

Do high and low climate sensitivity GCMs show differences in projected precipitation changes in Finland?

In this study, 13 bias corrected GCMs are divided into groups of high and low climate sensitivity and both groups' projected precipitation changes are studied separately. It is shown that yearly precipitation increases much more with high climate sensitivity models.

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Global climate models (GCMs) from the Coupled Model Intercomparison Phase 5 (CMIP5; van Vuuren et al., 2011) can be grouped by their sensitivity to feedback mechanisms such as water vapour and clouds; they are accordingly categorized into high climate sensitivity (HS) and low climate sensitivity (LS) models. Higher sensitivity to feedback mechanisms results in more pronounced changes in temperature and precipitation in the future climate (Mauritzen et al., 2017). Sherwood et al. (2014) found that HS models are more consistent with observations than LS models.

This study uses simulation results of precipitation from 13 GCMs under the RCP8.5 scenario (Riahi et al., 2011). There are five HS models: CanESM2, GFDL-CM3, IPSL-CM5A-MR, MIROC-ESM, MRI-CGCM3, and eight LS models: MIROC5, CCSM4, MPI-ESM-MR, CNRM-CM5, EC-EARTH, BCC-CSM1-1, NorESM1-M and GFDL-ESM2M. GCMs were downscaled following method 8 (M8), empirical quantile mapping bias correction method (Räty et al., 2014), conducted separately for each calendar month in 1981–2010 (baseline period) and 2071–2100 (projection period). Observed

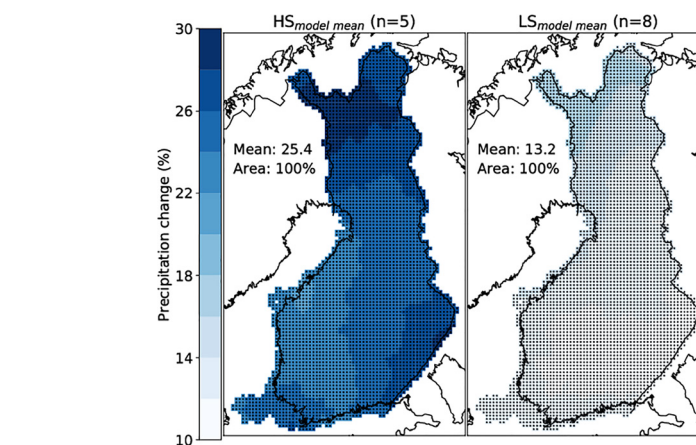


FIG 1: Mean annual precipitation change from 1981–2010 to 2071–2100. Grid points with significant change according to Wilcoxon signed-rank test at 5% level are marked with black dot.

precipitation data for downscaling was provided in a 10 km x 10 km grid resulting from a kriging-interpolation procedure (Aalto et al., 2016).

There is a clear difference between HS and LS models in the magnitude of precipitation change from 1981–2010 to 2070–2100 (Fig. 1). HS models show an average relative change of +25% ranging from about +20% to +30%, while LS models reveal an average increase of only 13% ranging from 10% to 18%. Changes are statistically significant in all of Finland for both HS and LS.

This study shows that climate sensitivity differences in GCMs have a large effect on the magnitude of projected precipitation changes in Finland. For some impact studies it might be useful to treat HS and LS models separately as Mauritzen et al. (2017) proposes.

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