Summary

In this study, climate scenarios were derived by performing statistical analyses on several data sets of climate model outputs that recently became available. This was done by analyzing the climate model results for Uccle for a future period (2071-2100 standard) in relation to a recent historical period and then rescale for periods of 30, 50 and 100 years. From a wide range of climate model projections three climate scenarios (high, medium, low) were distilled.

Projections for the annual average temperature show an increase of 0 °C to 7,2 °C over a period of 100 years. For the winter months the increases are smaller than the annual average temperature increase: 0 °C to 6.2 °C and higher for the summer months: 0 °C – 8.9 °C. The number of extremely hot days with a daily mean temperature above 25 °C increases by 0-64 days on average per year. The number of extremely cold days with a daily average temperature below 0 °C decreases by 1-33 days on average per year. Coastal regions warm up less than inland areas, but this effect is small compared to the magnitude of the climate change signal. The number of days hotter than 25 °C increases the most in the center of Belgium, while the number of days colder than 0 °C decreases the most in the Belgian Ardennes. The climate change signal in Flanders is highly dependent on the global emissions of greenhouse gases. Both globally and for Flanders, the temperature increase is approximately twice as large for the RCP8.5 scenario compared to the RCP4.5 scenario. Also, the changes in precipitation are expected to be larger for the scenarios that involve higher concentrations of greenhouse gases in the atmosphere.

Projections for precipitation show an increase in winter precipitation for all scenarios and a decrease in summer precipitation for two of the three scenarios. The mean change in winter precipitation varies over a period of 100 years between about 0 % and +38 %. For the summer months, the average rainfall change varies between -52 % and +18 %. Despite the decline in total summer precipitation, the summer extremes can greatly increase. For Flanders, differences were found between the coast (polders) and the inland region. The precipitation increase is stronger along the coast for the winter season. For the summer season, a north-south pattern is determined with more severe droughts in the south of the country. Potential evapotranspiration increases in all scenarios both in winter and summer. Changes in wind speed for Flanders are generally not significant and there is considerable uncertainty about the sign of the change. Also, the changes in the wind direction is small. For the extremely strong winds it is likely that this will increase.

In addition to these scenarios, there is also scientific knowledge available about climate transitions with far-reaching implications for Flanders. This is because certain elements in the climate system, called tipping elements, react disproportionately strong to a disturbance. Thus, a given change in climate can cause a chain reaction leading to abrupt climate transitions. Some examples are the disintegration of the Greenland or West Antarctic Ice Sheet, loss of Arctic sea ice, disappearance of Alpine glaciers, etc. The risk of these abrupt climate transitions increase with rising global warming. Emission reductions mitigate climate change and will thus decrease the risk of abrupt climate transitions.

The projections for precipitation and evapotranspiration indicate a decrease of the lowest summer flows along Flemish rivers to 60 %-70 % over a future period of 100 years. This evolution towards more droughts is problematic. Flanders is very vulnerable to droughts due to the low availability of water associated with the high population density. Long dry summer periods lowers surface water availability for drinking water, industrial production and agriculture. The shipping might be affected, salt intrusion will increase (higher chloride concentrations, e.g. along the canal Ghent-Terneuzen) and water quality might deteriorate due to the reduced dilution. The latter increases the cost for the production of drinking water due to the stronger treatment that is required of the surface water into drinking water.

The influence of climate scenarios on the high peak flows along Flemish rivers is less clear and highly dependent on the precise climate scenarios. The high climate scenario is associated with an increase in the peak flows along the Flemish rivers up to several tens % over 100 years (about 30 % for larger rivers, higher for small watercourses). Along sewer systems, floods over a future period of 100 years might occur 2 times as likely. For storage reservoirs or other source control measures (e.g. rainwater tanks), for the high climate scenario in summer (most extreme summer storms), 15 % to 35 %

additional storage capacity would be necessary in order to maintain the overflow frequency at the current level.

A major challenge consists of managing the various sectors (water, agriculture, spatial planning, health incl. air quality, shipping, nature conservation, etc.) to adapt to the changing climatic conditions. Climate scenarios are subject to significant uncertainties, and the appropriate management cannot rely on precise, deterministic future evolutions. Because of these uncertainties, there is a danger that policy makers and administrators ignore the existing information on future climate change. As in other areas, such as demographic changes including population aging, secure pensions, insurance, etc., policymakers and managers would benefit from considering the best available information, including the uncertainty associated with it. This is best done by bringing the available climate scenarios into account, to quantify the impacts of these scenarios on the various sectors and use the precautionary principle. Following the principles of risk management, there is a need for sustainable adaptation strategies that are cost-effective in the long term in each climate scenario.