Summertime Precipitation in Finland under Recent and Projected climate

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Motivation and objective

- In northern Europe, precipitation amounts are expected to increase with increasing temperatures in the projected future climate.

- The largest fractional increase in precipitation is expected to take place in winter, whereas the increase is more modest in summertime.

- Changes in summertime precipitation during the last 100 years were analyzed based on high-resolution observed data set
  - Comparison of three different data sets

- Future precipitation projections until 2100 were studied based on an ensemble of 13 RCM’s.
Study area

- Two study areas sized 100 x 100 km located in north-eastern (NE) and south-western (SW) part of Finland
- Climatologically different zones:
  - **NE:**
    - between middle- and north-boreal zones
    - continental climate
  - **SW:**
    - between hemi- and south-boreal zones
    - maritime influence
- Past and future monthly precipitation sums in May-September
Data and Methods

3 observational data sets

**FMI grid**
- Longest and highest-resolution data set
- Observed monthly precipitation
- 1908-2008
- 10 x 10 km grid size

**E-OBS 2.0 (Haylock et al.)**
- Monthly values calculated from daily values
- 1961-2000
- 0.25 degree grid

**CRU TS2.1 (Mitchell and Jones)**
- Global monthly data
- 1961-2000
- 0.5 degree grid
Data and Methods

13 regional climate model (RCM) simulations

- provided by the EU FP6 ENSEMBLES project
- SRES emissions scenario A1B
- 0.25 degrees resolution
- 1961-2100

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• Comparison of **monthly precipitation sums** in **1961-2000** between different data sets and the multi-model mean (MMM)

• Differences between the observed data sets are smaller in SW than in NE

• MMM overestimates precipitation, but is closer to observations in SW than NE → Better observational coverage in SW
- Precipitation trends (mm / 10 yr) in *1961-2000* according to **observations** and **model simulations** (MMM)

- Including the range of simulations (whiskers in the plot)
  - Range is very large because of the climate’s internal variability
  - In every case, the observed trend does not even fit the simulation range
• Long-term precipitation trends (mm / 10 yr) in the
  • **PAST** as observed **1908-2008** and
  • **FUTURE** as multi-model-mean (MMM) **1961-2100**
• Future MMM trends are all increasing
  • MMM is not “a realization of the real-world” but heavily smoothed
Large variation between model simulations = climate’s internal variability

Increase in summertime precipitation by the end of the 21st century
Relative increase largest in **May**

**NE:** Absolute increase largest in **May-June** → the difference between the driest and wettest summer months will decrease

**SW:** Absolute increase largest in **July** → increasing the inter-monhtly differences in precipitation

Smallest increase in August in both areas
Conclusions

• Most of the past precipitation trends are statistically not significant
  • During the last decades precipitation has increased in early summer (May-July) and decreased in late summer (August-September)

• Model projections for the future indicate increase in precipitation by 2100
  • In SW, increasing the difference between the wettest and driest summer months
  • In NE, vice versa
  • Very large range within the simulations

• Larger number of observation stations in the study area leads to
  • better compatibility between different observational data sets
  • smaller bias in the model simulations
References
