Simulazioni Multi-Modello ad Alta Risoluzione della Tempesta Vaia Sull’Italia Nord-Orientale

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Synoptic Situation

The synoptic situation over Europe was characterized by a trough, which deepened over the eastern Atlantic, extending to France and Spain, driving a strong moist flow towards the Alpine region. At the surface, a wide cyclonic area developed over the western Mediterranean. On 29 October at lower levels the Mistral generated an outbreak of cold air over the Gulf of Lion, which caused a sharp contrast with the warm and humid air advected by the strong southerly winds preceding the cold front. This represented a strongly baroclinic environment, favorable for the rapid deepening of the surface cyclone, which underwent an explosive intensification and attained the lowest value of 977 hPa, while moving northward towards northwestern Italy.

Observations

Weather stations used in the present work for a) precipitation, and b) wind speed. The blue stars in b) represent the stations used in the bottom-right figure of the poster. The red star in a) and b) represents the location of the sounding data. The white line in both a) and b) shows the section represented in the bottom-left figure of the poster.

- 531 hourly time series of precipitation
- 192 hourly time series of wind gust
- Maximum daily wind gust from additional 122 stations
- Sounding data from Udine Rivolto

Modeling Set Up

Domains used for the simulations with a) WRF b) MOLOCH.

Modeling Results: Soundings

The vertical profiles of equivalent potential temperature and wind speed from soundings indicate the presence of a low-level jet at 18 UTC, 29 October, reaching its maximum intensity at the top of the mixed-layer displaying a uniform vertical profile of equivalent potential temperature. All simulations capture this wind maximum, even though with some differences with respect to observations.

Modeling Results: Precipitation

All simulations capture the spatial distribution of precipitation, with maximum values in the prealpine region and a sharp gradient from the plain to the mountain. However, the maximum values of accumulated precipitation are underestimated by both WRF simulations, while MOLOCH better reproduces extreme values in the Alpine area, even if rainfall tends to be overestimated over the southernmost prealpine reliefs.

Modeling Results: Low-Level Jet

A low-level jet is located immediately east of the cold front. Considerably lower wind speeds are found in the low levels behind the cold front, as opposed to stronger wind speeds at higher levels, connected with the passage of the main upper tropospheric jet.

Modeling Results: Wind

All simulations tend to overestimate the maximum wind speed, especially in the northwestern part of the region of interest. Wind speed is overestimated especially in narrow Alpine valleys, which are not well reproduced by the models orography even at the rather high resolution adopted.


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