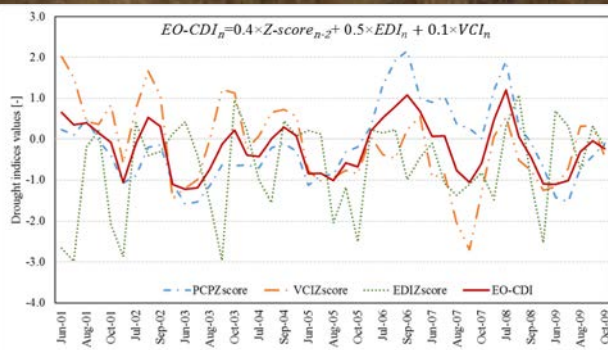


Multi-dimensional nature of drought in Abbay/Upper Blue Nile Basin and the importance of regional coordination efforts for mitigation

International Conference on the Nile and Grand Ethiopian Renaissance
Dam: Science, Conflict Resolution and Cooperation

August 20-21, 2020



By:

Yared A. Bayissa, Semu A. Moges, Assefa M. Melesse,
Tsegaye Tadesse, Anteneh Z. Abiy

Outline

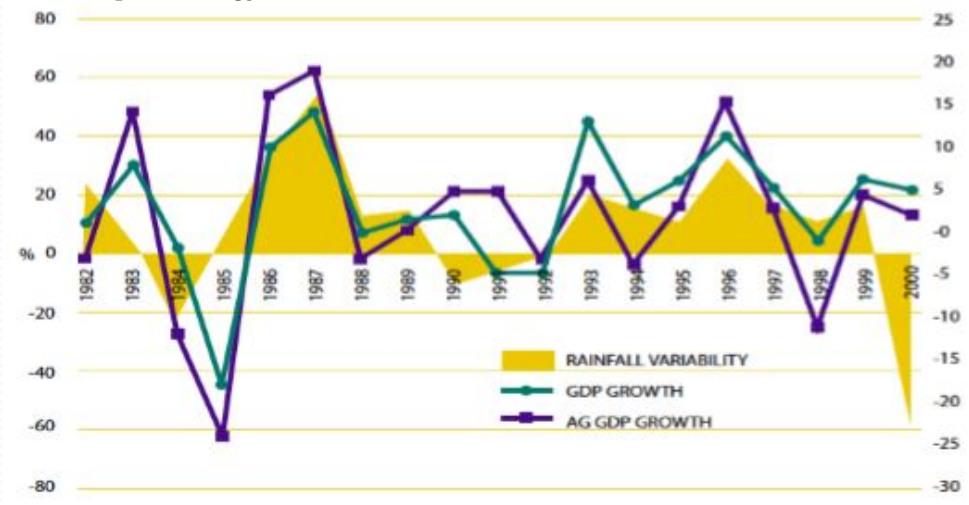
- Background
- Drought history of the UBN basin
- Material and methods
- Spatial and temporal features of different types of droughts
- Drought impact on socio-economic
- Summary and recommendation

Background

- **Historic droughts in Ethiopia**
 - 1983/84 was one of the worst drought events
 - Covered large area and affected many populations
 - Drought has become more frequent
 - Now it occurs every 2 to 3 years
- **Drought impacts on Ethiopia economy**
 - The economy is less resilient to drought
 - The economy is highly linked to annual rainfall variability

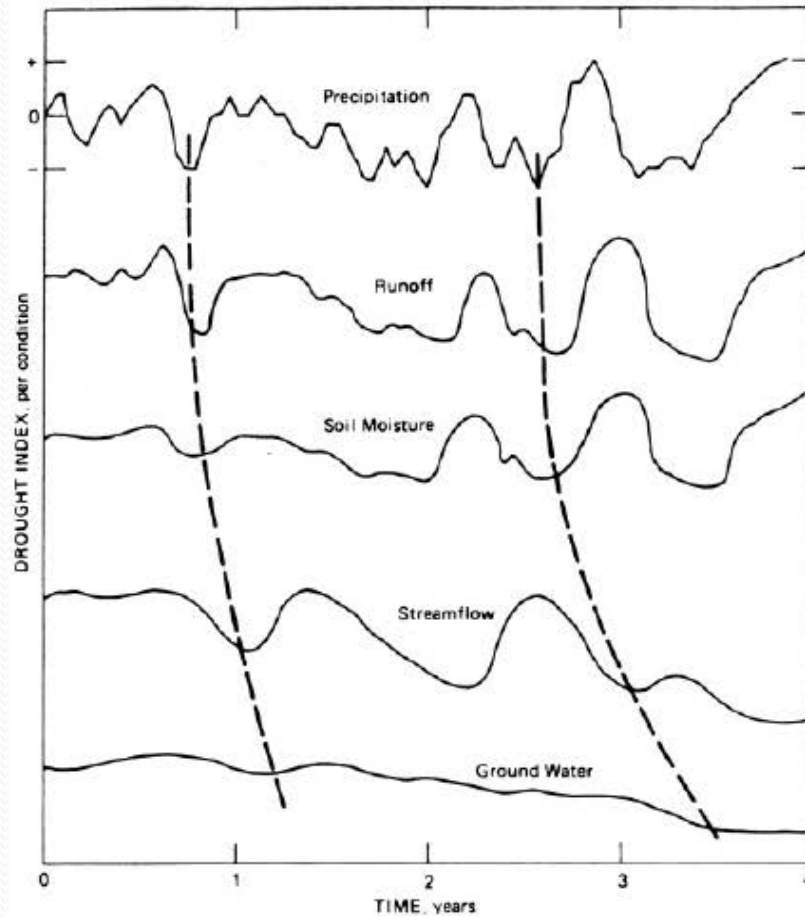
Start date	End date	Location	Total affected populations (10 ⁶)	Total number of population (10 ⁶)	Ratio (%)
1973	1978	Wollo, North Shoa , Tigray, Kangra province	3	32.57	9
1983	1984	Wollo, Gondar , Gore, Tigray, Shoa , Harerge, Sidamo	7.75	35.24	22
1987	1987	Ogaden, Tigray, Wollo, Shewa, Gondar , Bale, Sidama,	7	48.06	15
1989	1994	Northern Ethiopia , Tigray, Wollo, Gondar , Harerge	6.5	48.06	14
2003	2004	Tigray, Oromia, Amhara , Somali, Afar province	12.6	76.61	16
2008	2009	Oromia , Somali, Amhara , Afar, Tigray, SNNPR province	6.4	87.56	7
2015	2017	Oromia , Somali, Amhara , Afar, SNNPR province	10.2	100.08	10

(Data source: EM-DAT: The International Disaster Database. Centre for Research on the Epidemiology of Disasters-CRED)

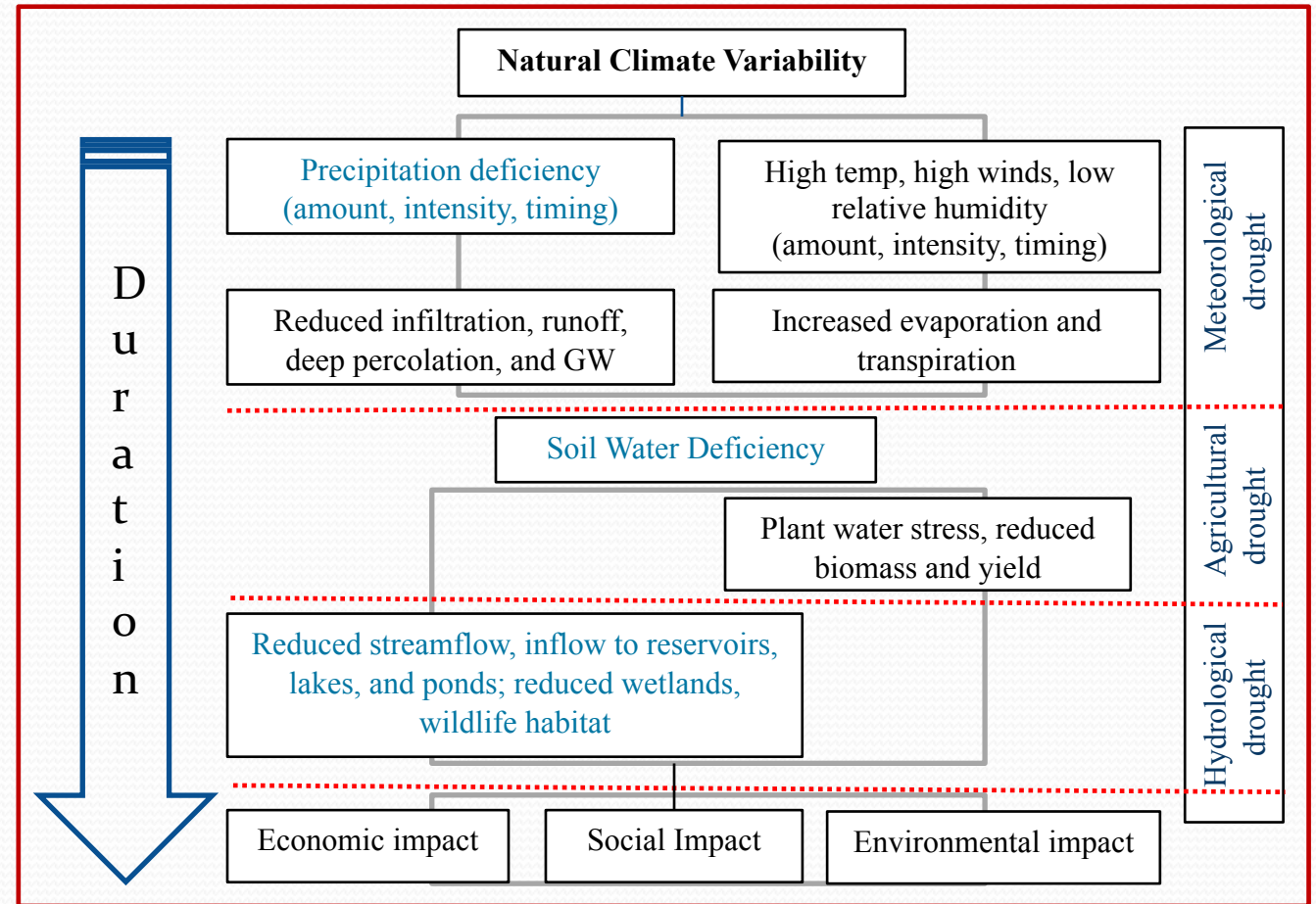


(Source: Economics of resilience to drought: Ethiopia analysis (USAID report, 2018))

Cont'd ...



Proceeding of precipitation deficit throughout the Hydrological cycle (Rasmusson, 1993)



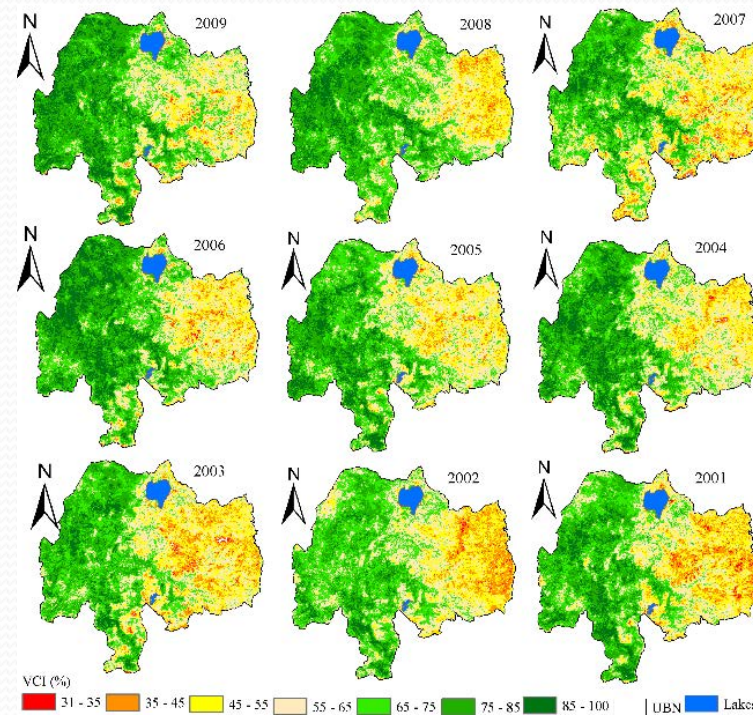
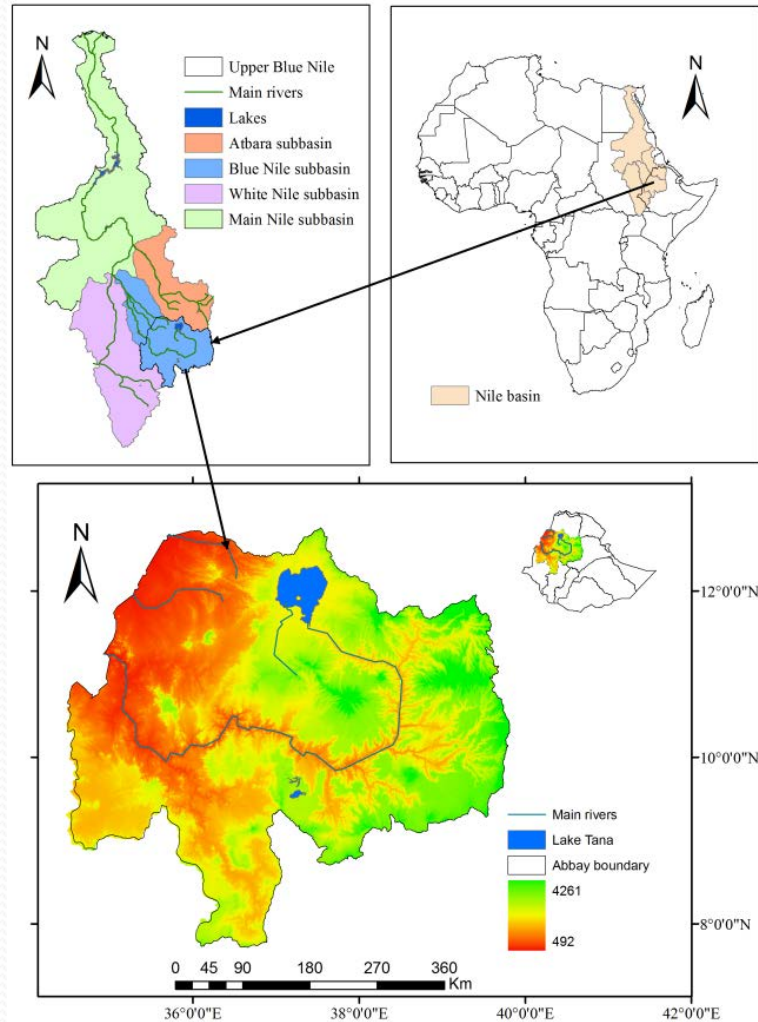
Influence of precipitation deficiency and other factors on drought development (National Drought Mitigation Center)



Cont'd ...

Demonstrate the different forms of droughts that occurred in the Abbay/ Upper Blue Nile River basin and its national and regional implication

Drought history of the UBN basin

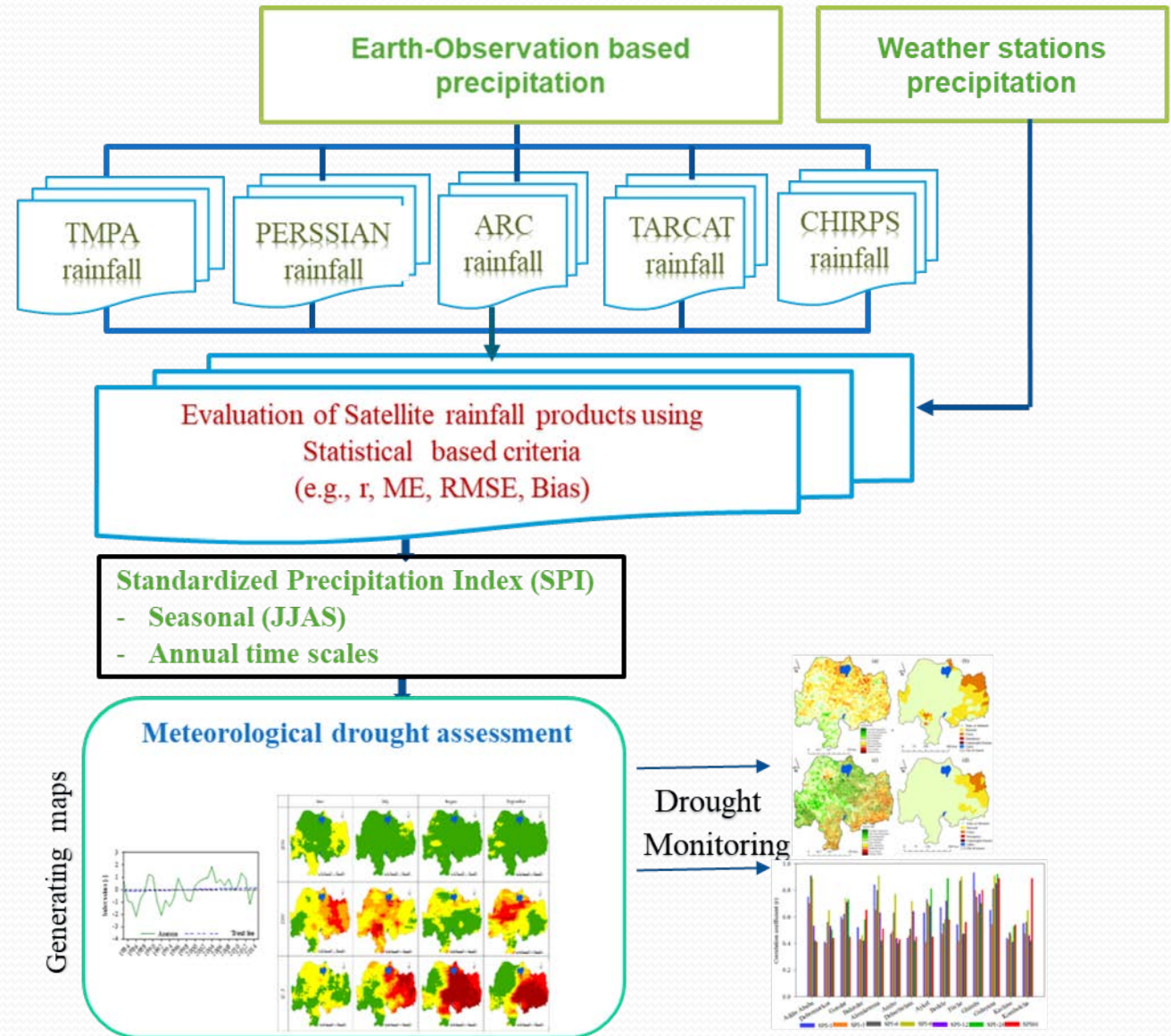


- UBN basin is vulnerable to drought
- 1984, 2002, 2009 and 2015 drought years
- The eastern part more drought susceptible
- Regional cooperation is vital to mitigating its impact

Material and methods

- **Drought indices**
 - Standardized Precipitation Index
 - Soil Moisture Deficit Index
 - Surface Runoff Index

Standardized Precipitation Index (SPI)



Cont'd ...

Soil Moisture Deficit Index (SMDI)

Land Data Assimilation System
(FLDAS)
(Monthly soil moisture time series)

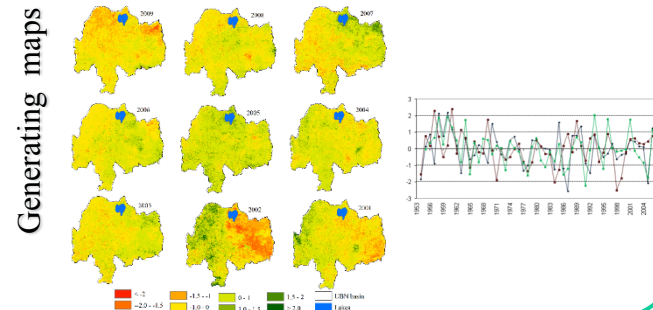
Soil Moisture Deficit Index (SMDI)
- Seasonal
- Annual time scales

$$SD_{i,j} = \frac{SW_{i,j} - MSW_j}{MSW_j - \min SW_j} \times 100, \text{ if } SW_{i,j} < MSW_j$$

$$SD_{i,j} = \frac{SW_{i,j} - MSW_j}{\max SW_j - MSW_j} \times 100, \text{ if } SW_{i,j} > MSW_j$$

$$SMDI_{i,j} = 0.5SMDI_{j-1} + \frac{SD_j}{100}$$

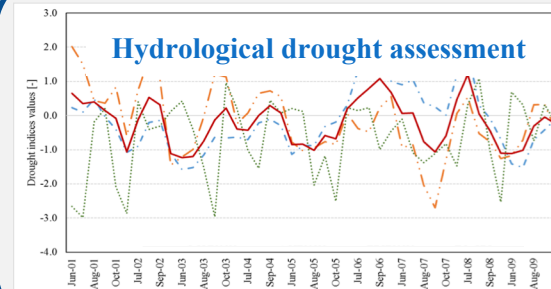
Agricultural drought assessment



Standardized Runoff Index (SRI)

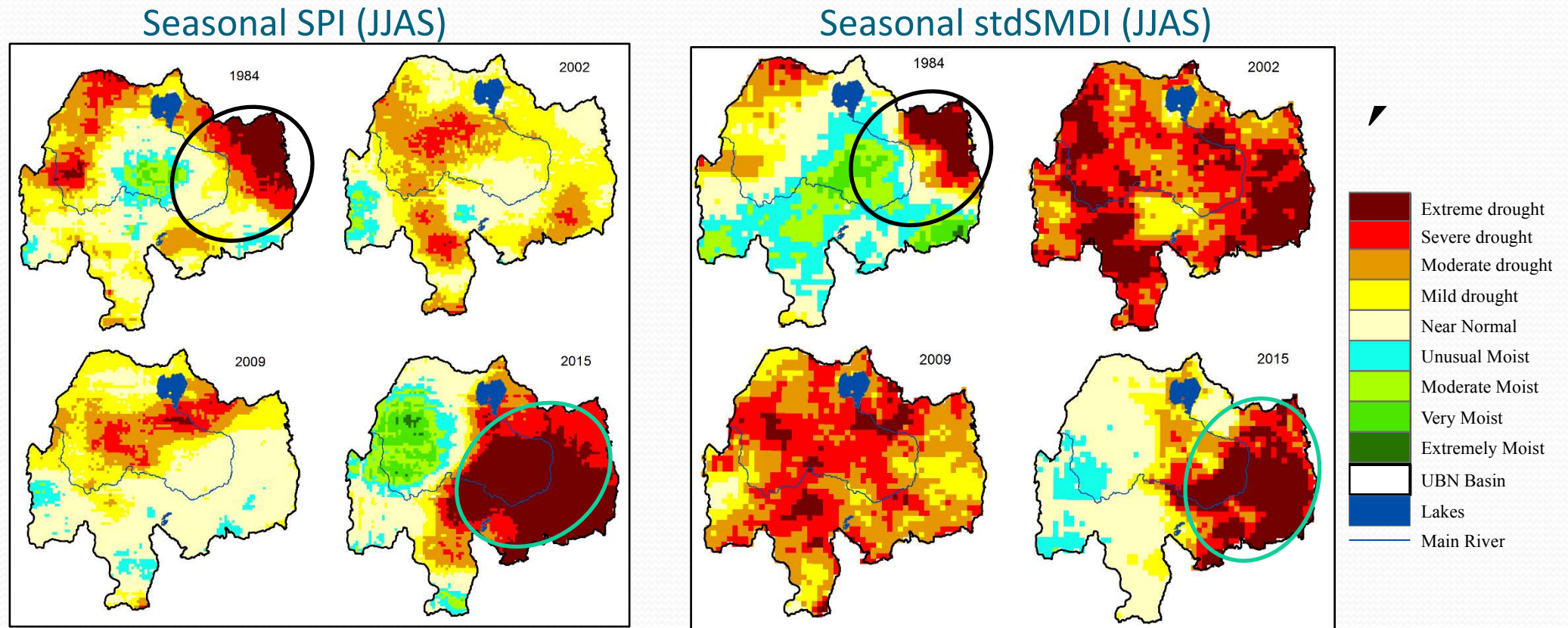
Long-term
Stream flow

Surface Runoff
Index (SRI)
- Seasonal
- Annual



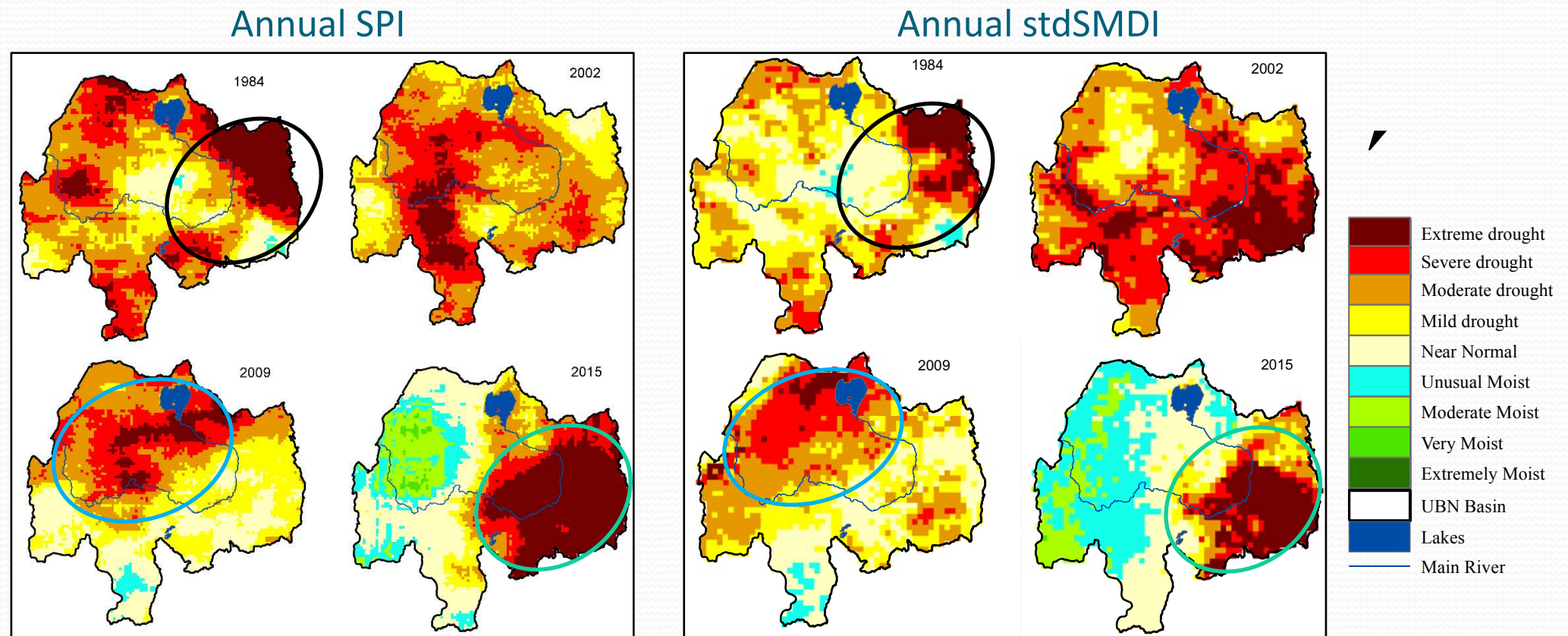
Drought category	Index value
Near Normal	0.50 - -0.49
Mild drought	-0.50 - -0.99
Moderate drought	-1.00 - -1.49
Severe drought	-1.50 - -1.99
Extreme drought	< -2.00

Spatial features of meteorological and agricultural droughts



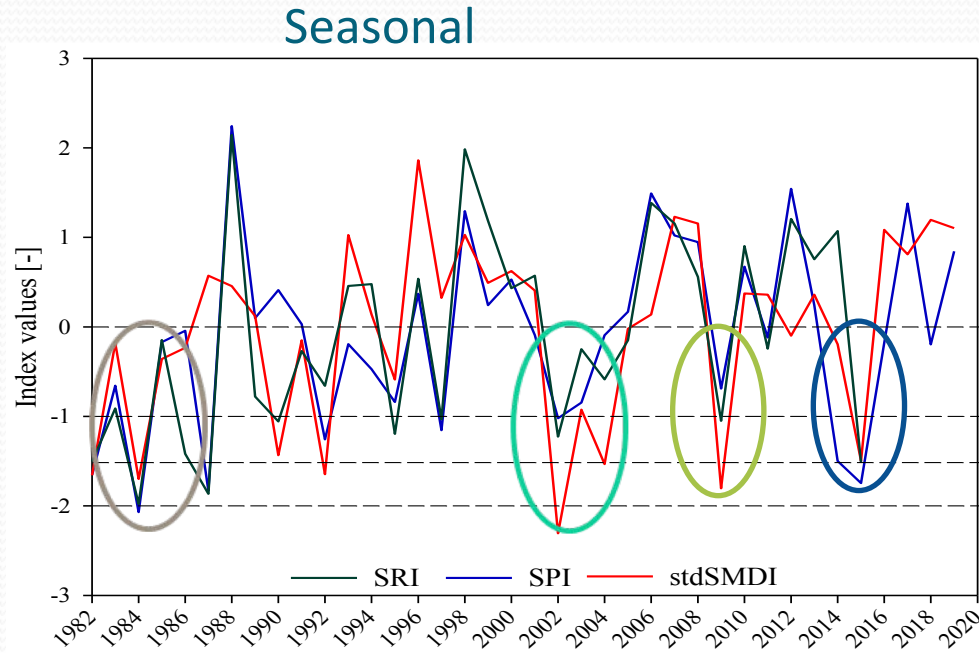
- Similar drought pattern b/n SPI and stdSMDI in 1984 and 2015
- Wide spread and severe drought is shown by stdSMDI as compared to SPI in 2002 and 2009

Cont'd ...

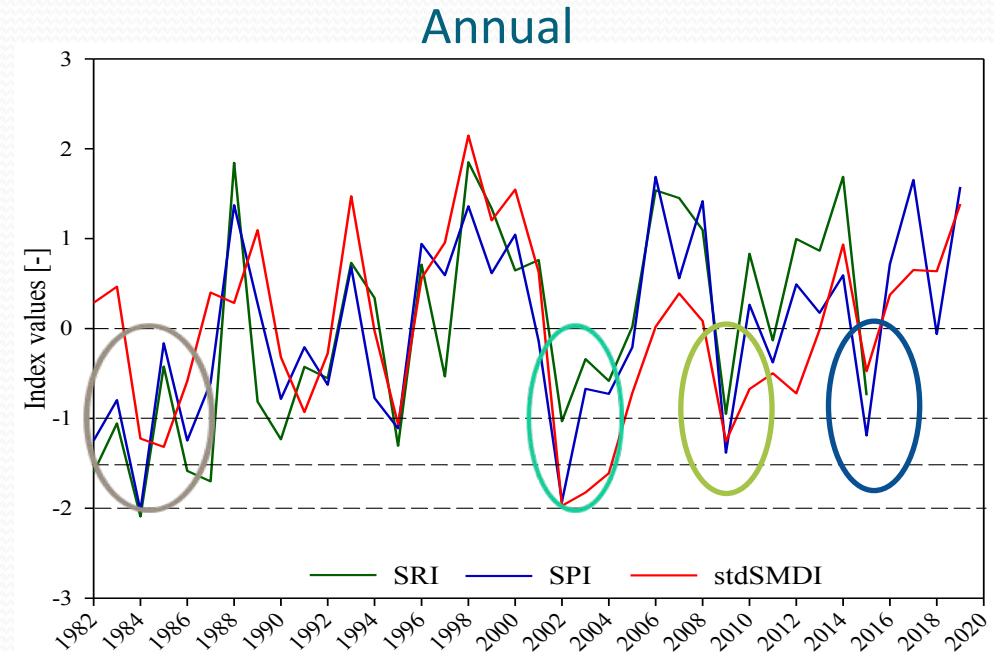


- Similar drought patterns as compared to seasonal for the selected years
- Relatively widespread and intensified drought condition in 1984, 2002 and 2009

Temporal pattern of meteorological, agricultural and hydrological droughts



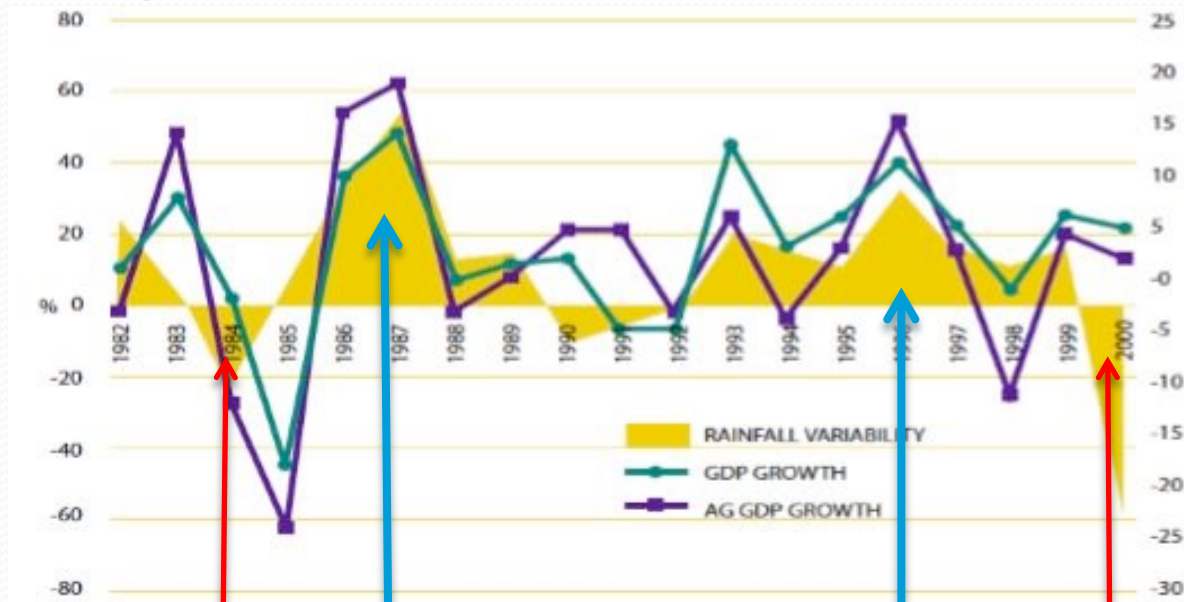
Seasonal correlation coefficient		
	SPI	SRI
SRI	0.79	
stdSMDI	0.56	0.64



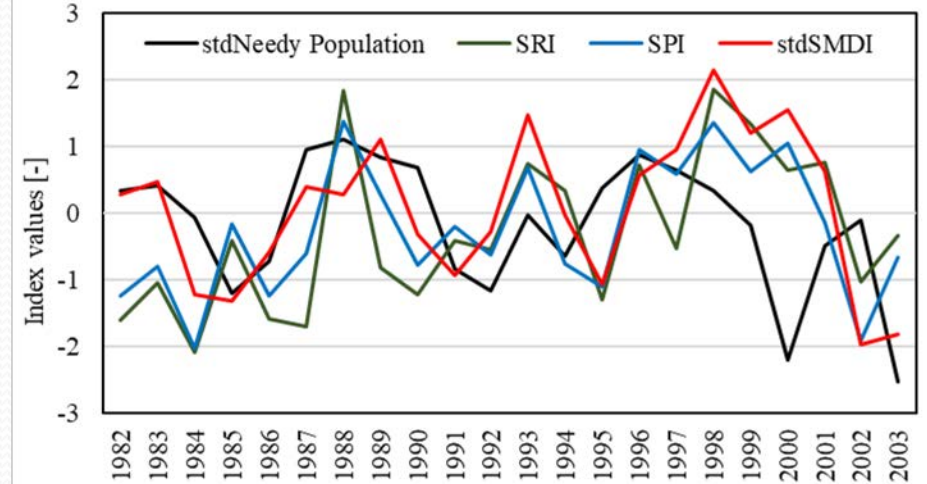
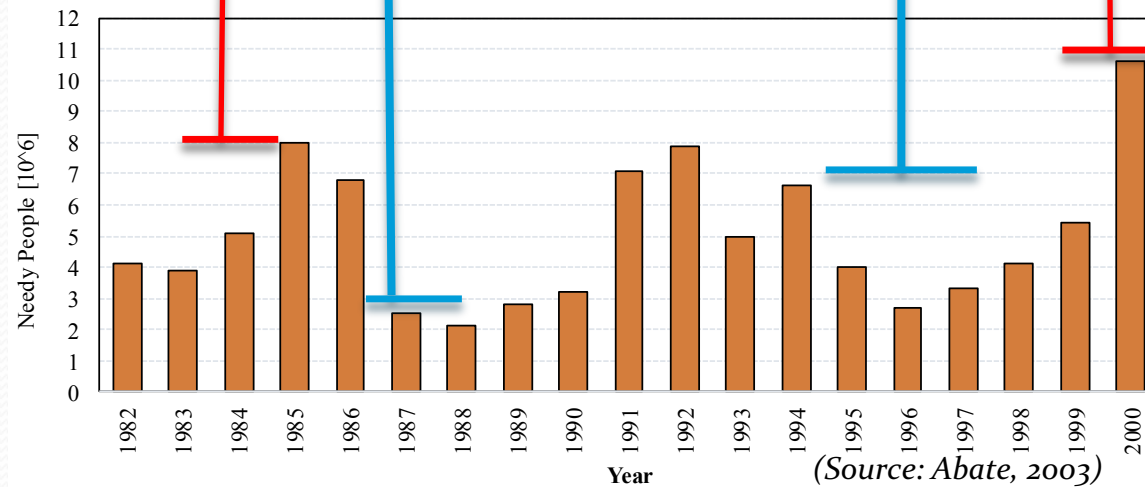
Annual correlation coefficient		
	SPI	SRI
SRI	0.85	
stdSMDI	0.67	0.49

- There is a high nexus between each drought type and all indices consistently indicated the historic drought events in the basin.

Drought impact on socio-economic



Number of population in need for relief food assistance (1982-2000)



Summary and recommendation

- The nature of drought in Abbay/UBN basin is multi-dimensional and occurring concurrently
- It has both complementary as well as supplementary socio-economic impacts (agriculture, GDP)
- We recommend constructing upstream storage facilities to delink drought induced socio-economic losses and to mitigate the multi-dimensional drought related disaster
- Understanding multidimensional aspects of drought provides perspectives for regional cooperation and the need for shared drought management



Thank you!!!

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