Verifying CORe Precipitation against a Gauge-based Analysis of Daily Precipitation over the Global Lnad

2022-11-06

Objectives

- Objective:

  To evaluate the CORe precipitation over the global land through comparison against a gauge-based analysis of daily precipitation;

- Features to be examined:

  - *Mean climatology;*
  - *Inter-annual variability associated with ENSO, PNA, and NAO; and*
  - *Intra-seasonal variability associated with MJO;*

Gauge-based Analysis of Daily Precipitation

1) The raw CUPA Daily Gauge Analysis

- The 'raw' gauge-based analysis of daily precipitation, also called CPC Unified Precipitation Analysis (CUPA);

  - *Defined through interpolation of gauge reports from nearby stations;*
  - *Constructed on a 0.125°lat/lon grid over the global land;*
  - *Available over the entire global land from 1979 to the present and over CONUS from 1948;*

  - *Bias of non-negligible magnitude is observed relative to high-quality monthly gauge analysis over many places, caused by imperfect station reports;*

Gauge-based Analysis of Daily Precipitation

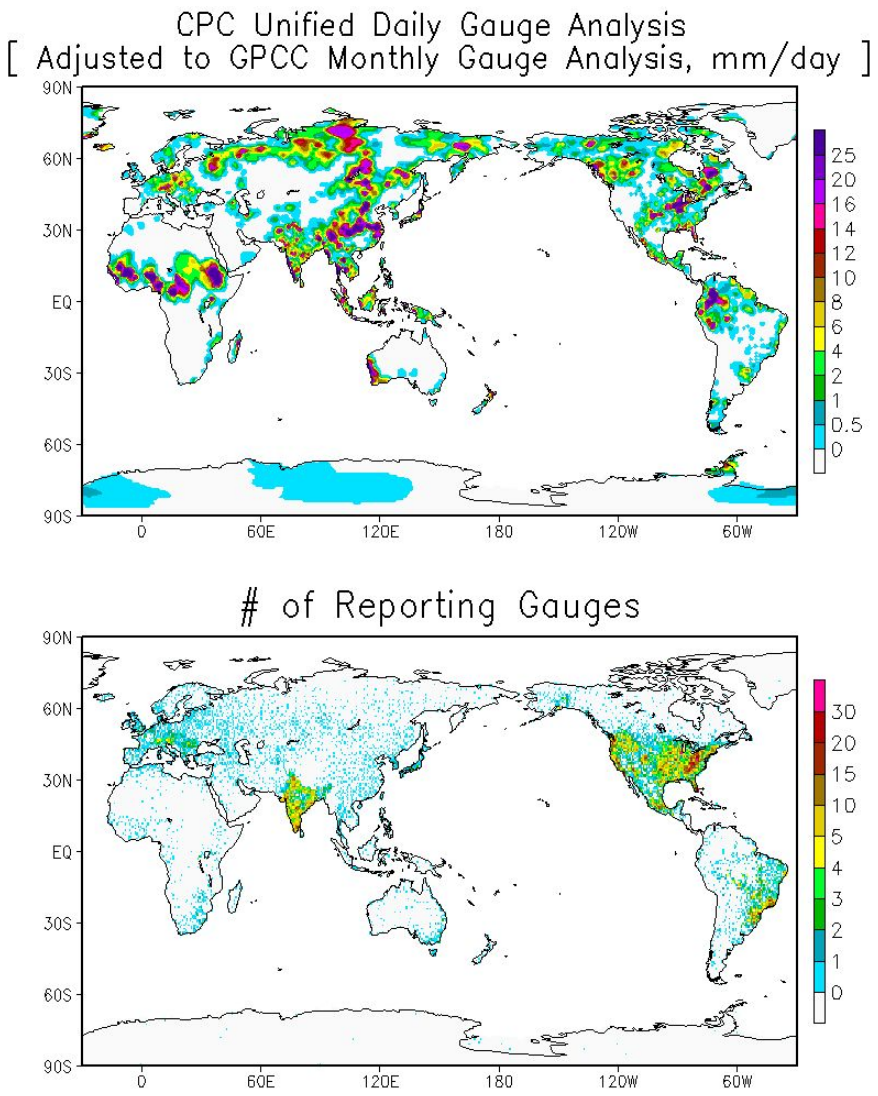
2) Adjustment to GPCC Monthly Gauge Analysis

- The raw CUPA daily gauge analysis is adjusted against the GPCC monthly gauge analysis Version 2022 to remove the bias (mainly under-estimation);
- Ratio between the GPCC monthly and the mean mean fields derived from the raw CUPA daily gauge analysis is calculated on each 1deg lat/lon and for each day and then down-scaled to the CUPA native grid of 0.125°lat/lon;
- The ratio is then applied to multiply to the raw CUPA to correct the bias;
- Examinations show that the large-scale bias in the raw CUPA is removed while the day-to-day variability is retained;
- **The bias-corrected CUPA is called CUPA adjusted;**

Gauge-based Analysis of Daily Precipitation

3) CUPA Adjusted Re-gridded to the CORe Gaussian Grid

- The CUPA adjusted is regrided from its native grid of 0.125°lat/lon to the CORe Gaussian grid of 512x256;
- Precipitation at a Gaussian grid is assumed to be representing an areal mean over a rectangular box of centering at the target grid point and extending between the mid points with the neighboring grid points in both S-N and W-E directions;
- CUPA adjusted over a CORe grid is defined as the mean precipitation values over all 0.125°lat/lon grids falling into the above mentioned rectangular box, weighted by the area of the 0.125°lat/lon grid box;
- **Sample CUPA adjusted daily precipitation fields for 16 July 2020;**



Gauge-based Analysis of Daily Precipitation

4) Where to get the CUPA Adjusted daily Gauge Analysis

- CUPA Adjusted Daily Gauge Analysis
  - Daily Time series: /cpc/prcp/CORe/OBS/CUPA_ADJ/CTL/CUPA_ADJ_TO_GPCC_V2022_512x256.lnx.ctl
  - Daily Climatology: /cpc/prcp/CORe/OBS/CUPA_ADJ/CTL/CUPA_ADJ_TO_GPCC_V2022_512x256_CLIM_DLY.lnx.1991-2020.366.ctl
  - Daily Anomaly: /cpc/prcp/CORe/OBS/CUPA_ADJ/CTL/CUPA_ADJ_TO_GPCC_V2022_512x256_ANOM_DLY.lnx.ctl
  - NOTE: It is NOT appropriate to compare the daily gauge analysis directly to CORe daily precipitation due to differing daily ending hours for the gauge reports;
- CUPA Adjusted Monthly Gauge Analysis (averaged from daily data)
  - Monthly Time Series: /cpc/prcp/CORe/OBS/CUPA_ADJ/CTL/CUPA_ADJ_TO_GPCC_V2022_512x256_MON.lnx.ctl
  - Monthly Climatology: /cpc/prcp/CORe/OBS/CUPA_ADJ/CTL/CUPA_ADJ_TO_GPCC_V2022_512x256_CLIM_MON.lnx.1991-2020.ctl
  - Monthly Anomaly: /cpc/prcp/CORe/OBS/CUPA_ADJ/CTL/CUPA_ADJ_TO_GPCC_V2022_512x256_ANOM_MON.lnx.ctl

CORe Precipitation Fields

1) Daily Precipitation

- Daily precipitation is computed from the CORe 3-hourly fields on the CORe native grid;
- Monthly precipitation is averaged from respective daily fields;
- Daily and monthly climatology is defined in the same way as that for the construction of CUPA ADJ climatology;

CORe Precipitation Fields

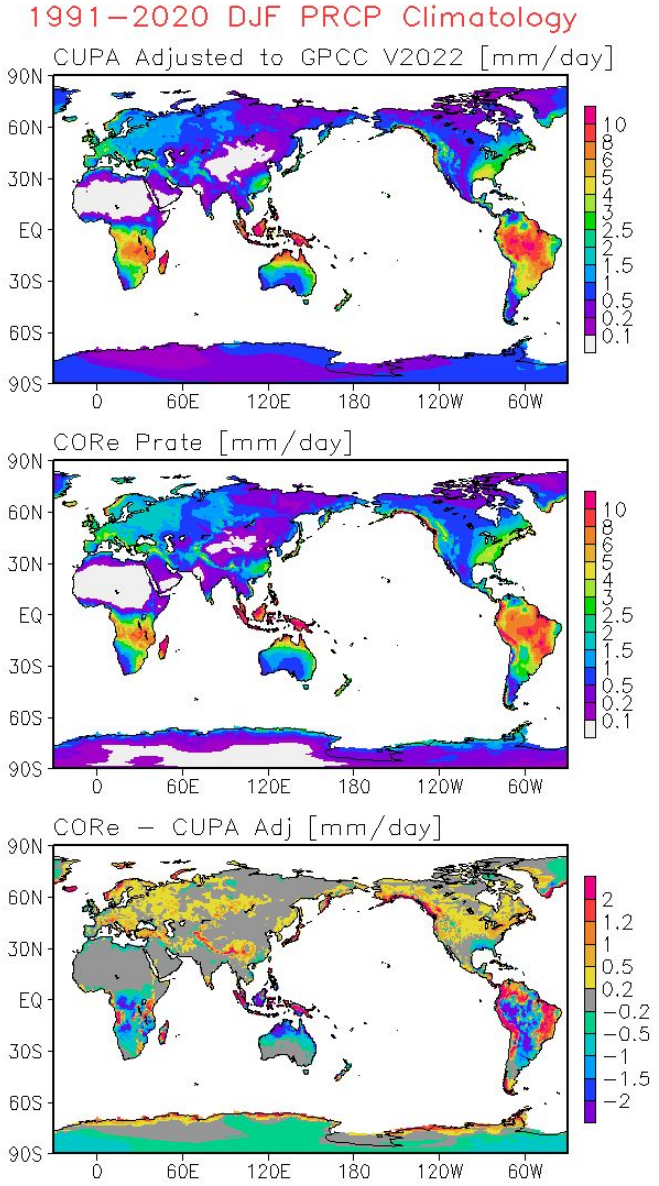
2) Where to get the CORe precipitation data

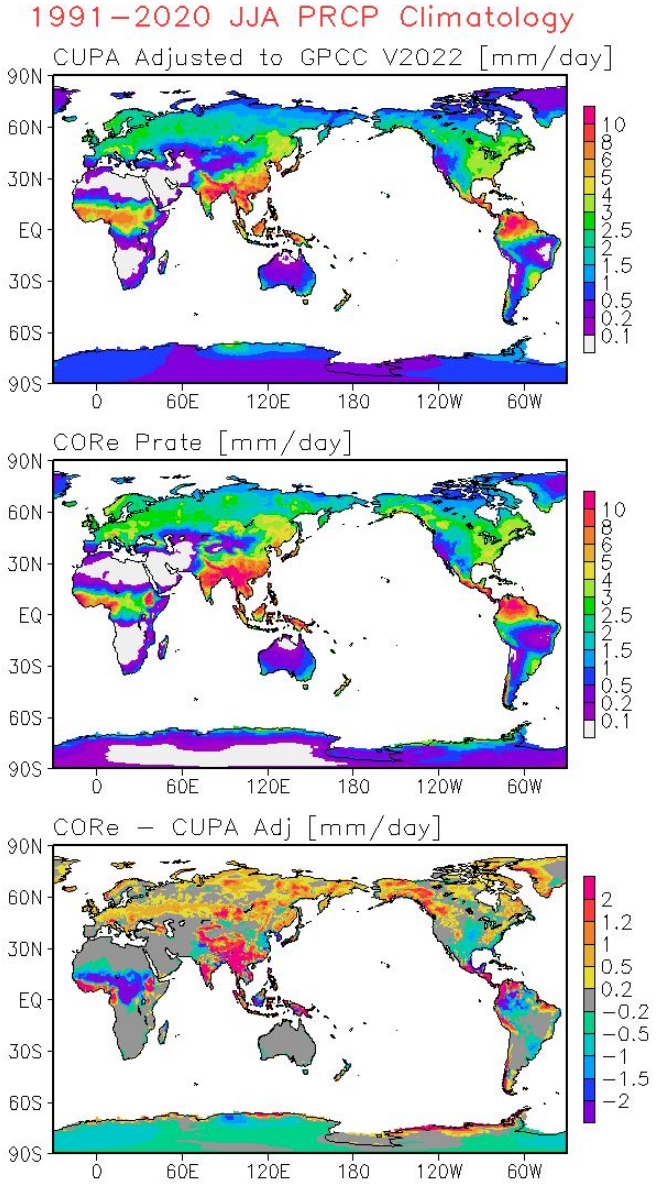
- CORe Daily Precipitation :
  - Daily Time series:
    /cpc/prcp/CORe/precip/ctl/c1.precip_512x256.lnx.ctl
  - Daily Climatology:
    /cpc/prcp/CORe/precip/ctl/CORe_PRCP_512x256_CLIM_DLY.lnx.1991-2020.366.ctl
  - Daily Anomaly:
    /cpc/prcp/CORe/precip/ctl/precip_512x256_ANOM_DLY.lnx.ctl

  - NOTE: It is NOT appropriate to compare the daily gauge analysis directly to CORe daily precipitation due to differing daily ending hours for the gauge reports;

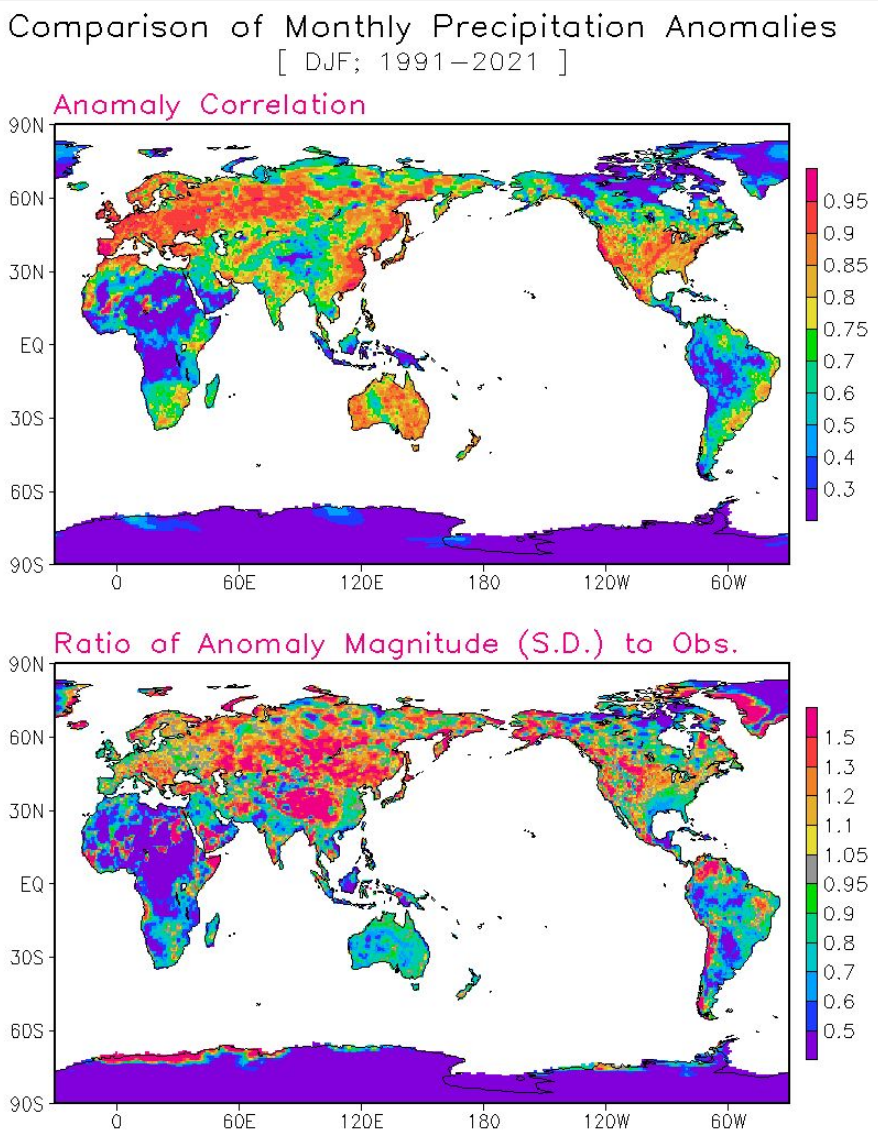
- CORe Monthly Precipitation (averaged from daily data)
  - Monthly Time Series:
    /cpc/prcp/CORe/precip/ctl/precip_512x256_MON.lnx.ctl
  - Monthly Climatology:
    /cpc/prcp/CORe/precip/ctl/CORe_PRCP_512x256_CLIM_MON.lnx.1991-2020.ctl
  - Monthly Anomaly:
    /cpc/prcp/CORe/precip/ctl/precip_512x256_ANOM_MON.lnx.ctl

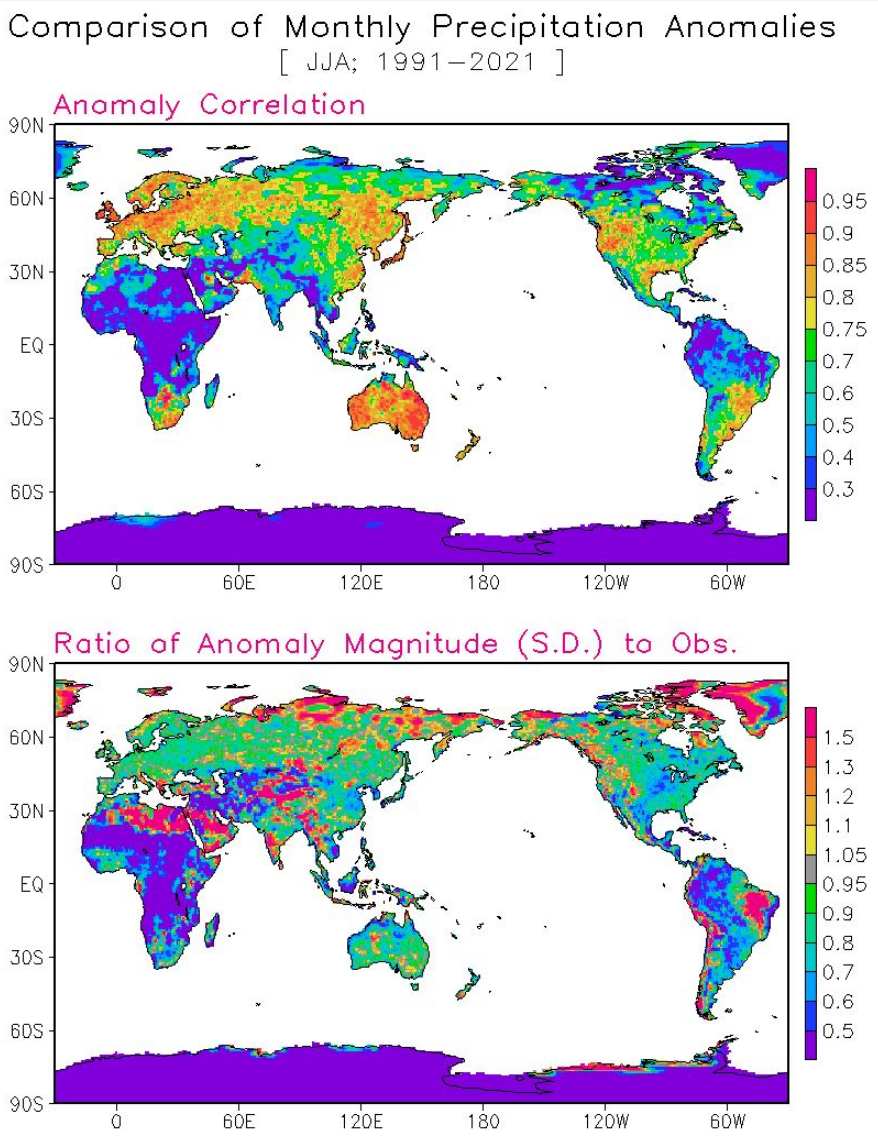
Comparison of Seasonal Climatology



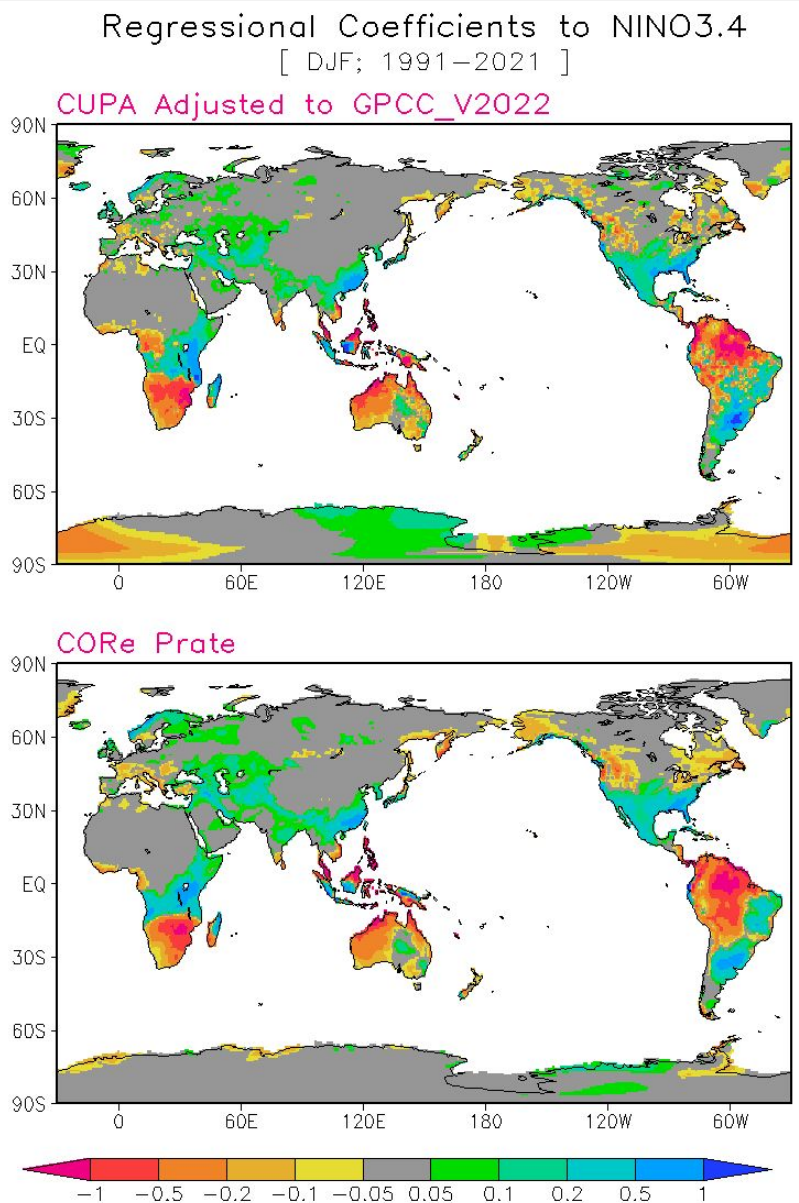


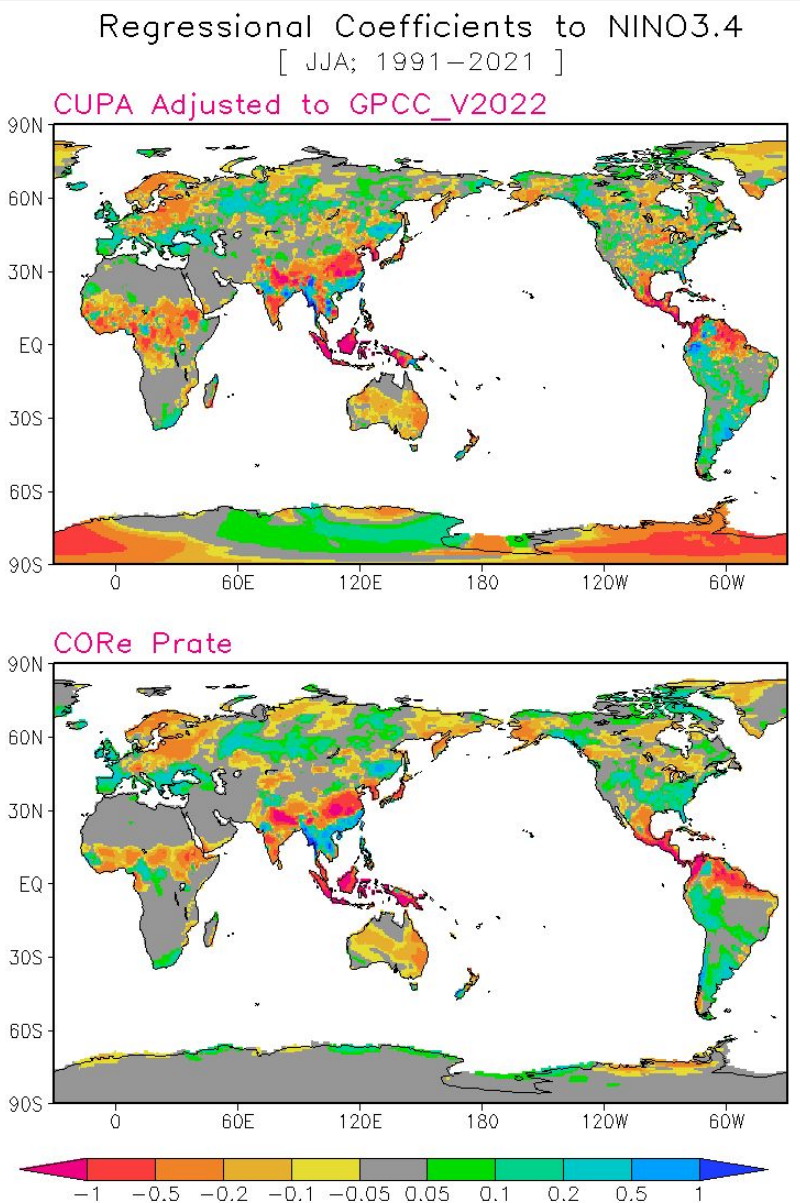
Monthly Anomaly Correlation for 1991-2021



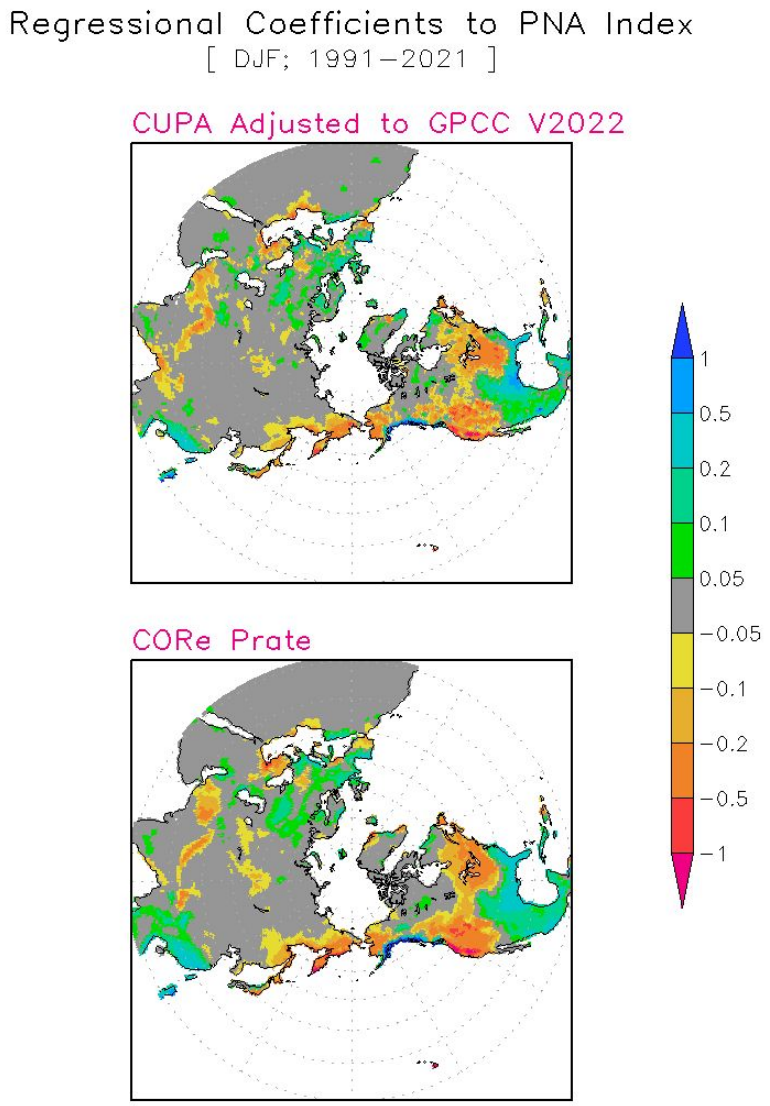


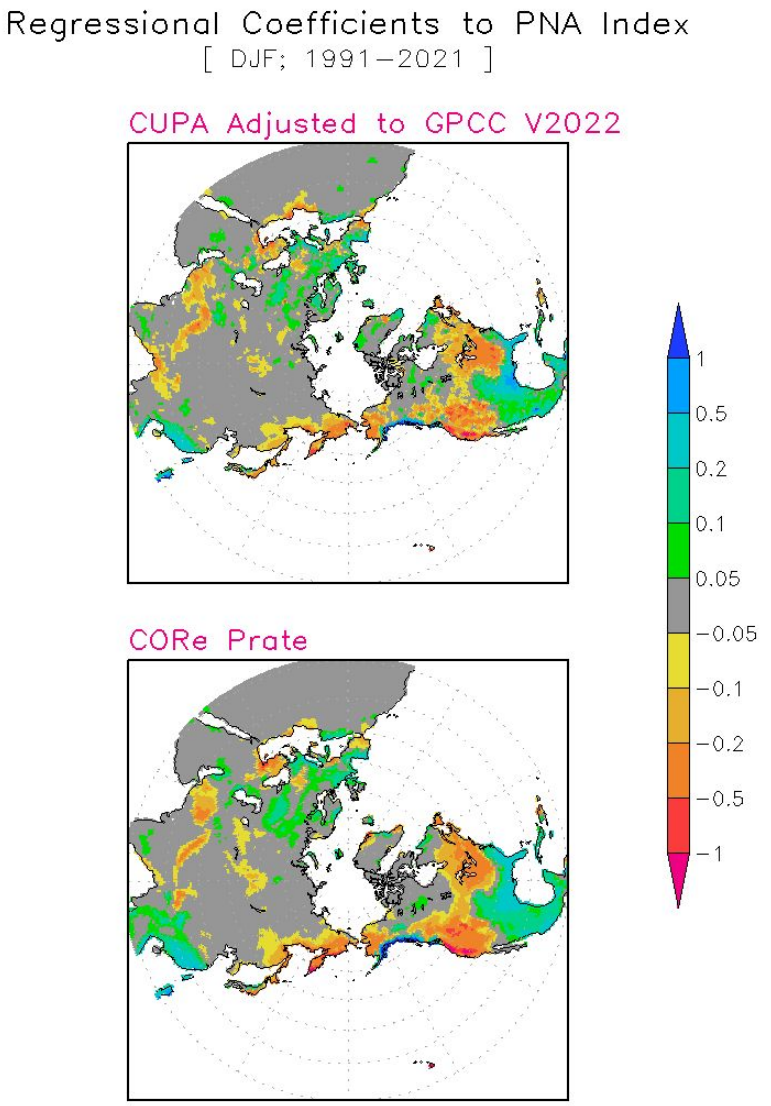
Regression of Mon Anomaly agnst NINO3.4



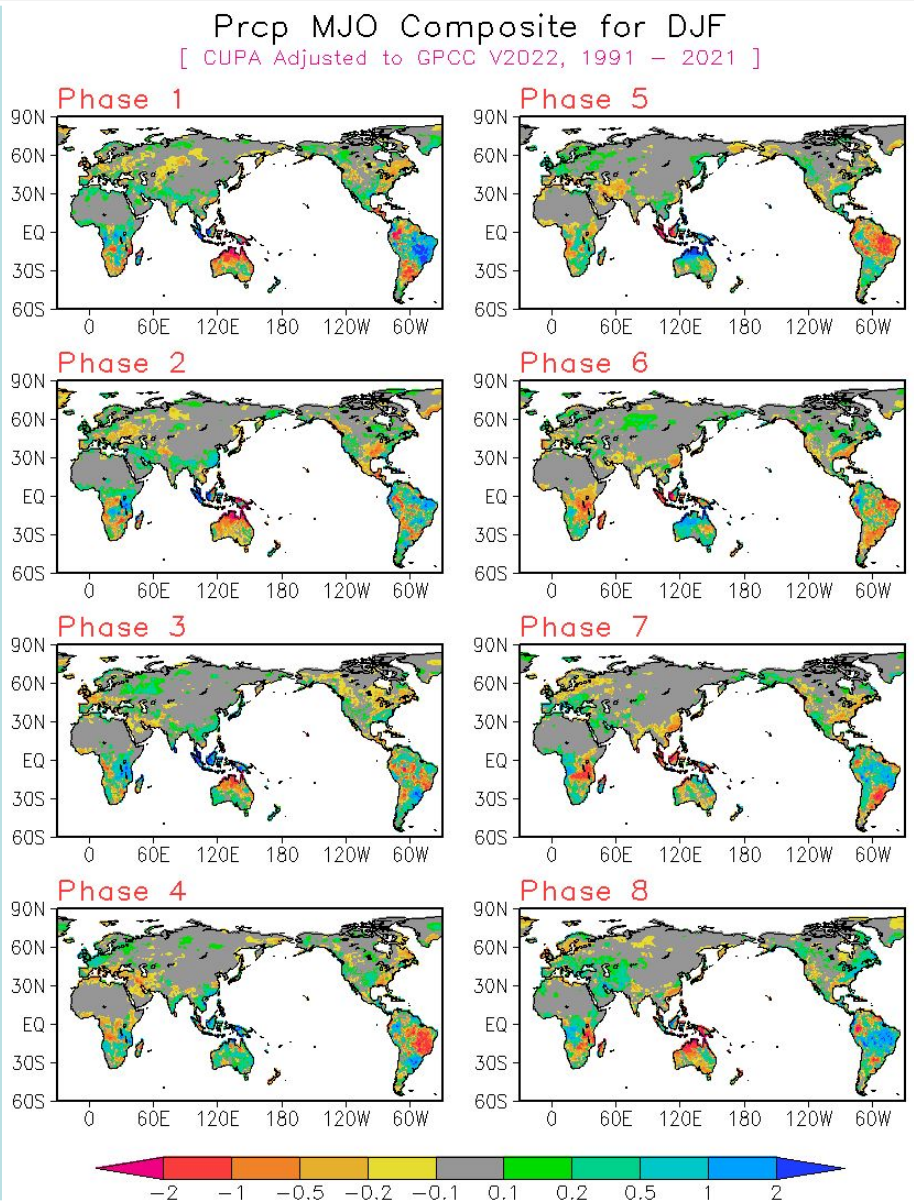


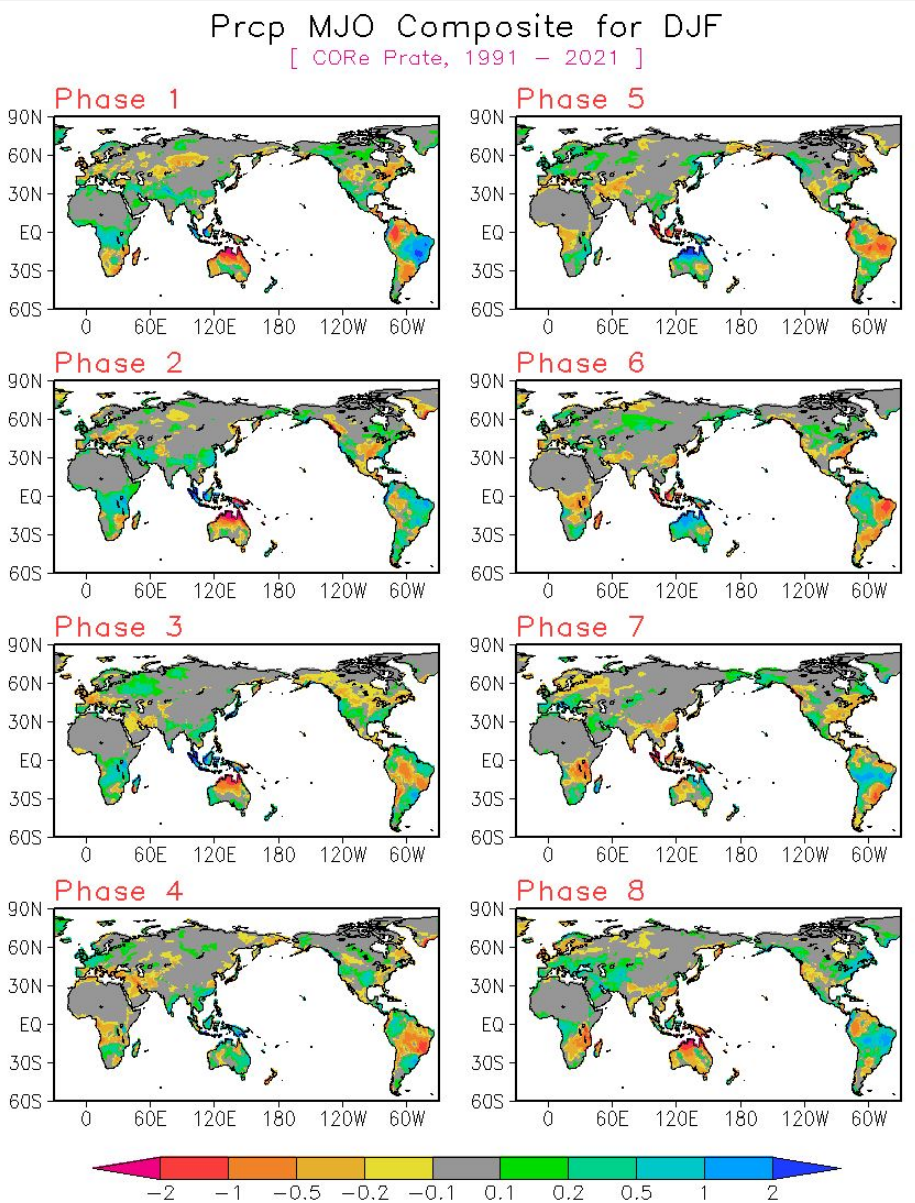
Regression of Mon Anomaly agnst PNA & NAO Indies



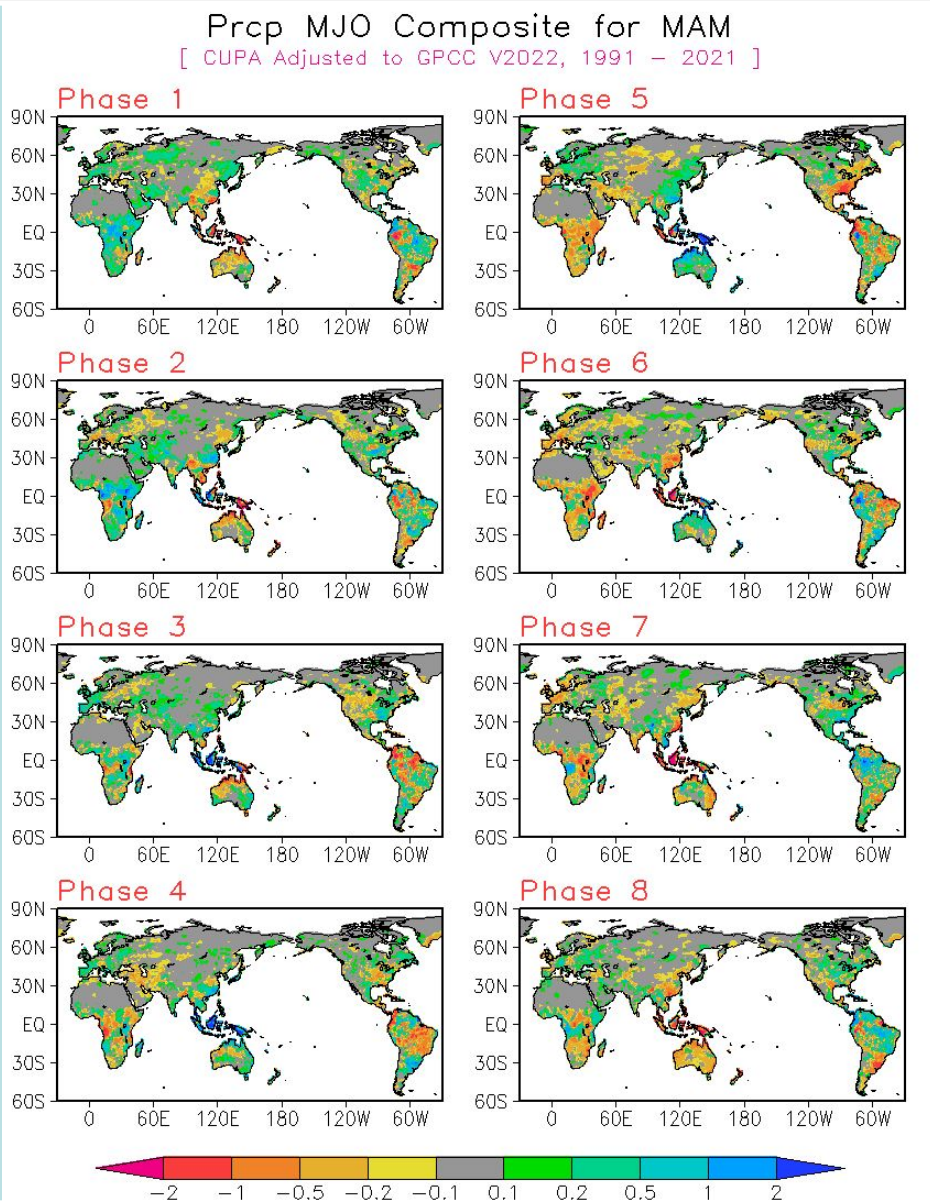


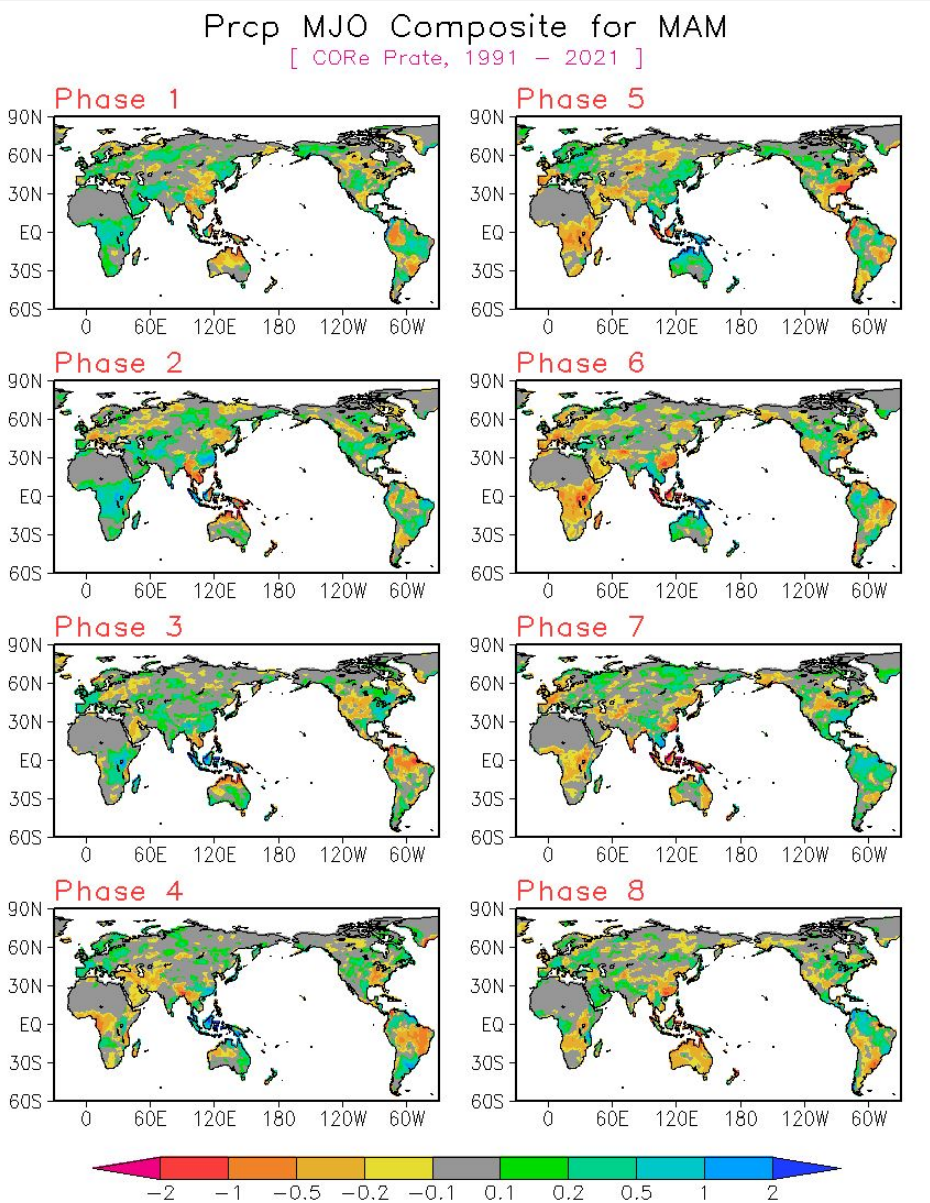
MJO Composite [DJF]



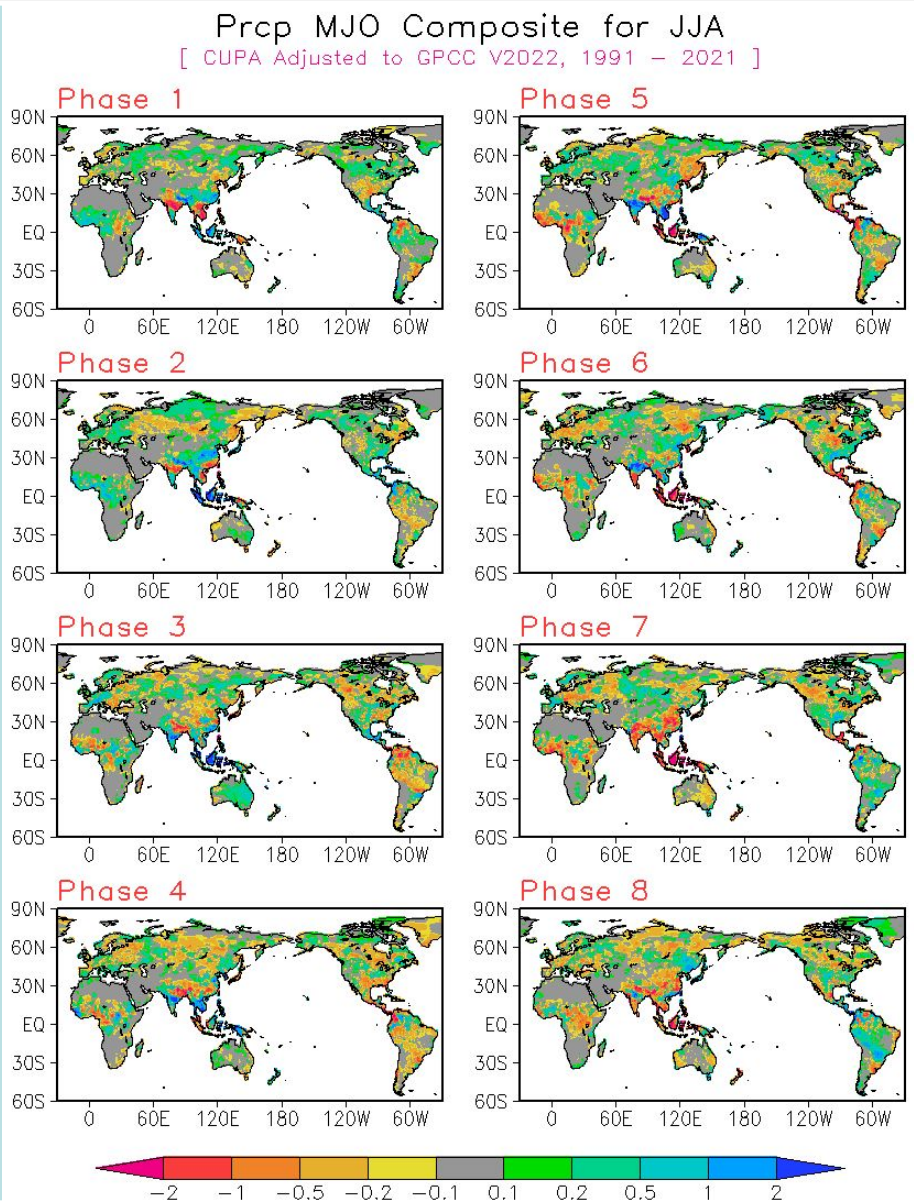


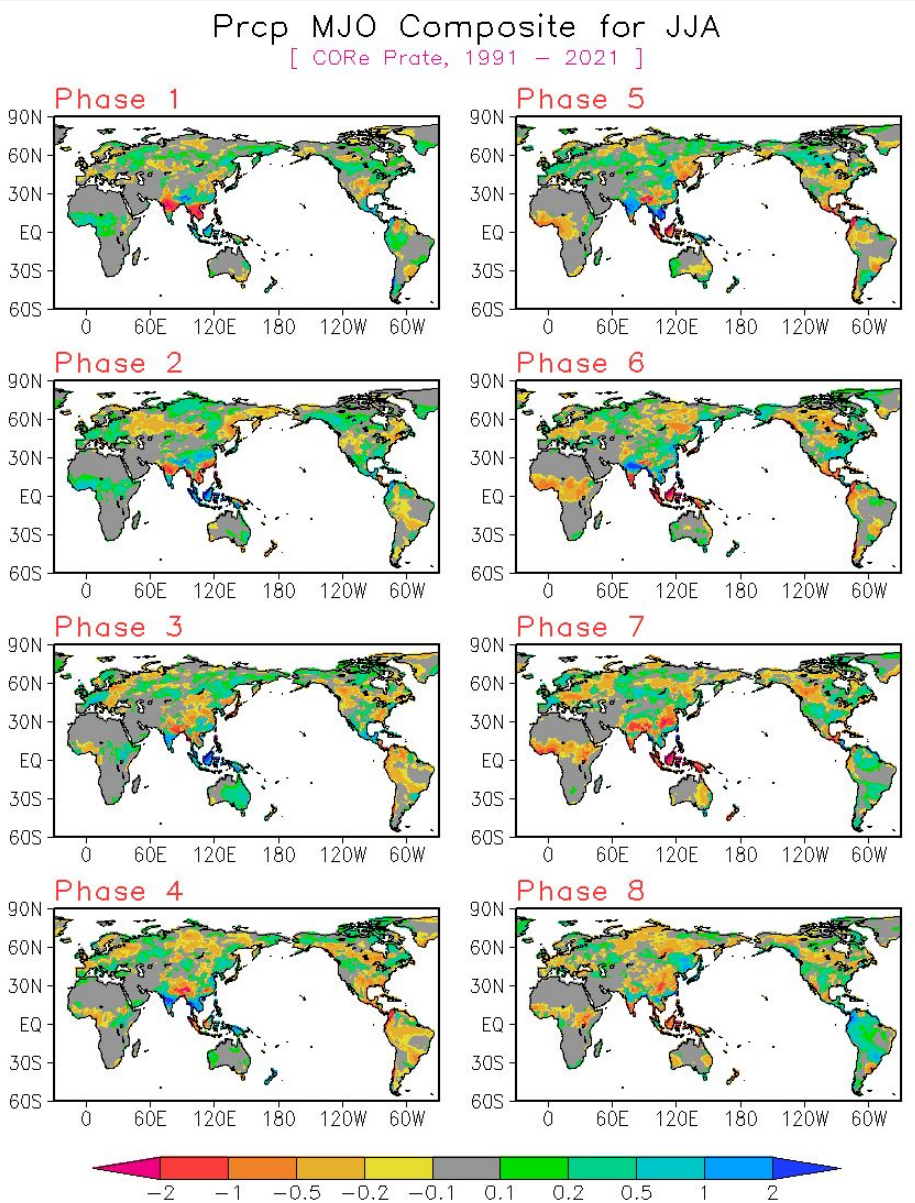
MJO Composite [MAM]



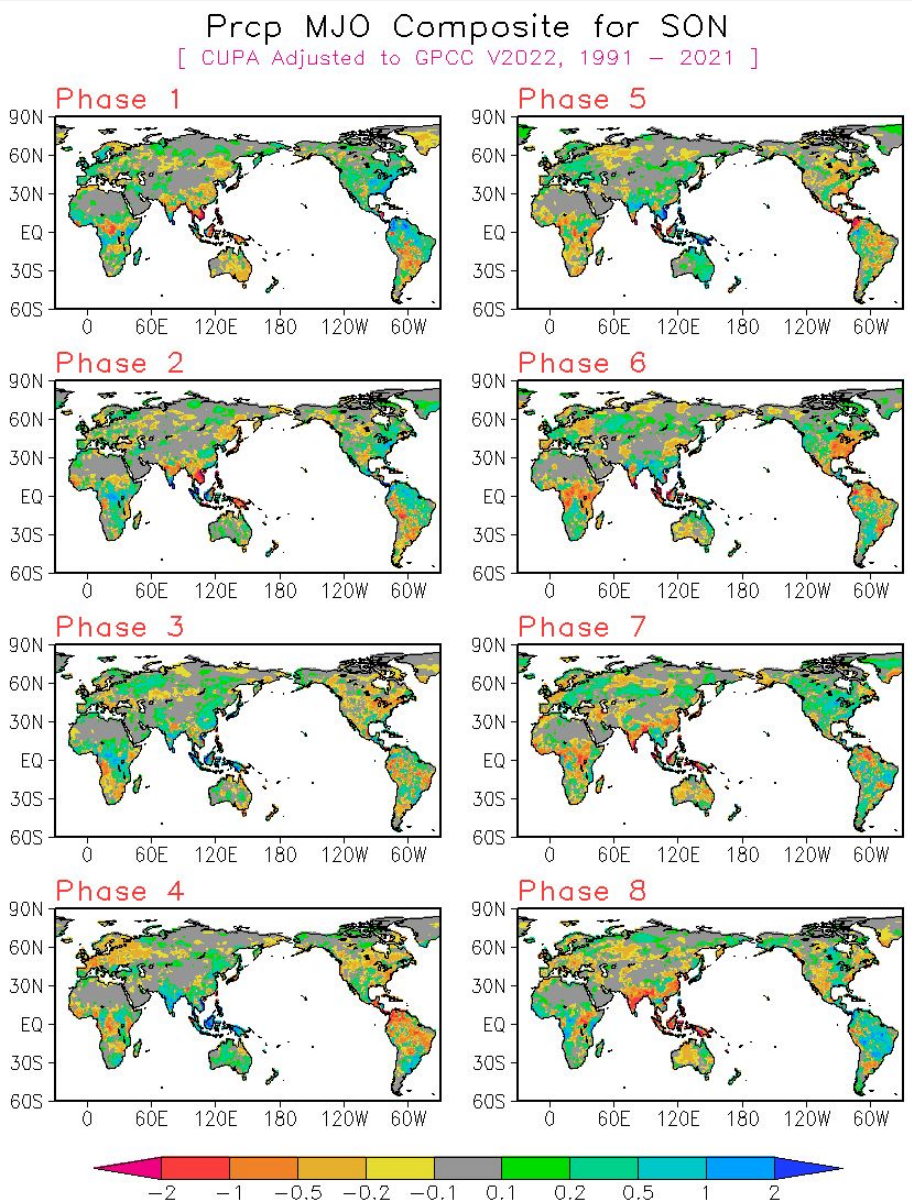


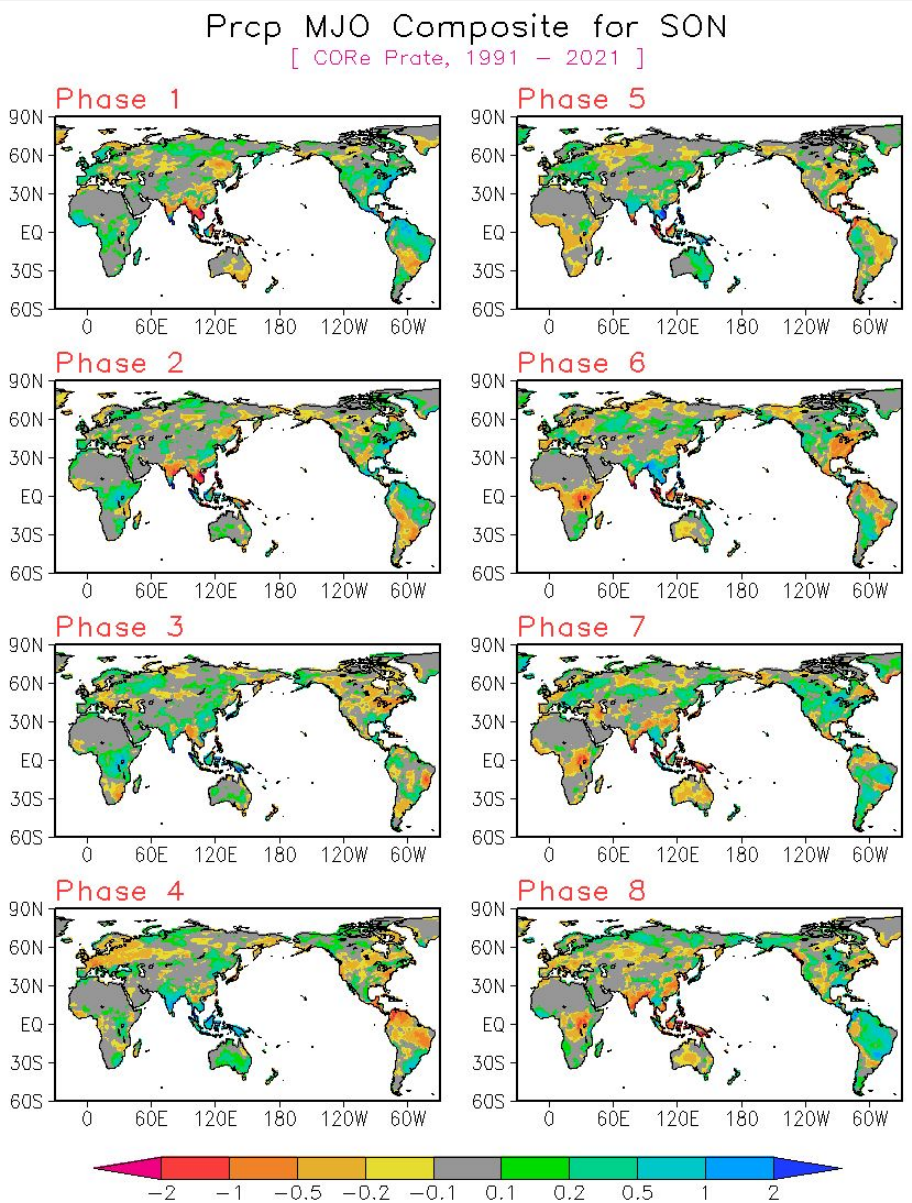
MJO Composite [JJA]





MJO Composite [SON]





Summary

- The CPC Unified Daily Gauge Precipitation Analysis (CUPA) is adjusted against the GPCC monthly gauge analysis to remove biases and the adjusted dialysis is regraded to the CORe Gaussian grid for 1948 to the present;

- The CORe precipitation fields are compared to the CUPA Adjusted and the results showed the following:
  - The CORe precipitation agrees very well with the CUPA Adjusted in large-scale patterns over the global land;
  - Positive bias is observed over a large part of the northern hemisphere, while under-estimation is noticed over equatorial Africa;
  - Anomaly correlation is quite good over most of the regions with reasonable gauge analysis quality;
  - Poor anomaly correlation appears over equatorial Africa and Amazon likely attributable to issues in both the gauge and CORe precipitation data;
  - CORe is capable of capturing and quantifying the precipitation variations associated with the major climate variability very well;

- Work is underway to conduct a similar examination using the CMORPH satellite precipitation estimates;