8th ASIAN REGIONAL CONFERENCE

Assessment of meteorological drought using different approaches in the Karnali River Basin, Nepal

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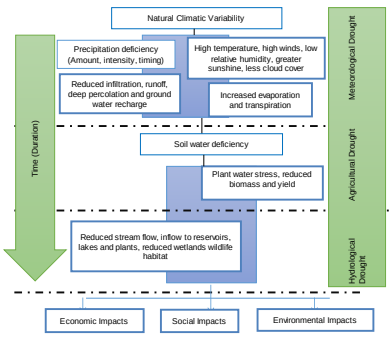
- Introduction and application of drought indices,
- dynamics of drought at western Nepal,
- comparison of output from different drought indices,
- apt drought indices for Himalayan basin.





Context

- Nepal is experiencing frequent drought since last few years, however there are few literatures on the regional study inside Nepal,
- Karnali basin, though being climatically more sensitive and less resilient to winter drought (Wang et al. 2013), still lacks comprehensive study,
- The quest for the most effective drought index which can significantly represent the drought scenario in the data spare Himalayan region,
- Proper understanding of historical event is important for better future interventions,

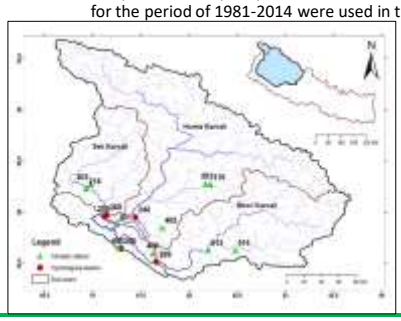


Relationship between Meteorological, Agricultural and Hydrological droughts (Source: Wilhite, 2000)

- Creeping phenomenon,
- slowly sneaks up and impacts many sectors,
- operates on different time scales,
- has severe impact on other drought types and agricultural, ecological, socio-economic spheres.

Karnali River Basin

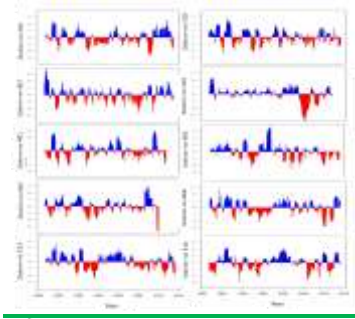
Temperature and precipitation data from 10 stations for the period of 1981-2014 were used in the analysis.



Four different Meteorological Drought Indices are used:

- Standardized Precipitation Index "SPI" (McKee et al. 1993),
- Standardized Precipitation Evapotranspiration Index "SPEI" (Vicente-Serrano et al. 2010),
- Reconnaissance Drought Index "RDI" (Tsakiris and Vangelis 2005),
- Self-calibrated Palmer Drought Severity Index "sc-PDSI" (Palmer 1965; Wells et al. 2004).

SPI

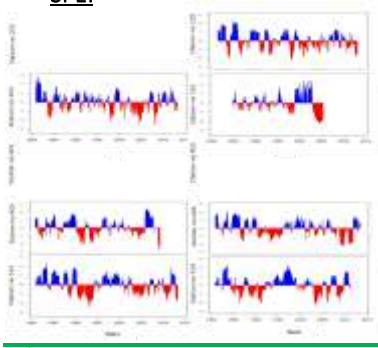


Calculated on :
Software available at National Drought Mitigation Centre maintained by University of Nebraska

Years: 1993, 2006, 2008, 2009, 2010,2011

SPI values	Drought categories
2.0 and above	Extremely Wet
1.5 to 1.99	Very wet
1.0 to 1.49	Moderately wet
-0.99 to 0.99	Near Normal
-1.0 to -1.49	Moderately dry
-1.5 to -1.99	Severely Dry
-2.0 and less	Extremely dry

SPEI

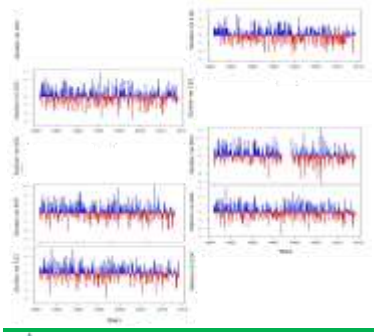


Calculated on :
SPEI Calculator available at (http://hdl.handle.net/10261/10002)

Years: 1986, 1998, 2004, 2005, 2010, and 2011.

SPEI values	Categories
Less than -2	Extremely dryness
-1.99 to -1.5	Severe dryness
-1.49 to -1.0	Moderate dryness
-1.0 to 1.0	Near normal
1.0 to 1.49	Moderate wetness
1.50 to 1.99	Severe wetness
More than -2	Extremely wetness

RDI

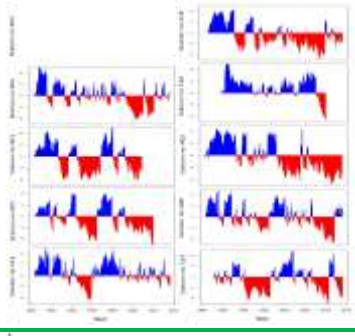


Calculated on :
DRIC software developed at the National Technical University of Athens under the supervision of Prof. George Tsakiris

Years: 2004-06, 2009

RDI values	Categories
2.0 and above	Extreme wet condition
1.5 to 1.99	Very wet condition
1.0 to 1.49	Moderately wet condition
-0.99 to 0.99	Near normal condition
-1.0 to -1.49	Moderately dry condition
-1.5 to -1.99	Severely dry condition
-2.0 and less	Extreme dry condition

scPDSI



Calculated on :
Software available at the GreenLeaf Project

Years: 1996, 2010

scPDSI values	Categories
4.0 or more	Extremely Wet
3.0 to 3.99	Very Wet
2.0 to 2.99	Moderately Wet
1.0 to 1.99	Slightly Wet
0.5 to 0.99	Incipient Wet Spell
0.49 to - .49	Near Normal
-0.5 to -0.99	Incipient Dry Spell
-1.0 to -1.99	Mild Drought
-2.0 to -2.99	Moderate Drought
-3.0 to -3.99	Severe Drought
-4.0 or less	Extreme Drought

Comparative graph of SPI, RDI, SPEI and PDSI



- The same event can be extreme drought for some station and moderate drought for the other station and even normal event for some station

Correlation among the different indices

- The correlation coefficient is both negative and positive: negative up to -0.37 at station 218 for the SPEI and SPI, positive up to 0.7 for SPI and PDSI at station 513.
- The results show, at most of the station, SPI is well correlated with the PDSI, with minimal correlation between SPI and RDI.
- It is both positive and negative for the relation between SPI and SPEI.

