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Regional Climate Change Scenarios for the Water Management in Lahti and Mikkeli

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Abstract This report provides an overview over climate change scenarios for the cities of Lahti and Mikkeli, background information about the modelling of scenarios, and challenges related to the calculations and use of data. The information helps to maintain and protect the good state of the groundwater resources in Lahti and Mikkeli. According to the two scenarios presented in these report the increase in temperature in the near future (2021-2050) ranges roughly between 1 and 2.5 °C and between 1.5 and 5.5 °C for the period 2071-2100. The smallest increase in in summer and the largest increase is in winter time. Both scenarios show for both time periods and both locations (Lahti and Mikkeli) an increase in yearly precipitation.	
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Tiivistelmä Tässä raportissa annetaan yleiskuva Lahden ja Mikkelin kaupunkien ilmastonmuutosskenaarioista sekä yhteenveto valikoiduista alueellisista ilmastonmuutosmalleista ja mallintamiseen käytetyistä taustatiedoista. Lisäksi pohditaan eri ilmastonmuutosmallien laskentatapojen ja käytetyn datan haasteita ja epävarmuustekijöitä. Tieto tukee Lahden ja Mikkelin pohjavesivarojen hallintaa ja suojelua. Raportissa esitetään kaksi ilmastonmuutosmallia (REMO2009 ja CCLM) päästöskenaariolla RCP8.5. (pahin mahdollinen uhkakuva). Molempien ilmastonmuutosmallien mukaan lämpötilan nousun on arvoitu olevan sekä Lahdessa että Mikkelissä vuosina 2021-2050 noin 1-2.5 °C ja vuosina 2071-2100 1.5-5.5 °C. Lämpötilan nousu on pienintä kesällä ja suurinta talvikuukausina. Ilmastonmuutosmallien mukaan vuosisadanta kasvaa sekä Lahdessa että Mikkelissä. Vertailuarvoina molemmissa kaupungeissa on käytetty Ilmatieteen laitoksen säähavaintoasemilta v.1981-2010 mitattujen havaintojen keskimääräisiä arvoja.	
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Contents

1 INTRODUCTION

The aim of the RAINMAN project is to reduce sewage system overloads due to increasing storm water volumes, to prevent urban flooding and to preserve fresh water resources. Increasing storm water volumes are caused by urbanization and soil sealing, climate change and changing precipitation. The use of climate scenarios helps to estimate potential future impacts on storm water management and can inform decisions and design solutions.

Most climatic data are freely available and publicly accessible for everybody. This is true for measured historical climate data as well as for future scenarios resulting from model calculations. However, often the data are perceived as not useful for the problems at hand. Either they are presented in an incomprehensible way or they are in an unsuitable format (Bohman et al. 2018). Therefore, the data have to be processed and compiled in a way that they can help to maintain and protect the good state of the groundwater resources in Lahti and Mikkeli.

The purpose of this report is to provide an overview over climate change scenarios for the cities of Lahti and Mikkeli, background information about the modelling of scenarios, and challenges related to the calculations and use of data.

At the core of this report are the climate change scenarios for Lahti and Mikkeli that are retrieved from regional climate models (Section 5). Before presenting these data, the report provides a short introduction how climate change scenarios are downscaled to the regional level (Section 2), an overview of the main challenges related to model data (Section 3), a description of the data selection and processing for the purposes of the RAINMAN project (Section 4). The report closes with a short discussion (Section 6) and advice, how to use (or not to use) the presented information (Section 7).

2 FROM GLOBAL CIRCULATION MODELS TO REGIONAL CLIMATE MODELS

The climate of the future is usually estimated by climate models. These are mathematical models that try to represent the earth’s climate system based on physical laws that underlie the climatic processes. These models are called global circulation models (GCM). The models are necessarily incomplete and simplified representation of the climate system. GCMs have typically a horizontal resolution of 180 km to 200 km and vertical resolution of 1 km covering the earth’s atmosphere up to a height of 50 km. These models are fairly well capable to estimate changes at a global scale and come to similar results for the development of the average temperature. GCMs produce less clear results for precipitation, but also here GCMs estimate direction and size of change similarly for large parts of the globe. Whereas GCMs provide reasonable support for the need of mitigation actions at a global scale, adaptation actions at the regional and local scale are poorly informed by GCMs.

Researchers have developed regional climate models (RCM) to address this gap and provide more detailed information about future climate and climate change. Individual

RCMs usually cover only a certain geographic area, e.g. Europe. The climatic values (temperature, air pressure, wind, etc.) at the boundaries of the RCMs are taken from GCMs. Often RCMs are run many times with boundary conditions from a range of GCMs.

The regional models have a resolution of down to 12 km (horizontally) per grid cell. This means that more detailed information e.g. about the topography is taken into account, but at the same time as the results are geographically more precise the uncertainty of individual values might not decrease (Räisänen 2009; Flato et al. 2014).

The above presented overview about GCMs and RCMs is mostly based on the information provided by ilmasto-opas.fi. Ilmasto-opas.fi is run by several Finnish research organizations and provides a wide range of information about climate change for different target groups.

For further reading about global circulation models and regional climate models, visit:

http://ilmasto-opas.fi/fi/ilmastonmuutos/ilmio/-/artikkeli/6c5a9908-7033-47a8-9855-e745b4fa7604/maapallon-ilmasto-tulevaisuudessa.html

http://ilmasto-opas.fi/fi/ilmastonmuutos/ilmio/-/artikkeli/493ab3a6-184a-421f-8d59-979532ebe160/alueelliset-ilmastomallit.html

3 CHALLENGES

Model results are neither weather forecasts nor are they observed weather conditions. Therefore, several issues have to be taken into account: (1) different types of uncertainties in model results, (2) bias in model results.

Since models are always incomplete, the results are always imprecise (and sometimes also inaccurate). This means, even if the models are used to simulate observed and historic conditions, model results and observations differ from each other (Jylhä et al. 2004).

Our weather system has stochastic and chaotic elements (Jylhä et al. 2004). Therefore, weather models can produce reliable forecasts only for several days ahead. Longer forecasts will not provide useful information about which days will be warm and which days will be rainy. Also, climate model simulate this variability, but over much longer periods. It is impossible to provide exact information on individual years or even days. However, the climatic information, i.e. the average weather over longer time periods (typically 30 years) is valuable, because the average includes a large number of potential weather conditions.

In addition to the weather conditions at the start of the model and the physical laws describing our climate system, climate models need input information about the development of greenhouse gas (GHG) concentrations in the atmosphere. This development depends on past and future emission of GHG and the concentrations of GHG and aerosols in the atmosphere. Future emissions in turn depend on how we expect the world to develop. This means, the uncertainty about how mankind will behave in the future has to be taken into account as well. Therefore models use the input of the so-called Representative Concentration Pathways (RCP, see Box 1), which are based on different assumptions about global socioeconomic and technological developments (IPCC 2013).

Because of these limitations (incomplete models, stochastic weather, and different development pathways) individual model runs always represent only one possible scenario

Representative Concentration Pathways: The IPCC provides four different RCPs (RCP2.6, RCP4.5, RCP6, and RCP8.5). The number behind each RPC stand for the resulting radiative forcing of each pathway in W/m^2 by the year 2100. RCP2.6 would require strong mitigation activities and would probably keep global temperature rise below 2°C, RCP4.5 and RCP6 are intermediate scenarios, and RCP8.5 is a very high emission scenario. A continuation of current emission development would probably lead to concentrations and radiative forcing between RCP4.5 and RCP8.5 (IPCC 2014).

Box 1: Representative Concentration Pathways (RCP)

of wide range of potential futures. Researchers recommend therefore -whenever possible- to use ensembles of different models and model runs to get a representative picture of potential future climatic conditions (Kotlarski et al. 2014; Kjellström et al. 2018).

The above-mentioned differences between model results and observations for historic climate conditions is called model bias (see Figure 1). This bias tells little about the model quality as such, because it is more important that models are capable to represent the change over time (Ruosteenoja et al. 2016). Nevertheless, this bias has to be considered when using climate model data (Jylhä et al. 2004).

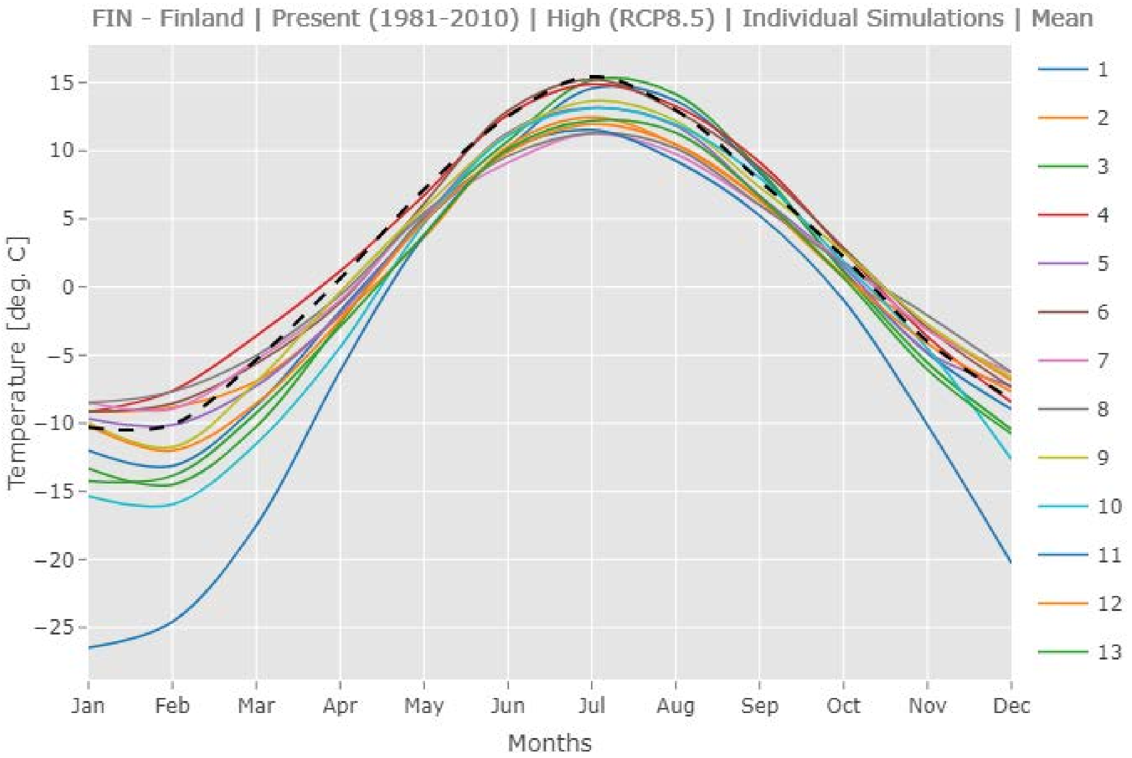

Figure 1: Observed climatic temperature values and regional climate model results for Finland (1981-2010). The list of models can be found in Annex 1. (Source: https://decm.copernicus-climate.eu/decmapps/)

One approach to reduce the impact of this bias is to add the change of climate variables (model result) to observed climate conditions (Jylhä et al. 2004; Veijalainen et al. 2010; Luoma et al. 2013). We use, for example, the measured climatic mean temperature for the period 1981-2010 (T_{OBS}) and add the model results for the change of temperature between 1981-2010 and 2071-2100 (ΔT), to generate projections for temperature conditions in the period of 2071 to 2100. The formula for the calculation is:

$$T_{PROJ} = T_{OBS} + \Delta T$$

Because the change for precipitation is calculated in percentage (Δ), the formula to calculate the precipitation projections looks differently:

$$P_{PROJ} = P_{OBS}\left(1 + \frac{\Delta P}{100}\right)$$

Although this bias correction approach has been commonly used and recommended, there is also reason for caution. This correction assumes a constant bias over time. By doing so, it neglects potential feedback mechanisms of over- or underestimations; in some cases, it might lead to future model results that are in conflict with the underlying physical laws; and it can hide some of the inherent uncertainty of the models (Ehret et al. 2012; Bellprat et al. 2013).

In the RAINMAN project, we stick to the simple bias correction presented above. When using these data (based on a small number models and a stationary bias correction), we have to be aware that the resulting numbers are indicative for the direction and magnitude of change, but they do not cover the full range of uncertainty and possible future climatic conditions.

4 DATA SELECTION AND PROCESSING

For this project we selected the results of two regional models under RCP8.5 (see Box 1). The RCMs are (1) MPI-CSC-REMO2009 (REMO2009) by Max-Planck-Institute for Meteorology and the Climate Service Center Germany (GERICS 2017) and (2) CLMcom-CCLM4-8-17 (CCLM) developed by the Climate Limited-area Modelling Community (CLMcom 2016). The boundary conditions (or the external forcing) for the RCM are based on the results of two different GCMs. REMO2009 has been forced with the Max-Planck-Institute's own MPI-ESM-LR (MPI-M) (Annex 2). CCLM has been forced with ICHEC-EC-EARTH (ICHEC) (see Annex 2). Using only two RCMs falls short of the recommended use of an ensemble of scenarios as explained in the previous section. It is a compromise to provide useful scenarios within the resource restrictions of the project. With RCP8.5 we expect to get results that show changes at the upper edge of future developments. The use of two RCMs forced by two different GCMs gives at least and idea of the uncertainty related to model results.

We selected the RCMs based on their ability to represent the current climate in Finland (i.e. a small model bias). In a first step, we used the data evaluation tool for climate models provided by Copernicus Climate Change Service (https://decm.copernicus-climate.eu/) and we did a qualitative analysis of the model-bias maps presented by Kotlarski et al. (2014). This first step led to the selection of three RCMs forced with several GCMs: REMO2009 forced with MPI-M; CCLM forced with MPI-M, CNRM-CERFACS-CNRM-CM5, and ICHEC. We also considered to use the KNMI regional atmospheric climate model RACMO forced with Met Office Hadley Centre (MOHC) HadGEM2-ES model. However, we had to discard the RACMO data, because the authors of the model found a substantial error and retracted the data.

In a second step we downloaded the data for monthly mean temperature and monthly mean precipitation for the relevant grid points of the models for Mikkeli and Lahti. Figure 2 shows the locations of the weather stations in Mikkeli and Lahti and the selected grid points of the RCMs nearest to the weather stations. We used the average of 4 points for Mikkeli and one point for Lahti.

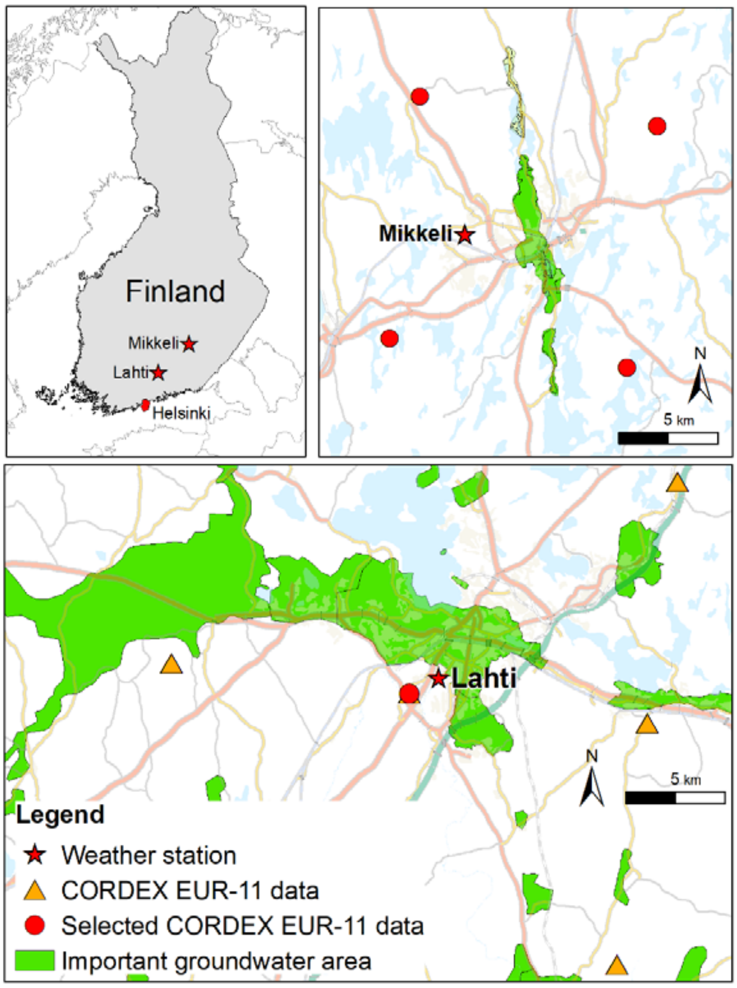

Figure 2: Location of weather stations and RCM grid points in Mikkeli and Lahti.

We compared these data to the observed data for the period 1981 to 2010 in Mikkeli and Lahti and calculated the Root Mean Square Error (RMSE) for the monthly mean temperature and monthly mean precipitation (see Annex 3). Generally, the RMSE is slightly higher for REMO2009 compared to CCLM (for both temperature and precipitation in Mikkeli and Lahti). The precipitation RMSE was the lowest for CCLM forced with ICHEC. Therefore we decided to use REMO2009 forced with MPI-M and CCLM forced with ICHEC for further calculations and assessments in this project (see Figure 3 to Figure 6).

Figure 3 to Figure 6 show that both models underestimate current summer temperature (temperature bias). Both models overestimate precipitation for the months February, March, and April. For the rest of the year they either under- and overestimate monthly precipitation. The summer temperature bias is a phenomenon that can affect almost all RCMs (Figure 1). Also a less robust performance with respect to precipitation compared to temperature is commonly observed (Kjellström et al. 2018).

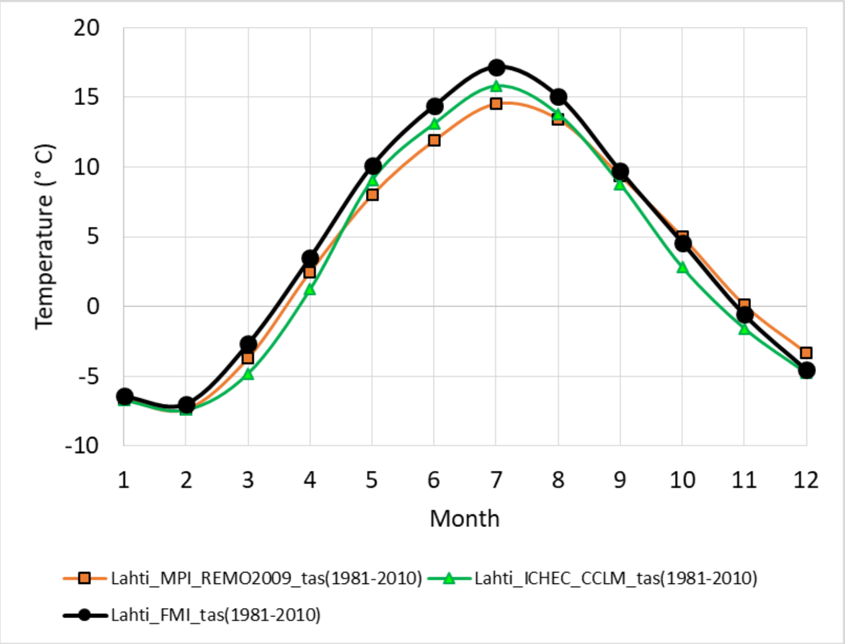

Figure 3: Monthly mean temperature in Lahti for the period 1981-2010 according to observed data, and REMO2009 and CCLM model results.

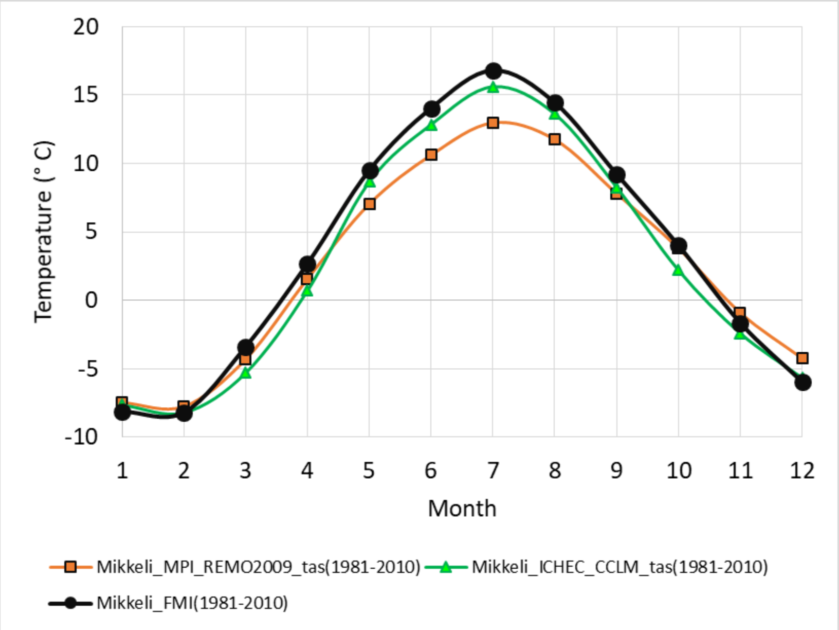

Figure 4: Monthly mean temperature in Mikkeli for the period 1981-2010 according to observed data, and REMO2009 and CCLM model results.

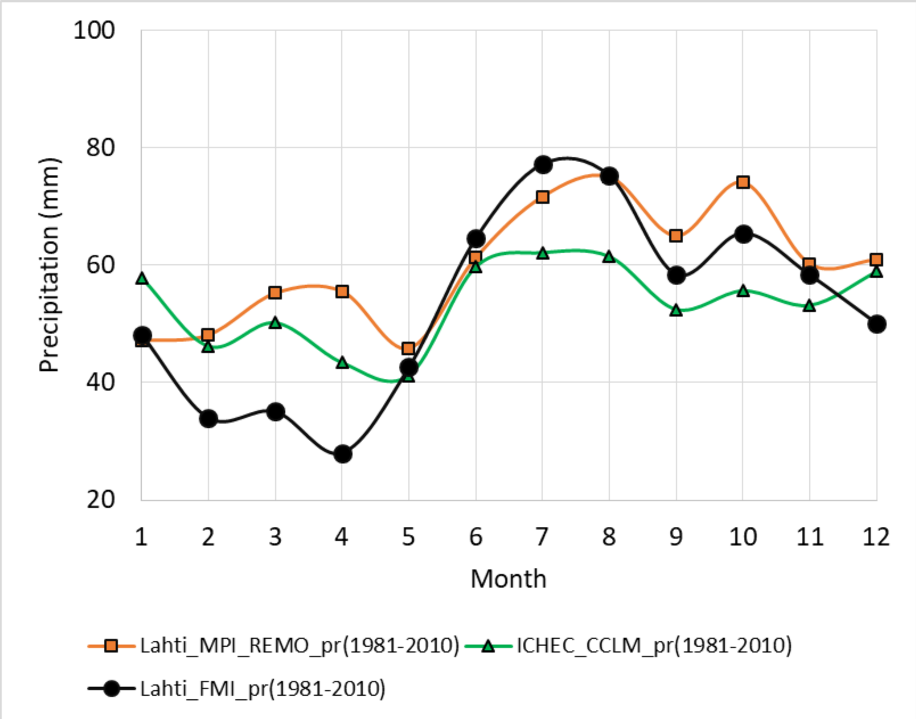

Figure 5: Monthly mean precipitation in Lahti for the period 1981-2010 according to observed data and REMO2009 and CCLM model results.

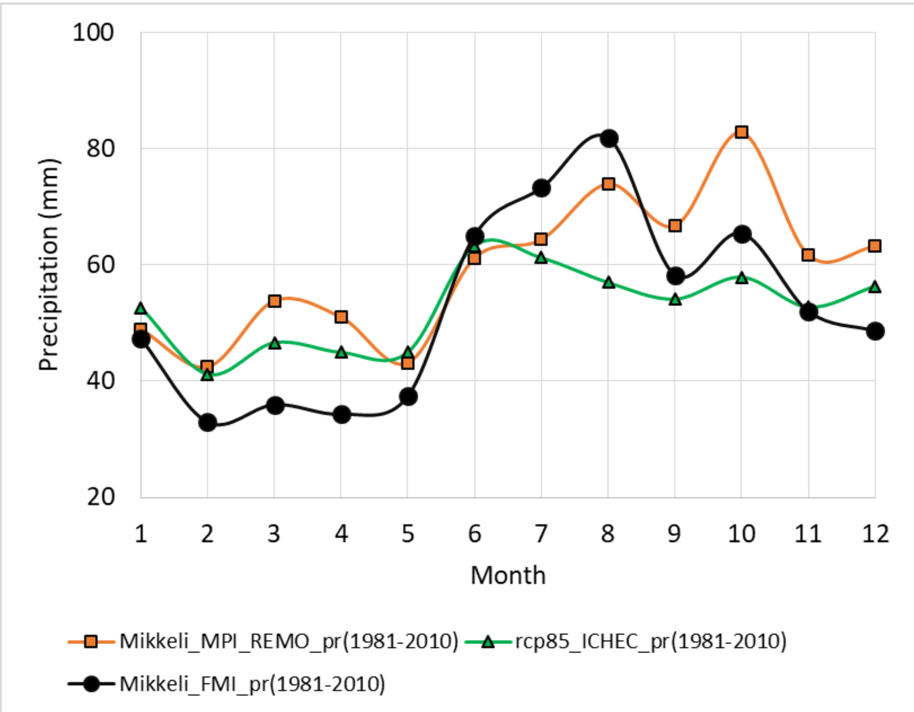

Figure 6: Monthly mean precipitation in Mikkeli for the period 1981-2010 according to observed data and REMO2009 and CCLM model results.

In a final step we corrected the data for the model bias based on the formula presented in section 3 above. We corrected temperature data for their absolute bias in degrees and precipitation data for their relative bias in percentage (Jylhä et al. 2004).

5 CLIMATE CHANGE SCENARIOS FOR LAHTI AND MIKKELI

In this section we present the results of the climate change scenarios for Lahti and Mikkeli. We have chosen to present the change in temperature and precipitation between 1981-2010 and 2021-2050, and between 1981-2010 and 2071-2100.

5.1 Temperature

The following graphs (Figure 7 to Figure 10) show the change of monthly mean temperature between 1981-2010 and 2021-2050 and absolute monthly mean temperature for the period 2021-2050 according to the results of REMO2009 and CCLM under RCP8.5.

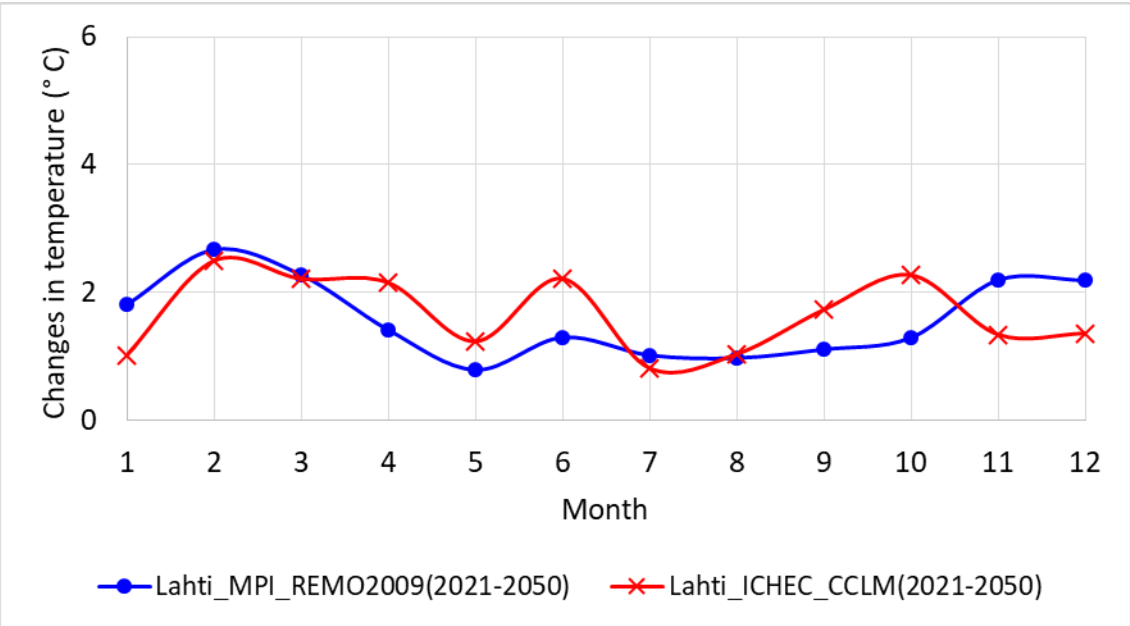

Figure 7: Change of monthly mean temperature in Lahti between 1981-2010 and 2021-2050 according to REMO2009 and CCLM under RCP8.5.

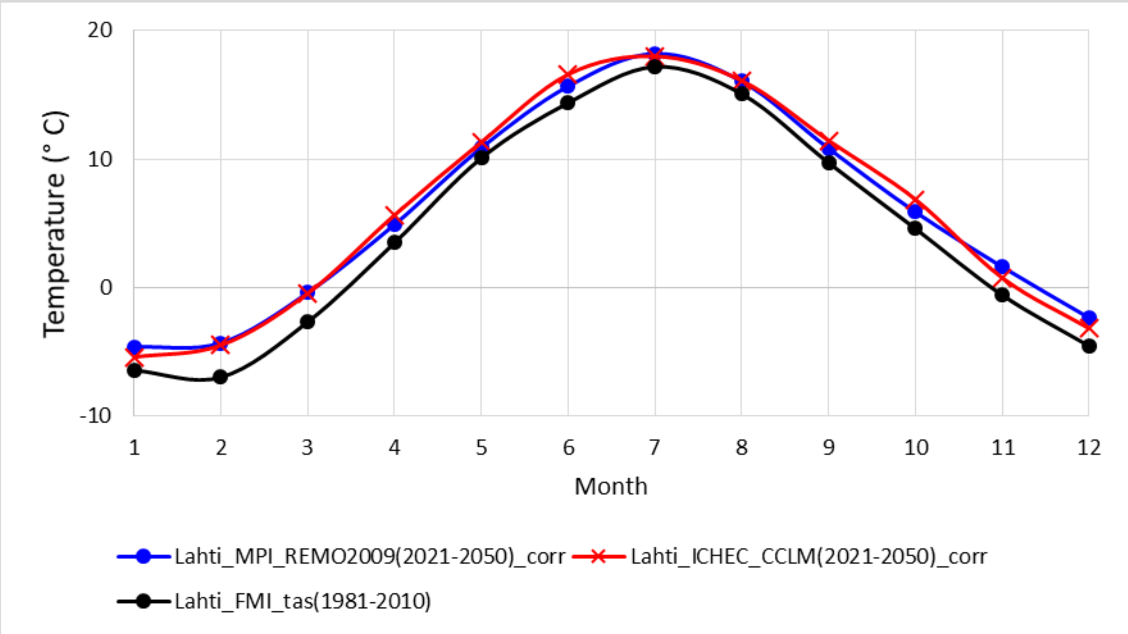

Figure 8: Absolute monthly mean temperature in Lahti between 1981-2010 and 2021-2050 according to REMO2009 and CCLM under RCP8.5.

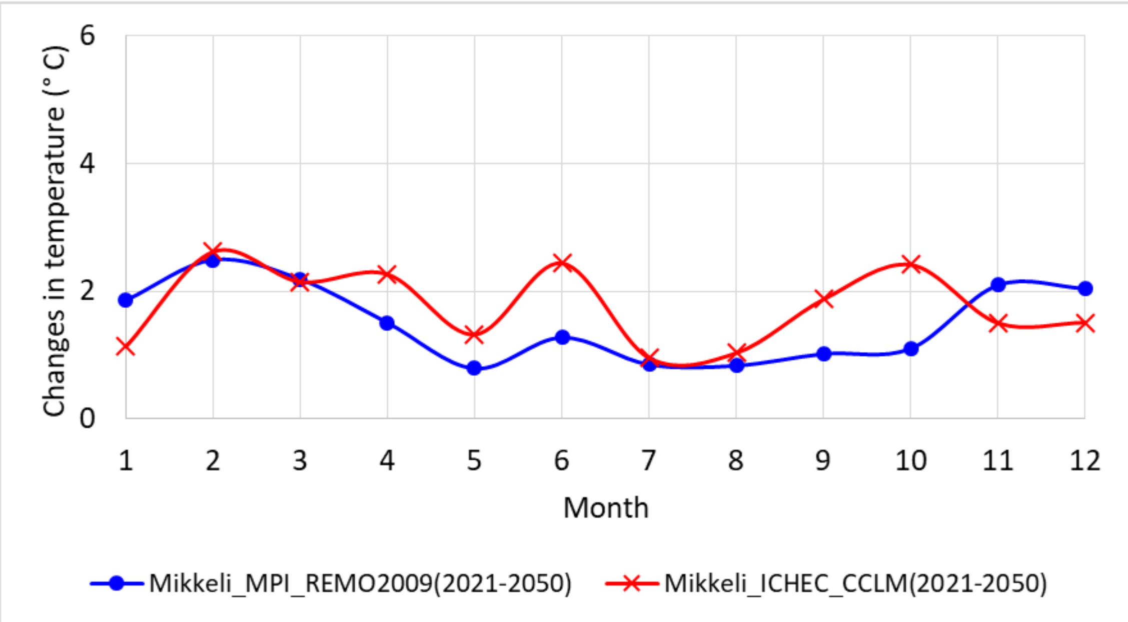

Figure 9: Change of monthly mean temperature in Mikkeli between 1981-2010 and 2021-2050 according to REMO2009 and CCLM under RCP8.5.

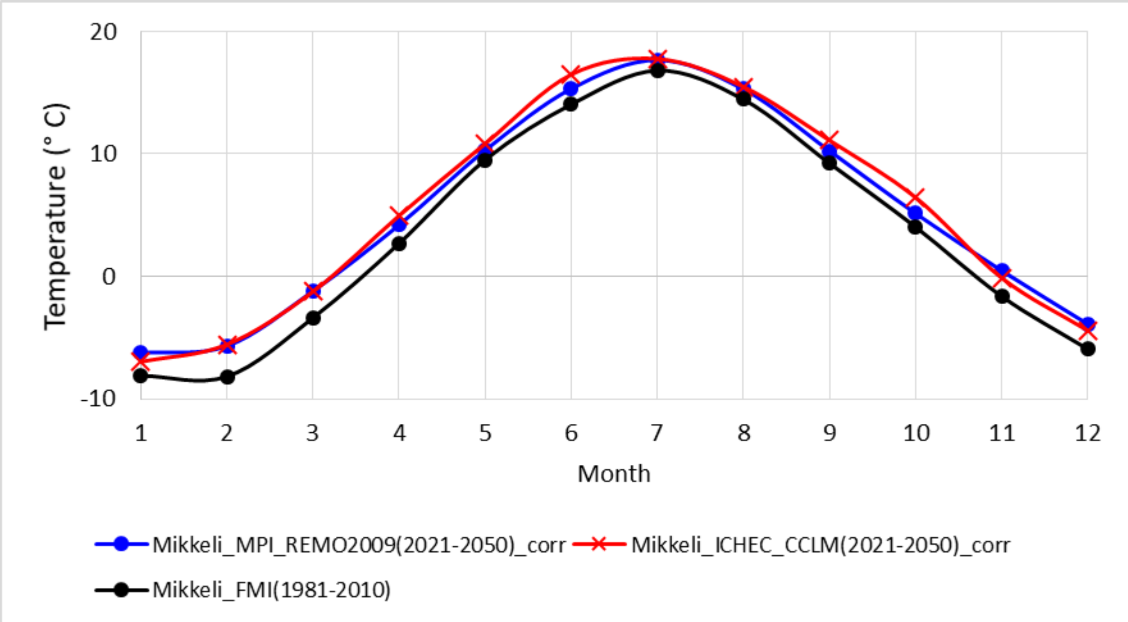

Figure 10: Absolute monthly mean temperature in Mikkeli between 1981-2010 and 2021-2050 according to REMO2009 and CCLM under RCP8.5.

The following graphs (Figure 11 to Figure 14) show the change of monthly mean temperature between 1981-2010 and 2071-2100 and absolute monthly mean temperature for the period 2071-2100 according to the results of REMO2009 and CCLM under RCP8.5.

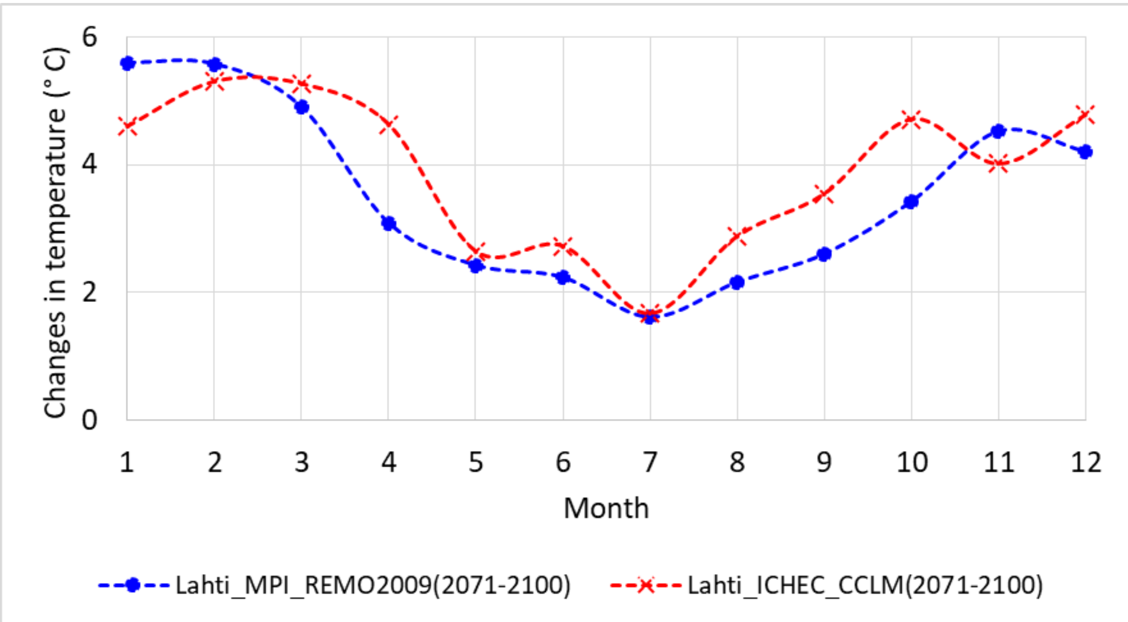

Figure 11: Change of monthly mean temperature in Lahti between 1981-2010 and 2071-2100 according to REMO2009 and CCLM under RCP8.5.

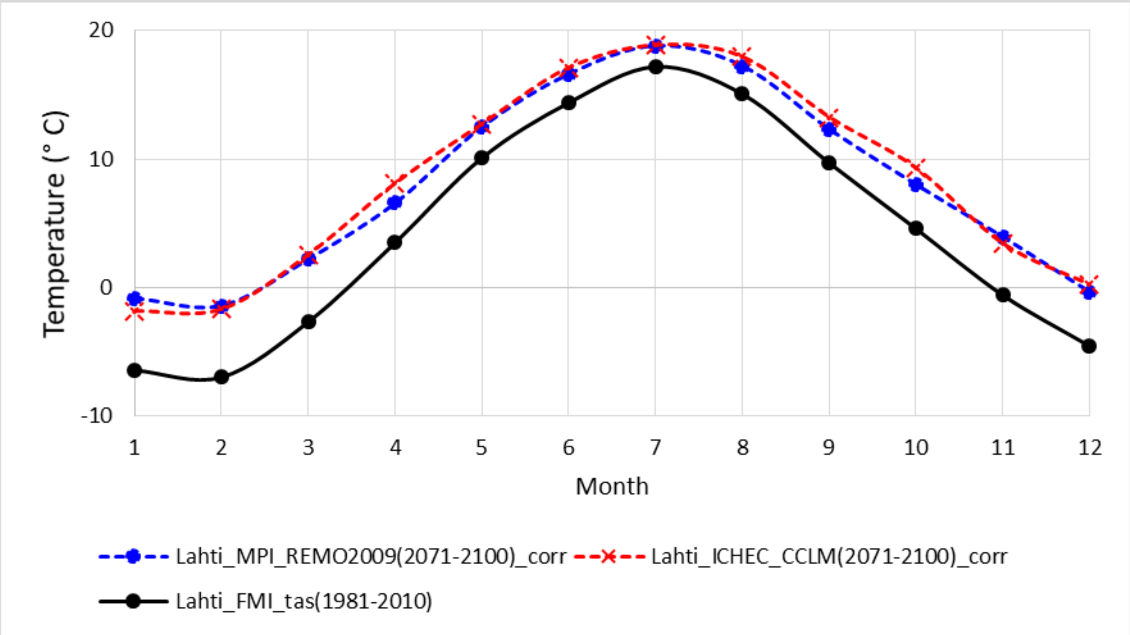

Figure 12: Absolute monthly mean temperature in Lahti between 1981-2010 and 2051-2100 according to REMO2009 and CCLM under RCP8.5.

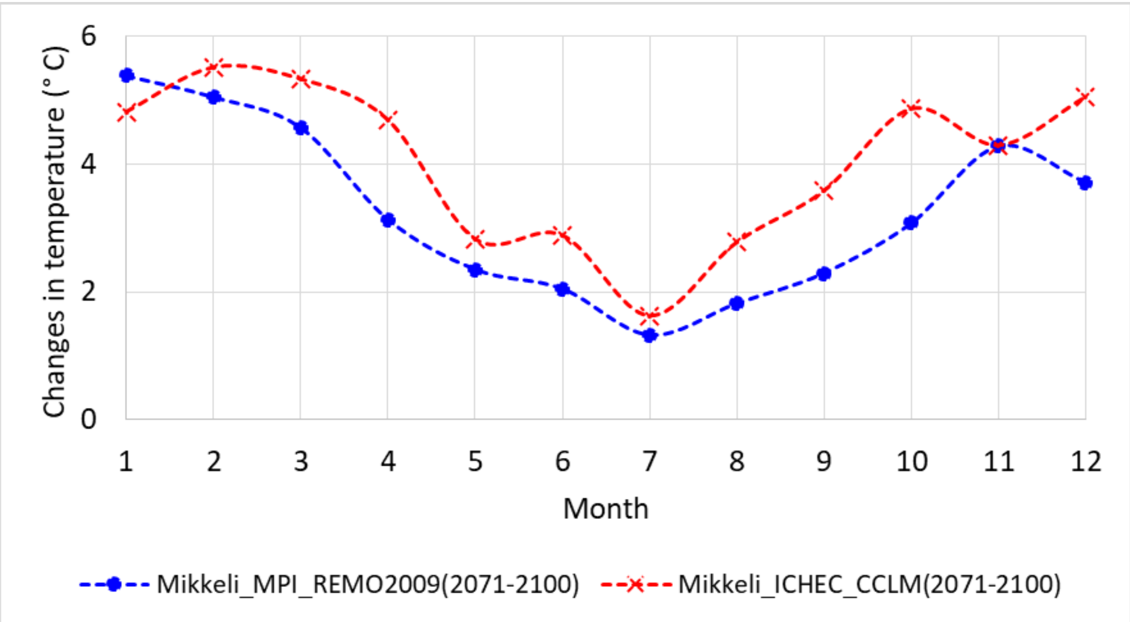

Figure 13: Change of monthly mean temperature in Mikkeli between 1981-2010 and 2071-2100 according to REMO2009 and CCLM under RCP8.5.

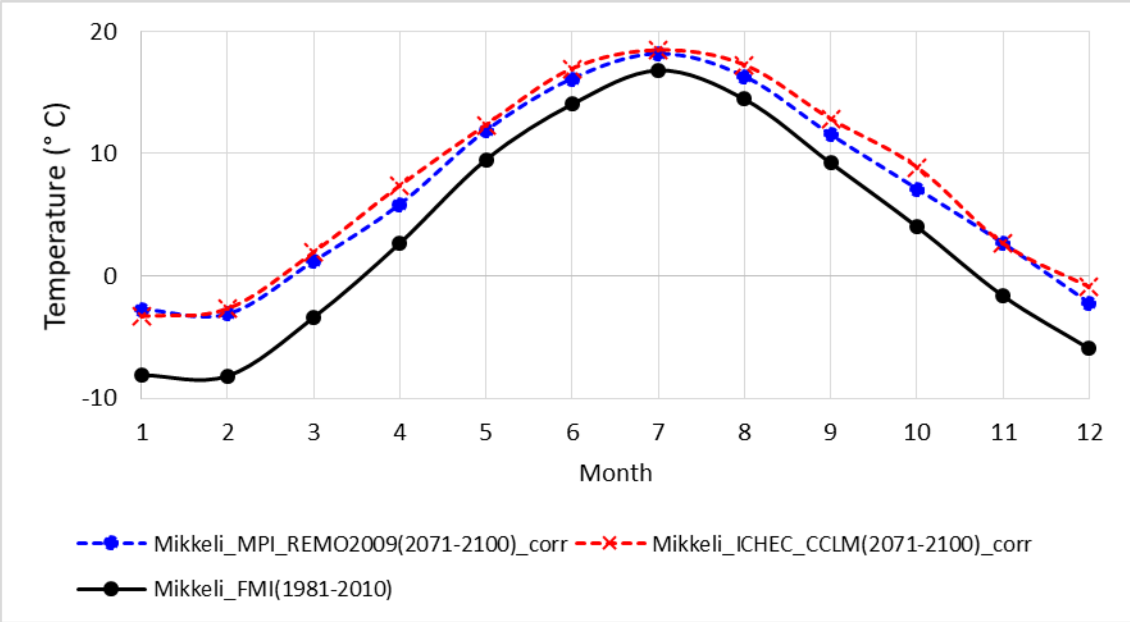

Figure 14: Absolute monthly mean temperature in Mikkeli between 1981-2010 and 2051-2100 according to REMO2009 and CCLM under RCP8.5.

5.2 Precipitation

The following graphs (Figure 15 to Figure 18) show the change in precipitation between 1981-2010 and 2021-2050 and absolute monthly mean precipitation for the period 2021-2050 according to the results of REMO2009 and CCLM under RCP8.5.

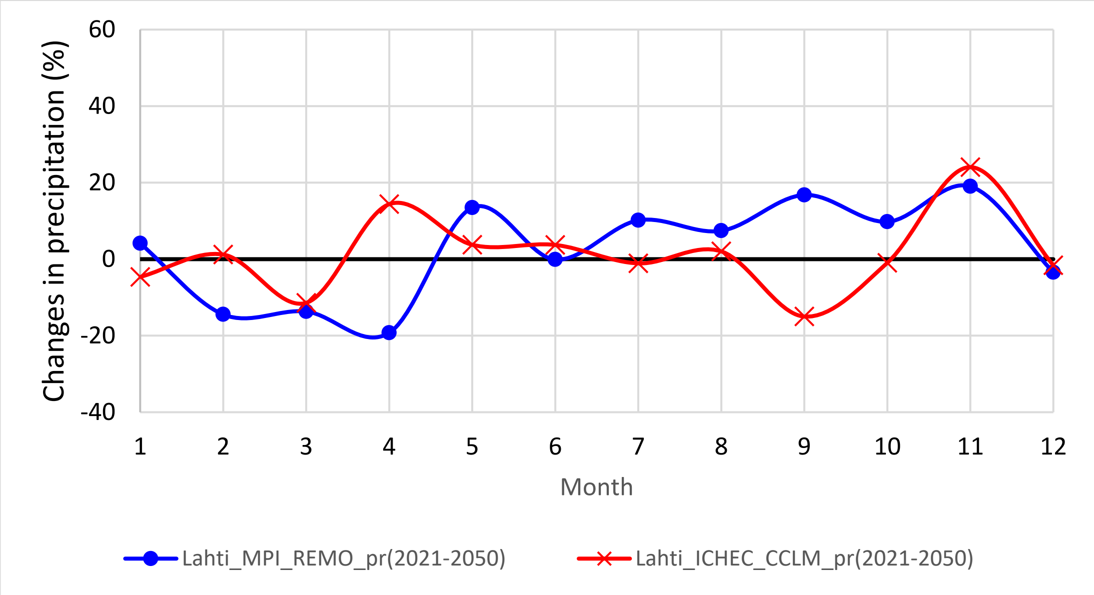

Figure 15: Change of monthly mean precipitation in Lahti between 1981-2010 and 2021-2050 according to REMO2009 and CCLM under RCP8.5.

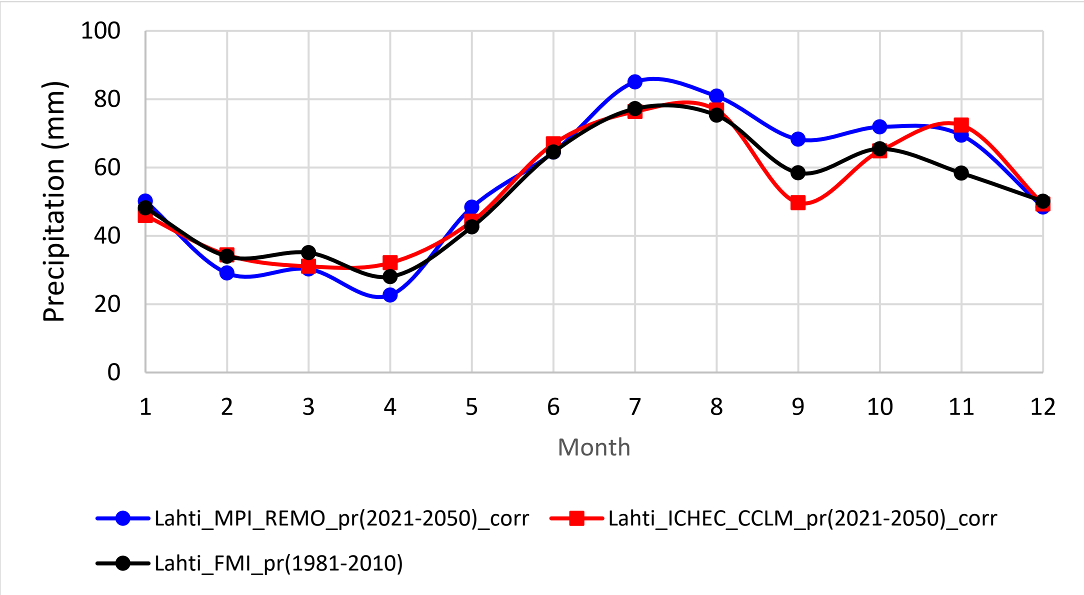

Figure 16: Absolute monthly mean precipitation in Lahti between 1981-2010 and 2021-2050 according to REMO2009 and CCLM under RCP8.5.

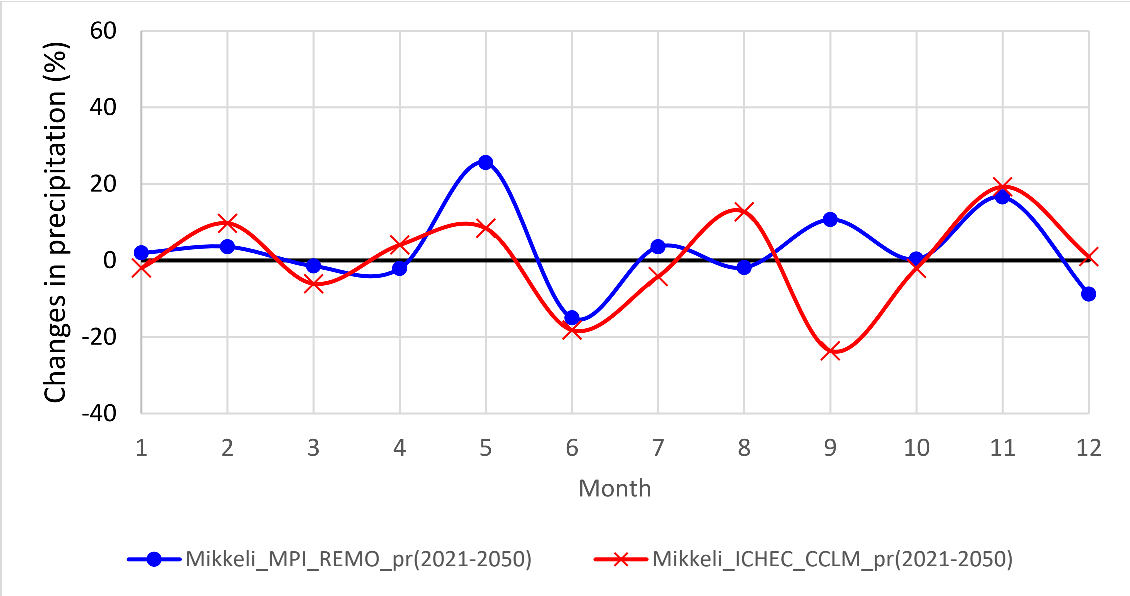

Figure 17: Change of monthly mean precipitation in Mikkeli between 1981-2010 and 2021-2050 according to REMO2009 and CCLM under RCP8.5.

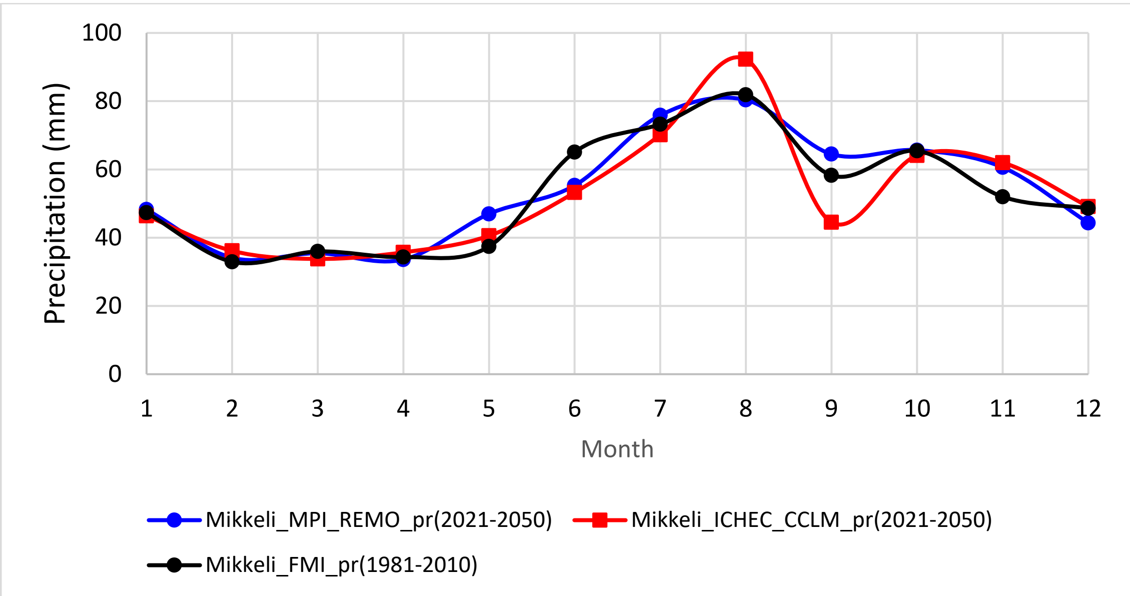

Figure 18: Absolute monthly mean precipitation in Mikkeli between 1981-2010 and 2021-2050 according to REMO2009 and CCLM under RCP8.5

The following graphs (Figure 19 to Figure 22) show the change in precipitation between 1981-2010 and 2071-2100 and absolute monthly mean precipitation for the period 2071-2100 according to the results of REMO2009 and CCLM under RCP8.5.

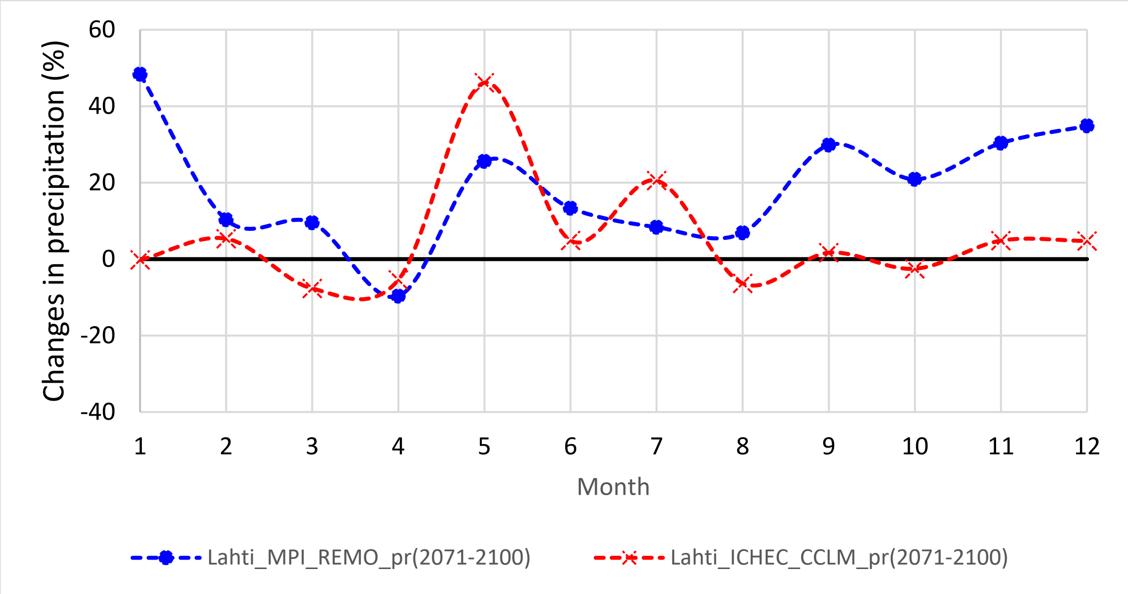

Figure 19: Change of monthly mean precipitation in Lahti between 1981-2010 and 2071-2100 according to REMO2009 and CCLM under RCP8.5.

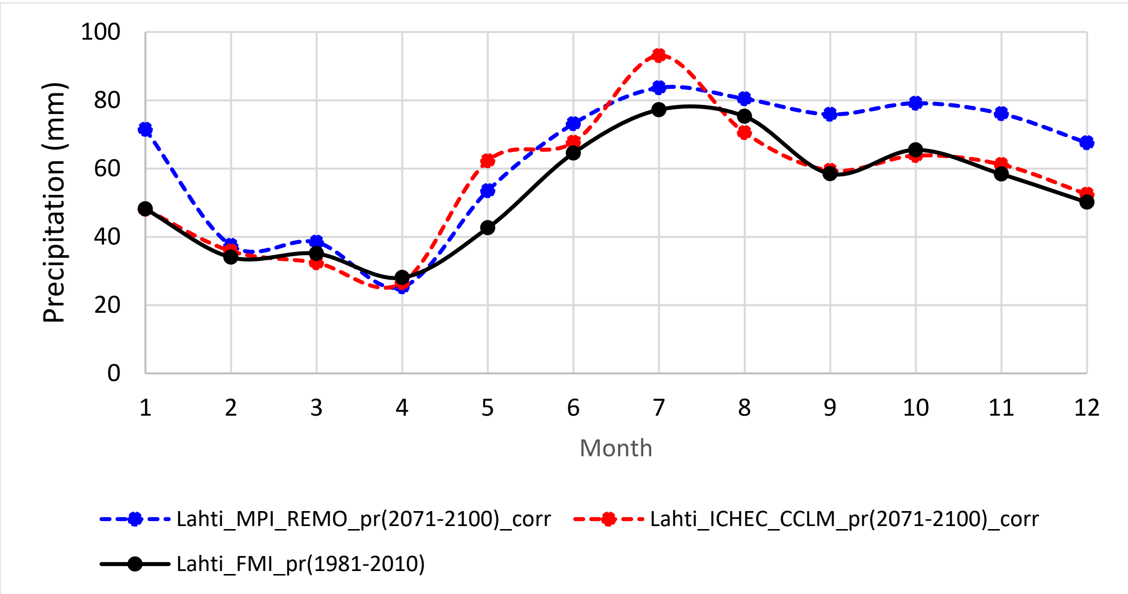

Figure 20: Absolute monthly mean precipitation in Lahti between 1981-2010 and 2071-2100 according to REMO2009 and CCLM under RCP8.5.

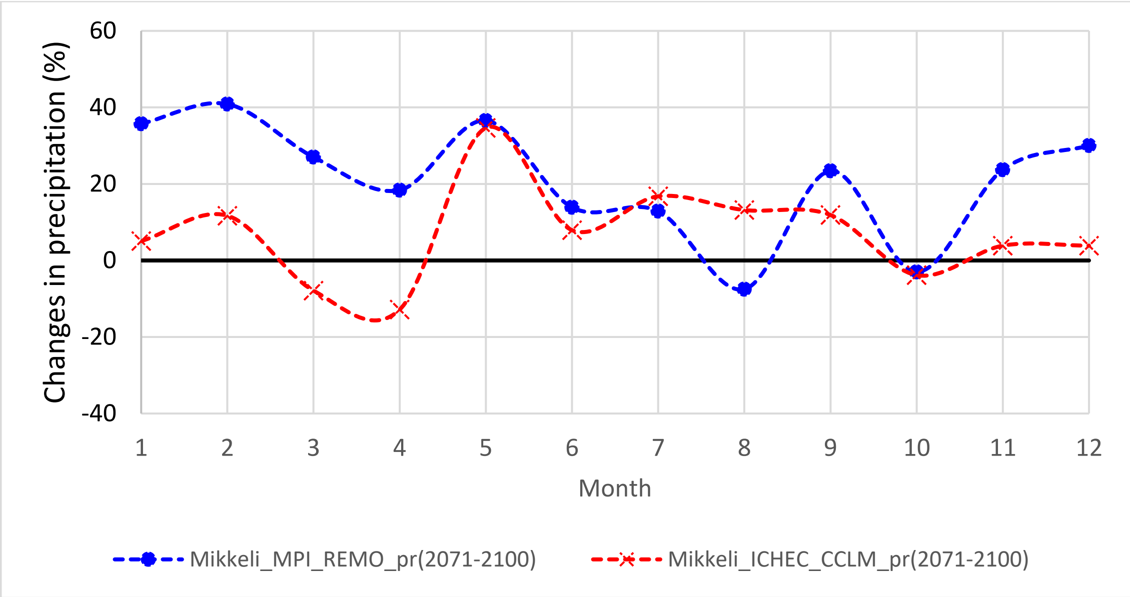

Figure 21: Change of monthly mean precipitation in Mikkeli between 1981-2010 and 2071-2100 according to REMO2009 and CCLM under RCP8.5.

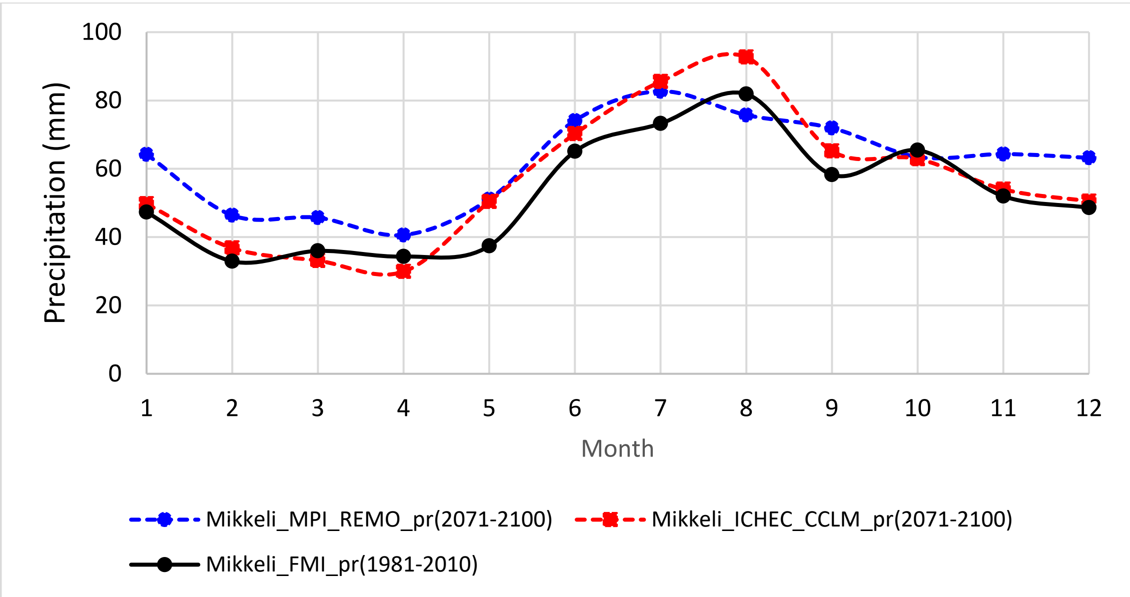

Figure 22: Absolute monthly mean precipitation in Mikkeli between 1981-2010 and 2071-2100 according to REMO2009 and CCLM under RCP8.5

6 DISCUSSION

Keeping in mind the limitations of the data (see Sections 3 and 4), we can draw some conclusions. Both models show an increase in temperature for both assessed periods (2021-2050 and 2071-2100). The increase in temperature in the near future (2021-2050) ranges roughly between 1 and 2.5 °C and between 1.5 and 5.5 °C for the period 2071-2100. The smallest increase in in summer and the largest increase is in winter time. The magnitude and pattern of change is in line with the results of many other RCMs, although the results of larger ensembles of RCMs cover a larger temperature range.

The models provide a less clear picture for changes in precipitation patterns. Generally, both models show for both time periods and both locations (Lahti and Mikkeli) an increase in yearly precipitation. REMO2009 projects a clear increase in precipitation in winter and a small increase in summer for Lahti and Mikkeli. This is within the range of other findings about future climate change in Finland (Ruosteenoja et al. 2016). The projected precipitation patterns according to CCLM are not well in line with the results of other models (Ruosteenoja et al. 2016). The discrepancy between CCLM and other models indicates the range of uncertainty of model results, but caution is advised when using the CCLM precipitation data.

7 HOW TO USE THE DATA

The data presented in this report show current and projected monthly average temperature and precipitation in Mikkeli and Lahti. The values are based on climatic 30-year averages. This type of presentation gives a quick overview over potential future climates, but it has also several limitations.

The values do not include information about the natural variation of everyday weather. This means that temperature and precipitation for individual months in individual years can be dramatically different from the presented values. In addition, the presented values provide no information about extreme events, which might last only from minutes (torrential rain) to days (extreme high or low temperature). Information about the development of extreme events would need other more specific assessments of the available data, which are out of the scope of this report.

The report includes only two future scenarios based on two RCMs and a high Representative Concentration Pathway (RCP8.5). This means that the presented future scenarios present only a small part of the range of potential climate developments. These two scenarios can be only indicative of the direction and magnitude of change. Also, the scenarios do not include the consequences of a possible faltering of the Atlantic Meridional Overturning Circulation (Gulf Stream). A faltering is not considered probable within the next 100 years, but it would result in considerably lower temperature than indicated by the chosen scenarios (Liu et al. 2017; Castellana et al. 2019). As a consequence, any decision or design should not be based on individual values. Sound climate change adaptation has to be always robust and flexible enough to account for a wide range of different future developments.

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ANNEX 1

List of RCMs presented in Figure 1

Data Evaluation for Climate Models (DECM)

N	Experiment	GCM	gcm_rip	RCM	URL
1	RCP8.5	CNRM-CERFACS-CNRM-CM5	r1i1p1	ALADIN53	http://climexp.knmi.nl/CORDEX/EUR-44/mon/pr/pr_EUR-44_cordex_rcp85_mon_000.nc
2	RCP8.5	ICHEC-EC-EARTH	r3i1p1	DMI-HIRHAM5	http://climexp.knmi.nl/CORDEX/EUR-44/mon/pr/pr_EUR-44_cordex_rcp85_mon_001.nc
3	RCP8.5	ICHEC-EC-EARTH	r1i1p1	KNMI-RACMO22E	http://climexp.knmi.nl/CORDEX/EUR-44/mon/pr/pr_EUR-44_cordex_rcp85_mon_004.nc
4	RCP8.5	MOHC-HadGEM2-ES	r1i1p1	KNMI-RACMO22E	http://climexp.knmi.nl/CORDEX/EUR-44/mon/pr/pr_EUR-44_cordex_rcp85_mon_005.nc
5	RCP8.5	MPI-M-MPI-ESM-LR	r1i1p1	MPI-CSC-REMO2009	http://climexp.knmi.nl/CORDEX/EUR-44/mon/pr/pr_EUR-44_cordex_rcp85_mon_006.nc
6	RCP8.5	MPI-M-MPI-ESM-LR	r2i1p1	MPI-CSC-REMO2009	http://climexp.knmi.nl/CORDEX/EUR-44/mon/pr/pr_EUR-44_cordex_rcp85_mon_007.nc
7	RCP8.5	CCCma-CanESM2	r1i1p1	SMHI-RCA4	http://climexp.knmi.nl/CORDEX/EUR-44/mon/pr/pr_EUR-44_cordex_rcp85_mon_008.nc
8	RCP8.5	CNRM-CERFACS-CNRM-CM5	r1i1p1	SMHI-RCA4	http://climexp.knmi.nl/CORDEX/EUR-44/mon/pr/pr_EUR-44_cordex_rcp85_mon_009.nc
9	RCP8.5	CSIRO-QCCCE-CSIRO-Mk3-6-0	r1i1p1	SMHI-RCA4	http://climexp.knmi.nl/CORDEX/EUR-44/mon/pr/pr_EUR-44_cordex_rcp85_mon_010.nc
10	RCP8.5	ICHEC-EC-EARTH	r12i1p1	SMHI-RCA4	http://climexp.knmi.nl/CORDEX/EUR-44/mon/pr/pr_EUR-44_cordex_rcp85_mon_011.nc
11	RCP8.5	IPSL-IPSL-CM5A-MR	r1i1p1	SMHI-RCA4	http://climexp.knmi.nl/CORDEX/EUR-44/mon/pr/pr_EUR-44_cordex_rcp85_mon_012.nc
12	RCP8.5	MIROC-MIROC5	r1i1p1	SMHI-RCA4	http://climexp.knmi.nl/CORDEX/EUR-44/mon/pr/pr_EUR-44_cordex_rcp85_mon_013.nc
13	RCP8.5	MOHC-HadGEM2-ES	r1i1p1	SMHI-RCA4	http://climexp.knmi.nl/CORDEX/EUR-44/mon/pr/pr_EUR-44_cordex_rcp85_mon_014.nc

ANNEX 2

Lists of climate models for Lahti and Mikkeli

Ensenble (Scenario)	Institute and global model (GCM)	Institute	Global model (GCM)	Regional model (RCM)	Run	Variable	Period
CORDEX EUR-11, historic & RCP8.5	ICHEC-EC-EARTH	ICHEC	EC-EARTH	CLMcom-CCLM4-8-17	r12i1p1	pr, tas	1981-2100
CORDEX EUR-11, historic & RCP8.5	MPI-M-MPI-ESM-LR	MPI-M	MPI-ESM-LR	CLMcom-CCLM4-8-17	r1i1p1	pr, tas	1981-2100
CORDEX EUR-11, historic & RCP8.5	CNRM-CERFACS-CNRM-CM5	CNRM	CNRM-CM5	CLMcom-CCLM4-8-17	r1i1p1	pr, tas	1981-2100
CORDEX EUR-11, historic & RCP8.5	MPI-M-MPI-ESM-LR	MPI-M	MPI-ESM-LR	MPI-CSC-REMO2009	r1i1p1	pr, tas	1981-2100

COREDX - EUR11 model simulations and modeling groups:

CLMcom - CLM Community

ICHEC - Irish Centre for High-End Computing

MPI - Max Planck Institute for Meteorology

CNRM - French National Centre for Meteorological Research

ANNEX 3

Root Mean Square Error (RMSE) of Model Results compared to recorded data in Mikkeli and Lahti for the period 1981-2010

Model data	Location	Parameter	RMSE
pr_EUR-11_CNRM-CERFACS-CNRM-CM5_historical_r1i1p1_CLMcom-CCLM4-8-17_v1	Lahti	Precipitation	21,78
pr_EUR-11_ICHEC-EC-EARTH_historical_r12i1p1_CLMcom-CCLM4-8-17_v1	Lahti	Precipitation	10,75
pr_EUR-11_MPI-M-MPI-ESM-LR_historical_r1i1p1_CLMcom-CCLM4-8-17_v1	Lahti	Precipitation	12,27
pr_EUR-11_MPI-M-MPI-ESM-LR_historical_r1i1p1_MPI-CSC-REMO2009_v1	Lahti	Precipitation	11,74
pr_EUR-11_CNRM-CERFACS-CNRM-CM5_historical_r1i1p1_CLMcom-CCLM4-8-17_v1	Mikkeli	Precipitation	19,59
pr_EUR-11_ICHEC-EC-EARTH_historical_r12i1p1_CLMcom-CCLM4-8-17_v1	Mikkeli	Precipitation	10,34

pr_EUR-11_MPI-M-MPI-ESM-LR_historical_r1i1p1_CLMcom-CCLM4-8-17_v1	Mikkeli	Precipitation	11,70
pr_EUR-11_MPI-M-MPI-ESM-LR_historical_r1i1p1_MPI-CSC-REMO2009_v1	Mikkeli	Precipitation	11,40
tas_EUR-11_CNRM-CERFACS-CNRM-CM5_historical_r1i1p1_CLMcom-CCLM4-8-17_v1	Lahti	Temperature	2,35
tas_EUR-11_ICHEC-EC-EARTH_historical_r12i1p1_CLMcom-CCLM4-8-17_v1	Lahti	Temperature	1,33
tas_EUR-11_MPI-M-MPI-ESM-LR_historical_r1i1p1_CLMcom-CCLM4-8-17_v1	Lahti	Temperature	1,20
tas_EUR-11_MPI-M-MPI-ESM-LR_historical_r1i1p1_MPI-CSC-REMO2009_v1	Lahti	Temperature	1,44
tas_EUR-11_CNRM-CERFACS-CNRM-CM5_historical_r1i1p1_CLMcom-CCLM4-8-17_v1	Mikkeli	Temperature	2,03
tas_EUR-11_ICHEC-EC-EARTH_historical_r12i1p1_CLMcom-CCLM4-8-17_v1	Mikkeli	Temperature	1,19
tas_EUR-11_MPI-M-MPI-ESM-LR_historical_r1i1p1_CLMcom-CCLM4-8-17_v1	Mikkeli	Temperature	1,01
tas_EUR-11_MPI-M-MPI-ESM-LR_historical_r1i1p1_MPI-CSC-REMO2009_v1	Mikkeli	Temperature	2,00