Precipitation regridding – Impacts at global scale

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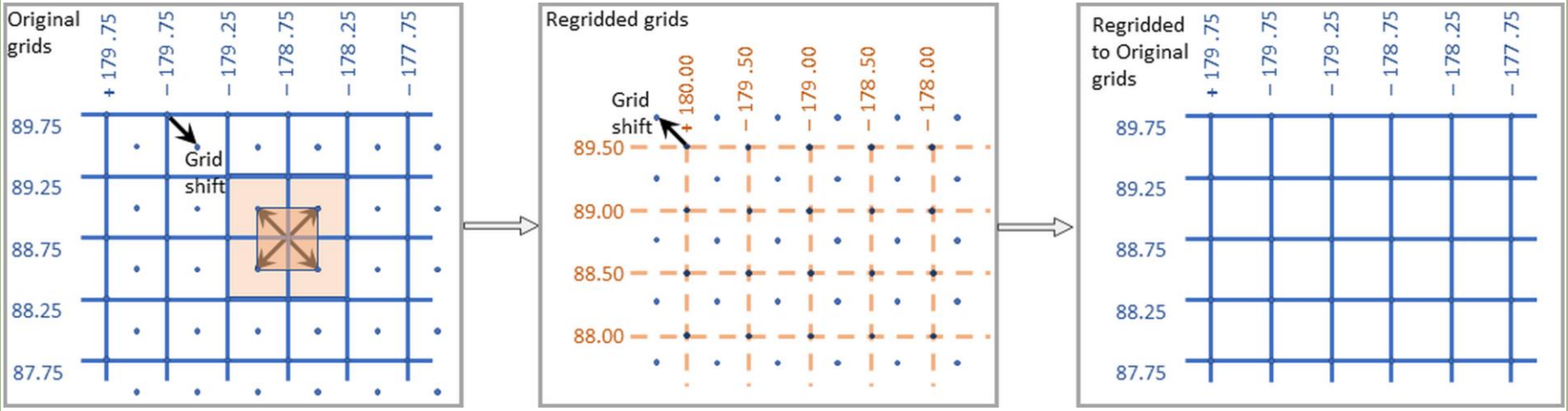
Introduction

- Interpolating from one grid to another - temporal and spatial (horizontal) interpolations
- Required for model coupling, comparing different models and datasets etc.
- Several applications - climate change impact studies, hydrological modelling, forecast applications
- Precipitation, sensitive to regridding - high spatial variability and intermittency

Introduction



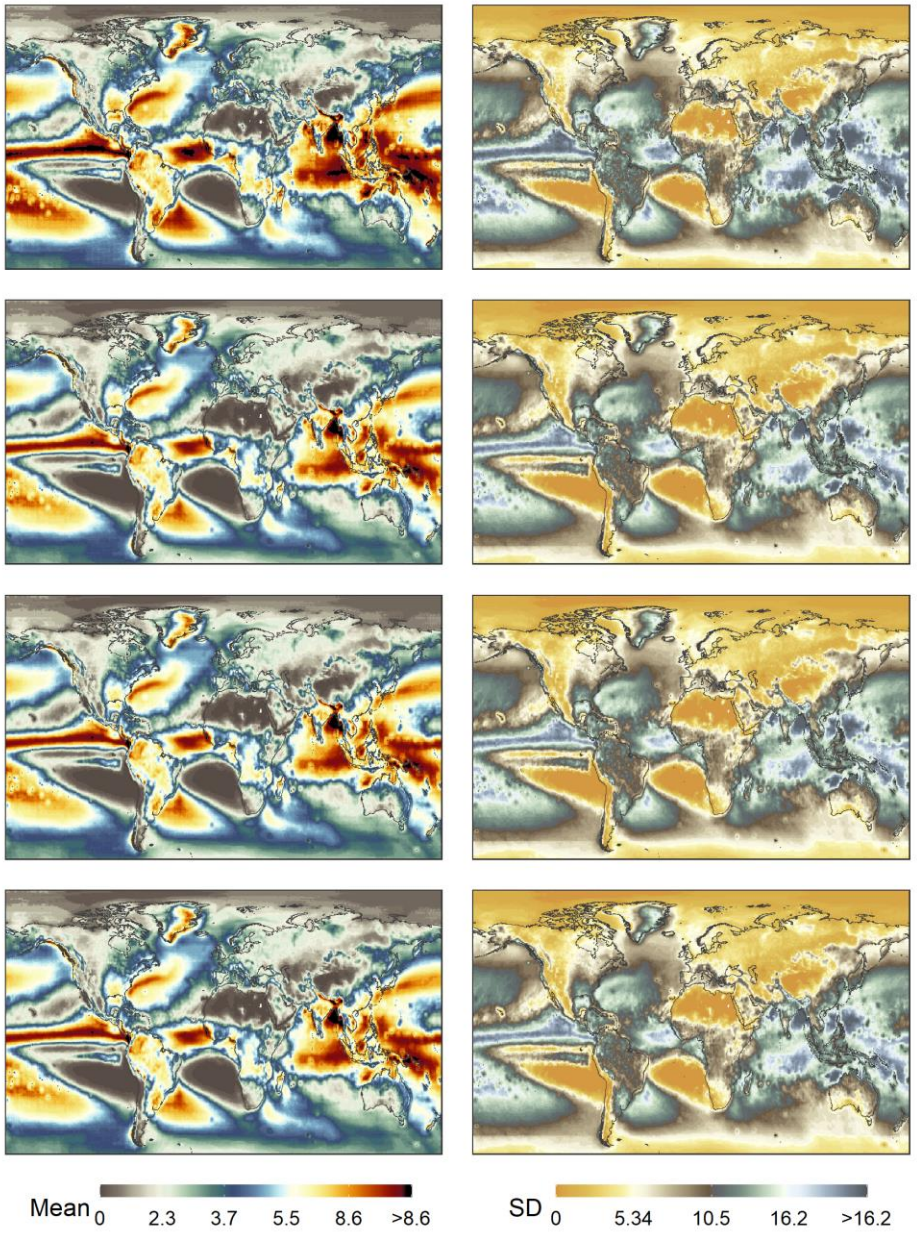
Effects of

- different regridding methods – three methods used
- the size of the shift – multiple small shifts were made in the 0.5° x 0.5° data and regridded back to the original 0.5° x 0.5°
- the size of the original grid – a simple shift of 0.05° was made in the 0.1° x 0.1° data

Results

Effects of different regridding methods

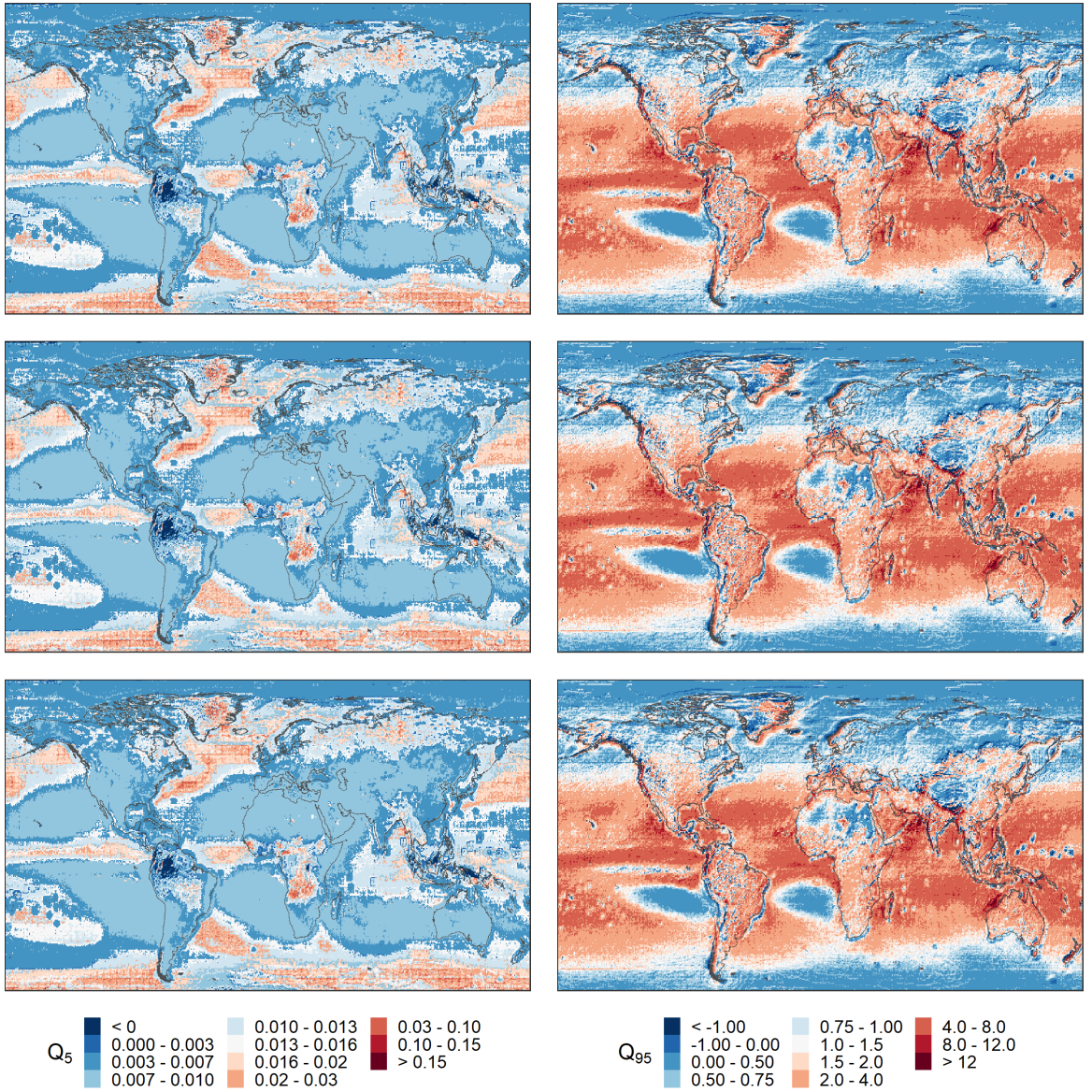
- Regridding smooths the precipitation, especially the extremes; however, smoothing may not be consistent for all quantiles
- Same effects of regridding based on three methods
  - First-order conservative
  - Bilinear and
  - Distance-weighted



Spatial pattern of (left) mean and (right) standard deviation of (top) original and regridded using (top middle) conservative, (bottom middle) bilinear, and (bottom) distance-weighted average techniques

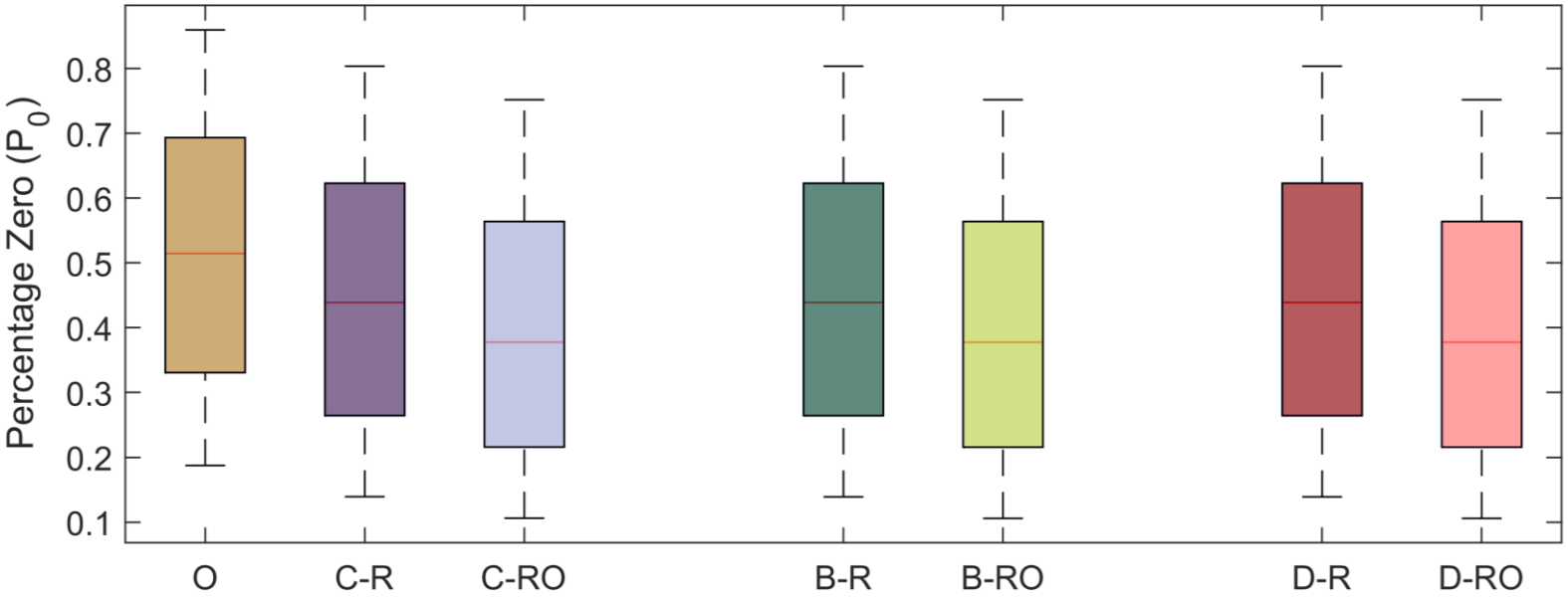
Results

- Low quantiles are highly affected in terms of percentage differences
- High differences in high quantiles in terms of differences



Spatial patterns of differences (mm) between the original and regridded data at (left) 5th and (right) 95th quantiles using (top) conservative, (middle) bilinear, and (bottom) distance-weighted average techniques

Results



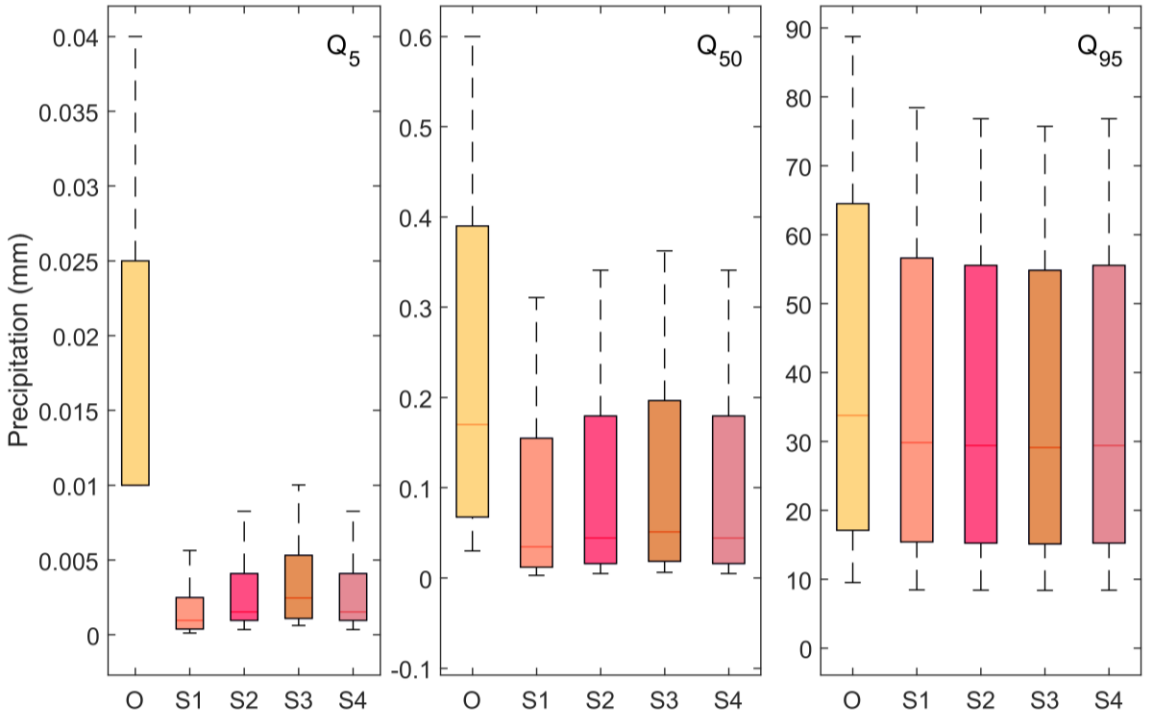
Boxplots of the probability zero or the percentage of zero precipitation (P0) at the global scale for original (O), regridded (R), and regridded-to-original grid (RO) data using conservative (C), bilinear (B), and distance-weighted average (D) techniques.

- Probability dry (percentage of dry days) reduced by 30% after regridding – same with any method of regridding

Results

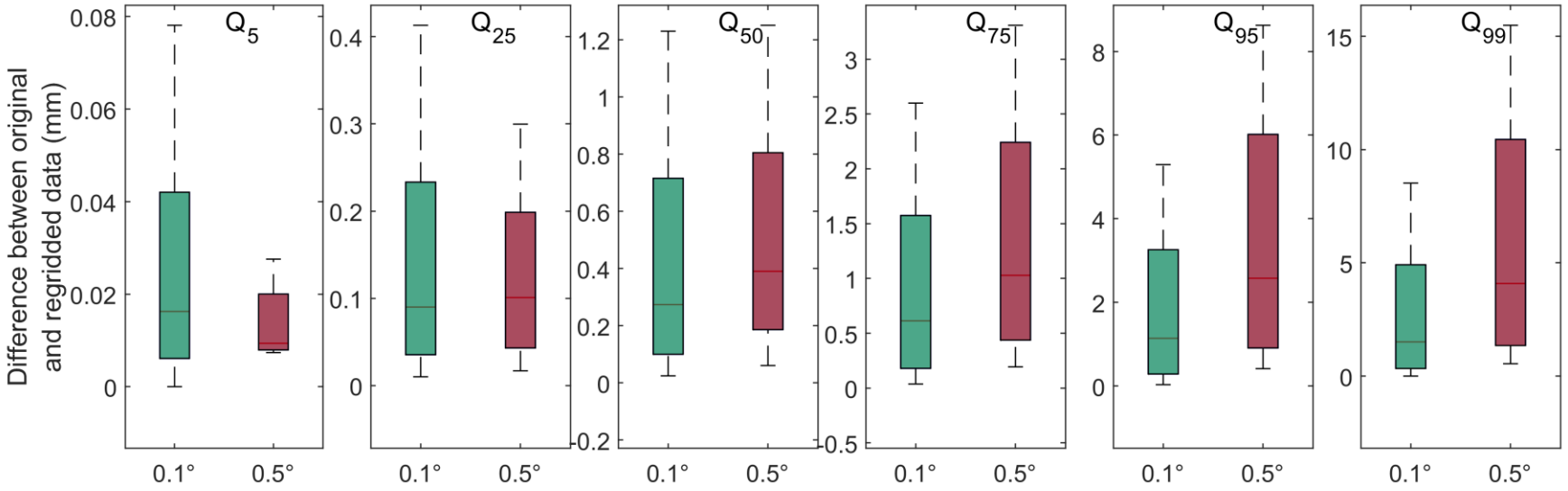
Effects of shift size

- Same effects
- Low quantiles are highly affected in terms of percentage differences
- Probability zero (probability of dry days) reduced on average by 15%



Boxplots of precipitation at different quantiles for original (O) and regridded-to-original grid for a shift size of 0.0625° (S1), 0.125° (S2), 0.25° (S3), and 0.375° (S4) using the conservative regridding technique.

Results



Boxplots of differences between original and regridded-to-original-resolution data at different quantiles for 0.1° and 0.5° resolution.

Effects of grid size

- A decrease of 15% and 18% in the mean and standard deviation, respectively, is observed at the global scale
- The spatial patterns of differences between the original and regridded-to-original data are approximately similar as those of 0.5°, yet the differences are higher at low quantiles and lower at high quantiles

Conclusions

- Same effects of regridding based on three methods
- Low quantiles are highly affected in terms of percentage differences and high absolute differences for high quantiles
- Probability zero (probability of dry days) reduced on average by 30%
- The size of the shift affects the statistics of precipitation - as the grid shift decreases, the mean values of mean, standard deviation, and high quantiles are close to those of the original data
  - there is no effect of the shift size on the probability of dry
- With finer resolution grids, the differences are larger. Spatial patterns of differences are approximately same at all resolutions.

Thank you!

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