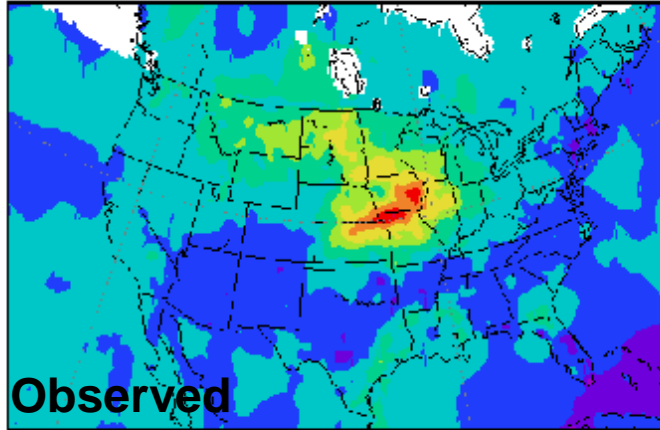


Seasonal forecast of summer precipitation and soil moisture analysis

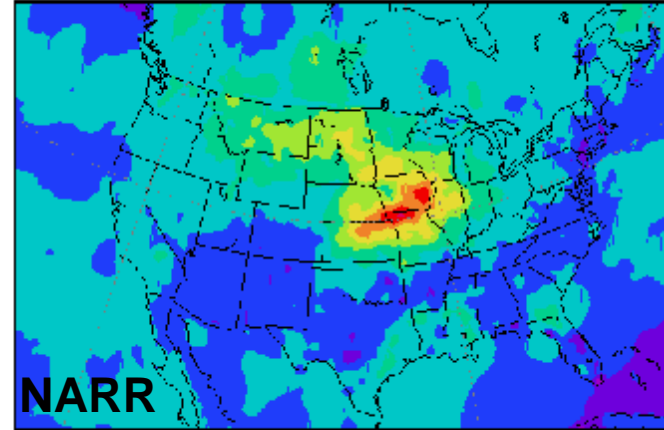
C.A. Lin, H. Lin, L. Wen, J. Derome
McGill University

Precipitation: 1993 (flood year) minus 1988 (drought)

"OBS" Precipitation (in/month) June, July mean 1993 minus 1988

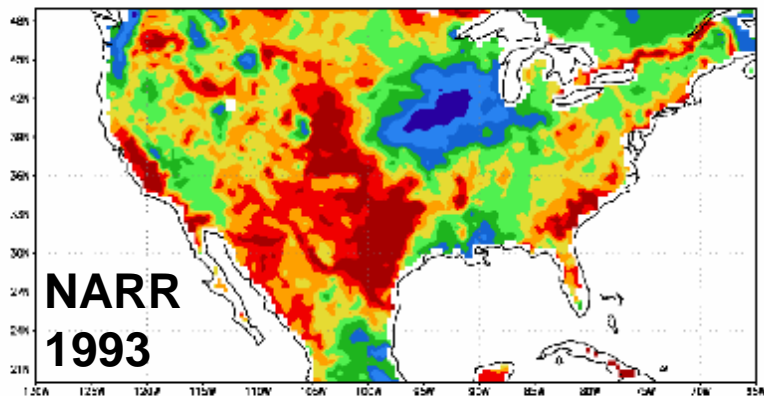


NARR Precipitation (in/month) June, July mean 1993 minus 1988

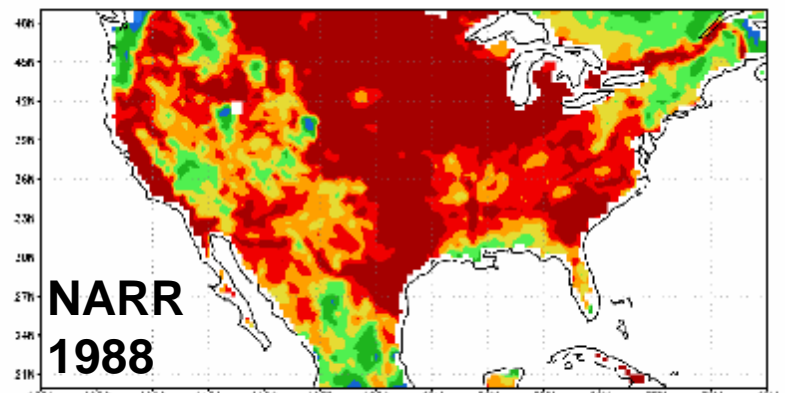


Top 1 meter soil moisture (July 16-31 average)

1993 Soil Moisture (% Saturation, top 1m), 21 UTC July 15-31 Mean (3hr fcst)



1988 Soil Moisture (% Saturation, top 1m), 21 UTC July 16-31 Mean (3hr fcst)



Difference field in GCM-simulated precipitation

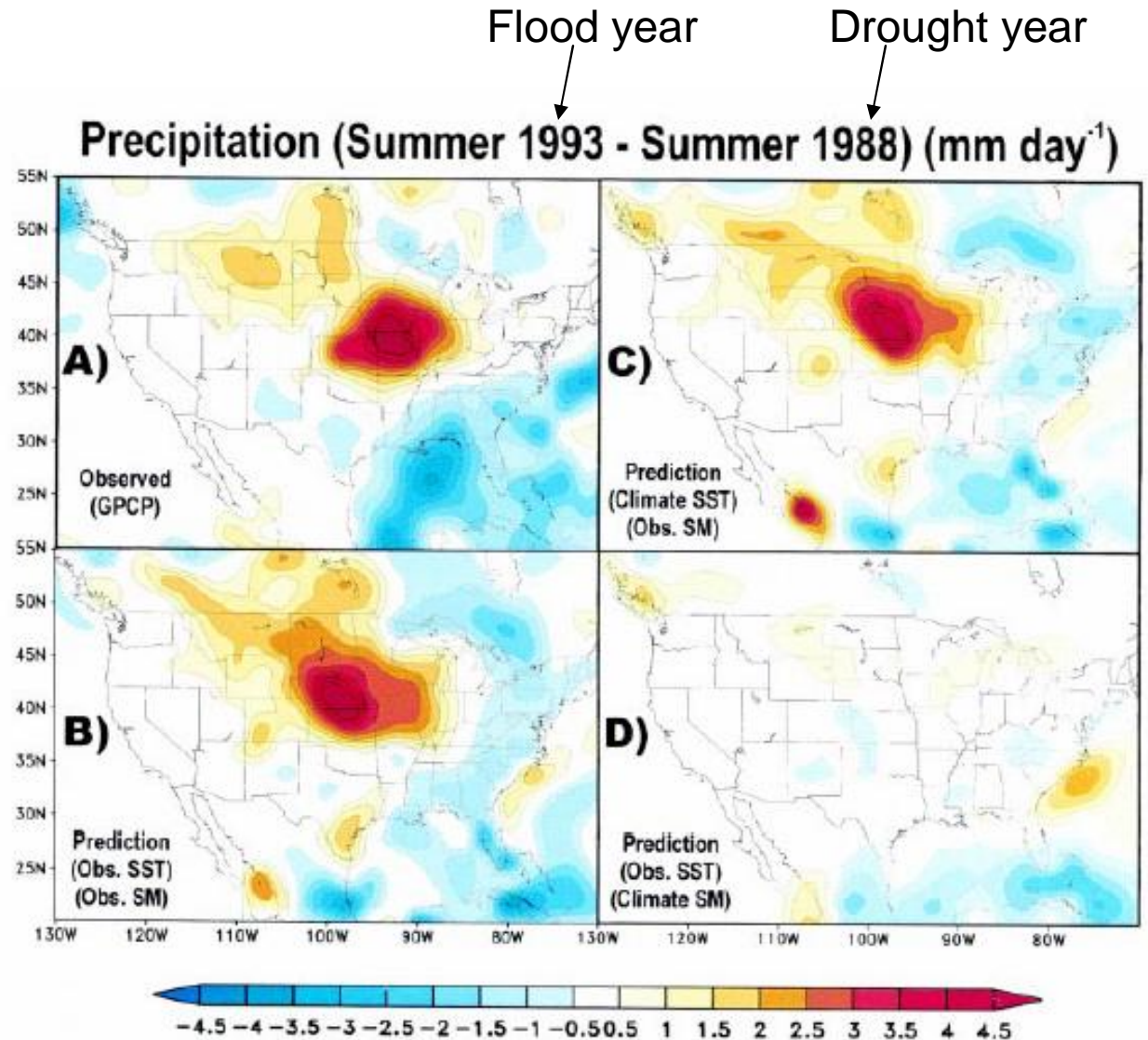
A) Observations

GCM simulations:

B) Control

C) Climatological SST

D) Climatological soil moisture



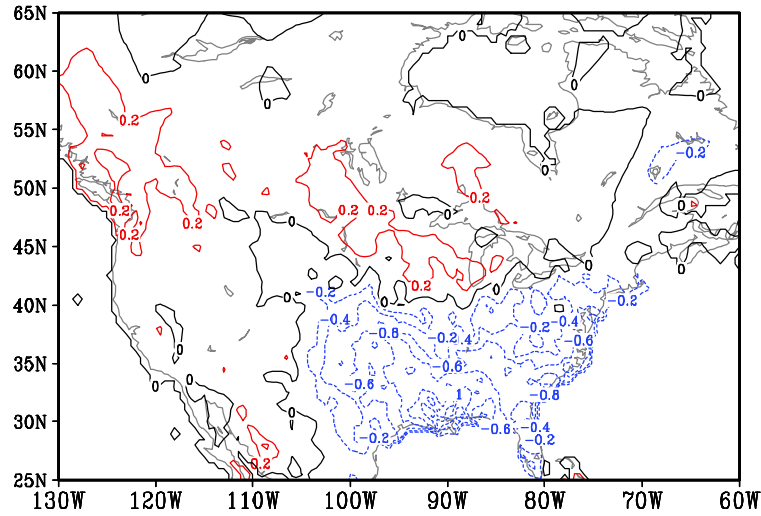
Entekhabi et al. (1999); Suarez et al. (1999)

Analysis of CRU precipitation

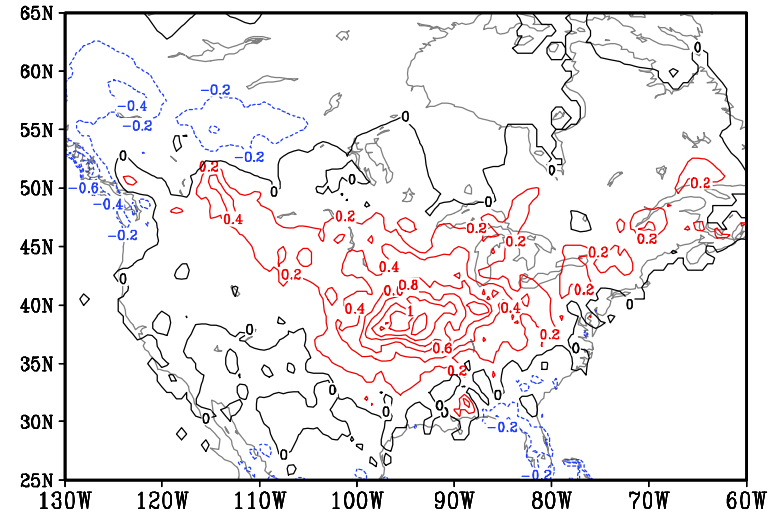
- Monthly, global land, $2.5^\circ \times 3.75^\circ$ resolution
- 1900-1998
- Focus initially on wet 1993 and dry 1988

First four Empirical Orthogonal Functions (EOFs) for June/July precipitation

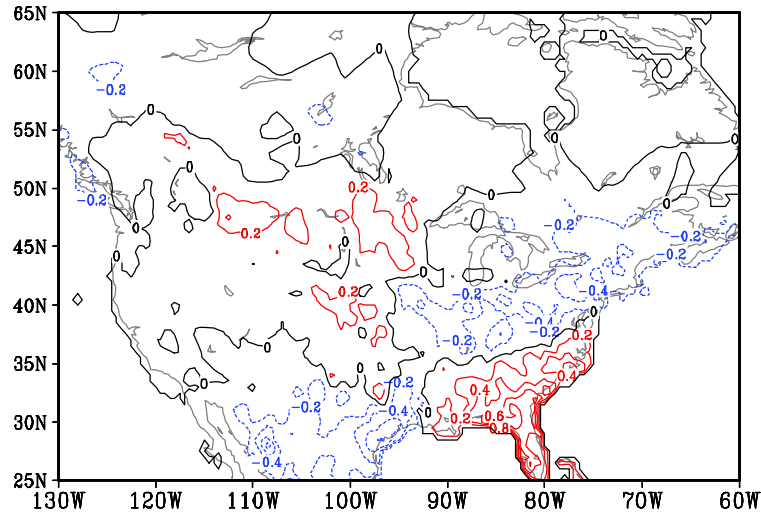
JJ EOF1 12.6%



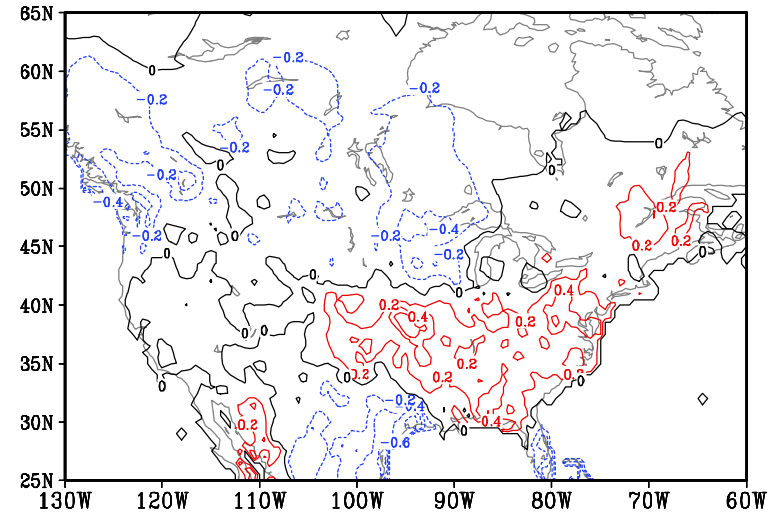
JJ EOF2 8.8%



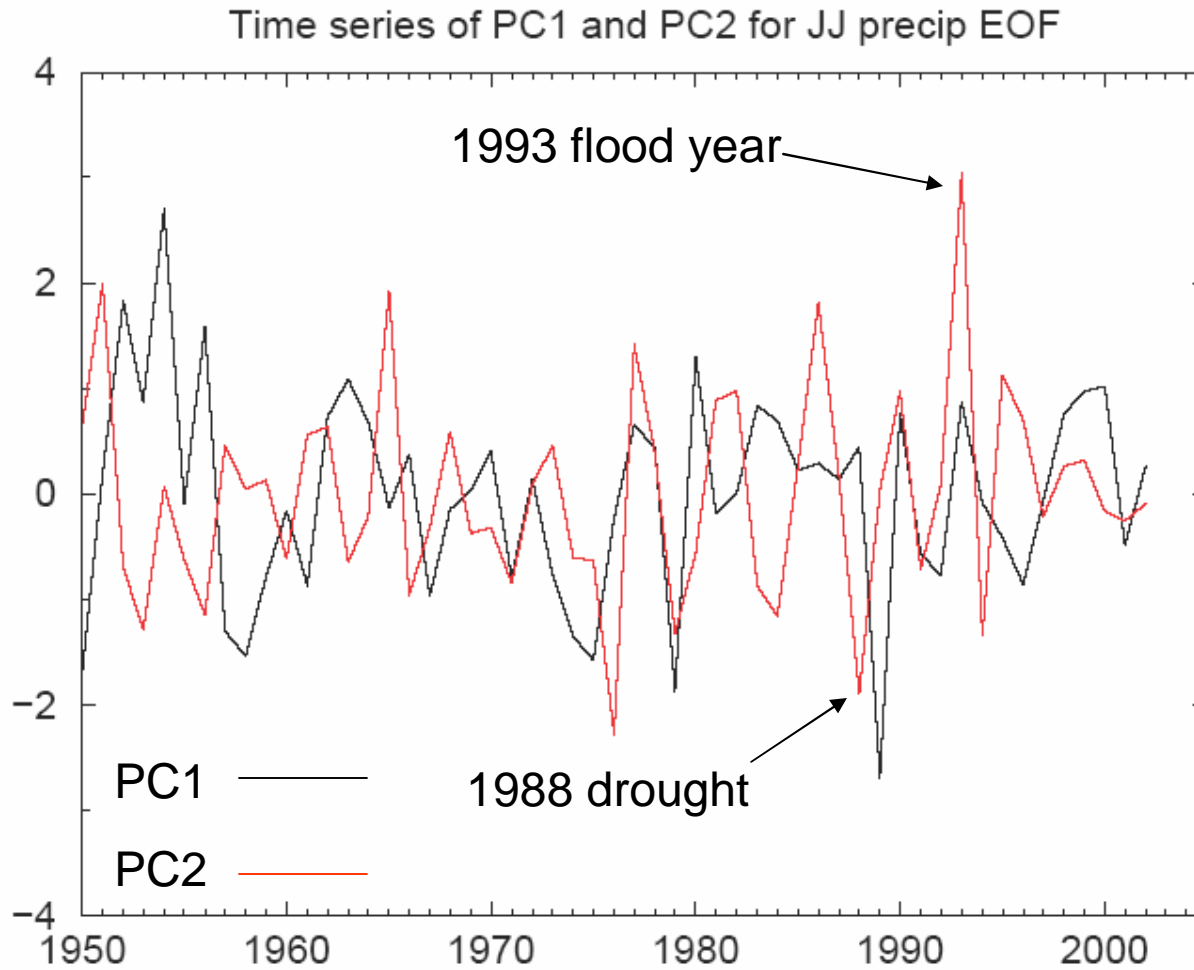
JJ EOF1 6.6%



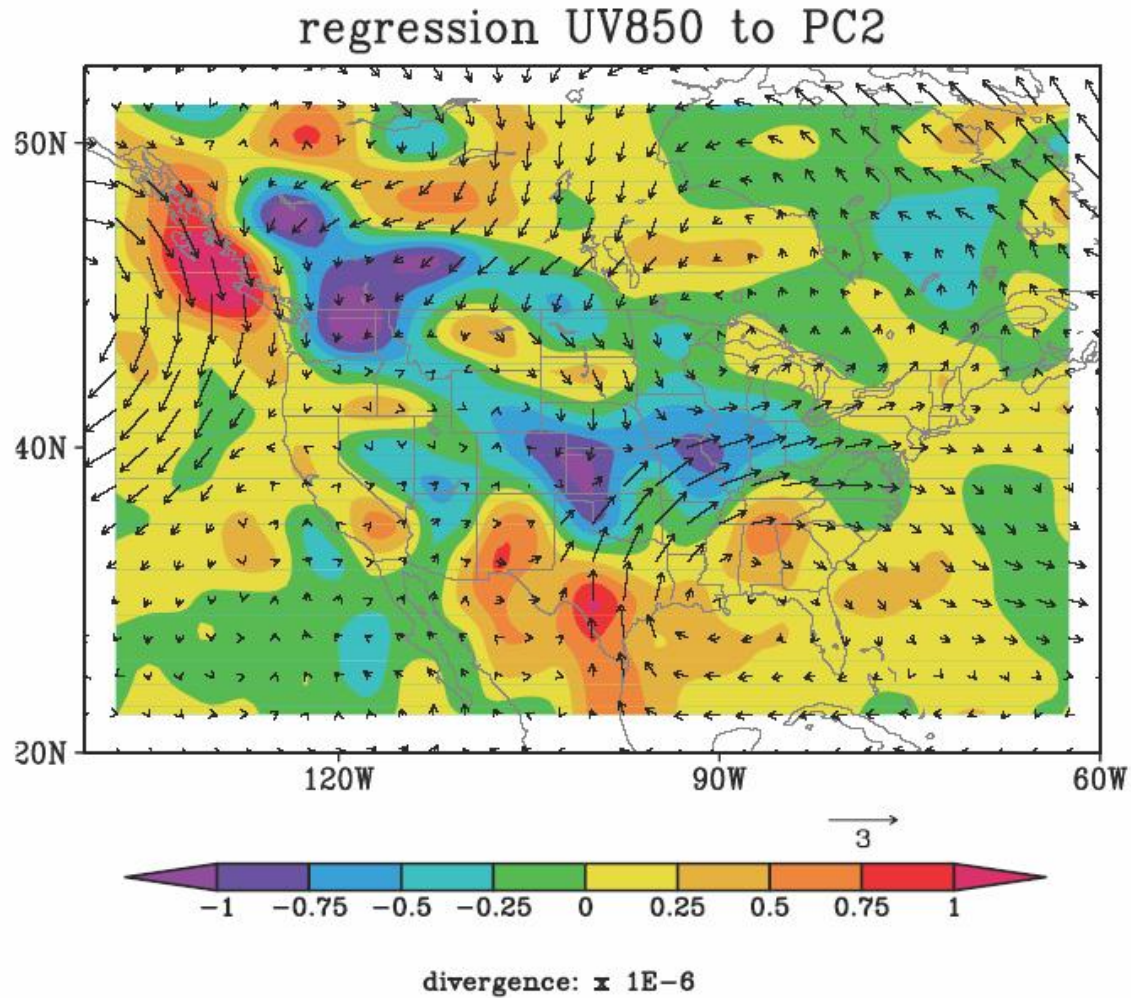
JJ EOF2 5.3%



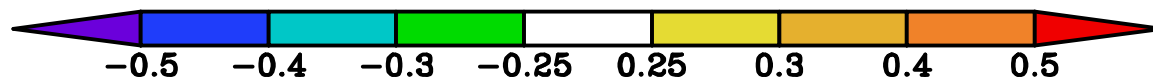
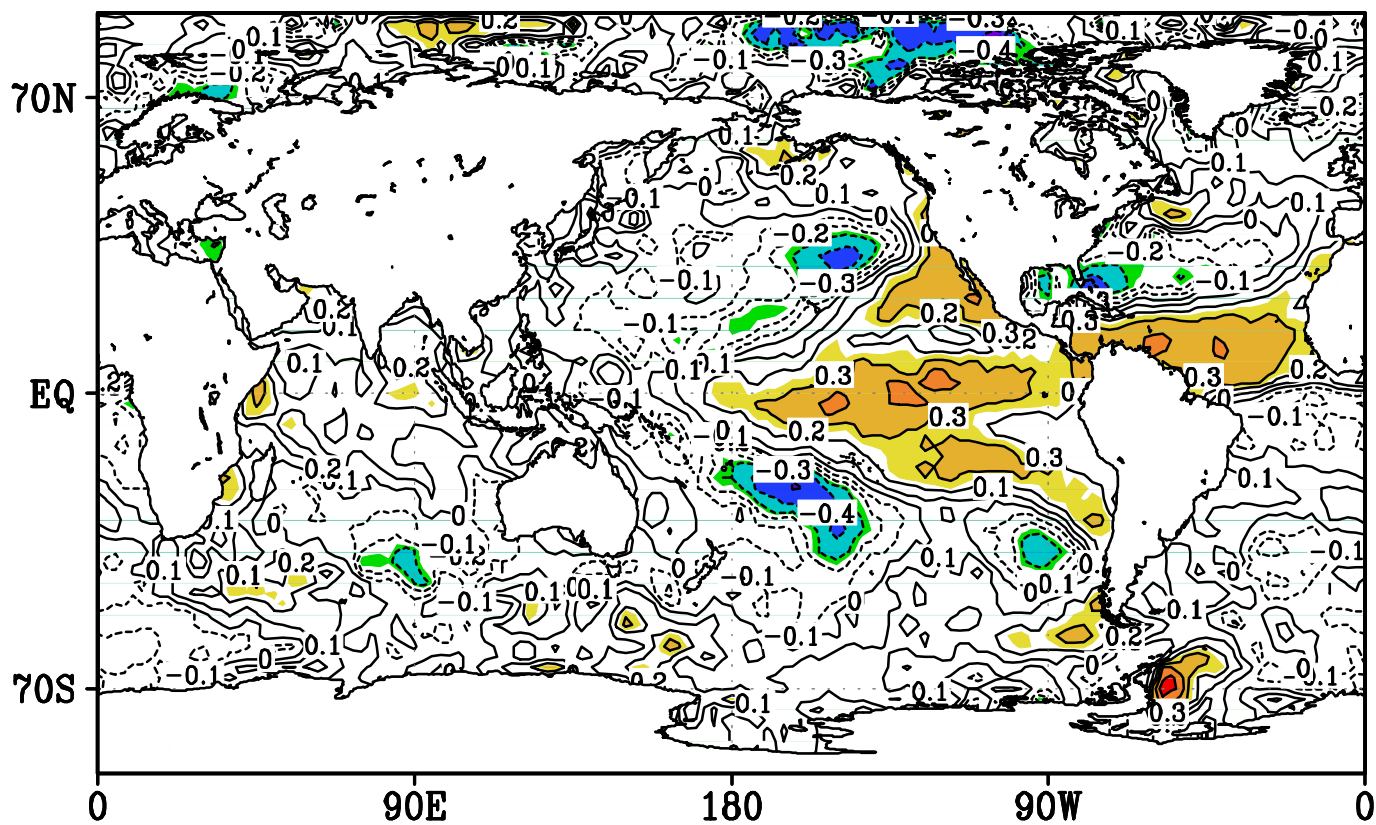
Time series of principal components for first two EOFs



Regression of low level wind field (850 mb) on PC2 and associated divergence field



Corr. SST-MAM and PC2



Canadian Seasonal Historical Forecast Project (HFP)

- Jacques Derome and CLIVAR colleagues
- Ensemble approach
 - 4 Canadian global atmospheric models
 - CGCM2, CGCM3. SEF, GEM
 - Different initial conditions
- Sea surface temperature (SST)
 - Persistence forecast (e.g., SST anomalies for MAM are persisted for JJAS forecast)

HFP JJAS forecast for JJ (Lag 0)

EOF	GCM2	GCM3	SEF	GEM
1	-0.08	-0.01	-0.06	-0.03
2	0.24	<u>0.39</u>	<u>0.44</u>	0.27
3	-0.03	0.04	-0.10	0.03
4	-0.05	0.15	-0.05	-0.06

Significant at 95%: >0.28



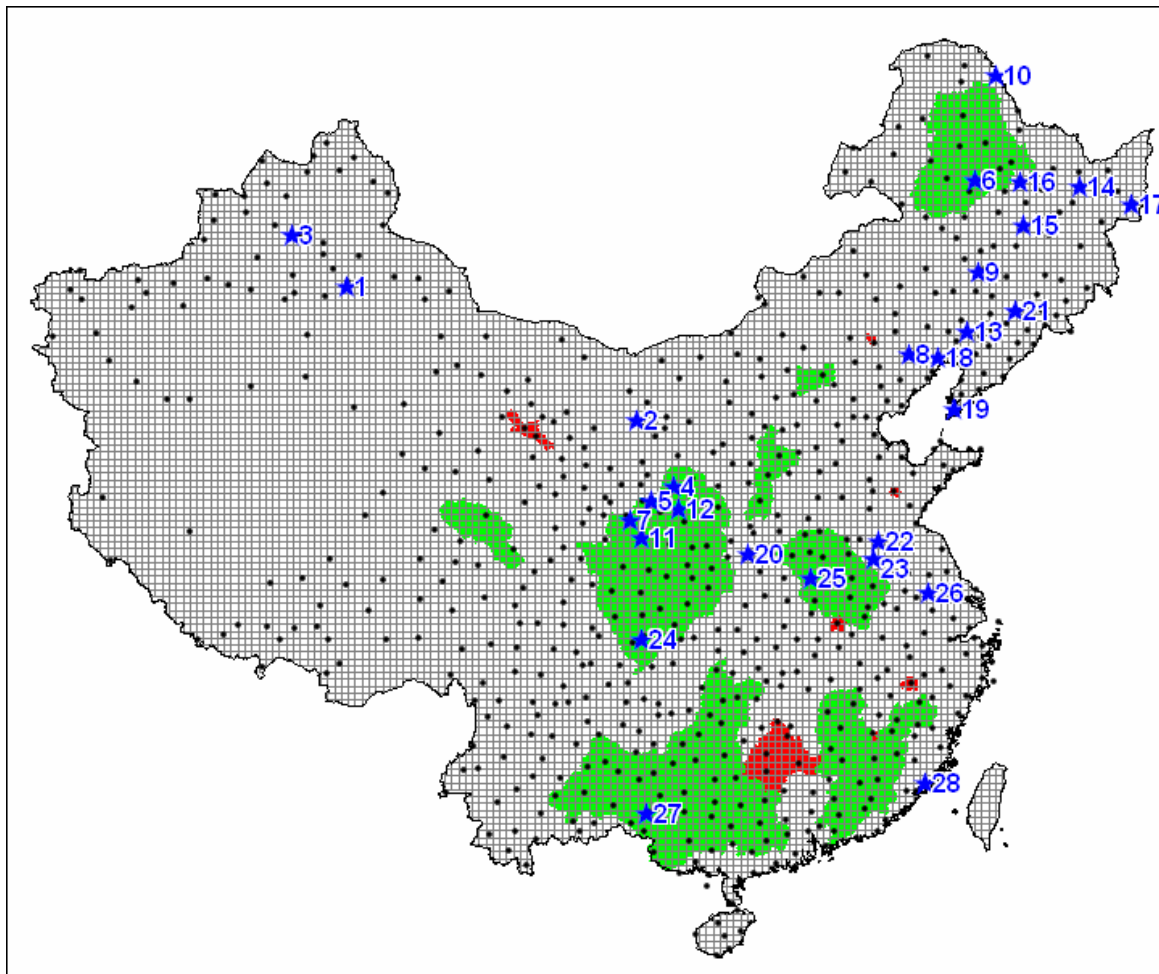
Lag	GCM2	GCM3	SEF
0 (JJAS for JJ)	0.24	<u>0.39</u>	<u>0.44</u>
1 month (MJJA for JJ)	-0.25	0.19	<u>0.38</u>
2 months (AMJJ for JJ)	0.26	<u>0.39</u>	0.25

Soil Moisture Simulation over China

- Team
 - Z. Wu, G. Lu, Hohai University, Nanjing, China
 - L. Wen, C.A. Lin, McGill University, Canada
 - J. Zhang, Y. Yang, Ministry of Water Resources, China
- VIC (Variable Infiltration Capacity) model (Lang et al., 1994, 1996)
- Driven by observed air temperature, precipitation over China from January 1971 to April 2005
- Grid of 10,458 points, resolution of 30 km × 30 km
- Calibration: hydrographs from 35 catchments
- Validation: hydrographs from 8 other catchments, and *in situ* soil moisture measurements from 28 sites

30-km VIC model grid with 10,458 points

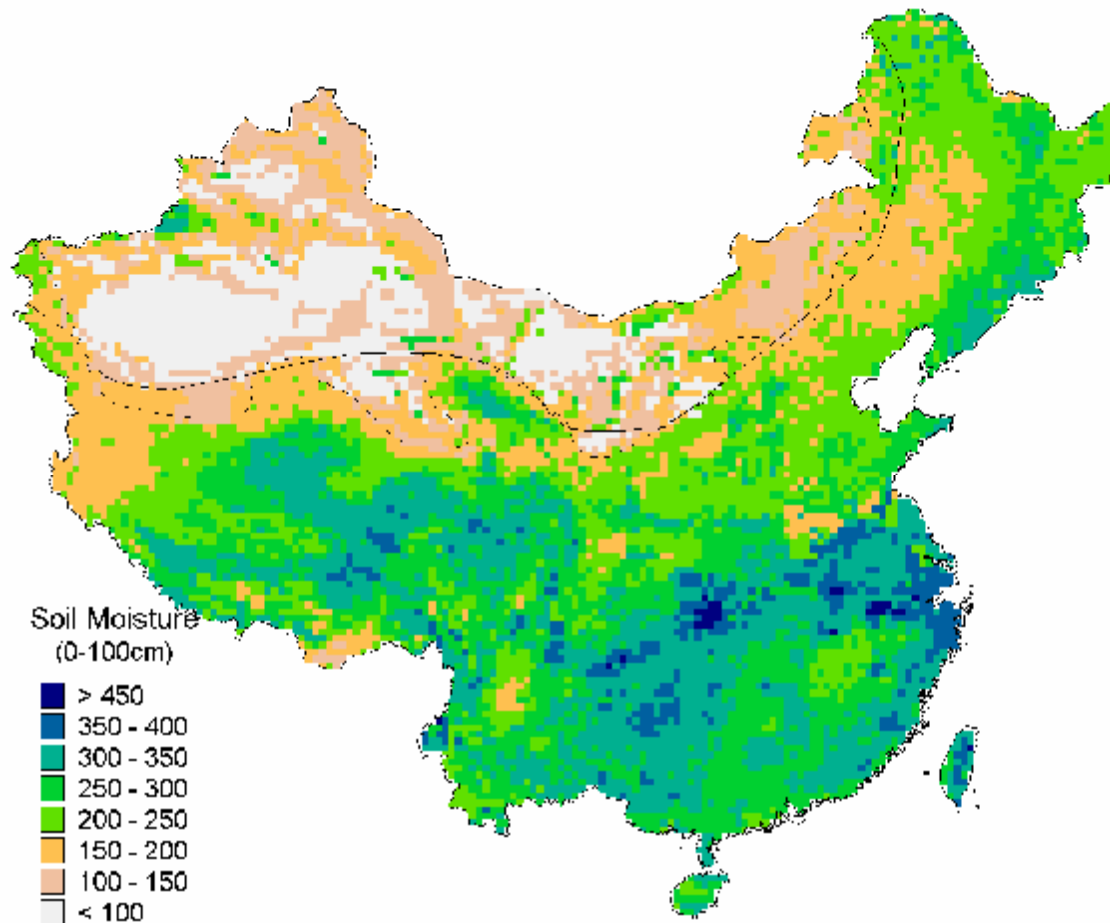
- 624 meteorological stations (•)
- 28 sites with *in situ* soil moisture measurements (3 times/month, top 1 meter, 1981-1999): blue stars, ordered according to annual precipitation



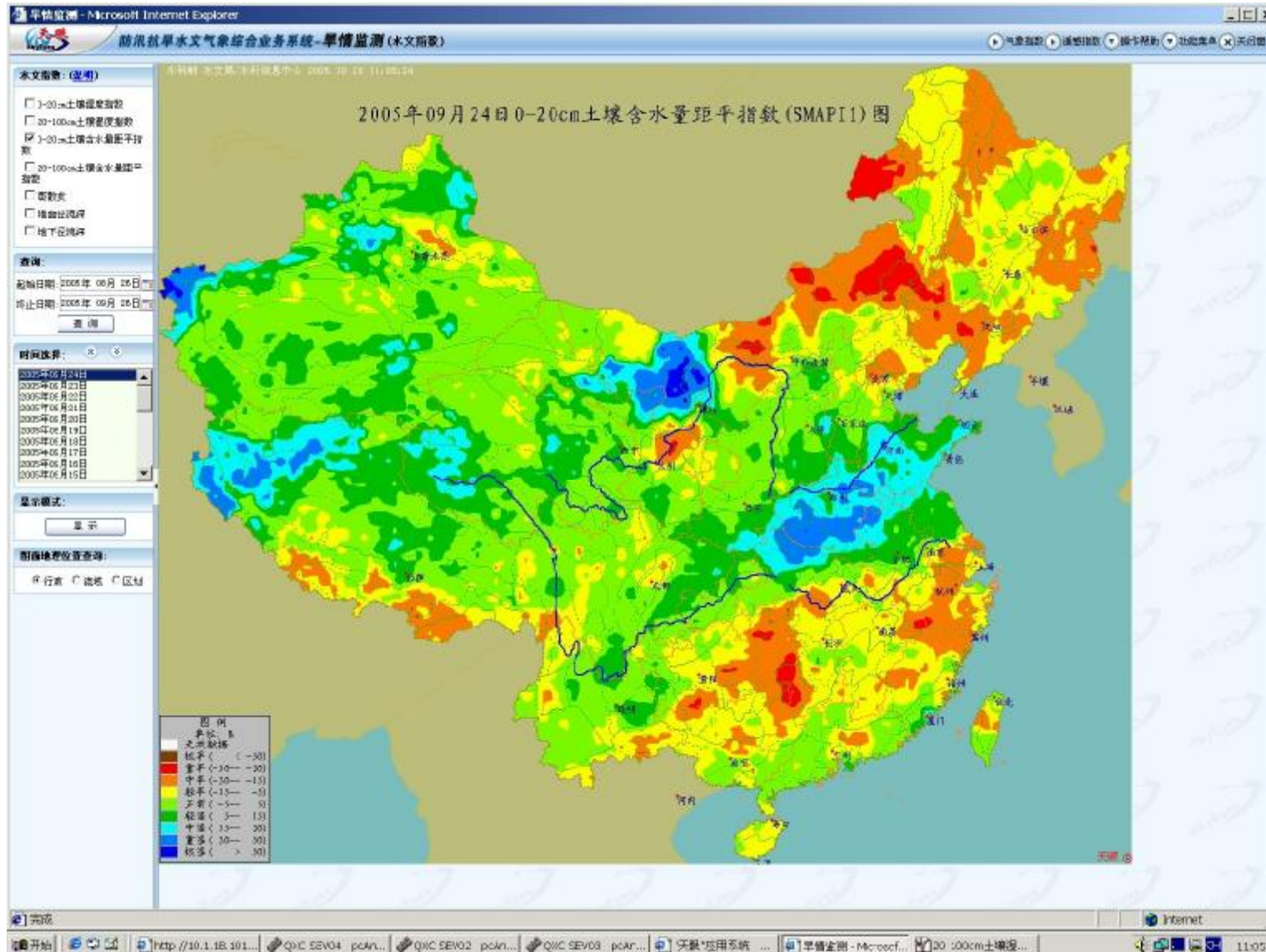
- 35 calibration and validation catchments (green; 190 to 351,530 km²)
- 8 additional validation catchments (red; 1,230 to 10,010 km²)

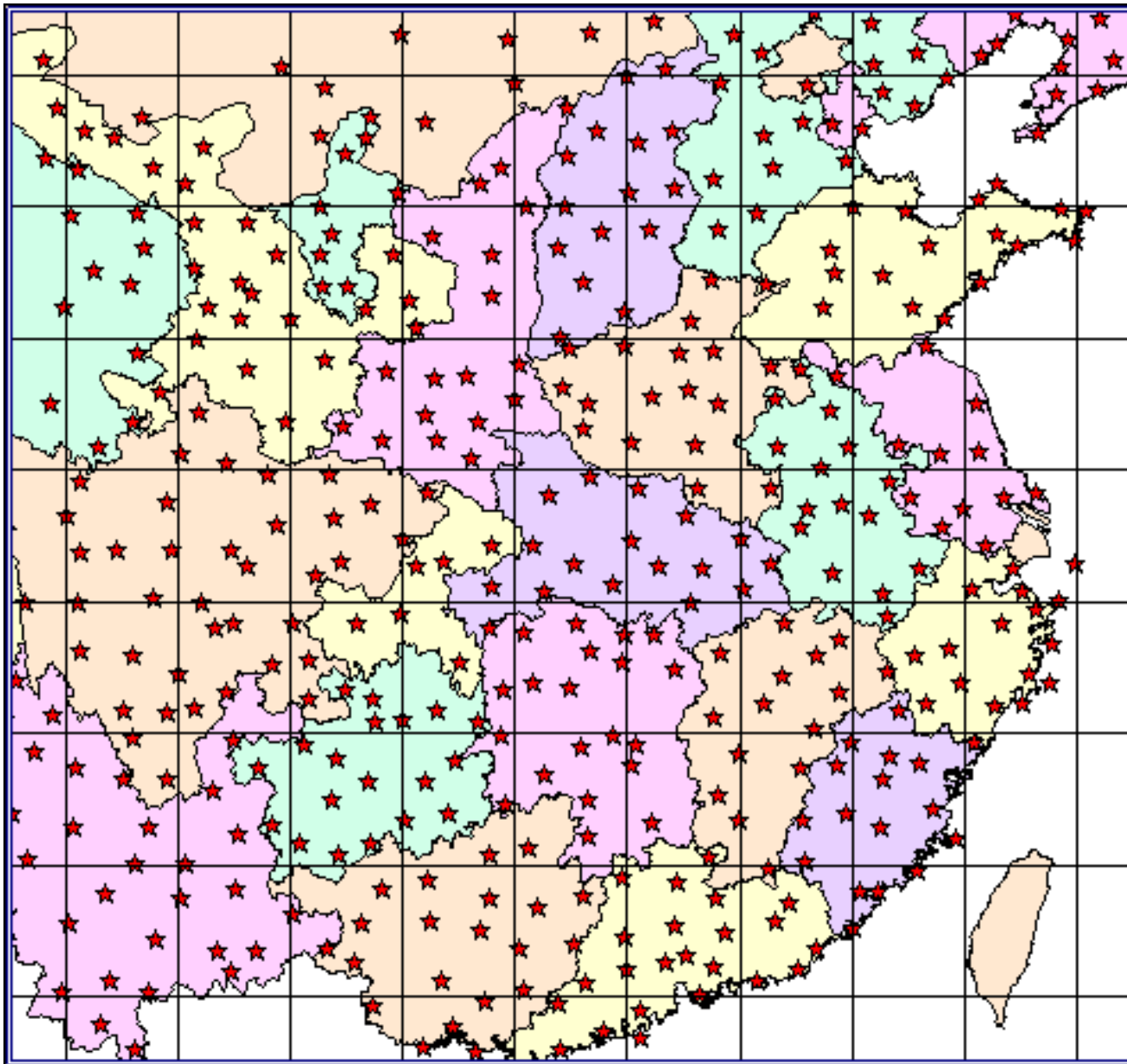
35-year soil moisture (top 1 meter) climatology from VIC model over China

- January 1971 to April 2005
- Climatology compares qualitatively well with charts of dry/wet zones from Office of State Flood Control and Drought Relief Headquarters of China



Operational drought monitoring in China currently uses soil moisture index derived from VIC model



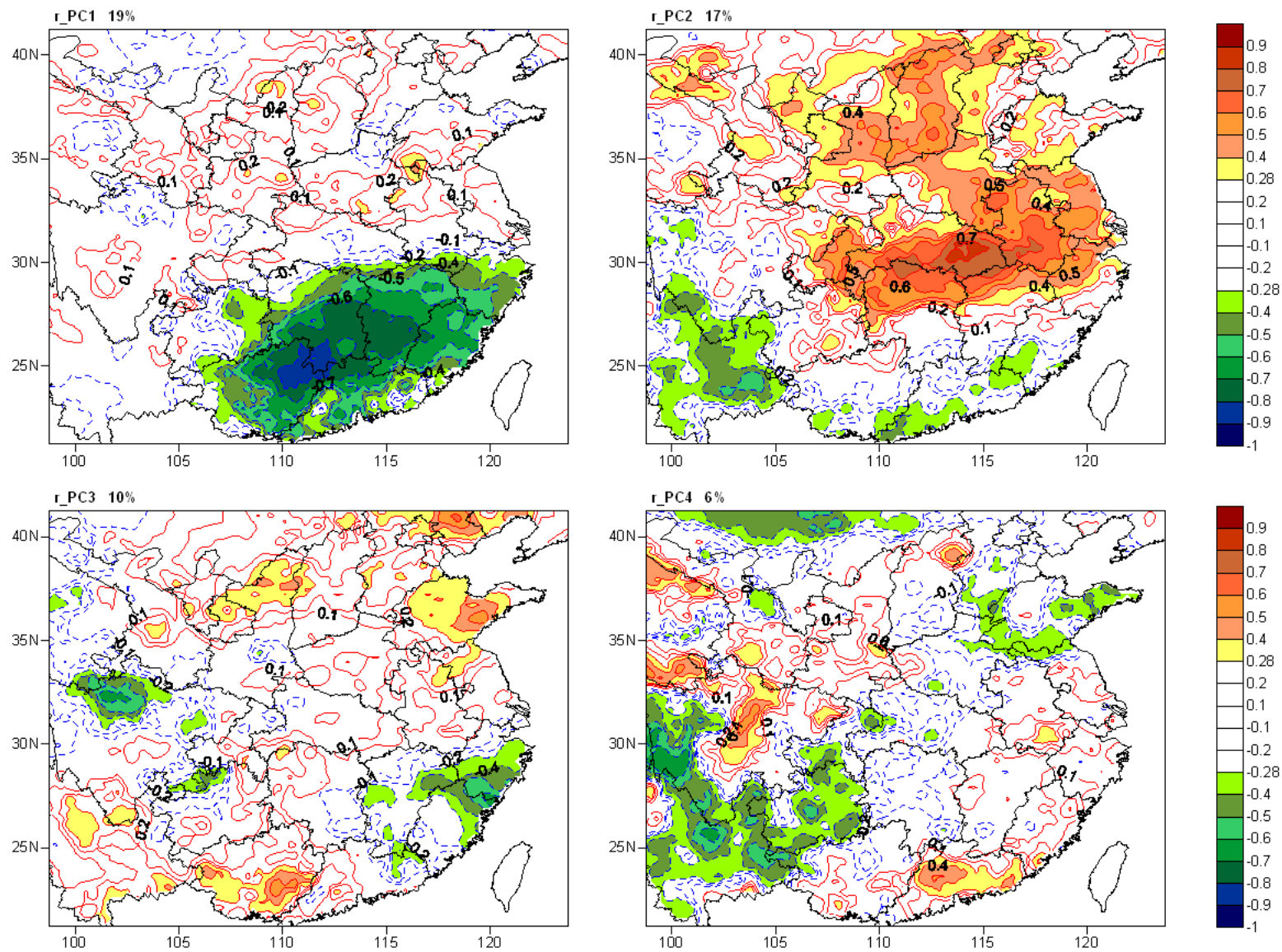


Total 402 rain gauges, period of 1969-2003

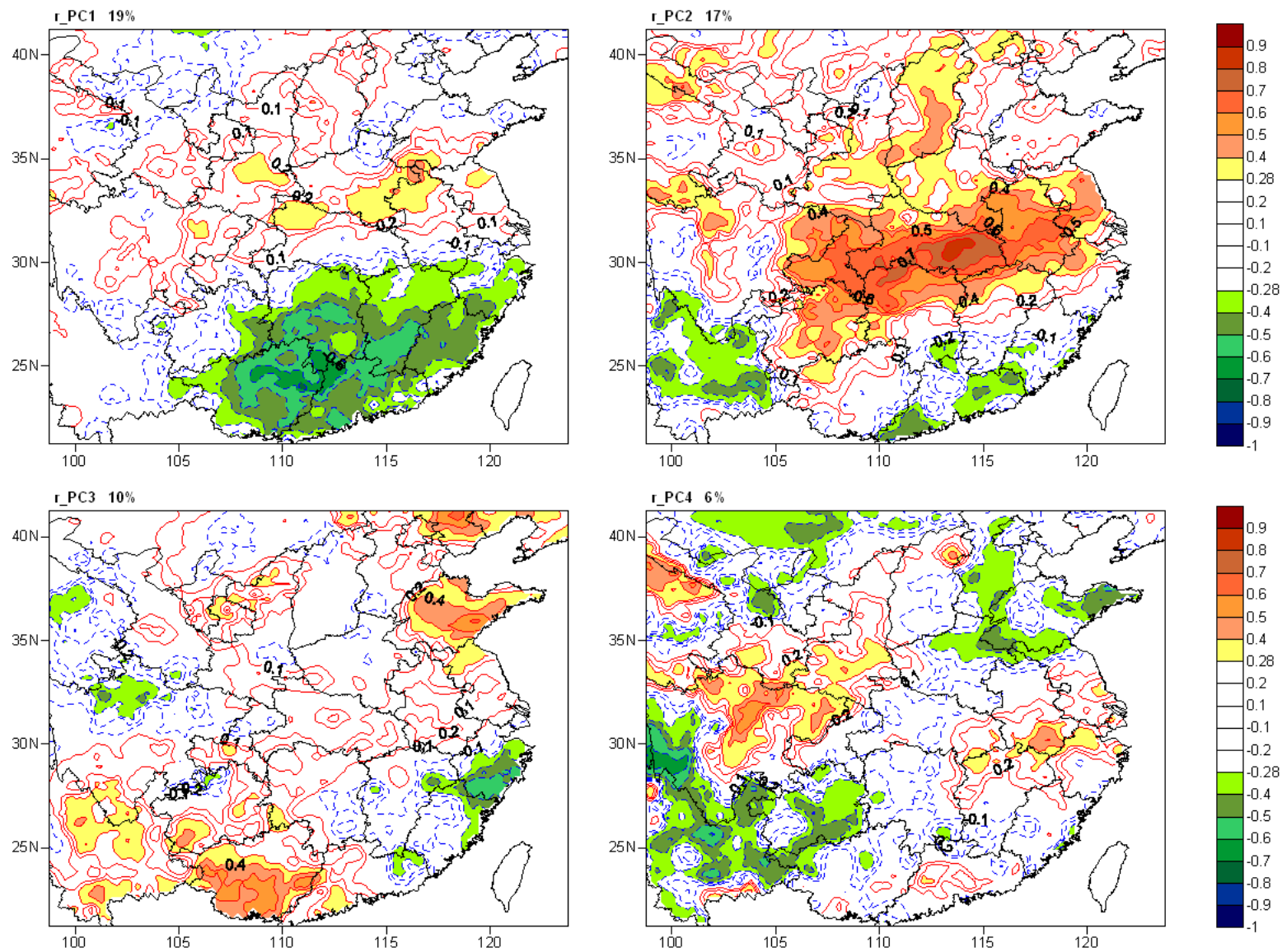
The coefficient correlation (r) field of the observed MJJ mean precipitation and VIC soil moisture at three depths (0-20, 20-100, and 0-100 cm), with 0 to 4 months lags in the soil moisture fields;

The color filled areas correspond to $r \geq \pm 0.28$, which is at the 95% significant level of Student T-test.

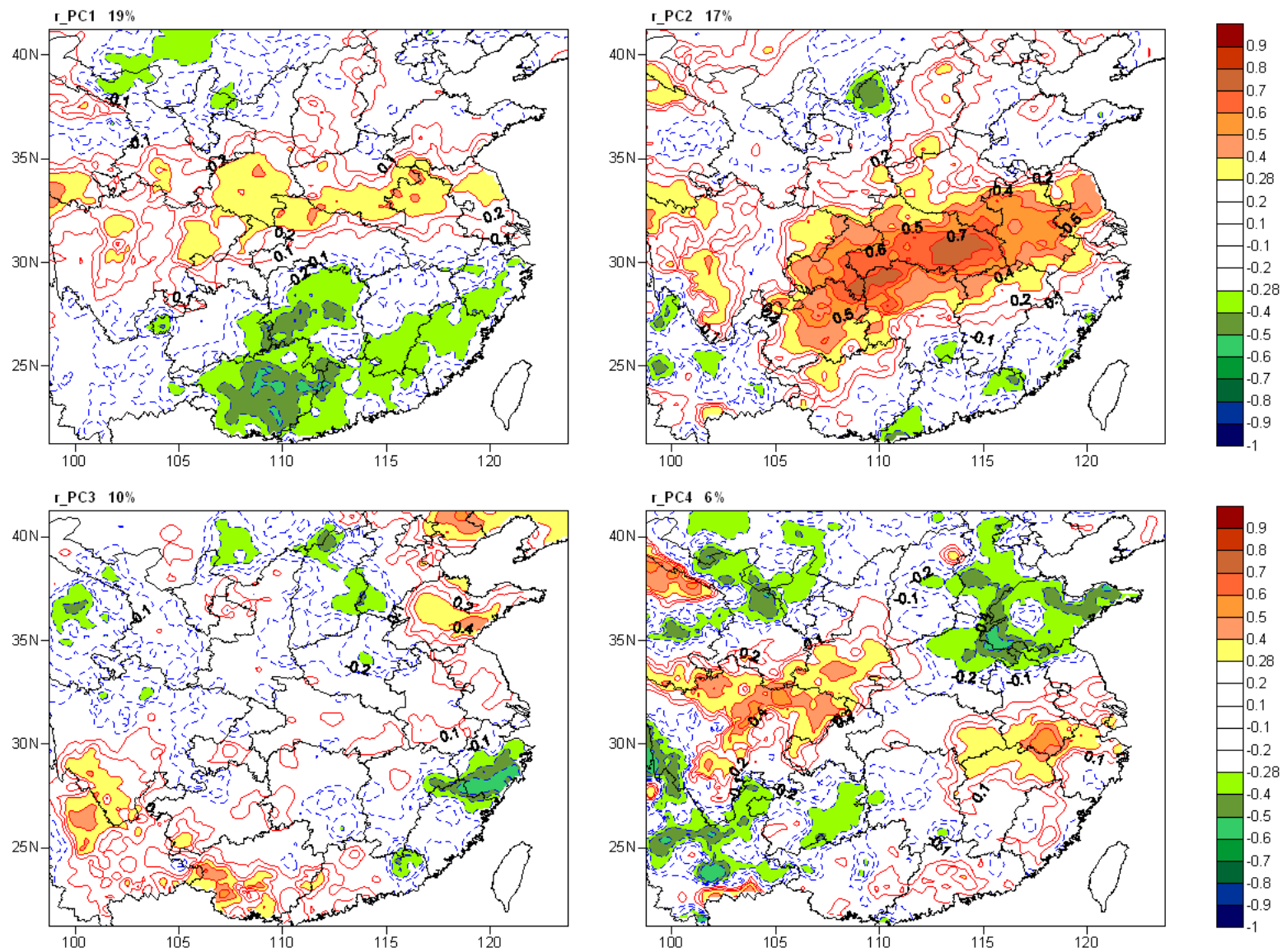
MJJ_PR_PC & MJJ_VIC_SM0-20cm



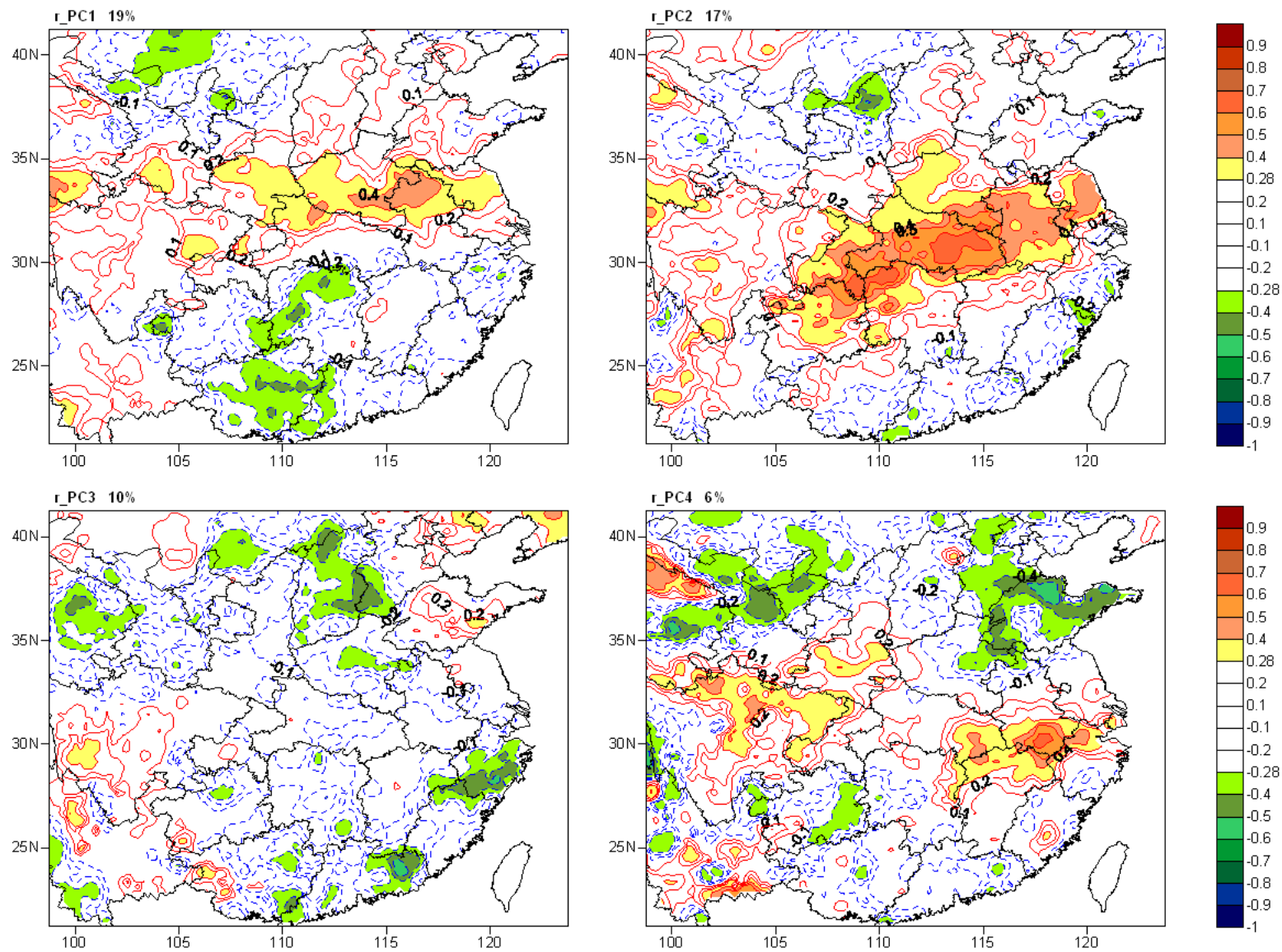
MJJ_PR_PC & JJA_VIC_SM0-20cm



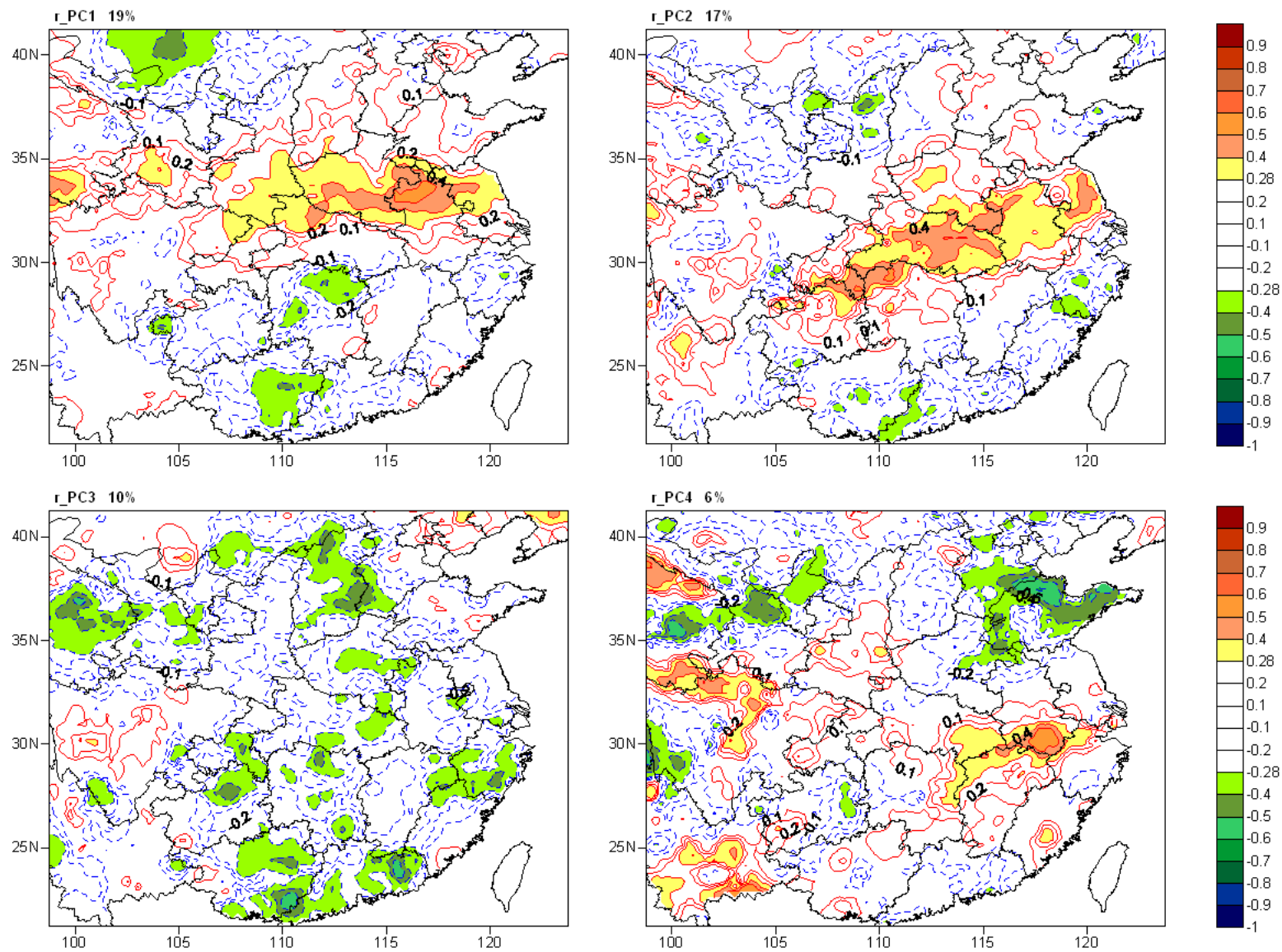
MJJ_PR_PC & JAS_VIC_SM0-20cm



MJJ_PR_PC & ASO_VIC_SM0-20cm



MJJ_PR_PC & SON_VIC_SM0-20cm



Conclusions

- Seasonal Forecast Project (HFP)
 - Extend analysis to Canadian prairies
 - Soil moisture analysis for CGCM3/CLASS
- Source of predictability
 - Soil moisture? Snow cover?
- Transfer VIC methodology to prairies?
- Canadian Regional Climate Model (CRCM4/CLASS)
- Everyone invited to participate!