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The Uncertainities Assessments of the Satellite Derived Rainfall Products

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Background

- Raingauges are direct measurements of rainfall but spatially limited (Kidd, Bauer et al. 2012).
- Satellite derived rainfall products have good coverage (Joyce, Janowiak et al. 2004) but have errors (Feidas, Lagouvardos et al. 2005) arising from their indirect estimates. Their uncertainities are seasonal and regionally dependent (Adeyewa and Nakamura 2003). They have low performance on high ground areas (Mashingia, Mtalo et al. 2014) which lacks long term assessments documentation.

Objective

Assess the performance, of each Satellite product spatially and temporally on monthly timescales, using gridded raingauge dataset over East Africa

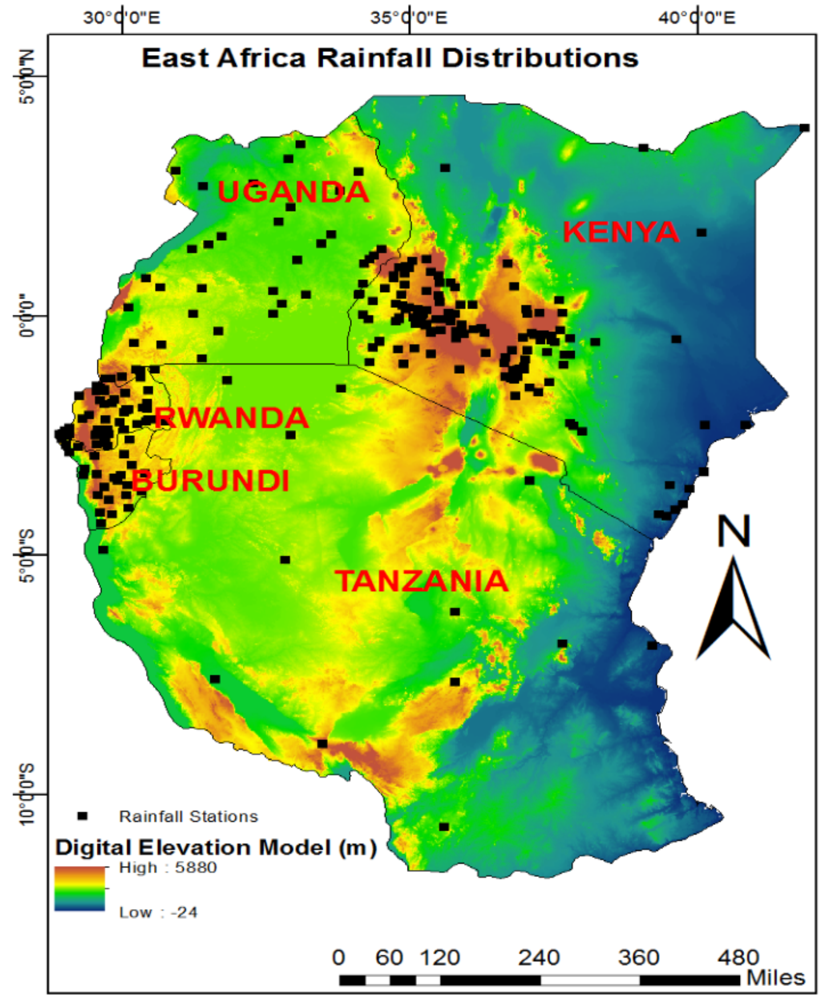
Specific Objectives

- Spatially and temporally characterize gridded raingauge data and wind flow patterns over East Africa region.
- Determine the spatial performance and of each satellite product in relation gridded raingauge data during the wet months.
- Determine the most appropriate satellite product for climate studies over East Africa

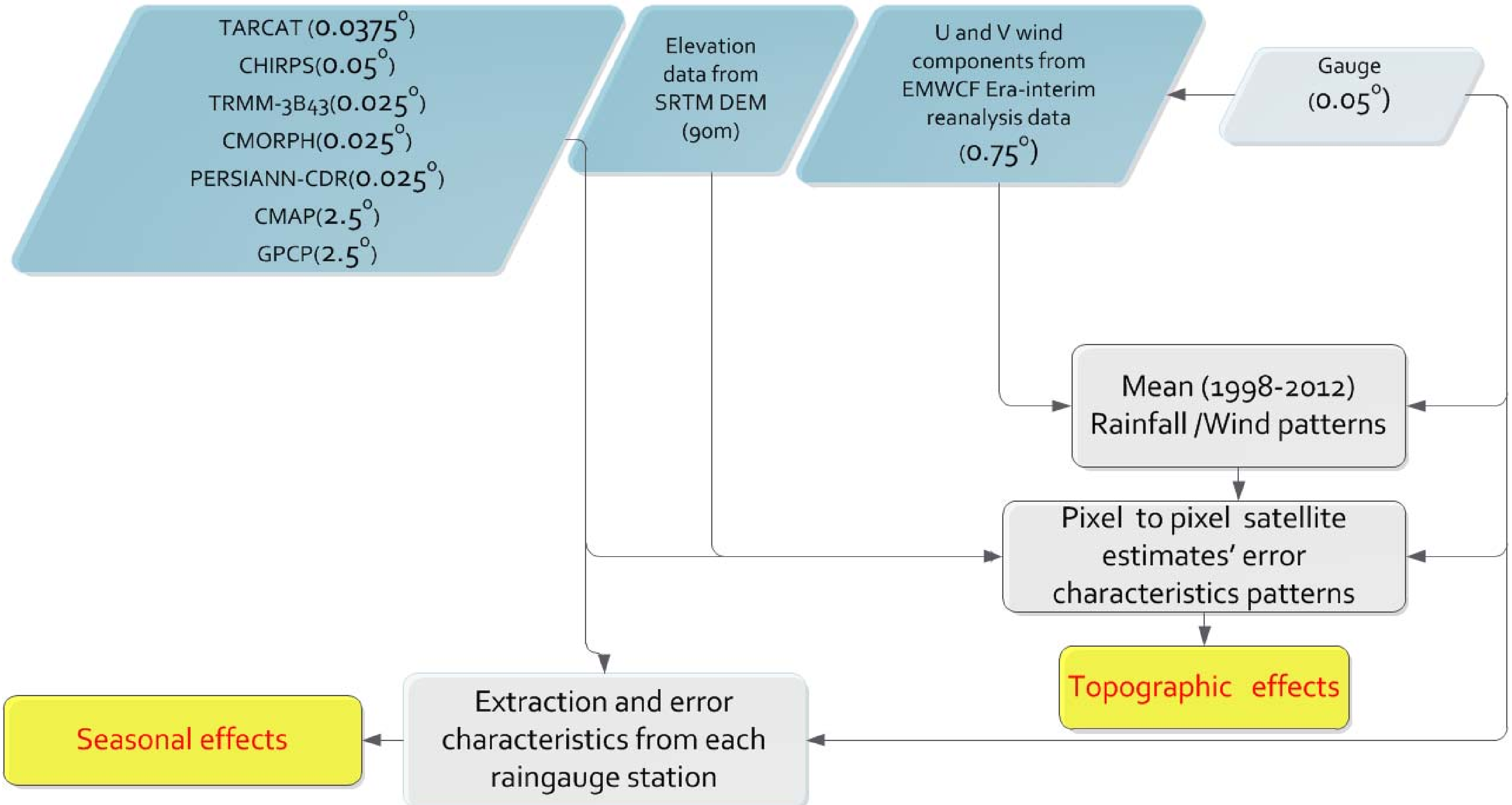
Study Area: East Africa elevation map

- ➢Bimodal Rainfall (March –May) and October-December
- ➢Complex topography as shown by the Digital elevation Model (DEM).
- ➢Gridded raingauges over Greater horn of Africa.

(Funk CC, Nicholson SE et al. 2015)

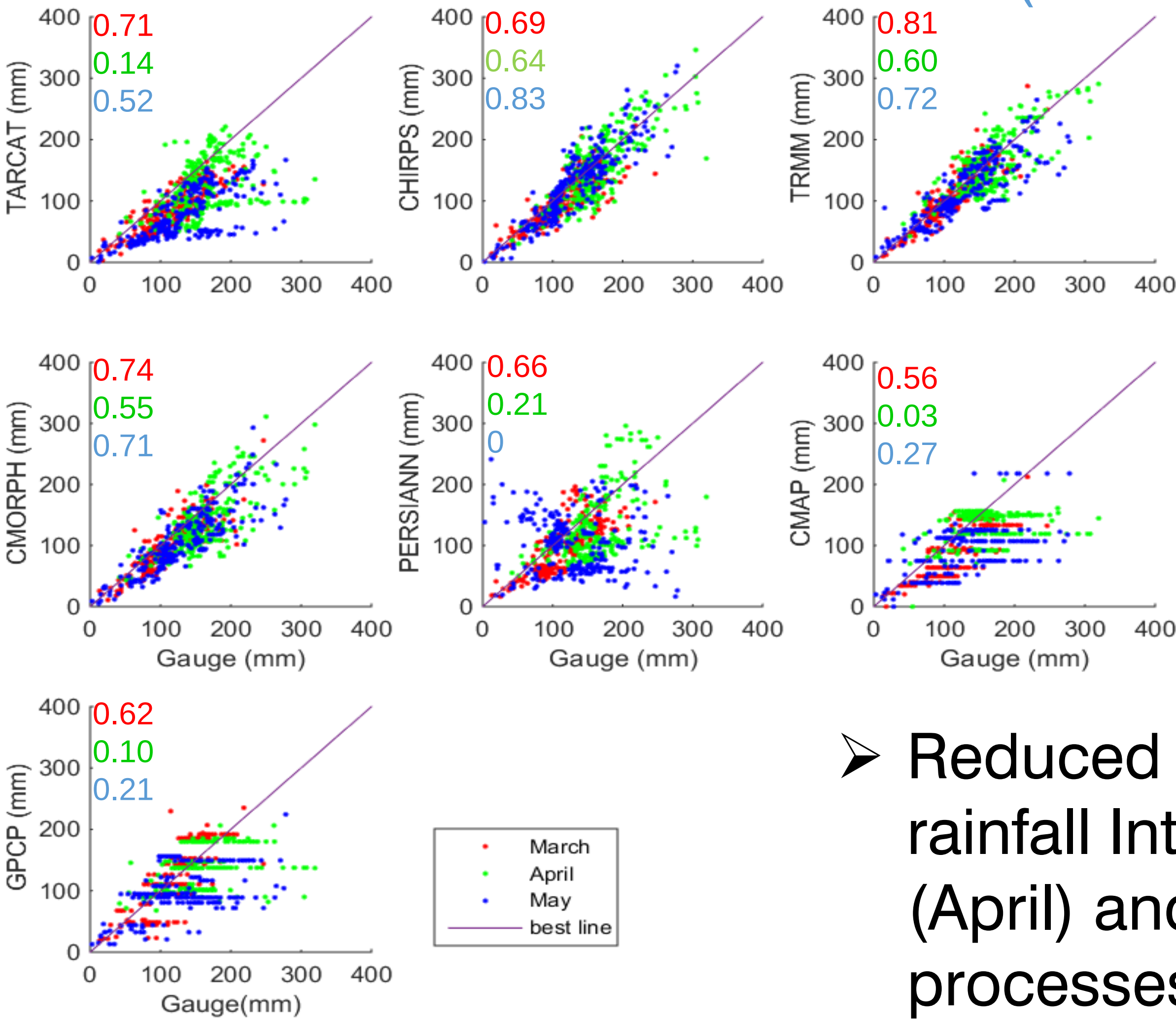


Data and Methodology



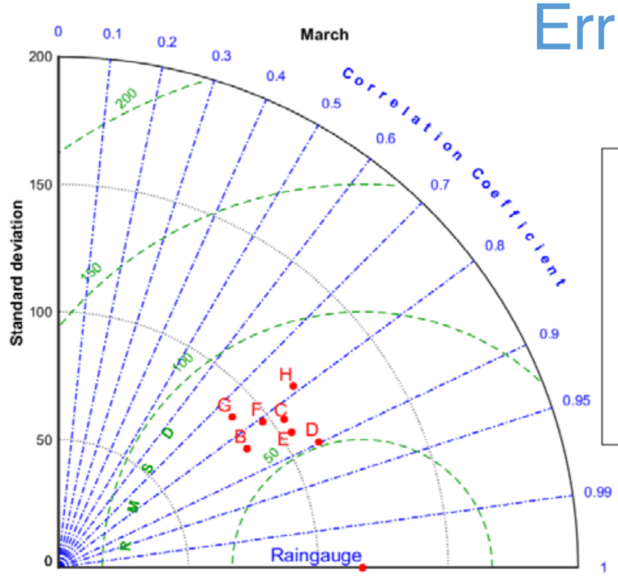
Results

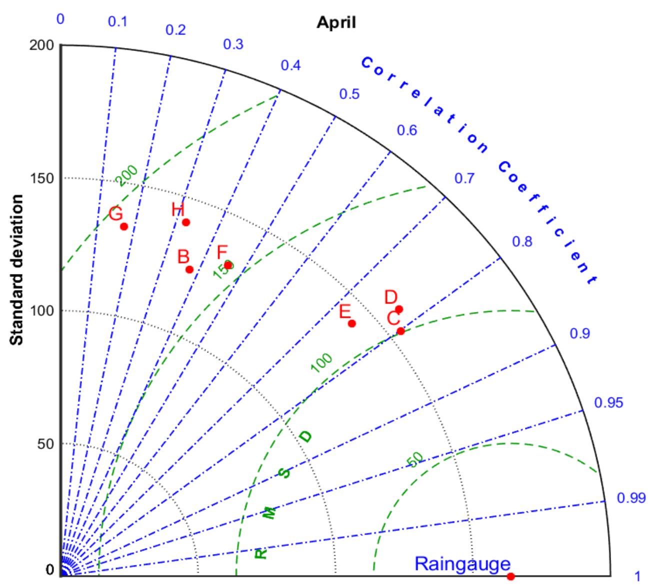
Monthly mean (1998-2012) Gridded Raingauge data versus Satellite Estimates (March-May)



- Reduced correspondence as rainfall Intensity increases (April) and orographic processes

Errors characteristics during onset and peak month



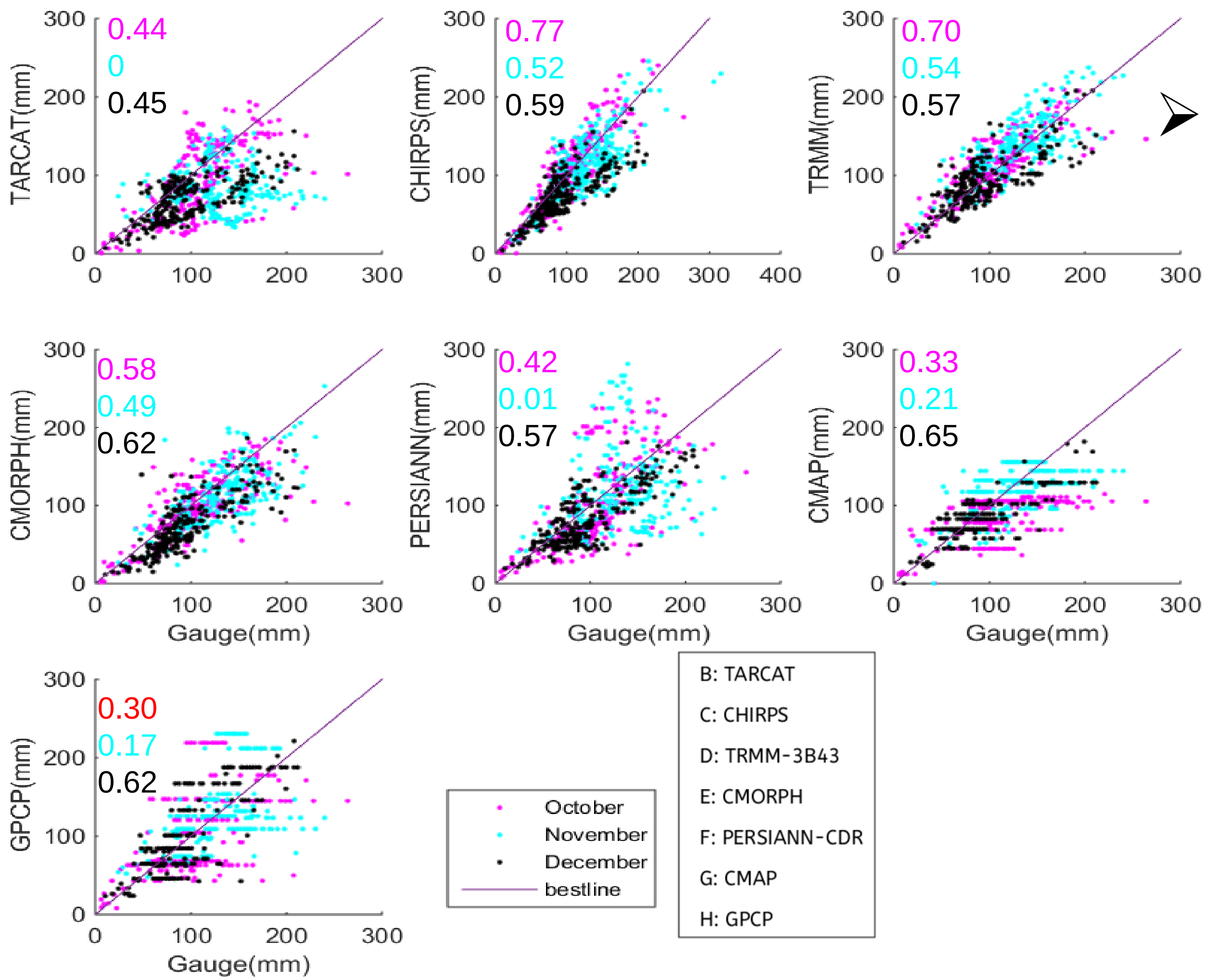


B: TARCAT
C: CHIRPS
D: TRMM-3B43
E: CMORPH
F: PERSIANN-CDR
G: CMAP
H: GPCP

Satellite Product	March % errors		April % errors	
	Accuracy	precision	Accuracy	precision
TARCAT	-14	-26	1	-24
CHIRPS	-3	-11	19	-6
TRMM-3B43	4	-4	7	-3
CMORPH	1	-11	11	-13
PERSIANN-CDR	7	-17	24	-19
CMAP	4	-24	-76	-18
GPCP	23	-2	-45	-14

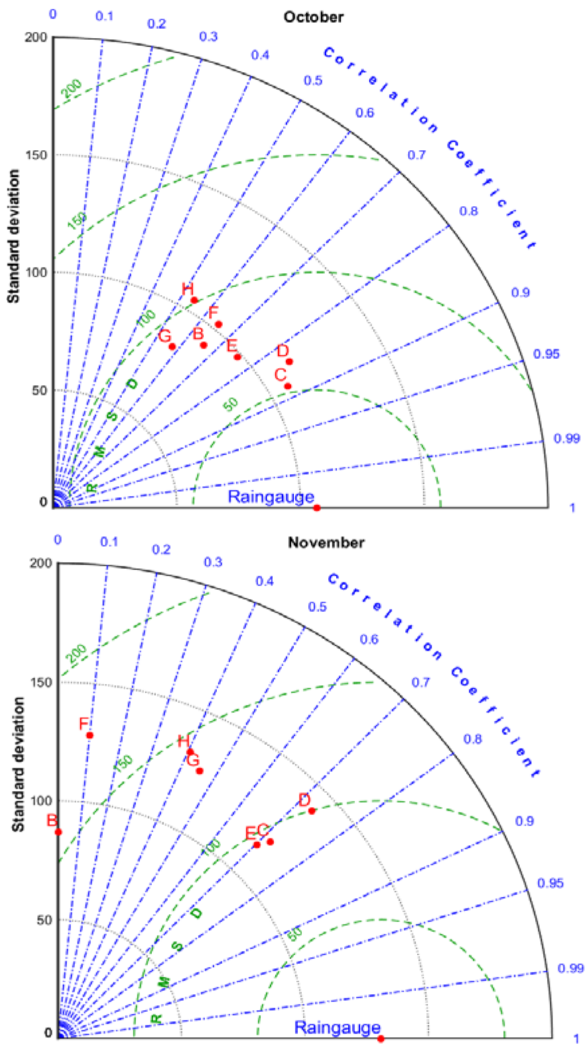
- Errors largely related to input data and spatial sampling

Monthly mean (1998-2012) Raingauge observations versus Satellite Estimates (October-December)



- Reduced rainfall amounts. Rainfall mainly orographic type high hence reduced products' performance

Errors characteristics with decreased rainfall intensity

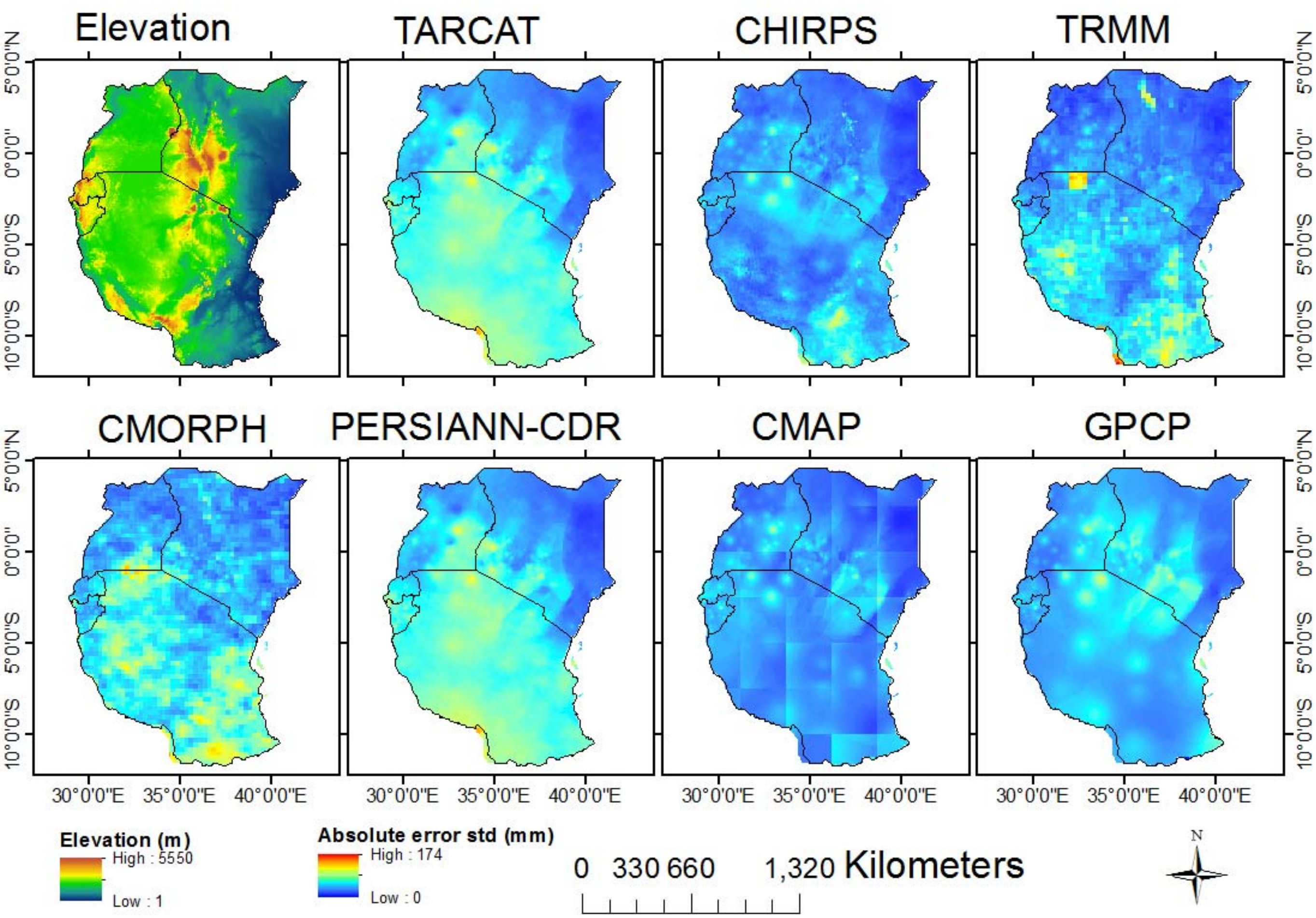


B: TARCAT
C: CHIRPS
D: TRMM-3B43
E: CMORPH
F: PERSIANN-CDR
G: CMAP
H: GPCP

Satellite Product	October % errors Accuracy	October % errors precision	November % errors Accuracy	November % errors precision
TARCAT	15	-14	-26	-34
CHIRPS	13	1	-3	-9
TRMM-3B43	-2	7	-10	-7
CMORPH	-5	-8	-2	-12
PERSIANN-CDR	30	-4	34	-2
CMAP	65	-22	-52	-3
GPCP	24	-1	-19	1

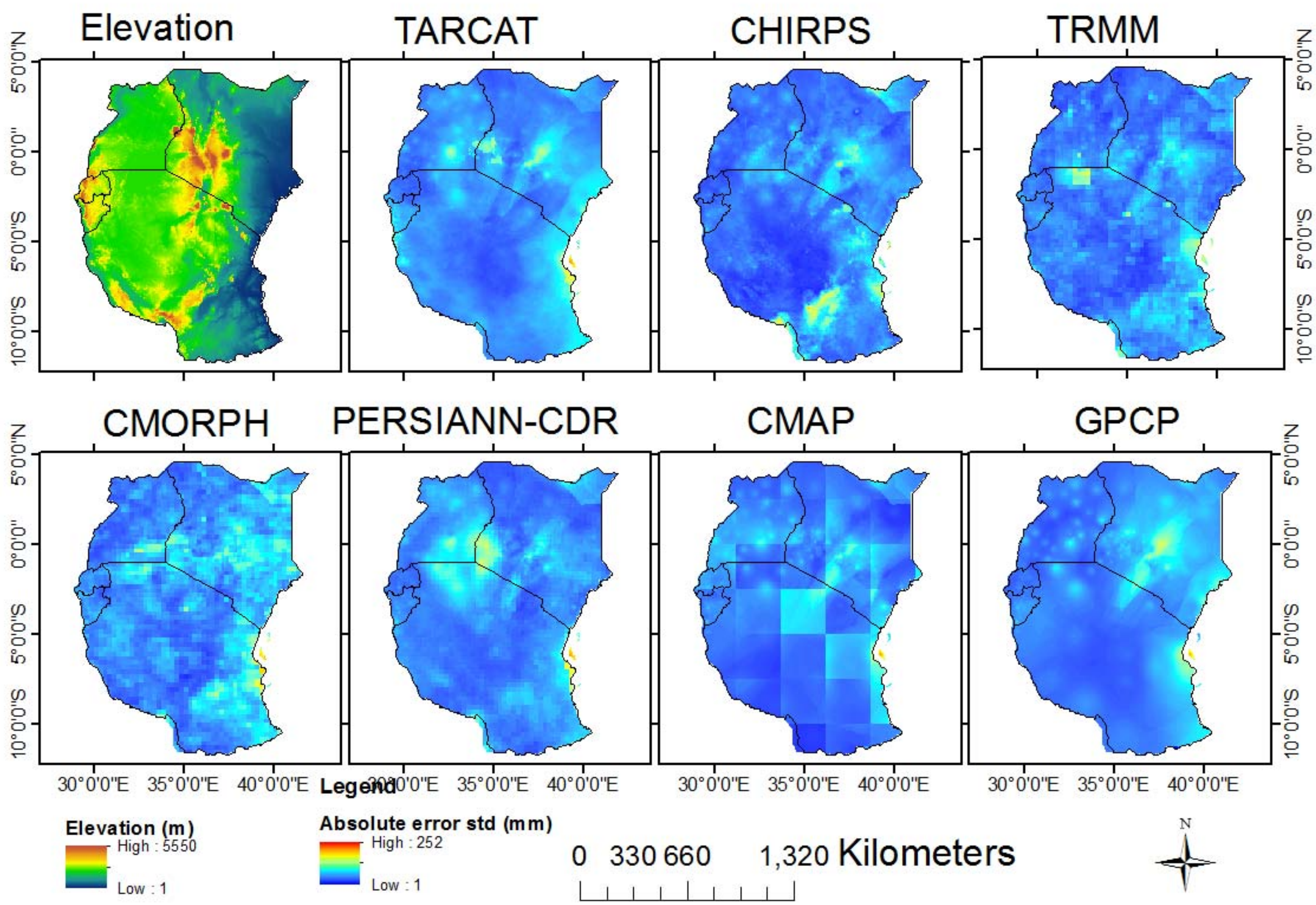
- Reduced accuracy in shallow convections

Satellite rainfall estimates' error STD during March -May rainfall onset (March)



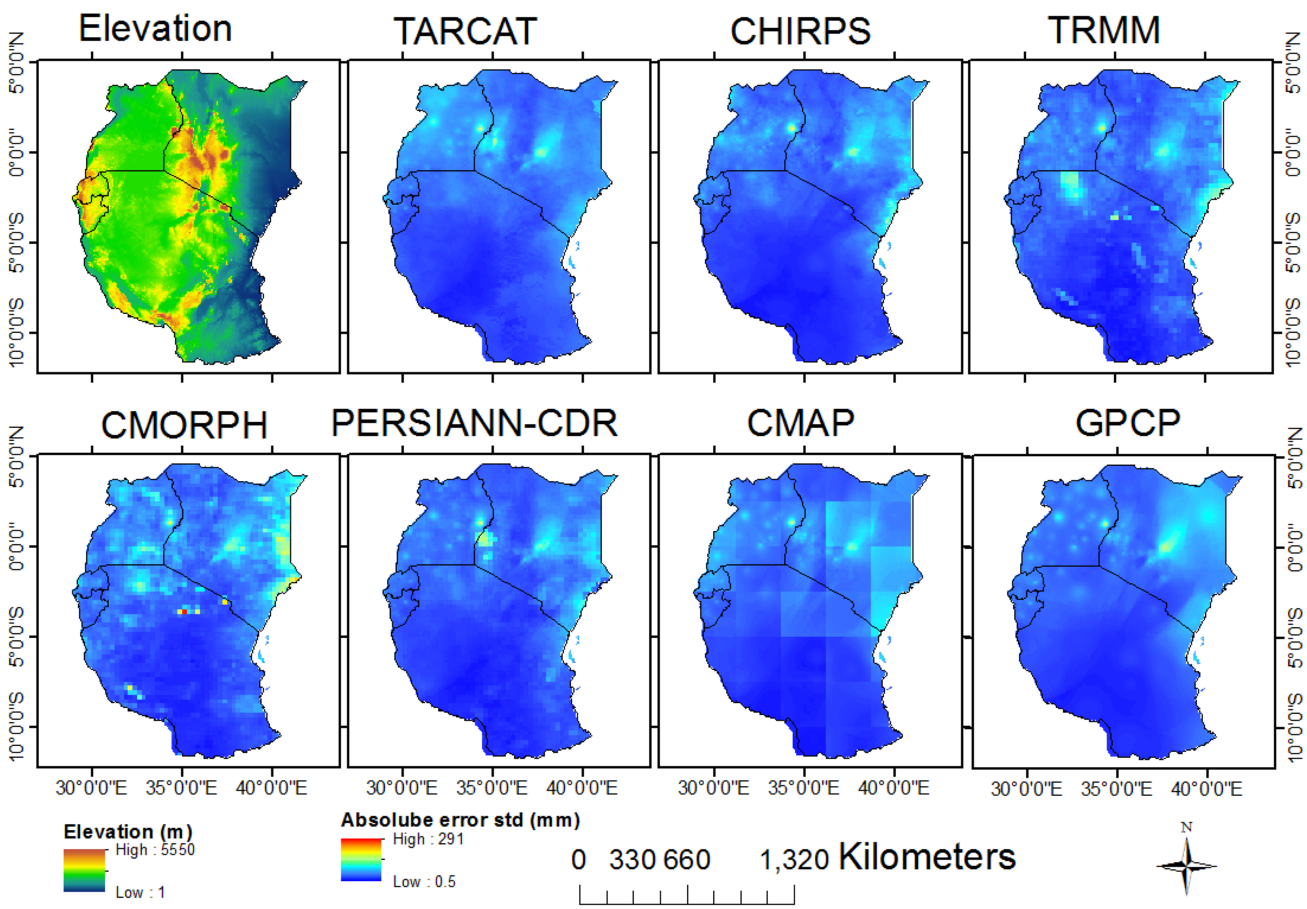
- ITCZ largely south of Equator (less topographic effects).

Satellite rainfall estimates' error STD during March -May rainfall peak (April)



- ITCZ largely over the region (increased topographic effects over Rwanda/Burundi, Kilimanjaro and Mt Kenya).

Satellite rainfall estimates' error STD during October -December rainfall onset (October)



- Rainfall mostly on high ground areas near equator (ITCZ largely to the North of equator hence errors distribution over those areas

Conclusions

- ➢Rainfall over East Africa is largely controlled by largescale horizontal winds and modulated by topographic effects.
- ➢All the Satellite derived rainfall estimates are able to characterize the large scale influences but fails to retrieve correctly the orographic rainfall.
- ➢Single sensor and coarse resolution products showed lowest performance.
- ➢TRMM outperformed other products
- ➢Future works aims at reducing the products' errors.