In search of Good/Valid Science to Facilitate Dialogues Between Nile Basin Countries

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Information/data is the key for coping water risks and enabling economic growth

Scientific community

Political community

Science - Policy

‘Science without policy is simply science; while policy without science is gambling’.

Accurate scientific generation and communication is key for societal transformation and bridging gaps

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Grand Ethiopian Renaissance Dam (GERD) has attracted a significant attention

Scientific community

250 peer-reviewed papers on GERD and Nile

- Author's responsibilities
- Peer-review process
- Publishing Ethics

Few papers can pass such rigorous self-correcting system, and convey misleading information

“Integrated Watershed Management of Grand Ethiopian Renaissance Dam via Watershed Modeling System and Remote Sensing” (Dandrawy & Omran, 2020).

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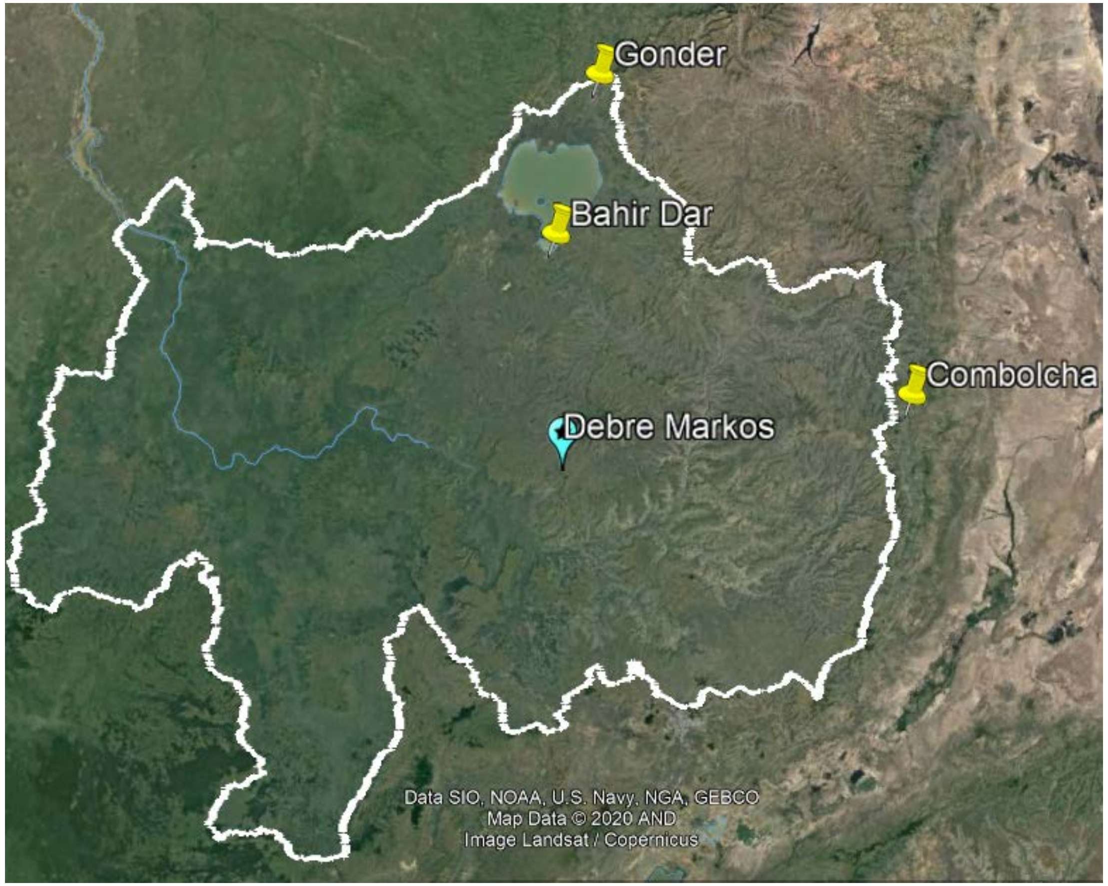
1. On estimation of design rainfall for extreme events

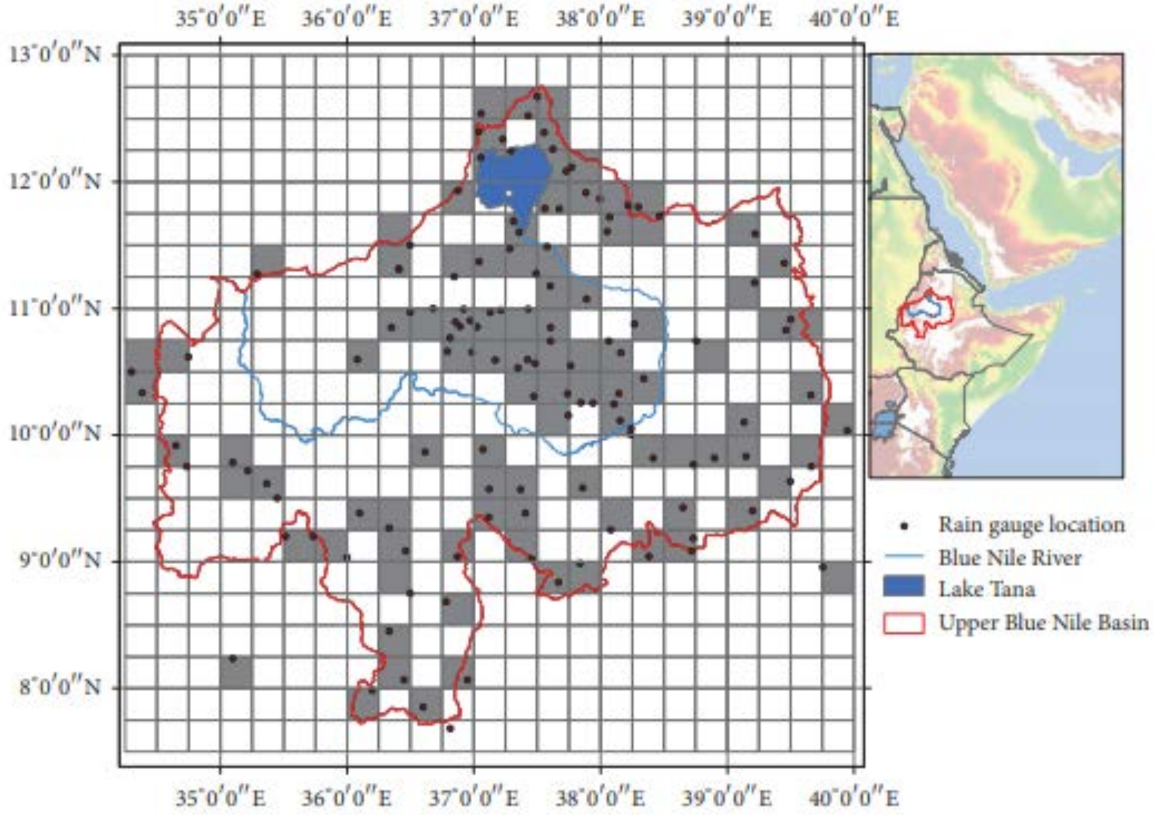
Dandrawy and Omran (2020)

- Three stations to characterize UBN and a single weather station IDF curves.



Concern/misconduct

1. # 153 stations (Sahlu etal, 2017) (NMA)



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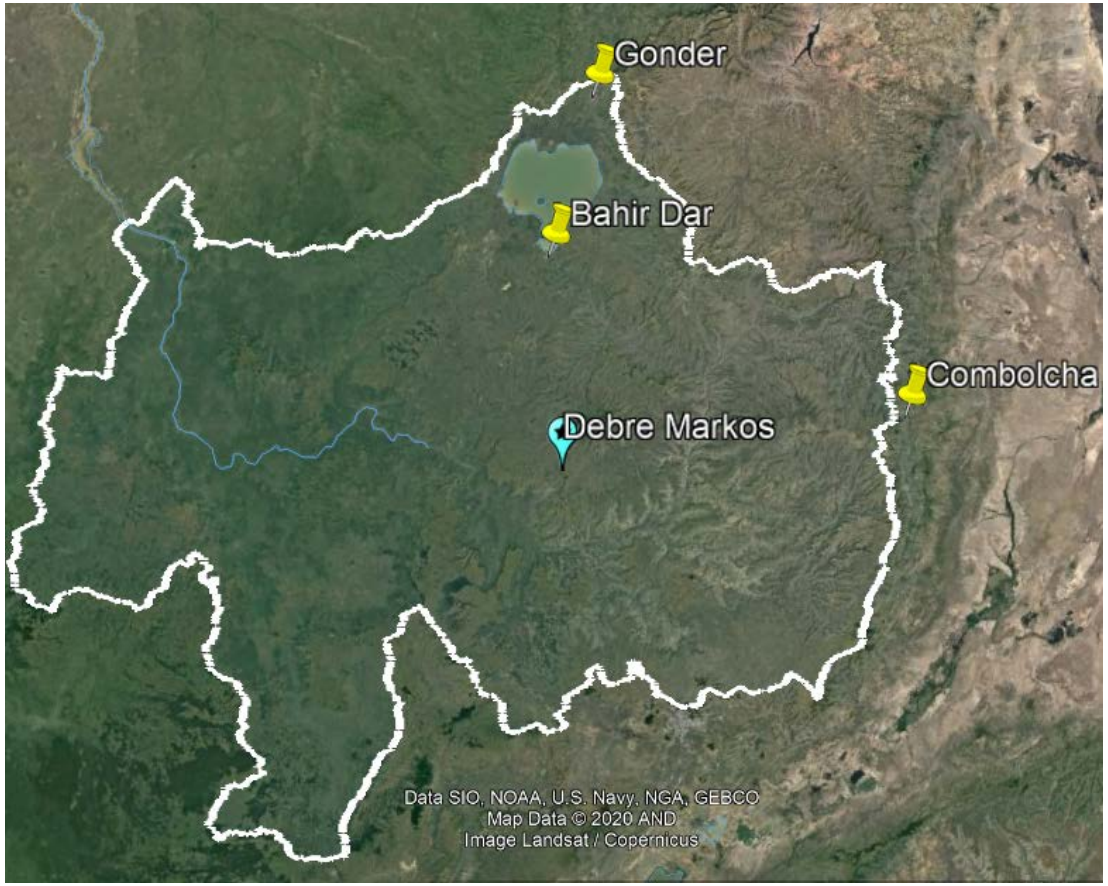
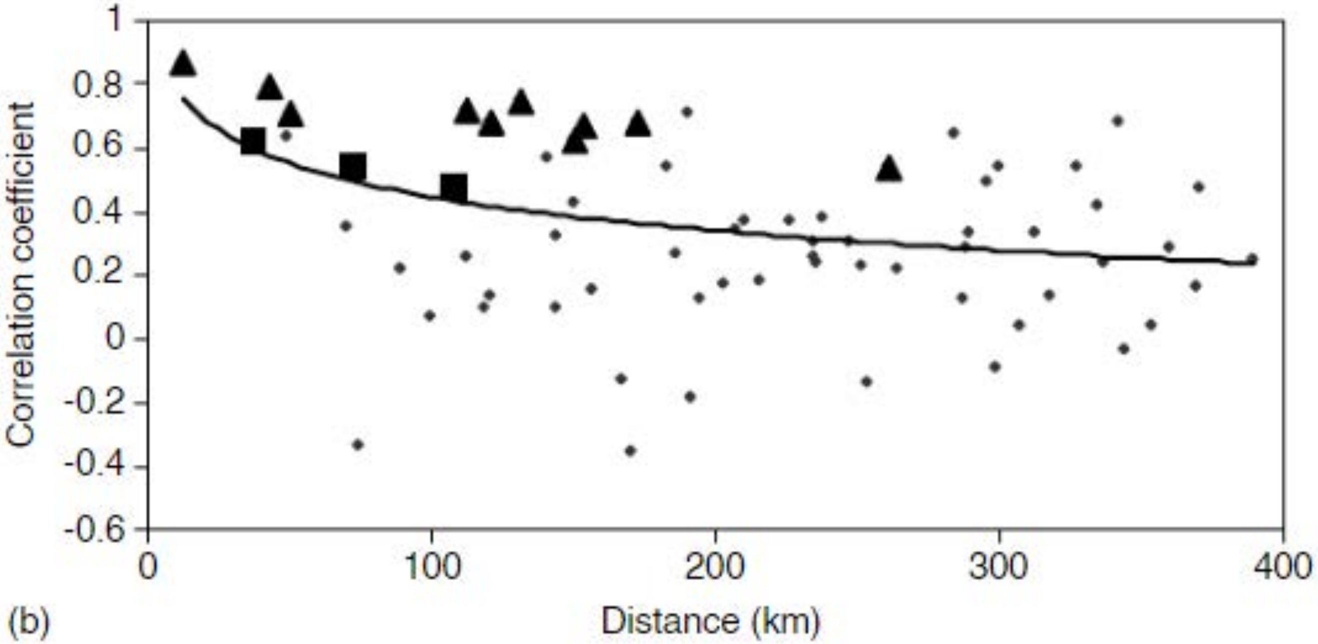


Concern/misconduct

2. Correlation decay length between rainy rainfall (Bewket and Conway, 2007)



Three stations are inadequate to represent a highly mountainous basin hydrology

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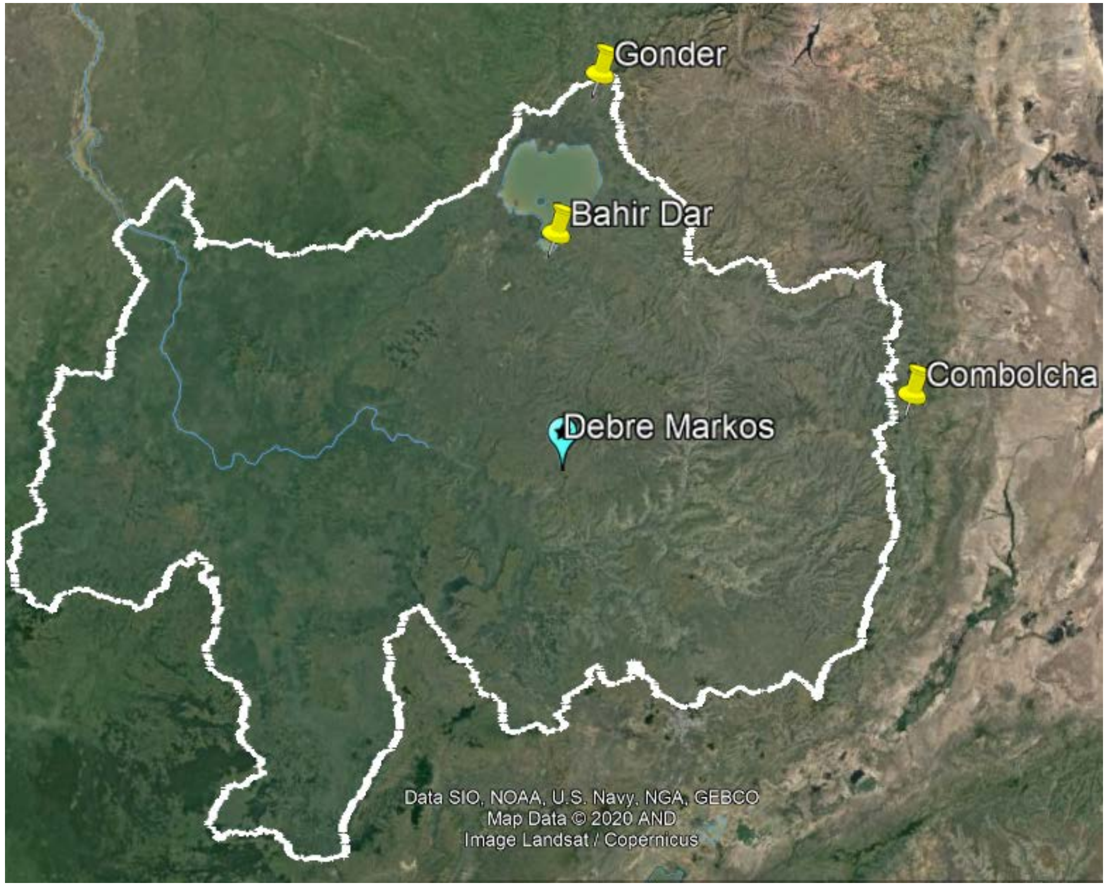

Concern/misconduct

3. IDF of a station works for radius of about 25 km (Tefera et al., 2006)

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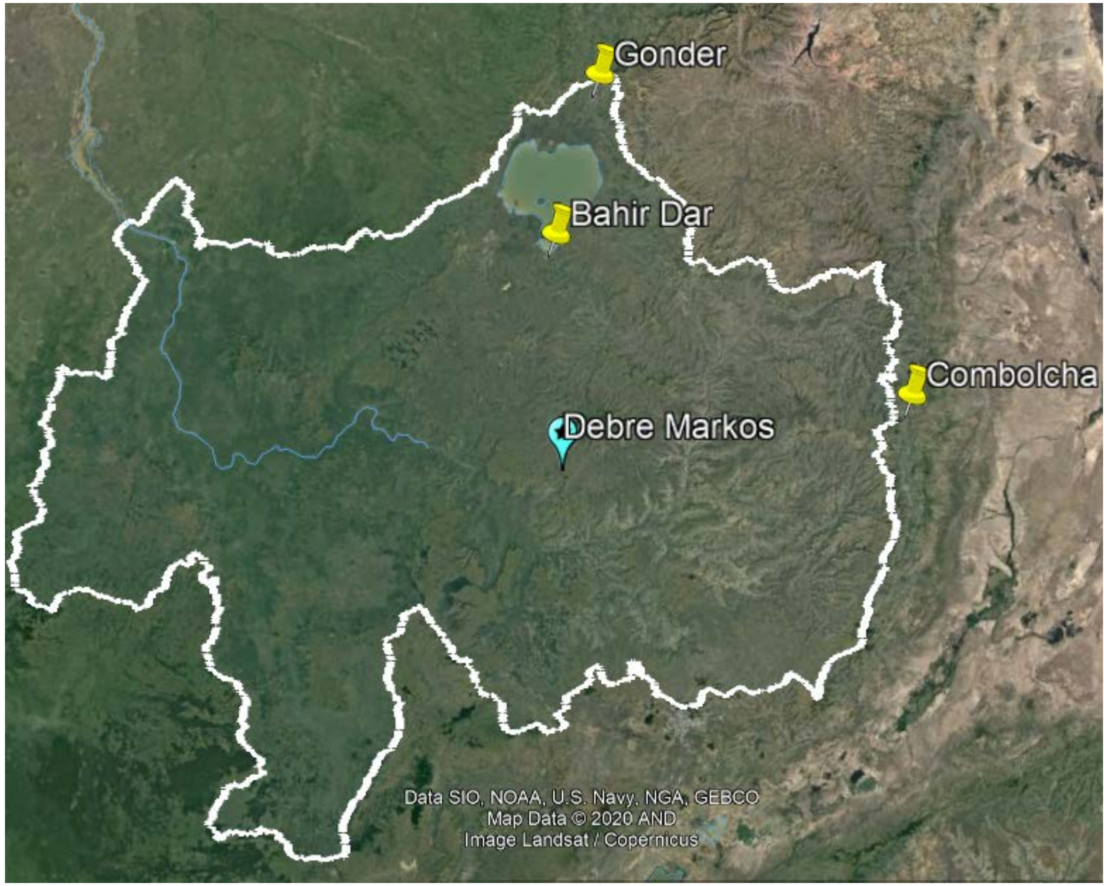
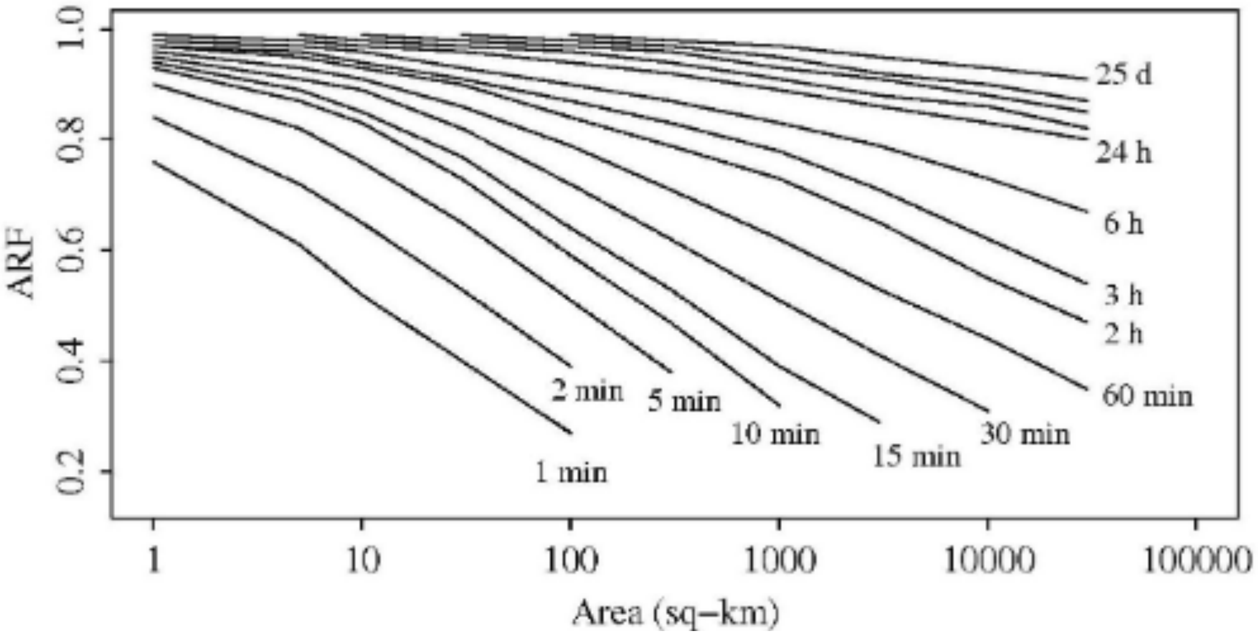


Proposed

1. ARF (from point to basin)



Areal reduction factors for precipitation in the UK

There is no reduction factor for area larger than 100,000. Blue Nile is more than 1750,00 sq.km

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Dandrawy and Omran (2020)

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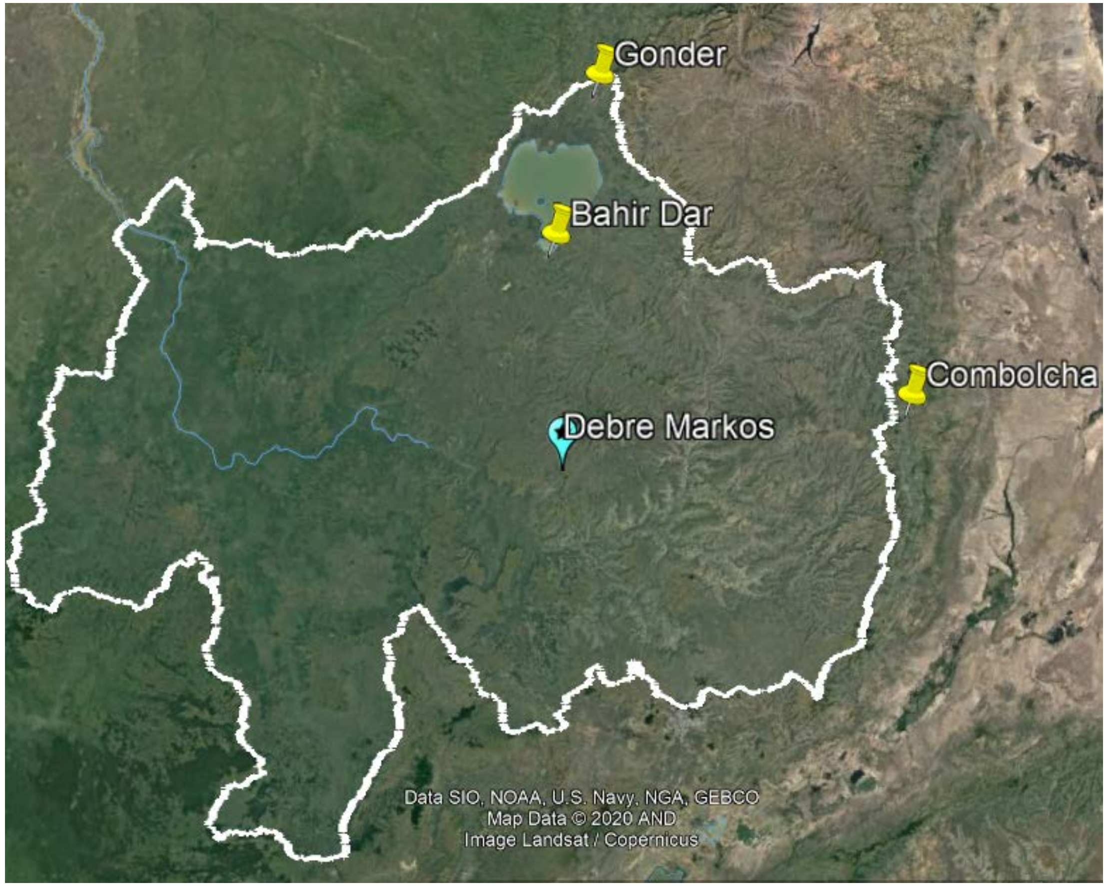
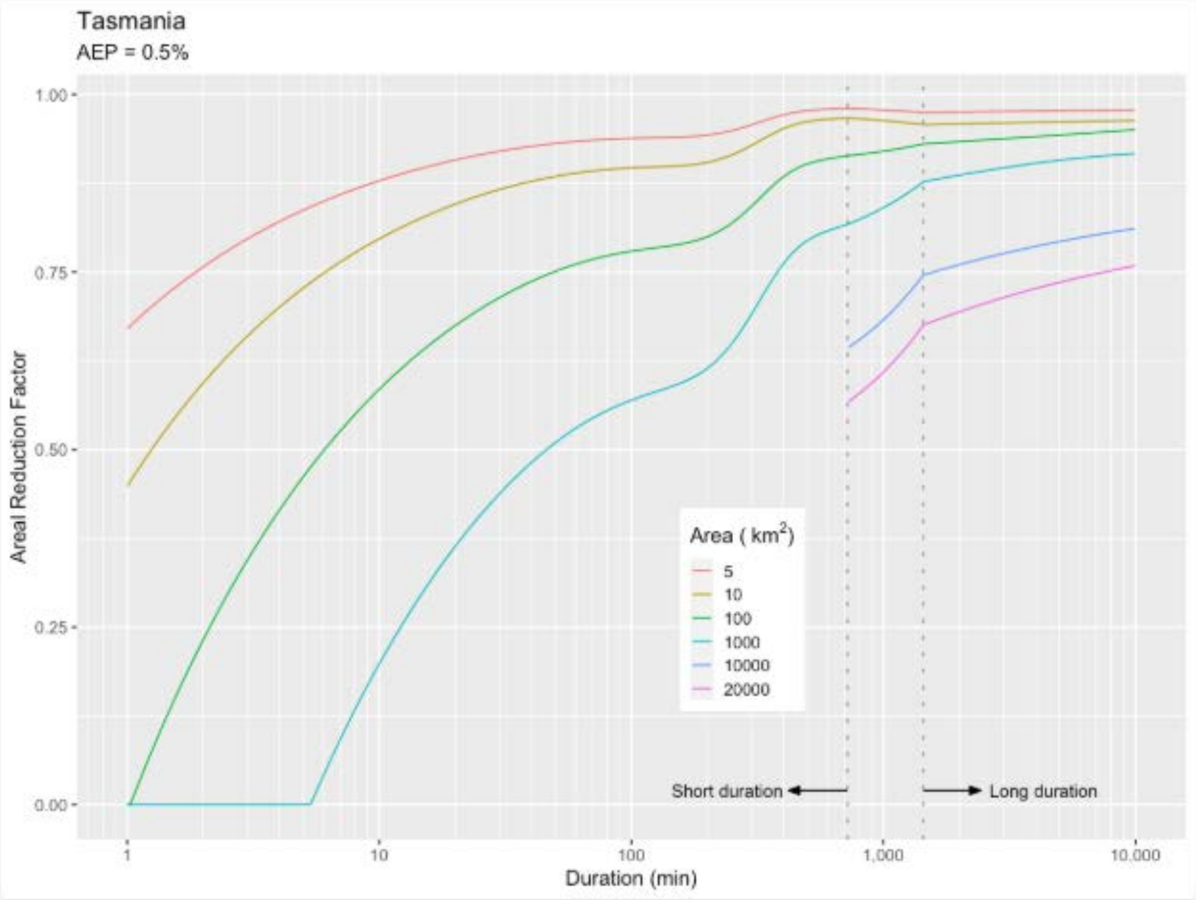


Proposed

2. ARF (from point to basin) - not applicable for area as big as Blue Nile



Areal reduction factor as a function of duration for various catchment areas and for an AEP of 0.5%

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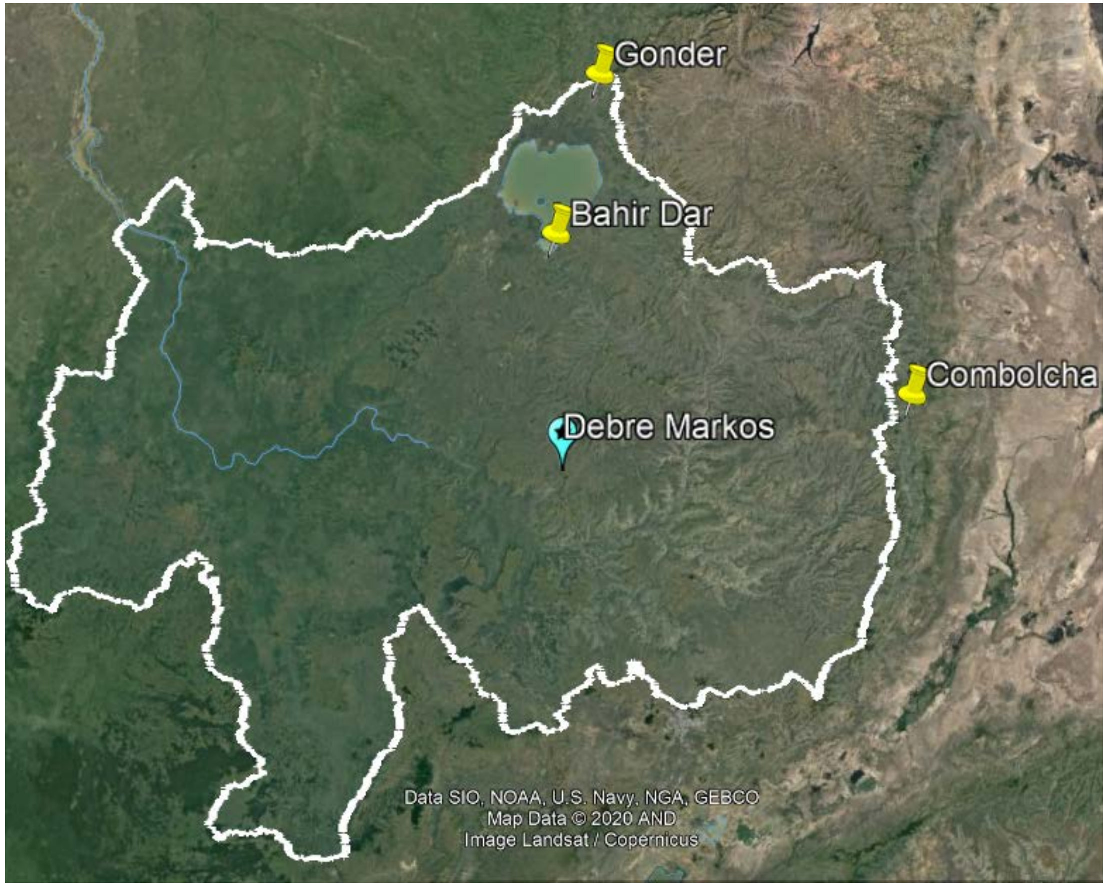
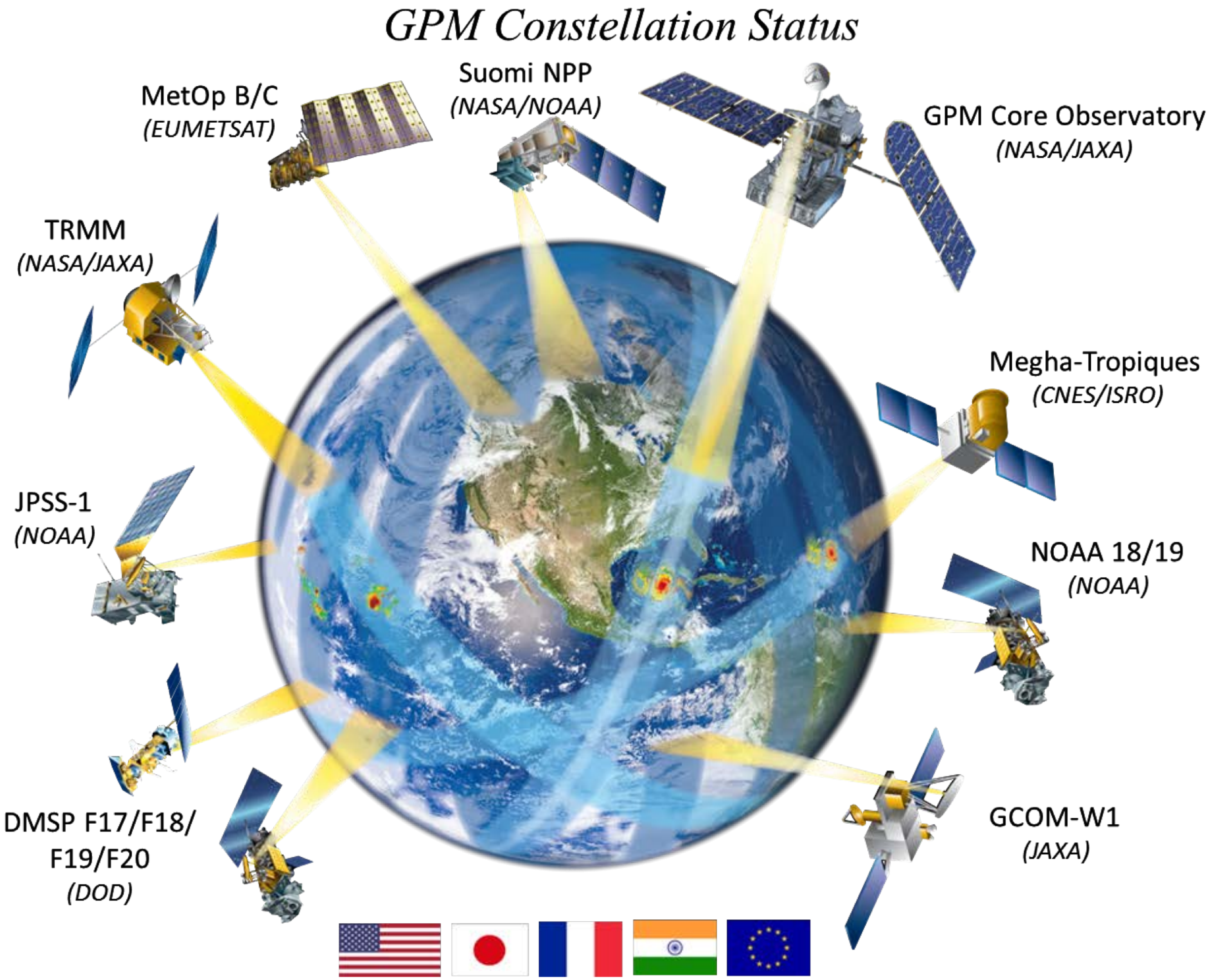


Proposed

3. RS space-time rainfall fields (GPM, CRU, CFSR, CHIRPS, etc)



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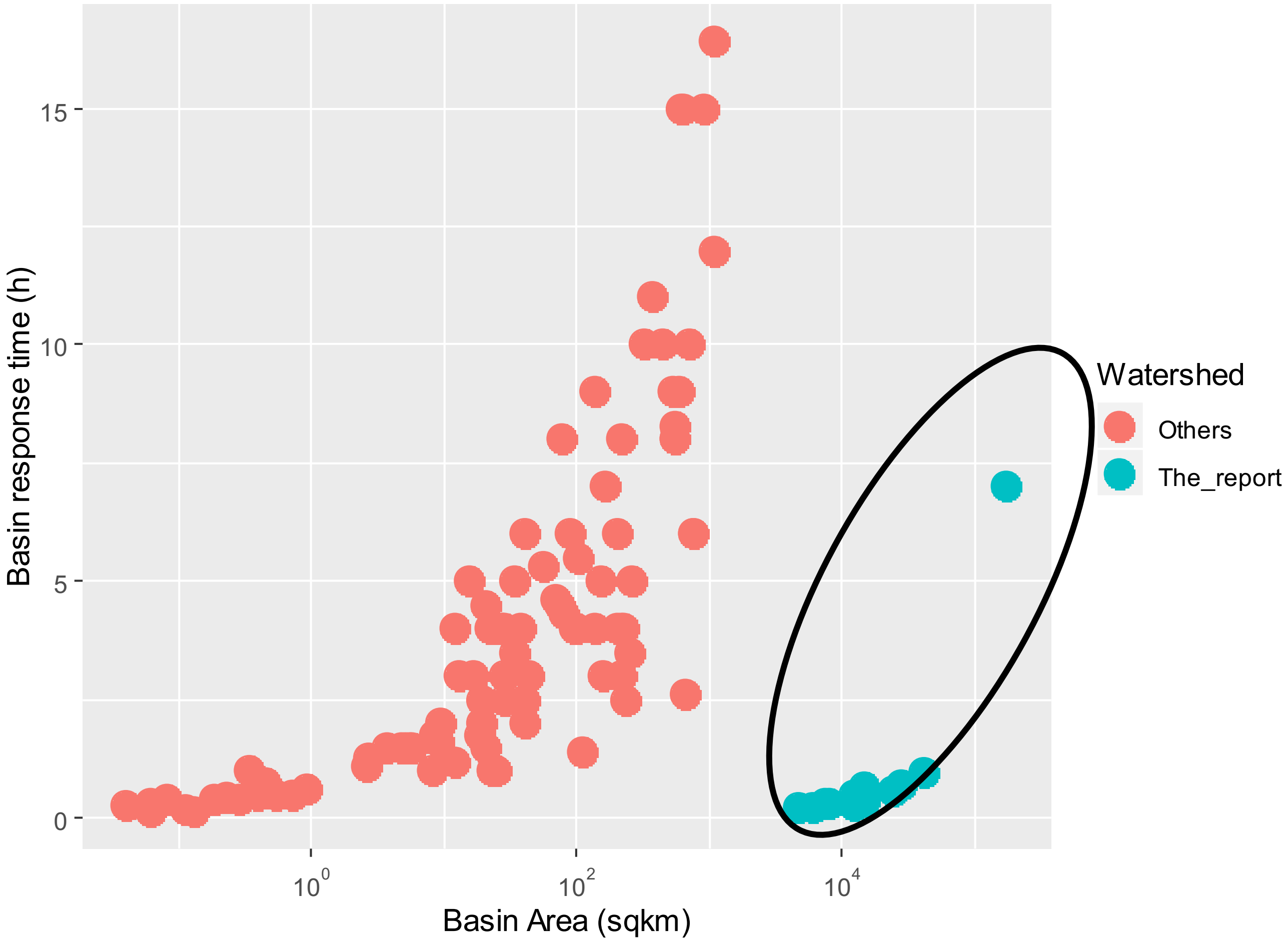
Dandrawy and Omran (2020)

- Topographic parameters to estimate the remaining runoff and associated processes

Name	Area	LAGTIME	TC
Dabus	14,708.5	38.1	63.6
Upper Blue Nile	41,555.8	56.3	93.8
Beles	12,404.0	30.6	51.0
Didessa	28,244.3	41.5	69.2
Tana	24,652.3	33.9	56.5
Guder	8148.5	17.5	29.1
Muger	7415.3	18.3	30.4
Beshilo	12,169.3	15.1	25.2
Jemma	14,730.0	20.2	33.7
Welaka	4736.8	14.4	24.0
South Gojjam	6065.0	14.2	23.6

Concern/Proposed

- Time of concentration/lag from different sub-basins
- Lack of model calibration invalidates the use of Tc for large watershed



McDermott and Pilgrim (1982)

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2. Topography representation for runoff estimation and routing

Dandrawy and Omran (2020)

- Topographic parameters to estimate the remaining runoff and associated processes

Name	Area	LAGTIME	TC
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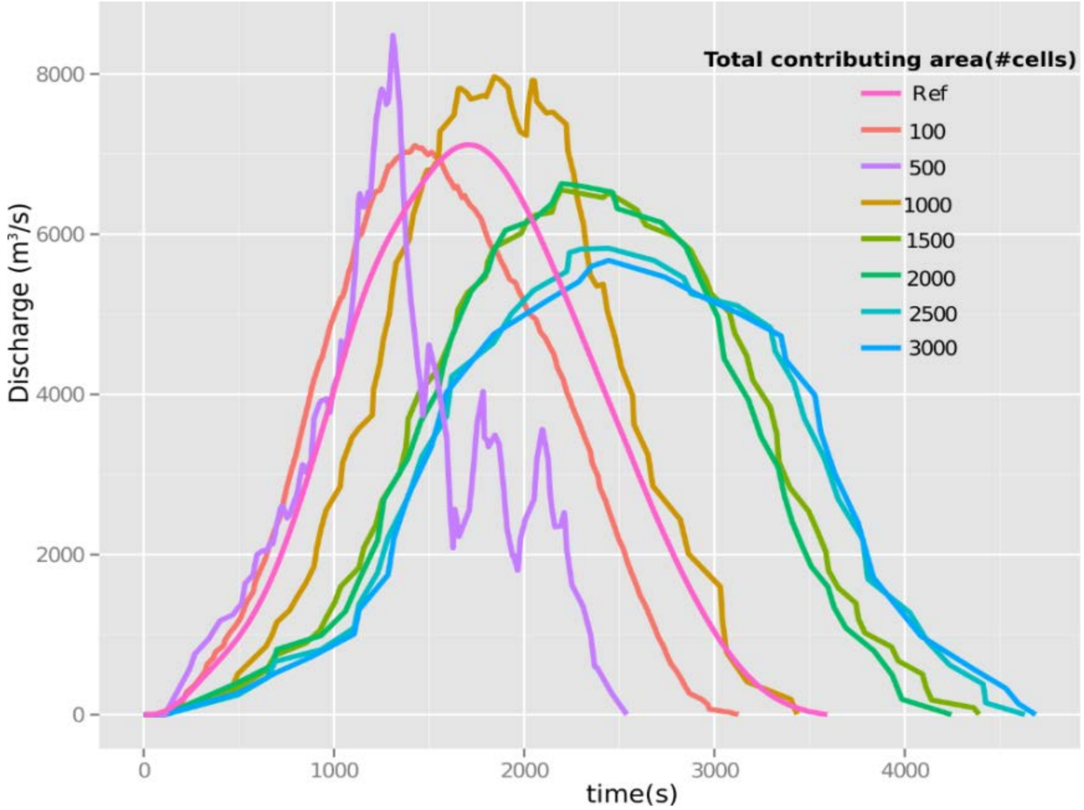
Concern/Proposed

- Flood hydrograph is sensitive to topographic parameter (i.e. threshold area to extract river network (41 minutes to 21 minutes; 5500 m3/s to 8300 m3/s)



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3. On flood routing

Dandrawy and Omran (2020)

- Flood attenuation effect due to storage outflow characteristics of Lake Tana

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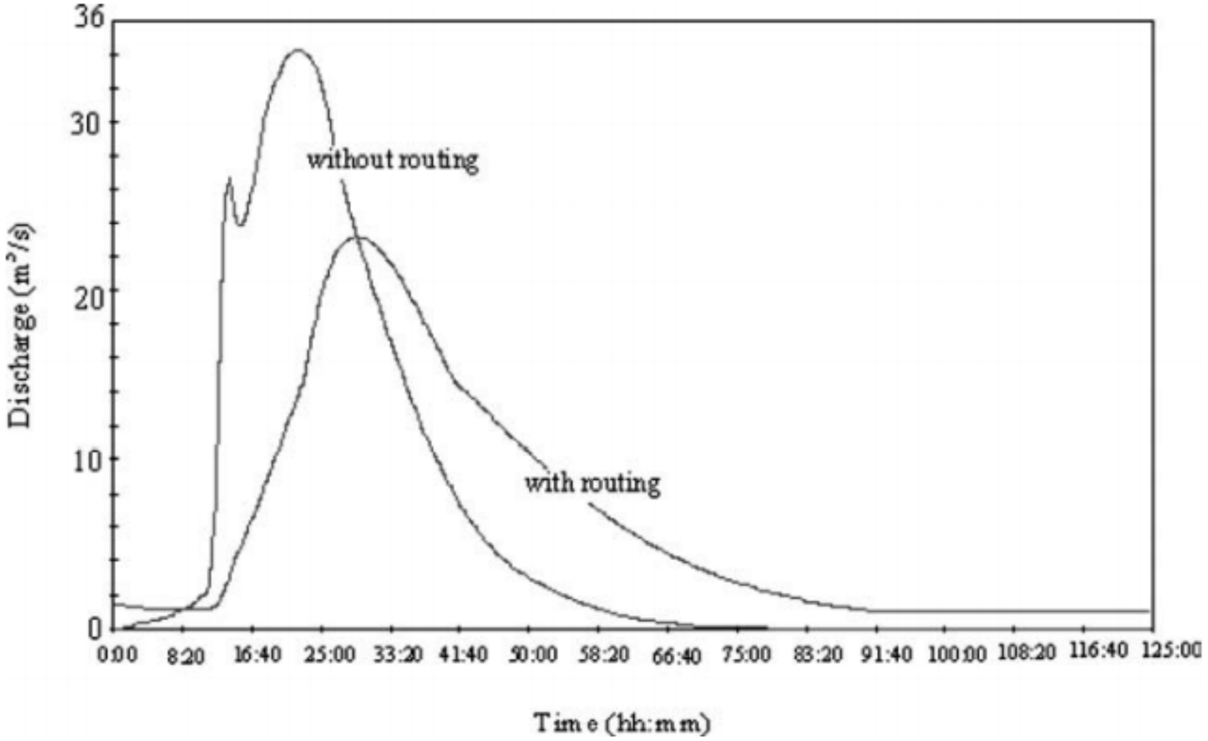
Concern/Proposed

- If flood peak simulated with HEC-1 model **without accounting routing**, the flood peak will significantly increase.



Sui, 2005

- **No routing** was not considered mean that all 11 sub-basins meet at the outlet at the same time.

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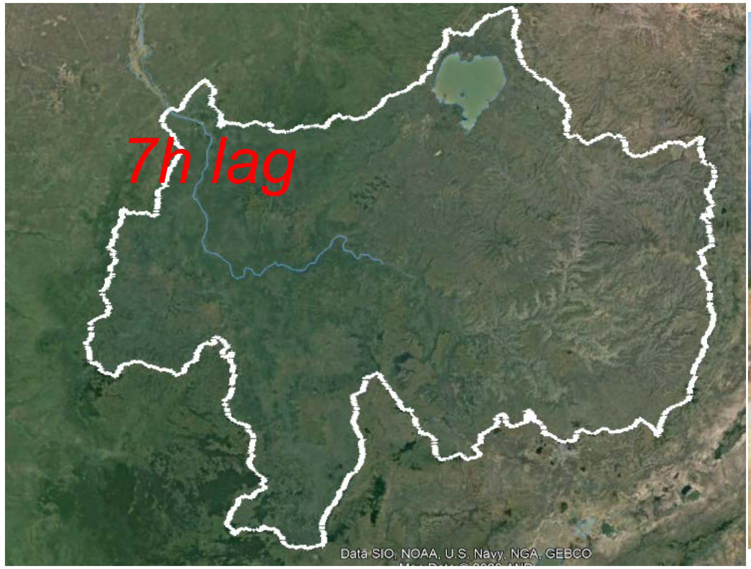
Dandrawy and Omran (2020)

- No calibration and validation (e.g. CN numbers in the model)
- A single CN number for the entire basin
- Not consistent in their presentation with their CN values



- Total volume of peak flow = **8,492,585,048** m3 (page 557, Table 17.3)

Concern/Proposed

- There are many discharge date in the basin
- Global Runoff Data Centre (GRDC, 2020).
- Experiences from Predictions in Ungauged Basins (PUB) initiative can be taken
- Inverse approach (based on their assumption)

= 0.1 m rainfall * 176,000 *1000 * 1000 m2 catchment area * 0.23 runoff coefficient

= **4,048,000,000** m3

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5. On elevation-area-capacity curve

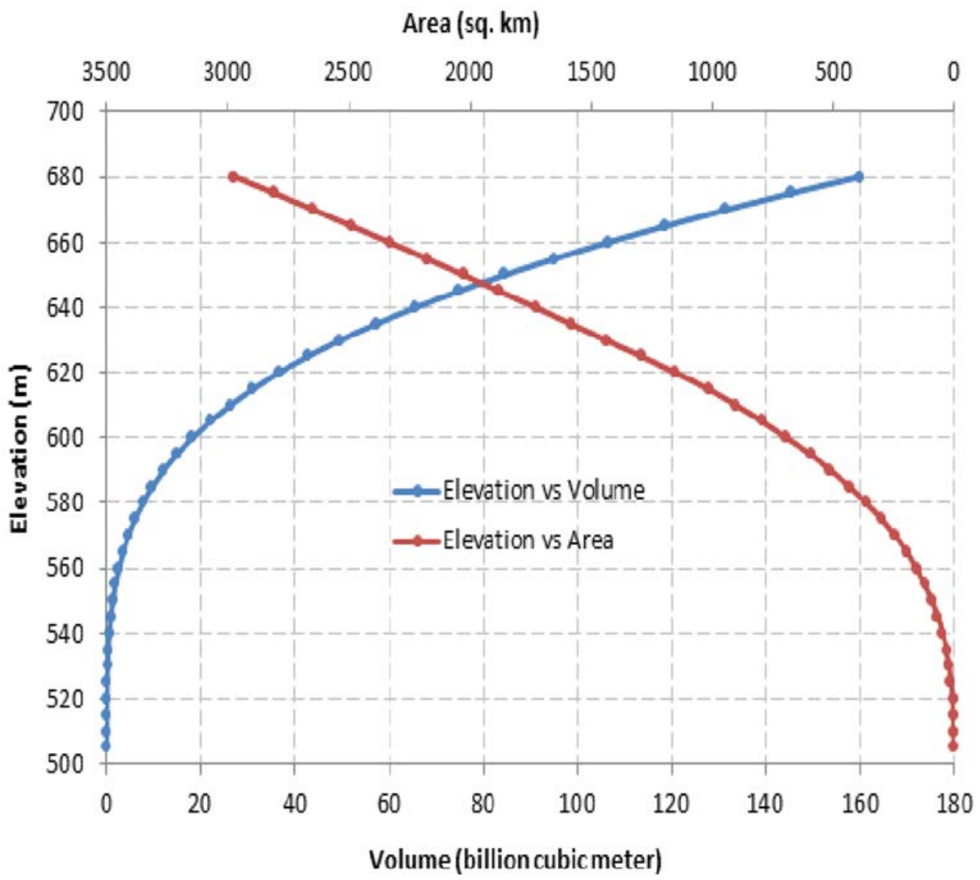
Dandrawy and Omran (2020)

- “the Renaissance Dam’s GIS-simulated reservoir at **606 masl** (i.e. 100 m maximum water depth) showed that the lake would cover roughly 745 km^2 and that the quantity of water stored would reach **[74]** billion cubic meters” (pages 561, [74] *in parenthesis added from abstract of the report*).

- Lake area size 745 km2

- GERD’s reservoir (lake) average width as **10,748 kms**, with a maximum width of about **37,941** kms (page 564)

Concern/Proposed



- 17.5 BCM at the 606 m a.s.l
- 74 BCM (max) is at about 640 masl
- Lake area size about 1800 km^2

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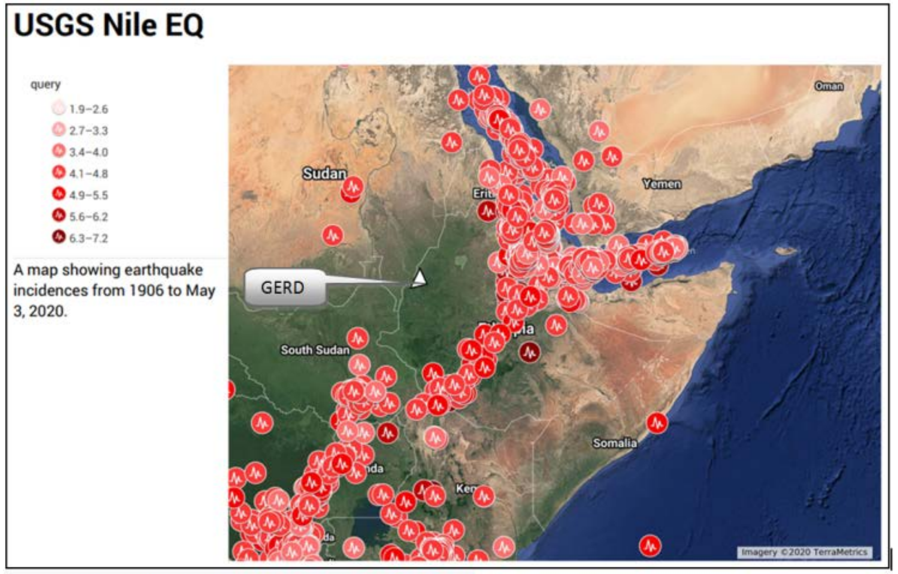
6. On GERD's safety

Dandrawy and Omran (2020)

- "Safety surveys on dams have shown that the Ethiopian GERD Dam's safety factor is only **1.5 degrees** from 9 degrees.
- **It is more probable that the GERD Dam will collapse. Experts said the dam was created to collapse.**
- The safety of the dam is very low. Any earthquake will damage this dam and it is a **seismic zone adjacent** to the African groove" (page 572).
- UBN basin is dominated by **basement rocks** (on page 536)

Concern/Proposed



A map showing earthquake incidences from 1906 to May 3, 2020

- Extensive ground improvement (consolidation and contact grouting) were carried out to ensure the highest safety of the dam (Pietrangeli et al., 2017)

- Underlain by Precambrian granites and granodiorites (Merla et al. , 1973)

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Dandrawy and Omran (2020)

- GERD associated with fault zones NNE–SSW, NNW–SSE and ENE–WSW (page 539).
- “GERD dam may fail and it may cause flooding to the capital of Sudan” (pages 534, 570–572).

Concern/Proposed

- No ground truthing has been made to confirm if those observations are in fact fractures and to assess their characteristics in terms of required design parameters to ensure safety of the dam.
- Not either scientifically supported with any dam failure analysis and or no proper hydrologic and flooding assessment
- Linear time history analysis proved the stability of the dam and its foundation (Pietrangeli et al., 2017)

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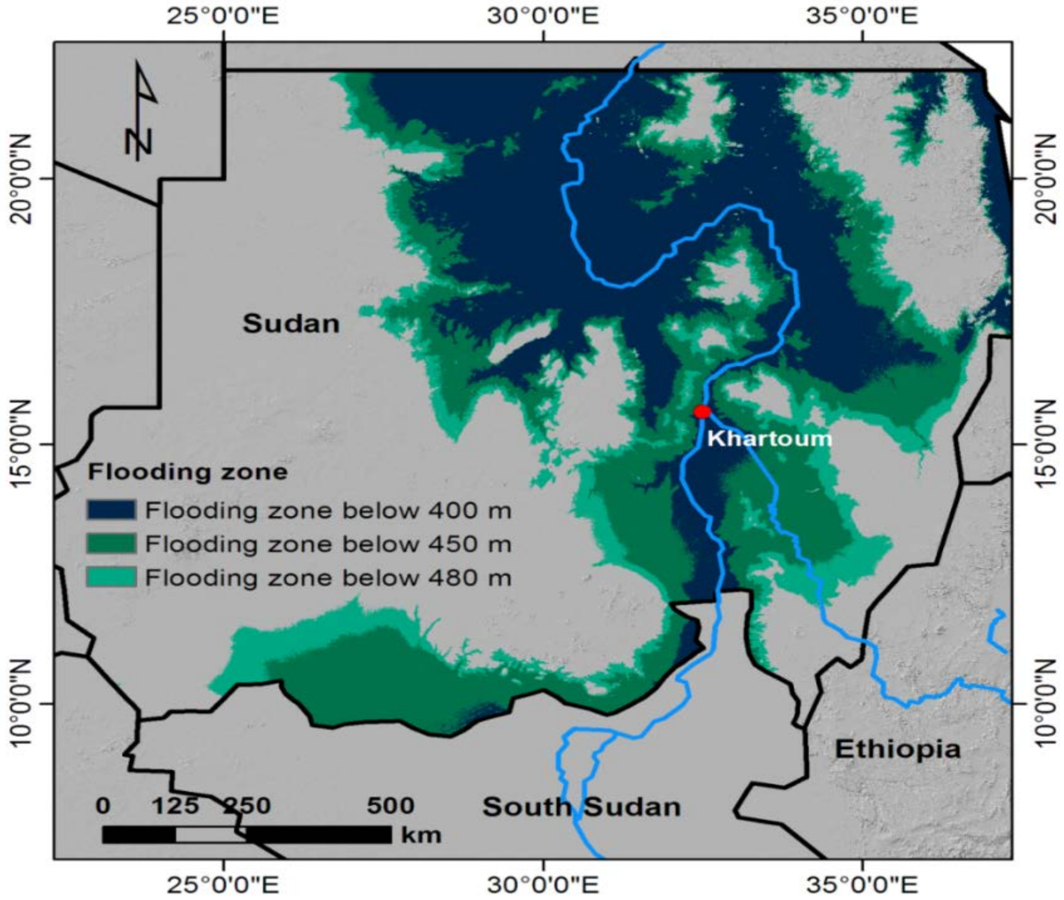
Dandrawy and Omran (2020)

- The maximum extent of the inundation area below 480 m. s. l. in Sudan was **667,228** km2.



Concern/Proposed

- No volume and depth of flood area (???)

- To cover 667,228 km^2 area, the average depth of flooding water will be about 11 cm

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8. Lack of basic research decency

- Lack of basic research decency (falsification, plagiarism, inconsistency)

- Mismatch between stated objectives and content of the article

- Misleading title with no content covered inside the text

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Summary and call for action

Summary

- use of **inappropriate rainfall data** for hydrological model setup to simulate peak flood and volume;
- the hydrological model was not properly calibrated, and validated (**garbage-in-garbage-out**);
- blatant conclusions about the **dam failure without properly evaluating the dam design** and safety protocols;
- use of the MicroDEM model out of context for flooding simulation and wrongly claiming that a potential failure of GERD may flood a large swath of Sudan;
- deliberately misinterpreted an evidence they have presented to reach into hasty conclusions;

- deliberately misinterpreted an evidence they have presented to reach into hasty conclusions;

Call for action

- Request to revoke the book chapter;
- Call scientists and researcher for producing more evidence on each component of GERD;
- Global scientists think twice before referencing such publications

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Thank you for attention!!!

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