NARCCAP

The Regional Spectral Model (RSM) Contribution to NARCCAP

Ana Nunes[1,2] and John Roads[1]*

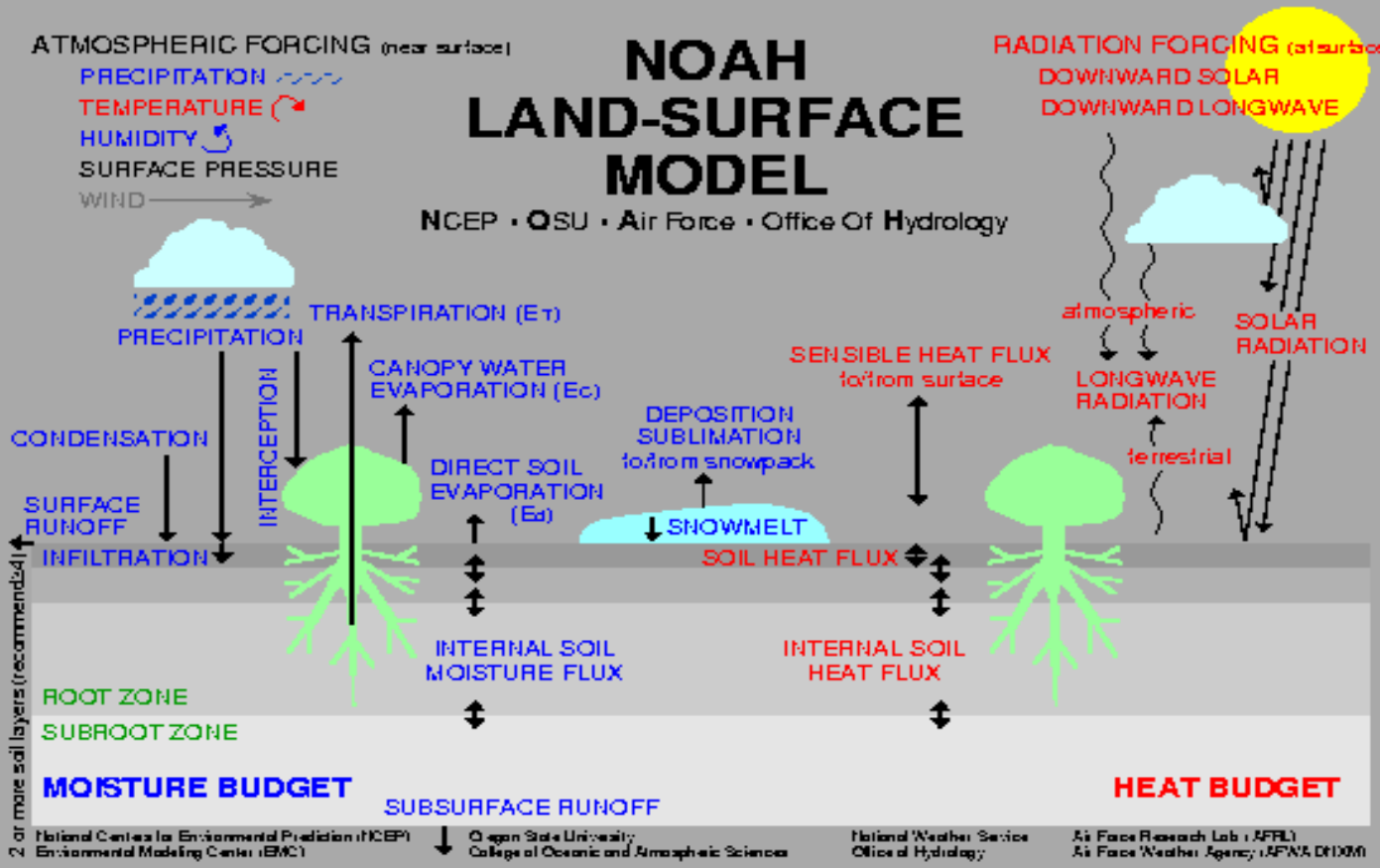
[1]SIO, UCSD, California, USA
[2]IGEO, UFRJ, Rio de Janeiro, Brazil

NARCCAP

Experimental Climate Prediction Center (ECPC) Regional Spectral Model (RSM)

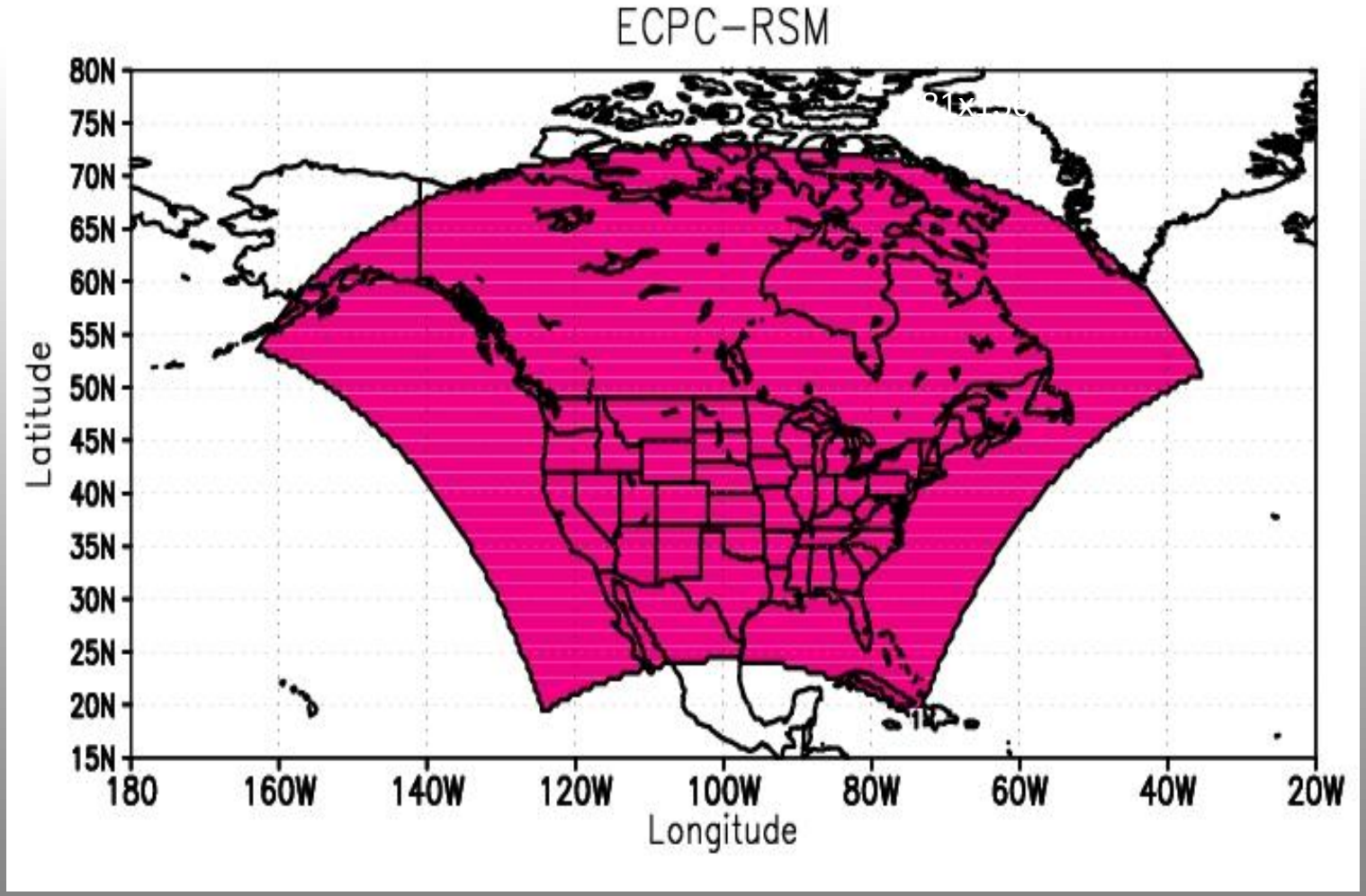
NARCCAP Configuration

Hydrostatic, Primitive Equations (RSM; Juang *et al*. 1997)	50-km resolution, 28-vertical layers to 10 hPa	Noah Land-Surface Model (Ek *et al.*, 2003; Mitchell *et al.* 2004); 4-soil layers	Simplified Arakawa-Schubert cumulus convection scheme (SAS; Hong and Pan 1998)	Boundary Forcing: Scale-Selective Bias Correction(SSBC; Kanamaru and Kanamitsu 2007)



Source: Ken Mitchell's slides, 2006 (NCEP/EMC).

ECP2-RSM Domain
Observational (NCEP R2) Forcing & AOGCM-Driven

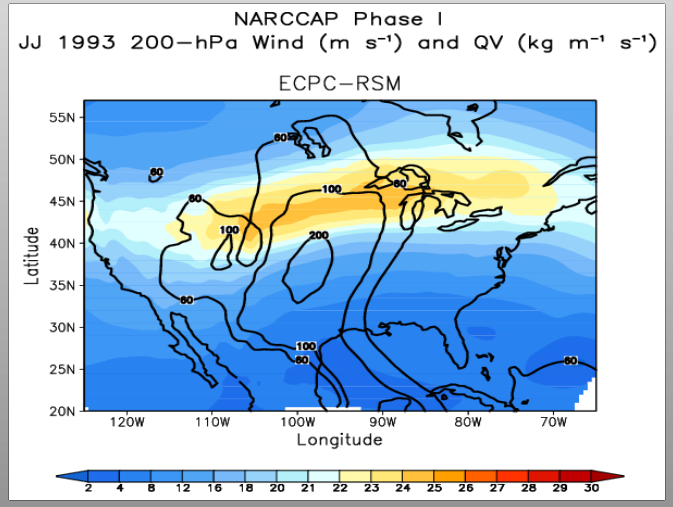


NCEP-R2 Driven Runs

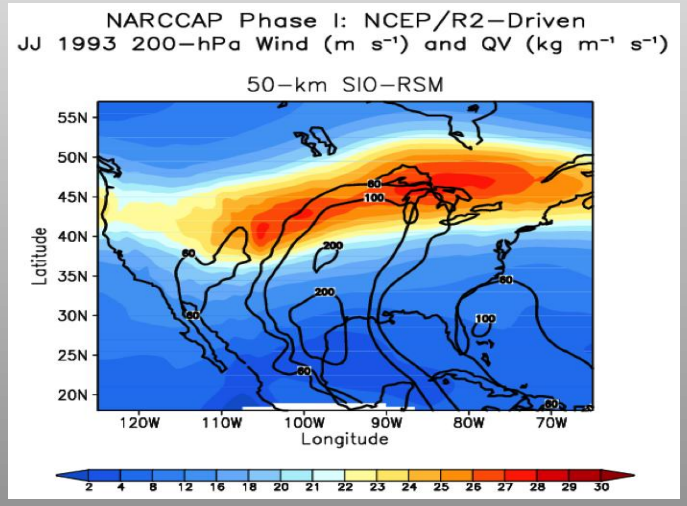
Improving large-scale features in the regional domain

- The NARCCAP ECP2-RSM has modified spectral nudging and larger horizontal domain in comparison to the NARCCAP ECPC-RSM (first realization).
- Phase I: Observational forcing [0 UTC 1 Jan 1979 – 0 UTC 01Jan 2005].

ECPC-RSM



ECP2-RSM



ECP2-RSM shows more realistic moisture transport from the Gulf of Mexico, and displays more robust upper-level jet in better agreement with observations.

ECP2-RSM AOGCM-Driven Runs

- Phase II

ECP2-RSM is scheduled to use initial and boundary conditions from GFDL CM2.1 and HADCM3. SRES A2 forces both global and regional models.

GFDL CM2.1-driven run:

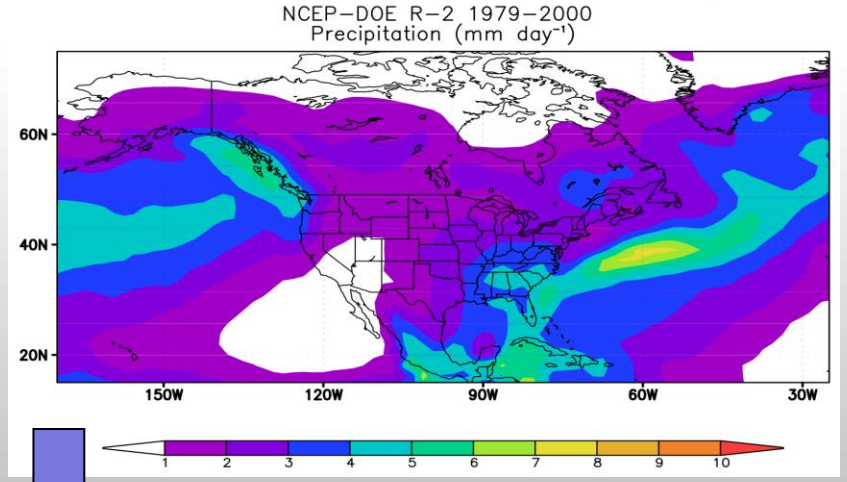
Present climate [1968-2000]: The ECP2-RSM precipitation and 2-m temperature fields are available in NetCDF for the entire period.

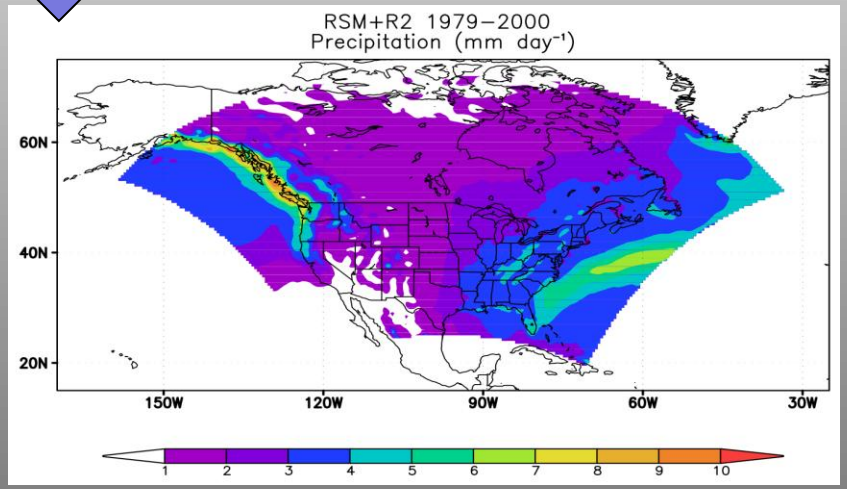
Future climate [2038-2070] is running.

HADCM3-driven runs depend upon available computer resources.

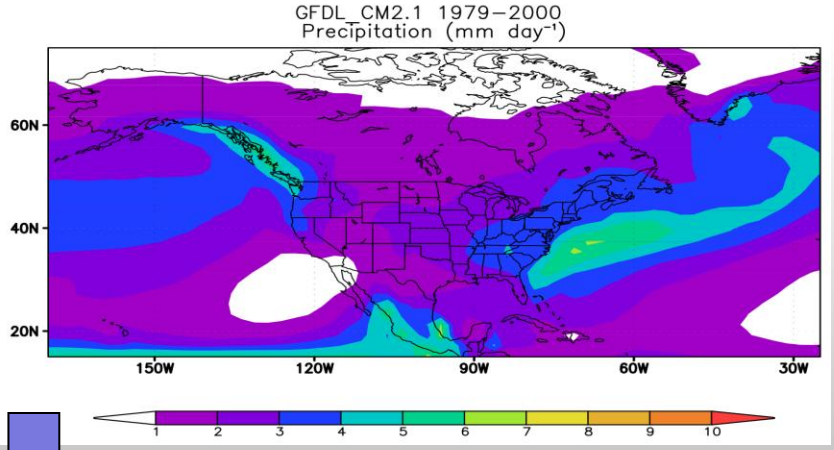
1979-2000 Precipitation

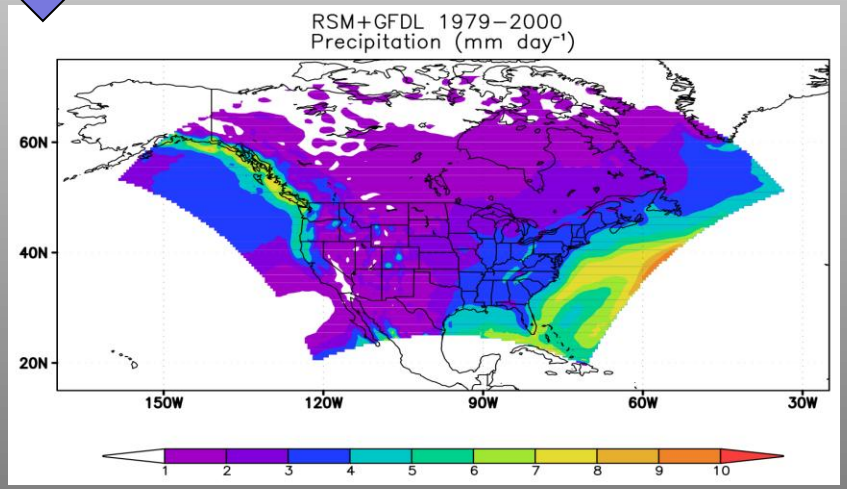
NCEP R2 & Downscaling



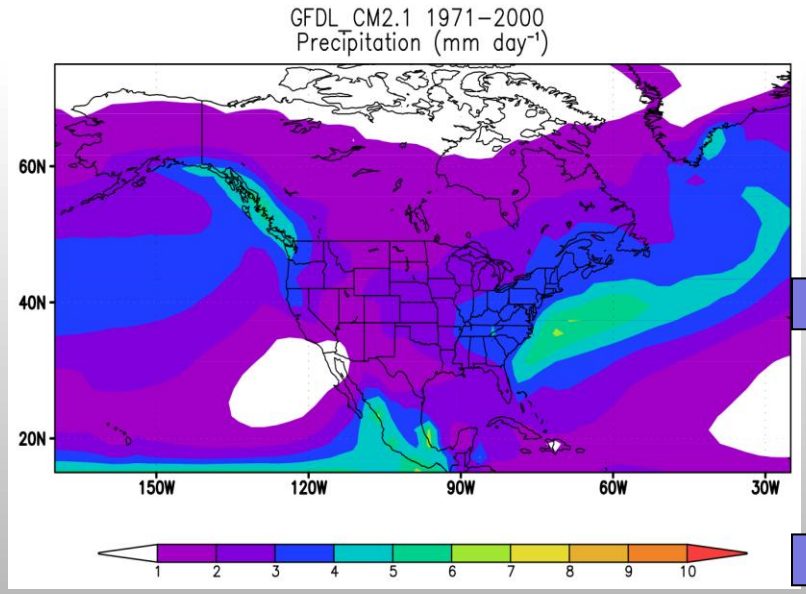


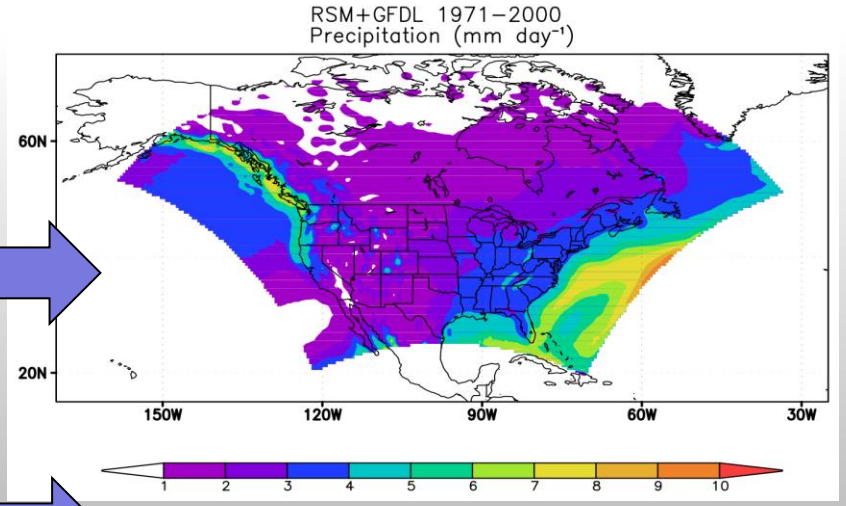
GFDL & Downscaling

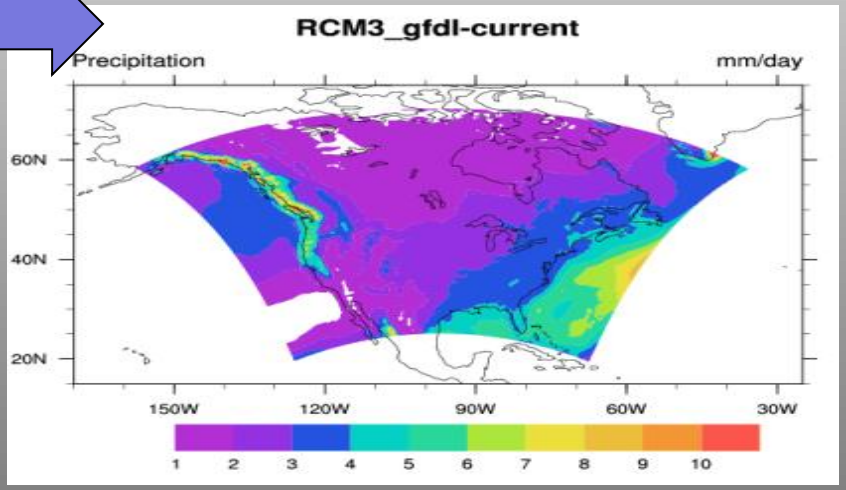




GFDL-Driven Run: 1971-2000 Precipitation

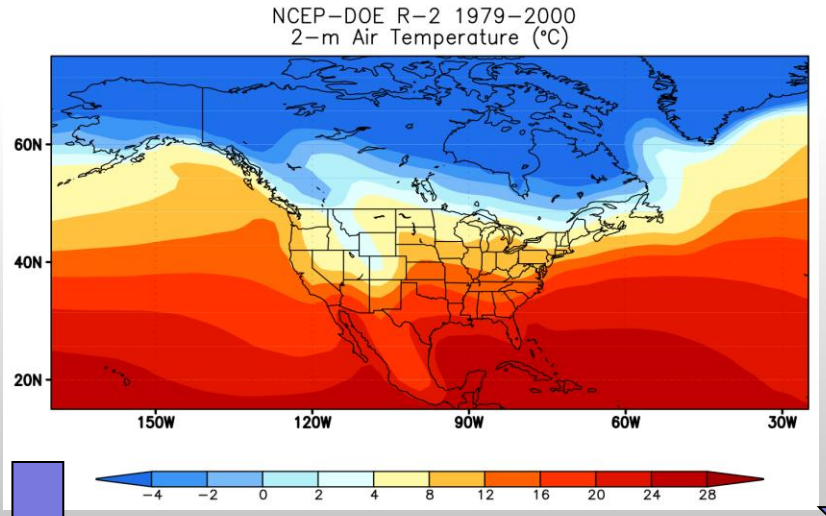


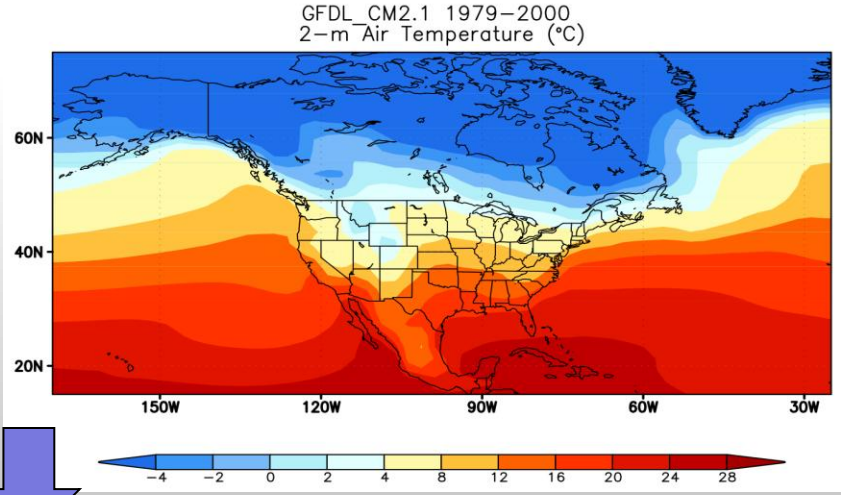


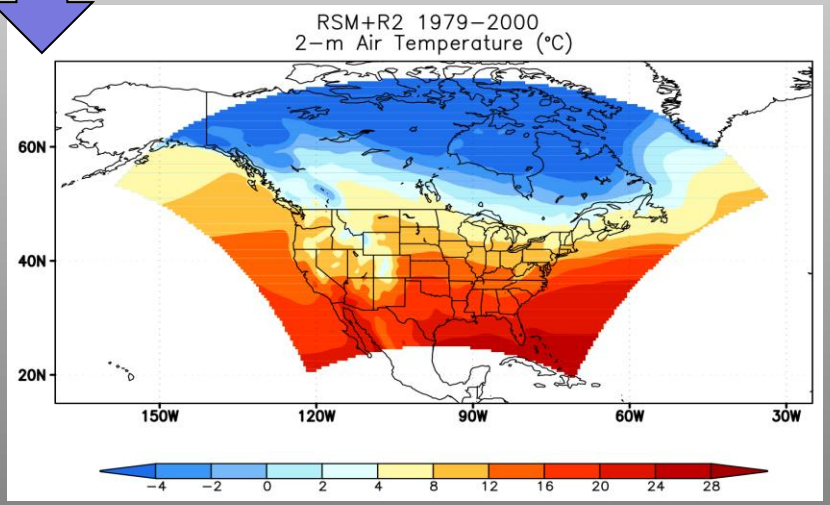


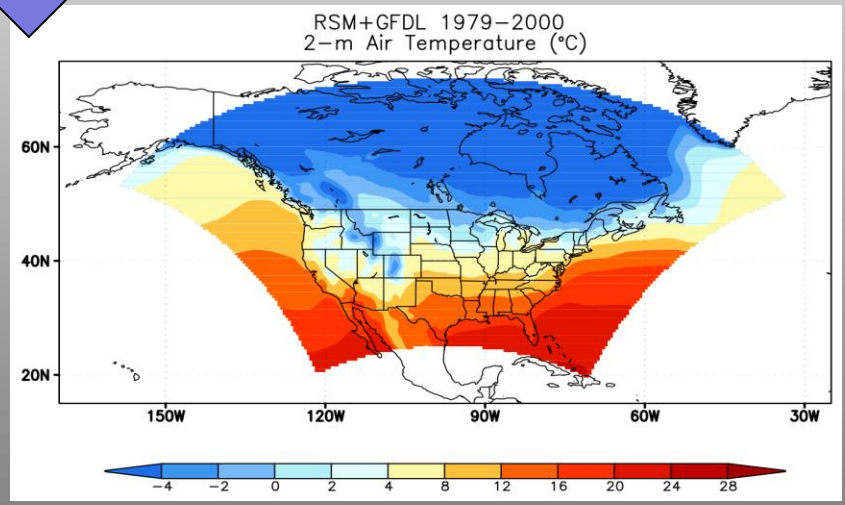
The ECP2-RSM domain covers a larger portion of the Atlantic Ocean in comparison to RegCM3. The Atlantic Ocean warmer areas show increased precipitation in both RCMs in comparison to the global model.

1979-2000 2-m Temperature









Concluding Remarks

- It is important to understand the uncertainty sources in regional scale climate projections associated with dynamical downscaling.

- Significant improvement in dynamical downscaling involves better model coupling strategies, *e.g.*, atmosphere-land-surface interactions produce better hydro-climatology, and, consequently, superior predictions and projections.

- NARCCAP has provided a good insight on model uncertainty as well as has shown advances in dynamical downscaling strategies (*e.g.,* better land-surface schemes, and spectral nudging techniques).

- Regarding model coupling strategies, the role of atmosphere-ocean-land coupling in dynamical downscaling of climate projections deserves investigation not only because the excessive downscaled precipitation seen over warmer ocean regions, but to better understand the impact of ocean forcing on coastal and continental areas.