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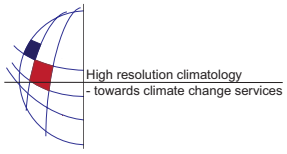

West African Climate and Linkages with the Atlantic Ocean, the Mediterranean Basin and Eurasia

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Large-scale Atlantic, Mediterranean and European climate conditions are not independent from anomalous rainfall patterns over the Sahel. Sahelian droughts are indeed linked to low-frequency climate variability in the North Atlantic i.e. multi-decadal (MDO) and quasi-decadal (QDO).

As such, linkages (significant correlations) were investigated for the 1926-2006 period between the Sahelian rainfall and the following Atlantic climate indices:
1. Atlantic Multi-decadal Oscillation (AMO)
2. Atlantic Meridional Mode (AMM, SST and Wind)
3. North Africa-West Asia index (NAWA, and NA & WA poles)
4. Multi-Decadal Oscillation (MDO)
5. Quasi-Decadal Oscillation (QDO)
6. Tropical North Atlantic (TNA, SST),
7. Tropical South Atlantic (TSA, SST)

The main results are:
Significant relationships (0.05 level, Z-test) were detected between the spring NA pole of the NAWA index and summer Sahelian rainfall of the same year. Correlations (r = 0.54/0.43) were found between the winter AMO and summer Sahelian rainfall indices for the 1950-2006 and 1926-2006 periods, respectively. During the 20th century, the north Atlantic SST anomalies have changed phases three times. The last cooling phase (between 1968 and 1995) resulted in the long-lasting drought in the Sahel. This is also the period when the Azores anticyclone was displaced anomalously south-eastward and the ITCZ further south. It is also found that the cooling over the northern latitudes of Eurasia is associated with a warming tendency over the Sahel. Correlations between fall AMO and summer NA (r = 0.57/0.63) were found for the 1950-2006 period.

Significant correlation were detected between summer AMM (wind and SST) and the Sahelian rainfall (r = 0.65 and 0.42 respectively). Linkages were also found with TNA-TSA (summer and fall). MDO/AMO and QDO SST/SLP displayed coherent patterns during the spatio-temporal evolution of the low-frequency climate signals.

These findings add more insight on the variability of northern atmospheric large-scale and multi-temporal circulation, with SLP (SST) ‘footprints’ over the Atlantic Ocean (AMO) and the eastern Mediterranean (NAWA) climate, and their linkages with Sahelian climate variability. Winter AMO can thus be viewed as a valuable predictors for Sahel rainfall intensity. The AMO is expected to exhibit a predominantly positive phase for the upcoming decades which could enhance Sahelian rainfall during that period.

Within the climate change context, the above results are important in regions where public health and socio-economical issues are highly dependent on multi-temporal climate variability. It is hoped that indices presented here can be used as predictors by modelers and decision-makers to improve mitigation of regional multi-disciplinary impacts from climate variability and contribute to early warning systems (EWS).