



## **Analysis of the thermal structure of the "Ora del Garda" wind from airborne and surface measurements**

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Systems of daily-periodic valley winds typically develop in the Alps, driven by the interaction between the thermally forced motion of air masses and the complex orographic configuration. The occurrence of large lakes can mark these phenomena with local peculiarities.

This study investigates a well known valley/lake breeze phenomenon, the so-called Ora del Garda. The latter is a diurnal wind originating in the late morning of sunny days on the northern shores of Lake Garda, channelling into the Sarca River Valley and the Lakes Valley nearby, and reaching, on days of greater intensity, the Adige River Valley, where it gets mixed with the local up-valley winds and produces a strong and gusty local flow. The Ora blows very regularly on sunny days under fair weather conditions, from late spring to early autumn, and marks local weather conditions in the area.

In order to explore how the development of this wind affects the boundary layer processes in the valleys, and in particular temperature and humidity structures, three measurements campaigns were performed in 1998-1999, including flights of an instrumented light airplane. Each flight trajectory explored three or four sections along the valley at specific locations (namely over the lake coast, at half valley, at the end of the valley). By following spiralling paths on vertical planes oriented either along or cross valley, data allowing detailed pictures of atmospheric structure on these sections were collected. At the same time data from surface weather stations located both on the valley floor and on the sidewall slopes were collected and analysed. In particular measurements from radiometers allowed to monitor the evolution of the radiation forcing the valley wind. For each single section suitable analytical expressions for mean vertical temperature and humidity profiles were first inferred to determine the dominating vertical structure. Then the characteristic spatial scales of variability of local deviations from the mean vertical profile and their variogram were analyzed. Finally temperature and humidity fields on cross-valley and along-valley sections of the atmosphere were reconstructed by means of a geostatistical interpolation technique (kriging).

This allowed an evaluation of the influence of the Ora del Garda on the temperature and moisture structure of the valley atmosphere and of the connections between the breeze flow depth and the convective boundary layer height. The pattern displays much features common to most diurnal valley winds. In particular the convective boundary layer height in the valley is rather shallow and surmounted by a deep stable layer. However close to the lake the atmosphere tends to stabilize throughout the boundary layer depth, due to the advection of colder air from above the lake surface.

Moreover some local small scale features of this circulation, chiefly due to morphological irregularities and surface coverage inhomogeneities were recognized and interpreted, such as the presence of the small Lake of Cavendine far up-valley, and the local contrasts between valley-bottom areas covered with bare rocks and densely vegetated areas.