Communicating risks and uncertainties of global environmental change and extreme events

Gabriela Marques Di Giulio
School of Public Health – University of São Paulo, Brazil
ggiulio@usp.br

José Eduardo Viglio
Environmental Studies Center – University of Campinas, Brazil
eduviglio@hotmail.com

Phil Macnaghten
Geography Department – Durham University, UK
Science and Technology Policy Department – University of Campinas, Brazil
p.m.macnaghten@durham.ac.uk

Jens Oliver Zinn
School of Social and Political Sciences, Melbourne University, Australia
jzinn@unimelb.edu.au

Abstract

While environmental change will expose different regions to different impacts, the extent of those impacts and effective responses at the local level will be determined not only by the location's sensitivity and vulnerability but also by local groups and individuals' capacity, including their institutional links, social networks and motivation to action. In parallel, scientific information plays a critical and ambivalent role in informing environmental change adaptation by providing both an improved understanding of the climate risks and response alternatives (Serrao-Neumann et al., 2013). How to make climate science more accessible and useful to decision-making? How communicate risks

and uncertainties in a way that allows science producers and users to own the problem and set common goals together? How to deal with climate challenges pose for science communication? In this panel session, we seek to explore these questions through a debate on two-way communication channels involving scientists, practitioners and community users for improving understanding about how stakeholders perceive and respond to climate risks, as well as fostering bilateral cooperation for both the identification of knowledge gaps and dissemination of available knowledge.

Introduction

It is now widely recognized that there is strong scientific evidence to confirm that climate change is already happening and that we will need to adapt to its impacts (IPCC, 2014). While environmental change will expose different regions to different impacts, the extent of those impacts and effective responses at the local level will be determined not only by the location's sensitivity and vulnerability but also by local groups and individuals' capacity, including their institutional links, social networks and motivation to action (Serrao-Neumann et al., 2013).

Adaptation planning and implementation at all levels of governance are contingent on societal values, objectives, and risk perceptions (IPCC, 2014). While there are many barriers to adaptation ranging from social through individual, the uncertainty and complexity inherent to climate science continues to be identified as a major hurdle for decision-making involving adaptation. Specifically, it is argued that climate science needs to be more useful to decision-making to enable and guide adaptation.

At this sense, scientific information plays a critical and ambivalent role in informing climate change adaptation by providing both an improved understanding of the climate risks and response alternatives (Serrao-Neumann et al., 2013). Making risk information accessible involves building trust through engaging with local knowledge sources and systems and supporting the co-production of information which is useful, useable and used, relevant for users in terms of its temporal and geographic scale and livelihood specificity and provided through trusted and accessible channels (Visman, 2014).

How to make climate science more accessible and useful to decision-making? How communicate risks and uncertainties in a way that allows science producers and users to own the problem and set common goals together? How to deal with climate challenges pose for science communication?

In this panel session, we seek to explore these questions through a debate on two-way communication channels involving scientists, practitioners and community users for improving understanding about how stakeholders perceive and respond to climate risks, as well as fostering bilateral cooperation for both the identification of knowledge gaps and dissemination of available knowledge.

In the first section Di Giulio and Viglio present a Brazilian study case aimed to investigate perceptions of risks associated with climate change and adaptation strategies (their possibilities and limitations) at the local level to encourage purposeful collective action and improve the dialogue between 'those who make science' and 'those who use science to make decisions' in order to make climate science more useful.

Macnaghten, in the second section, argues that recent policy and science communication treatments of solar radiation management (SRM) have insufficiently addressed its potential implications for contemporary political systems, and points the challenges SRM poses for science communication.

Finally Zinn presents a case study on coal based energy production in the Latrobe Valley (Australia) which shows that while risk communication is important in the risk governance process, other social factors influencing the success of adaptation practice in political and administrative decision-making.

How to engage the public on risk governance through a participative dialogue

Climate change offers a rich opportunity to investigate how risk perceptions and public engagement on risk governance are shaped by different elements, such as personal experience, social values, uncertainty, trust, economic issues, and in particular by the ways in which risk is communicated.

Many risk communication initiatives have been based on a knowledge deficit model, assuming that lack of scientific input is the main obstacle to more effective risk management and underestimating potential input from at-risk people. Yet policymakers

and local people obtain evidence from a variety of sources beyond scientific materials, and have to make decisions in contexts of political, economic and social complexity[1]. Recognizing that climate change and extreme weather events are characterized by considerable uncertainty and controversy, efforts to strengthen disaster risk management through improved dialogue between the providers and users of science need to take account that production of risk knowledge takes place in different social domains, and that these domains and their characteristics influence not only the dialogue among the social groups, but in particular how they deal with risks and disasters.

Based on these ideas an empirical study was conducted on São Paulo Coast (Brazil) aimed to enable local technicians, policymakers and at-risk groups to actively engage in climate research.

The north part of the São Paulo coastline is an area of heightened vulnerability. Irregular and unsafe settlements, scarcity of drinking water and poor sanitation are coupled with the socio-ecological dilemmas of economic development, including the combined pressures of tourism and extraction and transportation of offshore oil and natural gas (Viglio, 2012). Climate change is likely to exacerbate current vulnerabilities, with increased frequency and intensity of extreme weather events, including long and intense rain (causing landslides and floods), increases in air temperatures (heightening health risks), sea level rise and storm surges (Ferreira et al., 2012; Di Giulio and Ferreira, 2013).

Drawing on empirical research on this area, our study aimed to investigate perceptions of risks associated with climate change and adaptation strategies (their possibilities and limitations) at the local level to encourage purposeful collective action and improve the dialogue between 'those who make science' and 'those who use science to make decisions' in order to make climate science more useful.

Considering that participative risk communication is a decisive element to integrate the public in the debate of climate change, involving many forms of flow of

[1] See Di Giulio Annex - Case Study 2 Focus Groups for participative climate risk communication in Brazil. In: Visman, E (2014) Knowledge is power: Unlocking the potential for science and technology to enhance community resilience through knowledge exchange. London: Humanitarian Practice Network (HPN), Overseas Development Institute, 2014 (Network Paper - Humanitarian Practice Network).

information between social groups, our study elected focus group meetings as a qualitative and participatory research method which joined the opportunity for both the identification of knowledge gaps and risk perceptions, and the support of a co-production and use of risk knowledge.

Between August 2011 and June 2012 eight focus group meetings were held involving four types of stakeholder groups: a) a science-based group involving researchers from the Climate Project[2]; b) a practitioners group involving local technicians and policymakers dealing with risk assessment and management in the area; c) a neighborhood leaders group involving people considered to be living in areas at risk by emergency management authorities; and d) a youth group involving 12 to 17 years old youngsters also considered to be living in areas at risk.

The focus group meetings created opportunities for stakeholders to discuss urban problems and risks due to climate and environmental change that affected their area. These meetings also enabled stakeholders to deliberate about risk understanding and communication and engagement strategies seeking broader collaboration amongst other social groups also living in areas at risk. For example, stakeholders identified existing barriers to improved risk understanding, including the paucity and quality of weather forecasting and available scientific information, disconnect between the format in which scientific information is made available and how it can be applied to decision-making, and their own limited social, economic and emotional ability to retreat from areas considered at risk.

The collected narratives highlighted that the social and economic context such as deficient economic and government support as well as the influence of religion were determinants in the way people construct their understanding of and respond to risk threats. In parallel, practitioners indicated that, despite efforts in improving communication channels in order to make climate science more useful, communication with scientists remained challenging.

[2] The Climate Project funded by Fapesp (2009-2013) aimed to set groundwork research on the environmental consequences of climate change along the coast of São Paulo, including the investigation of how solutions may require better understanding of local and regional government stakeholders' knowledge, concerns and actions related to climate change.

Through focus group meetings, our research confirmed the limitations local governments had to implement adaptation strategies due to limited resources and political interest. Problems associated with collective decision-making were also detected, as there had been limited public participation in formal consultation exercises as well as reduced public interest and social mobilization. Additionally, stakeholders had greater concerns in relation to other local and regional issues that are currently affecting their liveability as opposed to climate risks, including the lack of urban planning and infrastructure provision and mega projects involving the extraction of oil and natural gas in the region.

Our analyses highlighted that while emergency managers stressed that it was critical to improve risk understanding and communication involving people living in areas at risk, neighborhood leaders highlighted a series of barriers impeding their ability to adapt, including inherent socio economic context, lack of public engagement and institutional capacity and other more urgent concerns affecting their day to day lives. Thus the availability and communication of scientific knowledge on their own were not sufficient to improve stakeholders' ability to adapt as other impediments also needed be overcome.

In terms of improving risk understanding and communication, our study confirmed issues also found in other Brazilian studies (Di Giulio 2012; Di Giulio et al. 2012), including the broader lack of institutional capacity to not only communicate but also to deal with risks, particularly in relation to availability of resources and public engagement in policy and decision-making. Our analyses highlighted the difficulties individuals have to make appropriate decisions when confronting risk situations caused by natural hazards, particularly given the uncertainties inherent to extreme weather events.

This experience on the North Coast of São Paulo had shown us that focus group meeting is in fact an applicable two-way communication channel which brings opportunities for improving our understanding about how stakeholders perceived risks, as well as fostering bilateral cooperation for both the identification of knowledge gaps and the dissemination of available knowledge.

This qualitative and participatory research method is very useful on qualitative risk studies, as aimed to make science more responsive to public concerns and

aspirations, include a comprehension on public perceptions and responses to risks, and elicit public forms of knowledge that are relevant to the risk governance process.

How to communicate the politics and science of solar radiation management (SRM) as a potential option to mitigate anthropogenic climate change

There has been a recent and rapid growth of interest within the scientific and policy community in exploring a range of techniques, collectively termed 'geoengineering' (or alternatively 'climate engineering'), for deliberatively intervening in the climate to counteract global warming. Within the space of a few years, and with the endorsement of learned societies and governance institutions, geoengineering has become a topic of mainstream respectable scientific and policy debate.

One class of geoengineering techniques, termed solar radiation management, are intended to counteract the warming effects of climate change by reflecting some of the inbound sunlight back into space and hence reducing global average temperature. Methods include increasing the reflectivity of the earth by brightening human settlements or deserts to make them more reflective, enhancing marine cloud reflectivity through for example the spraying of salt-rich sea water into the sky, injecting aerosols such as sulphates into the stratosphere to mimic the dimming effects of large volcanoes, or placing space mirrors or sunshades into space to reduce the amount of solar radiation entering the atmosphere. These techniques, particularly stratospheric aerosols, have received particular attention because of the perception that they could be fast acting and relatively cheap, but have also prompted concerns about unintended and potentially harmful side-effects.

Although geoengineering is largely at a pre-research and development stage, nevertheless it has received particular attention in recent years in the science policy community. This provides one explanation for explaining the rise of geoengineering as an emergent science policy discourse: concerns that current mitigation policies may not produce the necessary reductions in emissions that are necessary to avoid dangerous climate change. In the context of the lack of progress of Kyoto targets, the lack of strong international agreement at United Nations conferences at Copenhagen and Durban, the rapid and on-going growth of emerging economies such as China and India, and more

general questioning on the UNFCC/ Kyoto model as a plausible mechanism to deliver change, geoengineering is presented as at least a prudent option to explore.

The second reason is more pragmatic: proponents of geoengineering argue that solar radiation management techniques (stratospheric aerosol injection techniques in particular) could not only reduce global temperatures relatively quickly, perhaps within a few months of deployment, but also relatively cheaply, relative to the cost of implementing greenhouse gas emissions reductions. For both of these reasons, geoengineering is fast emerging as a third policy route for responding to climate change, alongside mitigation and adaptation, and as a necessary option that needs to be researched and developed in case it is ever to be required.

There is still considerable diversity of opinion about exactly what form geoengineering governance should take. However, there seems to be an emerging consensus that it should involve a combination of soft law and hard law, be guided by principles such as 'the public interest' and transparency, and involve 'upstream' engagement with wider stakeholders and the public. It is also argued that governance during the research stage might be relatively 'soft' to permit or even encourage 'safe', laboratory or small-scale research (with proposed governance mechanisms ranging through laissez-faire permissiveness, self-regulation, independent national policies, to an informal consortium of countries); however, most argue that governance would have to become 'harder' before any large-scale field research or deployment, probably through a multilateral, international body such as the United Nations.

Despite the fact that geoengineering remains at an early stage of development, there remains considerable scope for critical and engaged inquiry and the politics and science of solar radiation management (SRM) as a potential option to mitigate anthropogenic climate change should be communicated. In the remainder of this entry we suggest the forms that this may take. Firstly, there is argument from nature – that geoengineering is imagining its interaction with the natural world in novel and distinctive ways. Unlike many technoscientific issues, the distinctiveness of geoengineering does not lie in the use of novel technologies with new properties: the actual interventions themselves typically involve mundane technologies such as mirrors, iron dust, sulphate particles or crumbled rock, albeit deployed at a very large scale. Its novelty rather lies in

the intention to use these technologies in a project of bringing planetary systems under human control. In philosophical terms, this encompasses the existential argument that the deployment of geoengineering would represent a hubristic extension of human powers, in that it would establish a radically new relationship between society and nature through and the 'making' of new climates. Critical inquiry can help illuminate the ways in which geoengineering rhetoric deploys a distinctive 'airman's vision' and how this can be contrasted to more local and phenomenological approaches that can be used to explore the lifeworld of a geoengineered future.

Secondly, there is the argument from risk governance – the need to understand and communicate the distinctive ways in which geoengineering may produce unforeseen and unintended consequences and their implications for governance. The prominence of geoengineering in science policy debates is based largely on the idea that it could be 'cheap and effective' compared with other carbon mitigation strategies. Such assessments, however, make the crucial assumption that the impacts of geoengineering interventions on the climate will be in line with those predicted by climate models. However, this remains far from certain. Indeed, geoengineering has a distinctive relationship with uncertainty that problematises such assumptions. With most previous technologies that have been subject to regional and global governance and control (eg, persistent organic pollutants and CFCs), it is the side-effects, often after decades of use, that have been of concern. Such side-effects have typically been hard to predict or attribute, but research has increased certainty to a sufficient degree as a basis for global action, often underpinned by a degree of precaution, making possible both hard and soft governance arrangements. But with geoengineering technologies the task of governance is significantly different: it is the intended effects [for example, a reduction in global temperature) that are global; that may only become apparent over long timescales; and that are probabilistic and highly mediated, since they involve affecting technological and statistical constructs such as 'global average temperature' through intervening into an earth system which is highly chaotic and always in formation. One role for geographical inquiry is to problematize the boundaries and distinctions between geoengineering deployment and research.

Thirdly, there is the argument from politics – about the likely impact of geoengineering on political systems and on our collective ability to manage such interventions. Part of this concerns the 'moral hazard' dilemma: the idea that geoengineering could make emission reductions politically harder once there exists the theoretical possibility for a technological alternative solution. There remains a need for social research on geoengineering's impact on environmental attitudes and behavioral change, both with policy-makers and the wider public. Another element concerns geoengineering's relationship with intent. Questions of intent have been central to the political processes shaping the constitution of geoengineering as a technology. The formal definition of geoengineering is tied to the goal of offsetting anthropogenic climate change. Whether or not a specific action such as releasing particles into the upper atmosphere counts as SRM geoengineering deployment, or as research, or even as mere pollution cannot be determined by a mere technical procedure, but only by reference to intent. This implies that meaningful geoengineering governance would logically require the scrutiny and regulation of the intentions, whether explicit or implicit, of a huge range of research and deployment activities. Furthermore, the intent in SRM geoengineering is likely to be unstable and open to plural interpretations. Firstly, even the intended consequences of SRM are themselves not necessarily unproblematic, not least since good intentions can lead to perverse outcomes, particularly at scale. Secondly, due to the problem of the attribution of consequences in climate processes discussed above, there will not necessarily be consensus that any realized goal of SRM was indeed brought about by its deployment. Thirdly, what constitutes a 'good' motivation is itself likely to become the subject of contestation. The framing of SRM as a means of counteracting anthropogenic climate change is likely to be joined or displaced by alternative frames—for example, as a means to achieve humanitarian, environmental, nationalistic, military, or commercial goals. Understanding and mapping the interpretive flexibility of intent in SRM research, their intersections with democratic governance, and their potential for generating new kinds of conflict and controversy, is a rich arena for future geographical inquiry.

Fourthly, there is the argument from political economy – that geoengineering is likely to be conditioned by economic relations that are in tension with the imperative for

democratic control. Such issues can be expected to become significant shaping factors in geoengineering research once deployment becomes more than a theoretical possibility; yet they are currently receiving little attention. The science and politics of geoengineering have so far developed through a particular and restricted assemblage of actors and ideas, with the result that policy and regulatory treatments of geoengineering have largely failed to acknowledge questions of political economy. There have been accusations that advocacy for geoengineering research is part of a project that aims to protect established political and economic interests by creating a rhetorical defense against more aggressive carbon reduction measures. Such arguments are perhaps overly simplistic, but it is nevertheless true that geoengineering can readily be co-opted by vested interests. Substantial economic opportunities are likely to be created by any plan to deploy geoengineering, including: the patenting of geoengineering techniques; the design of particles for release into the stratosphere; the design of delivery systems; the sourcing and transport of raw materials; the design and implementation of monitoring systems; and the establishment and running of financial schemes of funding and possible compensation. In addition, there are likely to be profound issues of justice: that a geoengineered world may simply perpetuate North-South inequalities, and intensify rather than reverse the 'colonization of the sky' represented by historical anthropogenic greenhouse gases from the global North. Exploring the possible differential spatial effects of different geoengineering interventions and the geopolitics of producing artificial climates, critical geographical scholars can draw on world systems theory, postcolonial and subaltern studies, situating geoengineering in the long view of North-South relations.

Fifthly, there is the argument from public engagement – the need for robust research to clarify public attitudes to geoengineering and the conditions, if any, under which geoengineering research and deployment might secure public acceptability. Current research has to date been dominated by public opinion surveys although there also exist a number of attempts aimed at generating more qualitative public dialogue. Methodology, there exist a number of challenges for the delivery of public engagement research. A key consideration concerns how to design the dialogue exercise, including the provision of stimulus materials that provide participants with diverse ways of thinking about the debate that do not simply reproduce dominant framings. It is important too that

discussions are not framed by experts, that moderators seek to ensure a diversity of voice independent of background or experience, and that techniques are devised that support participants in the process of imagining the kinds of world that geoengineering might bring into being. Geographical inquiry, especially at its interface with science and technology studies, can provide examples of good practice and guidance in using deliberative methodology to research the unfamiliar, complex and ethically challenging issues arising out of scientific and technological innovation.

In relation to the above spheres of inquiry, it is important that critical approaches – and the interpretative social sciences more generally – need to move away from the logic of 'subordination', in which they are allocated the task of filling in the gaps within a dominant frame provided by the physical and natural sciences, towards a more reflexive imaginary for geoengineering, that promotes a mode of communicating from the various ways of seeing that different disciplines offer.

The stony path of regional adaptation to climate change in Australia – Institutional set-up and cultural framing

Debates on risk communication tend to focus on improving strategies of communicating expert knowledge to politicians or laypeople that they understand risks properly and respond accordingly. While risk communication has experienced massive professionalization in recent decades, there is an increasing awareness of the other social factors influencing the success of adaptation practice in political and administrative decision making.

The case study on coal based energy production in the Latrobe Valley (Zinn & Fitzsimons 2012-14) shows how the institutional set-up as well as the socio-cultural framing of economic transformation can prevent a substantial change of attitude necessary for successful adaptive practice.

The Latrobe Valley in Gippsland, Victoria, is well known as key provider of cheap energy for the state. It provides about 85 percent of the energy consumed in the state with a number of the coal burning power stations, most well-known Hazelwood, a relatively old and high CO_2 emission plant, closely placed to a mine providing cheap coal.

The regions identity is dominated by a long history in mining and burning coal. In the 1990s the privatization of the energy sector had a traumatic impact on the region causing long term unemployment, jumping poverty and suicide rates and domestic violence. This heritage of the privatization left its mark in the region and requires an ongoing commitment of the state to deal with the long term needs for economic adaptation.

In 2012 the Australian Federal government introduced a carbon price and encouraged the closure of old and inefficient power stations supported by economic adjustment funding for affected regions. The government of Victoria and the local governments saw an opportunity to get access to $200,000 federal adjustment funding for the economic transformation of the region. While the federal political ambition was to bring climate change policies under way that would make a long term difference, the practice of developing a plan for regional change has been influenced by other rationales. To deal with the challenge of organizing regional economic transformation The Latrobe Transition Committee (LTC) was set up by state representatives and including regional leaders. Federal government representatives were invited to join the process because of the shared interest to prevent similarly traumatic impact as in the 1990s. The policy framework was unison considered as a superior decision making structure paradigmatic for other complex problem situations. However, the particular set up, though generally appreciated, guided the process away from a climate change rationale.

A number of factors were responsible for this development. The LTC included community leaders but they had been mainly the CEO's of the administrative units. Only later the Unions and a representative of the Health sector have been included. However, they seem not to have the same access to the information networks outside the transition committee and were not very clear about their role in the committee. The process itself was mainly driven by the state and federal representatives. The regional leaders took on a more passive role in the process to find pragmatic solutions for economic transformation quickly to access federal resources.

This division of labor in the LVT had an impact on the selection of expertise and consultancy process. Some reports wished by the region such as a social impact study

were not produced because of the expected negative publicity for the federal and state governments.

Also the community consultation that should have been helped to develop a regionally grounded strategic plan was rather limited. The community had limited opportunity to impact the planning process. Community engagement was considered as "bringing the message other to the community" rather than entering a controversial debate. There was little of a bottom up involvement of the community.

Besides the recommendation to the government there was also a strategic regional plan developed and the attempt to set up a number of good projects that could become part of a regional transformation. However, the selection of projects was mainly driven by a pragmatic rationale that supported projects with a clear business plan, and that did not require long term financial commitment. Projects with a clear symbolic value such as GippsAero were also preferred. Thus there was a clear contradiction between the need for quickly available well developed projects and the more open nature of climate change adaptation that requires more innovative projects with not so clear outcomes.

After government and energy-company were not able to agree on the conditions for closure the process was stopped and the adjustment funding off the table. In response to the lack of funding the region started to develop a more regionally driven transformation strategy. However, the adaptation of the regional economy to climate change a deeper rethinking would be required as provided by the *Roadmap*, the strategic plan for the economic transition of the Latrobe Valley region developed by the LVT.

We are wondering how a window of opportunity might open to overcome the coal based economy and the ideas of centralized energy production. During a recent bushfire, one of the older parts of the Hazelwood mine caught fire with the result that the air quality rapidly decreased in a close by community. Parts of the people who lived there were evacuated. We are currently examining to what extent such an event might contribute to a more long term change in regional attitudes and also a stronger involvement of community voices that might be more interested in considering climate change issues in strategic regional planning among other issues.

References

Di Giulio, G. M., B. R. Figueiredo, L. C. Ferreira, and J. Â. S. Anjos (2012) Experiências brasileiras e o debate sobre comunicação e governança do risco em áreas contaminadas por chumbo. Ciência e Saúde Coletiva no. 17:337-349.

Di Giulio, G.M (2012) Risco, ambiente e saúde: um debate sobre comunicação e governança do risco em áreas contaminadas. São Paulo: Annablume.

Di Giulio, G.M.; Ferreira, L.C (2013) Governança do risco: uma proposta para lidar com riscos ambientais no nível local. Desenvolvimento e Meio Ambiente (UFPR), v. 28, p. 29-39, 2013.

Ferreira, L.C.; Joly, C.; Ferreira, L.C; Carmo, R. L (2012) Urban Growth, Vulnerability and Adaptation: Social and Ecological Dimensions of Climate Change on the Coast of São Paulo. Scientific Annual Report, Jul, 2011 – Aug, 2012.

IPCC (2014) WGII AR5 Summary for Policymakers - Climate Change 2014: Impacts, Adaptation, and Vulnerability. Available at: http://ipcc-wg2.gov/AR5/images/uploads/IPCC_WG2AR5_SPM_Approved.pdf (April 02, 2014).

Serrao-Neumann, S.; Di Giulio, G.M; Ferreira, L.C.; Low Choy, D (2013). "Climate change adaptation: Is there a role for intervention research?" Futures no. 53:86-97. doi: http://dx.doi.org/10.1016/j.futures.2013.08.002.

Viglio, J.E (2012) Usos sociais e políticos da ciência na definição de riscos e impactos ambientais no setor de petróleo e gás. Tese de doutorado em Ciências Sociais (IFCH-UNICAMP).

Visman, E (2014) Knowledge is power: Unlocking the potential for science and technology to enhance community resilience through knowledge exchange. See also Di Giulio, G.M. Annex - Case Study 2 Focus Groups for participative climate risk

communication in Brazil. London: Humanitarian Practice Network (HPN), Overseas Development Institute, 2014 (Network Paper - Humanitarian Practice Network).