Precipitation regime changes in GPCP?

A. Sudradjat*, A. Gruber*, R.R. Ferraro**

Abstract

The availability of the Global Precipitation Climatology Project (GPCP) pentad precipitation analysis makes possible higher temporal precipitation variability analyses. However, it should be cautioned that the dataset is still average values of five days precipitation. Hence, analyses on intensity, duration and frequency of precipitation that require higher temporal dataset should not be done with the dataset. Here we present changes in global precipitation regime (regions with significant seasonality) during a 24-year period between 1979 and 2007 shown in the dataset. Two "seasons" are used in order to show the changes: MAMJJA and SONDJF. By using the two seasons, we can show the regions where average total precipitation is roughly the same within the year. While there is no seasonality in average total precipitation, there may be seasonality in precipitation type i.e., between the two seasons. Results show that changes in precipitation regime are especially noticeable in the regions where land-water interactions exist, such as the monsoon regions. Further analyses are still needed in order to statistically and physically explain the causes of the changes.

Data and Methods

This study uses the Global Precipitation Climatology Project (GPCP) precipitation estimates on a 2.5-degree grid over the entire globe at 5-day (pentad) intervals for the period Mar 1979 – Aug 2007 (Xie, P., J.E. Janowiak, P.A. Arkin, R.F. Adler, A. Gruber, R.R. Ferraro, G.J. Huffman, S. Curtis, 2003). This 24-year period is divided into two subperiods: 1979-1993 (P1) and 1994-2007 (P2). Following the sun's progression between the Northern and Southern Hemispheres, the year in this study is divided into two 'seasons': Mar-Apr-May-Jun-Jul-Aug (MAMJJA) and Sep-Oct-Nov-Dec-Jan-Feb (SONDJF). In each year, pentad precipitation during each season is accumulated. Average values of the cumulative values for P1 and P2 are then computed.

Acknowledgements

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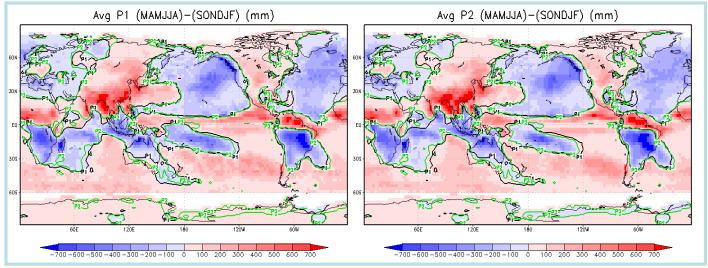
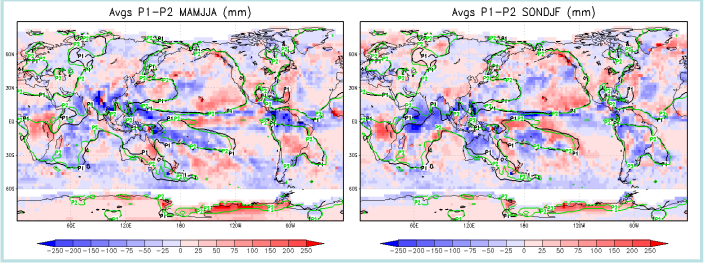


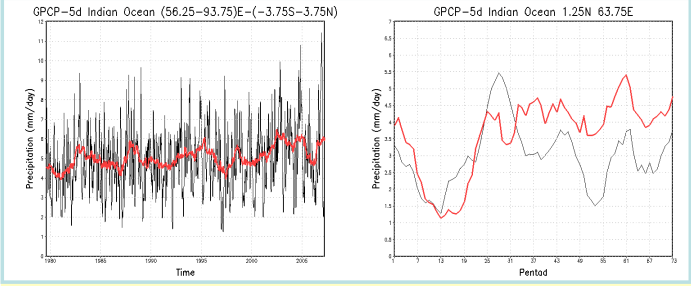
The contours are over the regions where precipitation in MAMJJA and SONDJF are equal in P1 (left) and P2 (right) showing no seasonality in average total precipitation within the year. However, there may be seasonality in precipitation type i.e., between the two seasons. Red regions are wet in MAMJJA and blue regions have the opposite. Blue regions are encircled by the contours.

Precipitation regime changes between P1 and P2 are especially noticeable over the regions where land-sea interactions play important role in moisture transport, monsoon regions, part of South Tropical Pacific Ocean, part of European Russia, the Baltic Sea, the Great Lakes of North America and the Hudson Bay.



Precipitation changes in MAMJJA (left) and SONDJF (right) between P1 and P2. Blue (red) regions show that precipitation is higher (lower) in P2 than in P1. Blue (red) colors over the same regions indicate that precipitation increases (decreases) during the 28-year period between 1979 and 2007.

Trend analysis over the blue (red) regions might find significant positive (negative) trends in precipitation over the 28-year period if the colors are the same over the same regions. If the colors are not the same over the same regions, trends might not be significant depending on the magnitudes of opposing trends.



The left figure shows the 28-year precipitation over an area in Indian Ocean (selected because the area shows changes and possible trend in the above figures). A 7-pentad (close to 1 month) moving average is used for the black line that shows the apparent positive trend. A 73-pentad (1 year) moving average is used for the red line in order to show the trend more clearly.

The right figure shows differences in the annual cycles in P1 (black line) and P2 (red line) at a point in Indian Ocean (selected because the above figures show dramatic seasonal changes at the point). Each point of the two lines is the 14-yr average of each pentad. Both lines are smoothed (a 7-pentad moving average).

* Cooperative Institute for Climate Studies/Earth System Science Interdisciplinary Center (CICS/ESSIC), University of Maryland, College Park, USA MD 20742; emails: ariefs@umd.edu, agruber@essic.umd.edu

** CICS/ESSIC and NOAA/NESDIS, College Park, MD 20742; email: Ralph.R.Ferraro@noaa.gov