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Winter Very Long Dry Spell over the Mediterranean Basin

Florian Raymond (1), Albin Ullmann (2), Pierre Camberlin (2), and Philippe Drobinski (3)

(1) Institut des Géosciences de l'Environnement, University Grenoble Alpes, St Martin d'Hères, France (florian.raymond@univ-grenoble-alpes.fr), (2) Biogéosciences, University of Burgundy, Dijon, France (albin.ullmann@u-bourgogne.fr ; pierre.camberlin@u-bourgogne.fr), (3) Laboratoire de Météorologie Dynamique, Institut Pierre Simon Laplace, Ecole Polytechnique, Palaiseau, France (philippe.drobinski@lmd.polytechnique.fr)

Mediterranean winter precipitations (September to April) are important for annual water resources, summer ground moisture, vegetation and agriculture. Decrease of precipitation during this season may cause many important economic and social impacts.

The study focuses on the identification and variability analyze of very long dry spells events (VLDSe) in the Mediterranean region, relying on observations. E-obs Data grid from ECA&D are used to 0.25° spatial resolution to the 1957-2013 period. NCEP/NCAR reanalysis data are then used to associate different and oceanic forcings to the very long dry spells events.

76 events are detected throughout the Mediterranean Basin for a total duration of 4423 days. Clustering analysis was applied to the 76 events and have detected 4 main cluster. The first spatial pattern, called North-East Mediterranean, grouped 11 VLDSe mainly located in the Balkans. The second pattern, called West Mediterranean, grouped 15 VLDSe mainly located in the Iberian Peninsula. The third pattern, called Scattered Localized, grouped 25 VLDSe occurring in different areas around the Mediterranean basin. The last spatial pattern, called South-East Mediterranean, grouped 25 VLDSe mainly located in the Levant, but also in the Iberian Peninsula for 10 of them.

VLDSe patterns are associated with anticyclonic conditions, which lead blocking high and large scale subsidence of the cold air flow, coming from northern latitude. It is noteworthy that for both the Balkans (North-East pattern) and the Iberian Peninsula (West pattern), the anticyclonic anomalies accompanying VLDSe are located about 1000km north-west of the area experiencing drought conditions, instead of being centred on the latter.

Euro-Atlantic weather regimes have some control on the VLDSe. The positive phase of the north-atlantic oscillation regime (NAO+) is the only one that is clearly favorable to the development of VLDSe on almost the entire basin. The east-atlantic regime (EA) does not show any control on the VLDSe, and the atlantic ridge (AR) and the negative phase of the northatlantic oscillation (NAO-) regimes are generally detrimental to VLDSe. However, long duration of the AR, EA and NAO+ regimes, which are coupled with sustained atmospheric stability, are preferentially associated with VLDSe, in contrast to the short duration. Conversely, the long duration of the NAO- regime, reinforcing the low atmospheric pressure on Europe and the Mediterranean basin, are weakly associated with VLDSe.

Although the two climate models ALADIN52 and LMDZ4-NEMOMED8 differ in several respects, they agree in that VLDSe should be longer by 2100, especially in the RCP8.5 trajectory. A multi-model analysis with 12 CMIP5 simulations shows that wintertime sea-level pressure tends to increase in the Atlantic Ocean, off the French coast and in the central the Mediterranean basin for the RCP8.5 trajectory. Conversely, the frequency and duration of the 4 weather regimes do not show significant trends until the end of the 21st century.