

Downscaling climate projections to 1 km with single-image super resolution

Petr Košťál, Pavel Kordík, Ondřej Podsztavek (ondrej.podsztavek@fit.cvut.cz)



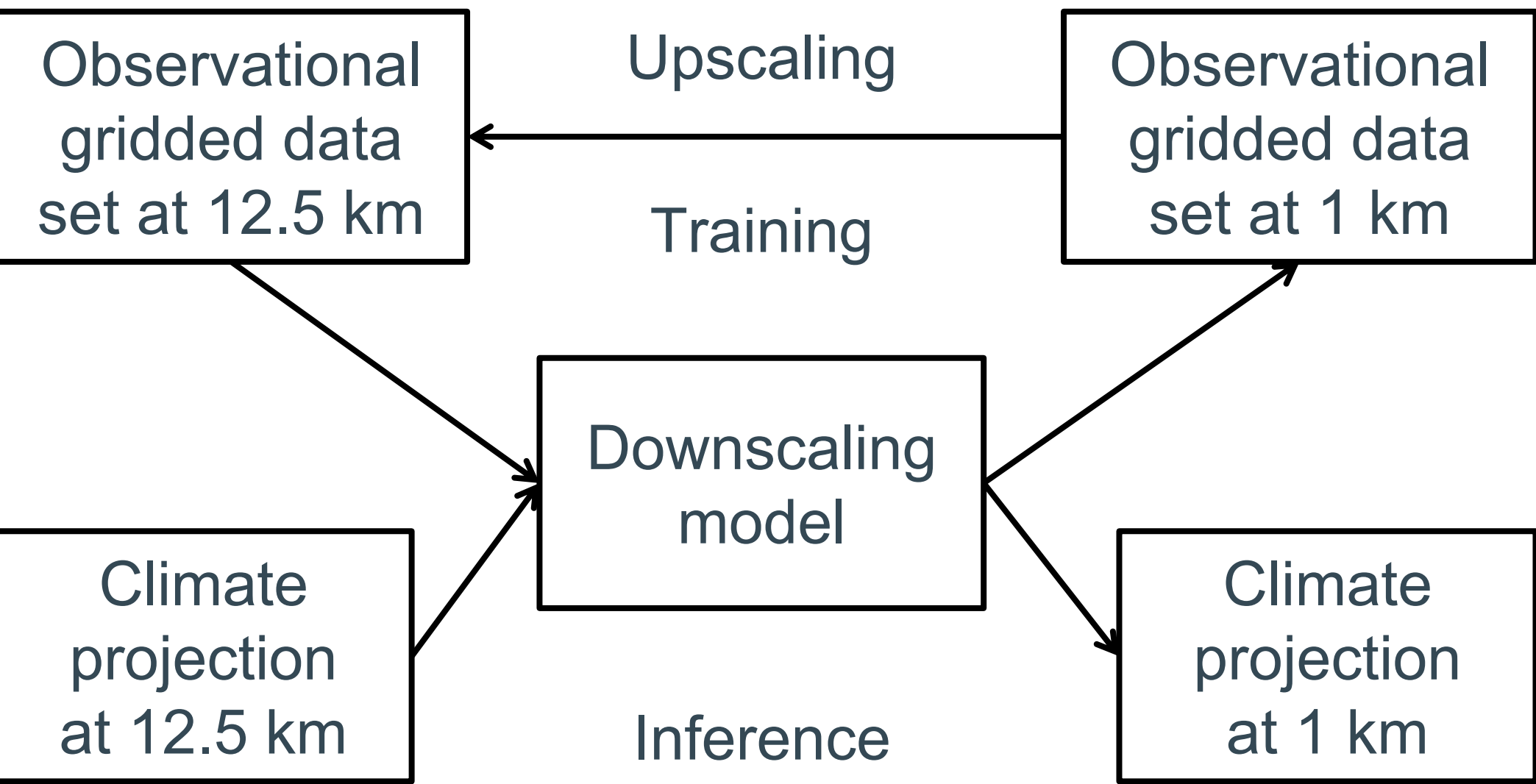
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1. Problem

- High-resolution climate projections are essential for local decision-making (e.g. assessment of urban heat islands or flood risks).

2. Single-image super resolution using observational gridded data sets

- We leverage **single-image super-resolution** models to **downscale** climate projections from 12.5 km to **1-km resolution**.
- Since we do not have high-resolution climate projections, we train models on a high-resolution **observational gridded data set**.



3. Evaluation of downscaled climate projections with climate indicators

- We evaluate **climate indicators computed at weather station locations** because we lack ground-truth high-resolution climate projections.

4. Results

Root-mean-square error (RMSE) of climate indicators on the test period (2003–2012)

Method	Annual mean of daily mean temperature (K)	Annual growing degree days (K days)	Annual cooling degree days (K days)	Annual heating degree days (K days)
Low-resolution climate model	0.88	258.58	31.30	261.00
Baseline bilinear Interpolation	0.88	256.77	30.23	265.38
Baseline bicubic interpolation	0.87	253.69	30.34	260.30
Enhanced deep super-resolution network	0.78	241.56	30.84	233.54
Fourier neural operator	0.82	250.92	30.80	243.84
Transformer-based image-restoration model SwinIR	0.77	241.30	31.02	227.90

