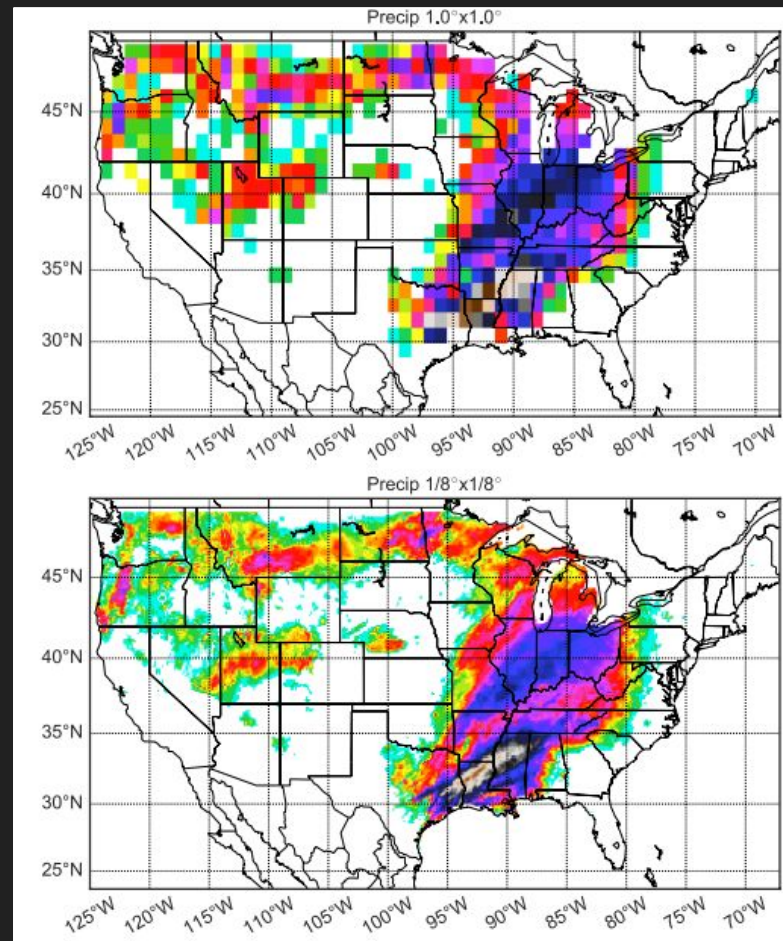


DeepSD: Climate Downscaling with modified stacked SRCNNs

Why

- Multivariate
 - Provides valuable context for climate modelling (see precipitation data on left)
- Performs well in adverse conditions
 - Sparse data
 - Outliers
- Does not necessitate high-resolution observational data
- Stacking networks allows the model to learn spacial patterns at multiple scales
 - Less complexity in spatial representations
 - Each SRCNN offers an “enhancement”
- Paper offers 8x resolution enhancement

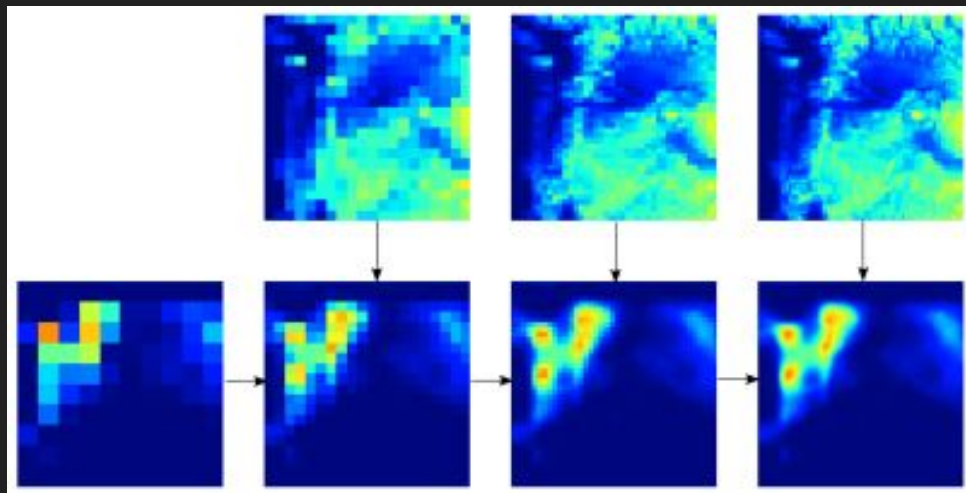


Disadvantages and Comparison

- Outperforms regression-based approaches in several key metrics
 - Much more effective in high-risk climate adverse locations which often lack
 - High-resolution observational data
 - High density data
 - High accuracy recordings (no “holes”)
 - BCSD, ASD
- Temporal non-stationarity results unknown
- Fails to quantify uncertainty of projections
 - Critical drawback that undermines the applicability of SRCNNs to climate downscaling
 - Potential resolutions introduced, revolve around verification using external models

Results

- Precipitation downscaling
 - Aided by elevation data which is continually downscaled in parallel to aid the metric of interest, precipitation
- Outperforms state-of-the-art regression methods in terms of bias, correlation, RMSE, and skill when validating over CONUS
 - Trails behind regression methods for a small subset of locations but is much more broadly applicable
 - More accurately predicts extreme events and outliers than top performing regression models
 - Attributed to multivariate capacity



Independently trained stacked SRCNNs downscale precipitation data layer-by-layer. Below is precipitation data, above is elevation data. (8x enhancement).

Future Direction

- Unknown performance on regions with few observations
- Temporal non-stationary untested
 - Inconsistent temperature patterns
- Experimenting with multivariate capacity
 - Utilize more “support” variables
 - Downscale multiple variables at once
 - Could potentially reveal valuable patterns
- Quantifying uncertainty
 - Critical step for making DeepSD fit for widespread adoption
 - Bayesian Deep Learning techniques