

## **Climate change – Is it worse than expected?**

Zbigniew W. Kundzewicz<sup>1,2</sup>, Valérie Masson-Delmotte<sup>3</sup>, Ulrich Cubasch<sup>4</sup>,  
Jim Skea<sup>5</sup> and Michał Kleiber<sup>6</sup>

<sup>1</sup> Institute for Agricultural and Forest Environment of the Polish Academy of Sciences, Poznań, Poland

<sup>2</sup> Potsdam Institute for Climate Impact Research, Potsdam, Germany

<sup>3</sup> 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

<sup>4</sup> Institute of Meteorology of the Free University of Berlin, Germany

<sup>5</sup> Imperial College London, UK

<sup>6</sup> President, Polish Academy of Sciences, Warsaw, 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 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, based on 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, 2015), was a good opportunity to bring the topical area to broader public attention.

The Polish Academy of Sciences, jointly with the embassies of the French Republic, the Federal Republic of Germany, and the United Kingdom of Great Britain and Northern Ireland in Warsaw, organized a public debate “Climate change – Is it worse than expected?”. It was held in the Staszic Palace, 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 the German Ambassador, Mr Rolf Nickel.

The conference, being a joint venture with the Polish Academy of Sciences, was not the first common activity of the ambassadors of France, Germany and UK in Warsaw in the area of climate change and climate change policy. 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 to the situation after the launch of earlier IPCC reports, where media coverage in Poland was very low, and often from a skeptical perspective, some progress could be noted in material related 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 24 October 2014, one of the leading daily newspapers in Poland, *Rzeczpospolita*, published a whole-page article co-authored by three ambassadors in Warsaw (Ambassador of France – Mr Pierre Buhler, Ambassador of Germany – Mr Rolf Nickel, and Ambassador 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 finalized in December 2015 in Paris, at the COP 21. The ambassadors informed the broad Polish readership about the positive experience of their countries in decarbonizing the energy sector and ambitious plans for the future. In Germany, as a result of implementation of the *Energiewende* (energy turnaround) strategy, 80% of energy is planned to come from renewable sources in 2050. In France, the *Transition énergétique pour une croissance verte* (energy transition for green growth) aims to reduce greenhouse gas emissions by 40% from 1990 to 2030, 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% in 2050, in parallel with a reduction of fuel poverty.



**Fig. 1** - Upper part of the whole-page article co-authored by three ambassadors in Warsaw (Ambassador of France – Mr Pierre Buhler, Ambassador of Germany – Mr Rolf Nickel, and Ambassador of the UK – Mr Robin Barnett) entitled *Zejsć z niebezpiecznej drogi* (To leave the dangerous path), published in *Rzeczpospolita*, one of the leading daily newspapers in Poland, on 24 October 2014.

### *Polish perspective on the coal and climate nexus*

Poland, a Member State of the European Union since 1 May 2004, is quite special, as far as climate and energy issues are concerned. It is a large country (ca 38.5 million inhabitants with an area of 312 thousand 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 coal and peat (KOBIZE, 2013). There are still abundant reserves of coal in Poland and the coal lobby has always been very strong and so remains 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 duty by much of the Polish nation (Kundzewicz and Matczak, 2012). The “inconvenient truth” (about climate change) formulated by the 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 where 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))

The change from production based on cheap coal towards a low-carbon-economy based on more expensive energy sources is considered to be costly and politically difficult. In Poland, several sectors are identified to be potentially vulnerable to climate change, e.g.: 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. A longer growing season could be beneficial for vegetation, but a summer water deficit is expected to reduce yields for 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 heat waves (Szwed et al., 2010).

There is no doubt that, gradually, Poland has to improve its energy efficiency and decarbonize its energy sector. This is also required to improve air quality, and specifically the concentration of fine particles emitted from coal power plants. However, the risk of introducing a high carbon tax abruptly and the threat of "carbon leakage" (i.e. shift of 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, loss of work places in Poland, is a reason for considerable concern throughout the Polish nation. It would be unfortunate if the cure (climate change mitigation) were perceived to be worse for Poland than the disease (climate change), which many Poles indeed believe.

The European Union (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 a global emission reduction. The recent joint announcement by the USA (with a pledge for 26% emission decrease from 2005 to 2025) and China (peak of emissions around 2030) provides new grounds for optimism. Given the differences in energy mix and the level of development of different countries, European policies which take into account national specificities are models of differentiated responsibilities. The EU has decided to implement binding legislation to reduce emissions by 20% below 1990 levels in 2020, and 40% by 2030. Polish "support" for this act (in the sense of 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 to the deal, Poland must be aware of adverse economic effects and considerable increase in energy prices.

*Principal 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, 2015).

There is a global picture of an increase in the energy stored inside the climate system. Warming of the climate system 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 melt. 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 likely the warmest 30-year period of the last 1400 years in the Northern Hemisphere, where paleoclimate 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 directly depending on natural systems (fisheries, agriculture, forestry).

Anthropogenic emissions of carbon dioxide, methane, and nitrous oxide to the atmosphere, have increased since the pre-industrial era, 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, where they are known from ice core records. The impact of human activities includes a warming effect from greenhouse gases and a smaller cooling effect from aerosols. A positive effect of human activities on the exchange of radiation between the Earth and the 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 subjective probability in excess of 95%) to have been the dominant cause of the observed warming since the mid-20th 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 emission 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 stabilized 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 larger over continents than oceans, and particularly enhanced around the Arctic, due to positive (amplifying) feedbacks. Heat waves 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 up and the global mean sea level to rise. The rate of sea level rise is expected to be at least twice as large 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 unevenly distributed 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 stopped. This is due to the inertia of both the carbon cycle, as today natural processes can only capture about half of anthropogenic CO<sub>2</sub> emissions, and to the inertia of 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 the 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 21st century will lead to a high risk of severe, widespread, and irreversible impacts.

*Take-home messages from international panelists in the Warsaw conference to the Polish audience*

The programme of the conference “Climate change – Is it worse than expected?” contained one scientific lecture delivered by Dr 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). After the lecture, a debate was led by Professor Michał Kleiber, in which four scientists participated, one from each of the countries co-organizing the conference, i.e. Dr Valérie Masson-Delmotte – the lecturer, Professor Ulrich Cubasch from 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 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 Fig. 2. 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 the Polish society at large.



**Fig. 2** – International panel of scientists participating in the public debate “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. In order to “turn down the heat”, adequate solutions have to be found in the domain of politics, as well as energy and industry. The mankind has

emitted some 2000 Gt CO<sub>2</sub> already, hence now there is only 1000 Gt left if 2°C warming, considered to be the “safe” level, is not to be exceeded (note: this “safe” warming does not guarantee that the complete melting of the Greenland ice sheet will not occur).

Present global warming is a fact and most of it has been caused by human activity. High levels of warming and accompanying effects are projected to be globally disadvantageous. 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 (being both possible and affordable) is therefore urgently needed, but it 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 developing countries. If emission reductions are delayed, reaching climate targets will be more difficult and expensive. Adapting to climate change is also a challenge, requiring people to learn from the past variability of local climate as well as to take into account new risks by 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 (the innovation that is necessary to achieve energy efficiency, climate-smart agriculture, and the energy transition). Moreover, climate change can be also 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 remote future but, more immediately, to our children. Will we make difficult decisions now, aimed at curbing the climate change, or are we going to leave this task to younger generations who will be forced to continually adapt 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 the problem?

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). IPCC did not find the 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? Indeed, greenhouse gas concentrations have been growing at an increasingly fast rate, despite climate policies implemented to date. 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. Global warming lies in the range of earlier projections performed by climate models, and sea level rise has accelerated in the last 20 years compared to the mean rate of change of 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 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 strong 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. So far, the anthropogenic perturbation through greenhouse gas emissions lies in the upper end of scenarios used to anticipate future risks.

The authors of this note believe that the public debate organized in Warsaw contributed to raising awareness of the 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 from some useful, competent, and high-level, web portals, such as: <http://doskonaleszare.blox.pl/html> and <http://naukaoklimacie.pl/>

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<sup>1</sup>El Niño (literal translation "a little boy / male child") is the warm phase of the so called [El Niño Southern Oscillation](#) (ENSO), associated with 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 El Niño and the global average temperature. Strong El Niño years are typically warmer, globally, than non El Niño years (and, in particular, La Niña years).

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