

# The Polar Regions are melting

– together, we can change the climate

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■ Man-made emissions of carbon dioxide to the atmosphere from fossil fuels have never been greater than they are today. Since the first systematic measurements in 1958 of the atmospheric concentration of carbon dioxide on mountain peaks around the globe, the concentration has increased to the present level (October 2009) of 388 ppm (parts per million), despite the Kyoto Protocol and global climate and energy policy plans. Meanwhile, according to the Intergovernmental Panel on Climate Change (IPCC) projected scenarios, the climate and the impacts of climate change are following worst-case.

## Warming will continue models predict

The climate is changing! The global average temperature has in the last 50 years increased approximately 0.6 degrees Celsius. The change in climate has been greatest in the Arctic as dwindling amounts of snow and ice cover enhance the effects of warming. At the same time a cooling of the stratosphere has been observed. These observations are by the book, if the warming of the last 50 years is caused mainly by the greenhouse effect. For the same period an almost unchanged and only very slightly increased solar activity has been observed of only  $0.12 \text{ W m}^{-2}$ , which corresponds to 8 percent of the total estimated anthropogenic climate impact. It is therefore without scientific evidence and extremely speculative to let the almost unchanged activity from the sun (over the past five decades) appear as the main reason for global warming. In contrast, it is reasonable to accept that the increasing temperatures are explained by the increas-

ing concentration of carbon dioxide in the atmosphere throughout the same period.

Climate model studies based on moderate scenarios for the evolution of the atmospheric content of greenhouse gases suggests that the present warming will continue in the future. An average temperature increase of 5 degrees Celsius by the end of 2100 is not unrealistic. According to the models, it is for example expected that the rise in temperature for East Greenland will be as high as 12 degrees during winter, an increase that will enhance the already accelerating glacier melt.

It is important to stress that we on the one hand, with increasing certainty can detect and quantify the anthropogenic impacts on the environment, and on the other hand can understand more and more of the dynamics of the earth system, which gives rise to year-to-year variability and long term periods with decreasing temperatures. This is caused by a natural dynamic oscillation, for example, by changes in ocean currents and surface albedo, which is influenced by a changing snow and sea ice cover. Both the present and future projected climate must therefore be viewed in this light, and the anthropogenic warming and its processes taken seriously during a longer-term documentation over several decades.

## Time to act

An increasing future global population, with the expectations of increasing wealth and economic growth will continue to raise the concentration of greenhouse gases in the atmosphere. The consequences of a warmer climate are significant in many aspects. An enhanced regional warming in the Arctic,

which until now has only been a problem and a challenge for the sparsely populated Arctic, will in the near future become a global problem. Where the Greenland Ice Sheet at present, according to latest research, is losing about  $250 \text{ km}^3$  per year, the projected average net loss in the year 2080 will increase approximately twofold. At East Antarctica as well, the ice sheet has started melting faster than previously believed. Millions of tons of ice have melted since 2006. The mass loss from the Greenland Ice Sheet and Antarctica contribute at the moment around 25 and 10 percent, respectively, of the global sea level rise of about 3 millimeters a year, a rate of sea level rise almost twice as high as the average over last century. The most recent improved computer models used to calculate changes in sea level indicate that the overall effect of the melting ice, including the thermal expansion due to higher ocean temperatures, may increase the global sea level between 0.8 to 1.9 m by 2100. Even with low carbon dioxide emissions to the atmosphere one can expect an increase in sea level of about 1 meter, which is considerably higher than the IPCC estimate of 18 to 59 cm for the same period. Unfortunately, sea level rise is not expected to end by 2100.

We are at the point where the trend in climate change seems clear – the Polar Regions are melting, and in many cases the trends are following a worst-case scenario. Climate change is not only a polar issue, but a global issue, which requires global solutions. Therefore, there is an urgent need for an effective global approach that reduces man-made emissions of carbon dioxide to the atmosphere and reduces the rate of temperature increase. ■