

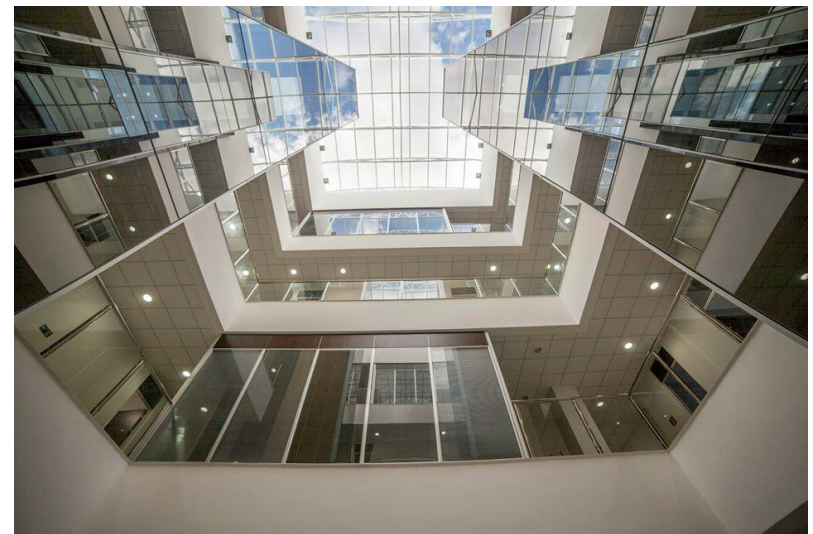
Statistical downscaling of climate projections over Brazil

by

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Contents

- ✓ **The importance of climate to Brazil**
- ✓ **Uncertainty quantification**
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The importance of climate to Brazil

✓ Agriculture

- The world's largest exporter of soybean, coffee, sugar cane, ethanol, beef and chicken
- Potential to become the world's largest agricultural exporter

✓ Energy production

- Hydropower (70% electricity), wind and solar (expanding),...
- Potential to become one of the global players

✓ Natural disasters

- Extreme droughts (e.g. inflation: food and energy price)

Uncertainty quantification in climate projections

- ✓ **Initial condition uncertainty** → **Ensemble**
- ✓ **Model formulation uncertainty** → **MME**
- ✓ **Scenario uncertainty** → **Several scenarios**

Data

✓ Observations

- INMET (Brazil's National Meteorological Institute)
- 1961-2014
- Daily observations

✓ CMIP5 Projections

- Historical: 1976-2005
 - Projections (RCP4.5 and RCP8.5): 2041-2070
1. CanESM2
 2. GFDL-ESM2G
 3. HadGEM2-CC
 4. IPSL-CM5A-LR
 5. MIROC-ESM

Choice of the stations



Fortaleza

- ✓ Equatorial climate
- ✓ Similar length of day all year long
- ✓ Coastal city

Rio de Janeiro

- ✓ Tropical climate
- ✓ Mountains
- ✓ Coastal city

Porto Alegre

- ✓ Extratropical climate
- ✓ Coastal city

Choice of the stations



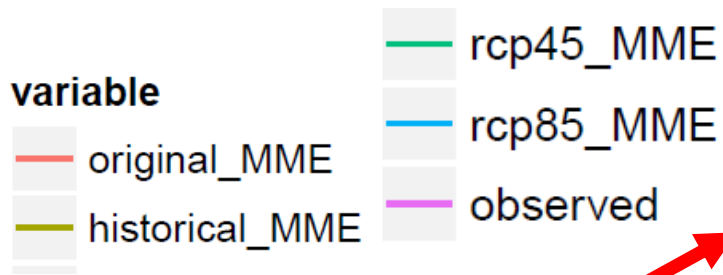
Fortaleza ✓ ENSO driven seasonal forecast skill

Rio de Janeiro ✓ Little seasonal forecast skill

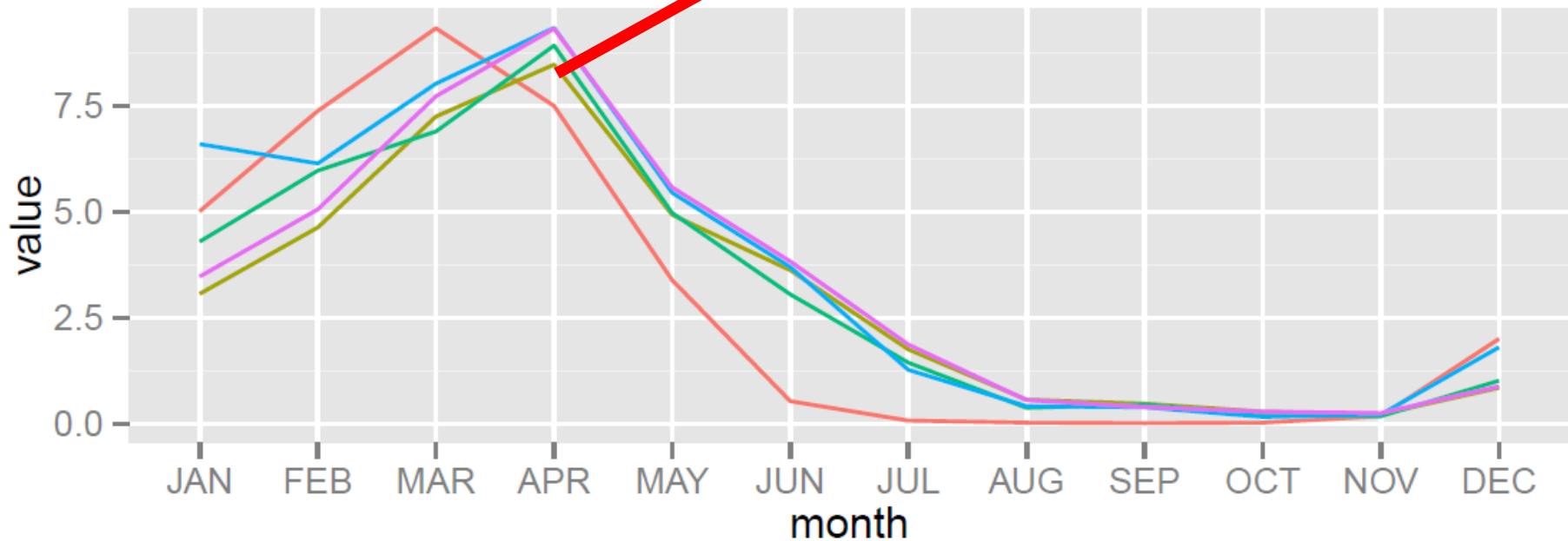
Porto Alegre ✓ ENSO driven seasonal forecast skill

Source: 

Precipitation projections for 2041-2070: Fortaleza

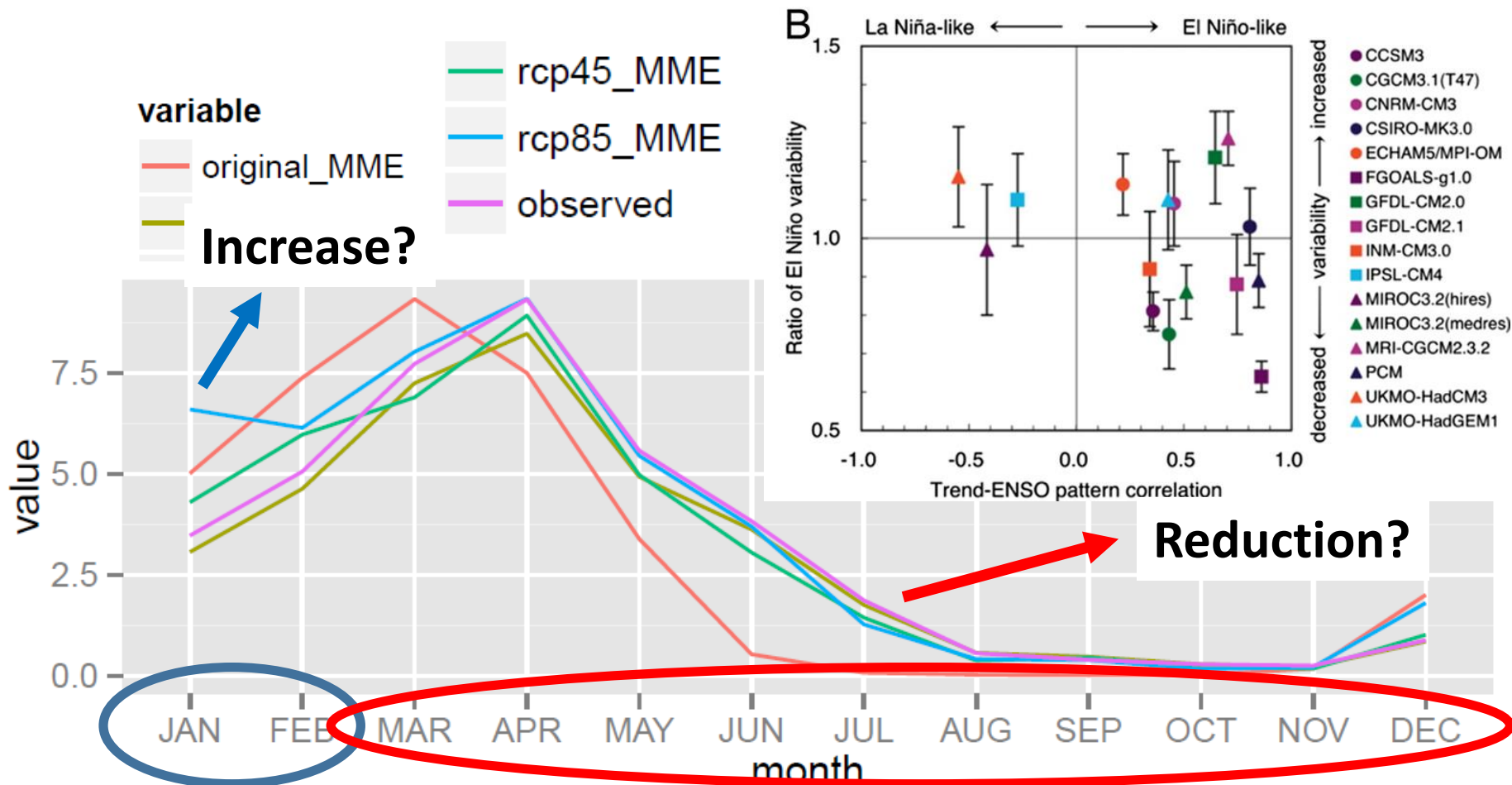


Bias correction improves historical annual cycle



Precipitation projections for 2041-2070: Fortaleza

Latif and Keenltside (2009): AR4



Precipitation: Fortaleza

Season: MAM

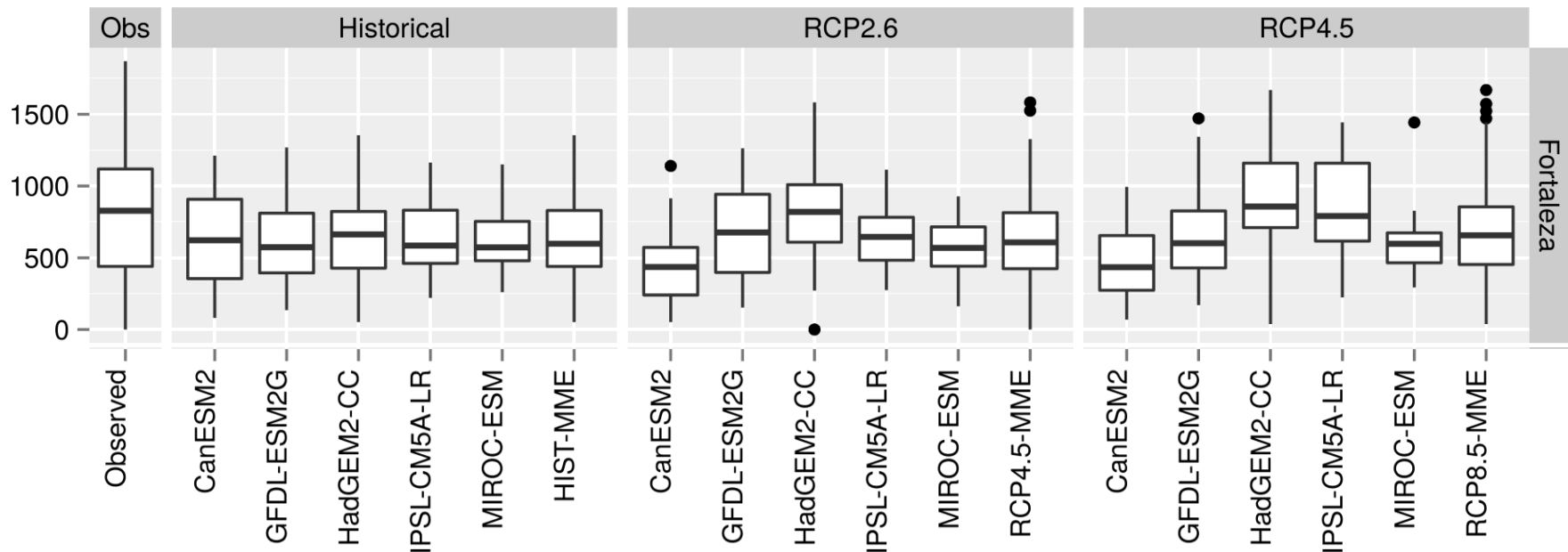
Observation: 1961-2014

Historical: 1976-2005

Projections: 2041-2070

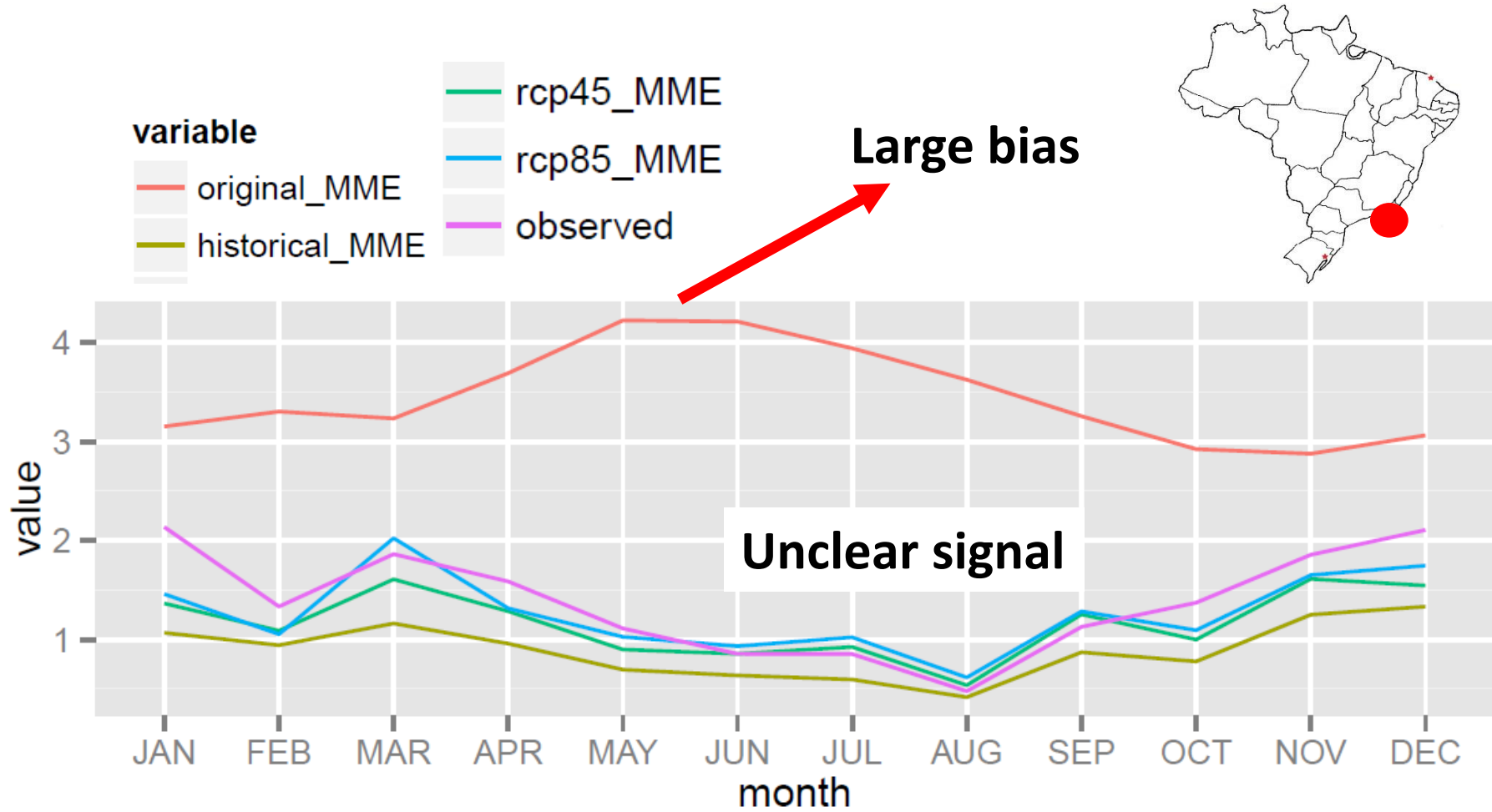


GCMs underestimate precip. variability



Fortaleza

Precipitation projections for 2041-2070: Rio de Janeiro



Precipitation: Rio de Janeiro

Season: JFM

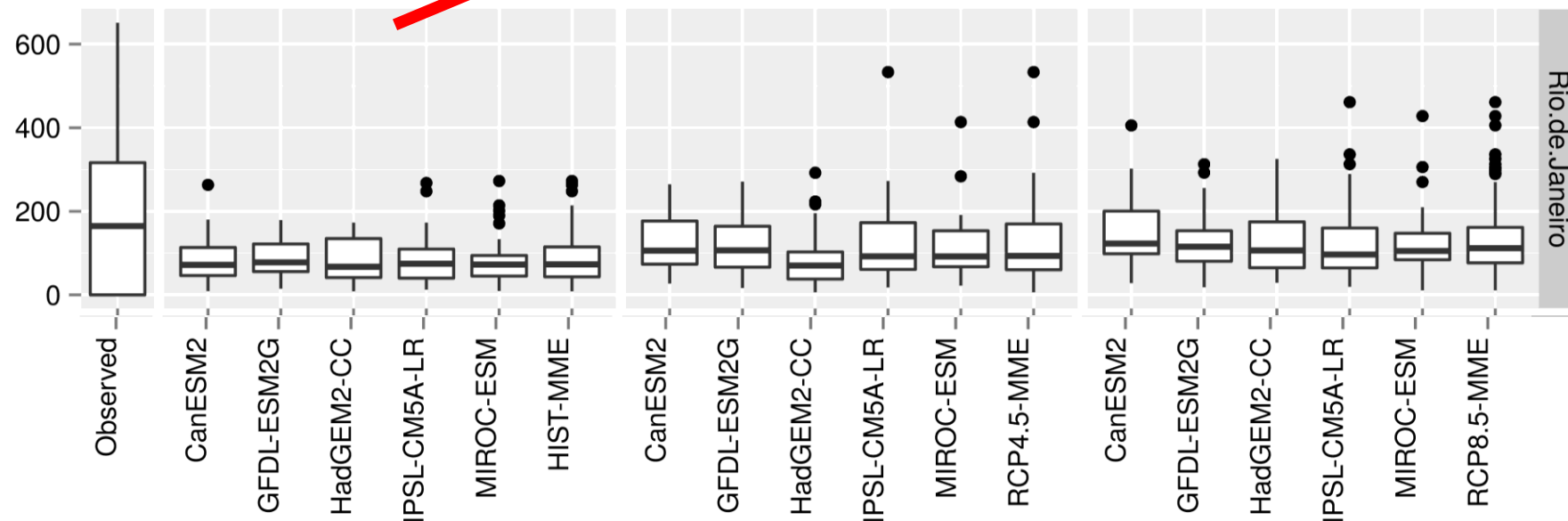
Observation: 1961-2014

Historical: 1976-2005

Projections: 2041-2070

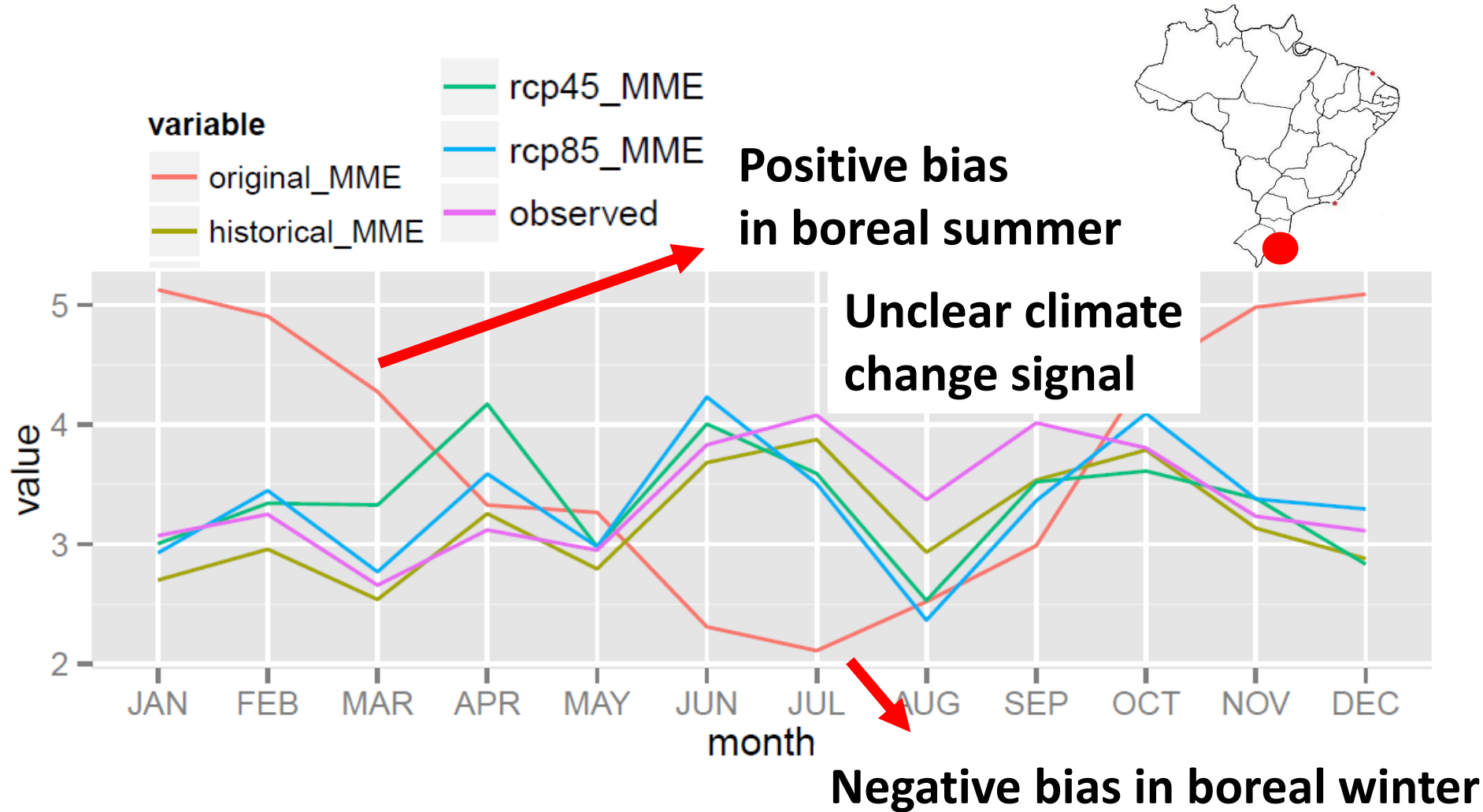


GCMs underestimate precip. variability



Rio de Janeiro

Precipitation projections for 2041-2070: Porto Alegre



Precipitation: Porto Alegre

Season: ASO

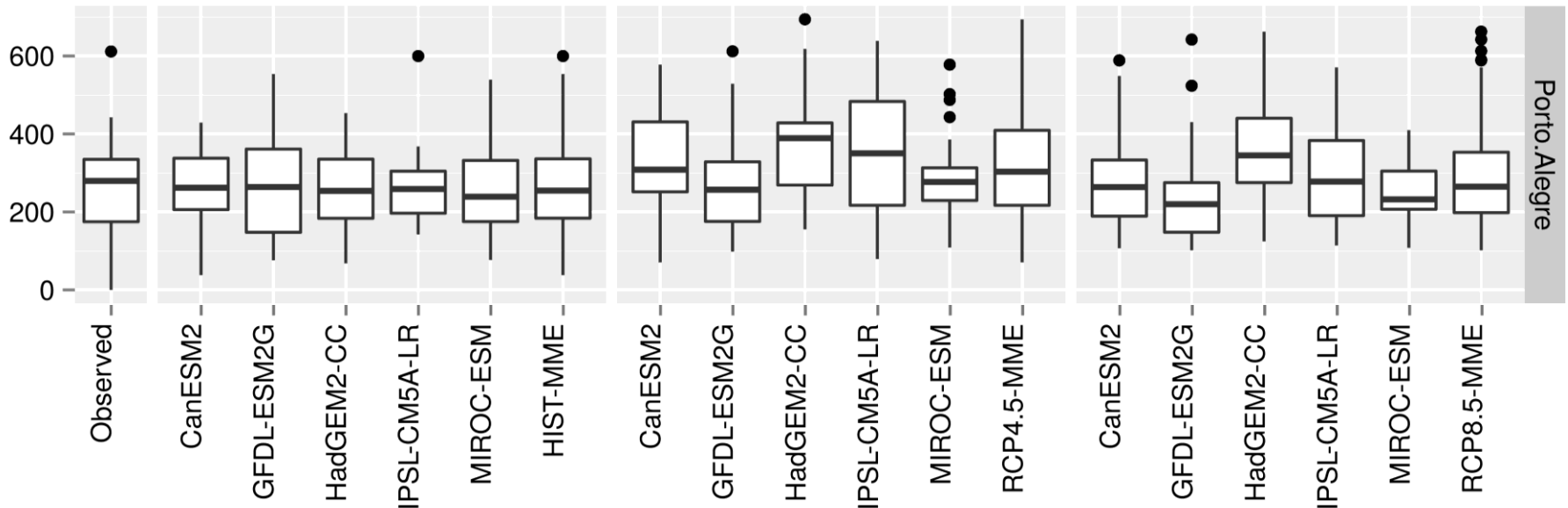
Observation: 1961-2014

Historical: 1976-2005

Projections: 2041-2070



Downscaling
performed well



Porto Alegre

Conclusions

- ✓ Different climates (tropical, extratropical, coastal, rainforest, mountains, ...) may prove ideal for testing different downscaling methods
- ✓ Quantile downscaling consistently improve historical simulations

Thank you