

## CLIMATE CHANGE – IS IT WORSE THAN EXPECTED?

ZBIGNIEW W. KUNDZEWICZ

Institute for the Agricultural and Forest Environment, Polish Academy of Sciences,  
60-809 Poznań, Bukowska 19, Poland  
Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany  
e-mail: kundzewicz@yahoo.com

VALÉRIE MASSON-DELMOTTE

Laboratory of Sciences of Climate and Environment,  
Commissariat of Atomic Energy and Alternative Energies,  
National Center for Scientific Research, University of Versailles Saint Quentin,  
Institute of Pierre Simon Laplace, Gif-sur-Yvette, France

ULRICH CUBASCH

Institute of Meteorology of the Free University of Berlin  
12165 Berlin, Carl-Heinrich-Becker-Weg 6-10, Germany

JIM SKEA

Imperial College London, South Kensington Campus, London SW7 2AZ, UK

MICHAŁ KLEIBER

Polish Academy of Sciences, 00-901-Warsaw, PKiN, Plac Defilad 1, Poland

**ABSTRACT:** A review of findings contained in the IPCC AR5 Synthesis Report, of particular relevance to the Polish audience, is offered. Polish perspectives on coal-climate nexus are discussed in a broader, universal, context. Positive examples of climate policies in other countries are provided. The title of this paper refers to a public conference

organized in Warsaw by the Embassies of France, Germany, and the UK and the Polish Academy of Sciences.

**KEY WORDS:** climate change, climate change mitigation, IPCC, coal-climate nexus in Poland.

## INTRODUCTION

The launch of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) in September 2013 and April 2014; and in particular the 19<sup>th</sup> Conference of the Parties (COP 19) of the United Nations Framework Convention on Climate Change (UNFCCC) held in Warsaw in November 2013; found a resonance in Poland. The IPCC, co-established by the United Nations Environment Programme and the World Meteorological Organization, performs a critical assessment of the state of knowledge, on the basis of peer-reviewed publications. Plenary sessions of three IPCC working groups, dealing with: (i) the science of climate change; (ii) impacts, adaptation and vulnerability; and (iii) mitigation, and approving three parts of the Fifth Assessment Report, were reflected in media coverage in Poland. The launch of the new IPCC Synthesis Report in November 2014, integrating the most essential findings from recent reports of all three IPCC working groups (IPCC 2014), was a good opportunity to bring the topical area to broader public attention.

The Polish Academy of Sciences, jointly with the Warsaw-seated Embassies of the French Republic, the Federal Republic of Germany, and the United Kingdom of Great Britain and Northern Ireland, organised a public debate entitled “Climate change – Is it worse than expected?”. This was held in the Staszic Palace, as the seat of the Polish Academy of Sciences in Warsaw, on 3 November 2014, i.e. the day immediately following the acceptance of the Synthesis Report at the IPCC Plenary Session in Copenhagen.

The Conference had a high profile. It was opened by Professor Michał Kleiber, President of the Polish Academy of Sciences. Embassies were represented by Their Excellencies: Mr Pierre Buhler (Ambassador of the French Republic), Mr Rolf Nickel (Ambassador of the Federal Republic of Germany) and Ms Sarah Tiffin, Deputy Head of Mission at the British Embassy in Warsaw, who represented the Ambassador of the UK. The opening address on behalf of three Ambassadors was delivered by German Ambassador Rolf Nickel.

The Conference, as a joint venture with the Polish Academy of Sciences, was not the first common activity of the Ambassadors of France, Germany and the UK in Warsaw in the area of climate change and climate-change policy. In fact, the Embassies regularly invite experts from their countries, including high-level scientists, to visit Poland and to share their experience with Polish experts and the broader society.

In comparison with the situation after the launch of earlier IPCC reports, where media coverage in Poland was very limited and often written from a sceptical perspective, some progress could be noted in material relating to the IPCC Fifth Assessment Report.

Several objective articles in Polish newspapers and magazines correctly reflected the messages of the IPCC AR5.

In parallel, on 23 October 2014, one of the leading daily newspapers in Poland, *Rzeczpospolita*, published a whole-page article co-authored by the three Ambassadors in Warsaw (Ambassador of France – Mr Pierre Buhler, of Germany – Mr Rolf Nickel, and of the UK – Mr Robin Barnett) entitled “To leave the dangerous path” (Fig. 1). The authors sketched a vision of an ambitious and comprehensive global agreement on the reduction of emissions of greenhouse gases, in order to avoid temperature increase to a dangerous level. Such an agreement is expected to be finalised in December 2015 in Paris, at the COP 21.



Figure 1. Upper part of the whole-page article co-authored by three Ambassadors in Warsaw (the Ambassador of France – Mr Pierre Buhler, of Germany – Mr Rolf Nickel, and of the UK – Mr Robin Barnett) entitled *Zejsć z niebezpiecznej drogi* (*To leave the dangerous path*), as published in *Rzeczpospolita*, one of the leading daily newspapers in Poland, on 23 October 2014

The Ambassadors informed the broad Polish readership about the positive experience of their countries in decarbonising the energy sector, and ambitious plans for the future. In Germany, as a result of implementation of the *Energiewende* strategy, 80% of energy is planned to come from renewable sources by 2050. In France, the *Transition énergétique pour une croissance verte* (Energy transition for green growth) aims to reduce greenhouse gas emissions by 40% between 1990 and 2030, as well as to reduce primary fossil-fuel consumption by 30% from 2012 to 2030, by which time renewable energy should represent 32% of final energy use, and reduce final energy consumption by 50% by 2050, in parallel with a reduction of energy poverty.

## **THE POLISH PERSPECTIVE ON THE COAL AND CLIMATE NEXUS**

Poland, a Member State of the European Union since 1<sup>st</sup> May 2004, is quite special, where climate and energy issues are concerned. It is a large country (ca 38.5 million inhabitants over an area of 312 000 km<sup>2</sup>), with an economy in transition that is heavily dependent on coal, the prime national mineral resource. The country virtually “sits on” coal, and its energy supply is strongly coal-dominated: 86% of electricity is produced from hard coal and lignite (KOBIZE 2013). There are still abundant reserves of coal in Poland, though coal reserves in working coal mines are assessed as much smaller (enough for only 40–50 years). The coal lobby has always been very strong in Poland and remains so today. Indeed, hundreds of thousands of jobs depend on coal.

The need to abide by European Union climate policy is perceived as an exceedingly heavy burden by much of Polish society (Kundzewicz and Matczak 2012). The “inconvenient truth” formulated by former US Vice-President Al Gore is certainly more inconvenient in Poland than in most other countries. Poland is also one of the European countries in which the perception of climate change as a serious problem is weakest (see: [http://ec.europa.eu/clima/citizens/support/docs/report\\_2014\\_en.pdf](http://ec.europa.eu/clima/citizens/support/docs/report_2014_en.pdf)).

A considerable part of Polish society thus believes that coal is the nation’s cheapest fuel and that an energy transition towards a low-carbon-economy would be very costly. In fact, from a macroeconomic point of view, coal is not especially cheap, if subsidies and externalities are taken into account. In Poland, several sectors are identified as potentially vulnerable to climate change: water management, associated with changes in extreme precipitation and floods, and an increased risk of summer droughts; coastal management, due to sea level rise; agriculture, forestry, and health. In some areas, there could be benefits associated with a longer growing season, but a summer water deficit is expected to reduce yields of wheat or potatoes, if no adaptation actions are taken. While Poland is perceived to be less vulnerable to climate change than southern European countries, hotter summers may cause discomfort for an aging population, and worsen atmospheric pollution during heatwaves (Szwed *et al.* 2010).

There is no doubt that Poland has to gradually improve its energy efficiency, and decarbonise its energy sector. There is also a requirement to improve air quality, and specifically the concentration of fine particles emitted from coal powered heating systems in individual houses and apartments. However, there are risks of introducing a high carbon tax abruptly, as well as a threat of “carbon leakage” in some branches of industry (i.e. a shift of production and carbon dioxide emissions to the east, to countries that do not partake in the global climate change mitigation and are not obliged to reduce emissions), and in consequence, a loss of jobs in Poland. This is a reason for considerable concern throughout Poland. It would be unfortunate if the cure (climate change mitigation) were perceived to be worse for Poland than the disease (climate change) – yet this is something that many Poles do indeed believe already.

The European Union (the third-largest emitter of greenhouse gases in the world, after China and the USA) has been at the forefront of international climate diplomacy, and has implemented initiatives aimed at curbing climate change. EU policy was conceived as paving the way for global emission reductions. The recent joint announcement by the USA (with a pledge of a 26–28% decrease in emissions from 2005 to 2025) and China (peak emissions around 2030) provides new grounds for optimism. Given the differences in the energy mix and the level of development of different countries, European policies which take account of specific national features are models of differentiated responsibilities. The EU has decided to implement binding legislation to reduce emissions by 20% below 1990 levels by 2020, and 40% by 2030. Polish “support” for this act (in the sense of its abstaining from a veto) was interpreted by the ruling coalition in Poland as a success (due to some concessions in negotiations) and by the opposition as a failure. According to critics of the deal, Poland must be aware of adverse economic effects and a considerable increase in energy prices. However, there is undoubtedly much room for improvement in energy efficiency, as production in Poland is still very energy-intensive per unit of GDP (higher by a factor of two in comparison with the EU).

## **FINDINGS OF THE IPCC SYNTHESIS REPORT IN A NUTSHELL**

The IPCC AR5 consists of four voluminous reports produced by the three IPCC working groups. The Synthesis Report integrates results from the three underlying Working Group reports (i.e. the complete IPCC AR5), established by a process of “multi-stage distillation”. A few headlines are of considerable relevance to the Polish audience (IPCC 2014).

There is a global picture of an increase in the energy stored within the climate system. The latter’s warming is unequivocal, and many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, amounts of snow and ice have diminished, and sea level has risen as a result of warmer seas, and glacier and ice-sheet melting. Each of the last three decades has been, successively, the warmest at the Earth’s surface over the instrumental record (since the mid-19<sup>th</sup> century), and the period from 1983 to 2012 was more likely (with a subjective probability of at least 66%, cf. IPCC 2014) the warmest 30-year period of the last 1400 years in the Northern Hemisphere, where palaeoclimate temperature records are available at annual resolution. Recent climate changes have already had widespread impacts on ecosystems, as well as on human activities, especially those depending directly on natural systems (fisheries, agriculture and forestry).

Anthropogenic emissions to the atmosphere of carbon dioxide, methane, and nitrous oxide have increased since the pre-industrial times, and are now the highest in history. As a result, atmospheric concentrations of greenhouse gases are unprecedented in at least the last 800 000 years, for which period they are known thanks to ice-core records.

The impact of human activities includes a warming effect from greenhouse gases and a smaller cooling effect due to aerosols. An effect of human activities on the exchange of radiation between the Earth and space was detected in the 1950s, and has doubled in the 1980s, and again in the 2010s. The influence of human activities has been detected throughout the climate system and is extremely likely (with a subjective probability in excess of 95%) to have been the dominant cause of the observed warming since the mid-20<sup>th</sup> century. Hence, the human influence on the climate system is clear.

Changes in many extreme weather events have been detected, some of which (e.g. a decrease in cold temperature extremes, an increase in warm temperature extremes, an increase in extreme sea levels, and an increase in the frequency of heavy precipitation events) have been linked to the response of the climate system to anthropogenic greenhouse gas emissions.

In the future, growing emissions of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. Only in the scenario where global greenhouse-gas emissions reach a maximum by 2030, followed by a strong subsequent decrease, will temperature be stabilised in the second half of this century. In all other scenarios, climate change and its impacts are expected to accelerate. Warming is projected to be greater over continents than oceans, and particularly enhanced around the Arctic, due to positive (amplifying) feedbacks. Heatwaves will occur more often and will last longer, and extreme precipitation events will become more intense and frequent in wet-monsoon and temperate regions. Precipitation is expected to undergo an increase close to the Equator, a decrease in the subtropics and around the Mediterranean, and an increase in temperate to polar areas, due to both changes in the structure of atmospheric circulation, and to the fact that a warmer atmosphere may contain 7% more moisture per °C of warming. The ocean will continue to warm and the global mean sea level to rise. The rate of sea-level rise is expected to be at least twice as great in the 21<sup>st</sup> century (40 cm) as it was during the 20<sup>th</sup> century (20 cm). Climate change will amplify existing risks and create new risks that will be distributed unevenly, and generally greater for disadvantaged people and communities. Many aspects of climate change and associated impacts will continue for centuries to millennia, even if anthropogenic emissions of greenhouse gases have been abated. This is due to inertia in both the carbon cycle (as today natural processes can only capture about half of the anthropogenic CO<sub>2</sub> emissions), and the global ocean, which is accumulating energy and will contribute to both sea-level rise and surface warming over centuries. The risks of dramatic, abrupt or irreversible changes increase with the magnitude of the warming.

Mitigation of and adaptation to climate change are complementary strategies for reducing and managing risks. Substantial and sustained emissions reductions over the next few decades can reduce the costs and challenges of mitigation, increase prospects for effective adaptation, reduce climate-change risks, and contribute to climate-resilient pathways for sustainable development.

Without additional, effective, mitigation efforts beyond those in place today, and even with adaptation, warming by the end of the 21<sup>st</sup> century will lead to a high risk of severe, widespread, and irreversible impacts.

## TAKE-HOME MESSAGES FROM INTERNATIONAL PANELISTS AT THE WARSAW CONFERENCE FOR THE POLISH AUDIENCE

The programme of the Conference entitled “Climate change – Is it worse than expected?” comprised a single scientific lecture delivered by Dr Valérie Masson-Delmotte (Laboratory of Sciences of Climate and the Environment, Commissariat of Atomic Energy and Alternative Energies, National Centre for Scientific Research, University of Versailles Saint Quentin, Institute of Pierre Simon Laplace, Gif-sur-Yvette, France). The lecture was followed by a debate led by Professor Michał Kleiber, in which four scientists participated, one from each of the countries co-organising the conference, i.e. the aforementioned Dr Valérie Masson-Delmotte – as the lecturer, Professor Ulrich Cubasch of the Institute of Meteorology of the Free University of Berlin, Professor Jim Skea from Imperial College London, UK and Professor Zbigniew W. Kundzewicz from the Institute for the Agricultural and Forest Environment of the Polish Academy of Sciences (also part-time from the Potsdam Institute for Climate Impact Research in Potsdam, Germany), see Photo 1. All four invited panelists have made significant contributions, in various roles, to the work of the Intergovernmental Panel on Climate Change (both earlier reports and the most recent Fifth Assessment Report).

The panelists were requested to deliver short statements addressing the Polish audience and Polish society at large.



Photo 1. The international panel of scientists participating in the public debate on “Climate change – Is it worse than expected?”, who jointly authored the present note. From left to right: Prof. Z.W. Kundzewicz, Dr V. Masson-Delmotte, Prof. U. Cubasch, Prof. J. Skea, and Prof. M. Kleiber. Photo: Polish Academy of Sciences

It was clear to all panelists participating in the debate that if no effective global agreement on curbing greenhouse gas emissions is reached, global warming will accelerate, amplifying threats to human security associated with the impacts of climate change on water distribution, food, coastal areas, and human health. To “turn down the heat”, adequate solutions have to be found in the domain of politics, as well as energy and industry. As humankind has already emitted some 2000 Gt CO<sub>2</sub>, there is only 1000 Gt left if 2°C warming, considered to be the “safe” level, is not to be exceeded (note even then that this “safe” warming does not preclude the complete melting of the Greenland ice sheet over time).

Present global warming is a fact, and most of that has been caused by human activity. High levels of warming and accompanying effects are projected to be disadvantageous globally. However, people can counteract climate change by curbing anthropogenic warming via the reduction of greenhouse gas emissions and the removal of carbon dioxide from the atmosphere. Effective and efficient climate-change mitigation (both possible and affordable) is therefore needed urgently, but is not in sight yet, as evidenced by the acceleration in worldwide CO<sub>2</sub> emissions during the last decade, due to the growing consumption of coal, especially in China and India. If emission reductions are delayed, the achievement of climate targets will prove more difficult and expensive. Adaptation to climate change is also a challenge, requiring people to learn from the past variability of local climate, and to take account of new risks through the smart use of climate projections. The side benefits of climate policies also have to be assessed. These include reduced overall energy costs through energy efficiency and improvements in air quality.

Climate change is therefore a scientific challenge (to reduce uncertainties surrounding future climate change and its regional impacts) and a technological challenge (through the innovation that is necessary to achieve energy efficiency, climate-smart agriculture, and an energy transition). Moreover, climate change can also be treated as a moral challenge. The safe operating space for humanity may contract. At stake is the heritage left, not only to further generations in the remote future but also, more immediately, to our own children. Will we make difficult decisions now, to curb climate change, or are we going to leave this task to younger generations who will be forced to adapt continually to a moving target of unprecedented climate change, in the context of increased pressure on non-renewable resources? Do we want to contribute to the problem, or to solve it?

The key question is whether climate change (the disease, to use a medical analogy) would have more negative impacts on human society than climate mitigation (the cure to continue the analogy). The IPCC did not find evidence to support a simple cost-benefit analysis, but concluded that delaying climate mitigation would entail unknown levels of risk. By way of contrast, many Poles would prefer to take the risk associated with declining to take the cure.



## IS IT WORSE THAN EXPECTED?

Is the situation worse than expected? Global warming has not accelerated at the Earth's surface, a feature sometimes described incorrectly as a “hiatus”, because of increased heat storage in the depths of oceans. Nevertheless, the 1990s were warmer globally than the 1980s, and the 2000s warmer than the 1990s. Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since records began in 1850 (IPCC 2014). Global warming lies in the range of earlier projections obtained from climate models, and sea level rise has accelerated in the last 20 years compared with the mean rate of change characterising the 20<sup>th</sup> century. The year 2014 appears to be the warmest year ever, globally, in several observation records (i.e. since 1880), despite the fact that internal ocean-atmosphere heat exchange did not favour a record degree of warmth usually observed during a strong *El Niño*<sup>1</sup> years. It can be speculated that, in a future strong El-Niño year, global temperatures will reach new heights. We can also note that, in the last decade, warming has been particularly marked in the Arctic, where sea-ice retreat has accelerated. Global mean sea level has continued to rise, with an increasing contribution from the Greenland and Antarctic ice sheets, due to increased melt or flow.

To come, then, to a brief response to the title question – is climate change worse than expected? So far, the anthropogenic perturbation due to greenhouse gas emissions lies in the upper end of the scenarios used to anticipate future risks, contrary to the expectations of many spectators and players. They anticipated that global climate-change mitigation policy would work, i.e. that efforts “to turn down the heat” would be more successful. The recent projections of climate risks (the so called burning-ember diagrams) now look more dramatic than in the early 2000s, when the concept was coined (IPCC 2014). Major warming will very likely cause major problems, and the causes for concern entail unique and threatened systems, extreme weather events, distribution of impacts, global aggregate impacts, and large-scale singular events. The present warming trend must therefore be seen as dangerous for human civilization. Even a 2°C warming above the preindustrial level (the official target of international climate policy) is not without its dangerous and negative impacts, as associated with extreme events, accelerated sea-level rise, and harm done to some unique and threatened systems.

So far, the results of global climate policy have been rather disappointing. Every year more than ten thousand delegates from all over the world attend the UNFCCC Conference of the Parties, yet no meaningful and tangible progress of global emission reductions can be seen. The atmospheric greenhouse gas concentrations are still growing at a fast rate. Will COP 21 in Paris bring a breakthrough?

---

<sup>1</sup> *El Niño* (literal translation “the little boy / male child”) is the warm phase of the so called *El Niño* Southern Oscillation (ENSO), associated with the occurrence of warm water in the central and east-central equatorial Pacific up to the coast of South America. There is a correlation between the strength of an *El Niño* and the global average temperature. Strong *El Niño* years are typically warmer, globally, than non-El Niño years (and, in particular, the so-called *La Niña* years).

The authors of this note believe that the public debate organised in Warsaw contributed to raised awareness in Polish society. A platform for scientists on climate change, climate change impacts, adaptation and mitigation (a national *pendant* to IPCC) is clearly missing in Poland, except for some useful, competent, and high-level web portals like <http://doskonaleszare.blox.pl/html> and <http://naukaoklimacie.pl/>

## ACKNOWLEDGEMENTS

The public debate entitled “Climate change – Is it worse than expected?”, held in Warsaw, Poland, on 3 November 2014, was organised and sponsored by the Polish Academy of Sciences, jointly with the Embassies in Warsaw of the French Republic, the Federal Republic of Germany, and the United Kingdom of Great Britain and Northern Ireland. The useful, constructive remarks of two anonymous referees of this paper are gratefully acknowledged.

## REFERENCES

- IPCC, 2014, *Climate Change 2014: Synthesis Report*. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Core Writing Team, Pachauri R.K. and Meyer L.A. (eds), IPCC, Geneva, Switzerland, 151 pp., <http://www.ipcc.ch/report/ar5/syr/>
- KOBIZE (Krajowy Ośrodek Bilansowania i Zarządzania Emisjami), 2013, *A success story of effective decoupling – costs and benefits of the Polish transformation* (report prepared for COP19), Warsaw, 18 pp, <http://www.cop19.gov.pl/poland-a-success-story-of-effective-decoupling>
- Kundzewicz Z.W., Matczak P., 2012, Climate change regional review: Poland, *Wiley Interdisciplinary Reviews: Climate Change*, 3, 4, 297–311.
- Szwed M., Karg G., Pińskwar I., Radziejewski M., Graczyk D., Kędzióra A., Kundzewicz Z. W., 2010, *Climate change and its effect on agriculture, water resources and human health sectors in Poland*, *Nat. Hazards Earth Syst. Sci.*, 10, 1725–1737, DOI: 10.5194/nhess-10-1725-2010.