Utility of IMERG Daily Dataset in Assessing Extreme Precipitation Tendencies

Andrey Savtchenko ; NASA/GSFC/ADNET ; andrey.savtchenko@nasa.gov

Motivation

- While global precipitation is constrained by the planetary energy budget, regional extreme precipitation scales with water vapor increases and enhanced advection in a warming climate.
- The frequency and intensity of heavy precipitation events have increased since the 1950s over most land area (IPCC, AR6, ch.11, “Weather and Climate Extreme Events in a Changing Climate, 2021, doi: 10.1017/9781009157896.013)
- The Integrated Multi-satellitE Retrievals for GPM (IMERG) improved substantially in Version “07B”; e.g. previous discontinuities at the transition from TRMM to GPM era are resolved. IMERG resolution, and now stability, allow estimates of trends in regional precipitation extremes.

Data Used; Extremes indicators

Data: IMERG Daily,

Huffman, G.J., E.F. Stocker, D.T. Bolvin, E.J. Nelkin, Jackson Tan (2023), GPM IMERG Final Precipitation L3 1 day 0.1 degree x 0.1 degree V07, Edited by Andrey Savtchenko, Greenbelt, MD, Goddard Earth Sciences Data and Information Services Center (GES DISC), accessed: 08/2024, doi: 10.5067/GPM/IMERGDF/DAY/07

Extremes indicators, derived at seasonal scales:

- **SDII** - Simple precipitation intensity index, here for a given season, from wet days with daily totals $RR_i > 1$ mm/day

$$SDII = \frac{\sum_{i=0}^{W} RR_i}{W}$$ W – number of days RR>1 mm/day

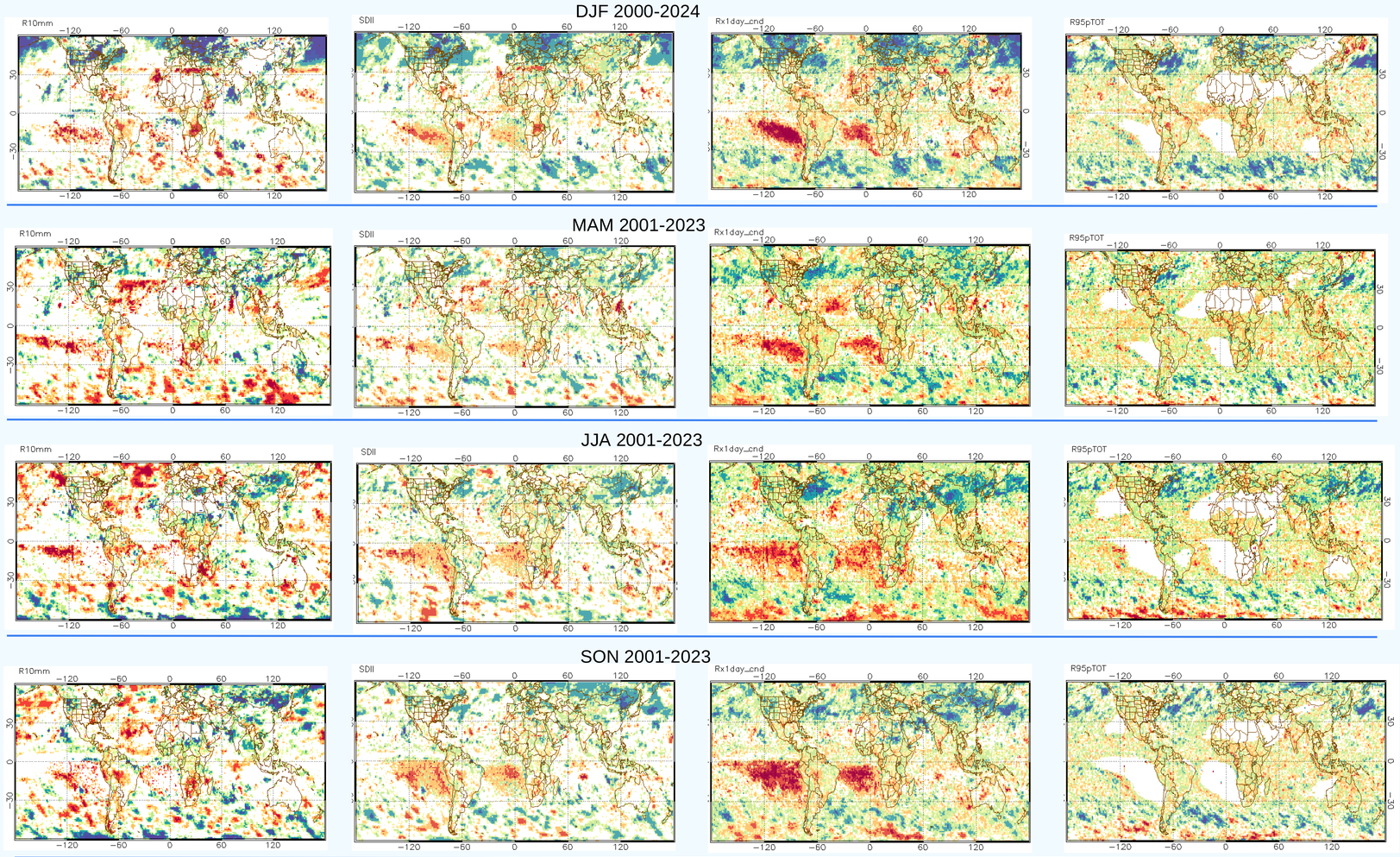
- **R10mm** - Number of days with RR>10 mm, here for a given season
- **Rx1day_cnd** - Maximum 1-day conditional precipitation rate (mm/hr), for a given season. Only wet (precip> 0.01 mm/hr) half-hourly events considered. This indicator is sensitive to total daily precipitation amounts that while the same, are received in shorter time. Thus, it is sensitive to the intensification of the water cycle.
- **R95pTOT** - Contribution to total precipitation from very wet days, here for a given season. Percentiles and totals derived from wet days only, precip> 1mm/day

$$R95pTOT = \frac{R95p}{PRCPTOT}$$

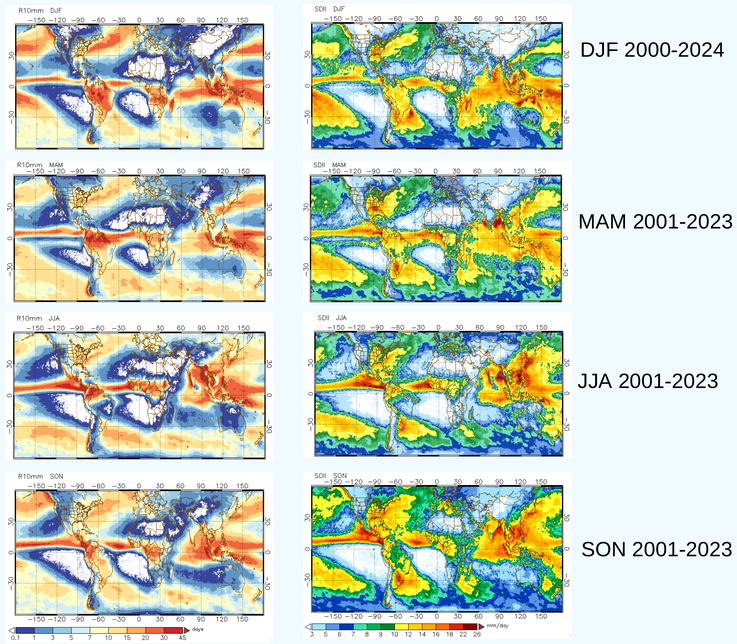
R95p - Total precipitation from the wettest 5% of days

PRCPTOT - Total precipitation from wet days precip> 1 mm/day

Confident Trends, per season (% / decade)



Climatology of *R10mm* and *SDII*



Summary

- Improved stability and time range of IMERG version “07B” allows consistent estimates of extreme precipitation and the **seasonal** dependence of emerging trends in the past two decades.
- Since extremes are best revealed at fine regional scales, the utility of IMERG Daily to derive seasonal estimates is of particular value, using widely accepted climate extremes indices.
- Test of confidence is applied to all trends, which apparently brings up only the largest trends. This is indicative of the large natural variability of the extremes from year to year, that masks smaller trends at this sample length.
- The strongest increasing trends of ***R10mm***, ***SDII***, and ***Rx1day_cnd*** are found over North America and Europe during the DJF (Boreal winter) season.