

# **FINSKEN, FMI-1 Climate**

## **Progress during the first year of the project and an updated workplan**

### *ROLE IN THE PROJECT*

- *Determination of current climate trends in Finland*
- *Development of scenarios of climate and carbon dioxide*
- *Provision of information and guidance to users of climate scenarios*

## **1. ACTIVITIES DURING THE FIRST YEAR (November 1999 – November 2000)**

### **Analysis of observations**

Methodologies of homogeneity testing and adjusting of geophysical time series have been developed (Tuomenvirta 2000a). They are based on combination of the use of statistical testing and the metadata (i.e. information on observation methods, instruments and data processing). The influences of adjustment on data have been evaluated (Tuomenvirta 2001) and trends in Nordic and Arctic temperature extremes and ranges (Tuomenvirta et al. 2000a) as well as in storms have been presented (Alexandersson et al. 2000).

For the calculation of long-term area-averages of temperature and precipitation, Finland has been divided into 7 regions. This regionalization is mainly based on precipitation variability and, therefore, the borders of regions in many cases roughly follow the orographic features. Synoptic-scale storm activity index is based on station air pressure data. The calculations of national and regional climate indices will be performed from the reliable, homogeneity tested data.

### **Development of climate scenarios**

The AOGCM simulations available from IPCC-DDC have been used to characterise temperature and precipitation changes in Finland and other European countries (Hulme and Carter 2000) as well as in other world regions (Carter et al. 2000). AOGCM simulations forced with atmospheric greenhouse gas and aerosol concentrations according to SRES emission scenarios are only becoming available. Therefore, a method has been used, where climate simulations forced 1% per annum growth of greenhouse gas concentrations after 1990 are scaled to represent simulations forced with SRES marker scenarios (Tuomenvirta 2000b).

Data from the new HadCM3 simulations, not used in the above-mentioned studies, have been retrieved. Although the model simulations are not yet based on the SRES emission scenarios, some upgradings have been made. The HadCM3 model optionally allows the

transport, oxidation and removal by physical deposition and rain out of anthropogenic sulphur emissions to be included interactively. This permits the direct and indirect forcing effects of sulphate aerosols to be modelled for given scenarios of sulphur emissions and oxidants. Two HadCM3 simulation sets, one with and the other without effects of sulphate aerosols and tropospheric ozone, have been studied.

Results from dynamical downscaling of HadCM2 simulation with Rossby Centre regional climate model (RCA1-88H) have been used in impact studies. More recent RCA1 climate change experiments of the Rossby Centre, now with a finer resolution (44 km) are also available within the FINSKEN.

Scenarios of future climate have been used in climate change impact studies. The impacts of climate change on the transport conditions were studied for the Ministry of Transport and Communications (Tuomenvirta et al. 2000b). The Baltic Sea ice cover will be smaller, the ice season will be shorter and the ice will be thinner (Haapala et al. 2001). The soil frost below snow-free surfaces (e.g. roads) will decrease due to warming in whole Finland (Venäläinen et al. 2001a) while in the forests the changes in snow cover make the response of ground frost to warming more complex (Venäläinen et al. 2001b). In order to investigate impacts of climate change on dam safety and flood risks, scenarios of precipitation, its extremes and precipitation were developed (Tuomenvirta et al. 2000c).

FMI is participating in the project Regional Earth System Modelling Network for the Arctic (RESMoNA) 2001-2003 funded by the Nordic Arctic Research Programme. RESMoNA gathers together regional climate modellers from Denmark, Sweden and Norway as well as climate scenario developers from Finland and Iceland. Inside Finland FMI-1 has created contacts with potential users of scenarios from forest researchers (within a SUNARE application, which was not funded).

### **Scientific meetings with presentations on FINSKEN**

1. The Climate Impacts LINK Project 4th Workshop: Current Climate Change Science and Impacts Studies, Norwich, UK, 13 - 15 September 2000 (KJ).
2. International Scientific Meeting on Detection and Modelling of Recent Climate Change and Its Effects on a Regional Scale in Tarragona, Spain, 29 - 31 May 2000 (HT).
3. The 22nd Nordic Meteorologists' Meeting in Maarianhamina, 27 June – 1 July 2000 (HT).

### **Education**

Kirsti Jylhä, FT in January 2001 (public examination in December 2000)  
Heikki Tuomenvirta, FL in November 2000

## **Publications**

Alexandersson, H., Tuomenvirta, H., Schmith, T. and Iden, 2000: Trends of storms in NW Europe derived from an updated pressure data set. *Climate Research*, 14, 71-73.

Carter, T.R., Hulme, M., Crossley, J.F., Malyshev, S., New, M.G., Schlesinger, M.E., and Tuomenvirta, H. 2000. *Climate Change in the 21st Century: Interim Characterizations based on the New IPCC Emissions Scenarios*. The Finnish Environment 433, Finnish Environment Institute, Helsinki. 150 pp.

Haapala, J., Juottonen, A., Marnela, M., Leppäranta, M. and Tuomenvirta, H., 2001: Modelling the variability of the sea ice conditions in the Baltic Sea. (accepted to *Annals of Glaciology*)

Hulme, M. and Carter, T.R., 2000: The ACACIA climate change and related scenarios for Europe. (in preparation)

Tuomenvirta, H., 2000a: Homogeneity testing and analysis of climatological time series from Finland and the Nordic region. University of Helsinki, Department of Meteorology, 59 pp. + 31 pp. append. (Lisensiaatti-tutkilema)

Tuomenvirta, H., 2000b: FINSKEN climate - AOGCM simulations of temperature and precipitation change in Finland. Proceedings of the 22nd Nordic Meteorologists' Meeting, 6 pp.

Tuomenvirta, H., 2001: Homogeneity adjustments of temperature and precipitation series – Finnish and Nordic data. (accepted to *Int. J. Climatol.*)

Tuomenvirta, H., Alexandersson, H., Drebs, A., Frich, P., and Nordli, P.O., 2000a: Trends in Nordic and Arctic temperature extremes and ranges. *J. Climate*, 13, 977-990.

Tuomenvirta, H., Venäläinen, A., Juottonen, A., and Haapala, J., 2000b: The impact of climate change on the Baltic Sea ice and soil frost beneath snow-free surfaces in Finland. Ministry of Transport and Communications Finland, Publications 13/2000, 56 pp.

Tuomenvirta, H., Uusitalo, K., Vehviläinen, B. ja Carter, T., 2000c: Ilmastonmuutos, mitoitussadanta ja patoturvallisuus: arvio sadannan ja sen ääriarvojen sekä lämpötilan muutoksista Suomessa vuoteen 2100 (English abstract: Climate change, design precipitation and dam safety: estimate of changes in precipitation, its extremes and temperature in Finland up to 2100). Ilmatieteen laitos, Raportteja, (Finnish Meteorological Institute, Reports) 2000:4, 65 s.

Venäläinen, A., Tuomenvirta, H., Lahtinen, R., and Heikinheimo, M., 2001a: The influence of climate warming on soil frost on snow-free surfaces in Finland. (accepted to *Clim. Change*)

Venäläinen, A., Tuomenvirta, H., Heikinheimo, M., Kellomäki, S., Peltola, H., Strandman, H. and Väisänen, H., 2001b: The impact of climate change on soil frost under snow cover in a forested landscape. (accepted to *Climate Research*)

## **2. PLANS FOR THE SECOND PHASE**

### **Analysis of observations**

The calculation of regional and national climate indices to be used in the analysis of trends, natural climate variability and detection of possible anthropogenic signatures in climate. First a FMI report will be produced, but later on journal articles will be written. Circulation typing based on methods used in the CRU/UEA (UK) will be tested and applied to both observations and climate model data.

## **Development of climate scenarios**

Many AOGCM simulations based on the marker SRES emission scenarios are expected to be finished in 2001. The next regional climate change simulations (RCA2) of the Rossby Centre, which will use HadCM3 boundary data and SRES (A2, B2) forcing, are also planned to be conducted during 2001. These new runs will supersede older runs in scenario development as soon as they become available. The results of user survey will be taken into account in scenario development.

Because of the huge data volume produced by the Rossby Centre (monthly and 6-hour resolution), attention has to be paid to practical questions: data management, storing and delivery to users.

## **Provision of information and guidance**

Through FINSKEN web pages information on the reference climate (1961-1990) will be distributed (analyses prepared in NordKlim and FMI). NordKlim will also provide some long-term climatological time series from Scandinavian countries.

Maps of change fields from GCM and RCM simulations will be prepared for the web pages.

## **3. SCENARIOS TO BE RELEASED IN SPRING 2001**

The present global (GCMs available via IPCC-DDC) and regional scale (RCA1-44H) climate simulations for changes in different meteorological parameters in Finland, as well as in some calculated variables (circulation typing indices, NAO index) will be presented. Because simulations based on SRES emission scenarios may not be available scenarios may have to be based on scaling of "older" (IS92a) simulations.

Atmospheric carbon dioxide concentrations derived from SRES emission scenarios with MAGICC model will be distributed.