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A two year (2008-2009) analysis of severe convective storms in the Mediterranean basin as observed by satellite imagery

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The increasing damages caused by natural disasters, a great part of them being direct or indirect effects of severe convective storms (SCS), seem to suggest that extreme events occur with greater frequency, also as a consequence of climate changes. A better comprehension of the genesis and evolution of SCS is then necessary to clarify if and what is changing in these extreme events. The major reason to go through the mechanisms driving such events is given by the growing need to have timely and precise predictions of severe weather events, especially in areas that show to be more and more sensitive to their occurrence. When dealing with severe weather events, either from a researcher or an operational point of view, it is necessary to know precisely the conditions under which these events take place to upgrade conceptual models or theories, and consequently to improve the quality of forecasts as well as to establish effective warning decision procedures.
The Mediterranean basin is, in general terms, a sea of small areal extent, characterised by the presence of several islands; thus, a severe convection phenomenon originating over the sea, that lasts several hours, is very likely to make landfall during its lifetime. On the other hand, these storms are quasi-stationary or very slow moving so that, when convection happens close to the shoreline, it is normally very dangerous and in many cases can cause very severe weather, with flash floods or tornadoes. An example of these extreme events is one of the case study analysed in this work, regarding the flash flood occurred in Giampileri (Sicily, Italy) the evening of 1st October 2009, where 18 people died, other 79 injured and the historical centre of the village seriously damaged.
Severe weather systems and strong convection occurring in the Mediterranean basin have been investigated for two years (2008-2009) using geostationary (MSG) and polar orbiting (AVHRR) satellite data, supported by ECMWF analyses and severe weather reports. The spatial and seasonal variability of storm occurrence have been also analysed, as well as the most favourable synoptic conditions for their formation.
The analysis shows the existence of preferential areas of genesis of these extreme events, mainly located in the central Mediterranean (i.e. Ionic and Tyrrhenian seas), where the storms develop and grow preferentially in fall. The synoptic features, identified as precursors of severe convective events genesis, show how the totality of the identified cases occur in mid-troposphere (500 hPa) troughs or cut-off circulation within southerly flow, with values of deep level shear of at least 15 m s-1 and high θe (850 hPa) values. Among all the detected cases of severe convection, two selected cases of enhanced-V features are presented in detail, either for the different synoptic environments in which they are embedded, and for being long-lived or severe in terms of heavy rainfall and damages they produced at the ground.
In a long-term perspective, this preliminary study aims to make a climatological database of severe weather events occurring in the Mediterranean sea which may critically impact on the Italian peninsula and potentially affect population, in order to develop an objective procedure which can support regional meteorological services in forecasting extreme events, their development and impact, for taking proper early decisions.