

Climate of the 20th Century project (C20C) Report

BACKGROUND

Both the observation and the simulation of precipitation from the existing models are relatively limited in skill and accuracy, large spatial scales and long-time scales have been focused in evaluating the models. Three aspects are addressed in this project:

- 1) Validation of precipitation simulation in the C20C models;
- 2) Improvement of observational datasets; and
- 3) Enhanced understanding of climate variability and change during the 20th Century.

Datasets to be used include the modern global precipitation analyses that begin in 1979, GPCP (Global Precipitation Climatology Project) and CMAP (Climate Prediction Center Merged Analysis of Precipitation), the 20th Century reconstruction of precipitation produced by Smith et al., CMIP5 historical simulations, CMIP3 model runs and reanalysis products including ERA-Interim, NCEP1, MERRA, CFSR, JRA25 and 20thC.

ACCOMPLISHMENTS

Simulations of precipitation from one C20C, 12 CMIP5 historical simulations and 24 AR4 model runs are compared to 6 Reanalysis products (ERA-Interim, NCEP1, MERRA, CFSR, JRA25, 20thC) and GPCP and CMAP observations. For the global mean annual mean (Figure 1): the observations (mean of GPCP and CMAP) are lower than the reanalyses (mean of 6 reanalyses) and the simulations; CMIP5 are closer to the reanalyses; C20C is the highest. For the mean seasonal cycle: not much seasonal cycle on a global average; the N. and S. hemisphere out of phase; the simulations differ more from the observations in the ocean; in the tropics GPCP is the lowest over the ocean. For the ENSO signal, C20C captures the ENSO signal well in both the DJF (e.g. Figure 2) and the JJA seasons; the spatial pattern correlation between the C20C and reanalyses is generally higher than the correlation between C20C and the observations and the C20C has a higher correlation with both observations and reanalyses in the tropics than the higher latitudes (Figure 2).

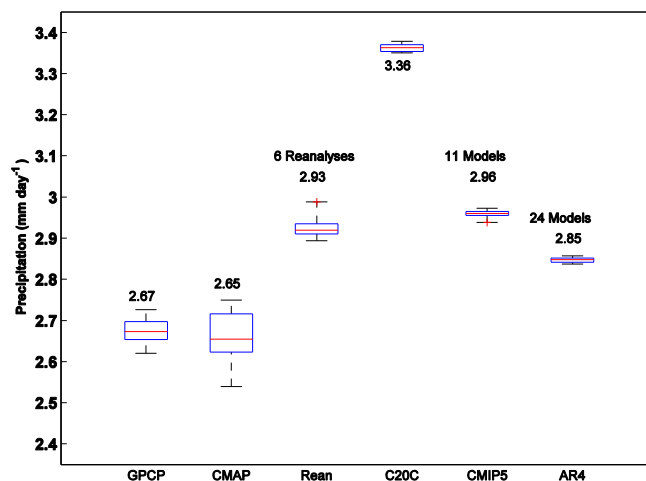


Figure 1: Global mean annual mean of GPCP, CMAP, mean of six reanalyses (ERA-Interim, NCEP1, MERRA, CFSR, JRA25, 20thC), 11 CMIP5 models and 24 CMIP3 models. Red lines mark the medians; the bottom of the box marks the 25th percentile; the top of the box marks the 75th percentile; lines extending from the top of the boxes mark the 98th percentile and from the bottom of the boxes mark the 2th percentile; the red plus signs mark the outliers (outside of the 98th percentile and 2th percentile).

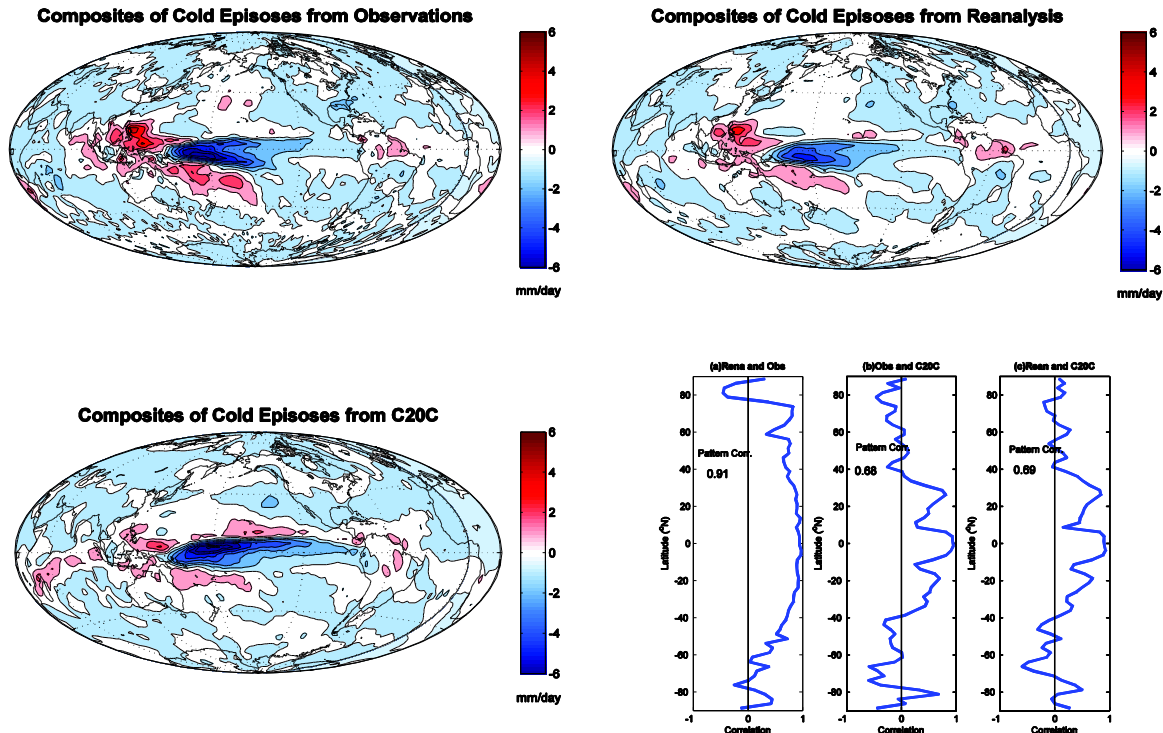


Figure 2: Composites of the cold episodes of ENSO for precipitation anomalies of observations (mean of GPCP and CMAP, left upper panel), reanalysis (mean of the six reanalysis, right upper panel) and C20C (left lower panel) in DJF season. The lower right panel shows the spatial correlation among C20C, observations and reanalyses along each latitudes.

PLANNED WORK

- Add more C20C and CMIP5 simulations when available to the evaluation.
- Investigate the global precipitation trend from precipitation reconstruction and compare it with reanalyses and C20C simulations.
- Study the precipitation features in NAO, PDO with the observations, reanalyses and simulations.

PUBLICATIONS

L. Ren, P. Arkin and T. Smith and J. Janowiak, trends in 20th Century Global Precipitation: observations and models, in preparation.

PRESENTATIONS

Ren, L., P. A. Arkin, J. Janowiak and T. Smith, Evaluation of Simulations of 20th Century Precipitation, World Climate Research Programm Open Science Conference, Denver, 10/2011, poster.