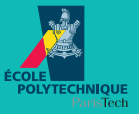


# The Chairs' Update

Department of Economics

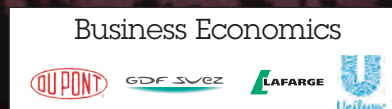
February 2012

N°6 Édition Spéciale



This Special Edition of February, 2012 presents articles pertaining to the Chairs' last three conferences:

- Natural Disasters in the Caribbean: Assessing the Physical and Economic Impacts, Mitigation and Insurance  
Co-organized by the Chairs for Sustainable Development-EDF-Ecole Polytechnique and Large Risk in Insurance-AXA
- Low Carbon Economy and Technology Innovation Mechanism  
First Joint Franco-Chinese Workshop Ecole Polytechnique - Harbin Institute of Technology, Harbin, China  
Co-organized by the Chairs for Business Economics and Sustainable Development-Ecole Polytechnique-EDF
- La Science des perturbations anthropiques du climat à découvert  
Organized by the Chair for Sustainable Development-EDF in collaboration with Nicolas Hulot Foundation (FNH) and GIS-Climat Environnement Société



# The Chairs' Update

## Chairs' Partners

### Chair for Business Economics:



GDF SUEZ



### Chair for Sustainable Development:



### Chair on Large Risks in Insurance:



*Chair Large Risks in Insurance*

### Chair for Sustainable Finance and Responsible Investment:



# The Chairs' Update

In this edition, along with the list of conferences organized by the Chairs since 2004, we are featuring the last three workshops organized in 2011. Indeed, you will find an exhaustive list of all workshops sponsored by our Chairs' Partners and consciously prepared by our researchers since 2004. Most presentations and/or Executive Summaries are available on our websites:

 <http://chair-business-economics.polytechnique.edu>

 <http://chaire-edf-ddx.polytechnique.fr>

 <http://www.idei.fr/fdir/>

The last three workshops of 2011 scientifically discussed an array of topics directly or indirectly related to Climate Change. During these workshops, one could notice the narrow relationship that exists between our scientists and our Chairs' Partners. They have exchanged practices, findings, and point of views which are critical in today's Research world.

We would like to take this opportunity to thank all of our Chairs' Partners for having participated in these events, and for all the support they are giving us on a daily basis.



# The Chairs' Update

## Conferences organized by the Chairs of the Department of Economics 2011-2004

2011

-  **Natural Disasters in the Caribbean: Assessing the Physical and Economic Impacts, Mitigation and Insurance**  
Co-organized by the Chairs for Sustainable Development-Ecole Polytechnique-EDF and Large Risk in Insurance- AXA
-  **La Science des perturbations anthropiques du climat à découvert**  
Organized by the Chair for Sustainable Development-Ecole Polytechnique-EDF.
-  **Low Carbon Economy and Technology Innovation Mechanism** - First Joint Franco-Chinese Workshop Ecole Polytechnique – HIT - Co-organized by the Chairs for Business Economics and Sustainable Development-Ecole Polytechnique-EDF.
-  **Energies : Enjeux économiques, géostratégiques et environnementaux**  
Co-organized by the Chairs for Sustainable Development-Ecole Polytechnique-EDF and Business Economics, and the magazine Passages (Paris)
-  **Sustainability & Impact Challenges at the Base of the Pyramid**  
Organized by the Chair for Business Economics in collaboration with ESSEC Business School and HEC (Paris)
-  **La RSE est-elle de la Com ?** Presentation by the Chairs for Business Economics for Ingénieurs sans Frontières, Ecole Polytechnique.
-  **Annual Conference of the Chair for Sustainable Finance & Responsible Investment (FDIR)** on the topic of Corporate Social Responsibility.
-  **Lectures on Risk and Insurance Economics**  
Organized by the Department of Economics (Ecole Polytechnique) and sponsored by the AXA-Research Fund (Chair on Large Risks in Insurance).
-  **Longevity and Pension Funds**  
Organized by the Chair on Large Risks in Insurance-AXA

2010

-  **Corporate Social Responsibility**  
Co-organized with CIRANO took place in Montreal (Canada) with the support of the Chair for Business Economics and the Chair for Sustainable Finance & Responsible Investment (FDIR).
-  **The Freedom of Choice Principle for Consumers and Farmers and Its Implications on the Value Chain**  
Second Workshop GMO Ecole Polytechnique Chair for Business Economics-INRA.
-  **Hydropower as a Solution to Africa's Energy Problem in the Context of Change**  
Organized by the Chair for Sustainable Development-Ecole Polytechnique-EDF.
-  **Smart Grids**  
Co-organized by the Chairs for Sustainable Development-EDF-Ecole Polytechnique and Business Economics.
-  **Les effets de la loi NOME sur le marché électrique français : Echange de points de vue académiques.**  
Co-organized by the Chairs for Business Economics and Sustainable Finance & Responsible Investment.
-  **Corporate Social Responsibility: From Compliance to Opportunity?** Conference on the book edited by Polytechnique Editions  
Organized by the Chair for Business Economics in collaboration with the Chair for Sustainable Finance & Responsible Investment.
-  **Large Portfolio, Concentration and Granularity**  
Organized by the Chair on Large Risks in Insurance-AXA

2009

-  **L'architecture internationale pour la lutte contre le changement climatique**  
Organized by the Chair for Business Economics in collaboration with Toulouse Sciences Économiques (TSE).
-  **Ecomobilité**  
Organized by the Chair for Sustainable Development-Ecole Polytechnique-EDF in collaboration with the « Chaire Management de l'Innovation ».
-  **Alimentation et Santé : Standards privés substitués à la régulation publique ?** First joint workshop Ecole Polytechnique-INRA  
Organized by the Chairs for Business Economics and Sustainable Development-EDF.



***Climate Policy and Long Term Decisions-Investment and R&D***

Co-organized by the Chairs for Business Economics and Sustainable Development Ecole Polytechnique-EDF, and Bocconi University (IEFE-Centre for Research on Energy and Environmental Economics and Policy)



***Emerging Risks***

Organized by the Chair on Large Risks in Insurance-AXA



***Climate-Related Catastrophes, Financial Innovations and Development : One Month before Copenhagen***

Organized by the Chairs for Sustainable Development-EDF and Large Risks in Insurance-AXA

**2008**



***Vertical Integration: A Review of Recent Results***

Chair for Business Economics.



***The EU Climate Policy and Border Adjustment: Designing an Efficient and Politically Viable Mechanism.***

Co-organized by the Chairs for Sustainable Development-EDF-Ecole Polytechnique and Business Economics.



***Le Développement Durable et l'Eco-conception entraînent des changements majeurs dans la Chimie***

Organized by the Chair for Sustainable Development- Ecole Polytechnique-EDF



***Changement climatique et compétitivité industrielle***

Thème 1 : Prise en compte du facteur CO2 dans la dynamique concurrentielle

Thème 2 : Prix du CO2, objectifs et trajectoire

Organized by the Chair for Business Economics



***Technologies innovantes de capture, transport, stockage du carbone, et politiques publiques associées***

Co-organized by the Chairs for Sustainable Development-Ecole Polytechnique-EDF and Business Economics.

**2007**



***Développement Durable et développement des pays les moins avancés.***

Co-organized by the Chairs for Sustainable Development-EDF-Ecole Polytechnique and Business Economics.



***The Impacts of Climate Change Policies on Industrial Competitiveness.***

Co-organized by the Chairs for Sustainable Development-EDF-Ecole Polytechnique and Business Economics.



***Choix inter temporels, actualisation et changement climatique.***

Co-organized by the Chairs for Sustainable Development-EDF-Ecole Polytechnique and Business Economics.



***Verticals Relations***

Organized by the Chair for Business Economics



***Insurance and Adaptation to Climate Change.***

Co-organized by the Chairs for Sustainable Development-Ecole Polytechnique-EDF and Large Risk in Insurance- AXA

**2006**



***Biodiversité Aménagements : situations de référence et évaluations des impacts.***

Organized by the Chair for Sustainable Development- Ecole Polytechnique-EDF



***Stratégie de gestion et de financement des risques de catastrophes touchant les grands réseaux : Quel rôle et responsabilité des secteurs public et privé ?***

Organized by the Chair for Sustainable Development- Ecole Polytechnique-EDF

**2005**



***La prise en compte du Long Terme et les arbitrages entre générations éloignées : un éclairage éthique et économique.***

Organized by the Chair for Sustainable Development- Ecole Polytechnique-EDF

**2004**



***Développement Durable et entreprises des indicateurs pour qui, comment, pour quoi faire ?***

Organized by the Chair for Sustainable Development- Ecole Polytechnique-EDF

# The Chairs' Update



## UpNext

### Past Events

#### Recent Ph.D Defenses

**Samer Hobeika** : L'investissement socialement responsable : les investisseurs de long-terme et le financement de la croissance verte, December 9, 2011

**Jean-Philippe Nicolai**: Market Design of Pollution Permits : The issues of Permits Allocation and Abatement Technology, December 16, 2011

**François Perrot**: Multinational Corporations at the Base of the Economic Pyramid: A Strategic Analysis Framework, September, 23, 2011

### Seminars

#### IDDRI :

February 7 : **Yves Jegouzo** : Le droit de la ville saisi par le développement durable, Science Po, 13h00 - 14h30, à Reid Hall - salle de conférence, 4 rue de Chevreuse 75006 Paris

#### Social and Environmental Responsibility:

February 7 : **Daniela Laurel** (Politecnico di Milano - Dept. of Management Engineering / HEC Paris - Dept. of Accounting and Management Control), Library, First Floor Department of Economics

#### GT2 Chair for Sustainable Finance and Responsible Investment:

February 22 : Groupe de travail « Gouvernance et Engagement Actionnarial », Troisième réunion thématique, AFG, 31 rue de Miromesnil 75008 Paris

# The Chairs' Update

Department of Economics

Février 2012 N°6 Édition Spéciale



## Atelier : « La Science des perturbations anthropiques du climat à découvert »

### Avant-propos

Le 10 novembre 2011, la Chaire Développement Durable-École Polytechnique-EDF, la Commission Scientifique de la Fondation pour la Nature et l'Homme (FNH) et l'AFEP, a organisé un atelier sur la science du climat. En effet, la situation actuelle est paradoxale. A la fin des années 80, les gouvernements étaient pleinement conscients des incertitudes associées alors à l'évaluation des impacts du forçage radiatif lié aux émissions anthropiques. Pour autant, les risques (notamment ceux liés aux modifications des régimes de précipitations et à l'élévation des niveaux des mers) leur étaient apparus suffisamment importants, pour appuyer d'abord la création du GIEC (en 1988), puis adopter la convention de Rio (en 1992). Aujourd'hui, la qualification de ces risques et la quantification de leurs impacts ont considérablement progressé. Et pourtant, les débats sur la réalité du changement climatique constituent un élément de blocage à l'action pour s'y préparer... L'objet de cet atelier était d'examiner ces questions, pour que le fossé « entre la réalité de la science qui se construit et la perception qu'en a le public » ne se creuse.

### Recherche scientifique, incertitude et communication

Pour le profane, l'analyse du changement climatique est l'objet de multiples controverses dans lesquelles il est difficile de se retrouver. Beaucoup d'entre-elles reflètent simplement des problèmes de communication. Ainsi, on entend souvent critiquer les modèles et les prévisions du GIEC, comme si celui-ci produisait un travail scientifique « original », alors qu'il s'agit d'un organisme qui produit des synthèses de l'état des connaissances, validées par la communauté scientifique. De même, il convient de bien distinguer entre les incertitudes sur l'évolution des émissions de gaz à effet de serre, qui renvoie aux modèles économiques de prévision de croissance et de structures productives, et celle sur les évaluations de l'impact du forçage radiatif correspondant, qui est l'objet des modèles climatiques. Ceci a d'ailleurs conduit le GIEC, pour éviter les malentendus, à présenter maintenant les résultats en ce domaine, en considérant une hypothèse, réaliste, mais conventionnelle, de doublement des concentrations de gaz à effet de serre, par rapport à l'ère pré-industrielle.

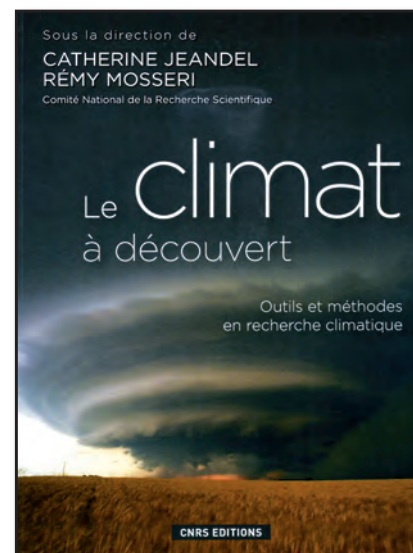
Claude Henry souligne cependant que l'appréhension de l'incertitude associée à la science du climat soulève des problèmes plus fondamentaux. En effet, la science est supposée être objective et

certaine, ou à tout le moins, parfaitement prédictive. A cet égard, la physique moderne – quoique se référant à un principe d'incertitude, celui d'Heisenberg – demeure dans un tel cadre, les phénomènes étant décrits par des distributions de probabilités précises, et par là, statistiquement prévisibles. La situation est plus complexe pour des sciences comme la climatologie, l'écologie, ou l'océanographie, qui demeurent plus incertaines, compte tenu de la multiplicité des échelles et des mécanismes pouvant entrer en jeu.

En effet, le climato-scepticisme s'est engouffré dans la brèche que représente l'asymétrie d'information entre le grand public et les scientifiques, pour convaincre le grand public de l'absence d'impact significatif de l'homme sur le climat, avec un grande réussite parfois, comme aux Etats-Unis. Une meilleure communication sur les résultats scientifiques joue et jouera un rôle prédominant pour responsabiliser nos sociétés modernes face à la question du changement climatique.

Trois concepts liés directement au changement climatique sont donc ressortis largement pendant cette conférence : recherche, incertitude et communication. Il va de soi que ces trois concepts sont connexes : la recherche en climatologie permet de réduire l'incertitude sur le changement climatique pour que l'information transmise à la société soit plus complète et précise.

La publication de l'ouvrage aux éditions du CNRS intitulé "Le climat à découvert : Outils et méthodes en recherche climatique" et rédigé sous la direction de Catherine Jeandel et Rémy Mosseri au nom du CoNRS (Comité National de Recherche Scientifique) est inscrite dans cette perspective.



## Rapport de l'Académie des Sciences sur le changement climatique (Octobre 2010)

À la demande de la ministre de l'enseignement supérieur et de la recherche, l'Académie des Sciences, a organisé, en 2010, un débat pour établir l'état actuel des connaissances scientifiques sur le changement climatique. Le rapport met en exergue quelques points saillants :

### - Sur les indicateurs de l'évolution climatique :

« L'augmentation de la température de surface sur la terre est de  $0.8 \pm 0.2$  °C depuis 1870. Le contenu d'énergie thermique de l'océan a aussi augmenté, surtout depuis le début des années 1980. Ce réchauffement n'est pas uniforme. Il présente une importante variabilité régionale avec d'importantes oscillations pluriannuelles, voire décennales. »

### - Sur les facteurs d'évolution du climat :

« L'augmentation des concentrations atmosphériques des gaz à effet de serre, autres que la vapeur d'eau qui se recycle rapidement et en permanence, est un élément très important. Le dioxyde de carbone (CO<sub>2</sub>) augmente continuellement depuis le milieu du XIX<sup>e</sup> siècle [...]. Les études isotopiques montrent que l'origine de cette augmentation est due pour plus de la moitié à la combustion des combustibles fossiles, le reste aux déboisements massifs et pour une faible part à la production de ciment. »

### - Sur l'étude des climats passés :

« Les climats du passé nous sont accessibles par un ensemble d'indicateurs. Les analyses de la glace des calottes polaires montrent que les concentrations en CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O n'ont vraisemblablement jamais été aussi élevées depuis 800 000 ans. »

### - Sur les mécanismes climatiques :

« Le soleil, par l'énergie que la Terre en reçoit, est le moteur principal de la machine climatique. Une partie de l'énergie solaire est directement envoyée vers l'espace par les nuages et la surface terrestre ; l'autre partie est absorbée par le sol et les océans [...]. L'effet direct d'un changement de concentration du CO<sub>2</sub> sur l'atmosphère est bien compris. Il se traduit par une augmentation du rayonnement infrarouge émis par le sol, évalué à  $3,7 \pm 0,1$  W/m<sup>2</sup> pour un doublement du CO<sub>2</sub> atmosphérique, correspondant à un réchauffement moyen en surface évalué à  $1.1 \pm 0.2$ °C »

## Les modèles climatiques : développement et validation

La description du forçage radiatif constitue un premier élément à prendre en compte pour évaluer l'impact des émissions anthropiques de gaz à effet de serre sur le climat (« effet direct »). Mais il faut considérer ensuite de multiples interactions et rétroactions. Les modèles sont alors indispensables pour évaluer cet effet indirect.

Hervé le Treut rappelle à cet égard que les modèles ont considérablement évolué. Les modèles des années 1980 demeuraient des modèles atmosphériques, décrivant les transferts de rayonnement au travers de l'atmosphère, en intégrant la circulation tridimensionnelle de l'atmosphère et son évolution. Leur résolution spatiale était de 500 km. Les modèles des années 2000 incorporaient le couplage océan-atmosphère, avec une résolution de 300 km. Aujourd'hui, sont développés des modèles globaux, intégrant à la fois les processus atmosphériques et hydrodynamiques que l'on peut bien traduire en équations, et d'autres, plus complexes, demeurant paramétrés. Leur résolution atteint 3,5 km.

Dans ce cadre, « une simulation climatique » se présente d'abord comme un ensemble de conditions aux limites, notamment : l'évolution de l'orbite terrestre, les constantes solaires, le CO<sub>2</sub>, et, pour l'échelle de résolution considérée, le relief. Ensuite, sont paramétrés différents processus physiques de petite échelle (rayonnement, turbulence, convection, nuages) qui affectent la circulation de grande échelle, décrite par les équations de la mécanique des fluides et les lois de conservation de la physique.

On peut ainsi évaluer l'évolution de la distribution des différents climats à la surface de la Terre. La comparaison entre les évaluations des modèles et les observations (satellitaires, campagnes de terrain, observations in-situ) constitue un premier élément pour évaluer les capacités prédictives des modèles. Il en ressort notamment que l'incorporation du forçage anthropique améliore nettement la qualité des représentations. Mais, cet élément n'est pas suffisant. Plus intéressant, est, par exemple, le fait que ces modèles ont prédit le réchauffement plus fort à la surface des continents qu'à la surface des océans, et plus fort encore dans les régions arctiques.

Sandrine Bony souligne que l'appréciation de la capacité prédictive des modèles de climat nécessite une comparaison systématique entre simulations et observations, qui se décline à plusieurs niveaux :

- capacité à interpréter les résultats par rapport à des principes physiques fondamentaux,
- qualité « climatologique », en termes de distribution des différentes variables (cartes de pluie, nuages, vents, température, humidité, glace de mer, courants océaniques...),
- capacité à décrire des phénomènes comme les ondes tropicales, ou les moussons,
- pertinence de la réponse simulée à des perturbations naturelles, telles que les éruptions volcaniques (Pinatubo) ou aux variations de l'orbite terrestre (Paléo-Climats).

Ce travail, qui est maintenant réalisé systématiquement, permet de mieux cerner les zones de robustesse et d'incertitudes de ces modèles.

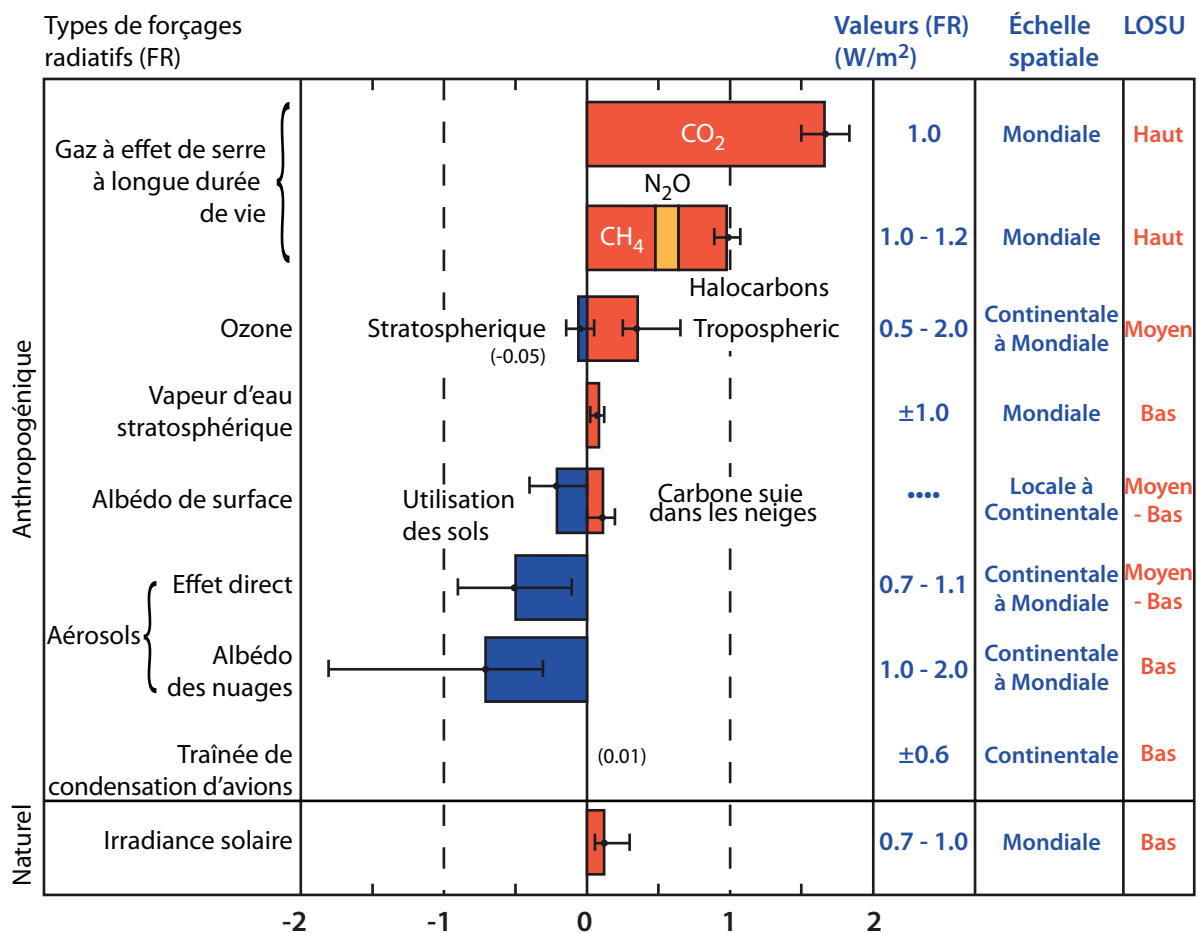
Il en ressort que la rétroaction radiative à la vapeur d'eau est bien estimée. Elle ajoute à l'effet direct d'un doublement du CO<sub>2</sub>, un supplément de 0.5 à 1°C. L'effet des nuages demeure plus incertain, car se combinent deux effets contradictoires, avec d'une part, un effet « parasol », et, d'autre part, une rétroaction positive par les nuages hauts. À cet égard, la réponse des modèles va ainsi d'une résultante neutre, à un réchauffement encore accru de 2°C.



## Atelier : « La Science des perturbations anthropiques du climat à découvert »

A.

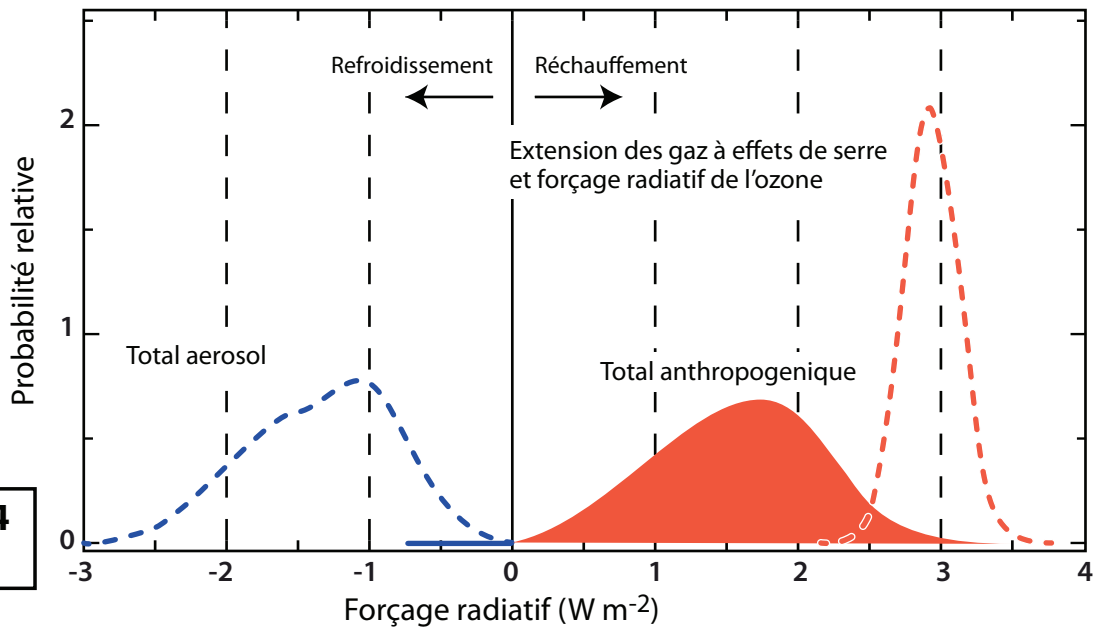
### Forçage radiatif du climat entre 1750 et 2005



Estimation des forçages radiatifs (FR) anthropiques ou naturels depuis le début de l'ère industrielle. Chaque rectangle représente l'estimation moyenne du forçage et les traits noirs indiquent l'incertitude associée. Les forçages positifs (en rouge) correspondent à un réchauffement du climat et ceux négatifs (en bleu) à un refroidissement. La dernière colonne (Level Of Scientific Understanding) donne le niveau actuel de compréhension scientifique du forçage. IPCC, 2007.

Le forçage radiatif désigne la modification du bilan radiatif (énergie disponible pour chauffer le système de la terre estimée «au sommet» de l'atmosphère (en W/m<sup>2</sup>).

**IPCC AR4  
(2007)**



Les incertitudes sur ce forçage ne permettent guère de contraindre la sensibilité climatique au-delà de la fourchette "classique" 1,5 à 4,5°C pour un doublement de CO<sub>2</sub> à partir des observations de température ... mais la recherche progresse.

**B.**

**Variabilité du système climatique**

**Temps caractéristiques (années)**

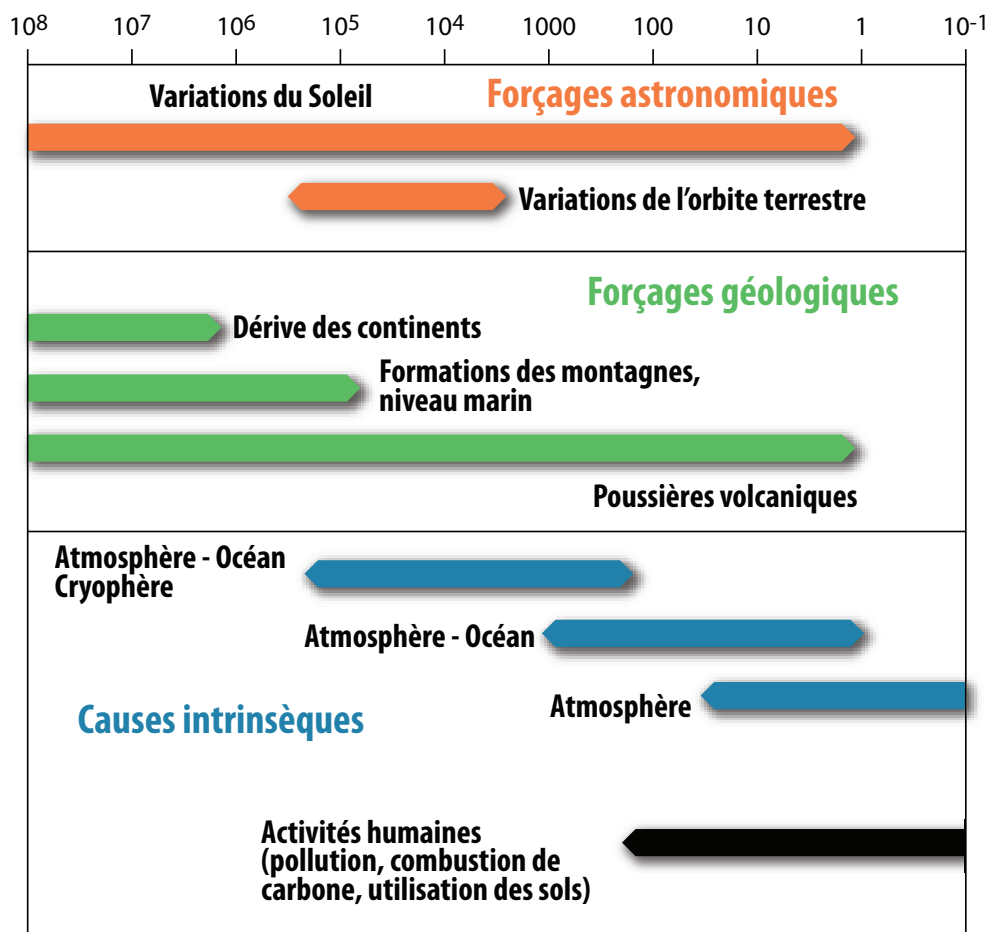


Schéma en unité logarithmique présentant les principales causes de changements du climat ainsi que quelques exemples caractéristiques de fluctuations climatiques. En rouge et en vert sont distingués les forçages externes au système climatique, en bleu les réarrangements internes au système et finalement en noir les effets anthropiques. Source : Bard, Leçon inaugurale du Collège de France, 2002.



## La recherche sur le climat

Les modèles climatiques permettent d'affirmer avec quasi certitude que la hausse moyenne des températures sera comprise entre 2°C et 6°C à l'horizon 2100, ce qui, même si l'on considère la borne inférieure de cette intervalle, représente une hausse très importante, avec de forts impacts pour un horizon aussi rapproché. De plus, les variations de climat sont de mieux en mieux connues à des échelles régionales. Mais elles restent très incertaines à l'échelle locale. Enfin, les fortes incertitudes sur certains aspects de la modélisation ne remettent pas en cause la fiabilité des résultats.

### • Vapeur d'eau, nuages et aérosols

Les aérosols sont des particules en suspension dans l'atmosphère d'origine naturelle ou anthropique. Il existe de plus grandes incertitudes sur l'impact des aérosols sur le climat que sur l'impact des GES sur le climat. L'état actuel de la connaissance sur les aérosols permet de dire qu'ils ont des effets directs sur le climat en augmentant l'albédo de la Terre, et des effets indirects en modifiant les propriétés des nuages. Leur forçage radiatif, qui est globalement négatif, a masqué une partie du forçage des GES (annexe tableaux A et B). S'agissant du rôle des rayons cosmiques, une petite dizaine d'études indiquent qu'il semble y avoir un léger lien entre rayons cosmiques et couverture nuageuse. Mais celui-ci est ténu quand il existe et souvent invisible. L'expérience CLOUD suggère que la nucléation est sensible à l'ionisation, mais cela reste un effet faible comparé à celui des vapeurs (NH<sub>3</sub>, organiques). Les modèles microphysiques montrent aussi que l'impact de la nucléation sur les propriétés des nuages est très petit. Par ailleurs, la quantité de rayons cosmiques n'a que peu évolué sur les dernières décennies.

*Olivier Bouchet*

### • Enseignements des données paléo-climatiques

L'évolution passée du climat résulte de différents phénomènes, correspondant à des échelles de temps très différentes.

L'étude de l'évolution passée du climat est précieuse pour :

- mettre les changements en cours dans la perspective de la variabilité naturelle ;
- comprendre les rétroactions lentes (climat, océan profond, calottes de glace, cycle du carbone) ;

- accéder à des « expériences naturelles » sur le système climatique (réponse aux perturbations radiatives, non linéarités) ;

- tester les modèles de climat par rapport à différents « bancs d'essai ».

L'étude du paléoclimat permet ainsi d'acquérir des connaissances sur des amplitudes de variations climatiques très larges, en raison des variations naturelles sur ces temps là (orbite terrestre, activité du soleil, répartition des terres et des océans...). Un effet de seuil a par exemple été observé dans le passage de l'âge glaciaire à l'âge interglaciaire, notamment en raison de l'albédo des glaces polaires. Les rétroactions entre concentration atmosphérique de CO<sub>2</sub> et température sont aussi mieux comprises, avec le rôle important joué par l'océan dont le stock de CO<sub>2</sub> varie avec la température (annexe tableau C).

*Valérie Masson-Delmotte*

### • L'impact du changement climatique sur la biodiversité

Lorsque l'on parle de perte de biodiversité, il ne s'agit pas seulement de l'extinction des espèces. En effet, en plus de l'extinction des espèces, il faut tenir compte des espèces qui n'ont pas disparu mais qui sont moins abondantes, de la perte d'habitat, des changements dans la répartition des espèces, de la perte des services environnementaux ou encore des effets de seuil. Il demeure encore beaucoup d'incertitudes concernant l'impact du changement climatique sur la biodiversité. A titre d'exemple, l'IPCC annonçait en 2007 que 20 à 30% des espèces étaient en danger d'extinction pour une augmentation de température de l'ordre de 2 degrés mais ces chiffres ont largement été remis en question depuis puisque l'on observe des résultats très différents selon le modèle d'extinction des espèces utilisé. Néanmoins, même s'il y a énormément d'incertitudes sur le taux d'extinction futur, le taux d'extinction minimum qui a été prédit reste très supérieur au taux d'extinction naturel et le risque d'un taux d'extinction extrêmement élevé est non négligeable. Les prédictions concernant les variations d'abondance et de distribution spatiale, temporelle et génétique sont quant à elles moins incertaines. C'est pourquoi les modèles de variations d'abondance et de distribution des espèces sont maintenant préférés aux modèles d'extinction. Ceux-ci permettent non seulement d'étudier l'impact du changement climatique sur la biodiversité, mais aussi d'adapter la gestion des espèces.



# The Chairs' Update

Des modèles avec variation de températures des mers et des océans prédisent une perte d'abondance des poissons pélagiques dans les zones intertropicales et des déplacements très importants de ceux-ci, ce qui aurait des implications socioéconomiques très fortes pour les pays de ces régions. D'autres modèles considérant le double impact du changement climatique sur la température et l'acidification des eaux mettent en avant le risque de dépérissement total des récifs coralliens. En effet, une concentration atmosphérique en CO<sub>2</sub> supérieure à 600 ppm engendrerait une acidification des océans telle que la formation d'aragonite deviendrait impossible.

*Paul Leadley*

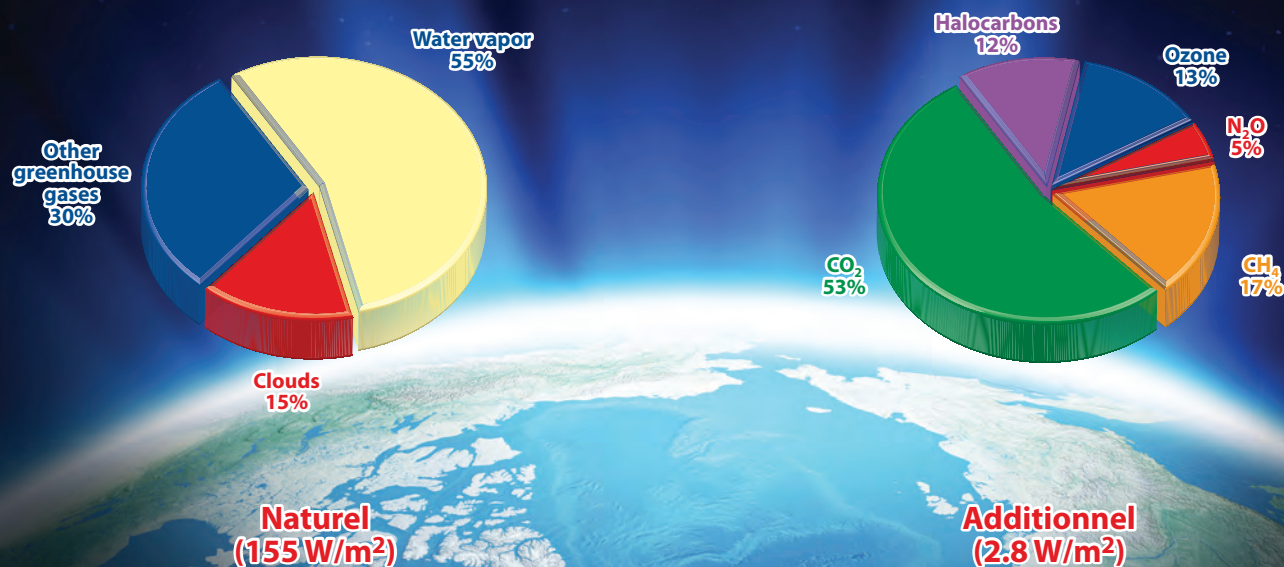
## • De l'évaluation des impacts aux politiques climatiques

Dans de nombreuses filières dont les échelles de temps sont longues (foresterie, viticulture, etc.), les acteurs économiques prennent des décisions dont les résultats dépendent de l'ampleur des impacts du changement climatique. L'évaluation des impacts est donc d'ores et déjà stratégique pour ces acteurs privés, mais

aussi pour l'élaboration et la conduite de politiques publiques d'adaptation dans ces domaines. Evaluer les impacts requiert de la recherche fondamentale, notamment sur la réaction des systèmes biologiques aux évolutions du climat. Evaluer les impacts requiert aussi des travaux de recherche appliquée systématiques, pas toujours bien valorisés dans le monde académique. Les organismes de développement technique ont ici un rôle très important à jouer, à la fois pour la production de ces connaissances, leur diffusion, mais aussi, dans le sens inverse, pour faire remonter aux organismes de recherche les questions prioritaires pour les acteurs. En pratique, l'information disponible aujourd'hui sur les impacts reste parcellaire, et les agents doivent prendre leurs décisions en tenant compte de l'incertitude climatique en plus des autres incertitudes (de prix, etc.) qu'ils intègrent déjà. Dans ce contexte, les stratégies flexibles et/ou permettant de gagner du temps ont une importante valeur ajoutée. Les outils d'observation (type surveillance de la santé des écosystèmes) permettant de donner l'alerte le plus tôt possible sont aussi essentiels.

*Franck Lecocq*

## Principaux constituants atmosphériques contribuant à l'effet de serre



## Publications

**Henry, C.,** 2011. Scientific Uncertainty and Fabricated Uncertainty - The Royal Swedish Academy of Sciences.

**Jeandel, C. et Mosseri, R.,** 2011. Le climat à découvert, Outils et méthodes en recherche climatique – Ouvrage CNRS Editions.

**Le Treut, H. et al,** 2007. "Historical Overview of Climate Change", in Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the 4th Assessment Report of the IPCC, Cambridge University Press.

**Le Treut, H., et Jancovici, J-M.,** 2009. L'effet de serre, Ouvrage Flammarion Editions.

**Puget, J-L, Blanchet, R., Salençon, J., et Carpentier, A.,** 2010. Le changement climatique- Rapport de l'Académie des Sciences.

**The IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation,** 2010. Intergovernmental Panel on Climate Change (IPCC).

# The Chairs' Update

Department of Economics

February 2012 N°6 Édition Spéciale



## “Natural Disasters in the Caribbean: Assessing the Physical and Economic Impacts, Mitigation, and Insurance”



On October 28th, 2011, the Chairs for Sustainable Development-EDF and Large Risks in Insurance-AXA have organized a scientific conference entitled “Natural Disasters in the Caribbean: Assessing the Physical and Economic Impacts, Mitigation, and Insurance”. This workshop brought together experts, both academic and non-academic, from across the globe, allowing speakers and participants to share their knowledge on the topic and form new research links that surely will stimulate future research activity. The workshop was opened by Professor Henry de Lumley (Institute of Human Paleontology, Paris) who brought some interesting insights on the impact of climate change in France. This was then followed by the first session dealing with sea level rise, chaired by Professor Eric Strobl (Ecole Polytechnique). In particular, Dr. Sonja Teelucksingh (University of the West Indies, Trinidad and Tobago) spoke about her research on the perceptions of local communities of extent of climate change and its likely impact- research that is done under an international Caribbean-Canadian project called C-Change. Her speech was then followed by a presentation by Professor Patrick Watson (SALISES Director, Trinidad and Tobago), who outlined his research on how biodiversity affects tourism, a topic particularly important for many of the Caribbean economies. The following session was chaired by Dr. Michael Brei (Paris X University) who dealt with earthquakes in the region.

Professor John Mutter (Earth Institute, Columbia University) spoke of the current risks of future earthquakes in the Caribbean and the current state of art of knowledge. Charley Granvorka (CEREGMIA, West Indies and Guyana University) spoke of her work on the aftermath of Haiti 2010 earthquake. The afternoon sessions continued with one on hurricanes, chaired by Dr. Agustin Perez (INRA and Ecole Polytechnique). In particular, there was first a presentation by Dr. Rick Murnane (Bermuda Institute of Ocean Sciences) who gave an overview of the existing current research on the link between climate and hurricane landfall rates. His presentation was then followed by Professor Eric Strobl (Ecole Polytechnique and SALISES) on why current estimates of the impact of hurricane strikes in the Caribbean on the economic growth rates of their economies appear to differ so widely. The workshop concluded with a lively roundtable discussion, chaired by Professor Robert Elliott, and included Professor John Mutter, Dr. Rick Murnane and Dr. Sonja Teelucksingh – each of which summed up their research and then entered into a debate of what can be taken from the current state of knowledge in terms of implications for policy makers and potential venues of future research.

*The organizing committee*



## The Economic Growth Impact of Hurricanes in the Caribbean

Hurricanes are the most frequent and destructive of all types of natural disasters in the Caribbean. In this regard, the media mostly quantifies the effects of hurricanes in terms of cost of physical damages. But of course hurricanes can have much more wide reaching effects, where damages can lead to business interruptions, including loss in output and employment, but also may act to boost the economy by requiring new investment. Arguably, however, it is these indirect, longer-term effects that policy makers are more interested in since it is these that will determine the long-term impact on the economy. So what are the true quantitative impacts of a hurricane strike on a Caribbean economy? A casual perusal of the literature unfortunately provides no clear answer to this question – where academic studies have found from very large to no effects. However, more detailed analysis reveals that there may be a number of reasons of why we may not believe in the existing figures as an indication of the range of the impact or why figures may logically differ. Firstly, studies differ widely in their proxies of hurricane potential destruction, using ex-ante (physical characteristics of the storms) or ex-post (estimated damages) measures. Arguably the latter is particularly problematic and may induce biased estimates because the extent of ex-post damages will depend on country specific factors, such as the degree disaster mitigation and disaster preparedness. Secondly, there appears to be very different impacts across sectors so that there may be an aggregation bias if one solely looks at the aggregate effect in isolation – in other words, different sectoral compositions could be driving the wide range of estimates. For example, construction industry usually benefits from natural disasters, while agricultural and service sectors appear to suffer particularly badly. Thirdly, studying the impact on net economic growth rates, as is standard in the literature, masks the likely underlying processes. More specifically, hurricanes firstly cause direct damages, which then translate into indirect impacts by affecting business activity, and may finally have at least partially economy boosting effects by leading to reparation and construction efforts and new investments and, possibly, Schumpeterian 'creative destruction' effects. What one sees in aggregate will thus depend on the chosen time horizon, investment efforts, etc. Finally, natural disasters tend to be local phenomena in that at least their direct effects are spatially limited. Differences in country sizes and other features could thus be important factors in the extent to which hurricanes affect economies. In the end it becomes clear that the literature on the impact of hurricanes on economies, as with other natural disasters, is still very much in its infancy and will require greater efforts in data collection and estimation to provide estimates that policy makers or other academics can use with reasonable confidence.

*Eric Strobl*

## Haiti in the aftermath of the earthquake of January 2010

Haiti is located in the Caribbean Sea in the middle of the hurricane belt. The earthquake that hit the country in January 2010 officially killed more than 250,000 people, injured 300,000 and left over one million homeless (UNEG, 2010). It was one of the most powerful the country has experienced in 200 years. The question that arises almost two years later is what happens now in Haiti?

Prior the earthquake Haiti was yet regarded as the poorest country of the Western hemisphere with a GDP per capita valued at US \$ 729 in 2008 and a growth rate of 1,3 % for the same year (World Bank Report, 2009). About the three-fourths of the population is impoverished-living on less than US \$ 2 per day, and the UN Human Development Index (HDI) ranks Haiti 154th least developed among the world's 177 countries.

The Haitian economy is fuelled by tradable services (28%), agriculture and other activities for 29 % as a ratio to GDP. The economy is essentially rural. The sector of services accounts for 60 % into GDP and it employs 40 % of the working population. In Haiti the grey economy is predominant, and the weight of remittances from the Diaspora is estimated at 80 % in the total of the economic activity. Politically Haiti is considered by the international community as the worst governed and undemocratic State.

After the earthquake the total value of damage and losses has been estimated by the PDNA (2010) at 7.804 billion of US\$ as an equivalent to 100 % of the GDP of 2009. The assets destroyed included housing, schools, hospitals, roads, bridges, ports and airports. Consequently, production decreased leading to job and salary losses, increases in insecurity and violence, production costs and prices. Housing is the sector that suffered the most. This sector represents almost 40 % of the effects of the earthquake. As correlated effects, commerce, public buildings and urban infrastructures, education and health, tourism, banking, finance and retail have been severely impacted as well.

Proposals for natural disasters mitigation have been done at both the public and private levels. They apply to Governance to be improved through the State of law, justice and public security, the democratic process, public administration and public service, regional development. All of them aim at risk reduction and the protection of environment. Even if concerted proposals have been made between the public and private sectors, strong assessments are required. They relate to environment, insurance and clear property rights. This must be prioritized through a strong legal and organizational framework as an effective and efficient EIA depends upon it.

*Charley G. GRANVORKA*



## The Impact of Light Pollution on the Sea Turtle Population in the Caribbean

Marine biodiversity is and continues to be a growing point of attraction for the Caribbean tourism sector. At the same time, it is also well known that coastal pollution can severely affect marine biodiversity and is thus of considerable concern. One largely neglected aspect in this regard has been what role increased coastal lighting due to the development of tourism facilities and housing on or near the coast may play. More specifically, while a number of studies in the natural sciences have already pointed out that some marine species are particularly sensitive to light pollution, the impact of the rising degree of light pollution in the Caribbean has gone largely unexplored. In this paper, we set out to study how light pollution in the Caribbean coastal areas may have affected one particular aspect of biodiversity in the region, namely the sea turtle population. Arguably, light pollution may be particularly important for marine turtles, where their beach nesting and mortality rates of the newborns are negatively affected by coastal lights. Our approach to quantitatively estimate the impact of light pollution on turtle populations is to combine a number of unique data sets. Firstly, we identify those beaches that are important for turtle breeding within the Caribbean. We then use satellite derived nightlight imagery at the 1km grid levels as derived from the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS) to estimate the extent of night time pollution over time across these locations. Finally, we collect from a variety of data sources (surveys, turtle tagging, etc.) to proxy the local extent of turtle breeding/population. Combining these data sets will then allow us to econometrically identify the impact of night pollution on the turtle population within the Caribbean.

This work has been presented in the conference “The Sustainable Development of Coastal Communities: Challenges and Solutions”, organized by the Sir Arthur Lewis Institute of Social and Economic Studies (SALISES) of the University of the West Indies, St Augustine Campus, and the Turtle Village Trust of Trinidad and Tobago. Its main objective was the exchange of ideas on critical issues related to climate change and coastal communities, biodiversity, turtle conservation, ecotourism, sustainable community development, and the environment. The meeting has focused on theoretical and policy-oriented papers from a range of disciplines, including economics, ecology, biology, geography, geomatics engineering, GIS, sociology, anthropology, humanities and public policy, as well as interdisciplinary approaches. In particular, they have paid much attention to coastal communities that are nesting sites for sea turtles. In this regard our paper has provided a very valuable contribution. Moreover, the conference also gave us the opportunity to interact with biologists and NGOs closely related to sea turtle protection in the Caribbean, offering us new insights and data for future research.

*Agustin Perez-Barahona*



# The Chairs' Update



## Selected Related Publications:

**Kossin, J. P., K. R. Knapp, D. J. Vimont, R. J. Murnane, and B. A. Harper, A.,** 2007. Globally Consistent Reanalysis of Hurricane Trends", *Geophys. Res. Lett.*, 34, L04815, doi:10.1029/2006GL028836.

**Mutter, J.C., and A. Lerner-Lam,** 2000. edition in prep., "Seismology: Imaging the Earth's Interior", McGraw-Hill Encyclopedia of Science and Technology.

**Picard P.,** 2008. Natural Disaster Insurance and the Equity-Efficiency Trade-Off *The Journal of Risk and Insurance*, 2008, Vol. 75, No. 1, 17-38.

**Strobl, E.,** 2012. "The Macroeconomic Impact of Natural Disasters in Developing Countries: Evidence from Hurricane Strikes in the Central American and Caribbean Region", *Journal of Development Economics*, forthcoming.

**Strobl, E.,** 2011. "The Economic Growth Impact of Hurricanes: Evidence from U.S. Coastal Counties", *Review of Economics and Statistics*, Vol. 93, No. 2, Pages 575-589.

**Witherington, B., Kubilis, V., Brost, B., and Meylan, A.,** 2009. "Decreasing Annual Nest Counts in a Globally Important Loggerhead Sea Turtle Population Ecological Applications", 19(1), 2009, pp. 30-54 by the Ecological Society of America.



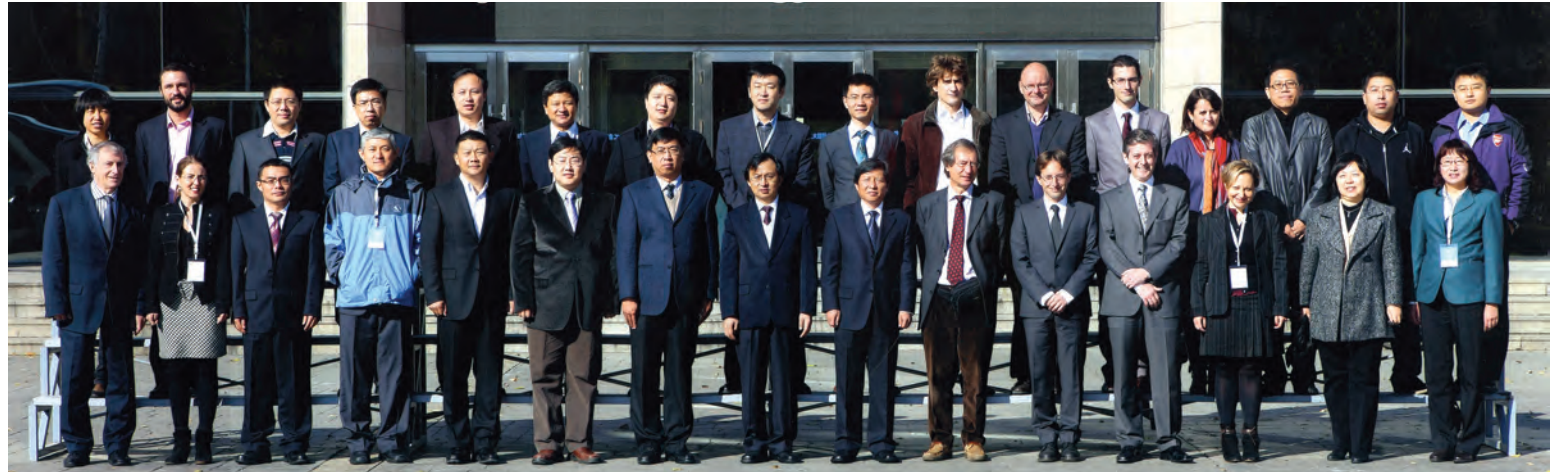
# The Chairs' Update

Department of Economics

February 2012 N°6 Édition Spéciale



## First Joint Franco-Chinese Workshop Ecole Polytechnique - HIT : Low Carbon Economy and Technology Innovation Mechanism



### Foreword :

This is the first Joint Franco-Chinese Workshop between Ecole Polytechnique and the Harbin Institute of Technology (HIT), held in Harbin on October, 2011 and co-organized by the Chairs for Business Economics and Sustainable Development - Ecole Polytechnique - EDF ; this workshop was the first step of a research partnership on international climate negotiations and technological innovation.

China is today a major actor in the energy landscape. Environmental concerns are also at stake. A sustainable development ambition is confirmed by the Chinese government, which not only set up low-carbon targets in the 12<sup>th</sup> five-year plan for national economic development (2011-2015) but also reaffirmed the plan

to promote seven new strategic industries including clean energies sector. Emerging countries are playing an increasingly important part to ensure better access to clean technologies on a global scale. On one hand, the energy and environmental constraints resulting from their economic catch-up create a market favorable to the emergence of clean technologies. On another, hand the application on an industrial scale combined with their manufacturing capacity and political support can quickly reduce the intrinsic costs of technologies and shorten the period of deployment to satisfy the huge needs from the domestic markets.

*Anna Creti and Jean-Pierre Ponsard*

### Survey of the workshop

The purpose of the workshop was to share academic work on the European and Chinese strategies to mitigate their greenhouse gas emissions, develop new technologies, and discuss the feasibility of international mechanisms to ensure technological diffusion.

The workshop was opened by the welcome speeches of Mr. Wang Shuguo, Harbin Institute of Technology President, and Mr. Xia Xin, Director of the Economic Operations Bureau for National Development and Reform Commission. They highlighted the importance of the workshop for promoting the bilateral cooperation and dialogue in the development of low carbon economy.

The workshop continued with three sessions dealing with efficiency and equity issues in climate change, R&D, and innovation policies for low carbon technologies and economic models of climate change. Dr. Fan Ying (CAOS-Institute of Policy and Management, Chinese Academy of Sciences) and Dr. Jiang Kejun (Economic Operations Bureau for National Development and Reform Commission) presented respectively the economic modeling works about carbon tax and long-term emissions reduction scenarios in China. This was followed by the presentation from Florent Le Strat and Benoît Peluchon (EdF Research Institute) who shared also their research on the economic assessment of emissions reduction and energy consumption scenarios from an European perspective.



With a computable general equilibrium model, Alain Bernard (Laboratoire d'économétrie, Ecole Polytechnique) brought his insights on the energy efficiency policy particularly in the French residence sector. Jean-Pierre Ponsard (Laboratoire d'économétrie, Ecole Polytechnique) proposed a sectoral approach of emissions trading based on a China-Europe simulation, and Benoît Leguet (Caisse des Dépôts et Consignations-Climat, CDC-Climat) shared his views on the clean development mechanism and joint implementation mechanism in the carbon market. Regarding technology innovation and diffusion mechanism, Anna Creti (University of Nanterre, Paris-West and Laboratoire d'économétrie, Ecole Polytechnique), Mathieu Glachant (Cerna, Ecole des Mines ParisTech) shared their visions respectively on the photovoltaic policy analysis in Europe and global technology transfer dynamics. Liang Dapeng (Harbin Institute of Technology), Liu Hengwei (Harvard Kennedy Government School), Qiu Penghua (Harbin Institute of Technology) and Xu Xiangyang (China University of Mining and Technology) spoke of the roadmap and perspective of clean technologies in China, such as different technology options in the power production and clean coal solutions. Lu Xuedu (Asia Development Bank) and Bai Quan (Energy Efficiency Research Institute of the National Development and Reform Commission) detailed different policy instruments to be implemented by government agencies and financial institutions. Patricia Crifo (University of Nanterre, Paris-West and Laboratoire d'économétrie, Ecole Polytechnique) and Ma Zhenzhong (HIT, University of Windsor) compared the green economy development in the world, and particularly the concept of business ethics in China. The workshop concluded with a lively roundtable discussion on the potential venues of future research.

*Yang Liu*

## Follow up from the workshop

The Harbin workshop has been a challenging and enriching experience. Several research works are actually underway to further analyze the links between carbon policies, innovation and technology diffusion. Researchers from the Chairs Business Economics and Sustainable Development are involved, together with EdF R&D, in a research project on the international allocation of long term CO<sub>2</sub> emission targets and their impact on emitting sectors. As far as the international dimension is concerned, the harmonization of different carbon markets has come as an interesting issue to develop. The link between CDM and FIT in China and the coordination between national and international carbon policy objectives is also under investigation. Furthermore, exploring the effectiveness of subsidies to green R&D in presence of uncertainty and spillovers is another topic on which research is being conducted. We are sure that these, among others, will be the topics we are going to discuss in our second French-Chinese Workshop which will be organized together with HIT at the Ecole Polytechnique in 2012.

**For the presentations:**

<http://chair-business-economics.polytechnique.edu/home/workshops/>

## Economic Growth and Greenhouse Gas Emissions: China's Perspective

China is now tackling several commitments to set a long-term strategy of developing the low carbon economy. In November, 2009, China committed for the first time to reduce its emissions intensity of GDP by 40-45% in 2020 based on 2005 level. The achievements of the 11<sup>th</sup> five-year plan (2006-10) and the targets of the 12<sup>th</sup> five-year plan (2011-15) witness the Chinese strategy toward the low carbon economy. This view has been confirmed by **Mr. Xia Xin, Economic Operations Bureau for National Development and Reform Commission Director**, at the workshop's launching ceremony. Even though total energy consumption has been increasing, China has succeeded in reducing the energy intensity of the economy by 19.1% below 2005 level. Some figures illustrate the efforts of the Chinese society: shutdown of 72 GW of backward production capacity in small thermal power plants and elimination of 6.9 million and 330 million of tones obsolete production capacity respectively in the steel and cement sector. The export value added tax refund rebate and export tax on energy-intensive products have also been massively implemented since 2007. If the Chinese policies are largely based on a command and control approach more market-based instruments to mitigate the emissions are introduced in the agenda of the 12<sup>th</sup> five-year plan. By 2015, two targets will be achieved: reduction of energy intensity and carbon intensity of the GDP respectively by 16% and 17% below 2010 level. Other major policies of the Chinese government involve optimizing the economic structure, strengthening emerging strategic clean technology industries through R&D expenditure and incentives, launching a 10 000 Energy-Consuming Enterprises program, readjusting further the pricing system for the resource products, and increasing the forest stock volume.

Constrained by the bottleneck of carbon emissions mitigation and energy resources conservation, Chinese decision makers understand well that it is no longer possible to replicate the development pathways of industrialized countries. China has to substantially readjust its socio-economic policies towards a "scientific development concept", proposed by the central government as a guidance of low carbon economy. However, the challenge for China, as said by the President Hu Jintao, is to make its endeavor on climate change a win-win situation for both developed and emerging countries, as well as for the interests of individual countries along with the common interests of humanity.

*Yang Liu*

## Looking Further Ahead, How will China Evolve?

Assuming that CO<sub>2</sub> emissions in 2050 would be at the level of 2005 (1500Mt), together with a continuous economic development, a progressive reduction of carbon intensity up to a reduction of total emissions is needed. Research by Chinese experts, like **Dr. Kejun JIANG (Energy Research Institute of the National Development and Reform Commission of China)** identifies several technologies and policies. The reduction of the carbon intensity

of the Chinese economy would occur via the move to less carbon intensive productions in industry coupled with the penetration of technologies in three key sectors: power generation, transport and building. For power generation, the main technological options are nuclear, renewable (hydro and wind) and super critical coal and CCS. Concerning transportation, the rise of the number of vehicles in the country is compensated by a higher efficiency and the development of bio fuels, electric cars and cell fuels. The costs of these technologies would depend on the learning curve. The development of technologies is stimulated by norms and financial incentives. Furthermore, quantitative objectives on emissions are fixed at the national and provincial level, and an emission permits market is envisioned. Cities have been identified as major actors via their local urban and transportation policies.

*Guy Meunier*



## A Carbon Tax for China

The pressure that China's fast economic growth exerts on the global environmental system raises concerns both among international partners and inside China itself. Chinese growth was accompanied with a fast increase in energy consumption without a proportional increase on the Chinese production side. Between 1978 and 2010 annual economic growth has been above 9% in average. Simultaneously, energy consumption growth rate has been of 5.6% while energy production growth rate has only achieved 5%. Professor Ying Fan from the Center for Energy & Environmental Policy Research (part of the Institute of Policy and Management, Chinese Academy of Sciences) underlines that the impossibility of covering its demand with own sources has increased China's dependence in oil imports to 53.7% in 2010. The concern regarding growing demand is aggravated

by the fact that most Chinese energy production is undertaken with coal (70.45%, in 2010) which leads to green house gas emissions and other environmental damage, and this does not seem to be changing soon (since the coal reserve-production ratio is 38). Other sources are marginal in comparison: oil, gas, and renewable have accounted for 17.62%, 4.03%, and 7.21%, respectively.

To the light of the situation described the possible implementation of a Chinese carbon tax and its impact on the production and energy sector is very pertinent. Research conducted at the Chinese academy of Science shows that, as expected, the higher the carbon tax the higher the energy consumption reduction and the emissions reduction, even if, after around 2035, energy savings become less important in all policy scenarios since it becomes more attractive to switch between energy technologies rather than to reduce consumption. Moreover, carbon tax can increase the investment in non-fossil energy. More interestingly, endogenous technological change could ease the negative impact of carbon taxes on GDP growth. For instance, China has recently announced a carbon tax to be set in force as from 2015. Together with this command and control policy instrument, the possibility of setting a Chinese carbon trading scheme inspired by the European is becoming a reality. Recently the National Development and Reform Commission requested the cities of Beijing, Tianjin, Shanghai, Chongqing and Shenzhen, along with the provinces of Hubei and Guangdong, to set "overall emissions control targets" and submit proposals as to how the targets will be allocated.

*Maria Eugenia Sanin*

## The Debate on International Carbon Policies: Contrasting Views

Major emerging economies, like China, have a special interest in the technology development and transfer topics. Emerging countries are playing an increasingly important part to ensure better access to clean technologies on a global scale. On one hand, the energy and environmental constraints resulting from their economic catch-up create a market favorable to the emergence of clean technologies. On the other hand the application on an industrial scale combined with their manufacturing capacity and political support can quickly reduce the intrinsic costs of technologies and shorten the period of deployment to satisfy the huge needs from the domestic markets.

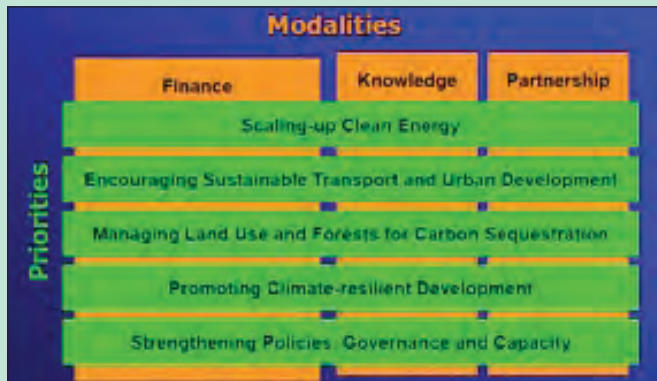
In order to address certain limits revealed in the project-based market instrument established by the Kyoto Protocol, the Cancun Agreement also plans the establishment of a new market mechanism with a sectorial approach in favor of appropriate national mitigation actions (NAMA). In this context it is appropriate to consider an industry solution that ensures consistency between the climate finance and the dissemination of clean technologies would be most welcome.

Support to the development of sectoral schemes can go along three directions: establishing an enlarged, sector oriented CDM; coordinating these initiatives with countries having set intensity targets and export taxes; and finally, tackling both the competitiveness and the technology transfer issues.

Sectoral agreements seem to be accepted as one of the levers for China to decarbonize its electricity sector, on one side, and to enter worldwide CO<sub>2</sub> trade on the other. Nevertheless, the Chinese CO<sub>2</sub>

# The Chairs' Update

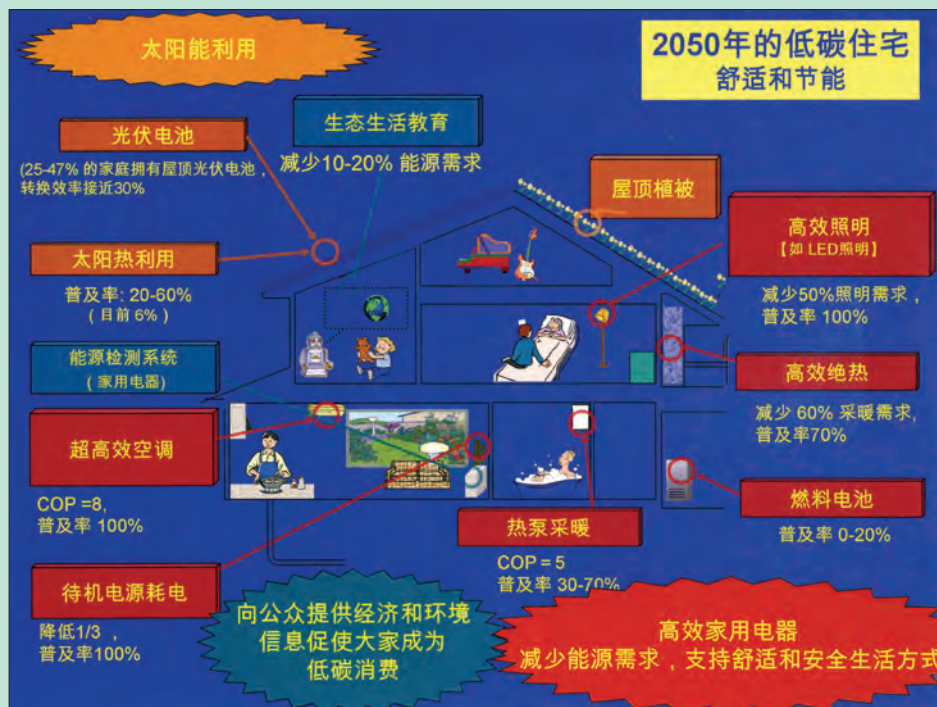
intensity reduction target of reducing its emissions intensity of GDP by 40–45% in 2020 based on 2005 level is of going to seriously constrain the economy. Further investments being less probable after a boom period, pilot projects and tests are the way to go. In the perspective of the financing sector, as for instance the Asian Development Bank, there is a mix to be achieved, tacking into account several dimensions of carbon reduction strategies (see figure below: Modalities and priorities of carbon policies in China. Source Mr. Xu Luedu, Asian Development Bank).



However, emerging economies like China have incentives to participate to international agreements only if both equity and efficiency are ensured. To design equitable and efficient project-based mechanisms, the focus must be on « operational » additionality, simplicity and mainstream carbon finance. Up to 30 September 2011, almost 3 500 CDM projects have been registered in 72 countries and 750 million certified emission reductions (CERs) issued from 45 countries. About a further 3 400 projects are currently under validation. The Chinese CDM market is the most mature in the world. Over the same reporting period, China represents 46% of total registered projects and 39% the total projects under validation. The CDM growth in China is expected to continue in 2012, even under the uncertainty regarding the level, timing and nature of new emissions targets at the international level.

Anna Creti

## Major Abatement Sources at the 2050 Horizon:



## Selected Related Publications:

Economie du climat - Pistes pour l'après-Kyoto, **Godard, O. & Ponsard, J-P., (Eds.)**, Editions de l'Ecole Polytechnique, Mars 2011.

**Cook, G.L and Ponsard, J.-P.**, 2011, A proposal for the renewal of sectoral approaches building on the Cement Sustainability Initiative. *Climate Policy*, 11:5, 1246-1256.

**De La Tour, A., Glachant, M., and Ménière, Y.**, 2010, Innovation and international technology transfer: The case of the Chinese photovoltaic industry, *Energy Policy* 39(2), 761—770.

**Jiang, K.J. and Hu X.L.**, 2006, Energy demand and emissions in 2030 in China : scenarios and policy options, *Environmental economics and policy studies*, vol. 7, No. 3, pages 233-250

**Fan Y. et al.**, 2007, A model for China's energy requirements and CO2 emissions analysis, *Environmental Modelling & Software*, Volume 22, Issue 3, Pages 378–393

**Liang D.P. and Wu W.W.**, 2009, Barriers and incentives of CCS deployment in China: Results from semi-structured interviews, *Energy Policy*, Volume 37, Issue 6, Pages 2421–2432



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