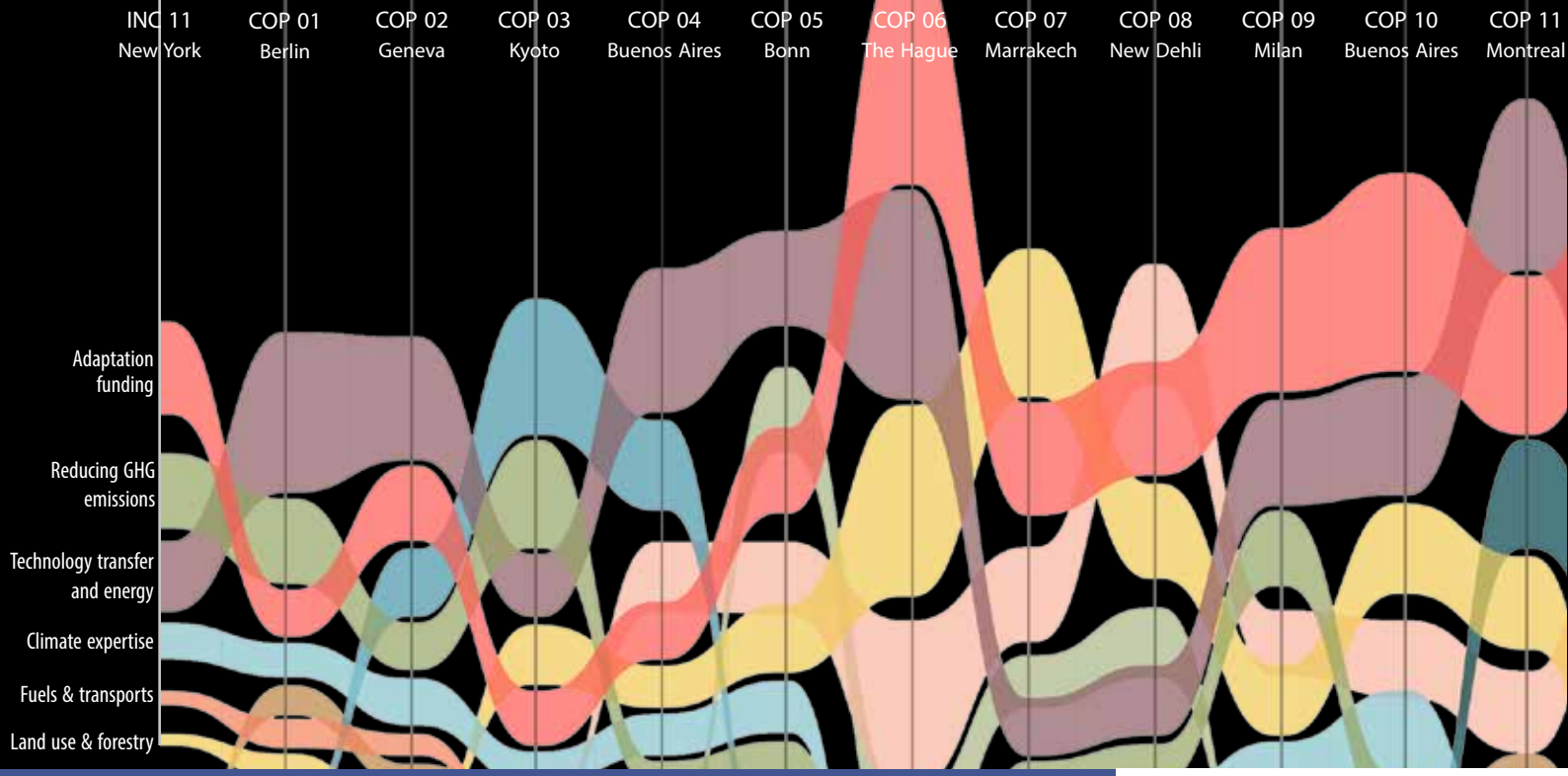


GIS Climat-Environnement-Société

CLIMAT ENVIRONNEMENT SOCIÉTÉ

Groupement d'Intérêt Scientifique

New Perspectives on Global Environmental Images

Actes of the international conference

Paris-Meudon

October 9&10, 2014

New Perspectives
on Global Environmental Images

Acts of the international conference of October 9&10, 2014

ORGANISATION OF THE CONFERENCE

Groupement d'interêt scientifique Climat-Environnement-Société
Centre Alexandre Koyré

PUBLICATION EDITED BY

Sebastian Grevsmühl

CONFERENCE SUMMARY

Aurore Viard-Crétat

TRANSLATION

Marie Furthner

ASSISTANCE WITH ORGANIZATION AND EDITION

Clotilde Péan

GRAPHIC DESIGN

Clotilde Péan

Cover photos:

Top:
Excerpt of the representation of the evolution of climate negotiation themes' visibility between 1995 and 2013.
MEDEA project.
Medialab Sciences Po, Paris, 2014

Bottom:
The Blue Marble

Foreword

The "New perspectives on global environmental images" international conference which took place on October 9th and 10th, 2014, is part of the ENVIGLOB ("*Debate over the global environment: controversies and images*") project supported by the *GIS Climat-Environnement-Société*. The aim of the project was to discuss the notion of "global environment" from two angles: "discourses and controversies" and "images and representations". This conference focused mainly on the second theme and on the role of images in the creation of environmental questions, including climate change, as a public and planetary issue, as well as its' political dynamics.

This conference was organised by Sebastian Grevsmühl and the *GIS Climat*, with the support of the *Centre Alexandre Koyré*. The idea was to mobilise a variety of perspectives from a large spectrum of disciplines in order to analyse strategies and imaginaries linked to the production, circulation and power of global environmental images. From icons of the environmentalist movement, through IPCC experts' graphs, to satellite imagery, global environmental images form the sensory basis of planetary processes that govern the "Anthropocene". Images all play an active part (though on different scales) in our interpretation and understanding of changes in the Earth system and the consequences we intricately associate to global climate change. As true mediators between various groups and cultures, and between global processes and local impacts, new questions on global environmental images lead to a highly productive debate on the complex relations between science, society, politics and nature.

This publication is a collection of the syntheses of the presentations given during this colloquium. The presentations helped broaden the debate, reveal the tensions linked to global environmental images and identify transversal areas of research to encourage dialogue between sciences and humanities, which will undoubtedly produce both surprising and innovative results.

All media and recordings of the presentations given during the conference are available on the GIS Climat website at the following address: *http://www.gisclimat.fr/feedback-international-conference-new-perspectives-global-environmental-images.*

Sylvie Joussaume
Director GIS Climat-Environnement-Société

Contents

(T) : translation of the original text

The Groupement d'intérêt scientifique Climat-Environment-Society (GIS Climat) is...

A scientific consortium

Created in 2007, the GIS CLIMAT develops, funds and coordinates interdisciplinary research into climate change and its impacts on society and the environment. The consortium relies on the research expertise of 17 laboratories in the Paris area working in various disciplines.

CLIMAT ENVIRONNEMENT SOCIÉTÉ
Groupement d'Intérêt Scientifique

A permanent team

Director:
Sylvie Joussaume
Sylvie.Joussaume@gisclimat.fr

Deputy director:
Robert Vautard
Robert.Vautard@gisclimat.fr

Deputy director for interdisciplinarity:
Chantal Pacteau
Chantal.Pacteau@gisclimat.fr

Communication et administration:
Clotilde Péan
Clotilde.Pean@gisclimat.fr

Human resources

The GIS Climate runs on a permanent three-person team that defines the major scientific orientations, helped by a head of communications and administration. The steering committee consisting of ten experts selected among the laboratories that are part of the consortium, supports and advises all scientific decisions. The consortium board, with representatives of the founding members and ministries, decides on the strategic direction of the consortium. As for the Scientific Committee, composed of internationally recognised experts, it expresses its opinion and recommendations regarding the actions and the proposed guidelines.

Financial resources

The consortium has an endowment of eight million euros over a period of nine years (2007-2016), brought by its six founding members:

- the Centre national de la recherche scientifique (CNRS)
- the Commissariat à l'énergie atomique et aux énergies alternatives (CEA)
- Versailles Saint-Quentin-en-Yvelines University
- École polytechnique
- Pierre and Marie Curie University
- the Agence de l'environnement et de la maîtrise de l'énergie (ADEME)
- with the support of the ministries in charge of research and environment.

17 partner laboratories

Climate

7 laboratories within the Institut Pierre Simon Laplace (IPSL) federative structure:

- Laboratoire atmosphères, milieux, observations spatiales (LATMOS)
- Laboratoire inter-universitaire des systèmes atmosphériques (LISA)
- Laboratoire de météorologie dynamique (LMD)
- Laboratoire d'océanographie et du climat : expérimentation et approches numériques (LOCEAN)
- Laboratoire de physique moléculaire pour l'atmosphère et l'astrophysique (LPMAA)
- Laboratoire des sciences du climat et de l'environnement (LSCE)
- Laboratoire Milieux environnementaux, transferts et interactions dans les hydrosystèmes et les sols (METIS)

Health

- Laboratories part of the UFR médicale Paris Île-de-France Ouest (PIFO)

Ecology

- Institut d'écologie et des sciences de l'environnement de Paris (iEES Paris)
- Laboratoire d'Écologie, systématique et évolution (ESE)

Human and Social sciences

- Centre Alexandre Koyré
- Centre d'études sur la mondialisation, les conflits, les territoires et les vulnérabilités (CEMOTEV)
- Centre international de recherche sur l'environnement et le développement (CIRED)
- Centre de Recherches en économie-écologie, éco-innovation et ingénierie du développement soutenable (REEDS)
- Laboratoire dynamiques sociales et recomposition des espaces (LADYSS)
- Pôle de recherche en économie et gestion de l'École polytechnique (PREG)
- Laboratoire Cultures, Environnements, Arctique, Représentations, Climat (CEARC)

31 funded projects, over 20 conferences, seminars or symposiums organised.
Over 100 scientific publications

Five areas of research

- Global climate, energy policies and economic development
- Climate extremes and vulnerable regions
- Climate change, ecosystems, water resources and land use
- Climate change impacts on health
- Climate change adaptation

A web site
www.gisclimat.fr

Why the Groupement d'intérêt scientifique Climat-Environnement-Société ?

Sylvie Joussaume, director

What lead to the creation of the GIS Climat-Environnement-Société?

The project was supported as part of the 2006 update of the "2004-2012 climate plan", which was the first exhaustive plan defining national actions to fight climate change in order to meet the objectives of the Kyoto Protocol. The aim was to create a consortium of interdisciplinary research in the *Île de France* region around studying climate change and its impacts. Drawing on the Institut Pierre Simon Laplace, specialised in climate research, the consortium was created with laboratories working in different fields: ecology, hydrology, health, human and social sciences. With the support of the ministries of research and of the environment, a network was created with an agreement between research organisms (CNRS and CEA), universities (UPMC and UVSQ), the Ecole Polytechnique and the French Agency for the Environment and Energy Management (ADEME). A scientific cooperation contract was signed in the form of a contractual structure requiring the pooling of skills and means, entitled "groupement d'intérêt scientifique" or GIS.

Why interdisciplinarity?

The project was lead by climatologists who wanted to obtain partnerships with other fields to explore the impact of climate change both on the environment and societies. It was therefore necessary to work in close collaboration with fields of knowledge that brought other visions and ways of thinking. Hence the idea of teaming up with ecologists, hydrologists, economists, health researchers… The need to reinforce the interdisciplinary dimension in the study of climate change impacts had already been discussed as part of the international Earth System Science Partnership program and it is useful to note that several initiatives similar to ours saw the light in other countries around the same time.

What was its objective?

The objective being to gain a better understanding of climate change, we needed a structure that was able to give momentum to projects that chose different approaches. The GIS Climat was the incentive to create collaboration and networks chosen by both ministries to meet the challenge. At first, the GIS Climat aimed to deepen climate research and develop studies on climate change impacts, but gradually, its supervisors focused on developing interdisciplinary research, as the GIS Climat could play a key role thanks to its scientific animation approach and its ability to incite. These approaches needed time to be thought through and designed, so the GIS Climat, initially created for 5 years, was prolonged for another 4 years.

How does the GIS Climat work?

In order to encourage the interdisciplinary dimension of the projects and to reinforce their integrative potential, the GIS Climate works with calls for projects and scientific animations. Thus researchers can define and implement projects that need the help of several disciplines in a cooperative manner. After a first wave of projects that benefited from collaborations that existed before the creation of the consortium, the GIS Climate decided to spend a year focusing on discussions and scientific animations to consolidate its approach in building robust and integrated debates necessary to the renewal of questions and methodologies. Gradually, the interdisciplinary nature of the projects widened and showed the necessity of what we call an incubation period. ■

The workings of the GIS Climat

Chantal Pacteau, deputy director for interdisciplinarity

What are the constraints of projects financed by the GIS Climat?

To bring explicit and concrete support to interdisciplinary research within the GIS Climat's areas of research, we diversified the notion of project: we launched original topics which implied the creation of a small team, we facilitated the start of projects that were then developed as part of national or European projects, we welcomed specialists of ill-represented fields in the French scientific community, we supported structuring projects and platforms that aimed to improve interfaces with society, we encouraged international collaboration and the co-financing of interdisciplinary theses. To implement this variety of actions, we adopted a very flexible policy in terms of finance (the threshold being in line with our means of course!) and duration (three years maximum). To guarantee the crossing of disciplines, we chose one simple rule: each project has to be led by researchers whose field of study covers at least two research fields – project leaders necessarily belong to one of the GIS Climat teams but they include in the project colleagues with the required skills regardless of where they come from.

What is your line of conduct in choosing a project?

The scientific community has to relentlessly further its disciplinary knowledge (e.g.: green house gases, the water cycle, soil erosion) and produce new knowledge. The mission of the GIS Climat is to put its knowledge in common and to build communities to reach an understanding of climate change and of possible changes to come on different levels of complexity. This is why on top of our support to exploratory research we have also encouraged projects that were part of big research programs to help further the emergence of shared research questions and the thinking tools they require. For instance, we raised the question of "adapting to climate change" in the "trames vertes" (green corridor) program of the ANR (French National Agency for Research), as it had previously not been taken into account… which is perfectly legitimate! ■

Interdisciplinarity at the heart of the GIS Climat : the RAMONS project

Jean-Paul Vanderlinden, Professor of economic sciences at the UVSQ, member of the CEARC laboratory

Why choose a project on building interdisciplinarity?

The aim of the RAMONS project was to ensure interdisciplinarity in questions linked with climate change. That was the object of Anne Blanchard's thesis defended in 2011: the idea was to better understand how cooperation emerges and develops beyond disciplines. It linked interdisciplinarity and reflexivity in a novel way, with reflexivity being defined as a questioning and an analysis of people's representations, beliefs, motivations as well as personal and field interests. It was based on a participative research-action used on some of the GIS Climat's projects with the help of a specific toolbox. The idea was to give it to researchers to help them build and develop their own interdisciplinary project. .

What is this toolbox?

One of Anne's fine ideas was to give members of the projects different standardised documents to exchange either during presentations or workshops. The participants had to give an opinion on their field, subject study or expectations of others in an interdisciplinary approach. The aim was altogether to help participants better understand the realm of their own field, to help them think about their own field and to encourage open-mindedness and respect of others' fields. Anne also put in place the concept of an inaugural contract between the members of the consortium in order to define people's expectations and understanding of interdisciplinarity.

Tools aren't everything…

The building phase of an interdisciplinary project is essential. It is at that stage that players disengage the most, because the complexity of the stakes as well as their time-consuming nature appear, with the endless uncertainties inherent to interdisciplinary contexts. Not only is it necessary to have an in-depth analysis of one's own scientific approach and to learn to work with the concepts and methods of others, but one also needs to prepare for what I would call "long term reflexivity" to juggle with differences and complementarities, personal development and disillusions, learning and efficiency… It is also essential to move away from the feeling that one's expertise isn't sufficiently taken into account. This process isn't particularly pleasant and is far from easy to undertake: it requires true motivation.

What do you take out of this research project?

I prolong RAMONS every day! I reuse the tools put in place. But most of all, I always take the time to redefine the notion of interdisciplinarity with my colleagues before launching a project. We have to agree on a common definition of interdisciplinarity, not on "THE" definition, to ensure there are no illusions and no disappointments later on.

How can interdisciplinarity be rooted within the scientific approach?

Lack of explicit practice of reflexivity is a real obstacle. Reflexivity goes beyond tools and exercises tested in RAMONS, it has to be included in any scientific curriculum from the start so as to be understood by all. I have students in a physics master's degree who say they don't see the point in philosophy of science! Then we, as science and technology researchers, need to impose a new discipline on ourselves. Other scientists are not very sensitive to our discourse, we therefore need to evolve.

What paths could be explored?

I don't think we are looking at interdisciplinarity from the right angle. Today, we take bits of disciplines and try to put them together. We should look at topics, places, territories and simply approach them without any disciplinary bias. We should consider an object as a whole, decisively and straight off. ■

Introduction[1]

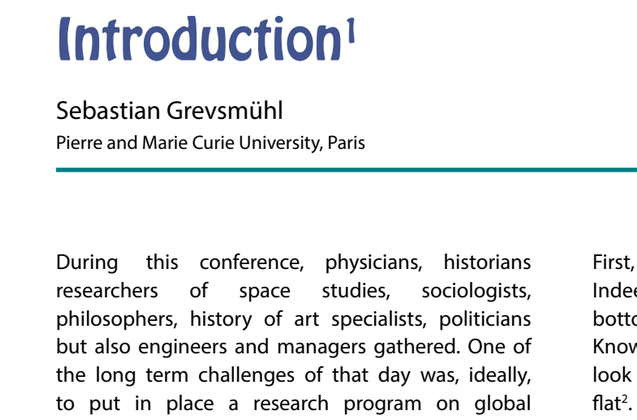
Sebastian Grevsmühl
Pierre and Marie Curie University, Paris

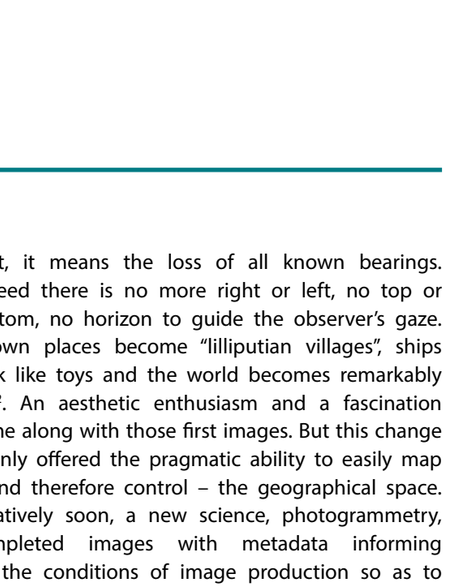
During this conference, physicians, historians researchers of space studies, sociologists, philosophers, history of art specialists, politicians but also engineers and managers gathered. One of the long term challenges of that day was, ideally, to put in place a research program on global environmental images that would include as many diversified skills as possible.

Today, we are all used to space perspectives, yet it does not go without saying, it calls into question many conventions regarding historically rooted human perspectives. This adaptation has therefore been a long, ever-evolving learning process, from the first aerial photographs taken in inflatable aircrafts in the 19th century to the iconic images of a vulnerable blue planet seen from space.

What does this change in perspective, from panoramic perception to a vertical view, mean? First, it means the loss of all known bearings. Indeed there is no more right or left, no top or bottom, no horizon to guide the observer's gaze. Known places become "lilliputian villages", ships look like toys and the world becomes remarkably flat[2]. An aesthetic enthusiasm and a fascination came along with those first images. But this change mainly offered the pragmatic ability to easily map – and therefore control – the geographical space. Relatively soon, a new science, photogrammetry, completed images with metadata informing on the conditions of image production so as to better define their nature. The height of the photo shoot therefore quickly became necessary to the technical use of aerial photos as it helped calculate the scale.

This ambivalence between aesthetic pleasure and instrumental concept was perpetuated throughout the history of images "seen from above": aerial photographs became a major tool during the First World War and filled artists' imaginaries at the start of the 20th century. Equally, in spatial imagery, the military dimension wasn't enough to explain the success of the blue planet pictures, though it was influential. Famous images such as *Earthrise* or *Blue Marble* were not programmed, nor did they have an instrumental goal. It is probably their aesthetic power that turned them into icons.





Figures 1 and 2
The first aerial photographs date back to the 19th century and open many utilitarian and artistic perspectives.
Left: G. Tissander, J. Ducom, "photography taken from a hot-air balloon by Messrs. Gaston Tissandier and Jacques Ducom – Ascent of 19th June 1885 (…)", vertical aerial photograph (BNF).
Right: H. Daumier, "Nadar, élevant la Photographie à la hauteur de l'Art" (Nadar elevating Photography to Art), Le Boulevard, 25th May 1862 (LACMA).

Figure 3
The first "Earthrise", Lunar Orbiter I, 1966 (NASA). As with its more famous successor in 1968 (Apollo 8), the image was already turned by 90 degrees to better fit into the tradition of landscape perspective.

Another essential element to analyze these images is the framing they imposed on our conceptualizations of nature and how they determined representations and metaphors of the Anthropocene. Spatial images and the ever-increasingly efficient transformation of space into a quantifiable object through drawings also nourished an increasingly powerful imaginary of planetary management during the cold war. The famous metaphor of the "spaceship Earth" – popularised in the 1960s – corresponds precisely to this technocratic concept of the environment and the ambition to manage the Earth at will.

This systemic notion stemmed from research in building life maintenance systems for space exploration, systems we inherited from military submarines and nuclear shelters. Through this metaphor, engineer-architect Richard Buckminster Fuller and many others like economists Barbara Ward and Kenneth Boulding attempted to modelise the entire economic and environmental space based on astronauts' ideals. In that sense, it was a utopian quest for a profoundly rational life, the exact opposite of the precarious state that "professional pessimists" on Earth supported. In other words, the "spaceship Earth" metaphor carried a strongly managerial and technocratic view of environmentalism, because it aimed at putting an elite of designers, experts and technocrats at the steering wheel of «spaceship Earth». Today, highly speculative approaches such as geo-engineering draw from this imaginary.

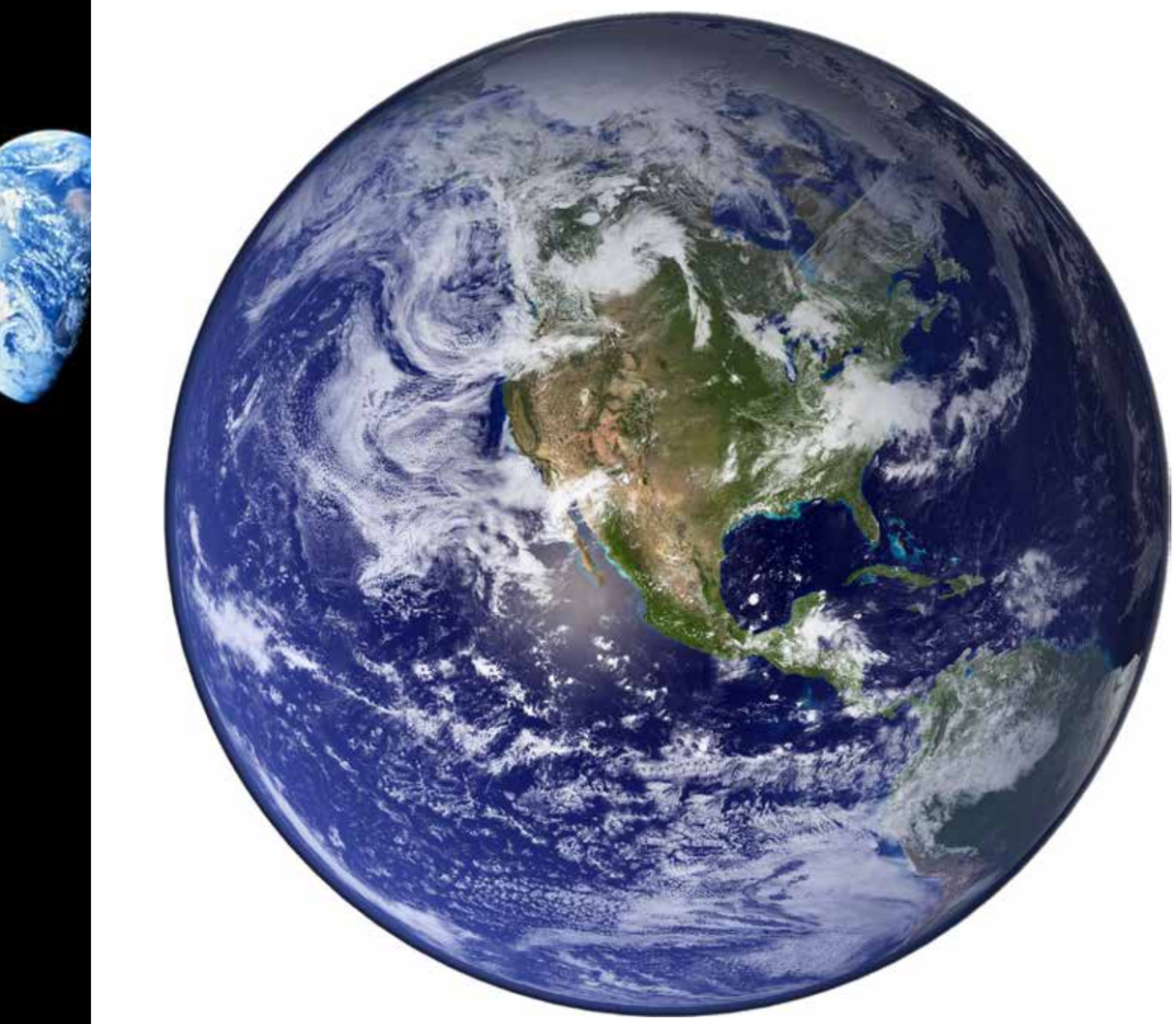
On the one hand, spatial images have clearly helped establish once and for all the fact that we live in a finite world and that we have, in other words, followed the opposite path described by

1 This introduction uses elements developed in a recently published book: Sebastian Grevsmühl, *La Terre vue d'en haut. L'invention de l'environnement global*, Paris : Seuil, 2014, p.34.

2 James Glaisher, Camille Flammarion, W. de Fonvielle and Gaston Tissandier (eds.), *Travels in the Air*, 2nd eds., London, (1870) 1871, p.80, 146 and 147.

Koyré, i.e. the path from the infinite universe to a closed world. With the loss of peripheries, it is clear that we live in a closed space where there is no "exterior" to which we could dispose of our rubbish and industrial waste. Yet the notion of a finite planet also carries a politically ambiguous message. The cold war has left us a highly problematic holistic way of thinking. This heritage clearly isn't neutral as it has given way to aspirations that have paved the way for so-called "top-down" solutions, technocratic dreams to save the planet.

Here are therefore the main questions we are going to raise: why do some images, specifically scientific images, become extremely powerful, when others hardly impact our imaginaries? To what extent do some visualisations have hidden effects on our representations? What factors and contexts change the game? What political and ideological ideas are carried by images and metaphors of the global environment? Exploring the many dimensions discussed during this conference implies having to share and compare approaches, which is why it was essential to combine such a diversity of disciplines. ■



The Blue Marble
© NASA -Earth Observatory 2014

The icons of the environmental age

Chair: Christophe Bonneuil
Centre Alexandre Koyré

Global images of the Earth have not only been used for utilitarian and aesthetic ends. They have also modified the way we think about the environment. By offering humanity the possibility of seeing its natural environment "from the outside" in the form of a small, beautiful and vulnerable marble in the middle of a dark and mysterious universe, photographs of the Apollo missions have fed into the feeling of belonging, of vulnerability and of responsibility. Thus environmental problems are no longer looked at on a local scale, but the entire Earth becomes an entity that needs protecting. This evolution has socio-political consequences: multilateral institutions and international organisations become legitimate platforms to display environmental thought and actions.

By doing so, global environmental images have been reclaimed by numerous organisations and have become omnipresent in public and commercial communications. During that process, they have acquired new connotations and have been reconfigured. This first session is on the uses of the environmental imaginary and their symbolic and socio-political performativity. How did environmental awareness campaigns in the US in the 1990s paradoxically restrain actions in favor of green consumerism? How do marketing and the media industry use the planet as a symbol of globalism?

Earthrise, Apollo 8, 1968
© NASA

Global Crisis, Green Consumers: Environmental Spectacle in a Neoliberal Age.

Finis Dunaway
Trent University

As Earth Day 1990 approached, green went mainstream in the United States. A wide array of visual media all seemed to align with the environmental movement, to disseminate disturbing images of global crisis and to promote a new era of ecological responsibility. While these images mobilised feelings of environmental anxiety, they also played a crucial role in codifying neoliberal templates of environmental citizenship. Capitalism and emotional politics became enmeshed in new and complicated ways during this period: while corporations sometimes seemed responsible for the environmental crisis, the market, spurred on by enlightened consumers, also seemed to offer the most promising path out of the abyss. Ultimately, media packaging of environmental hope presented the movement itself as a form of therapy, a way for individuals to cope with the distressing imagery of environmental crisis. While environmental anxiety often depended upon a vision of citizens as victims in need of protection *from* the market, the therapeutic frame reimagined consumers as empowered players *in* the market.

This paper is derived from my forthcoming book, *Seeing Green: The Use and Abuse of American Environmental Images*, which explains how media images have made the environmental crisis visible to a mass public, but have often masked systemic causes and ignored structural inequalities[1]. Deflecting attention from corporate and government responsibility, popular images have instead emphasized the idea that individuals are personally culpable for pollution and other environmental problems. The visual media have thus offered environmentalists a double-edged sword: images have helped them popularise their cause, but have also distorted their ideas by portraying their movement as a moralistic crusade to absolve the nation of its guilt. Ultimately, this dual focus on spectacles of crisis and individual consumer choices has hidden underlying causes and structural solutions behind a veil of inattention.

Media images from the late 1980s and early 1990s fused the notion of a long-term, escalating global crisis with a short-term, privatised focus on individual action and green consumerism. These two themes of planetary peril and personal responsibility had long been central to the history of popular environmentalism, yet they became more tightly linked during this period than they ever had before.

Why did this particular vision of environmentalism become so widely represented and enshrined during this particular historical moment? Three reasons stand out. First, the end of the Cold War, together with the success of certain green consumerist projects, all reinforced the increasing popular faith in the capitalist market as an instrument of democracy. Second, the visual politics of Earth Day 1990 oscillated between the global and the personal to create a neoliberal politics of scale. At the macro level, the environmental crisis seemed both worldwide and potentially apocalyptic. This global sense of crisis would be joined by a relentless focus on the micro, on the individual as the agent of change, the enlightened consumer who can redirect markets to ensure sustainability. The neoliberal emphasis upon individual responsibility imagined environmental citizens governing at a distance, saving the earth by demonstrating their ecological concern in the private realm. Third, the rise of recycling programs provided a tangible way for individuals to gain a sense of involvement in the environmental cause. It is not coincidental that recycling—above all other actions—became the most prescribed form of environmental citizenship during the period surrounding Earth Day 1990. The recycling logo suddenly became ubiquitous, appearing on bins and beverage containers as an emblem of sustainability, a reminder for consumers to take personal responsibility for the planetary future.

The popular farming of environmentalism as a market-oriented, green-consumerist strategy contributed to the national neglect of climate change and other accretive disasters in the making. Indeed, the limits to environmental reform were embedded within these depictions of the movement as a personal, consumerist response to crisis. While the repeated emphasis on individual responsibility furthered the popular commitment to recycling, while pesticide fears boosted sales of organic food and led high-end grocers to expand their market share, the neoliberal template of environmental citizenship did not call upon the state to limit greenhouse gas emissions or curb the power of globalising corporations. Americans instead were urged to recycle and, if they could afford it, to shop their way to ecological salvation. In a period marked by rising rates of economic inequality, green consumerism catered to the affluent and obscured questions of power relations. The structural, systemic assault on the ecosphere continued, the release of greenhouse gases and the production of toxicity escalated, the poor and racial minorities within the United States, together with people in the Global South, experienced higher levels of ecological risk. All of this happened while recycling programs expanded across the United States, while green consumer products promised to shield the affluent from harm, and while recycling and other individual actions provided Americans with a therapeutic dose of environmental hope. ■

Figure 4
"If you don't recycle, it's the entire planet you're throwing away". As of the end of the eighties, recycling became the environmentally-friendly gesture (Environmental Defense Fund campaign).
© EDF

1 Finis Dunaway, *Seeing Green: The Use and Abuse of American Environmental Images,* Chicago: University of Chicago Press, 2015.

The blue planet through the marketing and communication prism

Silke Vetter-Schultheiß
Darmstadt University of Technology

For centuries, images of the Earth have been associated with a variety of meanings. Long before the 20th century and its fundamental changes in experiences of space, iconographies of the Earth appeared that depicted it as a small sphere as

Figure 5
Coin featuring on one side the Roman emperor, and on the other hand Jupiter with a globe in his hand, 4th century.

if seen from outside its boundaries. Thus, what Donna Haraway calls a "neocolonial Earth", can be traced back for hundreds of years. For example, a 4th century Roman coin depicts Jupiter holding a globe in his arms on one side and the emperor on the other: in doing so, the coin transferred divine power, symbolised by the control of the earth, to the emperor.

There was, however, a fundamental development in the 20th century: The first satellite images, particularly *Earthrise* (1968) and the *Blue Marble* (1972), gave rise to a new set of meanings and led to a struggle about the interpretative authority over these images. The images were realised within NASA's space programme, but these representations of Earth as seen from space were used by many other organisations, including NGOs and environmental groups, but also news agencies and big corporations. No longer was the political power of the Empire represented in these images, they became tools of marketing campaigns and thus developed meaning beyond power representations. Despite mass usage of the Earth as a symbol, it remains a favored medium. Thus, during one's daily activities one sees multiple evocations of the planet as a global entity, in many contexts and in different media. How did these iconic representations adapt to the aims of organisations that used them, for example in the travel, banking, packaging or food sectors? What happens to the connotations they acquire and spread? To answer these questions, the images cannot be considered as representations *of the reality*, but as the expression of *our representations of reality*, as what communication experts would like us to associate with their products and activities. This exploratory paper has identified three main connotations that are transported through earth imagery.

Figure 6
"Today, I save the world with a current account at GLS Bank" (German bank GLS advertisement in: *Der Lebensbaum. Magazin für ökologischen Genuss*, no. 70/Fall 2014, p. 24).

One Earth-associated connotation concerns the relationship between distance and travel. Just as travel agencies use planet images to suggest ease of travel to far-away destinations, banks use the symbol of the planet as a medium to show the multiple possibilities on offer for its clients. As shown in fig. 6, earth imagery can be used to promote the idea that bank and clients can work together for mutual benefit while at the same time respecting the environment. Refined and toned-down drawings erase the technical and complex aspects inherent to the banking sector, to spatial programs or to travel. An impression of human cohesion and of connection to the global environment remains the transported message.

Figures 7 and 8
The planet, a symbol of knowledge preserved thanks to knowledge.
Left: an organic chocolate wrapping (www. lovechock.com).
Right: a mural painting at the Fatih University of Istanbul.
Photographies : Silke Vetter-Schultheiß.

Earth images are also used to evoke the power of knowledge. The Fatih University of Istanbul uses the image of a globe integrated into a tree as a symbol of knowledge shared with humanity. More pragmatically and on a rather different note, an organic chocolate wrapping represents a globe with a heart to show the company's commitment to sustainability. The text next to the drawing suggests that informing consumers is essential: technical explanations are given on the chocolate wrapping which is entirely composed of bio-degenerable material and an internet link is provided to find out more. This company's core strategy is to enlighten and raise the awareness of its clients, both for environmental and commercial implications.

Figure 9
Through this advertisment that promotes a living planet, the Earthrise spirulina production company presents its mission in promoting healthy foods, associating it with the Apollo 8 mission that took the image known as "Earthrise".
www.earthrise.com

Finally, the Earth is mobilised as a tool for self-disciplining individuals when consuming those products. Food marketing uses the Earth recurrently to associate products with a holistic life and with a natural and healthy diet. This conveys the reassuring notion of a united, nourishing and benevolent Earth. At the same time, the consumers are told to be responsible for their own health and that of their planet.

In the end, whether or not the recipients of these marketing campaigns know the origins or history of the satellite images is of little matter. The images are transformed in order to bring out the intended message: sometimes the black and hostile space is kept as a background to suggest danger. Sometimes, when the intent is to show serenity, it is replaced by a wonderful sunlit blue sky. In order to expand the research, it would be interesting to ponder over the following themes: first, the effect of these images on the recipients and second, the production context of these marketing choices. The profusion of "blue marbles" appears to be symptomatic of a will to draw the attention (and money) of potential customers rather than to contribute to a reflexive visual culture of the environment. ■

Climate icons and the IPCC's visual culture

Chair: Hélène Guillemot
Centre Alexandre Koyré

The representation of the environment as a global and finite entity is not the only result of Earth photographs taken from space. Many other factors also play a role in this representation, for instance economic and media globalisation and the development of IT and communication networks. The emergence of problems perceived as global contributes to this in a large part. An action taken in one corner of the world now seems to have consequences in other remote parts of the planet. Pollution is no longer the problem of a city or river, as traces of pollutants can be found at the poles. The disappearance of entire species is no longer a question of local heritage; it is becoming a global crisis with the publication of global figures. In particular, climate change and the entire visual culture associated with it (graphs, maps of the world, statistics, *etc*.) are important elements of the current environmental imaginary. The idea of a "warming Earth" or of the sea levels rise helps building green house gases as a global problem. In that context, scientists and the IPCC are central players. Climate change cannot be seen directly, only its consequences are perceivable, often in a dramatic way. The production of scientific images of the climate therefore plays an important role in communications on the issue. But how do these representations include uncertainty, when each piece of information is, by nature, related to a certain level of trust? How can climatologists manage the border between scientific neutrality and the intention to appeal? How do sciences, ethics and politics join forces when there is a need to produce and publish information on an urgent environmental problem? Human and social sciences are included in the production of scientific images: how can graphs created by political and sociological sciences help better understand and question the process of international climate negotiations, their evolution and their blockages?

Hole in the ozone layer-Excerpt of figure 10.

"Of Exactitude in Science": uncertainty and visual representation

Richard Hamblyn
Birkbeck College, London University

"Everything simple is false. Everything which is complex is unusable." (Paul Valéry, *Œuvres II* (1942)).

The production of scientific images is caught in a recurring problem: how can a 3D world be represented by 2D artifacts? As Bruno Latour observed, scientific tools and materials come from a colorful 3D world, whereas intellectual artifacts are flat and monochrome, whether in the form of graphs, diagrams or published articles. Moreover, these results are full of methodological or political biases because data and facts are inevitably manipulated in order to be represented.

If one takes science-produced images, graphs are efficient as long as the conclusion appears straight away, which means that uncertainties and background noises have to be made sufficiently invisible. This will, to focus the attention on one phenomenon, appeared with the very first graphs published by William Playfair at the end of the 18th century. According to Edward Tufte, the good graphs are those that only show data, where data alone speaks for itself[1]. But how can these precepts be applied in a context as controversial and complex as climate change?

If the sky changed colour as a result of increased greenhouse loading, would the problem of climate change have been taken on any quicker and any better? Examples of the past show how important it is to be able to see an environmental problem to solve it. In the middle of the 20th century, mass coal combustion blackened walls in Great Britain. In other words, one could see the pollution

The problem of the reality/ representation relationship, as seen by Lewis Carroll

And then came the grandest idea of all! We actually made a map of the country, on the scale of a mile to the mile! "Have you used it much?" I enquired. "It has never been spread out, yet," said Mein Herr: "the farmers objected: they said it would cover the whole country, and shut out the sunlight! So we now use the country itself, as its own map, and I assure you it does nearly as well."

Lewis Carroll, *Sylvie and Bruno Concluded*, London : Macmillan, 1893.

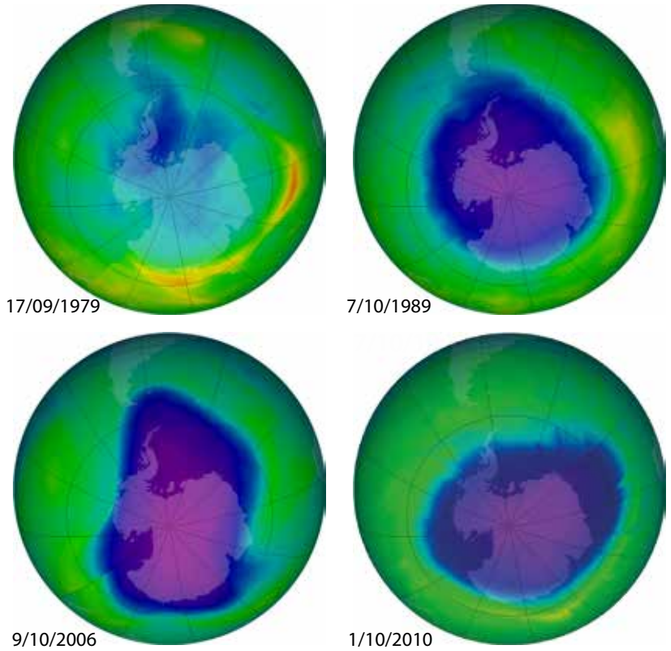


Figure 10
The "hole" in the ozone layer over the Antarctic, 1979-2010.
GSFC Scientific Visualization Studio.

1 Edward Tufte, *The Visual Display of Quantitative Information*, 2nd ed., Cheshire: CT, 2001, p.92.

leaving its mark on the environment "live". Another success story, much closer to us, is the "hole" in the ozone layer and the Montreal Protocol. In the 1970s, scientists expressed their worry at the destruction of the atmospheric ozone. In 1985, satellite images were published, helping the world "see" the metaphorical "hole" over the Antarctic. In just two years, negotiations led to an international agreement to ban harmful industrial substances. In this particular case, it seems that broadcasting images of a "hole" in the atmosphere contributed to reaching quick political decisions.

To contribute to this visualisation effort, climate scientists are permanently caught in a tension between on the one hand, showing their results in a clear and simple manner, and, on the other hand, having detailed protocols and precise results. The challenge is to find a balance between precise information and data overload. Another challenge is the visualisation of uncertainties. Though there is now a consensus on the fact that there is a major phenomenon of anthropogenic origin, research on climate change is by nature full of uncertainties. Results often only make sense when associated with probabilities and error margins. How can images that are both precise and convincing be produced? How can uncertainties feature in climate representations?

This problem is illustrated in the controversy around the well-known "hockey stick" graph. The graph shows a global increase in temperatures culminating at the end of the 20th century. The argument around the graph is relatively simple to see, with a steep increase of the black curve on the right-hand side. However, only an in-depth reading can help even a specialist understand its content precisely. The graph was created from various substitution data (tree rings, ice cores, isotopic coral analyses). The thick grey trace around the graph represents the error margin. Its thickness puts in question the choice of the black curve: is this dominating trend truly representative? Debates around this representation therefore did not only revolve around the objectivity of the basic data and the authors' conclusion, but also around graphing design choices.

Another representation has become a major communication tool for the climate crisis: the Keeling curve. It has been used by various mobilisation media, in particular Al Gore's *An Inconvenient Truth*. The curve shows the advantage of turning relatively homogenous data – measuring CO2 concentration levels on the Hawaiian Mauna Loa site since the International Geophysical Year of 1958 – into images. Its efficiency stems from its simplicity. It has become an icon of the entire environmental crisis. Given this analysis, what future graph representations of the climate could support pro-climate mobilisation? ■

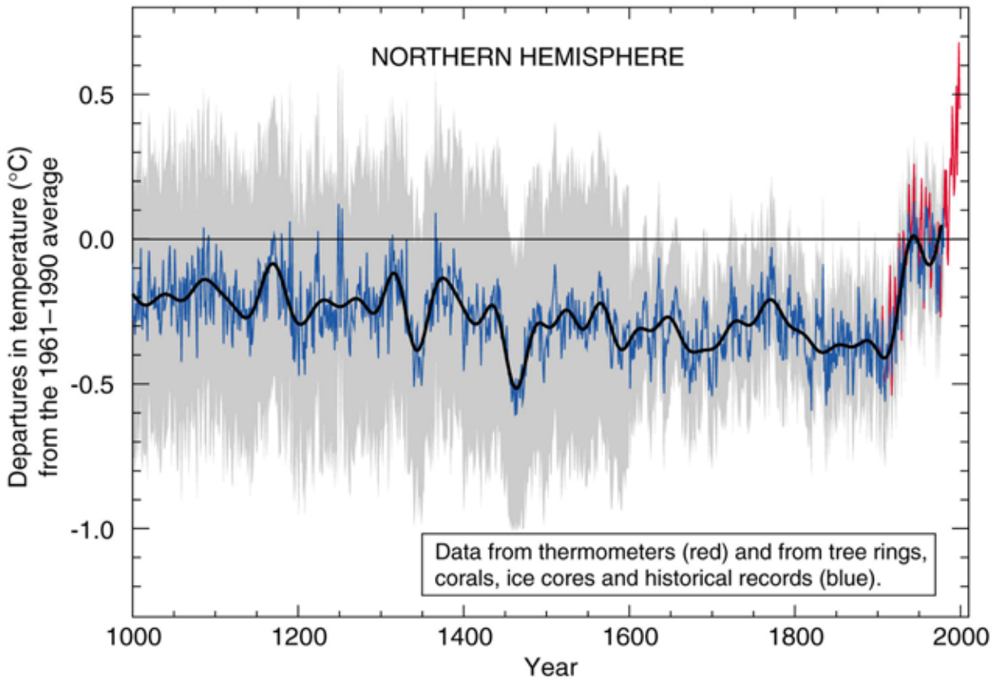
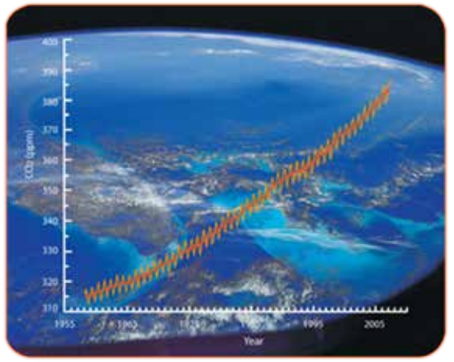


Figure 11
"Hockey stick" graph.
IPCC report, 2001.



Figures 12 and 13
The Keeling curve, representing the increase in atmospheric CO_2 concentration levels over time, has become an icon for communicating on climate change (Top: the cover of Nature, 6th December 2007. Left: NOAA).

DISCUSSION WITH THE FLOOR
What can be expected of scientific images in climate mobilisation?

Is it possible to hope that a successful representation of climate change will lead to an efficient handling of the problem? This question has been the source of heated debates, with some researchers and experts believing this to be a naïve affirmation.

Green house gas emissions are linked to the economy and to anthropogenic activities in a much more intrinsic and generalised manner than gases responsible for the "hole" in the ozone layer. Inertia therefore stems a great deal more from the economic and industrial stakes surrounding the climate problem, than from an awareness problem to which scientific images may contribute. In fact, within the IPCC, negotiations to decide which images to include in official reports are weighed with national stakes. It is therefore important to put these images in more global and complex contexts, so as to avoid overestimating their power.

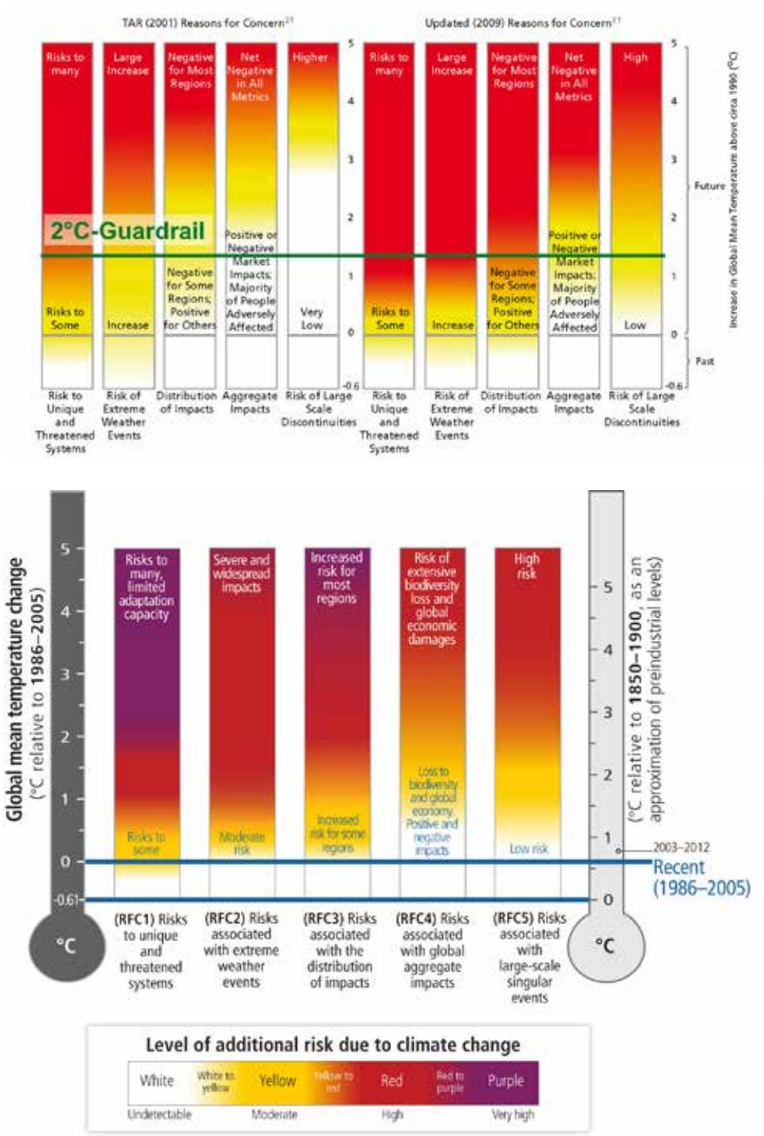
The issue of the atmospheric ozone wasn't just made public through images, but also because of the powerful metaphor of a «hole» in the sky; and solving the problem wasn't as obvious as one might think. One speaker spoke of the artificial nature of climate graph analyses as isolated objects. The Keeling curve (showing the increase in atmospheric CO_2) only has real meaning when read together with the "Hockey stick" curve (showing the increase in temperature), as it helps linking up anthropogenic green house gas emissions and the planet's global warming.

Reflecting on climate images implies looking into several other aspects: which representations already present in imaginaries help making climate images efficient? In what ways are scientific graphs shaped by normative and political elements? And finally, which factors and interests limit their impact and control their message?

Visual cultures of the IPCC: objectivity, judgment, futures

Martin Mahony[1]
King's College, London

How can the danger threshold for climate change be determined? How can studies of climate change impacts and the projections of climate models play a role in this definition? The history of the "burning embers" diagram is significant. Controversies around its creation and dissemination illustrate the ongoing articulation of the boundary between what we usually distinguish as science and politics.



Figures 14 and 15
Different versions of the "burning embers" diagram, 2001 (reused in 2009 for comparison), 2009 and 2014.
Richardson et al 2009; IPCC 2014, © University of Copenhagen/IPCC.

This diagram first appeared in the IPCC's 3rd report in 2001 under the title "Reasons for concern". It subsequently became an icon of climate change debates. During the first IPCC author meetings in the 3rd assessment cycle, the colour range to be used for different risk levels was discussed at length. One proposal was to have the initial stability of the climate represented in green, then shades of yellows and reds to suggest a transition towards ever more dramatic scenarios. But several felt that green was inappropriate both for epistemic (green gives too great an impression of safety) and aesthetic reasons. There were also disagreements on the location of the colour transitions. Conscious that these choices were value judgments, the authors finally decided to show the uncertainty through "skilful blurring", with zones where colours progressively mesh into each other. This visual effect aimed to show that indeterminacy reigns. The authors of this graph also wanted to avoid giving the impression that humans control the climate system, and that risk levels can be chosen as though one had an on/off switch - i.e. that one could say that with an average temperature increase of 1.9°C everything would be fine, but that 2.1°C would be a disaster.

Some of the diagram's authors didn't fully agree with the final choices made and thought the graph wouldn't be taken seriously – yet it was hugely successful. However, once published, the graph escaped its creators' caution and became both an object and subject of great debate. Some researchers reworked the diagram to turn it into an "action guide" that linked political choices with risk levels: threshold temperatures, symbolised by a clearly visible line, were superimposed on the blurred transitions.

In 2004, during preliminary work on the 4th IPCC report, the diagram was discussed once again. At first, only the text was to be updated, but in the end, the graph itself was called into question. The implicit normative injunction was discussed: some government representatives objected to its integration into the official report, whilst others, on the contrary, applauded the sense of warning offered by this representation. The Germans even wanted to reinforce the idea of 2°C being the threshold of harm, but countries that were reticent about a legally constraining convention (the United States, Australia, Saudi Arabia…) rejected what they considered to be political rather than scientific judgments. In the end, because of the need to reaffirm an elusive border between objective and normative elements, the diagram was excluded from the report. In its stead, a textual description of different risk levels was added, to the disappointment of many of the IPCC scientists who preferred the powerful messaging of the diagram.

Before the 2009 conference in Copenhagen, a safeguard line at 2°C was added to the diagram to show the danger of this threshold. However, eminent scientists expressed their concern that the objective of 2°C was insufficient. This position unsettled the Danish Prime Minister who was in charge of the forthcoming negotiations. He felt overwhelmed by scientific uncertainty and needed a clear objective. In the end, despite the cautions of the graph's authors with respect to uncertainties and the derivation of clear thresholds, the graph contributed to the controversial construction of 2°C as a regulatory objective.

More recently, a new colour has been added to express the most important risks: purple. Moreover, elements of social vulnerability have been considered according to various socio-political scenarios. The idea of including various thresholds as lines across the diagram, such as one at 1.5°C - a key target for threatened small island countries - again generated tensions among IPCC scientists and government representatives. The question raised by this history isn't just about how to communicate a complex problem and its uncertainties. It is also about a desire to attain perfect, objective knowledge and perhaps control over the climatic system. One cannot conclude that prudence and scientific precision were deformed by ill-intentioned politicians, but that this example shows how much epistemic and normative elements, science and politics, are inexorably entwined with one another. ■

Scientific objectivity, a changing notion

The story of the "burning embers" diagram shows the tensions that structure the definition of scientific objectivity, and the way it is rooted in technical, political and moral preoccupations. Objectivity means different things in a meeting where scientists design a diagram or in a meeting where the IPCC report's summary is being negotiated.

The notion of objectivity has also been through evolutions in history, depending on what was considered 'science' at different times. First, it was rooted in the linear perspective that emerged during the Renaissance in the West. This way of representing what is real gives the observer the impression of being both inside and out, as though s/he could disregard the subjective and biased nature of his gaze. This distance taken, this wish to make the sense of reality objective, also feeds the ambitions of humanity's control over its environment (Panofsky, Perspective as Symbolic Form, 1991).

Since the Renaissance objectivity has been constituted variously by the reasoning of wise men isolated from the rest of society or by mechanical and material proofs offered by disinterested analysis. More recently, the attentive and experienced judgment of accredited experts has offered a new source of objectivity at the boundaries of science and politics (Daston and Galison, Objectivity, 2010). According to Porter and Jasanoff, there are also geographical variants, inherited from the cultural and political history of each nation: American political culture values the mechanist approach of objectivity, whereas German 'civic epistemology' tends to value collective knowledge- and decision-making processes (Porter, Trust in Numbers, 1996 and Jasanoff, Designs on Nature, 2004). These elements are difficult to generalise but could in part contribute to explaining oppositions that the IPCC has to handle, even if geopolitical interests are evidently decisive.

1 Mahony, M. (2014). Climate change and the geographies of objectivity: the case of the IPCC's burning embers diagram. *Transactions of the Institute of British Geographers*. doi:10.1111/tran.1206.

Uncertainty visualisation in the climate change discourse: from the IPCC reports to climate web portals

Thomas Nocke
Potsdam Institute for Climate Impact Research (PIK)

In climate sciences, various types of uncertainties exist: *natural* uncertainties due to the intrinsically unpredictable and random nature of some phenomena, *epistemic* uncertainties due to the limits of modeling (structure problems in the models themselves, insufficient or inappropriately injected data, *etc.*) and finally *socio-economic* uncertainties to determine future trajectories and political choices of human societies that often come into play in determining scenarios[1].

These uncertainties can be represented textually or graphically. Communicating appropriately on uncertainties is one of the IPCC's major challenges, having developed elaborate methods to make the results of modeling accessible. In particular, similarities are normalised to replace probabilities by text, going from *exceptionally improbable* (0-1% probability) to *almost probable* (99-100%) via *as probable as improbable* (33-66%). To faithfully reflect a large range of possibilities, the IPCC makes the difference between two gradients of trust: trust levels and consensus level amongst experts. Works have shown that these modes of communicating uncertainty are perceived very differently depending on cultures. For instance, Asians or Europeans don't necessarily give the same level of trust when marking a result described as "unlikely" or "very likely"[2]. However, there haven't been many studies on visualising uncertainty in climate maps and graphs.

Let's take an example on the difficulties in drawing spatial uncertainties. This map (fig.16) was published in the IPCC's 4th report (WG1 SPM). It superimposes two types of information: colours go from red to mauve and show rainfall changes up to 2100. The difference between dotted and non-dotted zones represents certainty levels on these rainfall changes. This representation has several limits. First the choice in colour range isn't optimal, with the grey in the middle of the colour

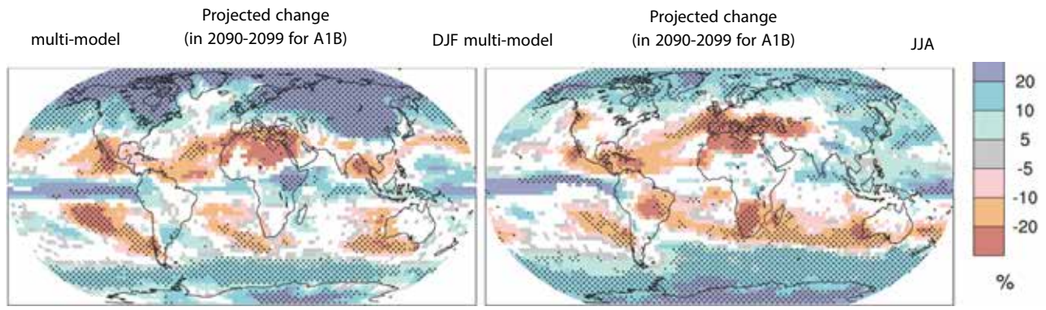


Figure 16
Modeling of rainfall changes up to 2100 according to scenario A1B, in which human societies reduce their emissions as a mix, with energy sources divided between fossil, nuclear and renewable energies, with a significant improvement in technologies' energy efficiency (4th IPCC report); dotted regions: strong model homogeneity; white regions: strong model differences.

1 Suraje Dessai and Mike Hulme, «Does Climate Adaptation Policy Need Probabilities?», *Climate Policy*, vol. 4, no. 2, 2004, p.107-128.

2 Adam J. L. Harris, Adam Corner, Juemin Xu, and Xiufang Du, «Lost in translation? Interpretations of the probability phrases used by the Intergovernmental Panel on Climate Change in China and the UK», *Climatic Change*, vol. 121, no. 2, 2013, p.415–425.

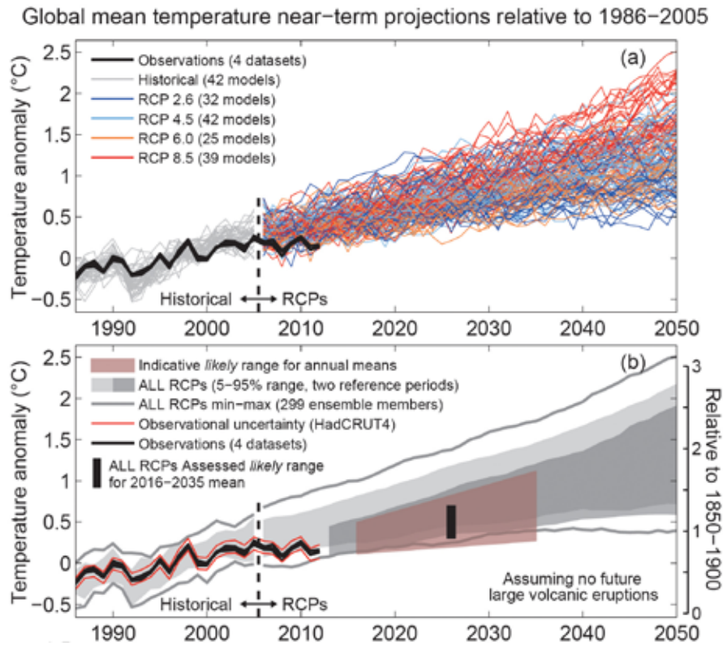


Figure 17
Aggregation of the results of multiple climate models on the evolution of global mean temperatures by 2050. Top: each line represents one model. Bottom: only the global trend is indicated, as well as trust levels of various ranges (5th IPCC report).

range looking like mauve with the risk of having it spontaneously associated with a high increase in rainfall rather than with stability. Also, at first glance, it is difficult to know what the white zones refer to: white isn't in the legend. This presupposes a certain effort before realising that these are zones of total uncertainty. Finally, superimposing both pieces of information is problematic because dotted coloured zones look darker than non-dotted zones of identical colour. The information given on uncertainty therefore clouds rainfall elements and the spontaneous reading of the map.

Another graph, taken from the 5th IPCC report fig.17), shows how to aggregate information to make it more readable whilst showing uncertainty. It describes the evolution of temperature across time, according to a high number of models that take different emission scenarios given by the IPCC. The graph at the top shows overlapping individual simulations, which makes it difficult to read, whereas the graph at the bottom makes a more readable synthesis of multiple results, whilst showing error margins. Still, these multiple sources of uncertainties are still complex to comprehend, and require a lot of subtext reading.

Beyond such static representations, which often try to compile all the required information together, it is useful to develop web portals to make IPCC data and its intrinsic uncertainties accessible[3]. The main interest resides in interactive tools that can be deployed for a more in-depth 'experience` of the data, even enabling explorative tasks. For instance, a user of such a web portal can start with a relatively simple visualisation that he can modify by clicking on a specific region of interest or by changing parameters in order to see the effect on individual climate parameters and their impacts. This supports users in having a better understanding of the specificities and limits of the data and models that generate those results.

The main difficulty for the interactive representation of climate data lies in finding a balance between simple illustrations, that are simple to read but that risk being misinterpreted, and representations that integrate a certain level of complexity, but that are difficult to read, at times even incomprehensible without elaborate textual explanations. Ideally, uncertainty representations are linked to the climate data representations. How this must be done strongly depends on the audience addressed: experts in the field, decision makers or the wider public. ■

3 Dominik E. Reusser et al., « Resentation of uncertainties on web platforms for climate change information», *Procedia Environmental Sciences*, vol. 7, 2011, p. 80-85.

Mapping climate negotiations[1]

Nicolas Baya-Laffite
Médialab, Sciences Po Paris

How can twenty years of climate negotiations be translated into images thanks to digital data treatment methods? The first step is the corpus: what sources of information should be chosen? A compromise between processing times and reliability was found in the Earth Negotiations Bulletin (ENB), published by the International Institute for Sustainable Development[2]. These bulletins were published every day during international environment conferences so as to inform negotiators of the advances and blockages on various topics. ENBs are a precious resource for the qualitative and quantitative analysis of political processes. If they are reliable, it is because the writing is normalised and constrained by a number of rules for editors to avoid any subjectivity. Thanks to this standardised structure, they allow for an automatic analysis of their content, without major biases linked to changes in editing teams or other factors unrelated to negotiations. Thus, the ENB worked as a proxy field investigator (hence the idea of a proxy corpus of negotiations).

The corpus built for the purposes of the investigation only kept daily texts on negotiations within the Conference of the Parties, and deleted all summary bulletins on technical and parallel sessions. It is, first of all, the lexical content of negotiations that the team was interested in, in order to look at negotiation themes through an analysis of the semantic network of terms that were regularly and jointly used. This led to selecting terms, which in itself was a question of negotiation, and led to analysing the co-occurrences of 300 nominal groups on the basis of an automatic extraction of around 1700. Through a semi-manual selection, "noise" was eliminated to bring forward signals in our visualisations. This work implied strong knowledge of climate negotiations to allow for adjustments during the creation of the corpus of data and to parameter the software use. Events were also organized with climate specialists and expert negotiators in various fields to deepen the discussion. The result showed 300 expressions divided in 12 themes: 8 on mitigation, 3 on adaptation and one on scientific foundations. Through a new analysis of the corpus, these 12 themes were attributed to each paragraph of the ENB corpus according to the terms defining them. This helped working out the number of paragraphs per theme during the 19 sessions of the Conference of the Parties.

The results were formatted according to two types of representations: one was synchronic and showed how co-occurrence of the "question-terms" being debated configured the thematic space of negotiations (fig. 18);

1 This paper presents the first results of two projects of the Sciences Po Médialab, entitled EMASP and MEDEA. Amongst others, they used the Cortext digital platform. http://www.medialab.sciences-po.fr/fr/projets/medea-mapping-environmental-debates-on-adaptation/

2 See the IISD website: http://www.iisd.ca/french/

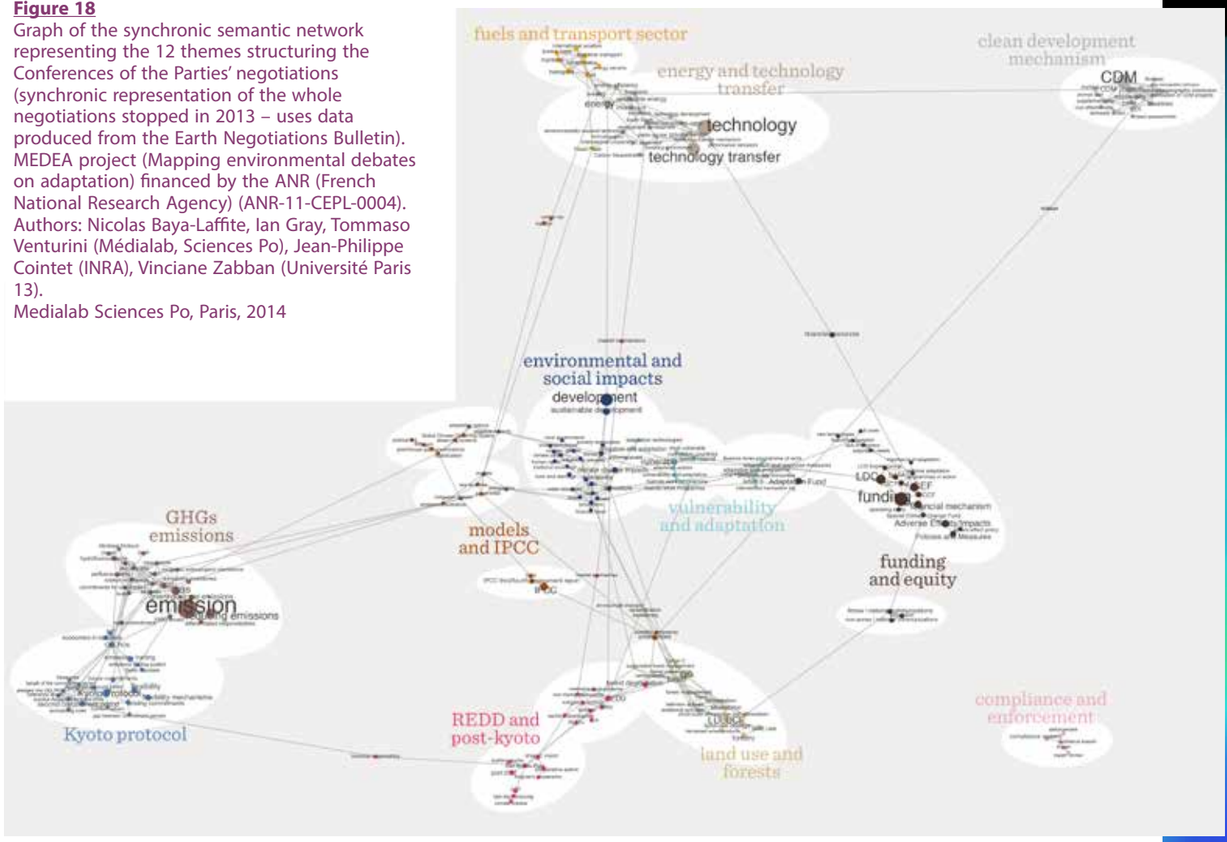


Figure 18
Graph of the synchronic semantic network representing the 12 themes structuring the Conferences of the Parties' negotiations (synchronic representation of the whole negotiations stopped in 2013 – uses data produced from the Earth Negotiations Bulletin). MEDEA project (Mapping environmental debates on adaptation) financed by the ANR (French National Research Agency) (ANR-11-CEPL-0004). Authors: Nicolas Baya-Laffite, Ian Gray, Tommaso Venturini (Médialab, Sciences Po), Jean-Philippe Cointet (INRA), Vinciane Zabban (Université Paris 13).
Medialab Sciences Po, Paris, 2014

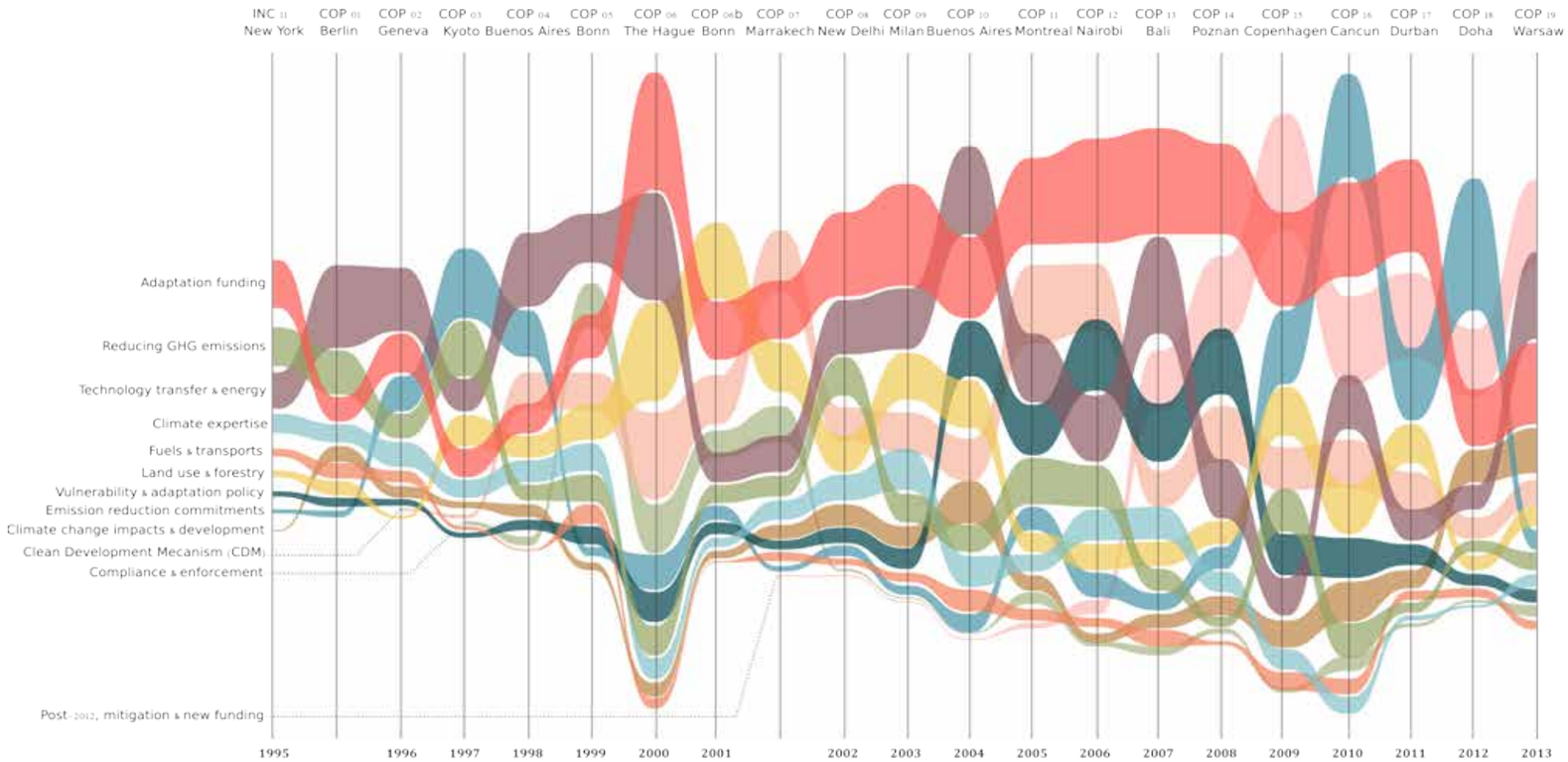


Figure 19
Representation of the evolution of climate negotiation themes' visibility between 1995 and 2013.
On this diagram, the thickness of the line represents the themes' absolute visibility (number of paragraphs where they appear) whereas the height of the line represents their relative presence as compared with one another.
MEDEA project (Mapping environmental debates on adaptation) financed by the ANR (French National Research Agency) (ANR-11-CEPL-0004).
Authors : Nicolas Baya-Laffite, Ian Gray, Benjamin Ooghe-Tabanou, Tommaso Venturini (médialab, Sciences Po), Jean-Philippe Cointet (INRA); Martina Elisa Cecchi, Paolo Ciuccarelli, Federica Bardelli and Carlo De Gaetano (Density Design).
Medialab Sciences po, Paris, 2014

the other was diachronic and showed the evolution between 1995 and 2013 and the relative position and absolute weight of the 12 themes per sessions. This showed how each theme evolved, when it emerged, became predominant or was marginalised (fig 19).

These are just two examples of the visualisations that can be represented from data obtained by processing the ENB corpus. One could mention visualisations of coalitions of countries that speak with a common voice on a topic, or the importance that each theme seems to have for each delegation.

One of the objectives of this study was to map the emergence of adaptation in negotiations as an initially marginal subject.

In the theme map, all expressions linked to adaptation challenges – which correspond to "environmental and social impacts", "vulnerability and adaptation" and "financing and equity" – are grouped in a specific cluster at the centre of the semantic network, compared to other themes relating to mitigation which are scattered around that centre. The following terms can be found: "development", "poverty eradication", "food security", "local communities", "local knowledge", "health", "climate justice", "adaptation funds" *etc*. Another result is that the graph puts forward connections between the questions of impact, development and the challenges of technology and energy transfers.

If one looks at these questions in a temporal perspective, it appears that in the initial stage, these topics were not much discussed, except for financing and equity questions given the constant pressure that was put on the most vulnerable countries from the start of the negotiations. Heated debates on mechanisms to guarantee the availability of adaptation funds reached an all-time high in The Hague in 2001, in a context of generalised tension. In a second phase, adaptation as an object of action programs started taking a more prominent place. The difficulty in reaching reduction objectives contributed to putting adaptation questions to the fore of debates. If emissions levels could not be mitigated rapidly (and even if that was achieved), then adaptation to inevitable changes would be necessary, given the climate system's inertia. Thus the issue of environmental and social impacts became most prominent during the New Delhi and Buenos Aires conferences in 2002 and 2004, whilst vulnerability and adaptation policies were debated in 2004 and mostly in 2007, given the Bali roadmap for a new strategic framework. In 2009, adaptation issues lost ground again. This can be explained by two factors. First, after the failure of the Copenhagen Conference to impose new binding objectives, the priority was on mitigation. Second, this topic seems to have gained worldwide recognition in the discussions, as shown by the creation of a mitigation committee and an adaptation framework between Cancun and Warsaw. Its defenders complained less and started concentrating more specifically on financing to make the necessary actions operational.

One of the expectations of the researchers who take part in this mapping is to offer interactive tools addressed mainly to a public already informed on climate negotiation. Thus, on top of many other questions that can be explored through these methods, they can help the reader get more detailed information by clicking on a zone of interest. A major asset of this representation of complex and, in some ways, stern political processes is that it calls on users to talk about these images, to engage in a reflection and to produce new interpretative hypotheses, new narrations on the evolution of negotiation themes. As such, researchers hope that these visualisations could become boundary objects for the debate. ■

Remote sensing and the global environment

Chair: Isabelle Sourbès-Verger
Centre Alexandre Koyré

In the aftermath of the famous icons of the environmental mouvement, how can space activities contribute today to solving environmental problems - and in particular climate change? To avoid any counterproductive effect, satellite imagery specialists call for caution: in order to be efficient, the use of satellite imagery should not stand alone as it might confine us to an abstract, dehumanised and technocratic vision. It has to have a reinforced connection to local reality and take into account the preoccupations of the inhabitants, of local players and of human and social science specialists. Concrete examples show how much the interaction with end-users is essential in satellite map production in the case of natural disasters.

It is therefore necessary to be constructively reflexive of global images and their distribution. This is because of both, the misuse of images that escape the control of their creators and because of their performativity on imaginaries. The sheer volume of information contributes to a permanent, meticulous and generalised monitoring of the planet and therefore to new social arrangements and new inequalities. So before discussing the distribution of these images, this reflexivity should also focus on the technical, political and economic stakes of image production, and on the choices made and the conditions that limit them.

Representation of satellites and debris in orbit around the Earth (ESA).

Space at the service of climate, or how to reincarnate images "seen from above"[1]

Cathy Dubois and Michel Avignon
Laboratoire Histoire des technosciences en société (HT2S)

Human experience is set in a specific geographical reality. Satellite images, built from a distant point of view, create a tension between this local context and the planet represented as a global entity. This tension may also be found in the climate issue: climatologists have an in-depth knowledge of climate regimes based on a global approach of the Earth system, whilst social actors can only grasp the issue from a local point of view that corresponds to their living experience. Can images and data produced from the point of view of Outer Space be considered as resources to bring together both the knowledge of the Earth system and the human experience of local contexts?

Historically, links between space, the environment and climate are highly intricate, both in the creation of representations and imaginaries and in the framing and building of knowledge. Many studies have shown the importance of broadcasting images of Earth seen from space to help both raise awareness of its global nature and to create an imaginary of a vulnerable and finite Earth. Right or wrong, climate has become the emblem of all environmental problems for the public at large, even though environmental problems cover a wide range of scientific issues and even though the very notion of environment presents various layers of complexity.

During the emerging phase, space and spatial images produced were used as a "dream-making machine". This required heavy investment, high level experts were needed to advise decision-makers and the public at large was considered as an audience that had to be seduced, educated and convinced of the benefits of these investments made with national budgets.

The fascination for the first images of the blue planet could also be seen as the last magical moment, the end of a world where infinite progress was still considered as possible. The trend moved from a Narcissus figure, fascinated by its own image, to the stunned shock generated by Medusa's gaze in the 1970s. As space probes moved further away from Earth, the planet started looking isolated in the midst of a hostile universe, and dreams of colonizing other planets collapsed. Protests grew stronger, denouncing the illusion of unlimited growth, environmental disasters or the Vietnam War.

Finally, after Medusa's gaze, we move to the Saint Thomas metaphor. Thanks to spatial representations, we want to touch reality "with our fingers" and give meaning to abstract numbers.

Figure 20
Metaphors of the evolution of humans' relation to Earth seen from space: from a Narcissistic fascination, to the stunned shock generated by Medusa's gaze to finish like Saint Thomas, wishing to touch reality "with his own fingers" thanks to science. Left: *Narcissus*, Caravaggio, 1594-1596 ; middle: *Medusa*, Caravaggio, 1597-1598 ; right: *The Incredulity of Saint Thomas*, Caravaggio, 1601-1602.

This means transforming the imperceptible into tangible facts. Take sea levels: specialists have to correct dozens of parameters before "seeing" the average sea level that apparently increases by a few millimeters each year. This might seem strange when you go to the *Pointe du Raz* in Brittany, France and see fluctuations of several meters because of waves, tides and storms… How is it possible to explain a "scientific reality" such as "sea levels increase by an average of 3mm per year" to observers at the *Pointe du Raz* or to Vanuatu inhabitants who are going to have to leave their island in the near future and who are confronted with seasonal variations of several dozens of centimeters? To overcome this difficulty in understanding, we chose a middle ground, changed the scale and presented a regional map of variations rather than talking about a global average increase.

But changing scales is not enough. The question of climate change has to be analyzed through individuals' experiences as suggested by sociologists and geographers. Climatologists' works, because they relate to the Earth system as a whole, have tried to communicate on an emotional level on the increasing risk that this evolution might be irreversible. If you look at individuals' point of view, the challenge is to produce facts and representations that can be grasped by them and that can help them decide and act at their own level.

Studies show that individuals are concerned by a number of factors and their priorities vary. An organic producer or parents of a school surrounded by vineyards will be less preoccupied by the near-by nuclear plant and the increase of sea levels than they will be of pesticides used in the region. Studies show ways in which space could still contribute to explaining problems and representing them and their proportion so that individuals can make up their minds and start acting. It is the case of a study lead with the KAL-Haiti database, or of scientific studies of the CORDEX (Coordinated Regional Climate Downscaling) initiative. Using space for climate change must, in the end, help us fully conceive the Blue Marble as an inhabited planet. ■

Does fear trigger mobilisation or mere shock?

The use of images plays a clear role on emotions. Beyond questions of audience ratings, the will to mobilize by reaching the emotions of an audience seems an integral part of communications in favor of fighting climate change. Thus in 2014, the World Meteorological Organization started broadcasting fake weather forecasts supposedly produced in 2050*. The show was made more realistic through the use of famous weather presenters. However, as Cathy Dubois noted, many works question the efficiency of fear as a lever of action. Stunned shock could even provoke the opposite of the expected result. Hence the importance of thinking about and experimenting on other paradigms, such as the empowerment of citizens, to which image production could contribute.

* To find out more, see the WMO website: http://www.wmo.int/pages/mediacentre/news/Bresil-unbulletinmteorologiquepour2050faitapparaitreleseffetsduchangementclimatique.html

From physics to data, the construction of satellite images.

A recently defended thesis* looks into scientific constructions of satellite data. Spontaneously, we tend to look at physical measurements as self explanatory. But in reality, they are made up of a number of indications, representations, local models, etc. These measurements are then entered into other models, crossed with other satellite and non-satellite measurements and data. In this cascade of operations, data becomes autonomous with a history and a hierarchy of its own. This data is initially instrumental: it is produced by a physician for his own use in physics (radiance for instance). Then it can be transformed, via exogenous models and data, into geophysical data: then it is expressed in a more traditional unit of terrestrial understanding and is integrated into a more global epistemic field (sea levels, temperature, etc.). It can from that point onwards be perceived by everyone and in consequence, more general uses are developed. The data can be used by other users and become part of complex knowledge systems, in other grids and models, and it can be used to look at local phenomena unrelated to the initial measurement context.

* To find out more: see Gemma Cirac Claveras, *POLDER and the Age of the Space Earth Sciences. A Study of Technological Satellite Data Practices*, thesis co-directed by I. Sourbès-Verger and D. Pestre, Centre Alexandre Koyré, EHESS-CNES, 2014.

1 The discussion on the relation between space and climate will be prolonged during a working group made up of engineers, human and social science researchers and managers during the 21st Conference of the Parties in Paris.

Satellite cartography at the service of disaster management

Arnaud Saint-Martin
Versailles Saint-Quentin-en-Yvelines University

In 2000, the *Centre National d'Etudes Spatiales* (CNES) and the European Spatial Agency launched the "International Space and Major Disaster Charter". The aim of the initiative was to make cartographic information available to emergency relief to optimise their intervention in the event of natural disasters. This implies the immediate and coordinated mobilisation of a number of cartography services and laboratories to select the most pertinent data and put it in readable form. It takes about thirty hours for cartographic products to be broadcast, free of charge, to the other end of the chain. Around fifteen spatial agencies and private operators are involved. Since its inception, this device has been activated more than 400 times.

Given the choices that have to be made in emergency situations (What sensors are best suited to specific meteorological conditions? What resolutions and scenes should be chosen? What cartographic processes should be applied? *etc.*), producers are conscious of the technical aspects linked to maps. However, political and social implications remain explicit, as though technology was a given. What performative effects result from the production, circulation and power of global environmental images through these types of devices?

Beyond their apparent objectivity as "coming from nowhere" and the epistemic authority they project, images are productions: they are the result of data transformed into objects that can be looked at for predetermined uses. They are used in various sectors: satellite, humanitarian and disaster management industries. Finally, they offer a material aspect to disasters in the immediacy of

Figure 21
Map monitoring floods, Xynthia storm, Charente maritime, France.
SERTIT 2010

Figure 22
The Fukushima nuclear disaster from above, March 16, 2011.
©DigitalGlobe.

emergencies but also to future memories of the event. The map production process also contributes to a *social production of space*[1]: the device shows a specific socio-geographic space formatted for emergency relief use. This process is the result of a tension between routine and adaptability. On the one hand, formalised and automatic processes help operations take place more quickly. On the other, each activation means adjusting even more so when it is activated at a distance and with uncertainty, given that cartographic products are destined to characterise a given crisis situation.

According to some critical geographic approaches, the orbital point of view expresses the ethno-centered, masculine, voyeuristic and coldly mechanist gaze on the Earth system[2]. Others denounce a project of generalised surveillance and the establishment of a bio-security order on a planetary level[3]. Without agreeing with

1 Henri Lefebvre, *La production de l'espace*, Paris: Editions Anthropos, 1974 (*The production of space*).

2 For instance, see Susan Roberts, Richard Schein, «Earth Shattering: Global Imagery and GIS», in John Pickles (ed.), *Ground Truth : The Social Implications of Geographic Information Systems*, New York: The Guilford Press, 1995, p.189-190.

3 Marc Monmonier, *Spying with Maps: Surveillance Technologies and the Future of Privacy*, Chicago: University of Chicago Press, 2002.

DISCUSSION WITH THE FLOOR
Feedback of a player on the field

The representative of an agriculture Chamber gave feedback on his experience, in the Poitou-Charentes region of France, of the ORACLE observatory (Regional Observatory on Agriculture and Climate Change), launched in 2011. He underlined the fact that in putting in place devices handling climate difficulties, it is essential to ensure more proximity between producers and users. This implies developing adapted frameworks that make sense to stakeholders. In particular, this proximity is based on three elements: a spatial and temporal dimension, by defining geographical analyses that are coherent with decision-makers' perimeters, as well as a professional dimension, by selecting information on climate change that is pertinent for the relevant sectors.

either analysis, it is true that satellite data, via their aggregation into geographical information systems, feed into technocratic fantasies of a "total control of the globe"[4]. This effect is reinforced by the crisis-specific use of those products: they are part of a paradigm that is specific of disaster management devices according to which a supposedly preexisting order would be restored.

Once broadcast, the maps are often used for other purposes, copied and pasted here and there, transplanted from professional GIS databases to websites and media used by the wider public, sometimes without their legends. They can be recycled by citizens as media through which to protest against public authorities' land use policies.

Most of all, media use of satellite images saturates disaster representations. Plunging views of the ripped open Fukushima plant thus replaced a discourse that was paralysed by the event's gravity. Because of its suggested abstraction, the satellite image reinforces the *referential presence*[5] of zones affected as real territories. The fact that images of these disasters are shown non-stop in the media, one after another, generates a cumulative effect among viewers: it is an entire visual economy that penetrates the imaginary. Interactive animations are rapidly made available on big media websites: by clicking on an image, an internet user can go back in time and see images from before the disaster and in one instant see the damage caused. The immediacy and mass display of images plays on collective fear and paradoxically contributes towards trivialising stupor. Sometimes even, announcements of imminent disasters are broadcast in real time before the disaster, and its progress is displayed through available images. Specular and spectacular elements are brought together through this live observation of the disaster yet to come. What is left to determine is to what extent the emotional and rational implication of individuals (which could reinforce their resilience in the event of an extreme disaster) can be coupled with a bottom-up and less technocratic approach of disaster management. ■

DISCUSSION WITH THE FLOOR
Turning invisible dangers into images: what parallels can be drawn between the climate and the nuclear debate?

Just as with climate change, nuclear risks and pollutions are invisible. There is therefore the same difficulty in making visible the potential and factual consequences of this sector, whether they are linked to military testing, daily plant activities, waste transport or disasters of a magnitude such as Fukushima or Chernobyl. It is no coincidence if the first climate modeling tools inherited directly from techniques used for nuclear experimentation and developed during the cold war. Administrative processes enhance this invisibility when two potential problems coincide, for instance when a nuclear plant is near a coast. Administrations in charge of storm risks are not the same as those dealing with nuclear risks, thus giving rise to difficulties when communicating and raising awareness of multiplied risks.

In the case of climate change, the question of visualisation is generally seen from the angle of raising awareness of disasters that could occur in the future. However, in the case of nuclear issues, images mainly revolve around stunned shock across the media after major disasters. The relationship between broadcasting images and managing feelings is decisive in all cases, whether it is for NGOs or scientists wanting to mobilise, or for the media looking for an audience or public authorities trying to channel population's fears.

To what extent can past experience with nuclear accidents help affirm a new paradigm for climate issues, no longer based on managing populations paralysed by shock, which isn't efficient, but on their empowerment, so as to bring about real changes?

4 Sebastian Grevsmühl, *La Terre vue d'en haut. L'invention de l'environnement global*, Paris: Seuil, 2014, p.34. (*The Earth seen from above. The invention of the global environment*).

5 Anne Beyaert-Geslin, *La photographie aérienne, pseudo carte et pseudo plan*, *Visible*, no.5, 2009, p. 61-76. (*Areal photographies, pseudo maps and pseudo plans*).

The Earth under remote control: spatial imagery and the emergence of a 'planet-body'

Leandro Siquera
Doctoral student in political sciences at the Programa de Ciências Sociais da Pontifícia Universidade Católica of São Paulo (PUC-SP), researcher at the Núcleo de Sociabilidade Libertária (Nu-Sol) and scholarship holder of the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP).

Spatial technologies don't just produce information and services; they also have political consequences and reconfigure power relations. They are also political technologies for the government. One of their effects relates to the emergence of the *planet-body*, the new target of power relations when one looks at the shift from biopolitics to ecopolitics. In his analysis of *biopower*, Foucault[1] shows how, from the 18th century, power technologies started administering life: on the one hand, individuals have disciplined *machine-bodies* in schools, hospitals and prisons, and on the other, populations, or the *species-body* as he calls them, who are regulated by birth, death, marriage rates, public health policies, *etc*.

For Deleuze[2], the disciplinary societies described by Foucault are disappearing. Since the end of the Second World War, control societies have emerged with powers that operate openly, outside of closed institutions, via continuous and unlimited power relations based in part on instant communication.

Passetti[3] goes further by applying *biopower* not only to the control of people and populations, but also to Earth, by showing that in control societies, biopolitics is being replaced by ecopolitics. According to him, beyond the *machine-body* and the *species-body*, control societies invest in a *planet-body* that has to be controlled and regulated to guarantee the continuity of capitalist investments.

Images of the Earth seen from space contribute largely to the emergence of a *planet-body*. As of the 1960s, the stakes of the cold war used the terrestrial orbit as the preferred platform to control nuclear arsenals and guarantee planetary security. Then the first photos of the entire Earth taken with the help of astronauts and satellites appeared. The 1970s marked the creation of the first Earth and water remote sensing civil programme with Landsat and Seasat American satellites.

Spatial imagery and environmental discussions have indeed developed simultaneously and managing the planet has become a major challenge for international, political, economic and military relations. The competition between American capitalism and Soviet socialism can be read as two opposing suggestions on how to manage and administer the Earth. The planet's division between North and South also reflects a polarisation of the debate on how to manage the planet and its resources.

As of the 1960s, environmental movements progressively became legitimate stakeholders of debates on the economic and social development of nations and the planet, giving alternatives to an industrialism that was considered as disproportionate. In the 1980s, the creation of other remote sensing systems disrupted the American and Soviet supremacy of producing images of the Earth. France, India or Japan developed their own remote sensing systems. China and Brasil signed a South-South satellite cooperation. Finally, in the end of the 1990s, on top of the increase in national remote sensing programmes, the first private companies selling remote sensing services appeared.

Today, the advent of *sustainable development* legitimises Earth monitoring and management. Satellite images have become a major tool to show the regulation of what is at the surface of the Earth. For instance agro-fuel is not produced at the expense of Brazilian forests. Sugar cane plantations are limited to avoid deforestation. Since the launch of the Real Time Deforestation Detection System of the Brazilian National Institute of Space Research in

1 Michel Foucault, *História da sexualidade I : A vontade de saber*. Rio de Janeiro : Edições Graal, 2005, pp. 131. (In French: *Histoire de la sexualité I : La Volonté de savoir,* Paris : Gallimard, 1976).

2 Gilles Deleuze, *Pourparlers 1972-1990,* Paris : Les Éditions de Minuit, 1990, p. 240-247.

3 Edson Passetti, *Anarquismos e sociedade de controle*. São Paulo: Cortez, 2003.

2004, deforestation rates in the legal Amazon forest is said to decrease year after year.

The publication of IPCC reports illustrates the way in which spatial technologies are used as strategies to govern the planet and individuals' behaviors. Image proliferation for the regulation of the *planet-body* also contributes to what Gros described as the end of a conventional war and the proliferation of *violence states*[4] between armed groups and targeted, technological and amoral interventions carried out in the name of security, which also puts Earth management at the heart of power relations. Thus to develop a new way of managing the Earth, control societies produce a double digital-information of the Earth, a digital interface built in part with images recorded by satellites.

Figures 23 and 24
From the blue planet to a "planet body".
Top: images of the Suomi NPP satellite (NASA).
Bottom: a representation of satellites and debris in orbit around the Earth (ESA)..

States, societies and individuals are becoming ever more dependent and consequently are subjected to spatial technologies for making decisions in a dynamic that often isn't limited to national territories, but that inevitably has a trans-territorial nature. This globalised control doesn't meet a model centralised as per a totalitarian-type hierarchy, as imagined by Orwell in the figure of *Big Brother*. Satellite surveillance, like urban security surveillance, offers a decentralised access to control because everyone can participate to it as can be seen with live images broadcast on the internet or the popularity of Google Earth. It is therefore also to a *community of voyeurists*, to use Frédéric Gros's expression[5], that the planet-body is now accessible. Technology isn't the instrument of a central authoritarian system. This evolution therefore mixes both democracy and technocracy, according to unprecedented social arrangements that need to be analysed.

What remains to be determined is what this spotlight shining on a globalised Earth leaves in the shade: whilst guaranteeing a sustainable access to resources, this focus continues to date to condemn three quarters of the world population to poverty, confinement or wandering.

4 Frédéric Gros, *Estados de Violência: ensaio sobre o fim da guerra,* aparecida: Editora Idéias e Letras, 2009. (In French: *États de violence : essai sur la fin de la guerre,* Paris: Gallimard, 2006).

5 Frédéric Gros, *Le principe sécurité,* Paris: Gallimard, 2012, p. 195.

Processing SPOT images, a Trojan horse for the Swedish space conquest

Johan Gärdebo[1]
KTH Royal Institute of Technology, Stockholm

SPOT (*Système pour l´observation de la Terre* - Satellite for observation of Earth) is the first European high-resolution spatial imagery system. It was launched in 1986, in competition with the American Landsat program. It was conceived specifically to improve European knowledge and management of the Earth and its resources. SPOT was initiated by France's CNES (*Centre national d'études spatiales* – the French space agency), but with Sweden[2] and Belgium also signing up for the project.

The aim of this presentation is to understand how Sweden, a relatively minor partner (4%) in France's SPOT program, used their share to become one of the leaders in commercialising satellite images. We will probe into how the political and technological stakes of space research and space industry contributed towards a specific type of global environmental images.

The bilateral space collaboration between France and Sweden began in the early 1970s. Many contextual elements fostered the development of bi- or multilateral space programs. From a global point of view, competition in the economy increased internationally, which meant European countries had to promote new state-of-the-art industries in order to secure economic growth and jobs. The Cold War *détente* in 1972 stimulated the production of new space materials for civil use. Environmental movements were advancing and the dynamism that followed the publication of The *Limits of Growth* report in 1972 encouraged monitoring and ecological considerations. The environment quickly became a topic of international cooperation for intervention and precaution[3]. After all, 'nature' involved many actors and went well beyond national borders.

1 Project: "Views From A Distance", with Nina Wormbs and Sabine Höhler, funded by the Swedish Research Council.

2 More particularly the Swedish Space Corporation and the Swedish Board for Space Activities, referred to as "Swedish spatial agency" in this text.

3 John R. McNeill and Corinna Unger (eds.), *Environmental Histories of the Cold War*, Cambridge: Cambridge University Press, 2010..

On the French side, bilateral collaboration "Europeanised" the space enterprise, adding additional funds but more so increased CNES' legitimacy. Sweden was a given partner given its neutral geopolitical standpoint and its ESRANGE space base that could serve as receiver station for polar orbit satellites like SPOT1. On the Swedish side, developing an innovative industrial sector was perfectly in line with the newly installed government's ambitions. A partnership with CNES as a major player in the space sector offered some guarantees in an otherwise uncertain and costly industry.

As the SPOT program progressed, tensions arose that required the partnership to be renegotiated. A formal agreement was reached in 1978, but several *ad hoc* treaties had to be signed thereafter. Most conflicts were related to responsibility, use, cost and benefit allocation between the French Spot Image and Swedish Satellus who were commissioned with commercialising images. The launch of SPOT1 was initially set to 1984 but was postponed and delayed until 1986. As a result of these negotiations, more responsibility and investments were given to Sweden, though it still only held a minority share in the partnership. Satellus did not own but had access to a large number of satellite images. Also, Sweden was able to piggyback its own satellite, Viking, along with SPOT1.

Sweden's success was determined by it taking a lead in developing services for processing and circulating satellite images. As of 1976, a Swedish study identified image processing and interpretation as major bottlenecks to developing a widespread civil use of spatial information. Without owning the images, Sweden could still use its access to imagery to commercialise derivatives. 1986 marked the confirmation of Swedish expertise. Not only were SPOT1 and Viking launched, but coincidentally, the Swedish agency was the first to bring to the world satellite images of the Chernobyl disaster. When the French industry went on holiday 1st of May, Sweden

managed to process SPOT images before CNES. This proved sound marketing material for SPOT1 but was also a trespassing of courtesy in the French-Swedish collaboration, and more would follow. In particular, Sweden unilaterally offered contracts to developing countries in order to package, commercialise and sell SPOT products.

Finally, it would be interesting to further research the environmentalist theme prevalent in mission descriptions and visions for remote sensing tools of the late 20th century. An emerging conflict area was the right to sense others and the risk of being sensed, which was debated throughout the drafting of the *United Nations' principles of remote sensing*, ratified 1986. Here, 'environment' played the role of legitimising remote sensing, with references by developed countries, among them France and Sweden, to potential benefits for 'nature' and 'humanity'. It would be interesting to see if there are corresponding arguments *within* bilateral space collaborations to cushion or deflect geopolitical and economic tensions. This helps us understand what purposes environmentalism served in power struggles relating to the ownership and usage of technology. ■

Figure 25
The Chernobyl nuclear power plant shortly after the disaster, May 1986.
CNES - Distribution Astrium Services / Spot Image.

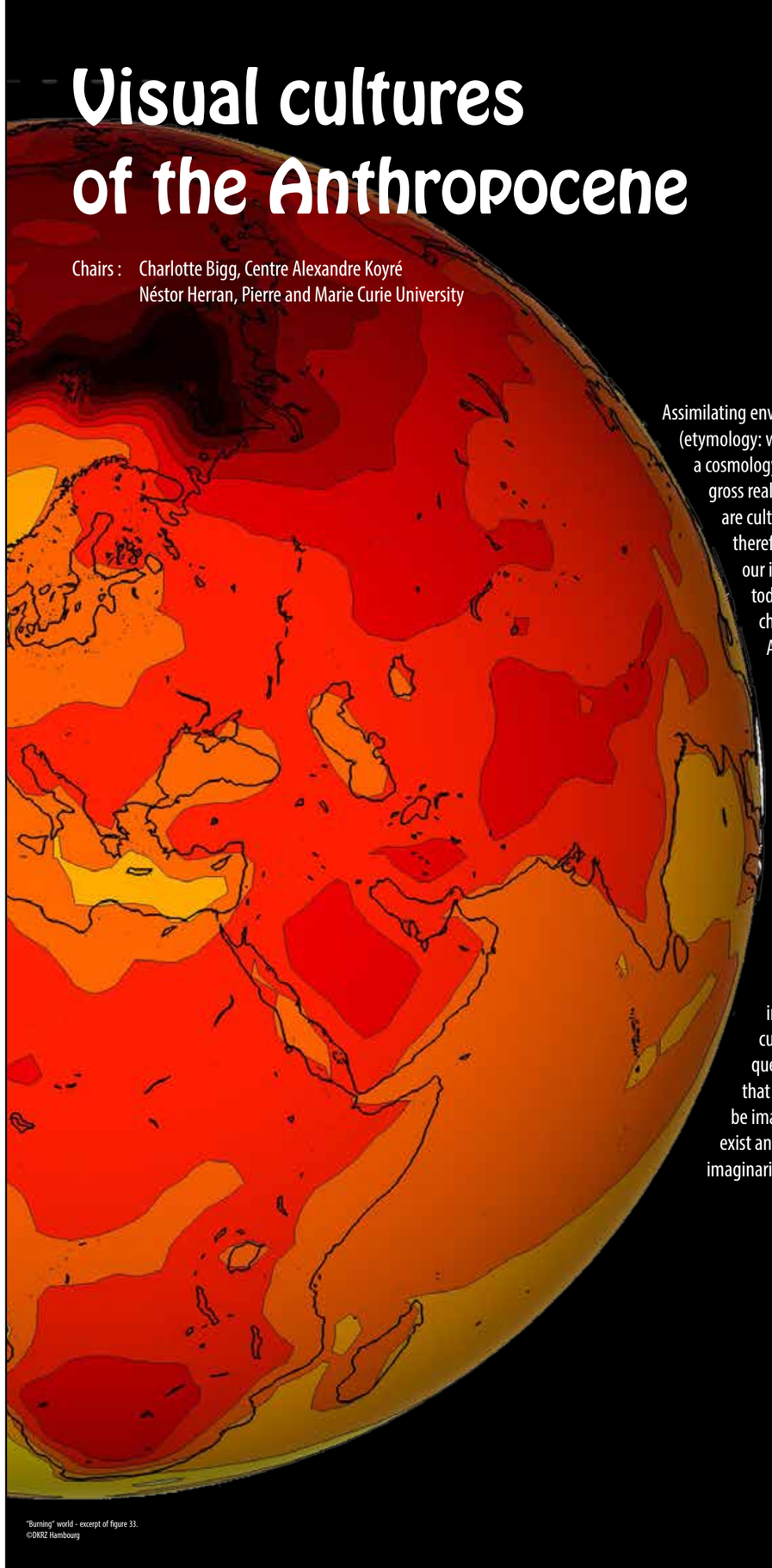
In the end, this study illustrates some of the technological and political importance of using rather than owning satellite imagery and how this influenced its production chain. For this reason it is important to distinguish between, on the one hand, taking satellite images and, on the other hand, interpreting and making imagery available as products on a market, which for satellite imagery did not exist at the end of the 1980s. CNES played a key role in deploying remote sensing tools, yet it lost market shares to Sweden. By way of comparison, Sweden benefitted immensely from its 4% investment in SPOT1, also due to its gateway function for other Swedish space enterprises, like Viking and subsequent telecommunication satellites.

Visual cultures of the Anthropocene

Chairs : Charlotte Bigg, Centre Alexandre Koyré
Néstor Herran, Pierre and Marie Curie University

Assimilating environmental images to "cosmograms" (etymology: written or drawn up representations of a cosmology) reminds us that they do not depict a gross reality of the environment, but that they are cultural representations thereof. They therefore interact with the complexity of our imaginaries and representations. Yet today, our societies have to face a major change, summed up in the concept of the Anthropocene, i.e. the massive, global and unprecedented impact of human activities on the planet, reminding humans of the limits of the planet's resilience.

But then what are cosmograms of the Anthropocene? How can a cultural analysis of scientific images of the climate enlighten us? For instance, our imaginary and our visual culture also inherit utopian or dystopian visions emanating from science-fiction. How do these possible futures, as imagined in the past, interact with the current socio-technical reality? These questions open up possibilities and show that there is not only one cosmology to be imagined and that alternative visions exist and clash, including in the images and imaginaries they produce.



"Burning" world - excerpt of figure 33.
©DKRZ Hambourg

Imag(e)ing technocultures of the future in light of the past

James R. Fleming
Colby College, Waterville.

What does it mean for humanity to go from the *Holocene* (geological period of the past 10,000 years) to the *Anthropocene*, where the Earth system is deeply disturbed by human activity, in particular by greenhouse gas emissions? The Anthropocene resembles a science-fiction plot. Think of Jules Verne's *The Purchase of the North Pole* (1889), in which scientific excesses are denounced with much irony through a project to modify the Earth's axis. This recalls Olaf Stapledon's *Last and First Men: A Story of the Near and Far Future* (1930), depicting a humanity about to disappear for good after cycles of extinction of various human species.

The concept of Anthropocene hasn't yet been fully accepted by scientists, nor has it been stabilised by historians. For some, it isn't just a concept, it is a radical change that could open up the chapter of a decisive era for our planet and for humanity. When did the Anthropocene start? With the extinction of big mammals, with the start of agriculture, with the industrial revolution, or more recently, at the dawn of the nuclear age? In any event, the end of the 20th century marks a new moment for the Anthropocene. Whether it is through nuclear risk, the acceleration of resource depletion, the explosion of demographics, or of pollution rates, multiple evolutions are precipitating us towards potential large scale disasters.

The Anthropocene and science fiction: what is the moral of the story?

Just as with science fiction, the concept of the Anthropocene questions the place of technosciences and looks at the future. It is also a tale of humanity's history. What role does science fiction play in preparing the future? Has fiction changed our way of imagining ourselves in the future? In science fiction, there is often a moral indicating what humankind can or cannot do, the idea that Mother Earth, often represented by a female character, must be respected… but science fantasy often does away with the normative dimension and any moral thread to the story; it simply claims that we can do anything.

Analyses of thinkers of the middle of the 20th century shine a light on the current socio-technical situation. In 1934, Lewis Mumford published a long history of the evolution of the relationship between technology and civilisation, showing the heritage and the breaks brought by each new era[1]. He conceptualises three over-lapping and interpenetrating phases, each characterised by technology complexes based on specific sources of energy and materials. The *Eotechnic* phase (1000-1750) is typical of the increase of non-human energy: water, wood, wind, animal traction... The *Paleotechnic* phase (1750-1900) represents the shift towards "carbon capitalism", with the development of fossil energies and mass production, the excesses of which lead to uncertainties and conflicts. Finally, the *Neotechnic* phase (1900-2000), encapsulated Mumford's fascination with high technology.

What can a contemporary historian add to this? The roots of the Anthropocene can be found even earlier than in the *Eotechnic* phase. Already in the Paleolithic period (40000-10000 BC), humans probably worried about climate change, as they were experiencing intense climate cooling which was putting their lives at risk. One could also reassess Mumford's anticipations on the 20th century, since imbalances increased rather than subsided. The *Neotechnic* era was in fact the era of plastic, mass consumption, individual cars, overdependence to oil and throwaway mentalities. One could also make projections on the future based on the current situation, a possible future called the *Ecotechnic* era, where humans take the environment's limits seriously. But as shown in the failure of international climate negotiations, humans are struggling to move on from the *Neotechnic* era. The trend that seems to be emerging is that of an *interventionist Anthropocene*, who wants to find technological solutions applicable to the Earth system as a whole

1 Lewis Mumford, *Technics and civilization*, New York: Harcourt, 1934.

DISCUSSION WITH THE FLOOR
Tiros, the cold war meteorological satellite

In April 1960, Tiros 1, the first meteorological observation satellite was launched. Meteorological ambitions were set high, as the aim was to monitor the formation of hurricanes and therefore to strengthen environmental safety. The consequences were cultural, with the images produced and widely broadcast were carved into imaginaries. The stakes were largely geopolitical. In the midst of a cold war, the United States scored points in the race to space with this satellite, at a time when Soviet successes dominated the geopolitical scene. As an illustration of these tensions, the satellite was programmed not to fly over the Soviet Union's air space to avoid exacerbating hostilities.

Meteorology was used as a diplomatic and strategic tool to ease tensions between both powers around common initiatives. In 1961, Kennedy and Khrushchev forged tentative agreements on the peaceful use of outer space. In 1962, as tensions mounted and war seemed imminent, the World Meteorological Organization began planning for the World Weather Watch, bringing together competences and images of the United Stated and the USSR and to generate cooperation.

to counter, rather than mitigate, the dramatic consequences of human activity. But is there a technological solution for each problem? Dystopic scenarios take shape: humanity could enter a *Geotechnic* era of geoingineering, of pesticide mass dissemination… or other *Biotechnic* (genetic modification of the living), *Nanotechnic*, or *Cybertechnic* futures…

John Desmond Bernal and his essay *The World, the Flesh and the Devil* (1929) give another take on the current situation. Bernal relates the results of technology by a superior and dehumanised human species that transcends its condition by colonising and exploiting interstellar space, and that over-mechanises bodies. Humanity also frees itself from the "devil" of its psychological dependencies. Most of humanity remains chained to life on Earth. It just so happens that NASA currently supports projects aiming to send a small part of humanity elsewhere in space to avoid future disasters. In 2011, a meeting was held to discuss technical means necessary to leave the planet and even the solar system. A contest was organised to collect innovative ideas. Many studies, often unconvincing, are carried out to experiment on artificial biospheres to support long term living on a space ship. Thus science-fiction meets reality. The *homo faber*[2] we have become cannot do away with all technologies, but we must use them with wisdom and we must take into account the limits of our planet as fast as possible. ■

Figure 26
Experimenting on an artificial biosphere in the Arizona desert.
©Hok Network

2 This concept refers to humans' ability to build tools.

Cosmograms for the Anthropocene... and after?

John Tresch
University of Pennsylvania.

Global environmental images don't just have scientific, instrumental, aesthetic or geopolitical implications. They also bear cosmologies; they offer representations of the universe. That is why my presentation analyses them through the notion of *cosmogram*, in order to analyse these images and the cosmologies that help humans imagine their environment.

This concept is the result of a combination of *diagram* and *cosmos*. It comes from religious studies: a classic example of cosmograms can be found in Hindu and Buddhist mandalas, but also in the Western world, for instance in Christian liturgical art. The link between cosmograms and visions of the world appears, for instance, in the drawings of the Catholic saint Hildegard von Bingen in the 12th century. Her representations of the cycle of the seasons show a notion of cyclical time and of a geocentric universe based on four elements. The fact that she includes herself in the image – showing the circumstances in which she has had these mystical visions of the universe, in the lower left, places the act of representation itself within the natural and divine order, and therefore reveals her own place (and the place of her work) in this cosmos.

Figure 27
The world as recorded by Hildegard von Bingen ("The cycle of the seasons" in *Liber Divinorum Operum*, Lucca, Biblioteca Statale, c.1150).

Science too produces cosmograms. It doesn't just offer facts, but also tales that contribute to giving an order and therefore a meaning to the world as we know it. This is the case for the tree of evolution for Darwin, or, more recently for the astrophysicist Carl Sagan's cosmological epics, *Cosmos*, a popular television series recently relaunched by Neil de Grasse Tyson. The term cosmogram doesn't necessarily imply a unified or complete whole: these tales and images can be multiple, controversial, incomplete or subject to modification. The analysis and comparison of cosmograms helps us see and compare various metaphysics and different modes of knowledge.

Figure 28
Darwin's phylogenetic tree, a scientific cosmogram (*First notebook on Transmutation of Species*, 1837).

In particular, we can see how modern representations of the universe emerge along with mechanist philosophy and modern science, going back to the 17th century and developing over the next three hundred years. This new order can be summed up under the following acronym: MeMO (for *mechanical*, *materialistic* and *objectivistic*). Modern cosmic representations tend to show the world as impersonal, something that can be described by mathematics and general laws. The sound of this acronym, MeMO, carries several meanings: the *memorandum*, as an impersonal note summing up an essence, in an imperative voice; the concept of *meme* invented by Dawkins to describe a cultural element that, just like its "selfish" gene, self-replicates and is transmitted from one individual to another through no choice of their own; and, in addition, also Jules Verne's Captain Nemo, whose name means "nobody"- everywhere and nowhere, MeMO is no one's creation, it's nature itself.

Though the cosmology spread through the MeMO model has become dominant, it isn't the only one. Western history shows many other cosmological conceptions holding sway, both before and often alongside mechanist rationalism. Anthropology also provides a systematic view on some of these alternatives. Philippe Descola's work in *Beyond Nature and Culture* (2013) (French publication date 2005) analysed four main "ontological routes" revealed by the ethnographic record. MeMO is

Figure 29
Cosmograms of various representations of relations between humans and nature. From left to right: naturalism (Vaucanson's duck), totemism (Ojibway example), animism (Inuit example), analogism (Han example in China, Tomb of Marquis Run Yin, ca. 168 BCE). (Sources: Alfred Chapuis, *Le monde des automates*, Paris: Gélis, 1928; Norval Morrisseau and Selwyn H. Dewdney (eds.), *Legends of my people: the great Ojibway*, Toronto: Ryerson Press, 1965; drawing from Davidialuk Alasuaq, reproduced in: Tim Ingold, *The perception of the environment: essays on livelihood, dwelling and skill*, London: Routledge, 2000; David W. Pankenier, "Cosmic Capitals and Numinous Precincts in Early China," *Journal of Cosmology*, vol. 9, 2010, p.2030-2040).

what Descola describes as *naturalism*, embodied in Descartes and his split between the thinking soul and the extended matter of the external world. Yet it also shows three other cosmologies, or ways of looking at relations between humans and non-human beings: *animism*, *analogism* and *totemism*. Descola sums up these possibilities into four ideal types, but in their appearance over time, given the endless ways in which nature may be carved up, and the endless creativity of human consciousness, it's hard not to imagine a potentially infinite range of detailed cosmologies.

Without even looking beyond Western cultures, the history of sciences shows that within Western science, alternative cosmologies have coexisted with the MeMO mode, with naturalism. To give but one example, Auguste Comte, known as the father of positivism, also developed what he called the "Religion of Humanity", based on a new fetishism and an explicit return to what he believed to be an animist phase of humanity, so that society and science – properly reorganised – would face up to their absolute dependence on the Earth and its nonhuman inhabitants. Western modernity therefore emerged – even in its most exemplarily modern sites, such as positivism – amidst powerful counter-currents which negated the dominant naturalism.

Figures 30 et 31
Two contemporary cosmograms.
Left: a representation of the Anthropocene according to a mechanical, materialistic and objectivistic frame (*The Economist*, May 28-June 11, 2011).
Right: a poster defending Mother Earth, during the *People's Climate March*, 20-21 September 2014 (Favianna Rodriguez, *peoplesclimate.org*).

Where are we today? Becoming aware of the Anthropocene may correspond to a change away from the MeMO-type gaze towards the universe, as well as to new ways of inhabiting our relations with the Earth. If this development implies a change in cosmology, what cosmograms have been used to characterise the Anthropocene, and what do they tell us about the evolution of our apprehension of the world? The cover of *The Economist*, "Welcome to Anthropocene", shows an Earth that is technocatically managed; it represents a typically naturalist cosmogram that inherits the MeMO frame, the Blue Marble subject to lego modification – as well as the very approach to conceptualising the Earth that has created the conditions of the Anthropocene since the 18th century. As a counterpoint, a poster of the recent Earth March featuring translocal imagery borrowing from indigenous movements presents the earth as a personified, neo-animist Mother Earth whose voice must be heeded.

Focusing on both the major, MeMO-style cosmograms which we continue to produce, and contrasting them with alternative cosmograms, launched as both critical and utopian frameworks for alternative cosmologies may suggest ways to move past the modes of thinking, activities, aesthetic sensitivities that led to crises of the Anthropocene. Along these lines, not only visual representations should be considered as cosmograms, but also performances, sonic and other sensory experiments in deliberately-chosen settings, including the images mobilised in environmental demonstrations. We can attend to – and participate in – cosmograms in action, and reflect on the ways they help further debates and acts of collective coordination by linking the material, immediately present, to the infinitely wider frame of the cosmos. ■

Burning worlds: a critical approach of climatic cosmograms of the Anthropocene

Birgit Schneider
Potsdam University

This presentation follows the previous one with the analysis of a specific cosmogram of the Anthropocene: maps representing simulations of future terrestrial temperature changes. How do these representations, which are created to help understand climatic phenomena, also show a cosmology or a notion of the human/Earth relationship, and, at the same time, shape the imaginary of the possible futures of this relationship? What messages are sent through these images, beyond the scientific message?

The starting point of this discussion consists in questioning the reasons for switching from the highly publicised image of the Blue Marble to a red planet, which represents in color the increase in temperature as assessed in different parts of the world. The climatic maps representing a red globe have, in some way, taken over from the blue planet in our collective imaginaries.

In September 2013, during a press conference in Stockholm on the fifth IPCC report, Thomas Stocker, head of the IPCC working group 1, commented on a planet map, representing climate history during the last century, as follows: "This is the face of the surface of our planet if you look at the atmosphere. It is red. The world has been warming. The trend that you see is clearly given as colours of red". Similar maps, representing red planets, are used for climate predictions. They stem from a complex process based on atmosphere-ocean models and the construction of a specific emission scenario, as well as on specific representation choices. Of course, in reality, the atmosphere isn't red! By putting aside the fact that this map is a reconstruction, by making the metaphor invisible, this scientist is attempting to link up very abstract data resulting from a complex process to a concrete and comprehensive meaning. In that sense, the red planet is a visualisation of climate change, in the literal sense. It makes visible an invisible phenomenon. With other images from climate sciences, it turns climate into a clear epistemic object, whereas, at the start, it can only be grasped through mediation measures, quantified data and statistics. The creators of this map use the intuitive perception of spectators so that without understanding the scientific and technical complexity needed for an in-depth reading of the map, in just one look, the message of a dangerous warming trend is clear. On the basis of a business-as-usual scenario, three maps are shown, representing projected chronological futures that clearly show a dramatic aggravation of global warming with darker shades of red taking

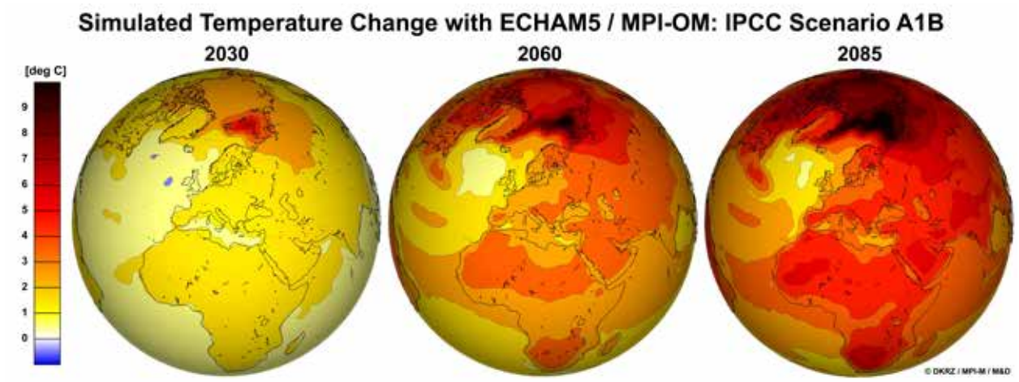


Figure 32
Modeling representation of temperature changes in 2030, 2060 and 2085, DKRZ, Hambourg

over the planet. The advantage of the map format, as against graphs, helps show the most affected geographical zones. The choice of red is significant. Indeed, if the representation were shown in different shades of green, the effect produced wouldn't be the same at all.

The metaphor of the blue planet has been highly publicised as the environmental global icon and it has become a reference in Earth imaginaries. It presents an Earth without borders, without mapping construction lines, with no visible trace of humanity, and it shows a natural view of the planet. It draws from previous historic areal representations, even though in actual fact it can only be seen by a handful of astronauts, and the necessary technology to make this possible is disproportionate because of its complexity and cost. This representation shows a beautiful, vulnerable and controllable planet all at once. To what extent does the emergence of red planet representations prolong and reconfigure these imaginaries and associated cosmologies?

The red planet has lost the clearly visible vaporous atmosphere of the Blue Marble. Red is a colour that has been used since the 19th century in map design to connote heat. At the same time the red colour refers to many connotations that might vary culturally. Besides positive meanings, red indicates abnormalities and danger like fire and blood. It is a significant colour because it is relatively absent from nature. While not only marking rising temperatures, red also calls for action. The red planet metaphor might also bring to mind planet Mars that refers to the god of War. Because of this interplay of meanings, the red maps got nicknamed "burning worlds" conjuring religious pictorial representations of the apocalypse, the last judgment and the purgatory. So the implications of the use of red shades by climatologists are extremely complex as they wipe out beauty and suggest a "burning planet". Therefore, these

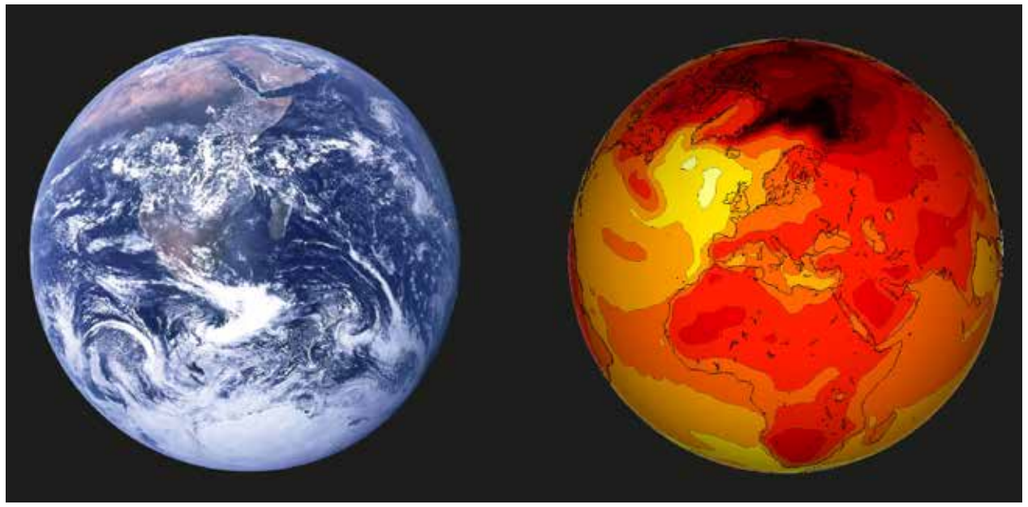


Figure 33
From the "blue planet" (NASA 1972) to the "burning" world (2001) and excerpt of figure 33.
Collage by the author to highlight the similarities and differences of the two ecological images in comparison..

DISCUSSION WITH THE FLOOR
The Earth is blue as an orange…
or the cultural notion of colours

Is there such a thing as a universal notion of connotations associated with colours? Does red refer to heat and danger everywhere in the world, green to safety and blue to cold? How does the framing impact the reading of the image? It would appear that the IPCC's colour choices can be interpreted in a similar way by all cultures, but are they not more relevant to western countries than to others? And how can one take into account local and national colour connotations? One speaker recalled that in the United States for instance, red is also the colour of the conservative party. The question of the cultural significance of colours and choices made by scientists is therefore worth considering in depth.

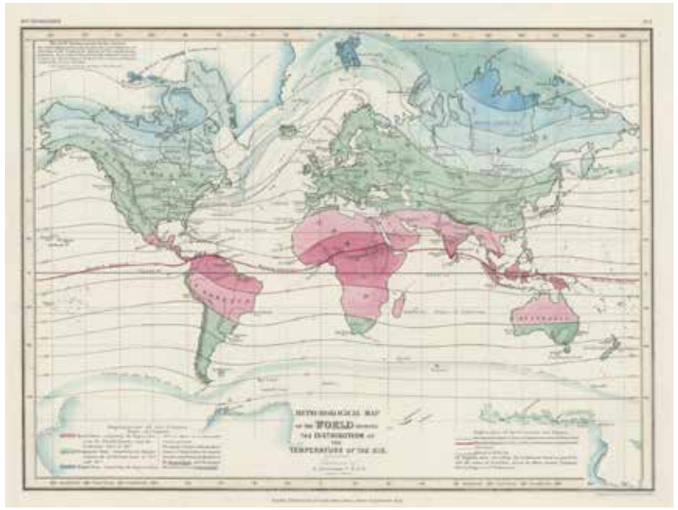


Figure 34
Map showing different climatic zones in red, blue and green from Petermann 1850.

scientific representations do not only imply a rational reading but also an emotional one, suggesting horror and fear.

This burning planet also borrows the globalising perspective of the Blue Marble. As such, criticism made of the Earth's holistic view by people such as Ingold, Arendt, Haraway, Grevsmühl[1] *etc.* is also relevant insofar as it feeds the notion that we don't belong to the Earth, but that the Earth belongs to us. It favors the global over the local, by turning the planet into a controllable object. Images of the red planet prolong this perspective, but in the context of an Earth gone hostile rather than a Mother Earth, an Earth that no longer needs protecting, but that needs to be managed. Rather than questionning modern techno-sciences and the consequences thereof, these images reveal their tragic triumph as well as the narcissistic mirror effect that was previously represented by the Blue Marble.

The efficiency of these new icons must therefore be questioned, in a context where IPCC reports are saturated with burning planets. The use of the concept of *cosmogram* to qualify these images helps establishing a distance, by suggesting that these representations are not only fulfilling objective and epistemic roles, but at the same time conflicting roles like fictional, subjective and rhetorical functions. ■

DISCUSSION WITH THE FLOOR
From a scientific image to an image of the media

Scientists, including climate specialists, produce images for their colleagues, for decision-makers or for the public at large, and these images summarise their conclusions through representations that are adapted for the recipient. By doing this, they also want to show the intrinsic uncertainty and complexity of their work. But the use and dissemination of their work depart from this caution. For climate specialists, the map of the "burning Planet" for an emissions' scenario, considered as an isolated element, doesn't make sense. It has to be read in comparison to maps that depict other possible scenarios.

Equally, it seems abusive, from a technical point of view, to assimilate photographs, maps and graphs in the same vague "image" category, when in fact these are objects that are very different by nature, that imply extremely different production chains, readings and references to reality.

Yet–and this is inevitable–reclaiming these images means blurring boundaries, getting rid of captions, separating representations from their production context and from the counterpoints that can be brought by other representations to nuance the argument or to insist on uncertainties.

To what extent can and must scientists and the IPCC take into account the derived uses of their work? Can they reconcile the climate urgency–and therefore the urgency to communicate on this issue–and the reflexivity necessary to fully grasp the consequences of turning scientific images over to the media?

1 Donna Haraway, *Arendt, Vita Activa oder vom tätigen Leben*, München: Piper, 1981 [1967] ; Tim Ingold, *Globes and Spheres*, in: Kay Milton (ed.), *Environmentalism. The View from Anthropology*, London: Routledge, 1995, p.31-42; Sebastian Grevsmühl, *La Terre vue d'en haut. L'invention de l'environnement global*, Paris: Seuil, 2014.

Environmental aesthetics

Chair : Jean-Paul Vanderlinden
Versailles Saint-Quentin-en-Yvelines University

The cultural nature of global environmental images is expressed through their aesthetic nature amongst others. The first presentation asks the question of environmental aesthetics in a long-term historic perspective: how has nature become the object of a debate on beauty and sensibility? How can art contribute to a pragmatic aesthetics of nature, i.e. support a growing environmental awareness or sustain a constructive debate on social power struggles that structure humans' relations to the environment? The second presentation analyses one concrete example of the environment constructed as a global entity: through which processes can maritime coastlines be integrated to the idea of a global ocean in constant change and how can they be described through universal scientific models when they are valued for their picturesque and aesthetic charms and their local specificities? Geographical representations are entangled in political, economic or technical determinations, whereas art can free itself from those and play with our collective imaginary.

Falaise d'Etretat, Normandie, France.
© Hervé Regnauld

Environmental aesthetics and the Anthropocene

Nathalie Blanc
Laboratoire Dynamiques sociales et recomposition des espaces (LADYSS)

As a human science, what oversight and what analysis can aesthetics give on the Anthropocene, and more generally on our relation with the environment?

Since Antiquity, philosophy has held a debate on *beauty* and *sensibility*, though at the time it wasn't considered as a fully fledged discipline. Thus in Greek philosopher Plato's *The Republic*, ethics and art were thought as one, images and art pieces being an integral part of citizens' moral education[1]. Aesthetics as an autonomous subject appeared in the 18th century. It lost its moral dimension and art became the field of pure expression. This evolution was due in particular to German philosopher Alexander Gottlieb Baumgarten[2]. Not only did he create the concept of "aesthetic art" but he brought this "science of sensible cognition" to the rank of a specific discipline equal to other sciences. Sensory experiences must be describable by general laws and senses should be amplified and expanded thanks to instruments such as telescopes, *etc*. Baumgarten's aesthetics, rather than looking at reason, focuses on sensibility.

Kant gave aesthetics its full philosophical depth. Kant insists on the subjective dimension of aesthetic satisfaction[3]. For him, beauty doesn't reside in the object, but in the gaze of the person admiring it. He believes aesthetics isn't a theory, but a judgment, a freedom within human faculties. He analyses all sorts of aesthetic experiences from that point of view. In particular, beyond art, Kant invents a theory on a nature-based aesthetics. There is also an education of aesthetics with Kant, but rather than a moral education, it is an education of taste. In summary, we, as human beings, are far from nature, and as such our aesthetic relationship to the environment should be educated so as to help us apprehend our own nature. He is one of the rare thinkers before the 1960s to have considered the complex relations between aesthetics and nature.

Coming back to the contemporary stakes of the Anthropocene, any environmental question leads us to modify aesthetic concepts. Images are no longer separate from their world, they model the world. It is all the more true when looking at climate change where millions of people model the atmosphere and the planet without even knowing it. This process updates the necessity Kant raised of not limiting aesthetics to art, but to develop a true aesthetics of the natural and built-up environment. In 1966, Robert Hepburn initiated a debate around the fact that natural beauty hadn't been sufficiently taken into account in the notion of the aesthetic experience[4]. Since then, many intellectuals have followed that momentum, starting from the posture that perceiving beauty doesn't just apply to art or cultural monuments, and that it is also possible to apprehend the environment from an aesthetic point of view. This *environmental aesthetics* thus applies to natural locations as well as to our general daily environment. This approach therefore gives a more popular and open notion of aesthetics, underlining the way in which we all contribute to modeling the world because of our aesthetic relationship to the environment.

This evolution also redefines the status of the subject, the way individuals build their conscience of reality. Neurologists have therefore studied the reactions of the brain faced with more or less beautiful and agreeable situations. Aesthetics plays a role in both, our senses and bodies but also in nature, just as two sides of the same coin. The subject can create its own world and builds itself as an aesthetic subject, with a specific imaginary, taste and sensibility.

Many books critical of contemporary aesthetics have looked at the way we model our world and cities like a giant Disneyland, to sell the world bit by bit, as we build it. In a sense, these negative perspectives stop us from truly thinking about the role of aesthetics in our world. Shouldn't we move away from a metaphysical aesthetics that represents a debate detached from physical reality, and move towards a pragmatic aesthetics that acts on the world? In fact, the possibility of remodeling humanity's destiny by modeling its aesthetic form isn't new. It can be found, for instance, in Fourier's socialist utopia. Thus, for years now, eco-art or environmental art have contributed to questioning our relationship with the environment and to criticising it.

The Anthropocene evokes a sense of the world that hides complexities and local power struggles; the production of global environmental images is part of this fascination for global control. To fight this trend, it isn't enough to produce images at different scales that show different levels of reality. To truly see local and global aspects, art and aesthetics can help us go further in a reflexive approach, in order to question, recreate and disturb our daily relationship with the environment. Hence the importance of including artisanal forms of creation found in town planning or landscape architecture in this aesthetics debate. ■

Figure 35
For his "Rhine Water Purification Plant" installation (Museum Haus Lange, Krefeld, 1972), Hans Haacke exposed the water purification system of a treatment plant before sending the purified water into a basin full of goldfish about to die because of the persistent pollution. Bénédicte Ramade, «Mutation écologique de l'art ?» - *Cosmopolitiques* 15, 2007, p.31-42).

1 Plato, *The Republic*.

2 1735 *Meditationes*, 1750 *Aesthetica*.

3 Critique of the Power of Judgment (1790).

4 Ronald Hepburn, *Contemporary Aesthetics and the Neglect of Natural Beauty* in: Allen Carlson and Arnold Berleant (eds.), *The Aesthetics of Natural Environments*, Peterborough: Broadview Press, 2004.

From coastal landscapes to a global ocean[1]

Hervé Regnauld
Rennes 2 University

How can a coastline, a unique natural site, be described by global and universal models that result from equations? An historic synthesis can help understand how modern geographical thoughts have tackled this question. In the 18th century, according to Kant, geography belonged to descriptive sciences as opposed to logical sciences. Geography therefore offers a *description* of the world, but this description is part of a universal perspective. It isn't the described object that becomes global, but the understanding thereof that must be global and understandable by all.

After his many travels, the naturalist Humboldt produced maps that are today among the most iconic contributions representing the world as a *global object*. It is a major change, with a shift from description to model. The image is no longer an illustration but becomes an explanation (Gayet, 2006, Buttimer, 2012). Information can be seen on his maps that cannot be seen in reality. Contour lines drawn through continents cannot be seen, nor can these three mountains of varying latitudes be seen next to one another.

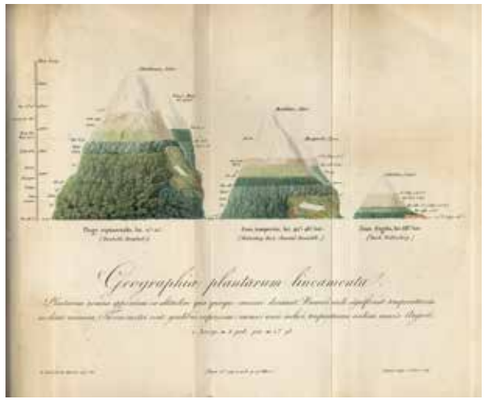


Figure 36
Humboldt's representations globalize the world by giving humans a joint view of places that are thousands of kilometers apart. They don't show the natural environment, they explain it.
Géographie des plantes, 1817.

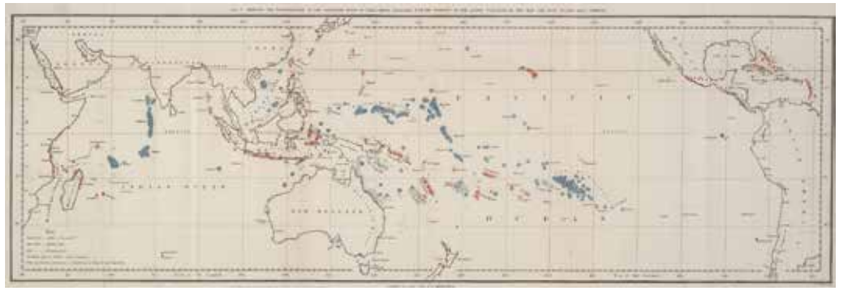


Figure 37
On one map, Darwin draws different types of corals and the environments in which they can be found to derive a general law.
The structure and distribution of coral reefs – 1842.

Soon after Humboldt, Charles Darwin drew on one map a representation of two types of coral, fringing reefs and barrier reefs. By correlating the location of these types of corals with the types of environments in which they can be found (lithosphere subsiding, the presence of volcanoes, proximity to a continent, *etc*…), he derived one single law for all reefs, even if this unity shows very varied landscapes.

1 Bibliography:
Anne Buttimer, «Alexander von Humboldt and planet earth's green mantle», *Cybergéo: European Journal of Geography*, no.616, 2012.
Charles Darwin (1834), French edition: *Voyage d'un naturaliste autour du Monde*, François Maspero, Paris: La Découverte, 1982.
Hali Felt, Soundings: *The Story of the Remarkable Woman Who Mapped the Ocean Floor*, New York: Henry Holt, 2012.
Mireille Gayet, *Alexandre de Humboldt*, Paris: Vuibert, 2006.
Immanuel Kant (1802), *Géographie*, Paris: Aubier, 1999.
J. Musereau, H. Regnauld and O. Planchon, «Vulnérabilité aux tempêtes des dunes littorales: développement d'un modèle de prédiction du dommage à travers l'exemple de Saint Trojan (Ile d'Oléron, France)», *Annales de l'Association Internationale de Climatologie*, vol.4, 2007, p.1-22.
Alexandre de Humboldt (1845), *Cosmos*, vol.1 and 2, Paris: Utz Editions, 2000.
Hervé Regnauld, A. Volvey and P. Heulot, «Géomorphosites et collection du FRAC Bretagne: comment les Arts Plastiques actuels peuvent-ils participer à la réflexion sur les sites littoraux remarquables?», *Geocarrefour*, vol.87, no.3-4, p.219-228.

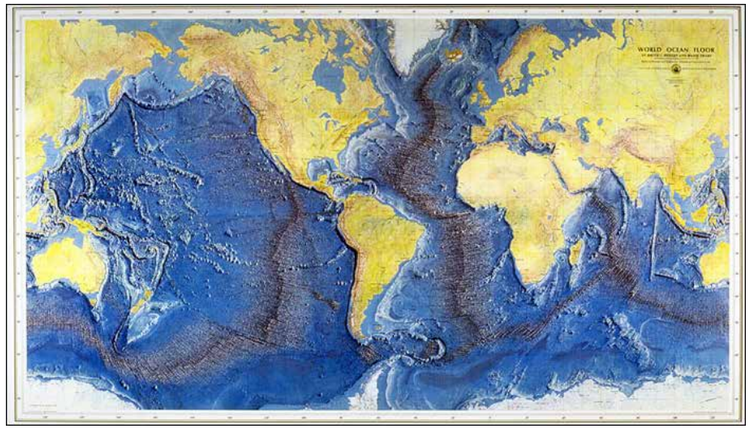


Figure 38
World ocean floor map based on Marie Tharp and Bruce Heezen's analyses.
World Ocean Floor Map, 1977.

Drawings that represent what exists but cannot be seen are also important when you look at seabed maps created during the cold war by Marie Tharp, a scientist who, as a woman, did not have access to scientific ships (Felt, 2012). She played a central role in that period of history by collecting information when hydrographic campaigns returned and by turning it into physiographic drawings and maps. Her drawings favour the acceptance of the plate tectonics theory during the second half of the 1960s. With the help of Swiss painter Heinrich Berann, she finally created the first world ocean floor map.

The ocean as a global phenomenon is not a description of something one can see, but it is a logical and graphic construction. However, one can think about the ocean as a global entity. On the contrary, in our imaginaries, coastlines remain a notion that is strongly localised, linked to images of specific landscapes. Why is that the case? First, precise and specific descriptions are essential to navigation, to allow ships to move along coasts or reach harbours without risk, by avoiding reefs or other dangers. Many maps were therefore created, completed with small drawings to include notable visual landmarks, such as lighthouses and rocks, to find the entry to a harbour or change course. Navigating on a global ocean does not mean one can ignore the diversity of coastlines.

Figure 39
Navigation maps contain both abstract mapping representations and concrete local landmarks.
Sketch of Anacapa Island, James Whistler, 1854.

But coastlines are also a political landscape. It is above all a border that needs to be protected from invasion. It is believed that in France, Napoleon III asked artists to represent French landscapes so as to naturalise territorial unity. Thus there are a number of representations of French coastlines,

Figure 40
Economic challenges linked to tourism encourage the promotion of local specificities of coastal landscapes (Etretat cliffs in Normandie, France seen from the ocean)
© Hervé Regnauld.

that put forward their specificity. There is also an economic factor: to generate revenue through tourism, you need to sell original landscapes. This encourages therefore representations that insist on picturesque aspects of coastlines, be it through paintings or photographs.

Scientists have also encouraged the trend to join coastlines and local aspects by developing typologies and classifications. These usually use the notion of "model" sites: each category being

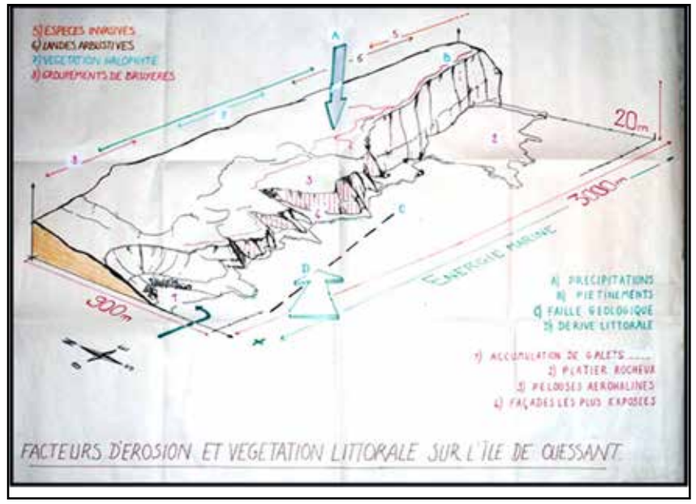


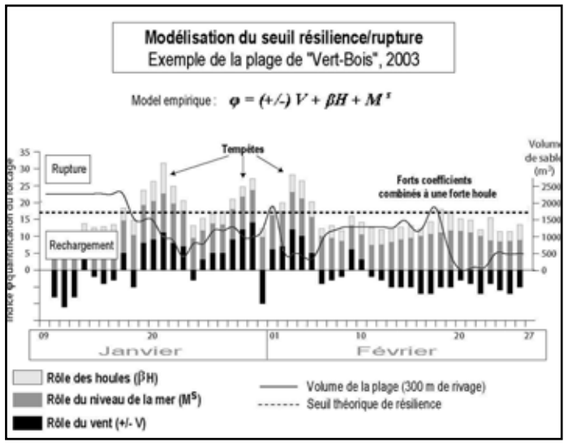
Figure 41
Geographical representation of a specific coastline made by a student (J.Gayraud) and published on the internet for its global explicative value.

perfectly represented by a type of coastline. More specifically, the usual work of a geographer is largely based on drawings made of a specific site or photographs. These representations, even if they are to be broadcast on a large scale, do not erase the specificities of the location where the information was collected. They are therefore not freed from the local aspect of the knowledge they convey. If protecting coastlines is a global question, management and political decisions can only be based on very local characteristics.

However, three main factors have been identified. Together, they help consider any coastline in the world as being the result of similar processes. They are:

i) Sea level movements, a complex phenomenon resulting from permanent variations;
ii) Sediment movements, which occur in a relatively limited space conceptualised by the notion of sedimentary cells regrouping eroded sites, transit sites and accumulation sites;
iii) Variations linked to the fact that sites where sediments transit receive variable quantities of matter, which implies that for a coastline to work normally, a certain accommodation space is necessary.

We therefore have to move from a representation of coastlines as *unmoving continental landscapes* to a conception that includes their nature as *dynamic marine landscapes* that can change depending on the quantity of energy, matter and space in interaction. This change has aesthetic, cultural and ecological consequences. A cliff such as Étretat and its famous pointed needle is destined to disappear, just as the water around *Mont Saint Michel*. How can images show the complexity apprehended by scientific graphs whilst making them understandable by all? One medium is art (particularly contemporary plastic arts with, for instance, Marcel Dinahet or Jan Dibbets) and it can contribute to changing the way we look at coastlines, so as to perceive them as a perpetual process rather than as unmoving sites. ■



Figures 42 et 43
Coastlines, a moving reality, seen by sciences (J.Musereau et al, 2007) and seen by art (*The Wave*, Gustave Courbet).

Conclusion

Sebastian Grevsmühl
Pierre and Marie Curie University

The international conference on global environmental images has shown a fact that remains largely absent from "interdisciplinary" studies of environmental imagery: the necessity to open a real dialogue between disciplines, between what C. P. Snow called the "two cultures", to give the floor to engineers as well as geographers, to climatologists as well as historians. In my view, this dialogue can only take place if we let go of the dangerously misleading premise that only one's own discipline has true interpretative powers. In fact, it is only if we find a *common* debate and interest (that are sometimes far from the usual issues raised) that this dialogue will be sustainable. It is in that spirit that the conference took place and this helped bring out several transversal avenues of reflection that have intertwined over these past two days of highly stimulating dialogue. I would like to mention three, without claiming to be exhaustive.

The first avenue of reflection focuses on visual means mobilised to make global environmental phenomena perceivable and visible. It is a starting point of sorts, because without this essential "representation" work, the phenomena discussed during the conference would neither be analysable, nor discussable – be it the global ocean (Hervé Regnauld, Rennes 2 University), the "hole" in the ozone layer (Richard Hamblyn, Birkbeck College, University of London), radioactive pollution (Arnaud Saint-Martin, Versailles Saint-Quentin-en-Yvelines University; Johan Gärdebo, KTH Stockholm), sea level rise (Cathy Dubois and Michel Avignon, CNES) or climate change (Birgit Schneider, Potsdam University; Thomas Nocke, PIK Potsdam Institute for Climate Impact Research; Martin Mahony, King's College London). Yet choosing and finding adequate modes of representations is a complex task without any guarantee of political success in the future. Thus, in the field of climate change for instance, one would aspire to imitate the great success met after the representation of another global environmental problem, i.e. the "hole" in the ozone layer in 1985[1]. Yet the complexity of climate change seems a much greater obstacle. In the space field, it seems important to distinguish those who produce data from those how make them commensurable thanks to visualisations. The example of the SPOT program (Gärdebo) shows that producing space data and satellite images always involves national interests. Therefore, by analysing the problem from close up, this first avenue of reflection leads to many other questions that also need to be taken into consideration.

Thus a second theme appeared through the conference on the complex interweaving between science and politics. In a context of global ecological crises, climatology and atmospheric chemistry offer a fascinating ground for studying the visual. As discussed in Hamblyn and Nocke's presentations, the main challenge seems to be to find the right balance between the quantity of information that has to be taken in (uncertainty is part of it for example), the application context which varies considerably, and finally the demands of the public or politicians to present a concise and clear message.

Despite the wide differences noted in climatology, both in approaches ("top-down" or "bottom up"), in models (which vary greatly from one institution or country to another), or in scenarios (that diverge vastly at times), the scientific community has been able to reach a broad consensus on the scientific soundness of climate change. Visual products of this evolution all try in various degrees to show a sense of urgency, whilst defending some sort of scientific objectivity. This "objectivity" is now negotiated in various spheres and is part of debates led by scientists all the way to politicians (Mahony). A similar observation can be made on visual choices in the cultural field, like the climate change colour code discussed by Schneider. Any emergency message is in that sense a cultural construction with its own history and a specific iconographical tradition, which is rooted in our collective visual imaginary. This analysis can be even stretched further. Global environmental images presented during the conference are all built at the cross roads between institutional power, technical and material constraints and social, political and cultural dynamics within the various scientific disciplines involved. Climate

1 Richard Hamblyn, Martin Callanan, *Data soliloquies*, London : Slade, 2009 ; Sebastian Grevsmühl, « *The creation of global imaginaries : The Antarctic ozone hole and the isoline tradition in the atmospheric sciences* », in : Birgit Schneider and Thomas Nocke (eds.), *Image politics of climate change*, Berlin : Transcript, 2014, p.29-53.

change is again a good example. The choice of images for the IPCC report and the way certain elements were chosen to be presented over others – such as introducing a line marking a threshold at 2°C or a colour code evoking grave danger in red – are profoundly political choices negotiated for each report according to national interests.

The third and final avenue for reflection focuses on power stakes and the truly central place of technology in the production of globalising visions. Seeing the Earth from above emanates from a fundamental tension between on the one hand aesthetic exaltation, often associated with an increasing ecological awareness, and on the other fantasies of total power and control over the environment (Sebastian Grevsmühl, Pierre and Marie Curie University, Paris). This second reading of globalising visions amongst others seems to be gaining ground through calls for purely technocratic solutions, thus avoiding any political process. However, James Fleming's (Colby College) presentation confirms that clearly, controlling the environment, when considered at on a planetary level, escapes us completely. Moreover, the disincarnate and highly abstract vision of global environmental images, marked by the complete absence of humankind can also lead to the normalisation of horror (Saint-Martin) and can even have a demobilising effect (Dubois and Avignon).

However, different solutions are emerging to thwart this development. First, instead of adopting a purely "top-down" methodology, such as those defended by standard-setting institutions and external experts, we need to focus on local projects. For instance, we should start from local preoccupations of players we meet on the field and start by reintegrating their views in the global environmental image production process. Moreover it may be recalled that in the West, science represents only a model, one way of thinking the relationship between humankind and nature, and that many other "cosmograms" can help us think about the world globally (John Tresch, University of Pennsylvania). Finally the objective of environmental art, as Nathalie Blanc (CNRS/LADYSS) argues, helps us radically rethink our link to what is around us from a local to a global scale.

Thus the conference has helped open up new horizons for reflection, to unveil the great tensions surrounding global environmental images and to identify transversal avenues for reflection to engage in a real dialogue between sciences and humanities, a dialogue sure to produce both surprising and innovative results. ■

Printed March 2015


www.gisclimat.fr
To receive a copy,
please contact
contact@gisclimat.fr
A French version of this brochure
is also available
contact@gisclimat.fr