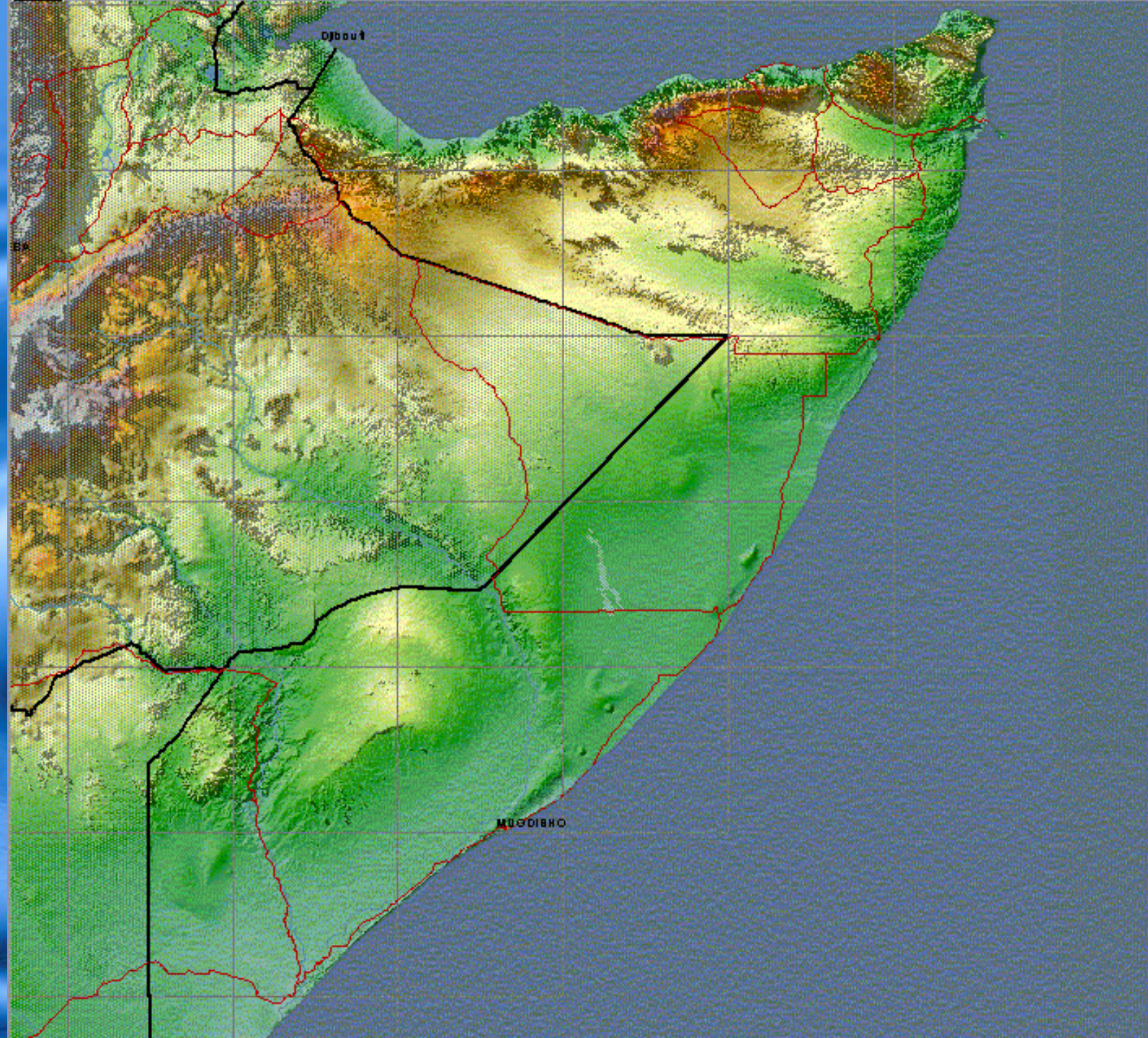

وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيٍّ
We made from water every living thing
@Hmdoch

Water Resources Management of Juba and Shabelle Rivers

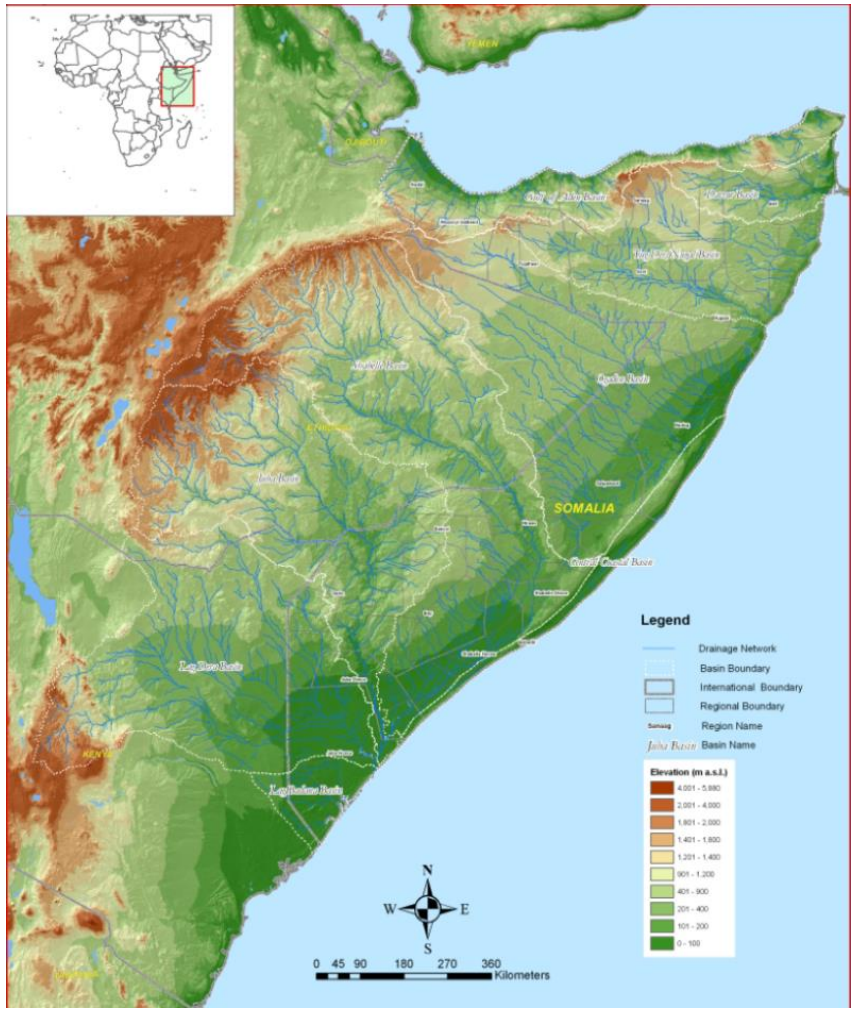
Awes Karama

Yusuf Mohammoud

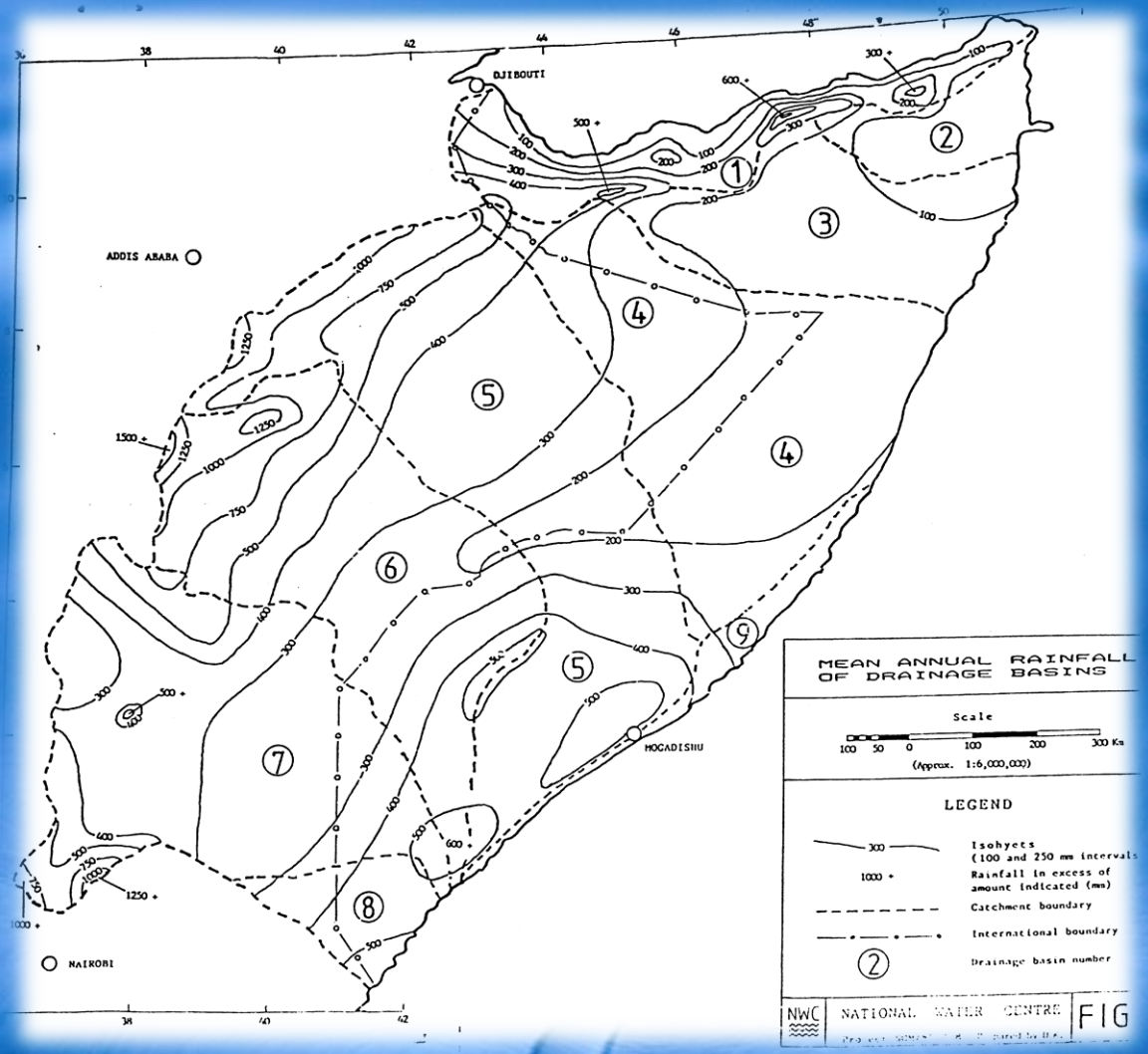


Major Hydrologic Basins in Somalia

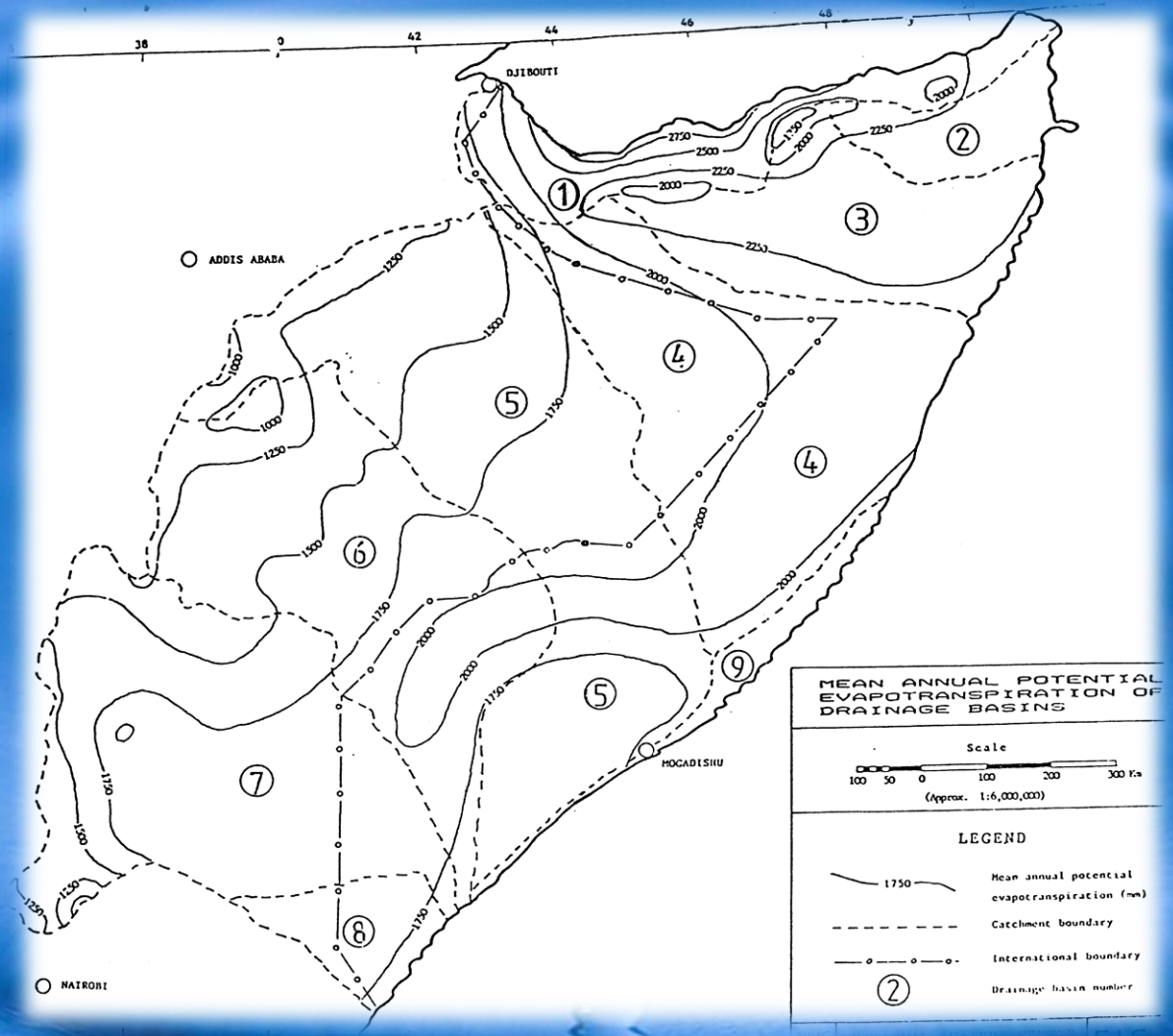
- Gulf of Aden
- Darror
- Tog Dheer/Nugal
- Centeral
- Shabelle
- Juba
- Indian Ocean
- Lag Dera
- Lag Badana



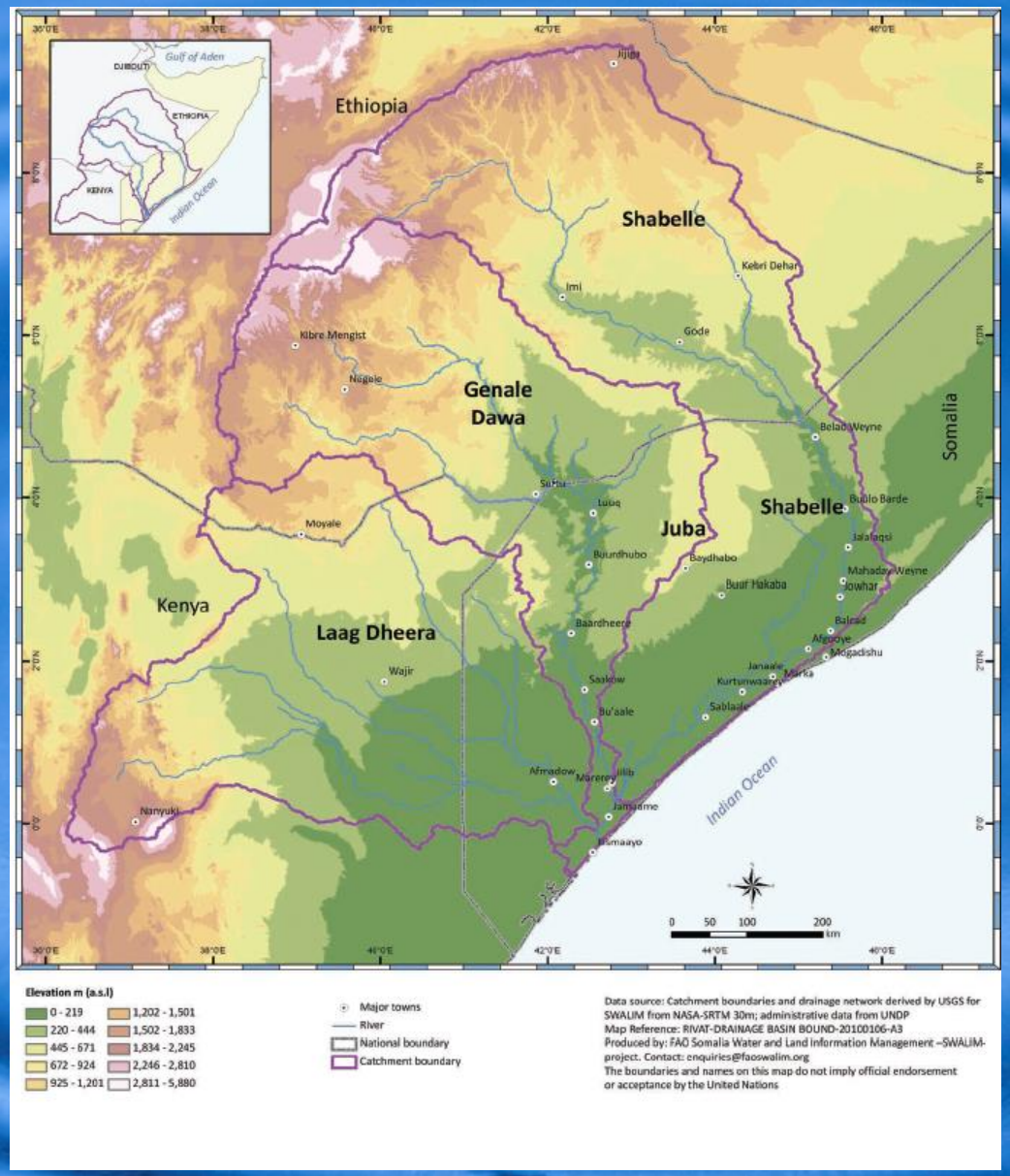
Mean Annual Rainfall



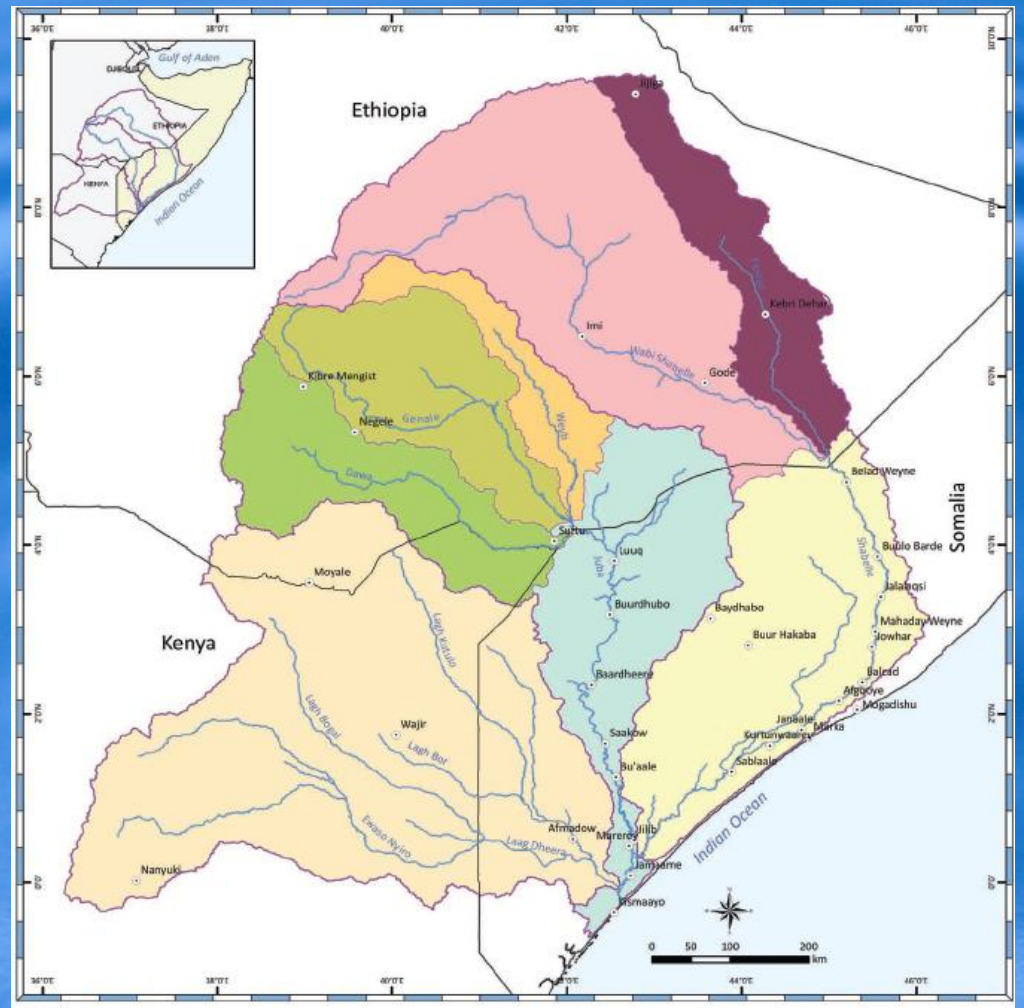
Mean Annual Potential Evapotranspiration



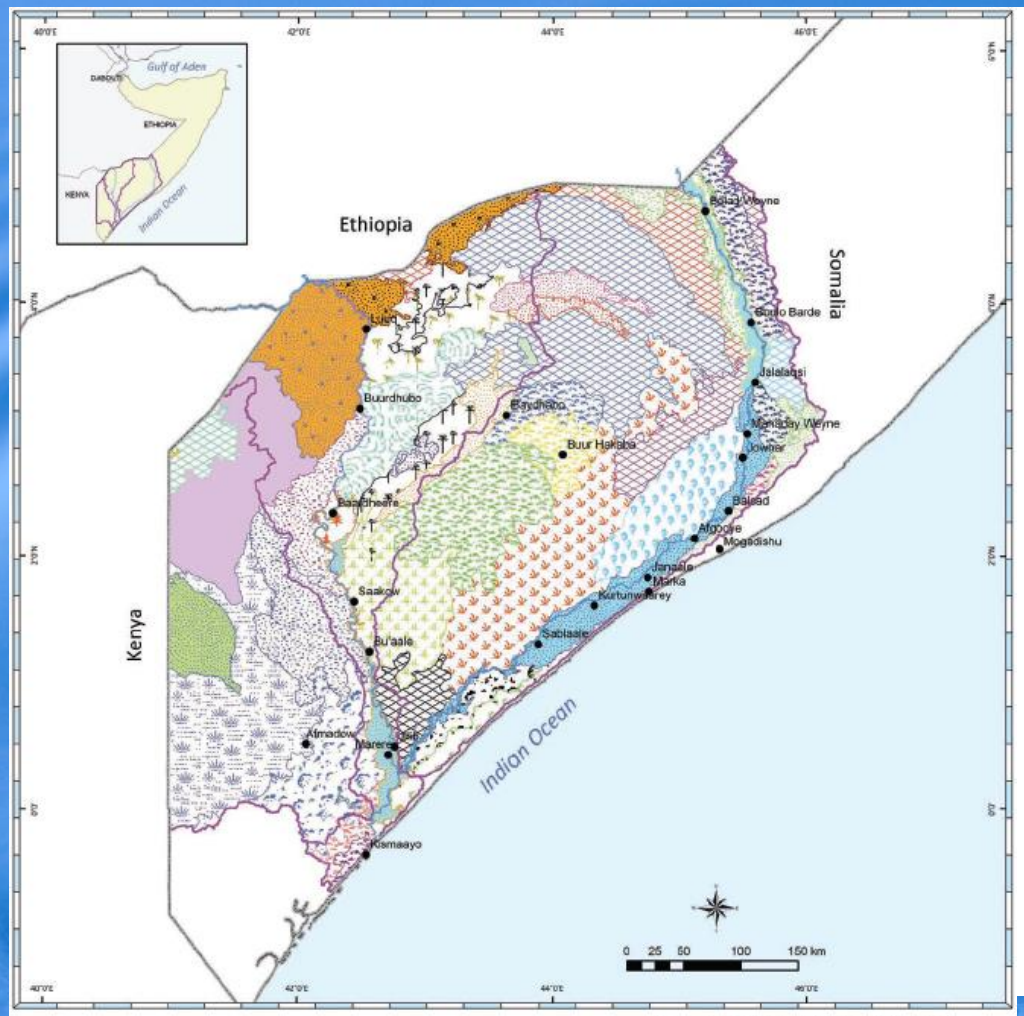
Shabelle and Juba Basins



Shabelle and Juba Sub-basins



Shabelle and Juba Basin Land Use



- Major towns
- River
- National boundary
- Catchment boundary

Data source: Land Use System data from SWALIM; catchment boundaries and drainage network derived by USGS for SWALIM from NASA-SRTM 30m; administrative data from UNDP
Map Reference: RIVAT-BASIN_SOM_LUS-20091212-A4-400dpi-01
Produced by: FAO Somalia Water and Land Information Management -SWALIM- project. Contact: enquiries@faoswalim.org
The boundaries and names on this map do not imply official endorsement or acceptance by the United Nations.

Shrubland/Rainfed Crop Fields

- Agropastoralism (high density)/wood collection with scattered rainfed fields: sorghum, camels, shoats, cattle
- Agropastoralism (low density of fields)/ wood collection: sorghum, vegetables, camels, shoats
- Agropastoralism (low density of fields): sorghum, cowpea, cattle, goats
- Agropastoralism (low density) with scattered rainfed fields: shoats, camels
- Agropastoralism (medium density of fields): maize, cowpea, millet, cattle, goats
- Agropastoralism (medium density of fields): sorghum, cattle, shoats, camels
- Pastoralism (low density) with scattered rainfed fields in coastal plain/dunes: cowpea, shoats, camels, cattle
- Pastoralism (medium density)/wood collection with scattered rainfed fields: maize, sesame, shoats, cattle, camels

Woodland/Rainfed Crop Fields

- Agropastoral (medium density of fields): maize, cowpea, millet, cattle, goats
- Agropastoralism (high density)/wood collection with scattered rainfed fields: cattle, shoats, camels
- Agropastoralism (low density of fields): sorghum, shoats, camels, cattle
- Agropastoralism (medium density of fields): sorghum, cattle, camels, goats
- Agropastoralism (medium density of fields): sorghum, cowpea, sesame, cattle, shoats
- Agropastoralism (medium density) with sparse rainfed fields: camels, shoats
- Agropastoralism (medium density) with sparse rainfed fields: sorghum, shoats, camels
- Agropastoralism (medium density)/wood collection with scattered rainfed fields: sorghum, camels, goats, cattle
- Agropastoralism (medium density): maize, sorghum, cattle, shoats
- Dry season Agropastoralism (low density) with scattered rainfed fields: cattle, shoats

Rainfed Crop Fields

- Agropastoralism (high density of fields): sorghum, cattle, goats
- Agropastoralism (medium density of fields) in stabilized sand dune: cowpea, cassava, shoats, cattle, camels
- Agropastoralism (medium density of fields): sorghum, cattle, shoats, camels
- Agropastoralism (medium density of fields): sorghum, maize, shoats, camels, honey production
- Agropastoralism (medium density)/gum and resins extraction: camels, shoats, cattle

Shrubland/Crop fields

- Pastoralism (high density)/sparse flood recession farms: maize, cattle, camels, shoats

Shrubland/Rainfed Crop Fields/Irrigated_fields

- Agropastoralism (low density) with scattered irrigated/rainfed fields: shoats, camels
- Agropastoralism (low density)/wood collection with scattered rainfed and irrigated fields: shoats, camels, cattle

Woodland/Irrigated fields

- Agropastoralism (medium density) with scattered rainfed/irrigated fields: sorghum, vegetables, shoats, camels, cattle

Shrubland

- Pastoralism (low density): shoats, camels
- Pastoralism (medium density) with sparse rainfed fields: sorghum, shoats, camels
- Pastoralism (medium density): camels, cattle, shoats

Woodland/Rainfed Crop Fields/Irrigated_Fields

- Agropastoralism (high density of fields): sorghum, cattle, goats

Woodland

- Dry season pastoralism: cattle, shoats
- Pastoralism (high density)/wood collection with honey production: sorghum, camels, shoats
- Pastoralism (high density): camels, shoats, cattle
- Pastoralism (low density): shoats, cattle, camels
- Pastoralism (medium density)/gum and resins extraction: camels, shoats, cattle
- Pastoralism (medium density)/wood collection: camels, shoats

Irrigated Fields/Shrublands

- Agropastoralism/Irrigated Shabelle floodplains: cereals, fruits, vegetables, cattle
- Irrigated Agropastoral Juba floodplains: cereals, fruits, vegetables, cattle
- Rainfed/Irrigated Agropastoral: cereals, vegetables, camel, goats
- Rainfed/Irrigated Agropastoralism: cereals, vegetables, cattle, shoats

Grassland

- Pastoralism (high density): camels, shoats, cattle
- Pastoralism (medium density): cattle, shoats

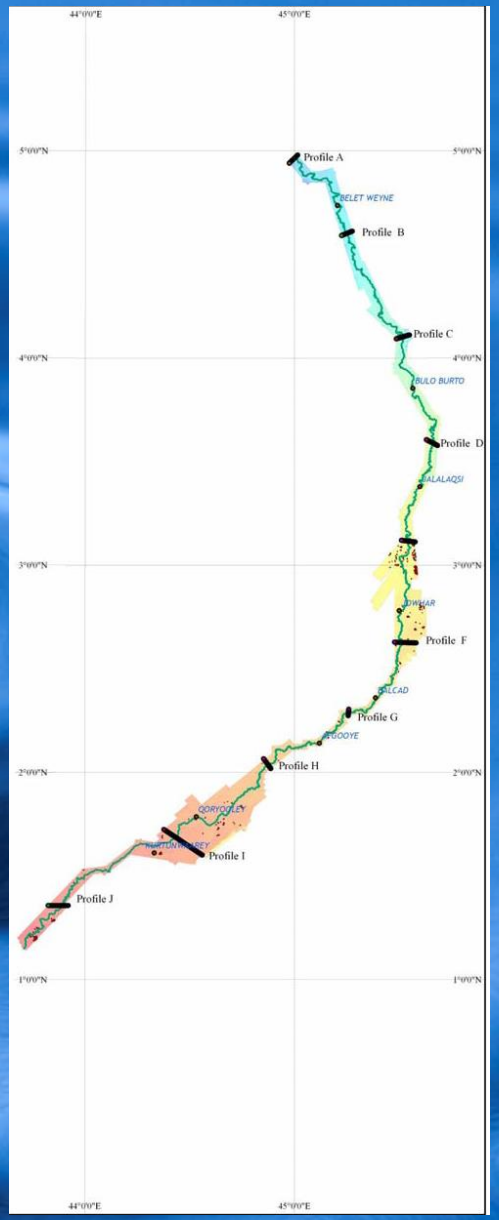
Sparse Vegetation

- Pastoralism (medium density)/wood collection in coastal plain/dunes: shoats, camels

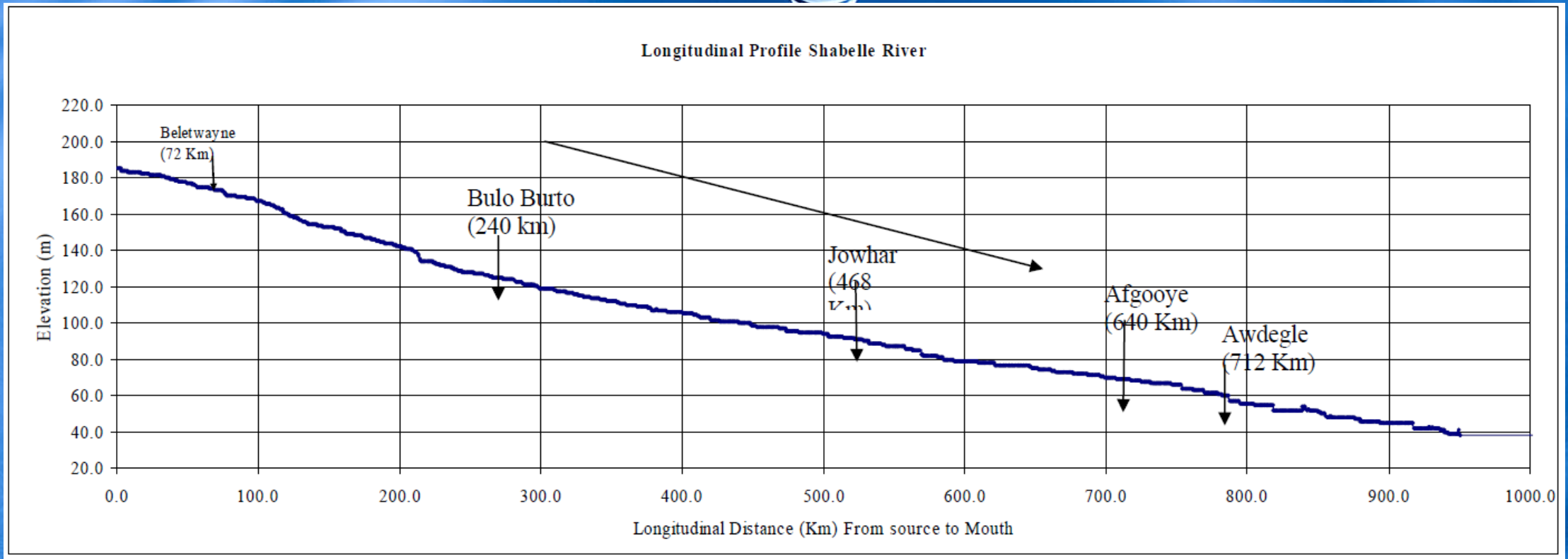
Hydrologic Characteristics of Shabelle Basin

- The total basin area is about 297,000 km^2.
- 108,300 km^2 of the basin lies in Somalia.
- Its elevation ranges from above 4,000 m msl at Ethiopian highlands to about 20 m msl at southern coast of Somalia.
- The Shabelle River originates from Bale Mountains in Ethiopian highlands.
- The total length of the main river is about 2,625 km.
- 1,236 km of the river is in Somalia.
- It ends in wetland areas in Haway, Somalia.
- The wetlands are very important habitat for flora and fauna and groundwater recharge in the area.

Shabelle River Hydraulics



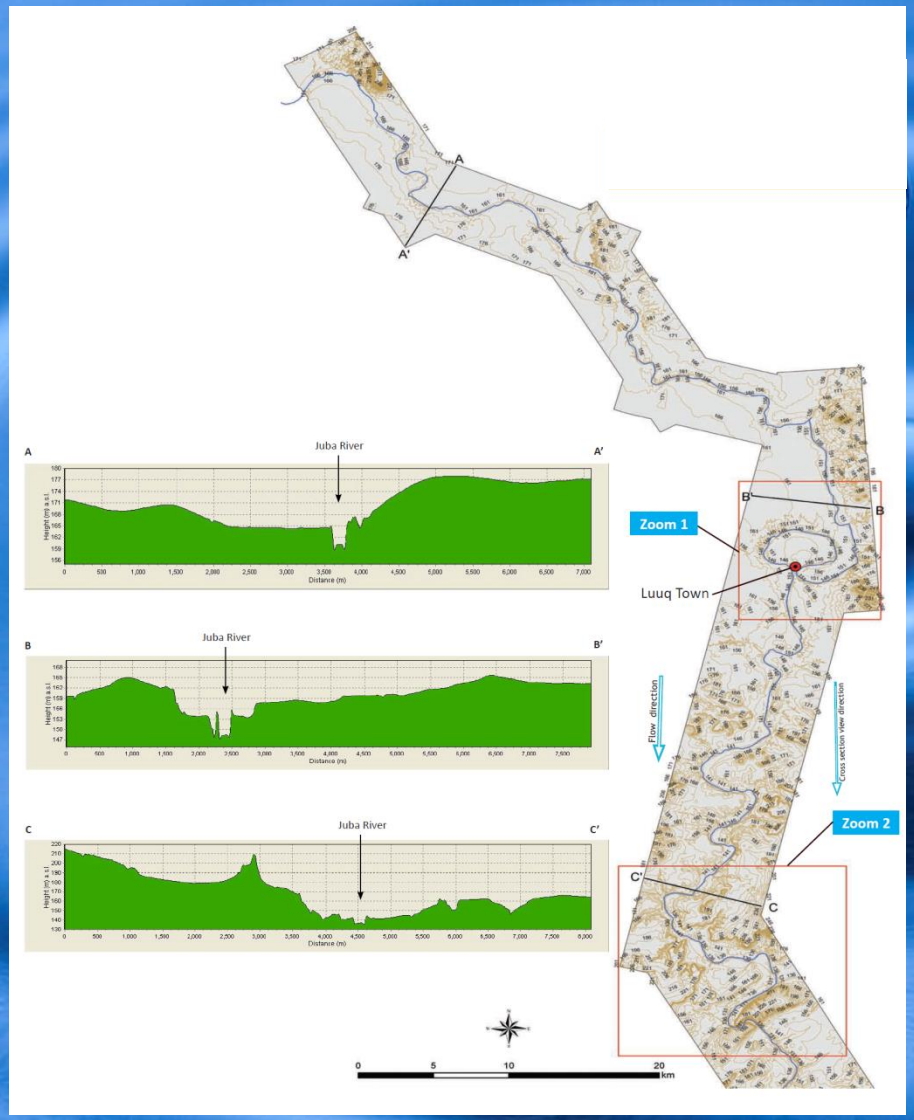
Shabelle River Profile

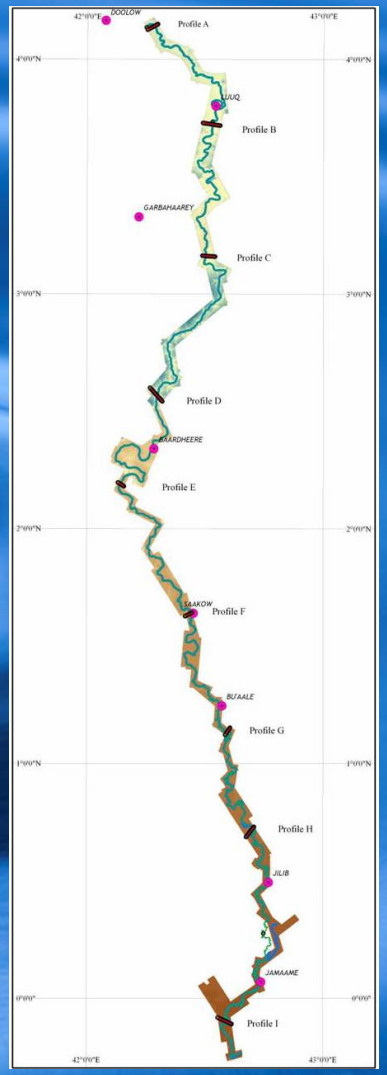


Hydrologic Characteristics of Juba Basin

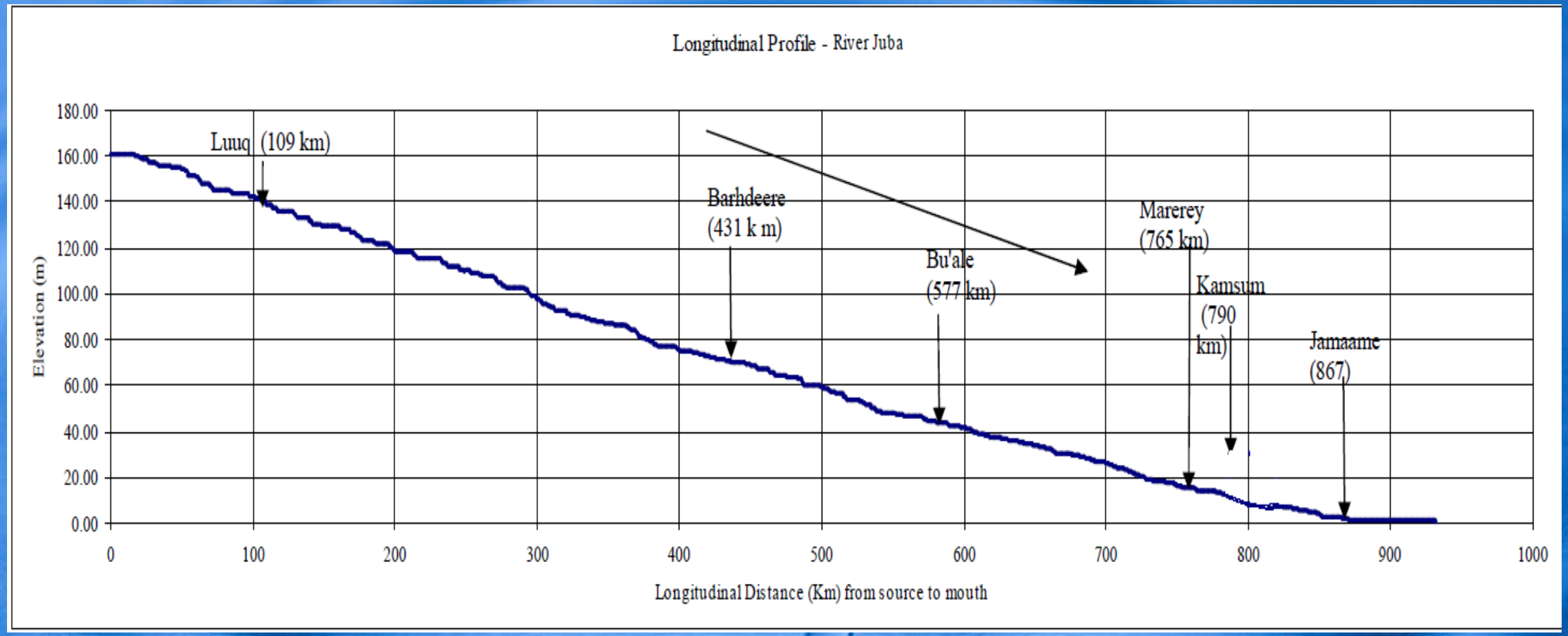
- The total basin area is about 221,000 km^2.
- 73,000 km^2 of the basin is in Somalia.
- Its elevation ranges from above 3,000 m msl at western Ethiopian highlands to sea level at its mouth in the Indian Ocean at Goobweyn, Somalia.
- Three main tributaries Genale, Gastro, and Dawa confluence to form Juba River at Dolo.
- The total length of the main river is about 1,808 km on the longest tributary, the Genale.
- 1,004 km of the river is in Somalia.
- Both Shabelle and Lag Dera Rivers join the Juba River during high rainfall.

Juba River Hydraulics

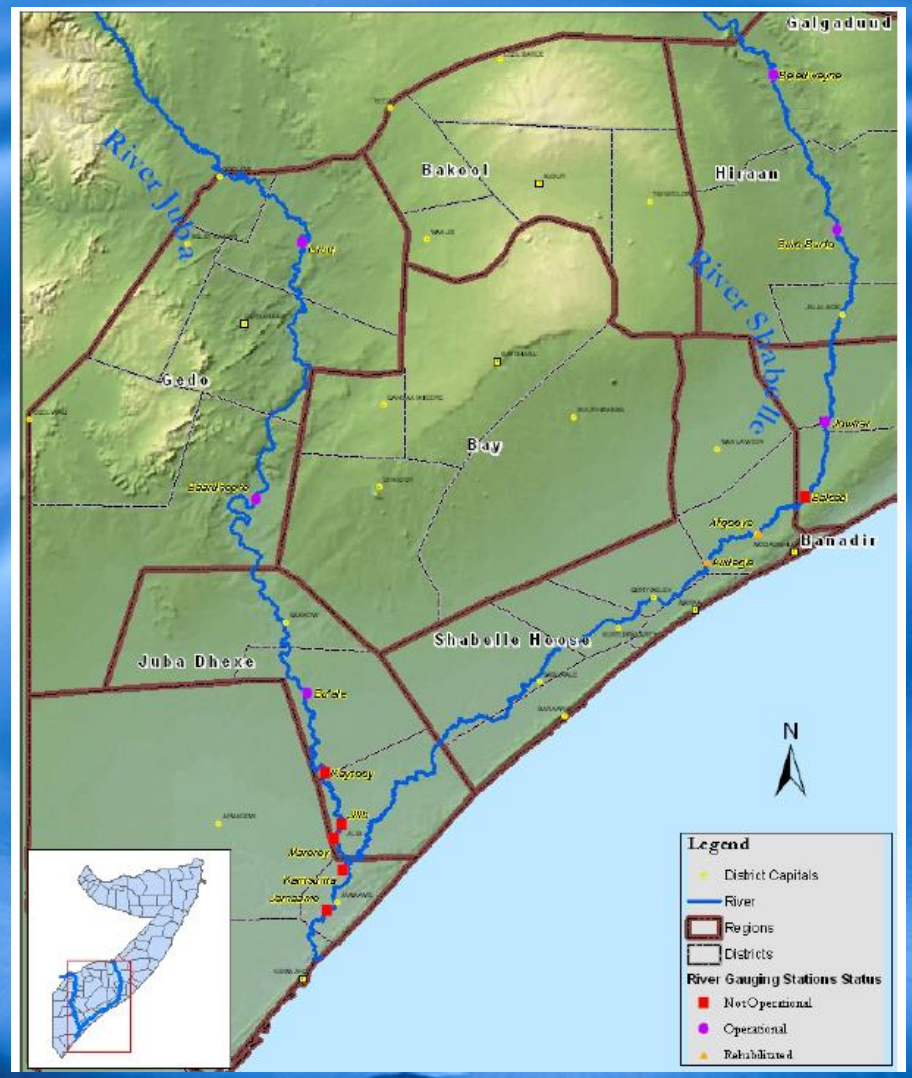




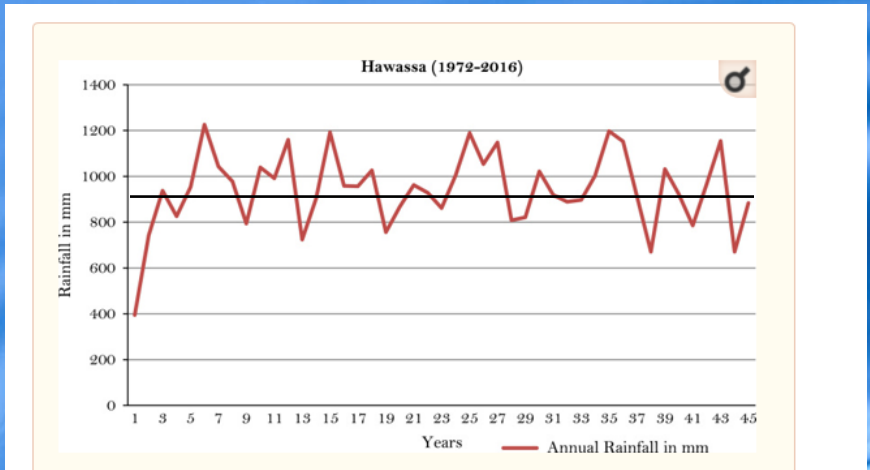
Juba River Profile

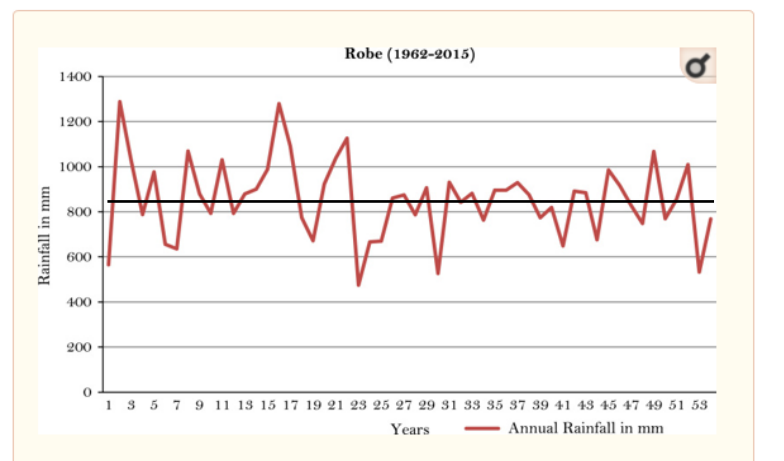


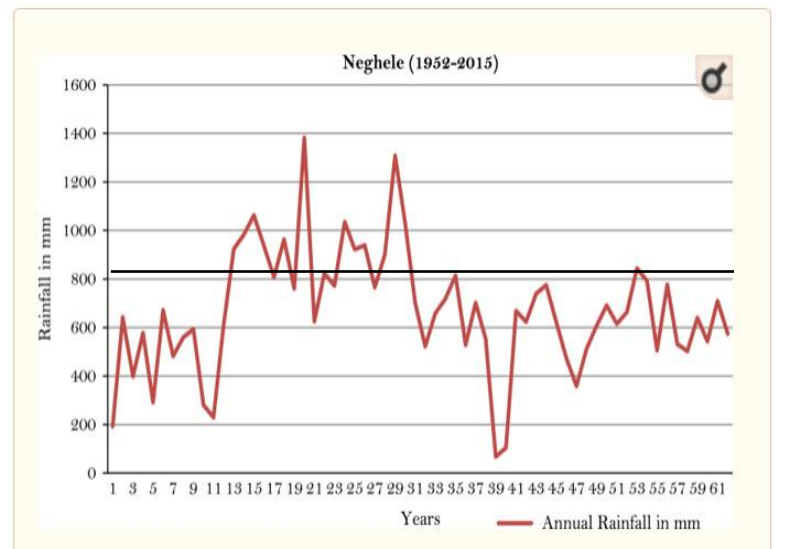
Hydrometric Stations at Juba and Shabelle

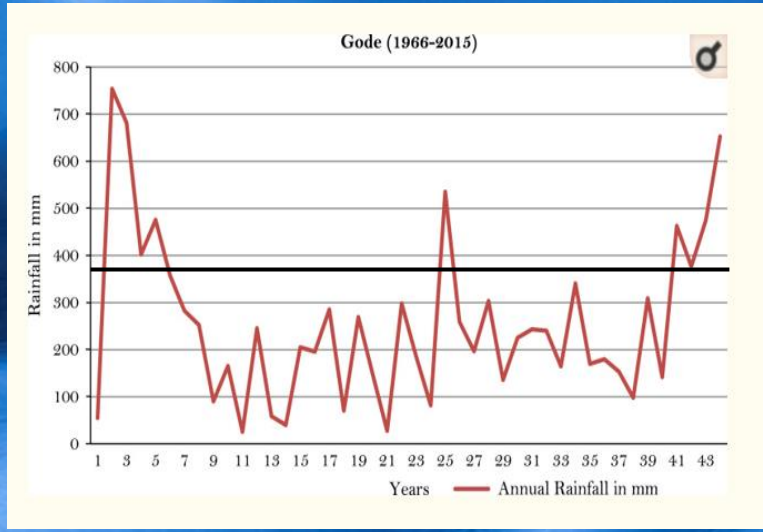


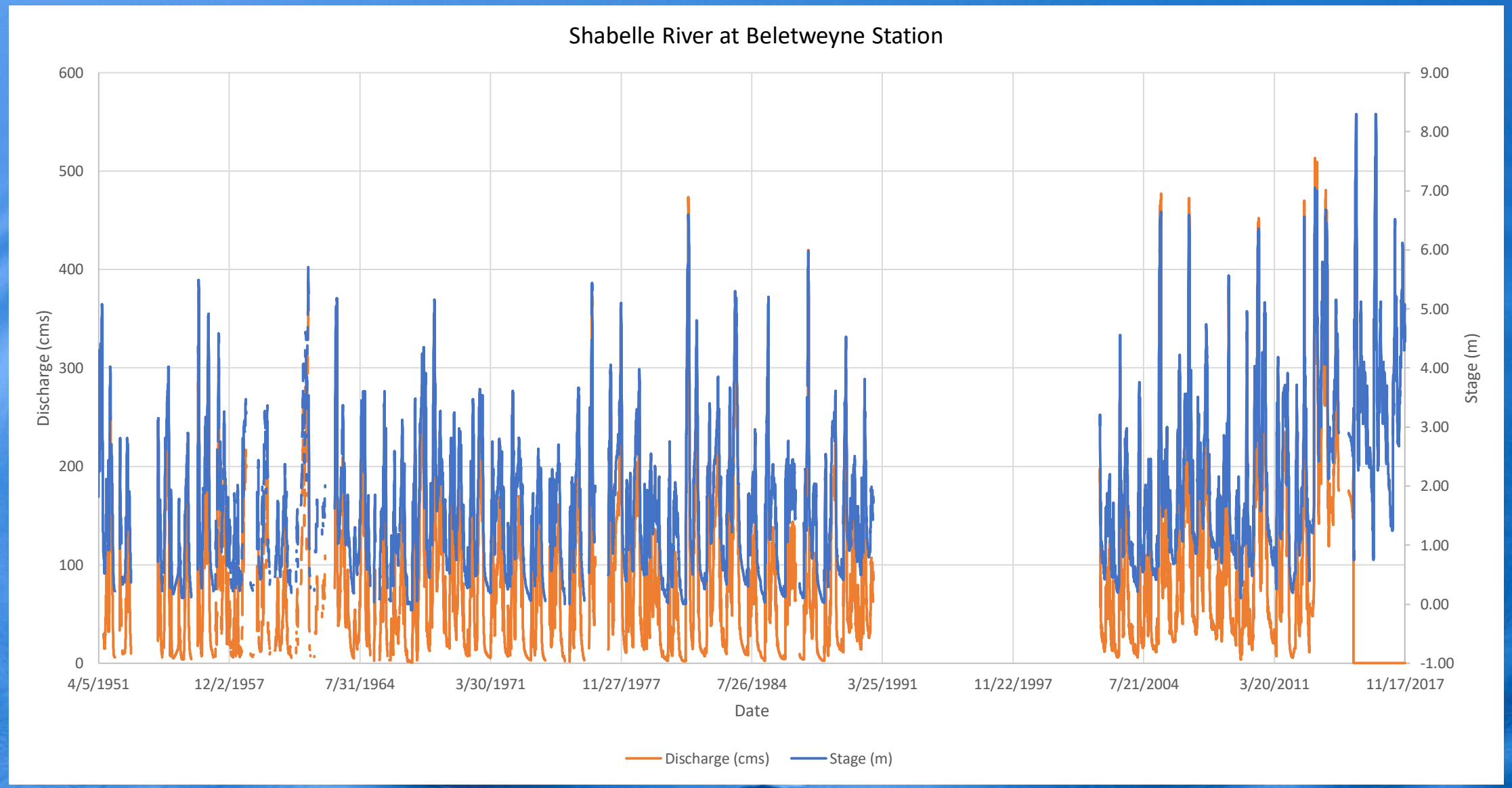
Annual Rainfall Trend

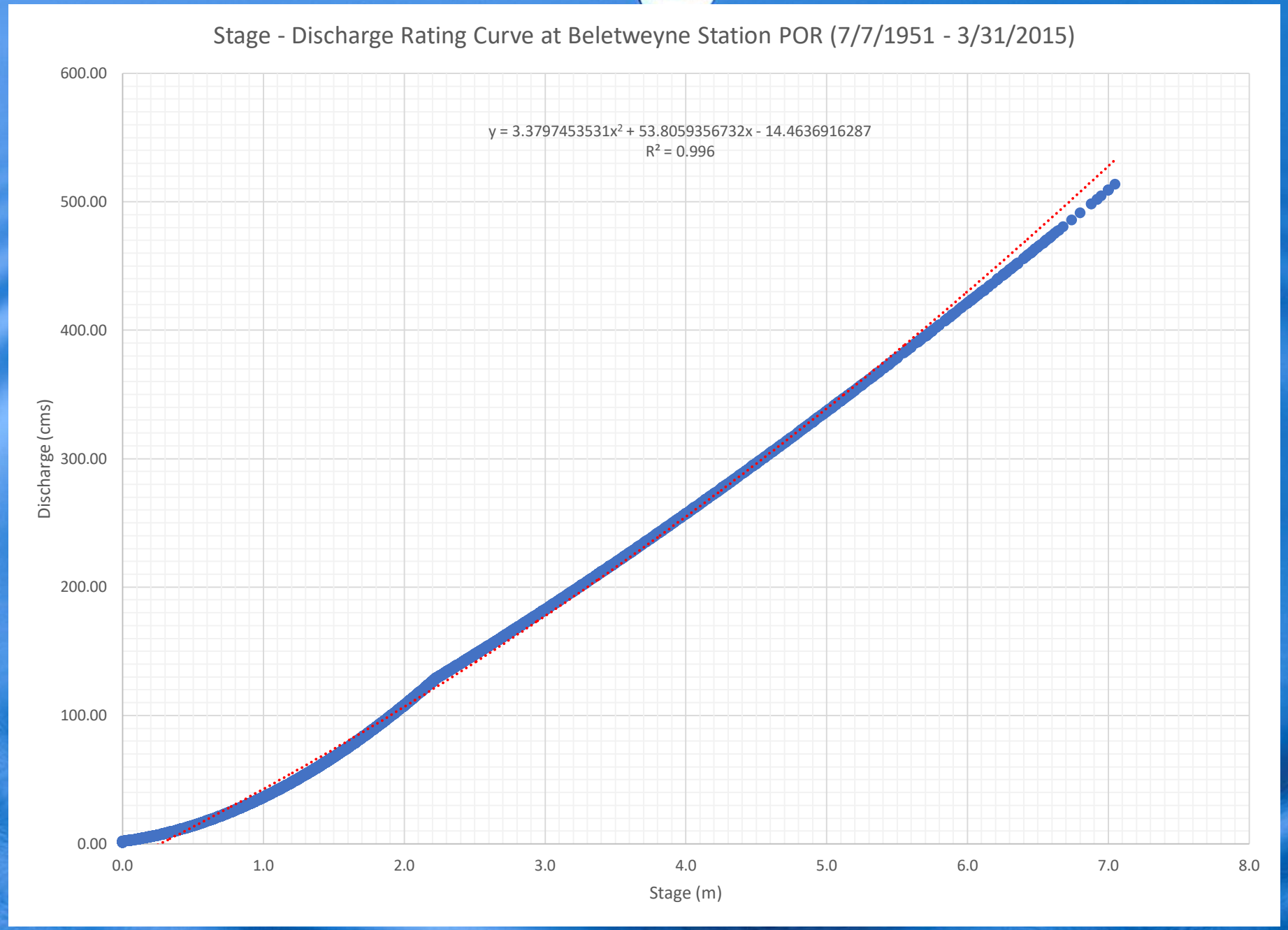


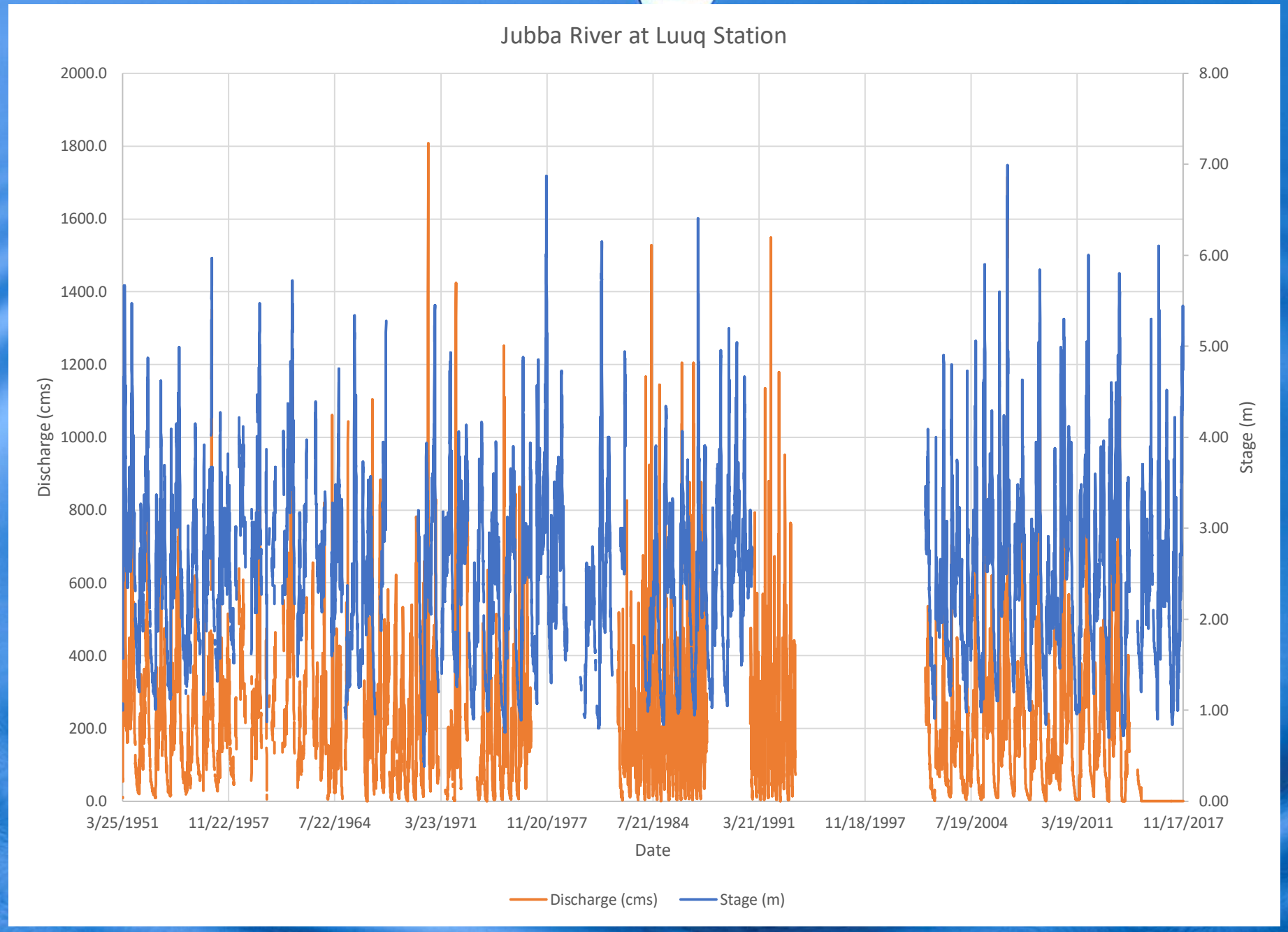


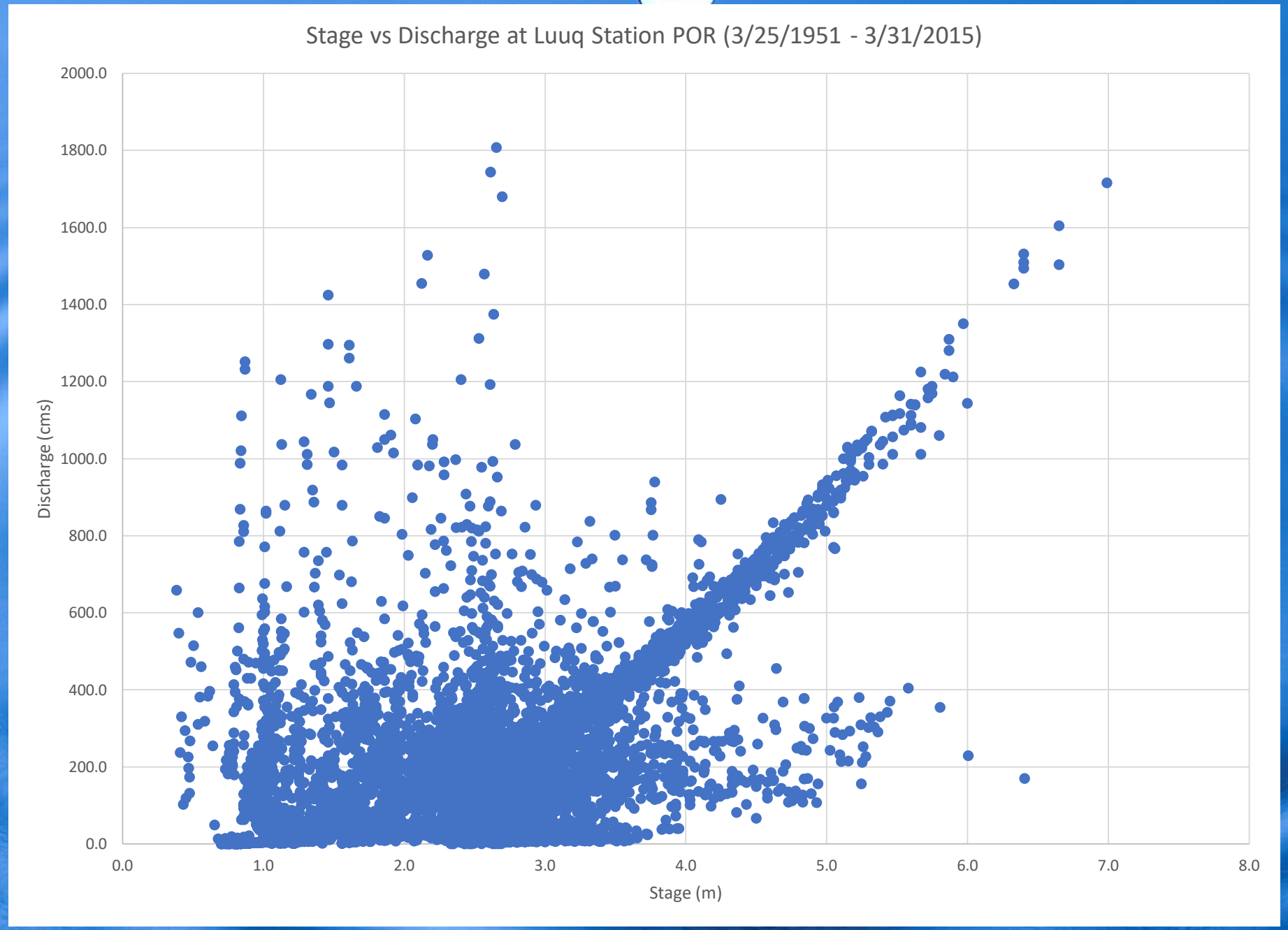


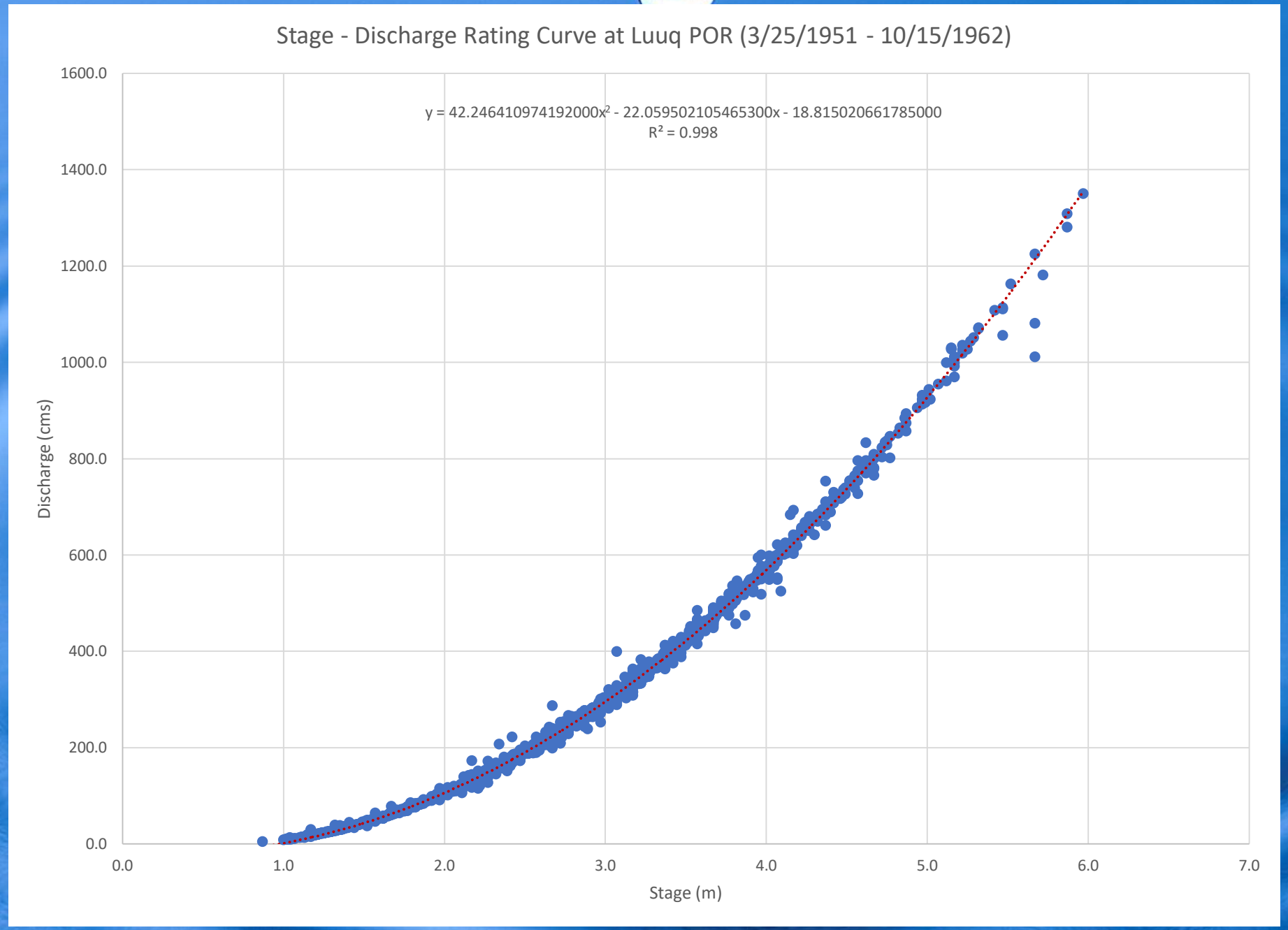


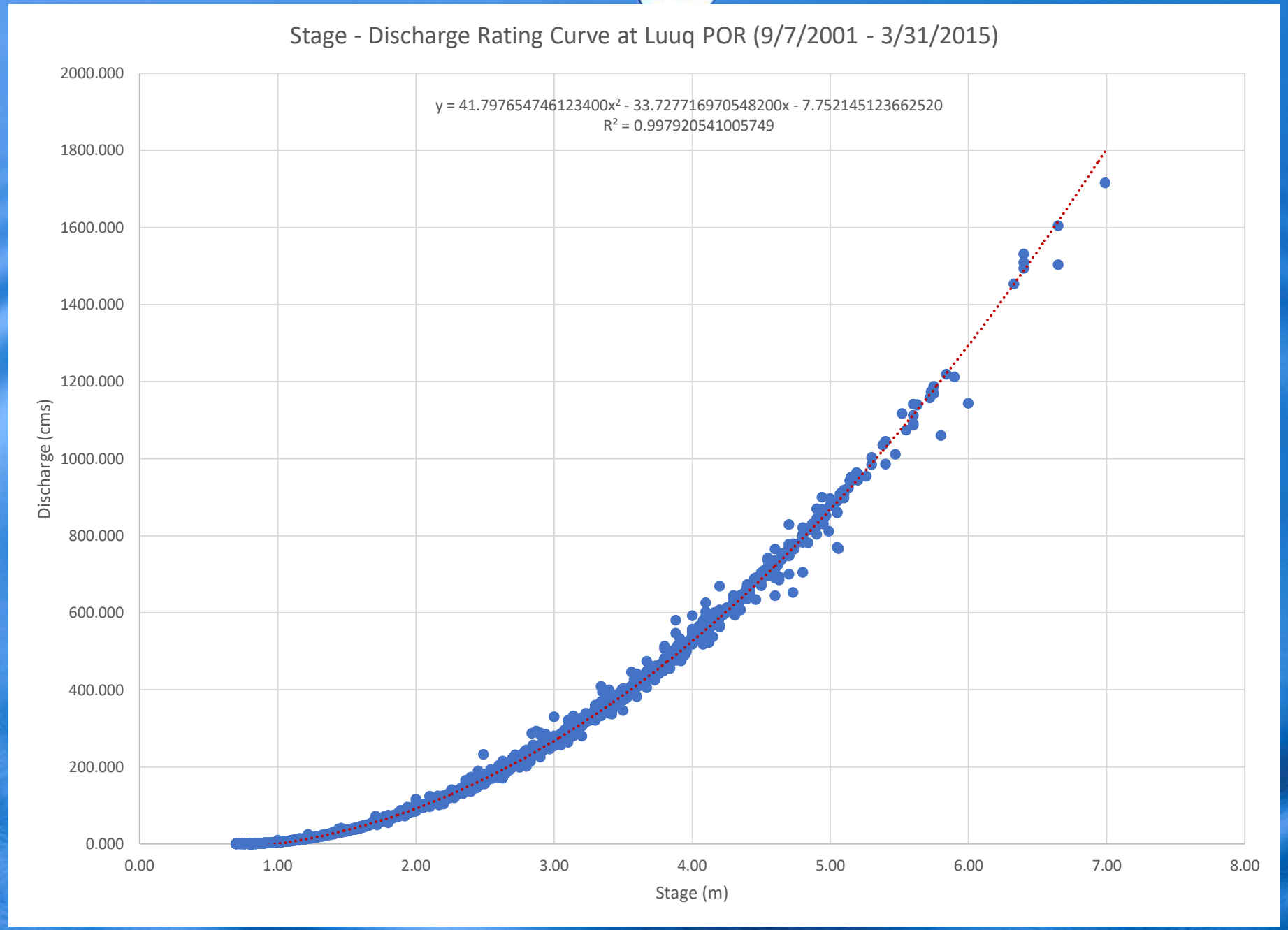

Shabelle River at Beletweyne Station
Discharge (cms)
Stage (m)
Date
600
500
400
300
200
100
0
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
4/5/1951
12/2/1957
7/31/1964
3/30/1971
11/27/1977
7/26/1984
3/25/1991
11/22/1997
7/21/2004
3/20/2011
11/17/2017
Discharge (cms)
Stage (m)

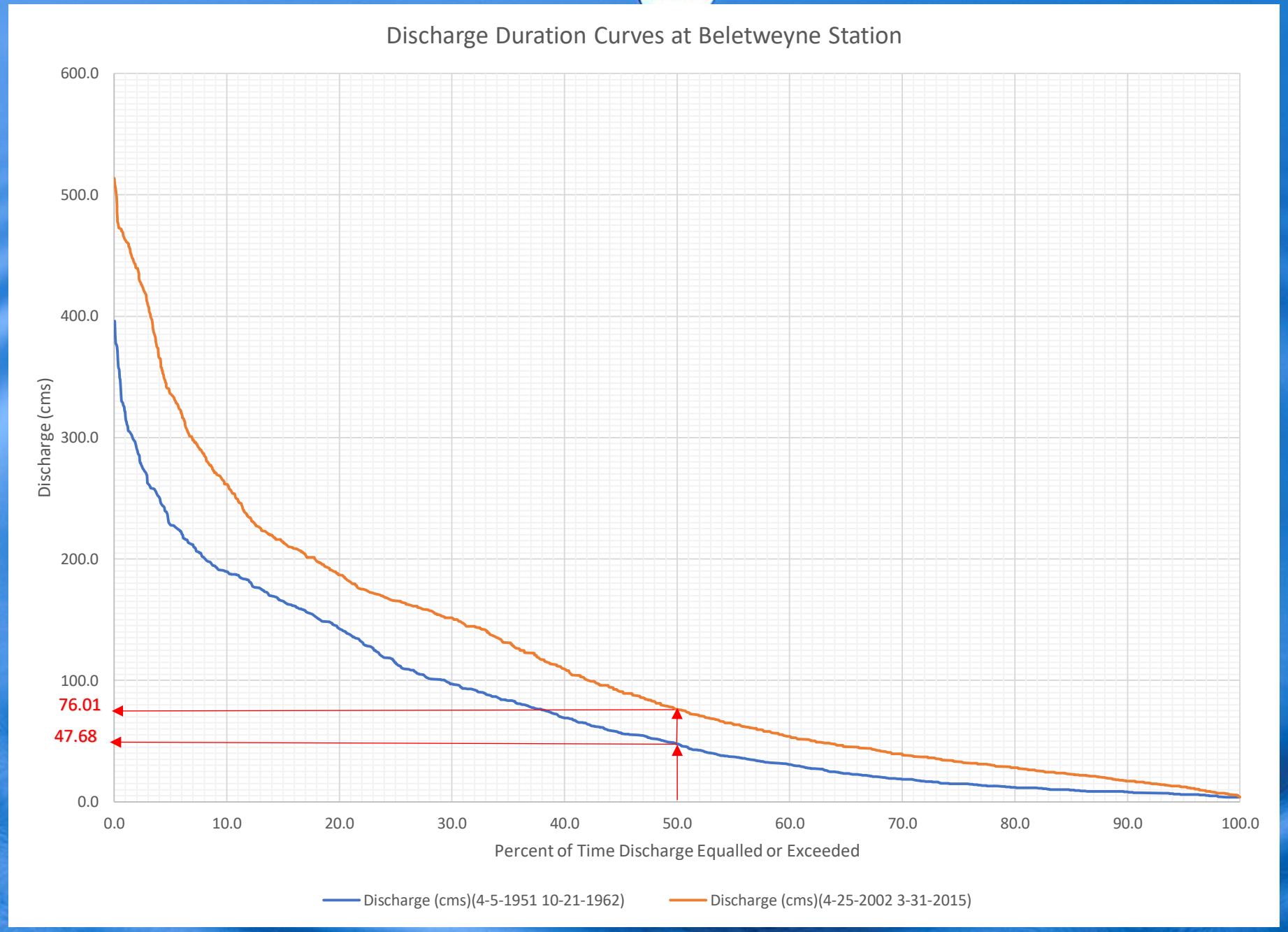

Stage - Discharge Rating Curve at Beletweyne Station POR (7/7/1951 - 3/31/2015)
y = 3.3797453531x² + 53.8059356732x - 14.4636916287
R² = 0.996
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Discharge (cms)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
Stage (m)


Jubba River at Luuq Station
2000.0
1800.0
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
Discharge (cms)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Stage (m)
3/25/1951
11/22/1957
7/22/1964
3/23/1971
11/20/1977
7/21/1984
3/21/1991
11/18/1997
7/19/2004
3/19/2011
11/17/2017
Date
Discharge (cms)
Stage (m)

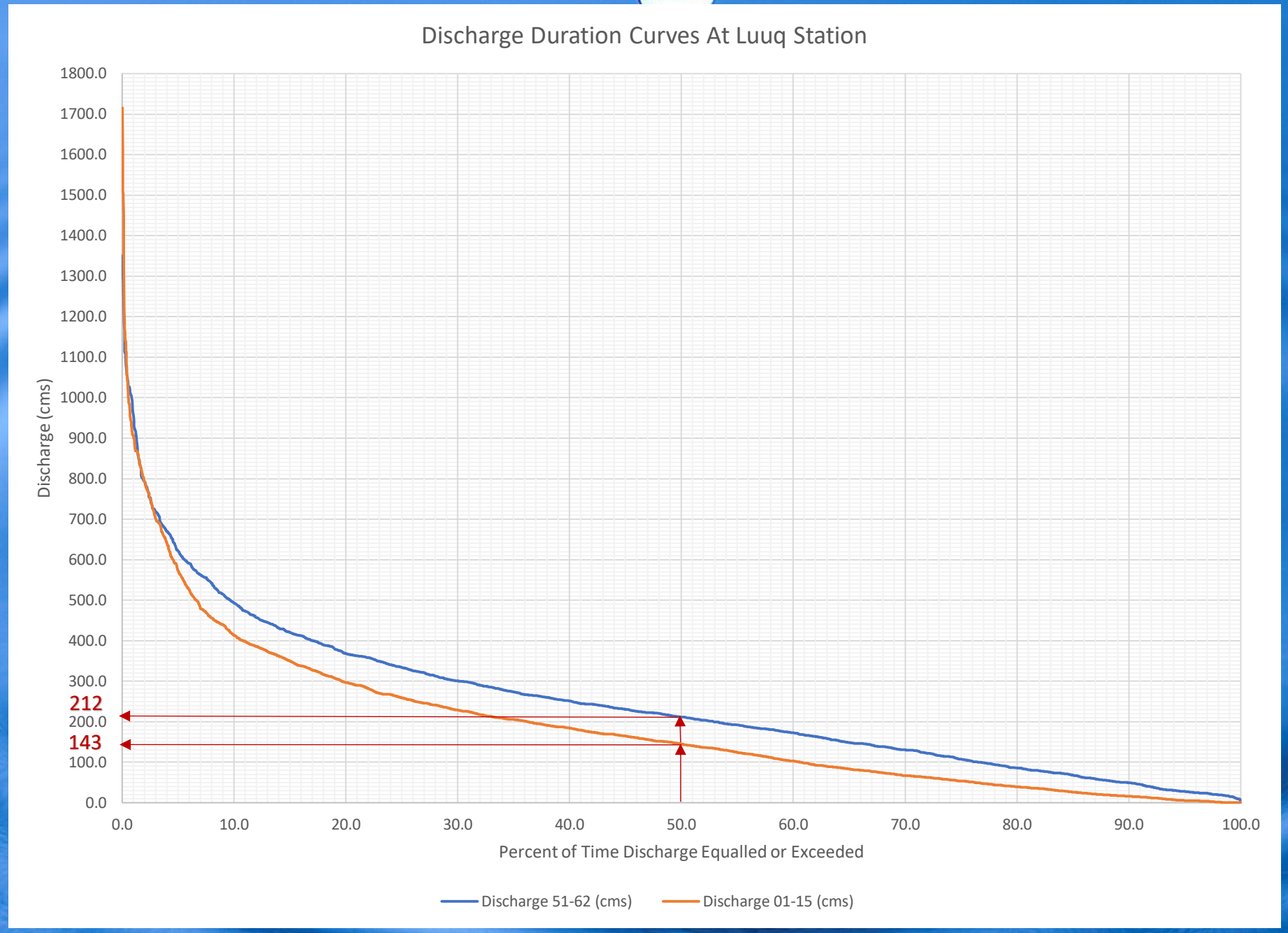

Stage vs Discharge at Luuq Station POR (3/25/1951 - 3/31/2015)
Discharge (cms)
2000.0
1800.0
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
Stage (m)


Stage - Discharge Rating Curve at Luuq POR (3/25/1951 - 10/15/1962)
y = 42.246410974192000x² - 22.059502105465300x - 18.815020661785000
R² = 0.998
Discharge (cms)
Stage (m)
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0


Stage - Discharge Rating Curve at Luuq POR (9/7/2001 - 3/31/2015)
y = 41.797654746123400x² - 33.727716970548200x - 7.752145123662520
R² = 0.997920541005749
Discharge (cms)
2000.000
1800.000
1600.000
1400.000
1200.000
1000.000
800.000
600.000
400.000
200.000
0.000
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
Stage (m)


Discharge Duration Curves at Beletweyne Station
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Discharge (cms)
76.01
47.68
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
Percent of Time Discharge Equalled or Exceeded
Discharge (cms)(4-5-1951 10-21-1962)
Discharge (cms)(4-25-2002 3-31-2015)

Beletweyne Station			
Statistical Parameter	Discharge (4/5/1951 - 10/15/1962) (cms)	Discharge (4/25/2002 - 3/31/2015) (cms)	% Difference
Mean	76.21	114.10	33
Standard Error	1.55	1.57	
Median	47.68	76.01	37
Standard Deviation	76.99	105.55	
Minimum	3.57	3.61	
Maximum	395.90	513.60	
Confidence Level(95.0%)	3.04	3.07	


Discharge Duration Curves At Luuq Station
Discharge (cms)
1800.0
1700.0
1600.0
1500.0
1400.0
1300.0
1200.0
1100.0
1000.0
900.0
800.0
700.0
600.0
500.0
400.0
300.0
212
200.0
143
100.0
0.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
Percent of Time Discharge Equalled or Exceeded
Discharge 51-62 (cms)
Discharge 01-15 (cms)

Luuq Station					
Statistical Paramater	Discharge (3/25/1951 - 10/15/1962) (cms)	Discharge (9/7/2001 - 3/31/2015)(cms)	Discharge Difference (cms)	% Difference	Discharge Difference (bcmy)
Mean	248.71	189.39			
Standard Error	3.45	2.55			
Median	211.89	142.53	-69.36	-33	-2.19
Standard Deviation	192.06	192.54			
Minimum	4.69	0.00			
Maximum	1350.18	1716.04			
Confidence Level(95.0%)	6.77	5.01			

Median	Discharge (3/25/1951 - 10/15/1962) (cms)	Discharge (9/7/2001 - 3/31/2015)(cms)	Discharge Difference (cms)	Discharge Difference (bcmy)	Discharge Difference (billion US bbl liquid)
Current	211.89	142.53	-69.36	-2.19	-18
Potential	290.29	142.53	-147.76	-4.66	-39

Annual Shabelle River Flow into Somalia

	Mean flow leaving model area			
Year	Base (2005)	2010	2020	2035
Flows in m^3/s	123.33	83.15	80.90	23.84
Flows in BCM	3.9	2,6	2,5	0,75
Change to Base		-32.6 %	-34.4 %	-80.7 %

Source: Numbers based on MoWR, 2005b

Annual Juba River Flow into Somalia

	1973-2002	2005	2007–2012	2012-2022	2022-2037	2037
	Mean	Base Case	Low Scenario	Medium Scenario	High Scenario	Full Development
Flow in m^3/s	207,47	206,8	186,27	184,1	179,48	171,23
Flow in BCM	6.75	6.73	6.06	5.99	5.84	5.57
Change to Base Case			-9.9%	-12.2%	-14.8%	-19.8%

Source: MoWR, 2007

Convention on the Law of the Non-navigational Uses of International Watercourses 1977

- Adapted by the General Assembly of the United Nations on 21 May 1997.
- Entered into force on 17 August 2014.
- Key Provisions:
  - Article 5 in Part II:
    - Principle of equitable and reasonable use of shared watercourses.
      - It requires that a State sharing an international watercourse with other states utilize the watercourse, in its territory, in a manner that is equitable and reasonable vis-à-vis the other States sharing it.
    - Principle of participation.
      - States are to participate in the use, development and protection of an international watercourse in an equitable and reasonable manner.
  - Article 7:
    - Obligation not to cause significant harm.
      - States should take all appropriate measures to prevent the causing of significant harm.

- Note:
  - Ethiopia:
    - Did not vote for the law, consequently, did not rectify it.
  - Kenya:
    - Had voted for the law, but has not rectify it, yet.
  - Somalia:
    - Missing in action!!!

IGAD and Transboundary Issue

- Acknowledging the regional river transboundary issue, IGAD sponsored a study known as *"Mapping, Assessment and Management of Transboundary Water Resources in the IGAD Sub-Region Project"*.
- Some key findings and recommendations are:
  - Establishment of transboundary river basin organization.
  - Develop common monitoring and information sharing network at sub-regional level.
  - Harmonization of water sector strategies between riparian countries.

Recommendations

- Conduct a detailed study focused on the impacts of upstream developments in Juba and Shabelle basins on Somalia's water resources.
- Join and rectify the UN convention on the law of the international watercourses.
- Utilize the efforts of IGAD in harmonizing the beneficial use of water resources between riparian countries.
- Given the current good relations between Somalia and Ethiopia, initiate a dialog aimed at equitable and beneficial use of the common watercourses of Juba and Shabelle rivers.