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EU Life+ MONIMET
LIFE12 ENV/FI/000409

Retrieving climate change indicators from model results

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LUONNONVARAKESKUS



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Climate change indicators

Future climatic drivers propagated through impact models

Our impact model: JSBACH a land surface model of MPI-ESM

Our drivers: Selection of CMIP5 models

- In CMIP5 the development GHGs and LUCG are prescribed as optional representative concentration pathways (RCPs)
- There are altogether four RCPs; RCP2.6, **RCP4.5**, RCP6.0 and **RCP8.5**, ordered by increasing severity of the climate impact
- Altogether 28 models participated CMIP5



CMIP5 Model	Institute(s), Countr(y)ies	Scenarios	Time-span
BCC-CSM1	Beijing Climate Center, China Meteorological Administration, China	RCP 4.5 r1 RCP 8.5 r1	1980-2099
CanESM2	Canadian Centre for Climate Modelling and Analysis, Canada	RCP 4.5 r1 RCP 8.5 r1	1980-2099
CNRM-CM5	National Centre for Meteorological Research, Météo France and CERFACS, FRANCE	RCP 4.5 r1 RCP 8.5 r1	1980-2099
GFDL-CM3	Geophysical Fluid Dynamics Laboratory, NOAA, USA	RCP 4.5 r3 RCP 8.5 r1	1980-2099
HadGE M2-ES	Met Office, UK	RCP 4.5 r1 RCP 8.5 r1	1980-2099
MIROC5	Atmosphere and Ocean Research Institute (The University of Tokyo), National Institute for Environmental Studies, and Japan Agency for Marine-Earth Science and Technology, Japan	RCP 4.5 r2 RCP 8.5 r2	1980-2099
MPI-ESM	Max Planck Institute for Meteorology, Germany	RCP 4.5 r1 RCP 8.5 r1	1980-2099



Selected scenario data

The above are

- downscaled ($0.1^{\circ} \times 0.2^{\circ}$ lat-lon)
- biascorrected for Finland in daily resolution

The selected models

- reproduce the current climate well
- are a bit warmer than the average CMIP5





MONIMET target indicators

vegetation active season (VAP, days)

carbon uptake rate (gross primary production, GPP, g(C)/m²/a)

forest and soil respiration rates (g/m²/a)

wetland methane emission rates (mol(CH₄)/m²/a)

vegetation and soil evaporation rates (ET) (mol/m²/a)

soil moisture (soil moisture index, SMI, %)

soil frost period (days)

snow cover (depth, extent, %)

surface albedo (extremes, %)

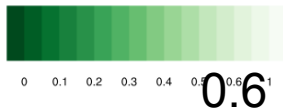
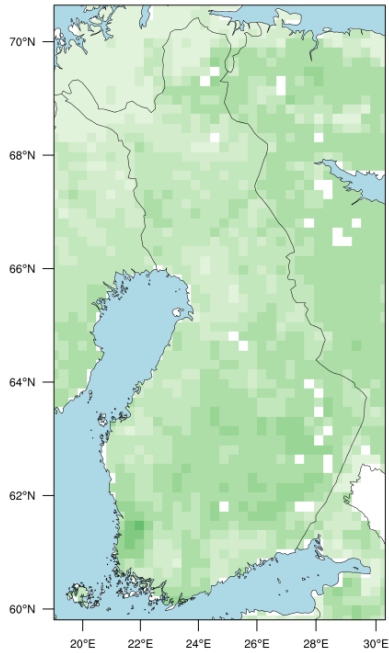




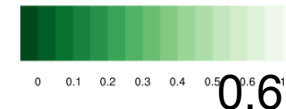
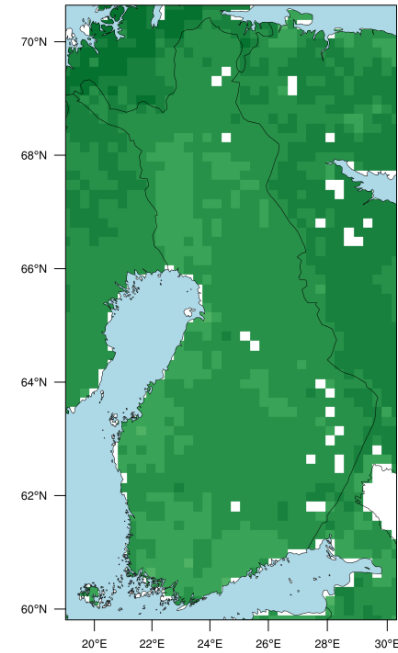
Albedo

A high yearly variability → lowest and highest values

Feb



Jul

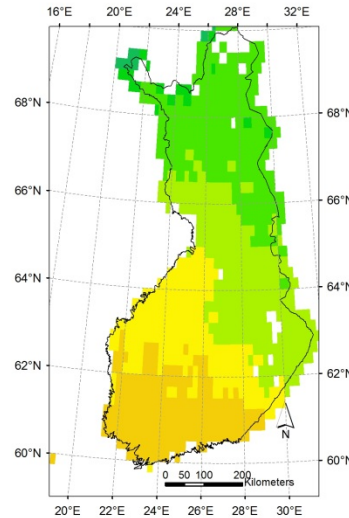




VAP

Beginning of growing season for coniferous as in Bötcher et al. 2014

Start of season (day of year)



End of growing season similarly?



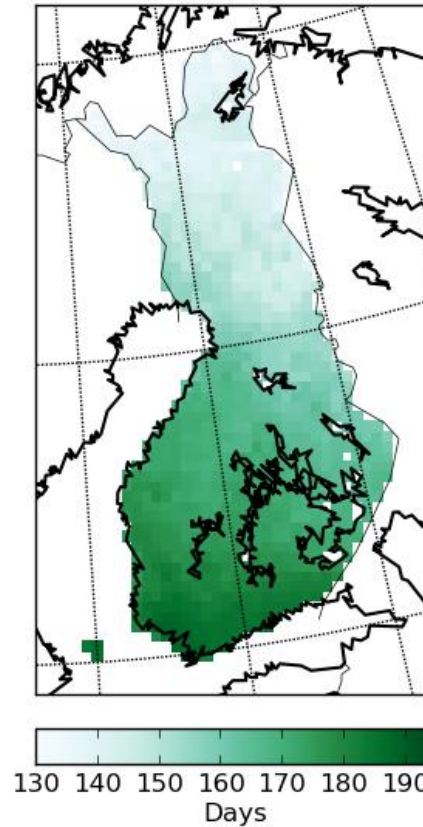


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VAP

Continuous period with GPP 15% of growing season maximum

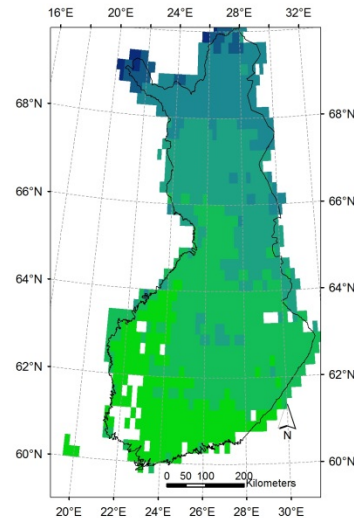




VAP

Beginning of growing season for deciduous as bud burst

Start of season (day of year)

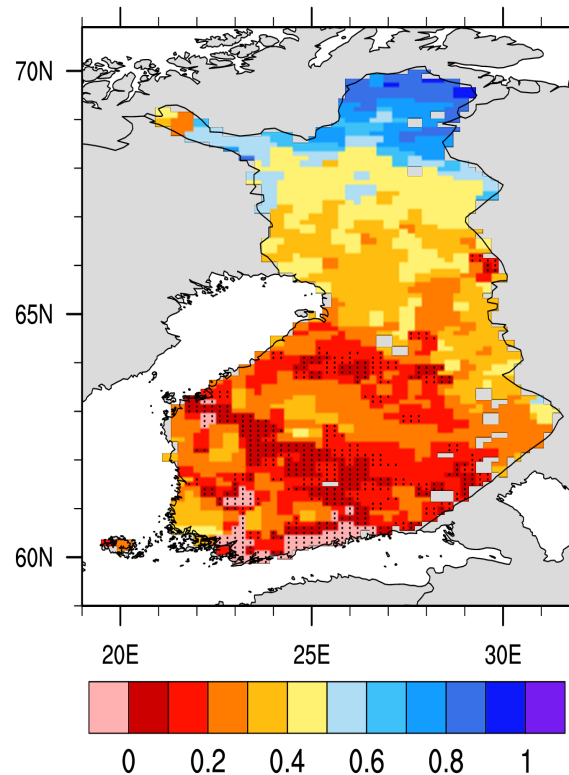


End of growing season?



Soil moisture index, $SMI = (\theta - \theta_{WILT}) / (\theta_{FC} - \theta_{WILT})$

Seasonal averages? Low extreme for vulnerability?

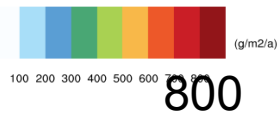
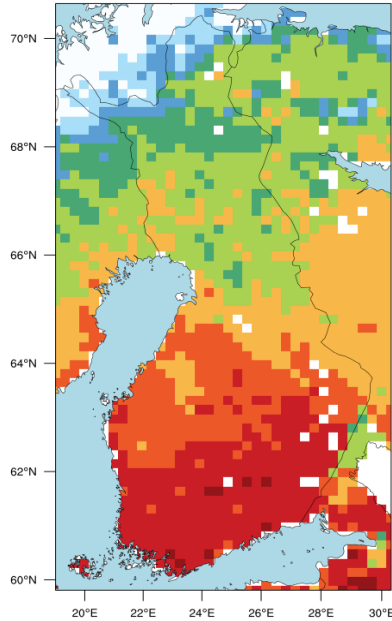


The driest period of 2006

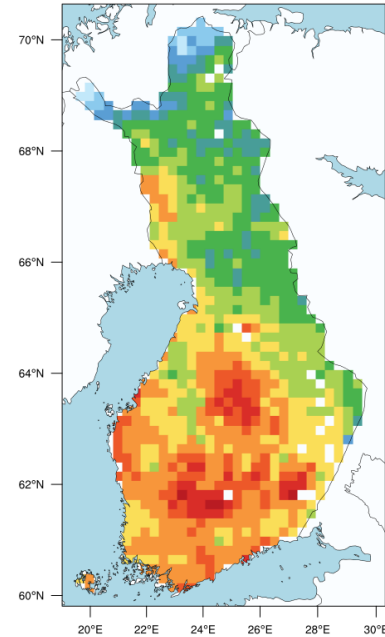


Mean GPP and its trend through 1980-2011

Average GPP
(g/m²/a)



GPP trend





Concluding remarks

Our modeling tools can provide the selected MONIMET climate change indicators

The trends of the indicators will be produced with CMIP5 scenarios

The target statistics are either yearly sums or yearly extremes

For certain variables both lower and upper extremes have to be extracted

