Large Scale Climate Indices, Environmental Variability and Impact on Human Health Conclusion 7

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February 27, 2023

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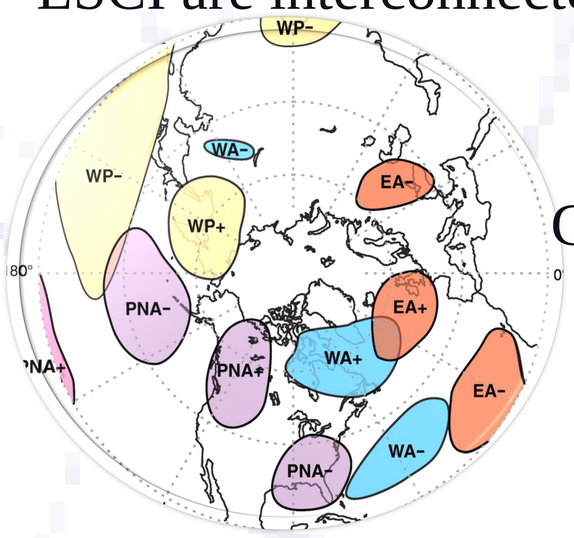
1 Matter

Large-Scale Climate Indices (LSCI) are numerical indicators of the strength and phase of teleconnections between the atmosphere, oceans, and continents for given regions.

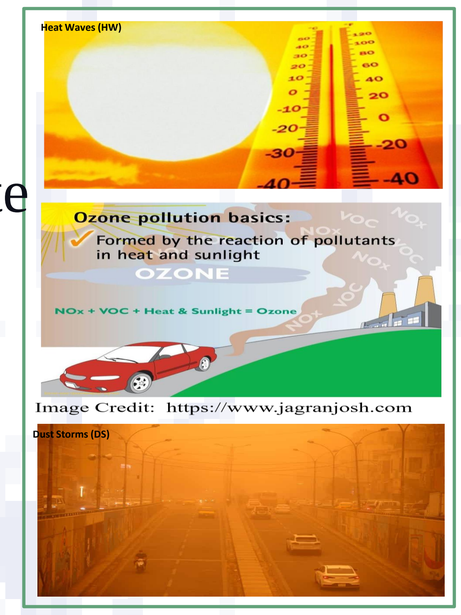
LSCI are interconnected



(An et al., 2021)

Contribute to

Environmental Extremes



Impact

Human Health

2 Aim

To further understand LSCI and their impacts on environmental variability, 2m, Skin and Sea Surface temperatures and pollution by PM10 in Morocco.

3 Tools

- Daily data of the North Atlantic Oscillation (NAO), the Mediterranean Oscillation (MO) and the Saharan Oscillation (SaO) indexes from the CRU[1];
- 2m temperature (2mT), Skin temperature (ST) and Sea Surface Temperature (SST) reanalysis data from ERA5[2];
- Daily average PM10;
- Statistical approach for trends, ruptures and correlations.

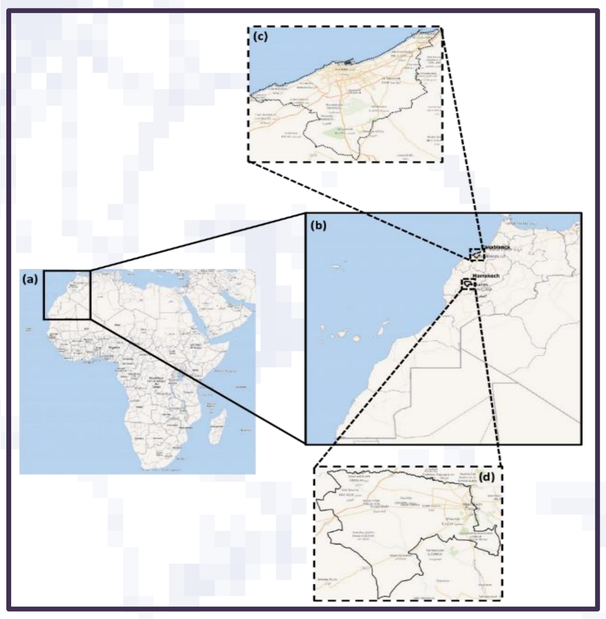
1. https://crudata.uea.ac.uk/cru/data/pci.htm
2. https://cds.climate.copernicus.eu/#!/search?text=ERA5&type=dataset

4 Period

- 2013 to 2016 for PM10.
- 1950 to 2020 for all other parameters.

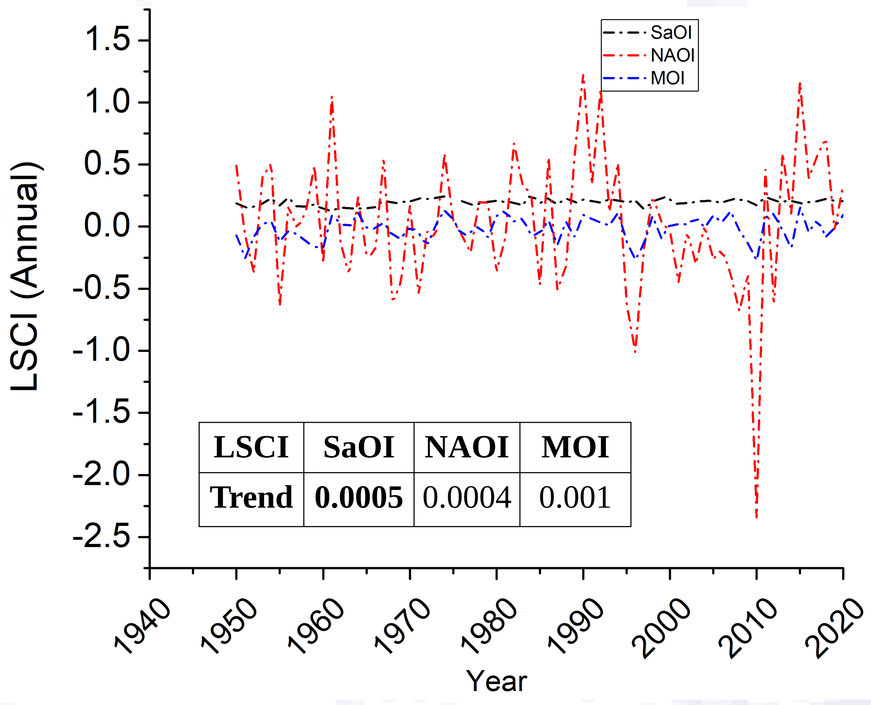
5 Area

(a) Africa (b) Morocco (c) Casablanca (d) Marrakech



6 Results

Trends in annual LSCI are positive. The SaOI trend is statistically significant.



LSCI	SaOI	NAOI	MOI
Trend	**0.0005**	0.0004	0.001

Trends in annual LSCI
Bold: Statistically Significant

Trends and Ruptures in LSCI annual and seasonal timeseries
Bold Character: Coefficient is statistically significant, NR: No Rupture, Significance level = 0.05
DJF: December, January, February; MAM: March, April, May; JJA: June, July, August; SON: September, October, November

LSCI	Annual/ Seasonal	Trends	Rupture's Year	
			Pettitt	Hubert
SaOI	Annual	**+0.005**	NR	1959/1965
	DJF	+0.002	NR	NR
	MAM	+0.007	NR	1983/1995
	JJA	+0.005	NR	NR
	SON	+0.01	1988	1988
NAOI	Annual	+0.004	NR	NR
	DJF	+0.14	1988	2011
	MAM	+0.03	NR	NR
	JJA	-0.1	1994	2006/2012
	SON	-0.12	1987	1987
MOI	Annual	+0.011	NR	1960
	DJF	+0.06	1979	1979
	MAM	-0.003	NR	NR
	JJA	-0.003	NR	NR
	SON	-0.009	NR	NR

- Trends are mostly positive for all indexes.
- Negative trends may appear at the seasonal scale for the NAOI and MOI.
- Shifts in annual and seasonal large-scale patterns were recorded in early and mid-1960s for the annual scale and in the 1980s for the seasonal scale.
- Significant correlations appear between the SaOI and PM10 and the studied temperatures.

Spearman coefficient of correlation between averages in annual SaOI and PM_{10}, 2mT, ST and SST.
Bold Character: Coefficient is statistically significant. Significance level = 0.05

Site/ Parameters	Casablanca			Marrakech			LSCI		SST		
	PM10	2mT	ST	PM10	2mT	ST	NAOI	MOI	(33,-11)	(22,-23)	(35,-21)
SaOI	**-0.17**	**0.1**	**0.14**	**-0.1**	**0.16**	**0.18**	0.06	-0.02	**-0.29**	**-0.33**	**-0.24**

7 Conclusion

Skin temperature and thus the thermal comfort, and particulate pollution and thus their impacts on human health may be partly explained by large scale atmospheric indexes and patterns.

This work was supported by the Geo Hub for Climate and Health in the MENA.

8 References

An, S.-I., Wang, C., Mechoso, C.R., 2021. Teleconnections in the Atmosphere, in: Interacting Climates of Ocean Basins. https://doi.org/10.1017/9781108610995.003

Khomsi, K., Najmi, H., Chelhaoui, Y. and Souhaili, Z. (2020). The Contribution of Large-scale Atmospheric Patterns to PM10 Pollution: The New Saharan Oscillation Index. Aerosol Air Qual. Res. 20:1038-1047. https://doi.org/10.4209/aaqr.2019.08.0401