Geophysical Research Abstracts
Vol. 16, EGU2014-538, 2014
EGU General Assembly 2014

Mediterranean Tropical-like Cyclones: Present and Future

Leone Cavicchia (1), Hans von Storch (2), Silvio Gualdi (1,3)

(1) CMCC (Euro-Mediterranean Center on Climate Change), Bologna, Italy (leone.cavicchia@cmcc.it), (2) Institute for Coastal Research, HZG (Helmholtz-Zentrum Geesthacht - Zentrum für Material- und Küstenforschung), Geesthacht, Germany, (3) INGV (Istituto Nazionale di Geofisica e Vulcanologia), Bologna, Italy

The Mediterranean basin is characterized by the genesis of a large number of cyclonic systems. Most of the cyclones generated in this area have a baroclinic nature. A few storms every year, however, develop a dynamical evolution similar to the one of tropical cyclones, showing an axis-symmetric vertical profile, a warm core, a cloud-free eye surrounded by a cloud cover with spiral shape, and winds up to the hurricane speed. The strongest between such storms exhibit a striking resemblance to the lower-latitudes hurricanes, except for the mesoscale spatial extent, and have thus been termed medicanes (Mediterranean hurricanes).

Medicanes are considered rare phenomena, - the number of observed cases documented in the literature is around ten - but are associated to severe damage on coastal areas. Due to the scarcity of observations over sea, and to the coarse resolution of the long-term reanalysis datasets, it is difficult to construct a homogeneous statistics of the formation of medicanes.

Using an approach (tested on a number of historical medicane cases) based on the high-resolution dynamical downscaling of the NCEP/NCAR reanalysis, and exploiting an objective detection algorithm specifically designed to single out the features of medicanes, the statistical properties of such storms (annual cycle, decadal and inter-annual variability, geographical distribution, trends) over the last six decades have been studied in a systematic way, and the linkage between the frequency of medicanes formation and synoptic patterns has been investigated.

It was found that medicanes occur indeed with a low frequency, and that they are formed mostly during the cold season in the western Mediterranean and in the region extending between the Ionian Sea and the northern coast of Africa. The analysis of the environmental factors related with the formation of medicanes shows that the genesis mechanism requires a sufficiently large difference between the sea surface temperature and the temperature in the upper atmospheric layers, in order to increase the atmospheric instability. A low wind shear, high moisture content, and high low-level vorticity are all factors that favor the development of medicanes.

Applying the same downscaling procedure to the atmospheric fields produced by a global model, forced with the greenhouse gas concentration prescribed in different future climate scenarios, the impact of climate change on the statistics of Mediterranean tropical-like cyclones is estimated.
It is found that in the last three decades of the current century, the frequency of mesoscale Mediterranean storms showing tropical-like features is projected to decrease. On the other hand, the percentage of such storms reaching a high intensity shows a tendency towards a moderate increase.

References:

- Cavicchia L, von Storch H: The simulation of medicanes in a high-resolution regional climate model. Clim. Dyn. 39:2273–2290 (2012)
- Cavicchia L, von Storch H, Gualdi S: A long-term climatology of medicanes. Clim. Dyn. DOI: 10.1007/s00382-013-1893-7 (2013)
- Cavicchia L, Gualdi S, von Storch H: Mediterranean tropical-like cyclones: present and future, in preparation.