Atmospheric dynamics over the Mediterranean Basin: linkages with circulation patterns, precipitation, and teleconnections

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The variability of atmospheric anomalies over Northwest Africa (NA), which includes one of the poles of the NAWA index identified by Paz et al. (2003), is investigated during the second half of the 20^{th}century. Insight into the inter-annual variability of NAWA is obtained from composited patterns. During positive/negative (P/N) values of the index, higher/lower SLP values over the Mediterranean and lower/higher values east of the Caspian Sea are displayed, respectively. In both cases, maximum SLP gradients are found over the Eastern Mediterranean (EM). During P/N phases, decrease/ increase in winter rainfall amounts and cooler/warmer temperatures are found to be associated with enhanced northerlies/south-easterlies over the EM. While correlations between NAWA and NAM are larger than that between NAWA and the North Atlantic Oscillation (NAO) it is also found that NAWA can be viewed as the regional signature of the hemispheric northern annular mode/arctic oscillation (NAM/AO), at all time scales.

While over the western Mediterranean basin (WM) a significant quasi-biennial (QB) signal seems to dominate (95% significance level), another powerful inter-annual signal ($\sim$2.9-3.3 years period band, 99% significance level) is found over West Africa. Significant positive correlations of 0.55 (0.60) are also found first between spring (summer) SLP anomalies of the NA pole and Sahelian summer rainfall of the same year. By tracking the position of the Azores anticyclone, associated with the phasing of the NAO and its influence over the WM, it is argued that the thickness of the Sahara/Sahel thermal low is an important parameters/predictors modulating precipitation over the Sahel. It is also suggested that low latitude diabatic heating through intense convection may be compensated by increased subsidence further north (i.e., western Mediterranean, southern Europe like during the extreme heat-wave of summer 2003). Long-term linkages between south-western Europe summer weather regimes, and extreme atmospheric blocking (such as during summer 2003), are discussed.

In addition to the AO, the natural 'penta-decadal' climate variability, slow global increase in greenhouse gases (GHG) concentrations, and sea surface temperature might

modulate as well rainfall variability over the Sahel. The results presented here should contribute to enhancing management of water resources over the Mediterranean basin by decision and policy makers. This is particularly important if the region is proven to get warmer (dryer) in a climate change context.