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0.1 Evolution of katabatic flow (bora) on the northern Black sea cost

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When an air flow passes through mountain ridges katabatic winds form on the leeward slopes. This winds may cause warming as a föhn or cooling as bora through sinking motions. Katabatic winds are an important feature of the local climate in mountains. They can be strong, passes a large directional constancy and thus exert a considerable influence on weather.

During winters, the northern Black Sea near Novorossisk experiences frequent, intense cold-air outbreaks that drive oceanic heat loss andimprint complex but predictable patterns in the underlying waters. This strong, reliable forcing makes this region an excellent laboratory for observational and numerical investigations of air-sea interaction, sediment and biological transport, and mesoscale wind-driven flow. Bora is a cold, dry wind that blows above the Noworossisk bay from the northeast quadrant, most often during winter season, but it is possible another seasons. Its average speed is usually not high, but the bora speed maxima may surpass 60 m/s. In this region the bora winds sometimes cause a lot of damage to the power-line network and a complete road, railway and sea traffic disruption. The violent storm also causes a considerable damage to houses, harbours and trees. Thus, bora is one of the severest local winds in the world. Previous measurements of the bora speed and direction were performed either with the large sampling intervals (greater than 1 min) over a day or more or with the small sampling intervals (1-16 s) over an hour at most, thus tending to emphasize low- or high-frequency part of the spectrum, respectively. The data collected on May and October in Black sea coast zone were analyzed to study the evolution of katabatic flow.

The maximum wind speeds surpassed 40 m/s. Throughout the night, the katabatic flow extended gradually over the sea. A narrow updraft of 0.5 m s^{-1} was observed along the leading edge of the offshore flow, which resembled a density current. The location of the convergence zone between the offshore flow and the incoming trade winds is related to the offshore extension of katabatic flow and is not solely determined by the upstream Froude number. The dynamics of katabatic flows have been used to determine the vertical momentum flux profiles and surface roughness lengths under stable conditions on sea surfaces. The roughness length obtained in this way agrees well with estimates made under nonkatabatic conditions using standard log-linear fits. The katabatically determined fluxes were compared with eddy correlation measurements and with bulk methods. The eddy correlation measurements were not always in agreement with the katabatic fluxes; the comparison with bulk-derived fluxes, however, was particularly good.

Also we represent the detailed description of one episode of a bora wind. It was the very rare case summer strong katabatic wind on July 2-4 2006. The dynamic atmosphere and sea as well as aerosol and cloud condition were analyzed.

These studies allow one to address the problem of severe wind forecast which is especially important for commercial harbors. The investigations goal is also to determine and specify the lower boundary conditions for regional climate models in the regions with inhomogeneous topography.