Abstract. In this paper we explore the dominant position of a particular style of scientific modelling in the provision of policy-relevant scientific knowledge on future climate change. We describe how the apical position of General Circulation Models (GCMs) appears to follow ‘logically’ both from conventional understandings of scientific representation and the use of knowledge, so acquired, in decision-making. We argue, however, that both of these particular understandings are contestable. In addition to questioning their current policy-usefulness, we draw upon existing analyses of GCMs which discuss model trade-offs, errors, and the effects of parameterisations, to raise questions about the validity of the conception of complexity in conventional accounts. An alternative approach to modelling, incorporating concepts of uncertainty, is discussed, and an illustrative example given for the case of the global carbon cycle.

In then addressing the question of how GCMs have come to occupy their dominant position, we argue that the development of global climate change science and global environmental ‘management’ frameworks occurs concurrently and in a mutually supportive fashion, so uniting GCMs and environmental policy developments in certain industrialised nations and international organisations. The more basic questions about what kinds of commitments to theories of knowledge underpin different models of ‘complexity’ as a normative principle of ‘good science’ are concealed in this mutual reinforcement. Additionally, a rather technocratic policy orientation to climate change may be supported by such science, even though it involves political choices which deserve to be more widely debated.

“The multiplicity of models is imposed by the contradictory demands of a complex, heterogeneous nature and a mind that can only cope with few variables at a time; by the contradictory desiderata of generality, realism, and precision; by the need to understand and also to control; even by the opposing esthetic standards which emphasize the stark simplicity and power of a general theorem as against the richness and the diversity of living nature. These conflicts are irreconcilable’ (Richard Levins) [1].

1. Introduction

The information available on climate change for policy making purposes is plagued by large inherent uncertainties. This includes uncertainties in the climate change models, as well as in the models of climate change impacts, economic costs and policy responses. It also includes those uncertainties which affect the social and
policy contexts into which such knowledge is intended to be used. In such situations of endemic social and political uncertainty, policy analysts have frequently recommended a strategy of pluralism. They have reasoned that a diversity of policy approaches should be adopted to increase the likelihood that at least some of these will prove useful and successful despite the uncertainty that characterises both the present and future in this most challenging area of study [2]. This argument is, however, rarely extended to the provision of scientific knowledge itself. That is because objective criteria for defining ‘good science’ are widely held to be available which can be used to ‘sort out’ competing approaches to the production of new scientific knowledge, such that only the most successful and promising are supported. Thus consolidation around General Circulation Models (GCMs) in much contemporary climate change research is explained by the higher rating that the climate science community gives to GCMs in comparison with alternative approaches.

In this paper, we present a different, less widely known, viewpoint according to which the criteria defining good science for policy are not solely derived from science, with its currently cherished paradigms, but also incorporate social and policy judgements. Little has been written about the role of such non-scientific judgements in the provision of climate science for policy [3]. Past studies of environmental policy have suggested that the successful reception and implementation of environmental policy is dependent upon a coalition of assorted actors (such as scientists, policy makers, environmentalists and industrialists), often with divergent expectations and agendas, yet who come together for the specific support of certain policy measures (albeit it sometimes for different reasons) [4]. Whilst shared scientific knowledge and understanding is frequently important, such studies suggest also the major role of shared social commitments about the issue and its solution. This insight is important in two respects: it disputes the impression, still found amongst some, that science by itself is sufficient to determine environmental policy; and it suggests that, for policy determination purposes, a comparison of competing interpretations of knowledge might come to include more than purely scientific considerations.

We suggest that although GCMs are widely considered to be the ‘best science’ for the study of future climate change, this judgement is significantly influenced by factors which are not purely scientific. For the following reasons, reflection on these non-scientific factors which, we argue, also support their dominant position, is important to the overall resilience of the scientific research base for global environmental change policy making.

- Firstly, it is easier to argue a case, say, for research funding, if all the reasons in support of that case are fully appreciated.
- Secondly, the validity of non-scientific elements, especially when used in contexts of application different from those in which the criteria were originally developed, can be better appreciated and evaluated.