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Air-sea heat and water vapour exchange in coastal zone and their dependence on the wind direction

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The unique data are used in this investigation based on three years (2004-2006) June-July meteorological and oceanography measurements of 5-minutes time resolution in coastal zone of Black Sea. The aim of this work is to study vertical gradients of temperature and water vapour in 10-m layer above water surface in coastal zone and their dependence on the wind direction at 10-m level and at 500 hPa. Empirical data show three main types of vertical potential temperature gradient (dT=T(water surface)-T(air),C) daily course: dT<0 at daytime, dT>0at nighttime; dT>0 all day long; dT<0 all day long. Wind rose for summer time reflects mesoscale circulations (breeze) influence - preference of northern winds in nighttime and southwestern winds in daytime. If not to separate on the wind direction the frequency of vertical temperature gradient value, we can see that in nighttime it is moved toward positive values more than in daytime, but the maximum of dT frequency is slightly above zero. The distribution function of dT covers interval between -10 and 9 C degrees. When we start to distinguish vertical temperature gradient between wind direction we can find following. For surface wind (10 m) positive values of dT (+1Ě+2C/10m) in nighttime prevail almost for all wind directions. In daytime, the most negative values are observed for southern, southwestern and western winds (coming from the sea) as well as for calm situations. For wind direction at 500 hPa distinction of distribution function between wind directions is even more clear. Thus, in nighttime we observe a prevalence of positive values of dT for wind from north, north-east, east and south-east. Winds at 500 hPa from south, south-west and west are followed by negative dT (-4Ě-5 C/10 m). Day maxima for those directions are moved towards more negative values as well as maxima for other directions compared to nighttimes. If to summarize we see that air masses coming from south and west bring to more stable boundary layer

stratification above water surface then these from other directions. On the other hand, local mesoscale circulations in the boundary layer smooth this dependence of vertical air stratification in first meters above water on the surface wind direction. Studying of the vertical gradient of water vapour partial pressure de=E(water)-e(air), hPa, showed that night maximum values of de (7-9 hPa) are greater then those for daytime (5-7 hPa). Their dependence on the wind direction is not as clear as for the vertical temperature gradient. It Data analysis shows that both in night and daytime vertical gradient of water vapour is the smallest for south-east, south and southwest winds at 10 m. The greatest vertical gradients of water vapour pressure are observed for northern wind both at 10 m and 500 hPa.