IMPACTS OF CLIMATE CHANGE IN BELGIUM : Summary

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Climate change

Carbon dioxide (CO2), an inevitable waste product from the combustion of fossil fuels, has been emitted into the atmosphere in increasing quantities since the industrial revolution. It significantly strengthens the natural greenhouse effect, raises the average temperature and changes the climate. Approximately thirty billion tons of CO2 are emitted into the atmosphere every year, that is an average of 5 tons per person (and 12 tons per Belgian!). The concentration of CO2 has risen by 30% in some 250 years. In order to attempt to determine the possible consequences of the intensification of the greenhouse effect, the United Nations set up the Intergovernmental Panel on Climate Change (IPCC) in 1988, grouping most of the world's specialists in a rigorous process of expert assessment. The IPCC makes projections on climate change based on different socioeconomic development scenarios, the results of different climatic models and other research, which it analyses and brings together.

Although many uncertainties persist, the work of the IPCC has led to a number of convincing conclusions. In particular, with regard to man's impact on the climate: "Most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations". The IPCC also confirms that it has increased confidence in the capacity of models to project future climatic trends. Having considered the results of all the models and scenarios, the IPCC projects an average global rise in temperature of 1.4 to 5.8°C for the period 1990-2100. The temperature has never risen as quickly over the last 10,000 years at least and the temperatures feared for 2100 have probably never been reached for several hundreds of thousands of years.

A rise in temperature is not the only manifestation of climate change. The IPCC projections show a tendency towards increased precipitation, with considerable disparities according to the season and region. Another consequence is a rise in the level of the oceans, following the thermal expansion of water bodies on the one hand, and the melting of glaciers as well as the ice sheets of Greenland and the Antarctic, on the other. Considerable uncertainty surrounding this subject remains with a projected rise in ocean levels ranging between 9 and 88 cm for the period 1990-2100.

The excess CO2 in the atmosphere will persist for a long time and the warming of ocean water masses will take a very long time. This is why, even if the concentration of CO2 is stabilized – which requires a considerable reduction of emissions – the temperature will continue to rise slowly with a strong chance of this leading to the melting of a significant fraction of the ice-caps. Together, the warming and melting of continental ice sheets would have the capacity to increase the average sea level by up to 8 m (!) over the next 1,000 years in an "average" scenario. Finally, global warming could cause major "surprises" such as a change in ocean circulation with the potential halting of the Gulf Stream, which would reduce global warming at our latitudes and could lead to a possible cooling in Northern Europe, several centuries down the line. The shutdown of the Gulf Stream does not figure in the projections between now and 2100, but current knowledge does not permit this possibility to be excluded in the longer term. One also estimates that the shutdown of the Gulf Stream would induce an increased rise in the level of the North Sea.

Projections for Belgium

Although the expected rise in the average global temperature is relatively well known, the same does not apply to the regional distribution of climate change, in particular with regard to the water cycle. What is

more, Belgium is small on a climate zone scale and global models have a resolution of a few hundred kilometres. Nevertheless, a number of trends have emerged from the scenarios and models:

- in all cases considered, temperatures rise significantly by 2050 in both summer and winter. At the end of the 21st century, the rise in temperature in relation to the end of the 20th century would be 1.7 to 4.9°C in winter and 2.4 to 6.6°C in summer;

- the projections for the change in precipitation until the end of the 21st century show a rise of between 6 and 23% for winter and a change in summer between the status quo and a drop of up to 50%.

Other changes follow on from this. Cold winters would gradually disappear. Cloud cover could increase. The likelihood of severe heat waves such as the one during the summer of 2003 would rise significantly. It is very likely that we will experience more frequent episodes of heavy rain. As far as storms are concerned, uncertainty is large but it is possible that their intensity and/or frequency increase.

Risks of flooding

Given the projected increase of precipitation in winter, the groundwater level and flow of watercourses should increase during the winter months. Studies carried out on different hydrographic basins in our country conclude that there will be a rise in the risk of flooding until 2100 for all basins studied.

Relatively few studies on the hydrological impact of climate change in Belgium have been carried out to date. However, a study concerning Great Britain recently concluded that climate change would lead the risks of flooding to reach “unacceptable” levels with serious socio-economic consequences.
The decrease in summer rainfall and increased evaporation could be accompanied by droughts in the summer, as well as deterioration in surface water quality.

Coastal region

Climate change expose coastal regions to three main types of impact: floods during storms, coastal erosion and loss or movement inland of natural wetlands. Other expected impacts are a rise in groundwater level and the salinisation of soil and groundwater.

A 1- metre rise in average sea level could result in almost 63,000 hectares being at a negative altitude in Belgium. In 1,000 years, with a potential 8-m rise, more than one tenth of Belgian territory (almost 3,700 km2) would be below sea level. We could try to manage this situation as in the Netherlands using appropriate protection, but it increases the risk of wide-scale flooding anyway. The authorities have already implemented the Sigma Plan, following the floods in the lower basin of the river Scheldt in January 1976, caused by a storm in the North Sea. This plan is currently in the process of being updated, in particular to take account of a 60-cm rise in sea level.

The coast is currently affected by erosion, which varies according to the beaches, and sand has often had to be added. A rise in sea level, and probably in the frequency of storms, could aggravate this phenomenon.

On an environmental level, the Zwin natural reserve provides an example of the complex consequences which climate change could have in the coastal region. In the short term, and excluding climate change, this biotope of huge environmental and ecological value is at risk of silting up. Therefore, the management of the Zwin can probably adapt to a moderate rise in sea level. But in the longer term, the rise in sea level could pose serious problems, the movement of the wetland inland in response to flooding being impossible.

Biodiversity

In its paper "Climate change and biodiversity", the IPCC concludes that climate change, which has already begun to influence biological diversity, exerts an additional pressure on the latter and that the risks of extinction will increase for many already vulnerable species. The IPCC also believes that it is a well established fact that the geographical extent of the damage or loss and the number of systems affected will increase pro rata to the extent and rate of climate change.

Some effects of climate change on biodiversity can now be seen in Europe and, therefore, in Belgium. The northward progression of many species from warm regions is noticeable. This change is clearly established among certain animal species (molluscs, dragonflies, ants, butterflies etc.) and plant species (mosses, algae, lichens etc.). For the moment, the regression of species from cold areas is less evident.

As far as Belgium is concerned, we have tried to estimate the proportion of species at risk of extinction or the frequency of which is liable to increase following climate warming. To do this, we first classified the species according to their biogeographical or climate type (boreal, continental or oceanic etc.). This way, it was possible to divide the species living in Belgium into 3 categories: temperate species, species from warm areas and species from cold areas. The current distribution of species indicates, in fact, the conditions required for their survival and growth (that is their ecological niche).
Species from cold areas will be the first ones at risk. Species of trees with a long life span (oak, beech and hornbeam) might no longer find a favourable climate for their development here. What is more, they could suffer problems linked to parasites and diseases, particularly if they are weakened by heat waves.

During the 21st century, it seems that climate change will cause the disappearance of some species found in Belgium. Climate change may also cause shifts between certain biological processes; for instance, certain populations of caterpillars hatching sooner when spring comes early, not finding enough to eat as the buds of trees have not yet bloomed and, therefore, being decimated, this will be harmful to tits etc. As far as the North Sea is concerned, it is already possible to observe the establishment of warm water species, some of which compete with the local species, such as mussels. The structure of the ecosystems, that is, the distribution and relative abundance of the different species, as well as their relationships with each other, could therefore be profoundly altered.

After a few decades, climate change will have a significant impact, which will be combined with these other factors. Climate change indeed adds on to the destruction of habitats, air, water and soil pollution as well as an environmental management, which is far too economical and technocratic. Certainly, these last factors constitute the most serious threats, currently, to biodiversity and the rare natural or semi-natural ecosystems of interest which still exist in Belgium. However, it is possible, in the long term, that climate change will outweigh these factors in terms of importance.

The Hautes Fagnes natural reserve provides an example of the combined impacts of climate change and other factors. The peat bogs have been deteriorating for a long while for many reasons: drying out, pollution and tourism. If this deterioration continues and climate change increases, the most probable scenario is that the remainders of the peat bogs which are still virtually intact will disappear within the next 20 to 50 years. But climate change alone would cause the peat bogs to disappear in time, as they would lead to the latter drying out considerably.

Agriculture and land use

Below a three-degree rise in local temperature, the effects on agriculture of the climate change expected in Belgium during the 21st century seem modest, in all scenarios. A rise in temperature tends to lower the yields of most crops but a higher concentration of CO2 tends to increase them. The offsetting of the two effects varies according to species. In Belgium, the global impact should be limited and even positive for certain crops (e.g.: wheat), at least whilst the temperature increase does not exceed approximately 3°C. In

general, within the limit of 3°C, agriculture in Belgium has ample opportunities to adapt and deal with the climate change.

It is interesting to note that according to land use projections (agricultural, forest, urban etc.) in the 21st century, the main determining factor of evolution in this area remains the socio-economic framework and agricultural policy decisions, the impact of the climate being comparatively low as long as global warming is moderate.

Effects on health

The effects of climate change on health will be much more serious in developing countries than at home. For example, the increased risk of contracting malaria could affect the health of more than 200 million more people in those countries between now and the end of the century.

However, the impacts at home should not be underestimated. Climate change may affect human health in many ways. A rise in the frequency or intensity of heat waves increases mortality and morbidity rates; conversely, a fall in the number of very cold days in winter decreases the rate of mortality due to cardiovascular problems. Air quality is also affected: heat promotes the formation of ozone and extends the season during which allergenic pollens are released etc. Extreme events such as floods and storms also cause their share of deaths and injured.

The actual impact of climate change on the health of a population depends largely on its vulnerability, which in turn depends to a large extent on the standard of living, access to care and capacity of this population to adapt to new climate conditions. In Belgium, a study by the Scientific Institute of Public Health has shown that the 1994 summer heat wave, associated with high tropospheric ozone concentrations, caused 1,226 additional deaths in six weeks (of which 236 related to persons under 64 years old). The heat wave in 2003 caused in Belgium the death of an additional 1,300 people of 65 years of age or above. When the average daily temperature is higher than twenty or so degrees, it is primarily the heat which explains the rise in the mortality rate, ozone playing a smaller but additional part. For the “high” climate scenarios, we have to expect a considerable increase in the frequency of particularly hot summers. Summers such as the one in 2003 could become the norm before the end of the century. Undoubtedly, it would be possible to anticipate some of the health effects by technical means and hygiene (drinking water etc.) Some physiological adaptation can also take place, but only if the change is gradual and does not exceed certain limits.

Another known phenomenon in Belgium is the increase in the number of cases of Lyme disease since the start of the 1990s. This increase may have several causes, but Swedish researchers have shown that the increase in ticks, carriers of this disease, between 1960 and 1998 was consistent with a rise in daily minimum temperatures. This suggests that climate change could in the future contribute to an increase in the number of cases in Belgium.

Impacts on tourism

A rise in sea level and temperature could cause serious difficulties at certain tourist destinations. Low lying coastlines and islands such as the Maldives would risk being partly submerged and the erosion of their beaches accentuated. Numerous small island states could be ruined by the loss of revenue from tourism.

In Europe too, negative impacts are to be feared. Sunshine is considered essential for tourism but a higher average temperature associated with more heat waves would damage the attraction of Mediterranean countries. At our latitudes, a moderate temperature increase associated with dry weather could promote tourism. However, it is necessary to consider reduction in river flow rate in summer and the need to maintain the beaches more frequently owing to increased erosion.

According to the extent of the change, winter sports resorts in the Alps could be affected by a serious lack of snow, particularly at low altitude. In Belgium, snow on the ground could become increasingly rare but there would be plenty of grey sky and rain in winter.

Cost of climatic impacts

The evaluation of costs linked to climate change is a delicate matter, particularly because many effects do not have an obvious monetary value. Capacity for adaptation is an important parameter, but is very variable, which contributes to the difficulty of documenting the socio-economic effects on a regional scale.

For a problem as global by definition as that of climate change, reflecting on the scale of Belgium alone is of limited interest only. A monetary value can be placed on some of the impacts up to a certain point. A few percent decrease in heating consumption in winter, an increase in electricity consumption for air-conditioning in summer, the repair of flood damage etc. The total cost of these "monetizable" impacts is apparently quite low at global level: in the region of 1 to 2% of the GNP for an average temperature rise of 2.5 °C, but the uncertainties are large.

Other impacts pose a problem where placing a monetary value on them is concerned what of the cost of human lives and threatened plant species etc? The last IPCC report summarizes the risks linked to projected climate change in the form of five "reasons for concern". The IPCC believes, in particular, that even for global warming below approximately 2.5 °C, most populations will be adversely affected.

Conclusion

In terms of the 21st century and for Belgium, the initial effects of climate change will probably be relatively limited, particularly if we take account of adaptation measures which may be taken whilst the changes are not too great. But we must not delude ourselves: adaptation also brings a cost, and has limits. Some of these impacts could be very significant and would become increasingly visible if global warming was not controlled: effects of heat waves on health and mortality rates, disturbance of ecosystems and loss of species and fragile environments, and contribution to the risk of flooding and beach erosion. Initially, agriculture would not be damaged and certain crops could even profit from a small heat increase. Beyond an average rise of approximately 3°C in Belgium, though, many crops will begin to suffer and yields will decrease. Likewise, adapting to a rise in sea level of 50 cm or one metre is without doubt not too difficult in a rich country. But when it is known that uninterrupted global warming would very likely lead – in an average scenario – to a rise of 8m within 1,000 years, we should ask ourselves which towns and villages will be celebrating their 1,500th or 2,000th anniversary with their feet under water.

Furthermore, the world is now interdependent. For such a global problem as that of climate change, it would be a serious error to imagine that we could limit ourselves to the impacts which would affect our small country alone. Without even raising ethical concerns, it is necessary to consider that, today, food prices depend on the health of the entire global agricultural system. Viruses are not confined to remote areas. Repeated droughts affecting the areas surrounding the Mediterranean would clearly have consequences for us in terms of the influx of refugees for example.

The last figure in this report, taken from the work done by the IPCC, clearly shows that in order to limit climatic risks to certain ecosystems and limit the increase of the risk linked to extreme events, it is necessary to maintain the temperature increase below the approximate 1.5 °C barrier in relation to 1990, which means 2 °C above pre-industrial temperatures. This requires the stabilization of CO2 concentrations in the atmosphere at a level such that, in order not to exceed it, it is necessary to divide global emissions by a

factor of three to four by 2100, and more still beyond this[1]. Such is the challenge, but one which is commensurate with today's vast scientific, technical and socio-economic knowledge. What is lacking, above all, is the desire to get down to the job seriously. Perhaps this report will have made a modest contribution towards this.

[1] Curious readers are encouraged to see by themselves what the consequences of various temperature stabilization levels are in-terms of greenhouse gases emissions by using the interactive climate model of Dr. Ben Matthews (UCL) at: jcm.chooseclimate.org.