

EASTERN NILE SYSTEM UNDER THREE DIFFERENT WATER APPORTIONMENT ALTERNATIVES: THE COLONIAL ERA, WASHINGTON DC AND EQUITABLE SHARE



By Yared Gari, Seifu Tilahun, Paul Block,
Getachew Assefa, Muluneh Mokonnen (2021)

What is going on in the Nile basin

- For one decade the three Nile basin countries (Ethiopia, Sudan and Egypt) have been debated over the Grand renaissance Ethiopian dam filling and operation policy.

Overview



- Due to this, multiple rounds of negotiations as well as scientific communities contribution over the past 10 years also focused on searching for this policy.
- However, even though the tension between countries escalated due to GERD, but in reality the actual or root of problem is not that (even if it is a cause).



“We are not calling for war, but we will never permit our water security...to be threatened ...our blood is the alternative to losing one drop of water”

Overview



“Am not worried that the Egyptian will suddenly invade Ethiopia. Nobody who has tried that has lived to tell the story... the Egyptian have yet to make up their minds as to whether they want to live in 21st or 19th century ”



"Sudan will benefit from the GERD in terms of generating electricity and reducing silt and floods, but only on the condition that there is a binding tripartite agreement,”



- These three speeches clearly implies the exact mind set of countries leader who are playing the game in the negotiation field in the past and current time.
- So to achieve their goal, when the downstream states follow a strategy of associating upstream development with “significant impact” and “existential threat”, Ethiopia was firmly defending its right through “equitable utilization”.
- While countries undercover interest is maintaining status quo versus securing fair water share from the Nile, the negotiation up to date focused on GERD filling and operation policy alone.
- That is why none of the proposed policies couldn’t narrow down the difference between countries.
- Still, despite a continued effort of the African union to bring riparian

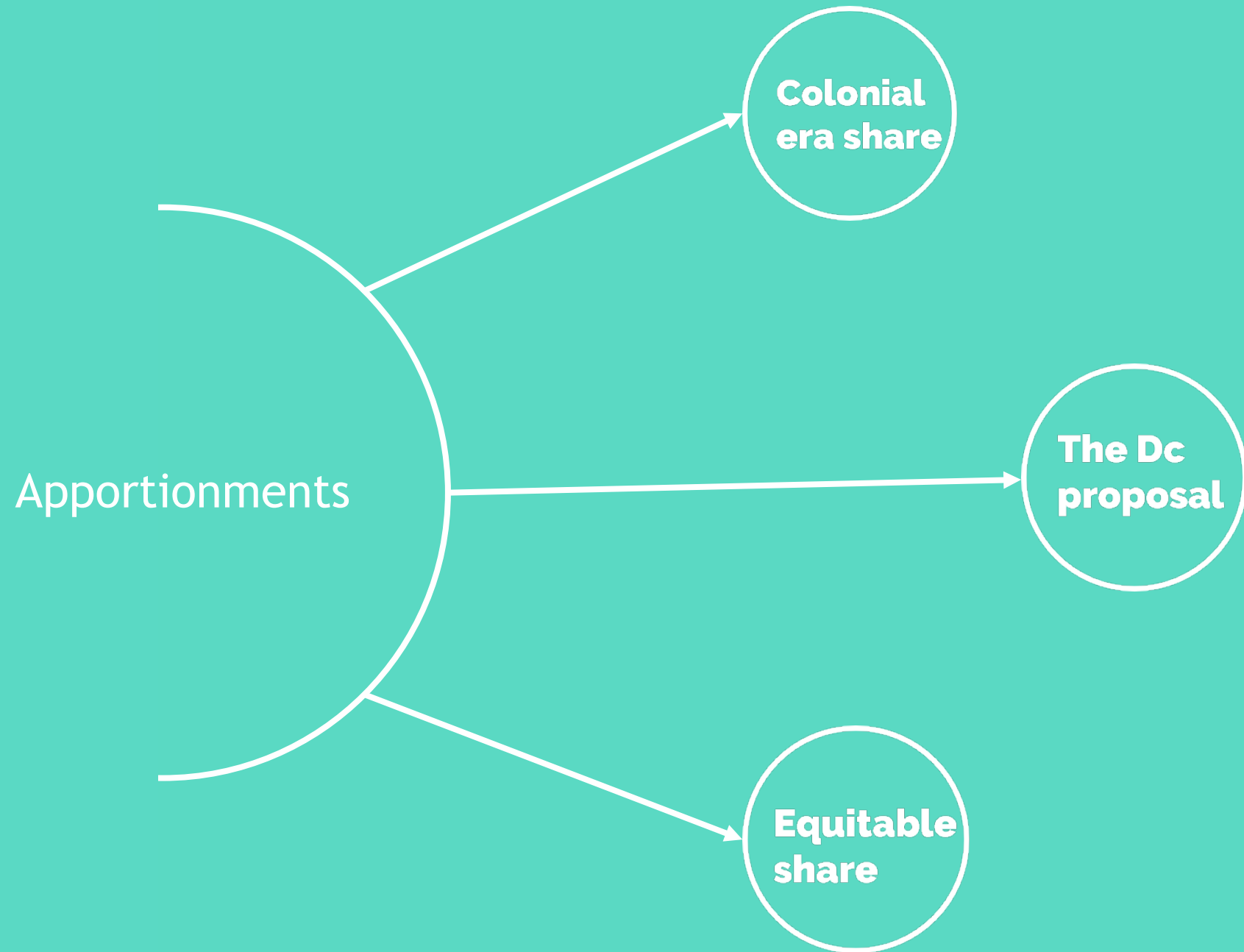


- This situation also indicates, the need for developing of all inclusive water apportionment agreement in a way that can able to address the inner fear of countries than focusing on a single dam operation policy search.
- Currently, three alternatives are claimed to serve this interest. These options are; colonial share, the Washington DC proposal & equitable share.

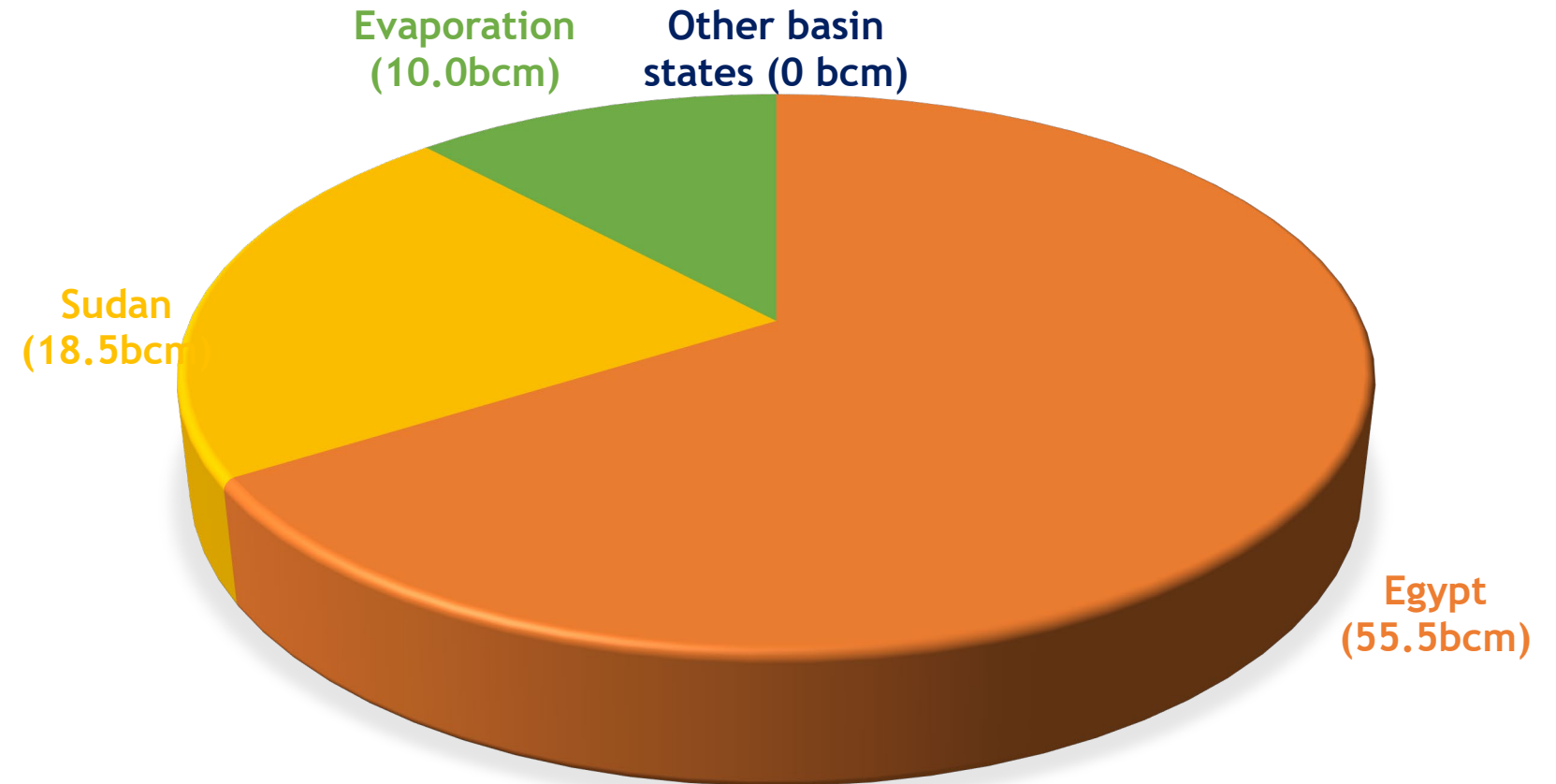
Objective



- Thus, by considering the interest of basin countries, this study aimed to **evaluate and understand the efficiency of three apportionments claimed to be binding agreement by the 3 countries.**



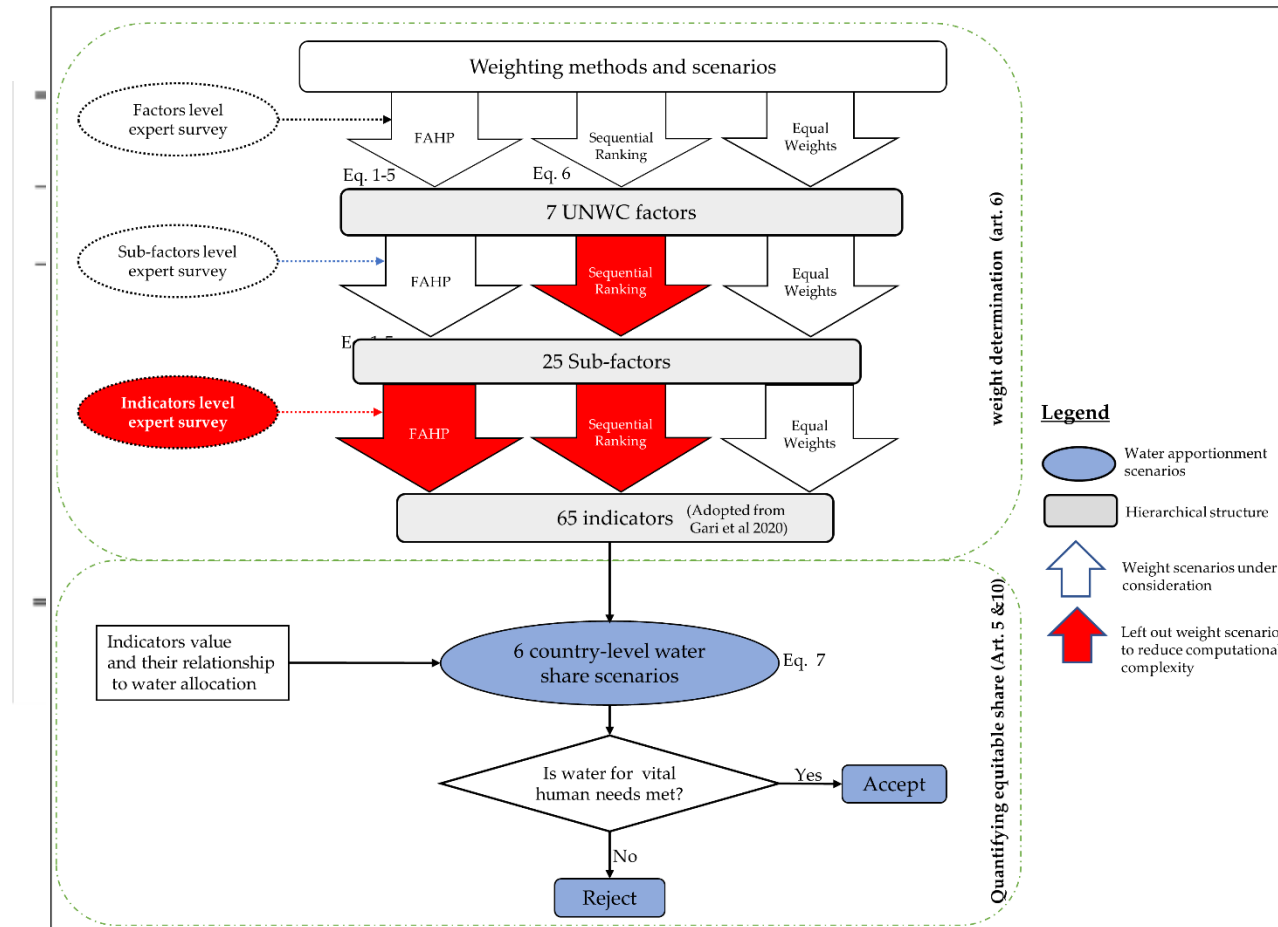
- Based on the bilateral agreement between Egypt and Sudan in 1959, a volumetric water apportionment agreement is made.



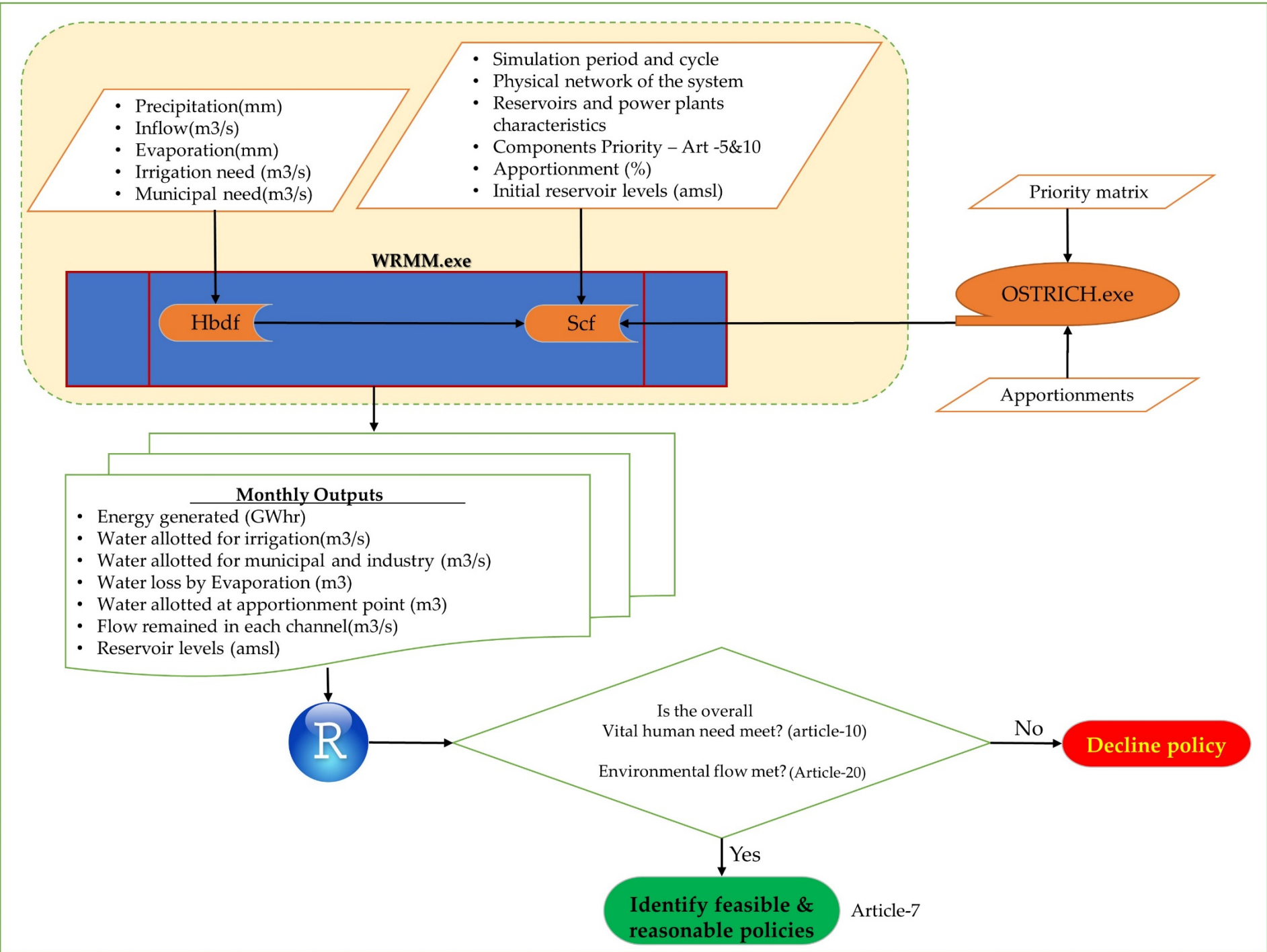
- This proposal was designed and proposed by the US dept. of treasury, to serve as a binding agreement among the 3 basin countries during drought condition.

Drought	Filling phase		Long-Term Operation	
	Inflow (Q_i)	Minimum Release (Q_r)	Inflow (Q_i)	Minimum Release (Q_r)
Drought (Annual)	$Q_i < 37$ bcm	$Q_r = Q_i + (\text{Annex A})$	$Q_i < 37$ bcm	$Q_r = Q_i + (\text{Annex A})$
Prolonged Drought (4-yr Average)	Q_i (4-yr Avg.) < 37 bcm	$Q_r = Q_i + 62.5\%$ of Storage Above 603 m a.s.l.)	Q_i (4-yr Avg.) < 39 bcm	$Q_r = Q_i + 100\%$ of Storage Above 603 m a.s.l
Prolonged Period of Dry Years	Q_i (4-yr Avg.) < 40 bcm	$Q_r = Q_i + 50\%$ of Storage Above 603 m a.s.l.), the Following 4 years	Q_i (5-yr Avg.) < 40 bcm	$Q_r = Q_i + 100\%$ of Storage Above 603 m a.s.l.),

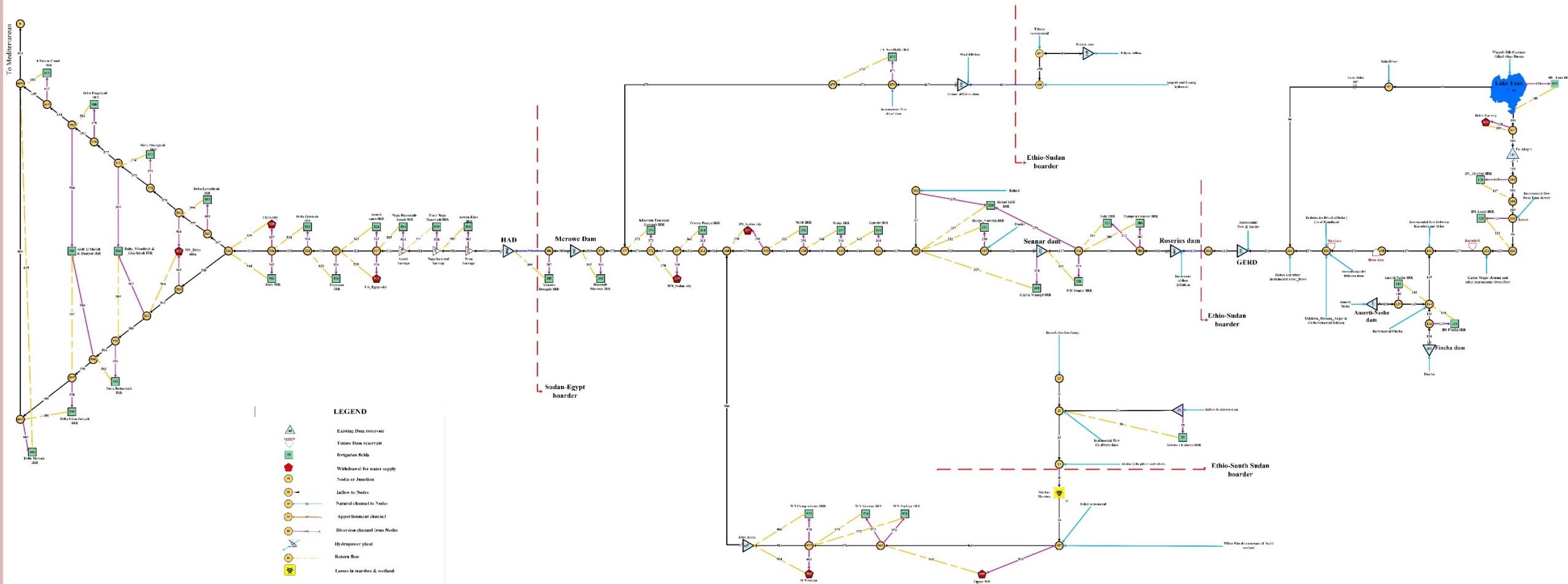
- In our previous study, we have quantified the equitable apportionment of basin countries based on UN watercourses conventions.
- Below is 88 scenarios obtained from a combination of different weighting techniques.



e from sub-basins					
Baro-Sobat			White Nile		
hiopia	Sudan	Egypt	Equatorial State	Both Sudans	Egypt
42.1	26.8	31.1	37.2	32.2	30.6
41.3	27.7	30.9	36.8	33.3	29.9
7.6-44.2	25.4-30.7	27.2-35.2	35.2-42.2	28.3-32.6	25.5-34.5
6.8-44.4	25.1-30.7	26.8-35.2	35-42.6	29-33	24.8-34
41.3	27.6	31.1	39.8	30.4	29.8
41.5	27.6	30.9	39.9	30.9	29.2



The Eastern Nile basin physical schematics of the water resource system



Model run conditions

Description of parameter	Base Scenario	Scenario-1	Scenario-2
Irrigation efficiency	60-70%	65-75%	65-75%
Return flow	0%	5%	5%
The lowest limit of HAD water level	165 amsl	160 amsl	No limit until 147 amsl
Hydrologic conditions	Prolonged drought Normal Wet	Prolonged drought Normal Wet	Prolonged drought Normal Wet

- To make the inflow time series consistent with the DC proposal, the first 4yrs of the inflow was rearranged based on the SPI index value

Finding



Base scenario result (Energy generation performance)

Eastern Nile Riparian countries	Target demand	Average annual energy production during GERD filling phase (GWh)						
		Drought			Normal		Wet	
		Equitable share	The DC proposal	Colonial share	Equitable share	Colonial share	Equitable share	Colonial share
Ethiopia	20,132	17,586-18,083	959	992	17,996-18,588	1,629	18,773-18,931	9200
Sudan	8,332	8,313	8,313	8,313	8,313	8,313	8,313	8313
Egypt	8,313	8,059	8,059	8,059	8,059	8,059	8,059	8059
Overall basin	36,777	33,958-34,455	17,331	17,364	34,368-34,960	18,001	35,146-35,304	25573

- In the post filling period, on average, GERD can generate additional 1651-1703GWh/year energy during drought and 912-1028GWh/year in the wet periods through equitable apportionment

Finding



Base scenario (Irrigation performance)

Eastern Nile Riparian countries	Average annual Irrigation water deficit during GERD filling phase (Bcm)							
	Target demand	Drought			Normal		Wet	
		Equitable share	The Washington DC proposal	Colonial share	Equitable share	Colonial share	Equitable share	Colonial share
Ethiopia	1.77	1.50-1.68	1.728	1.727	1.40 -1.58	1.700	1.11-1.16	1.615
Sudan	12.53	0.23-0.31	0.044	0.062	0.14 - 0.18	0.034	0.05-0.12	0.013
Egypt	58.89	4.85-6.26	0.560	0.619	1.04-1.51	0.576	0.81-0.93	0.552
Overall basin	73.19	6.58-8.10	2.331	2.408	2.58-3.27	2.310	1.97-2.21	2.180

- Since Ethiopia's current demand does not absorb the entire apportionment under the equitable share, the irrigation deficit in the country's will disappear. Correspondingly, the irrigation deficits in Egypt and Sudan will drop to 0.5bcm .

Finding

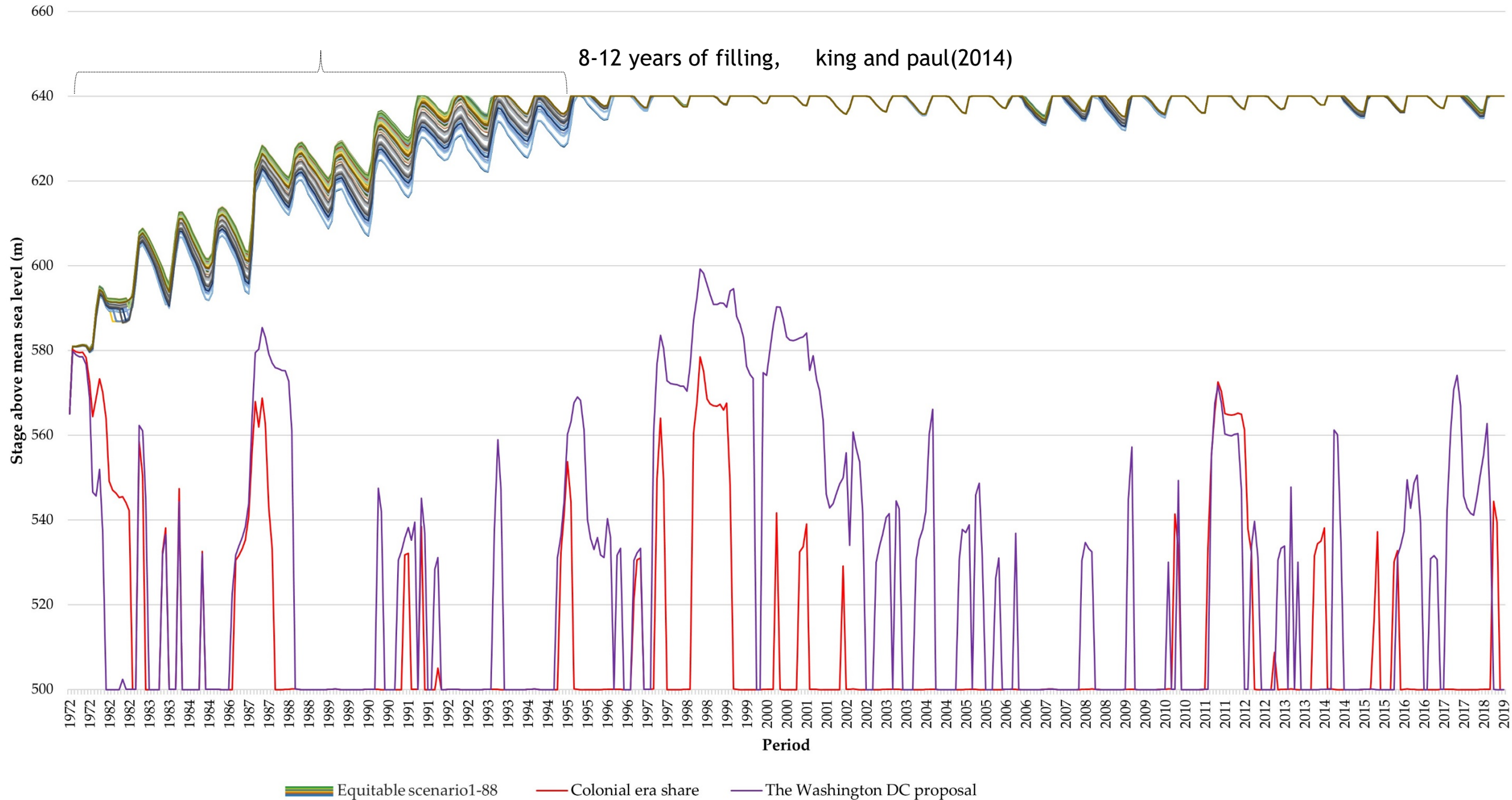


Base scenario result (Evaporation loss)

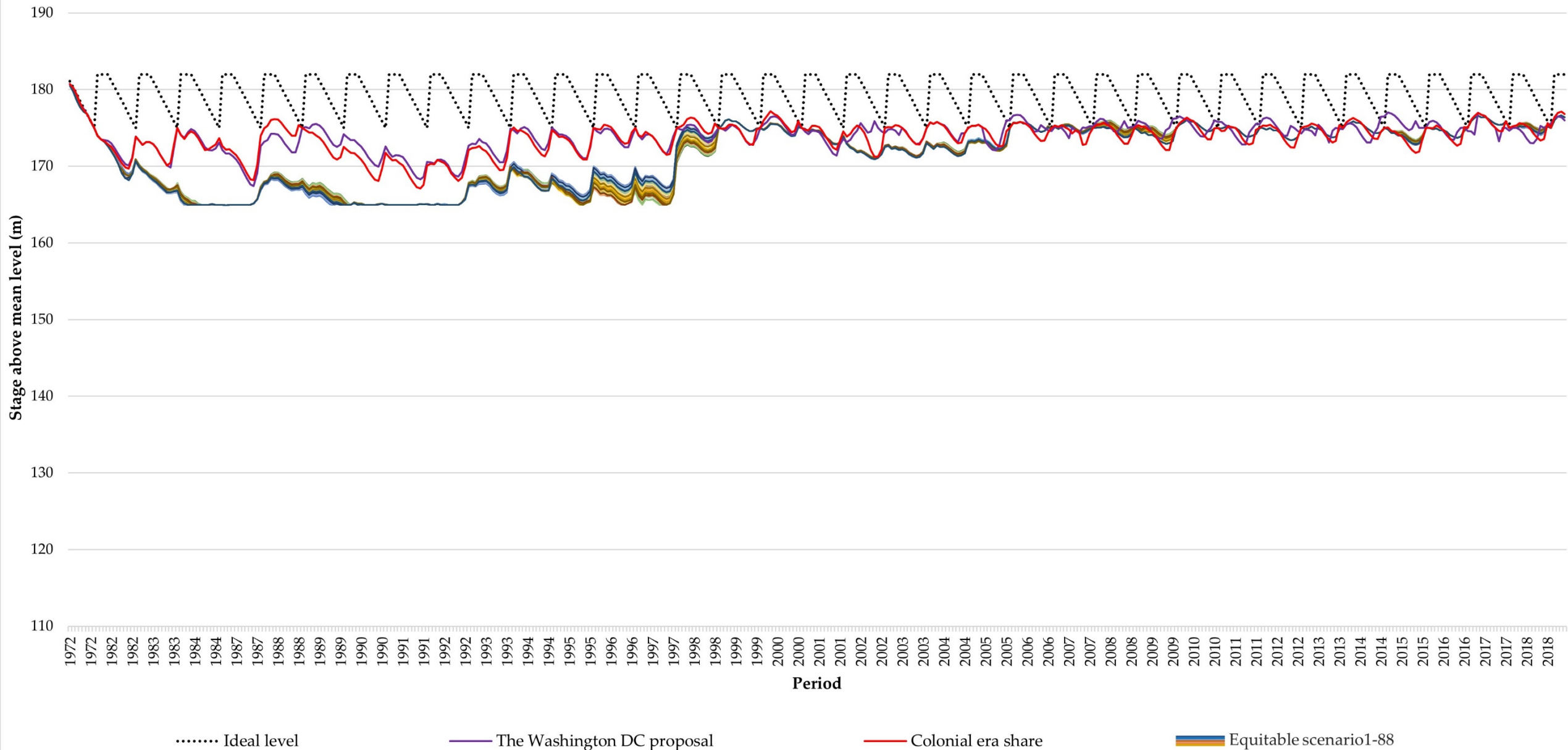
Eastern Nile Riparian countries	Average annual water loss by evaporation from reservoirs during GERD filling phase (Bcm)						
	Drought			Normal		Wet	
	Equitable share	The Washington DC proposal	Colonial share	Equitable share	Colonial share	Equitable share	Colonial share
Ethiopia	2.57-2.72	1.53	1.53	2.65-2.77	1.59	2.82 -2.86	2.67
Sudan	4.49-4.50	4.50	4.50	4.49-4.52	4.52	4.49 - 4.59	4.65
Egypt	9.34-9.41	11.07	10.99	9.78-10.1	11.95	10.94-11.19	12.06
Overall basin	16.47-16.60	17.10	17.02	16.92-17.39	18.06	18.25-18.64	19.38

- In the post filling phase, Ethiopia's apportionment under the equitable share is diverted for consumptive uses, the evaporation can worsen by up to 1bcm compared to the colonial and the DC

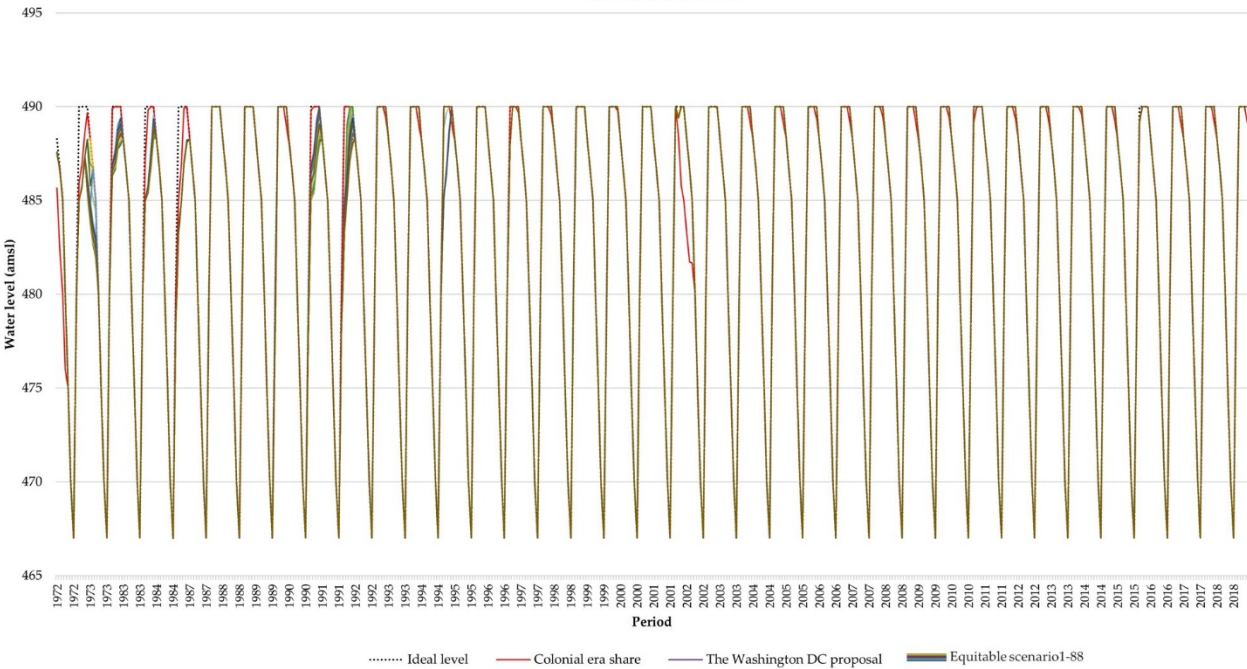
GERD reservoir water level under dry hydrologic condition and three different apportionments



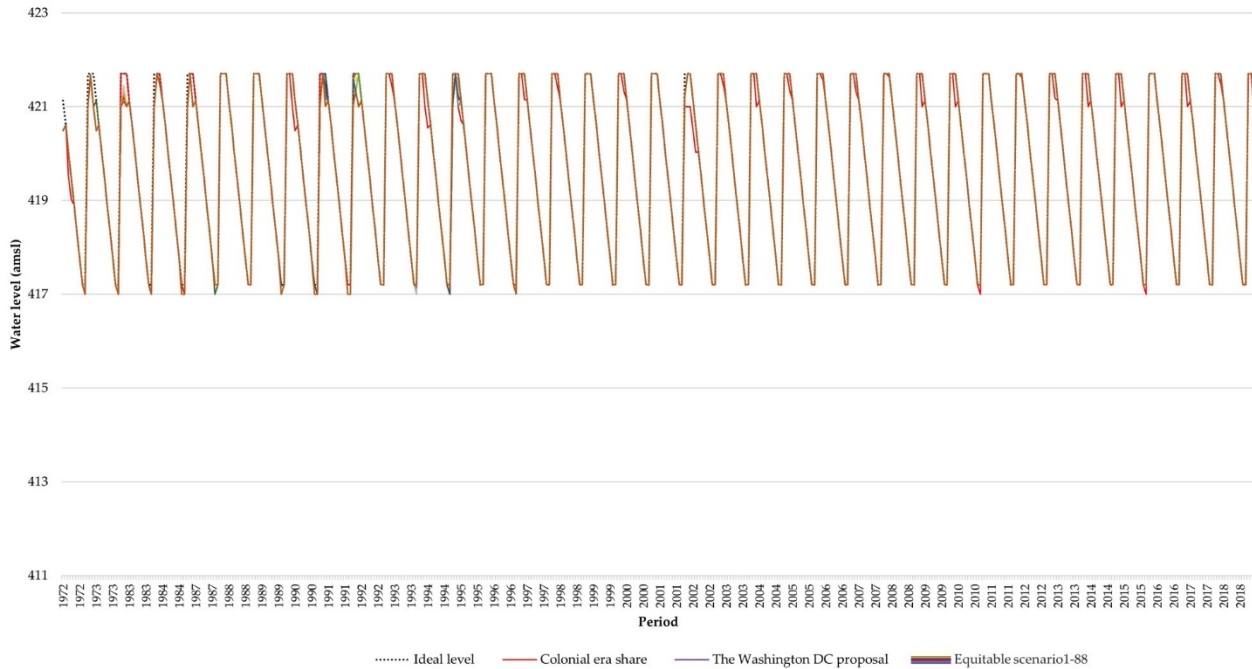
High Aswan dam reservoir water level under dry hydrologic condition and three different apportionments



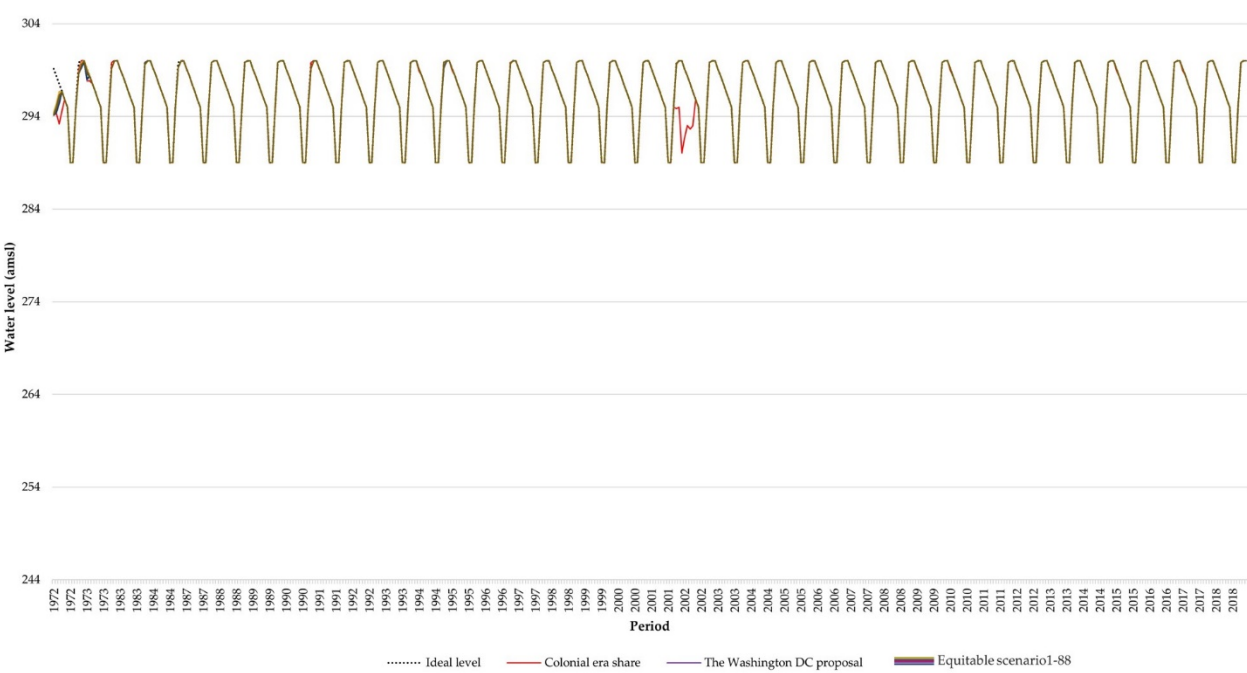
Roseriers reservoir



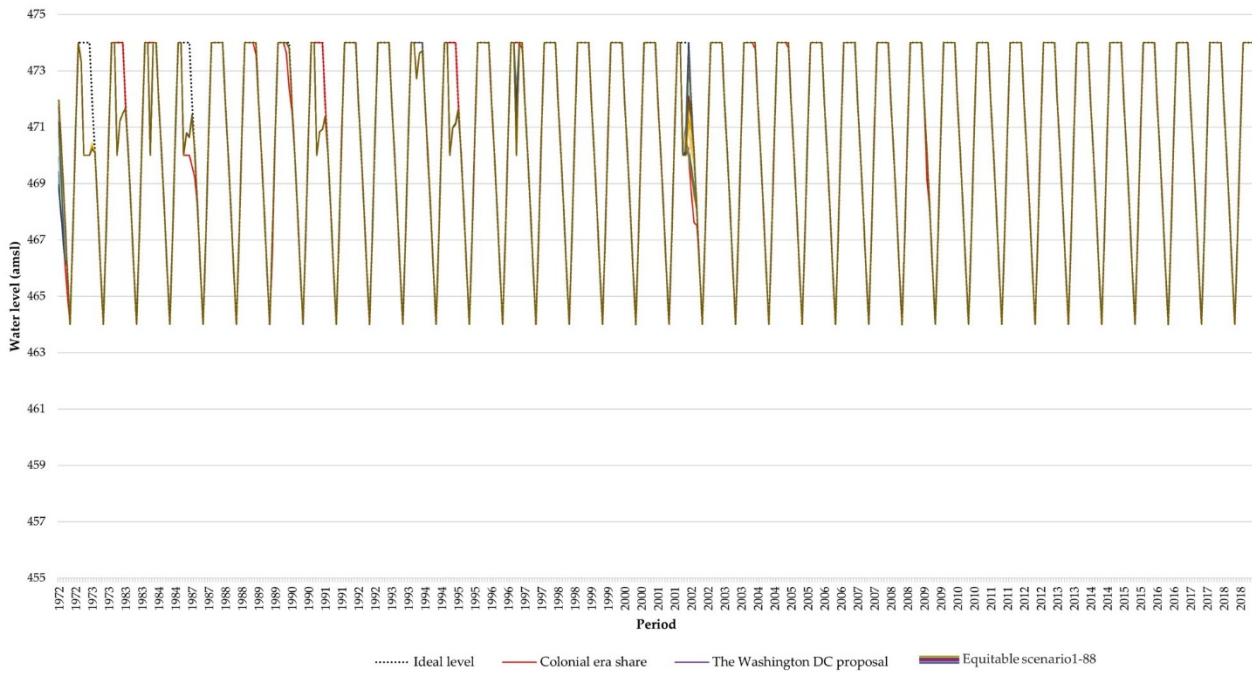
Sennar reservoir



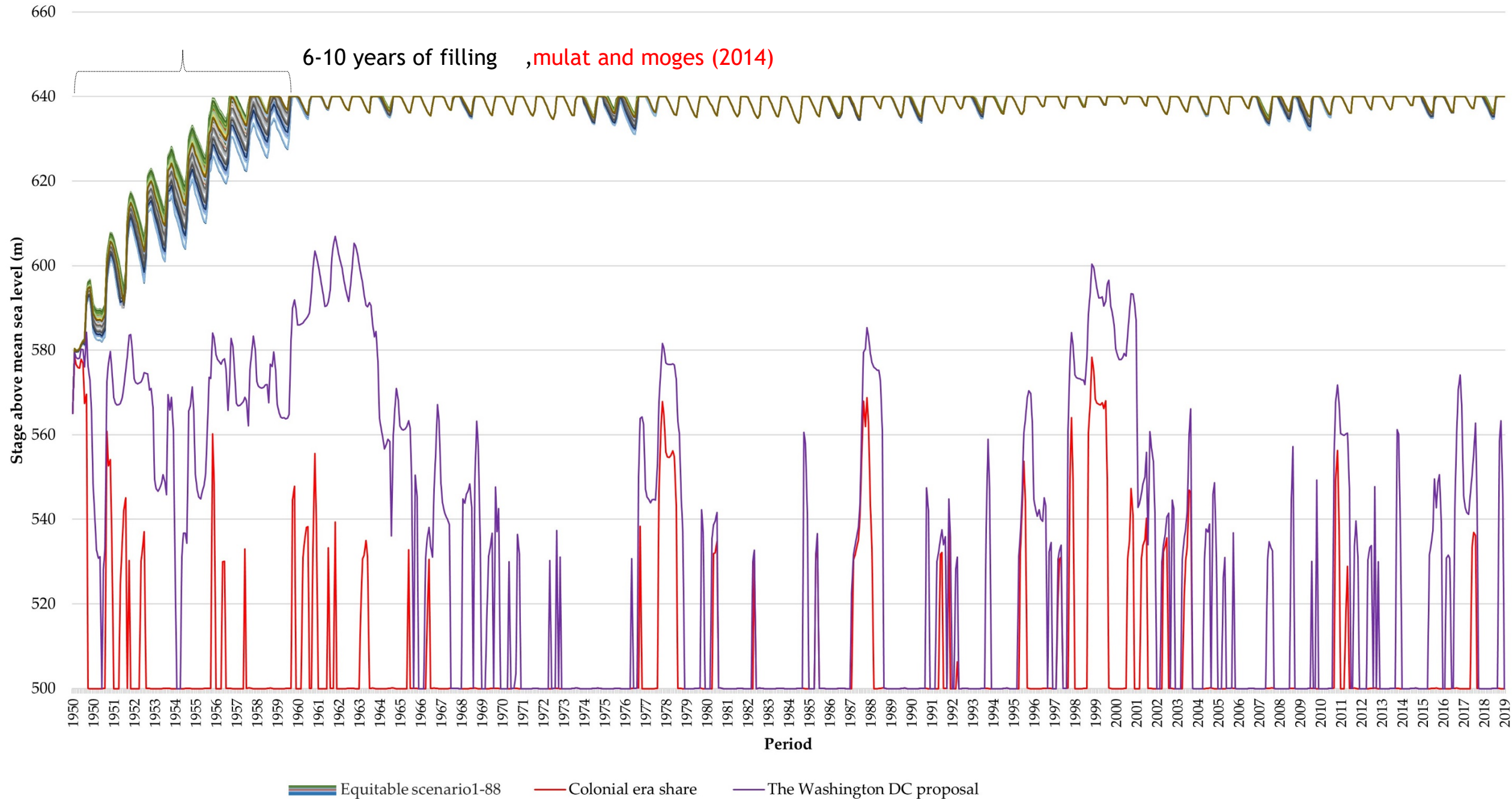
Merowe reservoir



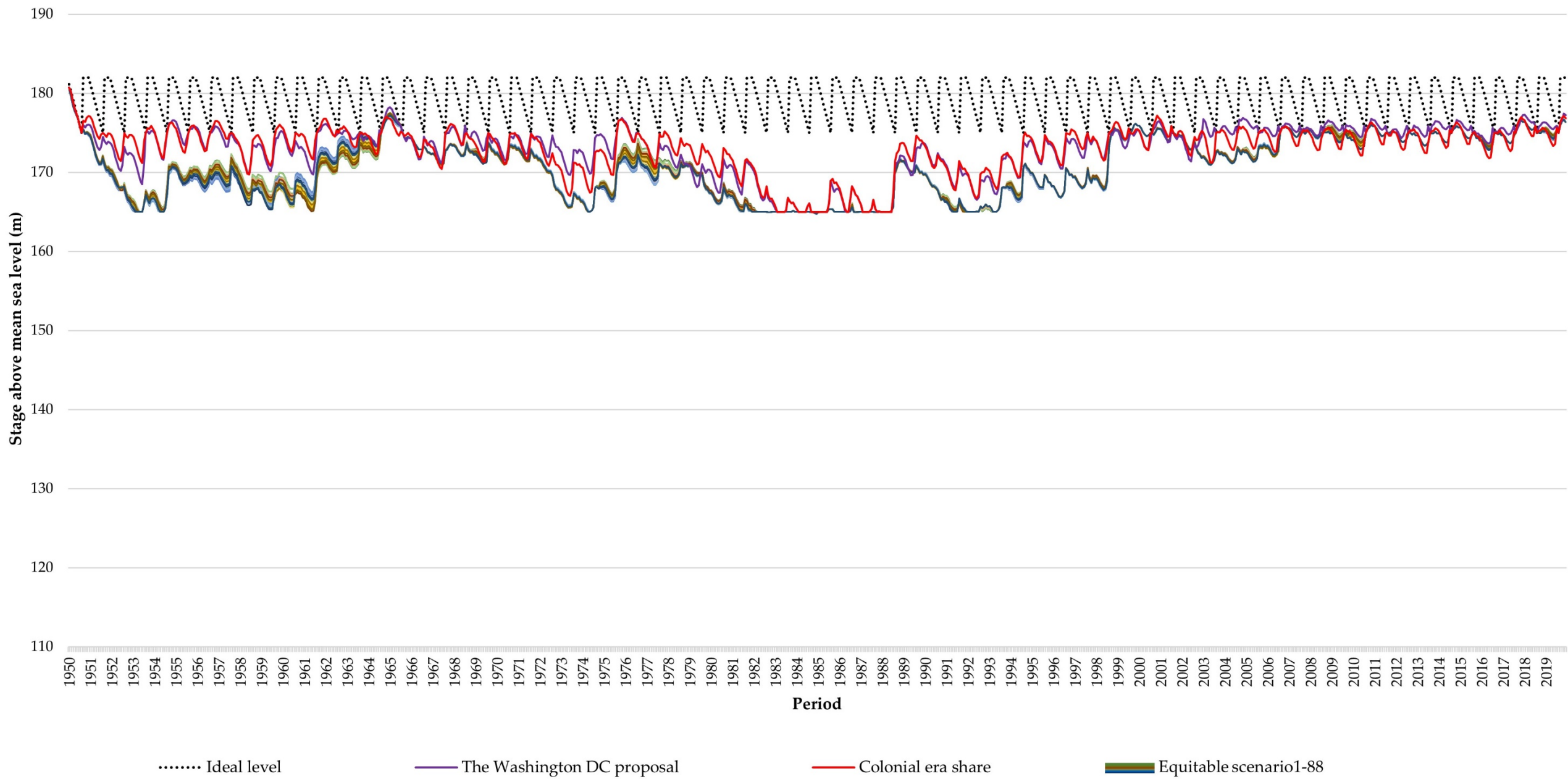
Khashm-el Girba reservoir



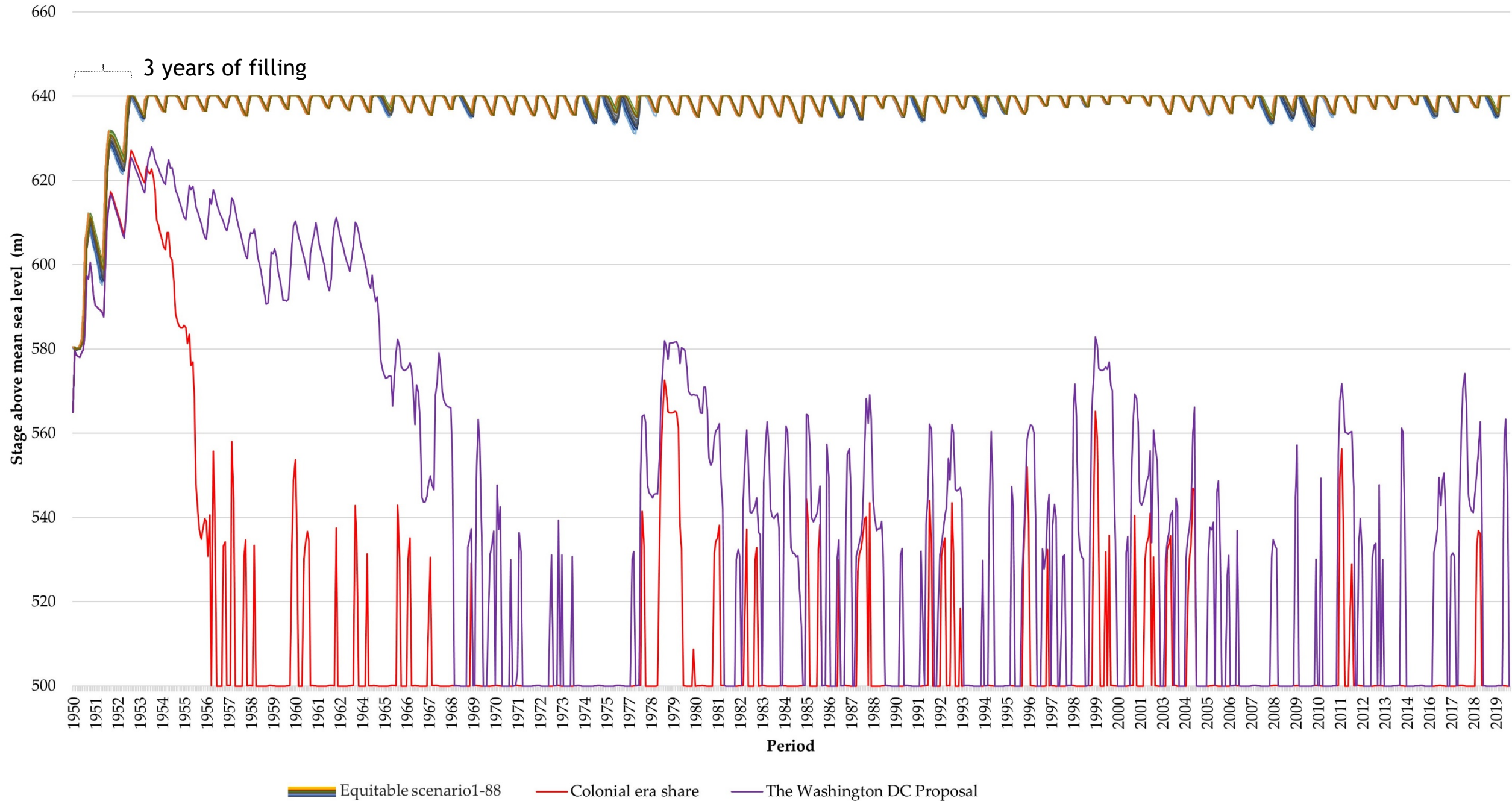
GERD water level under normal hydrologic condition and three different apportionments



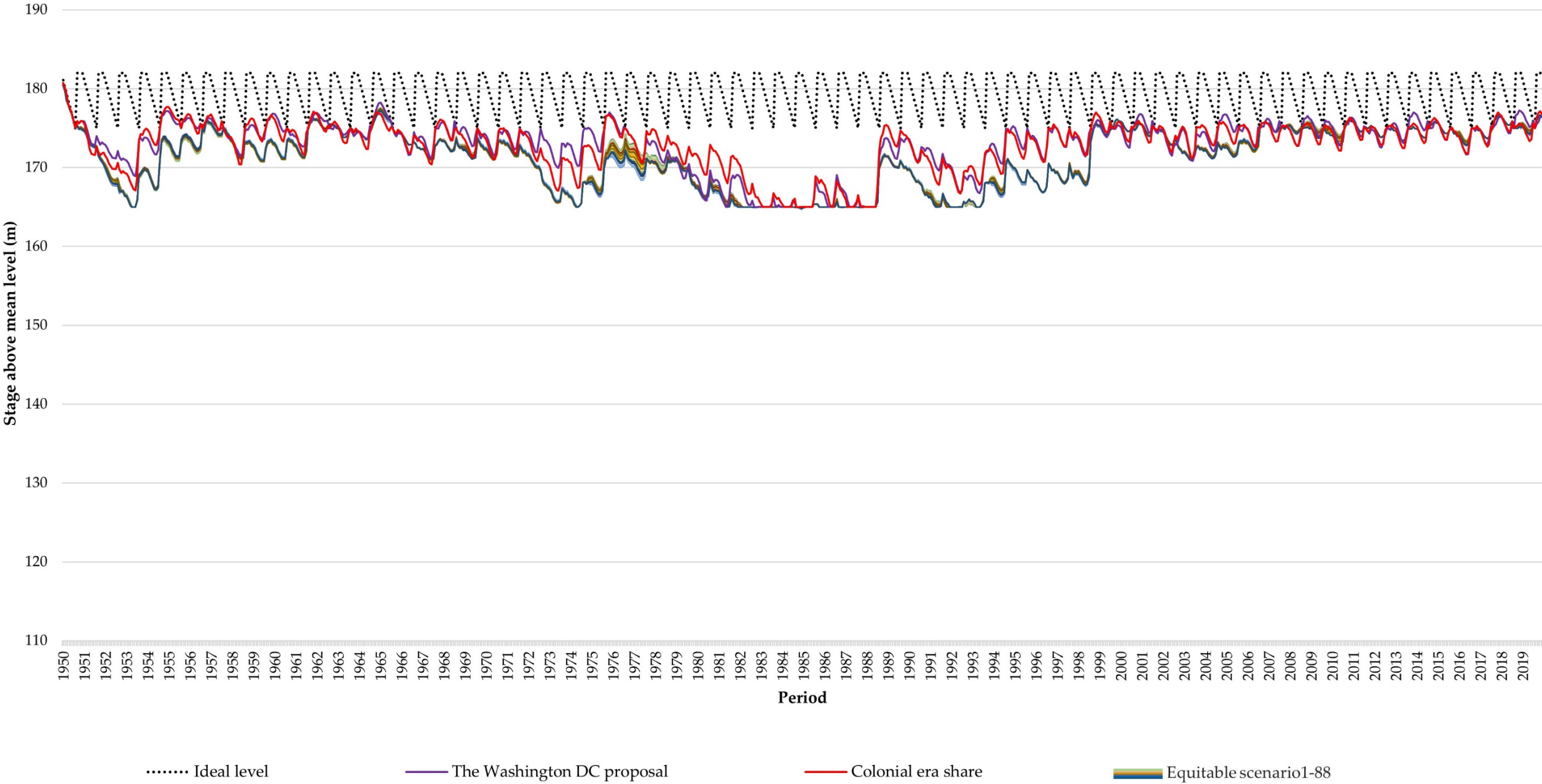
High Aswan dam reservoir water level under normal hydrologic condition and three different apportionments



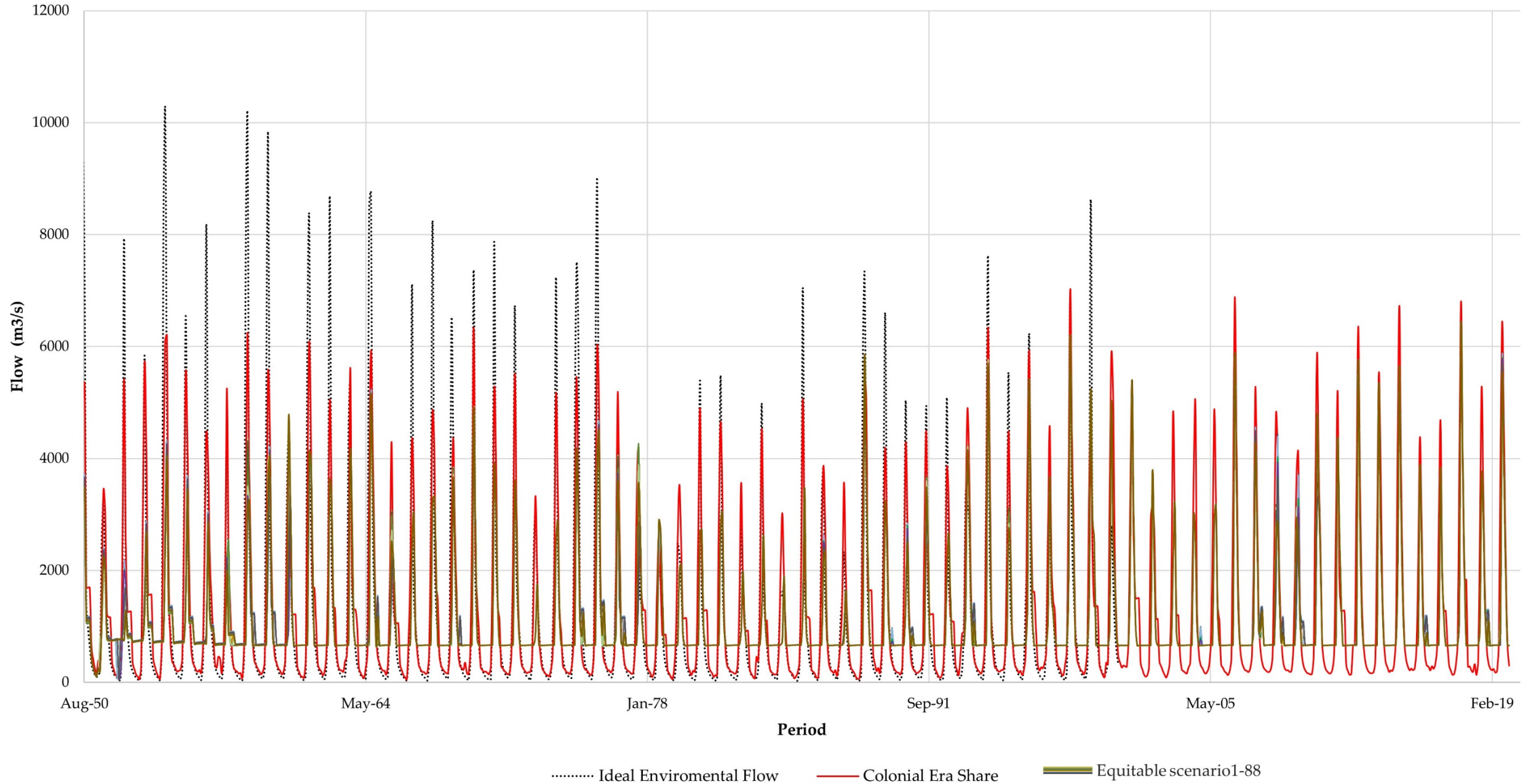
GERD reservoir water level under wet hydrologic condition and three different apportionments



High Aswan dam reservoir water level under wet condition and three different apportionments



Environmental flow requirement for natural management class versus release from GERD under different apportionment





Scenario-1 result (Irrigation performance)

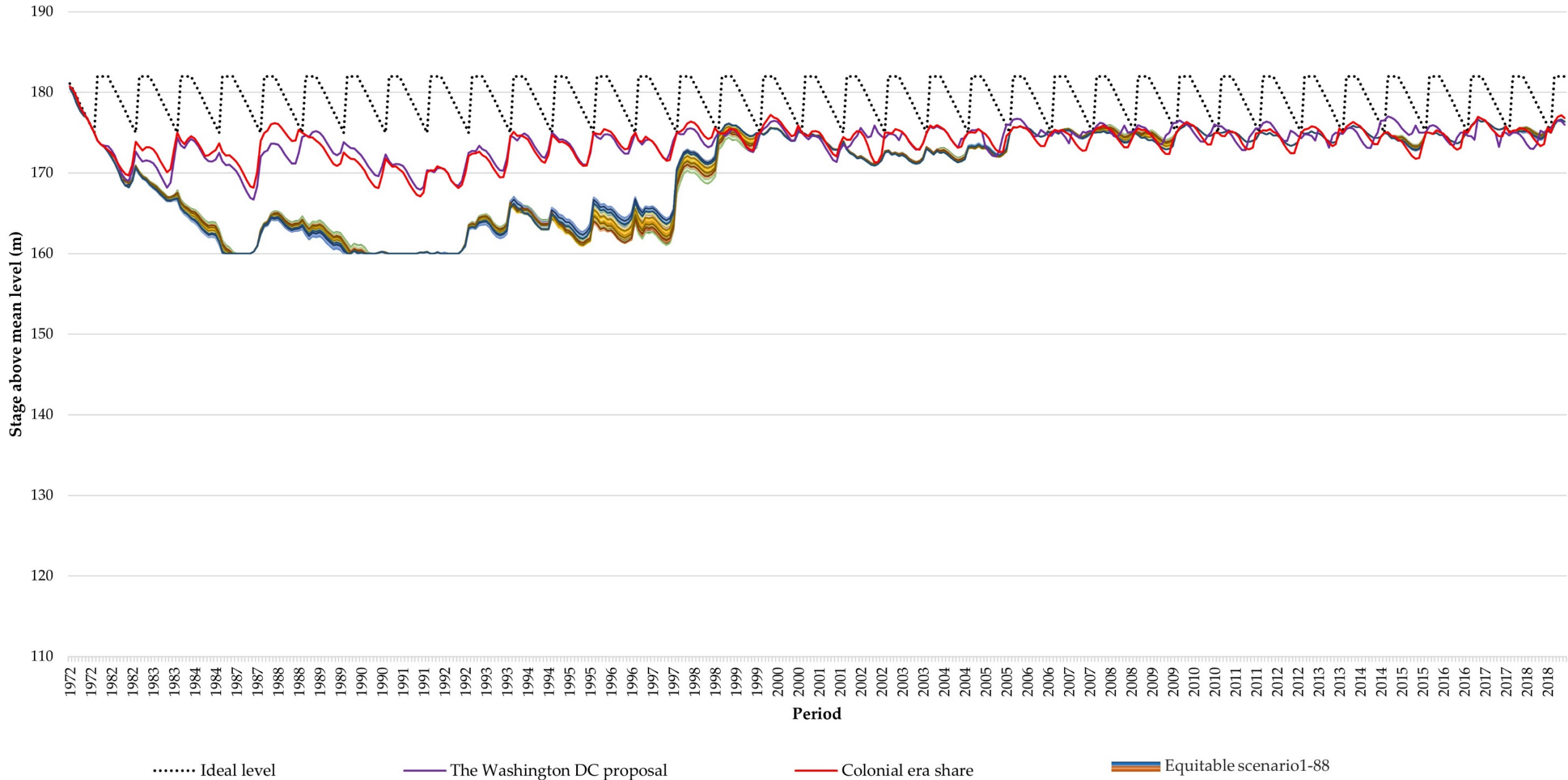
Eastern Nile Riparian countries	Average annual irrigation water deficit during GERD filling (Bcm)									
	Target demand	Drought			Normal			Wet		
		Equitable share	The DC's proposal	Colonial share	Equitable share	The DC's proposal	Colonial share	Equitable share	The DC's proposal	Colonial share
Ethiopia	1.77	1.50-1.68	1.64	1.64	1.38 -1.51	-	1.61	0.90-1.12	-	1.44
Sudan	12.53	0.22-0.30	0.00	0.00	0.00	-	0.00	0.00	-	0.00
Egypt	58.89	2.81-4.19	0.00	0.00	0.00	-	0.00	0.00	-	0.00
Overall basin	73.19	4.73-6.03	1.64	1.64	1.38-1.51	-	1.61	0.90-1.12	-	1.44



Scenario-1 result (Evaporation Loss)

Eastern Nile Riparian countries	Average annual water loss by evaporation during GERD filling phase (Bcm)						
	Drought			Normal		Wet	
	Equitable share	The Washington DC proposal	Colonial share	Equitable share	Colonial share	Equitable share	Colonial share
Ethiopia	2.57-2.72	1.53	1.53	2.65-2.77	1.59	2.82 -2.86	2.67
Sudan	4.49-4.55	4.50	4.50	4.49-4.52	4.52	4.49 - 4.59	4.65
Egypt	8.24-8.47	11.07	10.99	8.88-9.04	11.95	9.95-10.05	12.06
Overall basin	15.53-15.61	17.10	17.02	16.0-16.33	18.06	17.26-17.50	19.38

High Aswan dam reservoir water level under dry hydrologic condition and three different apportionments





Scenario-2 result (Irrigation performance)

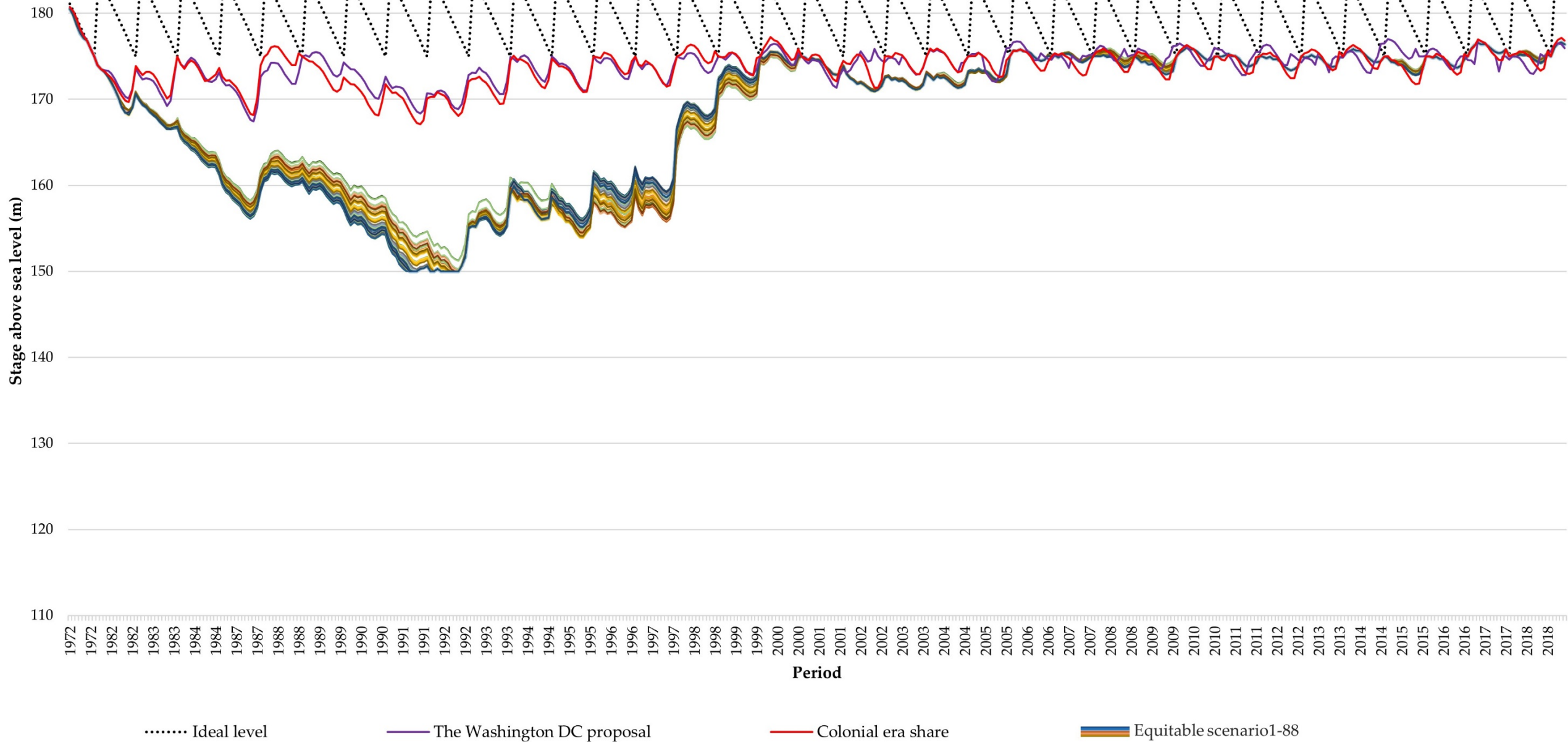
Eastern Nile Riparian countries	Average annual irrigation water deficit during GERD filling (Bcm)									
	Target demand	Drought			Normal			Wet		
		Equitable share	The DC's proposal	Colonial share	Equitable share	The DC's proposal	Colonial share	Equitable share	The DC's proposal	Colonial share
Ethiopia	1.77	1.50-1.68	1.64	1.64	1.38 -1.51	-	0.90-1.12	1.44	-	1.77
Sudan	12.53	0.22-0.30	0.00	0.00	0.00	-	0.00	0.00	-	12.53
Egypt	58.89	0.63-1.49	0.00	0.00	0.00	-	0.00	0.00	-	58.89
Overall basin	73.19	2.54-3.33	1.64	1.64	1.38 -1.51	-	0.90-0.59	1.44	-	73.19



Scenario-2 result (Evaporation Loss)

Eastern Nile Riparian countries	Average annual water loss by evaporation during GERD filling phase (BCM)						
	Drought			Normal		Wet	
	Equitable share	The Washington DC proposal	Colonial share	Equitable share	Colonial share	Equitable share	Colonial share
Ethiopia	2.57-2.72	1.53	1.53	2.65-2.77	1.59	2.82 -2.86	2.67
Sudan	4.49-4.55	4.50	4.50	4.49-4.52	4.52	4.49 - 4.59	4.65
Egypt	7.03-7.54	11.07	10.99	7.69-8.11	11.95	8.73-9.09	12.06
Overall basin	14.40-14.81	17.10	17.02	14.83-15.40	18.06	16.04-16.54	19.38

High Aswan dam reservoir water level under dry hydrologic condition and three different apportionments



- Among the three alternatives, in terms of basin wise energy generation, water loss conservation, flood control, the equitable share performs much better than the Washington DC proposal and the colonial era agreement.

Conclusions



- Whereas, in terms meeting the Irrigation demand in Egypt both the DC Proposal and the colonial shares are ideal.
- Depending on the hydrologic condition, while the equitable share enables the GERD to attain its full supply level within 3-12 years, under the two apportionments the dam can't become full.
- When the equitable share is implemented with a fixed HAD draw dawn level at (165 & 160amsl), irrigation deficit in Egypt could reach 4-6bcm (while HAD contains 78bcm of water).

- In the post filling as well, even though the energy generation increases and irrigation deficit decreases through equitable apportionment, however, evaporation will increase by up to 2bcm.

Conclusions



- Therefore, to cure the dispute from its source, revisiting the existing mindset and treaty is important. Its also fair to say that equitable apportionment is a more reasonable vehicle to arrive at an agreement than the other two.
- By doing so, the new agreement by itself can enable the basin to control, operate and regulate the current and future water resource infrastructures in the basin.



Thank you