Predictability of intense rain storms in the Central Mediterranean basin: sensitivity to upper-level forcing

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We study the sensitivity of eight rain storms that occurred in the Central Mediterranean basin to the upper level forcing. Our focus is over Calabria, the southernmost tip of the Italian boot, where these events produced severe damage and casualties.

These rain storms encompass several kinds of severe weather situations that are classified in southern Italy as the “Atlantic storm”, the cyclogenesis on the lee of the Alps, the “Saharian storm” etc. Despite the different kinds of the storms reported, like many others rain storms that develop in the Mediterranean, these events were associated with a more or less pronounced tropospheric intrusion of stratospheric air masses and high values of potential vorticity (PV).

In this study, we investigate the impact of this synoptic feature using the Regional Atmospheric Modeling System (RAMS), which is used daily at CRATI Scrl to issue weather forecast over Calabria. More specifically, a set of perturbed synoptic scenarios are defined starting from the European Centre for Medium Weather Range Forecast-Ensemble Prediction System (ECMWF-EPS). Starting from the whole 51-member ensemble, we generate five scenarios performing a hierarchical cluster analysis on the 1.5 PVU (1 PVU=10^{-6}m^{2}s^{-1}/(K kg)) surface height, which represents the height of the dynamical tropopause.

It is shown that such modifications may have a strong impact on the fine-scale precipitation forecast, thereby demonstrating the key role of the PV anomaly during severe weather over Calabria and the Central Mediterranean basin.