

Investigation on the three-dimensional fine structures (i.e., HCRs and lobe/cleft) of the sea breeze; observation and simulation

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Research interest has been growing in studying of much more small scale phenomena, i.e., the so-called HCRs (horizontal convective rolls) and lobe/cleft in sea-breeze circulation. Recent investigations on HCRs have been extensively conducted both observationally and by numerical modeling (e.g., Wakimoto and Atkins 1994; Atkins et al. 1995; Weckwerth et al. 1996, 1997; Dailey and Fovell 1999; Fovell and Dailey 2001; Fovell 2005; Rao et al. 1999; Rao and Fuelberg 2000). And furthermore, it should be noticed that in more recent field observation campaign over Sendai Airport, Japan in June 2007, the 3D distinct HCRs wind field structure in sea breeze layer has been firstly revealed by a Dual-Doppler lidar system(measurement) (Iwai et al. 2008). Although the characteristics of the HCRs were quite well described in previous studies, the dynamical questions on it (i.e., detailed structure, formation process, and generation mechanism) have remained unanswered. Thus a LES (Large-Eddy Simulation) numerical study with much higher resolution would be suitable for more detailed investigation of the HCRs. As for the lobe/cleft, another more interesting phenomenon in sea breeze, there are still just few works on this topic (e.g., Ohno and Suzuki 1993; Cunningham 2007). Fortunately, there is the evidence that the fascinating lobe/cleft event has also been captured in above-mentioned field observation campaign (Iwai, personal communication). However, much less is known about the lobe/cleft, for example, its basic structure and dynamics. In this work, an extra-high resolution numerical experiment is particularly performed to simulate the sea breeze as a gravity current, and attempted to investigate details of the HCRs, lobe/cleft phenomena caught by observation. Some results will be presented in the meeting.