

The North American Regional Climate Change Assessment Program (NARCCAP): A Multiple AOGCM and RCM Climate Scenario Project for North America

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GOALS

1. Quantify the multiple uncertainties of GCM-RCM regional projections of future climate
2. Develop multiple high-res regional climate change scenarios for impacts & risk assessments
3. Evaluate regional model performance over North America by nesting RCMs in reanalyses
4. Understand critical regional climate change processes
5. Create greater collaboration among US, Canadian & European climate modeling groups
6. Derive added value from diverse, ongoing regional & global modeling projects



Builds on and complements ...



PRUDENCE (EU):

Reduce deficiencies and quantify uncertainties in predictions of future climate



ENSEMBLES (EU):

Produce very high resolution regional climate model ensembles for Europe

Create probabilistic high-resolution regional climate scenarios



CREAS (South America):

Downscale climate change scenarios (2 GCMs, 6 RCMs)

Exp. 0: The RCM domain must satisfy needs of Canadian and U.S. impacts researchers: what is sensitivity to boundary locations?



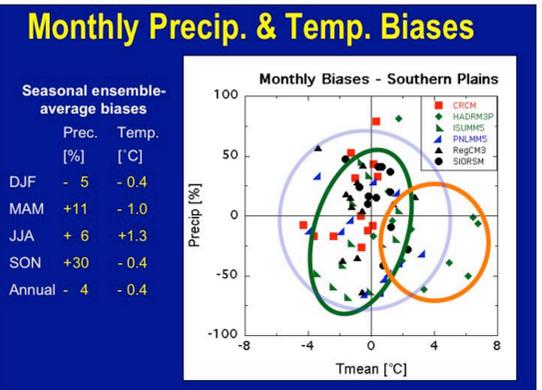
Each simulation lasts for one year (1979) using NCEP/DOE reanalysis boundary conditions

Sensitivity results show

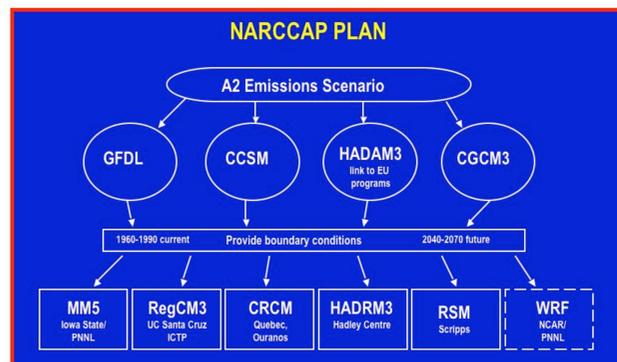
- Smallest differences tend to occur for smallest domain
 - Otherwise, no systematic dependence on domain size
- ⇒ Use most computationally efficient (smallest) domain

Ensemble Uncertainty Statistics - Southern U.S. Plains Example

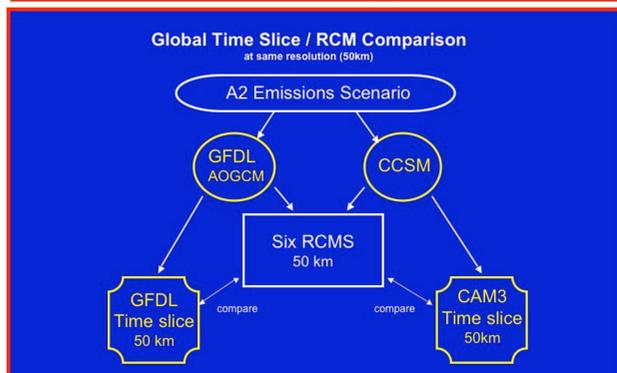
- Ensemble-average biases tend to be smaller than those of individual models
- Individual models show systematic or correlated errors - may not occur in future climate
- Ensemble show more even, uncorrelated distribution of errors and more complete rendition of uncertainty



A suite of AOGCMs is driving a suite of RCMs with 50-km grid spacing to produce an ensemble of regional climate-change scenarios for mid- to late-21st century.



A complementary set of time-slice AGCMs, also with 50-km grid spacing, are simulating the same period.

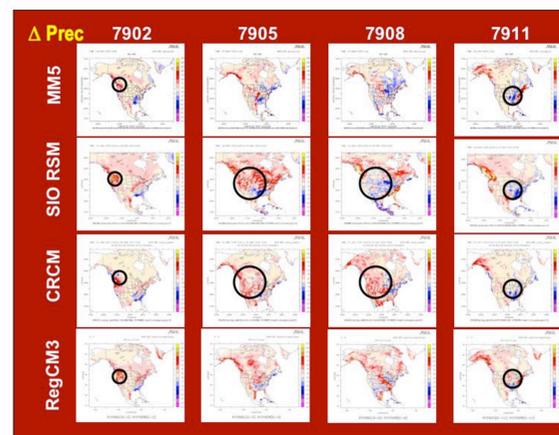


We will compare the two methods of dynamic downscaling.

Δ Precip [mm/month]
Differences from CRU data

- are largest in April & Aug for the two models with smallest height error (not shown) ⇒ weak coupling of surface & circulation errors
- show autumn precipitation deficit in southern U.S. common to many models (Gutowski et al. 2004; Liang et al. 2004)
- are all positive in Pacific Northwest during winter: lack of orographic effects in CRU?

Simulated Precipitation vs. CRU Observations



Summary

- ♦ NARCCAP is a multiple GCM-RCM program for North American regional climate scenarios and uncertainty
- ♦ NARCCAP complements programs in Europe and South America
- ♦ Results of initial domain sensitivity study show
 - weak relationship between bias in I-s circulation & T/P
 - no obvious trends in T & P biases as the domain grows
- ♦ Ongoing analysis (not shown here) suggests multiple-model ensemble will yield better characterization of uncertainty.

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www.narccap.ucar.edu