Geophysical Research Abstracts
Vol. 20, EGU2018-2607, 2018
EGU General Assembly 2018

Drivers of decadal drought in the Western and Eastern Mediterranean in the past millennium as simulated in two CMIP5 models

Miguel Zorita (1), Eduardo Zorita (2), Sebastian Wagner (2), and Birgit Hünicke (2)
(1) Universidad de León, Spain, (2) Helmholtz-Zentrum Geesthacht, Institute for Coastal Research, Geesthacht, Germany

The land areas surrounding the Mediterranean are prone to naturally occurring multi-year and decadal droughts. Precipitation in this region is concentrated in the winter half-year and its variability at inter-annual time scales is strongly controlled by the North Atlantic Oscillation, although this influence is weaker in the Eastern Mediterranean. The responsible mechanism is the dependence of the North Atlantic storm tracks on the intensity of the North Atlantic Oscillation pattern. Paleo-climate evidence seems to suggests that decadal periods of low and high precipitation during the past millennium display a sea-saw pattern spanning the Western and Eastern Mediterranean basin. This drought or precipitation dipole could explain some patterns of agricultural trade between these two regions in periods with severe historical droughts in the Eastern Mediterranean. This contribution analyses two past-millennium simulations with the models MPI-ESM-P and NCAR-CCSM4 of the CMIP5 suite (r1i1p1, 850-1850 AD) driven by all external forcings, with the goal of identifying the atmospheric circulation and sea-surface temperature patterns that are linked with drought periods in these two regions, and ascertain whether or not the Mediterranean drought dipole also exists in these simulations.
The atmospheric circulation patterns related to precipitation in both regions are similar in both models, but slightly more realistic in the MPI-ESM-P simulation, specially for the Western Mediterranean. The analysis indicates that the winter half-year (Oct-March) precipitation in the Western and in the Eastern Mediterranean basins are weakly positively correlated (r $\sim$0.3) at interannual, decadal and multidecadal timescales. The simulations do not generally support the existence of a east-west drought dipole, although it might exist for extreme droughts, which have not been investigated in detail so far.
Both models support a link between Mediterranean precipitation and North Atlantic sea-surface temperatures. The analysis of the associated heat-fluxes suggests that the high latitudes in the North Atlantic may be involved in driving the precipitation anomalies, especially in the Western Mediterranean. There is a link of Eastern Mediterranean precipitation and Tropical Pacific sea-surface temperatures, reminiscent of ENSO. This link appears in both models. The precise mechanisms are under current investigation.