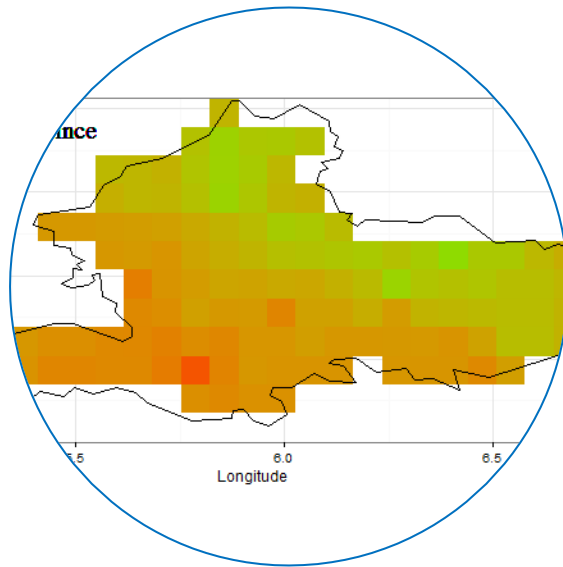


Bayesian Area-to-point Kriging using Expert Knowledge as Informative Priors

Phuong N. Truong and Gerard Heuvelink

EGU General Assembly 2013, Vienna, Austria, 11 April 2013



Outline

- Introduction
- Methods
- Results
- Summary

Introduction

- Downscaling or spatial disaggregation – increasing spatial resolution
- Spatial disaggregation with Area-to-point kriging
 - For continuously distributed variables
 - Follow classical kriging principle
 - Satisfy conservation of mass (coherence)
 - Quantify uncertainty by ATP kriging variance
 - Point support variogram has to be known

Matters of concern in ATP Kriging

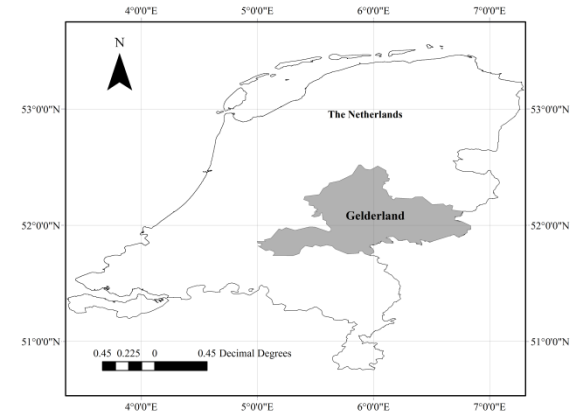
- Estimation of point support variogram from block support data
- Uncertainty quantification for point support variogram estimation from block support data
- Uncertainty quantification for ATP predictions
- Inference of point support nugget variance

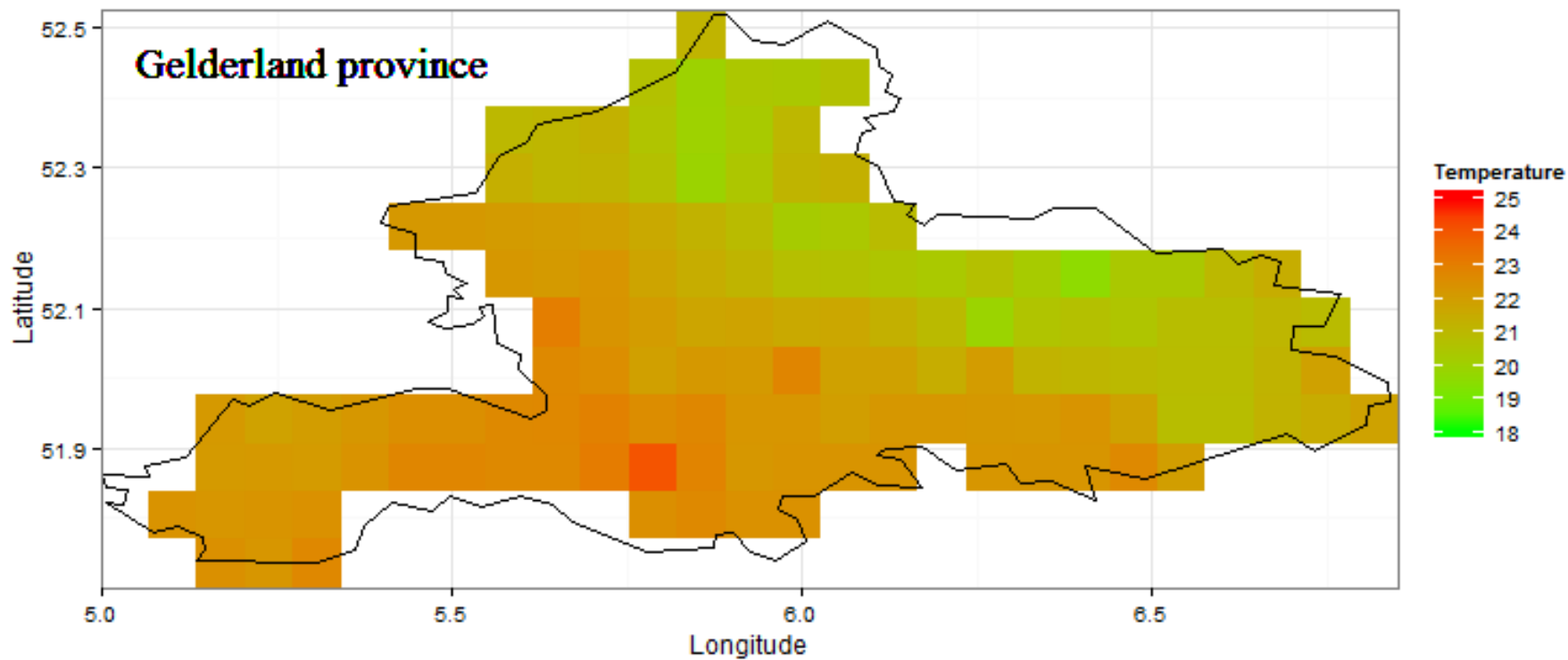
Subjective Bayesian ATP conditional simulation

- Use expert knowledge as informative prior
- Combine prior with block support observations using Bayesian updating (Markov chain Monte Carlo)
- Resolve the problem of nugget parameter estimation
- Quantify uncertainty about point support variogram parameters by means of probability distribution
- Quantify uncertainty about ATP predictions, includes point support variogram uncertainty

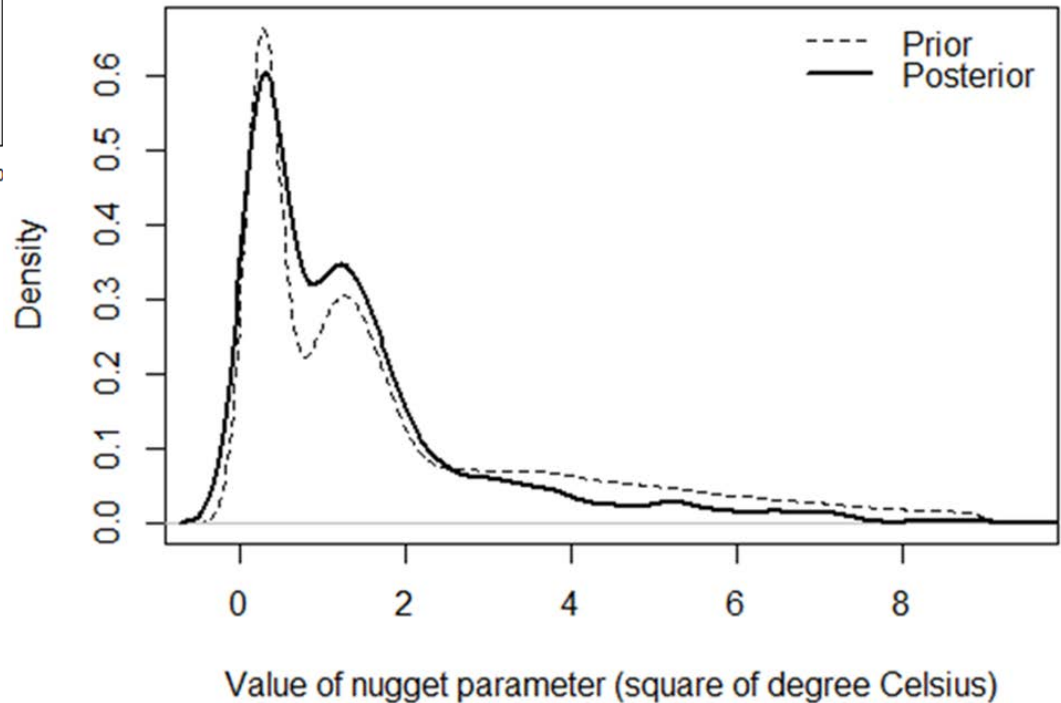
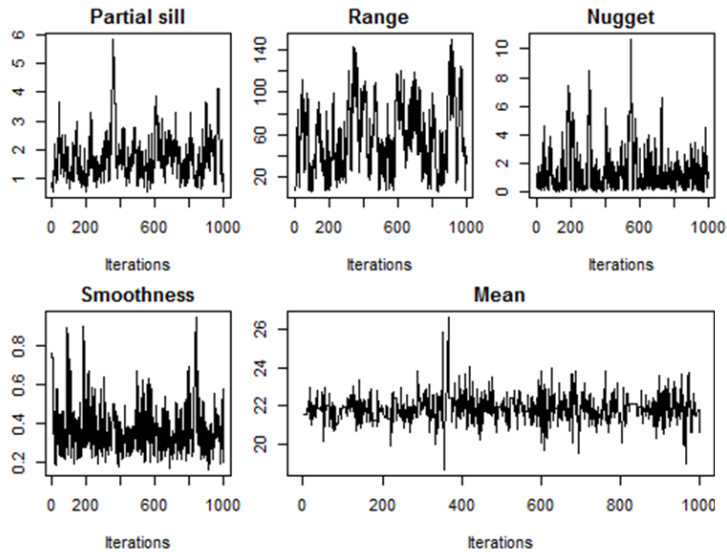
Example

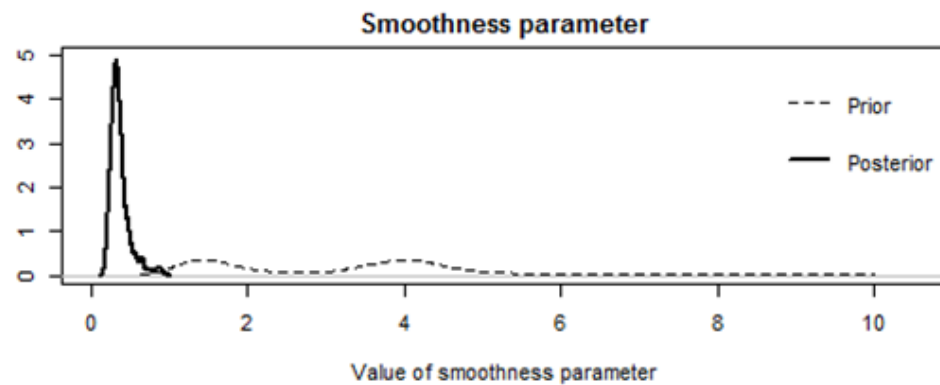
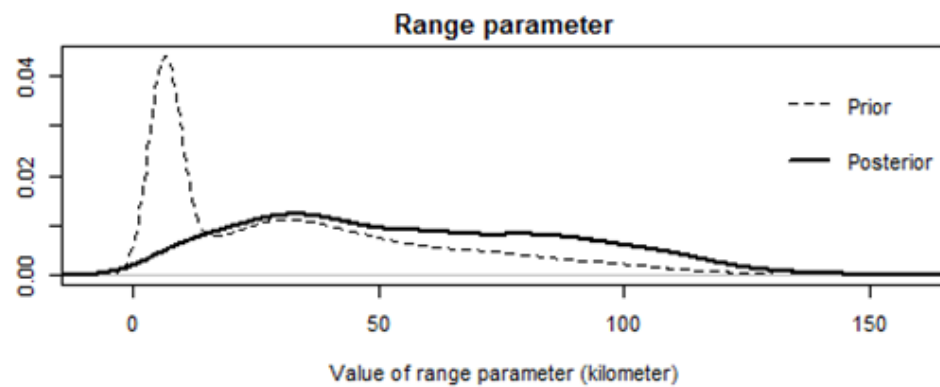
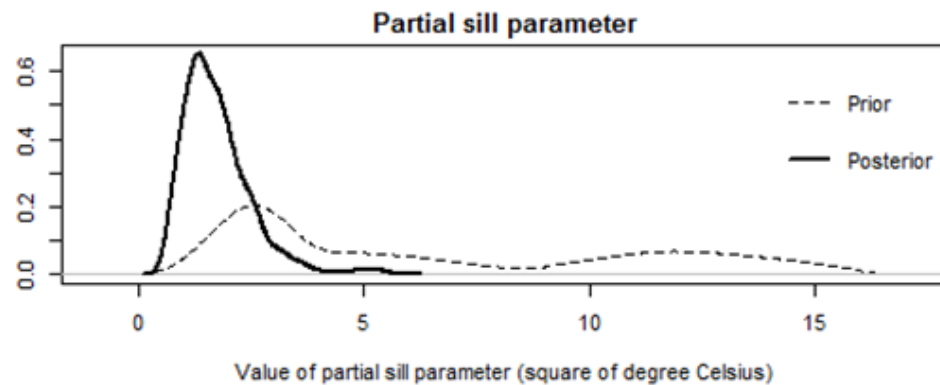
- Study area: Gelderland, NL
- Dataset: MODIS atmospheric temperature profile (MOD07_L2), 5 km resolution
- Assumptions:
 - Intrinsic, isotropic stationary Gaussian process
 - Linear average value at block support

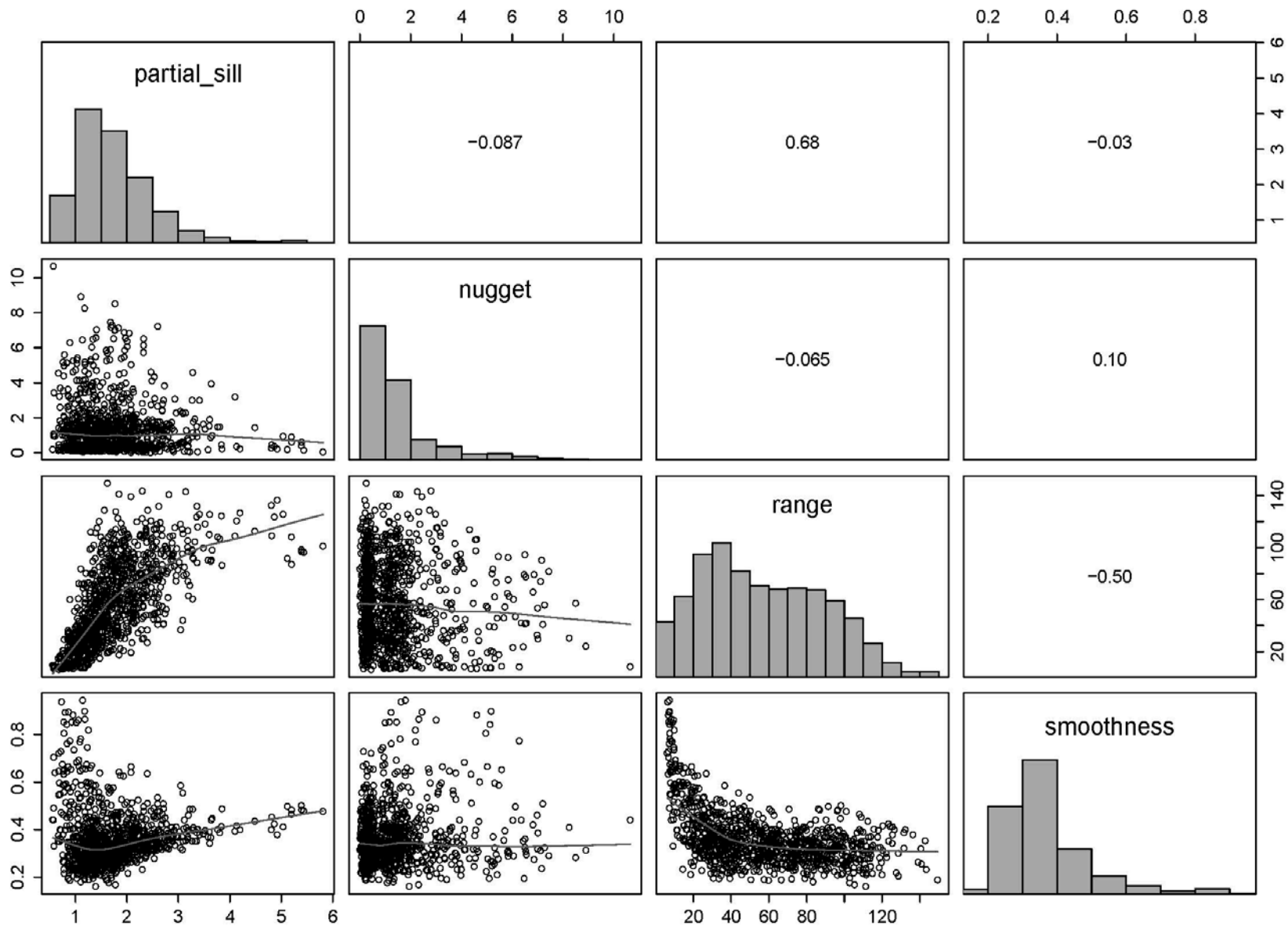




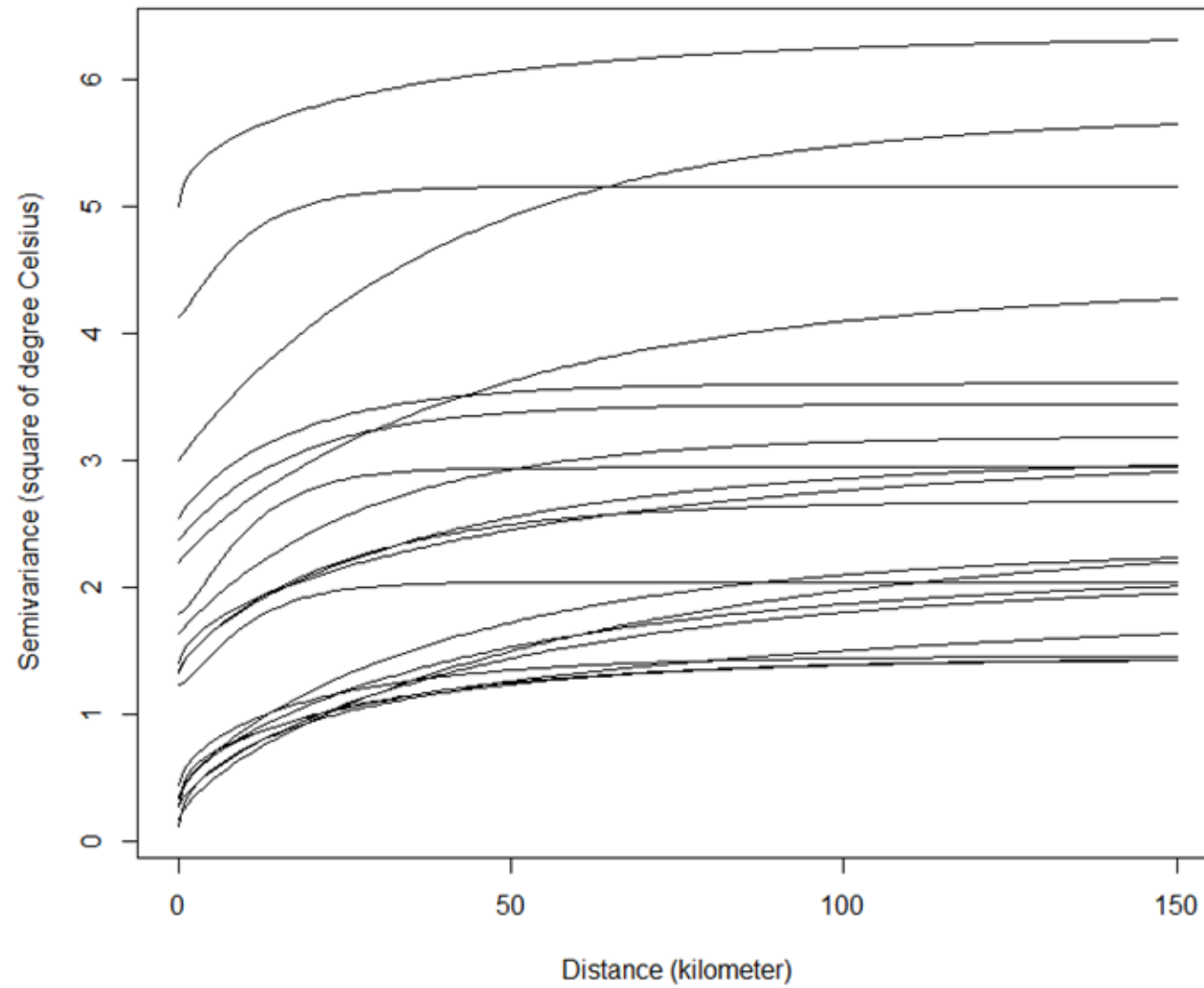
Results – MCMC runs



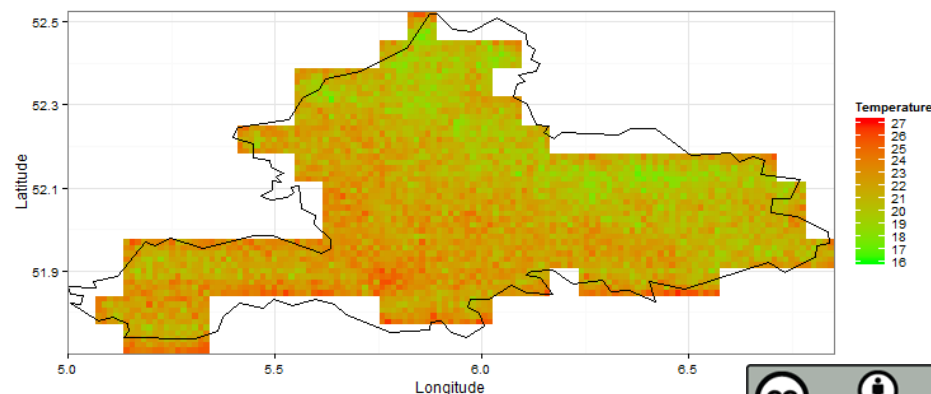
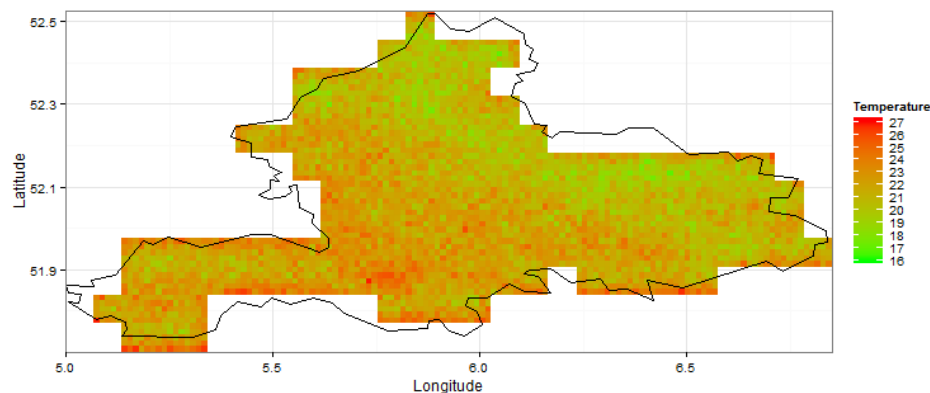
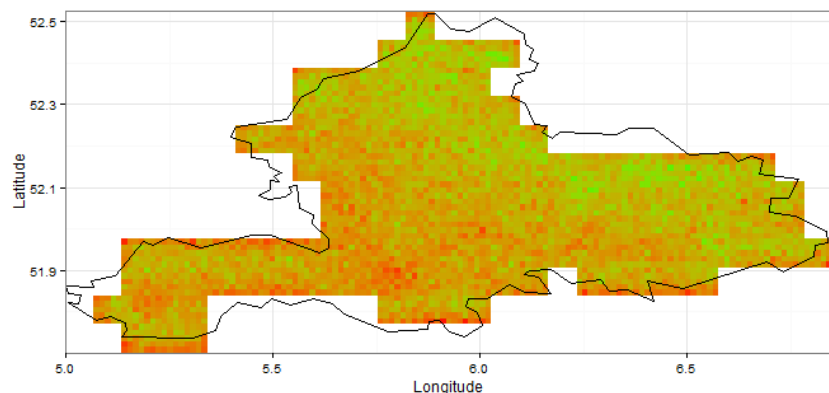




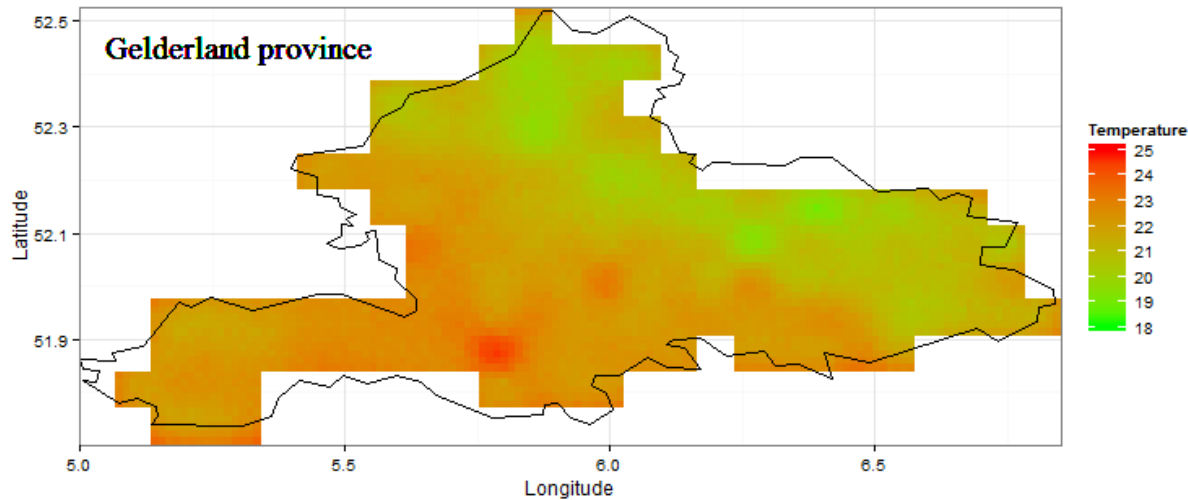
Posterior point-support variograms



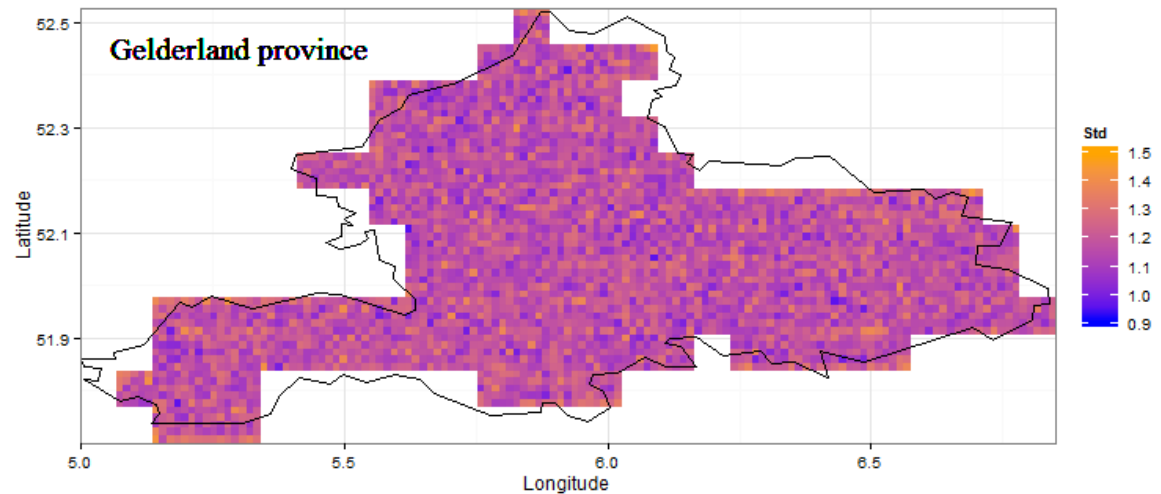
ATP conditional simulations on 1x1 km grid



Maps of mean and standard deviation



Mean



Standard deviation

Summary

- Bayesian ATP conditional simulation approach supports uncertainty quantification for ATP prediction
- Use expert knowledge as informative priors
- Solve the problem of unknown point support variogram

Thank you for your attention!

