Global Precipitation Variations and Extremes

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Objectives:
To examine/assess global precipitation variability, extremes and possible relations with surface temperature changes on seasonal-interannual-interdecadal time scales using the more-than-30-year (1979-present) precipitation product from the Global Precipitation Climatology Project (GPCP) and the over-10-year (1998-present) TRMM Multi-Satellite Precipitation Analysis Product (TMPA).

Interannual-to-interdecadal (long-term) precipitation variability quantified by the monthly GPCP product

Global annual-mean precipitation and surface temperature (NASA/GISS) during 1979-2008

Interannual variability: ENSO and volcanic impact

Tropical (land or ocean) precipitation, temperature, and water vapor are strongly modulated by both ENSO and volcanoes; correlations between either land or ocean precipitation and surface temperature are not significant after ENSO and volcanic effects are removed. However, strong correlations between water vapor and temperature do not depend on ENSO or volcanic forcing.

Global and (tropical) mean (land/ocean) precipitation responds to volcanic eruptions, but seem not to be sensitive to ENSO.

Global and (tropical) mean (land/ocean) temperature responds to both ENSO and volcanic eruptions.

SUMMARY:
A ten-year climatology of global precipitation is constructed based on the GPCP monthly product. The related bias errors are estimated using the currently-available consistent products. These error estimates may provide upper bounds due to regional averaging of errors and inclusion of still questionable input data-sets.

The impact of ENSO and volcanic eruptions during the GPCP record on precipitation are examined. This examination is further extended to the correlation relationships between precipitation and surface temperature specifically on the interannual time scale.

By means of quasi-global TMPA, precipitation extremes are analyzed for the TRMM period, including examination is further extended to the correlation relationships between precipitation and surface temperature specifically on the interannual time scale.

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Regional features tend to be consistent across seasons.

An analysis of precipitation extremes based on the TMPA rain-rates

Indices computed based on TMPA:
- CDD—Maximum length of dry spell (<1 mm/d)
- R95pTOT—Annual total Precip when RR>R95p
- PRCPFOT—Annual total precipitation

The Patterns of yearly average precipitation (Avg. Precip) and 95th percentile of daily events (R95p) resemble each other; the patterns of Avg. Precip and average longest run of consecutive dry days (<1 mm/d; CDDavg) are nearly inverses; in both cases there are some interesting differences.

Larger spread at low rain totals likely reflects differences in seasonality. Both R95p and CDD tend to be higher for TMPA.