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Saturation fraction and gross moist stability in severely precipitating systems in the midlatitude Mediterranean environment

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Deep moist convection is a threatening phenomenon that recurrently hits both the Mediterranean and tropical seas. For this reason, many attempts have been made to try to characterize and predict it, and with this objective several physical indices have been proposed in literature during the last decade. Among these and for tropical environments, saturation fraction and gross moist stability, which are a measure of atmospheric columnar saturation and an estimation of the convective behavior through the relation of convective forcing and convection response, respectively, have been proposed. For the midlatitude, Mediterranean convection, the convective adjustment timescale τc has been introduced, which is an estimation of the convective equilibrium of the environment through the use of CAPE and its rate of change by convective heating.
This paper tests the idea of a potential suitability of the tropical indices in a continuously-warming Mediterranean atmosphere, by testing them for the set of severe rainfall events over Italy during January 2007-February 2009. In another study, those events have already been successfully classified into two categories showing non-equilibrium or equilibrium conditions, by using the convective adjustment timescale τc. Our results indicate that such classification based on the convective equilibrium criterion as function of the episodes' duration shows differences in the saturation fraction against rain rates for event types 1 and 2, while their mean normalized gross moist stability turns out to be near zero for both and thus showing no tendency for the different flow regimes. Saturation fraction appears to vary somewhat accordingly with time, revealing a seasonality with an apparent maximum during summer-autumn.