



## **Barrier winds in the Italian area: synoptic climatology, dynamics and meteorological impact**

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Barrier winds occur when a statically (very) stable flow impinges upon a high and long mountain chain. Barrier winds were first studied in the Antarctica. However they seem to be rather frequent also in the Mediterranean, in the near upstream of topographic ridges, although they usually represent a transient flow feature. Barrier winds are a manifestation of an orographically-generated disturbance of large amplitude, when the wind perturbation at low levels is comparable or even exceeds the magnitude of the incoming wind, producing a flow reversal or, more typically due to rotation, a large deviation of the wind direction, becoming nearly parallel to the ridge. In these cases the non dimensional orographic height  $NH/U$  (inverse of the Froude number) is locally larger than one. A short-term synoptic climatology is considered, based on the analysis of daily numerical forecasts made with the Moloch model over the Italian area. Results derived from idealized numerical experiments of barrier winds examples are presented. Sufficiently high values of stratification are observed in the presence of pre-existing cold air, piled up against mountain ridges by incoming warmer flow and/or by evaporative cooling due to precipitation. Real case studies and sensitivity experiments are discussed to show the significant impact that barrier winds exert on mesoscale circulations, advection of temperature and moisture and intensity and distribution of precipitation.