

## BOOK REVIEW SECTION

**Emanuel, K.: What We Know about Climate Change.** Updated Edition. Cambridge, MIT Press. 2018. 88 p.

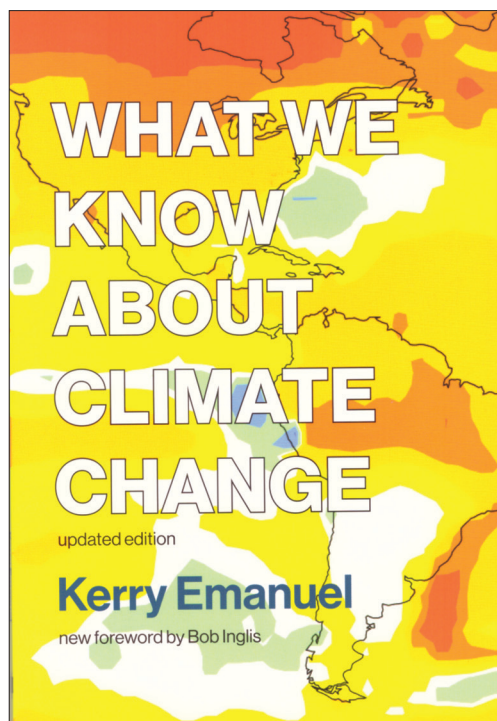
The problem of climate change has turned from a topic of some experts and some environmentalists to a leading issue in public debates, calling global attention in the past years. As researchers concerned about the environment, we might be satisfied with that, but it also lays a charge and responsibility on the relevant experts. Information spread and opinions expressed in public discussions should be based on the proper understanding of the natural and social science background of climate change and its underlying subprocesses. This is even more relevant knowing the complexity and interdependencies in the climate system of the Earth. The new contribution of Kerry EMANUEL excellently fulfils the above requirements. As the comprehensive presentation of the issue needs the use of the most recent datasets and policy documents, the short summarising book has reached its third edition last year.

EMANUEL is one of the leading and most influential experts of the topic, who provided a factual, perceptive and readable presentation of the scientific basis of climate change as well as its possible consequences and related socio-political issues. Though the target audience of the book is the wider public, its added value of giving a short summary of this complex problem makes it usable for environmental and geoscientists, university lecturers and policy experts as well.

In Chapter 1 (entitled *Natural Stability*) the author gives an overview of the past changes (and variability) of the climate of the Earth. He describes the astronomical-geographical background, as well as the positive and negative feedback processes (including the theoretical possibility of super greenhouse inferno or ice catastrophe), together with the possible role of biota in the latter. The characteristics of these past changes help the reader evaluate the magnitude of estimated future climate change effects.

The second chapter (*Greenhouse Physics*) may contribute to the more precise understanding of the related physical processes. Though a simplified presentation of radiation processes is quite a challenging task, the author leads the reader clearly to the understanding of the interdependencies between radiation circumstances, the presence of greenhouse gases in the atmosphere, and the documented effects of climate change. The author helps fix the connection between rising carbon-dioxide levels and the rising surface temperature of the Earth by emphasising the significance of this connection in the history of science (the discovery by Svante ARRHENIUS in 1897).

Similar processes are discussed in Chapter 3 (*Why the Climate Problem is Difficult*), but here the emphasis is on presenting the chaotic character of the climate system. Besides mentioning well-known atmospheric phenomena, the author quite expressively describes the attributes of chaotic systems employing the example of the movement of a leaf in a brook. The central role of relative humidity in global warming is discussed from different aspects. The water vapour takes part in the positive feedback process, and the forming and movement of clouds make the modelling efforts much more difficult. The details of the presence and role of airborne particles in the atmosphere are also presented briefly. As the author underlines, it is not only difficult to predict chaotic systems but, beyond a certain time frame, it is even impossible. The same goes for meteorological forecasts, and especially for



climate projections, where several additional factors have to be taken into consideration. The important term ‘forcing’ is introduced in this chapter. The factors embraced by this term have an influence on climate to a varying extent. But it is important to know that many of them are natural ones, which can be summarised as “climate noise”. Some of them are easy to predict (e.g. variations in the Earth’s orbit, collision with an already known comet or asteroid), but others have a chaotic character (e.g. volcanic eruptions). Modelling results show that the current trend of climate change is distinguishable from that background variability.

The complexity and forecasting difficulties are in the focus of the fourth chapter as well (*Determining Humanity’s Influence*). The main subjects are the difficulties of modelling and forecasting the effects of climate change. We can find a very didactic presentation of the basics of climate modelling, which highlights the importance of parameterisation. This refers to tuneable values in the complicated system of equations in a model. They are hard to estimate precisely, but they have a great effect on the outputs. Of course, there is no need and no way to provide a big number of figures with the results of different models in such a type of work. Professor EMANUEL chooses to include the results of two sets of simulations in a figure to demonstrate and delineate the effects of anthropogenic emissions from natural, time-varying forces (volcanic and solar). Seeing the curves in comparison with the observed average temperatures, we can say that there is no more need for proving that there have been unprecedented changes in the Earth’s climate system in the last decades.

In Chapter 5 (*The Consequences*) the author clarifies that the magnitude of the present warming process is smaller than some events in the history of Earth. But this does not decrease the risks caused by sea level rise, droughts or more intense precipitation events, which are presented very impressively and unambiguously. EMANUEL does not deny, either, that there could also be winners of the predicted changes (e.g. previously infertile lands on high latitudes). Meanwhile, it becomes clear to the reader from the description of the possible negative effects that these consequences must not be overlooked. The agriculture in huge parts of the world is finely tuned to the present climate, so, in other words, cannot be considered resilient to climate change. Nor is the sea level rise itself bigger than several ones in the history of Earth. But, as many of the large cities of the world are located on coastal estuaries, it may cause catastrophic events and national or even international political conflicts. There are direct pieces of evidence for the growing intensity of tropical storms: the hurricanes and typhoons of the recent years have broken records in terms of economic damages as well.

Chapter 6 (*Communicating Climate Science*) is brief but quite important, as it contains a summary of our

present knowledge on the effects of climate change in a shortlisted format, mainly based on the findings of the 5<sup>th</sup> IPCC (Intergovernmental Panel on Climate Change) Report. The short overview of the requirements and process of scientific publishing at the beginning of the chapter may seem out of place at first sight. But when we see the author’s explanation about some problematic characteristics of contemporary journalism, which can obstruct the dissemination of even consensual opinion in scientific communities about climate issues, we have to admit that it is an important factor, if not the most important one, if we want to tackle climate change. This was an important motive for establishing the IPCC and publishing its reports.

Chapter 7 (*Our Options*) summarises the possibilities of intervention. After presenting the terms of adaptation, mitigation and geoengineering, the author names concrete possibilities and compares them with each other. It is also huge merit of this part that it points at some important facts, like that the costs of mitigation are theoretically paid mostly by the largest emitters, while the need for adaptation actions concerns many other parts of the world, too. Perhaps it is not widely known, either, that market disturbing subsidies are present in many national economies with regard to the economic sectors closely connected with climate policy, e.g. coal, oil and natural gas industries.

The last, eighth chapter takes over an important, but not an easy task to present *The Politics of Climate Change*. The author’s politically unbiased standpoint is obvious from the parallel presentation of the sometimes problematic attitude or exact political actions of both political sides in the US. In an interesting part of the chapter the author calls attention to the possible loss of industrial and market positions if no actions are taken or even the direct denial of global warming gets dominate a country’s climate policy. This is especially relevant for the USA, which can be considered the leading technological superpower yet. The chapter finishes with an impressive demonstration of the effects of discrediting scientific results on climate change and other related phenomena, which is a widespread phenomenon in political and public discourses. The *Further readings* part helps the reader get a line on every subtopic presented in the book.

In summary, the author describes a quite complex issue with brilliant simplicity and good examples. There are some subprocesses and consequences of climate change that are often mentioned in books or teaching materials, but their exact background may remain there unclear for many readers – not like in the current volume. A great example in Chapter 5 is the explanation of thermodynamic reasons for the increasing intensity of precipitation events as a result of increasing temperature. Professor EMANUEL does not abstain from handling some not too easy topics, and carries it out with outstanding proficiency and sincerity, e.g. the clear expression of his support

for the use of nuclear energy, or dedicating a whole chapter to political issues. The author's knowledge and wide experience can be seen in the excellent collection, conclusion and clear presentation of the most important information about climate change.

I only find some minor shortcomings in the volume. The author provides remarkably few information about some subtopics, which are also somehow in the focus of attention, and may provide co-benefits to climate adaptation or mitigation activities. One example are the effects of land use (and possibilities of land-use changes) on greenhouse gas exchange in general, and the magnitude of forest carbon sequestration in mitigation efforts in particular. In addition, some more details would be welcome about the possible economic gains to achieve through energy efficiency investments.

Apart from the above remarks, the book will, hopefully, attract the attention of readers from East Central Europe as well. According to research results, some effects of climate change will be stronger in this region than on the global average. Besides, as it is a global problem which calls for the involvement of every people concerned, there will be increasing need for similar books and other relevant sources of information. We can just fully agree with former U.S. Representative Bob INGLIS, the writer of the "Foreword" of the book: "The risks of climate change carry with them the offer of nobility for the generation that rises to the challenge." (p. viii). As EMANUEL points out, "[T]here are few, if any, historical examples of civilizations consciously making sacrifices on behalf of descendants two or more generations removed. We have the opportunity to be the stunning exception to that rule." (p. 51.).

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