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Climate change: faster, stronger, sooner

A European update of climate science

An overview of the climate science published since the UN IPCC Fourth Assessment Report

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Your Decision Our Future

Keep global warming below 2°C

FOREWORD

Scientific research on climate change and its impacts published since the deadline for the latest assessment report from the Intergovernmental Panel on Climate Change (IPCC) is revealing that global warming is accelerating, at times far beyond IPCC 2007 forecasts. This brief summary seeks to bring together some of the key findings, including particular impacts of climate change in Europe.

This sobering overview comes at a critical time during the political negotiations of the EU's climate and energy package, which will set emission reduction targets out to 2020. An ambitious package could put the EU in the driving seat for negotiating a breakthrough to a successful global deal to tackle climate change that we so desperately need. To achieve this, the package must clearly be based on policies that accurately reflect the scale of the challenge we face. These policies must cover what the EU needs to do to put itself on a low carbon trajectory and play its fair part in keeping the increase in global average temperatures below 2°C. The EU must also determine the scale of financial assistance that we owe to developing countries to help them tackle climate change and adapt to those impacts that are already unavoidable.

A weak EU package, on the other hand, may well lead to a collapse of the international negotiations currently due to conclude at the UN conference in Copenhagen at the end of 2009. We must not allow this to happen.

WWF calls on the EU to:

1 Immediately adopt an emission reduction target of at least 30% below 1990 levels by 2020 – to be delivered within the boundaries of the EU; and

2 Commit – on top of its own reduction target – to provide additional substantial support and funding for investment in socially and environmentally robust adaptation and mitigation activities in developing countries.

INTRODUCTION

Last year, the UN Intergovernmental Panel on Climate Change (IPCC) set out an overwhelming body of scientific evidence which put the reality of human-induced climate change beyond any doubt. During 2007 the IPCC was also awarded the Nobel Peace prize in clear recognition that climate change poses a major challenge to the security of mankind in the 21st century[1].

Involving over 3,800 scientists from over 150 countries and six years of work, the IPCC Fourth Assessment Report, published in instalments between January and November 2007, reviewed and analysed scientific studies published up to the end of 2006, and in a few cases, to early 2007. Since the publication of this key report, scientific research on climate change and its impacts has continued and new studies are revealing that global warming is accelerating, at times far beyond forecasts outlined in earlier studies included the Fourth Assessment Report. New numerical modelling studies also provide more detailed indications of the impacts to come if warming continues.

Indeed important aspects of climate change seem to have been underestimated and the impacts are being felt sooner. For example, early signs of change suggest that the less than 1°C of global warming that the world has experienced to date may have already triggered the first tipping point of the Earth's climate system – the disappearance of summer Arctic sea ice. This process could open the gates to rapid and abrupt climate change, rather than the gradual changes that have been forecast so far.

The implication of this recent evidence is that our mitigation and adaptation responses to climate change need to be even more rapid and ambitious.

[1] The prize was awarded to the IPCC and Al Gore on 10 December 2007.

CLIMATE CHANGE TODAY: STRONGER THAN EXPECTED, SOONER THAN FORECAST

The Arctic Ocean is losing sea ice 30 or more years ahead of the projections presented in the Fourth Assessment Report (Stroeve et al, 2007). There is near consensus in the Arctic scientific community that significant aspects of this hastened loss of sea ice are caused by feedback mechanisms, the effects of which had been severely underestimated in the report. For example, a reduction in sea ice has meant that ocean waters have been warmed more by the sun, making it even more difficult to form and to retain sea ice the next winter. Indeed prominent scientists are now saying that we are at – or have already passed – the tipping point for the Arctic sea ice system. This means that the Arctic Ocean could very soon be ice-free during the summer. It is currently forecast that summer sea ice could completely disappear somewhere between 2013 and 2040 – a state not seen on planet Earth for more than a million years. An ice-free Arctic Ocean during summer is expected to amplify global warming through the absorption of more heat by a dark ocean surface (instead of the white surface of sea ice) and changes in ocean circulation. This is likely to open the gates to climate change that is even more rapid and abrupt than has been forecast up to now (WWF 2008, SEARCH 2008).

Floating tide-water glaciers in the Antarctic Peninsula are losing ice faster and are making a greater contribution to global sea level rise than reported in the Fourth Assessment Report (Pritchard and Vaughan 2007).

Since 1990, global sea level has been rising one and a half times faster than forecast in the IPCC's Third Assessment Report (published in 2001) (Rahmstorf et al 2007). In addition to this, new studies have projected global sea level rise by the end of the century to reach up to more than double the maximum estimate of 0.59m presented in the Fourth Assessment Report (Rahmstorf 2007, Rohling et al 2008). More than 1.2m sea level rise would put vast coastal areas at risk, in Europe and around the world.

Global carbon dioxide (CO_2) emissions released as a consequence of human activity have been accelerating, with their growth rate increasing from 1.1% per year between 1990 and 1999, to more than 3% per year between 2000 and 2004. The actual emissions growth rate since 2000 was greater than any of the scenarios used by the IPCC in either the Third or Fourth Assessment Reports (Raupach et al 2007). Over the past 15 years, about half the CO_2 emissions arising from human activity have been absorbed by land and ocean. However, the capability of these natural 'sinks' is declining (Le Quéré et al 2007) at a greater rate than forecast in earlier studies. This means that more of the CO_2 emitted from human activities will stay in the atmosphere and contribute to global warming (Canadell et al 2007).

A re-examination of the climate impacts reported in the Fourth Assessment Report indicates that 80% cuts in *global* greenhouse gas emissions are needed by 2050 to keep global average temperature rise below 2°C – and to limit climate impacts to 'acceptable' levels. Such a cut would stabilise atmospheric greenhouse gas concentration at 400-470 parts per million carbon dioxide equivalents. However, even with an 80% emissions cut, damages will be significant, and much more substantial adaptation efforts than those currently planned will be required to avoid much of the damage (Parry et al 2008). Clearly an 80% cut in global emissions will require the EU to do more, as developing countries still have basic energy needs that are likely to mean some growth of emissions over the next decades. Indeed, WWF advocates zero net emissions in the EU by 2050.

CLIMATE CHANGE TOMORROW? A SNAPSHOT OF A FUTURE, WARMER WORLD

Much of the scientific evidence that has emerged since the publication of the IPCC Fourth Assessment Report has rung the alarm bell about the speed and scale of the changes affecting the global climate. In addition, numerical modelling studies are showing us more of what it is to come if we do not urgently and decisively address the causes of climate change, and develop more robust measures to adapt to those changes that are now unavoidable.

Food, agriculture and fisheries

The well-being of the human society fundamentally depends on the availability and distribution of food. Lobell and Field (2007) demonstrated that the warming trend in global temperatures since 1981 has *already* led to the reduction in global yields of wheat, maize and barley. This has resulted in annual total combined losses of roughly 40 million tonnes or US$5 billion (€3.2 billion) per year. Under continued warming, Lobell et al (2008) predict that south Asia and southern Africa are the two regions that will likely suffer significant reductions in the yields of several crops that are important for their large populations. Tubiello and Fischer (2007) showed that reduction of greenhouse gas emissions could reduce the global costs of agricultural losses from climate change by 75-100%, and that the number of additional people at risk of malnutrition would be reduced by 80-90%. Brander (2008) concluded that the productivity of fisheries may suffer regional, and possibly global, decline as a result of global warming, and that this decline may have already begun.

Health

Human health will also be impacted by global warming, with the most vulnerable likely to be affected first and hardest. Shea et al (2007) concluded that children are likely to suffer disproportionately from the effects of climate change. Children are especially susceptible to certain diseases and the effects of air pollution because their bodies are still in development. They are also particularly vulnerable during extreme events because they depend on adults to ensure their safety and well-being. Not only will there be direct and immediate effects from extreme weather events and weather disasters, air pollution and thermal stress, etc. on the well-being of children, but there could also be long-term effects arising from changes in food and water availability and the possible forced migrations of coastal populations.

Ecosystems

The impacts of climate change reach beyond those on human society – they are also felt globally in natural ecosystems. Rosenzweig et al (2008) confirmed that climate change is having a significant impact on physical and biological systems globally. These changes include shrinking glaciers in every continent; lake and river warming; increases in coastal erosion; shifts in spring events in living organisms (such as leaf unfolding, blooming date, migration and time of reproduction); and replacement of cold-adapted species by warm-adapted species, especially in the oceans. Williams et al (2008) projected that under global warming, the tropics and subtropics will see warmer climatic conditions than are currently seen on the planet, while climatic conditions that are currently associated with tropical montane and polar regions are likely to disappear. Disappearing climates increase the likelihood of community disruption for species that can only be found under particular climatic conditions. For example in the tropics, many species do not have the ability to adapt to large changes in temperature. Williams et al (2008), Tewksbury et al (2008) and Deutsch et al (2008) all echo the same warning that the greatest extinction risks from global warming may be in the tropics, where biodiversity is also greatest. These warnings add to the stark prediction of the Fourth IPCC Assessment Report, which already stated that up to a 30% of higher plant and animal species would be at high risk of extinction with a warming of 'only' 1.5-2.5°C over present temperatures.

EUROPEAN PERSPECTIVES

Health

The exceptionally warm and dry European summer of 2003 was responsible for 35,000 extra deaths across Europe as a result of heat stress, bad air quality and high levels of air pollutants such as ozone. Under global warming, summer ozone levels are projected to be similar to those found during the summer of 2003, with the largest increase projected to occur over England, Belgium, Germany and France (Meleux et al 2007). In the Mediterranean region, extremely high temperatures and the associated intensification of heat stress, such as those experienced in 2003, are projected to be at least three times as frequent by the end of the century. While a reduction in greenhouse gas emissions will lead to some reduction in the risk of heat stress in the population, substantial cuts in greenhouse gas emissions are needed to avoid the high human and economic costs of more frequent heat waves (Diffenbaugh et al 2007).

The European Commission's impact assessment estimated that currently every year 369,000 people die prematurely in Europe due to air pollution, and that premature deaths, health care and medication associated with air pollution amount to 3-9% of EU Gross Domestic Product. However, new research carried out on behalf of WWF, CAN and Heal in 2008 calculated health savings up to an additional €25 billion could be achieved every year in Europe if the EU immediately opted for a domestic greenhouse gas emission cut of 30% below 1990 levels by 2020 (Holland 2008). The estimates are based on economic evaluations of loss of life and health, working days lost and hospital costs. The findings show reductions in hospital admissions of 8,000 per year and two million fewer work days lost per year by moving to the more ambitious target. These health savings are over and above the benefits of the EU's existing 20% target, increasing savings by 48%.

Water

Under global warming, annual maximum rainfall is projected to increase in most parts in Europe, except for southern Spain and localised regions in several other countries. Consequently, flood risk and its associated economic damages are projected to increase. For the Upper Danube catchment (in Austria, Germany, Switzerland, Slovak Republic and Czech Republic) and the Meuse catchment (in France, Luxembourg, Belgium and the Netherlands), the estimated total damage of a one in 100-year flood is projected to be in the order of €60-73 billion. Over two million people in nine countries, including residents of Vienna and Liège, would be affected (Feyen et al 2006).

Conversely the Mediterranean region is expected to experience notable increases in the frequency of long-term drought. Global drying of soils is projected to occur by the end of the century (Sheffield and Wood 2008).

Glaciers in the Swiss Alps are currently experiencing changes that are accelerating their further disintegration, such as the formation of lakes. Therefore, the recent trend of glacier shrinkage and disappearance is unlikely to stop or reverse in the near future (Paul et al 2007). In the case study of one hydroelectric reservoir system in the Swiss Alps, it is forecast that, for the period 2070-2099, the hydropower production will decrease on average by 36% compared to the period 1961-1990 as a result of global warming (Schaefli et al 2007).

Wind storms

Under global warming, the number and intensity of extreme cyclones over the British Isles and the North Sea are projected to increase, leading to increased wind speeds and storm-related losses over western and central Europe (Pinto et al 2007). Without the adoption of adaptation measures, storm-related losses are expected to increase by up to 37% between 2060 and 2100 for the UK and Germany (Leckebusch et al 2007). In 2005, timber volumes corresponding to substantial parts of Swedish and Latvian annual forest harvests were damaged by one single storm. Numerical models project that, under global warming, windiness will increase in southernmost Sweden, augmenting the probability of wind damage on the forestry industry (Blennow and Olofson 2008).

Ecosystems

The analysis of 542 plant and 19 animal species across 19 European countries demonstrates without doubt that the timing of activities of plants and animals, especially in spring and in autumn (such as flowering and fruit maturation in plants, and migration in birds) have changed following national warming trends (Menzel et al 2006).

Marine ecosystems in the North and Baltic Seas are becoming exposed to warm temperatures which are unprecedented in the history of recorded measurements in this region. Warming is exceeding the ability of local species to adapt and is leading to major changes in these ecosystems (MacKenzie and Schiedek 2007).

In northern Europe, damage of northern birch forests caused by leaf-chewing and leaf-mining insects is projected to be at least double with expected climatic warming (Kozlov 2008). This increase in insect damage can change predictions of future forest composition (Wolf et al 2008).

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The mission of WWF is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by

- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- reducing pollution and wasteful consumption

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