Climate Modelling School

Hörsalen, SMHI, Norrköping 13 October 2010

PROGRAMME	
09:00 - 09:15	**Welcome and introduction** Markus Meier, SMHI
09:15 - 10:15	**An introduction to global climate models** Eduardo Zorita, GKSS
10:15 - 10:45	**Coffee break**
10:45 - 11:45	**Impacts of climate change on sea level rise and spatial planning in metropolitan areas** Sten Bergström, SMHI
11:45 - 12:00	**Short break**
12:00 - 13:00	**Regional climate models** Erik Kjellström, SMHI
13:00 - 14:00	**Lunch**
14:00 - 15:00	**Artic climate modelling** Ralf Döscher, SMHI
15:00 - 15:30	**Coffee break**
15:30 - 16:30	**Baltic Sea climate modelling** Markus Meier, SMHI
16:30 - 17:30	**Discussion and summary**
18:00	**Dinner**

Abstracts

An introduction to global climate models

Eduardo Zorita, GKSS Research Centre Geesthacht, Germany

Computer climate models allow to perform 'experiments' with the climate system that otherwise would be impossible to conduct. These 'numerical experiments' help to understand the functioning of the climate system and to estimate its responses to external perturbations, like an increase of atmospheric concentrations of greenhouse gases. Although climate models are very complex pieces of software, and often produce a surprisingly realistic picture of the Earth's climate, they are not free from uncertainties and approximations. Any student related to environmental or Earth sciences should have a basic understanding of the structure of climate models and of their strengths and limitations. This will be presented in the present lecture in a rather non-mathematical way, along with some examples of uses and misuses of climate simulations.

Impacts of climate change on sea level rise and spatial planning in metropolitan areas

Sten Bergström, SMHI

Since the 4th IPCC report arrived in 2007 future sea level rise has been discussed a lot among planners around the world. The numbers suggested by IPCC have also been questioned and e few new assessments have appeared from the Netherlands, UK and Vietnam among others. In Sweden the question has reached the planners in many cities, including Stockholm, Gothenburg and Malmö. The question is a complex one as it interacts with the expanding metropolitan areas and river flow from inland waters.

The presentation will discuss these problems, in particular with examples from Stockholm and Gothenburg. It will also give a general picture of the development of the climate issue since IPCC 2007 and on the decision maker's situation in real life.

Regional Climate Models

Erik Kjellström, SMHI

Global climate models (GCMs) provide the large-scale picture of the climate system and are extensively used for production of climate change scenarios for the future but also to simulate past climates. A drawback with today’s GCMs is that they are most often operated at relatively coarse horizontal resolution, i.e. a grid spacing of 100-300 km. An implication of this is that regional details are not resolved in such models. Of particular importance here are geographical features including land-sea distribution and representation of mountainous regions. In general mountains are too low and surrounding valleys too high resulting in biases in simulated temperature and precipitation at, or in the vicinity of, the mountains. The coarse resolution also leads to a poor representation of some important meteorological phenomenon in the atmosphere including tropical cyclones and extra-tropical depressions with associated frontal systems. Regional climate models (RCMs) are designed to operate on a limited part of the globe. As the required computational power decreases for a smaller region, resources can instead be put in increasing the horizontal resolution so that fine-scale features are captured.

RCMs have been extensively used for many regions worldwide during the last 20 years. In the lecture I will present the principles behind RCMs and what information they need from GCMs. Further, I will discuss how they can be evaluated against the observed climate and how they are used for producing climate change scenarios. Examples of RCM results for past, present and future climates with a focus on Europe will be presented. Finally, I will also discuss limitations in RCMs and RCM generated climate scenarios.

Arctic Climate Modelling

Ralf Döscher, SMHI

The Arctic region plays a special role in the climate system due to its capability to change rapidly and more intense compared to global averages. Modelling of Arctic climate processes need to account for feedback processes involving sea-ice, ocean and atmosphere, as well as for the representation of geographic features such as narrows. Thus, high-resolution regional climate model studies constitute a necessary complement to global climate models, which more directly can be used for climate impact studies.

Baltic Sea climate modelling

Markus Meier, SMHI

Regional climate modeling results suggest that global warming may cause increased water temperatures and reduced sea ice cover combined with eventually increased winter mean wind speeds and eventually increased river runoff. The projected hydrographic changes could therefore have significant impacts on biogeochemical cycles. These changes may compete with presently discussed nutrient load reductions that aim to improve the ecological status. Targets that may be sufficient in present climate might fail under future climate conditions. In this lecture various drivers and processes on land, in the atmosphere and in the sea that are important for the long-term evolution of the marine environment will be discussed. The state-of-the-art knowledge of past and future climate changes in the Baltic Sea will be summarized.