Social Sciences and Humanities facing Climate Change Challenges
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Is climate change an environmental problem? Epistemological and political reflections.
VERSION courte pour présentation orale

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For the past few years I have headed a team in "science studies" that conducts research in several aspects of climate change.
I will use these experiences to develop the following reflexions.
Climate change now appears to constitute **a turning point:**

- in guiding scientific research;
- in terms of the links between science and politics and various forms of expertise; and
- in the quest for action strategies.

We need to seriously reconsider all of the approaches and analytical frameworks used over the past twenty five years in relation to climate change, sustainable development and the links between science and society, or between the West and other countries (emerging capitalist economies and developing countries).

1. My first point concerns the scientific construction of the topic and how it has developed over time.

The topic of Climate Change is not a recent one. This year, a group of historians headed up by Naomi Oreskes[2] published an in-depth study analyzing the long list of opinions or reports concerning the action of CO2 commissioned by successive US presidents from the US National Academy of Science or various other scientific committees from the 1960s through the 1980s. A broad consensus emerged from the beginning of the 1980s concerning anthropogenic greenhouse gas effects based around an average increase in temperature of 2°-3°C by 2050, and even the possibility of polar warming amplification of 10° to 12°C. However, even back in the 1980s, the economists William Nordhaus and Thomas Shelling were arguing that CC is uncertain, whereas technological change is not, and that we should not therefore worry about CC as it will be much cheaper to adapt to the new climate. The conclusion of the physicist William Nierenberg tasked with drafting the 1983 report of the National Academy was that humans have always adapted and should simply be allowed to move to more favourable places so, in essence, "let them migrate". As the peer reviewer Alvin Weinberg pointed out, while it draws on the two chapters written by the economists, the conclusion clearly contradicts the body of the report. As he said, the message on global warming was "cool it". This conclusion allowed the Reagan administration to continue to ignore the problem.

Does this mean that for the past twenty-five years, science has contributed nothing and our conceptions of climate and climate change have barely altered? The answer is definitely 'no'.

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2 Naomi Oreskes, Erik M.Conway, and Matthew Shindell, From Chicken Little to Dr.Pangloss : William Nierenberg, Global Warming, and the Social Deconstruction of Scientific Knowledge, *Historical Studies in the Natural Sciences*, 2008, vol 38, N°1, p 109-152.

We know that with the computer, it was the 'meteorological sector' that rapidly achieved 'climatology hegemony'
In the 1970's, a climate model was simply an atmospheric model with prescribed surface conditions whose results (simulations) were interpreted in a statistical way. The conception of climate that emerged from these models was one of **'average weather'** calculated statistically over 30-year periods; a climate whose phenomena were based on evidence concerning atmospheric variables (temperature, rainfall, wind, etc.), but whose physical contours and determining factors remained vague. The approach had severe limitations, since some prescribed conditions such as soil temperature or moisture are heavily dependent on the state of the atmosphere and **should be computed** by the model and not prescribed *a priori*.

In the ongoing evolution towards more realistic models, the interaction between the atmosphere and the ocean was the first necessary step in view of the latter's crucial role in the heat redistribution process.

In the course of this coupled ocean-atmosphere phase, the metaphor of the planetary **climate machine** was especially apt and depicted a machine that was both dynamic and thermic; indeed, the main conflicts described by sociologists of science at the time of the controversy in the US over the adjustments required to avoid the phenomena of climate drift pitted dynamic modellers against physicists (principally thermodynamicists) [3]

In the 1990s, climate modelling underwent major transformations, increasingly linked to the emergence of the issue of climate change. The most wide-ranging one is probably the acceleration of so-called coupling activity and the integration into models of a growing number of environments, interactions and feedbacks. It is interesting to note that climate modellers are now increasingly defining their object in terms of an "Earth System" instead of a "climate system".

The issue of integration that I wish to focus on arises in climate modelling in the case of Earth System models and in relation to socio-economic/climate integration. It is linked to the IPCC's overall methodology. This tendency has in the past and may meet with resistance in the future and provoke controversy in various different sectors of the scientific community: how far should we take integration – leaf sizes, nutrients in the oceans, etc? Will this not make things overly-complex? We are aware of several examples of such reticence.

Nevertheless, this increasingly evident trend can only continue as it forms part of a political imperative as well as scientific logic. The issue of integration weighs on the uncertainty of the predictions made by models and their reliability. We will fail to place the same level of trust in models that have ignored such and such a major interaction. However, uncertainty is closely bound up with the political acceptability of all measures and actions that may be envisaged to combat climate change.

The transition from standard, thematic models to coupled models introduces a lot of changes. According to Pascale Braconnot, coordinator of the IPSL coupled model:

> We have moved from quite a static world in which we observe an average state to

[3] see Shackley *et al*; see Dahan (2007)

one that is in a constant state of flux!"[4]

And also, from a mainly atmosphere-based vision of the Earth's climate to one in which a potentially unlimited number of factors may come into play.

There has in fact been **a dual evolution** in climate modelling. In addition to the generalized use of coupling and the integration of an increasing number of *milieu* and new phenomena that inter-react with the climate (ice, pollution and chemical reactions in the atmosphere, vegetation and hydrology), the **carbon cycle and its retro effects** on the *milieu* has also entered the fray – slowly at first, beginning around 2000, and much more rapidly thereinafter.

At the beginning of the new millennium, physicists gradually began to introduce biogeochemical cycles - especially the carbon cycle – into their models. They parameterized the photosynthesis mechanism either at plant level or on a more global scale. Global models of vegetation dynamics that simulate competition between different plant species appeared in the arena of climate change. The respiratory and exchange mechanisms specific to living matter were to have an increasing bearing on the new model of vegetation cover and issues concerning the adaptation of vegetation emerge. The notion of **ecosystems** also had to be taken into account.

The role of paleoclimatology in the transition from climate models to Earth System. must be emphasized. Considerable progress made in reconstructing past climates thanks to the multiplication of paleoclimatic indicators (especially the famous ice core) challenge the slow-moving view of climate change inherent in the previous statistical conception of average weather. Paleoclimatology has helped to provide a more complex picture of climate and to exhibit the notion of climate '**system**' (in terms of a dynamic system) with possible bifurcations and brutal changes[5].

To sum up, the climate appears under close biological control, and the supremacy of physics which imposed its laws on the model is not as apparent as before. Biology retroacts directly and explicitly with physics. The term biosphere (and no more the climate machine) attains its full meaning and assumes a key importance.

I would like to finish off this first point by highlighting a paradox.
On the one hand, once confronted with climate change, in just a few years scientists have managed to develop a methodology that, while neither holistic nor systemic to begin with, has laid down a trail that provides a *de facto* response to the holistic aspiration, such as the "unity of nature", so beloved of Alexandre von Humboldt, the great explorer and naturalist active in the early nineteenth centuries. This methodology appeared successively in models generalized coupling models (ocean, ice and ice-bank, soil, hydrological cycles, vegetation), the integration of **living matter and the carbon cycle** into coupling, and the integration by the same means of **human activities** (agriculture, soil use, socio-economic activities, etc.).

The integration methodology draws on a growing number and diversity of scientific groups forming networks that exchange modules or model components, translate their notions and concepts, and learn to co-ordinate their coupling codes and interface with other models. Each coupling model expands the community of researchers concerned and "complexifies" the map

4 Interview with P. Braconnot, LSCE, July 2003, in H. Guillemot [2007]

5 D.Paillard, *Interdisciplinary Science Reviews*, vol 33, N°1, March 2008., p 25-35.

of actors. As such, enhanced multi-disciplinarity needs to give way to inter-disciplinarity and trans-disciplinarity.

The holistic aspiration of Humboldt, Lamarck or Claude Bernard, which was explicitly present in the work of Vernadsky or the founders of the Gaia hypothesis (James Lovelock and Lynn Margulis), no longer appears to be a metaphysical imperative. The methodology provides a perfect example of a concrete anti-reductionist analytical method.

On the other hand, we are mesmerized by the ambition and the sheer enormity of the project itself. The scientific approach that has resulted in the Earth System being placed in a numerical box illustrates the new face of contemporary science which, far from being in a position of dominance and neutral vis-à-vis the world that it seeks to analyze, transforms this world in a whole host of different ways and at all levels; a science that "appears less and less like an instrument of knowledge and more and more like an **operator**"[6], hitting on strategies that humanity can only attempt to grapple with.

2. My second point concerns questions of expertise and the relationship between science and politics.

It is now common knowledge that one highly original non-governmental body, the IPCC, has a determining role in climate change expertise to the extent that it constitutes a ideal-type for other international projects.
The UN institutional framework in which it was created, its structure consisting of three groups, the cumbersome process under which its reports are drafted[7], the report ratification process..., all this has all been adequately covered before.

What is less well know is the extent to which the IPCC had to fight to preserve its scientific legitimacy while taking account of a certain number of geopolitical imperatives, especially the preoccupations of Southern countries. In a nutshell, it had to earn the respect of the politicians. The mission entrusted by the politicians to the scientists was a traditional (sometimes referred to as a 'linear') expertise paradigm[8]: "first agree among yourselves so that we the politicians can then act". Scientists often like this radical separation between science and political action as it helps safeguard their autonomy. But the linear model never actually works like this and cannot handle the "joint-construction" processes involving scientists and politicians, particularly those relating to climate change over the past twenty years.

Between 1990 and 1995, a major realignment of the climate change regime clearly took place in the wake of the dissatisfaction of emerging countries with the IPCC[9]. In 1990, the IPCC (whose bureau was dominated by the "hard sciences") was still presenting climate change as a

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6 L.Charles, Nature, environnement et développement durable, unpublished note.

7 All chapters of the reports have to be reread and edited twice: once by scientific peers and then by peers and governments. Final reports have to be accepted in a full plenary session and must be accompanied by technical summaries and "summaries for decision-makers". They have to be accepted line-by-line.

8 There is a vast literature on the « linear model », particularly, Roqueplo (1997) on the science/expertise relationship, and Forman (History and Technology, 2007) on science/ technology.

9 Miller Clark A., Challenges in the Application of Science to Global Affairs : Contingency, Trust and Moral Order, in *Changing the Atmosphere*, C.A.Miller and P.N. Edwards (eds), 2001b, p 247-285.

global problem, i.e., with global environmental limits, whereas the bulk of Southern countries saw it primarily as a problem of over consumption by the North. The IPCC did not pronounce on this latter issue as it was outside of its brief.

In 1992, the UN Convention laid the groundwork for the creation of another subsidiary scientific and technical evaluation body, the Subsidiary Body for Scientific and Technological Advice (SBSTA), which was effectively created in 1995. The SBSTA is also an *expert* body but it has a specific mission: providing governments with *explicit advice*. It was to become the body that dealt with political disagreements *strictu sensu* concerning scientific expertise and provided a forum to discuss this. What is credible scientific knowledge? What is legitimate policy? How is policy-relevant knowledge used to define global policy? Aside from the related conflicts, the creation of the SBSTA marked the opening of the spectrum between science and politics and redefined roles.

To paraphrase Bruno Latour, the IPCC's role is a science *purification plant* and the SBSTA deals with the political expression of divisions and disputes that appear in the Conference of Parties and its accompanying forums.

The reconfiguration of the climate change regime between 1992 and 1995, as well as the criticisms levelled at the IPCC, did not fail to influence the organization. Firstly, political processes gradually redefined influences within the three working groups. Secondly, in 1992, its Bureau launched the preparation of (six) "technical" or "special" reports on the national assessment of greenhouse gas emissions, energy-related and industrial issues (including carbon capture and sequestration technologies), agriculture, forestry and soil use in general, as well as emission scenarios. We are impressed by the diversity, amplitude and prospective dimension of these topics. The publication of the resulting reports in the late 1990s and post 2000 reflected the IPCC's wish to be more responsive to the demands of politicians and to contribute to the decision-making process directly. The related tasks were ultimately split between the IPCC and the SBSTA.

In terms of links to the scientific community, the IPCC remained the key body that oversees a world-class activity and applies the rigorous procedures that serve to safeguard its strictly scientific brief. Moreover, the IPCC encourages reflexive scientific thinking, particularly in relation to contentious issues laden with political implications[10].

The debates that took place within the SBSTA during the late 1990s illustrate the challenges inherent in any effort to harness science to public policy. They crystallized mainly around three issues [11]:

- the question of contingencies: the contingency-based argument versus assertion of the universal validity of scientific declarations or their consequences,
- issues of trust or credibility: how to guarantee the validity of certain assertions and trust in expert findings,
- the moral issues:

Different means have been used to validate scientific findings and advance the debate: 1) the political standards of democratic participation; 2) the consensus rule for reinforcing the

[10] Example of the controversy launched by Richard Lindzen on the effect of cloud feedback on greenhouse gas warming. See Bony [2004] and Dahan [2007]

[11] We draw here on the analysis of Clark Miller (2001) who studied these issues in detail during the early years of the SBSTA

credibility of scientific expertise - here especially, it is essential to open up the debate to include all governments; and 3) the participation of all NGOs, which confers a certain moral credit.
Thus, the credibility of scientific thought is not treated as a solely internal scientific matter but appears closely linked to institutions and political standards. The issue is not one of informing governments of current scientific truths but of developing a shared understanding of global environmental risks.

It was really Delhi in 2002, – at the first Conference of Parties at which the United States announced they would not be signing the Kyoto Protocol— that marked the emergence of the theme of adaptation. Thence, a *de facto* consensus emerged between the United States, which wished to play for time, and the Southern countries, which saw this issue as a potential source of additional funding that would neither constrain their development nor require any discussion of what would happen after 2012.

Adaptation appears as a *leitmotif* in the constant challenge to the methodology underpinning the framework of the climate change regime over the past fifteen years, particularly by considering 1990 as the base (base year for Kyoto, benchmark for additional environmentally-friendly development mechanisms). Critics claim that a meteorological physics-based approach cannot be used to define the future of the planet from a socio-economic perspective. Similarly, the base year must incorporate a historical legacy of political, economic and social conditions. The heads of the IPCC have enthusiastically taken up the new priority of adaptation by linking it to reduction and the fourth assessment report (published in 2007) focused more on analyzing vulnerabilities and adaptation and included far more concrete examples.

So, in brief, since 1988, scientists and politicians have been moving forward together. Each major IPCC assessment report has paved the way for key political decisions. Conversely, each COP, each new phase in the negotiating process and each potential decision have been marked by conflict and been accompanied by a request for additional expertise or new research under the impetus of the IPCC. The IPCC-SBSTA tandem embodies this joint scientific/political production process where the two normally antagonistic processes of political conflict and scientific consensus building combine in a complex series of trade offs and competition.

3. Climate Change and Sustainable Development: I would now like to discuss action strategies.
I will be briefer here and leave a number of questions for my colleagues specialised in economics and political science.

The 4th IPCC Report is a cornerstone in the construction of the truth of climate change. The wake-up call concerning the reality of the phenomenon was duly issued. It is by no means certain that there will be an analogous cornerstone in the short- to medium-term.

During the 28th session of the IPCC held in Budapest last April , the participants noticed a **shift** from the 'hard' science on the existence and causes of climate change to the increasing urgency to obtain information on regional impacts, adaptation and mitigations options [...] a shift from more theoretical concerns to concrete needs" [12]. However, in the scientific

[12] *Earth Negotiations Bulletin*, 2008, p 9.

construction of the problem of climate change, the local-global link is a particularly thorny issue. The demand for regional predictions, the notions of the speed of change or amplitude of extremes, etc. raise the certain/uncertain frontier that we know to be difficult to deal with where there are links to the political process.

Up to now, adaptation has had pretty bad press. It has not been 'politically correct' as it is equated with acceptance of climate change. To a ceratin extent it has become inevitable given the time already lost in terms of the action and irreversability of the CO_2 concentration process. Adaptation may be analysed from a number of different perspectives. I believe that in Europe, at the international level, we need to closely link adaptation to sustainable development (SD) even though we have to recognise that SD suffers from a credibility deficit due to the failure to bring about any convergence between the economy and the environment and between North and South despite promises going back 30 years.

Nevertheless, a number of key SD themes have forced their way onto the political agenda. For decades now, proponents of SD have been sounding off about the limits of natural resources and the need to increase their costs. The current oil crisis has pushed this topic centre stage along with, the current food crisis. In one fell swoop the market has imposed what public authorities were unable to do in relation to the polluter payer principle, for example increase the price of energy.

It is actually climate change (CC) that has become the "**driving force**" for the whole area of sustainable development. This means that all other environmental questions, all issues of North-South development or equity issues which previously fell under the question of SD are now viewed through the prism the CC regime and subjected to the pace of its development and accompanying geopolitical dynamic.

The carbon issue provides an indicator that is easier to use than 'natural capital' or 'ecological footprint'. The "carbon footprint" indicator has the enormous advantage of being a comparative and universally applicable classification tool: the "climate-friendliness" of a production activity or a technology is gauged in terms of whether it emits less carbon for the same output. Furthermore, an IPCC report has laid down the guidelines to be used - in an initiative that is all the more remarkable for having been accepted by Southern countries which now have the capacity to implement these guidelines themselves (without the intervention of externally-imposed experts)[13].

Consequently, on a global level, CC has increased the '**technical complexity**' of SD which was previously couched in broader, more multi-cultural and woollier terms. It now comprises the core of the whole domain, a dramatic development that excludes other aspects – particularly social ones – to an increasing extent. In the international climate arena of the COPs, the priorities are **technical proficiency**, energy efficiency and **green technologies**. From a cultural perspective, the domain is characterised by the care taken to avoiding any ideological connotations and by a highly **pragmatic** approach that looks to the market on the one hand (especially the carbon market), and whole range of related regulatory and legal provisions on the other. Technology transfer and the adjoining compensation mechanisms appear to limit the creative imagination.

[13] See the analysis of the guideline adoption process complied by Clark Miller (2001) as well as the summary in Dahan (2007)

A slow transition to less carbon intensive technologies is undoubtedly taking place and green business is developing apace. But with what sense of urgency, at what rhythm and on what social basis will this transition take place? The same questions apply to the race to come up with adequate responses to tackle climate degradation. Will we be able to hold global warming at an average of +2°? or will it be +4° or even more? - thus giving rise to completely different challenges.

What is the future for political governance of CC ?

For the past ten years, we have only had one model of governance, i.e., the UN-sponsored Kyoto process Even disregarding the obvious desirability of a post-Kyoto agreement, it is clear that this regime cannot continue to operate alone. The question of adaptation cannot be dealt with at this level. Moreover, there is no simple economic tool for adaptation, which will undoubtedly call for increased cooperation between states with diverging interests and negotiated agreements incorporating a wide range of interests, as well as the participation of actors from the civil (NGOs) and corporate domains. Furthermore, the geo-political framework conceived of in the 1990s totally disregarded sector-based economic competition. This was ignored, except by the US which never signed up to Kyoto. But the new carbon geopolitical environment is very different and is determined by competition between the traditional capitalist economies and the new emerging capitalist powerhouses. Climate change regulation depends as much on a negotiated competition-based agreement as it does on an environmental regime and nothing can really get done if these imperatives are artificially blurred.[14]

It should be stressed that the extent of the climate wake-up call and the seriousness of the ecological crisis that it reveals have not triggered any in-depth review of the existing social contract in developing countries in either the public opinion, the political process or in the intellectual or academic sphere of the social sciences. There has been little debate over forms of growth, finite resources (apart from petrol), adjustments required to consumption patterns in developing countries, or the various scenarios and their underlying visions of the world. There are enormous gaps in the debate over the future of urban life in the broad sense (North and South) which have obviously a historical and strategic significance.

The Bali Conference has highlighted above all that the key issue for any climate negotiations has to be **development** - in both developing and developed countries.
1. One unavoidable question has been raised: To what extent can our society provide decent living conditions for its populations while reducing GHG emissions? Is it possible here? Is it possible in developing countries?
2. Then a second question arises : what pace of development is compatible with stabilising the Earth's climate? This in turn brings us back to the issue of reducing emissions by 50% by 2050. Developing countries may accept to be part of this discussion if they are given guarantees concerning their pace of development.
3. If agreement is achieved on halving emissions by 2050, the following issues may be addressed: how can commitments be broken down in an **equitable manner**? What **commitments** should be imposed on major industrialised countries? What should the **obligations** of emerging countries be? etc.
Tackling this series of questions may avoid potential stalemate at Poznan or Copenhagen .

[14] Michel Damian, *L'éclatement du régime climatique, communication orale à l'Atelier De la Nature au Système Terre, environnement et durabilité, MNHN, 23 Juin 2008.*

Development is now inextricably linked to meeting the challenge of climate change. It cannot be reduced to an engineering science problem (proprietary or green technologies) or an economic conundrum (carbon market, taxes, incentives) even though solutions are needed in both areas. A combination of technical innovation and social lifestyle innovation (dwellings, territories) needs to be linked to a **philosophical project** based on worldwide equity. In other words, the canvas is still bare.