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Evolution of Internal Gravity Waves Under the Association of Katabatic Wind and Sea-Land Breeze Circulation Over Coastal Complex Terrain

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The evolution of internal gravity waves was investigated under the development of katabatic wind, when mountain-land breeze associated with westerly synoptic wind blowing over the top of the mountain in the west toward the East Sea of Korea (called Japan Sea) from August 13, 1995 through August 16, 1995, using three dimensional non-hydrostatic numerical models such as Local Wind Model and MM5 model. As westerly synoptic wind blowing over the top of the mountain toward the coastal sea in the east, during the day was hindered from the strong intrusion of upslope wind associated with sea-valley wind from the East Sea toward the top of the mountain, two different kinds of wind regimes confront each other in the mid of eastern slope of the mountain and the upslope wind goes up to the height of 1700m over the ground, becoming an easterly return flow in the upper level of the sea. Below sea-breeze front, two kinds of circulations were detected with a small circulation over the coast and a large one from the coast to the open sea. Then, katabatic wind did not exist in the lee side of the mountain. Near the sunset, synoptic westerly wind blowing over the top of the mountain in the west toward the sea side in the east became katabatic wind under the weaken sea-valley breeze. As nighttime went on, synoptic westerly wind became a strong downslope wind (katabatic wind), which was under the change of sea-valley wind into mountain-land breeze, due the cooling of the ground surface at night, but the sea-valley circulation still existed in the coastal sea. Thus, katabatic wind in the inland basin of the coast and sea-valley wind circulation in the coastal sea produced the development of internal gravity waves over the coastal sea. After midnight, katabatic wind should be intensified by both westerly synoptic wind and mountain-land breeze induced by more nighttime radiative cooling of the ground surfaces, resulting in the formation of a strong downslope windstorm. The wind storm caused the development of internal gravity waves with hydraulic jump motion in the eastern side of the mountain from the ground surface of the coast bounding up toward the upper level of the sea, while relatively moderate wind on the sea surface.