



Sea-land-breeze circulation over the Seoul Metropolitan Area

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Local circulation plays an important role in producing high-resolution meteorological and air quality information. In this study, detailed surface meteorological and vertical profile features about sea and land breezes in the Seoul Metropolitan Area (SMA) were investigated using the data from urban meteorological observation system in SMA (UMS-Seoul). These data were obtained from high-resolution surface meteorological stations and three wind lidar stations for six consecutive days (17–22 May 2016) with very weak synoptic winds and low cloud covers. The six-day average diurnal variations of surface meteorological variables revealed temperature differences between land and sea, driving the pressure differences between the two. This induced sea-land breeze circulation as well as other minor local circulation. The resulting sea-breeze began at the shoreline at 1200 Local Standard Time (LST, UTC + 0900), moved landward at a rate of about 10 km h⁻¹, and reached 60 km from the shoreline at 1800 LST. The land-breeze occurred within 50 km of the shoreline until noon. The sea breeze front was identified by a steep horizontal temperature gradient, and its passage was accompanied by an abrupt temperature drop as well as vapor pressure and wind increases. The time-height cross-section of wind indicated that the top of sea breeze reached a maximum height of 1.5 km with maximum winds 0.4 km high in the late afternoon. The returning (easterly) flow at 1.5–1.6 km was clearly observed over the sea breeze cells. On the contrary, the top of land breeze reached a maximum height of 0.8 km with maximum winds 0.3–0.4 km high in early morning.