NILE BASIN INITIATIVE
INITIATIVE DU BASSIN DU NIL

The Nile Basin Initiative experience on climate change

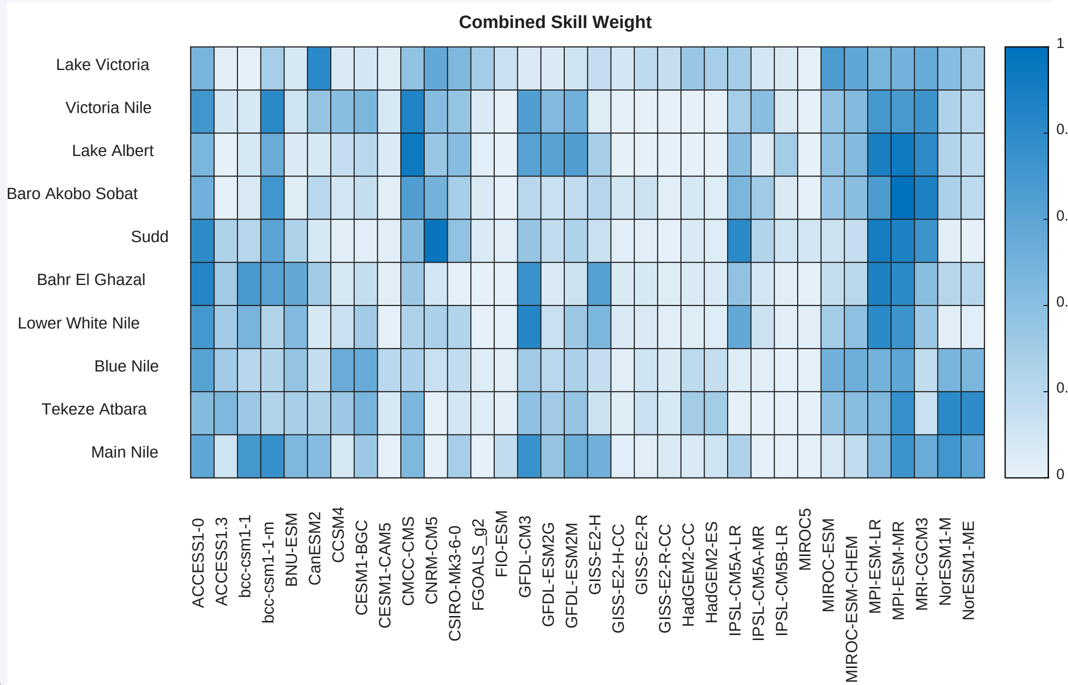
BY: Modathir Zaroug

Expected impact of CC on water resource

Basin Names: Lake Victoria													Table 3
Rank Criteria													
Independence		Skill		Seasonal variation		Annual variation		Close to consensus		Rainfall Extreme		Temperature Extreme	
GCMs	Weight	GCMs	Weight	GCMs	Weight	GCMs	Weight	GCMs	Weight	GCMs	Weight	GCM	Weight
'IPSL-CM5A-LR'	1.00	'CanESM2'	0.80	'ACCESS1-0'	0.88	'NorESM1-ME'	0.80	'GISS-E2-R-CC'	0.87	'CNRM-CM5'	0.70	'ACCESS1-0'	1.00
'MIROC5'	1.00	'MIROC-ESM'	0.66	'bcc-csm1-1-m'	0.77	'MIROC-ESM-CHEM'	0.71	'GFDL-ESM2G'	0.79	'GISS-E2-H'	0.69	'MIROC-ESM'	0.94
'NorESM1-ME'	1.00	'MIROC-ESM-CHEM'	0.59	'CNRM-CM5'	0.62	'MIROC-ESM'	0.68	'GISS-E2-H-CC'	0.73	'GISS-E2-H-CC'	0.66	'MPI-ESM-LR'	0.83
'IPSL-CM5B-LR'	0.93	'CNRM-CM5'	0.57	'MPI-ESM-LR'	0.58	'bcc-csm1-1-m'	0.66	'GISS-E2-R'	0.73	'GISS-E2-R'	0.65	'MIROC-ESM-CHEM'	0.81
'MRI-CGCM3'	0.80	'MRI-CGCM3'	0.55	'HadGEM2-CC'	0.54	'ACCESS1-0'	0.53	'GFDL-ESM2M'	0.63	'GISS-E2-R-CC'	0.64	'IPSL-CM5A-LR'	0.76
'GFDL-ESM2M'	0.76	'MPI-ESM-MR'	0.50	'bcc-csm1-1'	0.53	'bcc-csm1-1'	0.48	'CCSM4'	0.48	'bcc-csm1-1-m'	0.42	'CNRM-CM5'	0.69
'GFDL-ESM2G'	0.75	'ACCESS1-0'	0.48	'MIROC5'	0.43	'NorESM1-M'	0.47	'ACCESS1.3'	0.43	'NorESM1-M'	0.42	'bcc-csm1-1-m'	0.66
'GFDL-CM3'	0.75	'MPI-ESM-LR'	0.47	'CMCC-CMS'	0.37	'MPI-ESM-LR'	0.45	'GFDL-CM3'	0.42	'NorESM1-ME'	0.42	'CanESM2'	0.56
'MPI-ESM-MR'	0.71	'CSIRO-Mk3-6-0'	0.45	'MIROC-ESM-CHEM'	0.37	'GISS-E2-R-CC'	0.41	'bcc-csm1-1'	0.34	'FGOALS_g2'	0.42	'CSIRO-Mk3-6-0'	0.53

Approach for selecting GCMs:

- Independence Weight Approach.
- Reproducing Seasonal and Annual Variability.
- Overall Skill Based weight.
- Agreement to Consensus Weight.
- Reproducing Extreme Statistics



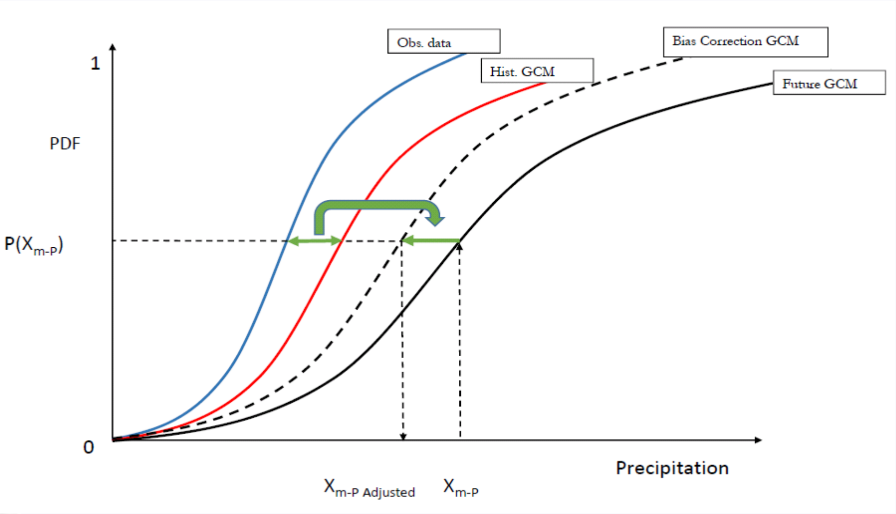
Example of selected GCMs:

NBI Criterion	Waterresources Planning			Flood/Wet Condition	Drought
Selection Criteria	Skill	Seasonal Variability	Annual Variability	Rainfall Extreme (wet 10th percentile)	Rainfall Extreme (dry 10th percentile)
Lake Victoria	CanESM2	ACCESS1-0 bcc-csm1-1-m	NorESM1-ME MIROC-ESM-CHEM	IPSL-CM5B-LR GISS-E2-H-CC GISS-E2-H GISS-E2-R GISS-E2-R-CC GFDL-ESM2G CNRM-CM5	CNRM-CM5 NorESM1-Me NorESM1-M bcc-csm1-1-m CMCC-CMS bcc-csm1-1 GISS-E2-H GISS-E2-R-CC GISS-E2-R CCSM4
Victoria Nile	CMCC-CMS bcc-csm1-1-m MRI-CGCM3 ACCESS1-0	CESM1-CAM5 MIROC5	GISS-E2-R-CC	GISS-E2-H-CC IPSL-CM5B-LR GISS-E2-H GISS-E2-R-CC GISS-E2-R CNRM-CM5	FGOALs_g2 CMCC-CMS HadGEM2-CC CESM1-BGC GISS-E2-R GFDL-CM3 GISS-E2-R-CC CNRM-CM5 GISS-E2-H GISS-E2-H-CC CCSM4 CanESM2 ACCESS1.3 HadGEM2-ES

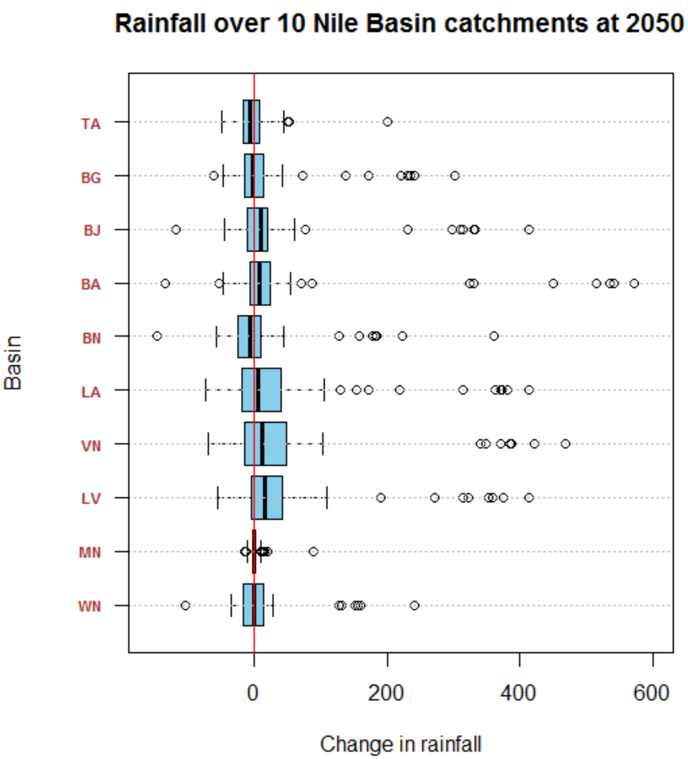
Expected impact of CC on water resource

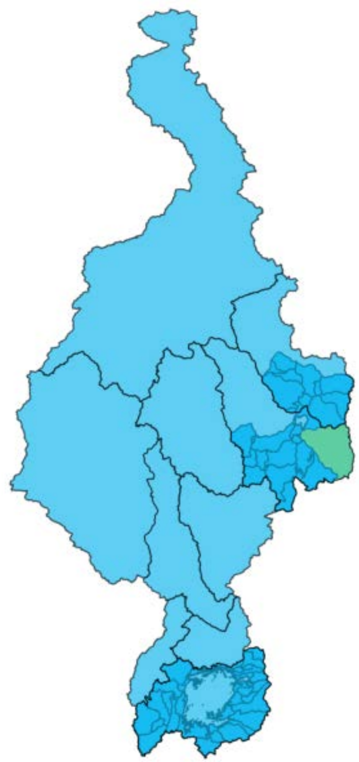
CC data preparation for impact studies over the Nile Basin

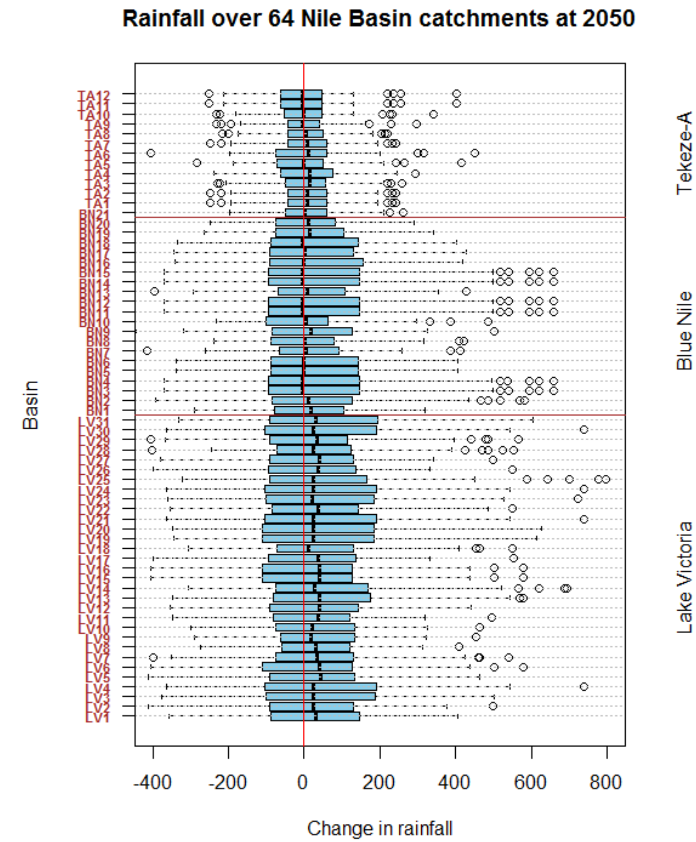
- **Bias correction and downscaling of the GCMs (P and T) for RCP8.5 and 4.5**
- **Bias correction of the RCMs RCP8.5 and 4.5.**



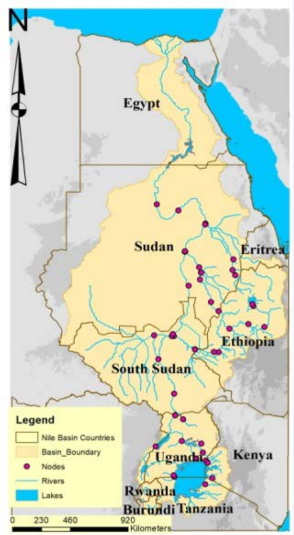
GCMs


Rainfall over 10 Nile Basin catchments at 2050
TA
BG
BJ
BA
BN
LA
VN
LV
MN
WN
Basin
0
200
400
600
Change in rainfall




Rainfall over 64 Nile Basin catchments at 2050
Tekeze-A
Blue Nile
Lake Victoria
Basin
-400
-200
0
200
400
600
800
Change in rainfall

Future hydrological scenarios over the Nile Basin



NILE BASIN INITIATIVE
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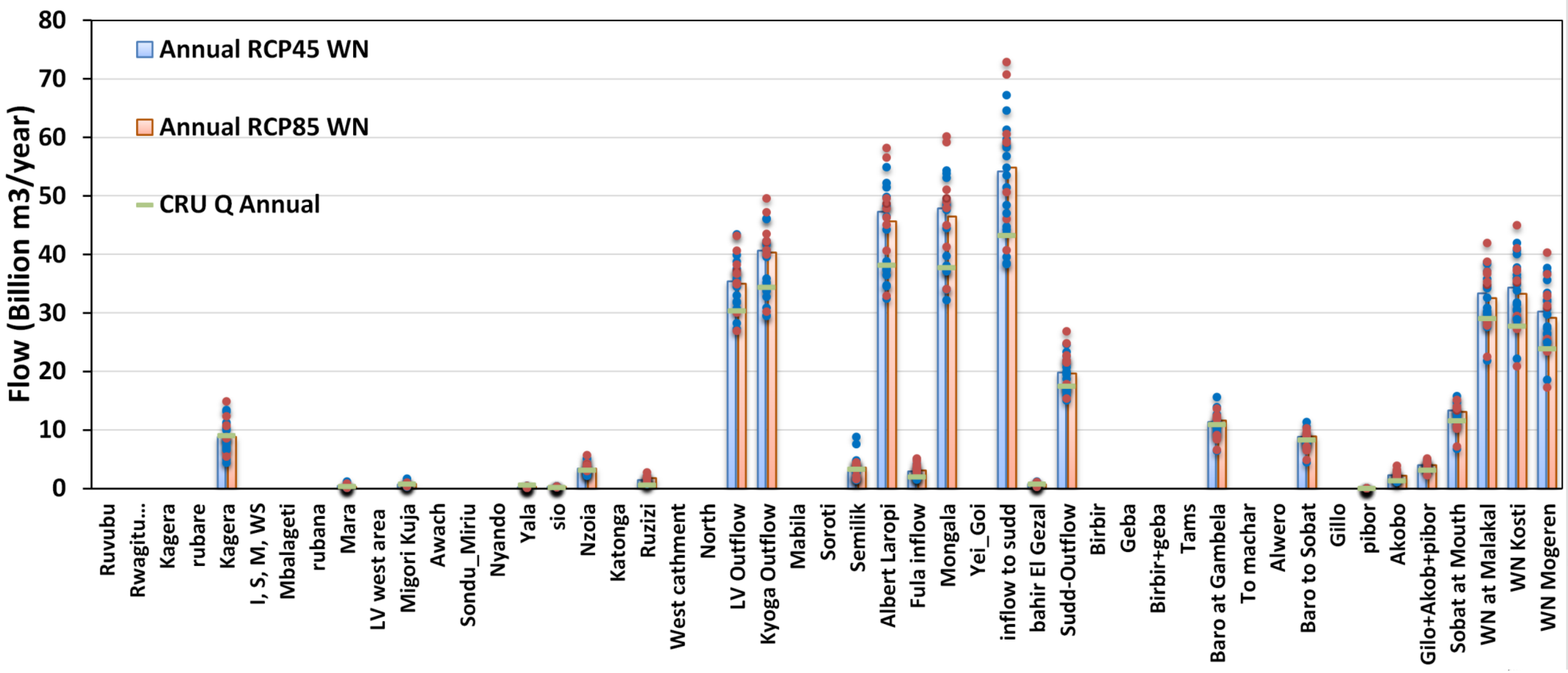

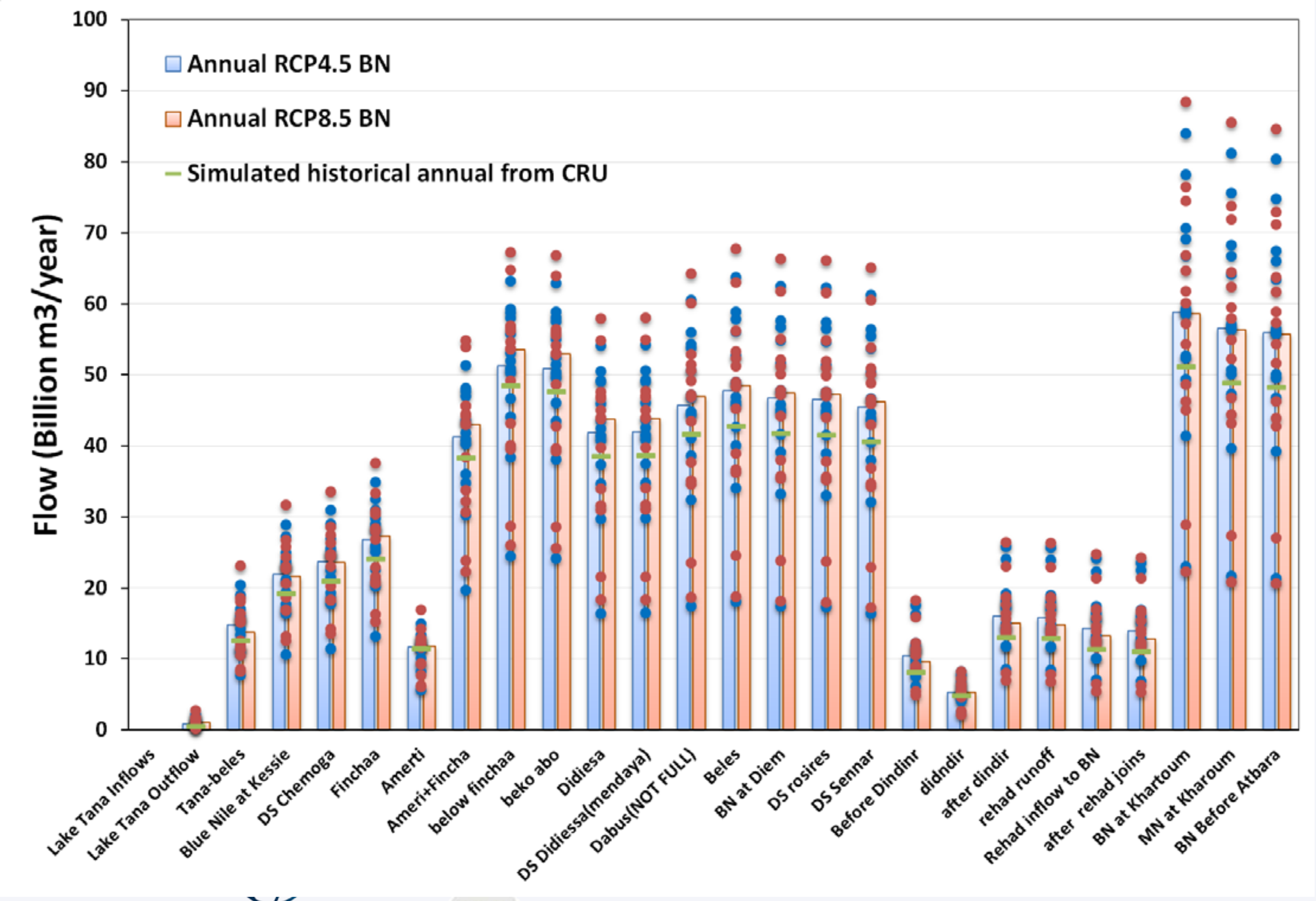

Annual RCP4.5 BN
Annual RCP8.5 BN
Simulated historical annual from CRU
Flow (Billion m3/year)
100
90
80
70
60
50
40
30
20
10
0
Lake Tana Inflows
Lake Tana Outflow
Tana-beles
Blue Nile at Kessie
DS Chemoga
Finchaa
Ameri
Ameri+Fincha
below finchaa
beko abo
Didiesa
DS Didiessa(mendaya)
Dabus(NOT FULL)
Beles
BN at Diem
DS rosires
DS Sennar
Before Dindinr
didndir
after dindir
rehad runoff
Rehad inflow to BN
after rehad joins
BN at Khartoum
MN at Kharoum
BN Before Atbara

Nile Basin River Flow Forecasting System

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- Provide basin-wide river flow forecasts
- Improve water resources management
- Reduce the impact of devastations to life and property
- Improve operational decisions
- Improve dams' coordination
- Improve planning decisions on cropping.

Preparatory phase

Review of available forecast systems (international and regional).

User Needs assessment.

Conceptual design.

Forecast System Name and Location	Status			Lead-time				Coverage				Data				Methods			Users			
	Research	Operational (internal)	Operational (online)	<7 days	<20 days	<6 month	>6 month	Basin	Country-wide	Transboundary	Global	Teleconnections	Ensemble Streamflow	Deterministic NWP	Ensemble NWP	Discharge regression	Hydrological Model	Routing model	Flood	Drought	Reservoir operation	Other
GloFAS - Global			■			■					■				■		■	■	■			
GLOFFIS - Global			■		■						■				■		■	■	■			
E-Hype - Europe			■		■					■				■			■	■	■			
EFAS - Europe		■			■					■					■		■	■	■			
EDO - Europe			■		■	■				■					■		■			■		
HEFS - continental USA			■	■	■	■	■		■			■			■	■	■	■	■			
AFFS - continental Africa	■				■					■					■		■	■	■			
Short Term - Yellow River Basin		■		■				■						■		■	■	■	■	■		
Short Term - Benue Basin	■			■						■				■			■	■	■			
KJ-IFS-OPT - Niger Basin		■		■		■				■				■			■	■	■		■	
Hydromax - Meuse River		■		■						■				■		■	■		■			
Seasonal Forecast - Yakima Basin	■				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		■
Forecasts at the Zambezi River	■			■	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	■	
FEWS - Australia			■	■	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	■	
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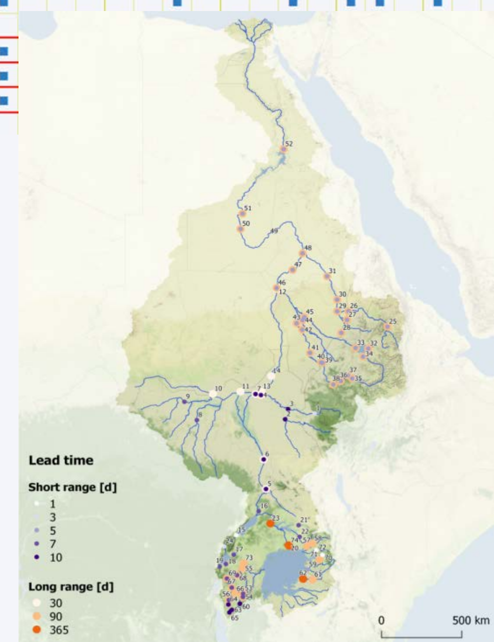
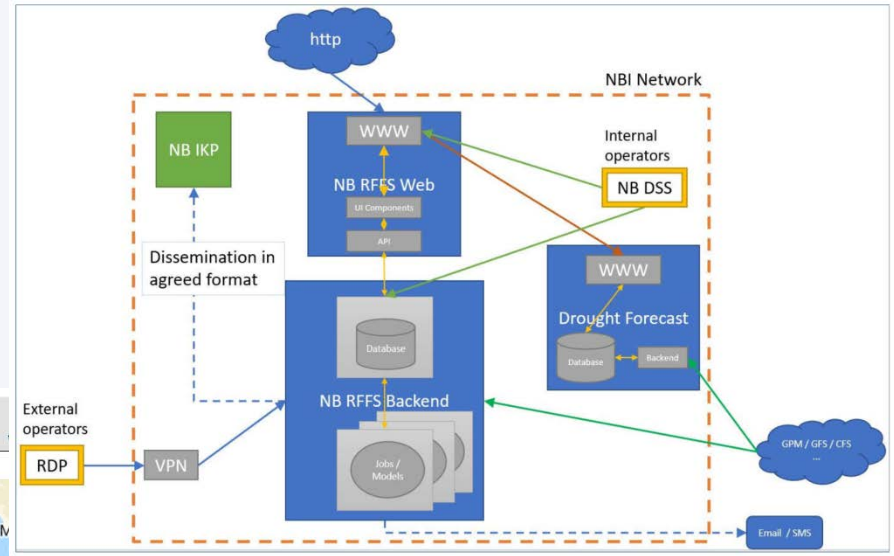
FEWS-FOEN - Switzerland		■			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		

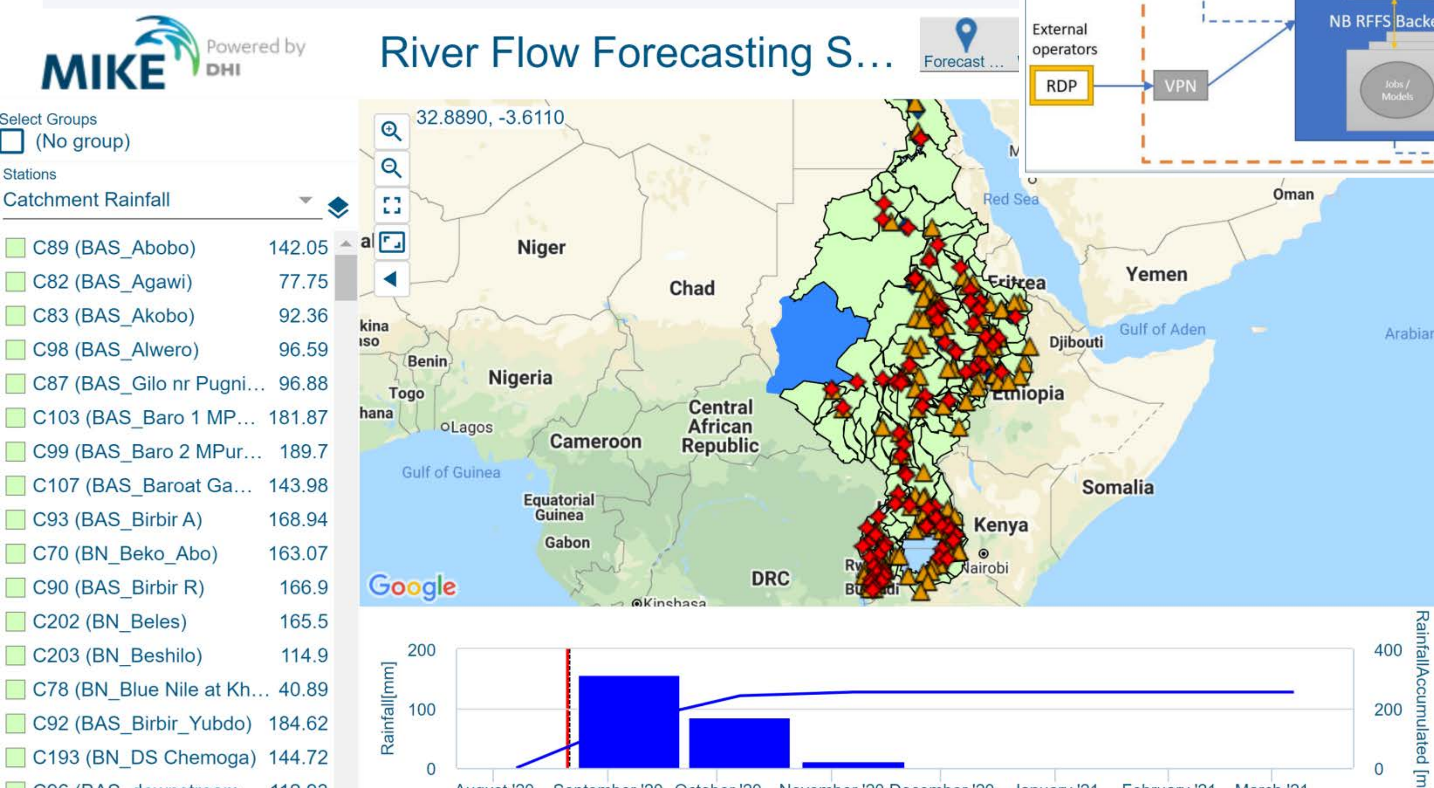


german cooperation
DEUTSCHE ZUSAMMENARBEIT
giz
THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP
CIWA
2021
6th Nile Basin Development Forum - Ethiopia

Nile Basin River Flow Forecasting system

http://13.80.108.118/

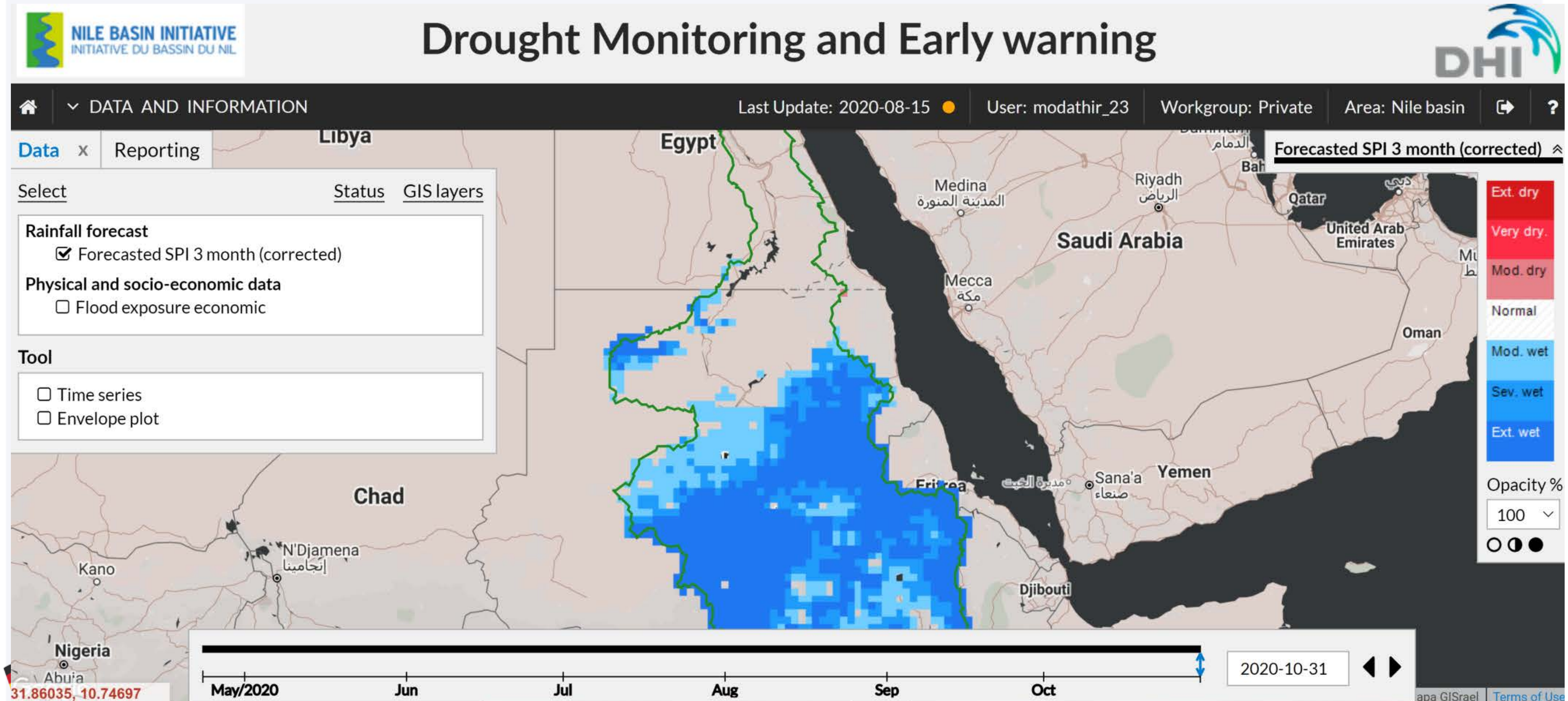




Drought monitoring and early warning

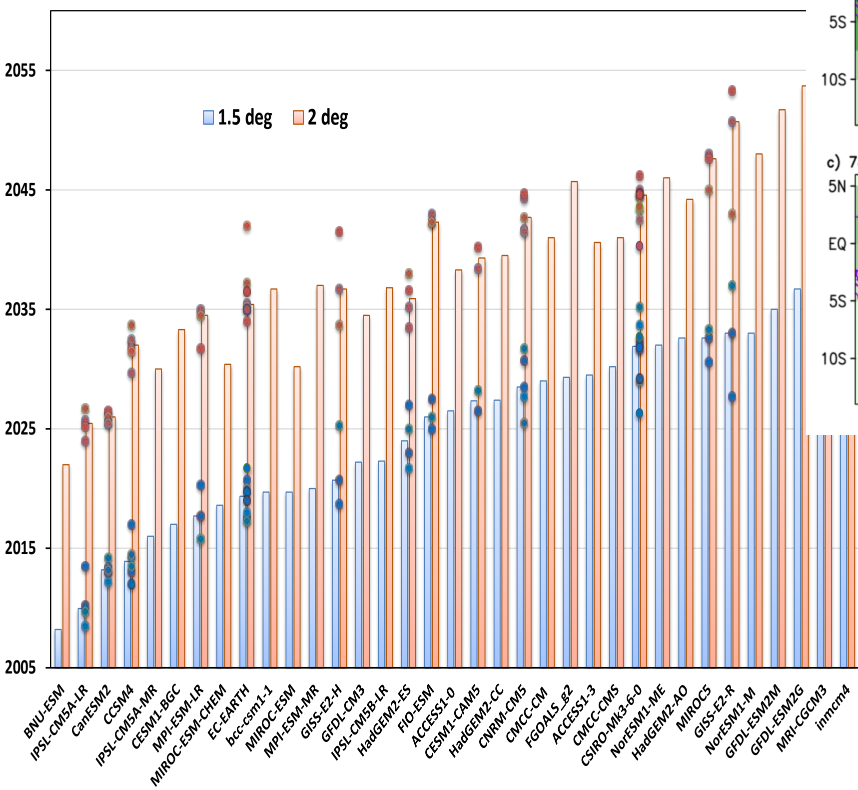
https://www.flooddroughtmonitor.com/data

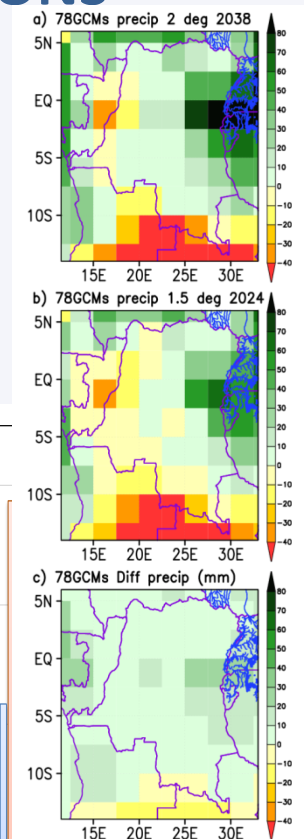
Bi-weekly drought bulletin is generated.

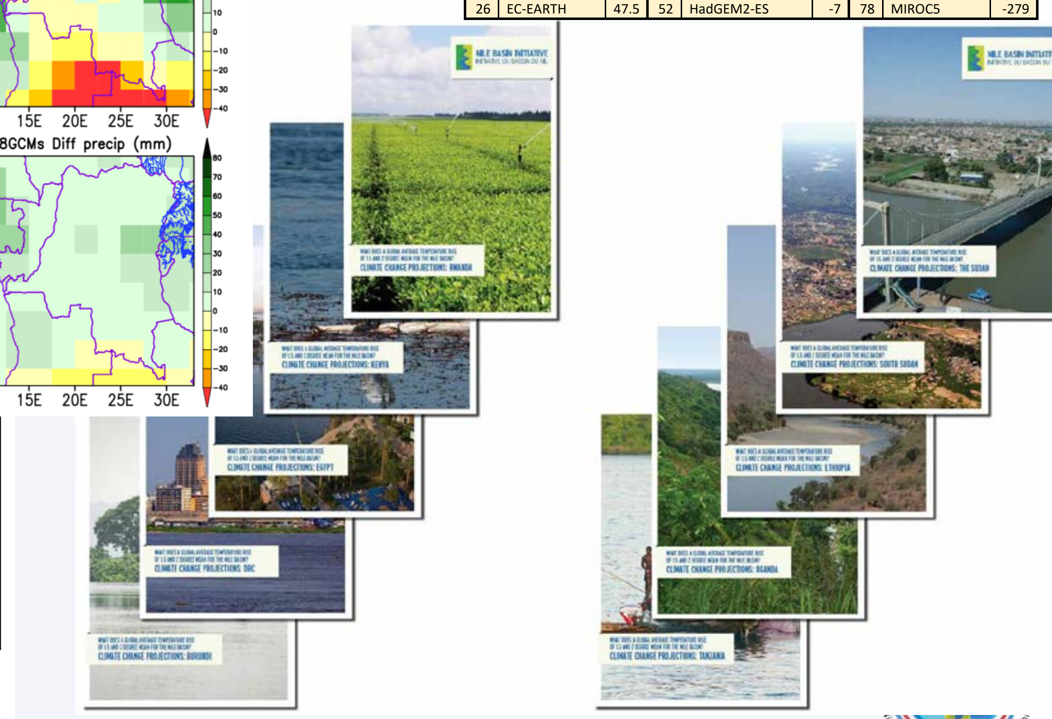


WHAT DOES A GLOBAL AVERAGE TEMPERATURE OF 1.5 AND 2 DEGREE MEAN FOR THE NILE BASI CLIMATE CHANGE PROJECTIONS

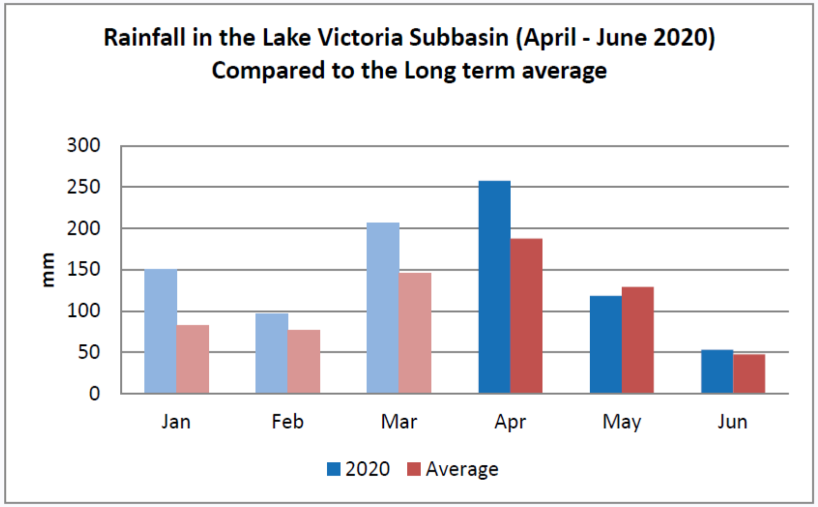
No	Model	pre	No	Model	pre	No	Model	pre
1	IPSL-CM5A-LR	277	27	inmcm4	47	53	CNRM-CM5	-17.2
2	IPSL-CM5A-LR	194	28	EC-EARTH	46	54	HadGEM2-AO	-18.9
3	IPSL-CM5A-LR	184	29	CanESM2	45	55	GISS-E2-H	-22.6
4	IPSL-CM5A-LR	171	30	IPSL-CM5B-LR	41	56	CNRM-CM5	-26
5	MPI-ESM-LR	164	31	CCSM4	40	57	GISS-E2-R	-33.1
6	MPI-ESM-MR	124	32	CCSM4	34	58	HadGEM2-ES	-35.5
7	CanESM2	119	33	CESM1-CAM5	33	59	BNU-ESM	-38.3
8	MPI-ESM-LR	110	34	EC-EARTH	33	60	NorESM1-M	-45.2
9	MPI-ESM-LR	110	35	FIO-ESM	32	61	GISS-E2-R	-66.3
10	CESM1-BGC	92.5	36	ACCESS1-0	30	62	GISS-E2-H	-67.6
11	CCSM4	86	37	CMCC-CMS	28	63	CSIRO-Mk3-6-0	-86.1
12	CCSM4	84.6	38	HadGEM2-ES	22	64	GISS-E2-R	-95.3
13	bcc-csm1-1	84.1	39	CNRM-CM5	17	65	MRI-CGCM3	-106
14	CCSM4	83.4	40	FIO-ESM	17	66	CSIRO-Mk3-6-0	-114
15	CCSM4	80.3	41	CESM1-CAM5	16	67	CSIRO-Mk3-6-0	-118
16	IPSL-CM5A-MR	78.9	42	MIROC-ESM-CHEM	14	68	CSIRO-Mk3-6-0	-120
17	CanESM2	78.2	43	CNRM-CM5	12	69	GISS-E2-H	-121
18	CESM1-CAM5	72.6	44	HadGEM2-CC	11	70	CSIRO-Mk3-6-0	-136
19	FIO-ESM	65.5	45	CNRM-CM5	9	71	CSIRO-Mk3-6-0	-145
20	CanESM2	62.8	46	FGOALS_g2	6	72	CSIRO-Mk3-6-0	-156
21	CMCC-CM	58.9	47	HadGEM2-ES	1	73	CSIRO-Mk3-6-0	-157
22	EC-EARTH	58.7	48	MIROC-ESM	-3	74	CSIRO-Mk3-6-0	-191
23	GFDL-ESM2M	57.3	49	GFDL-ESM2G	-4	75	CSIRO-Mk3-6-0	-202
24	CanESM2	54.2	50	GFDL-CM3	-4	76	MIROC5	-237
25	ACCESS1-3	48.7	51	NorESM1-ME	-6	77	MIROC5	-240
26	EC-EARTH	47.5	52	HadGEM2-ES	-7	78	MIROC5	-279

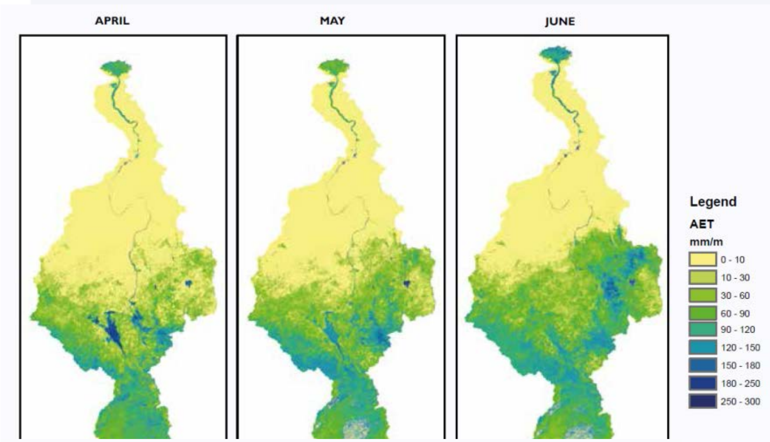


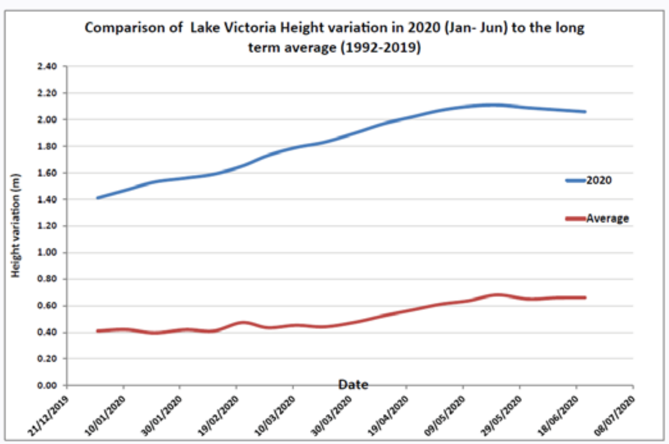


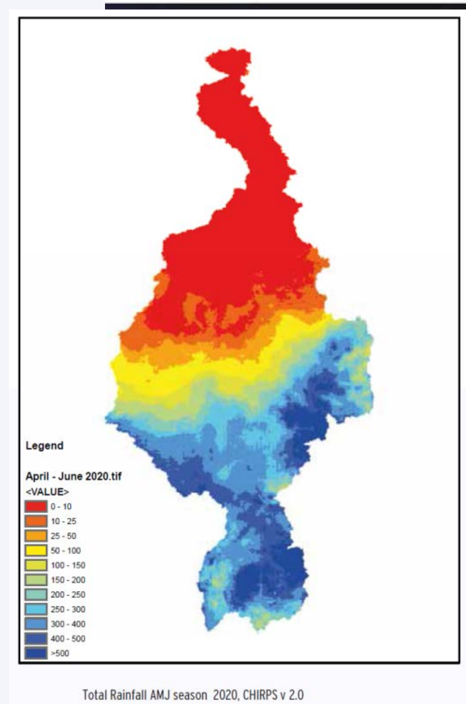


Basin monitoring Bulletin









CSI project is the umbrella under which climate services for infrastructure investment is taking place

Climate proofing guideline
Climate Risk Assessment.

NBI is progressing well in terms of data preparation for impacts studies.

It enables NBI to foster cooperation in the Nile Basin (around the topic of better informed decision making consider current and future available resources).

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THANK YOU!