



On the Small-scale Variability of Daily Rainfall in Complex Terrain and Tropical Region in Africa: Observational Evidence

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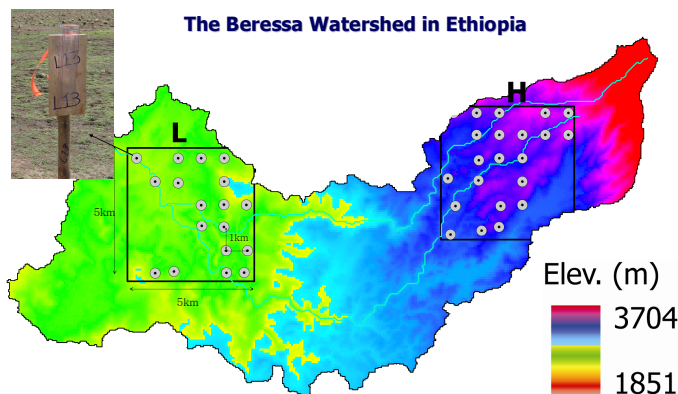
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Research Questions

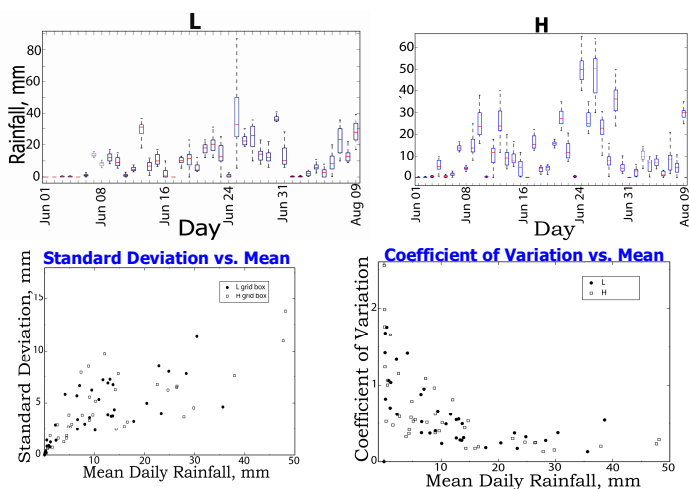
- What is the small-scale (<25 km²) variability of daily rainfall?
- What is the effect of elevation on rainfall variability?
- How many raingauges do we need for validation of satellite products?
- How good is CMORPH?

Experimental Setup

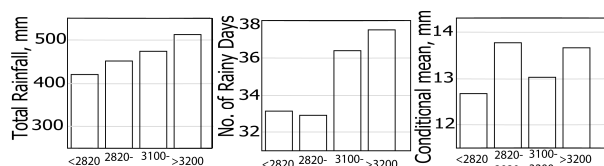


- 40 days (July 01 – August 09, 2008) of daily rainfall data recorded at each point

1. Daily Rainfall Variability



2. Effect of Elevation



- High elevation areas receive more due to high number of rainy days (and not necessarily higher intensity)

3. Sampling Uncertainty

Methodology

Reference Rainfall $R_A = \frac{\sum_{i=1}^N R_s(i)}{N}$

Estimated rainfall $\hat{R}_A = \frac{\sum_{i=1}^N R_s(i) \delta(i)}{N}$

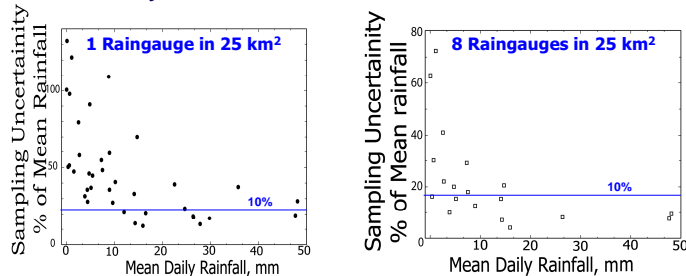
Sampling error is $\varepsilon = \hat{R}_A - R_A$

Standard Deviation of the Error $\sigma_\varepsilon = E[\sqrt{(\hat{R}_A - R_A)^2}]$

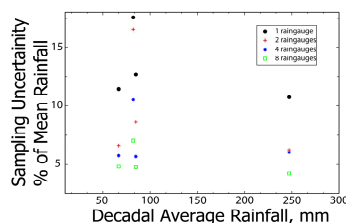
Sampling uncertainty, in % of mean rainfall $S = \frac{\sigma_\varepsilon}{R_A} \cdot 100 \%$

Sampling Uncertainty

1. Daily Time Scale



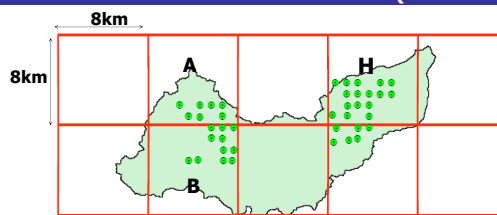
2. Ten-day Time Scale



3. Monthly Time Scale

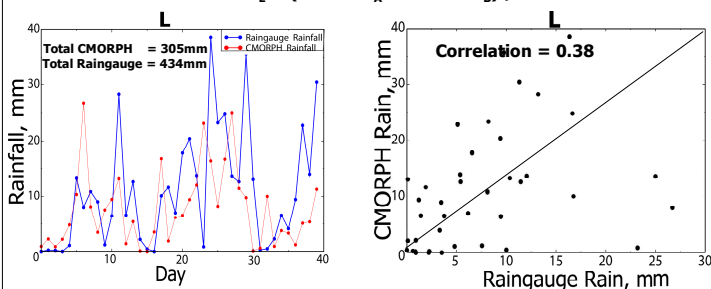
# of gauges in 25 km ²	L-Grid Box Sampling Uncertainty (%)	H-Grid Box Sampling Uncertainty (%)
1	10.9	9.52
2	9.44	5.27
4	7.55	4.71
8	5.11	3.69

4. Evaluation of CMORPH (~8 km Grid)

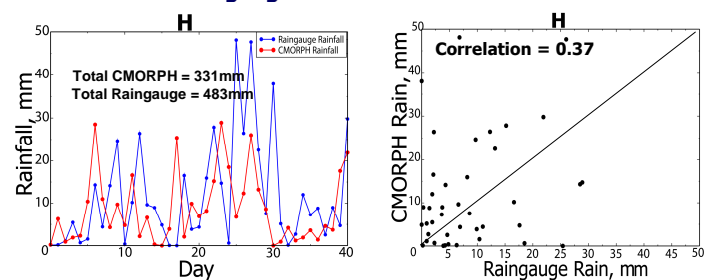


1. CMORPH vs. Raingauge: Grid L

$$CMORPH_L = (CMORPH_A + CMORPH_B) / 2$$



2. CMORPH vs. Raingauge: Grid H



- CMORPH under estimates by 30%

3. Conditional Bias

Quantile	No. Rainfall days	Rainfall (mm/day)	Rainfall (mm/day), Raingauge	Rainfall (mm/day), CMORPH	Rainfall Bias (mm/day)
10	3	0.04-0.14	0.14	0.41	0.27
25	7	0.14-2.60	2.58	2.13	-0.46
50	10	2.60-8.20	8.16	6.45	-1.72
75	10	8.20-16.4	16.37	12.98	-3.39
90	6	16.4-29.6	46.73	25.05	-21.68
100	4	29.6-48.5	48.5	30.0	-18.50