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Precipitation Uncertainty: How well do we know this critical Hydrological Variable

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Review

Gauges:

- regarded as most reliable precipitation measurement
- unable to sample large-area means (sparse coverage)
- wind-induced undercatch
- significant cold-season issues.
- Tend to be located at low elevations

Ground-based radars:

- promising to understand spatial characteristics
- accuracy of depends on the Z-R relationship
- subject to mountain blockage, spurious echoes, bright band contamination and ground clutter.

Visible/infrared /microwave satellite:

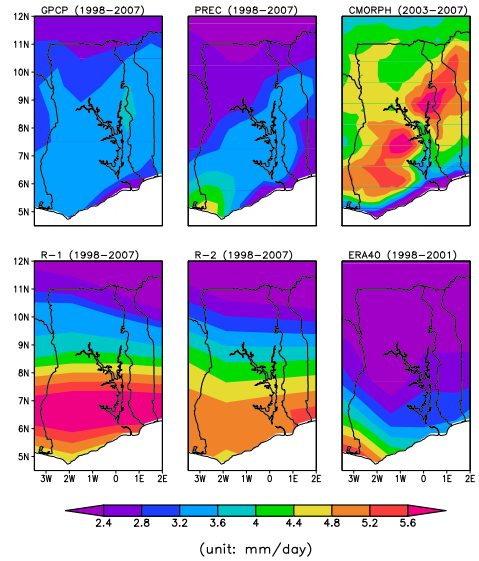
- approximate forward model and related errors
- model parameters and their errors
- inversion parameters and uncertainties
- representativeness errors

Adam et al. (2006) used stream-flow measurements and an emprical Potential Evapotranspiration/Precipitation curve (Sankarasubramanian and Vogel, 2002) to correct the Willmott and Matsuura (2001) precipitation dataset for the orography effects and found 20% precipitation underestimation in orographically influenced regions. Comparing gauge and satellite based precipitations, Fekete et al. (2004) found the drier regions have larger uncertainties both in terms of capturing the mean precipitation and in representing its seasonality. Satellite PMW based algorithms are good at detecting strong, convective precipitation events, but tend to miss shallow and warm rains (Tian et al., 2007). McCollum and Ferraro (2003) found that TRMM V6 algorithm has an overestimate in equatorial latitudes balanced by an underestimation in northern midlatitudes. Fekete et al. (2004) compared several gauge- and satellite-based precipitation products and found different datasets showed largest absolute differences in tropics/wet regions, but relative performance were worst in dry regions. Furthermore, Schlosser and Houser (2007) states “the results of this study indicate that on an annual basis, the current satellite-based retrieval synthesis and parametric global water cycling estimates can neither provide trend detection nor balanced and/or consistent analyses to verify the range of climate model global hydrologic change projections”.

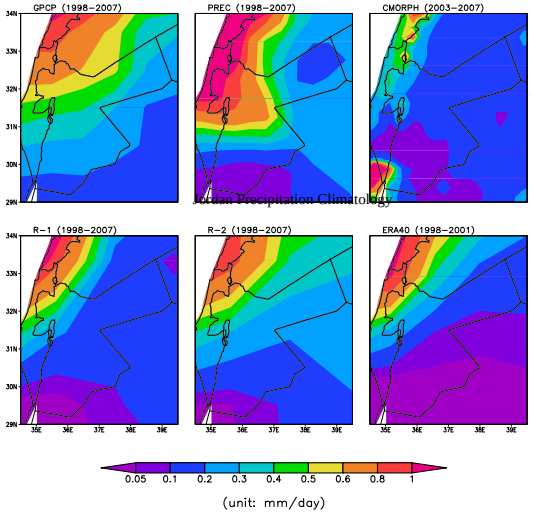
Therefore, this study compares the precipitation averages, variability, and timing for various regions around the world in an attempt to determine how well we currently know this critical hydrological variable.

Study Areas

Ghana



Jordan



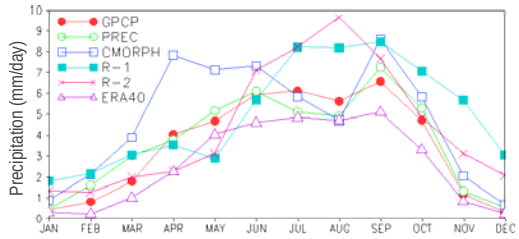


Fig. 1 Comparison of 6 different precipitation products for Ghana (6.75N – 9.0N and 0.0E – 1.25E) for year 2006

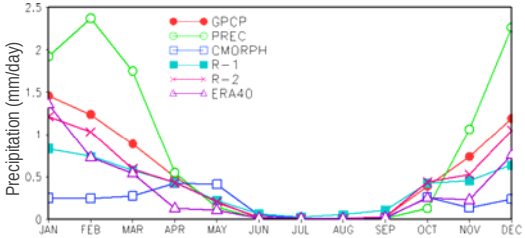


Fig. 2 Comparison of 6 different precipitation products for Jordan (31.5N – 33.0N and 35.5E – 37.0E) for year 2006

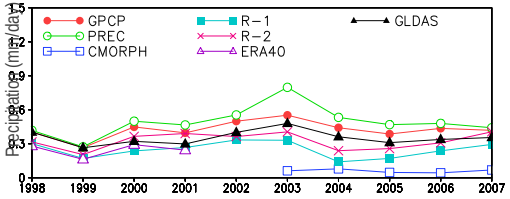


Fig. 3 Comparison of 7 different precipitation products (mm/day) for Jordan (29.0N – 34.0N and 35.0E – 38.0E) for years 1998 - 2007

	RUC	TRMM	Stg IV	PERS	NRL	NLDS
Precip. ave. (*mm/year*)	630	610	682	1235	1007	722
P > 0.0 (%)	15.9	5.7	11.4	9.1	9.6	18.9
Intensity (*mm/year/1%*)	39	107	60	136	105	38

Table 1 Precipitation intensity comparison for Red-Arkansas River Basin (32.0N – 40.0N and -107.0W – -91.0W) for year 2006 at 0.25° spatial resolution.

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