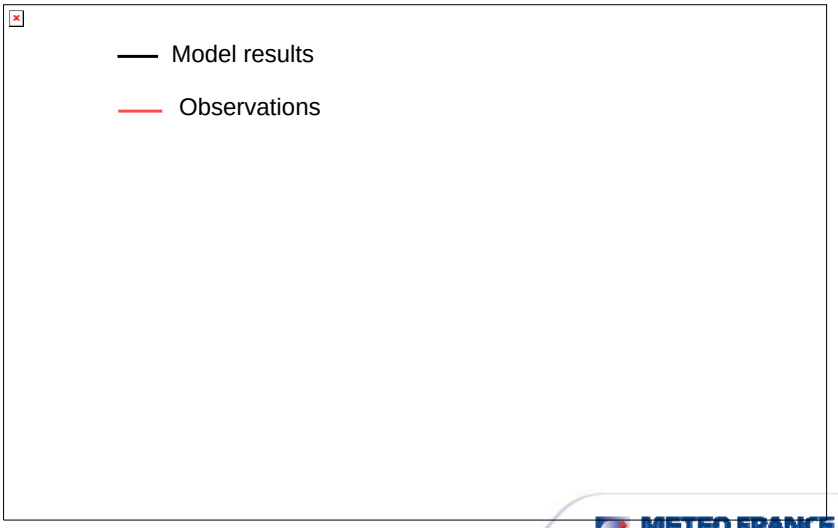
- **Taking into account other policy goals to get support to adaptation investments**

The 2003 heat wave: a chilly 2080 summer?



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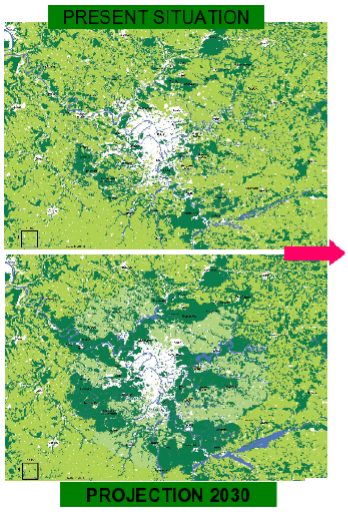
We can adapt our cities to higher temperatures

Assuming the implementation of specific measures to limit the urban heat island.



Source: CNRM, Météo-France (V. Masson, G. Pigeon, A. Lemonsu, C. Marchadier)

Trade-offs in urban policies in Paris

- **More resilient buildings, promoted by stricter construction norms:**
  - Lower energy consumption and carbon emissions;
  - Lower vulnerability to heat waves, and possibly floods;
  - **BUT** Higher construction costs and higher rents, smaller housing surface and more difficulty for modest households to access housing;
  - And transformation of the city of Paris – **Patrimonial and cultural issues.**

- **Introduction of additional parks and vegetation:**
  - Lower housing density, if buildings are not modified, and larger transportation needs;
  - Amenities from parks and vegetation;
  - Weaker urban heat island and higher resilience to heat waves and heavy precipitations (but not quantified precisely yet…)
  - **BUT** higher land prices, smaller housing surface, and more difficulty for modest households to access housing;

- **Many of these trade-offs imply non-market impacts:**
  - **Multi-criteria decision-making**
  - **Participatory approaches are needed (top-down will not work)**

French National Adaptation Plan

First phase (2008-2009):

- Top-down selection of 2 climate and economic scenarios
- Participatory approach to identify climate change impacts
  - Government, Local authorities, Business unions, Worker unions, NGOs

Second phase (2010):

- Participatory approach to identify adaptation measures
- Participatory assessment with simple methods, **with 6 metrics** (urgency, monetary, health, biodiversity, quality of life, redistributive impacts).
- Government (detailed) assessment and selection of measures:
  - Consistency with other policy goals
  - Robustness to climate and socio-economic uncertainty
  - If possible and necessary, detailed economic and financial analysis
- Definition of indicators for success

Follow-up:

- Review and revision in 5 (?) years

Screening of adaptation options

Sector	Examples of adaptation options	No regret strategy	Reversible / flexible	Existence of cheap safety margins	Soft strategy	Reduced decision horizon	Synergies with mitigation	Ranking
AGRICULTURE	• Developing crop insurance	+	+		+			1
	• Irrigation (possibly with water storage & transport)	+	–	+				2
	• Forestry with shorter rotation time	–	–			+		2
	• Development of resistant crops	+ +						1
COASTAL ZONES	• Coastal defences / sea walls	+	–	+				2
	• "Easy-to-retrofit" defences		+	+		+		1
	• Enhanced drainage systems	+	–	+				2
	• Restrictive land use planning	+	+	+				1
	• Insurance, warning and evacuation schemes	+ +	+		+			1
	• Relocation and retreat	–	–					3
	• Creation of risk analysis institution and long-term plans	+	+		+			1
HEALTH & HOUSING	• Air conditioning						–	3
	• Improved building standards	+		+			+	1
	• R&D on vector control, vaccines	+						1
	• Improvements in public health systems	+ +						1
WATER RESOURCES	• Institutionalization of long-term prospective	+ +	+		+			1
	• Loss reduction (leakage control, etc.)	+ +						1
	• Demand control and water reuse	+ +	+		+			1
	• Storage capacity increase (new reservoirs)	+	–	+				2
	• Desalination and water transport	+	–	+			–	3
HUMAN SETTLEMENTS	• Climate proofing of new building and infrastructure	+		+			+	1
	• Climate proofing of old building and infrastructure		–				+	2
	• Improvement of urban infrastructures	+	–	+			+	2
	• Restrictive land use planning	+ +	+	+				1
	• Flood barriers, storm / flood proof infrastructure	+	–	+				2
	• Development of early warning systems	+ +	+		+			1

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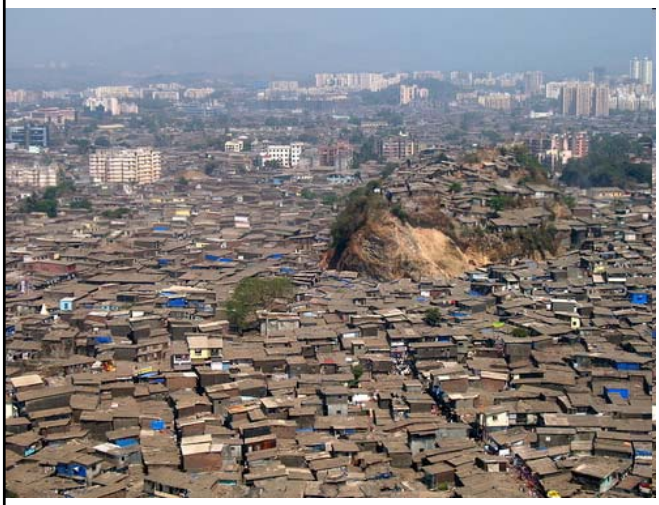
Which urban plan should we adapt?



Credit: Joe Harder Buxtehude

-Mumbai has about 18 million inhabitants
-50% of the Mumbai population lives in slum and work in the informal sector
-Dharavi is the largest slum in the World

- **Land scarcity and transportation issues are hard to resolve.**
- **How to act in places with no land tenure?**
- **Political and economic weight of these populations?**

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